

PINE BEND BLUFFS
SCIENTIFIC AND NATURAL AREA
RECHTZIGEL PARCEL
NATURAL RESOURCE MANAGEMENT PLAN



Wooded Ravine

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

2009

Prepared by:
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FRIENDS OF THE MISSISSIPPI RIVER

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

Landowner

Ruth Rechtzigel _____ Date: _____

Allen Rechtzigel _____ Date: _____

Dakota County

Alan Singer, Supervisor _____ Date: _____
Farmland and Natural Areas Program

By this signature, I have determined that the natural resource management goals of this plan and the activities proposed to meet those goals are consistent with preserving the conservation values stated in the conservation easement granted on this date _____, by Dakota County farmland and Natural Areas Program over the subject property.

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EXECUTIVE SUMMARY

In 2001, Friends of the Mississippi River (FMR) contacted Ruth and Allen Rehtzigel and the Dakota County Farmland and Natural Area Program (FNAP) to discuss land protection options. In 2007, the Rehtzigels made the decision to apply to the program to permanently protect a large portion of their 80-acre parcel. Subsequent to making this decision, reconstruction of Hwy 52 and the need to build storm water ponds on the property, have occurred, and discussions regarding the interest of Department of Natural Resources (DNR) Scientific and Natural Areas (SNA) Program in acquiring the land also evolved. The proposal for protection was subsequently approved for FNAP funding, prompting the request for FMR to develop this natural resource management plan for the property, in coordination with the landowners and Dakota County. The final protection details have yet to be worked out at the time of this writing.

The Rehtzigel parcel consists of about 80 acres located in Inver Grove Township in the east central portion of Dakota County. About 10 acres of the parcel was purchased by the City of Inver Grove Heights on which to construct two storm water ponds as part of the Hwy 52 reconstruction project. Most of the remaining 71 acres will be protected by a permanent conservation easement held by Dakota County. The size of an in-holding adjacent to the homestead and possibly including the drive, to be withheld for personal use is yet to be determined.

Although the property contains no known rare plant or animal species, rare species are found in close proximity. The native vegetation, in particular the oak 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 oak forest, woodland and savanna with patches of open prairie on the southwest and east-facing slopes. After European settlement, the property was mostly used for pasture and fire wood. Current land cover is (approximate): 52 acres oak forest dry sub-type, 5 acres floodplain forest, 5 acres altered non-native dominated grassland, and 2 acres residential/impervious land. The balance of 7 acres is under water.

A long history of agricultural uses, a lack of natural fire, 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 a conversion of the oak forest. The oak wilt is opening up the closed tree canopy of the oak forest. The increased sunlight and the earthworm invasion have resulted in the loss of the ground cover native to the shady conditions of the mature oak forest. These changes have created ideal conditions for the subsequent invasion of exotic species, notably garlic mustard (*Alliaria petiolata*), buckthorn (*Rhamnus cathartica*) and

honeysuckle (*Lonicera* spp.). 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.

The proposed oak forest restoration involves removing the exotic shrubs. The loss of the canopy oaks may drive the plant community toward savanna – especially on the southwest-facing slopes and more level areas away from the river, perhaps, grading into dry prairie on the upper slopes. This management plan will address some initial management activities while other options may develop – such as biological controls for garlic mustard and buckthorn.

In the short-term, grassland management would be to moderately improve it by reducing the most invasive woody and herbaceous species, and to stabilize the steep banks. A longer-term goal might be to restore it so that it more closely resembles the historic condition of dry prairie, dry oak savanna, or oak forest. Some of the grassland is along pipelines and power lines and will remain open grassland.

Although this natural resource management plan is required and cited in the conservation easement, the landowner is not required to implement any or all of the recommended activities. The enhancement and restoration activities detailed in the plan are allowable activities that may be completed with the consent of the landowner and Dakota County. Moreover, the plan may be revised or altered with the joint approval of the County and landowners as necessary. Funding and implementing the plan and its associated projects and activities, though strongly encouraged, will be voluntary on the part of current or future landowners.

INTRODUCTION

This Natural Resource Management Plan presents the site analysis and management plan for the Rehtzigel parcel of the Pine Bend Bluffs Natural Area in Inver Grove Heights, Minnesota. The Rehtzigel parcel is between two sections of the Pine Bend Bluff Scientific and Natural Area (SNA), owned and managed by the Department of Natural Resources. The SNA is part of the larger Pine Bend Natural Area, a 1,300 acre area that is one of the least disturbed areas along the lower Mississippi River in the Twin Cities. Mesic oak forests occupy most of the Rehtzigel parcel from the riverbanks to the tops of the 200-foot bluffs.

The recommended management and land use activities for the 71-acre conservation easement of the Rehtzigel parcel are presented in this management plan. The document can be changed only by written agreement by both the landowners and Dakota County.

The purpose of this plan was to evaluate the existing condition of natural communities on the property, determine the target natural communities it could be restored to, define management and restoration methods for improving the wildlife habitat value of the property, and to document allowable uses and activities of the property.

The FNAP conservation easement requires a management plan for natural resource management practices and recreational uses on the protected property. Specifically, a management plan is needed to address the following activities that could potentially impact the natural resources:

- Manipulation or alteration of natural watercourses, lakes, shorelines, wetlands, springs or other surface or subsurface bodies of water.
- Alteration of the topography, including ditching, draining, filling, excavation or removal of soil, sand, gravel, rock or other materials.
- Removal of timber and other wood products.
- Creating, maintaining, restoring or enhancing habitat for wildlife and native biological communities.

Ecological Management Goals for the Property

The over-arching goal for the property is to restore ecological functions so that the property approximates conditions and functions that would have been present at the time of European settlement, approximately 1840. Specific ecological goals are to:

- Restore a complement of native plant communities to increase biological diversity, improve ecological functions and improve wildlife habitat.
- Provide connectivity with other natural areas in the landscape.
- Maintain and manage the property for water quality by avoiding or controlling any erosion, and retaining continuous groundcover throughout the site.
- Create a model for responsible land stewardship.
- Utilize this property to guide construction and surface water management activities on adjacent land (if developed) in a manner that protects and fosters natural community establishment.

BACKGROUND INFORMATION

Parcel Information

Owner name, address, city/township, county, and phone:

Allen (Butch) and Ruth Rehtzigel
10620 Courthouse Blvd.
Inver Grove Heights, MN 55077
651-554-9122
Inver Grove Heights Township, Dakota County

Township, range, section: T27N, R22W, N1/2 Section 27

Parcel data: Property Identification Numbers (PIN): 037-200270001075
(excluding west ~8 acres). Total size: 71 ac

Conservation easement: Held by: Dakota County
Size: 71 acres (excluding in-holding for house lot & drive)

Element Occurrences: Mesic Oak Forest: Status S2 - Imperiled due to rarity. 1993
DNR quality rank: Unit H=A/B; I=not ranked; K=B/C; N=A (see **Map 8** and **Table 2**).

Landscape Context

Proximity to established greenways

The Department of Natural Resources has identified a network of corridors throughout the Twin Cities metropolitan area, known as the Metro Conservation Corridors (MeCC), a strategy for accelerating and enhancing habitat protection and restoration by targeting high-priority focus areas. The network of connectivity is critical for the movement of native plants and wildlife across the landscape. The Rehtzigel property is located within the portion of the MeCC along the Mississippi River (**Map 1**). Pine Bend Bluffs SNA abuts the parcel on the north and south, the Katherine Ordway Natural History Study Area, Macalester College, is 1/2 mile to the north and also abuts the Rehtzigel parcel on the east on a river island. Flint Hills Resources Natural Area is 1 1/2 miles to the south. All of these areas are part of the larger Pine Bend Natural Area identified in 1993 by the Minnesota County Biological Survey as the largest diverse natural area remaining in Dakota County.

Ecological significance and wildlife value

The Rehtzigel parcel was identified by the Department of Natural Resources as an area of High Biodiversity Significance. One of the most important ecological features of the Rehtzigel parcel is the mesic oak forest, which occupies about 52 acres of the site. This plant community is considered imperiled in the state, due to its rarity. It provides wildlife habitat, riverbank protection, and water quality protection. It also provides connectivity with other natural areas in the landscape along the Mississippi River.

