

HASTINGS RIVER FLATS

NATURAL RESOURCE MANAGEMENT AND RESTORATION RECOMMENDATIONS



December 2002



Friends of the Mississippi River

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RESTORATION RECOMMENDATIONS

Hastings, Minnesota

Dakota County

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EXECUTIVE SUMMARY

This Natural Resource Management Plan for the Hastings River Flats was completed for, and partially funded by, the City of Hastings. The plan was initiated to serve as a component of the Hastings River Flats Master Plan, which specifies extensive habitat restoration for the site, but for which a formal survey of the natural resources had not been completed.

Located on the Mississippi River at Lock and Dam No. 2 in Hastings, Minnesota, Hastings River Flats is about 216 acres, some of which was formerly a petroleum tank terminal. The City of Hastings now manages it as a city park, except for about 15 acres, which remains in the ownership of Flint Hills Resources and was not included in this management plan. The site is not only an important local resource, but is part of the larger Mississippi River ecosystem and internationally significant migration corridor.

The primary purposes of this project were to:

- Describe the existing natural vegetation at the site.
- Evaluate the ecological condition of the natural areas.
- Identify management needs for the natural areas.
- Evaluate conditions of the disturbed areas.
- Determine suitable habitat restoration for disturbed areas.

Vegetation surveys were the primary evaluation tool, but a survey of migratory and breeding bird species provided additional information.

The natural area, about 133 acres, consisted primarily of floodplain forest and emergent marsh. While generally in good ecological condition, these areas require some management, especially for invasive plant species, to improve and maintain their condition. Buckthorn removal is needed in the floodplain forest and purple loosestrife control is needed in areas near the emergent marsh, though no loosestrife was detected in the marsh itself.

Three areas at the site present excellent opportunities for native plant community restorations – 30 acres at the former tank farm, 6 acres at the former swimming beach, and 3 acres on the south slope of the dam. This plan identifies the historic plant communities that were likely present at the time of European settlement and describes several suitable options for habitat restoration at each area. Input from the public for these options was solicited at a public meeting and responses helped to shape the final recommendations. Recommendations are to 1) restore the tank farm area to wet prairie, 2) restore the swimming beach to floodplain forest with a wet prairie and emergent marsh buffer along the lakeshore, and 3) restore the dam slope to dry prairie and mesic prairie. Other options are presented in this document.

Detailed implementation plans must be developed prior to initiating any of the recommended actions. Plans should include adaptive management practices and long-term monitoring, essential for determining the efficacy of management and restoration practices.

INTRODUCTION

The Hastings River Flats is an important resource in Hastings, for passive recreation and nature exploration. The City of Hastings has long recognized this resource and maintained it for public use. With removal of the petroleum tanks, followed by clean-up and donation of a portion of the land to the city, more opportunities became available for protecting the area and for inviting public use. The city developed a master plan for development of the site, which included an interpretive center and an amphitheater. The primary component of the plan, however, was habitat restoration. Friends of the Mississippi River (FMR) became involved in this project when they expressed to the city an interest in conducting a detailed site evaluation and developing restoration recommendations. After soliciting additional funding from other sources, FMR initiated the project and began conducting fieldwork in spring 2002.

The primary ecological principles used while preparing this document were:

- Evaluate the site within a landscape scale context.
- Preserve existing natural areas, minimizing additional impacts from human activities.
- Restore ecological functions in existing natural areas by reducing negative impacts (e.g. exotic species).
- Maximize biodiversity.
- “Bigger is Better” - create larger contiguous natural areas whenever possible.
- Create greenway corridors to connect natural areas.
- Create buffers around sensitive natural areas, such as buffering water features to reduce impacts from upland areas.
- Encourage long-term protection of natural areas through conservation easements and other means.

We also sought to include a human component in the natural areas, though recreational activities were not the focus of this document. Suggestions include using restoration areas as demonstration sites, providing opportunities for natural history interpretation, and providing opportunities to involve volunteers in habitat restoration and ecological monitoring.

This document is intended to provide guidance to preserve and enhance existing natural areas and to restore a natural condition to areas that have been disturbed by past use. The first section describes historic natural conditions and human uses. This information helps us understand the site better and is an important first step in determining what a site can or should become. The next step is to conduct vegetation and wildlife surveys to identify existing conditions. These are described in the second section. A direct result of the surveys is management recommendations, which are presented in the third section. Several options for habitat restoration are also presented for the disturbed areas. Lastly, suggestions for how to begin to implement the management are presented in the fourth section.

While the management recommendations presented in this document are an important step in the long-term preservation of the unique resources at Hastings River Flats, success of the project will ultimately depend in large part on the long-term commitment of the city and community to this valuable resource.

BACKGROUND

Local and Regional Context

Hastings River Flats is located at Lock and Dam No. 2 on the Mississippi River, about 20 miles downstream from St. Paul in Dakota County and just upstream of Highway 61 where it crosses the Mississippi River at Hastings (Figure 1). Oriented northwest/southeast, River Flats is about 215 acres, measuring about 1 mile long and 2,000 feet wide (Figure 2). Except for the dam operations, the site is managed by the City of Hastings as a public park. Vehicle access to the park is from County Road 42 (Lock Boulevard). Aside from its connection to the “mainland” at the south end and northwest corner, the park is surrounded by water. The Mississippi lies along the north and northeast sides, and Lake Rebecca lies along the southwest side. The dike on the north side also provides foot access from that end, on a trail that runs the length of the park.

Hastings, a city of over 18,000 people, is the dominant land use adjacent to the park, but agriculture is the overall dominant land use in Dakota and Washington Counties. Natural communities, defined as assemblages of plants and animals that interact with each other and abiotic features of the environment in ways not significantly altered by human activities or introduced species, are very limited in both counties. Such areas have high biodiversity significance and retain many characteristics of the presettlement condition. According to the DNR County Biological Survey, natural communities cover only about 2.5% of Dakota County (DNR 1997), and about 4 % in Washington County. The highest concentrations are located along the large rivers – Mississippi, Minnesota, and St. Croix. There are also, however, many disturbed natural areas that still provide valuable wildlife habitat.

The largest and most significant natural area in Dakota County is the Vermillion River Bottoms, located two miles downstream of the River Flats (Figure 1). This extensive complex of floodplain habitats, designated by the DNR as “outstanding biodiversity significance,” extends 20 miles to Red Wing. It also connects to the Lower Cannon River. Together, these two areas comprise one of the top four sites in the state for rare forest birds (red-shouldered hawk, cerulean warbler, peregrine falcon, bald eagle, and acadian flycatcher) (Dunevitz 2001). Numerous other rare animals and plants are also harbored there.

The Mississippi River itself is an outstanding wildlife resource. The third largest river in the world, it is a globally significant migration corridor, due to its north-to-south orientation. The corridor is a flyway for 326 North American bird species and 40 percent of all the North American waterfowl (McGuiness 2000). In addition, 260 fish species have been reported in the basin, as well as 45 species of reptiles and amphibians and 50 mammal species.

Over half the land at Hastings River Flats is natural communities – primarily floodplain forest and emergent marsh. The remainder is disturbed land, including parkland, former industrial, paved, and buildings. The natural communities were designated by the DNR as “moderate biodiversity significance,” along with the mesic oak forest on the west bank of Lake Rebecca.

The nearest natural area to the park is located one-half mile downstream, south of Conley Lake (Figure 2). About the same size as the River Flats, it is primarily silver maple floodplain forest, designated as high biodiversity significance. Upstream, the nearest sizable natural community is Spring Lake Park, nearly three miles away, also designated as high biodiversity significance. Few other natural areas of significant size exist in the five miles between Spring Lake Park and the Vermillion River Bottoms (Figure 1), demonstrating the importance of Hastings River Flats as a link in the natural habitat of the river corridor.

Both Dakota and Washington counties are growing rapidly, with a nearly 30 percent growth expected in Dakota County by 2020 (Dakota County 2000). This expansion continually encroaches on natural areas, reducing their size and creating fragments and isolated patches. Creating and maintaining linkages between these fragments has become an increasingly important goal for land use management.

Geology and Soils

Hastings River Flats, created by primarily sandy deposits from modern flooding events, provides little evidence of the geologic forces that acted upon this area over millions of years. The high bluffs across the river and the river channel itself, however, attest to much older geologic events that carved the land.

In striking contrast to the flat, low terrain of the River Flats, the river bluffs to the east in Washington County rise up nearly 200 feet in vertical cliffs composed of Prairie du Chien dolostone (similar to limestone) overlying Jordan sandstone (Mossler and Bloomgren 1990). Both of these bedrock types formed from sedimentary deposits laid down by shallow seas present from 525 to 400 million years ago. Banks on the west side of Lake Rebecca are less than half the height of the east banks and not as steep.

The river valley was carved during the ice age (between 2 million and 10,000 years ago), from glacial meltwater (Balaban and Hobbs 1990). As the glaciers receded in the Late Wisconsinan period, moderate flow from glaciers was replaced by torrential flows originating from the expansive Glacial Lake Agassiz in northern Minnesota and Canada. Glacial River Warren, as it is known, carved a wide valley and created terrace deposits at three distinct levels. The City of Hastings is built on the middle terrace, composed of sand and gravel, and located 70 to 130 feet above the current floodplain. Directly upstream and downstream of the River Flats along the westerly banks are lower terraces at 5 to 20 feet or 40 to 70 feet above the floodplain.

The sedimentary deposits of the River Flats are 200 to 250 feet thick, lying upon bedrock composed of St. Lawrence and Franconia formations. These formations consist of dolomitic shale, siltstone, and sandstone. Soils that formed from the sedimentary deposits were primarily colo silt loam (Figure 3), which is a nearly level, poorly drained soil (SCS 1983). Colo soil is described as having a surface layer of silt loam, about 8 inches thick. Below that is about 46 inches of silt loam and silty clay loam. Very dark gray, mottled silty clay loam is the underlying material to a depth of about 60 inches. Permeability of this soil is moderate, with high water capacity and slow runoff. Organic matter is high and the seasonal high water table is at a depth

of 1 to 3 feet. Soils at the site have also been reworked during flood events and river deposits of sand, gravelly sand, and loamy sand have covered the surface.

The colo silt loam probably occupied the entire site at one time, but the half of the park that was in industrial use is classified by the Soil Conservation Service as Udorthents, a heterogeneous fill material generally composed of organic and inorganic waste and sandy, gravelly, loamy, and silty soil material. The fill was used to create building and road sites on the poorly drained soils.

Soils in the wetland on the northwest side of the parcel are ponded aquolls and histosols. These are level, very poorly drained mineral and organic soils and are generally continuously ponded.

Land use history

Native Americans inhabited Dakota County for thousands of years prior to European settlement in the early to mid 1800s. At the time of European settlement, the Mdewakanton Dakota (Sioux) were the primary inhabitants of the area. The Kaposia band, four miles south of St. Paul on the east side of the Mississippi, was one of the most important settlements in the area near Hastings. The Dakota were not known to inhabit the Hastings area, but used it for hunting, fishing and gathering (Neil and Williams 1881).

The first Europeans to settle at what is now the City of Hastings arrived in 1819, on an expedition of Colonel Leavenworth to establish a military post. Stopped by poor river conditions, a small group of people over-wintered at the site. The settlement persisted, later became the City of Hastings, and grew to a booming community after the town was platted in 1853. Farming was the dominant industry initially, but grain mills and lumbering were soon equally important, and Hastings became one of the leading cities in Minnesota in both industries.

Navigation was an important component in the success of this town, and most of the grain and lumber produced there was transported via the Mississippi to markets in other parts of the country. Variable and inconsistent water depths made navigation on the river difficult, especially upstream of Hastings. Several engineering projects were initiated to increase the depth, including wing dams, dredging and, ultimately lock and dam structures. Lock and Dam No. 2 was completed at Hastings in 1930 (Anfinson, pers. comm.) and owned and operated by the Department of Defense. It was modified in 1948 to create a 9-foot channel for barge traffic.

Prior to dam construction, the area that now includes the River Flats was about 1/2 mile wide and 2 1/2 miles long, more than twice as large as the park is today. It was separated from land to the west by Lake Rebecca and by its in-flowing and out-flowing streams that connected back to the Mississippi at either end (Warner and Foote 1879). The land was fully platted and privately owned since the late 1800s. It would likely have been used primarily for lumber, cultivation and grazing.

Construction of the dam dramatically altered the hydrology, vegetation and shoreline of the river. Water levels increased upstream by about two feet, submerging islands and floodplains and widening the river. The pool created by the dam stretched overland 1/2 mile west to Lake

Rebecca, which became contiguous with the river north of the dike. What remains of Lake Rebecca is less than half its former length and size. A narrow chain of islands on the upstream side of the lock marks the former location of the river's edge.

In 1951 the Air Force installed five aboveground storage tanks (100,200 to 180,000 gallons each) for aviation fuel on 65 acres of the site (Barr 1998). Northwest Refining then operated the tank farm (1961 to 1962), followed by Great Northern Oil (1962 to 1969), and Koch Petroleum (now Flint Hills Resources) (1969 to 1995). The tanks were used for gasoline and No. 2 fuel. In 1995 the tanks were dismantled and removed.

Soil remediation of the site took place after the tank demolition. An area of petroleum contaminated soils was excavated and replaced with clean fill. Paint chips from tank demolition resulted in lead contaminated soils, which were excavated and encapsulated under the existing new road. The site was graded and partially seeded with a temporary grass cover. After site remediation was completed, Flint Hills Resources (FHR) donated most of the property to the City of Hastings for a nature preserve in 2000, retaining about 15 acres in FHR ownership.

Historic aerial photographs (1937, 1940, 1951, 1957, 1970) (Appendix A) show additional changes over time to the landscape at the River Flats. In 1937 the land appeared to be somewhat dissected by former river channels and ponds. These virtually disappeared with construction of the petroleum tanks in 1951 when part of the site was filled and graded.

The east side of Lake Rebecca was mostly open, not wooded, in 1937. Woodland covered about half the site, concentrated in the central and northern parts with large open areas, especially to the west. Woodland coverage gradually increased and was at its densest coverage in the 1970 photo, when the entire property was wooded except for wetland areas and the tank operation area.

Between 1970 and 2000 several changes occurred in addition to the tank removal. Water levels increased so that Lake Rebecca was much larger than previously, and the small island at the southwest end was formed. Wetlands along the south side of the dike expanded in size. New wetlands formed at the south end of the site, in part due to tree removal. Trees were removed along a powerline corridor and large areas of trees were also apparently removed south of the powerline, especially in the former swimming beach/picnic area. Other areas north of the picnic grounds that converted from woodland to wetland may have been a result of increased water levels.

Current ownership of the Hastings River Flats is divided among three entities. Most of the land, about 164 acres and excluding the former industrial area, is federally owned. The Army Corps of Engineers is responsible for the lock and dam operations, but the remainder of the government property, about 146 acres, is leased to the City of Hastings and managed as parkland. The city also owns most of the land that was formerly industrial, however, about 15 acres along the western side of the industrial area remains in the ownership of FHR (see land cover, Figure 7).

At this time, FHR plans for the property are undetermined and it was not included in the evaluation or recommendations developed for this document. For the purposes of this report, the

industrial area managed by the city is referred to as the “former tank farm” and excludes the FHR property.

Current and Future Land Uses

Currently, most of Hastings River Flats is used as a public recreational area for passive activities. A swimming beach at the south end of Lake Rebecca was closed in recent years, but the area still attracts many people for picnicking and the small island is used for fishing. The lake itself and the river are used by boaters. A paved trail that goes lengthwise through the park, along the river and the dike, is used extensively for walking and biking. A carnival is held at the park in the summer. The lock and dam facilities occupy the northeast corner of the property, but an overlook deck is also there for public use. The Army Corps of Engineers uses the north end of the former tank farm as a repository for dredge spoils from the river. The sand piles are subsequently available for public use.

Future potential plans by the city for development at the park include an interpretive center and bandshell at the southeast end, additional trails, a viewing platform at the wetland off the dike road, interpretive signage, a boardwalk, festival grounds, and an outdoor ecology laboratory.

Presettlement Vegetation

European settlers began homesteading Minnesota in the mid-1800’s in large numbers and the landscape quickly changed as prairie and woodland were converted to cropland. The best records of what plant communities existed at the time of settlement were taken during the public land survey (PLS) in the mid-1800’s. Surveyors noted dominant plant species, and recorded bearing tree species every mile in a grid-formation. These notes were later interpreted and compiled to create a map showing dominant plant communities throughout the state (Marchner 1974).

Marchner’s map depicts the River Flats area as “Oak Openings and Barrens”, which is similar to what we now call oak savanna (Figure 4). The map, however, is a generalization of large areas, so small plant communities are not always depicted. Although oak savanna was common in uplands of the area, given the proximity of the park to the river, its low elevation and floodplain soils, it is more likely that it was historically floodplain forest. This is substantiated by reviewing the bearing tree data directly, which shows that species most frequently recorded in the vicinity of the park were elm, silver maple, green ash, and hackberry - species consistent with floodplain forest (described as “bottoms” in the PLS records). Conditions at the park indicate that emergent marsh was also common in the floodplain.

Floodplain Forest

According to Wovcha et. al (1995): “Floodplain forests are composed of deciduous trees and herbs that develop on mineral soil on river floodplains and are adapted to prolonged flooding, severe erosion, and sedimentation.” Silver maple is generally the dominant species in floodplain forests of Minnesota, though there can be much variability between different river systems and

different regions. Black willow and cottonwood are also abundant and green ash, hackberry, box elder, basswood and bur oak are other typical species. Understory shrubs are generally sparse, but viney species are abundant, especially grape vine and Virginia creeper. Moonseed, wild cucumber, hops (*Humulus lupulus*), clematis (*Clematis virginiana*), and groundnut (*Apios americana*) are also common (scientific names, in italics, are shown only for species not listed in Appendix C).

The ground layer may be very sparse, especially in years of heavy flooding, but is occupied by species adapted to flooding and sedimentation, including annuals such as wood nettle, clear weed, beggarticks, and smartweed. Rhizomatous perennials such as Virginia wild-rye (*Elymus virginica*), rice cut-grass, goldenglow (*Rudbeckia laciniata*), and the sedge *Carex tribuloides* are other common species.

Mixed Emergent Marsh

Mixed emergent marshes are dominated by bur-reed and bulrushes, especially hard-stemmed bulrush (*Schoenoplectus acutus*), river bulrush, softstem bulrush. Cattails are present but not dominant. Common reed grass (*Phragmites australis*), spike rushes, and prairie cordgrass are often present and broad-leaved arrowhead and boneset (*Eupatorium perfoliatum*) are common forbs. Many plant species of this community are sensitive to fertilizer runoff and other disturbances, which often causes these wetlands to become dominated by cattail or reed canary grass.

Rare species

The bald eagle, state special-concern and federally threatened, is the only known rare species on the park property. A year-round resident pair has been present in the park since 1991. The nest site has moved numerous times, but has always been along the east side of Lake Rebecca, or slightly inland from the shore (Figure 5). The pair fledged one young in the first year they nested, but nesting attempts apparently failed in several subsequent years, or data were unavailable. Better data on the pair has been available since 2000 when a volunteer (Wendell Snider) began regular monitoring. Two young were fledged in both 2000 and in 2002.

While no other rare species occurrences are recorded for the River Flats, five animal species are recorded within one mile of the site, plus one plant species and six plant communities (Figure 5). The park may provide important habitat for several of the species, especially the pair of peregrine falcons that frequently occupies a nest box on the east bank of the Mississippi River above the dam, and the pair of red shouldered hawks, recorded about one mile east of the park.

NATURAL RESOURCE EVALUATION

Bird Community and Other Wildlife

Methods

A bird survey was completed in spring and early summer 2002 to document migratory and breeding bird populations that use Hastings River Flats. The survey was designed to provide baseline data on avian species and to establish a method that can be repeated in future surveys for comparison and monitoring. A walk-through modified transect survey was used during migration and a combination point count/transect survey method was used for breeding birds. All surveys were conducted between sunrise and 9:30 am, but species observed at other times were also documented.

Spring migration surveys were conducted on two occasions in April and May. Each survey was about three hours and consisted of walking the entire site, generally following the same route established for the point count survey. All species seen or heard were recorded, but not quantified. Species observed during other brief visits in this time period were also recorded, as well as records received from other experienced birders who have visited the site in recent years.

Breeding birds were surveyed on two occasions (June 6 and June 20), using a combination of point count and transect methods, adapted from the method used by the DNR (Stucker 1990). In the wooded area, four 50-meter radius plots were established, with at least 200 meters between centroids (Figure 6). Each point was surveyed for a ten-minute period, recording species and numbers of individuals seen or heard. Flyovers and species observed between survey points were recorded separately and not quantified.

The wetland along the dike path was surveyed along the northwest edge. Two fifty-meter radius semi-circles, spaced at least 125 m apart, were surveyed for 10-minute periods. While the size of the marsh would have warranted an additional survey point, doing so would have resulted in approaching too closely to the eagle nest.

Some marsh species are quite secretive and are only detected if they vocalize. To elicit responses, taped recordings of sora, Virginia rail, common moorhen, American coot, pied-billed grebe, American bittern and least bittern were broadcast during the survey. The total time of the recordings was five minutes, including breaks between species, and it was played after five minutes of survey.

Habitats that are very open or linear are often best surveyed by transects walks. This method was used for the primarily open grassland in the southerly half of the park. The transect was dominated by the former industrial wasteland, but included mowed parkland, the river edge, and a small edge of willow shrub wetland. All species and numbers of individuals observed within 50 meters of either side of the roughly 1,200-meter transect were recorded during a 60-minute survey period.

Results

Site Total and Migratory Species Bird species recorded in all habitats are shown in Appendix B. A total of 99 species were observed at Hastings River Flats in 2002. An additional 41 species were recorded by another observer over multiple years, during spring, fall and winter months, for a total of 140 species recorded at the site. The spring 2002 migration survey showed 86 species (Table 2), though many of those species were also residents. A more accurate list of migratory species can be obtained by subtracting breeding birds (52) from the total number of species (140), resulting in 88 species. Migratory species were not quantified, but rough estimates were made of a few species. The most dramatic numbers were observed on April 24, when it was estimated that thousands of double-crested cormorants were present and feeding at Lake Rebecca.

A study of bird species actively migrating through the Mississippi River corridor at Hastings was conducted by Karl J. Bardon in 2001 (Bardon 2002). The study recorded about 73 migrating species between 11 March and 25 April, representing over 100,000 individuals. Nearly all the species reported in 2001 were also recorded in the 2002 survey, indicating that most species that use the Mississippi corridor for migration also use the Hastings River Flats as a stopover site. While the list is fairly complete, no doubt additional species could be found if continuous surveys were conducted during spring and fall migration.

