# GORES WILDLIFE MANAGEMENT AREA AND AQUATIC MANAGEMENT AREA
# FREITAG UNIT
## NATURAL RESOURCE MANAGEMENT PLAN

Even-aged floodplain forest, Gores Pool AMA, Freitag Unit, 2009

*December 28, 2009*

**Friends of the Mississippi River**

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# FREITAG UNIT
## NATURAL RESOURCE MANAGEMENT PLAN

*Prepared for:*
Minnesota Department of Natural Resources Scientific and Natural Areas Program
and
Dakota County Farmland and Natural Area Program

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**This Natural Area Management plan and Work Plan has been reviewed and approved by:**

_____ _____

**Robert Fashingbauer** **Date**
Wildlife Area Manager
Division of Fish and Wildlife
Minnesota Department of Natural Resources

_____ _____

**Gerald Johnson** **Date**
East Metro Fisheries Supervisor
Division of Fish and Wildlife
Minnesota Department of Natural Resources

# EXECUTIVE SUMMARY

The property formerly owned by Raymond Freitag was purchased by the Minnesota Department of Natural Resources in December 2008 as the northernmost addition to the Gores Wildlife Management Area (WMA). Located in the Vermillion River Bottoms – the floodplain between the lower Vermillion River and the Mississippi River - the Freitag unit consists of about 307 acres just east of downtown Hastings, MN. The unit is a combination of 187 acres of Aquatic Management Area between 4th Street and the river, and 120 acres of Wildlife Management Area to the south. For the purposes of this document, the units will be collectively referred to as the Freitag unit.

Although the property contains no known rare plant or animal species, rare species are found in close proximity. The native vegetation, in particular the floodplain forest, is part of a continuous block of forest along the river. Fragmentation of this feature would diminish its function and value for providing important wildlife habitat and water quality benefits. It has been identified as ecologically important by several natural resource protection initiatives: the Minnesota County Biological Survey, the Dakota County Farmland and Natural Areas Protection Plan; and the Metro Conservation Corridors, a regional land protection plan of the Department of Natural Resources. The site is within the Mississippi National River and Recreation Area and is adjacent to the river.

Historically, the property was likely dominated by floodplain forest, interspersed with small forested wetlands or shallow marshes and wet meadows. Oak savanna may have been present on the terrace to the south. After European settlement, the property was mostly used for cropland and pasture. Current land cover is over 50 percent floodplain forest, about 20 percent reed canary grassland, 11 percent degraded maple-basswood forest, 5 percent degraded oak savanna, 3 percent brome dominated grassland, and 6 percent open water and degraded wet meadow. The site is dissected by 4th Street, which zigzags through the southwest part of the site.

A long history of agricultural uses, and the introduction of oak wilt, earth-worms, increased turkey and deer populations, and the arrival of many species of exotic plants have resulted in alteration of some of the historic native plant communities. Much of the floodplain forest is relatively intact, but much of it was cleared and is now dominated by non-native grasses. Woodland areas to the south are mostly dominated by common buckthorn and tartarian honeysuckle.

This document describes the recommendations, methods and approximate costs for enhancing the ecological health of the entire property and restoring natural communities. The primary goal for the property is to restore and improve the ecological functions that the historic native plant communities would have provided, including: habitat for a diversity of wildlife species; nutrient and water cycling; carbon storage; moderation of water-table levels; erosion control; filtration of nutrients; sediments and pollutants; development and enrichment of soils; and local temperature moderation.

Restoration recommendations include exotic brush control in wooded areas, converting grassland to native prairie, and restoring shallow wetlands.

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# INTRODUCTION

This Natural Resource Management Plan presents the site analysis and management recommendations for the Freitag unit of Gores Wildlife Management Area (WMA) in Hastings, MN. Gores WMA, over 2,600 acres in the Vermillion River Bottoms, is one of the most significant areas in the Twin Cities region for biodiversity. The Freitag unit, about 307 acres, is the northernmost addition to the WMA. The property was purchased by the Minnesota Department of Natural Resources in December 2008. The northern part of the site, about 187 acres, is designated as an Aquatic Management Area, (AMA) while the southern 120 acres is designated a Wildlife Management Area.

The Freitag unit, though owned by the MN Department of Natural Resources (DNR), lies within the jurisdiction of the City of Hastings and the two agencies worked cooperatively on the acquisition and long-term plans for the site. The city obtained funding from the Supplemental Environmental Projects through the MN Pollution Control Agency to complete a natural resource management plan for the property and contracted Friends of the Mississippi River to complete the plan, in cooperation with the DNR.

The AMA Freitag unit is almost 70 percent floodplain forest and 26 percent reed-canary dominated grassland. The remaining 6 percent is equal amounts of open water and degraded wet meadow. The WMA is about 30 percent floodplain forest, including silver maple floodplain forest, about 30 percent degraded maple-basswood forest, 14 percent degraded oak savanna, 13 percent reed-canary dominated grassland, 9 percent brome-dominated grassland, and 7 percent open water.

The purpose of this plan was to:

- Evaluate the historic and existing condition of vegetation cover on the property.
- Identify target natural communities and restoration goals.
- Identify methods for improving the wildlife habitat value of the property.

Specific ecological goals for the property are to:

- Restore the complement and composition of native plant communities.
- Improve wildlife habitat.
- Provide connectivity with other natural areas in the landscape.
- Maintain and manage the property for water quality.
- Utilize this property to enhance and expand the ecological functions of the property and of the larger Metro Conservation Corridor.

This plan provides background data on the site geology and soils, historic ecological conditions, it's context within the landscape and any known rare features. It provides a detailed evaluation of the site conditions at the time of the survey in 2009 and uses the combination of gathered information to propose ecological management and restoration recommendations. A schedule and approximate costs of management tasks are also provided.

# BACKGROUND INFORMATION

## Freitag Unit Information

**Owner name, address, city/township, county, and phone:**
Minnesota Department of Natural Resources
Central Region Headquarters
Division of Fish and Wildlife
1200 Warner Rd,
St Paul, MN 55106
Contacts: Robert Faschingbauer, Wildlife Area Manager, 651-322-4643;
Gerald Johnson, East Metro Fisheries Supervisor, 651-259-5770

**Township, range, section:** T115N, R17W, Portions of Sections 22, 23, 26 27

**Parcel data:** Total size: 307 ac
Property Identification Numbers (PIN):

| | |
|---|---|
| 037-190410001007 | 037-190410001035 |
| 037-190410001008 | 037-190410001037 |
| 037-190410001013 | 037-190410001124 |
| 037-190410001034 | |

**Element Occurrences:** Silver maple floodplain forest of outstanding biodiversity significance (15.5 acres) is located on the site. The state rank is S3 (vulnerable in Minnesota either because rare or uncommon, or found in a restricted range, or because of other factors making it vulnerable to extirpation).

## Landscape Context

The Freitag unit is bounded by the Mississippi River on the north, Gores WMA on the east, woodland, non-native grassland and some large lot residential on the south, and the Vermillion river and some cropland on the west. Land use within a one-mile radius of the property can roughly be described as follows: 50 percent natural/semi natural land and water areas, 20 percent cropland, 15 percent urban commercial and residential, and 15 percent industrial.

The Freitag Unit is located at the confluence of the Mississippi River, the Vermillion River and the St. Croix River, making it a key location for connectivity in the landscape. It is likewise at the confluence of five branches of the Metro Conservation Corridors, a strategy developed by the DNR and partners for accelerating and enhancing habitat protection and restoration by targeting high-priority focus areas (**Map 1**).

The location of the Freitag unit is also significant for its connection to other important natural areas – the rest of Gores WMA to the southeast with outstanding biodiversity designation, the close proximity to Hastings Sand Coulee SNA(outstanding biodiversity) and Hastings SNA (moderate biodiversity) to the south, and other high and moderate biodiversity sites to the north and northwest.

The proximity along the river itself is also a key feature of this site. The Mississippi River serves as a corridor for hundreds of migratory bird species and is a designated Important Bird Area - global effort lead by the Audubon Society to identify and conserve areas that are vital to birds and other biodiversity. The mature floodplain forests and approximately 5,550 feet of shoreline help to defray pollution impacts from other parts of the watershed and also contribute to the quality of the wildlife habitat.

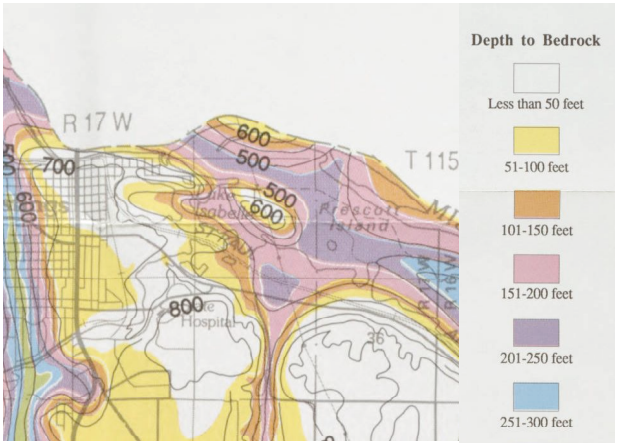
According to the Department of Natural Resources County Biological Survey, 9,400 acres, or 2.6 % of the land area of Dakota County supported remnant natural communities as of the 1993 survey. That amount has certainly decreased since then as urban development in the county has flourished. The growth rate is expected to continue in the next few decades and will continue to expand into farmland and natural areas, making natural resource protection and restoration increasingly important.

## Site Geology and Soils

### Geology

Gore's Pool WMA, located in the bottomlands of the Mississippi River, was mostly formed from alluvium deposited during modern flooding events (**Fig. 1**). The southwest part of the site, however, rises up into a knoll about 20 feet above the floodplain. This is the lower terrace, consisting of sand and gravel, that was created by the Glacial River Warren. While the level terrain over most of the site defies evidence of the dramatic geologic forces that altered the landscape, the terrace provides a reminder of the glacial river that carved the river valley in the last glacial period, ending roughly 10,000 years ago. The nearby high bluffs upstream and downstream of the site also attest to the geologic history. The much-reduced flow of the Mississippi River now occupies a much smaller channel of the river valley, and is flanked by floodplain between the channel and the bluffs. Gores WMA lies within that floodplain.

The sedimentary deposits of the site are generally about 151 to 250 feet thick, lying upon bedrock composed of St. Lawrence and Franconia formations, which consist of dolomitic shale, siltstone, and sandstone. The terrace is underlain by Jordan Sandstone and the Prairie du Chien Group. The depth to bedrock is less along the river (51 to 150 feet) and at the terrace, where it is less than 50 feet. The elevation of the site ranges from 678 feet at the riverbanks, to 680 feet over most of the site, rising to 708 feet at the terrace. The water table elevation is 675 feet. The direction of groundwater flow is to the northeast. Due to the relatively shallow depth to the groundwater over most of the site, the sensitivity of the ground water to pollution is rated Moderate (several years to decades). The terrace in the south, however, is ranked Very High (hours to months).