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 contains some of the area's most scenic native vistas. The Pine Bend Bluffs Natural Area contains several large populations of state endangered plants and several species that are unlisted but considered rare in Minnesota. The mature oak forests and approximately 1,340 feet of shoreline at the Rehtzigel property 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.

Dominant land use within a mile

Land use within a one-mile radius of the property can roughly be described as follows: 1 percent cropland, 24 percent natural/semi natural areas, 1 percent altered, non-native forest and shrubland, 8 percent non-native dominated grassland (pasture, hayfield & old field) and 62 percent residential development. The rest of the area around the Rehtzigel property in Dakota County, about 4 percent, is open water.

Site Geology

Geologic formation and bedrock

Glaciers were the primary force that shaped the present-day landscape of the Twin Cities metropolitan area. They determined most of the existing soil types and topography, which, in turn, affected the types of plant communities that developed. Glaciers carved the landscape, worked and re-worked the land surface, and deposited tremendous amounts of till and outwash. Most of Dakota County was overlain by sand and gravel glacial outwash from the Superior Lobe during Late Wisconsinan period. Later geologic processes altered much of the outwash area. Along the modern day Mississippi River in Dakota County, the outwash was carved away and over-deposited by water flowing from Glacial Lake Agassiz by Glacial River Warren. The Rehtzigel property is mostly covered by glacial till deposited by the Superior lobe of the last glaciers (**Map 2**). Only the southeastern-most corner of the site is composed of Superior outwash. Depth to bedrock is from 200 to 300 feet moving from east to west on the site. Summary of geologic information:

- Bedrock: Franconia Formation
- Depth to Bedrock: 200 - 300 feet.
- Elevation: From about 700 feet above sea level along the river up to 830 feet in the northwest part of the property.
- Ground Water Flow Direction: easterly.
- Sensitivity of the Ground Water to Pollution: The Superior outwash is mostly High (weeks to years). The Superior till covering most of the site is Moderate (several years to decades)

Soils

Most of the soils on the property are sandy loam. They were derived from loamy and sandy glacial till (**Map 2**). The soils types are summarized in **Table 1**. The following descriptions of the most prevalent soils on this site are based on information from Soil Survey of Dakota County (SCS 1983).

Table 1. Soil Types

Soil Code	Soil Name	Percent Slope	Acres	Erosion potential
1821	Alganssee sandy loam	0 - 2	6.2	low
98	Colo silt loam	0 -2	.04	low
1902B	Jewett silt loam	1 - 6	1.5	medium
342	Kinsley sandy loam	25 - 35	36.3	high
454F	Mahtomedi loamy sand	25-40	5.5	high
94C	Terril loam	4 - 12	5.8	medium

1821 Alganssee sandy loam

This nearly level poorly drained soil is on floodplains of major rivers. The surface layer of very dark grayish brown sandy loam is about 12 inches thick, the subsoil is about 60 inches. The underlying material is dark brown to yellowish-brown sand. The permeability of this soil is very rapid. The available water capacity is low, surface runoff is slow and the organic matter content and natural fertility are moderate to moderately low. The soil is fairly suitable for trees and most crops typically grown in the area. The greatest concern for this soil if cultivated or disturbed is wind erosion. The soil occupies the flat southern tip of the sand bar island at the east end of the Rehtzigel property.

98 Colo silt loam

This is a poorly drained soil on nearly level terrain in the lower part of drainage ways and in upland depressions. The very dark grey silt loam surface layer is about 8 inches thick, lying over a 41-inch thick layer of mottled silt loam and silty clay loam. The underlying material of mottled, very dark grey silty clay loam is about 60 inches thick. Permeability is moderate. Surface runoff is slow, available water capacity is high, and organic matter content is high. At the Rehtzigel property, this soil occupies .04 acre at the very west edge adjacent to the driveway.

1902B Jewett silt loam

This well-drained soil is on side slopes and hillcrests on end moraines. Typically the surface layer is very dark brown silt loam about 4 inches thick. The subsurface is brown silt loam around 9 inches thick. The subsoil is about 20 inches thick and composed of a yellowish brown silt loam top layer with a lower dark brown loam layer. The underlying material reddish brown sandy loam can be 60 inches deep. The permeability of this soil is moderate, available water capacity is high and runoff is medium. Organic matter content is moderate. If disturbed or cultivated, erosion is the primary concern. Jewett silt loam is well suited to woodland.

342 Kingsley sandy loam

In general, this soil type occurs on sloping to very steep slopes on side slopes and crest of hills and ridges of end moraines. The surface layer is black sandy loam 3 to 8 inches thick. The subsurface is brown loamy sand 4 inches thick. The subsoil is composed of an upper part of dark brown and reddish brown gravelly sandy loam that grades into a dark brown gravelly sandy loam totaling 26 inches thick. The underlying material is dark brown sandy loam with layers of loamy sand and is about 60 inches thick. The permeability of the soil is moderate in the surface layer and moderately slow in the subsoil and underlying material. The available water capacity is moderate and runoff is rapid. The organic matter content is moderate. Most areas of the Kingsley soil are in woodland or have been developed for housing. The soil is poorly suited to cultivation because of the high erosion potential. Map unit 342 covers the largest acreage on the Rehtzigel property.

454E Mahtomedi loamy sand

This is an excessively drained soil on hilly to steep slopes. It occupies pitted outwash plains and end moraines. The surface layer is about 4 inches thick of very dark gray loamy sand. The 28-inch subsoil is dark brown and dark yellowish brown gravelly coarse sand and coarse sand. The underlying material is yellowish brown stratified sand and gravelly coarse sand. Permeability of this soil is rapid, runoff is very rapid, available water capacity is very low, organic matter and natural fertility are low. The steep slopes and high erosion and drought potential make it poorly suited to crops. Lawns, shrubs and trees are also difficult to establish on this soil. This soil is found at the Rehtzigel property along the steep north-facing slope at the southeast corner of the site.

Topography

The topography at the site is primarily a consequence of historic water flows, which cut a series of ravines along the banks of the river. A prominent east-flowing ravine enters the property from the south and cuts deeply through the southeast corner of the site. In addition to the steep slopes along this ravine, other precipitous slopes are found along the banks of the river. The north and west part of the site is less dissected and more rolling.

Elevation drops about 212 feet, from 912 feet above sea level (asl) at the top of the slopes in the southwest corner of the property to about 700 feet asl at the mouth of the ravine and along the river. Slopes are over 35 percent in places, and are primarily south and east-facing. The direction of surface water flow is toward the large east-flowing ravine.

Erosion

The site was generally well vegetated, with minimal active erosion. The one area of erosion was along the gravel drive to the residence. Heavy rain events the summer of 2009 carried loads of sand and gravel from the drive down and over the cement parking pad by the residence. The runoff also deeply cut the ravine from the parking area down to the river. A large delta exists where the runoff enters the river indicating this erosion activity has occurred for a long time. The activity of earthworms and also to some degree, turkeys and deer, has begun to eliminate ground cover diversity, expose more and more soil, and create numerous mineral soil paths. The dominant plant on the floor of the woods is the invasive exotic, garlic mustard. Evidence of sheet erosion can be observed at the base of trees on

steep slopes. There is a potential that erosion will accelerate and cause more damage to slopes and ravines in the future.

Rare Species

There are no records of rare plant or animal occurrences directly on the Rehtzigel property. However, there is a bald eagle nest on the top of a pole on the power line easement on the Rehtzigel's south boundary. In addition, seven distinct rare plants and animals occur in the Pine Bend Natural Area, of which Rehtzigel's sits near the middle. Bald eagle (*Haliaeetus Leucocephalus*), creeping juniper (*Juniperus horizontalis*), fox snake (*Elaphe vulpina*), gopher snake (*Pituophis catenifer*), James' polania (*Polania jamesii*), and kitten-tails (*Besseyia bullii*) utilize and persist in the intact native habitat in this area largely due to the continuity of the relatively undisturbed vegetation. The mesic oak forest covering most of the Rehtzigel property has a state rank of S2, indicating it is imperiled in the state due to rarity.