Floodplain Forest Species A total of 25 species were recorded in the floodplain forest habitat. The point count surveys captured 19 species, but six additional species - bald eagle, broad-winged hawk, red-bellied woodpecker, eastern phoebe, red-eyed vireo, and white-breasted nuthatch - were observed outside the points. Two other species, great horned owl and blue jay, observed on-site at other times, were likely present, but were not recorded during the breeding bird surveys. The maximum number of birds observed at points during two visits was 53 individuals. House wrens were by far the most abundant species, followed by equal numbers of American redstart, warbling vireo and eastern wood pewee.

Emergent Marsh Species Sixteen species were recorded in the emergent marsh survey, including one unknown sandpiper species. The point count surveys captured all but one species, great blue heron, which was recorded outside the survey points. The maximum number of individuals recorded for the wetland points, from two survey dates, was 59. Cliff swallows (15) were nearly twice as abundant as the next most numerous species, red-winged blackbird (9) and American goldfinch (9). Sora, mallard and tree swallow were third most numerous (4 each).

Grassland Species The grassland survey, the longest in duration and the largest area, recorded 33 species and nearly 200 individuals. By far the most numerous species recorded was house sparrows (32), nearly twice as many as the next most abundant species, mallard (17). American goldfinch, house finch, mourning dove and rough-winged swallow had similar numbers and were the next most abundant species.

Four species were not captured in the transect survey but were observed on other occasions in the breeding season – indigo bunting, wild turkey (two adults and about 10 chicks), Canada goose, and ruddy duck (two adults). Five other common species - wood duck, blue jay, common grackle, belted kingfisher and chimney swift - were recorded in the spring survey but not the

breeding survey. It is likely, however, that these species were present during the breeding season.

Bobolinks (two singing males and two females) were recorded in the first breeding bird survey, but were apparently migrating and not breeding at the site. Although early June is a late date for observing migratory species, spring 2002 was unusually cold and migration was set back. The bobolinks, a very visible species, were not observed during any subsequent bird surveys or site visits.

The total number of species recorded during the breeding season in the floodplain forest, marsh and grassland represent very good species richness for the size of the site, especially given its metropolitan location. The most habitat specific species, such as green heron, great blue heron, sora, and Virginia rail, were found in the wetland. The grassland/mixed habitat had the greatest species richness, but also had the greatest number and abundance of habitat generalists, such as house sparrow, house finch, American goldfinch, mourning dove, brown-headed cowbird, and European starling. Several species were recorded in more than one habitat, but American goldfinch and yellow warbler were the only species recorded in all three survey regions.

Other animal species were not formally surveyed, but were recorded when observed during site visits. Species seen (or signs observed) were white-tailed deer, beaver, fox squirrel, gray squirrel, painted turtle, garter snake, and green frog.

Vegetation Survey

Methods

The term “natural community” is used to describe plant communities that have not been greatly altered by human disturbance or influence, and that reflect what was present at the time of European settlement. While most of the River Flats area was altered in the past, over half the park area has retained or recovered enough native vegetation to be identified as natural communities, primarily floodplain forest and emergent marsh. At the time of this report, the other half of the park consisted of mowed grass parkland and former industrial land dominated by non-native grasses and other weedy plants. It did not have characters of a natural community and was generally dominated by non-native species.

The diversity of plant species and plant communities, along with the fairly large size of the property, provides good habitat for a variety of wildlife species.

In 1997, the Department of Natural Resources completed a biological survey for Dakota County, wherein all natural communities were mapped. Hastings River Flats was not included on the map because it did not rank high enough in the DNR system. It was categorized as “moderate biodiversity significance” and given a ranking of C/D (DNR 1992), on a scale from A to D. A floodplain forest is given a C-ranking when, among other reasons, there is a history of moderate grazing, logging or cultivation, but it still retains a canopy cover of bottomland tree species and some native shrubs and groundcover (DNR 1995). A D-ranking is given to forests that a) are human-disturbed with little chance of recovery, b) have been heavily logged, grazed or

cultivated, or c) either has a canopy completely dominated by box elder or a groundlayer completely or nearly completely occupied by exotic species. The C-rank probably applies best to the forested and wetland areas, whereas the D-rank applies most to the former industrial part of the park. A D-rank does not imply that a site can not be restored to native vegetation, but a true native plant community probably cannot be restored. Created prairies, for example, cannot completely replicate original prairie, but may be composed of primarily native species.

A vegetation survey of the River Flats was conducted by Friends of the Mississippi River in spring and summer 2002 to document the species composition and to evaluate the ecological condition of the plant communities. The survey consisted of a combination of relevés and walk-through reconnoiters. (A relevé is a standard method of identifying and quantifying plant species and their coverages in multiple strata of a plant community). The emergent marshes were evaluated primarily from the edges. Both qualitative and quantitative data were collected, including a plant species inventory, relative cover and abundance, tree diameter at breast height (dbh), and percent coverage of the canopy, shrub layer and ground layer. An assessment of habitat conditions was also conducted, which recorded ecological concerns such as exotic and invasive species occurrences, erosion, and species regeneration.

The Minnesota Land Cover Classification System (MLCCS) was used for baseline information of plant community types and other land covers. The MLCCS is a classification system recently developed by the Department of Natural Resources that integrates cultural and vegetation features of the landscape into one comprehensive system. It is now widely used by county and state agencies throughout the metropolitan area for natural resource management and other planning purposes. Dakota County Soil and Water Conservation District has completed classification of most of the county, including the Hastings area. Existing data are based on aerial photograph interpretation and provide a good basemap for additional detailed survey. The MLCCS map was modified for this document, based on FMR's field evaluation (Figure 7).

Results

Sixty-two percent of the River Flats consisted of natural and disturbed plant communities. Floodplain forest (79 acres) and emergent marsh (42 acres) were the dominant plant communities (Table 1). Together they comprised 91 percent of the natural area. The rest of the undeveloped land consisted of two to four acres each of willow swamp, grassland with sparse trees, flooded lakebed on the east side of Lake Rebecca, and disturbed wet meadow.

The remainder of the property, 38 percent, consisted of the small strip of land adjacent to the dike (3 acres), and the much larger temporarily flooded non-native dominated herbaceous vegetation (80 acres). The latter constituted most of the public use area. Excluding the 15-acre parcel owned by Flint Hills Resources and the dam operation building area, the rest of the temporarily flooded vegetation was divided into three management units: the former tank field (about 29 acres), former swimming beach (6 acres), and the Lake Rebecca island (1 acre) (Figure 8). A fourth management area was the south slope of the dike path. Detailed descriptions of each vegetated area are provided in the next section and plant species recorded in each are shown in Appendix C.

Table 1. LAND COVER SUMMARY

Developed/Transitional land	MLCCS Code	Acres	Percent of HRF	
Temporarily flooded non-native dominated herbaceous vegetation.	16330	80	37	
11%-25% exposed earth, transitional land	14224	3	1	
Total developed		81	38	
Undeveloped/Vegetation Cover	MLCCS Code	Acres	Percent of undeveloped	Percent of HRP
Floodplain forest	32210	79	59	37
Mixed Emergent Marsh	61620	42	32	19
Permanently flooded lakebed	92400	3	2	1
Grassland with sparse mixed coniferous/ deciduous trees	62200	3	2	1
Wet meadow - disturbed	61420	2	2	1
Willow swamp	52430	4	3	2
Total undeveloped		133	100	62
Total Acres		216		100

NATURAL RESOURCE MANAGEMENT AND RESTORATION RECOMMENDATIONS

Each of the land cover types is described below, followed by recommendations for management or restoration goals. The temporarily flooded non-native dominated herbaceous vegetation was divided into three primary management units (Figure 8), each of which has its own restoration recommendations. Photographs of many areas are shown in Appendix D.

Each land cover type also includes maintenance and monitoring tasks. Monitoring is a frequently overlooked, but vital component of any habitat restoration project. Prior to conducting restoration or management activities, a monitoring plan should be developed. It consists of identifying management and restoration goals, conducting inventories of pertinent features, and surveying those features again after management activities. The monitoring plan should identify parameters to be measured, methodology, and how the data will be interpreted and used. Survey results provide quantitative information on changes over time, and help identify if management is achieving its intended goals. Adaptive management, the corollary to monitoring, incorporates monitoring results into future management decisions.

Monitoring need not be intensive or time-consuming, but should include at least an annual vegetation survey and photograph, taken from an established (and inconspicuously marked) location. Plant species and coverages should be documented. Besides plants, other commonly measured biota are bird, insect, and amphibian populations.

To determine what plant community is most suitable at a restoration site, several factors are considered including: what the historic plant community was, what plant communities now exist in other nearby areas with similar soils and other ecological conditions, and what the desired human use is for the site. The historical condition is used as a general guideline for the desired state, but since ecological conditions have often been significantly altered, the historic condition is not always optimal for current situations. Examining existing nearby high quality sites that have similar ecology to the restoration site can therefore provide additional cues on what the site will support. High quality sites are considered to be those sites that best reflect what we know about that community prior to European settlement. These first two factors, however, must be considered within the context of intended human activities or uses of the site.

Historically, the River Flats was probably predominantly floodplain forest, braided by river channels and backwater sloughs, and interspersed with emergent marsh. Most trees were probably removed in the late 1800s and early 1900s and forests have been regenerating in undeveloped portions of the park since then, resulting in the existing forest, typical of an early or mid-successional stage. Aside from vegetation, existing ecological conditions also differ from the historic due to filling, grading and increased water levels. Nevertheless, the site still floods regularly and essentially functions as a floodplain. Any of the restoration areas under consideration could be restored to floodplain forest, which would be consistent with other nearby natural communities with similar conditions. Given the intended relatively high public use for this area, however, it may be more appropriate to restore other communities as well. Wet prairie

or mesic savanna, for instance, may be suitable for the intended uses in some areas. A variety of habitat types can also provide more educational opportunities and greater wildlife benefit.

In November 2002, a public meeting was held to present the management and restoration recommendations and to solicit public input. The overall sentiment of respondents was strongly in favor of habitat restoration (Appendix E).

Based on ecological considerations, the recommended option for each habitat restoration area is described below. Public comments generally seemed to support these suggestions.

The **former tank farm** should be restored to wet prairie/wet meadow. At this time we do not recommend adding trees, either for a savanna or a floodplain forest for, several reason. The primary reason is that the Flint Hills Resources property creates a disconnect between the restoration area and the forest. A restoration involving tree planting would appear odd next to the open field as there would be no continuity. Secondly, wet prairie/wet meadow, is the foundation that would be established for any of the restoration options presented and the least expensive to install. Having it established would allow the city flexibility to create different habitats in the future, if desired. Thirdly, wet prairie/wet meadow would increase the habitat diversity, rather than converting the area entirely to floodplain forest, for instance. The wet prairie/wet meadow plant communities likely existed in the area historically but are now rare. Oak savanna, on the other hand, could be an educational tool, but it would be out of place at this site from an ecological and historic perspective.

We recommend restoring the **former swimming beach** to floodplain forest, connecting to the adjacent forest. Initially, the groundcover would be wet prairie, until the trees form a canopy. Emergent marsh should be established in the shallow water along the lakeshore. Such a restoration would still be consistent with the master plan, which identifies the area as an outdoor laboratory in this area. Alternatively, it would also be compatible with the picnic areas, if they are retained.

The **Lake Rebecca island** should be maintained and managed as wet prairie, to which it was recently restored, to allow for public use of the site for fishing. If the city ever decides to remove the bridge and discontinue its use for fishing, the island would be most appropriate, ecologically, as floodplain forest.

Floodplain Forest (degraded)

Acres: 79

Existing Conditions:

The floodplain forest had fairly good species diversity and otherwise had good wildlife habitat with abundant snags, downed wood, and trees of multiple sizes and stratification. The canopy was dominated by large cottonwood trees (15 to 25-inch diameter), with a subcanopy of smaller silver maple (6 to 10-inch diameter). Other common tree species of the subcanopy were American elm, green ash, hackberry, and boxelder, with occasional basswood, red oak and bur

oak. These species were also common in the midstory and most were present in the understory as seedlings and saplings. The canopy was generally closed, with 75 to 100% cover.

The understory, including shrubs and sapling trees, was generally quite open, as is typical of the habitat (DNR 1993), with 30 percent cover or less. Shrub and tree seedling germination is restricted by flooding, though there was generally good regeneration of silver maple, green ash, elm and hackberry. Shrubs such as false indigo, silky dogwood and sandbar willow were present at the edges, but few native shrubs species were found in the interior woods. Saplings of the canopy trees were common, but overall, buckthorn and prickly ash were the most abundant shrubs.

Buckthorn stem density was estimated and plotted (Figure 9). The highest densities and largest plants were found along the north and northeast sides of the forest, with densities gradually diminishing away from the edge. Prickly ash and honeysuckle generally followed the same trend. Prickly ash, though native, becomes excessively abundant in disturbed lands. Floodplain forests are by nature disturbed habitat and although prickly ash is commonly found there, it can become quite dense and impenetrable if unmanaged.

Buckthorn stems were mostly less than 3 inches in diameter, but many were fruiting. Birds eat the fruit, but it passes through very quickly and seed is generally dropped within 1/3 mile from ingestion (Lerman 2001). Since buckthorn plants in the interior woods are mostly small, further spread of the plant could be substantially reduced by removal of the largest plants, with subsequent removal of smaller plants in following years (see Appendix E for removal details). Left unmanaged, however, the floodplain forest could have a nearly solid buckthorn understory in about 10 years or less.

The ground in the floodplain forest was generally carpeted with leaf litter, but vegetative cover was low and some areas that flooded extensively were nearly devoid of ground cover plants. As is typical in a floodplain forest, vines were common, especially moonseed, but also Virginia creeper, grapevine, hog peanut, and bittersweet. Other common ground cover species included wood nettle, cleavers, sedge species, and bottlebrush. Seedlings of all tree species except cottonwood were found, and silver maple was most abundant.

The species composition and vegetation structure of the floodplain forest was fairly typical of the plant community type (DNR 1993), though tree sizes and relative species abundances indicate that it is fairly young. Historic aerial photos (1937, 1941) show less forest, and apparently younger forest, than currently exists, suggesting that the oldest existing trees (cottonwoods) became established at the site in the late 1800s and early 1900s. Most other species were much younger and probably became established within the last 40 years. Silver maple is regenerating well, while cottonwood, a shade intolerant species, is not. Eventually the site will likely become a silver maple floodplain forest.

The riverbanks were more disturbed, with more shrubby trees. Exotic trees and shrubs were not found, however, except for a few Siberian elm near the boat launch. In addition, some parts of the banks were severely eroded and need stabilization work.

Target Plant Community: Floodplain Forest
See description under “Presettlement Vegetation” section.

Restoration and Management Goals:

- Tree and shrub coverage of 90% native species
- Improve wildlife habitat
- Stabilize river banks

Restoration and Management Methods:

1. Eliminate non-native woody species

Tasks

- Remove buckthorn, honeysuckle, and (some) prickly ash (see Removal Methods in Appendix E). Target highest density areas first, then moderate density areas. Low density areas can be addressed later, if needed.
- Remove Siberian elm from riverbank and treat the stumps with herbicide.

Maintenance and Monitoring

- Monitor every year or two for new occurrences of invasive shrubs and remove. Mapping is important because a seed bank likely exists where shrubs have been, and new plants may continue to emerge there. New plants can be removed as soon as they are found, or removal activities can be scheduled for every three years or so, as long as it is completed before plants begin producing fruit. In full-sun, buckthorn can begin to produce fruit within a few years. In shaded areas, fruit production may be delayed for 10 to 20 years. Seed can remain viable in the soil for five years, but most of it germinates in one to three years (Lerman pers comm).

2. Install vegetation at rip-rapped river bank.

Tasks

- Cut sand-bar willow “live-stakes” and install directly into rip-rap. Live-stakes are cut in fall, after the plants go dormant. Stakes should be about 4 feet long. The bottom end is cut at an angle to insert in the ground. It should be inserted at least two feet in the ground. Willows can be cut from the willow swamp on-site (willow readily re-sprouts) or from another source.
- Re-vegetate rip-rapped banks by covering with at least a foot of soil, installing erosion blanket to anchor soil in case of high water, and installing small bare-root shrub material.
- Alternatively, pockets could be created in the rip-rap by removing enough rock to reach soil and installing shrubs. This method is less likely to have plant loss in high water, but will not have a very natural appearance.

Maintenance and Monitoring

- Newly installed shrubs should be monitored for adequate water and watered if there has been less than an inch of precipitation per week.
- Live stakes should be monitored for survival. New stakes may need to be cut and installed the second year if survival was low.

3. Provide nesting structures for birds

Tasks

- Install wood duck houses, as space permits, on the east side of Lake Rebecca. Minimum habitat area requirements of wood ducks are unknown, but 10 acres of wetland is a general rule of thumb. Boxes should be mounted in inconspicuous places, either attached to trees or erected on metal poles near the water, but should be protected from predators by metal baffles around the pole or tree trunk. Duck houses should be well-designed, with appropriate size entrance holes and interior cavity, and adequate predator protection. Detailed information on wood duck house design and other specifications can be obtained from the USDA Natural Resource Conservation Service (www.mn.nrcs.usda.gov/ecs/wild/guide.html).

Maintenance and Monitoring

- Nest boxes should be *regularly inspected* for invasive species, such as starlings, and cleaned out. In addition, the use of the boxes by wood ducks and merganser should also be monitored to evaluate success of the boxes. Nest boxes should remain in place during the winter months to provide winter cover for screech owls and other birds.

4. Document and monitor wildlife

Tasks

- Continue to conduct bird surveys. The bird survey conducted in 2002 provides a starting point for on-going collection of bird data. Results of management activities may be observed by changes in the bird population. Over time, survey data can also provide valuable information on population trends or changes, which can be an indicator of habitat changes.

5. Stabilize riverbanks

Tasks

- Bioengineering methods should be used to stabilize the banks. Detailed plans should be developed by an expert in the field and approved by all affiliated government agencies. One very successful method involves initially grading very steep banks, placing boulder vanes in the river, installing root wads and willow bundles on the banks, broadcasting native grass seed on the banks and anchoring soils with erosion blanket. Boulder vanes consist of large boulders, piled in a narrow vane that is directed upstream. The boulders are just below the surface of the water (normal levels) at the banks, and decrease in height as they extend out. Trees and shrubs are also planted along the banks.

Maintenance and Monitoring

- Stabilization projects should be monitored for effectiveness and photographed over time from established points.
- The riverbanks should be monitored, as the rest of the site, for exotic shrubs and herbaceous plants. The banks are a likely location for purple loosestrife, so surveys should be conducted annually.

Mixed Emergent Marsh

Acres: 42

Existing Conditions:

Emergent marsh was divided into two primary locations – along the south side of the dike (19 acres) and a narrow long stretch along the east side of Lake Rebecca and the powerline corridor (19 acres). Dominant plant species were giant burreed, river bulrush, softstem bulrush, arrowhead, and narrow-leaved cattail. Many wetlands in the metropolitan area are impacted by nutrients, pollutants, and fluctuating water levels, resulting in nearly exclusive dominance by broad-leaved cattail, a very aggressive and disturbance-tolerant species. In contrast, this wetland has good species diversity with only small patches of the less aggressive narrow-leaved cattail. The fact that the wetland is behind the dike probably protects it from dramatic water level fluctuations, which are detrimental to many plant species.

Target Plant Community: Mixed Emergent Marsh (see description under “Presettlement Vegetation”)

Restoration and Management Goals:

- Maintain native species dominance and diversity

Restoration and Management Methods:

1. Reduce nearby invasive species populations

Tasks

- Eliminate purple loosestrife from wetland area northeast of the dike by spraying with herbicide. Apply 1% glyphosate herbicide that is safe for wetland areas (e.g. Rodeo) as soon as plants begin to flower (usually in July). See Appendix E for details.

Maintenance and Monitoring

- Monitor the entire site annually for purple loosestrife and other invasive species. Spot spray as needed.

2. Document and monitor wildlife

Tasks

- As with the floodplain forest, continue to conduct bird surveys in the emergent marsh. The bird survey conducted in 2002 provides a starting point for long-term collection of bird data. Over time, the data can provide valuable information on population trends or changes, which can be an indicator of habitat changes.
- Survey anuran population (early spring and summer). Amphibians are well-known indicators of habitat quality. Monitoring populations at Hastings River Flats over time will provide good information about impacts or changes to the natural community. The simplest way to obtain information is to conduct aural surveys in the spring, recording species heard and relative abundances.

Wetland survey methods and training kits can be obtained from the Marsh Monitoring Program, which is run by Bird Studies Canada. Information about the program can be found on their website (<http://www.bsc-eoc.org/mmpmain.html>). Survey work could be conducted by volunteers or as part of a school program.

It may also be beneficial to obtain more detailed information about the anuran populations by direct sampling. Aquatic traps can be set to capture animals and collect data such as the species, number of individuals, and general condition. Repeated sampling over the years can provide information about population trends and impacts of land use or management practices.

- Survey macroinvertebrates. Like amphibians and birds, macroinvertebrates are another group of organisms that can provide information about the ecological health of a wetland. An excellent program that uses school groups and volunteers to evaluate habitats is the Wildlife Habitat Evaluation Program, or WHEP (<http://www.whep.org/whepinfo.htm>). The city already uses this program in other wetlands and we encourage them to expand the program to the River Flats. The Volunteer Stream Monitoring Program (612-624-7460) at the University of Minnesota can also provide information, sampling methods and help the city to get a program established.

Willow Swamp

Acres: 4

Existing Conditions:

The willow swamp, located along the north side of the power line corridor, was mostly a dense stand comprised almost entirely of sandbar willow. It graded into emergent marsh to the west, and south, in the powerline corridor.

No ecological problems were noted for this habitat. It provides a somewhat unique wildlife habitat, not found elsewhere on the property, and can be left as it is. The sandbar willow can also be used as a source of live stakes to install in the rip-rap. Cutting will not harm the plants and will actually stimulate more growth.

Target Plant Community: Willow Swamp

Willow swamps are dominated by medium to tall willow shrubs and red-osier dogwood. In more open areas, graminoid species typical of wet meadow communities are common. Tussock sedge (*Carex stricta*), lake sedge (*C. lacustris*), cattail, blue-joint (*Calamagrostis canadensis*) and jewelweed are typical species.

Restoration and Management Goals:

- Retain willow swamp, monitor for invasive species.

Restoration and Management Methods:

Tasks

1. Monitor willow swamp, as part of whole-site monitoring, for invasive species, especially buckthorn and purple loosestrife.