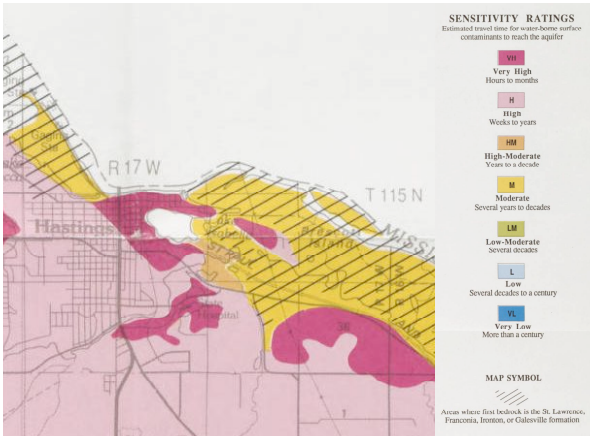
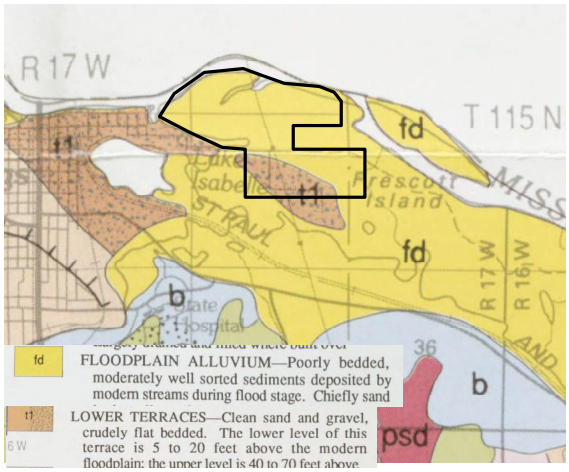




**Figure 1.** Geologic maps from the Minnesota Geologic Survey, University of Minnesota show the depth to bedrock (top left), the sensitivity to pollution (top right) and the surficial geology (bottom). Rough boundaries of the Freitag unit are shown (bottom map). The elevated terrace is seen as t1.




## Soils

Soils that formed from the sedimentary deposits at this site were primarily loams, derived from floodplain alluvium. The following descriptions of the most prevalent soils on this site are based on information from Soil Survey of Dakota County (SCS 1983). The soils types are summarized in **Table 1**.

**Table 1. Soil Types**

| Soil Code | Soil Name | Percent Slope | Acres | Hydric | Occ. annual flood duration | Erosion potential (water) |
|---|---|---|---|---|---|---|
| 7C | Hubbard loamy sand | 6-12 | 2.5 | No | -- | mod |
| 98 | Colo silt loam | level | 24 | Yes | long | low |
| 100A | Copaston loam | 0-2 | 40 | No | -- | high |
| 226 | Lawson silt loam | level | 6 | Yes | -- | low |
| 282 | Marshan silty clay loam | level | 17 | Yes | -- | low |
| 463 | Minneiska loam | level | 33 | No | brief | low |
| 1055 | Aquolls muck | level | 5 | Yes | -- | low |
| 1821 | Algansee sandy loam | level | 142 | Yes | long | low |
| 1848B | Sparty loamy sand | 2-8 | 4.5 | No | -- | low |

Algansee sandy loam (**Map 3**) is a nearly level, somewhat poorly drained, occasionally flooded soil that occupies most of the site, about 142 acres, in the northern half. The surface is about 12 inches of very dark grayish brown sandy loam, overlying about 60 inches of sand (Soil Conservation Service 1980). Permeability of this soil is very rapid, the available water capacity is low, and runoff is slow. Organic matter content is moderate to moderately low. The seasonal high water table is at a depth of 1 to 2 feet. This soil type supports both floodplain forest and reed canary dominated grassland in the northern half of the site.

Minneiska loam occupies about 33 acres to the south of the floodplain forest. The area is a mixture of non-native grassland and small patches of floodplain forest. Minneiska loam is occasionally flooded, nearly level, moderately well-drained, with an 8-inch surface layer of brown to very dark grayish brown loam overlying 60 inches of loam and loamy find sand. Permeability is moderately rapid, available water capacity is very high, runoff is slow, and organic content matter is moderate. The depth to the seasonal high water table is 3 to 6 feet.

Copaston loam is the primary soil on the knoll in the south, covering about 40 acres. The vegetated cover consists of lowland hardwood forest, non-native shrub land and non-native dominated woodland. Copaston is a shallow, nearly level, well-drained soil on upland terraces or benches. The surface layer is about 8 inches of very dark brown loam. The subsoil is about 10 inches of dark brown loam. Limestone bedrock is ad a depth of 18 inches, with occasional outcrops. The shallow bedrock makes this an area that has very high sensitivity to pollution. Permeability of the Copaston soil is moderate or moderately rapid, available water capacity is low and the soil is prone to drought. Runoff is slow, and organic matter content is moderate. The root zone ranges from 12 to 20 inches.

Colo silt loam occupies about 24 acre in the southeast part of the site covered by reed canary grassland. It is a nearly level, poorly drained soil. The surface layer is silt loam, about 8 inches thick, overlying 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.

Marshan silty clay loam occupies about 17 acres in the southeast corner of the site, covered by silver maple floodplain forest. This is a nearly level, poorly drained soil found on outwash plains and stream terraces. The surface layer is about 14 inches of black silty clay loam and loam. The subsoil is dark gray to olive gray loam about 18 inches thick, and the underlying material to a depth of 60 inches is sand. Soil permeability is moderate in the upper loam mantle and rapid in the underlying sand. The available water capacity is moderate, runoff is slow, organic matter content is high and the depth to the seasonal high water table is 1 to 2.5 feet.

**Topography**

In contrast to the nearly vertical, 100-ft bluffs along nearby portions of the river, the terrain of Freitag AMA is nearly level, broken only by small swales and very old, filled-in river channels. Leveled by regular flooding, the elevation varies only a few feet over most of the site, with the most significant change - 8 to 10 feet - along riverbanks or old channels.

The WMA on the south, however, has a markedly different appearance with steep slopes and 20-foot elevation changes. That area marks the lower terrace formed by the glacial river. This is the only area of the Freitag unit that is highly susceptible to water erosion (**Fig. 2**). Over the entire site, the elevation ranges from 678 feet above sea level to 708 feet.

# Rare Features

According to the DNR natural heritage database there are no rare feature records for the Freitag unit. In 2002, however, a bird survey was conducted on the terrace portions of the site (Bonestroo 2002) and five species of greatest conservation need (DNR 2005a) were detected: eastern wood pewee, least flycatcher, prothonotary warbler, bald eagle, and red-headed woodpecker. While the survey was done on July 9, a few days later than the typical breeding bird survey, in all likelihood these would have been breeding species.

In addition, the DNR records show thirteen rare plant and animal species (totaling 21 individual records) within one mile of the site, as well as one record of colonial water bird nesting site (**Table 2**). There was one endangered species (one record), and two threatened species (4 records), and seven special concern species (11 records). Three of the species are not officially listed but are being tracked.

While the Freitag unit would not provide suitable habitat for many of the rare species found nearby, it could provide habitat for several of them, such as Walter's barnyard grass, ginseng, red-shouldered hawk, bald eagle, and fox snake.

**Table 2**. **Rare features within one mile of the Freitag unit.**

| Element Name | Common Name | No. records | Last Observed date | Status | State rank |
|---|---|---|---|---|---|
| **Plants** | | | | | |
| *Besseya bullii* | Kitten-tails | 3 | 1994 | THR | S2 |
| *Echinochloa walteri* | Walter's barnyard grass | 2 | 1994 | NON | S4 |
| *Gymnocladus dioica* | Kentucky coffee-tree | 1 | 1994 | NON | SU |
| *Panax quinquefolius* | American ginseng | 1 | 1993 | SPC | S3 |
| *Trillium nivale* | Snow trillium | 2 | 1994 | SPC | S3 |
| **Birds** | | | | | |
| *Buteo lineatus* | Red-shouldered hawk | 3 | 1993 | SPC | S3 |
| *Haliaeetus leucocephalus* | Bald eagle | 2 | 2003 | SPC | S3 |
| *Falco peregrinus* | Peregrine falcon | 1 | 2002 | THR | S2 |
| Colonial water bird nesting site | | 1 | 1977 | | |
| **Herpetofauna** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| *Elaphe vulpina* | Fox snake | 1 | 1988 | NON | S4 |
| | | | | | |
| **Fish** | | | | | |
| *Cycleptus elongatus* | Blue sucker | 1 | 1996 | SPC | S3 |
| **Mussels** | | | | | |
| *Elliptio dilatata* | Spike mussel | 1 | 1978 | SPC | S3 |
| *Lampsilis higginsi* | Higgins eye mussel | 1 | 1907 | END | S1 |
| *Obovaria olivaria* | Hickorynut mussel | 1 | 2000 | SPC | S3 |
| | **Total Records** | **21** | | | |

The larger Vermillion Bottoms area is well-known for its high diversity of plant and animal species. Other bird surveys conducted there (DNR 2005b) identified a few more rare species for the area: one additional state threatened species (Wilson's phalarope), was recorded, two special concern species (acadian flycatcher, cerulean warbler) and nine species of greatest conservation need: Canada warbler, Cape May warbler, Connecticut warbler, golden-winged warbler, least bittern, olive-sided flycatcher, prothonotary warbler, red-headed woodpecker, and wood thrush. The Freitag Unit could provide additional important habitat for some of these species and should be managed with them in mind.

The Bonestroo survey (2002) also survey reptiles, amphibians and vegetation, as well as birds. Only very common species were detected, other than two sedges (*Carex muskingumensis* and *Carex grayi*), which are somewhat uncommon. Only 3 species of small mammals were detected (white-foot mouse, deer mouse and meadow vole), and only 4 individual little brown bats. Herpetofauna recorded were one spiny softshell turtle (*Apalone spinifera*) on the banks of the Vermillion River, gray treefrog (*Hyla versicolor*), green treefrog (*Rana clamitans*), and leopard frog (*Rana pipiens*) and common garter snake (*Thamnophis sirtalis*). It would appear that there is potential turtle nesting habitat along the banks of the Mississippi River; river beaches should be managed with that in consideration.

# Historic Vegetation

According to *The Original Vegetation of Minnesota* (Marschner 1974), which was based on land-surveyor notes from the mid-1800's, the dominant vegetation at the Freitag unit at the time of European settlement was floodplain forest (**Map 3**). Oak Openings and Barrens were also depicted on the west side of the site, and prairie was nearby. Bearing trees most frequently recorded in the floodplain were elm, hackberry, (green) ash and (silver) maple, all commonly in the 10 to15-inch diameter size. Bur oak of a similar size was the dominant tree in the Barrens areas.

While this provides a general picture of the historic land cover of area, it is not a complete picture of the Freitag unit because the land survey did not capture small areas of vegetation change. The topographic variation at the Freitag unit (e.g. the terrace) provides different ecological conditions with north and south-facing slopes. It also has smaller topographic variations with old river channels depressions and other irregularities. It would be reasonable to expect that the site could have been mostly

floodplain forest in the AMA, with small areas of forested wetlands, marshes, wet meadows and wet or mesic prairie. The WMA would likely have included the same plant communities, but would probably also have had some upland communities at the terrace such as oak savanna on the south and west slopes, and maple basswood forest on the cooler northeast slopes.

Historic aerial photographs from 1937 and 1951 also provide some indication of the previous site conditions and vegetation (**Maps 4a & 4b**), although by that time, the site had been significantly altered by clearing, cultivation and grazing. From the photos we can determine that the oldest floodplain forest on the site is at the east end of the WMA, seen as a fairly dense canopy in 1937. Relatively small trees were also present at that time along much of the northeast slope of the terrace, probably representing the early stages of the existing maple-basswood forest. The top of the terrace was fairly open, probably representing some remnant oak savanna. These areas may have been heavily grazed and/or selectively cut, judging from their appearance in the photos.

The AMA area was entirely cleared of trees as of 1937, with only a fringe of trees along the rivers. By 1957 much of the existing floodplain forest was covered with trees, so we expect that the trees began to establish shortly after 1937.