Although a formal bird survey was not conducted for the Rehtzigel property, a survey was carried out on the adjacent SNA parcel to the south. Seven species of greatest conservation need were recorded on the SNA, including wood thrush, rough-winged swallow, eastern wood pewee, rose-breasted grosbeak, least flycatcher, field sparrow and brown thrasher. Other animals observed at Rehtzigel's were white-tailed deer and turkeys.

Historic Vegetation

Following glaciation, fire was historically the most important natural process in the region to influence plant community patterns. Wild fires were a common occurrence and typically traveled from west to east in the region. Prairie persisted in part because regular fires prevented woody species from becoming established. Likewise, oak savanna communities – represented by prairie grasses and forbs with scattered individual or clusters of oak trees – were maintained because mature oak trees are fire-resistant, whereas seedlings and other woody plants are not. Woodlands and forests, on the other hand, developed in fire-protected areas, including north and east-facing slopes and ravines, low areas, and edges of streams and other water bodies.

Fire suppression began with European settlement in the mid 1800's, when most of the Twin Cities metropolitan region was developed for agricultural use. Remnants of native plant communities, especially prairie and savanna, are small and scattered and have been significantly altered by lack of fire. Most savannas and prairies have grown into woodlands and have been invaded by exotic shrubs (buckthorn and honeysuckle) that were brought from Europe and Asia as landscaping plants.

The best information available on plant communities present in Minnesota at the time of European settlement comes from the 1850's land surveyor notes, which recorded plant species at one-mile intervals. A compilation of those notes into a map indicates that the Rehtzigel property was primarily "oak openings and barrens," roughly equivalent to what

we now refer to as oak savanna (**Map 3**). The land survey information was a large-scale generalization, however, so it does not depict plant communities that may have been present at a finer scale. It is quite likely that the Rechtzigel property also had forested areas, especially in the deep ravines and north or east-facing slopes. The south and east-facing slopes may also have supported open prairie areas.

Historic aerial photographs from 1937 also provide some indication of the previous site conditions and vegetation (**Map 4**). It is apparent from the photograph that the north slopes of the ravines were forested, while south and east-facing slopes were much more open, appearing more as a prairie/savanna complex. It is difficult to determine how much this area may have been altered prior to 1937, but it seems reasonable to suggest that it could have been a more open savanna that had begun to fill in with trees in the absence of fire or grazing. The sequence of historic aerial photos from 1937 through 2004 (**Maps 4 through 6**) do show that the open areas become more wooded over time.

Historic and Existing Land Use

The Rechtzigel's purchased the property in 1987. Although it has been speculated that grazing may have impacted the site, no evidence of recent grazing (such as fences) or logging was noted in the 1993 DNR biological survey. No definitive indications of such activities are apparent on the aerial photos since 1938. At the time of the 2009 site visits, area H north of the drive (**Map 8**), was lacking brush and woody litter (**Photo 1**). A number of stumps and scattered firewood were observed. Mrs. Rechtzigel reported that firewood removal had taken place as a response to the extensive oak wilt affecting the area. No fencing was encountered that would indicate past grazing activity.



Photo 1 – Area of fire wood removal north of drive

Water Resources

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

There is one major ravine in the south half of the Rehtzigel property that dissects the river bluff from the top of the SNA to the south, and ends at the river near the southeast corner of the subject property. There is one significant branch to this ravine that cuts into the south part of the property west to east. As mentioned above, the only ravine found with active erosion was north of the driveway.

One small wetland (**Photos 2 & 3**) is located in the middle of the north part of the property (**Map 7**). Although some small patches of reed canary grass have become established in this little wetland, it is mostly populated with cut rice grass (*Leersia oryzoides*) and sedges. And surrounded by various trees and brush including oak, dogwood, and box elder. The wetland



Photo 2 – South half of wetland



Photo 3 – North half of wetland

management is discussed in the Target Communities section, under oak forest and woodland.

Of course, the major surface water feature in this property is the Mississippi River. The river action influences the shape and size of the island, a portion of which is part of this property. The river between the island and mainland of the Rehtzigel property is a side channel. The main navigational channel is on the east side of the island. The alluvial soils of the island are in turn deposited, sorted and removed, over and over, as the river moves and floods periodically. The soils and therefore the vegetation on the island may be relatively stable and long-lived in parts of the island, and more frequently changing in other parts. The river also impacts the shore of the mainland through deposition and erosion. The shoreline of the Rehtzigel property is steep, indicating erosion or cutting away of the land is more pertinent than deposition in this area. This is mainly due to the fact that the parcel is situated on the outer curve of a major bend in the Mississippi River. The greater incidence and degree of flooding that has occurred in recent decades, due to much greater impervious cover on the land, may also contribute to increased erosion along the shoreline. The outwash from ravines across the land affects the quality of the water in the river. The

maintenance of the navigation channel, including dredging, may have some effects on this property, but not of a nature to be addressed in this document.

Groundwater recharge or infiltration areas

The Geologic Atlas of Dakota County shows that most of the Rehtzigel site is underlain by the Superior till soils (Colo, Kingsley, Jewell and Terril loams) has a rating of “moderate” for sensitivity of the groundwater to pollution. These soils are moderately “permeable.” 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 very south east corner of the site is underlain by Mahtomedi loamy sand, a Superior outwash soil that is rapidly permeable, resulting in an area highly sensitive to groundwater pollution. Management recommendations will take into account these soil types and sensitivities.

Storm water management issues (erosion, contaminants, buffers)

The steep, erodable slopes on the Rehtzigel property are sensitive to erosion. The loss of ground cover due to the activity of earth worms may lead to erosion issues at some point. There were no areas seen with erosion that required specific management actions. The city of Inver Grove Heights purchased approximately 10 acres on the west end of the Rehtzigel property and built two storm water ponds and raceways to alleviate previous issues originating in a developed area west of Hwy 52 (**Map 8**).

Water resource management and restoration

Land use changes that have been taking place during the past several decades have helped to mitigate any erosion issues that may have existed in the ravines that dissect the Pine Bend Natural Area as a whole. Pasturing ceased, allowing grasses to recover, which then reduced runoff volume, velocity, as well as sediment and contaminant loads. Cultivation of the level bluff tops on much of the adjacent lands also ceased, which would have had similar positive effects. Further restoration of prairie, savanna and woodland will tend to stabilize the ravines. Comparison of 1937, 1951, and recent aerial photographs indicate that the east and south-facing slopes were more open in the past. It is possible that prairies once occupied these exposures as it still does to the south in other parts of the Pine Bend Natural Area. There may also have been grazing or logging that sustained more open vegetation as seen in the 1951 photo, but no information has been found to support any such activities.

While the existing vegetative cover at the site provides fair water quality benefits to the area and river, additional measures might be considered to improve water quality benefits and to further wildlife benefits. Those measures are discussed in Section 8 of this report.

Existing Land Cover and Ecological Concerns

The Minnesota Land Cover Classification System (MLCCS), developed by the Department of Natural Resources, defines and classifies all types of land cover (**Map 7**). This information was used as a basis for the site evaluation, which was conducted by FMR’s ecologists in summer 2009. Most of the Rehtzigel property, about 51 acres, was classified as mesic oak forest. Ecological information recorded for each management unit included the plant species and their relative coverage (**Appendix A**), soil type, slopes, animal signs, and ecological concerns, such as erosion, exotic species etc. Each of the land cover units is summarized in **Table 2**, and described in the paragraphs below.

While the DNR quality rankings from 1993 (**Table 2**) indicated a high quality site, the 2009 assessment revealed a much different condition. Degradation by non-native species, in particular, resulted in quality ranking of C to D throughout the site. The ravine in the southeast part of the site was slightly better quality than the rest of the site, as was the floodplain forest.