11-25% Exposed Earth, Transitional Land (Dike Slope)

Acres: 3

Existing Conditions:

This vegetation area was a narrow, long, and steep bank on the south side of the dike path. Many areas were sparsely vegetated or nearly barren, and the banks were otherwise dominated by invasive and exotic grasses and forbs. The bank has been impacted by flooding events, especially the major flood of 2001, which severely eroded the banks. In response, the city placed wood-chip mulch on the banks to stabilize them. Smooth brome and bladder campion were dominant species. Other common species were yellow avens, birdsfoot trefoil, daisy fleabane, wild lettuce, common ragweed, and horseweed.

The dike banks are directly adjacent to the emergent marsh and should act as a buffer to the wetland. Dense native vegetation on the slopes would help prevent erosion and prevent invasive species from establishing in the wetland. Many native grass species are very deep-rooted and provide excellent erosion control. The site should be treated to remove non-native species and seeded with native dry prairie species. Though dry prairie is not typical of the area, the steepness of the slope would dictate its presence at this location.

Target Plant Community: Mesic/Dry Prairie

1. Dry prairie

Dry prairie typically occurs on well-drained soils, and is often associated with steep slopes and south exposures. Short and mid-height grasses are dominant, such as little bluestem, sideoats grama, porcupine grass, and junegrass. Big bluestem is always present, though much less abundant than on more mesic sites, and Indiangrass is generally found only in more mesic locations. Many forb species found on mesic prairies can also occur on dry prairies, but characteristic species are stiff goldenrod, dotted blazing star, pasque flower, Missouri goldenrod, golden aster, silky aster and narrow-leaved puccoon.

2. Mesic prairie

Mesic prairie is dominated by tall grasses, especially big bluestem, Indiangrass, and prairie dropseed. Prairie cordgrass and switchgrass are common in wetter areas. Forb diversity is high and includes prairie clovers, rough blazing star, Canada goldenrod, northern bedstraw, smooth aster and stiff sunflower. The community is fire-dependent and will be invaded by trees and shrubs in the absence of fire. Mesic prairie grades into wet prairie on wetter sites and hill and sand-gravel subtypes of dry prairie on drier sites.

Restoration and Management Goals:

- 80% or more coverage by native grass and forb species.

- 0 to 30% tree and shrub coverage.
- Good diversity and abundance of native species, with no over-dominance by one species.

Restoration and Management Methods:

1. Eliminate non-native and weedy species

Tasks

- A 5% glyphosate herbicide that is safe for wetland areas (e.g. Rodeo) should be applied when spring growth reaches a height of 4 to 6 inches.
- The site should be sprayed a second time if new growth occurs.

Maintenance

- Monitor annually for infestations of invasive species and spot spray as needed.

2. Establish native plant species

Tasks

- A seed mix should be developed from the list in Appendix F, for mesic and dry prairie. Mesic prairie seed can be used at the base of the slope, and dry prairie seed for the rest of it.
- Parts of the site that still have a lot of wood chip may need to have soil spread on top in order to get plants established.
- Most of the site is too steep and loose to use a seed drill, so the seed should be hand-broadcast.
- After seeding, the banks should be anchored with 100% biodegradable erosion blanket. Turtles may use this area for nesting, so nylon-bound blanket should not be used.
- Seed should be sown by July or after mid-October.

Maintenance

- Short-term maintenance at the site would be the same as for the wet prairie, and will consist of mowing three or four times per year the first two years.
- By the third year the site should have enough fuel to support a burn. Burn in the spring to reduce exotic species and to favor the native species.
- Long-term maintenance will consist of regular burning (every 2 to 5 years), starting the third year, to control woody and exotic species and to invigorate the prairie. If burning is not feasible, the site can be mowed in the spring.
- Spot spraying, starting the third year, may be needed to control individual or small populations of exotic and invasive species.

Permanently Flooded Lakebed

Acres: 3

Existing Conditions: This submerged land along the eastern side of Lake Rebecca was not evaluated.

Target Plant Community: Permanently flooded lakebed.

Lakebed has less than 30 percent cover by persistent emergent plants. Submergent and floating-leaved aquatic plant are sparse to continuous cover and are not persistent.

Grassland with sparse mixed coniferous and deciduous trees

Acres: 3

Existing Conditions:

This small patch within the floodplain forest, at the north end of the former tank farm, had a very different appearance from the surrounding forest. The tree canopy was quite open with only scattered trees, especially red cedar. Small red oak and green ash were also present. Kentucky bluegrass dominated the groundcover, with abundant Canada goldenrod and large solid stands of 3 to 4-foot tall horsetail. This area was likely cleared long ago and used for pasture.

Although this area had historic disturbance and the groundcover is dominated by non-native grass, restoration and management is not needed. Eventually the area will merge into the floodplain forest. The grass is not a threat to the adjacent forest and the grassy opening provides a slightly different habitat for animals.

Target Plant Community: Same as existing

Restoration and Management Goals:

- Allow area to succeed to floodplain forest.
- Retain low coverage by invasive species.

Restoration and Management Methods:

Tasks

1. Monitor grassland, as part of whole-site monitoring, for invasive species, especially buckthorn.

Disturbed Wet meadow

Acres: 2

Existing Conditions:

The disturbed wet meadow communities, located in small depressional areas in the former tank farm (around and south of the dredge piles), were strongly dominated by swamp milkweed. Water levels fluctuated throughout the summer 2002, but it was a very wet year and the wet meadow was generally at least saturated to the surface and frequently had shallow standing water. Non-native species were not abundant, but there was some reed canary grass at the north end and some purple loosestrife along the edges.

Target Plant Community: Wet meadow

See description under “Former Tank Farm,” below.

Restoration and Management Goals:

Recommendations for this area are provided within the “Former Tank Farm” section, below.

Temporarily Flooded Non-native Dominated Herbaceous Vegetation

Former Tank Farm

Acres: 29

Existing Conditions:

Excluding the Flint Hills Resources property, the former tank farm restoration unit is about 29 acres (Figure 8). Of that, about two acres were in wetter depressions and were classified as disturbed wet meadow (previously described). The site was otherwise quite flat and tended to hold shallow water after spring thaws and heavy rain events. It was classified using the MLCCS as temporarily flooded non-native dominated herbaceous vegetation, and was a mix of weedy species. Daisy fleabane was among the most abundant species, along with common ragweed. Common grasses were slender wheatgrass and rye grass, which were apparently seeded as temporary cover along the perimeter of the site. Other common species were Timothy grass, quack grass, wooly plantain, bladder campion, and horseweed. There were also a few patches of dense aspen seedlings.

Restoration Options:

Several options are presented below for the target community intended for the area. All options, however, would involve establishing groundcover, which would necessarily be wet prairie and wet meadow species (Option 1).

Option 1: Wet Prairie

Wet prairie would be established throughout the unit, with a few pockets of wet meadow in wetter depressional areas. The wet meadow is primarily located near the north end of the unit, and consists of about two acres, divided among several areas.

Target Plant Communities: Wet prairie and wet meadow

1. Wet prairie

Wet prairie commonly occurs on flat river terraces and other depressional areas where the water table remains within the plant rooting zone for several weeks during the growing season, but inundation occurs infrequently and briefly. It is dominated by grasses including cordgrass, blue-joint (*Calamagrostis canadensis*), switchgrass (*Panicum virgatum*), wheatgrass, fowl meadow grass (*Poa palustris*), and sweet grass (*Hierocloe odorata*). Sedges include *Carex lanuginosa*, *C. sartwellii*, and *C. tetanica*. Common forbs include panicked aster (*Aster lanceolatus*), New England aster (*A. novae-angliae*), late goldenrod (*Solidago gigantea*), sneezeweed (*Helenium autumnale*), blazing star (*Liatris ligulostylis*), Indian hemp (*Apocynum sibiricum*), tall meadow rue (*Thalictrum dasycarpum*), mountain mint (*Pycnanthemum virginianum*) and marsh vetchling (*Lathyrus palustris*).

This plant community depends on fire for long-term survival; without fire it will tend to be overtaken by shrubs and trees. Wet prairie often grades into mesic prairie on the drier side and wet meadow on the wetter side. The three communities are not well-defined floristically and can be difficult to distinguish.

2. Wet meadow

Wet meadow is often associated with wet prairie and harbors some of the same species. The water table is generally below the surface for most of the growing season, but standing water is present in the spring and after heavy rains. Common sedges include *Carex lacustris*, *C. stricta* and *C. haydenii*. Forb diversity is high and includes spotted joe-pye weed (*Eupatorium maculatum*), common mint (*Mentha arvensis*), turtlehead (*Chelone glabra*) and swamp milkweed (*Asclepias incarnata*). Shrub cover is 0 to 70% and willows are the dominant species. Without fire, this plant community tends to succeed to shrub swamp.

Restoration and Management Goals:

- 80% or more coverage by native grass and forb species.
- 0 to 30% tree and shrub coverage.
- Good diversity and abundance of native species, with no over-dominance by one species.
- Improved habitat for native bird and animal species.

Restoration and Management Methods:

1. Eliminate non-native and weedy species.

Tasks

Greater tank area

- The site should be burned in the spring to remove dead vegetation and stimulate new growth. If burning is not feasible or if the project is initiated after the site has greened up, the site can be mowed instead, then allowed to re-grow.
- A 5% glyphosate herbicide that is safe for wetland areas (e.g. Rodeo) should be applied to the entire site, except for the wet meadow areas, when new growth reaches a height of 4 to 6 inches. If no surface water is present at the site, other glyphosates (e.g. Roundup) can be used. Herbicide should only be applied by professionals on non-windy days.
- The site should be sprayed a second time if new growth occurs.

Wet meadow

- The wet meadow can be burned along with the rest of the site.
- Apply herbicide to treat purple loosestrife, reed canary grass, and other exotic species. It may also be necessary to spray some of the swamp milkweed to create sites for seeded species to establish. Use a wetland-safe herbicide if there is any standing water. Reed canary grass will likely need several treatments.

Maintenance

- Monitor annually for infestations of invasive species and spot spray as needed.
- Burn site on a regular basis (see details under method 2, below).

2. Establish native plant species

Tasks

- Two seed mixes should be developed from the list in Appendix F, for wet prairie and wet meadow.
- A seed drill can be used to plant both the grass and forb seed in the wet prairie. A seed drill causes minimal soil disturbance, compared to tilling, and is less expensive since less site preparation is needed.
- The wet prairie mix should be applied throughout the site, except the low areas. These should be delimited with flagging and seeded with wet meadow mix. All seed should be broadcast before July or after early October.
- Seed should be applied in the wet meadow only when standing water is gone, which may not occur until later in the season. If there is non-native vegetation it should be sprayed with herbicide, along with the adjacent wet prairie. If the standing vegetation is native (i.e. swamp milkweed), it should be mowed and the seed hand-broadcast into it.
- It may be necessary to eliminate small patches of milkweed by applying herbicide, in order to facilitate more species establishment.

Maintenance

- Short-term maintenance at the site would consist of mowing both the wet prairie and the wet meadow three or four times per year the first two years, or as often as needed to prevent non-native plants from setting seed. It should be mowed to a height of 4 to 6

inches to prevent damage to native seedlings. Use a flail or mulching mower so the cuttings do not smother seedlings.

- By the third year the site should have enough fuel to support a burn. Burn in the spring to reduce exotic species and favor the native species.
- Long-term maintenance will consist of regular burning (every 2 to 5 years), starting the third year, to control woody and exotic species and to invigorate the prairie. Generally the site should be burned in the spring, but once the site is well-established, a fall burn can be an option. Fall burns can be used to favor forb species over grasses.
- Spot spraying, starting the third year, may be needed to control individual or small populations of exotic and invasive species. Most non-natives plants that appear initially will be annuals and are not a concern as long as mowing occurs regularly. They will be replaced once the native species become established.
- Since a bird survey was conducted on this area prior to any restoration work, it would be beneficial to repeat the survey for a few years after restoration to document changes. Other surveys, such as butterfly, would also be very informative and could be conducted by volunteers or incorporated in public programs.

3. Provide nesting structures for birds

Tasks

- Install bluebird houses in the restored grassland. Bluebird populations have declined dramatically throughout their range within the last few decades due to habitat loss and competition from non-native house sparrows and starlings. Populations are now recovering, largely due to widespread efforts among bird enthusiasts to provide nest boxes. Details on bluebird house design and management can be found on the North American Bluebird Association website (www.nabluebirdsociety.org/index.htm). Bluebirds are territorial and require at least 100 to 150 yards between houses, but houses are often placed in pairs to provide habitat for tree swallows, which also require cavities.
- Prevent public use of one of the piles of dredge spoils between May and August. These are used for nesting by cliff swallows.

Maintenance and Monitoring

- Monitor bluebird houses during early spring. If they are used by house sparrows, remove the nest and leave open for several days. After bluebirds and wrens or swallows leave the nest in late summer, open the boxes, clean or repair as needed, and leave open all winter. Boxes can be closed again in March.

Option 2: Wet Prairie and Mesic Oak Savanna

The groundcover prairie would be established, just as in option 1, but trees would also be added, in small clusters or scattered individuals, to create a savanna appearance. A portion of the prairie would be left treeless, and tree density would increase toward the edge of the floodplain forest to create a transition from prairie to woodland. While mesic oak savanna probably did not occur at this site historically, it is found in other places along the river in the Twin Cities. Its introduction here would be primarily for aesthetic and educational purposes, rather than historical accuracy.

Target Plant Communities: Wet Prairie/Wet Meadow and Mesic Oak Savanna

1. Wet prairie and wet meadow

These were described under Option 1, above.

2. Mesic oak savanna

Mesic oak savanna is characterized by prairie vegetation with 10% to 70% tree cover, which is more than 30% oaks. It occurs on dry-mesic to mesic sites, on glacial till or outwash, with soils ranging from clay loam to sandy loam. Bur oaks are the characteristic tree species, with quaking aspen common in wetter areas. Shrubs may include chokecherries (*Prunus virginiana*), gray dogwood (*Cornus foemina*), wolfberries (*Symphoricarpos occidentalis*), New Jersey tea (*Ceanothus americanus*), and leadplant (*Amorpha canescens*). This plant community is fire-dependent and often formed a transition zone between prairie and woodland. Fires traveling across a prairie and would burn into the woodland edge before dying out. Large, fire-resistant oak trees would survive at the edges, creating the oak savanna.

Restoration and Management Goals:

- Groundcover of 80% or more native grass and forb species.
- 30% to 70% tree and shrub coverage.
- Tree coverage of >30% oaks.
- Good diversity and abundance of native species, with no over-dominance by one species.
- Improved habitat for native bird and animal species.

Restoration and Management Methods:

1. Restore native prairie species

Methods 1 and 2 for Option 1 would apply here as well. Additional methods are described below.

2. Install trees

Tasks

- Install a mix of tree species (Appendix F) in a pattern that mimics the transition from prairie to woodland. Leave a large portion of the prairie open and plant individual and clustered trees in gradually increasing density towards the woods.
- Liberally apply a thick layer (6 inches) of shredded hardwood mulch around the bases of trees.
- Protect trees from deer browsing, as needed.

Maintenance and Monitoring

- Water trees the first year if the site receives less than one inch of rain per week, or if trees appear wilted.
- Survey for deer, rodent or rabbit damage and protect trees as needed.

3. Provide nesting structures for birds

The same tasks described in Option 1 apply here.

Option 3: Floodplain forest

Floodplain forest establishment is a long-term process, as trees mature much more slowly than herbaceous plants. Restoration would begin as with Option 1, with establishing a ground cover of native prairie species. Ultimately the groundcover species will change, but initially the site will be sunny, which is not suitable for floodplain forest groundcover species. Trees would be added throughout the site, in much higher density and different species composition than Option 2. As the trees mature and the canopy closes, the groundcover will transition to floodplain forest species.

Target Plant Communities: Floodplain Forest, with initial wet prairie and wet meadow.

1. Wet prairie and wet meadow
These were described under Option 1, above.
2. Floodplain forest
This community was described in the “Presettlement Vegetation” section.

Restoration and Management Goals:

- Groundcover of 80% or more native grass and forb species (short-term)
- 65% to 100% tree coverage, 30% to 50% shrub coverage (long-term)
- Tree and shrub coverage is 90% native species (short and long-term)
- Good diversity and abundance of native species, with no over-dominance by one or a few species.
- Improved habitat for native bird and animal species.

Restoration and Management Methods:

1. Restore native prairie species
Methods 1 and 2 in Option 1 would apply here as well.

2. Install trees

Tasks

- Install a mix of floodplain forest tree species (Appendix F) throughout the planting area. Trees could be planted in high density initially and thinned over time, or planted more sparsely and allowed to grow in. The first option results in a forested appearance more quickly and appears more natural, but is more expensive.
- The other tasks and maintenance are the same as those described for Option 2. Achieving a floodplain forest community takes many decades, so maintenance and monitoring will be on-going. Invasive, exotic species will be the primary management concern.

Former Swimming Beach Area

Acres: 6

Existing Condition:

The overall structure at the former beach area is short mowed grasses with scattered trees. Several picnic tables are scattered throughout. The ground is low and large portions of the site can be flooded or saturated for long periods in the spring and during rain events. Turf grasses gave way to native graminoids in wetter areas, and *Eleocharis* species were especially abundant. Where mowing was not feasible near the lake, wetland species such as swamp milkweed, smartweed (*Polygonum* sp.), and willow seedlings were evident.

The tree coverage was a mix of naturally occurring old trees, such as large (18 to 20 inch diameter) cottonwoods, black willow, green ash and elm, and smaller planted trees including river birch, silver maple, and white pine.

Like the former tank farm, the beach area, or a portion of it, could be restored to either wet prairie or floodplain forest, as described for the former tank farm. The picnic grounds tend to be fairly inaccessible for long periods of time throughout the growing season due to saturated soils, so restoring the site to native vegetation is likely the best use. If the area is desired for continued use as picnic grounds, however, at a minimum, the lakeshore itself should be restored with native emergent vegetation in the water and wet meadow species on the shore to create a buffer zone. This could be used as a demonstration site for “lakescaping” and could involve local volunteers to get it established.

Option 1: Wet Prairie, and Option 2: Floodplain Forest

These options would convert the entire six acres to either wet prairie or floodplain forest. Both options were described under the Former Tank Farm restoration recommendations and the same goals and tasks would apply here.

Target Plant Community: Wet Prairie or Floodplain Forest with initial wet prairie groundcover.

1. Wet prairie
This was described under Option 1, in the “Former Tank Farm” section, above.
2. Floodplain forest
This community was described in the “Presettlement Vegetation” section.

Restoration and Management Goals:

The goals for this area are the same as those described under Option 1 and Option 3, in the “Former Tank Farm” section.

Restoration and Management Methods:

The same restoration and management methods described under Option 1 and Option 3 in the “Former Tank Farm” section apply to this area.

Option 3: Parkland with Emergent Marsh and Wet Prairie Buffer

This options would retain most of the existing parkland, but would restore the lakeshore edge with emergent plants in the water, and a wet prairie zone along the shore.

Target Plant Community: Emergent Marsh and Wet Prairie

1. Emergent marsh

This community was described in the “Presettlement Vegetation” section.

2. Wet prairie

This was described under Option 1 in the “Former Tank Farm” section, above.

Restoration and Management Goals:

- Established emergent vegetation in a 10 to 20-foot zone in the former beach area.
- Established wet prairie in a 25 to 50-foot zone along the shore.
- 80% or more coverage by native grass and forb species in both plant communities.
- 0 to 30% tree and shrub coverage.
- Good diversity and abundance of native species, with no over-dominance by one species.
- Improved habitat for native bird and animal species.

Restoration and Management Methods:

The methods for wet prairie restoration are the same as those described under Option 1 in the “Former Tank Farm” section.

For the Emergent Marsh:

1. Establish native plant species

Tasks

- Select a mix of native emergent marsh plant species from Appendix F.
- Detailed instructions on Lakescaping can be obtained from the DNR’s “Restore Your Shore” CD or from the DNR booklet “Lakescaping for Wildlife.” General instructions will involve installing potted plants in the emergent zone in a predetermined planting area. Use anchoring devices and space plants 1 to 2 feet apart.

Maintenance

- Maintenance of the emergent marsh will involve careful and regular monitoring, beginning immediately after plant installation. Plant survival should be monitored and problems should be immediately addressed.
- The site condition should be documented with photographs for several years until it is well-established.

2. Provide nesting structures for birds

Tasks

- Install bluebird houses in the restored grassland. Bluebird populations have declined dramatically throughout their range within the last few decades due to habitat loss and competition from non-native house sparrows and starlings. Populations are now recovering, largely due to widespread efforts among bird enthusiasts to provide nest boxes. Details on bluebird house design and management can be found on the North American Bluebird Association website (www.nabluebirdsociety.org/index.htm). Bluebirds are territorial and require at least 100 to 150 yards between houses, but houses are often placed in pairs to provide habitat for tree swallows, which also require cavities.

Maintenance and Monitoring

- Monitor bluebird houses during early spring. If they are used by house sparrows, remove the nest and leave open for several days. After bluebirds and wrens or swallows leave the nest in late summer, open the boxes, clean or repair as needed, and leave open all winter. Boxes can be closed again in March.
- Annual bird and/or other animal surveys can be used to document the changes in wildlife use of the site.

Lake Rebecca Island

Acres: 1

Existing Condition:

The island was seeded by the city with native prairie species and is regularly mowed. At the time it was evaluated, it appeared to be dominated by non-native species, especially crab grass and barnyard grass. Pondweed was present in the water and *Eleocharis* sp. grew on the shore. A few natives forbs included swamp milkweed, blue vervain, and stinging nettle. Other natives may have been present, but were undetected due to mowing.

The island could be left as it is, vegetated with grasses and forbs (though additional management is needed to improve its condition) or it could be planted with trees and shrubs and restored to floodplain forest. Floodplain forest restoration was discussed under the “Former Tank Farm” section above, and the same goals and tasks would apply here.

Option 1: Wet Prairie, and Option 2: Floodplain Forest

Target Plant Community: Wet prairie or Floodplain forest (with initial wet prairie ground cover)

- Wet prairie
These were described under Option 1 in the “Former Tank Farm” section, above.
- Floodplain forest

This community was described in the “Presettlement Vegetation” section.

Restoration and Management Goals:

The goals for this area are the same as those described under Option 1 or Option 3 in the “Former Tank Farm” section.

Restoration and Management Methods:

1. Eliminate non-native species

Tasks

- The site should be surveyed (when un-mowed) to determine if native species dominate the site. Management methods will depend on results of the survey.
- Spot spraying may be needed to treat isolated patches of invasives.
- Additional measures may be needed such as burning in late spring and re-seeding with appropriate native seed (see list, Appendix F).

Maintenance

- Long-term monitoring for invasive species, along with monitoring the rest of the site.