## Historic and Existing Land Use

The exact date when European settlement and development occurred at the Freitag unit is not known, but based on the rapid development of the Hastings area in the mid-1800's this area was likely developed about the same time. The 1937 aerial photo shows that the site had been almost completely logged (**Map 4a**). Most of the AMA was cultivated or hayed at that time. The lower, northwest part of the AMA, bounded to the south by an old filled-in river channel, was logged but not apparently cultivated or hayed, although it appears to have been pastured. A bridge and a road enter the site from the south across the Vermillion River. There was also a ditch running diagonally through the AMA at that time. The only vestiges of these structures that remain are very faint mounds of the ditch banks, a bridge abutment **(Fig. 2)**, and ridge or road grade **(Map 4a)**.

**Figure 2.** Old bridge abutment on Vermillion River

The WMA was likewise heavily logged. There was less available land for cultivation or haying because of topography on the WMA, but fencing is found throughout both the

AMA and WMA. The fencing and the historic aerial photos indicate much of the area was used for grazing.

By 1964 the forests were becoming re-established in many areas (**Map 4b**). Some hay fields, no longer mowed, had trees beginning to break into the reed canary grass.

Currently there is a pipeline (Amoco) that follows along the eastern boundary of the site at the AMA, then cuts through the WMA about 1,500 feet from the east boundary. There is also a large power line that transects the property north/south, approximately through the middle of the site. The power company keeps the right-of-way free of trees and brush – probably through the application of herbicide. The gas pipeline company also typically would require a tree-free easement for management purposes, and parts of the easement had been mowed recently. One local power line crosses the WMA and goes to the residences to the southeast on E 4$^{th}$ Street.

The most active use of the area in recent times is hunting, fishing, and trapping. Several actively used ATV and 4X4 trails exist and are indicated on **Map 5**. The old road through the site that forms the boundary between the AMA and the WMA, has been gated to curtail use other than DNR management. However, ATVs still access the road by driving around the gate.

# Water Resources

### Surface waters (lakes, streams, rivers, wetlands, springs)

The National Wetlands Inventory show six wetlands at the Freitag unit, totaling about 48 acres (**Table 3**). Over half of the wetland area is forested.

**Table 3. Wetland types**

| Type | Description | Acres |
|---|---|---|
| PFO/SS1Ah | Palustrine forested/scrub shrub, temp flooded,diked/impounded | 3.1 |
| PFO1Ah | Palustrine forested, temp flooded,diked/impounded | 24.7 |
| PFO1Ah | Palustrine forested, temp flooded,diked/impounded | 11.8 |
| PSS1Ah | Palustrine scrub shrub, temp flooded,diked/impounded | 3.1 |
| PUBG | Palustrine unconsolidated bottom, Intermittently exposed | 3.4 |
| PUBGhx | Palustrine unconsolidated bottom, Intermittently exposed, excavated | 2.1 |
| | Total Acres | 48.2 |

### Groundwater recharge or infiltration areas

Due to the permeability of the soils and shallow depth to groundwater, the Geologic Atlas of Dakota County shows that the Freitag AMA has rating of “moderate” for sensitivity of the groundwater to pollution. Surface waters, and any pollutants carried in them, will reach the Prairie Du Chein water table – which provides drinking water for much of the metropolitan area - at a rate of several years to decades.

The terrace on the WMA is composed of sand and gravel deposits over dolostone bedrock. The dolostone is within 18 feet of the surface with exposures along the northeast slope **(Fig. 3)**. There is little distance to buffer any surface infiltration, making this an area of "very high" sensitivity to groundwater pollution. Pollutants can reach the ground water within hours to weeks. Management recommendations will take into account these soil types and sensitivities.

**Figure 3.** Dolostone outcrop on NE slope of terrace (GPS 8).

**Storm water management issues (erosion, contaminants, buffers)**

The steep slopes of the terrace area in the south part of the site are susceptible to erosion. There were no areas seen with erosion that required specific management actions. Any ecological restoration or management activities that occur in this area should consider the soil conditions and take actions to prevent erosion or other damage to the slopes.

# EXISTING CONDITIONS AND MANAGEMENT RECOMMENDATIONS

In 2009, Friends of the Mississippi River conducted vegetation surveys and ecological assessment of the entire Freitag property. The Minnesota Land Cover Classification (MLCCS) was used as a basis for the survey work, and modified as needed based on field observations (**Map 5**). For each land cover type, recorded information included a list of plant species and their percent coverage in each vegetation strata (**Appendix A**), soil type, slopes, animal signs, and ecological concerns, such as erosion, exotic species etc.

Target plant communities for each of the management units were determined based on the apparent vegetative cover seen in historic aerial photos, existing vegetation, landscape position, distribution on adjacent lands, and plant community descriptions in the *Field Guide to Native Plant Communities of Minnesota – The Eastern Broadleaf Forest Province* (DNR 2005c). The plant community descriptions and species lists (**Appendix B**) in the field guide can be used to guide the restoration process.

The existing vegetation and target plant community for restoration for each management unit at both the AMA and the WMA are summarized in **Table 4**, and described in the paragraphs below. General restoration goals are depicted in **Map 6** and additional photographs for the units are provided in **Appendix C**. None of the units were given a DNR quality ranking other than Unit FF6, which was recorded in the CBS survey. The remainder of the site had levels of disturbance that were too high or levels diversity that were too low to meet the criteria for being ranked by CBS standards.

The 2009 site surveys found established floodplain forest at elevations below 684 feet throughout the site. Portions of the site at or below 684 feet include all of the AMA and about half of the WMA. The AMA retains floodplain forest over most of the site, but large areas had been cleared in the past and converted to reed canary grassland. Most of that would be targeted for restoration to floodplain forest. The half of the WMA above 684 feet was situated on the elevated terrain of a lower terrace and supported highly disturbed maple-basswood forest, over-grown oak savanna, with some areas of old field and brome grasslands. The entire property contained indications of grazing in the past, including barbed wire fences, conversion to grazing tolerant non-native grasses, and heavy infestations of invasive exotic shrubs. Restoration goals would be for a mixture of maple-basswood forest on the north slopes, oak savanna on the crest, and prairie on the south and west slopes. Areas of wet meadow/shrub carr may also be appropriate adjacent to existing open water areas of the site.

**Table 4. Existing Condition and Proposed Restoration of Management Units**

| Management Unit | Acres | Existing Vegetation | Target Plant Community |
|---|---|---|---|
| **Aquatic Management Area (AMA)** | | | |
| FF1 | 66.2 | Floodplain forest | Southern Silver Maple Floodplain Forest (FFs68a) |
| FF2 | 32.5 | | |
| FF3 | 7.3 | | |
| FF4 | 21.8 | | |
| FF5 | 1.1 | | |
| TOTAL | 128.9 | | |
| GR1 | 4.3 | Reed canary-dominated grassland | Southern Silver Maple Floodplain Forest (FFs68a) |
| GR2 | 5.9 | | |
| GR3 | 31.1 | | |
| GR4 | 7.0 | | |
| TOTAL | 48.3 | | |
| WM | 5.3 | Wet meadow | Wet Meadow/Carr (WMn82) |
| W | 4.8 | Open water | Open water |
| **Total AMA** | **187.3** | | |
| **Wildlife Management Area (WMA)** | | | |
| GR5 | 15.4 | Reed canary dominated lowland grassland | Wet Meadow/Carr (WMn82) – 14 ac<br>Southern Silver Maple Floodplain Forest (FFs68a) – 1 ac |
| FF6 | 22.4 | Silver maple floodplain forest<br>Floodplain forest | Southern Silver Maple Floodplain Forest (FFs68a) |
| FF7 | 12.9 | | |
| TOTAL | 35.3 | | |
| MB1 | 9.9 | Degraded maple-basswood forest | Southern Mesic Maple Basswood Forest (MHs39) |
| MB2 | 23.6 | Degraded maple-basswood forest | Southern Mesic Maple Basswood Forest (MHs39) |
| TOTAL | 33.5 | | |
| PL | 2.6 | Powerline corridor-grassland | Possibly restore to dry prairie |
| PR1 | 4.2 | Brome dominated grassland | Southern Dry Prairie (UPs13) |
| PR2 | 3.9 | | Southern Dry Prairie (UPs13) |
| TOTAL | 8.1 | | |
| OS1 | 13.7 | Overgrown, degraded oak savanna | Southern Oak Savanna (UPs14) |
| OS2 | 2.6 | Overgrown, degraded oak savanna | Southern Oak Savanna (UPs14) |
| TOTAL | 16.3 | | |
| W | 8.8 | Open Water | Open Water |
| | | | |
| **Total WMA** | **120** | | |

# AMA Floodplain Forest (Units FF1,2,3,4,5)

The floodplain forest units, totaling about 130 acres, were typified by a closed canopy of generally even-aged trees, dominated by large silver maple and green ash, both ranging from 12 to 22 inches in diameter (**Fig. 4**). The even-age of the trees is indicative that the area was logged. Other common species included American elm (ups to 22" dbh), and boxelder. Larger diameter trees were found in Unit FF2 (**Fig. 5**), including a five-foot

diameter cottonwood. These were most common along the Mississippi River and were probably some of the trees seen on the 1937 aerial.

The understory for all units was open and primarily composed of young canopy trees, especially green ash. Sandbar willow was common along the river edges and prickly ash was abundant in patchy areas. Non-native woody species included buckthorn and honeysuckle. These were generally sparse in the forest interior, but were abundant along the edges and openings. Small amounts of young Siberian elm and amur maple were noted on the beach along the Mississippi River.

**Figure 4**. Even-aged floodplain forest with open understory, dense ground cover.

The groundcover was dense and diverse although it was heavily dominated by wood nettle. Moneywort, a non-native species was also abundant. Other common species included horsetail, Virginia stickseed, moonseed, violets, and creeping Charlie.

Species found in small slough areas included rice cutgrass, reed canary grass, and clearweed. A few different species were found on the more open, sandy beaches along the Mississippi, such as false nettle, sneezeweed, monkey flower and wood sorrel.

One tree species lacking from the groundcover and shrub layer was cottonwood. The forest cover is too dense for this species to regenerate. Re-establishing this species, important for eagles and other wildlife, should be a goal for reforestation efforts.

**Figure 5**. Large cottonwoods and silver maple were found in Unit FF2.

The target community for these units is Silver Maple Floodplain Forest (FFs68a), which has an interrupted to continuous canopy cover of 50 – 100% and is strongly dominated by silver maple. Green ash, cottonwood and American elm are also present. The ground layer is sparse especially in spring after being inundated by floodwaters. Wood nettle is a common ground plant that becomes established as the soils drain. Climbing plants and vines are important to this community.

Wild grape, moonseed and poison ivy are characteristic. Shrub layer species are mostly saplings of the canopy trees. Future goals for the area would be to support the natural development of the young floodplain forest.

Restoring the FF units will consist initially of exotic woody removal. Cutting, treating and burning the buckthorn will be the most effective method of control in this community (Detailed brush control methods are provided in **Appendix D**). Overall, buckthorn was only locally dense and largely absent throughout this community type. Most of the non-native herbaceous species do not need to be managed, but there are some, such as reed canary grass that could be targeted. Long-term monitoring should be conducted to detect any new species of concern. In adherence with the recommendations developed in *Technical Guidance Document for the Vermillion Bottoms and Lower Cannon River Area* (DNR 2005b), long-term management of the floodplain forest should also consider steps to increase the age diversity of the units. Selective cutting and small patch removal would be the primary methods to accomplish that. Restoration of the reed canary grassland areas to floodplain forest, however, will also provide age-diversity in the near term and may negate the need for altering the existing stands. Regular site assessments will be needed to determine the long-range plans for the site.

In addition, to the floodplain forest restoration, it should be noted that there were some stretches of open sandy beaches along the river, which may provide turtle nesting habitat. Some of these areas were also apparently used by motorboats for landing spots. It would be beneficial to post signage at the locations to notify boaters to minimize disturbances.