Table 2. Existing Land Cover

1993 CBS Unit	Existing Land Cover (MLCCS)	Acres	DNR Quality*	Dominant soil types
H	Oak Forest Dry Subtype	15.1	AB	Kingsley Sandy Loam
I	Oak Forest Dry Subtype	12.4	Not Ranked (<D)	Kingsley Sandy Loam
K	Oak Forest Dry Subtype	7.2	BC	Kingsley Sandy Loam
M & N	Oak Forest Dry Subtype	17.7	A	Kingsley Sandy Loam
Island	Floodplain Forest	5.0	AB	Alganssee Sandy Loam
Power line	Non-native Dominated Vegetation	4.8		Kingsley Sandy Loam & Mahtomedi Loamy Sand
River	Slow Moving Linear Open Water – Mississippi R.	7.5		
House site	11 – 25% Impervious Cover	1.6		Terril Loam
	Total	71.3		

*A = full complement of native species, B=some loss of native species, but minimal exotics. C=some exotic species, but natives dominant. D= dominance of exotic species.

Oak Forest

Historic condition

In 1993, the Rehtzigel property was surveyed by the Department of Natural Resources County Biological Survey (CBS) (**Map 8**). The area around and including this property exhibited a range of quality as described by the ecologists at that time. In general, the tops of the bluffs, where they had not been converted to agricultural use, supported woods that were “starting to deteriorate going to the west (away from the river)...ground cover thin or none locally...too much *Rubus occidentalis* (black raspberry), *Quercus ellipsoidalis* (pin oak) to 33 inches.” Or, “Attractive woods but appear somewhat disturbed, judging by the box elder, buckthorn, and lack of diversity in the ground cover...many big, dead trees...fallen trees and limbs present...ground cover variable, little to fair.” These areas were ranked BC (CBS area K – see **Map 8**) or not ranked at all (CBS area I), indicating a

high level of disturbance. On the other hand, toward the river and in the deep ravines, the ecologists found intact native woodlands and described them in glowing terms. CBS area H (ranked AB) was described as a "Very attractive woods with many trees 15-24", good understory, good ground cover. 2 stumps seen." And as in CBS areas M and N (ranked A) "Beautiful isolated wooded ravine. Many tall large closed-grown trees. Many moss-covered fallen trees. Understory discontinuous. Ground cover discontinuous, not very diverse. No stumps, no old paths or roads."

Current condition

In 2009, this site was covered by Southern Dry-Mesic Red Oak – White Oak Forest (MHs37a). The forest supported a good variety of native species on which to build and improve despite suffering from oak wilt, earthworms and exotic invasive plants. The presence of non-native, invasive species and the influx of disease had hampered natural processes, opened the canopy increasing the soil temperature, and altered the vegetation composition and diversity.

In 2009, FMR ecologists found the conditions of the forest had declined. In particular, the ground layer was extremely depauperate and locally carpeted by the exotic invasive garlic mustard (*Alliaria petiolata*). Disturbance indicators such as Pennsylvania sedge (*Carex pennsylvanica*) were plentiful, while species typical of a healthy woods such as wild geranium (*Geranium maculatum*) and wild sarsaparilla (*Aralia nudicaulis*) were only incidentally scattered here and there. Earthworm infestation was prevalent throughout the site as was garlic mustard. The shaded slopes of ravines supported ferns including interrupted, lady and maidenhair ferns.

The shrub layer included grape, Virginia creeper, and boxelder and cherry saplings with locally abundant honey suckle and buckthorn. In general, the woods had not yet become over-run with these invasive shrubs. Elevated populations of disturbance species such as gooseberry (*Ribes cynosbati*) and prickly ash were common. Red oak, green ash and hackberry seedlings were found throughout to varying degrees.

The canopy was diverse, dominated by red and white oak, with bur oak, basswood, ironwood, hackberry, cherry and American elm. Extensive evidence of oak wilt from the recent past to present (scattered pockets of standing dead and fallen red oak) was seen throughout the site. The canopy cover was interrupted, 75 – 80%. There were also large, moss covered logs, 12 – 18 inches dbh, on the forest floor from past disturbance.



Photo 4 – Area south of drive with honey suckle

In 2009, the condition of the western portion of the site agreed with the 1993 description in

that it was disturbed and exhibited the same indicators of box elder, buckthorn, honey suckle, and lack of diversity in the ground layer (**Photo4**). The buckthorn ranged in size from small seedlings to 8-inch diameter mature plants. Honeysuckle was also common. Going toward the river, the vegetation was more lush and diverse in part due to the topography of the ravines. Buckthorn was less continuous but still found in patches. Other shrub species included red-berried elder, gray dogwood, gooseberry, black cherry, prickly ash, and raspberry.



Photo 5 – Wooded ravine south of drive

South of the drive and encompassing the large ravine in the southeast part of the site, was more intact, yet still affected by oak wilt, earthworms, and garlic mustard (**Photo 5**).

East of the small wetland in the north central part of the site, the woods were largely lacking the invasive shrubs. However, the ground layer was missing many elements typical of a dry oak woodland, earthworms were present, oak wilt had opened the canopy, and garlic mustard was well established throughout the area. The east edge along the Mississippi River was in similar condition (**Photo 6**).

Ecological concerns

Oak forest and woodland are very important plant communities for a wide variety of wildlife. The abundance and quality of these plant communities in the landscape has been enormously reduced and degraded since the time of European settlement, by agriculture, development, and exotic species. Managing and maintaining these communities at this property to improve ecological function and provide better habitat would be very beneficial. The location of this parcel on the banks of the Mississippi River also warrants ecological management of these forests to maintain and improve their function in water quality management.

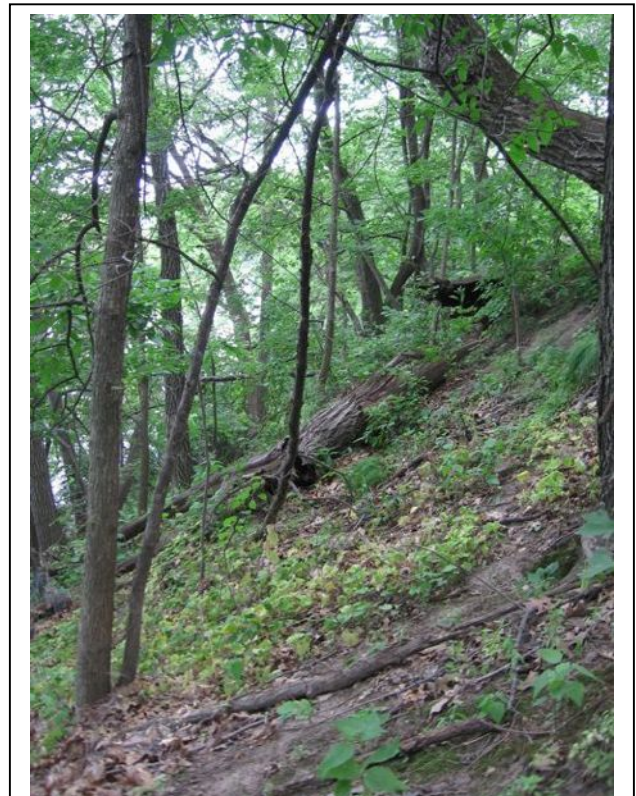


Photo 6 – West bank of the Mississippi River north of the Rehtzigel home site – exposed soils

The primary ecological concerns are the abundance of non-native invasive species (earthworms, shrubs and forbs), the elevated levels of deer and turkeys, and the presence of disease (oak wilt). The combined impact of these conditions contributes to elevated soil temperatures, the lack of native ground cover and tree regeneration, and the potential for soil erosion.

The soils in this area and especially on the slopes were very soft and erodible. As management activities proceed, it will be important to be aware of that, especially in areas of extensive invasive shrub removal. Prior to beginning shrub removal in such situations, the area should be evaluated and a plan developed that considers the need for erosion control measures and re-vegetation.

Oak wilt is a disease that primarily kills oaks in the red oak group (pin, northern red, black oak, etc), and can occasionally affect members of the white oak group. It has been in the region for many years, however, the spread during the last ten years has been dramatic and devastating. The woodlands have an abundance of large northern red oak and pin oak trees that are dead or dying, standing and fallen throughout the property. The canopy is opening to an extent that is more indicative of woodland or savanna than oak forest. Management methods available for this disease at the time of this writing (vibratory plow and removal of infected trees) are very invasive, and if considered, very strict guidelines will be needed to protect the ecosystem, especially the steep slopes and erodible soils. New methods may be developed over time that may be used to manage this disease in the future.

