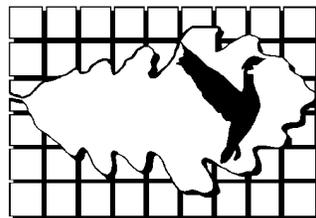


VEGETATION AND ECOLOGICAL CONDITIONS
OF
THE CITY OF MUSKEGO SYSTEM:
OPPORTUNITIES FOR
RESTORATION AND MANAGEMENT

A P P L I E D
E C O L O G I C A L
S E R V I C E S



I N C.

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OPPORTUNITIES FOR
RESTORATION AND MANAGEMENT

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VEGETATION AND ECOLOGICAL CONDITIONS OF THE CITY OF MUSKEGO SYSTEM: OPPORTUNITIES FOR RESTORATION AND MANAGEMENT

EXECUTIVE SUMMARY

This report summarizes results from natural resource inventories conducted to understand existing ecological conditions, needs, and opportunities for ecological restoration and management in approximately 23,000-acres in the City of Muskego, Waukesha County, Wisconsin.

This report also provides 1) a prioritization of the selected natural resources useful in focusing management based on ecological and historical values, and the City of Muskego's Comprehensive Plan, 2) management programs for existing public and private lands that will contribute to the restoration of vegetation, soils, and hydrologic systems of the natural resources consistent with long-term needs of the ecological system, and 3) proposed buffer systems to alleviate potential intrusions (i.e. adverse hydrologic changes, contaminants, noise, shade suppression, naturalized species, etc.).

Within the City of Muskego a wide range of native wetland plant communities exist, ranging from small seepage fen areas to larger expanses of cattail marsh. Woodland communities range from long narrow fence rows to high quality oak woodlands. Prioritization of 87 selected natural resource areas in the City of Muskego indicated that 38% of these sites received a low ecological health score, 48% had a medium ecological health score, and only 14% had a high ecological health score. Many of the medium scored communities have a high degree of recuperative potential with the implementation of the appropriate management strategies.

Wetlands within the City of Muskego range from large expanses of degraded wetland systems containing reed canary grass (*Phalaris arundinacea*) and cattail (*Typha spp.*) to smaller high quality sedge meadow and fen remnants. Restoration and management strategies differ depending on size and level of degradation. Small sedge meadow and fen remnants will require minimal maintenance such as periodic prescribed burning and limited herbicide application. However, large expanses of the non-native reed canary grass will require extensive herbicide application, for perhaps several to many years, in conjunction with prescribed burning and reseeding/planting with native wetland species.

Woodlands within the City of Muskego range from several large tracts containing oaks (*Quercus spp.*) or sugar maples (*Acer saccharum/A. nigrum*) or black walnut (*Juglans nigra*) to small degraded recently developed woodlands containing cottonwood (*Populus deltoides*), boxelder (*Acer negundo*), and black cherry (*Prunus serotina*). Only a few woodlots within the City are of high quality. These will require minimal maintenance, of which prescribed burning is the most efficient, both for labor and expense.

Most other woodlands containing oaks and black walnut are in adverse ecological health. Restoration of these woodlands will require significant labor and expense. Cutting and herbiciding of non-native shrubs of European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera sp.*) will be required. After which prescribed burning will be necessary to control these species. In some woodlands the native seed bank component may have been lost. Remedial

seeding and planting of native woodland ground cover species may be required.

Sugar maple woodlots require little restoration and/or maintenance activities. Reduced sapling density may be desired to decrease shade suppression and allow for a more diverse ground story flora.

Buffering of natural resources within the City of Muskego should also be considered. Incorporation of adjacent agricultural lands as ecological buffers restored to native vegetation will further protect the existing natural resources within the City of Muskego.

Prior to large scale restoration efforts it may be desirable for the City of Muskego to indicate a series of restoration or demonstration plots or zones within the City. Currently the City of Muskego has areas within its existing park lands to provide both wetland and woodland restoration plots. These plots can be provided with signage to outline the major tasks occurring in each type of restoration. This allows citizens to see and learn about specific restoration strategies prior to large scale activities.

SECTION I. SUMMARY OF FIELD INVESTIGATIONS

INTRODUCTION

Public lands are often purchased for the protection of natural resources. Natural resource systems change, and the nature and direction of these changes need to be understood. This study was commissioned to provide a conservation plan by performing studies that characterized selected natural resources in and around the City of Muskego, Waukesha County, Wisconsin.

Numerous changes in land-use, hydrology, water quality, establishment of local populations of exotic noxious weeds, and other changes have occurred within the City of Muskego in the past decades. This study had three important goals.

1. Document and rank existing ecological conditions in selected public and private lands in the City of Muskego.
2. Identify ecological management and restoration needs to reduce ecological system deterioration.
3. Provide a basis for beginning this restoration and management programming.

This summary report is presented in three main sections.

- Section I. Summary of field investigations.
Field investigations to determine the existing ecological health of representative parcels in Muskego are summarized here and in referenced appendices.
- Section II. The restoration and management planning process.
This section provides key information to begin planning for future management and restoration programs to address ecological conditions found in the study area.
- Section III. Testing and demonstration programs for publicly owned land.
Education of public agencies and private landowners on ecological system health and management needs is often best accomplished by installation of test and demonstration programs. This section provides a framework for design and implementation of such a program.

METHODS

Prior to conducting field studies, available information on the 23,000-acres, including recent aerial photographs, historic aerial photographs, wetland inventory maps, and soil surveys, were reviewed to best understand the natural resources and land-use in the project area depicted in Figure 1. From July through October 2000, the project area and surrounding properties were mapped by reconnoitering through representative areas on public lands and private holdings, where permission was obtained from the property owners. Where permission to enter private lands was not obtained, land cover types were determined from public roads, from boat, or were interpreted from black and white aerial photographs (1995).

Descriptions and maps of existing vegetation and land cover types, using the most recent aerial photograph (Figure 2) were prepared (Figure 3).

Quantitative vegetation sampling was conducted to more specifically characterize vegetation in selected areas and to assist in determining restoration strategies. Quadrat sampling was conducted at ten-meter intervals along 50-meter line transects to provide adequate representation of the selected areas in the City of Muskego. Vegetation was examined in 1m² circular quadrats nested along the transect line. Seventy-one (71) quadrats were sampled along 14 transects placed in selected plant communities. Plant species less than 1 meter in height were recorded as the percent cover in each quadrat.

Woody vegetation was sampled along the 50 meter vegetation belt transects. Trees greater than 2 inches Diameter at Breast Height (DBH) rooted within 1 meter on both sides of the transect were tallied to species and size (inches DBH). Live and dead woody stems (both small tree and shrub species) less than 2 inches DBH, greater than 1 meter in height, and rooted within 1 meter to the right of the transect were tallied to species along the 50 meter transects. Sprouts arising from a single root collar were recorded as individual stems if the sucker shoot was less than 2 inches from the ground.

In representative areas of each vegetation type a Timed Meander Search was conducted to understand plant species richness and composition. Timed Meander Search techniques (Goff, et al. 1982) involve the development of time-equated plant species lists. The rate of encountering new species during the process relates directly to the distribution and frequency of species in the site and the diversity of the plant community. The timed meander search is not intended to develop a total species list in a community, but to provide a method for observing a majority of the species in the most efficient time frame. Together the quadrat and timed meander search data provide a good level of detail as to the species present in a given transect location.

During the field visits, historic conditions were confirmed by review of conditions created by previous activities (drainage ditching, dead furrows, fencing, property lot lines, boundary changes, dredging, ditching of waterways and other disturbances associated with previous land-use).

The primary goals of the field reconnaissance were to define and prioritize management and restoration zones in the project area, and to evaluate and document how the City of Muskego's ecological system has been, or is, influenced by changes and disruptions in terrestrial and aquatic systems.

RESULTS AND DISCUSSIONS

The natural resources of the City of Muskego system were divided into five primary land cover type classes (Table 1). Field studies concentrated on forested and wetland communities and associated buffers. The land cover classification map for the study area is depicted in Figure 3. Slopes in excess of 12% were also mapped as part of this study (Figure 4). Most of these slopes are found in the northwest corner of the City of Muskego. Each vegetation/land cover type has been mapped to determine size in acres (Table 2), which is important to the restoration and management planning sections of this document.

TABLE 1. LAND COVER TYPE CLASSIFICATION

1. Developed Land
 - A. Residential
 - B. Industrial/commercial

2. Agricultural Land
 - A. Residence/out buildings
 - B. Fields (cropped)
 - C. Fields (fallowed)
 - D. Prairie remnant/restoration

3. Forested Communities
 - A. Fence rows
 - B. Recently developed forested systems in degraded condition
 - C. Historic oak (*Quercus spp.*) savanna
 - D. Plantations/orchards
 - E. Black walnut (*Juglans nigra*)/oak (*Quercus spp.*) woods
 - F. Oak (*Quercus sp.*)/maple woods (*Acer saccharum*)
 - G. Maple (*Acer saccharum*)/basswood (*Tilia americana*)

4. Wetlands
 - A. Wet prairie
 - B. Sedge meadow
 - C. Cattail (*Typha sp.*)
 - D. Reed canary grass (*Phalaris arundinacea*)
 - E. Native forbs
 - F. Wet woods and shrub thicket (*Salix/Cornus*).

5. Open Water/Drainages
 - A. Lake
 - B. River
 - C. Stream/creek
 - D. Springs/seeps
 - E. Natural pond
 - F. Created pond/ditches

Table 2. Approximate acreage of Vegetation/Land Cover Types for the City of Muskego Project Area (calculated from Figure 3). Not mapped=NM.

	<u>Cover types</u>					
	<u>Acreage</u>					
1. Developed Land	1A NM	1B NM				
2. Agricultural Land	2A NM	2B NM	2C 231	2D 21		
3. Woodlands	3A 79	3B 302	3C 1609	3D 50	3F 26	3G 105
4. Wetlands	4A 5	4B 86	4C 2616	4D 1068	4E 1	4F 693
5. Natural Open Water	5A 1832	5B 4	5C 14	5D 1	5E 109	5F 42

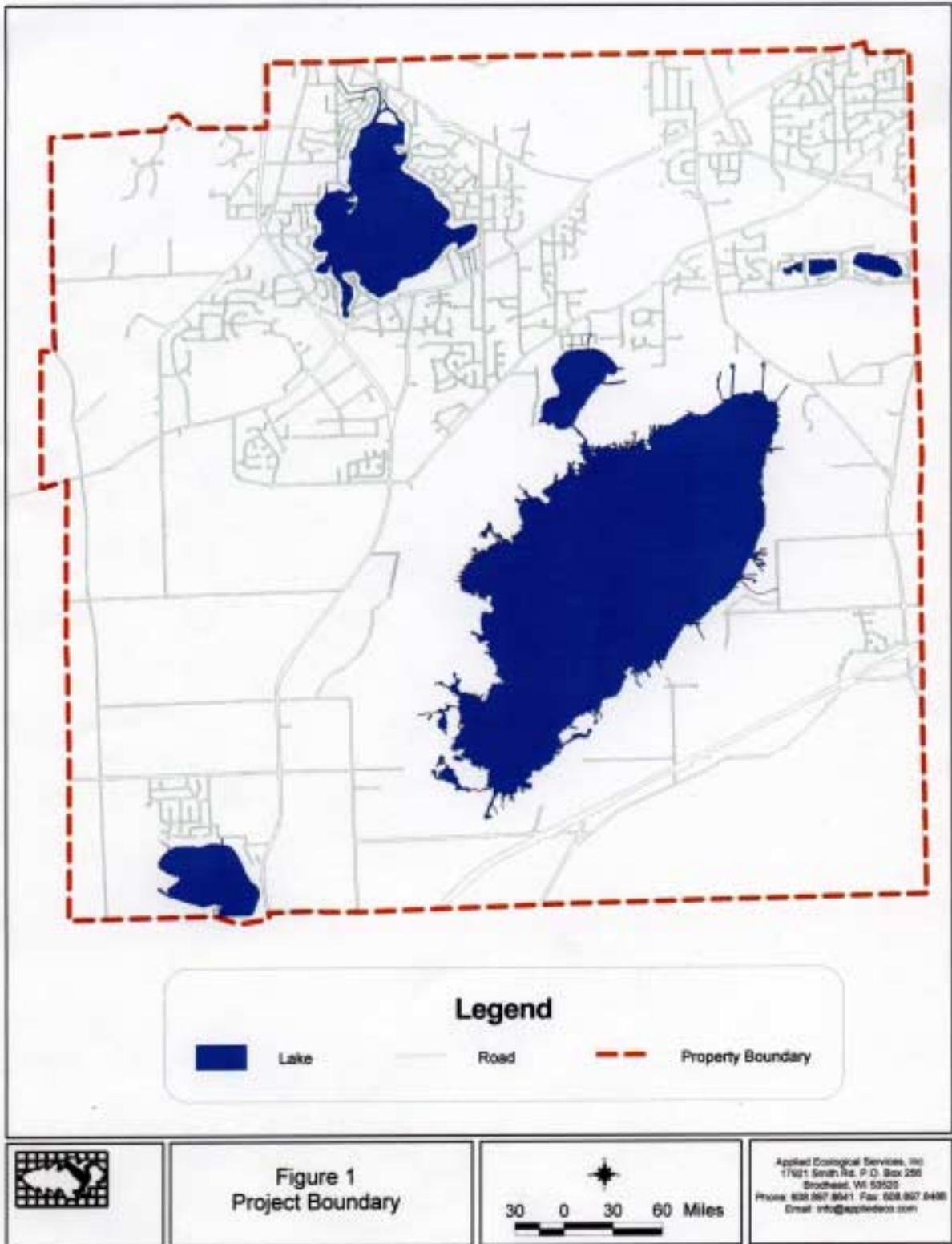


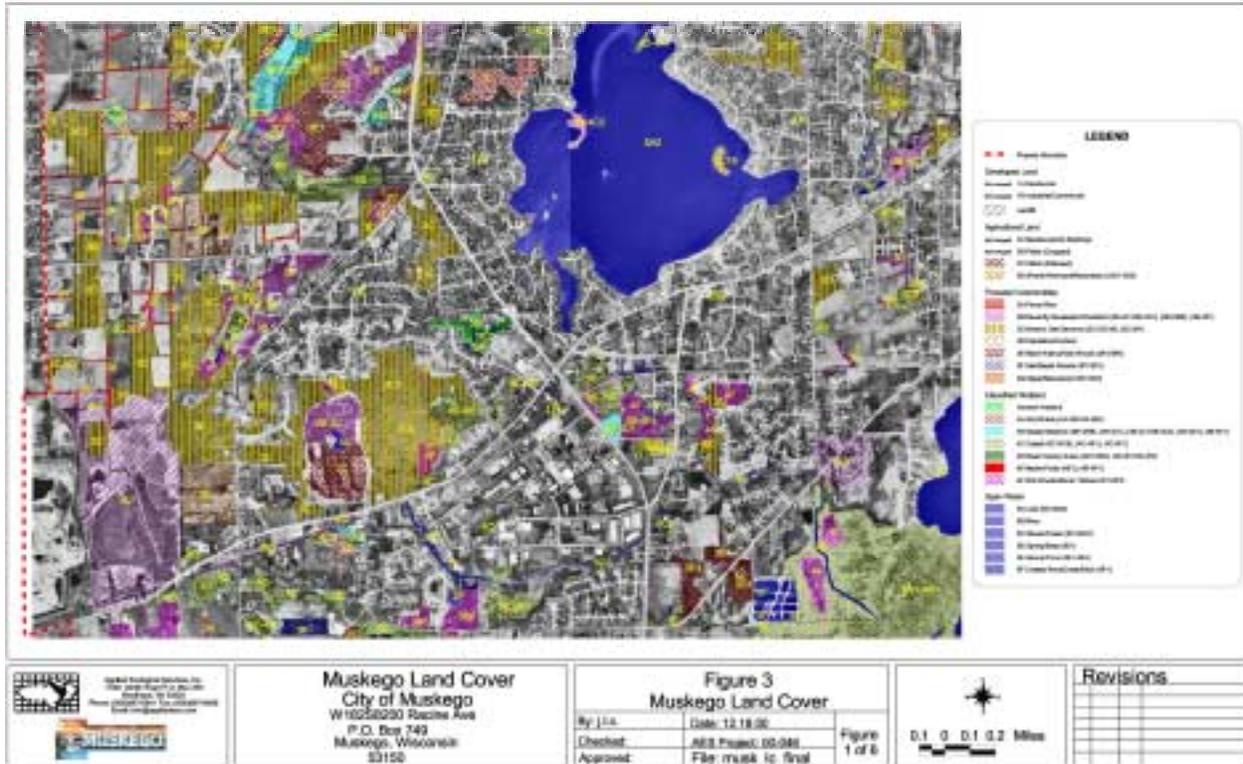


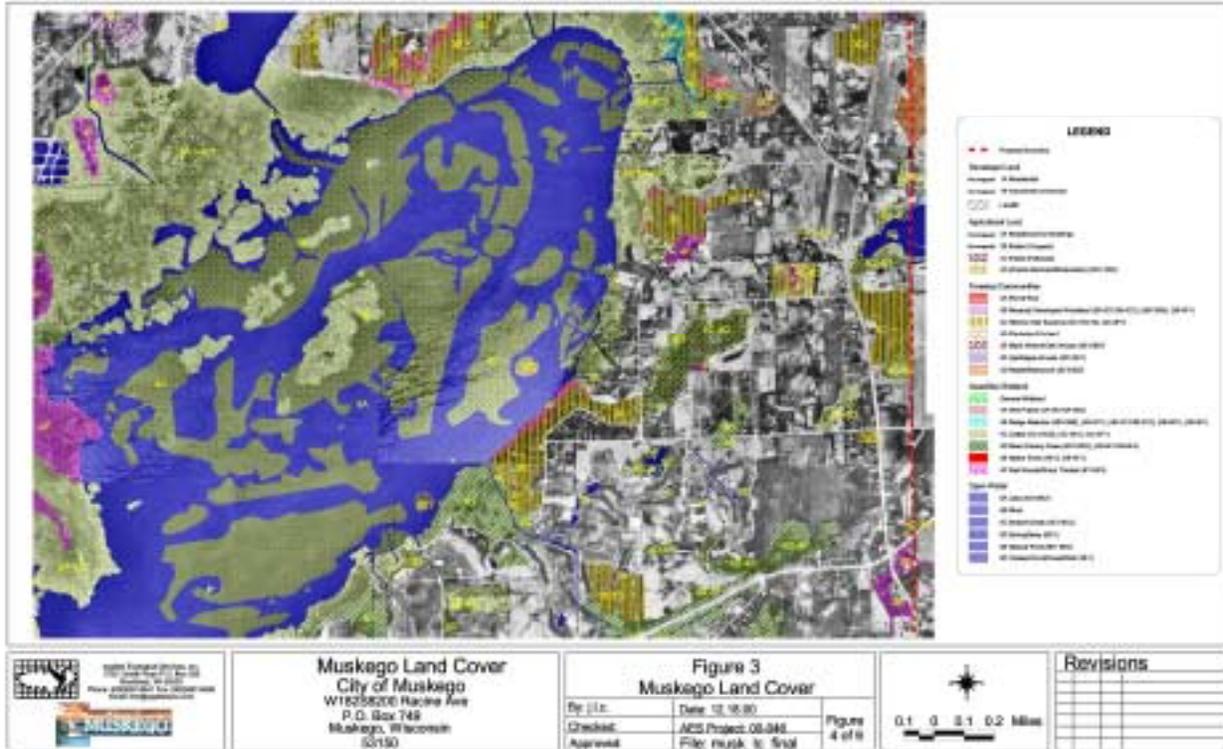
Figure 2
Aerial Photograph

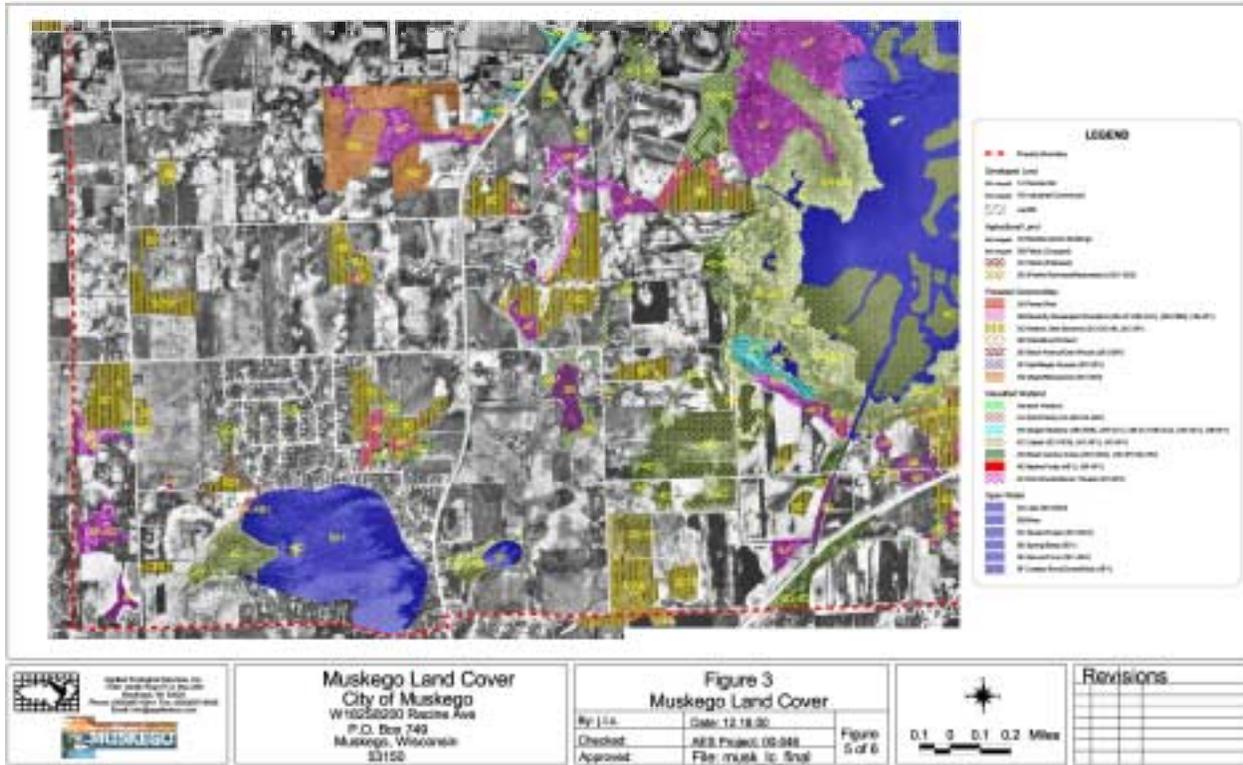


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FIGURE 3. LAND COVER TYPE MAP OF THE 23,000 ACRE PROJECT AREA IN THE CITY OF MUSKEGO, WAUKESHA COUNTY, WISCONSIN.







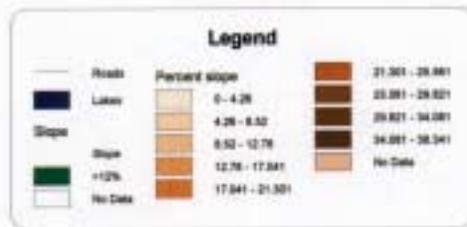
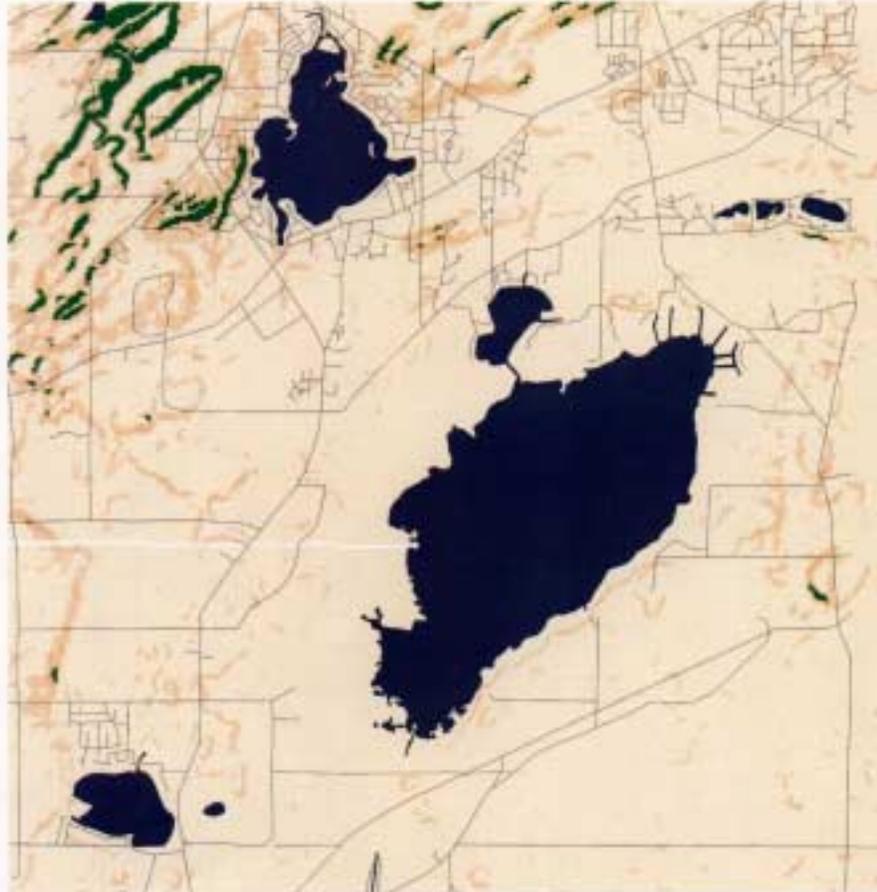


Figure 4
Muskego Slope Map

Source: GeoConn (DEM)
1985 Tiger files (lines and polygons)
Coordinate System: 1984 UTM Zone 18N Meters



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GENERAL DESCRIPTION AND OVERVIEW OF ECOLOGICAL CONDITIONS OF VEGETATION/LAND COVER TYPES

Based on site inventory work, most upland and wetland habitats in the City of Muskego project area are moderately to seriously deteriorated. However, several areas contain high quality native vegetation. Figure 3 (Maps 1-6) depict land cover types found in the City of Muskego. The following is a general overview of the vegetation/land cover types in the project area.

Developed Land (1)

Developed land received little attention during this project. Residential (1A) and industrial/commercial(1B) land generally consisted of buildings and their associated landscaping. Recreational areas such as mowed parklands also received little attention.

Agricultural Lands (2)

Agricultural lands consisted of farms with their associated buildings (2A). Agricultural fields (2B) adjacent to significant ecological resources were investigated as were fallowed fields (2C). Agricultural fields were typically planted to corn, soybeans, and alfalfa, and contained non-native annual weeds. Farms (2A) and associated agricultural fields (2B) were not mapped by this effort.

Fallowed fields (2C) and roadsides were found throughout the system and were dominated by introduced naturalized grasses and forbs. Much of the vegetation was typical of weed species found in disturbed agricultural soils or invade following disruption of the soil systems by agricultural and other land development activities. Dominant plant species of open, old-field sites and roadsides include non-native grasses such as European brome grass (*Bromus inermis*), blue grass (*Poa pratensis*, *P. compressa*), and an assortment of other grasses (*Festuca elatior*, *Dactylis glomerata*, and *Phleum pratense*). Non-native broad-leaved forbs found in the fields included dandelion (*Taraxacum officinale*), plantains (*Plantago major*, *P. lanceolata*), thistles (*Cirsium arvense*, *C. vulgare*), wild carrot (*Daucus carota*), wild parsnip (*Pastinaca sativa*), sweet clovers (*Melilotus_spp.*), and others. Native plant species found in the old-field settings are infrequent, and typically are the plant species most tolerant of disturbance. Plant species in this category include native weedy species such as Canada goldenrod (*Solidago canadensis*), hairy aster (*Aster pilosus*), avens (*Geum canadense*), fleabane (*Erigeron annuus*, *E. strigosus*), common milkweed (*Asclepias syriaca*), and ragweeds (*Ambrosia artemisiifolia*, *A. trifida*).

Most fallowed fields are experiencing a conspicuous invasion by shrubs and saplings. Native woody plants invading into the old fields include boxelder (*Acer negundo*), elm (*Ulmus spp.*), and cottonwood (*Populus deltoides*). Several exotics that are becoming predominant in some locations include European buckthorn (*Rhamnus frangula*, *R. cathartica*) and honeysuckle (*Lonicera spp.*).

In most locations where fallowed fields are identified, they are associated with past agricultural land-uses, and have been fallowed a decade or more. In some old farm fields that are level, agricultural drain tiles and ditching systems are found or are believed to be present.

Native remnant prairies within the City of Muskego are confined to the Luther Parker Cemetery (2D). This is a small cemetery that contains native grasses such as Indian grass (*Sorghastrum nutans*) and big bluestem grass (*Andropogon gerardii*) as well as native flowers such as prairie dock (*Silphium terebinthinaceum*). Several planted prairie areas were observed within the City of Muskego (2D). For instance, islands created from dredge spoils within Big Muskego Lake were planted to prairie species in 1997. Additionally, the Wisconsin Department of Transportation has a wetland mitigation area in the southern portion of the City of Muskego with portions planted to prairie. At least one homeowner has planted prairie in a portion of their lawn and the Muskego High School has a small prairie planting in the front of the building.

Forested Communities (3)

Several types of forested communities are found in the Muskego City of Muskego project area. These include:

Fence Rows (A)

Recently Developed Forested Systems in Degraded Conditions (B)

Historic Oak Savanna (C)

Plantations/orchards (D)

Black walnut/oak woods (E)

Oak/maple woods (F)

Maple/basswood woods (G)

Each of these is described generally below.

Fence Rows (3A)

Fence rows are associated with agricultural fields. Typically these are elevated above the surrounding fields and probably provide windbreaks, in some cases. Fence rows consist of scattered native species such as oaks (*Quercus spp.*) and hickories (*Carya spp.*), with a dominance of black cherry (*Prunus serotina*), boxelder (*Acer negundo*), and hawthorn (*Crataegus sp.*). An understory of non-native woody species such as buckthorn (*Rhamnus spp.*), and hawthorn (*Crataegus spp.*), and non-native grasses including brome (*Bromus inermis*), quack (*Agropyron repens*), fescues (*Festuca spp.*), orchard grass (*Dactylis glomerata*), and timothy (*Phleum pratense*) were also associated with fence rows. Typical shrubs and forbs consist of native brambles (*Rubus sp.*), and non-natives such as honeysuckle (*Lonicera tatarica*), wild carrot (*Daucus carota*), and dandelion (*Taraxacum officinale*).

Recently Developed Forested Systems in Degraded Conditions (3B)

Recently developed forested systems are comprised of native early-invading species such as cottonwood (*Populus deltoides*), boxelder (*Acer negundo*), green ash (*Fraxinus pennsylvanica*), black cherry (*Prunus sp.*), elm (*Ulmus spp.*), and non-native white poplar (*Populus alba*). These areas typically occupy fallowed fields, former wetland soils (hydric soils) that have been drained, spoils piles along ditches, and riparian margins, where successional tree species have invaded and create shade suppression of the native, soil-stabilizing vegetation. Often, the sub-canopy, which is usually closed, includes dense growths of European buckthorn (*Rhamnus cathartica*), Tartarian honeysuckle (*Lonicera spp.*), and other shrubs that are semi- to completely shade-tolerant. The combined influence of shading by young trees and buckthorn (*Rhamnus cathartica*) have contributed to the decline of the native, soil-stabilizing vegetation. These are typically depauperate, low-diversity, and unstable systems.

Historic Oak Savanna Systems (3C)

Oak (*Quercus sp.*) savannas dominated by bur oak (*Quercus macrocarpa*), white oak (*Quercus alba*) and red oak (*Quercus rubra*) with native and introduced forbs, grasses, and sedges (*Carex spp.*) are found in the City of Muskego system. In many locations these occur on higher, drier ridge tops (Figure 4). Ground cover vegetation varies from shade suppressed areas with an overstocked canopy, to areas of dense invasion by European buckthorn (*Rhamnus cathartica*) and Tartarian honeysuckle (*Lonicera spp.*). Some areas have relatively diverse ground cover vegetation along the edges and in light gaps. However, oak (*Quercus sp.*) savanna systems on slopes have experienced severe degradation, where substantial erosion of

the topsoil has occurred. Topsoil loss is associated with the loss of long-lived seeds, roots, tubers, bulbs, and other plant stock from the soil. In many of the savanna sites, no or little ground cover vegetation is found and woody vegetation is entirely dominated by European buckthorn (*Rhamnus cathartica*), native prickly ash (*Xanthoxylum americanum*) and others. Substantial die-back is observed on lower branches of bur and white oak (*Quercus sp.*) from the dense shading caused by the associated overstocked canopy (overstocked by cherry (*Prunus sp.*), hickory (*Carya ovata*), elm (*Ulmus americana*), green ash (*Fraxinus sp.*), European buckthorn (*Rhamnus cathartica*), and several other species).

The deterioration of these oak (*Quercus sp.*) savannas has followed a process of degradation documented by previous studies throughout the Upper Midwest (Apfelbaum and Haney, 1989). Documentation produced by the other studies and corroborated during this inventory suggests that the previously identified trends are occurring in the City of Muskego system. These include a precipitous decline in breeding bird and native vascular plant species richness, severe erosion, and a decline in the opportunity for restoring these savanna systems with increasing time, due to erosion and loss of the soil seed bank.

Plantations/Orchards (3D)

Several pine plantations and orchards were located within or adjacent to the project areas. These were noted as land cover types, but no time was spent surveying these areas.

Black Walnut/Oak Woods (3E)

_____ Native trees such as black walnut (*Juglans nigra*) and oak (*Quercus spp.*) dominated woodlands that are found mostly in the northern part of the study area on ridge tops. Most of these areas contain residential developments. In some areas 15-20 inch DBH (Diameter at Breast Height) black walnut (*Juglans nigra*) is found interspersed with oak (*Quercus sp.*), black cherry (*Prunus serotina*), and shagbark hickory (*Carya ovata*). In most instances non-native and native shrubs were not overly dense to prevent establishment of a diverse ground cover. Typical native woodland ground cover species were Pennsylvania sedge (*Carex pensylvanica*), Jack-in-the-pulpit (*Arisaema triphyllum*), horse gentian (*Triosteum perfoliatum*), violets (*Viola spp.*), false Solomon seal (*Smilacina racemosa*), wild geranium (*Geranium maculatum*), white lettuce (*Prenanthes alba*) and starry campion (*Silene stellata*). Of the wooded areas studied, this woodland community had the greatest percentage of native ground cover vegetation.

Maple/Oak Woods (3F)

Several wooded areas are comprised of sugar (black) maple (*Acer saccharum*) with scattered oak (*Quercus sp.*) and basswood (*Tilia americana*). In most instances the shrub/sapling layer is dominated by numerous young sugar maple (*Acer saccharum*) with occasional black cherry (*Prunus sp.*), bitter-nut hickory (*Carya ovata*) and ironwood (*Ostrya virginiana*). Ground cover in summer was sparse with sedges (*Carex spp.*), Jack-in-the-pulpit (*Arisaema triphyllum*), Enchanter's night shade (*Circaea quadrisculata*), and woodland knot weed (*Polygonum virginianum*) the most frequently observed species. These woodlands can have a diverse spring flora, which was not evident at the time of survey.

Maple/Basswood Woods (3G)

A large mesic wooded tract (Parker Drive woods) consists of a sugar maple (*Acer saccharum*)/basswood (*Tilia americana*) community with interspersed oak (*Quercus sp.*) and ash (*Fraxinus sp.*). Low swale areas and wetland depressions are found in this woodland community. Portions of this woodland community consists of areas dominated by ash (*Fraxinus sp.*) and hickory (*Carya ovata*).

Wetlands (4)

Wetlands in the City of Muskego project area vary from expansive marshes, such as the cattail (*Typha sp.*) marshlands around the shoreline of Big Muskego Lake, to narrow linear wetlands along stream margins and channelized ditches. In most locations, wetlands are moderately to severely deteriorated. Hydrological changes brought about by road construction, open ditch drainage of wetlands, and increased sediment, salt and nutrient loading from surrounding uplands, have caused a shift to vegetation types that tolerate disturbance. In many locations within the City of Muskego, the dominant vegetation types are comprised of Southeast Asian introduced non-native reed canary grass (*Phalaris arundinacea*) (4D), monocultures of dense cattails (*Typha angustifolia*, *T. latifolia*) (4C) and extensive shrub thicket dominated by dogwood (*Cornus spp.*), and willows (*Salix spp.*) (4F). Reed canary grass (*Phalaris arundinacea*) invasion into fallowed, tiled and ditched agricultural fields was especially evident.

Along higher topographic margins of larger wetland areas and in areas that have not been subjected to major hydrologic changes, small pockets of sedge meadow (4B) and wet prairie (4A) remain. These are being invaded by woody growth in the absence of fire. Native plant species in these higher quality wetlands include lake sedge (*Carex lacustris*), tussock sedge (*Carex stricta*), Canada blue-joint grass (*Calamagrostis canadensis*), prairie cord grass

(*Spartina pectinata*), and other graminoid species. Native forb dominated wetlands (4E) found in a few areas and along wetland margins include boneset (*Eupatorium perfoliatum*), Joe-pye weed (*Eupatorium maculatum*), great blue lobelia (*Lobelia siphilitica*), Virginia mountain-mint (*Pycnanthemum virginianum*), marsh-marigold (*Caltha palustris*), wood germander (*Teucrium canadense*), hedge nettle (*Stachys hispida*, *S. palustris*), swamp milkweed (*Asclepias incarnata*), turtle head (*Chelone glabra*), New England aster (*Aster novae-angliae*), and blue vervain (*Verbena hastata*).

In most locations, the ecotonal edge between wetlands and the adjacent upland ecological system have been severely degraded. Where previously open and semi-open conditions were found, dense shading by European buckthorn (*Rhamnus cathartica*), boxelder (*Acer negundo*), green ash (*Fraxinus sp.*), cottonwood (*Populus deltoides*), and elm (*Ulmus americana*) now prevent the growth of diverse, soil-stabilizing ground cover vegetation. In many locations of this shade suppression, non-native plant species have invaded.