RESTORATION AND MANAGEMENT TIMELINE

Tasks for each restoration or management area are summarized in the table below, by year and season. Tasks may be adjusted to subsequent years, depending on when a project is initiated. Note that the same tasks for establishing wet prairie apply to both the tank farm and the former beach area, though the two projects may not be initiated in the same year.

Table 2. Schedule of Tasks - Restoration, Management and Monitoring

YEAR 1

Spring	TF/FB: Burn or mow site, spray with herbicide. Spray regrowth. Sow native seed
Summer	TF/FB: Mow site to 6 inches, 2-3 times (or more) in growing season EM: Treat purple loosestrife (July) Isl: Evaluate native species abundance, spray invasives.
Fall	FB: Install emergent marsh vegetation in shallow water zone TF: Install bluebird houses, leave open until March RCG: Spray reed canary grass with Roundup (September)
Late Fall, Winter	FF: Cut and treat all buckthorn > 2ft, honeysuckle, and 60% prickly ash Cut and treat Siberian elm (riverbank)
Any time	FF: Install wood duck houses in floodplain forest

YEAR 2

Spring	TF/FB: Mow site to 6 inches. RCG: Spray new growth Isl: Burn island. Re-seed with native seed, if necessary. Dike: Apply herbicide to spring growth. Spray regrowth. Sow native prairie seed by the end of June.
Summer	TF/FB: Mow site to 6 inches, repeat as needed RCG: Mow sites, allow green-up, then spray. Dike: Mow site to 6 inches, 2-3 times throughout summer.
Fall	RB: Conduct bank stabilization

YEAR 3

- Spring** RB: Install shrubs at stabilized banks.
 Install shrub into rip-rapped areas.
- Dike: Mow site to 6 inches, 2-3 times during growing season.
- Summer** TF/FB: Monitor and spot spray invasive species.
 Mow site to 6 inches, 2-3 times or more.
- RB: Water new shrubs, monitor willow live stakes.
 Monitor & photograph bank stabilization
- Dike: Mow site to 6 inches, 2-3 times or more.

YEAR 4

- Spring** Dike: Burn or mow.
 FB: After wet prairie is established, trees and shrubs can be installed and mulched.

EVERY YEAR AFTER RESTORATION

- Spring** FF: Bird survey
 EM: Bird survey
 Frog survey
 Macroinvertebrate survey
 TF: Bird survey
 Burn prairie, every 2 to 5 years, starting Year 4
- Dike: Burn or mow every 2-5 years.
- Summer** EM, WM: Monitor and treat purple loosestrife (July)
 TF/FB: Monitor, spot spray invasives
 Monitor, document restoration project
 RCG: Monitor and spray reed canary
 Isl: Monitor, spot spray invasive species.
 Dike: Monitor, spot spray invasive species.
- Fall** FF: Inspect, maintain wood duck houses
 TF: Inspect, maintain bluebird houses
- Fall, winter** FF: Monitor and map buckthorn, cut/treat any >2 feet tall.

* **Codes:** TF = Tank Farm, EM=Emergent Marsh, Isl=Island, RCG=Reed canary grass areas at tank farm and former beach, FF=Floodplain Forest, RB=Riverbanks, FB=Former Beach, WM=Wet Meadow.

MANAGEMENT RESOURCES

Organizations

We encourage the City of Hastings to work with a multidisciplinary team of local and state agencies, conservation organizations and other professionals to develop management and restoration priorities, to develop detailed implementation plans for chosen projects, and to implement projects. FMR could continue to be involved in developing project implementation details and project management. Both the DNR and Dakota SWCD can assist with habitat restoration projects and erosion or streambank related issues. The Fish and Wildlife Service may be able to assist in prairie and wetland restoration work. Local organizations such as Pheasants Forever and the Dakota Habitat Alliance may also be able to assist. A partnership with Flint Hills Resources would be beneficial in order to conduct restoration projects that would include their property.

Grant Programs

Numerous potential funding sources are available to implement habitat management and restoration. Some of the most likely sources are identified below.

North American Wetland Conservation Act

Friends of the Mississippi River currently has funding available from NAWCA for habitat restoration work in the Mississippi floodplain. These funds could be used toward a restoration project at Hastings River Flats.

Conservation Partners Grant

This DNR program is designed to encourage the enhancement of wildlife and native plant habitats. This program will fund habitat enhancement projects such as restoration of natural plant communities, reforestation, protection of wetlands, stream buffer establishment, and abatement of soil erosion. The program will provide a maximum of 50% of the total eligible project costs not to exceed a maximum grant of \$20,000. Funds are provided on a reimbursement basis.

Metro Greenways Acquisition and Restoration Program

The Metro Greenways Program was established to promote the development of a regional network of natural areas, parks, wildlife habitat, and other open spaces connected by greenways. This DNR program provides funds to acquire and restore important natural areas. A 1:1 match is required.

Big Rivers Partnership

This program, funded by the Legislative Commission on Minnesota Resources and managed by Great River Greening, provides financial and technical assistance to landowners along the Mississippi and Minnesota Rivers in the metropolitan area that are interested in restoring and managing the natural resources on their property. A 1:1 cost share is required.

National Fish and Wildlife Foundation, Wetlands and Private Lands Initiative

The NFWF is a private foundation that provides federal funds from Congress for natural resource protection, management, and restoration. These funds must be matched by at least 1:1 federal to nonfederal funding. However, because this program is very competitive, a 1:2 federal to nonfederal match is recommended.

Metro Wildlife Corridors Project

This program, approved by the Legislative Commission on Minnesota Resources and awaiting ratification from the full state legislature, is designed to protect and restore important natural areas in the Twin Cities metro area. While it has not been formally chosen, the Mississippi River in Dakota County will likely be a project focus area.

Contractors and Native Plant Suppliers

Nurseries

The following is a list of potential suppliers of native plant material. This is not an exhaustive list of available providers and does not represent an endorsement of these nurseries.

Dragonfly Gardens
P.O. box 192
Amery, WI 54001
(715) 268-6155
Focus: Prairie plants

MN Native Landscape L.L.C.
Paul Jackson
29734 131st St NW
Princeton, MN 55371
(612) 389-0909

Hild and Associates
326 Glover Road South
River Falls, WI 54022
(715) 426-5131
Focus: Wetland plants

North American Prairies
111754 Jarvis Ave NW
annandale, MN 55302
(302) 274-5316

Ion Exchange Nursery
1878 Old Mission Dr
Harpers Ferry, IA 52146
(319) 535-7231
Focus: Seeds and plants

Outback Nursery, Inc
15280 110th Street South
Hastings, MN 55033
(651) 438-2771
Focus: Native trees and shrubs

Landscape Alternatives
1705 St. Albans Street
Roseville, MN 55113
(651) 488-3860
Focus: Plants

Peterson Seed Company, Inc.
P.O. Box 346
Savage MN 55378
(612) 455-2606

Prairie Moon Nursery
Rt 3 Box 163
Winona, MN 55987
(507) 452-1362
www.prairiemoon.com
Focus: seed, some bare root plants

Spring Beauty
RT 3 Box 162B
Winona, MN 55987
(507) 454-8021

Prairie Restorations, Inc.
P.O. Box 327
Princeton, MN 55371
(612) 389-4342
www.prairieresto.com
Focus: Plants & seed, installations

Contractors and Consultants

The following is a short list of possible consultants and contractors for implementing the management plans. This is not a complete list, but does include ecologists who are familiar with natural resource management. Unless otherwise noted, all firms do prescribed burning. Those marked with an * may also do buckthorn/brush removal. Many other brush removal companies are listed in the yellow pages under tree care.

*Applied Ecology, Inc.
Andy Sudbrock
4316 45th Ave S
Minneapolis, MN 55406
612-724-8916

*Natural Resources Restoration Inc.
Craig Andresen
2013 Walnut St. NW
New Brighton, MN 55112
651-636-3462

*Applied Ecological Services, Inc.
Doug Mensing
Edina, MN
952-925-3359

North American Prairies Company
111754 Jarvis Ave NW
Annandale, MN 55302
320-274-5316

*Go Native
Ann Mueller
509 2nd St NE
Minneapolis, MN 55413
612-378-7060
Buckthorn removal, no burning.

Outback Nursery, Inc.
15280 110th Street South
Hastings, MN 55033
651-438-2771

*Great River Greening
David Cathcart
35 West Water St, Suite 201
St. Paul, MN 55107
651-665-9500

Prairie Restorations, Inc.
John Pauly
Cannon Falls, MN
507-663-1091

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Websites:

<http://www.bsc-eoc.org/mmpmain.html>

<http://www.dnr.state.wi.us/caer/ce/invasives/listing.htm>

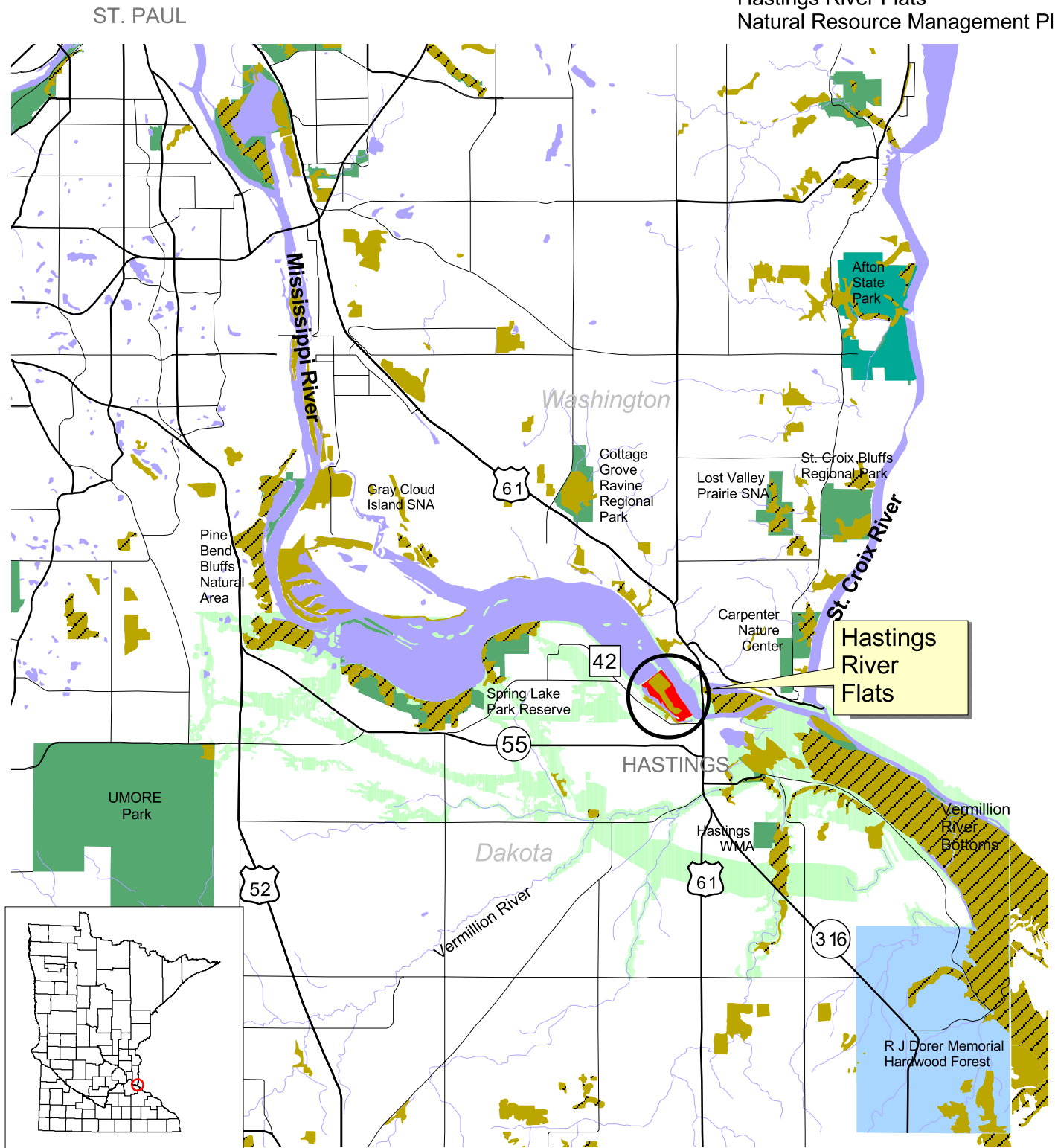
<http://www.nabluebirdsociety.org/index.htm>

<http://www.natureserve.org/explorer/>

<http://tncweeds.ucdavis.edu/>

www.mn.nrcs.usda.gov/ecs/wild/guide.html

Figure 1. Regional Context
Hastings River Flats
Natural Resource Management Plan



LEGEND



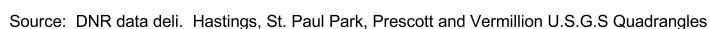
- DNR CBS sites - low /moderate biodiversity
- DNR CBS sites -high/outstanding biodiversity
- State Forest
- State Park
- City/County Park
- Mississippi Greenway Corridor



Scale 1:175,000

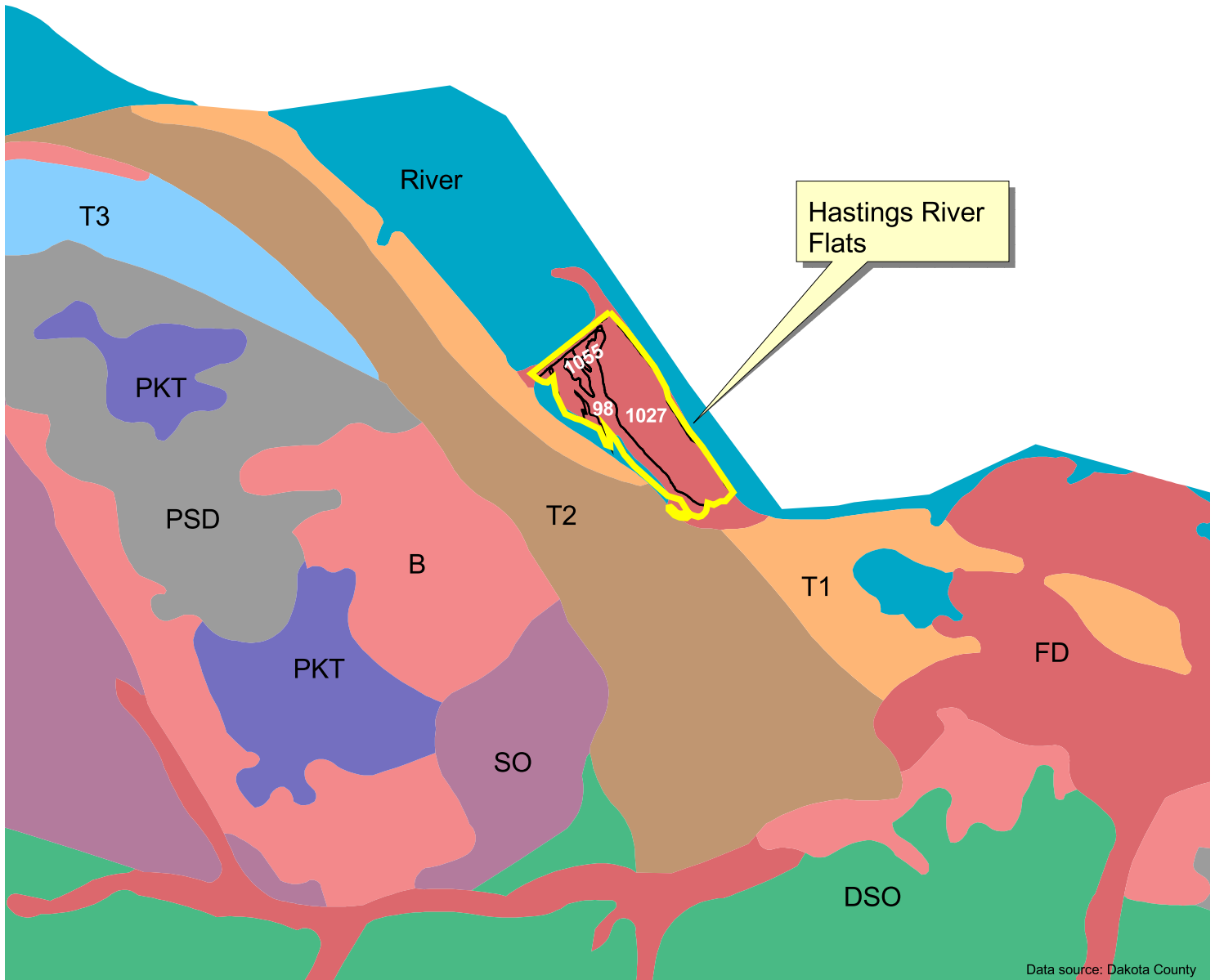
0 2 4 6 Miles

T115N, R17W, SENE20, 21



1 inch = 2,000 ft

Figure 3. Geology and Soils
Hastings River Flats
Natural Resource Management Plan



Data source: Dakota County

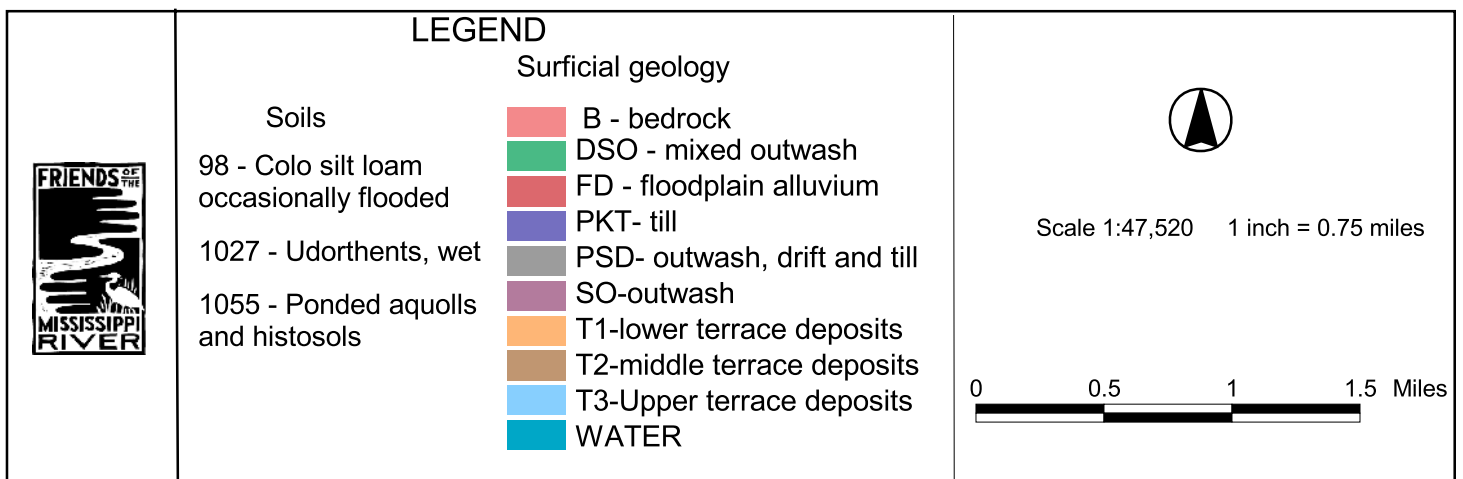
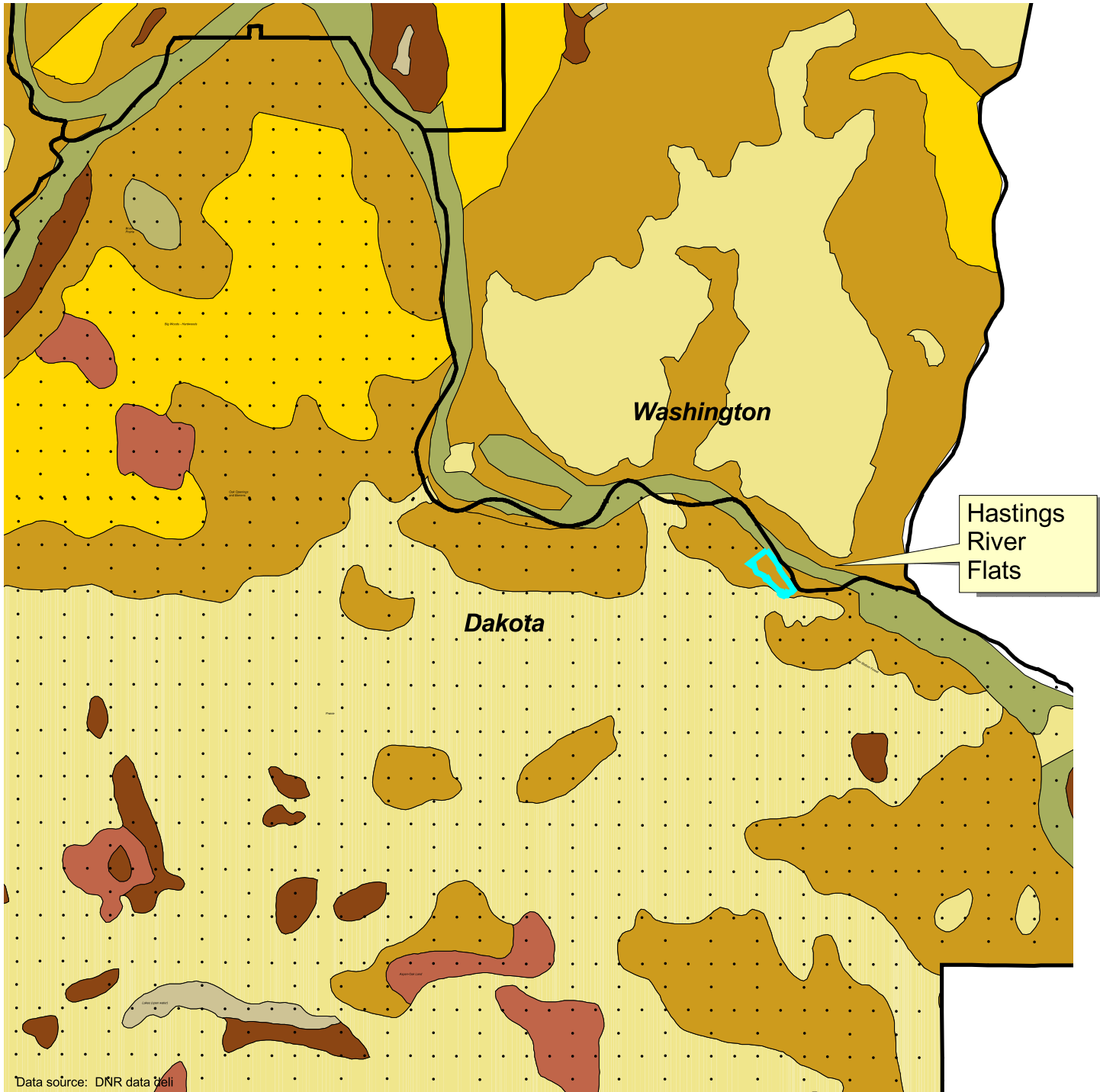