## AMA Reed Canary Grassland (Units GR1,2,3,4)

The grassland units occupied most of the southern half of the AMA, about 47 acres, and were heavily dominated by reed canary grass throughout. GR1 was slightly different than the other areas. It may have been an old utility corridor or just another hay field in the past. When its former use was abandoned, trees and shrubs, primarily honeysuckle and green ash, began to re-vegetate this area and currently provide about 30 percent cover.

Reed canary grass may have been planted at the AMA, as was a common practice to establish hay in lowland areas. Only a few other species were detected scattered within the reed canary. These were Canada anemone, common milkweed, late goldenrod, marsh hedgenettle, horsetail, and sedges.

DNR recommendations for the Vermillion River Bottoms area (DNR 2005b) strongly suggest that increasing the continuous forested cover for this area is very important for numerous bird species. In addition, the grassland areas were historically floodplain forest and that is the community type (Southern Silver Maple Floodplain Forest FFs68a) that they would be restored to most readily. While a wet prairie restoration might seem like a feasible option, maintaining native grassland in the long-term would be difficult, as encroachment by floodplain tree species would be a constant battle. Fire, typically used to maintain grassland, might also be difficult, as it is often too wet to burn in the spring.

Trees can be planted at the grasslands to accelerate the re-establishment of floodplain forest. The preferred method for accomplishing this would be direct seeding, timed to coincide with the natural production of seed on-site. This is the most cost-effective method and most closely resembles the natural process. Reed canary grass would be treated prior to seeding, so that the ground will be fairly clear of vegetation when seeds of desired tree species are falling. Cottonwood, for example, goes to seed mid-May through June. Reed canary control should begin the previous fall, with a burn, followed by one or two herbicide treatments. One or two treatments will be needed in spring the following year, unless there is flooding. Once trees begin to grow, follow-up herbicide work should use grass-specific herbicide.

The restoration could be done in stages, so that the entire grassland would not be treated all at once. The primary detriment of staging is that areas being restored will be subject to regular seed dispersal from adjacent reed canary patches. In addition, if the project is relying solely on naturally produced seed at the site, it's possible there may not be enough produced to adequately cover all of the grassland expanses. A primary benefit of staging is that the areas to be seeded will be more susceptible to erosion from flooding, so by having smaller areas exposed, erosion may be minimized. In addition, if flooding is particularly bad in a year when the seeding was intended, the project may be unsuccessful that year. Staging would potentially minimize the risk. If staging is desired, Unit GR4 would be an appropriate place to try direct seeding in Phase 1. This is a relatively small area, about 7 acres, that is likely to get flooded.

An alternative, or a complement, to planting direct seeding would be to install bareroot tree seedlings. This will require eradicating the grass by several cycles of burning/mowing, and herbicide, either in selected strips, patches, or whole fields. Herbicide treatment would be followed by planting seedling (bareroot) trees. A combination of methods is a realistic approach in the floodplain, where each method alone will encounter uncontrollable events and conditions.

Whichever method of tree establishment is use, it may also be helpful to broadcast other native graminoids, especially sedges, to provide some ground cover and to replace the reed canary. For seeded trees, continued herbicide of reed canary grass may be needed. For planted trees, continued mowing or herbiciding around planted trees and/or tree shelters or tree mats will be needed to allow the seedlings to grow to an age capable of withstanding the competition of grasses. As the plantings mature, they will eventually shade out the grass. Suitable plant species for restoration are listed in **Appendix B**. Important tree species to incorporate are cottonwood, peach leaf willow, hackberry, and black willow and silver maple. Green ash and American elm, while important components of a floodplain forest, could be omitted due to the disease issues associated with each.

The powerline corridor at the AMA occupies about 7 acres of the grassland. This area will be maintained by the power company to keep woody plants reduced. Coordination with the power company many enable restoration of the corridor to mesic prairie species

or similar. At a minimum, it may be possible to request the type of herbicide or other management done, to minimize negative ecological impacts.

An opportunity to increase the plant community diversity in the southeast corner of the AMA is on the north edge of grassland GR4. Bounding this field on the north is an old river channel that is expressed by a small swale and temporary wetland. This feature extends to the west, nearly to the bow in the Vermillion River. The swale could be expanded to include additional area around the old channel. Creating a wetland at this point may also curtail the use of a two-track, used by 4X4s and ATVs, that crosses on to private lands to the east of the swale. An alternative trail alignment is suggested in the paragraph entitled "Recreation Trail and Fishing Access" below.

**Figure 6**. Reed canary grass dominated swale within FF2 could potentially be restored to wet meadow.

## AMA Wet Meadow (Unit WM)

Unit WM is an old river channel that holds water each year at least temporarily. It was degraded by a dominance of reed canary grass, though a few native species remained (rice cutgrass, clearweed, sedge species). There were a few other small pockets of reed canary grass dominated swales within the floodplain forest (**Fig. 6**), though they were too small to map. Because this is floodplain, restoration of these patches is limited due to the continuous influx of reed canary grass seed with every flood. No specific restoration steps are recommended for the wetland for the five years of management covered by this plan, but in the long-term, reed canary grass eradication and re-establishing wet meadow species (Wet Meadow/Carr WMn82) native species should be considered.

## Recreation Trail and Fishing Access

The City of Hastings has proposed establishing a multi-use recreational trail through the AMA. The planned route is along 4$^{th}$ St, then following the powerline corridor to the south. In addition to that, there may be a future interest in having a walking path on the AMA for nature observation (note: trails are not permitted on WMAs). A path in the AMA would be subject to annual flooding, so a simple mowed path would be the best option for minimal maintenance and upkeep. Based on the field surveys and locations of existing vehicle tracks, a proposed route for this trail is indicated on **Map 6**. Both routes could potentially be used for both biking/hiking and vehicle tracks, with fishing piers at the river access points. As the exotic brush is cleared, there would also be an opportunity for a trail along the Vermillion River to its mouth. The existing grassland areas are slated to become floodplain forest (except for beneath the powerline), so ultimately mowing would not be necessary, and the path would be maintained by clearing fallen trees. Installing trail markers or interpretive signs may be desirable.

An interest was also expressed in providing fishing access at the AMA. Several limitations, however, make that an unlikely option. It is a long distance between the 4th St access and the Mississippi River, and it is all annually flooded floodplain. Creating solid road access would be very costly, both initially and for regular maintenance. It would also dissect the landscape. Access to the Vermillion river would be much closer, but water levels in that river are very low much of the season.

There was an existing truck track on the site, one of the most heavily used tracks, that mainly follows the powerline corridor to the river, then crosses on to private land to the east. Stopping the non-permissible use of this trail and ending the private land trespass will be challenging. The development of a wetland, suggested above for GR4, may be designed in a way to curtail the use of this current trail and encourage use of the proposed official trail. It was felt that utilizing the current patterns of activity and creating a fishing opportunity at the north end of the power line easement might be practical. However, monitoring the area may be more difficult than if a fishing area was developed across from the marina at the west end of the site. Both fishing locations and proposed trails are indicated on **Map 6**.

## WMA Floodplain Forest (Unit FF6 and FF7)

The existing silver maple floodplain forest in Unit FF6 of WMA is the oldest remnant native plant community at the Freitag property, having been there at least since 1937. Silver maples are large, including two mammoth trees of 72 and 96 inches diameter near the west edge (**Fig. 7**). Green ash, however, is currently the dominant tree species with trees ranging from 10 to 24 inches diameter. A few cottonwoods are present only along the old road. The canopy is closed and both the understory and groundcover are open. The understory is dominated by silver maples. Buctkhorn was rare in the understory, but seedlings were present near the edges, and abundant in some areas. Common ground cover species included creeping Charlie, moonseed, and wood nettle, with reed canary grass in openings and edges.

This unit is part of a CBS Site of High Biodiversity Significance. The quality of the area was still high, ranking as a B or B/C due to the non-natives beginning to encroach.

Unit FF7 was much younger forest than the other floodplain forests. Based on the 1937 aerial photo, the area was cleared and grazed. The closed canopy was dominated by small green ash of 8 to 12 inches diameter. Silver maples were less abundant, but fairly large, up to 22 inches (**Fig. 8**). Large cottonwoods were present in low numbers. The understory was fairly open and dominated by green ash saplings, but common buckthorn was also abundant, especially on the west edge. The groundcover was fairly sparse and very low diversity. Wood nettle and tree seedlings were most common, with reed canary in the wetland on the south.

**Figure 7.** Mature silver maple with undergrowth of young maple and buckthorn seedling carpet (Unit FF6).

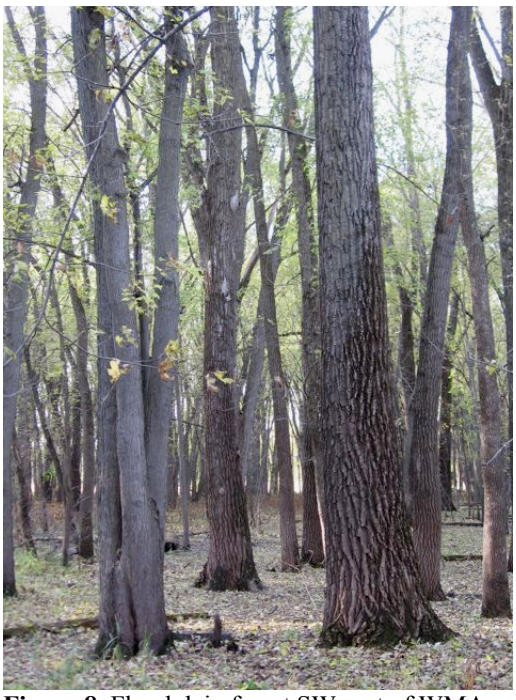


**Figure 8.** Floodplain forest SW part of WMA (Unit FF7).

The target plant community for both of these units is Southern Silver Maple Floodplain Forest (FFs68a). The primary management recommendation for both units is to control the exotic brush that is encroaching on the edges. After exotics control, and after other management units at the site have been generally restored, it would be valuable to assess the plant community at these units and determine potential for enhancing species diversity. It may be feasible to increase the tree species diversity, in particular, to better reflect the full floodplain forest composition. A list of suitable plant species can be found in **Appendix B**.

## WMA Maple Basswood Forest (Units MB1 and MB2)

Located on the north-facing side of the terrace in the WMA, the condition of the maple basswood forest in 2009 was indicative of years of heavy grazing followed by a number of years of rest from grazing. It may also have been selectively logged. Grazing would have suppressed recruitment of young trees, resulting in scattered mature trees. There is an age gap between the mature sugar maple, basswood, oak and hackberry and the patches of sugar maple, yellow bud hickory, and other tree seedlings.

Many large, mature sugar maple trees remain throughout this unit **(Fig. 9)** along with mature cherry, red, pin and bur oak, hackberry and ironwood. There is a conspicuous lack of other age trees, but patches of seedlings have developed since grazing ceased. Exotic brush, buckthorn and honeysuckle in particular, are well established in scattered areas. The condition of the ground layer was not apparent at the time of the 2009 survey.

**Figure 9.** Mature sugar maple with buckthorn seedling carpet.

Any species that may have survived the grazing will have a better chance to express themselves after invasive brush removal.

Where the pipeline transects this unit on the east side, the corridor has been mowed and supports some grassland species. Kentucky bluegrass was dominant, but a few native forbs were also found: bergamot, false gromwell, ironweed, sneezeweed, figwort, and horse gentian. A few non-native species were also noted, such as sweet clover, motherwort and mullein.