Most wetlands examined have been significantly modified. The modifications include ditching, tiling, and alterations in the water level dynamics. In cases of lowered water levels, where stream down-cutting and ditching have lowered the ground water level, seasonal dry-down of the upper wetland substrates allows for decomposition and the liberation of nitrogen, phosphorus, and other nutrients that are typically organically bound and held tightly under submerged, saturated, and anaerobic conditions.

These modified wetlands have dominant vegetation (i.e., reed canary grass (*Phalaris arundinacea*), cattail (*Typha sp.*), nettle (*Urtica dioica*)) typically found in enriched wetland systems, such as those receiving nutrient loading from agricultural systems or from stormwater runoff, resulting in high nitrogen, phosphorus, and potassium levels. Because of the widespread nature of the disturbance, many wetlands in the City of Muskego are indicators of enriched wetland systems.

Open Water /Drainages (5)

Lakes and ponds in the City of Muskego comprise a significant percentage of the area and are an important natural resource asset to the City of Muskego. In many locations, nutrient, salt, and sediment loading from adjacent agricultural areas, or erosion from adjacent degraded forested areas have contributed to the invasion of lake and stream edges by plants of enriched conditions and sediment loads, such as cattail (*Typha sp.*) and reed canary grass (*Phalaris arundinacea*).

Big Muskego Lake comprises 2,073 acres within the City of Muskego. Due to increased fertility from natural and human induced sources, Big Muskego Lake (including Bass Bay) has high amounts of nutrients available for emergent and aquatic plant growth. Large expanses of cattail (*Typha sp.*) comprise the shoreline and emergent zone with additional expanses within the lake proper. Big Muskego Lake is a relatively shallow lake and provides habitat for a number of wildlife species.

Little Muskego Lake is a smaller deeper lake that has most of its shoreline under some type of residential or commercial development. Recreational activities such as boating and water skiing are much more prevalent. Sediment loading from the inlet to the lake is evident in the water column in recent and past aerial photographs.

Selected Natural Resources

A number of selected sites within the City of Muskego project boundary were studied at various levels of intensity. The most general level was a basic description of sites from nearby roads. Sites were coded according to land cover type classification in Table 1. The numbers after the letter refer to a specific community type studied and is correlated to the land cover type map for selected natural resources (Figure 5). To assist in location of the following selected natural resources the section in which each is found is included in the site title. A total list of native and non-native plant species recorded within the City of Muskego during this study can be found in Appendix 5.

SUMMARY OF SURVEY RESULTS FOR SITES 1-87

1. Old gravel Quarry (1B1), NE ¼ Section 7
 - Number of plant species recorded 22, of which 18 were native species.
 - Historic vegetation – oak (*Quercus sp.*) woods.

Present vegetation

This is an unique area in that old slopes and debris areas left over from quarry operations consist of disturbed young woods consisting of non-natives such as honeysuckles (*Lonicera sp.*), European and glossy buckthorn (*Rhamnus cathartica* and *Rhamnus frangula*) and native trees such as quaking aspen (*Populus tremuloides*). However, some bottom areas of the quarry consist of a shallow soil layer on which species typically found in a rare wetland type called fen were found. These included native species such as Riddell's goldenrod (*Solidago riddellii*), grass of parnassus (*Parnassia glauca*) and shrubby cinquefoil (*Potentilla fruticosa*). In addition to fen species, a number of other native wetland species were observed in these areas. These included red osier dogwood (*Cornus stolonifera*), spike rush (*Eleocharis sp.*), sedge (*Carex sp.*), grass-leaved goldenrod (*Solidago graminifolia*), red stem aster (*Aster puniceus*), Dudley's rush (*Juncus dudleyi*), dark green bulrush (*Scirpus atrovirens*),

cattail (*Typha sp.*), rush (*Juncus sp.*), boneset (*Eupatorium perfoliatum*), slender false fox glove (*Gerardia tenuifolia*), horsetail (*Equisetum hyemale*) and great blue lobelia (*Lobelia siphilitica*). The bottom of this quarry is frequented by ATV's/motor bikes which have significantly adversely affected these wetlands on the quarry floor.

Management recommendations

If continued use of ATV's is to occur, high quality wetland areas should be roped or fenced off to protect this rare plant community. Another option if ATV traffic is not limited would be to obtain permission to remove these plants to another suitable location such as seepage areas associated with Spring Creek (5D1) or sedge meadow areas (4B8) or area along Spring Creek owned by the City of Muskego (4B/2C2).

2. Man made island (2D1), NW ¼ Section 26

- Number of plant species recorded 30 of which 24 were native species.
- Historic vegetation – not applicable.

Present vegetation – planted prairie

During the 1995-1996 draw down of Big Muskego Lake, islands were created from dredge spoils. Island Number 1 was seeded (1997) to prairie with additional prairie plugs installed in 1998, 1999, and 2000. Some areas have responded quite well to the seeding, while other areas of the island have non-native purple loosestrife (*Lythrum salicaria*) and Canada thistle (*Cirsium arvense*) problems. Native woody species of cottonwood (*Populus deltoides*) and sandbar willow (*Salix interior*) saplings have covered portions of the island. These can also become problematic if not controlled. Native prairie grass species observed were big bluestem (*Andropogon gerardii*), little bluestem (*Andropogon scoparius*), Indian grass (*Sorghastrum nutans*), and side oats grama (*Bouteloua curtipendula*). Native wet prairie and mesic prairie forbs observed were blue vervain (*Verbena hastata*), rough blazing star (*Liatris aspera*), false sunflower (*Heliopsis helianthoides*), tall goldenrod (*Solidago gigantea*), boneset (*Eupatorium perfoliatum*), black-eyed Susan (*Rudbeckia hirta*), grass-leaved goldenrod (*Solidago graminifolia*), cattail (*Typha sp.*), Canada tick trefoil (*Desmodium canadensis*), purple coneflower (*Echinacea purpurea*), New England aster (*Aster novae-angliae*), showy goldenrod (*Solidago speciosa*), dogbane (*Apocynum sp.*) and large-flowered beard tongue (*Penstemon grandiflorus*). Non-native species were also present. These included Kentucky blue grass (*Poa pratensis*), Canada blue grass (*Poa compressa*), sow thistle (*Sonchus sp.*) and birds foot trefoil (*Lotus corniculatus*).

Management recommendations

Eradication of non-native Canada thistle (*Cirsium arvense*) and purple loosestrife (*Lythrum salicaria*) by herbicide application is recommended. Prescribed burning of the island should also be initiated. Burning should occur annually for the first three years and then perhaps every third or fourth year. Portions of the island should remain unburned because of the initial patchy fuel loads. These unburned areas should provide adequate wildlife cover.

3. Man made island #2 (2D2), SW ¼, Section 27

- Number of plant species recorded 33, of which 25 were native species.
- Historic vegetation – not applicable.

Present vegetation - planted mesic prairie

This island was also created with dredge spoil piles in Big Muskego Lake and planted to prairie. Native prairie and wetland species observed included Indian grass (*Sorghastrum nutans*), Canada tick trefoil (*Desmodium canadense*), hairy aster (*Aster pilosus*), partridge pea (*Cassia fasciculata*), side oats grama (*Bouteloua curtipendula*), switch grass (*Panicum virgatum*), New England aster (*Aster novae-angliae*), grass-leaved goldenrod (*Solidago graminifolia*), little bluestem (*Andropogon scoparius*), purple coneflower, showy goldenrod, Culver's root (*Veronicastrum virginicum*), hard stem bulrush (*Scirpus acutus*), Canada wild rye (*Elymus canadense*), paniced aster (*Aster simplex*), stiff goldenrod (*Solidago rigida*), marsh milkweed (*Asclepias incarnata*), red stem aster (*Aster puniceus*), soft stem bulrush, hoary vervain (*Verbena stricta*), white indigo (*Baptisia leucantha*) and prairie dock (*Silphium terebinthinaceum*). Non-native problematic species such as Canada thistle (*Cirsium arvense*), white and yellow sweet clovers (*Melilotus alba*, *Melilotus officinalis*) were present as well as other non-natives.

Management recommendations

Eradication of non-native Canada thistle (*Cirsium arvense*) and purple loosestrife (*Lythrum salicaria*) by herbicide application is recommended. Prescribed burning of the island should also be initiated. Burning should occur annually for the first three years and then perhaps every third or fourth year. Control of sweet clovers through burning has also been successful. Since these are biannual species an early spring burn followed by a late spring burn the following year is recommended.

4. Luther Parker Cemetery (2D3), NE ¼ Section 25

- Number of plant species recorded 16, of which 12 were native species.
- Historic vegetation – mesic prairie.

Present vegetation - planted mesic prairie

The Luther Parker Cemetery has small native prairie remnant that has persisted in the cemetery. It has been noted by others that over 60 native species have been recorded for this site. For its small size, it has a moderate diversity of native prairie species such as big bluestem (*Andropogon gerardii*), yellow coneflower (*Ratibida pinnata*), Canada tick trefoil (*Desmodium canadense*), prairie dock (*Silphium terebinthinaceum*), rosin weed (*Silphium integrifolium*), wild indigo (*Baptisia sp.*), golden Alexanders (*Zizia aurea*), black-eyed Susan (*Rudbeckia hirta*), stiff goldenrod (*Solidago rigida*), culvers root (*Veronicastrum virginicum*), blue-eyed grass (*Sisyrinchium albidum*) and shooting star (*Dodecatheon meadia*). Because of the location within an old cemetery, non-native species which were planted around the grave sites have become problematic such as spurge (*Euphorbia sp.*), day lily (*Hemerocallis sp.*), lily of the valley (*Convallaria majalis*), and blue grass (*Poa pratensis*).

Management recommendations

Prescribed burning of this small remnant would be the most important management tool. Burning half the site every year or every third year is recommended. The invasion by non-native species which were planted as part of individual grave sites should be controlled in areas where they have spread beyond the original grave site. Herbicide application using Roundup (1-3% solution) should control most species. Respect for these non-natives within the grave site proper may want to be considered. Of the prairie areas observed within the City of Muskego this is the only remnant observed. Historically, this cemetery and native prairie component should be important to City of Muskego residents.

5. Young upland woods (3B1), SW ¼ Section 5
Young woods at top of ridge in the subdivision off Tans Road and next to County Y.
- Number of plant species recorded 10-15, of which 3 are native species.
 - Historic vegetation – oak savanna.

Present vegetation

Young growth of elms (*Ulmus sp.*) and walnut (*Juglans nigra*) in an old field/pasture dominated by non-native cool season grasses, such as Kentucky blue grass (*Poa pratensis*), brome grass (*Bromus inermis*), and fescue (*Festuca elatior*). Scattered individuals of sweet clover (*Melilotus sp.*), fleabane (*Erigeron sp.*), chickory (*Cichorium intybus*), and thistles (*Cirsium sp.*) were observed. Most larger trees have been removed and the old field/pasture has been grazed and fallow for many years.

Management recommendations

Area could be restored to prairie or meadows. Substantial brushing, herbiciding and prescribed burning would be required. Steep slope areas associated with Racine Avenue construction which abuts this area could also be restored to prairie.

6. Young woods/old field Section 5 (3B2), NE ¼ Section 5
- Number of plant species recorded 15, of which 10 are native species.
 - Historic vegetation, wet woods/prairie.

Present vegetation

This young woods had been previously scraped as part of the sand and gravel operation to the immediate west. The dominant tree is elm (*Ulmus americana*) with a variety of living and dying young stems. There is a dense shrub layer over most of this area. Typical native shrubs include gray dogwood (*Cornus racemosa*), boxelder (*Acer negundo*), sumac (*Rhus glabra*), Juniper (*Juniperus virginiana*), and ash (*Fraxinus sp.*). Non-native shrubs of European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera sp.*) were dense in areas. Portions of this area contain native old field vegetation such as Canada goldenrod (*Solidago canadensis*), poison ivy (*Rhus radicans*), bergamot (*Monarda fistulosa*) and brambles (*Rubus allegheniensis*), interspersed within the non-native cool season pasture grass, Timothy (*Phleum pratense*).

7. Young woods Section 5 (3B3), NE ¼ Section 5
- Number of plant species recorded 41, of which 22 are native species.
 - Historic vegetation, wet woods/prairie.

Present vegetation

Young woods dominated by cottonwood (*Populus deltoides*), willow shrubs, Chinese elm (*Ulmus pumila*), box elder (*Acer negundo*), sandbar willow (*Salix interior*), European buckthorn (*Rhamnus cathartica*), silky dogwood (*Cornus amomum*), elms (*Ulmus sp.*) and smooth sumac (*Rhus glabra*). This woods has also been scraped as in 3B2. A number of non-native and native old field species are also found. Natives include bergamot (*Monarda fistulosa*), wild grape (*Vitis riparia*), Canada goldenrod (*Solidago graminifolia*), white avens (*Geum canadense*), tall bellflower (*Campanula americana*), hairy aster (*Aster pilosus*), New England aster (*Aster novae-angliae*), heal-all (*Prunella vulgaris*), strawberry (*Fragaria virginiana*), arrowleaf aster (*Aster sagittifolius*), black raspberry (*Rubus occidentalis*), yellow coneflower (*Ratibida pinnata*), tall goldenrod (*Solidago gigantea*), grass-leaved goldenrod (*Solidago graminifolia*) and woolly sedge (*Carex lanuginosa*). Non-native species observed included common mullein (*Verbascum*

thapsus), chickory (*Cichorium intybus*), sweet clovers (*Melilotus alba*, *Melilotus officinalis*), Kentucky blue grass (*Poa pratensis*), Canada blue grass (*Poa compressa*), nodding thistle (*Carduus nutans*), yarrow (*Achillea millefolium*), multiflora rose (*Rosa multiflora*), European brome (*Bromus inermis*), fescue (*Festuca elatior*), reed canary grass (*Phalaris arundinacea*), ox-eyed daisy (*Chrysanthemum leucanthemum*) and sulfer cinquefoil (*Potentilla recta*).

8. Wooded/scrub shrub area along trail Section 17 (3B4), SW ¼ Section 17

- Number of plant species recorded 31, of which 18 were native species.
- Historic vegetation, unknown.

Present vegetation

Consists of dense wooded areas on both sides of trail. Typical native woody species include gray dogwood (*Cornus racemosa*), box elder (*Acer negundo*), elm (*Ulmus americana*), juniper (*Juniperus virginiana crebra*), and arrow-wood (*Viburnum sp.*). Non-native woody species of multiflora rose (*Rosa multiflora*), European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*) at times created an impenetrable thicket so dense one cannot see beyond a few feet off the trail. A number of native and non-native herbaceous species are found associated with the trail and surrounding land. These include natives such as flowering spurge (*Euphorbia corollata*), horsetail (*Equisetum arvense*), poison ivy (*Rhus radicans*), wild grape (*Vitis riparia*), bergamot (*Monarda fistulosa*), Canada goldenrod (*Solidago canadensis*), woolly sedge (*Carex lanuginosa*), white avens (*Geum canadense*), common milkweed (*Asclepias syriaca*), thimble weed (*Anemone cylindrica*), New England aster (*Aster novae-angliae*), water heartsease (*Polygonum amphibium*) and arrow-leaved aster (*Aster sagittifolius*). Non-natives included sulfur cinquefoil (*Potentilla recta*), poison parsnip (*Pastinaca sativa*), white sweet clover (*Melilotus alba*), asparagus (*Asparagus officinalis*), Queen Anne's lace (*Daucus carota*), brome grass (*Bromus inermis*), reed canary grass (*Phalaris arundinacea*) and yarrow (*Achillea millefolium*).

Management recommendations

Significant cutting and herbiciding of shrubs will be required to open views to surrounding lands.

9. Young woods Sections 17-18, along trail (3B5), SE ¼ Section 18

- Number of plant species recorded 9, of which 5 were native species.
- Historic vegetation, unknown.

Present vegetation - young woods shrub/scrub

A dense growth of young trees and shrubs has grown up along the trail. This impenetrable thicket obscures views into surrounding lands. Typical species include honeysuckle (*Lonicera sp.*), European buckthorn (*Rhamnus cathartica*), box elder (*Acer negundo*), elms (*Ulmus sp.*), green ash (*Fraxinus pennsylvanica*), gray dogwood (*Cornus racemosa*), wild grape (*Vitis riparia*) and high bush cranberry (*Viburnum opulus*).

Management recommendations

Significant cutting and herbiciding non-native shrubs of honeysuckle (*Lonicera spp.*) and buckthorn (*Rhamnus cathartica*) would greatly increase visibility to surrounding lands. Improvement of aesthetics and safety would result.

10. Young woods (3B6), SE ¼ Section 17
- Number of plant species recorded 6, of which all were native species.
 - Historic vegetation, oak woods.

Present vegetation

Young, disturbed woodland consisting of many young elms (*Ulmus sp.*), some cottonwood (*Populus deltoides*), ash (*Fraxinus sp.*), spruce (*Picea sp.*), cherry (*Prunus sp.*) and box elder (*Acer negundo*).

Management recommendations

Historic aerial photographs suggest there was once an oak (*Quercus sp.*) woodland that had been grazed. Significant modification of this area through subdivision development and creation of ponds has altered this area. Significant effort would be required to restore to oak (*Quercus sp.*) woodland.

11. Box elder (*Acer negundo*)/elm woods (3B7), North ½ Section 14
- Number of plant species recorded 4, of which 2 were native species.
 - Historic vegetation, wet woods.

Present vegetation

Young woods of native elm (*Ulmus americana*) and box elder (*Acer negundo*) with an understory dominated by non-native European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*). Disturbed woods with shade suppressed ground cover.

Management recommendations

Removal of non-native shrubs by cutting and herbiciding is recommended. Assess recovery of native ground cover component.

12. Young woods near Manchester Hill and park area (3B8), SW ¼ Section 10
- Number of plant species recorded 21, of which 18 were native species.
 - Historic vegetation – sedge meadow.

Present vegetation

Young disturbed woods surrounding a cattail (*Typha sp.*) marsh. Native species of box elder (*Acer negundo*), black walnut (*Juglans nigra*), and green ash (*Fraxinus sp.*) were the dominant tree canopy species. The sub-canopy was comprised of non-native honeysuckle (*Lonicera spp.*), European buckthorn (*Rhamnus cathartica*) and multiflora rose (*Rosa multiflora*), and native shrubs of prickly ash (*Fraxinus sp.*), elderberry (*Sambucus canadensis*), quaking aspen (*Populus tremuloides*), smooth sumac (*Rhus glabra*), nannyberry (*Viburnum lentago*), choke cherry (*Prunus sp.*) and sandbar willow (*Salix sp.*). The ground cover component was comprised of natives such as black raspberry (*Rubus occidentalis*), white avens (*Geum canadense*), wood sorrel (*Oxalis stricta*), woodbine (*Parthenocissus quinquefolia*), Enchanter's night shade (*Circaea quadrisculata*), false Solomon's seal (*Smilacina racemosa*), Solomon's seal (*Polygonatum biflorum*) and wild yam (*Dioscorea villosa*).

Management recommendations

Removal of non-native shrubs of honeysuckle (*Lonicera spp.*), buckthorn (*Rhamnus cathartica*) and multiflora rose (*Rosa multiflora*) through cutting and herbiciding is recommended. Increase in light will stimulate native ground cover component. Limited prescribed burning may be implemented.

13. Recently developed wet woods/cattail (3B/4C1), NW ¼ Section 10
- Number of plant species recorded 5, of which 4 were native species.
 - Historic vegetation – cattail (*Typha sp.*) marsh/sedge meadow.

Present vegetation

Early successional wet woods consisting of green ash (*Fraxinus sp.*), willow (*Salix sp.*), cottonwood (*Populus deltoides*) and box elder (*Acer negundo*) with patches of reed canary grass (*Phalaris arundinacea*) and cattail (*Typha sp.*).

14. Peninsula Little Muskego Lake (3B/4C2), NW ¼ Section 9
- Number of plant species recorded 11, of which 6 were native species.
 - Historic vegetation – wet woods.

Present vegetation

Most of the Peninsula has been modified for residential use through construction of residential lawn and associated landscaping. A few native species were observed along the shoreline as well as a small cattail (*Typha sp.*) area.

15. Wet woods (3B/4F1), NW ¼ Section 16
- Number of plant species recorded 14, of which 9 were native species.
 - Historic vegetation – wet woods.

Present vegetation

Wet/mesic woods. A ditch running east-west through the south portion of this wet woods has dewatered the area, which in part has resulted in degradation of the wet woods. Typical native tree species observed were cottonwood (*Populus deltoides*), ash (*Fraxinus sp.*), basswood (*Tilia americana*), black cherry (*Prunus sp.*), bitternut hickory (*Carya ovata*), black maple (*Acer nigrum*) and an occasional butternut (*Juglans cinerea*). In areas of ponding, the dominant trees were black willow (*Salix sp.*), green ash (*Fraxinus sp.*) and cottonwood (*Populus deltoides*). Where dewatering has occurred, non-native shrubs of European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*) have invaded and shade suppressed the native ground cover component.

Management recommendations

Investigate the potential for restoring the hydrological regime. In addition, cutting and herbiciding of non-native honeysuckle (*Lonicera spp.*) and buckthorn (*Rhamnus cathartica*) will increase light to the ground story and benefit native seed bank constituents. Removal of these non-natives may also allow for water table to rebound, increasing some of the previous ditching hydrological regime. Limited prescribed burning may be beneficial in portions of this woods.

16. Oak woods on east side of Spring Creek (3C1), SW ¼ Section 5
- Number of plant species recorded 62, of which 34 were native species.
 - Historic vegetation – oak savanna/woodland.

Present vegetation – oak/black walnut woods

Dominated by oak (*Quercus spp.*), and walnut (*Juglans nigra*) with some basswood (*Tilia americana*). Sugar maple (*Acer saccharum*), elms (*Ulmus spp.*) and European buckthorn (*Rhamnus cathartica*) dominate the shrub/sapling layer. A portion of this ridge consisted of old field, and/or pasture areas that have become over grown in the past 15 to 20 years.

Ground cover vegetation was sparse, except in larger light gaps. Typical ground cover species were thimbleweed (*Anemone virginiana*), woodbine (*Parthenocissus quinquefolia*), sedges (*Carex spp.*), false Solomon's seal (*Smilacina racemosa*), Carrion flower (*Smilax herbacea*), Jack-in-the-pulpit (*Arisaema triphyllum*), white avens (*Geum canadense*), enchanters night shade (*Circaea quadrisculata*), calico aster (*Aster lateriflorus*), may apple (*Podophyllum peltatum*), poison ivy (*Rhus radicans*), lady fern (*Athyrium filix-femina*) and yellow honeysuckle (*Lonicera prolifera*).

The old field area was overgrown with shrubs and saplings of European buckthorn (*Rhamnus cathartica*), honeysuckle (*Lonicera spp.*), black cherry (*Prunus serotina*), hawthorn (*Crataegus spp.*), prickly ash (*Xanthoxylum americanum*) and smooth sumac (*Rhus glabra*). The ground cover consisted of both native and non-native herbaceous and weedy species. Non-native species included Queen Anne's lace (*Daucus carota*), red clover (*Trifolium pratense*), white sweet clover (*Melilotus alba*), yarrow (*Achillea millefolium*), Kentucky blue grass (*Poa pratensis*), fescue grass (*Festuca elatior*) and butter and eggs (*Linaria vulgaris*).

Native species found included wild grape (*Vitis riparia*), Canada goldenrod (*Solidago canadensis*), arrow-leaf aster (*Aster sagittifolius*), bergamot (*Monarda fistulosa*), black-eyed Susan (*Rudbeckia hirta*) and frost aster (*Aster pilosus*).

In the absence of natural fire, invasion by native and non-native trees and shrubs have shade suppressed native ground cover. This leads to soil erosion and loss of native seedbank, making restoration more labor intensive and costly. Portions of this woodland were also probably grazed in the past.

Management recommendations

Reduce woody sub-canopy to reduce shade suppression and reintroduce periodic fire to the area.

17. Oak woods (3C2), SW ¼ Section 6

- Number of plant species recorded 18, of which 13 were native species.
- Historic vegetation – oak (*Quercus sp.*) woods/savanna.

Present vegetation – oak woods

Scattered throughout this woods are large native red and white oak (*Quercus rubra*, *Quercus alba*). Selective logging of this woods some 25 or so years ago was evident. The lack of periodic fire has resulted in the invasion of the sub-canopy with non-native and native small trees and shrubs. Non-native honeysuckle (*Lonicera sp.*) and European buckthorn (*Rhamnus cathartica*), gooseberry (*Ribes missouriense*) and European high bush cranberry (*Viburnum opulus*) were observed. Native small trees and shrubs included sugar/black maple (*Acer saccharum/nigrum*), quaking aspen (*Populus tremuloides*), choke cherry (*Prunus virginiana*), gray dogwood (*Cornus racemosa*), hop hornbeam (*Ostrya virginiana*), prickly ash (*Xanthoxylum americanum*), and white ash (*Fraxinus americana*). Ground cover was generally sparse and found in light gaps. Typical native species observed were Pennsylvania sedge (*Carex pennsylvanica*), may apple (*Podophyllum peltatum*), white avens (*Geum canadense*) and Enchanter's nightshade (*Circaea quadrisculata*). Limited oak (*Quercus sp.*) regeneration (seedlings) were found. Without active management, this area will move successional towards a maple woods.

Management recommendations

Introduce prescribed burning on a 1 to 3 year rotational basis to reduce sub-canopy density and to increase light. Limited cutting and herbiciding of non-native shrubs will also be required.

18. Oak woods Section 7 (3C3) NW ¼ Section 7

- Number of plant species recorded 7, of which 5 were native species.
- Historic vegetation – oak (*Quercus sp.*)/hickory woods.

Present vegetation

Consists of oak (*Quercus spp.*), shagbark hickory (*Carya ovata*) with some basswood (*Tilia americana*), black cherry (*Prunus serotina*) and black walnut (*Juglans nigra*). Non-native shrubs of European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera sp.*) were observed.

Management recommendations

Introduce prescribed burning on a 1 to 3 year rotational basis. Additional removal of non-native shrubs through cutting and herbiciding may be necessary.

19. Oak woods Section 7 (3C4), NE ¼ Section 7

- Number of plant species recorded 3, all of which were native species.
- Historic vegetation – oak/hickory woods.

Present vegetation

This area consists of an oak (*Quercus sp.*), walnut (*Juglans nigra*) and bitternut hickory (*Carya ovata*) woods. Evidence that most of this wooded area had been grazed/pastured in the past.

Management recommendations

Introduce prescribed burning on a 1 to 3 year rotational basis.

20. Muskego County Park oak woods (3C5), NW ¼ Section 17

- Number of plant species recorded ~200, of which 185+ are native species (Appendix 6).
- Historic vegetation – oak-hickory woods.

Present vegetation

This woodland complex is composed of an oak-hickory (*Carya ovata*) component (north), mesic forest (south) and low forest along the east woodland boundary adjacent to marsh areas (see map). These woodlands have a diverse assemblage of plant species (Appendix 6). This woodland is unique in that species such as blue ash (*Fraxinus quadrangulata*) and Kentucky coffee tree (*Gymnocladus dioica*), found in this woods are quite rare in Wisconsin woodlands. This woods has been studied intensely by others and thus little effort was spent here. This woodland community is the highest quality woodland area remaining in Muskego. Management activities in other woodland communities should strive to achieve a semblance of this wooded community as it currently exists.

Management recommendations

Periodic burning of the oak-hickory (*Carya ovata*) portion of the woods is recommended. This should occur early in the spring prior to emergence of spring flora. Existing trail(s)

could be used as fire breaks. Historically, mesic woods areas typically had a lower fire frequency than the oak-hickory (*Carya ovata*) complexes in the region. Very limited prescribed burning should be employed in the mesic woods. If burning is to occur it may have to be performed in autumn after leaf fall. Control of non-native shrubs such as buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*) could be accomplished by brushing and wick application of Garlon 4 to cut stumps. This should occur in the dormant season. The low woods section should be assessed for the presence and density of reed canary grass (*Phalaris arundinacea*) and buckthorn (*Rhamnus cathartica*), two non-native species that can quickly invade this plant community. The most effective control methods for these two species is cutting and herbiciding buckthorn (*Rhamnus cathartica*) and herbiciding reed canary grass (*Phalaris arundinacea*).

21. Oak woods (3C6), eastern ½ Section 20

- Number of plant species recorded 10, of which 8 are native species.
- Historic vegetation – white/bur oak savanna.

Present vegetation white/bur oak woodland

In the past 40 to 50 years this woods has gone from an open grown savanna with scattered white and bur oak (*Quercus alba* and *Quercus macrocarpa*) to a woodland containing young shagbark hickory (*Carya ovata*), black cherry (*Prunus serotina*), hawthorn (*Crataegus sp.*), prickly ash (*Xanthoxylum americanum*), white ash (*Fraxinus americana*) and ironwood (*Ostrya virginiana*). Scattered European buckthorn (*Rhamnus cathartica*) has begun to invade the sub-canopy. In addition, a non-native herbaceous species, garlic mustard (*Alliaria petiolata*), was also recorded at this site.

Management recommendations

Initiate a prescribed burn regime to control both native and non-native shrub numbers. Control of garlic mustard (*Alliaria petiolata*) through burning has been successful if burning occurs in fall or early spring (prior to emergent native wild flowers). Herbicide control of garlic mustard (*Alliaria petiolata*) in early spring or late fall when native species have gone dormant is also recommended if burning is not successful.

22. Degraded oak woods Denoon Park (3C7), NE ¼ Section 31

- Number of plant species recorded 26, of which 23 were native species (Appendix 1, Table 9).
- Historic vegetation – oak woods.

Present vegetation

This red oak /white oak woods (*Quercus rubra*, *Quercus alba*) is situated on a hill overlooking Lake Denoon. Serious deterioration of the health of this woods has occurred over the past 40 years. The lower reaches of the woods near the lake have been invaded by the non-native white poplar (*Populus alba*). This species was originally introduced from EurAsia as a shade and ornamental tree. This species produces large vegetative colonies through root suckering and are hard to eradicate. The upper portions of this oak (*Quercus sp.*) woods has been invaded by dense growths of European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*). Only the most shade tolerant weedy species were observed in the understory.

Management recommendations

This site will require an extensive input of labor and money to restore. Manual removal of non-native shrubs and trees through cutting and herbiciding will be required. This will

involve significant labor. The next step would be to reseed these areas with a native woodland mix, since it is believed a significant portion of the seedbank is gone. When fuel loads are sufficient an intensive (yearly) prescribed burn regime will also be required.

23. Oak woods (3C8), Western ½ Section 3

- Number of plant species recorded 25, of which 19 were native species.
- Historic vegetation – oak savanna/woods.

Present vegetation

Oak/hickory woods with scattered black walnut (*Juglans nigra*). Native woody species observed included white oak (*Quercus sp.*), shag bark hickory (*Carya ovata*), black walnut (*Juglans nigra*), basswood (*Tilia americana*), red oak (*Quercus sp.*), white ash (*Fraxinus sp.*), prickly ash (*Fraxinus sp.*), gray dogwood (*Cornus racemosa*), ironwood (*Ostrya virginiana*), red maple (*Acer rubrum*), woodbine (*Parthenocissus quinquefolia*), wild grape (*Vitis riparia*), and choke cherry (*Prunus virginiana*). Non-native woody species included black locust (*Robinia pseudoacacia*), European buckthorn (*Rhamnus cathartica*), hawthorn (*Crataegus sp.*), honeysuckles (*Lonicera spp.*) and Chinese elm (*Ulmus pumila*). Native herbaceous species included Pennsylvania sedge (*Carex pensylvanica*), false Solomon's seal (*Smilacina racemosa*), bottlebrush grass (*Hystrix patula*), American bellwort (*Campanula americana*), Jack-in-the-pulpit (*Arisaema triphyllum*), brambles (*Rubus occidentalis*) and white avens (*Geum canadense*). Because of the size of this woodland it is believed a more significant native plant species component can be found in this woodland complex.

Management recommendations

Introduce prescribed burning on a 1 to 3 year rotational basis.

24. Oak-hickory woods (3C9), SW ¼ Section 3

- Number of plant species recorded 18, of which 17 were native species.
- Historic vegetation – oak savanna.

Present vegetation

Oak (*Quercus sp.*) woods with scattered wet woods. A portion of this woodland has been recently subdivided with houses under construction. Upland oak (*Quercus sp.*) woods contain native bur oak (*Quercus macrocarpa*) and white oaks (*Quercus alba*) and shagbark hickory (*Carya ovata*), with sugar maple (*Acer saccharum*) saplings and basswood (*Tilia americana*), black cherry (*Prunus serotina*) and non-native honeysuckle (*Lonicera spp.*) understory. Native ground vegetation observed included false Solomon's seal (*Smilacina racemosa*), woodbine (*Parthenocissus quinquefolia*), Columbine (*Aquilegia canadensis*), Enchanter's nightshade (*Circaea quadrisculata*), agrimony (*Agrimonia gryposepala*), white avens (*Geum canadense*), Pennsylvania sedge (*Carex pensylvanica*) and other sedges (*Carex spp.*). Wet wood areas were dominated by elms (*Ulmus sp.*) with fowl manna grass (*Glyceria striata*) and wild grape (*Vitis riparia*) as ground vegetation components.

Management recommendations

Initiate a limited prescribed burn plan. Closeness to residential homes/lots may make burning problematic without prior homeowners education to burning, etc. Increasing light to historic wet woods areas should increase ground cover component.

25. Oak /hickory woods Bluhm Park (3C10), SW ¼ Section 12
- Number of plant species recorded 42, of which 34 were native species (Appendix 1, Table 13).
 - Historic vegetation – oak savanna.

Present vegetation

Oak/hickory woods. Large open grown white oaks (*Quercus sp.*) are present throughout this wooded area, with scattered red oak (*Quercus sp.*), shagbark hickory (*Carya ovata*) and white ash (*Fraxinus sp.*). Heavy shade suppression from native and non-native shrubs limits ground species growth. These included native shrubs of black currant (*Ribes americanum*), black cherry (*Prunus sp.*) and choke cherry (*Prunus sp.*). Non-native shrubs included European buckthorn (*Rhamnus cathartica*) and high bush cranberry (*Viburnum opulus*). Along trails and light gaps were found a moderate diversity of native woodland herbaceous and woody species. These included wild grape (*Vitis riparia*), Enchanter's nightshade (*Circaea quadrisculata*), Pennsylvania sedge (*Carex pennsylvanica*), false Solomon's seal (*Smilacina racemosa*), wild strawberry (*Fragaria virginiana*), sedge species (*Carex sp.*), wild geranium (*Geranium maculatum*), common cinquefoil (*Potentilla simplex*), agrimony (*Agrimonia gryposepala*), calico aster (*Aster lateriflorus*), and poison ivy (*Rhus radicans*). Portions of this woodland could provide a demonstration area for the restoration of these degraded woodlands.

Management recommendations

Manual removal of buckthorn (*Rhamnus cathartica*) and selected native shrubs by cutting and herbiciding. Initiate three years of annual burns. Assess response to native seedbank (which is believed to be present) as to whether reseeding of native woodland species is required.

26. Maple/basswood area north of City of Muskego Building (3C11), NW ¼ Section 16
- Number of plant species recorded 30, of which 25 were native species (Appendix 1, Table 10).
 - Historic vegetation – Oak /hickory woods.

Present vegetation

Black maple (*Acer nigrum*) woods with scattered white ash (*Fraxinus sp.*), hickory (*Carya ovata*) and basswood (*Tilia americana*). Many small saplings of maple as well as choke cherry (*Prunus sp.*) and ironwood (*Ostrya virginiana*). Some non-native honeysuckle (*Lonicera spp.*) shrubs present. Moderate ground cover vegetation with wild grape (*Vitis riparia*), Jack-in-the-pulpit (*Arisaema triphyllum*), Pennsylvania sedge (*Carex pennsylvanica*), black snake root (*Sanicula gregaria*), false Solomon's seal (*Smilacina racemosa*), may apple (*Podophyllum peltatum*) and Enchanter's night shade (*Circaea quadrisculata*).

Management recommendations

Selective cutting and herbiciding of honeysuckle (*Lonicera spp.*). Attempt a spring burn to remove smaller saplings and shrubs.

27. Maple/hickory woods City of Muskego woods (3C12), NW ¼ Section 16
- Number of plant species recorded 35, of which 29 were native species (Appendix 1, Table 11).
 - Historic vegetation – oak/hickory woods.

Present vegetation

Maple/hickory woods with scattered ash (*Fraxinus sp.*) and basswood (*Tilia americana*) and bitternut hickory (*Carya ovata*). This portion of the woods is severely degraded with invasion by both European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*) as well as hawthorn (*Crataegus sp.*). Some native ground cover component remains such as sedges (*Carex spp.*), Jack-in-the-pulpit (*Arisaema triphyllum*), Calico aster (*Aster lateriflorus*), curly styled wood sedge (*Carex rosea*), hairy wood sedge (*Carex hirtifolia*), woodbine (*Parthenocissus quinquefolia*), and may apple (*Podophyllum peltatum*) were found.

Management recommendations

Introduce prescribed burning on a 1 to 3 year rotational basis. Removal of European buckthorn (*Rhamnus cathartica*), honeysuckle (*Lonicera spp.*) and some hawthorn (*Crataegus sp.*) by cutting and herbiciding.

28. Oak woods (3C13), NW ¼ Section 34

- Number of plant species recorded 6, of which 5 are native species.
- Historic vegetation – oak savanna.

Present vegetation

Degraded red and white oak (*Quercus sp.*) woods with scattered hickory (*Carya ovata*) and non-native European buckthorn (*Rhamnus cathartica*). Many basswood (*Tilia americana*) saplings and small trees are found throughout this woods. Calico aster (*Aster lateriflorus*) was a native herbaceous species observed which typically is associated with degraded woodlands.

Management recommendations

Initiate prescribed burning in portions of this woods.

29. Oak /hickory woods (3C14), Western ½ Section 35

- Number of plant species recorded 12, of which 11 were native species.
- Historic vegetation – oak savanna.

Present vegetation

Degraded white and red oak (*Quercus rubra*)/shagbark hickory (*Carya ovata*) woods with basswood (*Tilia americana*) and scattered European buckthorn (*Rhamnus cathartica*), cherry (*Prunus sp.*), hawthorn (*Crataegus sp.*) and gray dogwood (*Cornus racemosa*) in sub-canopy. Trembling aspen (*Populus tremuloides*) was found at the periphery of the woods. Portions of the site appeared to be heavily grazed in the past. Ground cover species observed included white avens (*Geum canadense*), calico aster (*Aster lateriflorus*) and Canada goldenrod (*Solidago canadensis*).