No specific effort was made to look for evidence or presence of emerald ash borer beetles. It should be noted that this disease is in the region and likely to affect these woods and forest in the future and that it is likely the ash component of the canopy will also decline or disappear. This will affect any tree planting considerations in that planting ash, red oak or American elm will not be a sustainable option for management.

Earthworms, which are non-native to Minnesota, were present throughout the site, resulting in decreased leaf litter, lack of humus or duff layer, increased bare soil and compaction, and decreased ground layer vegetation and diversity. While little can be done to control earthworms, it's important to be aware that their presence introduces alterations to the forest that result in reduced moisture retention, increased droughty conditions, and increased invasion by non-native, invasive species such as honeysuckle, buckthorn and garlic mustard (**Photo 7**). The



Photo 7 – Canopy opening and carpet of garlic mustard north side of large ravine

resulting dry soil conditions in addition to the droughts of 2008-09 in this area may also have contributed to the increase in the incidence of oak wilt by weakening the trees and making them more susceptible to disease. Restoring ecological processes to the landscape, such as introducing ways to promote native tree or other plant regeneration, is the best way to support native plant species and composition, and deter non-natives.

Wild turkey and white-tailed deer are likely overly abundant at the site. Deer browse was readily evident and well-used game trails were abundant throughout the site contributing to fragmentation of the plant communities and erosion potential. Turkeys graze in the leaf layer, scratching to find food. With large flocks this scratching behavior may augment the exposed soils and surface disturbance introduced by earthworms. If seedlings are planted as part of the restoration process, they will need to be protected from browsing.

When management activities are initiated at the site, it is especially important to plan for long-term monitoring and management. Once management begins, it must be continued for the long-term or the site will again become degraded. The most intensive management will happen in the first few years or so, then it typically tapers off to a maintenance level.

Floodplain Forest

Historic condition

Historic aerial photos show changes in the configuration of the island as water levels and flooding moved alluvium. Vegetation was eliminated along some edges and established on others over time. The photos did not reveal any indication of human activity on the island such as logging, mining or dredge spoil deposition.

Current condition

The Mississippi River island on the east edge of the property supports floodplain forest dominated by a dense canopy of silver maple and green ash. At the time of the 2009 evaluation, the ground layer was variable with some areas carpeted by creeping Charlie (**Photo 8**). Other areas were populated by a more diverse mix of forbs, sedges and ferns (**Photo 9**). Wood nettle was locally common. Vines were also present along the ground and into the canopy. Although much of the forest was made up of 12 – 18 inch green ash and silver maple, there were a few larger trees including silver maple (40 inches), hackberry and American elm (24 inches) (**Photo 10**).



Photo 8 – Floodplain Forest with carpet of creeping Charlie

Ecological concerns

Concerns on the island portion of the site occupied by floodplain forest are primarily the occurrence of occasional populations of buckthorn. Other invasives or disturbance issues are rare. Emerald ash borer will impact this forest type profoundly. Monitoring the island will be important as buckthorn management proceeds and other potential changes occur over time.



Photo 9 – West bank of Floodplain Forest island



Photo 10 – Mississippi River floodplain forest with large silver maple on right

MANAGEMENT GOALS AND RECOMMENDATIONS

Management Goals

The primary objective for this site 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,
- local temperature moderation.

Although these functions exist at some level on the site, restoration of the plant communities will improve the functions of the ecosystem. The next steps would be to improve the composition of the plant communities throughout the property to better reflect the diversity, composition and structure that would have been present at the time of European settlement. A healthy plant community can provide many advantages to the environment. It will provide much greater wildlife value than a degraded one. It tends to be much more stable and less susceptible to disease, invasive species and erosion. The improved condition also contributes to protecting the water quality of the river.

Target Plant Communities

The Minnesota Department of Natural Resources and the U.S. Forest Service developed an ecological classification system for Minnesota, based on climate, geology, topography, soils, hydrology, and vegetation (DNR 2005). This information is used to identify, describe, and map land areas with similar ecological features. Major climate zones and vegetation define the four ecological provinces in MN (prairie parkland, eastern broadleaf forest, Laurentian mixed forest, and tallgrass aspen parkland). The provinces are divided into ten sections, defined by origin of glacial deposits, regional elevation, distribution of plants and regional climate. Sections are further divided into 26 subsections, defined by glacial deposits, surface bedrock, and other features. Land type associations are 291 divisions within the subsections that are defined by additional features including lake and stream distributions, wetland patterns, depth to groundwater, soil parent material and pre-European settlement vegetation.

Most of the Rehtzigel property is classified as follows:

- Ecological Province: Eastern Broadleaf Forest
- Section: Minnesota & NE Iowa Morainal
- Subsection: St. Paul-Baldwin Plains
- Land Type Association: Wescott Moraine

This information is useful both in defining the existing plant communities and in determining suitable communities for restoration. Descriptions of each of the target plant communities are provided below, based on the Minnesota Department of Natural Resources *Field Guide to the Native Plant Communities of Minnesota, The Eastern Broadleaf Forest Province* (DNR 2005). Lists of plant species recommended for restoration are provided in **Appendix B**.

Based on the information of past vegetation and historic aerial photos of the area, it is likely that the bluff tops supported oak savanna and woodland, the east to southwest-facing slopes were more open with prairie species and the cooler, north-facing slopes were mesic oak forest as they are today. Because of the changes taking place in the established forest community, a possible goal for the site would be to facilitate establishment of southern dry-mesic oak savanna, woodland, and prairie in their historic locations while restoring the oak forest in the ravines.

Savanna would be most appropriate for the more level topography north of the drive. The savanna would grade through oak woodland into oak forest to the north as the land drops off, and also south of the drive where the land begins to slope up toward the power line. Approaching the east and south-facing slopes along the ravine in the south east part of the property, the oak woodland would grade into prairie openings. The north facing slopes would remain mesic oak forest. Savanna could also be encouraged along the grassland/woodland edges with the power line to the south and storm water ponds to the west.

Ideally, restoration of the oak savanna and forest would include the neighboring property to the north and south (Pine Bend Bluffs Scientific and Natural Areas (SNA) - MN DNR), since it is contiguous. It would be far more beneficial and efficient to restore contiguous portions of each plant community on all the properties at the same time.

Descriptions of the target plant communities, described in the sections below, can be used to guide the restoration process. Target plant communities for each of the management units were determined based on the apparent vegetative cover seen in historic aerial photos, topography and current plant community distribution on adjacent lands, and *The Field Guide to Native Plant Communities of Minnesota – The Eastern Broadleaf Forest Province*. The opening of the canopy due to the extent of oak wilt, and the prevalence of garlic mustard and earthworm infestations also influenced the restoration goals. Locations of the target plant communities are listed in **Table 3** below and indicated on **Map 9** along with the management units,

Table 3. Proposed Restoration

Management Unit	Target Plant Community	Restoration Priority	Acres
OF-1	Southern Dry-Mesic Oak Forest (MHs37b)	3	3
OF-2		3	6
OW-1	Southern Dry-Mesic Oak Woodland (FDs27b)	2	8
OW-2		1	12
OS-1	Southern Dry-Mesic Oak Savanna (UPs24)	2	20
OS-2		3	3
DP-1	Southern Dry Sand-Gravel Prairie (Ups13b)	2	4
DP-2		1	3
DP-3		1	1
FF	Southern Silver Maple Floodplain Forest (FFs68a)	1	7

Southern Dry-Mesic Oak Forest and Oak Woodland

The southern dry-mesic oak forest and southern dry-mesic oak woodland are very similar plant communities. Management methods will be similar for both so they are considered here together.

Description

Southern Dry-Mesic Oak Forest (MHs37a) (Unit OF-1, OF-2)

Oak forest has a canopy that is interrupted to continuous (50 – 100%) commonly composed of northern red oak, white oak, and basswood. The shrub layer is patchy to interrupted (25 – 75%) and typically includes northern red oak and black cherry saplings, Missouri gooseberry and pagoda dogwood.