The area of potential maple basswood restoration covers about 36 acres on the northeast-facing slope of the terrace. Transition between the maple-basswood and the oak savanna areas on the crest of the terrace is somewhat arbitrary. Exotic brush removal is the primary activity needed to begin restoration of this plant community. After the exotic brush is removed an assessment of ground layer species and recruitment of tree species diversity will be needed before recommendations can be made to augment ground, brush, or tree layers in the forest.

## WMA Oak Savanna (Units OS1 and OS2)

The OS units were very shrubby, overgrown areas on the crest and upper southwest face of the terrace. The only indicator of a possible former oak savanna condition was the scattered open grown bur oak **(Fig. 10)**. They most often occurred on the crest of the ridge in the west part of the site adjacent to the old field (PR1) west of E. 4th Street. If the old field is converted to a native grassland/mesic prairie, oak savanna would be a good choice for a transition community all along the top of the terrace between the fields/prairie reconstructions and the maple basswood forest to the northeast.

**Figure 10.** Area of over-grown bur oak and scattered large cedar (GPS 16).

The canopy of the OS units was somewhat open, and was dominated by young bur oak and red cedar. A few large (30 inch) silver maple were also present, as well as small hackberry and butternut. The shrub layer was fairly dense and

was dominated by buckthorn and red cedar. Small bur oak, green ash and basswood were also present. The groundcover was moderate, with tree seedlings

Recommendations for restoring these units to savanna are to cut and treat invasive brush, followed by successive burns for up to three years. Repeated treatment of invasive shrubs will be needed. Interseeding with native prairie/savanna ground species may be initiated after burning for at least three years. Other invasives, such as prickly ash, may require cutting if fire does not set them back sufficiently. In addition, the house on the west side of the property is located very close to the property line. Planting red cedars along the property line should be considered to provide a clear indication of the boundary for hunters and to provide some screening for the neighbors.

## WMA Old Field (Units PR1 & 2)

The old field units were dominated by quack grass and Kentucky bluegrass. A few common native forbs were present, including bergamot, giant goldenrod, horse gentian, common milkweed and heath aster. Non-native forbs were not abundant, but included sweet clover, birds'foot trefoil, red clover, mullein, dame's rocket and butter and eggs.

Very little evidence of any prairie remnant on this site was encountered, either in historic records or photos. However, its presence or reconstruction on this site is not out of line with historic vegetation in this region. The presence of open grow oak may be an artifact of a past savanna/prairie complex or years of intense grazing. Two areas on top and west slope of the terrace are targeted for prairie reconstruction. For management purposes, reconstruction of prairie both east and west of E. 4th Street **(Fig. 11 & Map 5)** is recommended. It will provide open grassland for grassland species, and facilitate efforts to burn for savanna restoration and invasive shrub management.

**Figure 11.** Old field of bluegrass west of E. 4th Street (GPS 29).

The target plant community for these units would be Southern Dry Prairie (UPs13). Exotic shrub removal would be needed prior to any other steps, and then standard practices for establishing prairie in old field would be applicable: burn or mow, one or two herbicide applications to regrowth. Rather than discing the soil, however, simply broadcasting native seed (see **Appendix B** for suitable species) in the fall after herbicide can be and effective and less invasive technique. Applying herbicide during cool season would also

be recommended, to maximize impact on non-native grasses, while minimizing negative impacts to remnant native species. Mowing after seeding 2 – 3 times the first growing season followed by a second year of higher, less frequent mowing is typical. By the second or third year, burning may be introduced as a management tool for establishing and promoting the native prairie species and holding back the exotic and invasive shrubs and trees.

## WMA Grassland (Unit GR5)

The 15-acre grassland unit at the WMA was similar to the AMA grasslands in that is was dominated by reed canary grass, but unlike the AMA units, GR5 also had some diversity of native species. Many species were typical of a wet meadow, such as ironweed, marsh hedgenettle, swamp milkweed, smartweed, spreading dogbane and sedge species. There were several common non-native species, such as burdock, giant ragweed, sweet clover, bird's foot trefoil, and curly dock. These were found along the old road are not of significant management concern to the wetland, but should be eliminated before they spread.

Willows and boxelder were common in the shrub layer, but total coverage was only about five percent. Tree coverage was a little greater with willow trees dominant in more wooded areas. Scattered individual boxelder, cottonwood, green ash and silver maple were in the grassland.

This unit would be well-suited for restoration to a Wet Meadow/Carr (WMn82) community. It would require eradication of the reed canary grass and re-seeding with native forbs and graminoids. Methods to accomplish this would be to burn the grassland in spring or fall, when conditions allow. After regrowth reaches a height of about six inches, it could be sprayed with a grass-specific herbicide. This will eradicate the reed canary, but since there are no native grasses it would cause no harm to other plants. Application of the herbicide must take into account any surface water present. Ideally there would be none. If water is present, an aquatic formula of grass herbicide would have to be used, if available. If not, it may be feasible to treat the reed canary with a non-selective aquatic formula later in the fall when most native species are dormant.

It will take several years of treatment, typically several treatments per year, to reduce the reed canary. Since there are some existing native species present, it may not be necessary to re-seed the site, but this should be assessed. A list of suitable species is provided in **Appendix B**.

## Long-term Monitoring

Restored areas must be regularly monitored, at least once annually, to identify ecological issues, such as erosion, invasive species, and disease. Monitoring is also important for detecting human-related issues such as illegal activities (hunting, ATV use, etc). Early detection of concerns enables quick responses to address them before they become

significant problems. Exotic species can be managed by a combination of mowing, pulling, herbicide, and biocontrol (for some species).

It is also important to evaluate the success of restoration tasks by establishing permanent vegetation monitoring plots or transects. Plots/transects should generally be surveyed after significant restoration activities, to assess the effectiveness of the task, or annually for long-term assessment. The plots should be set up for easy access and survey methods should be straight-forward, repeatable and designed to provide the information needed. Releves, for example, are useful for a general assessment, but do not provide accurate information of small changes in coverages unless there are numerous plots.

Monitoring animal as well as plant communities is also helpful for evaluating results of the restoration. A comparison of bird populations before and after restoration, for example, is a useful tool for quantifying positive changes on the land.

# RESTORATION SCHEDULE AND COST ESTIMATES

The Freitag property is too large of a site to undertake all of the restoration recommendations at one time. The project was therefore divided into three phases (**Map 6**). Tasks within each phase were also prioritized (1 is highest), so projects that could most readily be postponed are easily identified.

The first phase, about 70 acres, is focused on restoration of the maple-basswood forest, as this was determined to be a higher quality remnant area on the site, yet in need of immediate attention before degradation advances. Because the first task involves exotic woody plant removal, a portion of the AMA where it is connected to the maple-basswood forest was included in Phase 1. The rest of Phase 1 involves restoring oak savanna and prairie on the terrace.

Phase 2, about 68 acres, covers the rest of the WMA, including exotic brush removal at the oldest floodplain forest units on the site, and restoring the other half of the maple-basswood forest, savanna and prairie, and restoring a reed-canary dominated wetland to wet meadow.

Phase 3, about 147 acres, covers the majority of the AMA and involves exotic woody removal in the floodplain forests, and restoring the reed-canary grasslands to floodplain forest. Some small opportunities for wet meadow/marsh restoration are also discussed.

Each of the phases is expected to take about five years to accomplish, but the phases could overlap. Exotic woody removal, for instance, may be more efficient to conduct for the entire property all at once, to take advantage of biofuels. The scheduling, however, will be primarily dependent on available funding.

Undertaking the recommended restoration project in this plan would be a significant task, and assistance is available to help landowners with the process. Friends of the Mississippi River will continue to work closely with the landowners, if desired, to secure funding and implement all or parts of the management plan. FMR could hire and oversee contractors such as a professional firm listed in **Appendix E**.

An approximation of restoration/management tasks, priorities, and costs is provided in Table 5, below. Project cost estimates are not based on actual contractor bids, but on typical costs for similar projects. Actual project costs could be significantly higher or lower, depending on multiple factors. Costs could potentially be decreased by, for example, reducing the diversity of prairie seed costs, contracting for the entire project with one contractor, using volunteers or using STS (Sentence to Serve) crew for portions of the labor such as hauling brush and tree planting.

## Table 5. Five-year restoration task schedule

**Highest Priority: Phase 1(FF4, FF5, FF7, GR4, MB1, OS1, PR1) (67 ac)**

**Remove exotic brush, restore old field to prairie, plant grassland to floodplain forest trees.**

| Prior-ity | Season | Units | Activity | Ac | Cost/ac | Cost est |
|---|---|---|---|---|---|---|
| | **YEAR 1** | | | | | |
| 1 | Jan - March | FF4, FF5, FF7, MB1, OS1, PR1 | Cut, treat, burn or slash exotic brush | 64 | $ 550.00 | $ 35,200.00 |
| 1 | Mid-May | PR1, OS1 | Prescribed burn | 18 | $ 250.00 | $ 4,500.00 |
| 2 | Spr-Fall | GR4 | Prep site for tree seeding - see RCG Management Guidelines below | 7 | $ 500.00 | $ 3,500.00 |
| 1 | June | Whole property | Bird surveys (especially breeding season) | 302 | | $ 2,380.00 |
| 1 | End of June | PR1 | Broadcast spray with Round-up at 2.5 qt/a | 4 | $ 165.00 | $ 660.00 |
| 1 | Mid-July | PR1 | Prescribed burn | 4 | $ 250.00 | $ 1,000.00 |
| 1 | September | PR1 | Re-spray with Round-up at 2.5 qt/a | 4 | $ 165.00 | $ 660.00 |
| 1 | Oct | FF4, FF5, FF7, MB1, OS1 | Treat exotic brush repsrouts | 59 | $ 225.00 | $ 13,275.00 |
| 1 | October - December | PR1 | Purchase & broadcast native prairie seed | 4 | $ 500.00 | $ 2,000.00 |
| 1 | All | All | Ecological monitoring, evaluation | 70 | | $ 3,850.00 |
| | | | | | | $ 67,025.00 |
| | **YEAR 2** | | | | | |
| 1 | Spring | Whole property | Bird surveys | 302 | | $ 2,380.00 |
| 2 | Apr | GR4 | Broad spectrum herbicide (glyphosate - Rodeo + surfactant ($50/Qt), or imazapyr - Arsenal) when RCG is 10 - 12 inches tall, if feasible. | 7 | $ 70.00 | $ 490.00 |
| 2 | Apr | GR4 | Purchase native trees - 300 per ac to supplement seeding | 7 | $ 300.00 | $ 2,100.00 |
| 2 | May | GR4 | Broadcast floodplain tree species seed. | 7 | $ 300.00 | $ 2,100.00 |
| 2 | Apr | GR4 | Install trees. Contractor (write specs) or use DNR Forestry Contract Process for tree planting. $0.15 per tree | 7 | $ 45.00 | $ 315.00 |
| 1 | May, July & Sept | PR1 | Mow 3X at 6 - 8 inches | 4 | $ 210.00 | $ 2,520.00 |
| 1 | Oct | FF4, FF5, FF7, MB1, OS1 | Treat exotic brush repsrouts | 59 | $ 225.00 | $ 13,275.00 |
| 1 | All | All | Ecological monitoring, evaluation | 70 | | $ 3,850.00 |
| | | | | | | $ 27,030.00 |

| Priority | Season | Units | Activity | Ac | Cost/ac | Cost est |
|---|---|---|---|---|---|---|
| | **YEAR 3** | | | | | |
| 1 | Spring | Whole property | Bird surveys | 302 | | $ 1,190.00 |
| 1 | July | PR1 | Mow 1X at 12 inches | 4 | $ 210.00 | $ 840.00 |
| 1 | Oct | FF4, FF5, FF7, MB1, OS1 | Treat exotic brush repsrouts | 59 | $ 225.00 | $ 13,275.00 |
| 2 | Summer 1-2X | GR4 | Spray grass-specific herbicide (i.e. sethoxydim or flauzifop) around tree seedlings | 7 | $ 170.00 | $ 2,380.00 |
| 1 | All | All | Ecological monitoring, evaluation | 70 | | $ 3,000.00 |
| | | | | | | $ 20,685.00 |
| | **YEAR 4** | | | | | |
| 1 | Mid-May | PR1, OS1 | Prescribed burn | 18 | $ 250.00 | $ 4,500.00 |
| 1 | Spring | Whole property | Bird surveys | 302 | | $ 2,380.00 |
| 2 | Summer 1-2X | GR4 | Spray grass-specific herbicide (i.e. sethoxydim or flauzifop) around tree seedlings | 7 | $ 170.00 | $ 2,380.00 |
| 1 | Oct | FF4, FF5, FF7, MB1 | Treat exotic brush repsrouts | 46 | $ 225.00 | $ 10,350.00 |
| 1 | All | All | Ecological monitoring, evaluation | 70 | | $ 2,625.00 |
| | | | | | | $ 22,235.00 |
| | **YEAR 5** | | | | | |
| 1 | Spring | Whole property | Bird surveys | 302 | | $ 2,380.00 |
| 2 | Summer 2 - 3X | GR4 | Spray grass-specific herbicide (i.e. sethoxydim or flauzifop) around tree seedlings | 7 | $ 210.00 | $ 3,780.00 |
| 1 | All | All | Ecological monitoring, evaluation | 70 | | $ 1,600.00 |
| | | | | | | $ 7,760.00 |
| | Subtotal Phase 1 | | | | | **$ 144,735.00** |