Management recommendations

Introduce prescribed burning on a 1 to 3 year rotational basis.

30. Oak /hickory woods golf course (3C15), SE ¼ Section 26

- Number of plant species recorded 9, of which 8 were native species.
- Historic vegetation – oak savanna.

Present vegetation

Bur oak/shagbark hickory (*Carya ovata*) woods. Trees present were bur oak (*Quercus*

macrocarpa), shag bark hickory (*Carya ovata*), white ash (*Fraxinus sp.*), red oak (*Quercus sp.*), quaking aspen (*Populus tremuloides*) and white oak (*Quercus sp.*). The non-Native European buckthorn (*Rhamnus cathartica*) dominates the sub-canopy along with scattered native hawthorn (*Crataegus sp.*). The native shrub, American hazelnut (*Corylus americana*) was observed also.

Management recommendations

Introduce prescribed burning on a 1 to 3 year rotational basis. Cutting and herbiciding of larger buckthorns is recommended as burning may not be as effective.

31. Holz Island oak woods (3C16), NE ¼ Section 9

- Number of plant species recorded 42, of which 28 were native species.
- Historic vegetation – oak woods.

Present vegetation – degraded oak woods

This small wooded island has a moderate and relatively diverse flora. Numerous species of trees and shrubs, both native and non-native were found on the island. Native species include basswood (*Tilia americana*), black haw (*Viburnum prunifolium*), wild black currant (*Ribes americanum*), red and white oaks (*Quercus sp.*), choke cherry (*Prunus virginiana*), gray dogwood (*Cornus racemosa*), shagbark hickory (*Carya ovata*), willows (*Salix sp.*), prickly ash (*Fraxinus sp.*), smooth sumac (*Rhus glabra*), bur oak (*Quercus sp.*), cottonwood (*Populus deltoides*), black cherry (*Prunus sp.*) and elm (*Ulmus americana*). Non-native trees and shrubs include honeysuckle (*Lonicera spp.*), arrow wood (*Viburnum dentatum*), high bush cranberry (*Viburnum opulus*), European buckthorn (*Rhamnus cathartica*), barberry (*Berberis thunbergii*), hawthorn (*Crataegus sp.*), black locust (*Robinia pseudoacacia*), and Missouri gooseberry (*Ribes missouriense*). Woody vines of wild grape (*Vitis riparia*), bittersweet (*Celastrus scandens*), and green brier (*Smilax sp.*) were also present. A native ground cover flora of both woodland and prairie species were also observed. These included calico aster (*Aster lateriflorus*), wild geranium (*Geranium maculatum*), bloodroot (*Sanguinaria canadensis*), false Solomon's seal (*Smilacina racemosa*), large-leaved aster (*Aster macrophyllus*), wild leek (*Allium tricoccum*), may apple (*Podophyllum peltatum*), wild sarsaparilla (*Aralia nudicaulis*), and starry campion (*Silene stellata*). In open areas, near slopes a few remnant prairie species, such as; bergamot (*Monarda fistulosa*) and lead plant (*Amorpha canescens*) were found. The non-native vine, crown vetch (*Coronilla varia*), had been seeded previously on slopes in an attempt to reduce erosion. This species has since become problematic within portions of the island.

Management recommendations

This site presents an unique opportunity to showcase a restoration effort. Removal of non-native woody species through cutting and herbiciding is recommended. Reseeding of seed (perhaps collected from existing plants) should occur as well as perhaps plant plugs. Control of crown vetch (*Coronilla varia*) through herbiciding will be necessary. Protection of slopes and island shorelines will need further assessment and perhaps use soil bioengineering techniques such as biologs, willow (*Salix sp.*) stakes and native plant plugs to stabilize the toe of slope as well as the slope proper. Installation of biologs and dogwood (*Cornus sp.*) cuttings previously has been performed. Assessment of the success of these techniques was not evaluated.

32. Marlan Meadow woods (3C17), SE ¼ Section 4
- Number of species 60, of which 51 were native species.
 - Historic vegetation – oak woods.

Present vegetation

Oak (*Quercus sp.*) woods with younger trees of ash (*Fraxinus sp.*), basswood (*Tilia americana*), and sugar/black maple (*Acer nigrum*). Past logging 40 to 50 years ago has removed some oaks (*Quercus sp.*) and allowed for establishment of younger, somewhat more shade tolerant tree species to dominate in smaller size classes. Non-native shrubs of European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*), while present, do not currently dominate in the sub-canopy. This is a moderately diverse woodland system containing several low wet depressions. The majority of the woods is comprised of medium sized to large scattered oaks (*Quercus sp.*) (red, white, bur), and younger growth trees of white ash (*Fraxinus sp.*), basswood (*Tilia americana*), box elder (*Acer negundo*), ironwood (*Ostrya virginiana*), sugar maple (*Acer saccharum*) and bitternut hickory (*Carya ovata*). Also in the sub-canopy were a number of shrub species such as high bush cranberry (*Viburnum opulus*), multiflora rose (*Rosa multiflora*), Missouri gooseberry (*Ribes missouriense*), wild black cherry (*Prunus serotina*), gray dogwood (*Cornus racemosa*) and choke cherry (*Prunus sp.*). The ground cover vegetation was generally sparse, with sporadic individuals of Pennsylvania sedge (*Carex pensylvanica*), wild strawberry (*Fragaria virginiana*), sedges (*Carex spp.*), white avens (*Geum canadense*), bloodroot (*Sanguinaria canadensis*), yellow violet (*Viola pubescens*), stick seed (*Hackelia virginiana*), late figwort (*Scrophularia marilandica*), common cinquefoil (*Potentilla simplex*), calico aster (*Aster lateriflorus*), white snake root (*Eupatorium rugosum*), arrow-leaved aster (*Aster sagittifolius*), Jack-in-the pulpit (*Arisaema triphyllum*), wild geranium (*Geranium maculatum*), path rush (*Juncus tenuis*), elm-leaved goldenrod (*Solidago ulmifolia*), thin grass (*Agrostis perennans*), bittersweet night shade (*Solanum dulcamara*), poison ivy (*Rhus radicans*), burdock (*Arctium minus*), St. John's wort (*Hypericum sp.*), common wood sedge (*Carex blanda*), curly styled wood sedge (*Carex rosea*), greenbrier (*Smilax sp.*), Enchanter's night shade (*Circaea quadrisculata*), Drummond's aster (*Aster drummondii*), false Solomon seal (*Smilacina racemosa*) and garlic mustard (*Alliaria petiolata*). Garlic mustard (*Alliaria petiolata*) a non-native very aggressive invader of oak (*Quercus sp.*) woods was observed along wood edges. This species could become a significant problem in the future. Early control would be effective.

Management recommendations

This site should be placed on a limited burn regime (i.e., every 3 years) to assess response. The site is almost surrounded by residential development and burning without substantial homeowner evaluation may be problematic. With homeowner education and use of a well-trained burn crew, prescribed burning of this woodland can be performed safely. Control of garlic mustard (*Alliaria petiolata*) through herbicide application in early spring when native ground cover species are dormant should be attempted.

33. Orville Peters woods (3C18), SW ¼ Section 33
- Number of plant species recorded 69, of which 55 were native species (Appendix 1, Table 15).
 - Historic vegetation – oak savanna.

Present vegetation

This woodland area is one of the highest quality oak (*Quercus sp.*) woods areas in the City of Muskego. The historic open grown nature of many of the oaks (*Quercus sp.*) is still evident by low horizontal branching. Unfortunately, lack of management and invasion by non-native shrub species of European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*) has decreased the ecological health of this woods. A diverse assemblage of native ground cover species such as white avens (*Geum canadense*), yellow honeysuckle (*Lonicera spp.*), woodbine (*Parthenocissus quinquefolia*), agrimony (*Agrimonia gryposepala*), Pennsylvania sedge (*Carex pennsylvanica*), calico aster (*Aster lateriflorus*), bed straw (*Galium sp.*), strawberry (*Fragaria virginiana*), woodland thimbleweed (*Anemone virginiana*), sedges (*Carex spp.*), blood root (*Sanguinaria canadensis*), may apple (*Podophyllum peltatum*), Jack-in-the pulpit (*Arisaema triphyllum*), and figwort (*Scrophularia marilandica*) is present.

Management recommendations

Initiate a prescribed burn regime at 3-5 year intervals, with limited manual removal and herbiciding of cut stumps of non-native woody species.

34. Oak woods (3C19), SW ¼ Section 30

- Number of plant species recorded 6, of which 5 were native species.
- Historic vegetation – oak savanna/woodland.

Present vegetation

White and red oak (*Quercus sp.*) woods with shagbark hickory (*Carya ovata*). The understory contains numerous honeysuckle (*Lonicera spp.*), hawthorn (*Crataegus sp.*) and ash (*Fraxinus sp.*) shrubs and saplings leading to a shade suppressed ground cover.

35. Park Arthur woods (3C/3F1), NE ¼ Section 4

- Number of plant species recorded 40, of which 35 were native species (Appendix 1, Table 12).
- Historic vegetation – oak savanna.

Present vegetation

Oak (*Quercus sp.*)/maple woods. This woods contains large white oaks (*Quercus sp.*) and hickories with areas of dense buckthorn (*Rhamnus cathartica*) and dense sugar/black maple (*Acer nigrum*) saplings and scattered basswood (*Tilia americana*).

Management recommendations

Portions of this woods is moving successional towards a mesic maple woods. If desired as a community, limited restoration is required. Densely shaded areas have inhibited invasion by non-native shrubs. If portions of this woods are to be maintained as an oak (*Quercus sp.*) woods/savanna, then cutting and herbiciding of native and non-native woody species in conjunction with prescribed burning should be initiated.

36. Oak/walnut woods Shroeder property (3E1), SW ¼ Section 5

- Number of plant species recorded 62, of which 54 were native species (Appendix 1, Table 16).
- Historic vegetation – oak savanna/woods.

Present vegetation

The south end of a large acreage oak (*Quercus sp.*) woods. Portions of the southern unit have been developed with residential lots. Relatively large areas appear intact. The northern fingers of woods consist of black locust (*Robinia pseudoacacia*) in areas of higher light (i.e., roadside) with interspersed white ash (*Fraxinus americana*), elms (*Ulmus sp.*) and white oak (*Quercus sp.*). The more interior woods is dominated by oak (*Quercus sp.*), ash (*Fraxinus sp.*), and walnut (*Juglans nigra*) with some basswood (*Tilia americana*), sugar maple (*Acer saccharum*) and bur oak (*Quercus macrocarpa*). The more interior woods system is partially shade suppressed by shrubs such as prickly ash (*Xanthoxylum americanum*), gray dogwood (*Cornus racemosa*), and hawthorn (*Crataegus sp.*). Ground cover is moderate to high in some locations with native species such as Enchanter's nightshade (*Circaea quadrisculata*), wild grape (*Vitis riparia*), woodbine (*Parthenocissus quinquefolia*), false Solomon's seal (*Smilacina racemosa*), calico aster (*Aster lateriflorus*), white avens (*Geum canadense*), may apple (*Podophyllum peltatum*), Canada goldenrod (*Solidago canadensis*), agrimony (*Agrimonia gryposepala*), shooting star (*Dodecatheon meadia*), hairy wood sedge (*Carex hirtifolia*), horse gentian (*Triosteum perfoliatum*), red baneberry (*Actaea rubra*), elm-leaved goldenrod (*Solidago ulmifolia*), nodding trillium (*Trillium cernuum*), white lettuce (*Prenanthes alba*), wood anemone (*Anemone quinquefolia*), wild geranium (*Geranium maculatum*), sweet cicely (*Osmorhiza claytonii*), alum root (*Heuchera richardsonii*), columbine (*Aquilegia canadensis*), red trillium (*Trillium recurvatum*), pointed tick trefoil (*Desmodium glutinosum*), bloodroot (*Sanguinaria canadensis*) and starry campion (*Silene stellata*). This woodland has a high recuperative potential, because of the low density of non-native shrubs of European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*).

Management recommendations

Initiate a prescribed burn regime at approximately 3 year interval.

37. Oak/walnut/basswood (3E2), NW ¼ Section 3

- Number of plant species recorded 9, of which 6 were native species.
- Historic vegetation – oak woods.

Present vegetation

Bur oak (*Quercus macrocarpa*), basswood (*Tilia americana*), black walnut (*Juglans nigra*) and black locust (*Robinia pseudoacacia*) woods. Edge species observed were woodland sunflower (*Helianthus sp.*), Canada moonseed (*Menispermum canadense*), and wild grape (*Vitis riparia*).

Management recommendations

Initiate a prescribed burn regime at approximately 3 year interval.

38. Oak/walnut woods (3E3), W ½ Section 2

- Number of plant species recorded 7, all of which were native species.
- Historic vegetation – oak woods.

Present vegetation

Oak (*Quercus sp.*) woods with scattered ash (*Fraxinus sp.*), elm (*Ulmus americana*) and walnut (*Juglans nigra*). Sugar maple (*Acer saccharum*) and basswood (*Tilia americana*) density is increasing and dominates the sapling/sub-canopy. Gray dogwood (*Cornus racemosa*) also is found at the woodland edge. A new road bisects a portion of this

woods. This woodland is on a successional path to a more mesic sugar maple (*Acer saccharum*), basswood (*Tilia americana*) system.

Management recommendations

Initiate a prescribed burn regime at approximately 3 year intervals if a more open oak (*Quercus sp.*) woods is the preferred goal, otherwise this woods will gradually succeed to a maple community. There is also an ecologically acceptable course of action as long as non-native shrubs do not dominate.

39. Oak /walnut woods (3E4), SE ¼ Section 16

- Number of plant species recorded 8, of which 7 were native species.
- Historic vegetation – oak/walnut woods.

Present vegetation

Degraded oak (*Quercus sp.*)/walnut (*Juglans nigra*) woods with a dense understory of European buckthorn (*Rhamnus cathartica*) and native gray dogwood (*Cornus racemosa*). Trees observed were white and red oak (*Quercus sp.*), shagbark hickory (*Carya ovata*), white ash (*Fraxinus sp.*), basswood (*Tilia americana*) and black walnut (*Juglans nigra*).

Management recommendations

Introduce prescribed burning on a 1 to 3 year rotational basis.

40. Off Tans Road, just before Ridges Subdivision (3F1), NE ¼ Section 6

- Number of plant species estimated 10-15, of which 7 were native species.
- Historic vegetation – Oak/maple association.

Present vegetation

Sugar maple (*Acer saccharum*) and white ash (*Fraxinus americana*) woods. The shrub/sapling layer is comprised of a dense growth of 1 inch to 4 inches DBH sugar maples (*Acer saccharum*). Occasional red oak (*Quercus rubra*), shag bark hickory (*Carya ovata*), black walnut (*Juglans nigra*) and American elm (*Ulmus americana*) are present. Ground cover varied from moderately dense to heavily shade suppressed. There may be a spring wildflower component to this woods. With the cessation of periodic wild fires the woods is moving successionally to a sugar maple (*Acer saccharum*) woods. A portion of this area was an orchard in the 1940's and 1950's as observed in historic aerial photographs.

41. Horn field woods (3F2), NW ¼ Section 16

- Number of plant species recorded 27, of which 23 were native species.
- Historic vegetation – oak woods with scattered wet woods.

Present vegetation

Maple/basswood (*Tilia americana*) woods with scattered pockets of wet woods. Other trees and shrubs observed were white ash (*Fraxinus sp.*), shag bark hickory (*Carya ovata*), prickly ash (*Xanthoxylum americanum*), gray dogwood (*Cornus racemosa*), honeysuckle (*Lonicera spp.*), red oak (*Quercus alba*), ironwood (*Ostrya virginiana*), wild black currant (*Ribes americanum*) and hawthorn (*Crataegus sp.*). Ground cover species observed were green brier (*Smilax sp.*), woodbine (*Parthenocissus quinquefolia*), Jack-in-the-pulpit (*Arisaema triphyllum*), wild geranium (*Geranium maculatum*), Enchanter's nightshade (*Circaea quadrisculata*), white avens (*Geum canadense*), strawberry (*Fragaria virginiana*), yellow honeysuckle (*Lonicera prolifera*), poison ivy (*Rhus radicans*),

Bebbs sedge (*Carex bebbii*), hop sedge (*Carex lupulina*), fowl manna grass (*Glyceria striata*), hairy wood sedge (*Carex hirtifolia*), may apple (*Podophyllum peltatum*), and late horse gentian (*Triosteum perfoliatum*).

Management recommendations

This is a moderate quality woodland that could be restored with reintroduction of limited management such as prescribed burning and non-native shrub control.

42. Parker Drive woods mesic basswood (*Tilia americana*) ash/hickory woods (3G1), NW ¼ Section 29

- Number of plant species recorded 49, of which 40 were native species.
- Historic vegetation – oak/maple woods.

Present vegetation

The Parker Drive woods consists of several woodland types of which mesic woods is one type. Only the north portion was investigated because access was granted. This woods contains several wet swales and wet pockets containing common wood reed (*Cinna arundinacea*), cardinal flower (*Lobelia cardinalis*), wild black currant (*Ribes americanum*), American elm (*Ulmus americana*), buttercup (*Ranunculus sp.*), fowl manna grass (*Glyceria striata*), Jack-in-the pulpit (*Arisaema triphyllum*), cinnamon willow herb (*Epilobium coloratum*) and some reed canary grass (*Phalaris arundinacea*). Upland areas are dominated by basswood (*Tilia americana*), white ash (*Fraxinus sp.*), and shagbark hickory (*Carya ovata*) with black walnut (*Juglans nigra*), and quaking aspen (*Populus tremuloides*) as minor components of the tree canopy. Gray dogwood (*Cornus racemosa*), European buckthorn (*Rhamnus cathartica*), choke cherry (*Prunus sp.*), honeysuckle (*Lonicera spp.*), prickly ash (*Fraxinus sp.*), bitternut hickory (*Carya ovata*), multiflora rose (*Rosa multiflora*), hawthorn (*Crataegus sp.*), and black haw (*Viburnum prunifolium*), comprised the shrub layer. Recent removal of several hundred ash (*Fraxinus sp.*) trees had occurred in this area.

A moderate ground cover component was present in this wooded section. Some species observed were hog peanut (*Amphicarpaea bracteata*), sedge (*Carex sp.*), white avens (*Geum canadense*), violet (*Viola sp.*), agrimony (*Agrimonia gryposepala*), common cinquefoil, Pennsylvania sedge (*Carex pennsylvanica*), woodbine (*Parthenocissus quinquefolia*), common carrion flower (*Smilax lasioneura*), yellow honeysuckle (*Lonicera prolifera*), calico aster (*Aster lateriflorus*), strawberry (*Fragaria virginiana*), moonseed (*Menispermum canadense*), bottle brush grass (*Hystrix patula*), lady fern (*Athyrium filix-femina*), Enchanter's nightshade (*Circaea quadrisculata*), yellow violet (*Viola pubescens*), Canada goldenrod (*Solidago canadensis*), nodding trillium (*Trillium cernuum*), wild geranium (*Geranium maculatum*), bittersweet nightshade (*Solanum dulcamara*) and bristly green brier (*Smilax tamnoides*). Selective logging of white ash (*Fraxinus sp.*) has occurred in the past 4-5 years.

Management recommendations

Limited brushing and herbiciding of non-native species is recommended. Reintroduction of prescribed burning every 3-4 years is also recommended.

43. Parker Drive Woods maple/basswood (*Tilia americana*) area (3G2), NW ¼ Section 29

- Number of plant species recorded 15, of which 13 were native species.
- Historic vegetation – oak woods.

Present vegetation

The northern portion of the Parker Drive Woods consists of sugar maple (*Acer saccharum*), basswood (*Tilia americana*), elm (*Ulmus americana*) and black cherry (*Prunus sp.*). Young saplings of sugar maple (*Acer saccharum*) dominate the sub-canopy of this wooded area. Other woody species observed included white ash (*Fraxinus sp.*), bitternut hickory (*Carya ovata*) and ironwood (*Ostrya virginiana*). The ground cover vegetation was shade suppressed and consisted of woodland knotweed (*Polygonum virginianum*), sedges (*Carex spp.*), Jack-in-the pulpit (*Arisaema triphyllum*), Enchanters nightshade (*Circaea quadrisculata*), fowl manna grass (*Glyceria striata*), wood reed (*Cinna arundinacea*) and Pennsylvania sedge (*Carex pennsylvanica*). Depressional areas add to the diversity of this woods. The Parker Drive woodland complex is one of the largest intact woodlands remaining in the Muskego boundary area.

Management recommendations

Limited brushing and herbiciding is recommended. Limited prescribed burning, i.e., every 5-7 years is recommended. This portion of Parker Drive Woods consists of a mesic woods where historic fires occurred sporadically and much less frequent than drier oak (*Quercus sp.*) and oak (*Quercus sp.*)/hickory (*Carya ovata*) woodlands.

44. Sedge meadow/wet prairie, Lake Denoon shoreline (4A/4B1), SE ¼ Section 31
- Number of plant species recorded 39, of which 36 were native species (Appendix 1, Table 7).
 - Historic vegetation – sedge meadow/wet prairie.

Present vegetation

A small fringe of sedge meadow/wet prairie exists on both sides of the public boat landing. Historically it is believed this area was much larger, but has been invaded by cattail (*Typha sp.*). This area is confined to the west edge of the lake and is transitional between the upland and open water/cattail (*Typha sp.*) areas. High quality wetland species remain and include burreed (*Sparganium eurycarpum*), wild iris (*Iris virginica*), tussock sedge (*Carex stricta*), cord grass (*Spartina pectinata*), great water dock (*Rumex orbiculatus*), elderberry (*Sambucus canadensis*), cattail (*Typha sp.*), rush (*Juncus canadensis*), marsh skullcap (*Scutellaria epilobiifolia*), skullcap (*Scutellaria lateriflora*), Joe pye weed (*Eupatorium maculatum*), Canada bluejoint grass (*Calamagrostis canadensis*), jewelweed (*Impatiens capensis*), wild mint (*Mentha arvensis villosa*), swamp rose (*Rosa palustris*), marsh bellflower (*Campanula aparinoides*), marsh milkweed (*Asclepias incarnata*) hedge nettle (*Stachys tenuifolia*), paniced aster (*Aster simplex*), water willow (*Decodon verticillatus*), rice cut grass (*Leersia oryzoides*), monkey flower (*Mimulus ringens*), water hemlock (*Cicuta maculata*), marsh marigold (*Caltha palustris*), sedges (*Carex spp.*) and bulbet bearing water hemlock (*Cicuta bulbifera*).

Management recommendations

Purple loosestrife (*Lythrum salicaria*) a non-native weed is present and will require control. Occasional fire (i.e., 5 year intervals) would also be beneficial. Currently the method most often employed is to herbicide purple loosestrife (*Lythrum salicaria*) just prior to flowering with Rodeo. In recent years several biological control methods (insect) have been used. Some of these are commercially available, but may require permits and permission by local, state and federal agencies.

45. Sedge meadow/wet prairie (4A/4B2), SE ¼ Section 11
- Number of plant species recorded 26, of which 21 were native species.
 - Historic vegetation – sedge meadow.

Present vegetation

Sedge meadow/wet prairie with reed canary grass (*Phalaris arundinacea*) and shrub invasion. Species observed included woolly sedge (*Carex lanuginosa*), European buckthorn (*Rhamnus cathartica*), Canada goldenrod (*Solidago canadensis*), wild grape (*Vitis riparia*), strawberry (*Fragaria virginiana*), frost aster (*Aster pilosus*), paniced aster (*Aster simplex*), gray dogwood (*Cornus racemosa*), heal all (*Prunella vulgaris*), New England aster (*Aster novae-angliae*), white avens (*Geum canadense*), reedtop grass (*Agrostis alba*), crested oval sedge (*Carex cristatella*), Dudley's rush, grass-leaved goldenrod (*Solidago graminifolia*), red bulrush, reed canary grass (*Phalaris arundinacea*), fox sedge (*Carex vulpinoidea*), marsh milkweed (*Asclepias incarnata*), tall goldenrod (*Solidago gigantea*), nannyberry (*Viburnum lentago*), basswood (*Tilia americana*), Timothy (*Phleum pratense*), willow (*Salix sp.*), glossy buckthorn (*Rhamnus frangula*) and Solomon's seal (*Polygonatum biflorum*).

Management recommendations

Periodic burning to reduce shrub cover is recommended. Selective herbicide of reed canary grass (*Phalaris arundinacea*) using Rodeo is also recommended.

46. Small pond area (4B1), SW ¼ Section 6
- Number of plant species recorded 35, of which 26 were native species.
 - Historic vegetation – sedge meadow.

Present vegetation

This area consists of a small pond surrounded by moderate quality sedge meadow remnant. Observed native wetland species included dark green bulrush (*Scirpus atrovirens*), wild iris (*Iris virginica*), Dudley's rush (*Juncus dudleyi*), grass-leaved goldenrod (*Solidago graminifolia*), fox sedge (*Carex vulpinoidea*), tall goldenrod (*Solidago gigantea*), hard stem bulrush (*Scirpus acutus*), fowl manna grass (*Glyceria septentrionalis*), duck weed (*Lemna minor*), willows (*Salix spp.*), water heartsease (*Polygonum coccineum*), tall water parsnip (*Sium suave*), marsh skull cap (*Scutellaria epilobiifolia*), Canada blue joint grass (*Calamagrostis canadensis*), marsh milkweed (*Asclepias incarnata*), tussock sedge (*Carex stricta*), sedge (*Carex sp.*), water horehound (*Lycopus americanus*), bristly aster (*Aster puniceus*), tall agrimony (*Agrimonia gryposepala*), red osier dogwood (*Cornus stolonifera*), cord grass (*Spartina pectinata*), wild grape (*Vitis riparia*), starry false Solomon's seal (*Smilacina stellata*), rice cut grass (*Leersia oryzoides*) and woolly sedge (*Carex lanuginosa*). Reed canary grass (*Phalaris arundinacea*), a non-native aggressive weedy species was also present.

Management recommendations

Periodic burning to reduce shrub cover is recommended. Herbicide of reed canary grass (*Phalaris arundinacea*) using Rodeo is also recommended. In some instances a selective grass herbicide such as Poast, has been successfully used to control reed canary grass (*Phalaris arundinacea*) in areas that contain high quality native sedges (*Carex spp.*) and wildflowers.

47. Sedge meadow, Section 5 (4B2), SW ¼ Section 5

- Number of plant species recorded 38, of which 35 were native species (Appendix 1, Table 6).
- Historic vegetation – sedge meadow.

Present vegetation – sedge meadow

This is a moderate to high quality sedge meadow that had been under agricultural production in the past. Since the cessation of farming, a tussock sedge (*Carex stricta*) meadow has re-developed. Within the sedge meadow are scattered wetland species such as wild iris (*Iris virginica*), cattail (*Typha sp.*), awl fruited sedge (*Carex stipata*), dogwood (*Cornus spp.*), water horehound (*Lycopus americanus*), marsh milkweed (*Asclepias incarnata*), cinnamon willow herb (*Epilobium coloratum*), bristly aster (*Aster puniceus*), blue vervain (*Verbena hastata*), Canada bluejoint grass (*Calamagrostis canadensis*), great water dock (*Rumex orbiculatus*), Joe pye weed (*Eupatorium maculata*), boneset (*Eupatorium perfoliatum*), tall goldenrod (*Solidago gigantea*), yellow avens (*Geum aleppicum*), mountain mint (*Pycnanthemum virginianum*), water hemlock (*Cicuta maculata*), dark green bulrush and Dudley's rush (*Juncus dudleyi*). Surrounding this sedge meadow is a wooded edge of elm (*Ulmus americana*), willow (*Salix sp.*) and box elder (*Acer negundo*). Occasional clumps of reed canary grass (*Phalaris arundinacea*) are also found.

Management recommendations

Prescribed burning on 5 year interval is recommended.

48. Wooded wetland/sedge meadow (4B3), SW ¼ Section 5

- Number of plant species recorded 40, of which 33 were native species.
- Historic vegetation – sedge meadow.

Present vegetation

Consists of open sedge meadow areas and brush/tree covered wetlands. Typical open sedge meadow native species were tussock sedge (*Carex stricta*), dogwood (*Cornus sp.*), wild iris (*Iris virginica*), paniced aster (*Aster simplex*), tall goldenrod (*Solidago gigantea*), smooth hedge nettle (*Stachys tenuifolia*), bristly aster (*Aster puniceus*), fox sedge (*Carex vulpinoidea*), New England aster (*Aster novae-angliae*), nannyberry (*Viburnum lentago*), water horehound (*Lycopus americanus*), boneset (*Eupatorium perfoliatum*), horse tail (*Equisetum arvense*), swamp rose (*Rosa palustris*), tall water parsnip (*Sium suave*), Joe pye weed (*Eupatorium maculatum*), cord grass (*Spartina pectinata*), turtle head (*Chelone glabra*), Culver's root (*Veronicastrum virginicum*), water heartsease (*Polygonum amphibium*), mountain mint (*Pycnanthemum virginianum*), tufted loosestrife (*Lysimachia thysiflora*), monkey flower (*Mimulus ringens*), gray dogwood (*Cornus racemosa*), bedstraw (*Galium sp.*), narrow leaved oval sedge (*Carex tenera*) and fringed loosestrife (*Lysimachia ciliata*). Glossy buckthorn (*Rhamnus frangula*), a non-native wetland shrub is found in this wetland, as was reed canary grass (*Phalaris arundinacea*) a non-native aggressive grass.

Management recommendations

This area has a very high recuperative potential with only minimal management required, such as periodic fire. Manual removal of glossy buckthorn (*Rhamnus frangula*) by cutting and herbiciding may be useful also.

49. Wetland, slough off trail (4B4), SW ¼ Section 17
- Number of plant species recorded 17, of which 16 were native species.
 - Historic vegetation – sedge meadow.

Present vegetation

Sedge meadow/wet prairie area dominated by native prairie cord grass (*Spartina pectinata*) and native sedges (*Carex stricta*, *Carex lanuginosa*). This is a small, but high quality wetland area. Other native species observed were Turk cap lily (*Lilium michiganense*), wild grape (*Vitis riparia*), fowl manna grass (*Glyceria striata*), New England aster (*Aster novae-angliae*), wood germander (*Teucrium canadense*), meadow rue (*Thalictrum dasycarpum*), tall goldenrod (*Solidago gigantea*), panicled aster (*Aster simplex*), Canada blue joint grass (*Calamagrostis canadensis*), water horehound (*Lycopus americanus*), and starry false Solomon's seal (*Smilacina stellata*) and sandbar willow (*Salix interior*). Reed canary grass (*Phalaris arundinacea*), an aggressive non-native species was observed in this wetland.

Management recommendations

Initiate a prescribed burn plan on an approximate 5 year rotation. Spot spray with Rodeo patches of reed canary grass.

50. Pastured/grazed sedge meadow swale (4B5), SE ¼ Section 20
- Number of plant species recorded 12, of which 7 were native species.
 - Historic vegetation – sedge meadow.

Present vegetation

Degraded sedge meadow/wet meadow running through pasture. Sedges (*Carex spp.*), such as woolly sedge (*Carex pellita*) and red bulrush (*Scirpus lineatus*) are found interspersed with Timothy grass (*Phleum pratense*) and redtop grass (*Agrostis alba*). The latter two grasses were probably planted within the sedge meadow for forage. Scattered herbaceous species such as meadow rue (*Thalictrum dasycarpum*), water hemlock (*Cicuta maculata*), Turk cap lily (*Lilium michiganense*), and cord grass (*Spartina pectinata*) attest to the former high quality of this swale. Another native species observed was common milkweed (*Asclepias syriaca*), along the upland edges of this swale. Non-native reed canary grass (*Phalaris arundinacea*) was also present.

Management recommendations

Discontinue or limit area as pasture and begin burn management.

51. Pastured/grazed sedge meadow (4B6), SE ¼ Section 20
- Number of plant species recorded 5, of which 4 were native species
 - Historic vegetation – sedge meadow.

Present vegetation

Degraded sedge meadow. This smaller area is located across Racine Avenue from 4B5 and the influence of the road and adjacent farming has produced a somewhat lower quality than 4B5. Reed canary grass (*Phalaris arundinacea*) is much more apparent in 4B6. Other species observed were cattail (*Typha sp.*), hard stem bulrush (*Scirpus acutus*), red bulrush and dark green bulrush (*Scirpus atrovirens*).

Management recommendations

Control reed canary grass (*Phalaris arundinacea*) through selective herbicide application and burn on regime concurrent with 4B5.

52. Sedge meadow (4B7), NE ¼ Section 29

- Number of plant species recorded 12, of which 10 were native species.
- Historic vegetation – sedge meadow/wet prairie.

Present vegetation

Sedge meadow with pond. Within a low swale area is a sedge/grass dominated swale system. A rip-rapped pond has been constructed in a portion of this area. Species observed included woolly sedge (*Carex pellita*), red bulrush (*Scirpus pendulous*), ironweed (*Vernonia fasciculata*), Dudley's rush (*Juncus dudleyi*), reed canary grass (*Phalaris arundinacea*), cattail (*Typha sp.*), marsh milkweed (*Asclepias incarnata*), cord grass (*Spartina pectinata*), water hemlock (*Cicuta maculata*), Turk cap's lily (*Lilium michiganense*), redtop grass (*Agrostis alba*) and willow shrubs (*Salix spp.*).

Management recommendations

Discontinue or limit area as pasture and begin burn management.

53. Sedge meadow Spring Creek (4B8), SW ¼ Section 5 and SE ¼ Section 6

- Number of plant species recorded 36, of which 34 were native species.
- Historic vegetation – sedge meadow.

Present vegetation

Sedge meadow dominated by tussock sedge (*Carex stricta*) with patches of woolly sedge (*Carex lanuginosa*). This sedge meadow area is receiving seepage water from the hillside and may be a degraded fen area. Other high quality wetland species observed included water hemlock (*Cicuta maculata*), angelica (*Angelica atropurpurea*), cowbane (*Oxypolis rigidior*), fen lobelia (*Lobelia kalmii*), red stem aster (*Aster puniceus*), Joe pye weed (*Eupatorium maculatum*), bergamot (*Monarda fistulosa*), boneset (*Eupatorium perfoliatum*), grass-leaved goldenrod (*Solidago graminifolia*), prairie cord grass (*Spartina pectinata*), Canada blue joint grass (*Calamagrostis canadensis*), New England aster (*Aster novae-angliae*), mountain mint (*Pycnanthemum virginianum*), sneezeweed (*Helenium autumnale*), turtlehead (*Chelone glabra*), leafy satin grass (*Muhlenbergia mexicana*), marsh skullcap (*Scutellaria epilobiifolia*), meadow rue (*Thalictrum dasycarpum*), fowl manna grass (*Glyceria striata*) and fen betony (*Pedicularis lanceolata*). This remnant is one of the highest quality sedge meadow sites found within the City of Muskego. Several native species typical of moderate quality wetlands were also observed in this area. These included water heartsease (*Polygonum amphibium*), blue vervain (*Verbena hastata*), water horehound (*Lycopus americanus*), cinnamon willow herb (*Epilobium coloratum*), nannyberry (*Viburnum lentago*), Dudley's rush (*Juncus dudleyi*), paniced aster (*Aster simplex*), jewelweed (*Impatiens capensis*), boxelder (*Acer negundo*) and smooth hedge nettle (*Stachys tenuifolia*). The non-native glossy buckthorn (*Rhamnus frangula*) has begun to invade portions of this area as has the non-native herbaceous species garlic mustard (*Alliaria petiolata*) in densely shaded areas.

Management recommendations

Initiate a prescribed burn program in sedge meadow, perhaps every 4-5 years. Also control of dense shrub layer in ecotonal area between sedge meadow and upland woods through cutting and herbiciding may restore some seepage areas that support this wetland.

54. Sedge meadow cattails (4B/4C1), NW ¼ Section 31

- Number of plant species recorded 5, all of which were native species.
- Historic vegetation – sedge meadow.

Present vegetation

Small wetland area with cattail (*Typha sp.*) and lake bank sedge (*Carex lacustris*) with scattered blue vervain (*Verbena hastata*), marsh milkweed (*Asclepias incarnata*), and dark green bulrush (*Scirpus atrovirens*).

55. Degraded sedge meadow/old field (4B/2C1), SW ¼ Section 5

- Number of plant species recorded 30, of which 23 were native species.
- Historic vegetation – probably sedge meadow.

Present vegetation – old field with scattered wetland species

This area and the adjacent sedge meadow were pastured or used for marsh hay in the past. In addition, channelization of Spring Creek has resulted in dewatering of the adjacent lands, which has allowed for more upland species to invade this historic sedge meadow area. Typical native wetland species observed were gray dogwood (*Cornus racemosa*), green ash (*Fraxinus sp.*), grass-leaved goldenrod (*Solidago graminifolia*), mountain mint (*Pycnanthemum virginianum*), silky dogwood (*Cornus obliqua*), red osier dogwood (*Cornus sp.*), willows (*Salix sp.*), Riddell's goldenrod (*Solidago riddellii*), woolly sedge (*Carex lanuginosa*) and tall goldenrod (*Solidago gigantea*). Typical non-native wetland species observed were reedtop grass (*Agrostis alba*), and reed canary grass (*Phalaris arundinacea*). Upland native species were Canada goldenrod (*Solidago canadensis*), black raspberry (*Rubus occidentalis*), smooth sumac (*Rhus glabra*), early goldenrod (*Solidago juncea*), black-eyed Susan (*Rudbeckia hirta*), hawthorn (*Crataegus sp.*), bergamot (*Monarda fistulosa*), hairy aster (*Aster pilosus*), black walnut (*Juglans nigra*), arrowleaf aster (*Aster sagittifolius*) and evening primrose (*Oenothera biennis*). Upland non-native species included Kentucky blue grass (*Poa pratensis*), Queen Anne's lace (*Daucus carota*), red clover (*Trifolium pratense*), Canada blue grass (*Poa compressa*) and honeysuckle (*Lonicera tatarica*).

Management recommendations

Initiate prescribed burn on same schedule as 4B8.

56. Sedge meadow/old field City of Muskego property (4B/2C2), SE ¼ Section 6

- Number of plant species recorded 25, of which 22 were native species.
- Historic vegetation – sedge meadow.