Southern Dry-Mesic Oak Woodland (FDs27b) (Unit OW-1, OW-2)

Oak woodland has a canopy cover of about 50-100%, dominated by bur oak and northern pin oak. Northern red oak, white oak, and red maple are occasionally present. Because of the open canopy, the shrub layer is often very dense with patchy to continuous cover (25–100%). Common species include black cherry, red maple, chokecherry, American hazelnut, gray dogwood, prickly ash, and Virginia creeper. The ground-layer cover is patchy to continuous (25–100%) and includes Pennsylvania sedge, pointed-leaved tick trefoil, Clayton’s sweet cicely, hog peanut, Canada mayflower, and wild geranium.

A small wetland (0.4 acres) within the oak woodland has some native plant components: sedges, grasses, and forbs, but also an abundance of the non-native reed canary grass. The National Wetlands Inventory classifies it as a deep marsh (PUBF Pulustrine/Unconsolidated Bottom/semi-permanently flooded). Common species of a marsh system include rice cut grass, soft-stemmed bulrush (*Scirpus validus*), bur marigold (*Bidens spp*), and broad-leaved

arrowhead (*Sagittaria latifolia*). Soil is usually covered with 6" to 3' or more of water during the growing season.

Management steps

1. Exotic woody plant removal. The process of restoring the forests and woodlands begins with exotic shrub removal. In most cases this will be a straightforward process of cutting and treating the stumps (**Appendix C**), but more evaluation will be needed for the denser buckthorn areas. If shrub removal will result in a very open canopy cover, the steep slopes may be susceptible to erosion, as well as additional invasive species. Erosion control or other measures maybe needed, such as seeding bare slopes with native seed, covering with erosion blanket, adding coconut fiber rolls, installing brush bundles, planting native shrubs, etc. In terms of priority, OW-2 would be the most important unit to begin to manage at the site, as it has the least disturbance and the best ecological condition.

2. Follow-up exotic woody plant control. Once shrubs are removed, follow-up control of resprouts and seedlings will be needed for several years. Prescribed burning may be used in areas slated to be restored to woodland, savanna and prairie. Burning for up to three successive years will help to control seedlings. Late spring burns are most effective for setting back and killing seedlings, but may also have more negative impact on native woodland wildflowers, though it is not known if there are many species present. Whether woodland wildflowers are present or not, burn impacts should be minimized by establishing multiple burn units to avoid burning all of the plant community type in one year. Staggering burns between units so that no adjacent units are burned in consecutive years is also a DNR requirement, to protect desired plant and animal habitat. The forested north-facing slopes will best be managed without fire to avoid damage to fire sensitive species, especially forb species.

In addition to fire, spot-spraying resprouted shrubs and plants that were too small to cut and treat the first time will be needed as well. Broadcast or foliar spray herbicide treatments are generally not recommended because of the potential impact to non-target species. Spot treatment will likely be needed for at least two seasons after the initial removal.

3. Increase native shrub and ground cover abundance and diversity. Once buckthorn has been reduced to a maintenance level and burning will not be needed for a few years, native shrubs, forbs and graminoids can be installed. Recommended species for each specific plant community are shown in **Appendix B**. Seeding is the least expensive method, but is very slow to show results. Installing some bare root shrubs can hasten the process somewhat. Installing potted forbs is very costly, and seeding will likely be adequate. Protective fencing must be installed around trees or shrubs to prevent deer browse.

4. The reed canary grass at the pond can also be controlled by herbicide. After a burn is completed the grass can be treated with an aquatic formula herbicide. A

wick application would be best, if feasible, to minimize impacts to native species. To effectively control the reed canary, treatment must be repeated several times during the growing season, especially in late summer (or in spring after a burning or mowing) for at least two seasons. Plants should be treated when they are less than a foot tall and plants should not be allowed to go to seed.

Southern Dry-Mesic Oak Savanna (UPs24): Unit OS-1, OS-2

Description

Oak savanna has the following general structure: nearly continuous ground cover (25-100% grasses, 5-50% forbs), a patchy shrub layer (5-50% cover), and scattered individual or clumps of trees (25-50% cover). It occurs on nearly level to steeply sloping sites with droughty soils. Mid-height grasses are most abundant, with tallgrass species common in mesic areas. Species composition varies with soils and topography variation, but little bluestem, porcupine grass, big bluestem, and Indian grass are common. Forb cover is sparse to patchy and includes gray goldenrod prairie sage, hairy and hoary puccoon, hoary frostweed, bird's foot violet, purple prairie clover, and starry false Solomon's seal. Common shrub species are leadplant, prairie rose, chokecherry, American hazelnut, and smooth sumac. Bur oak is the most common tree species and pin oak can occur as well.

Management steps

- 1) Restore OS units to oak savanna. The restoration process will begin with eradicating existing exotic plant species (whether buckthorn or grasses). Much of the dead red oak (oak wilt losses) should also be removed. Leaving a few dead trees for wildlife is beneficial.
- 2) The OS units should be burned after the exotic brush removal, and follow-up treatment of resprouts should be conducted annually. The brush removal and control should continue for about two years before next steps are taken.
- 3) Once the exotic brush has been controlled and dead trees removed, the site should be broadcast seeded with savanna species in the fall.
- 4) Follow-up management of the seeded savanna species will be needed, following the same general practices as for a prairie restoration: mow three times the first season, once the second and burn the third.
- 5) Once the ground cover is established (3 years), bur oak trees (or acorns) can be added to areas that need canopy cover.

Southern Dry Sand-Gravel Prairie (Ups13b): Unit DP-1, DP-2, DP-3

Description

Dry prairie has a ground layer of mid-height and shortgrass species distributed in a patchy to continuous cover (50 – 100%). Little bluestem is generally the dominant grass with other mid-height grasses such as side-oats grama, prairie dropseed and plains muhly, prominently represented. Tall grass species are also dominant and big bluegrass is usually important. Forb species are sparse to patchy (5-50%) and quite variable. Some common species are

gray goldenrod, dotted blazing star, hairy golden aster, harebell, western ragweed, false boneset, and flowering spurge. Shrubs are sparse (<5% cover) and composed mostly of lead plant, prairie rose, sage wormwood and smooth sumac.

Trees are absent.

Management steps

- 1) Reconstruct dry prairie at the DP units on south-facing bluffs. This activity may be delayed until oak wilt and emerald ash bore have run their course. Oak savanna or woodland can be maintained in these areas for the interim. As with the other units, removal of exotic brush and dead trees will be the first step for the reconstruction.
- 2) The prairie restoration process will follow the same steps outlined for oak savanna, with a somewhat different assembly of species for seeding (see **Appendix B**). Oak trees would *not* be planted after the prairie is established.
- 3) Burning will be the principle tool for managing and maintaining the prairie, once established. Burns should not be conducted on all of the dry prairie units in any given year, nor on adjacent units in consecutive years.
- 4) For all activities at the DP units, erosion prevention may be necessary on the steep slopes. Erosion mats or fiber rolls can be used. Working laterally across the slopes rather than vertically may be important for any on-site activities.

Southern Silver Maple Floodplain Forest (FFs68a): Unit FF

Description

Floodplain forest 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 flood waters. 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.

Management steps

Floodplain forest management. The greatest need in this plant community is exotic species removal. Buckthorn is the main invasive, but there are some others such as yellow iris and reed canary grass that could be targeted as well.

- 1) Cutting, treating and burning the buckthorn will be the primary management task on the island and the most effective method for restoring the native community. The inner channel may be frozen in the winter to make safe access for brush removal. Otherwise, access could be by motorboat, with permission to launch at the marina upstream, or by non-motorized boat, with access down a steep slope from the Rehtzigel's driveway.
- 2) Only a few yellow iris plants were detected. It can be controlled by digging it out. If it turns out there is a much larger population, herbicide may be necessary. An aquatic formula must be used at this location.

Long-term Monitoring

Restored areas must be regularly monitored 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).

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

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 and Dakota County 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 D**.

An approximation of restoration/management tasks, priorities, and costs is provided in **Table 4**, 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.