Figure 4. Presettlement Vegetation
Hastings River Flats
Natural Resource Management Plan



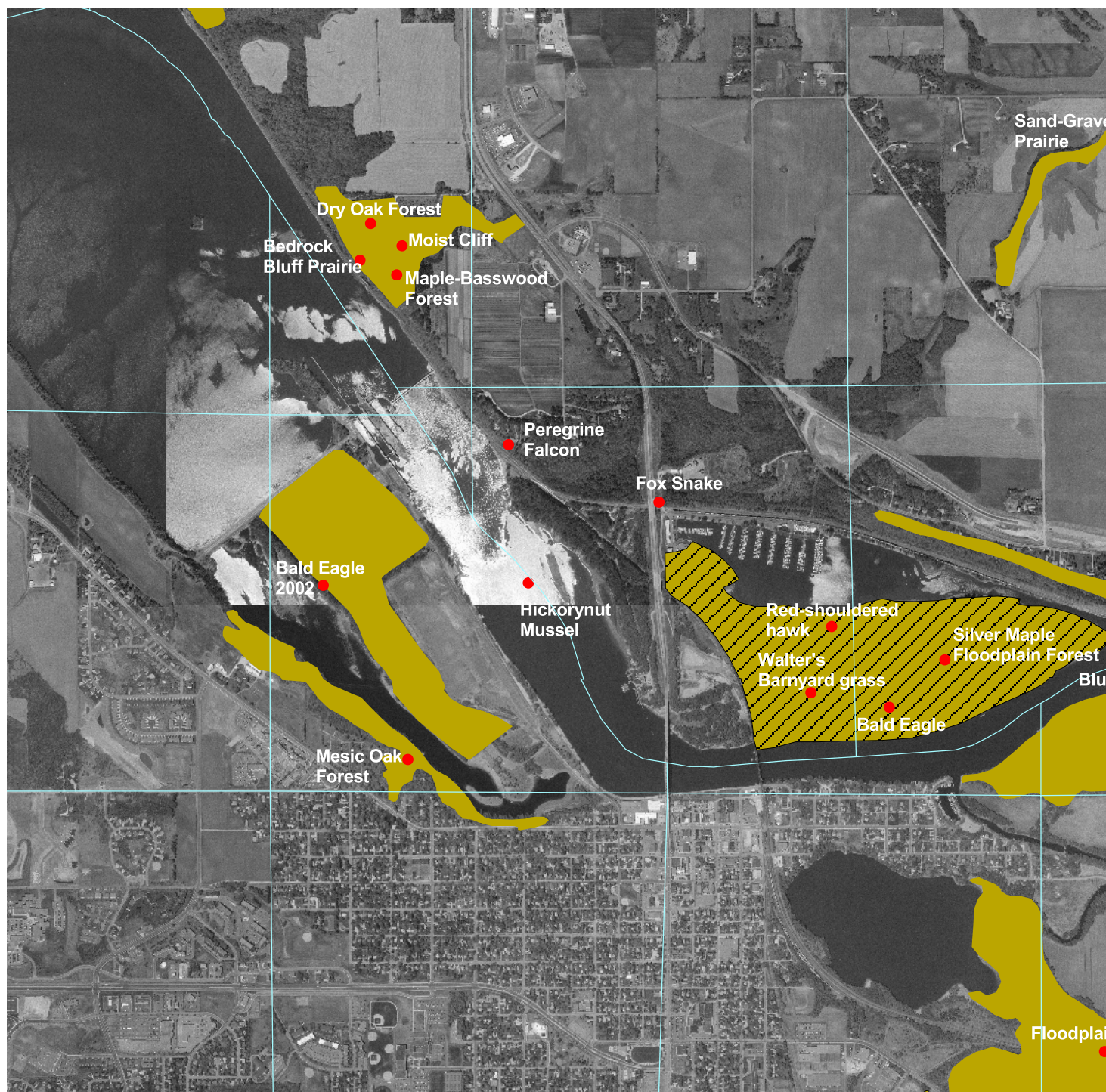
Public land survey
data points



Scale 1:200,000



Figure 5. Rare Features
 Hastings River Flats
 Natural Resource Management Plan



Data sources: 2000 Met Council DOQs, DNR Natural Heritage Data



LEGEND

- DNR CBS sites - low /moderate biodiversity
- DNR CBS sites -high/outstanding biodiversity
- Section lines

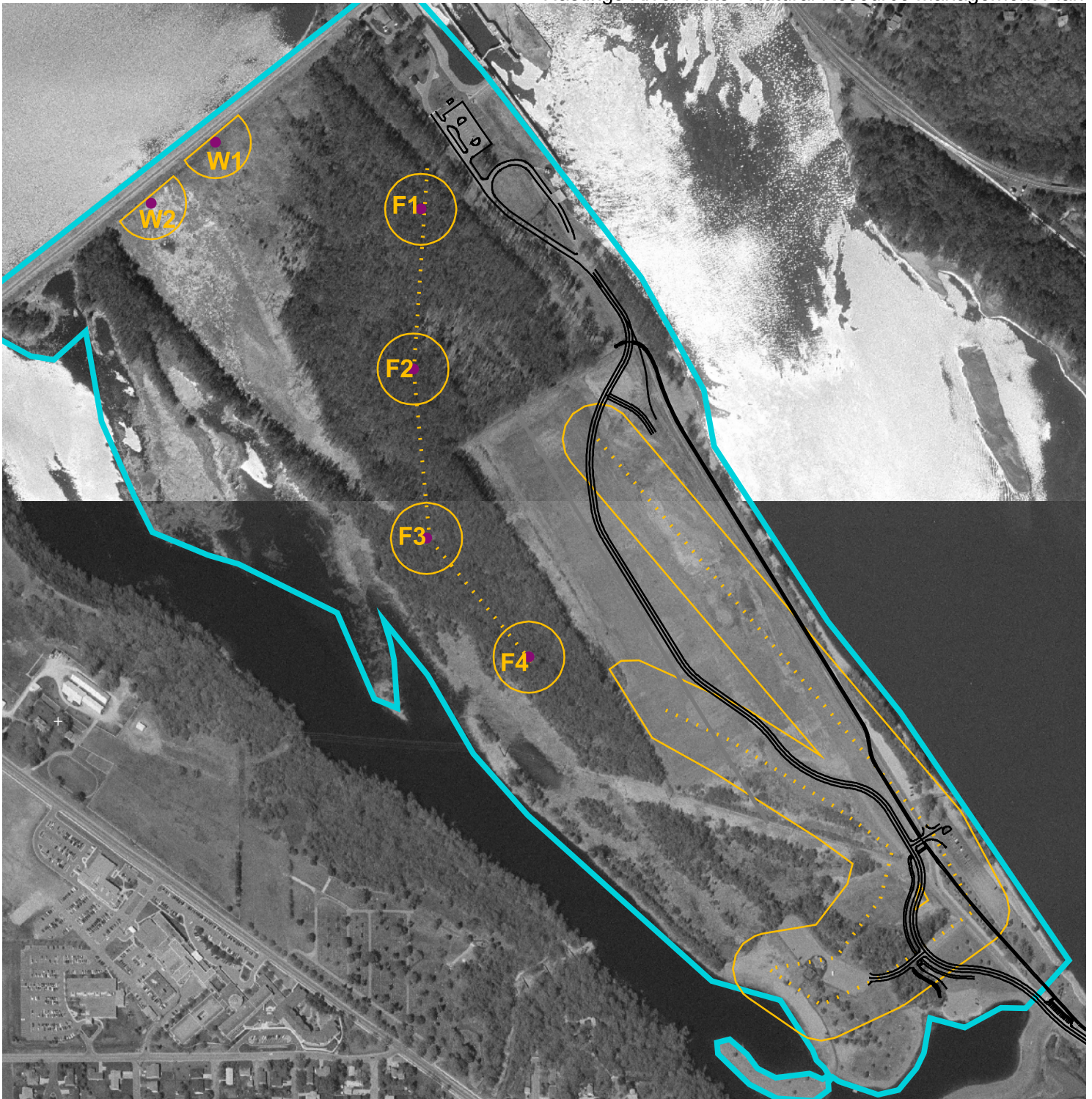


Scale 1:24,000 1 inch=2,000 feet

0 1000 2000 3000 4000 Feet

Figure 6. Bird Survey

Hastings River Flats - Natural Resource Management Plan



Data sources: Metropolitan Council 2000 DOQs, DNR data deli. Created July 2002

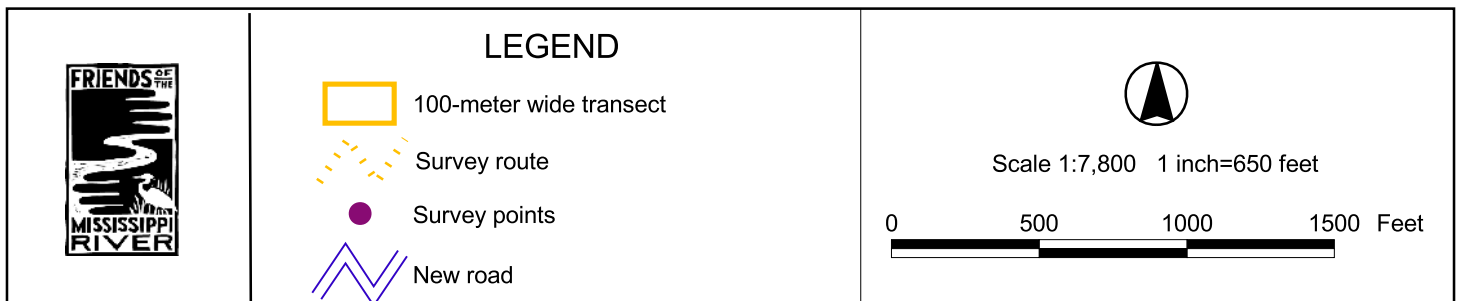


Figure 7. Land Cover
Hastings River Flats - Natural Resource Management Plan

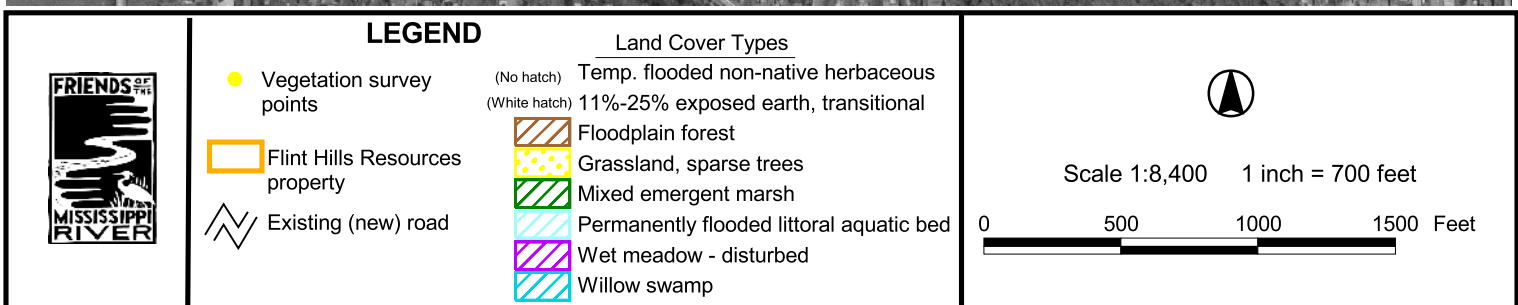
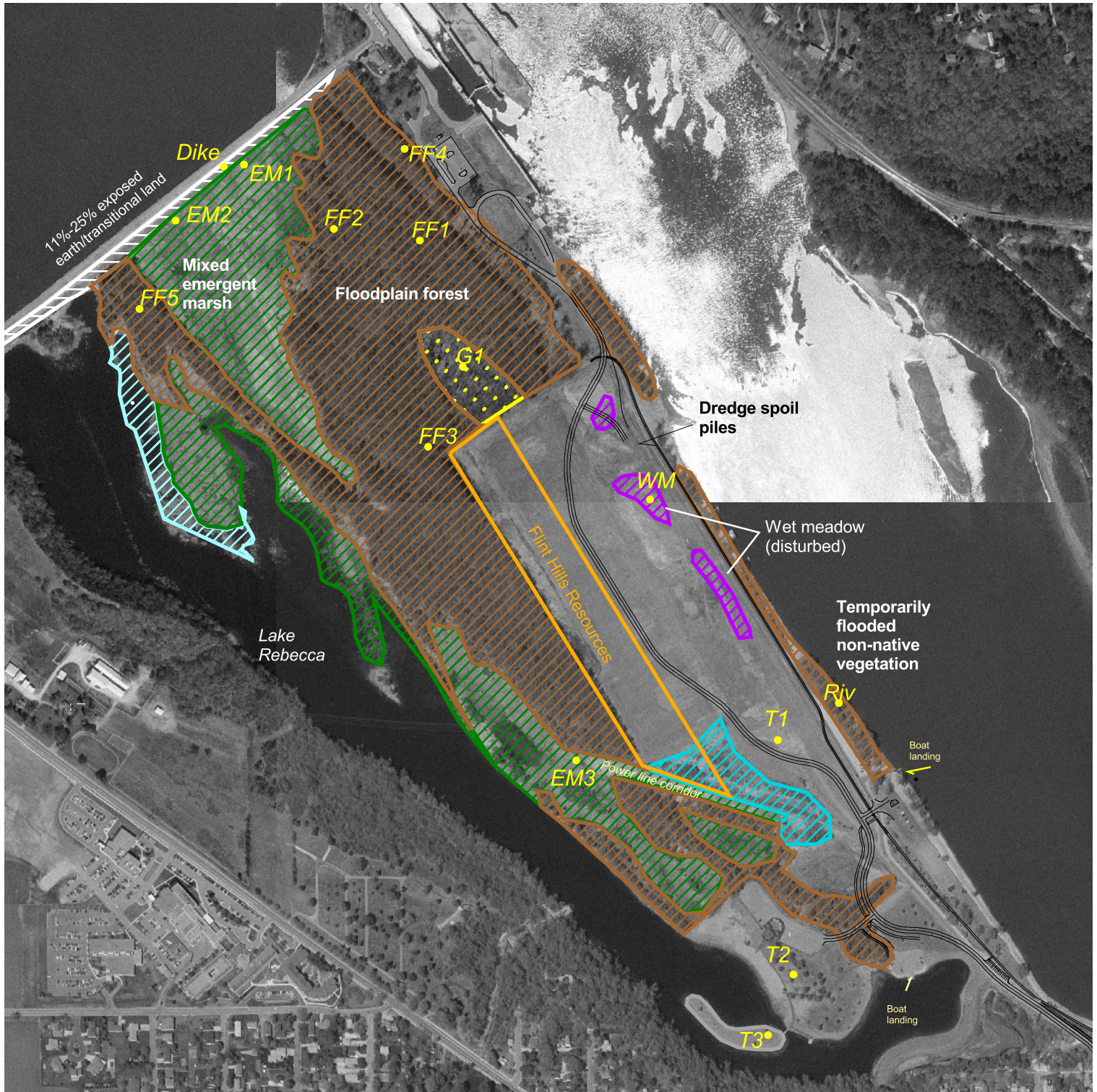
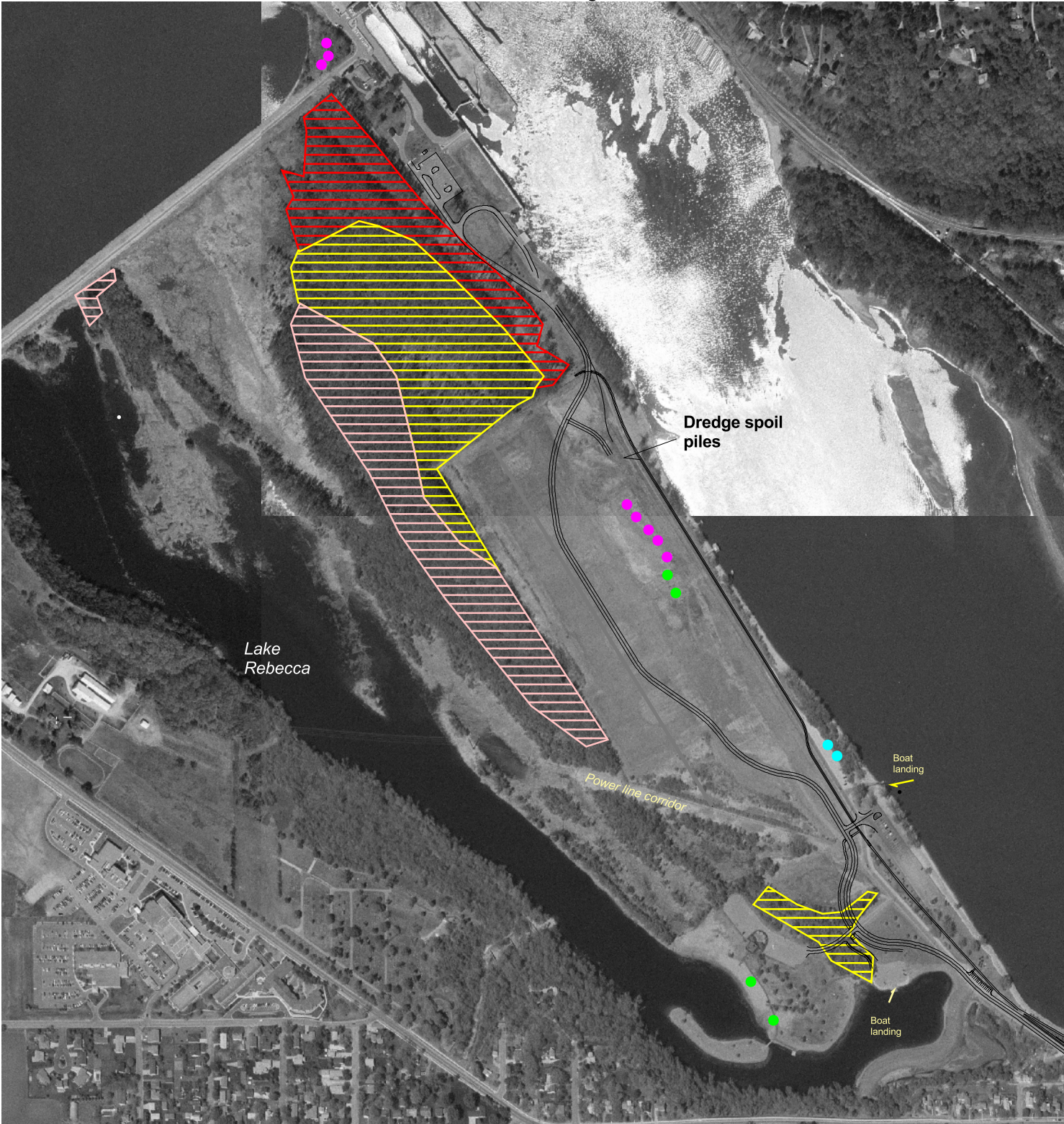


Figure 8. Habitat Restoration Areas
Hastings River Flats - Natural Resource Management Plan

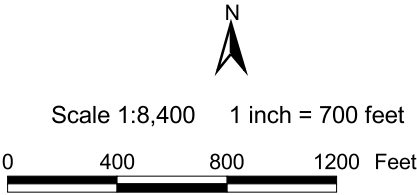


Figure 9. Invasive Species
Hastings River Flats - Natural Resource Management Plan



LEGEND

- | | |
|----------------------|---------------------------|
| Buckthorn | ● Reed canary grass stand |
| Low infestation | ● Purple loosestrife |
| Moderate infestation | ● Siberian elm |
| High infestation | |



APPENDIX A.

Historic Aerial Photos 1937-1970

Photos are not to scale.



1937



1940



1950



1957



1970

APPENDIX B

Bird Survey Data

Compiled Migration and Breeding Bird Survey, 2002

Hastings Riverfront Park

"x" denotes observations outside survey periods, which were not quantified.