Present vegetation

Degraded wetlands with interspersed old field vegetation. This site has been tilled, causing a shift from high quality sedge meadow to a highly disturbed system. Upland areas are dominated big European brome grass (*Bromus inermis*), Canada goldenrod (*Solidago canadensis*), nettle (*Urtica dioica*), common milkweed (*Asclepias syriaca*), Canada thistle (*Cirsium arvense*) and reed canary grass (*Phalaris arundinacea*). Wetter

areas are dominated by reed canary grass (*Phalaris arundinacea*). Scattered native wetland herbaceous species and woody species are indicative of the recuperative potential of this area. Native species observed still growing in this dewatered wetland system were tall goldenrod (*Solidago gigantea*), white avens (*Geum canadense*), willows (*Salix sp.*), box elder (*Acer negundo*), gray dogwood (*Cornus racemosa*), bergamot (*Monarda fistulosa*), red osier dogwood (*Cornus sp.*), great water dock (*Rumex orbiculatus*), water horehound (*Lycopus americanus*), dark green bulrush (*Scirpus atrovirens*), grass-leaved goldenrod (*Solidago graminifolia*), Joe pye weed (*Eupatorium maculatum*), blue vervain (*Verbena hastata*), sedges (*Carex spp.*), sandbar willow (*Salix sp.*), elderberry (*Sambucus canadensis*), panicked aster (*Aster simplex*), jewelweed (*Impatiens capensis*) and wild black currant (*Ribes americanum*).

Management recommendations

Tile disablement would be a method for restoring the hydrology to this 20-acre site, which would benefit the native species. Eradication of reed canary grass (*Phalaris arundinacea*) by herbiciding is also imperative if restoration of this site is to occur.

57. Wetland depression, City of Muskego woods (4B/4D1), NW ¼ Section 16

- Number of plant species recorded 35, of which 30 were native species (Appendix 1, Table 5).
- Historic vegetation – sedge meadow/wet woods.

Present vegetation

Degraded sedge meadow. This area harbors a very rare sedge, called crowfoot fox sedge (*Carex crus-corvi*). This sedge is known from only a few locations in the state. This small wetland pocket has been severely degraded by the invasion of reed canary grass (*Phalaris arundinacea*) with sedges (*Carex spp.*) and other natives confined to the wetland periphery. Other species observed in this wetland were fowl manna grass (*Glyceria striata*), hop sedge (*Carex lupulina*), wild iris (*Iris virginica*), water horehound (*Lycopus americanus*), ash (*Fraxinus sp.*), Bebb's sedge (*Carex bebbii*), calico aster (*Aster lateriflorus*), meadow rue (*Thalictrum dasycarpum*), fox sedge (*Carex vulpinoidea*), dogwood (*Cornus sp.*) and tall water parsnip (*Sium suave*).

Management recommendations

Very careful herbicide control of reed canary grass (*Phalaris arundinacea*) is imperative, as is the restoration of the surrounding woods. Runoff from adjacent parking lot, if occurring, should be halted.

58. Big Muskego Lake boat landing sedge meadow shrub/scrub (4B/4F1), Western ½ Section 13

- Number of plant species recorded 57+, of which 50 were native species (Appendix 1, Table 8).
- Historic vegetation – sedge meadow.

Present vegetation

Sedge meadow invaded by native and non-native shrubs. This is a narrow band of remnant sedge meadow in a transitional zone between the upland slope and the large cattail (*Typha sp.*) complex surrounding Big Muskego Lake. Native shrubs and saplings include sandbar willow (*Salix sp.*), red osier dogwood (*Cornus stolonifera*), grey dogwood (*Cornus racemosa*), willows (*Salix sp.*) and green ash (*Fraxinus sp.*). Two non-native buckthorns European (*Rhamnus cathartica*) and glossy (*Rhamnus frangula*) have

invaded this transitional zone as well as reed canary grass (*Phalaris arundinacea*). In some areas these shrubs are extremely dense and have and are continuing to degrade this plant community. In more open areas a very diverse sedge meadow community was found. Observed species included grass-leaved goldenrod (*Solidago graminifolia*), marsh milkweed (*Asclepias incarnata*), Canada goldenrod (*Solidago canadensis*), white avens (*Geum canadense*), Torrey's rush (*Juncus torreyi*), reedtop grass (*Agrostis alba*), woolly sedge (*Carex lanuginosa*), rush (*Juncus spp.*), boneset (*Eupatorium perfoliatum*), swamp thistle (*Cirsium muticum*), wild iris (*Iris virginica*), hard stem bulrush (*Scirpus acutus*), Dudley's rush, water horehound (*Lycopus americanus*), heal all (*Prunella vulgaris*), Joe pye weed (*Eupatorium maculatum*), tussock sedge (*Carex stricta*), horsetail (*Equisetum arvense*), rice cut grass (*Leersia oryzoides*), cattail (*Typha sp.*), lake bank edge (*Carex lacustris*), fen betony (*Pedicularis lanceolata*), fen lobelia (*Lobelia kalmii*), blue vervain (*Verbena hastata*), dark green bulrush (*Scirpus atrovirens*) and water heartsease (*Polygonum amphibium*). The only orchid species (*Liparis lilifolia*) observed during this study was found in this sedge meadow. Closer to the lake, cattail (*Typha sp.*) dominates with scattered arrowhead (*Sagittaria latifolia*), soft stem bulrush (*Scirpus validus*), water plantain (*Alisma subcordatum*), water lilies (*Nymphaea sp.*), bladderwort (*Utricularia spp.*) and chara (*Chara vulgaris*) observed.

Management recommendations

Because of dense buckthorn (*Rhamnus cathartica*) growth it will be necessary to cut and herbicide these shrubs, after which periodic fire should be used to control re-invasion of shrubs, both native and non-native.

59. Cattail marsh (4C1), SE ¼ Section 7

- Number of plant species recorded 3+, of which the three were native species.
- Historic vegetation – Sedge meadow/wet prairie.

Present vegetation

A series of open ponds surrounded by cattails (*Typha sp.*), willow (*Salix sp.*) and dogwood (*Cornus sp.*).

Management recommendations

Periodic prescribed burn should be employed to maintain a more open wetland habitat.

60. Cattail marsh, Section 5 (4C2), NE ¼ Section 5

- Number of plant species recorded 8, of which 6 were native species.
- Historic vegetation – sedge meadow.

Present vegetation

This wetland is dominated by cattails (*Typha sp.*) with scattered willows (*Salix spp.*), weeping willows (*Salix babylonica*), cottonwood (*Populus deltoides*), reed canary grass (*Phalaris arundinacea*), sawtooth sunflower (*Helianthus grosseserratus*), grass-leaved goldenrod (*Solidago graminifolia*), and giant ragweed.

Management recommendations

Reed canary grass (*Phalaris arundinacea*) control using herbicide and/or late season spring burning is recommended.

61. Wetland, Section 17 off trail (4C3), SW ¼ Section 17
- Number of plant species recorded 9, of which 8 were native species.
 - Historic vegetation – sedge meadow.

Present vegetation

Cattail (*Typha sp.*) marsh, this historic sedge meadow area is dominated by cattail (*Typha sp.*). An increase in recent hydrology, perhaps resulting from trail embankment has shifted the vegetation community to a more stable water level system with cattail (*Typha sp.*). Some reed canary grass (*Phalaris arundinacea*) has invaded edges of these areas. Other species observed included sandbar willow (*Salix interior*), tussock sedge (*Carex stricta*), elm (*Ulmus sp.*), water hemlock (*Cicuta maculata*), lake bank sedge (*Carex lacustris*), soft stem bulrush (*Scirpus validus creber*) and marsh milkweed (*Asclepias incarnata*).

Management recommendations

Because of hydrological alterations this community should be maintained as cattail (*Typha sp.*) marsh surrounded by an edge of sedges (*Carex spp.*). Reed canary grass (*Phalaris arundinacea*) control will be required.

62. Cattail marsh (4C4), NE ¼ Section 31
- Number of plant species recorded 29, of which 27 were native species.
 - Historic vegetation – sedge meadow.

Present vegetation

Cattail (*Typha sp.*) marsh with associated wooded area along inlet into Lake Denoon. A board walk on the north end has been constructed through the wetland. The interior of the wetland is dominated by cattail (*Typha sp.*). However, along the periphery are a number of native wetland species such as sandbar willow (*Salix interior*), jewel weed (*Impatiens capensis*), lake bank sedge (*Carex lacustris*), panicled aster (*Aster simplex*), red osier dogwood (*Cornus stolonifera*), red bulrush, grass-leaved goldenrod (*Solidago graminifolia*), sneezeweed (*Helenium autumnale*), meadow rue (*Thalictrum dasycarpum*), water hemlock (*Cicuta maculata*), dark green bulrush (*Scirpus atrovirens*), red stem aster (*Aster puniceus*), water heartsease (*Polygonum amphibium*), tussock sedge (*Carex stricta*), Canada bluejoint grass (*Calamagrostis canadensis*), hairy leaved lake sedge (*Carex atherodes*), marsh milkweed (*Asclepias incarnata*), boneset (*Eupatorium perfoliatum*), gray dogwood (*Cornus racemosa*) and wood germander (*Teucrium canadense*). Along the upland edge of this wetland were observed native prairie species such as bergamot (*Monarda fistulosa*) and false sunflower (*Heliopsis helianthoides*), and non-natives such as reedtop grass (*Agrostis alba*) and Timothy (*Phleum pratense*).

Management recommendations

Periodic burning of this edge of high diversity vegetation will help to maintain this area. Fire, if it burns a portion or all of the cattail (*Typha sp.*) marsh in the interior, will not be detrimental.

63. Cattail marsh near Manchester Hill Park (4C5), SW ¼ Section 10
- Number of plant species recorded 33, of which 26 were native species.
 - Historic vegetation – sedge meadow.

Present vegetation

Cattail (*Typha sp.*) marsh with small sedge meadow remnant. The majority of this area is a dense cattail (*Typha sp.*) marsh with a small, moderately diverse edge of sedges

(*Carex spp.*) and other wetland species. These include wild grape (*Vitis riparia*), calico aster (*Aster lateriflorus*), Jack-in-the-pulpit (*Arisaema triphyllum*), red osier dogwood (*Cornus sp.*), fowl manna grass (*Glyceria striata*), reed canary grass (*Phalaris arundinacea*), lake bank sedge (*Carex lacustris*), arrowhead (*Sagittaria latifolia*), bittersweet nightshade (*Solanum dulcamara*), sedges (*Carex spp.*), jewelweed (*Impatiens capensis*), tall goldenrod (*Solidago gigantea*), horsetail (*Equisetum hyemale*), wild black currant (*Ribes americanum*), cinnamon willow herb (*Epilobium coloratum*), boneset (*Eupatorium perfoliatum*), false nettle (*Boehmeria cylindrica*), water hemlock (*Cicuta maculata*), bugle weed (*Lycopus virginicus*), water dock (*Rumex orbiculatus*), Joe pye weed (*Eupatorium maculatum*), wild iris (*Iris virginica*), marsh hedge nettle (*Urtica dioica*), sawtooth sunflower (*Helianthus grosseserratus*), tussock sedge (*Carex stricta*), meadow rue (*Thalictrum dasycarpum*), dark green bulrush (*Scirpus atrovirens*), and barnyard grass (*Echinochloa crusgalli*).

Management recommendations

Maintain ecotonal sedge meadow area by selected herbicide control of cattail (*Typha sp.*) and reed canary grass (*Phalaris arundinacea*). Burn periphery as in 4C4.

64. Cattail marsh/pond (4C/4E1), NW ¼ Section 14

- Number of plant species recorded 8, of which 7 were native species.
- Historic vegetation – sedge meadow.

Present vegetation

Cattail (*Typha sp.*) wetland with invasion by reed canary grass (*Phalaris arundinacea*). Open water pond along south side of bike path. Other native species observed include sandbar willow (*Salix interior*), swamp milkweed (*Asclepias incarnata*), panicked aster (*Aster simplex*), duckweed (*Lemna minor*), black willow (*Salix nigra*) and red-osier dogwood (*Cornus stolonifera*). A green heron was observed using this pond.

65. Ditched wetland, Section 17 (4C/4F1), SE ¼ Section 17

- Number of plant species recorded 9, of which 8 were native species.
- Historic vegetation – emergent/wet meadow.

Present vegetation

Low diversity wetland in abandoned/ditched agricultural field. Since the cessation of farming this area has reverted back to wetland. Typically these systems, because of ditching and subsequent dewatering of hydric soils are quickly invaded by early successional native wetland species, which are interspersed with a large matrix of non-native reed canary grass (*Phalaris arundinacea*). These systems have low diversity and little wetland wildlife functional value. Clones of sandbar willow (*Salix interior*) and cattail (*Typha latifolia*) are scattered throughout the reed canary grass (*Phalaris arundinacea*) matrix. Other native species scattered in this area included black willow (*Salix nigra*), elm (*Ulmus sp.*), dark green bulrush (*Scirpus atrovirens*), white avens (*Geum canadense*) and elderberry (*Sambucus canadensis*).

Management recommendations

Purple loosestrife (*Lythrum salicaria*), a non-native, highly invasive weed was found in this complex and will need to be controlled, as will reed canary grass (*Phalaris arundinacea*). Significant effort of herbiciding, burning and perhaps reseeding will be necessary if a more diversified, higher quality wetland system is desired.

66. Reed canary grass (4D1), SE ¼ Section 5
- Number of plant species recorded 7, of which 6 were native species.
 - Historic vegetation – sedge meadow.

Present vegetation

This wetland adjacent to a new subdivision is dominated by reed canary grass (*Phalaris arundinacea*). A small ponded area is located within this wetland. The reed canary grass (*Phalaris arundinacea*) area is bordered by willow (*Salix spp.*), goldenrod (*Solidago spp.*), giant ragweed (*Ambrosia trifida*), dark green bulrush (*Scirpus atrovirens*), soft stem bulrush (*Scirpus validus creber*) and cattails (*Typha sp.*).

Management recommendations

Control reed canary grass (*Phalaris arundinacea*) through herbiciding and late spring burns.

67. Reed canary grass area, Bluhm Park (4D2), SW ¼ Section 12
- Number of plant species recorded 23, of which 8 were native species (Appendix 1, Table 1).
 - Historic vegetation – sedge meadow.

Present vegetation

Reed canary grass (*Phalaris arundinacea*) wetland with interspersed cropland and wetland species. Currently this wetland has a moderate diversity of native species. However, typically only a few individuals of each of these species were found. Moderate quality wetland plants included fox sedge (*Carex vulpinoidea*), panicked aster (*Aster simplex*), red-osier dogwood (*Cornus stolonifera*), water plantain, grass-leaved goldenrod (*Solidago graminifolia*), dark-green bulrush (*Scirpus atrovirens*), water heartsease (*Polygonum coccineum*) and water horehound (*Lycopus americanus*).

Management recommendations

The location and small size of this area suggests this area may best serve as a demonstration area for restoring degraded wetlands within The City of Muskego. The steps involved would be to first herbicide reed canary grass (*Phalaris arundinacea*), then perform a prescribed burn. Additional herbiciding and/or burning may be required for a couple of years. The area could then be seeded and planted with a diverse wet prairie/sedge meadow mix.

68. Reed canary grass wetland Bluhm Park (4D3), SW ¼ Section 12
- Number of plant species recorded 22, of which 14 were native species.
 - Historic vegetation – sedge meadow/wet prairie.

Present vegetation

Reed canary grass (*Phalaris arundinacea*) dominated wetland with scattered native wetland species and an adjacent upland old field. Native species observed included Dudley's rush, New England aster (*Aster novae-angliae*), stiff goldenrod (*Solidago rigida*), marsh milkweed (*Asclepias incarnata*), common milkweed (*Asclepias syriaca*), fleabane (*Erigeron sp.*), Canada goldenrod (*Solidago canadensis*), tall goldenrod (*Solidago gigantea*), fox sedge (*Carex vulpinoidea*), arrowleaf aster (*Aster sagittifolius*), grass-leaved goldenrod (*Solidago graminifolia*), common wood sedge (*Carex blanda*), agrimony (*Agrimonia gryposepala*) and nannyberry (*Viburnum lentago*). Other non-native species observed included Kentucky blue grass (*Poa pratensis*), European brome

grass (*Bromus inermis*), yarrow (*Achillea millefolium*), reedtop grass (*Agrostis alba*), chickory (*Cichorium intybus*), Queen Anne's lace (*Daucus carota*) and Timothy (*Phleum pratense*).

Management recommendations

Restoring this degraded wetland would involve several steps. The steps involved would be to first herbicide reed canary grass (*Phalaris arundinacea*), then perform a prescribed burn. Additional herbiciding and/or burning may be required for a couple of years. The area could then be seeded and planted with a diverse wet prairie/sedge meadow mix.

69. Wetland east of Reynold's Machine Company (4D/4F1), NE ¼ Section 4

- Number of plant species recorded 5, of which 4 were native species.
- Historic vegetation – sedge meadow/wet prairie.

Present vegetation

Reed canary grass (*Phalaris arundinacea*) dominated wetland with scattered cottonwood (*Populus deltoides*), elm (*Ulmus americana*), green ash (*Fraxinus sp.*) and box elder (*Acer negundo*).

70. Wooded wetland (4D/4F2), SW ¼ Section 3

- Number of plant species recorded 8, of which 6 were native species.
- Historic vegetation – sedge meadow/wet prairie.

Present vegetation

Early successional wet woods containing cottonwood (*Populus deltoides*), willow (*Salix sp.*), elm (*Ulmus americana*), box elder (*Acer negundo*), green ash (*Fraxinus sp.*) and black locust (*Robinia pseudoacacia*). Understory vegetation is almost all reed canary grass (*Phalaris arundinacea*).

71. Wet woods/reed canary grass (4D/4F3), NW ¼ Section 11

- Number of plant species recorded 5, of which 3 were native species.
- Historic vegetation – oak savanna.

Present vegetation

Most of this area contains early successional trees such as box elder (*Acer negundo*), willow (*Salix sp.*) and elderberry (*Sambucus canadensis*).

72. Little Muskego Lake Island (4D/4F4), SW ¼ Section 4

- Number of plant species recorded 10, of which 9 were native species.
- Historic vegetation – wet woods/sedge meadow.

Present vegetation

Currently this island represents a low quality system dominated by reed canary grass (*Phalaris arundinacea*) with scattered sedges (*Carex spp.*) and common reed (*Phragmites australis*) in the ground cover. Black willow (*Salix nigra*), box elder (*Acer negundo*), basswood (*Tilia americana*), elm (*Ulmus americana*) and black walnut (*Juglans nigra*) are found in the tree layer. Shrubs such as red osier dogwood (*Cornus stolonifera*) and elderberry (*Sambucus canadensis*) were also observed.

73. Small wetland off County Highway Y (4E1), NE ¼ Section 5

- Number of plant species recorded 30, of which 25 were native species.
- Historic vegetation – wet woods.

Present vegetation

Forb dominated wet depression. This small depressional area adjacent to County Y just east of the sand and gravel operation probably formed as a result of previous sand and gravel operations or may have been associated with the original floodplain of Spring Creek. Construction of County Y (Racine Avenue) has impacted this area. Over the year's a number of wetland species, of which some are high quality species have invaded this area. Species observed included grass-leaved goldenrod (*Solidago graminifolia*), Kentucky blue grass (*Poa pratensis*), sawtooth sunflower (*Helianthus grosseserratus*), New England aster (*Aster novae-angliae*), gray dogwood (*Cornus racemosa*), American elm (*Ulmus americana*), ragweed (*Ambrosia artemisiifolia*), Canada goldenrod (*Solidago canadensis*), reed canary grass (*Phalaris arundinacea*), Riddell's goldenrod (*Solidago riddellii*), woolly sedge (*Carex lanuginosa*), strawberry (*Fragaria virginiana*), tall goldenrod (*Solidago gigantea*), Dudley's rush (*Juncus dudleyi*), panicled aster (*Aster simplex*), hairy aster (*Aster pilosus*), wild grape (*Vitis riparia*), bergamot (*Monarda fistulosa*), arrow-leaved aster (*Aster sagittifolius*), silky dogwood (*Cornus sp.*), cinnamon willow herb (*Epilobium coloratum*), leafy satin grass (*Muhlenbergia mexicana*), reedtop grass (*Agrostis alba*), water hemlock (*Cicuta maculata*), European buckthorn (*Rhamnus cathartica*), calico aster (*Aster lateriflorus*), sandbar willow (*Salix sp.*), box elder (*Acer negundo*) and hedge nettle (*Stachys clingmanii*).

Management recommendations

Initiate a prescribed burn plan at a 3-4 year interval.

74. Created wetland Denoon Park (4E/4F1), NW ¼ Section 31

- Number of plant species recorded 20, of which 14 were native species.
- Historic vegetation - unknown.

Present vegetation

Small wetland which appears to have been created or preserved resulting from construction of Denoon Park. A small shallow ponded area is surrounded by a fringe of wetland plants. Plant diversity is relatively high considering location and history. Wetland shrubs and trees have begun to invade. These include willow (*Salix spp.*) and cottonwood (*Populus deltoides*). Reed canary grass (*Phalaris arundinacea*) has also invaded. Wetland herbaceous species observed were grass-leaved goldenrod (*Solidago graminifolia*), water plantain (*Alisma subcordatum*), wild water pepper (*Polygonum hydropiper*), fox sedge (*Carex vulpinoidea*), marsh milkweed (*Asclepias incarnata*), cattail (*Typha sp.*), Pennsylvania smartweed (*Polygonum pennsylvanicum*), reedtop grass (*Agrostis alba*), spike rush (*Eleocharis erythropoda*), purple loosestrife (*Lythrum salicaria*), Dudley's rush, panicled aster (*Aster simplex*), awl fruited sedge (*Carex stipata*), willow herb (*Epilobium coloratum*) and squirrel tail bailey (*Hordeum jubatum*).

Management recommendations

Purple loosestrife (*Lythrum salicaria*) a non-native aggressive weed was observed in this wetland. Control through herbicide treatment is recommended immediately. Periodic burning of wetland edge would also be beneficial.

75. Ditch and associated woods (4F1), Eastern ½ Section 29
- Number of plant species recorded 11, of which 9 were native species
 - Historic vegetation – wet meadow/oak woods.

Present vegetation

Channelized ditch and shade suppressed woods. The ditch is approximately 8-10 feet wide and incised along the ditch edges are dense growths of box elder (*Acer negundo*), European buckthorn (*Rhamnus cathartica*), black cherry (*Prunus serotina*), shag bark hickory (*Carya ovata*), hawthorn (*Crataegus sp.*), honeysuckle (*Lonicera sp.*) and ash (*Fraxinus sp.*). Occasional small bur oak (*Quercus macrocarpa*) were also present. In areas where woody species were less dense, reed canary grass (*Phalaris arundinacea*), wild grape (*Vitis riparia*) and black currant (*Ribes americanum*) were more persistent. Arrowhead (*Sagittaria latifolia*) was found within the ditch bottom.

Management recommendations

Decrease canopy of shade suppressing woody species through selective cutting and herbiciding. Reseed or replant ground stabilizing native herbaceous species.

76. Wet woods Bluhm Park (4F2), SE 1/4 Section 12
- Number of plant species recorded 11, of which 9 were native species.
 - Historic vegetation - unknown.

Present vegetation

Wet woods with patches of reed canary grass (*Phalaris arundinacea*). Dominant trees were box elder (*Acer negundo*), black willow (*Salix nigra*) and silver maple (*Acer saccharinum*) with scattered gray dogwood (*Cornus racemosa*), wild grape (*Vitis riparia*), European buckthorn (*Rhamnus cathartica*), brambles (*Rubus occidentalis*), fox sedge (*Carex vulpinoidea*), paniced aster (*Aster simplex*) and grass-leaved goldenrod (*Solidago graminifolia*). Most of this area had been under agricultural production on historic aerial photos (1941, 1956).

77. Wet woods on Big Muskego Lake (4F3), NE ¼ Section 33
- Number of plant species recorded 24, of which 18 were native species.
 - Historic vegetation – low wet woods.

Present vegetation – young green ash woods

This woodland is periodically inundated as evidenced by water marks on trees and water stained leaves. This has resulted in a wet woods dominated by green ash (*Fraxinus sp.*), box elder (*Acer negundo*) and elms (*Ulmus sp.*) which are capable of tolerating flooded soils. Within the ground cover are wetland species which tolerate both flooding and semi-shade conditions. These include reed canary grass (*Phalaris arundinacea*), jewel weed, Joe pye weed (*Eupatorium maculatum*), sawtooth sunflower (*Helianthus grosseserratus*), paniced aster (*Aster simplex*), water plantain (*Alisma plantago-aquatica*), tall water parsnip (*Sium suave*), bitter sweet night shade (*Solanum dulcamara*), wild black currant (*Ribes americanum*), elderberry (*Sambucus canadensis*), beggar's ticks (*Bidens frondosa*), nodding bur marigold (*Bidens cernua*), false nettle (*Boehmeria cylindrica*), fowl manna grass (*Glyceria striata*), cursed buttercup (*Ranunculus sceleratus*), willow herb (*Epilobium coloratum*) and alternate leaf seed box (*Ludwigia alternifolia*). Purple loosestrife (*Lythrum salicaria*) was observed in some areas of this woods.

Management recommendations

Eradication of reed canary grass (*Phalaris arundinacea*) and purple loosestrife (*Lythrum salicaria*) through herbicide application is recommended. Natural fire did little to shape this plant community in the past and would not be considered as a major restoration strategy.

78. Lake Denoon (5A1), SE ¼ Section 31 and SW ¼ Section 32

- Number of plant species recorded – not applicable.
- Historic vegetation – open water lake with floating leaved and submerged aquatics.

Present vegetation

Lake Denoon is currently used for recreational activities such as fishing, boating and swimming. The shoreline (except for the west end) has been almost entirely developed as residential homes. Pockets of cattail (*Typha sp.*) and floating leaved emergents remain.

79. Big Muskego Lake and wetlands (5A/4C1), Sections 13-15, 21-23, 26-28, 33-34

- Number of plant species recorded 35, of which 33 were native species (Appendix 1, Table 4).
- Historic vegetation – open water lake with cattail (*Typha sp.*).

Present vegetation

Cattail (*Typha sp.*) dominated shoreline with numerous cattail (*Typha sp.*) islands. For its' size Big Muskego Lake is very shallow. Cattail (*Typha sp.*) edges contain scattered individuals of willow (*Salix sp.*), purple loosestrife (*Lythrum salicaria*), arrowhead (*Sagittaria latifolia*), elms (*Ulmus sp.*), marsh milkweed (*Asclepias incarnata*), cottonwood (*Populus deltoides*), reed canary grass (*Phalaris arundinacea*), jewelweed (*Impatiens capensis*), marsh fern (*Thelypteris palustris*), red osier dogwood (*Cornus sp.*), green ash (*Fraxinus sp.*), sensitive fern (*Onoclea sensibilis*), water willow (*Decodon verticillatus*), black currant (*Ribes americanum*), river bulrush (*Scirpus fluviatilis*), marsh hedge nettle (*Stachys tenuifolia*), hard stem bulrush (*Scirpus acutus*). In more open water areas water lilies such as *Nymphaea odorata* and *Nuphar advena* formed large colonies. Other floating and submerged aquatics observed were pond weeds (*Potamogeton spp.*), milfoil (*Myriophyllum spicatum*), duck weed (*Lemna minor*), and water meal (*Wolffia sp.*). Large expanses of dead cattail (*Typha sp.*) were observed in portions of lake.

Management recommendations

Control of purple loosestrife (*Lythrum salicaria*) through selective herbicide application (or biological control) should begin. Control of huge expanses of cattail (*Typha sp.*) is more problematic. Burning historically does little to control cattail. Water level manipulation may be necessary for control. Control of Eurasian watermilfoil (*Myriophyllum spicatum*), through biological control (weevils) has been tried. If results have been favorable this should continue.

80. Little Muskego Lake (5A2), Sections 4, 8-9

- Number of plant species recorded – not applicable.
- Historic vegetation – open water lake with floating leaved and submerged aquatics.

Present vegetation

Little Muskego Lake covers 506-acres and is relatively shallow overall, but does contain deeper areas. Shallower areas contain submerged aquatics such as water celery (*Vallisneria americana*). Significant silt loading occurs from upstream through Jewel Creek, which has been rip rapped and channelized. Most, if not all, the shoreline of this lake has been modified resulting from residential development. The USGS Trophic State Index (TSI) has categorized Little Muskego Lake in the Eutrophic (nutrient-rich) range. Significant beds of Eurasian watermilfoil (*Myriophyllum spicatum*) occur in Little Muskego Lake.

Management recommendations

Continue mechanical weed harvester operations throughout summer to control Eurasian watermilfoil. Investigate use of biological control (weevil) for Eurasian watermilfoil (*Myriophyllum spicatum*). Past activities have included application of 2, 4-D as weed control for Eurasian watermilfoil.

81. Jewel Creek flowing into Little Muskego Lake(5C1), NW ¼ Section 4 and NE ¼ Section 5

- Number of plant species recorded 8, of which 6 were native species.
- Historic vegetation - unknown.

Present vegetation

A degraded system associated with an approximate 10 foot wide creek channel with less than one foot of running water. Portions of the slopes of the creek channel have been heavily rip rapped. A dense woodland has developed on the banks of the channel. The dominant woody species are willow (*Salix spp.*), green ash (*Fraxinus pennsylvanica*), elm (*Ulmus sp.*), box elder (*Acer negundo*), black walnut (*Juglans nigra*) and Chinese elm (*Ulmus pumila*). The ground layer is dominated by reed canary grass (*Phalaris arundinacea*) with some areas of brambles (*Rubus spp.*).

Management recommendations

Decrease canopy of shade suppressing woody species through selective cutting and herbiciding. Reseed or replant ground stabilizing native herbaceous species.

82. Plum Creek (5C2), South ½ Sections 15-16

- Number of plant species recorded 6, of which 3 were native species.
- Historic vegetation – Prior to ditching may have been wet meadow.

Present vegetation

Highly disturbed wooded area along ditch banks which are dominated by young native trees such as elms (*Ulmus sp.*), ash (*Fraxinus sp.*), and box elder (*Acer negundo*) with a sub-canopy of non-native shrubs of European buckthorn (*Rhamnus cathartica*), honeysuckle (*Lonicera spp.*) and reed canary grass (*Phalaris arundinacea*) in more open areas.

Management recommendations

Decrease canopy of shade suppressing woody species through selective cutting and herbiciding. Reseed or replant ground stabilizing native herbaceous species.

83. Springs/seeps associated with areas along Spring Creek (5D1), NW ¼ Section 7
- Number of plant species recorded 34, of which 32 were native species (Appendix 1, Table 3).
 - Historic vegetation – Fen

Present vegetation – seepage wetlands

Several seepage wetland areas are found along slopes, which feed into Spring Creek, some of which are found on the City of Muskego property. Typical species observed included jewelweed (*Impatiens capensis*), water cress (*Nasturtium officinale*), great blue lobelia (*Lobelia siphilitica*), swamp goldenrod (*Solidago patula*), wild black currant (*Ribes americanum*), bittersweet night shade (*Solanum dulcamara*), nannyberry (*Viburnum lentago*), multiflora rose (*Rosa multiflora*), white avens (*Geum canadense*), basswood (*Tilia americana*), elderberry (*Sambucus canadensis*), cinnamon willow herb (*Epilobium coloratum*), reed canary grass (*Phalaris arundinacea*), giant ragweed (*Ambrosia trifida*), black willow (*Salix sp.*), smartweed (*Polygonum sp.*), bristly aster (*Aster puniceus*), elm (*Ulmus americana*), green ash (*Fraxinus sp.*), wild grape (*Vitis riparia*) and European buckthorn (*Rhamnus cathartica*). Some areas may be degraded fens.

Management recommendations

Control of woody species through cutting and herbiciding will be necessary. Assess response and feasibility of burning after woody species control.

84. Pond (5E1), NW ¼ Section 7
- Number of plant species recorded 13, of which 11 were native species.
 - Historic vegetation sedge meadow/wet prairie

Present vegetation

A small ponded area containing duck weed (*Lemna spp.*) and cattail (*Typha spp.*) is surrounded by box elder (*Acer negundo*), reed canary grass (*Phalaris arundinacea*), quaking aspen (*Populus tremuloides*), water horehound (*Lycopus americanus*), elms (*Ulmus sp.*), black walnut (*Juglans nigra*), willow (*Salix sp.*), horsetail (*Equisetum arvense*), button bush (*Cephalanthus occidentalis*) and silky dogwood (*Cornus amomum*).

85. Detention wetland (5E2), SE ¼ Section 8
- Number of plant species recorded 7, of which 6 were native species.
 - Historic vegetation – sedge meadow/wet woods.

Present vegetation

Consists of a wooded shoreline with most of the interior open water. Mortality of many interior trees suggests water levels are much higher now than historically. Probably serving as detention area for adjacent subdivisions. Area is surrounded by willow (*Salix sp.*), elms (*Ulmus sp.*), and cottonwoods (*Populus deltoides*) with reed canary grass (*Phalaris arundinacea*), panicled aster (*Aster simplex*) and wild grape (*Vitis riparia*) in the understory. Duckweed is found growing on the pond surface.

86. Pond in Muskego County Park (5E3), NW ¼ Section 17
- Number of plant species recorded 20, of which 19 were native species.
 - Historic vegetation – wet woods/meadow

Present vegetation

A small pond within the north woods in Muskego County Park has developed from a historic shallow depression. Subdivisions to the north and west may have affected surface hydrology leading to an increase in hydrological impacts into this system. Duck weeds (*Lemna minor*, *L. trisulca*) were found on the pond surface. The edges of the pond contain reed canary grass (*Phalaris arundinacea*), Bebb's sedge (*Carex bebbii*), dogwood (*Cornus sp.*), dark green bulrush, black willow (*Salix nigra*), green ash (*Fraxinus sp.*), quaking aspen (*Populus tremuloides*), American elm (*Ulmus americana*), water plantain (*Alisma plantago-aquatica*), marsh milkweed (*Asclepias incarnata*), heal-all (*Prunella vulgaris*), meadow rue (*Thalictrum dasycarpum*), calico aster (*Aster lateriflorus*), boneset (*Eupatorium perfoliatum*), poison ivy (*Rhus radicans*), pointed broom sedge (*Carex scoparia*), tussock sedge (*Carex stricta*), and black snakeroot (*Sanicula gregaria*).

87. Ditch through apple orchard (5F1), SE ¼ Section 3

- Number of plant species recorded 7, of which 3 were native species.
- Historic vegetation.

Present vegetation

Ditch is dominated by reed canary grass (*Phalaris arundinacea*) with scattered wild grape (*Vitis riparia*), water hemlock (*Cicuta maculata*), Canada thistle (*Cirsium arvense*), box elder (*Acer negundo*), burdock (*Arctium minus*) and cat nip (*Nepeta cataria*).

ASSESSMENT OF ECOLOGICAL CONDITION OF QUANTITATIVELY SAMPLED NATURAL RESOURCES

Site descriptions, species lists, quantitative vegetation data and Timed Meander Search (TMS) data collected in more selected vegetation types than the previous section were analyzed to further assess ecological conditions in the City of Muskego vegetation systems. These data document relationships between plant species richness, plant species distribution, and the plant species frequency in a vegetation type.

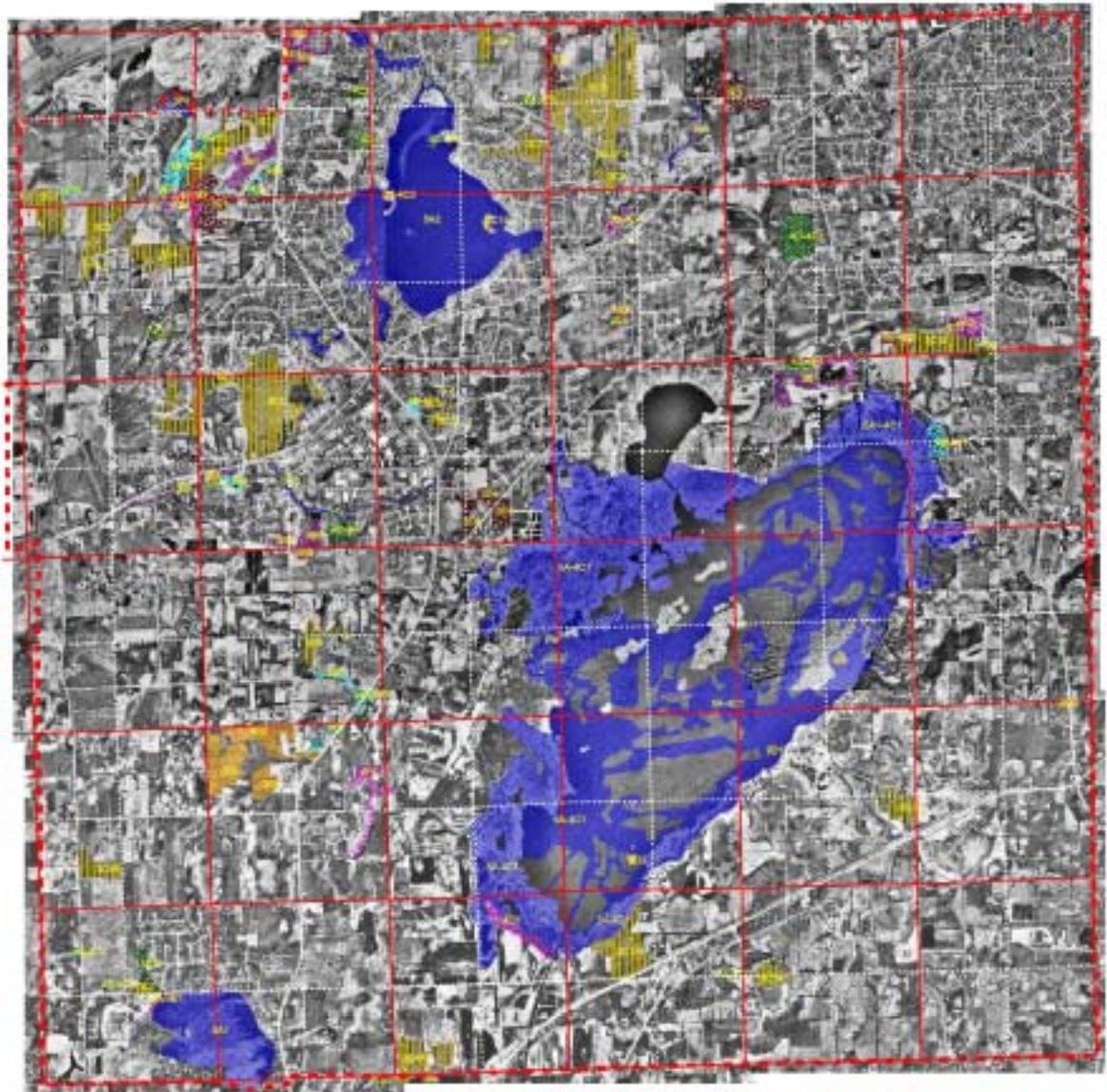
Locations in the project area, where the selected vegetation and ecological surveys were conducted, are mapped (Figure 5). Appendix 1 provides a summary of the TMS survey results for each numbered site, including plant species numbers, present vegetation, ecological changes, wildlife observations, management recommendations, and priority status. Quantitative data for selected sites are provided in Appendix 2. Vegetation and land cover type codes are indicated in parentheses in the vegetation descriptions. Priority status of each selected natural resource type has been determined using a scoring system based on ecological/physical parameters outlined in Table 3.