**Second Priority: Phase 2 (OF5, FF2, MB2, OS2, PR2) (70 ac)**

Remove exotic brush, restore old field to prairie, restore grassland to wet meadow.

| Priority | Season | | Activity | Ac | Cost/ac | Cost est |
|---|---|---|---|---|---|---|
| | **YEAR 1** | | | | | |
| 1 | Jan - March | GR5, FF6, MB2, OS2, PR2 | Cut, treat, burn or slash exotic brush | 68 | $ 550.00 | $ 37,400.00 |
| 1 | Mid-May | PR2, OS2 | Prescribed burn | 7 | $ 250.00 | $ 1,750.00 |
| 1 | End of June | PR2 | Broadcast spray with Round-up at 2.5 qt/a | 4 | $ 165.00 | $ 660.00 |
| 2 | Spring-fall | GR5 | Prep site for wet meadow seeding- see RCG Management Guidelines | 15 | $ 500.00 | $ 7,500.00 |
| 1 | Mid-July | PR2 | Prescribed burn | 4 | $ 250.00 | $ 1,000.00 |
| 1 | September | PR2 | Re-spray with Round-up at 2.5 qt/a | 4 | $ 165.00 | $ 660.00 |
| 1 | October - December | PR2 | Purchase & broadcast native prairie seed | 4 | $ 500.00 | $ 2,000.00 |
| 1 | Oct | FF6, MB2, OS2 | Treat exotic brush resprouts | 49 | $ 225.00 | $ 11,025.00 |
| 1 | All | All | Ecological monitoring, evaluation | 68 | | $ 3,750.00 |
| | | | | | | $ 65,745.00 |
| | **YEAR 2** | | | | | |
| 1 | May, July & Sept | PR2 | Mow 3X at 6 - 8 inches | 4 | $ 70.00 | $ 840.00 |
| 2 | Spring-fall | GR5 | Broad spectrum herbicide (glyphosate - Rodeo + surfactant ($50/Qt), or imazapyr - Arsenal) when RCG is 10 - 12 inches tall | 15 | $ 70.00 | $ 1,050.00 |
| 1 | October - December | GR5 | Purchase & broadcast wet meadow seed | 15 | $ 620.00 | $ 9,300.00 |
| 1 | Oct | FF6, MB2, OS2 | Treat exotic brush resprouts | 49 | $ 225.00 | $ 11,025.00 |
| 1 | All | All | Ecological monitoring, evaluation | 68 | | $ 3,750.00 |
| | | | | | | $ 25,965.00 |
| | **YEAR 3** | | | | | |
| 1 | June | PR2 | Mow 1X at 12 inches | 4 | $ 70.00 | $ 280.00 |
| 1 | May, July & Sept | GR5 | Mow 3X at 6 - 8 inches | 15 | $ 70.00 | $ 3,150.00 |
| 1 | May-Aug | GR5, PR2 | Treat exotic invasive forbs | 19 | $ 50.00 | $ 950.00 |
| 1 | Aug/Sept | GR5 | Spray grass-specific herbicide (i.e. sethoxydim or flauzifop) as needed | 15 | $ 70.00 | $ 1,050.00 |
| 1 | All | All | Ecological monitoring, evaluation | 68 | | $ 3,750.00 |
| | | | | | | $ 9,180.00 |

| Prior-ity | Season | | Activity | Ac | Cost/ac | Cost est |
|---|---|---|---|---|---|---|
| | **YEAR 4** | | | | | |
| 1 | Mid-May | PR2, OS2 | Prescribed burn | 7 | $ 250.00 | $ 1,750.00 |
| 1 | June | GR5 | Mow 1X at 12 inches | 15 | $ 70.00 | $ 1,050.00 |
| 1 | Aug/Sept | GR5 | Spray grass-specific herbicide (i.e. sethoxydim or flauzifop) as needed | 15 | $ 50.00 | $ 750.00 |
| 1 | Oct | FF6, MB2 | Treat exotic brush resprouts | 49 | $ 225.00 | $ 11,025.00 |
| 1 | All | All | Ecological monitoring, evaluation | 68 | | $ 3,750.00 |
| | | | | | | $ 18,325.00 |
| | **YEAR 5** | | | | | |
| 1 | Mid-May | GR5 | Prescribed burn | 15 | $ 250.00 | $ 3,750.00 |
| 2 | Summer 2 - 3X | GR5 | Spray grass-specific herbicide (i.e. sethoxydim or flauzifop) around tree seedlings | 15 | $ 210.00 | $ 3,780.00 |
| 2 | Oct | FF6, MB2 | Treat exotic brush resprouts | 49 | $ 150.00 | $ 7,350.00 |
| 1 | All | All | Ecological monitoring, evaluation | 68 | | $ 3,750.00 |
| | | | | | | $ 18,630.00 |
| SUBTOTAL PHASE 2 | | | | | | **$ 137,845.00** |

| Third Priority: Phase 3 (Units FF1, FF2, FF3, GR1, GR2, GR3) (146 ac) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Prior-ity** | **Season** | | **Activity** | **Ac** | | **Cost/ac** | | **Cost est** |
| | **YEAR 1** | | | | | | | |
| 1 | Jan - March | FF1, FF2, FF3, GR1 | Cut, treat, burn or slash exotic brush | 110 | $ | 300.00 | $ | 33,000.00 |
| 2 | Spring-Fall | GR1, GR2 | Prep site for tree planting - see RCG Management Guidelines below | 10 | $ | 500.00 | $ | 5,000.00 |
| 3 | Spring-Fall | GR3 | Prep site for tree planting - see RCG Management Guidelines below | 31 | $ | 500.00 | $ | 15,500.00 |
| 1 | Oct | FF1, FF6, FF7 | Treat exotic brush repsrouts | 105 | $ | 100.00 | $ | 10,500.00 |
| 1 | All | All | Ecological monitoring, evaluation | 147 | | | $ | 3,750.00 |
| | | | | | | | $ | 67,750.00 |
| | **YEAR 2** | | | | | | | |
| 2 | Spring | GR1, GR2 | Site prep, purchase & install trees & maintain. | 10 | $ | 935.00 | $ | 9,350.00 |
| 3 | Spring | GR3 | Site prep, purchase & install trees & maintain. (exclude powerline) | 24 | $ | 935.00 | $ | 22,440.00 |
| | Oct | FF1, FF6, FF7 | Treat exotic brush resprouts | 105 | $ | 100.00 | $ | 10,500.00 |
| 1 | All | All | Ecological monitoring, evaluation | 147 | | | $ | 3,750.00 |
| | | | | | | | $ | 46,040.00 |
| | **YEAR 3** | | | | | | | |
| 2 | Smr/Fall 1-2X | GR1, GR2 | Spray grass-specific herbicide (i.e. sethoxydim or flauzifop) around tree seedlings, mow between rows | 10 | $ | 90.00 | $ | 1,800.00 |
| 3 | Smr/Fall 1-2X | GR3 | Spray grass-specific herbicide (i.e. sethoxydim or flauzifop) around tree seedlings, mow between rows | 24 | $ | 90.00 | $ | 4,320.00 |
| 1 | All | All | Ecological monitoring, evaluation | 147 | | | $ | 3,750.00 |
| | | | | | | | $ | 9,870.00 |
| | **YEAR 4** | | | | | | | |
| 2 | Summer 2 - 3X | GR1, GR2 | Spray grass-specific herbicide (i.e. sethoxydim or flauzifop) around tree seedlings, mow between rows | 10 | $ | 90.00 | $ | 1,800.00 |
| 3 | Summer 2 - 3X | GR3 | Spray grass-specific herbicide (i.e. sethoxydim or flauzifop) around tree seedlings, mow between rows | 24 | $ | 90.00 | $ | 4,320.00 |
| 1 | Oct | FF1, FF6, FF7, GR1, GR2, GR3 | Treat exotic brush resprouts | 146 | $ | 100.00 | $ | 14,600.00 |
| 1 | All | All | Ecological monitoring, evaluation | 147 | | | $ | 3,750.00 |
| | | | | | | | $ | 24,470.00 |
| | **YEAR 5** | | | | | | | |
| 2 | July & Sept | GR1, GR2 | Spray grass-specific herbicide (i.e. sethoxydim or flauzifop) around tree seedlings, mow between rows | 10 | $ | 90.00 | $ | 900.00 |
| 3 | July & Sept | GR3 | Spray grass-specific herbicide (i.e. sethoxydim or flauzifop) around tree seedlings, mow between rows | 24 | $ | 90.00 | $ | 2,160.00 |
| 1 | All | All | Ecological monitoring, evaluation | 147 | | | $ | 3,750.00 |
| | | | | | | | $ | 6,810.00 |
| SUBTOTAL PHASE 2 | | | | | | | $ | 154,940.00 |

**TOTAL PROJECT COST ESTIMATE** **$ 299,320.00**

| Reed Canary Grass Management Guilelines (Units GR1, GR2, GR3, GR4, GR5 = 62 ac) | | | | | | |
|---|---|---|---|---|---|---|
| Prior-ity | Yr | Season | Units | Activity | | Cost/ac |
| 1 | 1 | Spring | | Burn when RCG is just active (spring)/or to remove thatch (fall) or Mow if burn not feasible. | $ | 270.00 |
| 2 | 1 | Before or instead of burn | | Mow - to prepare for herbicide treatment or reduce fire behavior by lowering fuels | $ | 210.00 |
| 1 | 1 | After mowing or fire-May/June | | Broad spectrum herbicide (glyphosate - Rodeo + surfactant ($50/Qt), or imazapyr - Arsenal) when RCG is 10 - 12 inches tall | $ | 80.00 |
| 1 | 1 | Aug/Sept | | Mow to reduce height & stimulate growth (or burn). | $ | 60.00 |
| 1 | 1 | Oct | | Broad spectrum herbicide (glyphosate - Rodeo + surfactant ($50/Qt), or imazapyr - Arsenal) when RCG is 10 - 12 inches tall | $ | 80.00 |
| | | | | Total first year | **$** | **490.00** |
| 1 | 2 | Apr/May | | Broad spectrum herbicide (glyphosate - Rodeo + surfactant ($50/Qt), or imazapyr - Arsenal) when RCG is 10 - 12 inches tall | $ | 80.00 |
| 1 | 2 | Spring | | Purchase and broadcast cover crop native seed - e.g Virginia wild rye | $ | 200.00 |
| 1 | 2 | Spring | | Purchase 0-2 or 0-3 bareroot trees ($1.00 ea) 500/ac - see FF species list to select at least 3 - 5 species. | $ | 500.00 |
| 1 | 2 | April | | Install trees. Contractor (write specs) or use DNR Forestry Contract Process for tree planting | $ | 80.00 |
| 1 | 2 | June-Sep | | Mow twice between rows of trees | $ | 75.00 |
| | | | | Total second yr | **$** | **935.00** |
| 1 | 3-5 | Summer | | Spray grass-specific herbicide (i.e. sethoxydim or flauzifop) around tree seedlings | $ | 15.00 |
| 1 | 3-4 | Summer | | Mow between rows of trees 1 to 2X | $ | 75.00 |
| | | | | Total Yr 3-5 | **$** | **90.00** |
| | | | | **TOTAL** | **$** | **1,515.00** |