Scientific Name	Common Name	Code	Floodplain	Emergent	Grassland	Migration
			Forest	Marsh	Transect	
<i>Gavia immer</i>	Common Loon	COLO				x
<i>Aechmophorus occidentalis</i>	Western Grebe	WEGR				x
<i>Phalacrocorax auritus</i>	Double-crested Cormorant	DCCO				x
<i>Anas discors</i>	Blue-winged Teal	BWTE				x
<i>Branta canadensis</i>	Canada Goose	CAGO		2	x	x
<i>Mergus merganser</i>	Common Merganser	COME				x
<i>Lophodytes cucullatus</i>	Hooded Merganser	HOME				x
<i>Aythya affinis</i>	Lesser Scaup	LESC				x
<i>Anas platyrhynchos</i>	Mallard	MALL		4	17	x
<i>Anas clypeat</i>	Northern Shoveler	NOSL				x
<i>Aythya americana</i>	Redhead	REDH				x
<i>Oxyura jamaicensis</i>	Ruddy Duck	RUDU			x	x
<i>Aix sponsa</i>	Wood Duck	WODU				x
<i>Ardea herodias</i>	Great Blue Heron	GBHE		x		x
<i>Casmerodius albus</i>	Great Egret	GREG				x
<i>Butorides striatus</i>	Green Heron	GRHE			1	x
<i>Fulica americana</i>	American Coot	AMCO				x
<i>Porzana carolina</i>	Sora	SORA		4		x
<i>Rallus limicola</i>	Virginia Rail	VIRA		1		x
<i>Charadrius vociferus</i>	Killdeer	KILL		2	4	x
<i>Tringa melanoleuca</i>	Greater Yellowlegs	GRYE				x
<i>Tringa flavipes</i>	Lesser Yellowlegs	LEYE				x
<i>Tringa solitaria</i>	Solitary Sandpiper	SOSA				x
<i>Actitis macularia</i>	Spotted Sandpiper	SPSA			3	x
<i>Gallinago gallinago</i>	Common Snipe	COSN				x
<i>Sterna hirundo</i>	Common Tern	COTE				x
<i>Larus delawarensis</i>	Ring-billed Gull	RBGU				x
<i>Cathartes aura</i>	Turkey Vulture	TUVU				x
<i>Haliaeetus leucocephalus</i>	Bald Eagle	BAEA	x			x
<i>Buteo platypterus</i>	Broad-winged Hawk	BWHA	x			
<i>Buteo jamaicensis</i>	Red-tailed Hawk	RTHA			1	
<i>Pandion haliaeetus</i>	Osprey	OSPR				x
<i>Meleagris gallopavo</i>	Wild Turkey	WITU			x	
<i>Zenaidura macroura</i>	Mourning Dove	MODO			13	x
<i>Bubo virginianus</i>	Great Horned Owl	GHOW				x
<i>Chaetura pelagica</i>	Chimney swift	CHSW				x
<i>Ceryle alcyon</i>	Belted Kingfisher	BEKI				x
<i>Picoides pubescens</i>	Downy Woodpecker	DOWO	1			x
<i>Picoides villosus</i>	Hairy Woodpecker	HAWO	3		1	x
<i>Colaptes auratus</i>	Northern Flicker	NOFL	1			x
<i>Dryocopus pileatus</i>	Pileated Woodpecker	PIWO	1			x
<i>Melanerpes carolinus</i>	Red-bellied woodpecker	RBWO	x			x
<i>Melanerpes erythrocephalus</i>	Red-headed Woodpecker	RHWO				x
<i>Sayornis phoebe</i>	Eastern Phoebe	EAPH	x			
<i>Empidonax sp</i>	Empidonax flycatcher	EMPI				x
<i>Contopus virens</i>	Eastern wood pewee	EWPE	6		1	
<i>Myiarchus crinitus</i>	Great-crested Flycatcher	GCFL	4			x
<i>Empidonax minimus</i>	Least Flycatcher	LEFL	1			
<i>Hirundo rustica</i>	Barn Swallow	BASW		1	8	x
<i>Hirundo pyrrhonota</i>	Cliff Swallow	CLSW		15	2	

Scientific Name	Common Name	Code	Floodplain Emergent Grassland			
			Forest	Marsh	Transect	Migration
<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow	NRWS		2	15	x
<i>Tachycineta bicolor</i>	Tree Swallow	TRSW		4	8	x
<i>Cyanocitta cristata</i>	Blue Jay	BLJA				x
<i>Corvus brachyrhynchos</i>	American Crow	AMCR	2		7	x
<i>Parus atricapillus</i>	Black-capped Chickadee	BCCH	2			x
<i>Chordeiles minor</i>	Common Nighthawk	CONI				x
<i>Sitta carolinensis</i>	White-breasted Nuthatch	WBNU	x			x
<i>Troglodytes aedon</i>	House Wren	HOWR	10			x
<i>Turdus migratorius</i>	American Robin	AMRO	2		3	x
<i>Toxostoma rufum</i>	Brown Thrasher	BRTN				x
<i>Catharus minimus</i>	Gray-cheeked Thrush	GCTH				x
<i>Dumetella carolinensis</i>	Gray Catbird	GRCA	1			x
<i>Catharus ustulatus</i>	Swainson's Thrush	SWTH				x
<i>Poliophtila caerulea</i>	Blue-gray Gnatcatcher	BGGN				x
<i>Regulus calendula</i>	Ruby-crowned Kinglet	RCKI				x
<i>Bombycilla cedrorum</i>	Cedar Waxwing	CEWA			2	x
<i>Sturnus vulgaris</i>	European Starling	EUST			7	x
<i>Vireo olivaceus</i>	Red-eyed Vireo	REVI	x			
<i>Vireo gilvus</i>	Warbling Vireo	WAVI	6		9	
<i>Setophaga ruticilla</i>	American Redstart	AMRE	6			x
<i>Mniotilta varia</i>	Black-and-white Warbler	BAWW				x
<i>Dendroica pensylvanica</i>	Chestnut-sided Warbler	CSWA				x
<i>Geothlypis trichas</i>	Common Yellowthroat	COYE		1	6	x
<i>Vermivora chrysoptera</i>	Golden-winged warbler	GWWA				x
<i>Dendroica magnolia</i>	Magnolia Warbler	MAWA				x
<i>Vermivora ruficapilla</i>	Nashville Warbler	NAWA				x
<i>Seiurus noveboracensis</i>	Northern Waterthrush	NOWA				x
<i>Vermivora celata</i>	Orange-crowned Warbler	OCWA				x
<i>Dendroica palmarum</i>	Palm Warbler	PAWA				x
<i>Wilsonia pusilla</i>	Wilson's Warbler	WIWA				x
<i>Dendroica petechia</i>	Yellow Warbler	YEWA	3	1	4	x
<i>Dendroica coronata</i>	Yellow-rumped Warbler	YRWA				x
<i>Cardinalis cardinalis</i>	Northern cardinal	NOCA	1			x
<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak	RBGR			1	x
<i>Passerina cyanea</i>	Indigo Bunting	INBU			x	
<i>Spizella passerina</i>	Chipping Sparrow	CHSP			4	x
<i>Passerculus sandwichensis</i>	Savannah Sparrow	SAVS				x
<i>Melospiza melodia</i>	Song Sparrow	SOSP		2	6	x
<i>Melospiza georgiana</i>	Swamp Sparrow	SWSP				x
<i>Zonotrichia albicollis</i>	White-throated Sparrow	WTSP				x
<i>Molothrus ater</i>	Brown-headed Cowbird	BHCO	1		4	x
<i>Dolichonyx oryzivorus</i>	Bobolink	BOBO			1	
<i>Quiscalus quiscula</i>	Common Grackle	COGR				x
<i>Euphagus carolinus</i>	Rusty Blackbird	RUBL				x
<i>Agelaius phoeniceus</i>	Red-winged Blackbird	RWBL		9	8	x
<i>Icterus galbula</i>	Baltimore Oriole	BAOR	1		1	x
<i>Carduelis tristis</i>	American Goldfinch	AMGO	1	9	16	x
<i>Carpodacus mexicanus</i>	House Finch	HOFI			14	
<i>Passer domesticus</i>	House Sparrow	HOSP			32	
99 species			25	15	33	

Additional species recorded by an experienced birder. Winter, spring, fall - 1997 to 2002.

<i>Podilymbus podiceps</i>	Pied-billed Grebe	PBGR	Spring	2001
<i>Pelecanus erythrorhynchos</i>	American White Pelican	AWPE	Spring	2001
<i>Anas americana</i>	American Wigeon	AMWI	Spring	
<i>Anas crecca</i>	Green-winged Teal	GWTE	Spring	
<i>Anas rubripes</i>	American Black Duck	ABDU	Spring	2001
<i>Anas strepera</i>	Gadwall	GADW	Spring	
<i>Aythya collaris</i>	Ring-necked Duck	RNDU	Spring	
<i>Aythya valisineria</i>	Canvasback	CANV	Spring	2001
<i>Bucephala albeola</i>	Bufflehead	BUFF	Spring	2001
<i>Cygnus columbianus</i>	Tundra Swan	TUSW	Spring	2002
<i>Mergus serrator</i>	Red-breasted Merganser	RBME	Spring	
<i>Charadrius semipalmatus</i>	Semipalmated Plover	SEPL	Spring	1997
<i>Calidris alpina</i>	Dunlin	DUNL	Spring	1997
<i>Calidris fuscicollis</i>	White-rumped Sandpiper	WRSa	Spring	1997
<i>Calidris pusilla</i>	Semipalmated Sandpiper	SESA	Spring	1997
<i>Calidris minutilla</i>	Least sandpiper	LESA	Spring	1997
<i>Limosa haemastica</i>	Hudsonian Godwit	HUGO	Spring	1997
<i>Scolopax minor</i>	American Woodcock	AMWO	Spring	
<i>Larus argentatus</i>	Herring Gull	HEGU		
<i>Larus hyperboreus</i>	Glaucous Gull	GLGU	Fall	
<i>Larus philadelphia</i>	Bonaparte's Gull	BOGU	Spring	2001
<i>Larus pipixcan</i>	Franklin's Gull	FRGU	Spring	2001
<i>Accipiter cooperii</i>	Cooper's Hawk	COHA	Spring	2002
<i>Bonasa umbellus</i>	Ruffed Grouse	RUGR	Winter	
<i>Strix varia</i>	Barred Owl	BAOW		
<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker	YBSA	Spring	
<i>Sialia sialis</i>	Eastern bluebird	EABL		
<i>Polioptila caerulea</i>	Blue-gray Gnatcatcher	BGGN	Spring	
<i>Vireo solitarius</i>	Solitary Vireo	SOVI	Spring	
<i>Dendroica fusca</i>	Blackburnian Warbler	BLWA	Spring	1997
<i>Dendroica striata</i>	Blackpoll Warbler	BPWA	Spring	1997
<i>Dendroica virens</i>	Black-throated Green Warbler	BTNW	Spring	1997
<i>Oporonis philadelphia</i>	Mourning Warbler	MOWA	Spring	1997
<i>Wilsonia canadensis</i>	Canada Warbler	CAWA	Spring	1997
<i>Vermivora pinus</i>	Blue-winged warbler	BWWA	Spring	1998
<i>Junco hyemalis</i>	Dark-eyed Junco	DEJU	Spring	
<i>Melospiza lincolni</i>	Lincoln's Sparrow	LISP	Spring	
<i>Spizella arborea</i>	American Tree Sparrow	ATSP		
<i>Zonotrichia leucophrys</i>	White-crowned Sparrow	WCSP	Spring	
<i>Piranga olivacea</i>	Scarlet Tanager	SCTA	Spring	
<i>Icterus spurius</i>	Orchard oriole	OROR	Spring	
41 species				

Bird species observed during spring migration 2002.
Hastings Riverfront Park

Scientific Name	Common Name	Code	4/3	4/24	4/30*	5/13*	5/16	Comments
<i>Gavia immer</i>	Common Loon	COLO	x					River
<i>Phalacrocorax auritus</i>	Double-crested Cormorant	DCCO		x	x	x		Lake
<i>Anas discors</i>	Blue-winged Teal	BWTE			x	x		Wetland
<i>Branta canadensis</i>	Canada Goose	CAGO	x	x	x	x	x	Wetland
<i>Mergus merganser</i>	Common Merganser	COME	x					
<i>Lophodytes cucullatus</i>	Hooded Merganser	HOME	x					
<i>Aythya affinis</i>	Lesser Scaup	LESC	x		x			
<i>Anas platyrhynchos</i>	Mallard	MALL	x	x	x	x		Wetland
<i>Anas clypeat</i>	Northern Shoveler	NOSL	x		x		x	
<i>Aythya americana</i>	Redhead	REDH	x					
<i>Oxyura jamaicensis</i>	Ruddy Duck	RUDU			x			River
<i>Aix sponsa</i>	Wood Duck	WODU			x	x		
<i>Fulica americana</i>	American Coot	AMCO	x					
<i>Porzana carolina</i>	Sora	SORA			x	x	x	Wetland
<i>Rallus limicola</i>	Virginia Rail	VIRA				x		Wetland
<i>Charadrius vociferus</i>	Killdeer	KILL	x		x	x	x	
<i>Tringa melanoleuca</i>	Greater Yellowlegs	GRYE				x	x	S. Lk Rebecca
<i>Tringa flavipes</i>	Lesser Yellowlegs	LEYE				x		Wetland
<i>Tringa solitaria</i>	Solitary Sandpiper	SOSA			x	x		
<i>Actitis macularia</i>	Spotted Sandpiper	SPSA			x	x		River, S. Lk Rebecca
<i>Gallinago gallinago</i>	Common Snipe	COSN			x			
<i>Sterna hirundo</i>	Common Tern	COTE					x	
<i>Larus delawarensis</i>	Ring-billed Gull	RBGU	x	x	x			
<i>Cathartes aura</i>	Turkey Vulture	TUVU				x	x	Flyover
<i>Haliaeetus leucocephalus</i>	Bald Eagle	BAEA	x		x	x		
<i>Pandion haliaeetus</i>	Osprey	OSPR			x			Flyover
<i>Zenaidura macroura</i>	Mourning Dove	MODO			x	x		
<i>Bubo virginianus</i>	Great Horned Owl	GHOW				x		Woodland
<i>Chaetura pelagica</i>	Chimney swift	CHSW				x		
<i>Ceryle alcyon</i>	Belted Kingfisher	BEKI				x		
<i>Picoides pubescens</i>	Downy Woodpecker	DOWO		x	x	x		Woodland
<i>Picoides villosus</i>	Hairy Woodpecker	HAWO				x		Woodland
<i>Colaptes auratus</i>	Northern Flicker	NOFL		x	x	x	x	
<i>Dryocopus pileatus</i>	Pileated Woodpecker	PIWO				x		
<i>Melanerpes carolinus</i>	Red-bellied woodpecker	RBWO	x	x	x	x		
<i>Melanerpes erythrocephalus</i>	Red-headed Woodpecker	RHWO				x		
<i>Empidonax sp</i>	Empidonax flycatcher	EMPI				x		
<i>Myiarchus crinitus</i>	Great-crested Flycatcher	GCFL				x	x	Woodland
<i>Hirundo rustica</i>	Barn Swallow	BASW				x	x	
<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow	NRWS		x	x	x	x	
<i>Tachycineta bicolor</i>	Tree Swallow	TRSW		x	x	x	x	
<i>Cyanocitta cristata</i>	Blue Jay	BLJA			x	x		
<i>Corvus brachyrhynchos</i>	American Crow	AMCR			x	x		
<i>Parus atricapillus</i>	Black-capped Chickadee	BCCH		x	x	x	x	
<i>Chordeiles minor</i>	Common Nighthawk	CONI					x	
<i>Sitta carolinensis</i>	White-breasted Nuthatch	WBNU		x	x	x		Woodland
<i>Troglodytes aedon</i>	House Wren	HOWR				x		
<i>Turdus migratorius</i>	American Robin	AMRO	x		x	x	x	
<i>Toxostoma rufum</i>	Brown Thrasher	BRTH				x		
<i>Catharus minimus</i>	Gray-cheeked Thrush	GCTH				x		
<i>Dumetella carolinensis</i>	Gray Catbird	GRCA				x		
<i>Catharus ustulatus</i>	Swainson's Thrush	SWTH				x		
<i>Poliophtila caerulea</i>	Blue-gray Gnatcatcher	BGGN				x	x	Woodland
<i>Regulus calendula</i>	Ruby-crowned Kinglet	RCKI			x			
<i>Bombicilla cedrorum</i>	Cedar Waxwing	CEWA					x	
<i>Sturnus vulgaris</i>	European Starling	EUST			x	x		
<i>Setophaga ruticilla</i>	American Redstart	AMRE				x	x	
<i>Mniotilta varia</i>	Black-and-white Warbler	BAWW				x		

Scientific Name	Common Name	Code	4/3	4/24	4/30*	5/13*	5/16	Comments
<i>Geothlypis trichas</i>	Common Yellowthroat	COYE				x	x	
<i>Dendroica pensylvanica</i>	Chestnut-sided Warbler	CSWA				x		
<i>Vermivora chrysoptera</i>	Golden-winged warbler	GWWA					x	
<i>Dendroica magnolia</i>	Magnolia Warbler	MAWA				x	x	
<i>Vermivora ruficapilla</i>	Nashville Warbler	NAWA				x	x	
<i>Seiurus noveboracensis</i>	Northern Waterthrush	NOWA				x		Woodland/wetland
<i>Vermivora celata</i>	Orange-crowned Warbler	OCWA				x		
<i>Dendroica palmarum</i>	Palm Warbler	PAWA			x	x	x	
<i>Wilsonia pusilla</i>	Wilson's Warbler	WIWA					x	
<i>Dendroica petechia</i>	Yellow Warbler	Yewa				x	x	
<i>Dendroica coronata</i>	Yellow-rumped Warbler	YRWA		x	x	x	x	
<i>Cardinalis cardinalis</i>	Northern cardinal	NOCA			x	x	x	
<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak	RBGR				x		
<i>Spizella passerina</i>	Chipping Sparrow	CHSP		x	x	x		
<i>Passerculus sandwichensis</i>	Savannah Sparrow	SAVS		x	x			
<i>Melospiza melodia</i>	Song Sparrow	SOSP	x		x	x	x	
<i>Melospiza georgiana</i>	Swamp Sparrow	SWSP			x	x		Wetland
<i>Zonotrichia albicollis</i>	White-throated Sparrow	WTSP		x	x	x		
<i>Molothrus ater</i>	Brown-headed Cowbird	BHCO		x	x	x	x	
<i>Quiscalus quiscula</i>	Common Grackle	COGR				x		
<i>Euphagus carolinus</i>	Rusty Blackbird	RUBL		x	x			
<i>Agelaius phoeniceus</i>	Red-winged Blackbird	RWBL		x	x	x	x	Wetland
<i>Icterus galbula</i>	Baltimore Oriole	BAOR				x		
<i>Carduelis tristis</i>	American Goldfinch	AMGO		x	x	x	x	
<i>Aechmophorus occidentalis</i>	Western Grebe	WEGR					x	River
<i>Ardea herodias</i>	Great Blue Heron	GBHE			x	x	x	Wetland
<i>Casmerodius albus</i>	Great Egret	GREG			x	x	x	Wetland
<i>Butorides striatus</i>	Green Heron	GRHE				x	x	Wetland
86 species		No. Spp	15	19	43	66	35	

* 3-hour morning surveys

Floodplain Forest Breeding Bird Survey, June 2002

Hastings Riverfront Park

Scientific Name	Common Name	Code	June 8					All Pts		June 17	June 17					All Pts		Max of 2 Surveys
			F1	F2	F3	F4	Out	F	F		F1	F2	F3	F4	Out	F	F	
<i>Haliaeetus leucocephalus</i>	Bald Eagle	BAEA						0	0						1	0	1	
<i>Buteo platypterus</i>	Broad-winged Hawk	BWHA						0	0						1	0	1	
<i>Picoides villosus</i>	Hairy Woodpecker	HAWO				1		1	1				3			3	3	3
<i>Picoides pubescens</i>	Downy Woodpecker	DOWO						0	0				1			1	1	1
<i>Colaptes auratus</i>	Northern Flicker	NOFL		1				1	1			1			1	1	2	1
<i>Dryocopus pileatus</i>	Pileated Woodpecker	PIWO						0	0				1			1	1	1
<i>Melanerpes carolinus</i>	Red-bellied woodpecker	RBWO					1	0	1						1	0	1	
<i>Contopus virens</i>	Eastern wood pewee	EWPE	1	2				3	3		1	2	2	1		6	6	6
<i>Myiarchus crinitus</i>	Great-crested Flycatcher	GCFL			1	1	2	4	4			1				1	1	4
<i>Empidonax minimus</i>	Least Flycatcher	LEFL		1			1	1	2							0	0	1
<i>Sayornis phoebe</i>	Eastern Phoebe	EAPH					1	0	1							0	0	
<i>Parus atricapillus</i>	Black-capped Chickadee	BCCH						0	0		1		1			2	2	2
<i>Sitta carolinensis</i>	White-breasted Nuthatch	WBNU					1	0	1						1	0	1	
<i>Troglodytes aedon</i>	House Wren	HOWR	1		2	2		5	5		3	1	2	4		10	10	10
<i>Turdus migratorius</i>	American Robin	AMRO			1		2	1	3		1			1		2	2	2
<i>Dumetella carolinensis</i>	Gray Catbird	GRCA						0	0			1			2	1	3	1
<i>Vireo gilvus</i>	Warbling Vireo	WAVI	2	1	1	2		6	6		1	1	1	3		6	6	6
<i>Vireo olivaceus</i>	Red-eyed Vireo	REVI					1	0	1							0	0	
<i>Setophaga ruticilla</i>	American Redstart	AMRE	3	1	1	1		6	6		2	2	2			6	6	6
<i>Dendroica petechia</i>	Yellow Warbler	YEWA						0	0		2	1				3	3	3
<i>Cardinalis cardinalis</i>	Northern cardinal	NOCA	1					1	1						1	0	1	1
<i>Molothrus ater</i>	Brown-headed Cowbird	BHCO						0	0		1					1	1	1
<i>Icterus galbula</i>	Baltimore Oriole	BAOR	1				1	1	2						1	0	1	1
<i>Carduelis tristis</i>	American Goldfinch	AMGO						0	0		1					1	1	1
25 species			No. Spp	6	6	6	5	7	12	16	7	10	6	6	9	15	22	19
			No. Birds	9	7	8	8	8	32	40	11	12	11	11	10	45	55	53

Species likely present during breeding season but not recorded in surveys

<i>Bubo virginianus</i>	Great Horned Owl	GHOW
<i>Cyanocitta cristata</i>	Blue Jay	BLJA

Emergent Marsh Breeding Bird Survey, June 2002

Hastings Riverfront Park

Scientific Name	Common Name	Code	June 8		All Pts	June 17			All Pts	All	Max of 2 Surveys
			W1	W2	W	W1	W2	Out	W	W	
<i>Ardea herodias</i>	Great Blue Heron	GBHE			0			1	0	1	
<i>Anas platyrhynchos</i>	Mallard	MALL		4	4				0	0	4
<i>Branta canadensis</i>	Canada Goose	CAGO		2	2				0	0	2
<i>Porzana carolina</i>	Sora	SORA	2	2	4	1	2	2	3	5	4
<i>Rallus limicola</i>	Virginia Rail	VIRA			0		1		1	1	1
<i>Charadrius vociferus</i>	Killdeer	KILL		1	1	1	1		2	2	2
	Sandpiper sp	Unk sand		2	2				0	0	2
<i>Hirundo pyrrhonota</i>	Cliff Swallow	CLSW	5	10	15				0	0	15
<i>Tachycineta bicolor</i>	Tree Swallow	TRSW			0	2	2		4	4	4
<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow	NRWS			0		2		2	2	2
<i>Hirundo rustica</i>	Barn Swallow	BASW			0	1			1	1	1
<i>Geothlypis trichas</i>	Common Yellowthroat	COYE	1		1	1			1	1	1
<i>Dendroica petechia</i>	Yellow Warbler	Yewa	1		1				0	0	1
<i>Melospiza melodia</i>	Song Sparrow	SOSP	1	1	2		1		1	1	2
<i>Agelaius phoeniceus</i>	Red-winged Blackbird	RWBL	4	1	5	6	3		9	9	9
<i>Carduelis tristis</i>	American Goldfinch	AMGO		2	2	7	2		9	9	9
16 species		No. Spp			11	7	8	2	10	11	15
		No. Birds			39	19	14	3	33	36	59

Grassland Breeding Bird Survey, June 2002

Hastings Riverfront Park

Scientific Name	Common Name	Code	June 8			June 17			Other dates		Max of 2 Surveys
			G	Out	Tot	G	Out	Tot	No.	Comments	
<i>Butorides striatus</i>	Green Heron	GRHE			0	1		1			1
<i>Anas platyrhynchos</i>	Mallard	MALL			0	17		17			17
<i>Branta canadensis</i>	Canada Goose	CAGO			0			0	20	6/25	
<i>Oxyura jamaicensis</i>	Ruddy Duck	RUDU			0			0	3	6/25 1M, 2F, LK	
<i>Charadrius vociferus</i>	Killdeer	KILL	4		4	3		3			4
<i>Actitis macularia</i>	Spotted Sandpiper	SPSA			0	3		3			3
<i>Buteo jamaicensis</i>	Red-tailed Hawk	RTHA	1		1			0			1
<i>Meleagris gallopavo</i>	Wild Turkey	WITU			0			0	12	6/14, 10 chicks	
<i>Zenaida macroura</i>	Mourning Dove	MODO	7	4	11	13		13			13
<i>Picoides villosus</i>	Hairy Woodpecker	HAWO	1		1			0			1
<i>Contopus virens</i>	Eastern wood pewee	EWPE	1		1			0			1
<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow	NRWS	15		15	2		2			15
<i>Tachycineta bicolor</i>	Tree Swallow	TRSW	8		8	5		5			8
<i>Hirundo rustica</i>	Barn Swallow	BASW	8		8	2		2			8
<i>Hirundo pyrrhonota</i>	Cliff Swallow	CLSW	1		1	2		2			2
<i>Corvus brachyrhynchos</i>	American Crow	AMCR	7		7	3		3			7
<i>Turdus migratorius</i>	American Robin	AMRO	2	2	4	3		3			3
<i>Bombycilla cedrorum</i>	Cedar Waxwing	CEWA		1	1	2		2			2
<i>Sturnus vulgaris</i>	European Starling	EUST	5		5	7		7			7
<i>Vireo gilvus</i>	Warbling Vireo	WAVI	9		9	3		3			9
<i>Geothlypis trichas</i>	Common Yellowthroat	COYE	6		6			0			6
<i>Dendroica petechia</i>	Yellow Warbler	YEWA	3		3	4		4			4
<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak	RBGR	1		1			0			1
<i>Passerina cyanea</i>	Indigo Bunting	INBU			0			0	1		
<i>Melospiza melodia</i>	Song Sparrow	SOSP	6		6	6		6			6
<i>Spizella passerina</i>	Chipping Sparrow	CHSP	4		4	3		3			4
<i>Agelaius phoeniceus</i>	Red-winged Blackbird	RWBL	5		5	8		8			8
<i>Molothrus ater</i>	Brown-headed Cowbird	BHCO	2		2	4	4	8			4
<i>Dolichonyx oryzivorus</i>	Bobolink	BOBO	1	3	4			0			1
<i>Icterus galbula</i>	Baltimore Oriole	BAOR		1	1	1		1			1
<i>Passer domesticus</i>	House Sparrow	HOSP	10		10	32		32			32
<i>Carduelis tristis</i>	American Goldfinch	AMGO	9		9	16		16			16
<i>Carpodacus mexicanus</i>	House Finch	HOFI	2		2	14		14			14
33 Species			No. Spp	24	5	26	23	1	23	4	29
			No. Birds	118	11	129	154	4	158	36	199

Species likely present during breeding season but not recorded in surveys

<i>Chaetura pelagica</i>	Chimney swift	CHSW
<i>Ceryle alcyon</i>	Belted Kingfisher	BEKI
<i>Chordeiles minor</i>	Common Nighthawk	CONI
<i>Quiscalus quiscula</i>	Common Grackle	COGR
<i>Aix sponsa</i>	Wood Duck	WODU

APPENDIX C

Vegetation Survey Data

APPENDIX C. Plant species recorded at Hastings River Flats.