TIMED MEANDER SEARCH RESULTS

Timed Meander Search lists are given for seventeen of the selected vegetation types (Appendix 1), along with search duration (number of minutes), number of species recorded found per minute, and the cumulative number of species recorded. Generally speaking, searches that were of short duration, yielded relatively few species. This was often characteristic of poor or degraded sites. Searches of long duration, yielded an abundance of species. This was often characteristic of moderate to high quality sites.

Wetlands

Low diversity wetland sites are dominated by monotypic stands or have few species. These are represented by Timed Meander Search results in Tables 1 and 2 in Appendix 1. These are a reed canary grass (*Phalaris arundinacea*) wetland (4D2) found in Bluhm Park (Table 1) and a small depressional wetland (4E1) east of Racine Avenue across from Valley Sand and Gravel (Table 2). Wetland 4E1 had a low diversity of graminoid species. However it had a moderate diversity of forb species, including one species (*Solidago riddellii*), which is usually associated with high quality wetlands.



Muskego Land Cover
City of Muskego
 W18258200 Racine Ave.
 P.O. Box 749
 Muskego, Wisconsin
 53150

Figure 5
Muskego Selected Natural Resources
Land Cover Types

Applied Ecological Services, Inc.
 17521 Smith Road P.O. Box 258
 Brookfield, WI 53005
 Phone: (262)887-0661 Fax: (262)887-8488
 Email: info@appliedeco.com

Examples of moderate quality wetlands sampled by Timed Meander Search methodology are found in Tables 3-7. The first area consisted of a series of small seeps feeding into Spring Creek (5D1) (Table 3). While this area currently has a moderate diversity the area was historically a fen, one of the rarest wetland communities in the state. With restoration, it is possible this site could become a high quality wetland associated with Spring Creek.

The second moderate quality wetland is a cattail (*Typha sp.*) dominated central marsh with a periphery of moderately diverse plant species (5A/4C1) surrounding Big Muskego Lake (Table 4). In areas where cattail (*Typha sp.*) does not dominate, a number of moderate to high quality species can be found. These range from sedge meadow species *Verbena hastata*, *Eupatorium maculata*, *Scutellaria lateriflora*, *Leersia oryzoides*, *Carex sp.*, *Mentha arvensis villosa*, *Eleocharis erythropoda*, *Carex vulpinoidea*, *Calamagrostis canadensis* to emergent species such as *Scirpus acutus*, *Carex lacustris*, *Decodon verticillatus*, *Scirpus validus*, *Sparganium eurycarpum*, *Alisma subcordatum*, *Scirpus fluviatilis*.

The third moderate quality wetland area (4B/4D1) was located just north of the City of Muskego Building (Table 5). This small depressional wetland of less than 1 acre contained 35 plant species. One of which (*Carex crus-corvi*) is a rare sedge, known from few locations in the state. Restoration of this area would require minimal effort. Controlling reed canary grass (*Phalaris arundinacea*) would be the major management task. Restoration of adjacent woodlands will also be necessary to buffer this wetland.

The fourth moderate to high quality wetland was a sedge meadow area (4B2) in a small subdivision off Racine Avenue (Table 6). If sedge meadow 4B3 is included in this community, with minor management a high quality, high diversity sedge meadow would result. A number of high quality graminoid species (*Carex stricta*, *Carex pellita*, *Carex lacustris*, *Carex blanda*, *Leersia oryzoides*) were found interspersed with numerous native sedge meadow forb species (*Asclepias incarnata*, *Iris virginica*, *Rumex orbiculatus*, *Eupatorium perfoliatum*, *Lycopus spp.*, *Aster puniceus*, *Eupatorium maculatum*).

The fifth moderate (to high) quality wetland was another sedge meadow area (4A/4B1) along the western shoreline of Denoon Lake (Table 7). While the area was relatively small, a moderate diversity of high quality species were found.

The highest diversity sedge meadow wetland (4B/4F1) studied in the City of Muskego was located adjacent to the Big Muskego Lake boat landing (Table 8). Although this is a diverse community significant degradation through invasion of non-native shrubs and herbaceous species has occurred. Control of buckthorn (*Rhamnus cathartica*), reed canary grass (*Phalaris arundinacea*) and purple loosestrife (*Lythrum salicaria*) will be required. However, as a

demonstration area next to a high use area, this area has high recuperative potential with high educational value.

Woodlands

Three wooded areas studied were classified as low quality (Appendix 1, Tables 9-11). The most highly disturbed woodland of those studied was within Denoon Park, south of the Boat Landing Road (3C7) (Table 9). European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*) dominated the sub-canopy creating a depauperate ground cover layer. Oak present (*Quercus rubra*, *Quercus alba*, *Quercus macrocarpa*) were not regenerating because of low light conditions. A non-native tree, white poplar (*Populus alba*), was typically confined to peripheral areas and those areas closer to the lake. The presence of some moderate quality herbaceous species in light gaps suggests restoration of this area by brushing/herbicide and prescribed burning may be successful. However, a significant work effort to reduce shrub canopy will be required. Removal of white poplar trees and shrubs will also be necessary if ecological health of the woodland is to be restored.

The second low quality woods example was a mesic woods located on the City of Muskego building site (Table 10). As above, the presence of moderate quality ground cover species in light gaps and scattered throughout is indicative that restoration efforts could be successful. Native trees and shrubs, such as wild black cherry (*Prunus serotina*), white ash (*Fraxinus americana*), red oak (*Quercus rubra*), elm (*Ulmus americana*), choke cherry (*Prunus virginiana*) and black maple (*Acer nigrum*) found in this area are indicative of a mesic woods.

The third low quality example is a black maple (*Acer nigrum*) woods on City of Muskego building site (3C12). This area is probably intermediate between low quality and moderate quality (Table 11). Non-native European buckthorn (*Rhamnus cathartica*), honeysuckle (*Lonicera spp.*), Missouri gooseberry (*Ribes missouriense*) and garlic mustard (*Alliaria petiolata*) suggest the low quality of this woods. However, a moderately diverse native groundstory component is still intact. The presence of a diverse spring flora would elevate this woods type into a moderate quality site.

Two moderate quality woodlands were also studied (Appendix 1, Tables 12 & 13).

The first moderate quality woodland area was located in Park Arthur (3C/3F1). Portions of this site had a high density sub-canopy of sugar maple (*Acer saccharum*) saplings. In other areas where oak (*Quercus sp.*) and shagbark hickory (*Carya ovata*) were found there was a sparse to moderate diversity of herbaceous species. Several sedges (*Carex pensylvanica*, *Carex blanda*, *Carex tenera*, *Carex spp.*) as well as other ground cover species were found

including Jack-in-the pulpit (*Arisaema triphyllum*), yellow honeysuckle (*Lonicera prolifera*), yellow violet (*Viola pubescens*), white avens (*Geum canadense*), calico aster (*Aster lateriflorus*), wild strawberry (*Fragaria virginiana*) and carrion flower (*Smilax lasioneura*).

The second moderate quality woodland was an oak (*Quercus sp.*) savanna area in Bluhm Park (3C10). Oak species, white, red and bur (*Quercus alba*, *Quercus rubra*, *Quercus macrocarpa*) were the dominant trees with other trees such as black cherry (*Prunus serotina*), white ash (*Fraxinus americana*) and shagbark hickory (*Carya ovata*) found as scattered individuals (Table 13). Non-native shrubs of European buckthorn (*Rhamnus cathartica*), glossy buckthorn (*Rhamnus cathartica*), honeysuckle (*Lonicera spp.*), European high bush cranberry (*Viburnum opulus*), multiflora rose (*Rosa multiflora*), and Missouri gooseberry (*Ribes missouriense*) had invaded the sub-canopy of this woodland system. It is believed that this woodland had been grazed in the past. Fire suppression in these woodland types has resulted in the invasion of both the non-native weedy species listed above but also has allowed for an increase in native shrubs such as arrow woods (*Viburnum prunifolium*, *Viburnum rafinesquianum*), choke cherry (*Prunus sp.*), gray dogwood (*Cornus racemosa*), ironwood (*Ostrya virginiana*), boxelder (*Acer negundo*) and red osier dogwood (*Cornus stolonifera*).

Two of the three highest quality woods investigated consisted of an oak (*Quercus sp.*)/walnut (*Juglans nigra*) woods and a oak-hickory (*Carya ovata*) woods (Tables 14 & 15).

The first high quality woods was found along the ridges in the northwest corner of the property (3E1) (Table 14). This woodland community had a high diversity of native woodland species. The dominant sub-canopy shrub was prickly ash (*Xanthoxylum americanum*) with scattered non-native shrubs of European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*). Prescribed burning every 4 or 5 years is probably the only major restoration strategy to be employed in this woodland. If desired, limited control of the few buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*) could be performed by brushing and herbiciding the cut stumps with Garlon 4.

The second high quality woodlot examined was on the Peters Property (3C18). This oak (*Quercus sp.*) woods contained a diverse assemblage of native trees, shrubs and herbaceous species (Table 15). This oak (*Quercus sp.*) wood grades into a created Wisconsin Department of Transportation (WDOT) wetland mitigation area on the north side of the woods. While it's believed this woods had been grazed in the past, an existing diverse assemblage of ground cover species is indicative of an intact seedbank. Restoration and enhancement of this woodlot through periodic prescribed burns is probably all that is necessary at this stage.

The third high quality woods was the Parker Drive Woods (3G1 and 3G2). While only 50 species were observed, only a small portion of the woods was investigated (Table 16). This woodlot consists of several wooded types and wet swales and depressions scattered throughout. A diversity of graminoid species as well as herbaceous forb species is indicative of a more open canopy and higher quality system.

Old Fields

One old field area adjacent to a high quality sedge meadow was also studied (4B/2C1). This area has a moderate diversity of species that represent a combination old field species, native prairie species, native wetland species, and upland species (Table 17). Dewatering from creek downcutting or drain tiles have allowed for invasion of upland species into this historic sedge meadow/wet prairie community. A similar, less diverse community is found on the City of Muskego property, west of this area and on the other side of Spring Creek.

If the goal for restoration in the City of Muskego system is to identify a trajectory and a potential end point for the restoration activities, the TMS differences between existing conditions of degraded sites and the existing conditions of the highest quality ecosystem sites in the region can provide a portrayal of the changes in the species richness relationships that might be a major goal of the restoration efforts.

QUADRAT RESULTS

Fourteen sites were sampled to collect quantitative data on ground story vegetation frequency, cover and importance (Appendix 2). In addition, the number of trees, saplings and shrubs (Appendix 3) were determined to assess the degree of ecological degradation from shade suppression and presence of non-native woody species and the ecological health of a particular ecological system.

Wetlands

An example of a degraded wetland system, dominated by reed canary grass (*Phalaris arundinacea*) was located within Bluhm Park (land cover description 4D2, Appendix 2, Table 1). Reed canary grass (*Phalaris arundinacea*) is the most frequently observed species in quadrats with the greatest coverage. Only two other species were found in quadrats. This is an example of many of the low diversity reed canary grass (*Phalaris arundinacea*) areas within the City of Muskego.

An example of a moderate quality cattail (*Typha sp.*) marsh is shown in Appendix 2, Table 2 (5A1). The number of species recorded shows a moderate diversity of species. Two species dominate, (*Typha angustifolia*, *Leersia oryzoides*), with (*Phalaris arundinacea*) as a secondary dominant. If all cattail (*Typha sp.*) systems within the City of Muskego had this diversity, very few restoration activities would be required.

Sedge meadow areas received the most attention of the wetlands, because these are typically the most diverse and/or ecologically stable systems within the wetland communities found within the City of Muskego. Minimal maintenance will be required to maintain these systems in a high level of ecological health. The first sedge meadow area (4B2) had a species composition dominated (IV, Importance Value) by sedges (*Carex spp.*), especially tussock sedge (*Carex stricta*) (Appendix 2, Table 3). Moderate plant cover (AC=59%) is indicative of these sedge meadows. Tussocks are interspersed throughout the area with flowering species found on the tussocks or between tussocks. Reed canary grass (*Phalaris arundinacea*) is a minor component of this area, but with time could become problematic.

Another sedge meadow remnant area studied was adjacent to the Big Muskego Lake boat access (4B/4F1). This represents a high quality, high diversity wetland type that is being invaded by native and non-native trees and shrubs and non-native grass. The dominant species are non-native reedtop grass (*Agrostis alba*), glossy buckthorn (*Rhamnus frangula*) and woolly sedge (*Carex pellita*) (Appendix 2, Table 4). This sedge meadow is located in the transitional zone between uplands and the large cattail (*Typha sp.*) expanses in and around Big Muskego Lake. A combination of high quality wetland species (*Lobelia kalmii*, *Pedicularis lanceolata*) are interspersed with species usually associated with upland habitats (*Solidago canadensis*, *Daucus carota*, *Chrysanthemum leucanthemum*, *Melilotus alba*, *Prunella vulgaris*). This may be indicative of a change in lake hydrology, with lower water levels currently than were historically present. This along with fire suppression would also be indicative of shrub invasion into this zone.

Another high quality sedge meadow/wet prairie area was studied adjacent to Denoon Park Public Boat Launch (4A/B1). Tussock sedge (*Carex stricta*) was the dominant plant species with numerous other native wetland species (Appendix 2, Table 5). This small area has been invaded to a limited extent by reed canary grass (*Phalaris arundinacea*). Management in this zone will require limited herbicide application to individual clumps of reed canary grass (*Phalaris arundinacea*) and periodic prescribed burns. Because this area is already self sustaining for the most part, prescribed burning on a 4 or 5 year rotational period is recommended.

The last wetland area studied, (4B/3D1) consisting of a small depressional wetland located within a degraded woodland just north of the City of Muskego's municipal building, (Appendix 2, Table 6) was also looked at in greater detail. This wetland represents an example of a high quality wooded wetland that has been degraded by the invasion of the non-native reed canary grass (*Phalaris arundinacea*). This small wetland contains a rare sedge called crowfoot fox sedge (*Carex crus-corvi*). This plant has only been found in a few locations in the State of Wisconsin. Restoration of this site, while labor intensive should be able to be performed quite easily because of the small size. Restoration of the surrounding woods is also essential to provide adequate buffering for this depressional wetland.

Woodlands

Several wooded areas were studied intensively to describe the existing condition and to serve as a baseline reference to restoration activities. Most woodlands within the City of Muskego have been degraded through the invasion of non-native aggressive shrubs or by lack of historic fires. The two most common non-native shrubs found within the City of Muskego are European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*). Brief descriptions of the wooded communities are provided below.

A moderate quality black maple (*Acer nigrum*) woods on the City of Muskego offices property (3C11) was dominated by a few native species with limited honeysuckle (*Lonicera spp.*) and buckthorn (*Rhamnus cathartica*) invasion (Appendix 2, Table 7). Young black maple (*Acer nigrum*) saplings were the dominant sub-canopy species. This has resulted in a shade suppressed groundstory. Restoration of this woodland will require cutting and herbiciding of non-native shrubs of honeysuckle (*Lonicera spp.*) and European buckthorn (*Rhamnus cathartica*). The best method to employ would be to apply a herbicide such as Garlon 4 to cut stumps of these two species. Prescribed burning will be problematic in this area, since insufficient leaf fuel is typically the situation in this woods type and periodic historic fires for the most part did not shape this woodland community type.

Just south of this maple woods (3C12) and associated with the edge of the City of Muskego offices parking lot is a degraded mesic woods (3C12) (Appendix 2, Table 8). This area is also associated with a depressional wetland harboring the rare crowfoot fox sedge (*Carex crus-corvi*). Restoration of the groundstory of this area is essential to the ecological health of this small depressional wetland. Shade suppression from non-native honeysuckle (*Lonicera spp.*) and native shrubs and saplings have resulted in depauperate ground cover vegetation, which in turn increases the potential for soil erosion into the adjacent wetland. Removal of non-

native shrubs and perhaps some small saplings of native ashes (*Fraxinus spp.*) (both white and green) through cutting and herbicide application of Garlon 4 is recommended. In addition, if native seedbank has been lost, reseeding and/or planting may be necessary to reestablish the ground cover in this area. This area is relatively small and through management and restoration could provide an aesthetic and educational component to the City's property.

A historic oak (*Quercus sp.*) savanna area is located within Bluhm Park (3C10). No herbaceous species were encountered in quadrats, indicative of a very shade suppressed ground cover (Appendix 2, Table 9). Native woody species dominated the ground cover as well as the sub-canopy. For instance the equivalent of 11,200 stems of woody species/hectare less than 2 inches DBH were found in this wooded area (Appendix 3). Of these only 400 stems/hectare were from non-native woody species. Restoration of this woodlot is recommended by using prescribed burning. Where fuel loads are sufficient, an annual prescribed burn is recommended for three successive years in an attempt to reduce the number of shrubs and saplings. The recovery of the herbaceous ground cover vegetation should be monitored annually. It is anticipated that a native seedbank and/or propagule (includes seed, rhizome, bulbs, corns, etc.) bank is present and should respond to the increase in light and nutrients provided by the annual burns. After three years of prescribed burning the burn schedule should be re-evaluated depending on the response of the herbaceous vegetation community.

Within Denoon Park and associated with the public boat launch road is the most degraded woodland sampled (3C7) in this study (Appendix 2, Table 10). European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*) dominate the sub-canopy with the equivalent of 18,600 stems/hectare, less than 2 inch DBH of these two species along (Appendix 3). The total density of shrubs and saplings less than 2 inch DBH is 20,000 stems/hectare. Seedlings of European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*) are also observed in quadrats, as were very shade tolerant herbaceous species such as white avens (*Geum canadense*), false Solomon's seal (*Smilacina racemosa*), and enchanters night shade. Restoration of this woods will require substantial effort and time and will require brushing, herbiciding, and prescribed burning as management tools.

The largest private tract of woodland within the City of Muskego is the Parker Drive Woods Complex (3G1 and 3G2). This mesic basswood (*Tilia americana*) ash (*Fraxinus sp.*) woods is interspersed with wetlands and wet swales. The ground cover vegetation is relatively diverse consisting of herbaceous species and woody tree seedlings, saplings and vines (Appendix 2, Table 11). The equivalent of 9,000 stems/hectare less than 2 inches DBH were

found (Appendix 3). However, only 2,800 stems/hectare were of European buckthorn (*Rhamnus cathartica*), honeysuckle (*Lonicera spp.*) and multiflora rose (*Rosa multiflora*). Because of the large size of this woodland, restoration will involve a sizeable effort. Introduction of prescribed burning in portions of the site on an annual basis would be the most cost efficient task to be initiated. Portions of the woodland could be burned to reduce both native and non-native woody cover and to stimulate a response of native herbaceous ground cover component. Limited removal of non-native shrubs of buckthorn (*Rhamnus cathartica*), honeysuckle (*Lonicera spp.*) and multiflora rose (*Rosa multiflora*) should also be initiated.

Another example of a degraded oak (*Quercus sp.*) woods was found at the Park Arthur Woods (3C/3F1). The ground story vegetation consisted only of woody species (Appendix 2, Table 12). No herbaceous ground cover species were observed in quadrats. The presence of European buckthorn (*Rhamnus cathartica*) in quadrats is indicative of the beginning invasion by this species. It wasn't found in the shrub or sapling transect which was dominated by small (<2 inch DBH) black maple (*Acer nigrum*) saplings. Because of the nature of this woods, prescribed burning would be problematic because currently insufficient fuel loads are present to sustain even a brief spring burn. This woodland appears to be moving successional towards a sugar/black maple (*Acer nigrum*) basswood (*Tilia americana*) and red oak (*Quercus sp.*) woods. Historically wild fires had little impact on these communities. These woodlands typically have a diverse spring flora and through moderate shrub/sapling thinning, may best be maintained as a maple, basswood (*Tilia americana*) oak (*Quercus sp.*) community.

Another woods (3C18) studied, of moderate to high quality, consisted of old open grown (historically) oak (*Quercus sp.*) and hickory (*Carya ovata*) that have been seriously degraded by European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*) (Appendix 2, Table 13). Ground cover vegetation was sparse and contained mostly woody seedlings and very shade tolerant herbaceous species. European buckthorn (*Rhamnus cathartica*) (3,400 stems/hectare) and honeysuckle (*Lonicera spp.*) (3,200 stems/hectare) dominated the shrub/sapling layer (<2 inch DBH) (Appendix 3). Native cherries; both choke cherry (*Prunus sp.*) and wild black cherry (*Prunus sp.*), were also well represented in the shrub/sapling layer (1,600 and 2,000 stems/hectare respectively). Restoration and management needs for this community should include a combination of cutting and herbiciding of European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*) and periodic prescribed burning to decrease native woody species. It is anticipated that native seed and propagule banks are still present and the response of these banks after other restoration treatments should be evaluated.

The best example of an ecologically healthy oak (*Quercus sp.*)/black walnut (*Juglans*

nigra) woods was found on the Schroeder property (3E1) in the northwest portion of the City of Muskego (Appendix 2, Table 14). The ground cover vegetation was diverse and the cover was moderate to high. Non-native shrubs comprised only 1,000 stems/hectare that were less than 2 inches DBH (Appendix 3). Prickly ash (*Fraxinus sp.*), a native shrub, had the highest density (4,000 stems/hectare) of saplings. Overall 7 native species of saplings or shrubs were found in this woods. Overall woody sapling and shrub density was 10,000 stems/hectare, which is approximately one half the density observed in the highly degraded Denoon Park Woods. Management in this woods should be periodic prescribed burning. Every three to four years should be sufficient. If desired, herbicide control of European buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera spp.*) would help to control these two non-native species.

SUMMARY

In summary, many of the upland and wetland ecological systems in the project area are seriously degraded, and will continue to degrade. Ecological changes that are now occurring include:

- 1) Loss and reduction of native plant species numbers and quantities leads to declines in animal species as a response to declining plant community structure and diversity;
- 2) Lack of oak (*Quercus sp.*) species reproduction in most areas, suggesting that bur and white oak (*Quercus sp.*) will decline in the forests in the near future;
- 3) Shade suppression and loss of ground-stabilizing vegetation, nutrient, salt, and sediment loading of adjacent wetlands, streams, and lakes contributing to already deteriorated ecological conditions; and,
- 4) Conversion of historic, heterogeneous landscapes to monocultures with single species domination. Conversion of sedge meadows and wet prairies to cattail (*Typha sp.*) and/or reed canary grass (*Phalaris arundinacea*) monocultures provides one such example of this type of change.

Prioritization of Sites

Seven ecological parameters were used in scoring, and for prioritizing the selected natural resources found as representative resources in the City of Muskego. Each site received a low, medium, or high value for each parameter, which corresponded to the numbers 1, 2, or 3, respectively. Values for all parameters were summed for a total score for the site. The lowest possible score for a site was seven (7) points and the highest was twenty-one (21) points. A summary of scores for all sites is included in Appendix 4.

TABLE 3. PRIORITIZATION CRITERIA FOR EVALUATING ECOLOGICAL CONDITION OF SELECTED NATURAL RESOURCE AREAS IN THE CITY OF MUSKEGO PROJECT AREA. NUMBERS IN () ARE THE CORRESPONDING NUMERICAL SCORES USED IN THIS RANKING SYSTEM.

	FLORISTIC QUALITY		
1. <u>Low (1)</u> 0-20 plant species	<u>Medium (2)</u> 21-40 plant species	<u>HIGH (3)</u> >41 plant species	
	CONNECTIVITY		
2. <u>Low (1)</u> Highly fragmented or isolated areas surrounded by development; hydrologically and vegetatively isolated	<u>Medium (2)</u> Ditch and tree row connections, Some development connection to other woodlands and/or wetlands	<u>HIGH (3)</u> Hydrologic or vegetation connections to large tracts; unfragmented natural vegetation patterns; uninterrupted hydrology	
	SIZE		
3. <u>Low (1)</u> 1-5 acres	<u>Medium (2)</u> 6-25 acres	<u>HIGH (3)</u> >25 acres	
	HABITAT VALUE		
4. <u>Low (1)</u> Low species diversity, dominance by non-natives, structurally uniform, one community type	<u>Medium (2)</u> Medium diversity, some dominance of non-natives, little structural diversity usually one community type as dominant	<u>HIGH (3)</u> High species diversity, structural diversity, few non-natives, wildlife cover and food, presence of threatened and endangered species, several community types	
	RARITY		
5. <u>Low (1)</u> Disturbed vegetation, monocultures common to region	<u>Medium (2)</u> Native communities with few disturbances species, typical of region	<u>HIGH (3)</u> Native communities, little or no disturbance, few non-natives, regionally scarce, species rarity	

TABLE 3. PRIORITIZATION CRITERIA -CONTINUED-

	RESTORATION POTENTIAL		
6. <u>Low (1)</u>	<u>Medium (2)</u>	<u>HIGH (3)</u>	
Loss of seed bank, high costs and labor needed to restore, hydrology significantly or permanently altered, ground cover absent or sparse, intense logging, steep slopes, major erosion, farming	Seed bank probably present, moderate restoration costs and labor, no significant hydrological modifications, ground cover present with few shade tolerant species, moderate slopes, old fields	Seed bank present, low restoration costs and labor required (such as prescribed burning), little soil and/or hydrological disturbance, little or no erosion	
	BUFFERING CAPACITY		
7. <u>Low (1)</u>	<u>Medium (2)</u>	<u>HIGH (3)</u>	
Adjacent to highly disturbed sites, roadways, not near high quality uplands or wetlands, unstable soils	Existing prairie plantings, old fields, pastures, narrow, small in size	Adjacent to high quality uplands, wetlands, lake or river corridor, near highly erodible land	

RESULTS OF NUMERICAL SCORING

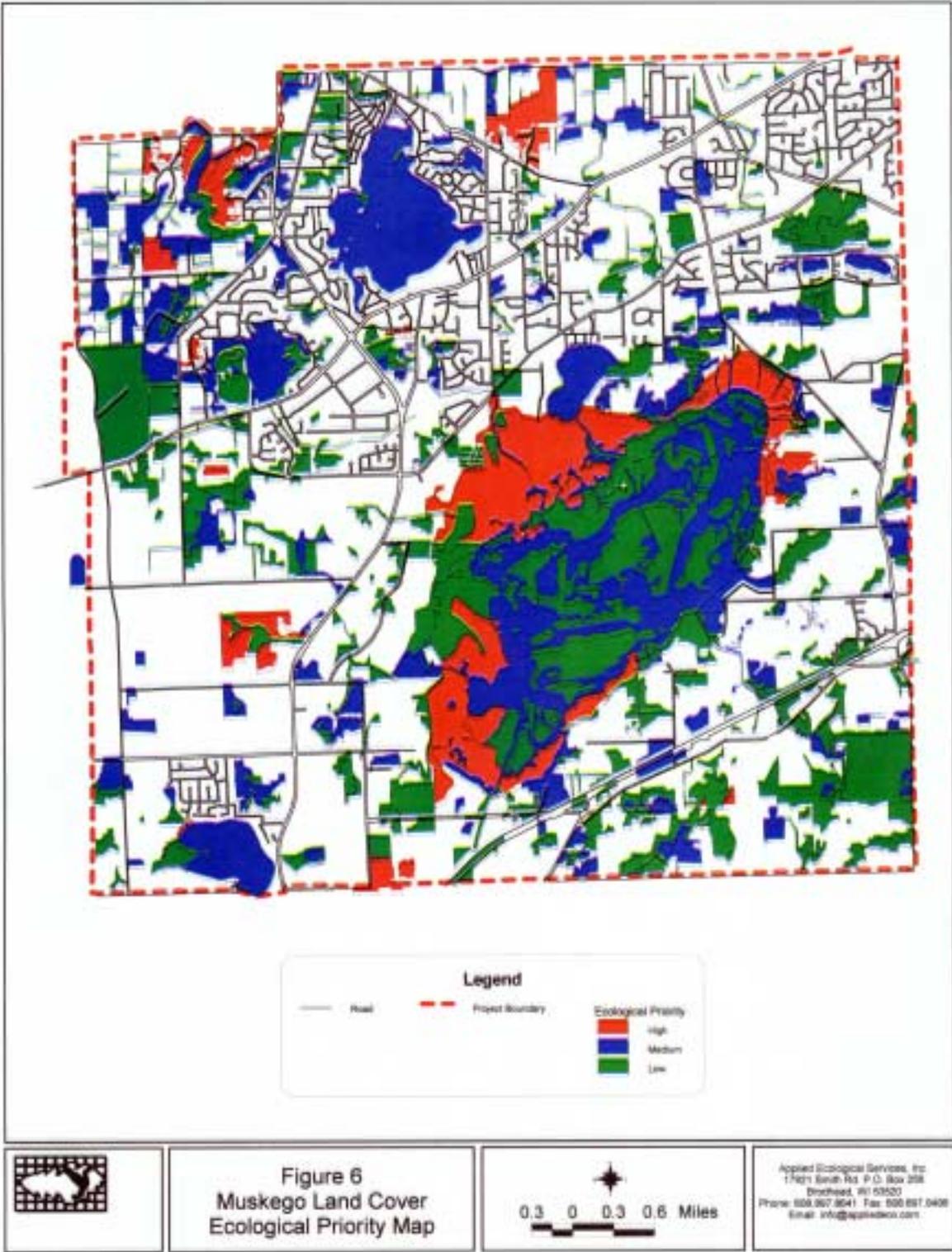
Based on the scoring process:

- 33 sites (38%) scored low (score range 7-11),
- 42 sites (48%) scored medium (score range 12-16), and
- 12 sites (14%) scored high (high score range 17-21) values.

Because the study sites that were scored are representative of the vegetation types present in the City of Muskego, this scoring process suggests that a high percentage of the vegetation cover types present (as represented in 33 of 87 study sites) are in serious decline, losing ecological values and restoration potential (Figure 6).

The highest scoring areas were sedge meadows, and oak (*Quercus sp.*) savannas that have high restoration potential and still retain significant biological diversity (Figure 6). Most medium score areas are areas with long-term restoration potential, but that will require significant management intervention to achieve success. It is these areas that have been impacted by sediment, salt, and nutrient enrichment, and hydrologic changes, or absence of fire. The performance of these areas with restoration and management programming will closely follow from the opportunities to control, obscure, or reverse variables contributing to degradation and the innate biological responses from seed banks, invasion of propagules, and management effectiveness at effecting change.

A record of 87 representative areas used in developing this scoring are included in the text and appendices.



SECTION II. RESTORATION AND MANAGEMENT PLANNING PROCESS

INTRODUCTION

This study has documented the degraded or monotypic nature of some of the wetland and woodland systems in the City of Muskego. Woodland systems ranged from low quality, highly disturbed systems, to high quality areas with high recuperative potential. The goal of the reporting process in previous sections was to prioritize areas as to their ecological and/or historical value and to identify restoration and management needs. This section develops a restoration management and monitoring framework for each of the selected general ecosystem types identified in the City of Muskego project area.

RESTORATION MANAGEMENT PHILOSOPHY

This document provides the basic ingredients to satisfy the general goals and objectives, as provided in the preceding sections.

The philosophical basis of this plan is heavily reliant on efficient implementation of the programs detailed herein. The philosophy has focused on creating ecologically valuable biological communities within the context of a disturbed landscape. Landscape disturbances and the existing condition of the landscape have been detailed in this report. This document provides information that serves as a baseline for assessing the effectiveness of future restoration management programs. Vascular vegetation in this project is being used as a surrogate for environmental quality. The assumption is that if the vascular vegetation communities are restored, wildlife opportunities and human enjoyment benefits will be realized.

The restoration philosophy for this project focuses on creating and restoring ecological systems with minimum effort. It is not our intent to re-create landscapes that were present 150 years ago. Some changes in the landscape, in the existing condition, preclude the opportunities for doing this, and it is not a goal of this project to burden the landowners or the City of Muskego with restoration and management that would not be practical or have achievable objectives and goals.

ADAPTIVE MANAGEMENT

Management plans need to be flexible because of the variability exhibited by the temporal and spatial resources addressed by a plan. Plans need at times to be changed in response to new data and derived insights. For these reasons, this plan should be viewed as being neither conclusive, nor absolute. This plan is a starting point in an ongoing process. The process relies on monitoring to provide feedback on program effectiveness, and for evaluation

and justification for changes. This process of evaluation, adjustment, refinement, and change is adaptive management. This process is fundamental to management, maintenance, and restoration.

1) Structure of a Management and Restoration Program and Implementation:

This program needs to incorporate all findings from the two levels outlined below of the restoration program to finalize a program schedule. This phase also is useful for finalizing boundaries of the restoration and management efforts.

The restoration and management program plan will be comprised of the two parts described:

- a) Remedial Phase: The remedial phase is the period during which major efforts to restore vegetation, habitat structure, and biological diversity is undertaken to begin the process of restoring ecological and bio-geochemical functions. Tasks undertaken during this phase may include reducing introduced non-native and other undesirable trees and brush, addressing erosion and nutrient problems, and other general tasks. In some projects this phase may involve machine/manual planting of native plants, including larger trees, and other plants.

- b) Maintenance Phase: After major investments of human energy and money are expended to achieve initial goals, restoration shifts to a low-intervention program. This is less costly, and provides an excellent opportunity for long-term community involvement. Once established, the maintenance phase is guided by both regular management techniques and by strategies that are implemented on a rotation through identified subunits (i.e. units that are convenient to manage such as prescribed burning units demarcated by existing and convenient hiking trails that serve as safe fire breaks).

- 2) Scheduling Monitoring and Management For Ecological Restoration Projects:
- a) In most land management programs, tasks to be undertaken are relatively simple, and most are repetitive. Often the most difficult part of the restoration program is organization of the tasks in a clear and easily understood format. It is also important that the program and schedule be designed to be flexible. Any time activities are planned that require complementary and facilitating meteorologic conditions, flexibility is required to identify changes in strategy, techniques, and timing that may be necessary or desirable to satisfy the restoration goals. Feedback from the monitoring program is also essential to ascertain if restoration and management activities have put the subject site on the correct trajectory to ecological health.
 - b) A simple time line oriented format for displaying and scheduling tasks may be appropriate (Table 4). This approach provides all tasks in the left hand column and quarterly scheduling of each task over, at least, a 5-year period in check off columns. During each quarter, specific target dates for implementation are identified with ample time to provide appropriate notice for scheduling personnel, volunteers, and equipment needs. Annually, budget projections are created for each task and level of effort expected. Maps for each task, identifying limits of the work effort, and corresponding in-field markings are also provided to personnel organizing the restoration field work.
 - c) The Restoration and Management Schedule for specific land cover type areas is depicted in Table 5. Finalization of this schedule for restoration and management is contingent on several pieces of information and timing:
 1. An assessment of financial commitment
 2. Personnel and labor availability and requirements
 3. Duration and guidance provided by the public participation process, and
 4. Results of the monitoring programs.

Table 4. EXAMPLE CITY OF MUSKEGO RESTORATION, MANAGEMENT AND MONITORING SCHEDULE

I. MANAGEMENT UNIT:	MANAGEMENT OBJECTIVE:	MANAGEMENT ACTIVITY:	REMEDIAL												MAINTENANCE																							
			2001				2002				2003				2004				2005				2006				2007											
			1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th								
a. Upland Prairie Buffer (old fields)	-Restore natural systems -Enhance habitat for native plants and animals -Reduce cover and frequency of naturalized plants by 95% in 5 growing seasons Increase native ground cover vegetation to 70-100% cover in 5 yrs -Increase frequency of dominant native species	-Remove shrubs and stump treat with Garlon 4 -Spray or wick with Rodeo -Prescribed burning -Seed area by hydro mulching or drilling	---	---	---	---	X	---	---	---	X	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	X	---	---	---	X	---	---	---
b. Upland Forests	-Restore natural systems -Enhance habitat for native plants and animals -Reduce cover and frequency of naturalized and target early successional plants by 95% in 5 growing seasons Increase native ground cover vegetation to 70-100% cover in 5 yrs -Increase frequency of dominant native species -Reduction/control of noxious weeds -Reduce canopy cover by 20-30%	-Cut non-native and marked early successional shrubs, trees and stump treat with Garlon 4 - -Prescribed burning -Seed harvesting and hand dispersal -Seed area by hand dispersal for enrichment purposes -Prescribed burning -Selected herbicide applications	---	---	---	---	X	---	---	---	X	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	X	---	---	---	X	---	---	---
c. Wetlands	-Restore natural systems -Enhance habitat for native plants and animals -Reduce cover and frequency of naturalized plants by 95% in 5 growing seasons - Increase native ground cover vegetation to 70-100% cover in 5 yrs -Increase frequency of dominant native species	-Shrubs and stump treat with Garlon 4 - -Prescribed burning -Seed harvesting and hand dispersal -Seed area by hand dispersal for enrichment purposes -Brushing of undesirable woody plants	---	---	---	---	X	---	---	---	X	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	X	---	---	---	X	---	---	---
II. MONITORING																																						
a. Monitoring photo document process-	Prepare documentary video and slides showing restoration process and success	-Document all major tasks in streambank stabilization restoration and program. -Human use -Success (immediate and after several years)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
video - 35mm slides																																						
b. Ecological monitoring	-Use quantitative datum for evaluation of success of restoration and stabilization activities and for characterization of problems and necessary refinements.	-Repeat surveying of monitoring transects for repeated sampling and analysis of trend -Establish plant cover monitoring protocol -Establish bank monitoring program	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---				
1. Vegetation associations			---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---				
Rare plants																																						
2. Hydrology			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
3. Water quality																																						
4. Bank stabilization																																						
III. PUBLIC INVOLVEMENT																																						
a. Education	-Develop newsletter for informing residents of local natural history to assist in their development of an appreciation for the savanna	-Develop newsletter goals and format -Design copy and art, prepare layout and draft for review -Prepare 2-4 copies/year	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
b. Human perceptions and attitudes	-Develop assessment of park user attitudes of native communities -Develop focus groups to assess park visitor feelings	-Surveys -Develop newsletter contributions	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---				
c. Tours and public relations	-Show off the process	-Press releases -Organized tours and events -Work shops	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---	---	X	X	---				

TABLE 5.