The entire site was divided into three phases (**Map 9**), where Phase 1 is the highest priority area to begin work. It consists of Units OW-2, DP-1, DP-2, DP-3 and FF, totaling 27 acres. Phase 2 consists of Units OS-1 and OW-1, totaling 28 acres. Phase 3 consists of OF-1, OF-2 and OS-2, totaling 12 acres. Within each phase, the tasks are prioritized and ordered chronologically. It should be noted that the Phases can overlap, so that Phase 2 could start long before the Phase 1 tasks are completed, depending on funding availability. In addition, these project tasks are conceptual. As implementation begins, project tasks and schedule will almost certainly change as the implementation begins and the project develops. Not included in the project costs are ecological tasks associated with project monitoring and management.

Table 4. Five-year restoration task schedule.

Highest Priority: Phase 1(Units OW-2, DP-1, DP-2, DP-3, FF) (27 ac)

Prior-ity	Yr	Season	Units	Activity	Ac	Cost/ac	Cost est
1	1	Spring	Whole property	Bird surveys (especially breeding season)	67		\$ 1,190.00
1	1	Oct-Dec	OW2, DP1,2,3, FF	Cut, treat, burn or slash exotic brush and up to 90% of dead oak.	27	\$ 900.00	\$ 24,300.00
1	2	Apr/May	OW2, DP1,2,3	Prescribed burn all except floodplain	20	\$ 250.00	\$ 5,000.00
1	1	Spring	Whole property	Bird surveys	67		\$ 1,190.00
1	2	May/June	OW2, DP1,2,3, FF	Evaluate steep slopes and establish erosion control measures if needed.	27	\$ 80.00	\$ 2,160.00
1	2	Oct	OW2, DP1,2,3, FF	Treat exotic brush repsrouts	27	\$ 300.00	\$ 8,100.00
1	3	Oct	OW2, DP1,2,3, FF	Treat exotic brush repsrouts	27	\$ 200.00	\$ 5,400.00
1	3	Spring	Whole property	Bird surveys	67		\$ 1,190.00
1	4	Spr or Fall	OW2, DP1,2,3	Prescribed burn all except floodplain	20	\$ 250.00	\$ 5,000.00
1	4	Spring	Whole property	Bird surveys	67		\$ 1,190.00
2	4	Apr	OW2	Install bareroot native trees, shrubs, & forbs in Oak Woodland	12	\$ 320.00	\$ 3,840.00
3	4	Oct	DP1,2,3	Broadcast native prairie seed in DP units	8	\$ 500.00	\$ 4,000.00
3	5	May-Sept	DP1,2,3	Mow DPs 3 times	8	\$ 70.00	\$ 560.00
1	5	Spring	Whole property	Bird surveys	67		\$ 1,190.00
3	6	May	DP1,2,3	Mow DPs 1x	8	\$ 70.00	\$ 560.00
3	7	Spr or Fall	DP1,2,3, OW2	Burn DP units and OW-2	20	\$ 300.00	\$ 6,000.00
							\$ 70,870.00

Second Priority: Phase 2 (Units OW-1, OS-1) (28 ac)

Prior-ity	Yr	Season	Activity	Ac	Cost/ac	Cost est	
1	1	Oct-Dec	OW1, OS1	Cut, treat, burn or slash exotic brush and up to 90% of dead oak. Reduce cover of select tree in OS-1 to open canopy.	28	\$1,200.00	\$ 33,600.00
1	2	Apr/May	OW1, OS1	Prescribed burn-entire area	28	\$ 250.00	\$ 7,000.00
1	2	Jun, Aug, Sep	OW-1	Herbicide reed canary 3X after burn (wick or spray).	3	\$ 280.00	\$ 840.00
1	2	May/June	OW1, OS1	Evaluate steep slopes and establish erosion control measures if needed.	28	\$ 80.00	\$ 2,240.00
1	2	Oct	OW1, OS1	Treat exotic brush repsrouts	28	\$ 300.00	\$ 8,400.00
1	2	Oct	OS-1	Broadcast native prairie seed in OS-1	20	\$ 300.00	\$ 6,000.00
1	3	May-Sept	OS-1	Mow OS-1, 2-3 times if feasible	20	\$ 80.00	\$ 1,600.00
2	3	Apr	OW1	Install bareroot native trees, shrubs, forbs in Oak Woodland	8	\$ 400.00	\$ 3,200.00
1	3	Oct	OW1, OS1	Treat exotic brush repsrouts	28	\$ 200.00	\$ 5,600.00
1	4	May	OS-1	Mow or burn OS-1	20	\$ 80.00	\$ 1,600.00
1	4	Oct	OW1, OS1	Treat exotic brush repsrouts	28	\$ 200.00	\$ 5,600.00
1	5	Apr/May	OW1, OS1	Prescribed burn-entire area	28	\$ 250.00	\$ 7,000.00
2	5	Oct	OW1, OS1	Plant acorns in areas where needed	28	\$ 250.00	\$ 7,000.00
\$ 89,680.00							

Third Priority: Phase 3 (Units OF-1, OF-2, OS-2) (12 ac)

Prior-ity	Yr	Season	Activity	Ac	Cost/ac	Cost est	
1	1	Oct-Dec	OF1,2, OS2	Cut, treat, burn or slash exotic brush and up to 90% of dead oak. Reduce cover of select tree in OS-2 to open canopy.	12	\$1,200.00	\$ 14,400.00
1	2	Apr/May	OF1,2, OS2	Prescribed burn-entire area	12	\$ 250.00	\$ 3,000.00
1	2	May/June	OF1,2, OS2	Evaluate steep slopes and establish erosion control measures if needed.	12	\$ 80.00	\$ 960.00
1	2	Oct	OF1,2, OS2	Treat exotic brush repsrouts	12	\$ 300.00	\$ 3,600.00
1	2	Oct	OS2	Broadcast native prairie seed in OS2	3	\$ 300.00	\$ 900.00
1	3	May-Sept	OS2	Mow OS2, 2-3 times if feasible	3	\$ 80.00	\$ 240.00
2	3	Apr	OF1,2	Install bareroot native trees and shrubs in Oak Forest	9	\$ 300.00	\$ 2,700.00
1	3	Oct	OF1,2, OS2	Treat exotic brush repsrouts	12	\$ 200.00	\$ 2,400.00
1	4	May	OS2	Mow OS-2	3	\$ 80.00	\$ 240.00
1	4	Oct	OF1,2, OS2	Treat exotic brush repsrouts	12	\$ 200.00	\$ 2,400.00
1	5	Apr/May	OF1,2, OS2	Prescribed burn-entire area	12	\$ 250.00	\$ 3,000.00
\$ 33,840.00							

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Appendix A. Plant Species Recorded at Rechtzigel Property.

Friends of the Mississippi River identified the following plant species at the site in July 2009.