Relative abundances are shown by: D=dominant, A=abundant, C=common, P=present, R=rare
Tree diameter at breast height (dbh) is shown for some species (inches).
An * indicates non-native species.

FLOODPLAIN FOREST

Family	Scientific name	Common name	FF1	FF2	Sites			FF5	RIV
					FF3	FF4			
<u>Ground cover</u>									
Aceraceae	<i>Acer saccharinum</i>	silver maple	P	C				P	
Asteraceae	<i>Ambrosia artemisiifolia</i>	common ragweed							P
Asteraceae	<i>Ambrosia trifida</i>	giant ragweed							P
Fabaceae	<i>Amphicarpaea bracteata</i>	hog peanut	P						
Ranunculaceae	<i>Anemone canadensis</i>	Canada anemone				P			
Apocynaceae	<i>Apocynum cannabinum</i>	Indian hemp							P
Asclepiaceae	<i>Asclepias syriaca</i>	common milkweed				P			
Brassicaceae	<i>Berteroa incana</i>	hoary allysum							P
Cyperaceae	<i>Carex cf normalis</i>	porcupine sedge							P
Cyperaceae	<i>Carex sp.</i>	Sedge				P			
Ulmaceae	<i>Celtis occidentalis</i>	hackberry						P	
Cyperaceae	<i>Eleocharis cf parvula</i>	dwarf spike rush						P, Lk edge	
Equisetaceae	<i>Equisetum sylvaticum</i>	woodland horsetail		P					
Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash	P					P	
Rubiaceae	<i>Galium aparine</i>	cleavers	P						
Balsaminaceae	<i>Impatiens capensis</i>	jewelweed	P						
Urticaceae	<i>Laportea canadensis</i>	wood nettle	C						
Graminaceae	<i>Leersia oryzoides</i>	rice cut-grass	P			C			
* Caprifoliaceae	<i>Lonicera tartarica</i>	Tartarian honeysuckle	P						
Lamiaceae	<i>Lycopus americanus</i>	water horehound					P		P
* Fabaceae	<i>Melilotus alba</i>	white sweet-clover							P
Menispermaceae	<i>Menispermum canadense</i>	moonseed					P	A	
Vitaceae	<i>Parthenocissus inserta</i>	Virginia creeper	P				A		
* Graminaceae	<i>Phalaris arundinacea</i>	reed canary grass							P
* Graminaceae	<i>Poa pratensis</i>	Kentucky bluegrass					P		
Roseaceae	<i>Prunus serotina</i>	black cherry	P						
* Rhamnaceae	<i>Rhamnus cathartica</i>	common buckthorn	C	P					
Saxifragaceae	<i>Ribes cynosbati</i>	gooseberry	P						
Roseaceae	<i>Rosa sp</i>	rose					P		
Liliaceae	<i>Smilacina stellata</i>	starry solomon's seal					P		
* Asteraceae	<i>Taraxacum officinale</i>	dandelion	p						
Anacardiaceae	<i>Toxicodendron radicans</i>	poison ivy	p				P		
Ulmaceae	<i>Ulmus americana</i>	American elm	P						
Urticaceae	<i>Urtica dioica</i>	stinging nettle							P
Violaceae	<i>Viola sp.</i>	violet					P		
Vitaceae	<i>Vitis riparia</i>	wild grape						P	P
Percent Cover			50	70	40	30			
<u>Shrubs and Saplings</u>									
Aceraceae	<i>Acer negundo</i>	boxelder	P						
Aceraceae	<i>Acer saccharinum</i>	silver maple	P						P
Fabaceae	<i>Amorpha fruticosa</i>	false indigo bush					C		P
Celastraceae	<i>Celastrus scandens</i>	bittersweet			P				
Ulmaceae	<i>Celtis occidentalis</i>	hackberry	P						
Cornaceae	<i>Cornus racemosa</i>	gray dogwood					P		
Cornaceae	<i>Cornus amomum</i>	silky dogwood					C		
Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash	P, 6"						P
Salicaceae	<i>Populus deltoides</i>	cottonwood							
Fagaceae	<i>Quercus macrocarpa</i>	bur oak						R	
Fagaceae	<i>Quercus rubra</i>	red oak			P				
* Rhamnaceae	<i>Rhamnus cathartica</i>	common buckthorn	C	A, 1-2"			D		
Saxifragaceae	<i>Ribes missouriense</i>	Missouri gooseberry					P		
Salicaceae	<i>Salix exigua</i>	sandbar willow							P
Ulmaceae	<i>Ulmus americana</i>	American elm	D, 4-6"						
Rutaceae	<i>Zanthoxylum americana</i>	prickly ash	D	P					
Percent Cover			60	80	75				
<u>Canopy</u>									
Aceraceae	<i>Acer negundo</i>	boxelder						P	
Aceraceae	<i>Acer saccharinum</i>	silver maple	P, 10"	D, 6"				D, 10"	P
Ulmaceae	<i>Celtis occidentalis</i>	hackberry						P	
Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash						C, 8"	P
Moraceae	<i>Morus rubra</i>	red mulberry							P
Salicaceae	<i>Populus deltoides</i>	cottonwood	D, 14-22"	A, 20"				D, 20"	D
Tiliaceae	<i>Tilia americana</i>	American basswood			P, 8"				
Ulmaceae	<i>Ulmus americana</i>	American elm						C, 10"	P
* Ulmaceae	<i>Ulmus pumila</i>	Siberian elm							P
Percent Cover			80		80	90			

EMERGENT MARSH

Family	Scientific name	Common name	EM1	Sites	
				EM2	EM3
<u>Ground cover</u>					
Ranunculaceae	<i>Anemone canadensis</i>	Canada anemone	P		
Apocynaceae	<i>Apocynum cannabinum</i>	Indian hemp	P		C
Asclepiaceae	<i>Asclepias incarnata</i>	swamp milkweed	C		P
Asteraceae	<i>Bidens cernua</i>	nodding bur marigold		C	
Asteraceae	<i>Bidens frondosa</i>	beggars tick	P, edge		
Cyperaceae	<i>Carex cf tuckermanii</i>	Tuckerman's sedge	P		
Cyperaceae	<i>Cyperus sp</i>	nut sedge	P, edge		
Cyperaceae	<i>Eleocharis sp</i>	spikerush	P		P
Asteraceae	<i>Helenium autumnale</i>	sneezeweed	P, edge		
* Clusiaceae	<i>Hypericum perforatum</i>	common St. Johnswort	P		
Balsaminaceae	<i>Impatiens capensis</i>	jewelweed	P, edge	P	
Iridaceae	<i>Iris versicolor</i>	Blue-flag iris	P		P
Graminaceae	<i>Leersia oryzoides</i>	rice cut-grass	P, edge		
Lythraceae	<i>Lysimachia thrysiflora</i>	swamp loosestrife	P		
* Fabaceae	<i>Mellilotus alba</i>	white sweet-clover	P, edge		
Lamiaceae	<i>Mentha arvense</i>	common mint	P, edge		
Graminaceae	<i>Panicum sp.</i>	Panic grass	P, edge		
Alismataceae	<i>Sagittaria latifolia</i>	arrowhead	A		A
Cyperaceae	<i>Schoenoplectus fluviatilis</i>	river bulrush	C		C
Cyperaceae	<i>Schoenoplectus validus</i>	softstem bulrush	A		C
Asteraceae	<i>Solidago canadensis</i>	Canada goldenrod	C, edge		
Asteraceae	<i>Solidago gigantea</i>	late goldenrod	C, edge		
Sparganiaceae	<i>Sparganium eurycarpum</i>	giant burreed	A		A
Graminaceae	<i>Spartina pectinata</i>	cordgrass		P, edge	
Typhaceae	<i>Typha angustifolia</i>	narrow-leaved cattail	A		
Typhaceae	<i>Typha latifolia</i>	cattail			A
Urticaceae	<i>Urtica dioica</i>	stinging nettle	P		P
Asteraceae	<i>Vernonia fasciculata</i>	ironweed	P, edge		
Percent Cover			85	70	75
<u>Shrubs and Saplings</u>					
Aceraceae	<i>Acer saccharinum</i>	silver maple	P, edge		
Fabaceae	<i>Amorpha fruticosa</i>	false indigo bush	C		P
Cornaceae	<i>Cornus amomum</i>	silky dogwood	P		
Salicaceae	<i>Salix exigua</i>	sandbar willow	D		D
Ulmaceae	<i>Ulmus americana</i>	American elm	P, edge		
Percent Cover			5	5	10

GRASSLAND WITH SPARSE TREES

			Site	
Family	Scientific name	Common name	GG1	
<u>Ground cover</u>				
*	Equisetaceae	<i>Equisetum arvense</i>	field horsetail	C
	Graminaceae	<i>Poa pratensis</i>	Kentucky bluegrass	D
	Asteraceae	<i>Solidago canadensis</i>	Canada goldenrod	A
	Percent Cover			100
<u>Canopy</u>				
Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash	P	
Cupressaceae	<i>Juniperus virginiana</i>	red cedar	A	
Salicaceae	<i>Populus deltoides</i>	cottonwood	P	
Fagaceae	<i>Quercus rubra</i>	red oak	P	
Percent Cover			25	

TEMPORARILY FLOODED NON-NATIVE DOMINATED HERBACEOUS VEGETATION

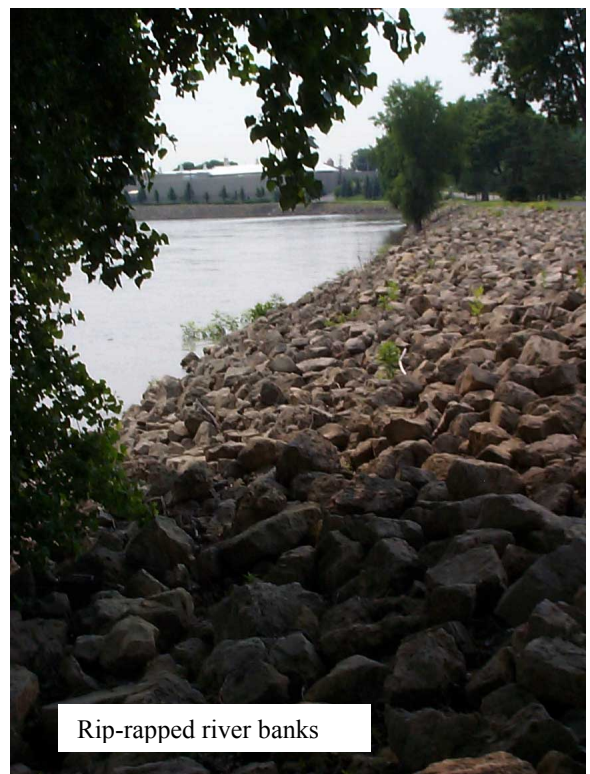
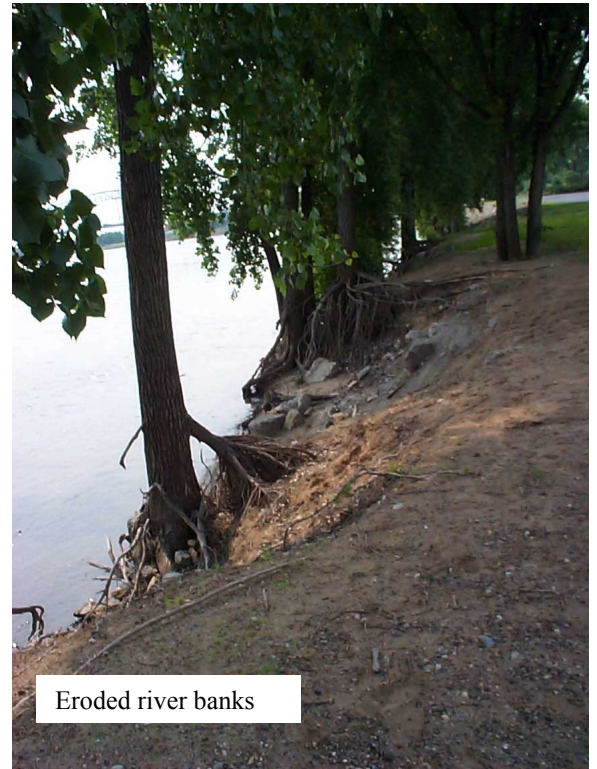
			Site		
Family	Scientific name	Common name	T1	T2	T3
<u>Ground cover</u>					
Aceraceae	<i>Acer saccharinum</i>	silver maple		Planted	
Asteraceae	<i>Achillea millefolium</i>	yarrow	P		
Graminaceae	<i>Agropyron repens</i>	quackgrass	P		
Graminaceae	<i>Agropyron trachycaulum</i>	slender wheatgrass	A, seeded		
Asteraceae	<i>Ambrosia artemisiifolia</i>	common ragweed	A		
Asclepiaceae	<i>Asclepias incarnata</i>	swamp milkweed		P	
Betulaceae	<i>Betula nigra</i>	river birch		Planted	
* Chenopodiaceae	<i>Chenopodium album</i>	lamb's quarters	P		
Asteraceae	<i>Cirsium</i> sp.	thistle		P	
* Asteraceae	<i>Conyza canadensis</i>	horseweed	P		
Poaceae	<i>Digitaria sanguinalis</i>	crab grass			D
Poaceae	<i>Echinocloa crus-galli</i>	barnyard grass			D
Cyperaceae	<i>Eleocharis</i> sp.	spikerush			P
Equisetaceae	<i>Equisetum cf hyemale</i>	common scouring rush	P		
Asteraceae	<i>Erigeron annuus</i>	daisy fleabane	D		
Oleaceae	<i>Fraxinus pennsylvanica</i>	green ash		P	
Asteraceae	<i>Helenium autumnale</i>	sneezeweed		P	
Graminaceae	<i>Hordeum jubatum</i>	foxtail barley	P		
* Clusiaceae	<i>Hypericum perforatum</i>	common St. Johnswort	P		
Brassicaceae	<i>Lepidium densiflorum</i>	peppergrass	P		
* Graminaceae	<i>Lolium perenne</i>	rye grass	A, seeded		
* Fabaceae	<i>Medicago lupulina</i>	black medick	P		
* Fabaceae	<i>Mellilotus alba</i>	white sweet-clover	P	P	
* Fabaceae	<i>Mellilotus officinalis</i>	yellow sweet clover	P		
Graminaceae	<i>Phleum pratense</i>	timothy	P		
Pinaceae	<i>Pinus strobus</i>	white pine		Planted	
* Plantaginaceae	<i>Plantago patagonica</i>	wooly plantain	C		
Polygonaceae	<i>Polygonum</i> sp.	smartweed		P	
Salicaceae	<i>Populus deltoides</i>	cottonwood		P	
Salicaceae	<i>Populus tremuloides</i>	quacking aspen	C		
Potamogetonaceae	<i>Potamogeton natens</i>	floating-leaved pondweed			In water
Roseaceae	<i>Potentilla norvegica</i>	rough cinquefoil	P		
Asteraceae	<i>Rudbeckia hirta</i>	black-eyed susan	P		
Salicaceae	<i>Salix exigua</i>	sandbar willow		P	
Salicaceae	<i>Salix nigra</i>	black willow		P	
Caryophyllaceae	<i>Silene cserei</i>	bladder campion	P		
Fabaceae	<i>Trifolium repens</i>	white clover		P	
Ulmaceae	<i>Ulmus americana</i>	American elm		P	
Urticaceae	<i>Urtica dioica</i>	stinging nettle		P	
Scrophulariaceae	<i>Verbascum thapsus</i>	common mullein	P		
Verbenaceae	<i>Verbena hastata</i>	blue vervain	P	P	
Verbenaceae	<i>Verbena stricta</i>	hoary vervain	P		
Percent Cover			80		

TRANSITIONAL LAND, 11-25% EXPOSED (Dike Trail)

Family	Scientific name	Common name	Dike
<u>Ground cover</u>			
Asteraceae	<i>Ambrosia artemisiifolia</i>	common ragweed	P
Ranunculaceae	<i>Anemone canadensis</i>	Canada anemone	P
Asteraceae	<i>Artemisia campestris</i>	wormwood	P
Asclepiaceae	<i>Asclepias syriaca</i>	common milkweed	P
* Graminaceae	<i>Bromus inermis</i>	smooth brome	D
* Asteraceae	<i>Conyza canadensis</i>	horseweed	P
* Asteraceae	<i>Crepis tectorum</i>	narrow-leaved hawkweed	P
Asteraceae	<i>Erigeron annuus</i>	daisy fleabane	P
Roseaceae	<i>Geum aleppicum</i>	yellow avens	P
Asteraceae	<i>Lactuca canadensis</i>	wild lettuce	P
Brassicaceae	<i>Lepidium densiflorum</i>	peppergrass	P
* Fabaceae	<i>Lotus corniculatus</i>	birdsfoot trefoil	P
* Fabaceae	<i>Mellilotus officinalis</i>	yellow sweet clover	P
Nyctaginaceae	<i>Mirabilis nyctaginea</i>	four o'clock	P
Graminaceae	<i>Panicum cf leibergii</i>	Leiberg's panic grass	P
Capparaceae	<i>Polanisia dodecandra</i>		P
Roseaceae	<i>Rosa sp</i>	rose	P
Caryophyllaceae	<i>Silene cserei</i>	bladder campion	D
Brassicaceae	<i>Sisymbrium sp.</i>	mustard	P
Commelinaceae	<i>Tradescantia occidentalis</i>	western spiderwort	P
Scrophulariaceae	<i>Verbascum thapsus</i>	common mullein	P
Verbenaceae	<i>Verbena stricta</i>	hoary vervain	P
Percent Cover			60

WET MEADOW, DISTURBED

Family	Scientific name	Common name	Site WM
<u>Ground cover</u>			
Asclepiaceae	<i>Asclepias incarnata</i>	swamp milkweed	D
Cyperaceae	<i>Carex cf cristatella</i>	crested sedge	P
Cyperaceae	<i>Eleocharis acicularis</i>	needle spike rush	A
Equisetaceae	<i>Equisetum arvense</i>	field horsetail	P
* Graminaceae	<i>Hordeum jubatum</i>	foxtail barley	C, edge
Lamiaceae	<i>Lycopus americanus</i>	water horehound	P
* Lythraceae	<i>Lythrum salicaria</i>	purple loosestrife	P, edge
* Graminaceae	<i>Phalaris arundinacea</i>	reed canary grass	P, N end
* Polygonaceae	<i>Rumex crispus</i>	curly dock	C
* Fabaceae	<i>Trifolium pratense</i>	red clover	C, edge
Percent Cover			85
<u>Shrubs and Saplings</u>			
Salicaceae	<i>Salix exigua</i>	sandbar willow	C
Percent Cover			10





Emergent marsh – north site



Blue-flag iris in emergent marsh



Former beach area – often flooded



Former tank farm – temporarily flooded non-native vegetation



Wet meadow – swamp milkweed

APPENDIX E. Summary of Public Comments

From Public Meeting held November 20th, 2002.

1. Former Tank Farm

- The most popular option for this area was Option 2, which recommends that the area be restored to wet prairie in the center, transitioning to mesic oak savanna toward the west and north sides. Seven participants, or 50% of those who responded to this question, checked this option as the one they preferred.
- The next popular option was Option 3, which recommends that the area be restored to floodplain forest. Four participants, or 28.5% of those who responded to this question, checked this option as the one they preferred.
- The third and least popular option was Option 1, which recommends that the area be restored to wet prairie, with pockets of wet meadow. Three participants, or 21% of those who completed this question, checked this option as the one they preferred.