**EXAMPLE FIVE YEAR MANAGEMENT AND MAINTENANCE SCHEDULE
FOR SPECIFIC PLANT COMMUNITY OR LAND COVER TYPE
FOR CITY OF MUSKEGO**

	<u>YEAR 1</u>	<u>YEAR 2</u>	<u>YEAR 3</u>	<u>YEAR 4</u>	<u>YEAR 5</u>
	QTR	QTR	QTR	QTR	QTR
1. Prescribed Burn Site Inspection: Assess site conditions to determine feasibility, fuel load conditions	1 2 [3]* 4	1 [2][3] 4	1 [2][3] 4	1 [2][3] 4	1 [2][3] 4
*[Bracket] indicates quarter when work will be conducted.					
2. Burn Management: Apply for permits, schedule burn, contact local authorities, finalize burn plan	1 [2] [3] 4	1 [2] 3 4	1 [2] 3 4	1 [2] 3 4	1 [2] 3 4
3. Conduct Burn:	1 [2] [3] 4	1 [2][3] 4	1 [2][3] 4	1 [2][3] 4	1 [2][3] 4
4. Weed Management and Site Inspection: Assess site condition, identify threats, i.e. purple loosestrife (<i>Lythrum salicaria</i>), reed canary grass (<i>Phalaris arundinacea</i>). Recommend mowing where necessary and/or design herbicide application plan	1 [2][3] 4	1 [2][3] 4	1 [2][3] 4	1 [2][3] 4	1 [2][3] 4
5. Mowing: Conducted once annually for weed control	1 [2][3] 4	1 [2][3] 4	1 [2][3] 4	1 [2][3] 4	1 [2][3] 4
6. Herbicide Management: Wick application to non-native invasions, purple loosestrife (<i>Lythrum salicaria</i>) and reed canary grass (<i>Phalaris arundinacea</i>).	1 [2][3] 4	1 [2][3] 4	1 [2][3] 4	1 [2][3] 4	1 [2][3] 4
7. Summary Report: Annual report to client to provide specifics on activity and recommendations	1 2 3 [4]	1 2 3 [4]	1 2 3 [4]	1 2 3 [4]	1 2 3 [4]
8. Vegetation Monitoring: Biannual quantitative field sampling and report for submittal to client	1 2 3 [4]	1 2 3 [4]	1 2 3 [4]	1 2 3 [4]	1 2 3 [4]
9. Hydrologic Monitoring: Installation of water level recorder	1 2 3 [4]	1 2 3 [4]	1 2 3 [4]	1 2 3 [4]	1 2 3 [4]
10. Hydrologic Monitoring: Quarterly data retrieval and report for submittal to client	1 2 3 [4]	1 2 3 [4]	1 2 3 [4]	1 2 3 [4]	1 2 3 [4]

- 3) **Specialized Training for Restoration and Management:** For many of the restoration tasks (i.e. prescribed burning, herbicide use, monitoring and research) specialized training, often licensing or certification, and oversight and guidance are required well in advance of the dates for commencement of the restoration program. Personnel and volunteers involved in prescribed burning, brush control, monitoring, seed collection, etc., should receive training commensurate with the activity in which they would be involved. Training is especially important for those activities that may have risk and safety implications (i.e. prescribed burning), but also for monitoring, where an accurate assessment of the ecological performance of the ecological system to the restoration treatments is required.

- 4) **Ecological Monitoring:** The process of ecological monitoring provides important and regular data on the effectiveness of the restoration program. Effectiveness is to be judged against the original (and new) goals and measurable objectives designed by the project. Goals are generally refined during project design phases and over time as project performance is measured.

Monitoring should use standard methods of measurement and provide a systematic record of important and key variables that directly or indirectly measure the ecological system and restoration performance. A brief plan for monitoring follows.

Monitoring for most variables can utilize study transects located within management or restoration units. Repeating the sampling methods for vegetation would provide measures of the response of the vegetation community to restoration treatments.

Photographic monitoring, including 35-millimeter color slide and color video coverage of the restoration treatment process and results, is useful. We would propose that permanently installed photographic stations be identified and regularly visited during the course of the restoration process. This documentation, when coordinated with vegetation monitoring (also birds, insects, etc.), will be immensely useful in development of interpretative and educational materials.

The monitoring program should focus on measurement of the following variables:

- * Effectiveness of management/restoration strategies on vascular vegetation
- * Erosion control effectiveness and sedimentation rates
- * Attainment of the management/restoration goals and objectives
- * Public perception of the restoration program results
- * Visual conditions and changes that occur once restoration and management programs are implemented

- 5) Reporting: Every year during the remedial phase, one report should be prepared for this restoration program. This report should detail all tasks, labor, costs, locations and dates of all management and restoration efforts undertaken. The report should also detail monitoring data collected, to identify trends in the status and condition of the ecological variables. Public perception information, such as that generated in association with the demonstration projects, may best be reported in memorandum format (if this surveying is intermittent) or perhaps as a separate report if a standard (survey form) program for assessment of perception is implemented. Generally, we recommend that every 5 years a detailed technical analysis and summary of all the previous data be completed. This report may best be termed "*Ecological Status Report*". It would be designed to assimilate all previous data, and prepare easily understood graphics and summary materials. This is a very useful report for identifying achievement of important milestones.

THE MANAGEMENT/RESTORATION PLAN

The management/restoration plan is comprised of two phases as stated previously: The remedial and maintenance phases. The remedial phase involves the major restoration and management tasks, and, consequently, is usually the more laborious and costly. The second phase is the maintenance phase. It is less costly, and represents the long-term management/restoration program tasks. It should be viewed as a routine maintenance program conducted annually at strategic times to achieve and maintain specific ecological and biological objectives.

The period of time required to conduct the remedial restoration phase depends on the level of effort required, condition of the ecological system, opportunities and constraints (i.e. access, weather, biological response), and financial base of the program. Typically a remedial phase of two to three years is required, followed by the maintenance phase.

RESTORATION TASKS

This study indicated non-native plants are present and often times have an overwhelming influence on the native vegetation. Restoration tasks associated with this project include:

- 1) Reduction of non-native shrubs and trees.
- 2) Reduction of non-native ground cover vegetation in the forested areas, wetlands and in open fields.
- 3) Reduction of overstocked canopy of native, early-successional trees. In some locations early successional trees (green ash (*Fraxinus sp.*), red elm (*Ulmus rubra*), and cottonwood (*Populus deltoides*)) dominate and provide an overall prevailing influence on the rate of succession, aesthetics, and diversity of the biological communities. In locations where these plants dominate, we propose that thinning of the canopy structure will allow more light to the ground, which will promote the establishment and growth of native ground cover vegetation.
- 4) Enhancement of opportunities for growth of native ground cover vegetation. Because of the dense shade, ground cover vegetation is largely suppressed and consequently not growing in many woodland areas. Non-native species are invading and becoming dominant plants in some locations in both woodlands and wetlands. Bare ground is also found in the shade suppressed wooded areas. A restoration strategy will require the reduction of the growth of these non-native plants, addition of seed collected from the local area, and management strategies to enhance the growth of the native ground cover vegetation.
- 5) Education. One of the principle needs associated with any restoration project is the understanding of the restoration goals, status, and process by the public and Parks staff.
- 6) Buffers. Human induced environmental impacts to ecological systems can be so severe that buffering is needed to protect existing natural resources. Establishment of buffers using native vegetation is recommended for significant natural resource areas within the City of Muskego.

RESTORATION OBJECTIVES AND PERFORMANCE CRITERIA

To address restoration tasks, specific performance criteria and objectives have been designed. These are briefly outlined below. Later sections of this report lay out the methods for implementing restoration tasks and achieving the objectives and performance criteria, and provide scheduling for these efforts.

MANAGEMENT OBJECTIVES AND PERFORMANCE CRITERIA

1. Brushing. Under this criteria, using the techniques defined in other sections of this report, 90% mortality of all treated stems shall be achieved within a three year period. This will include a 90% reduction in the non-native woody plants.
2. Native Ground Cover Vegetation. Within a period of five years, we propose that native ground cover vegetation should achieve a cover value in meter square quadrat samples of 40-50% grasses and sedges (*Carex spp.*), and 25-40% cover of native forbs.
3. Planted Areas. We propose that planted areas achieve performance within five years comparable to the native ground cover vegetation objectives.
4. Aesthetics and Visibility. We propose that a white card, 2 square feet in area, be held at a 2 meter height, and that it be visible at up to 60% of all sight line positions at distances of 200-400 feet within wooded areas to be restored to open oak (*Quercus sp.*) woods.\
5. Buffers. The width of buffers can be variable depending on function of the buffer. Generally a minimum of 30 to 50 foot buffer is necessary, but in some instances a 100 to 200 foot buffer may be necessary.

PROGRAM IMPLEMENTATION

INTRODUCTION

This section provides recommendations and additional detail to consider in implementation of the management and maintenance program.

RECOMMENDATIONS

Recommendations that follow are proposed to manage, maintain and monitor the effectiveness of management and restoration of upland buffer, floodplain forests, wetlands, prairies, and stream banks along creeks/rivers in the City of Muskego system. In the process, prescribed burning is the single most useful and important management method required for restoration. The other restoration strategies prepare a site for use of prescribed burning, or are primarily involved in reintroduction of proper conditions and species into sites. Once fire can be easily and safely reintroduced, the maintenance phase of the restoration program will be achieved. A shift to the maintenance phase will require less labor, money, and overall effort.

- 1) **Prepare sites for use of prescribed burning management:** Preparation of the site so that prescribed burning can be introduced is often a major remedial phase management strategy.

In many locations, on slopes or in stream banks where dense brush and little combustible fuel occurs, manual reduction of existing dense shrub growth will be required to open the areas. Once open, and especially if ground cover vegetation responds directly or after reintroduction, prescribed burning can be used.

If use of fire is hampered in areas with non-native, cool-season grasses, alternatives to consider to facilitate eventual use of fire are described as follows. Where the evergreen growth of cool season grasses does not carry fire, very careful and discriminate use of herbicides can assist in reduction of the cool season grasses. In these situations, direct plant contact with a wick applicator and the herbicide *Rodeo* or *Roundup* (Glyphosphate) have provided quick and safe initial control of the grasses. Often, low mowing of the grasses (.5 to 1 inch height) can reduce green foliage and, after drying, this litter can be used as fuel to carry a fire. In these situations, fire is prescribed to follow (5-15 days) the herbicide treatment. This method will be especially useful in old fields.

Herbicide is generally applied to cool season grasses after they have reached a height of 5-8 inches and display a new flush of green, actively growing foliage. Herbicide is applied at the label rates by trained applicators with good botanical training. Areas not receiving treatment should be cordoned off, and careful attention paid to inappropriate application and the problems that could result.

In larger pieces of property, large wick applicators with adjustable boom heights are very useful for wicking taller, dominant plants. This strategy often can utilize an all-terrain vehicle (or riding lawn mower) for carrying the boom.

Regardless of the method used, very careful oversight of the process is desirable. Although the herbicide *Roundup* is incorporated within several hours after application, and wick application in contrast to spraying involves a very small quantity of herbicide, the areas that are treated should be field-labeled and guarded to manage human-use for the first couple hours after application. *Roundup* has very low toxicity to wildlife, and will

not present a threat to pets.

2) **Policy for urban wildlife and human disruption of ecological system functions:**

Many of the problems affecting the condition, health, and sustainability of ecological systems result directly from years of advertent and inadvertent human intervention. Advertent intervention has been directed at producing certain results. Planting trees, stopping historic fires, development and concurrent destruction of ecological systems are but a few examples. Inadvertent intervention also includes fire suppression (the consequences of elimination of fire were not understood), hydrological and hydraulic changes resulting from regional development, contaminant loading from aerosol sources, combustion by-products from autos, winter deicing (road salting) contamination, and other sources.

Still other changes, which can be particularly disruptive of natural processes can result from human uses: random trail installations and erosion problems, ecosystem fragmentation by development and habitat destruction, and spatial isolation of remnants, which restricts or stops genetic and energy/nutrient transfer, and other important types of historic connections.

3) **Reintroduction of plant species:**

a) Because the City of Muskego project area is not a "natural area", a policy for determining which species of plants are appropriate for reintroduction or introduction may not be as important as in a Natural Area. However, we would propose that introductions be limited to species for which the likelihood of historic occurrence exists. This does not rule out the opportunities for display gardens with regional native prairie, that may or may not have occurred in the area. Nor should this rule out opportunities for use of short-lived, non-native species (i.e. annual rye grass (*Lolium multiflorum*), which may assist in stabilizing badly eroding slopes).

b) Plant propagation and introduction of seeds from local species should occur, if necessary, concurrently with other management and restoration strategies. Our observations suggest soil seed banks are present in most woodlands and in most moderate to high quality wetlands. Dense cattail (*Typha sp.*) areas and reed

canary grass (*Phalaris arundinacea*) areas as well as severely degraded woodlands (especially on slopes) may have lost most, if not all of their native seedbank. To enhance these areas, additional seeds from native species (propagated and cultivated for seed production, or wild harvested seeds) may be gathered or produced in ample quantity (and quality) to enable prompt introduction during the early years of restoration. For species that are no longer present in the area, appropriate and closest locations should be identified for seed harvesting, propagation, cultivation, and eventual introduction purposes. We generally recommend that seed come from as close to the site of introduction as possible. We generally limit the bounds for collection for any introduction program to the physiographic province (i.e. natural area division) of the recipient location. Propagation experts at Waukesha County Parks may be able to provide a program to cultivate the many native species that are now declining regionally. We encourage that priority be given to native grasses and sedges (*Carex spp.*) initially (to provide seed that can be used to quickly stabilize slopes in degraded savanna areas) followed by the annual, biennial, and perennial flowers.

4) **Creation of buffers:**

- a) Water quality and storm water runoff benefits of buffers(Karr and Schlosser 1977; Wong and McCuen 1981).

The quality of storm water leaving a development is related to such variables as slope, vegetation type and coverage, soil permeability, runoff velocity and volume, and detention time. On a steeper slope, there can be increased erosion due to higher water velocity leaving the land. When runoff velocity doubles, water moves particles 64 times larger, and transports 32 times more suspended material, making erosive power 4 times greater.

If slope length is doubled, an unvegetated 9% slope would lose 2.6 times more soil and 1.8 times greater runoff water. On a vegetated 9% slope, soil loss and runoff are significantly reduced when the slope length is increased.

Vegetation type and percentage of ground cover by vegetation affects runoff velocity and water quality by trapping sediment. A 5% slope of dense grass with runoff velocity at 0.50 feet/second requires a 200-foot-wide buffer to trap 95% of the water carried sediments. In contrast, for a 5% slope of light grass and a

runoff velocity of 0.70 ft./sec, a 400-foot buffer is required to trap the sediment.

Soil type influences buffer design. Clay soils compared to sandy soils have slow water infiltration and potentially greater runoff. Buffers with clay soils need to be wider to compensate for the less permeable soils.

b) Noise, human activity and wildlife (Schechter 1980).

Buffers can reduce noise problems for humans and wildlife. Buffers can also separate human activity zones from key wildlife areas. Rare birds may not successfully breed in noisy locations or where human activity occurs. Noise and human activity disrupts courtship, reduces successful rearing of young, and increases the vulnerability to predators.

Studies of noise impacts on some wildlife have suggested short-term exposure to loud sounds causes physiological and behavioral changes, especially at levels exceeding 55 decibels. Noise and human activity can cause nest abandonment and some species such as colonial wetland birds are very vulnerable.

Frequency, intensity, and persistence of noise and proximity of human activities during breeding and rearing periods are important factors that affect wildlife.

Sound is intercepted by taller, wider and denser vegetation plantings. Noise can be reduced with barriers, diffusers, deflectors, and by increasing the distance from source to wildlife. Barriers can provide up to 15 decibels of noise reduction. Effective barriers need to block the line of sight between source and wildlife. Vegetation barriers provide a desired aesthetic compared to steel or concrete structures. Trees and shrubs can significantly reduce noise; approximately 5 decibels of reduction per 100 feet of forest width, to a maximum of 10 decibels can be expected.

To reduce noise and human activity, a buffer of 330 to approximately 700 feet has been recommended for areas containing sensitive wildlife. Where birds have become habituated to human activity, reduced buffers may be effective.

Noise problems in adjacent wildlife areas or parks can often be reduced by creative designs. Houses can deflect noise; a 1-story building can reduce noise

by 4 to 6 decibels while 2-story or closely spaced 1-story buildings can provide up to 10 decibels of reduction. Choice of construction materials can also provide reduced noise to adjacent wildlife areas and for residents.

- c) Vegetation buffers can help offset regional wildlife habitat losses (Steinblums et al. 1971; Goldstein et al. 1983; Adams and Dove 1989; Mariner and Mertz-Irwin 1991).

Like people, plants and animals have requirements for the minimum size and quality of areas they use. Generally, the larger and more diverse the habitat area the greater the diversity of species.

Development pressures reduce habitat to small and often narrow strips. Habitat that does remain is often degraded, reducing opportunities for feeding, breeding, and avoiding predators. Many migratory species cannot exist in narrow habitat strips and rare plant and animal species are vulnerable to even minor habitat losses or disruptions. With habitat loss, species losses are often 10-fold greater than what acreage losses would suggest. Wildlife habitat buffers can be included in around, and between developments to the advantage of wildlife, and development marketing. These buffers can serve to reduce noise, increase water quality and provide aesthetic benefits. Habitat linkages and corridors in and between developments would be best if designed as larger blocks. Long, narrow vegetation strips do not harbor as many species as blocks or round shapes of habitat area. A round area of habitat of 2000 ft.² may harbor 2 species of breeding birds. But in a 5-acre round unit may harbor, 10 species of birds. The larger area would be valuable also to many other species.

Buffer widths can vary depending on use and the services desired, such as improved water quality control, noise reduction, and habitat protection.

Incorporation of buffers in developments provides ecological and marketing benefits. In addition to the beauty, buyers often appreciate knowing they live in an environmentally sensitive development.

SECTION III. TESTING AND DEMONSTRATION PROGRAMS FOR PUBLICLY OWNED PROPERTY (FIRST STEP)

Restoration of ecological systems can be a controversial process. This is partly because of the need to clearly articulate the process and the likely changes that will occur, which cannot all be explained. For this reason, testing and demonstration plots and programs of public education and scientific research are often intimate parts of a restoration program, especially in high-use, urban park systems. This section lays out a testing and demonstration program concept that can be used for educating Park personnel and the public, and, also, for reviewing and assessing the costs and procedural strategies associated with implementing restoration tasks in the entire City of Muskego system. The following general tests and demonstration plots are identified to be useful within the City of Muskego system. These include test plots in woodlands although in wetland communities specific sites have not been selected.

RATIONALE FOR ESTABLISHMENT OF RESEARCH, TEST, AND DEMONSTRATION PLOTS IN SUPPORT OF UNDERSTANDING RESTORATION OPTIONS IN THE CITY OF MUSKEGO SYSTEM

INTRODUCTION

Prior to finalization of the restoration plan, basic research questions need to be addressed. The research questions have been developed from the general conclusions included in this report. Based on other studies in similar ecological systems, the following conclusions have been identified:

- 1) Oak regeneration has declined or is not occurring, and existing larger oak are in serious decline.
- 2) Native plant species have experienced significant declines.
- 3) Introduction and proliferation by non-native plant species represents a serious threat to soil, fauna, and native vegetation systems.
- 4) Erosion problems are presently associated with the collapse of ground cover vegetation beneath the shade of introduced shrubs along some ditches and creeks. With this erosion, loss of soil seed banks, roots, and tubers is occurring.

THE NEED FOR RESEARCH PLOTS

This plan proposes to begin to understand the needs, options, and opportunities for restoration and management of declining ecosystems. Small test and demonstration plots in appropriate locations would be useful for undertaking the initial testing program.

Several different test and demonstration scenarios to develop an understanding of ways to reverse the serious degradation would be useful for finalization of the restoration plans. Each of these scenarios can be tested in small research plots and some can be tested in a greenhouse setting. The general types of testable scenarios and treatments include the following:

- 1) Oak Regeneration Test and Demonstration Plots:
 - a) Enclosures to test squirrel acorn depredation effects on oak regeneration.
 - b) Prescribed burning test of the potential to stimulate resprouting of old age oak.
 - c) Prescribed burning effects on reduction of cool season grass cover and soil mineralization for seed bed preparation.
 - d) Reintroduction of oak (nursery grown) seedlings into areas.

- 2) Introduced Shrub Test and Demonstration Plots:
 - a) Test manual ways (pruning, cutting, girdling) to reduce shrub cover and increase light to ground.
 - b) Test use of prescribed burning to reduce shrub cover and increase light to ground.

- 3) Cool Season Grass/Non-Native Ground Cover Test and Demonstration Plots: Test ways to reduce cool season grass (and associated duff) dominance to enable stimulation of soil seed banks and reintroduction of seeds and plants for native species.
 - a) Test prescribed burning
 - b) Test litter removal by manual raking
 - c) Test black plastic light inhibition methods
 - d) Test selective herbicide wicking

- 4) Ground Cover Plant and Seed Introduction Test and Demonstration Plots: Establish test plots for reintroduction of native seeds.
- 5) Response of Existing Highest Quality Oak Woodland Areas: Establish test plots in existing highest quality areas to evaluate response of these sites.
- 6) Establish Community Outreach Programs:
 - a) Establish a community seed collection and plant propagation program, perhaps in coordination with gardeners at the community gardens.
 - b) Solicit involvement of garden clubs and others to assist in propagation and growth of native species for seed and plant materials.
 - c) Generate educational programs to initiate native plant propagation programs with local schools and other educational programs.
 - d) Encourage use of native plants by local garden centers.

RESEARCH METHODS FOR USE IN PLOTS

GENERAL METHODS

Standardized ecological field sampling methods are proposed for use in the program plots. Following are suggested research methods.

- 1) Plant Species Composition
 - a) Random or regular systematic 1 meter² quadrats to measure plant cover and frequency for all vegetation less than 1 meter height.
 - b) Timed meander search method for collection of time standardized plant species listings and generation of species-time curves.
 - c) Dominance or importance values based on cover or frequency from quadrat (m²) sampling.
- 2) Tree/Shrub Canopy and Woody Vegetation Dominance
 - a) Basal area determination using tree caliper to measure Diameters at Breast Height (DBH) or use of Hirsch Prism (used for timber cruising).
 - b) Cover, frequency and importance measured along line intercepts.
 - c) Density of stems in 50 x 2 meter belt transects.

- 3) Oak Regeneration, Plant Mortality and Rare Plant Abundance and Distribution
 - a) Meter square quadrats for plotting oak seedlings and rare plants.
 - b) Individual plots specifically laid out to map rare plants.

- 4) Noxious Weed Test Plots
 - a) Stem density, cover, frequency and success of control. Use same methods as in 3.
 - b) For shrubs, use methods in 2.

- 5) Ground Cover Plant and Seed Introduction
 - a) Use methods as in 1 and 3.

RECORDS OF RESTORATION ACTIVITIES IN TEST PLOTS

It is essential that accurate records on the timing, methods employed, initial observations of treatments, and treatment affects, materials, supplies, labor, and costs be recorded to relate effectiveness to program efficiency. Standard forms need to be prepared for development of these records.

DATA ANALYSIS

Data usefulness is directly related to the experimental design, and quality of the data collected. Care must be taken in plot design, layout, and data collection to ensure that assumptions of statistical analysis to be employed are understood and integrated.

- 1) For all test plots, standardized, and reproducible primary and secondary methods of data summary and analysis need to be employed.
- 2) Plots can be laid out to provide measures of trend analysis (repeated sampling strategies), or plots can be split to establish separate controlled replicated opportunities, which provides for the use of the most robust, non-parametric statistics. We recommend use of statistical software for analysis such as SPSS, SAS, Systat, etc.
- 3) Multivariate statistical analyses (cluster analysis, ordination, etc.) provide very powerful methods for understanding relationships among data and variables. We recommend use of specialized software such as PC ORD for these analyses.

IMPACT OF RESTORATION IN TEST PLOTS

This section provides an overview of the potential ecological impacts of the test plots. We currently do not feel any adverse impacts will be associated with this test program.

- 1) For the several hours during prescribed burning treatments, access into plot areas will need to be restricted.
- 2) If spring prescribed burning is conducted, the site may appear burned for several days until grass green-up occurs.
- 3) Native and other rare plants will benefit from prescribed burning.
- 4) Overall aesthetics of Park site will be improved by management.
- 5) Management will offer security benefits because of increased visibility.
- 6) Creation of healthy assemblies of native species will restrict further invasion by non-native species.
- 7) Reduction of non-native species and the dense shade they provide will allow native species to again stabilize the soils.

BENEFITS OF RESTORATION

Preceding sections document deterioration of some of the ecological systems in the City of Muskego. Restoration can assist in reducing the cost of long-term maintenance of the system in addition to providing opportunities for stabilization of eroding uplands and shoreline environments, increasing the lag time of runoff in the upland systems, and stimulating ground cover vegetation in shade-suppressed areas. This would reduce erosion, nutrient loss, and loss of soil seedbank systems, and improve water quality in downstream environments (including lakes, streams, and wetlands).

Other major opportunities provided by restoration in Park settings are enhanced aesthetics. Currently, many overgrown oak woodland systems provide little aesthetic opportunity and human appreciation. Also, in some parks there has been a demonstrated fear associated with dense vegetation cover; people do not feel secure walking down trails lined with dense woody vegetation. The improved safety and aesthetics enhance human opportunities for appreciation. Restoration of the vegetation system and the hydrologic systems also provides opportunities for wildlife habitat enhancement. The return of structure and biodiversity, and productivity to the ecological system through the restoration process will provide opportunities for a response in breeding bird richness, invertebrates, mammals, and other species that are present or have been present in the recent past.

Once restoration costs and labor needs are reconciled through normal budgeting and labor appropriations for park maintenance, further benefits of restoration can be realized. Most of the tasks associated with a restoration plan can be implemented as a part of routine park maintenance and management activities. Only a few tasks require additional labor techniques, equipment, and know how for successful implementation. Perhaps the most important of the tasks that does require specialty training is prescribed burning.

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APPENDIX 1. TIMED MEANDER SEARCH DATA

Table 1. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration, Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego, Wetland, Bluhm Park (4D2), August 8, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
Agropyron repens	1	1	7	7
Phalaris arundinacea	1	2	1	8
Carex vulpinoidea	1	3	2	10
Agrostis alba	1	4	4	14
Aster simplex	1	5	2	16
Solidago canadensis	1	6	3	19
Acer negundo	1	7	2	21
Salix interior	2	8	2	23
Rumex crispus	3	9	0	23
Salix sp.	3	10	0	23
Cornus stolonifera	4	11	0	23
Vitis riparia	4	12	0	23
Salix nigra	4	13	0	23
Solidago gigantea	4	14	0	23
Lemna minor	5	15	0	23
Alisma subcordatum	5	16	0	23
Ambrosia trifida	6	17	0	23
Solidago graminifolia	6	18	0	23
Scirpus atrovirens	6	19	0	23
Poa pratensis	7	20	0	23
Juncus dudleyi	7	21	0	23
Polygonum amphibium stipulaceum	8	22	0	23
Lycopus americanus	8	23	0	23

Table 2. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration, Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego, Wetland off Racine, across from Valley Sand and Gravel operation (4E1), August 21, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
<i>Solidago graminifolia</i>	1	1	15	15
<i>Poa pratensis</i>	1	2	4	19
<i>Helianthus grosseserratus</i>	1	3	3	22
<i>Aster novae-angliae</i>	1	4	2	24
<i>Cornus racemosa</i>	1	5	0	24
<i>Ulmus americana</i>	1	6	4	28
<i>Ambrosia artemisiifolia (elatior)</i>	1	7	2	30
<i>Solidago canadensis</i>	1	8	0	30
<i>Phalaris arundinacea</i>	1	9	0	30
<i>Solidago riddellii</i>	1	10	0	30
<i>Carex sp.</i>	1	11	0	30
<i>Fragaria virginiana</i>	1	12	0	30
<i>Solidago gigantea</i>	1	13	0	30
<i>Juncus dudleyi</i>	1	14	0	30
<i>Aster simplex</i>	1	15	0	30
<i>Aster pilosus</i>	2	16	0	30
<i>Vitis riparia</i>	2	17	0	30
<i>Monarda fistulosa</i>	2	18	0	30
<i>Aster sagittifolius-drummondii</i>	2	19	0	30
<i>Cornus obliqua</i>	3	20	0	30
<i>Epilobium coloratum</i>	3	21	0	30
<i>Muhlenbergia mexicana</i>	3	22	0	30
<i>Geum canadense</i>	4	23	0	30
<i>Agrostis alba</i>	4	24	0	30
<i>Cicuta maculata</i>	6	25	0	30
<i>Rhamnus cathartica</i>	6	26	0	30
<i>Aster lateriflorus</i>	6	27	0	30
<i>Salix interior</i>	6	28	0	30
<i>Stachys tenuifolia</i>	7	29	0	30
<i>Acer negundo</i>	7	30	0	30

Table 3. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration (always five minutes beyond location of the last species), Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego, Seepage areas, (5D1), August 21, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
<i>Viburnum lentago</i>	1	1	4	4
<i>Cicuta maculata</i>	1	2	4	8
<i>Rhamnus frangula</i>	1	3	4	12
<i>Aster simplex</i>	1	4	4	16
<i>Impatiens capensis</i>	2	5	4	20
<i>Acer negundo</i>	2	6	4	24
<i>Carex stricta</i>	2	7	4	28
<i>Lobelia kalmii</i>	2	8	3	31
<i>Aster puniceus</i>	3	9	3	34
<i>Angelica atropurpurea</i>	3	10	0	34
<i>Monarda fistulosa</i>	3	11	0	34
<i>Eupatorium perfoliatum</i>	3	12	0	34
<i>Solidago graminifolia</i>	4	13	0	34
<i>Calamagrostis canadensis</i>	4	14	0	34
<i>Aster novae-angliae</i>	4	15	0	34
<i>Chelone glabra</i>	4	16	0	34
<i>Polygonum amphibium stipulaceum</i>	5	17	0	34
<i>Oxypolis rigidior</i>	5	18	0	34
<i>Rhamnus cathartica</i>	5	19	0	34
<i>Stachys tenuifolia hispida</i>	5	20	0	34
<i>Eupatorium maculatum</i>	6	21	0	34
<i>Juncus dudleyi</i>	6	22	0	34
<i>Pycnanthemum virginianum</i>	6	23	0	34
<i>Spartina pectinata</i>	6	24	0	34
<i>Helenium autumnale</i>	7	25	0	34
<i>Muhlenbergia mexicana</i>	7	26	0	34
<i>Scutellaria epilobiifolia</i>	7	27	0	34
<i>Thalictrum dasycarpum</i>	7	28	0	34
<i>Epilobium coloratum</i>	8	29	0	34
<i>Sanguinaria canadensis</i>	8	30	0	34
<i>Verbena hastata</i>	8	31	0	34
<i>Glyceria striata</i>	9	32	0	34
<i>Pedicularis lanceolata</i>	9	33	0	34
<i>Lycopus americanus</i>	9	34	0	34

Table 4. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration (always five minutes beyond location of the last species), Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego, H--Wetland, Cattail (*Typha sp.*) Marsh (5A/4C1), August 8, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
<i>Typha Latifolia</i>	1	1	11	11
<i>Scirpus acutus</i>	1	2	4	15
<i>Lythrum salicaria</i>	1	3	2	17
<i>Carex lacustris</i>	1	4	5	22
<i>Phalaris arundinacea</i>	1	5	2	24
<i>Verbena hastata</i>	1	6	3	27
<i>Polygonum amphibium stipulaceum</i>	1	7	3	30
<i>Eupatorium maculatum</i>	1	8	2	32
<i>Juncus dudleyi</i>	1	9	3	35
<i>Scutellaria lateriflora</i>	1	10	0	35
<i>Leersia oryzoides</i>	1	11	0	35
<i>Equisetum arvense</i>	2	12	0	35
<i>Carex sp.</i>	2	13	0	35
<i>Salix sp.</i>	2	14	0	35
<i>Juncus sp</i>	2	15	0	35
<i>Cornus stolonifera</i>	3	16	0	35
<i>Mentha arvensis villosa</i>	3	17	0	35
<i>Lysimachia thyrsoiflora</i>	4	18	0	35
<i>Salix interior</i>	4	19	0	35
<i>Scutellaria epilobiifolia</i>	4	20	0	35
<i>Impatiens capensis</i>	4	21	0	35
<i>Lycopus virginicus</i>	4	22	0	35
<i>Decodon verticillatus</i>	5	23	0	35
<i>Scirpus validus creber</i>	5	24	0	35
<i>Sparganium eurycarpum</i>	6	25	0	35
<i>Eleocharis erythropoda</i>	6	26	0	35
<i>Juncus torreyi</i>	6	27	0	35
<i>Alisma subcordatum</i>	7	28	0	35
<i>Carex vulpinoidea</i>	7	29	0	35
<i>Sium suave</i>	7	30	0	35
<i>Sagittaria latifolia</i>	8	31	0	35
<i>Nymphaea tuberosa</i>	8	32	0	35
<i>Scirpus fluviatilis</i>	9	33	0	35
<i>Calamagrostis canadensis</i>	9	34	0	35
<i>Solidago graminifolia</i>	9	35	0	35

Table 5. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration (always five minutes beyond location of the last species), Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego, C--Endangered Sedge Site (4B/4D1), August 8, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
Phalaris arundinacea	1	1	9	9
Carex lupulina	1	2	5	14
Glyceria striata	1	3	8	22
Fraxinus pensylvanica	1	4	2	24
Rhus radicans	1	5	1	25
Geum canadense	1	6	1	26
Sium suave	1	7	1	27
Vitis riparia	1	8	1	28
Parthenocissus quinquefolia	1	9	1	29
Acalypha rhomboidea	2	10	1	30
Rubus occidentalis	2	11	0	30
Solidago canadensis	2	12	0	30
Carex cristatella	2	13	2	32
Lycopus virginicus	2	14	3	35
Carex bebbii	3	15	0	35
Tilia americana	3	16	0	35
Ulmus americana	3	17	0	35
Aster lateriflorus	3	18	0	35
Alisma subcordatum	3	19	0	35
Carex rosea	3	20	0	35
Prunus virginiana	3	21	0	35
Rhamnus cathartica	3	22	0	35
Erigeron strigosus	4	23	0	35
Solanum dulcamara	4	24	0	35
Carex stricta	5	25	0	35
Taraxacum officinalis	6	26	0	35
Iris virginica shrevei	7	27	0	35
Ranunculus sp	8	28	0	35
Carex crus-corvi	9	29	0	35
Fraxinus nigra	10	30	0	35
Ribes americanum	13	31	0	35
Prunella vulgaris lanceolata	13	32	0	35
		33	0	35
		34	0	35
Other species:		35	0	35
Carex vulpinoidea	14	36	0	35
Lycopus americanus	14	37	0	35
Agrostis alba	14	38	0	35

Table 6. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration (always five minutes beyond location of the last species), Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego, A--Sedge Meadow (4B2), August 8, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
Typha latifolia	1	1	8	8
Leersia oryzoides	1	2	2	10
Epilobium coloratum	1	3	4	14
Phalaris arundinacea	1	4	2	16
Asclepias incarnata	1	5	4	20
Calamagrostis canadensis	1	6	6	26
Carex stricta	1	7	2	28
Iris virginica shrevei	1	8	1	29
Cornus obliqua	2	9	2	31
Rumex orbiculatus	2	10	0	31
Solanum dulcamara	3	11	1	32
Vitis riparia	3	12	1	33
Salix interior	3	13	0	33
Rhamnus frangula	3	14	3	36
Ulmus americana	4	15	2	38
Aster simplex	4	16	0	38
Lycopus americanus	5	17	0	38
Lycopus virginicus	5	18	0	38
Eupatorium perfoliatum	5	19	0	38
Verbena hastata	5	20	0	38
Viola sp	6	21	0	38
Aster puniceus	6	22	0	38
Cornus stolonifera	6	23	0	38
Geum canadense	6	24	0	38
Solidago gigantea	6	25	0	38
Rhus radicans	6	26	0	38
Monarda fistulosa	7	27	0	38
Eupatorium maculatum	7	28	0	38
Cornus racemosa	8	29	0	38
Carex pellita	9	30	0	38
Carex lacustris	9	31	0	38
Rosa sp	11	32	0	38
Viburnum lentago	12	33	0	38
Epilobium spp	14	34	0	38
Carex blanda	14	35	0	38
Juncus dudleyi	14	36	0	38
Fraxinus pennsylvanica	15	37	0	38
Scirpus atrovirens	15	38	0	38

Table 7. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration (always five minutes beyond location of the last species), Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego, J-Denoon Park (4A/4B1), Wetland August 8, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
Carex stricta	1	1	12	12
Calamagrostis canadensis	1	2	5	17
Phalaris arundinacea	1	3	3	20
Eupatorium maculatum	1	4	3	23
Convolvulus sepium	1	5	5	28
Mentha arvensis villosa	1	6	2	30
Impatiens capensis	1	7	3	33
Stachys tenuifolia hispida	1	8	2	35
Lythrum salicaria	1	9	1	36
Aster simplex	1	10	3	39
Scutellaria epilobiifolia	1	11	0	39
Asclepias incarnata	1	12	0	39
Iris virginica shrevei	2	13	0	39
Rosa palustris	2	14	0	39
Decodon verticillatus	2	15	0	39
Cornus stolonifera	2	16	0	39
Campanula aparinoides	2	17	0	39
Lycopus americanus	3	18	0	39
Carex lacustris	3	19	0	39
Boehmeria cylindrica	3	20	0	39
Acer saccharinum	4	21	0	39
Typha latifolia	4	22	0	39
Lysimachia thyrsoiflora	4	23	0	39
Bidens coronata	5	24	0	39
Cicuta bulbifera	5	25	0	39
Lycopus virginicus	5	26	0	39
Rumex orbiculatus	5	27	0	39
Solanum dulcamara	5	28	0	39
Galium trifidum	6	29	0	39
Sium suave	6	30	0	39
Lathyrus palustris	7	31	0	39
Verbena hastata	7	32	0	39
Sambucus canadensis	7	33	0	39
Cirsium arvense	8	34	0	39
Chelone glabra	8	35	0	39
Cornus obliqua	9	36	0	39
		37	0	39
		38	0	39
Other Species:		39	0	39
Lobelia siphilitica	10	40	0	39
Caltha palustris	10	41	0	39
Sparganium eurycarpum	10	42	0	39