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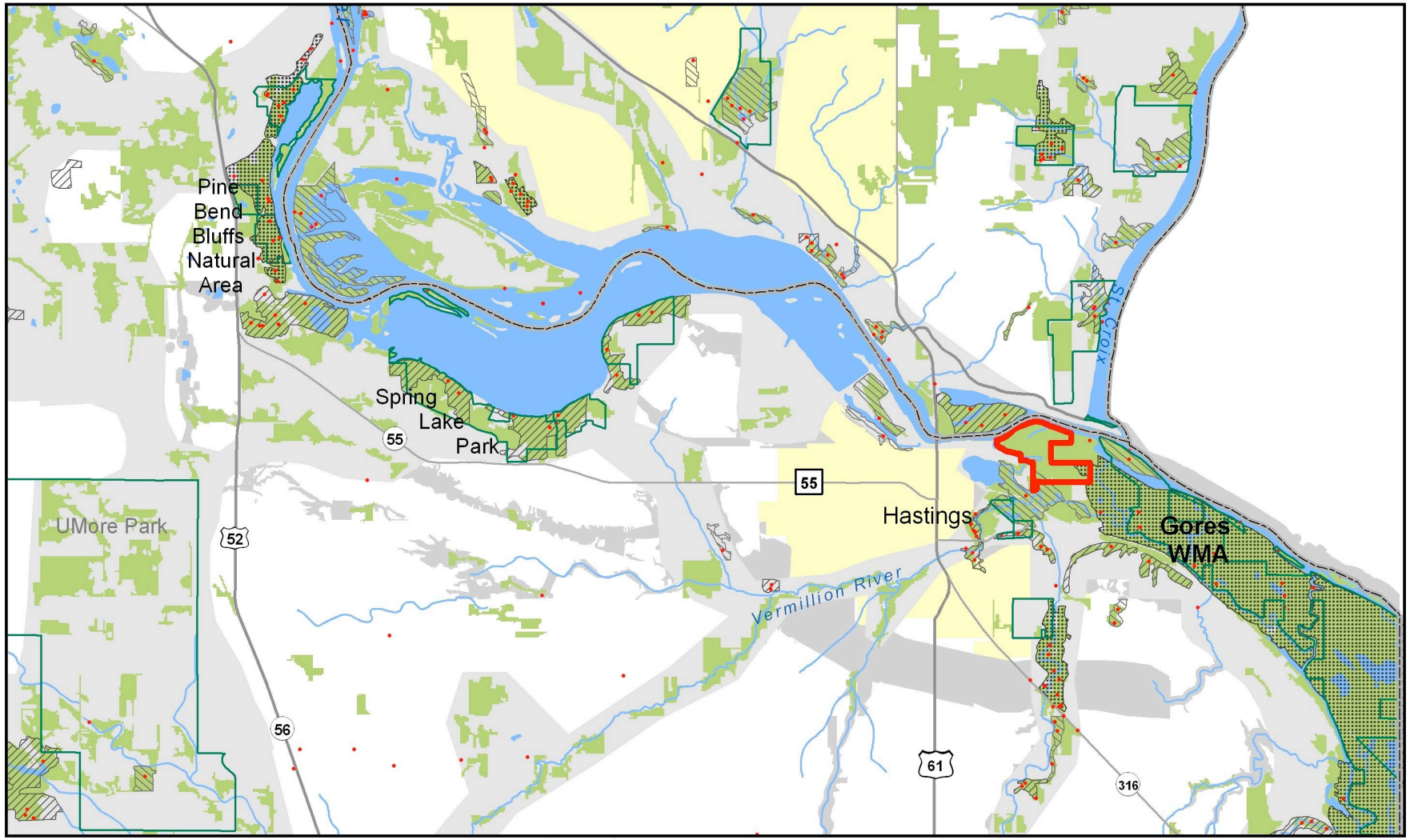



Sources: DNR data deli online data, DNR Natural Heritage database.

**Legend**

- Freitag Unit
- Parks and Natural areas
- Rare natural features
- Ecologically significant areas (DNR)
- Metro Conservation Corridors
- Mississippi Greenway Plan
- Outstanding biodiversity
- High biodiversity
- Moderate biodiversity

Natural Resource Management Plan
Gores WMA, Freitag Unit
T115, R17, Sections 22, 23, 26, 27

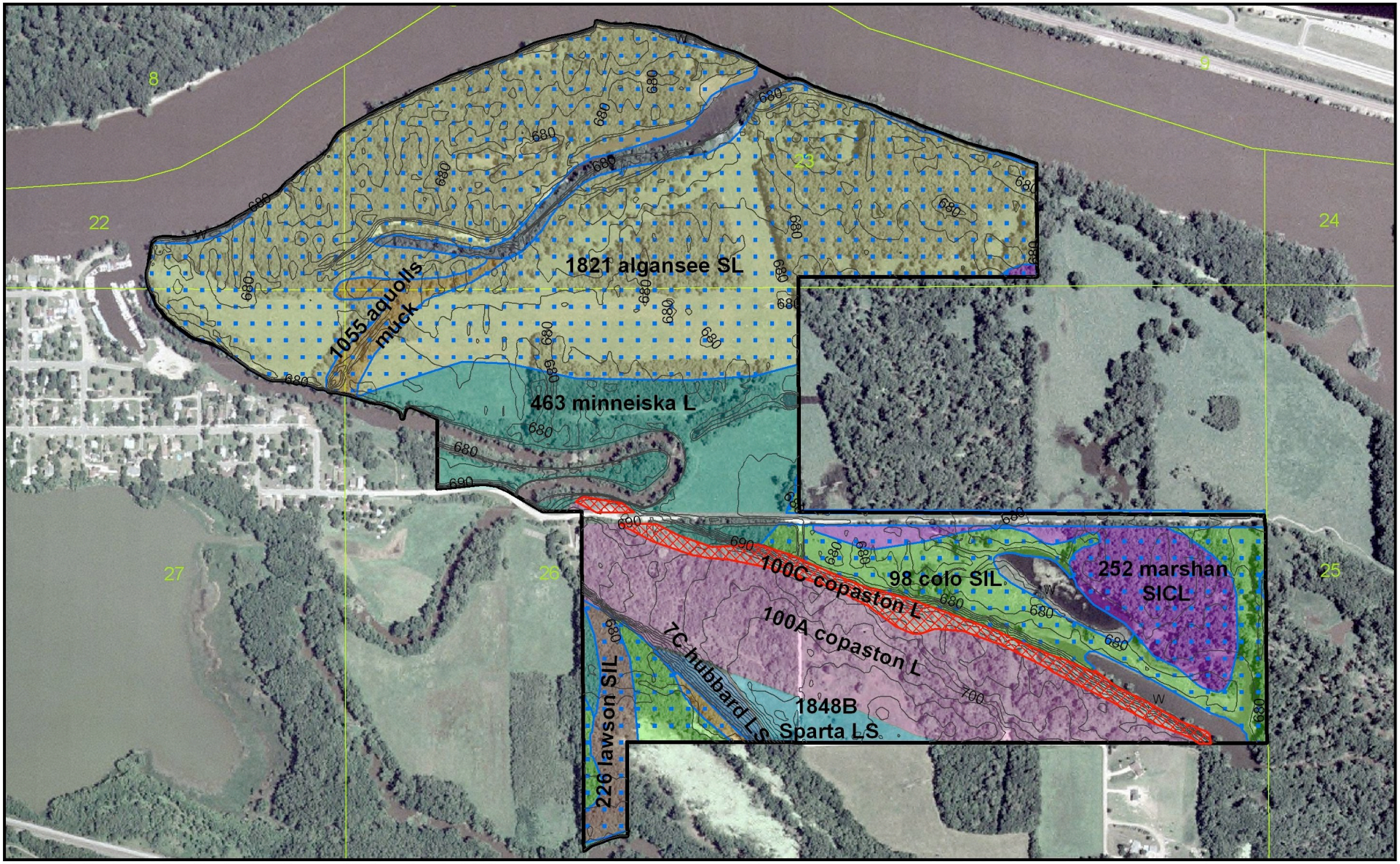
FRIENDS OF THE MISSISSIPPI RIVER

1:110,000

N

0 1 2 4 Miles

# Map 1. Landscape Context




Source: Soil Conservation Service, Soil Survey of Dakota County, 1983.
Farm Service Agency aerial, 2003.