Option	Number of participants who chose this option as their favorite	The percentage of those who answered this question
Option 1	7	50%
Option 3	4	28.5%
Option 2	3	21%

Summary of public comments:

The most popular theme in the public comments regarding this area is that it should be managed for the natural communities and wildlife. Two people made the point that this work should be emphasized over human uses. One person stressed the need to cognizant of people's safety in this project. Another person made the comment that Lake Rebecca should be cleaned up first. Another participant felt that until Flint Hills Resources decides on the use of their property, the area should be restored to wet prairie.

2. Former Swimming Beach

- The most popular option for this area was Option 3, which recommends that the picnic/park area be retained, while restoring wet prairie buffer along lakeshore and emergent marsh at the water's edge. Seven participants, or 50% of those who responded to this question, checked this option as the one they preferred.
- The next popular option was Option 1, which recommends that the area be restored to wet prairie. Five or 35.5% of those who responded to this question checked this option as the one they preferred.
- The third and least popular option was Option 2, which recommends that the area be restored to floodplain forest. Two or 14% of those who responded to this question checked this option as the one they preferred.

Option	Number of participants who chose this option as their favorite	The percentage of those who answered this question
Option 3	7	50%
Option 1	5	35.5%
Option 2	2	14%

Summary of public comments:

Four people wrote comments regarding the use of this area as a picnic site. Three of these people did not favor the use of the area for picnic grounds, while one person felt that it was an important use. There were five suggestions regarding not building additional human use facilities or suggesting the removal of existing parking lots. Four comments pertained to natural resource management.

3. Lake Rebecca Island

- The most popular option for this area was Option 1, which recommends that the island be managed as it is – as a wet prairie. Seven participants, or 58% of those who responded to this question, checked this option as the one they preferred.
- The second and least popular option was Option 2, which recommends that the island be restored to floodplain forest. Five or 41.5% of those who responded to this question checked this option as the one they preferred.

Option	Number of participants who chose this option as their favorite	The percentage of those who answered this question
Option 1	7	58%
Option 2	5	41.5%

Summary of public comments:

There were six comments regarding the bridge to the island. Five comments recommended removing the bridge, while one wanted to maintain the bridge for access to the island. There were several comments about managing the island as a natural area.

4. Summary of general comments recorded during public meeting and taken from written comments

There were several comments on preserving and restoring natural communities to the area. Several people made the point that the area should be restored and managed primarily for the natural community and not for recreation or human use. In fact, there were four comments that specifically suggested that no more development take place, especially, parking lots, an interpretive center, and bandshell. Several people stressed the importance of addressing the water quality in Lake Rebecca. Meeting participants who took the time to write comments seem to emphasize the beauty of the river.

APPENDIX F. Invasive Plant Species Control Methods

Control methods for several of the invasive plant species at Hastings River Flats are described below. Additional information may be obtained from the following websites:

<http://www.natureserve.org/explorer/>

<http://www.dnr.state.wi.us/org/caer/ce/invasives/listing.htm>

<http://tncweeds.ucdavis.edu/>

Common buckthorn (*Rhamnus cathartica*)

Common buckthorn is a European species that has escaped urban landscapes and invaded woodlands in many parts of the country. It is exceedingly aggressive, not only out-competing native species, but producing a toxin to prevent the growth of other species. Buckthorn invasions result in a dense, impenetrable brush thicket and depauperate species diversity.

Buckthorn removal involves a combination of mechanical and chemical methods. Weed wrenches can be used to remove plants up to two inches in diameter and no chemicals are needed. This is an effective tool, but it should be used carefully because it disturbs the soil, which can create opportunities for erosion or new weed species.

A combination of mechanical and chemical methods is a very effective method for removing shrubs greater than 3/4-inch diameter. The process involves cutting the shrubs and treating cut stumps with herbicide. Failure to treat the stumps will result in re-sprouting, creating much greater difficulty in control. Cutting can be accomplished with loppers or hand-saws in most cases. Larger shrubs may require chainsaw use by a properly trained professional. The most commonly used herbicide is Roundup, a glyphosate that has low residual environmental impacts. A 10 % concentration is applied to the cut stump *AND* to the bark all around the stump. A dye (e.g. diluent blue) is also added to the solution so treated stumps are visible. All herbicides should be used with extreme caution, carefully following label directions. Care should be taken to avoid application to other plants. “Weed Wands” or other devices that allow dabbing of the product can be used rather than spraying. *Roundup and regular herbicides cannot be used within 10 feet of standing or open water.* Specific glyphosate formulations, such as Rodeo (10%), must be used in those areas. Chemicals are best applied to stumps immediately after they are cut, when chemicals are most readily absorbed and stumps are most visible.

Late fall is the best time for buckthorn control for several reasons. 1) Buckthorn retains its leaves much longer than other deciduous shrubs, so it is easily identified in the fall. 2) Fall is the time when buckthorn plants are moving resources from the leaves to the roots. When chemicals are applied to the cut stumps they are taken deep into the roots and produce a more effective treatment than other times. 3) Chemical control treatments are effective during the growing season, but there is more risk of affecting non-target plants. Fall application avoids that risk.

Winter removal of buckthorn (and other woody species) is also possible, though snow conditions can make cutting treacherous and weed wrenches cannot be used. If the snow is high, tall stumps may be left, which can be re-cut in the spring or left to break down over time. Roundup may be used in the winter, but it may freeze in very cold temperatures. A 20% concentration of Garlon 4, an oil-based trichlopyr herbicide, is commonly used in winter.

Some buckthorn plants are too small to be cut and treated. Areas where buckthorn is removed may also have an eruption of new seedlings. Female shrubs can deposit thousands of seeds in the soil, creating dense patches of seedlings. Methods for control of very small plants include chemical treatment, hand-pulling, and burning.

Hand-pulling is fairly easy in small areas if the plants are not too dense. If plants are abundant, however, this method is often too labor-intensive. It should also be done carefully to minimize soil disturbance. Burning is the most effective and efficient method for eliminating seedlings, if site conditions permit, but opportunities for burning may be limited at many sites. Chemical treatment is likely to be the most feasible option. A 2% glyphosate herbicide (e.g. Round-up in upland or Rodeo in wetlands) is applied to foliage in the fall, when other species are dormant.

Use of insects for biological control is another method currently being researched and shows promising results. This method could be evaluated in the future for possible application.

Cut brush can be dealt with in several ways. The simplest method of disposal for small amounts of material is to leave it in the woods to decay. It could be cut in finer pieces to facilitate decay and set away from traffic areas. Leaving the shrubs in the woods will also prevent dispersing the seeds.

A second method to handle large amounts of brush is to create small piles for burning. Brush should be stacked in an open area and burned during the winter. Avoid very large piles because an intense fire can sterilize the soil.

Other methods of disposal involve either hauling the brush out of the woods and off-site, or chipping on-site and either using the chip or hauling it away. Both methods are more expensive and are probably not necessary at this site unless very large amounts of brush accumulated. Using wood chip on-site could spread seeds around and is generally not recommended.

Prickly ash (*Zanthoxylum americana*)

A native shrub, prickly ash can become excessively abundant, especially in areas that have been disturbed or grazed. Complete eradication may not be necessary, but management may target reducing the extent of a population. Removal is most easily accomplished in the same manner as for buckthorn – cutting shrubs and treating cut stumps with glyphosate herbicide. Cutting can be completed at any time of the year.

Purple Loosestrife (*Lythrum salicaria*)

Small patches of purple loosestrife can be effectively controlled by digging them out. Manual removal avoids the risks of herbicides, which can inadvertently eliminate adjacent desired plants or negatively impact other organisms. If tap roots break off in the soil, they will re-sprout, so it is important to visit a site repeatedly. If the soil is quite soft it may be possible to pull the plant out, otherwise a spade will be needed to dig it out.

Herbicides can be used for large populations or if digging is not feasible. Triclopyr herbicides that are formulated for water use appear to be the most effective. The herbicide should cover

nearly all of the foliage. An appropriate glyphosate herbicide can also be used (depending on the presence or absence of standing water), but glyphosate will kill all plants, not just broadleaf. A 1.5 –3.0% solution is used and application to 25% of the plant is adequate. The best time to treat plants is when they start to flower in July, but before they set seed. A site should be visited two or three times per season to get all plants, as blooming is staggered throughout the season. Herbicide should be applied to the plants before they set seed in late July (plants can produce viable seed quite soon after flowering and a single stalk can produce 100,000 to 300,000 seeds per year).

Reed Canary Grass (*Phalaris arundinacea*)

Reed canary grass is difficult to eradicate and treatment can take two years or more. The site should be burned in the spring to remove dead vegetation and stimulate new growth. Alternatively, the site can be mowed later in the spring after growth occurs. If the project is initiated in the fall, it can be sprayed first (fall) then burned in the spring. When new growth reaches a height of 4 to 6 inches it should be sprayed with 5% glyphosate herbicide that is safe for wetland areas (e.g. Rodeo). If no surface water is present at the site, other glyphosates (e.g. Roundup) can be used. Herbicide should only be applied by professionals on non-windy days.

Treatment continues for one or two seasons, following a sequence of mowing, followed by spraying when re-growth is 4 to 6 inches, or spot-spraying, as needed.

Tartartian honeysuckle (*Lonicera tartarica*)

Honeysuckle does not retain its leaves in the fall, but has distinctive bark that is readily identified. Like buckthorn, this shrub escaped cultivation and, though not as aggressive as buckthorn, can become quite invasive in woodlands. It is generally controlled at the same time and in the same manner as buckthorn.

APPENDIX G. Plant Species Lists for Proposed Plant Community Restorations

		Prairie			Wetland		Woodland	
		Dry	Mesic	Wet	Wet Meadow	Emergent Marsh	Mesic Oak Savanna*	Floodplain Forest*
Scientific Name	Common Name							
FORBS								
<i>Acorus calamus</i>	Sweetflag					EM		
<i>Alisma subcordatum</i>	Water plantain					EM		
<i>Anemone canadensis</i>	Canada anemone		Mesic	Wet				
<i>Anemone cylindrica</i>	Thimbleweed	Dry						
<i>Apocynum cannabinum</i>	Indian hemp			Wet				
<i>Aquilegia canadensis</i>	Columbine	Dry	Mesic					
<i>Artemisia ludoviciana</i>	Prairie Sage	Dry	Mesic					
<i>Asclepias incarnata</i>	Swamp milkweed			Wet	WM			
<i>Asclepias tuberosa</i>	Butterfly Weed	Dry	Mesic					
<i>Aster azureus</i>	Sky Blue Aster	Dry						
<i>Aster ericoides</i>	Heath Aster	Dry						
<i>Aster laevis</i>	Smooth Blue Aster		Mesic					
<i>Aster lanceolatus (simplex)</i>	Panicled aster			Wet	WM			
<i>Aster novae-angliae</i>	New England Aster		Mesic	Wet				
<i>Aster oolentangiensis</i>	Sky-blue aster		Mesic	Wet				
<i>Aster puniceus</i>	Red-stemmed aster			Wet	WM			
<i>Aster umbellatus</i>	Flat-topped aster			Wet	WM			
<i>Baptisia leucantha</i>	White Wild Indigo	Dry	Mesic					
<i>Bidens cernua</i>	Sticktight				WM			
<i>Bidens frondosa</i>	Beggar's tick			Wet	WM			
<i>Caltha palustris</i>	Marsh marigold				WM			
<i>Campanula aparinoides</i>	Marsh bellflower			Wet	WM			
<i>Chelone glabra</i>	Turtlehead				WM			
<i>Cicuta maculata</i>	Water hemlock			Wet	WM			
<i>Cirsium muticum</i>	Swamp thistle				WM			
<i>Coreopsis palmata</i>	Prairie Coreopsis	Dry	Mesic					
<i>Dalea candidum</i>	White Prairie Clover	Dry	Mesic					
<i>Dalea purpureum</i>	Purple Prairie Clover	Dry	Mesic					
<i>Dalea villosum</i>	Silky prairie-clover	Dry						
<i>Delphinium virescens</i>	Prairie Larkspur	Dry						
<i>Desmodium canadense</i>	Showy Tick Trefoil		Mesic					
<i>Eupatorium maculatum</i>	Spotted Joe-pye weed			Wet	WM			
<i>Eupatorium perfoliatum</i>	Boneset			Wet	WM	EM		
<i>Euphorbia corollata</i>	Flowering Spurge	Dry		Wet				
<i>Fragaria virginian</i>	Wild strawberry		Mesic					
<i>Galium boreale</i>	Northern Bedstraw	Dry	Mesic	Wet				
<i>Gentiana andrewsii</i>	Bottle gentian				WM			
<i>Gentiana flavida</i>	Cream Gentian		Mesic					
<i>Helenium autumnale</i>	Sneezeweed		Mesic	Wet	WM			
<i>Helianthus giganteus</i>	Giant sunflower		Mesic	Wet				
<i>Helianthus grosseserratus</i>	Sawtooth sunflower			Wet				
<i>Helianthus maximillanii</i>	Maximillian sunflower		Mesic					
<i>Helinathus rigidus</i>	Stiff sunflower		Mesic					

<i>Heliopsis helianthoides</i>	Early Sunflower	Dry	Mesic	Wet		
<i>Heterotheca villosa</i>	Golden aster	Dry				
<i>Heuchera richardsonii</i>	Alumroot		Mesic			
<i>Hypericum majus</i>	St. John's wort					EM
<i>Hypericum pyramidatum</i>	Great St. John's wort				WM	
<i>Impatiens capensis</i>	Spotted touch-me-not			Wet	WM	
<i>Iris versicolor</i>	Blue flag iris			Wet	WM	EM
<i>Lespedeza capitata</i>	Round-headed Bush Clover	Dry				
<i>Liatris aspera</i>	Button Blazing Star	Dry				
<i>Liatris ligulostylus</i>	Northern plains blazing star		Mesic	Wet		
<i>Liatris pycnostachya</i>	Prairie Blazing Star		Mesic	Wet		
<i>Lilium michiganense</i>	Turk's cap lily		Mesic	Wet		
<i>Lobelia cardinalis</i>	Cardinal flower			Wet	WM	
<i>Lobelia siphilitica</i>	Great blue lobelia			Wet	WM	
<i>Lobelia spicata</i>	Pale-spiked lobelia			Wet		
<i>Lycopus americanus</i>	Water horehound			Wet	WM	EM
<i>Lycopus uniflorus</i>	Bugleweed			Wet	WM	
<i>Lysimachia quadriflora</i>	Prairie loosestrife			Wet	WM	
<i>Lysimachia thrysiflora</i>	Swamp loosestrife					EM
<i>Mentha arvensis</i>	Common mint			Wet	WM	
<i>Mimulus ringens</i>	Monkey flower			Wet	WM	
<i>Monarda fistulosa</i>	Wild Bergamot	Dry	Mesic			
<i>Onoclea sensibilis</i>	Sensitive fern			Wet	WM	
<i>Penstemon grandiflorus</i>	Large-flowered penstemon	Dry				
<i>Phlox pilosa</i>	Prairie phlox		Mesic	Wet		
<i>Physostegia virginiana</i>	False dragonhead		Mesic	Wet		
<i>Pontedaria cordata</i>	Pickernelweed					EM
<i>Pycnanthemum virginianum</i>	Mountain Mint		Mesic	Wet	WM	
<i>Ratibida pinnata</i>	Yellow Coneflower	Dry	Mesic			
<i>Rosa arkansana</i>	Prairie rose		Mesic			
<i>Rudbeckia hirta</i>	Black-eyed Susan	Dry	Mesic			
<i>Rudbeckia laciniata</i>	Goldenglow					FF
<i>Rumex orbiculatus</i>	Great water dock					EM
<i>Rumex verticillatus</i>	Swamp dock				WM	
<i>Sagittaria latifolia</i>	Broad-leaved arrowhead				WM	EM
<i>Scutellaria lateriflora</i>	Mad-dog skullcap			Wet		
<i>Senecio aureus</i>	Golden ragwort				WM	
<i>Senecio paupercula</i>	Balsam ragwort			Wet	WM	
<i>Silphium laciniatum</i>	Compass Plant		Mesic			
<i>Silphium perfoliatum</i>	Cup plant				WM	
<i>Smilacina stellata</i>	Starry false solomon's seal		Mesic			
<i>Solidago gigantea</i>	Late goldenrod			Wet		
<i>Solidago nemoralis</i>	Gray Goldenrod	Dry				
<i>Solidago rigida</i>	Stiff Goldenrod	Dry	Mesic			
<i>Solidago speciosa</i>	Showy Goldenrod	Dry	Mesic			
<i>Stachys palustris</i>	Marsh hedgenettle			Wet	WM	
<i>Thalictrum dasycarpum</i>	Tall meadow rue		Mesic	Wet		
<i>Verbena hastata</i>	Blue Vervain		Mesic	Wet	WM	
<i>Verbena stricta</i>	Hoary Vervain	Dry				
<i>Vernonia fasciculata</i>	Ironweed			Wet	WM	
<i>Veronicastrum virginicum</i>	Culver's Root		Mesic	Wet		
<i>Zizia aptera</i>	Heart-leaved Alexanders	Dry	Mesic			
<i>Zizia aurea</i>	Golden Alexanders		Mesic	Wet		

GRASSES, SEDGES & RUSHES

<i>Agropyron trachycaulum</i>	Slender wheatgrass	Mesic				
<i>Andropogon gerardii</i>	Big Bluestem	Dry	Mesic	Wet	WM	
<i>Bouteloua curtipendula</i>	Side-oats Grama	Dry				
<i>Bouteloua hirsuta</i>	Hairy grama	Dry				
<i>Bromus ciliatus</i>	Fringed brome			Wet	WM	
<i>Bromus kalmii</i>	Kalm's brome		Mesic			
<i>Calamagrostis canadensis</i>	Blue-joint			Wet	WM	EM
<i>Carex bebbii</i>	Bebb's sedge			Wet		
<i>Carex comosa</i>	Bristly sedge					EM
<i>Carex haydenii</i>	Hayden's sedge			Wet	WM	
<i>Carex lacustris</i>	Lake sedge			Wet	WM	EM
<i>Carex lanuginosa</i>	Woolly sedge				WM	
<i>Carex pellita</i>	Broad-leaved woolly sedge			Wet		
<i>Carex stricta</i>	Tussock sedge			Wet	WM	
<i>Carex vulpinoidea</i>	Brown Fox Sedge		Mesic	Wet	WM	
<i>Elymus canadensis</i>	Canada Wild Rye	Dry	Mesic			
<i>Glyceria grandis</i>	Reed manna grass					EM
<i>Glyceria striata</i>	Fowl manna-grass			Wet		
<i>Hierochloe odorata</i>	Sweetgrass			Wet	WM	
<i>Juncus interior</i>	Inland rush				WM	
<i>Juncus tenuis</i>	Slender rush				WM	
<i>Koeleria cristata</i>	Junegrass	Dry				
<i>Muhlenbergia mexicana</i>	Mexican satin-grass			Wet		
<i>Panicum virgatum</i>	Switch Grass	Dry	Mesic	Wet		
<i>Schizachyrium scoparius</i>	Little Bluestem	Dry				
<i>Schoenoplectus atrovirens (Scirpus)</i>	Dark-green bulrush			Wet	WM	EM
<i>Schoenoplectus cyperinus (Scirpus)</i>	Woolgrass			Wet	WM	EM
<i>Schoenoplectus fluviatilis (Scirpus)</i>	River bulrush					EM
<i>Schoenoplectus validus (Scirpus)</i>	Soft-stem bulrush				WM	EM
<i>Sorghastrum nutans</i>	Indian Grass	Dry	Mesic	Wet		
<i>Sparganium eurycarpum</i>	Giant burreed					EM
<i>Spartina pectinata</i>	Prairie cordgrass			Wet	WM	EM
<i>Sporobolus heterolepis</i>	Prairie Dropseed	Dry	Mesic			
<i>Stipa spartea</i>	Porcupine Grass	Dry				
<i>Typha angustifolia</i>	Narrow-leaved cattail					EM

TREES and SHRUBS

<i>Acer rubrum</i>	Red maple					FF
<i>Acer saccharinum</i>	Silver maple					FF
<i>Amelanchier stolonifera</i>	Running serviceberry					OS
<i>Amorpha canescens</i>	Lead Plant	Dry	Mesic			OS
<i>Amorpha fruticosa</i>	False indigo bush				EM	FF
<i>Betula nigra</i>	River birch					FF
<i>Carya cordiformes</i>	Bitternut hickory					FF
<i>Ceanothus americanus</i>	New Jersey tea					OS
<i>Celtis occidentalis</i>	Hackberry					FF
<i>Cephalanthus occidentalis</i>	Buttonbush					FF
<i>Clematis virginiana</i>	Clematis					FF
<i>Cornus ammonum</i>	Silky dogwood					FF
<i>Cornus foemina</i>	Gray dogwood					OS
<i>Cornus stolonifera</i>	Red-osier dogwood			Wet	WM	EM
<i>Fraxinus pennsylvanica</i>	Green ash					FF
<i>Juglans cinerea</i>	Butternut					FF
<i>Populus deltoides</i>	Cottonwood					FF
<i>Prunus americana</i>	American plum					OS
<i>Prunus virginiana</i>	Chokecherry					OS

<i>Quercus bicolor</i>	Swamp white oak			FF
<i>Quercus macrocarpa</i>	Bur oak			OS
<i>Quercus rubra</i>	Red oak			OS
<i>Rosa blanda</i>	Early wild rose			OS
<i>Rosa palustris</i>	Swamp rose			OS
<i>Rubus occidentalis</i>	Black raspberry			OS
<i>Salix bebbii</i>	Bebb's willow		WM	FF
<i>Salix exigua</i>	Sandbar willow			FF
<i>Salix gracilis</i>	Slender willow	Wet	WM	
<i>Salix nigra</i>	Black willow			FF
<i>Sambucus pubens</i>	Red-berried elder			FF
<i>Spirea alba</i>	Meadowsweet	Wet	WM	
<i>Spirea tomentosa</i>	Steeplebush	Wet		
<i>Staphylea trifolia</i>	American bladdernut			FF
<i>Tilia americana</i>	American basswood			FF
<i>Ulmus americana</i>	American elm			FF
<i>Ulmus rubra</i>	Slippery elm			FF
<i>Viburnum lentago</i>	Nannyberry			OS
VINES				
<i>Celastrus scandens</i>	Bittersweet			FF
<i>Dioscorea villosa</i>	Wild yam			FF
<i>Humulus lupulus</i>	Common hop			FF
<i>Menispermum canadense</i>	Moonseed			FF
<i>Parthenocissus inserta</i>	Virginia creeper			FF
<i>Vitis riparia</i>	Wild grape			FF

* Use mesic prairie and wet prairie species lists for groundcover.