Table 8. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration (always five minutes beyond location of the last species), Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego, G--Wetland/Sedge Meadow Remnant (4B/4F1), August 8, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
Phalaris arundinacea	1	1	12	12
Agrostis alba	1	2	5	17
Rhamnus frangula	1	3	3	20
Solidago riddellii	1	4	6	26
Solidago graminifolia	1	5	5	31
Salix interior	1	6	3	34
Salix discolor	1	7	2	36
Vitis riparia	1	8	2	38
Mentha arvensis villosa	1	9	1	39
Daucus carota	1	10	6	45
Solidago canadensis	1	11	3	48
Larix laricina	1	12	1	49
Cornus stolonifera	2	13	2	51
Carex pellita	2	14	1	52
Juncus torreyi	2	15	4	56
Lactuca sp	2	16	0	56
Geum canadense	2	17	1	57
Cirsium muticum	3	18	0	57
Typha latifolia	3	19	0	57
Smilacina stellata	3	20	0	57
Eupatorium maculatum	4	21	0	57
Calamagrostis canadensis	4	22	0	57
Pedicularis lanceolata	4	23	0	57
Carex stricta	4	24	0	57
Iris virginica shrevei	4	25	0	57
Eupatorium perfoliatum	4	26	0	57
Hypericum virginicum	5	27	0	57
Lobelia kalmii	5	28	0	57
Lythrum salicaria	5	29	0	57
Lycopus virginicus	5	30	0	57
Lysimachia lanceolata	5	31	0	57
Juncus sp	6	32	0	57
Campanula aparinoides	6	33	0	57
Liparis lilifolia	6	34	0	57
Solidago gigantea	7	35	0	57
Scutellaria epilobiifolia	7	36	0	57
Helenium autumnale	8	37	0	57
Carex sp	8	38	0	57
Glyceria striata	9	39	0	57
Asclepias incarnata	10	40	0	57
Salix sp	10	41	0	57
Juniperus virginiana crebra	10	42	0	57
Prunella vulgaris lanceolata	10	43	0	57
Scirpus acutus	10	44	0	57
Rudbeckia hirta	10	45	0	57
Panicum sp	11	46	0	57
Rhamnus cathartica	11	47	0	57
Fragaria virginiana	11	48	0	57
Equisetum arvense	12	49	0	57
Rhus radicans	13	50	0	57
Juncus dudleyi	13	51	0	57
Fraxinus pennsylvanica subintegerrima	14	52	0	57
Mellilotus alba	15	53	0	57
Populus deltoides	15	54	0	57
Scirpus atrovirens	15	55	0	57
Polygonum amphibium stipulaceum	15	56	0	57
Carex sp	17	57	0	57
		58	0	57
		59	0	57
		60	0	57
Other species:		61	0	57
Lysimachia thyrsoiflora		62	0	57

Table 9. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration (always five minutes beyond location of the last species), Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego, I-Denoon Park, Woods (3C7), August 8, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
Rhamnus cathartica	1	1	7	7
Quercus rubra	1	2	3	10
Lonicera tatarica	1	3	1	11
Parthenocissus quinquefolia	1	4	6	17
Vitis riparia	1	5	2	19
Carex rosea	1	6	1	20
Fraxinus americana	1	7	2	22
Ulmus americana	2	8	0	22
Quercus alba	2	9	4	26
Smilacina racemosa	2	10	0	26
Arisaema triphyllum	3	11	0	26
Circaea lutetiana canadensis	4	12	0	26
Prunus serotina	4	13	0	26
Carya ovata	4	14	0	26
Geum canadense	4	15	0	26
Galium sp	4	16	0	26
Xanthoxylum americanum	4	17	0	26
Rubus occidentalis	5	18	0	26
Carex sp.	5	19	0	26
Ribes americanum	6	20	0	26
Lonicera prolifera	7	21	0	26
Quercus macrocarpa	7	22	0	26
Prunus virginiana	9	23	0	26
Geranium maculatum	9	24	0	26
Sanguinaria canadensis	9	25	0	26
Arctium minus	9	26	0	26

Table 10. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration (always five minutes beyond location of the last species), Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego, D--Degraded mesic woods (3C11), August 8, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
<i>Arisaema triphyllum</i>	1	1	9	9
<i>Prunus serotina</i>	1	2	5	14
<i>Fraxinus americana</i>	1	3	7	21
<i>Vitis riparia</i>	1	4	5	26
<i>Lonicera tatarica</i>	1	5	1	27
<i>Carex</i> sp	1	6	2	29
<i>Carya ovata</i>	1	7	1	30
<i>Ulmus americana</i>	1	8	0	30
<i>Rhamnus cathartica</i>	1	9	0	30
<i>Crataegus</i> sp	2	10	0	30
<i>Taraxacum officinale</i>	2	11	0	30
<i>Circaea lutetiana canadensis</i>	2	12	0	30
<i>Prunus virginiana</i>	2	13	0	30
<i>Podophyllum peltatum</i>	2	14	0	30
<i>Carex rosea</i>	3	15	0	30
<i>Aster lateriflorus</i>	3	16	0	30
<i>Carex</i> sp	3	17	0	30
<i>Ambrosia trifida</i>	3	18	0	30
<i>Oxalis stricta</i>	3	19	0	30
<i>Parthenocissus quinquefolia</i>	3	20	0	30
<i>Xanthoxylum americanum</i>	3	21	0	30
<i>Acer nigrum</i>	4	22	0	30
<i>Fraxinus pensylvanica</i>	4	23	0	30
<i>Smilacina racemosa</i>	4	24	0	30
<i>Polygonatum pubescens</i>	4	25	0	30
<i>Carex blanda</i>	4	26	0	30
<i>Ranunculus abortivus</i>	5	27	0	30
<i>Prunella vulgaris lanceolata</i>	6	28	0	30
<i>Cirsium vulgare</i>	6	29	0	30
		30	0	30
Other species:		31	0	30
<i>Quercus rubra</i>	7	32	0	30

Table 11. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration (always five minutes beyond location of the last species), Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego B--Degraded Black maple (*Acer nigrum*) Woods (3C12), August 8, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
Ostrya virginiana	1	1	7	7
Arisaema triphyllum	1	2	7	14
Lonicera tatarica	1	3	5	19
Circaea lutetiana canadensis	1	4	5	24
Quercus rubra	1	5	1	25
Fraxinus americana	1	6	2	27
Parthenocissus quinquefolia	1	7	1	28
Prunus virginiana	2	8	2	30
Acer nigrum	2	9	1	31
Carya ovata	2	10	1	32
Rhamnus cathartica	2	11	2	34
Smilacina racemosa	2	12	0	34
Podophyllum peltatum	2	13	1	35
Tilia americana	2	14	0	35
Ribes missouriense	3	15	0	35
Anemone quinquefolia	3	16	0	35
Polygonatum pubescens	3	17	0	35
Vitis riparia	3	18	0	35
Carya ovata	3	19	0	35
Oxalis stricta	4	20	0	35
Rubus occidentalis	4	21	0	35
Populus alba	4	22	0	35
Carex sp	4	23	0	35
Ulmus americana	4	24	0	35
Allium canadense	5	25	0	35
Juncus tenuis	6	26	0	35
Lonicera prolifera	6	27	0	35
Solanum dulcamara	7	28	0	35
Carex rosea	8	29	0	35
Sanguinaria canadensis	8	30	0	35
Allium tricoccum	9	31	0	35
Trillium erectum	10	32	0	35
Viburnum rafinesquianum	11	33	0	35
Populus tremuloides	11	34	0	35
Alliaria petiolata	13	35	0	35

Table 12. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration (always five minutes beyond location of the last species), Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego, Park Arthur Woods, Dry to mesic woods (3C/3F1), September 8, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
Quercus alba	1	1	12	12
Quercus rubra	1	2	6	18
Acer saccharum	1	3	6	24
Tilia americana	1	4	1	25
Carex pensylvanica	1	5	6	31
Carex sp.	1	6	1	32
Vitis riparia	1	7	1	33
Prunus serotina	1	8	2	35
Parthenocissus quinquefolia	1	9	2	37
Carex sp.	1	10	0	37
Cornus racemosa	1	11	0	37
Rhamnus cathartica	1	12	2	39
Arisaema triphyllum	2	13	0	39
Solanum dulcamara	2	14	1	40
Lonicera prolifera	2	15	0	40
Xanthoxylum americanum	2	16	0	40
Viburnum opulus	2	17	0	40
Viola pubescens	2	18	0	40
Glyceria striata	3	19	0	40
Carya cordiformis	3	20	0	40
Crataegus sp.	3	21	0	40
Fraxinus americana	3	22	0	40
Juglans nigra	3	23	0	40
Rubus occidentalis	3	24	0	40
Geum canadense	4	25	0	40
Rosa multiflora	5	26	0	40
Rhus radicans	5	27	0	40
Lonicera tatarica	5	28	0	40
Aster lateriflorus	5	29	0	40
Carya ovata	5	30	0	40
Carex blanda	5	31	0	40
Carex rosea	6	32	0	40
Ulmus americana	7	33	0	40
Fraxinus pennsylvanica	8	34	0	40
Carex tenera	8	35	0	40
Fragaria virginiana	9	36	0	40
Oxalis stricta	9	37	0	40
Smilax lasioneura	12	38	0	40
Celtis occidentalis	12	39	0	40
Populus deltoides	14	40	0	40

Table 13. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration (always five minutes beyond location of the last species), Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego, F--Oak (*Quercus sp.*) Savanna (3C10), Bluhm Park August 8, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
Carya ovata	1	1	7	7
Prunus serotina	1	2	3	10
Rhamnus cathartica	1	3	7	17
Quercus alba	1	4	5	22
Viburnum opulus	1	5	2	24
Geum canadense	1	6	1	25
Prunus virginiana	1	7	2	27
Fraxinus americana	2	8	6	33
Fragaria virginiana	2	9	3	36
Viburnum prunifolium	2	10	1	37
Ribes missouriense	3	11	2	39
Vitis riparia	3	12	0	39
Aster lateriflorus	3	13	2	41
Cornus racemosa	3	14	1	42
Rubus occidentalis	3	15	0	42
Parthenocissus quinquefolia	3	16	0	42
Ostrya virginiana	3	17	0	42
Scirpus pendulous	4	18	0	42
Agrimonia gryposepala	4	19	0	42
Carex sp	4	20	0	42
Ranunculus abortivus	4	21	0	42
Juncus tenuis	4	22	0	42
Smilacina racemosa	5	23	0	42
Malus sp	5	24	0	42
Rosa multiflora	6	25	0	42
Quercus macrocarpa	7	26	0	42
Lonicera tatarica	7	27	0	42
Asclepias exaltata	8	28	0	42
Solidago canadensis	8	29	0	42
Agropyron repens	8	30	0	42
Aster novae-angliae	8	31	0	42
Cornus stolonifera	8	32	0	42
Erigeron strigosus	8	33	0	42
Rhamnus frangula	9	34	0	42
Quercus rubra	9	35	0	42
Geum laciniatum	9	36	0	42
Acer negundo	10	37	0	42
Circaea lutetiana canadensis	11	38	0	42
Viburnum rafinesquianum	11	39	0	42
Erigeron philadelphicus	13	40	0	42
Carex rosea	13	41	0	42
		42	0	42
		43	0	42
Other Species:		44	0	42
Carex blanda	14	45	0	42

Table 14. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration (always five minutes beyond location of the last species), Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego, Schroeder Property (3E1), Dry woods September 8, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
Xanthoxylum americanum	1	1	9	9
Parthenocissus quinquefolia	1	2	10	19
Lonicera tatarica	1	3	4	23
Carex pensylvanicum	1	4	0	23
Geranium maculatum	1	5	6	29
Rubus occidentalis	1	6	1	30
Fraxinus americana	1	7	1	31
Solidago ulmifolia	1	8	2	33
Acer negundo	1	9	3	36
Smilacina racemosa	2	10	1	37
Circaea lutetiana canadensis	2	11	1	38
Viburnum acerifolium	2	12	2	40
Galium sp	2	13	2	42
Ulmus americana	2	14	1	43
Quercus alba	2	15	2	45
Aster lateriflorus	2	16	1	46
Ostrya virginiana	2	17	3	49
Lactuca sp	2	18	0	49
Prunus serotina	2	19	1	50
Quercus rubra	3	20	1	51
Potentilla simplex	3	21	4	55
Crataegus sp	3	22	1	56
Desmodium glutinosum	3	23	0	56
Triosteum perfoliatum	5	24	0	56
Monotropa uniflora	5	25	3	59
Podophyllum peltatum	5	26	3	62
Rhamnus cathartica	5	27	0	62
Ribes missouriense	5	28	0	62
Carya cordiformis	5	29	0	62
Smilax ecirrhata	6	30	0	62
Arisaema triphyllum	7	31	0	62
Prenanthes alba	8	32	0	62
Geum canadensis	8	33	0	62
Anemone virginiana	9	34	0	62
Juglans nigra	9	35	0	62
Dioscorea villosa	9	36	0	62
Agrimonia gryposepala	10	37	0	62
Scrophularia marilandica	11	38	0	62
Carex rosea	12	39	0	62
Rhamnus frangula	12	40	0	62
Carya ovata	13	41	0	62
Carex sparganioides ?	13	42	0	62
Vitis riparia	14	43	0	62
Tilia americana	15	44	0	62
Carex sp	15	45	0	62
Viola pubescens	16	46	0	62
Juncus dudleyi	17	47	0	62
Amphicarpaea bracteata	17	48	0	62
Lonicera prolifera	17	49	0	62
Asclepias exaltata	19	50	0	62
Aster shortii	20	51	0	62
Monarda fistulosa	21	52	0	62
Solidago flexicaulis	21	53	0	62
Poa compressa	21	54	0	62
Antennaria plantaginifolia	21	55	0	62
Muhlenbergia sp	22	56	0	62
Vicia/Lathyrus sp?	25	57	0	62
Dodecatheon meadia	25	58	0	62
Vicia sp	25	59	0	62
Daucus carota	26	60	0	62
Panicum sp	26	61	0	62
Taenidia integerrima	26	62	0	62

Table 15. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration (always five minutes beyond location of the last species), Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego, Orville Peters Woods (3C18), September 8, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
Quercus sp.	1	1	8	8
Ulmus americana	1	2	9	17
Carya ovata	1	3	2	19
Fraxinus pennsylvanica	1	4	1	20
Geum canadense	1	5	5	25
Rhamnus cathartica	1	6	4	29
Quercus rubra	1	7	3	32
Lonicera tatarica	1	8	3	35
Vitis riparia	2	9	9	44
Lonicera prolifera	2	10	1	45
Parthenocissus quinquefolia	2	11	2	47
Agrimonia gryposepala	2	12	0	47
Carex pensylvanica	2	13	2	49
Circaea lutetiana canadensis	2	14	5	54
Crataegus sp.	2	15	2	56
Aster lateriflorus	2	16	0	56
Quercus alba	2	17	2	58
Acer negundo	3	18	3	61
Prunus serotina	3	19	2	63
Galium sp.	4	20	0	63
Rosa multiflora	5	21	0	63
Phalaris arundinacea	5	22	0	63
Solidago canadensis	5	23	1	64
Fragaria virginiana	5	24	0	64
Rhamnus frangula	5	25	0	64
Potentilla simplex	6	26	4	68
Solanum dulcamara	6	27	0	68
Arctium minus	6	28	0	68
Rubus idaeus	6	29	0	68
Ribes missouriense	7	30	1	69
Rubus allegheniensis	7	31	0	69
Ribes americanum	7	32	0	69
Berberis thunbergii	8	33	0	69
Acer nigrum	8	34	0	69
Anemone virginiana	8	35	0	69
Carex sp.	9	36	0	69
Lobelia siphilitica	9	37	0	69
Ambrosia artemisiifolia elatior	9	38	0	69
Bidens frondosa	9	39	0	69
Glyceria striata	9	40	0	69
Polygonum hydropiper	9	41	0	69
Sonchus sp.	9	42	0	69
Phleum pratense	9	43	0	69
Viburnum opulus	9	44	0	69
Leersia oryzoides	10	45	0	69
Quercus macrocarpa	11	46	0	69
Salix babylonica	11	47	0	69
Osmorhiza claytonii	13	48	0	69
Rubus occidentalis	13	49	0	69
Carex sparganioides	14	50	0	69
Tilia americana	14	51	0	69
Smilax eckrhata	14	52	0	69
Desmodium glutinosum	14	53	0	69
Prunus virginiana	14	54	0	69
Carex rosea	15	55	0	69
Sanguinaria canadensis	15	56	0	69
Xanthoxylum americanum	17	57	0	69
Hackelia virginiana	17	58	0	69
Scrophularia marilandica	18	59	0	69
Podophyllum peltatum	18	60	0	69
Arisaema triphyllum	18	61	0	69
Vitis aestivalis	19	62	0	69
Athyrium filix-femina michauxii	19	63	0	69
Rhus radicans	23	64	0	69
Potentilla recta	26	65	0	69
Aster novae-angliae	26	66	0	69
Daucus carota	26	67	0	69
Cornus sp.	26	68	0	69
Cornus racemosa	30	69	0	69

Table 16. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration (always five minutes beyond location of the last species), Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego, Parker Drive Woods, Zielinski Property, Mesic woodland (3G1 and 3G2), August 21, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
Polygonum virginianum	1	1	9	9
Amphicarpaea bracteata	1	2	8	17
Carex sparganioides	1	3	5	22
Cinna arundinacea	1	4	6	28
Geum canadensis	1	5	1	29
Viola sp	1	6	7	36
Tilia americana	1	7	4	40
Carya cordiformis	1	8	5	45
Agrimonia gryposepala	1	9	2	47
Potentilla simplex	2	10	3	50
Ribes americanum	2	11	0	50
Vitis riparia	2	12	0	50
Cornus racemosa	2	13	0	50
Carex pennsylvanica	2	14	0	50
Rhamnus cathartica	2	15	0	50
Ranunculus sp	2	16	0	50
Parthenocissus quinquefolia	2	17	0	50
Smilax lasioneura	3	18	0	50
Juglans nigra	3	19	0	50
Phalaris arundinacea	3	20	0	50
Prunus virginiana	3	21	0	50
Lonicera prolifera	3	22	0	50
Lonicera tatarica	4	23	0	50
Ulmus americana	4	24	0	50
Aster lateriflorus	4	25	0	50
Fragaria virginiana	4	26	0	50
Xanthoxylum americana	4	27	0	50
Fraxinus americana	4	28	0	50
Carya ovata	5	29	0	50
Glyceria striata	6	30	0	50
Menispermum canadense	6	31	0	50
Arisaema triphyllum	6	32	0	50
Hystrix patula	6	33	0	50
Rosa multiflora	6	34	0	50
Athyrium filix-femina michauxii	6	35	0	50
Populus tremuloides	6	36	0	50
Circaea lutetiana canadensis	7	37	0	50
Rubus occidentalis	7	38	0	50
Oxalis stricta	7	39	0	50
Viola pubescens	7	40	0	50
Crataegus sp	8	41	0	50
Epilobium coloratum	8	42	0	50
Rhus radicans	8	43	0	50
Solidago canadensis	8	44	0	50
Trillium sp	8	45	0	50
Cornus racemosa	9	46	0	50
Viburnum prunifolium	9	47	0	50
Geranium maculatum	10	48	0	50
Solanum dulcamara	10	49	0	50
Smilax tamnoides hispida	10	50	0	50

Table 17. Timed Meander Search (TMS) species list, with the minute each species was located, minutes of the search duration (always five minutes beyond location of the last species), Number of species recorded found per minute, cumulative Number of species recorded at each minute. City of Muskego, Bentley Old Field (4B/2C1), August 21, 2000.

SPECIES	MINUTE	MINUTE	SP/MIN	SP(CUM)
Poa pratensis	1	1	11	11
Solidago canadensis	1	2	5	16
Cornus racemosa	1	3	6	22
Daucus carota	1	4	3	25
Rhus glabra	1	5	4	29
Solidago juncea	1	6	1	30
Rudbeckia hirta	1	7	0	30
Lonicera tatarica	1	8	5	35
Crataegus sp	1	9	2	37
Rubus occidentalis	1	10	5	42
Monarda fistulosa	1	11	3	45
Aster pilosus	2	12	0	45
Trifolium pratense	2	13	0	45
Poa compressa	2	14	0	45
Fraxinus pennsylvanica	2	15	0	45
Juglans nigra	2	16	0	45
Agrostis alba	3	17	0	45
Solidago graminifolia	3	18	0	45
Physocarpus opulifolius	3	19	0	45
Pycnanthemum virginiana	3	20	0	45
Aster sagittifolius	3	21	0	45
Cornus obliqua	3	22	0	45
Cornus stolonifera	4	23	0	45
Helianthus sp	4	24	0	45
Salix nigra	4	25	0	45
Solidago riddellii	5	26	0	45
Oenothera biennis	5	27	0	45
Carex pellita	5	28	0	45
Solidago gigantea	5	29	0	45
Phalaris arundinacea	6	30	0	45
Aster novae-angliae	8	31	0	45
Ulmus americana	8	32	0	45
Helianthus grosseserratus	8	33	0	45
Populus tremuloides	8	34	0	45
Amphicarpaea bracteata	8	35	0	45
Agrimonia gryposepala	9	36	0	45
Fragaria virginiana	9	37	0	45
Prunella vulgaris lanceolata	10	38	0	45
Lobelia siphilitica	10	39	0	45
Alliaria petiolata	10	40	0	45
Ambrosia trifida	10	41	0	45
Equisetum arvense	10	42	0	45
Solanum dulcamara	11	43	0	45
Rhamnus cathartica	11	44	0	45
Scrophularia marilandica	11	45	0	45

APPENDIX 2. QUANTITATIVE QUADRAT DATA FOR SELECTED NATURAL RESOURCE AREAS WITHIN THE CITY OF MUSKEGO

Table 1. Absolute Frequency (AF), Relative Frequency (RF), Absolute Cover (AC), Relative Cover (RC), and Importance Values (IV) for plant species encountered in 5 1m² quadrats along Bluhm Park, wetland study area (4D2) at the City of Muskego, Wisconsin. Based on sampling August 8, 2000.

SPECIES	AVG				IV	STD
	AF	RF	AC	RC		
Agropyron repens	1	16.67	20.00	20.79	37.46	44.72
Phalaris arundinacea	4	66.67	76.00	79.00	145.67	43.36
Polygonum pensylvanicum	1	16.67	0.20	0.21	16.87	0.45
	6	100.00	96.20	100.00	200.00	

Table 2. Absolute Frequency (AF), Relative Frequency (RF), Absolute Cover (AC), Relative Cover (RC), and Importance Values (IV) for plant species encountered in 5 1m² quadrats along Transect H – wetland, cattail (*Typha sp.*) marsh study area (5A1) at the City of Muskego, Wisconsin. Based on sampling August 8, 2000.

SPECIES	AVG				IV	STD
	AF	RF	AC	RC		
Typha angustifolia	4	14.29	27.60	22.01	36.30	30.92
Leersia oryzoides	5	17.86	47.00	37.48	55.34	24.39
Sagittaria latifolia	1	3.57	0.20	0.16	3.73	0.45
Scirpus validus creber	2	7.14	3.20	2.55	9.69	6.61
Sparganium eurycarpum	1	3.57	2.00	1.59	5.17	4.47
Eleocharis erythropoda	2	7.14	6.00	4.78	11.93	8.22
Phalaris arundinacea	3	10.71	13.60	10.85	21.56	15.73
Verbena hastata	3	10.71	3.00	2.39	13.11	3.46
Daucus carota	1	3.57	0.40	0.32	3.89	0.89
Equisetum sylvaticum	1	3.57	8.00	6.38	9.95	17.89
Melilotus alba	1	3.57	0.20	0.16	3.73	0.45
Mentha arvensis villosa	1	3.57	0.40	0.32	3.89	0.89
Lycopus americanus	1	3.57	0.60	0.48	4.05	1.34
Carex lacustris	1	3.57	1.20	0.96	4.53	2.68
Typha latifolia	1	3.57	12.00	9.57	13.14	26.83
	28	100.00	125.40	100.00	200.00	

Table 3. Absolute Frequency (AF), Relative Frequency (RF), Absolute Cover (AC), Relative Cover (RC), and Importance Values (IV) for plant species encountered in 6 1m² quadrats along Transect A, sedge meadow study area (4B2) at the City of Muskego, Wisconsin. Based on sampling August 8, 2000.

SPECIES	AVG				IV	STD
	AF	RF	AC	RC		STD
Carex stricta	6	37.50	85.83	86.85	124.35	9.17
Epilobium coloratum	1	6.25	0.83	0.84	7.09	2.04
Lycopus virginicus	2	12.50	1.17	1.18	13.68	2.04
Iris virginica shrevei	2	12.50	8.33	8.43	20.93	13.29
Aster puniceus	2	12.50	1.50	1.52	14.02	3.21
Erigeron annuus	1	6.25	0.17	0.17	6.42	0.41
Phalaris arundinacea	1	6.25	0.17	0.17	6.42	0.41
Lysimachia quadriflora	1	6.25	0.83	0.84	7.09	2.04
	16	100.00	98.83	100.00	200.00	

Table 4. Absolute Frequency (AF), Relative Frequency (RF), Absolute Cover (AC), Relative Cover (RC), and Importance Values (IV) for plant species encountered in 5 1m² quadrats along Transect G – wetland sedge meadow remnant study area (4B/4F1) at the City of Muskego, Wisconsin. Based on sampling August 8, 2000.

SPECIES	AVG				IV	STD
	AF	RF	AC	RC		STD
Phalaris arundinacea	2	3.85	2.60	2.75	6.60	4.34
Carex pellita	1	1.92	8.00	8.47	10.40	17.89
Rhamnus frangula	5	9.62	13.20	13.98	23.60	5.17
Solidago canadensis	3	5.77	3.60	3.81	9.58	4.98
Vitis riparia	2	3.85	3.80	4.03	7.87	6.50
Solidago graminifolia	2	3.85	1.80	1.91	5.75	2.68
Eupatorium maculatum	1	1.92	0.60	0.64	2.56	1.34
Mentha arvensis villosa	1	1.92	0.40	0.42	2.35	0.89
Rhamnus cathartica	3	5.77	9.00	9.53	15.30	17.41
Agrostis alba	4	7.69	29.00	30.72	38.41	25.59
Solidago gigantea	2	3.85	1.00	1.06	4.91	1.41
Salix interior	1	1.92	0.40	0.42	2.35	0.89
Sonchus asper	1	1.92	1.20	1.27	3.19	2.68
Daucus carota	1	1.92	0.80	0.85	2.77	1.79
Chrysanthemum leucanthemum	1	1.92	0.20	0.21	2.13	0.45
Melilotus alba	1	1.92	0.40	0.42	2.35	0.89
Fragaria virginiana	2	3.85	5.00	5.30	9.14	7.07
Fraxinus pennsylvanica	1	1.92	0.40	0.42	2.35	0.89
Rhus radicans	1	1.92	1.00	1.06	2.98	2.24
Geum canadense	1	1.92	0.80	0.85	2.77	1.79
Lycopus americanus	1	1.92	0.40	0.42	2.35	0.89
Lycopus virginicus	3	5.77	2.80	2.97	8.74	4.15
Pedicularis lanceolata	1	1.92	0.80	0.85	2.77	1.79
Asclepias incarnata	1	1.92	0.40	0.42	2.35	0.89
Lobelia kalmii	1	1.92	0.40	0.42	2.35	0.89
Prunella vulgaris lanceolata	1	1.92	0.60	0.64	2.56	1.34
Viola sororia	1	1.92	0.40	0.42	2.35	0.89
Impatiens capensis	1	1.92	0.40	0.42	2.35	0.89
Carex blanda	1	1.92	0.20	0.21	2.13	0.45
Equisetum arvense	2	3.85	3.60	3.81	7.66	6.50
Cornus racemosa	1	1.92	0.40	0.42	2.35	0.89
Viburnum opulus	1	1.92	0.40	0.42	2.35	0.89
Panicum spp	1	1.92	0.40	0.42	2.35	0.89
	52	100.00	94.40	100.00	200.00	

Table 5. Absolute Frequency (AF), Relative Frequency (RF), Absolute Cover (AC), Relative Cover (RC), and Importance Values (IV) for plant species encountered in 5 1m² quadrats along Transect J, Denoon Park, wetland study area (4A/4B1) at the City of Muskego, Wisconsin. Based on sampling August 8, 2000.

Transect J-Denoon Park, Wetland SPECIES	AVG					5	STD
	AF	RF	AC	RC	IV	STD	
<i>Phalaris arundinacea</i>	2	5.00	5.20	3.71	8.71	8.67	
<i>Cicuta bulbifera</i>	2	5.00	4.20	3.00	8.00	8.84	
<i>Scutellaria epilobiifolia</i>	2	5.00	6.00	4.29	9.29	8.22	
<i>Decodon verticillatus</i>	1	2.50	0.80	0.57	3.07	1.79	
<i>Sparganium eurycarpum</i>	1	2.50	1.20	0.86	3.36	2.68	
<i>Rumex orbiculatus</i>	1	2.50	0.80	0.57	3.07	1.79	
<i>Carex stricta</i>	5	12.50	65.00	46.43	58.93	27.84	
<i>Spartina pectinata</i>	1	2.50	0.60	0.43	2.93	1.34	
<i>Agrostis alba</i>	1	2.50	1.00	0.71	3.21	2.24	
<i>Leersia oryzoides</i>	1	2.50	2.00	1.43	3.93	4.47	
<i>Impatiens capensis</i>	1	2.50	8.00	5.71	8.21	17.89	
<i>Teucrium canadense</i>	2	5.00	6.60	4.71	9.71	10.85	
<i>Aster simplex</i>	1	2.50	0.40	0.29	2.79	0.89	
<i>Lycopus americanus</i>	2	5.00	2.80	2.00	7.00	4.38	
<i>Mentha arvensis villosa</i>	3	7.50	1.80	1.29	8.79	2.05	
<i>Convolvulus arvensis</i>	2	5.00	1.60	1.14	6.14	2.19	
<i>Eupatorium maculatum</i>	1	2.50	0.20	0.14	2.64	0.45	
<i>Calamagrostis canadensis</i>	2	5.00	13.00	9.29	14.29	18.57	
<i>Carex lacustris</i>	2	5.00	4.00	2.86	7.86	6.52	
<i>Solanum dulcamara</i>	1	2.50	10.00	7.14	9.64	22.36	
<i>Asclepias incarnata</i>	2	5.00	1.40	1.00	6.00	2.61	
<i>Equisetum hyemale</i>	1	2.50	0.20	0.14	2.64	0.45	
<i>Rosa palustris</i>	1	2.50	1.00	0.71	3.21	2.24	
<i>Campanula aparinoides</i>	1	2.50	2.00	1.43	3.93	4.47	
<i>Galium trifidum</i>	1	2.50	0.20	0.14	2.64	0.45	
	40	100.00	140.00	100.00	200.00		

Table 6. Absolute Frequency (AF), Relative Frequency (RF), Absolute Cover (AC), Relative Cover (RC), and Importance Values (IV) for plant species encountered in 5 1m² quadrats along Transect C – wetland, endangered sedge site area (4B/4D1) at the City of Muskego, Wisconsin. Based on sampling August 8, 2000.

Transect C- Wetland, Sedge Site		AVG			5	STD
SPECIES	AF	RF	AC	RC	IV	STD
Carex lupulina	3	23.08	12.60	20.79	43.87	17.43
Glyceria striata	1	7.69	0.40	0.66	8.35	0.89
Phalaris arundinacea	5	38.46	40.80	67.33	105.79	32.76
Sium suave	1	7.69	3.00	4.95	12.64	6.71
Carex crus-corvi	1	7.69	1.20	1.98	9.67	2.68
Bidens cernua	1	7.69	0.60	0.99	8.68	1.34
Solanum dulcamara	1	7.69	2.00	3.30	10.99	4.47
	13	100.00	60.60	100.00	200.00	

Table 7. Absolute Frequency (AF), Relative Frequency (RF), Absolute Cover (AC), Relative Cover (RC), and Importance Values (IV) for plant species encountered in 5 1m² quadrats along Transect B – black maple (*Acer nigrum*) woods study area (3C11) at the City of Muskego, Wisconsin. Based on sampling August 8, 2000.

Transect B-Black maple (<i>Acer nigrum</i>) Woods		AVG			5	STD
SPECIES	AF	RF	AC	RC	IV	STD
Fraxinus pennsylvanica subintegerrima	3	20.00	2.80	28.00	48.00	2.68
Arisaema triphyllum	2	13.33	0.60	6.00	19.33	0.89
Lonicera prolifera	1	6.67	0.80	8.00	14.67	1.79
Anemone quinquefolia	1	6.67	0.20	2.00	8.67	0.45
Solanum dulcamara	1	6.67	0.20	2.00	8.67	0.45
Geum canadense	1	6.67	0.20	2.00	8.67	0.45
Acer nigrum	2	13.33	0.40	4.00	17.33	0.55
Viola sororia	1	6.67	0.20	2.00	8.67	0.45
Prunus virginiana	1	6.67	0.20	2.00	8.67	0.45
Smilacina racemosa	1	6.67	0.40	4.00	10.67	0.89
Circaea lutetiana canadensis	1	6.67	4.00	40.00	46.67	8.94
	15	100.00	10.00	100.00	200.00	

Table 8. Absolute Frequency (AF), Relative Frequency (RF), Absolute Cover (AC), Relative Cover (RC), and Importance Values (IV) for plant species encountered in 5 1m² quadrats along Transect D – mesic woods area (3C12) at the City of Muskego, Wisconsin. Based on sampling August 8, 2000.

Transect D-Mesic Woods(Degraded)		AVG			5	STD
SPECIES	AF	RF	AC	RC	IV	STD
Parthenocissus quinquefolia	1	3.23	1.60	4.06	7.29	3.58
Rhus radicans	1	3.23	3.00	7.61	10.84	6.71
Ribes americanum	1	3.23	1.20	3.05	6.27	2.68
Circaea lutetiana canadensis	2	6.45	4.20	10.66	17.11	8.84
Aster lateriflorus	1	3.23	1.00	2.54	5.76	2.24
Geum canadense	1	3.23	1.00	2.54	5.76	2.24
Fragaria virginiana	1	3.23	0.40	1.02	4.24	0.89
Carex sparganioides	2	6.45	1.00	2.54	8.99	1.73
Prunella vulgaris lanceolata	1	3.23	1.60	4.06	7.29	3.58
Cornus racemosa	1	3.23	0.40	1.02	4.24	0.89
Fraxinus pennsylvanica subintegerrima	2	6.45	0.60	1.52	7.97	0.89
Quercus rubra	1	3.23	0.20	0.51	3.73	0.45
Taraxacum officinale	2	6.45	0.40	1.02	7.47	0.55
Arisaema triphyllum	3	9.68	4.60	11.68	21.35	8.65
Rhamnus cathartica	3	9.68	0.80	2.03	11.71	0.84
Carex blanda	1	3.23	0.20	0.51	3.73	0.45
Lonicera tatarica	1	3.23	5.00	12.69	15.92	11.18
Fraxinus americana	2	6.45	6.00	15.23	21.68	8.94
Oxalis stricta	1	3.23	0.20	0.51	3.73	0.45
Crataegus mollis	2	6.45	1.00	2.54	8.99	1.73
Prunus virginiana	1	3.23	5.00	12.69	15.92	11.18
	31	100.00	39.40	100.00	200.00	

Table 9. Absolute Frequency (AF), Relative Frequency (RF), Absolute Cover (AC), Relative Cover (RC), and Importance Values (IV) for plant species encountered in 5 1m² quadrats along Transect F – Bluhm Park, oak (*Quercus sp.*) savanna area (3C10) at the City of Muskego, Wisconsin. Based on sampling August 8, 2000.

Transect F-Bluhm Park, Oak Savanna		AVG			5	STD
SPECIES	AF	RF	AC	RC	IV	STD
Cornus racemosa	1	11.11	0.80	3.10	14.21	1.79
Fraxinus americana	3	33.33	9.20	35.66	68.99	12.28
Vitis riparia	1	11.11	0.60	2.33	13.44	1.34
Prunus virginiana	2	22.22	13.00	50.39	72.61	21.68
Ribes americanum	1	11.11	1.00	3.88	14.99	2.24
Prunus serotina	1	11.11	1.20	4.65	15.76	2.68
	9	100.00	25.80	100.00	200.00	

Table 10. Absolute Frequency (AF), Relative Frequency (RF), Absolute Cover (AC), Relative Cover (RC), and Importance Values (IV) for plant species encountered in 5 1m² quadrats along Transect I – Denoon Park, woods area (3C7) at the City of Muskego, Wisconsin. Based on sampling August 8, 2000.

Transect I-Denoon Park, Woods		AVG			5	STD
SPECIES	AF	RF	AC	RC	IV	STD
<i>Vitis riparia</i>	1	5.56	0.20	0.51	6.06	0.45
<i>Rhamnus cathartica</i>	5	27.78	25.40	64.14	91.92	26.47
<i>Lonicera tatarica</i>	3	16.67	6.40	16.16	32.83	10.60
<i>Geum canadense</i>	1	5.56	3.00	7.58	13.13	6.71
<i>Smilacina racemosa</i>	2	11.11	0.80	2.02	13.13	1.30
<i>Circaea lutetiana canadensis</i>	1	5.56	0.60	1.52	7.07	1.34
<i>Oxalis stricta</i>	1	5.56	0.20	0.51	6.06	0.45
<i>Fraxinus americana</i>	2	11.11	1.00	2.53	13.64	1.73
<i>Prunus virginiana</i>	1	5.56	1.60	4.04	9.60	3.58
<i>Galium spp</i>	1	5.56	0.40	1.01	6.57	0.89
	18	100.00	39.60	100.00	200.00	

Table 11. Absolute Frequency (AF), Relative Frequency (RF), Absolute Cover (AC), Relative Cover (RC), and Importance Values (IV) for plant species encountered in 5 1m² quadrats along Parker Drive woods area (3G1 and 3G2) at the City of Muskego, Wisconsin. Based on sampling August 8, 2000.