1:9,103

N

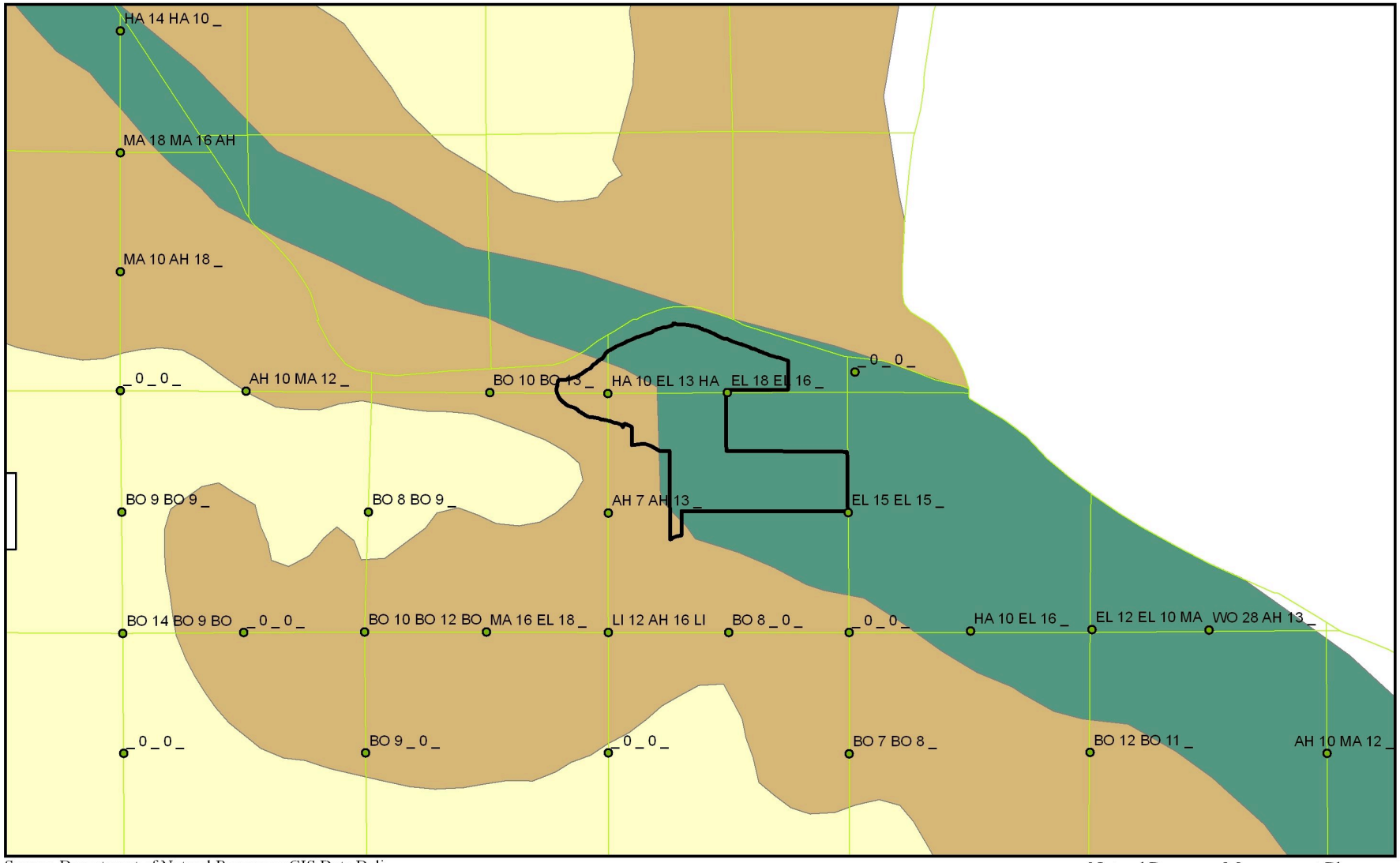
0 250 500 1,000 1,500 Feet

**Legend**

- Highly erodible soils
- Hydric soils

Natural Resource Management Plan
Gores WMA, Freitag Unit
T115, R17, Sections 22, 23, 26, 27

# Map 2. Soil Types




Source: Department of Natural Resources GIS Data Deli.

**Legend**

- Bearing trees-species, diameter
- Freitag Unit Gores WMA
- Section lines

**Presettlement vegetation**

- **Oak Openings and Barrens**
- **Prairie**
- **River Bottom Forest**

Natural Resource Management Plan
Gores WMA & AMA, Freitag Unit
T115, R17, Sections 22, 23, 26, 27

1:35,000

N

0 0.5 1 Miles

# Map 3. Presettlement Vegetation

## Map 4a: 1937Aerial Photo


Source: UMN Borchert Map Library

## Map 4b: 1964 Aerial Photo

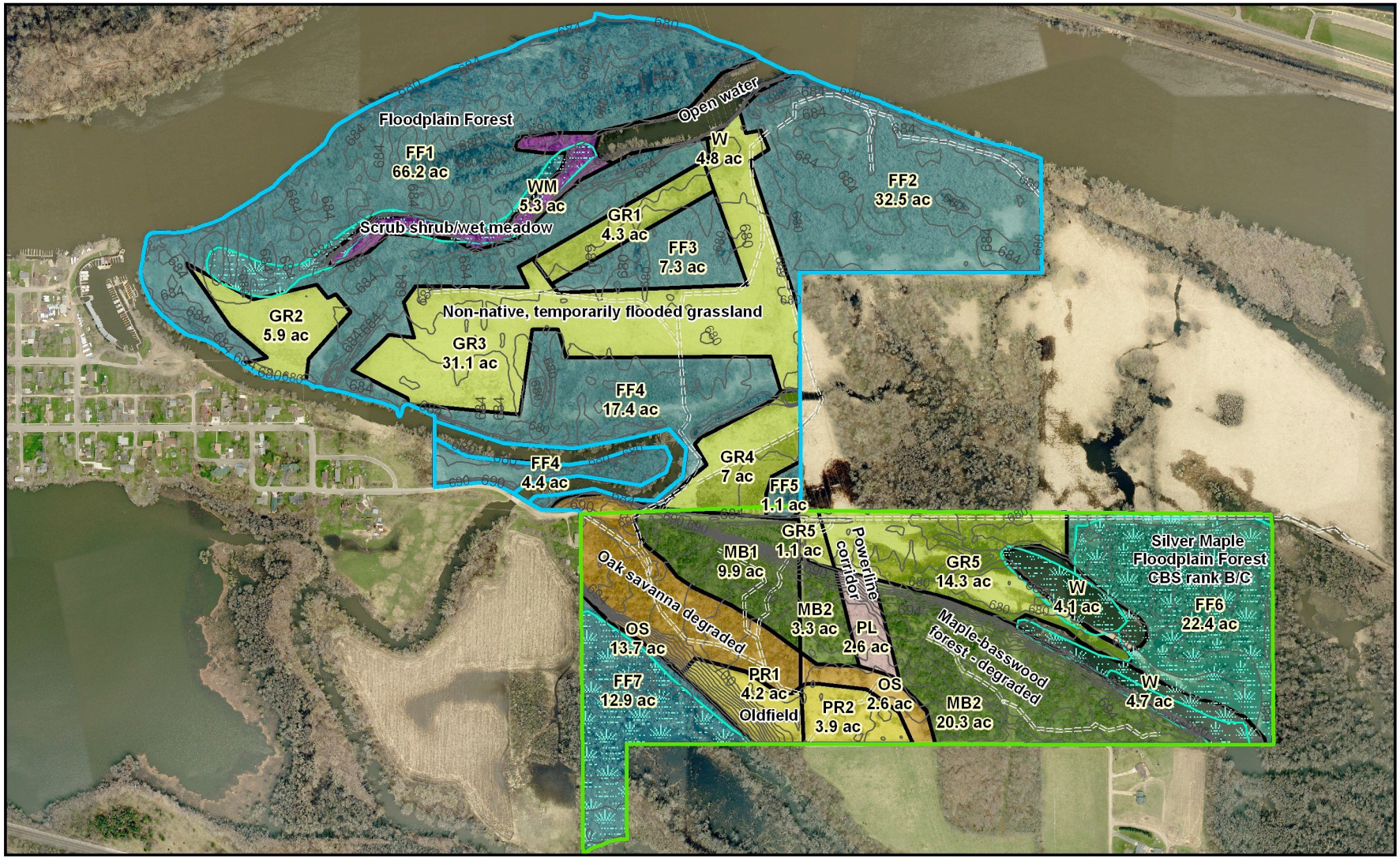

Source: UMN Borchert Map Library

1:12,500
1 inch = 1,042 feet
0 350 700 1,400 2,100 2,800 Feet

Freitag Unit Boundary

N

Natural Resource Management Plan
Gores WMA & AMA, Freitag Unit
T115 R17 Sect. 22, 23, 26, 217
Nininger Township




Source: Dakota County 2008 aerial.
DNR data deli online - Minnesota Land Cover Classification

Natural Resource Management Plan
Gores WMA, Freitag Unit
T115, R17, Sections 22, 23, 26, 27

FRIENDS OF THE MISSISSIPPI RIVER

1:9,089

N

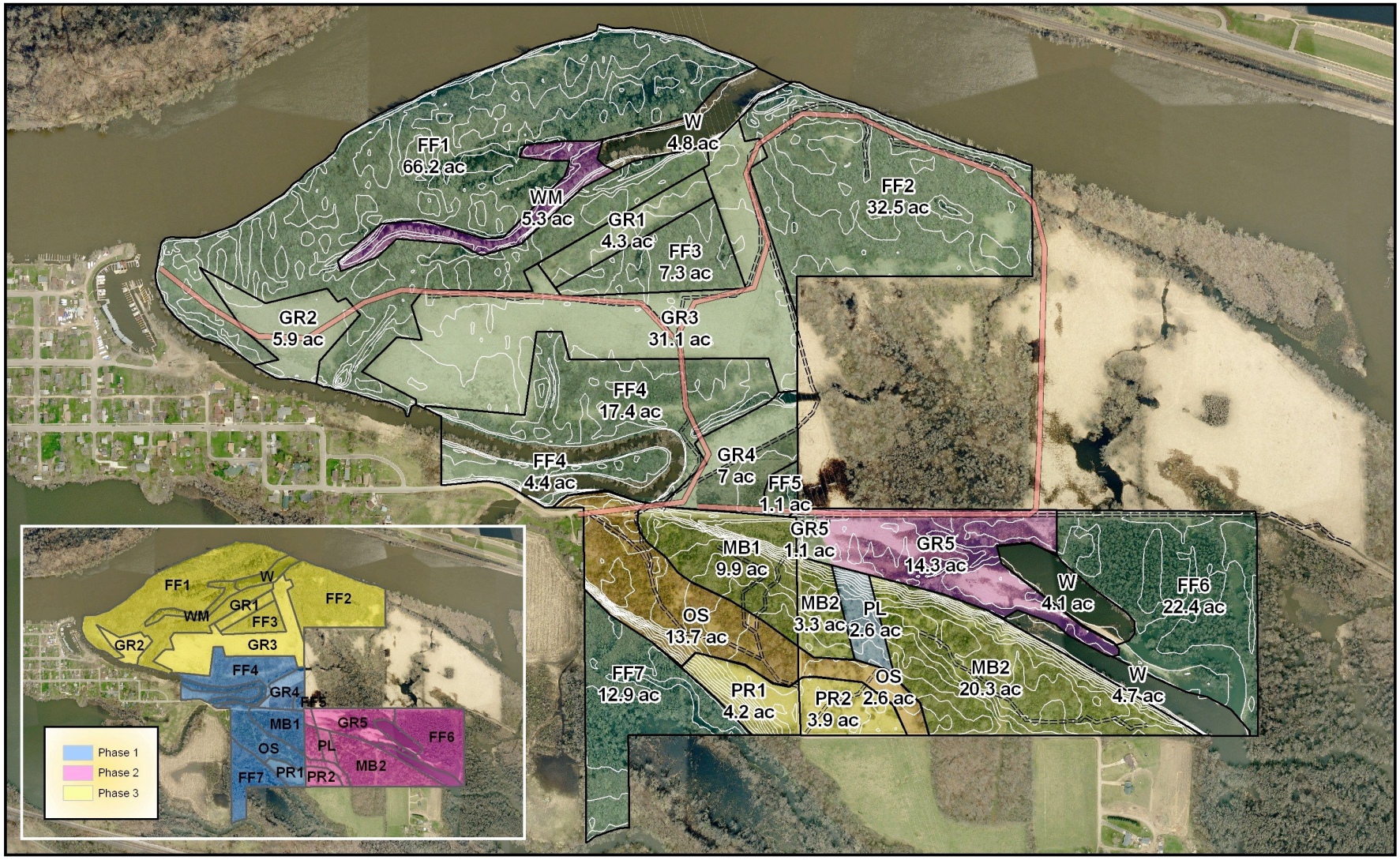
0 200 400 800 1,200 Feet

**Legend**

**Gores Freitag Unit**

- AMA 187 ac
- WMA 120 ac
- Roads & trails (white dashed)
- 2 ft Contours
- NWI wetlands

# Map 5. Existing Land Cover




Source: Dakota County 2008 aerial.

Natural Resource Management Plan
Gores WMA, Freitag Unit
T115, R17, Sections 22, 23, 26, 27

**Legend**

**Restoration Goals**

- Dry prairie
- Maple basswood forest
- Mesic/dry prairie
- Oak savanna
- Silver Maple Floodplain Forest
- Wet meadow/carr

- FF3 Management Units
- ProposedTrails
- ==== Roads & trails
- 2 ft Contours (whilte line)

FRIENDS OF THE MISSISSIPPI RIVER

1:9,239

N

0 200 400 800 1,200 1,600 Feet

# Map 6. Restoration Goals