Parker Drive Woods		AVG			5	STD
SPECIES	AF	RF	AC	RC	IV	STD
<i>Parthenocissus quinquefolia</i>	2	5.00	6.00	6.05	11.05	10.84
<i>Amphicarpaea bracteata</i>	2	5.00	2.80	2.82	7.82	4.38
<i>Polygonum virginianum</i>	4	10.00	11.40	11.49	21.49	16.18
<i>Cinna arundinacea</i>	1	2.50	0.60	0.60	3.10	1.34
<i>Ranunculus septentrionalis</i>	1	2.50	1.60	1.61	4.11	3.58
<i>Carex rosea</i>	1	2.50	17.00	17.14	19.64	38.01
<i>Aster lateriflorus</i>	1	2.50	0.40	0.40	2.90	0.89
<i>Geum canadense</i>	3	7.50	1.80	1.81	9.31	2.05
<i>Carex blanda</i>	1	2.50	1.20	1.21	3.71	2.68
<i>Viola sororia</i>	2	5.00	2.60	2.62	7.62	4.34
<i>Oxalis stricta</i>	1	2.50	0.40	0.40	2.90	0.89
<i>Potentilla simplex</i>	1	2.50	1.20	1.21	3.71	2.68
<i>Ribes americanum</i>	2	5.00	13.00	13.10	18.10	18.57
<i>Rubus idaeus</i>	2	5.00	12.00	12.10	17.10	16.43
<i>Crataegus mollis</i>	1	2.50	1.20	1.21	3.71	2.68
<i>Circaea lutetiana canadensis</i>	3	7.50	1.40	1.41	8.91	1.34
<i>Rhamnus cathartica</i>	1	2.50	3.00	3.02	5.52	6.71
<i>Hystrix patula</i>	1	2.50	0.80	0.81	3.31	1.79
<i>Fraxinus americana</i>	1	2.50	1.20	1.21	3.71	2.68
<i>Carex hirsutella</i>	1	2.50	6.00	6.05	8.55	13.42
<i>Viburnum prunifolium</i>	1	2.50	3.00	3.02	5.52	6.71
<i>Cornus racemosa</i>	1	2.50	0.40	0.40	2.90	0.89
<i>Fragaria virginiana</i>	1	2.50	0.40	0.40	2.90	0.89
<i>Carex sparganioides</i>	1	2.50	3.00	3.02	5.52	6.71
<i>Rosa multiflora</i>	1	2.50	3.00	3.02	5.52	6.71
<i>Carya ovata</i>	1	2.50	1.00	1.01	3.51	2.24
<i>Rhus radicans</i>	1	2.50	0.80	0.81	3.31	1.79
<i>Mentha arvensis villosa</i>	1	2.50	2.00	2.02	4.52	4.47
	40	100.00	99.20	100.00	200.00	

Table 12. Absolute Frequency (AF), Relative Frequency (RF), Absolute Cover (AC), Relative Cover (RC), and Importance Values (IV) for plant species encountered in 5 1m² quadrats along Arthur Park, degraded oak (*Quercus sp.*) savanna area (3C/3F1) at the City of Muskego, Wisconsin. Based on sampling September 8, 2000.

Arthur Park--Degraded Oak Savanna	AVG					5	STD
SPECIES	AF	RF	AC	RC	IV	STD	STD
Viburnum opulus	1	20.00	0.40	20.00	40.00		0.89
Fraxinus americana	1	20.00	0.60	30.00	50.00		1.34
Rhamnus cathartica	2	40.00	0.80	40.00	80.00		1.30
Carya ovata	1	20.00	0.20	10.00	30.00		0.45
	5	100.00	2.00	100.00	200.00		

Table 13. Absolute Frequency (AF), Relative Frequency (RF), Absolute Cover (AC), Relative Cover (RC), and Importance Values (IV) for plant species encountered in 5 1m² quadrats along Orville Peters area (3C18) at the City of Muskego, Wisconsin. Based on sampling September 8, 2000.

Orville Peters	AVG					5	STD
SPECIES	AF	RF	AC	RC	IV	STD	STD
Agrimonia gryposepala	3	9.38	6.20	17.42	26.79		8.38
Parthenocissus quinquefolia	4	12.50	3.00	8.43	20.93		3.16
Rhamnus cathartica	3	9.38	1.00	2.81	12.18		1.00
Geum canadense	1	3.13	0.20	0.56	3.69		0.45
Lonicera tatarica	3	9.38	11.20	31.46	40.84		12.83
Vitis riparia	2	6.25	1.40	3.93	10.18		1.95
Ribes americanum	3	9.38	1.60	4.49	13.87		1.67
Viburnum opulus	1	3.13	0.20	0.56	3.69		0.45
Prunus virginiana	2	6.25	2.60	7.30	13.55		3.71
Carex pensylvanica	1	3.13	0.20	0.56	3.69		0.45
Fragaria virginiana	2	6.25	1.00	2.81	9.06		1.41
Fraxinus americana	2	6.25	1.00	2.81	9.06		1.73
Viburnum prunifolium	1	3.13	0.40	1.12	4.25		0.89
Rubus occidentalis	1	3.13	1.60	4.49	7.62		3.58
Potentilla recta	1	3.13	0.60	1.69	4.81		1.34
Prunus serotina	1	3.13	3.00	8.43	11.55		6.71
Galium sp	1	3.13	0.40	1.12	4.25		0.89
	32	100.00	35.60	100.00	200.00		

Table 14. Absolute Frequency (AF), Relative Frequency (RF), Absolute Cover (AC), Relative Cover (RC), and Importance Values (IV) for plant species encountered in 5 1m² quadrats along Schroeder property (3E1) at the City of Muskego, Wisconsin. Based on sampling September 8, 2000.

Schroeder property SPECIES	AVG					STD
	AF	RF	AC	RC	IV	STD
Carex pensylvanica	5	8.77	58.00	64.16	72.93	13.04
Solidago ulmifolia	1	1.75	0.60	0.66	2.42	1.34
Cornus racemosa	4	7.02	1.40	1.55	8.57	1.52
Prunus serotina	3	5.26	3.40	3.76	9.02	4.45
Ribes missouriense	1	1.75	0.20	0.22	1.98	0.45
Xanthoxylum americanum	3	5.26	4.60	5.09	10.35	5.90
Fraxinus americana	3	5.26	0.60	0.66	5.93	0.55
Potentilla recta	1	1.75	0.20	0.22	1.98	0.45
Circaea lutetiana canadensis	3	5.26	4.60	5.09	10.35	8.65
Smilacina racemosa	3	5.26	0.60	0.66	5.93	0.55
Geum canadense	1	1.75	0.20	0.22	1.98	0.45
Ostrya virginiana	1	1.75	0.20	0.22	1.98	0.45
Crataegus mollis	2	3.51	0.80	0.88	4.39	1.30
Desmodium glutinosum	2	3.51	1.20	1.33	4.84	1.79
Quercus alba	1	1.75	0.20	0.22	1.98	0.45
Rhamnus cathartica	2	3.51	0.80	0.88	4.39	1.30
Podophyllum peltatum	1	1.75	1.00	1.11	2.86	2.24
Quercus rubra	1	1.75	0.20	0.22	1.98	0.45
Aster lateriflorus	1	1.75	0.20	0.22	1.98	0.45
Taraxacum officinale	1	1.75	0.20	0.22	1.98	0.45
Viburnum acerifolium	2	3.51	1.40	1.55	5.06	2.61
Fragaria virginiana	2	3.51	0.40	0.44	3.95	0.55
Rubus occidentalis	1	1.75	0.40	0.44	2.20	0.89
Vitis riparia	1	1.75	0.20	0.22	1.98	0.45
Amphicarpaea bracteata	1	1.75	0.20	0.22	1.98	0.45
Parthenocissus quinquefolia	1	1.75	0.60	0.66	2.42	1.34
Lonicera tatarica	1	1.75	3.00	3.32	5.07	6.71
Smilax ecirrhata	1	1.75	0.20	0.22	1.98	0.45
Poa compressa	1	1.75	0.20	0.22	1.98	0.45
Rhus radicans	1	1.75	0.20	0.22	1.98	0.45
Rubus idaeus strigosus	1	1.75	0.60	0.66	2.42	1.34
Galium sp.	2	3.51	3.40	3.76	7.27	6.54
Rosa sp.	1	1.75	0.20	0.22	1.98	0.45
Lactuca sp.	1	1.75	0.20	0.22	1.98	0.45
	57	100.00	90.40	100.00	200.00	

APPENDIX 3. WOODY SPECIES DENSITY IN SELECTED PLANT COMMUNITIES WITHIN THE CITY OF MUSKEGO

Species/Transect	Size Classes (DBH)										Stems per hectare									
	<2in	2-6in	6-10in	10-14in	14-18in	18-22in	22-26in	26-30in	30-34in		<2in	2-6in	6-10in	10-14in	14-18in	18-22in	22-26in	26-30in	30-34in	
A-Sedge Meadow																				
Cornus stolonifera	6									1200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salix interior	18									3600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cornus obliqua	4									800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B-Degraded Woods																				
Ulmus americana		4								0.0	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tilia americana		4	2							0.0	400.0	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acer saccharum	8	4								1600.0	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prunus serotina	3									600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lonicera tatarica	2									400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C-Wetland, endangered sedge																				
Fraxinus pennsylvanica	5	2	2							1000.0	200.0	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Populus deltoides										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ulmus americana										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D-Degraded Mesic Woods																				
Crataegus mollis		4								0.0	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fraxinus nigra		4								0.0	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ulmus americana		1								0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tilia americana		1	1							0.0	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fraxinus americana	8	3								1600.0	300.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fraxinus pennsylvanica	10	1								2000.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prunus serotina		1								0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lonicera tatarica	29									5800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carya ovata	1									200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E-Wetland Bluhm Park																				
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
F-Oak (Quercus sp.) Savanna Bluhm Park																				
Prunus serotina	14	2								2800.0	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acer negundo		1								0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carya ovata	3	1			2		1			600.0	100.0	0.0	0.0	200.0	100.0	0.0	0.0	0.0	0.0	0.0
Malus sp	1	1								200.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acer saccharum		1								0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Quercus alba				1				1		0.0	0.0	0.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Fraxinus americana	9									1800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prunus virginiana	23									4600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhamnus cathartica	1									200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cornus racemosa	5									1000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G-Wetland, Sedge Meadow Remnant																				
Cornus racemosa	42									8400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhamnus frangula	143									28600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhamnus cathartica	14									2800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Species	Count	DBH	Stems																								
Acer nigrum	27	1																5400.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tilia americana	2	7																400.0	700.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crataegus mollis																		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ulmus americana		1																0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Quercus rubra										1								0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
Vitis riparia	2																	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prunus serotina	2																	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
																		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
																		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Quercus alba		1																0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carya ovata	9	2																1800.0	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ulmus americana	4	5	1															800.0	500.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crataegus mollis		1																0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fraxinus americana	3	1																600.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Quercus macrocarpa										1								0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
Rhamnus cathartica	17																	3400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lonicera tatarica	16																	3200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prunus virginiana	8																	1600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prunus serotina	10																	2000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Quercus rubra	1																	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ribes missouriense	3																	600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Viburnum prunifolium	3																	600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vitis riparia	1																	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
																		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
																		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Tilia americana	3		1															600.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cornus racemosa	1																	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Rhamnus cathartica	5		1															1000.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ulmus americana	2																	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Crataegus sp	1																	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Carya ovata	2																	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Ribes americanum	9																	1800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Fraxinus americana	4			1														800.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	
Vitis riparia	2																	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Xanthoxylum americanum	2																	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Lonicera tatarica	5																	1000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Rosa multiflora	5																	1000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Viburnum prunifolium	4																	800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Carya ovata			2															0.0	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
																		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
																		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

CITY OF MUSKEGO - stem density / size classification (DEAD STEMS)
August 8, 21 & September 8, 2000

Species	0-50m Size Classes (DBH)								Stems Per Hectare-Dead Size Classes (DBH)									
	<2in	2-6in	6-10in	10-14in	14-18in	18-22in	22-26in	26-30in	30-34in	<2in	2-6in	6-10in	10-14in	14-18in	18-22in	22-26in	26-30in	30-34in
A-Sedge Meadow										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
B-Degraded Maple Woods																			
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
C-Wetland																			
Fraxinus pennsylvanica	1	1	3			1					200.0	100.0	300.0	0.0	100.0	0.0	0.0	0.0	
Populus deltoides								1			0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	
Ulmus americana					1						0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
D-Degraded Mesic Woods																			
Fraxinus pennsylvanica	2	1									400.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
E-Wetland, Bluhm Park																			
Acer negundo	1										200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
F-Oak Savanna, Bluhm Park																			
Prunus serotina	4										800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Fraxinus americana	2										400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Prunus virginiana	2										400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
G-Wetland, Sedge Meadow Remnant																			
Cornus racemosa	11										2200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Rhamnus frangula	1										200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
H-Wetland, Cattail (Typha sp.) Marsh																			
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
I-Woods, Denoon Park																			
Crataegus mollis		1									0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	
Rhamnus cathartica	8										1600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Lonicera tatarica	10										2000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

J-Wetland, Denoon Park										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Schroeder Property																		
<i>Fraxinus americana</i>	1									200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>Prunus serotina</i>	3									600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>Xanthoxylum americanum</i>	4									800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>Ulmus americana</i>	1									200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Arthur Park																		
<i>Crataegus mollis</i>		3								0.0	300.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>Acer nigrum</i>	11									2200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Orville Peters																		
<i>Quercus alba</i>			1							0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	
<i>Ulmus americana</i>	1	3								200.0	300.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>Rhamnus cathartica</i>	1									200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>Carya ovata</i>	2									400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>Fraxinus americana</i>	3									600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>Prunus virginiana</i>	2									400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>Prunus serotina</i>										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Parker Dow Woods																		
<i>Tilia americana</i>		1								0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

APPENDIX 4. ECOLOGICAL SCORING FOR SELECTED 87 SITES CITY OF MUSKEGO

Site	Score							Total
	1	2	3	4	5	6	7	
1	1	1	2	2	3	2	2	13
2	2	1	1	2	1	2	1	10
3	2	1	1	2	1	2	1	10
4	1	2	1	1	1	1	1	8
5	1	2	2	2	1	2	3	13
6	1	1	1	2	2	1	1	9
7	3	1	1	2	2	2	1	12
8	2	2	1	1	1	1	1	9
9	1	1	1	1	1	1	2	8
10	1	1	1	1	2	1	2	9
11	1	2	3	1	1	2	2	12
12	2	2	1	1	2	2	2	12
13	1	2	1	1	1	1	1	8
14	1	1	1	1	1	1	1	7
15	1	2	1	1	2	1	2	10
16	3	3	3	3	2	3	3	20
17	1	2	2	2	2	3	1	13
18	1	3	3	2	2	2	2	15
19	1	3	3	2	2	2	2	15
20	3	3	3	3	3	3	2	20
21	1	2	2	2	2	2	2	13
23	2	3	3	3	3	2	2	18
24	1	1	2	2	2	2	1	11
25	3	2	3	2	2	2	2	16
26	1	2	2	2	2	2	2	13
27	1	22	1	2	2	2	2	12
28	1	2	2	2	2	2	2	13
29	1	2	2	2	2	2	2	13
30	1	2	2	2	2	2	2	13
31	3	1	1	3	3	2	1	14
32	3	2	2	3	2	2	2	16
33	3	3	3	3	2	3	2	19
34	1	2	2	2	2	2	1	12
35	2	1	2	2	2	2	2	13
36	3	3	2	3	3	3	3	20
37	1	3	2	2	2	2	2	14
38	1	2	3	2	2	2	2	14
39	1	2	1	1	1	2	2	10
40	1	2	2	2	2	2	2	13
41	2	2	2	2	2	2	2	14
42	3	2	3	3	3	3	3	20
43	1	2	3	3	3	3	3	18
44	2	3	1	3	3	3	3	18
45	2	2	1	2	2	2	2	13
46	2	2	1	2	2	2	1	12

Site	Score							Total
	1	2	3	4	5	6	7	
47	2	1	1	2	3	3	2	14
48	2	1	1	2	3	3	2	14
49	1	1	1	2	2	2	1	10
50	1	2	1	2	2	2	2	12
51	1	2	1	1	2	2	2	11
52	1	2	1	2	2	2	2	12
53	2	3	3	2	3	3	2	18
54	1	2	1	1	1	2	1	9
55	2	2	2	2	2	2	2	14
56	2	2	2	2	2	2	2	14
57	2	2	1	2	3	2	2	14
58	3	2	2	3	3	3	3	19
59	1	2	2	2	2	2	2	13
60	1	1	1	2	2	1	1	9
61	1	1	1	2	2	2	1	10
62	2	2	2	2	2	2	2	14
63	2	2	2	2	2	2	2	14
64	1	2	1	2	2	2	2	12
65	1	2	2	1	1	1	1	9
66	1	1	1	1	2	1	1	8
67	2	1	1	1	1	2	2	10
68	2	2	1	1	1	2	2	11
69	1	1	1	1	1	1	1	7
70	1	1	1	1	1	1	1	7
71	1	1	2	1	1	1	1	8
72	2	1	2	1	1	1	1	9
72	1	1	1	1	1	1	1	7
74	1	1	1	2	2	2	1	10
75	1	2	1	1	1	1	1	8
76	1	2	2	1	2	2	1	11
77	2	3	2	2	2	2	2	15
78	2	2	1	2	2	2	2	13
78	1	2	3	1	2	1	2	12
79	2	3	3	2	2	2	3	17
80	1	2	3	2	2	2	1	13
81	1	2	1	1	1	1	1	8
82	1	2	1	1	1	1	1	8
83	2	3	2	3	3	2	2	17
84	1	2	1	2	1	1	2	10
85	1	1	1	2	2	2	2	11
86	1	3	1	2	2	2	2	13
87	2	2	3	2	2	2	2	15

APPENDIX 5. LIST OF SPECIES RECORDED DURING SUMMER OF 2000. A LIST OF SPECIES FOUND WITHIN MUSKEGO COUNTY PARK BY OTHERS IS FOUND IN APPENDIX 6.

Total Species list alphabetical by botanical name for the City of Muskego

<i>Acalypha rhomboidea</i>	Three-seeded mercury	N
<i>Acer negundo</i>	Box elder	N
<i>Acer nigrum</i>	Black maple	N
<i>Acer rubrum</i>	Red maple	N
<i>Acer saccharinum</i>	Silver maple	N
<i>Acer saccharum</i>	Sugar maple	N
<i>Achillea millefolium</i>	Yarrow	A
<i>Agrimonia gryposepala</i>	Tall agrimony	N
<i>Agropyron repens</i>	Quack grass	A
<i>Agrostis alba</i>	Red top	A
<i>Agrostis perennans</i>	Thin grass	N
<i>Alisma plantago-aquatica</i>	Water plantain	N
<i>Alliaria petiolata</i>	Garlic mustard	A
<i>Allium canadense</i>	Wild onion	N
<i>Allium tricoccum</i>	Wild leek	N
<i>Ambrosia artemisiifolia elatior</i>	Common ragweed	N
<i>Ambrosia trifida</i>	Giant ragweed	N
<i>Amorpha canescens</i>	Lead plant	N
<i>Amphicarpaea bracteata</i>	Hog peanut	N
<i>Andropogon gerardii</i>	Big bluestem grass	N
<i>Andropogon scoparius</i>	Little bluestem grass	N
<i>Anemone cylindrica</i>	Thimbleweed	N
<i>Anemone quinquefolia interior</i>	Wood anemone	N
<i>Anemone virginiana</i>	Tall anemone	N
<i>Angelica atropurpurea</i>	Great angelica	N
<i>Antennaria plantaginifolia</i>	Pussy toes	N
<i>Apocynum cannabinum</i>	Indian hemp	N
<i>Aquilegia canadensis</i>	Wild columbine	N
<i>Aralia nudicaulis</i>	Wild sarsaparilla	N
<i>Arctium minus</i>	Common burdock	A
<i>Arisaema triphyllum</i>	Jack-in-the-pulpit	N
<i>Asclepias exaltata</i>	Poke milkweed	N
<i>Asclepias incarnata</i>	Swamp milkweed	N
<i>Asclepias syriaca</i>	Common milkweed	N
<i>Asparagus officinalis</i>	Asparagus	A
<i>Aster drummondii</i>	Drummond's aster	N
<i>Aster lateriflorus</i>	Side-flowering aster	N
<i>Aster macrophyllus</i>	Big-leaved aster	N
<i>Aster novae-angliae</i>	New England aster	N
<i>Aster pilosus</i>	Hairy aster	N
<i>Aster puniceus</i>	Swamp aster	N
<i>Aster sagittifolius</i>	Arrow-leaved aster	N
<i>Aster shortii</i>	Short's aster	N

<i>Aster simplex</i>	Panicled aster	N
<i>Athyrium filix-femina michauxii</i>	Lady fern	N
<i>Baptisia leucantha</i>	White wild indigo	N
<i>Berberis thunbergii</i>	Japanese barberry	A
<i>Bidens cernua</i>	Nodding bur marigold	N
<i>Bidens coronata</i>	Tall swamp marigold	N
<i>Bidens frondosa</i>	Beggar's ticks	N
<i>Boehmeria cylindrica</i>	False nettle	N
<i>Bouteloua curtipendula</i>	Side-oats gramma	N
<i>Bromus inermis</i>	Smooth brome	A
<i>Calamagrostis canadensis</i>	Blue joint grass	N
<i>Caltha palustris</i>	Marsh marigold	N
<i>Campanula americana</i>	Tall bellflower	N
<i>Campanula aparinoides</i>	Marsh bellflower	N
<i>Carduus nutans</i>	Nodding thistle	A
<i>Carex atherodes</i>	Hairy-leaved lake sedge	N
<i>Carex bebbii</i>	Bebb's sedge	N
<i>Carex blanda</i>	White sedge	N
<i>Carex cristatella</i>	Crested oval sedge	N
<i>Carex crus-corvi</i>	Crow-spur sedge	N
<i>Carex hirsutella</i>	Hairy green sedge	N
<i>Carex hirtifolia</i>	Hairy sedge	N
<i>Carex lacustris</i>	Lake sedge	N
<i>Carex lanuginosa</i>	Woolly sedge	N
<i>Carex lupulina</i>	Hop sedge	N
<i>Carex pellita</i>	Woolly sedge	N
<i>Carex pennsylvanica</i>	Pennsylvania sedge	N
<i>Carex rosea</i>	Curly-styled wood sedge	N
<i>Carex scoparia</i>	Pointed broom sedge	N
<i>Carex sparganioides</i>	Loose-headed bracted sedge	N
<i>Carex stipata</i>	Awl-fruited sedge	N
<i>Carex stricta</i>	Tussock sedge	N
<i>Carex tenera</i>	Narrow-leaved oval sedge	N
<i>Carex vulpinoidea</i>	Fox sedge	N
<i>Carya cordiformis</i>	Bitternut hickory	N
<i>Carya ovata</i>	Shagbark hickory	N
<i>Cassia fasciculata</i>	Partridge pea	N
<i>Celastrus scandens</i>	American bittersweet	N
<i>Celtis occidentalis</i>	Hackberry	N
<i>Cephalanthus occidentalis</i>	Buttonbush	N
<i>Chelone glabra</i>	Turtlehead	N
<i>Chrysanthemum leucanthemum pinnatifidum</i>	Ox-eye daisy	A
<i>Cichorium intybus</i>	Chickory	A

Total Species list alphabetical by botanical name for the City of Muskego

<i>Cicuta bulbifera</i>	Bulbet bearing water hemlock	N
<i>Cicuta maculata</i>	Water hemlock	N
<i>Cinna arundinacea</i>	Wood reed	N
<i>Circaea quadrisculata</i>	Enchanter's nightshade	N
<i>Cirsium arvense</i>	Canada thistle	A
<i>Cirsium muticum</i>	Swamp thistle	N
<i>Convallaria majalis</i>	Lily of the valley	A
<i>Convolvulus arvensis</i>	Field bindweed	A
<i>Convolvulus sepium</i>	Hedge bindweed	N
<i>Cornus amomum</i>	Silky dogwood	N
<i>Cornus racemosa</i>	Gray dogwood	N
<i>Cornus stolonifera</i>	Red-osier dogwood	N
<i>Corylus americana</i>	American hazelnut	N
<i>Crataegus mollis</i>	Downy hawthorn	N
<i>Daucus carota</i>	Queen Anne's lace	A
<i>Decodon verticillatus</i>	Swamp loosestrife	N
<i>Desmodium canadense</i>	Showy tick trefoil	N
<i>Desmodium glutinosum</i>	Pointed tick trefoil	N
<i>Dioscorea villosa</i>	Wild yam	N
<i>Dodecatheon meadia</i>	Shooting star	N
<i>Echinacea purpurea</i>	Purple coneflower	A
<i>Echinochloa crusgalli</i>	Japanese millet	N
<i>Eleocharis erythropoda</i>	Red rooted spike rush	N
<i>Elymus canadensis</i>	Canada wild rye	N
<i>Epilobium coloratum</i>	Cinnamon willow herb	N
<i>Equisetum arvense</i>	Horsetail	N
<i>Equisetum sylvaticum</i>	Wood horsetail	N
<i>Erigeron annuus</i>	Annual fleabane	N
<i>Erigeron canadensis</i>	Horseweed	N
<i>Erigeron philadelphicus</i>	Marsh fleabane	N
<i>Erigeron strigosus</i>	Daisy fleabane	N
<i>Eupatorium maculatum</i>	Joe-pye weed	N
<i>Eupatorium perfoliatum</i>	Boneset	N
<i>Eupatorium rugosum</i>	White snakeroot	N
<i>Euphorbia corollata</i>	Flowering spurge	N
<i>Euphorbia sp.</i>	Spurge	A
<i>Festuca elatior</i>	Meadow fescue	A
<i>Fragaria virginiana</i>	Wild strawberry	N
<i>Fraxinus americana</i>	White ash	N
<i>Fraxinus nigra</i>	Black ash	N
<i>Fraxinus pennsylvanica</i>	Red ash	N
<i>Fraxinus quadrangulata</i>	Blue ash	N
<i>Galium trifidum</i>	Small bedstraw	N

<i>Geranium maculatum</i>	Wild geranium	N
<i>Gerardia tenuifolia</i>	Slender false foxglove	N
<i>Geum aleppicum strictum</i>	Yellow avens	N
<i>Geum canadense</i>	White avens	N
<i>Geum laciniatum</i>	Rough avens	N
<i>Glyceria septentrionalis</i>	Floating manna grass	N
<i>Glyceria striata</i>	Fowl manna grass	N
<i>Gymnocladus dioica</i>	Kentucky coffee tree	N
<i>Hackelia virginiana</i>	Stickseed	N
<i>Helenium autumnale</i>	Sneezeweed	N
<i>Helenium flexuosum</i>	Purple-headed sneezeweed	A
<i>Helianthus grosseserratus</i>	Sawtooth sunflower	N
<i>Heliopsis helianthoides</i>	False sunflower	N
<i>Hemerocallis sp.</i>	Day lily	A
<i>Hypericum virginicum</i>	Marsh St. John's wort	N
<i>Hystrix patula</i>	Bottlebrush grass	N
<i>Impatiens capensis</i>	Spotted touch-me-not	N
<i>Iris virginica shrevei</i>	Blue flag iris	N
<i>Juglans cinerea</i>	Butternut	N
<i>Juglans nigra</i>	Black walnut	N
<i>Juncus dudleyi</i>	Dudley's rush	N
<i>Juncus tenuis</i>	Roadside rush	N
<i>Juncus torreyi</i>	Torrey's rush	N
<i>Juniperus virginiana crebra</i>	Red cedar	N
<i>Larix laricina</i>	Tamarack	N
<i>Lathyrus palustris</i>	Marsh vetching	N
<i>Leersia oryzoides</i>	Rice cut grass	N
<i>Lemna minor</i>	Small duckweed	N
<i>Lemna trisulca</i>	Forked duckweed	N
<i>Liatris aspera</i>	Rough blazing star	N
<i>Lilium michiganense</i>	Turk cap's lily	N
<i>Linaria vulgaris</i>	Butter-and-eggs	A
<i>Liparis lilifolia</i>	Purple twayblade	N
<i>Lobelia cardinalis</i>	Cardinal flower	N
<i>Lobelia kalmii</i>	Bog lobelia	N
<i>Lobelia siphilitica</i>	Great blue lobelia	N
<i>Lonicera prolifera</i>	Yellow honeysuckle	N
<i>Lonicera tatarica</i>	Tartarian honeysuckle	A
<i>Lotus corniculatus</i>	Deer vetch	A
<i>Ludwigia alternifolia</i>	Seedbox	N
<i>Lycopus americanus</i>	Water horehound	N
<i>Lycopus virginicus</i>	Bugle weed	N
<i>Lysimachia ciliata</i>	Fringed loosestrife	N

Total Species list alphabetical by botanical name for the City of Muskego

<i>Lysimachia lanceolata</i>	Lance-leaved loosestrife	N
<i>Lysimachia quadriflora</i>	Narrow-leaved loosestrife	N
<i>Lysimachia thysiflora</i>	Tufted loosestrife	N
<i>Lythrum salicaria</i>	Purple loosestrife	A
<i>Melilotus alba</i>	White sweet clover	A
<i>Melilotus officinalis</i>	Yellow sweet clover	A
<i>Menispermum canadense</i>	Moonseed	N
<i>Mentha arvensis villosa</i>	Wild mint	N
<i>Mimulus ringens</i>	Monkey flower	N
<i>Monarda fistulosa</i>	Wild bergamot	N
<i>Monotropa uniflora</i>	Indian pipe	N
<i>Muhlenbergia mexicana</i>	Leafy satin grass	N
<i>Myriophyllum spicatum</i>	European water milfoil	A
<i>Nasturtium officinale</i>	Water cress	A
<i>Nepeta cataria</i>	Catnip	A
<i>Nymphaea tuberosa</i>	White water lily	N
<i>Oenothera biennis</i>	Evening primrose	N
<i>Onoclea sensibilis</i>	Sensitive fern	N
<i>Osmorhiza claytonii</i>	Hairy sweet cicely	N
<i>Ostrya virginiana</i>	Hop hornbeam	N
<i>Oxalis stricta</i>	Wood sorrel	N
<i>Oxypolis rigidior</i>	Cowbane	N
<i>Panicum virgatum</i>	Switch grass	N
<i>Parnassia glauca</i>	Grass of parnassus	N
<i>Parthenocissus quinquefolia</i>	Virginia creeper	N
<i>Pastinaca sativa</i>	Wild parsnip	A
<i>Pedicularis lanceolata</i>	Fen betony	N
<i>Penstemon grandiflorus</i>	Large-flowered beard tongue	A
<i>Phalaris arundinacea</i>	Reed canary grass	A
<i>Phleum pratense</i>	Timothy	A
<i>Phragmites australis</i>	Reed	A
<i>Physocarpus opulifolius</i>	Ninebark	N
<i>Poa compressa</i>	Canada blue grass	A
<i>Poa pratensis</i>	Kentucky blue grass	A
<i>Podophyllum peltatum</i>	May apple	N
<i>Polygonatum biflorum</i>	Solomon's seal	N
<i>Polygonum amphibium stipulaceum</i>	Water knotweed	N
<i>Polygonum hydropiper</i>	Water pepper	N
<i>Polygonum pensylvanicum</i>	Pennsylvania knotweed	N
<i>Populus alba</i>	White poplar	A
<i>Populus deltoides</i>	Cottonwood)	N
<i>Populus tremuloides</i>	Quaking aspen	N

<i>Potentilla fruticosa</i>	Shrubby cinquefoil	N
<i>Potentilla recta</i>	Sulfer cinquefoil	A
<i>Potentilla simplex</i>	Cinquefoil	N
<i>Prenanthes alba</i>	White lettuce	N
<i>Prunella vulgaris</i>	Heal all	A
<i>Prunus serotina</i>	Wild black cherry	N
<i>Prunus virginiana</i>	Choke cherry	N
<i>Pycnanthemum virginianum</i>	Mountain mint	N
<i>Quercus alba</i>	White oak	N
<i>Quercus macrocarpa</i>	Bur oak	N
<i>Quercus rubra</i>	Red oak	N
<i>Ranunculus abortivus</i>	Small-flowered buttercup	N
<i>Ranunculus sceleratus</i>	Cursed buttercup	N
<i>Ranunculus septentrionalis</i>	Swamp buttercup	N
<i>Ratibida pinnata</i>	Yellow coneflower	N
<i>Rhamnus cathartica</i>	Buckthorn	A
<i>Rhamnus frangula</i>	Glossy buckthorn	A
<i>Rhus glabra</i>	Smooth sumac	N
<i>Rhus radicans</i>	Poison ivy	N
<i>Ribes americanum</i>	Wild back currant	N
<i>Ribes missouriense</i>	Wild gooseberry	N
<i>Robinia pseudoacacia</i>	Black locust	A
<i>Rosa multiflora</i>	Multiflora rose	A
<i>Rosa palustris</i>	Swamp rose	N
<i>Rubus allegheniensis</i>	Blackberry	N
<i>Rubus idaeus strigosus</i>	Red raspberry	N
<i>Rubus occidentalis</i>	Black raspberry	N
<i>Rudbeckia hirta</i>	Black-eyed Susan	N
<i>Rumex orbiculatus</i>	Great water dock	N
<i>Sagittaria latifolia</i>	Arrowhead	N
<i>Salix babylonica</i>	Weeping willow	A
<i>Salix discolor</i>	Pussy willow	N
<i>Salix interior</i>	Sandbar willow	N
<i>Salix nigra</i>	Black willow	N
<i>Sambucus canadensis</i>	Elderberry	N
<i>Sanguinaria canadensis</i>	Bloodroot	N
<i>Sanicula gregaria</i>	Clustered black snakeroot	N
<i>Scirpus acutus</i>	Hard-stemmed bulrush	N
<i>Scirpus atrovirens</i>	Dark green rush	N
<i>Scirpus fluviatilis</i>	River bulrush	N
<i>Scirpus lineatus</i>	Red bulrush	N
<i>Scirpus pendulus</i>	Red bulrush	N
<i>Scirpus validus</i>	Soft stem bulrush	N

Total Species list alphabetical by botanical name for the City of Muskego

<i>Scrophularia marilandica</i>	Late figwort	N
<i>Scutellaria epilobiifolia</i>	Marsh skullcap	N
<i>Scutellaria lateriflora</i>	Mad-dog skullcap	N
<i>Silene stellata</i>	Starry campion	N
<i>Silphium integrifolium</i>	Rosin weed	N
<i>Silphium terebinthinaceum</i>	Prairie dock	N
<i>Sisyrinchium albidum</i>	Blue eyed grass	N
<i>Sium suave</i>	Water parsnip	N
<i>Smilacina racemosa</i>	Feathery false Solomon's seal	N
<i>Smilacina stellata</i>	Starry false Solomon's seal	N
<i>Smilax ecirrhata</i>	Upright carrion flower	N
<i>Smilax herbacea</i>	Carrion flower	N
<i>Smilax lasioneura</i>	Carrion flower	N
<i>Smilax tamnoides hispida</i>	Bristly green brier	N
<i>Solanum dulcamara</i>	Bittersweet nightshade	A
<i>Solidago canadensis</i>	Canada goldenrod	N
<i>Solidago flexicaulis</i>	Broad-leaved goldenrod	N
<i>Solidago gigantea</i>	Late goldenrod	N
<i>Solidago graminifolia</i>	Grass-leaved goldenrod	N
<i>Solidago juncea</i>	Early goldenrod	N
<i>Solidago patula</i>	Swamp goldenrod	N
<i>Solidago riddellii</i>	Riddell's goldenrod	N
<i>Solidago rigida</i>	Stiff goldenrod	N
<i>Solidago speciosa</i>	Showy goldenrod	N
<i>Solidago ulmifolia</i>	Elm-leaved goldenrod	N
<i>Sonchus asper</i>	Spiny sow thistle	A
<i>Sorghastrum nutans</i>	Indian grass	N
<i>Sparganium eurycarpum</i>	Bur reed	N
<i>Spartina pectinata</i>	Prairie cord grass	N
<i>Stachys tenuifolia</i>	Smooth hedge nettle	N
<i>Taenidia integerrima</i>	Yellow pimpernel	N
<i>Taraxacum officinale</i>	Dandelion	A
<i>Teucrium canadense</i>	Germander	N
<i>Thalictrum dasycarpum</i>	Purple meadow rue	N
<i>Thelypteris palustris</i>	Fern	-
<i>Tilia americana</i>	Basswood	N
<i>Trifolium pratense</i>	Red clover	A
<i>Trillium cernuum macranthum</i>	Nodding trillium	N
<i>Ulmus americana</i>	American elm	N
<i>Ulmus pumila</i>	Siberian elm	A
<i>Ulmus rubra</i>	Slippery elm	N
<i>Vallisneria americana</i>	Eel grass	N
<i>Verbascum thapsus</i>	Mullein	A

<i>Verbena hastata</i>	Blue vervain	N
<i>Verbena stricta</i>	Hoary vervain	N
<i>Vernonia fasciculata</i>	Ironweed	N
<i>Veronicastrum virginicum</i>	Culver's root	N
<i>Viburnum acerifolium</i>	Maple-leaved arrow wood	N
<i>Viburnum dentatum</i>	Arrow wood	A
<i>Viburnum lentago</i>	Nannyberry	N
<i>Viburnum opulus</i>	European highbush cranberry	A
<i>Viburnum prunifolium</i>	Black haw	N
<i>Vicia cracca</i>	Cow vetch	A
<i>Viola pubescens</i>	Downy yellow violet	N
<i>Viola sororia</i>	Hairy wood violet	N
<i>Vitis riparia</i>	Riverbank grape	N
<i>Wolffia columbiana</i>	Water meal	N
<i>Xanthoxylum americanum</i>	Prickly ash	N
<i>Zizia aurea</i>	Golden Alexanders	N

APPENDIX 6. MUSKEGO COUNTY PARK SPECIES LISTS PREPARED BY OTHERS.