Map Unit name: K

Scientific Name	Common Name	Abund ¹	Cov ²	dbh
Groundcover to 4 ft (Total cover= 4)				
Forbs, ferns, vines				
<i>Alliaria officinalis</i> *	garlic mustard	A	3	
<i>Amphicarpaea bracteata</i>	hog peanut	P		
<i>Arctium minus</i>	common burdock	R	1	
<i>Arisaema triphyllum</i>	Jack-in-the-pulpit	P	1	
<i>Athyrium filix-femina</i>	lady fern	C	2	
<i>Carex pensylvanica</i>	Pennsylvania sedge	P	2	
<i>Circea lutetiana</i>	enchanter's nightshade	P	1	
<i>Desmodium glutinosum</i>	pointed leaved tick trefoil	P		
<i>Galium aparine</i>	cleavers	R	1	
<i>Geranium maculatum</i>	wild geranium	R	1	
<i>Geum canadense</i>	white avens	R	1	
<i>Leonurus cardiaca</i> *	motherwort	R	1	
<i>Maianthemum canadense</i>	Canada mayflower	R	1	
<i>Osmorhiza claytonii</i>	sweet cicely	R	1	
<i>Osmunda claytoniana</i>	interrupted fern	C	2	
<i>Parthenocissus quinquefolia</i>	Virginia creeper	R	1	
<i>Ribes cynosbati</i>	gooseberry	A	3	
<i>Rubus occidentalis</i>	black raspberry	C	2	
<i>Sambucus racemosa</i>	red-berried elder	C	2	
<i>Scrophularia lanceolata</i>	American figwort	R	1	
<i>Smilax hispida</i>	greenbriar	R	1	
<i>Solidago gigantea</i>	giant goldenrod	R	1	
<i>Thalictrum dioicum</i>	early meadow rue	R	1	
<i>Vitis riparia</i>	wild grape	P	1	
Woody				
<i>Cornus foemina</i>	gray dogwood	R	1	
<i>Fraxinus pennsylvanica</i>	green ash	A	3	
<i>Quercus macrocarpa</i>	bur oak	R	1	
<i>Quercus rubra</i>	red oak	P	1	
<i>Rhamnus cathartica</i> *	common buckthorn	A	3	
<i>Tilia americana</i>	American basswood	P	1	
Understory/shrub layer (Total Cover= 3)				
<i>Acer negundo</i>	boxelder	A	1	
<i>Celtis occidentalis</i>	hackberry	R	1	
<i>Fraxinus pennsylvanica</i>	green ash	A	2	
<i>Ostrya virginiana</i>	ironwood	P	1	
<i>Prunus serotina</i>	black cherry	C	1	
<i>Quercus alba</i>	white oak	R	1	
<i>Rhamnus cathartica</i> *	common buckthorn	C	2	
<i>Ribes cynosbati</i>	gooseberry	P	1	
<i>Rubus strigosus</i>	red raspberry	R	1	
<i>Sambucus racemosa</i>	red-berried elder	R	1	
<i>Tilia americana</i>	American basswood	R	1	
Canopy, subcanopy (Total Cover= 5)				
<i>Acer negundo</i>	boxelder	A	2	12
<i>Celtis occidentalis</i>	hackberry	P		
<i>Ostrya virginiana</i>	ironwood	P	2	6-10
<i>Populus tremuloides</i>	Quaking aspen	P		14<
<i>Quercus ellipsoidalis</i>	pin oak	P		22
<i>Quercus macrocarpa</i>	bur oak	R		18
<i>Quercus rubra</i>	red oak	C	3	18-22
<i>Tilia americana</i>	American basswood	R	1	18

* non-native;

¹ D=Dominant, A=Abundant, C=Common, P=Present, R=Rare

² Cover: 1=<5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%

Map Unit name: N

Scientific Name	Common Name	Abund ¹	Cov ²	dbh	Comments
Groundcover to 4 ft (Total cover= 4)					
Forbs, ferns, vines					
<i>Adiantum pedatum</i>	maidenhair fern	C	1		
<i>Alliaria officinalis</i> *	garlic mustard	D	4		
<i>Amphicarpaea bracteata</i>	hog peanut	P	1		
<i>Arisaema triphyllum</i>	Jack-in-the-pulpit	P	1		
<i>Athyrium filix-femina</i>	lady fern	P	+		
<i>Desmodium glutinosum</i>	pointed-leaved tick-trefoil	P	+		
<i>Eupatorium rugosum</i>	white snakeroot	C	1		
<i>Galium aparine</i>	cleavers	C	1		
<i>Geranium maculatum</i>	wild geranium	P	1		
<i>Hackelia virginiana</i>	Virginia stick seed	C	1		
<i>Leonurus cardiaca</i> *	motherwort	P	1		
<i>Menispermum canadens</i>	moonseed	P	1		
<i>Osmunda claytoniana</i>	interrupted fern	C	2		
<i>Oxalis stricta.</i>	wood sorrow	P	1		
<i>Parthenocissus quinquefolia</i>	Virginia creeper	C	1		
<i>Phryma leptostachya</i>	lopseed	R	1		
<i>Rubus occidentalis</i>	black raspberry	C	1		
<i>Sambucus canadensis</i>	common elderberry	P	1		
<i>Scrophularia lanceolata</i>	American figwort	C	1		
<i>Urtica dioica</i>	stinging nettle	R	1		
Graminoids					
<i>Oryzopsis racemosa</i>	black fruited rice grass	C	2		
Woody					
<i>Quercus rubra</i>	red Oak	P	1		
Understory/shrub layer (Total Cover= 3)					
<i>Acer negundo</i>	boxelder	P	1		
<i>Betula papyrifera</i>	paper birch	R	1		
<i>Celtis occidentalis</i>	hackberry	P	1		
<i>Ostrya virginiana</i>	ironwood	C	1		
<i>Rhamnus cathartica</i> *	common buckthorn	P	2		
<i>Ribes cynosbati</i>	gooseberry	P	2		
<i>Ulmus Americana</i>	American elm	P	1		
<i>Vitis riparia</i>	wild grape	P	2	2-3"	
Canopy, subcanopy (Total Cover= 5)					
<i>Celtis occidentalis</i>	hackberry	P	1	10-12"	
<i>Ostrya virginiana</i>	ironwood	P	1	8"	
<i>Populus tremuloides</i>	quaking aspen	C	2	12"	
<i>Quercus alba</i>	white oak	C	2	10-18"	
<i>Quercus macrocarpa</i>	bur oak	C	1	8-26"	22" Dead, standing snag
<i>Quercus rubra</i>	red oak	A	3	10-20"	
<i>Ulmus Americana</i>	american elm	P	1	10"	

* non-native;

¹ D=Dominant, A=Abundant, C=Common, P=Present, R=Rare

² Cover: 1=<5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%

Map Unit name: H

Scientific Name	Common Name	Abund ¹	Cov ²	dbh	Comments
Groundcover to 4 ft (Total cover= 4)					
(same as area N)					
<i>Leersia oryzoides</i>	Rice cut grass	C	2		in woods near pond
Understory/shrub layer (Total Cover= 3)					
<i>Celtis Occidentalis</i>	Hackberry	C	2	3	
<i>Ulmus americana</i>	American elm	C	2	4	
Canopy, subcanopy (Total Cover= 5)					
<i>Quercus alba</i>	White oak	C	2	10 - 24	some double trunks 22-24"
<i>Quercus rubra</i>	Red oak	A	3	24	Many standing dead
* non-native;					
Pond					
<i>Carex sartwellii. Carex sp., Carex</i>	Sedge	C	2		
<i>Glyceria (striata or grandis)</i>	Reed or fowl manna grass	P			
<i>Leersia oryzoides</i>	rice cut grass	C	2		
<i>Phalaris arundinaceae</i>	reed canary grass	C	2		

¹ D=Dominant, A=Abundant, C=Common, P=Present, R=Rare

² Cover: 1=<5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%

APPENDIX B

PLANT SPECIES FOR RESTORATION AT THE RECHTZIGEL PROPERTY

The following species lists are based on data collected by the MN DNR of species recorded at native MN plant communities. All seed and plant material used at the property should be of Minnesota origin, ideally within 25 miles of the site, but no more than 75 miles. Nurseries can usually provide seed/ plant origin information.

Southern Dry-Mesic Oak Woodland (FDs37)

<u>Scientific name</u>	<u>Common name</u>	<u>Scientific name</u>	<u>Common name</u>
Forbs & graminoids		Shrubs	
<i>Actaea rubra</i>	Red baneberry	<i>Cornus alternifolia</i>	Pagoda dogwood
<i>Adiantum pedatum</i>	Maidenhair fern	<i>Cornus racemosa</i>	Gray dogwood
<i>Amphicarpaea bracteata</i>	Hog-peanut	<i>Corylus americana</i>	American hazelnut
<i>Anemone Americana</i>	Round-lobed hepatica	<i>Prunus virginiana</i>	Chokecherry
<i>Aquilegia Canadensis</i>	Columbine	<i>Ribes cynosbati</i>	Gooseberry
<i>Aralia nudicaulis</i>	Wild sarsaparilla	<i>Sambucus racemosa</i>	Red-berried elder
<i>Aralia racemosa</i>	American spikenard	<i>Symphoricarpus alba</i>	Snowberry
<i>Arisaema triphyllum</i>	Jack-in-the-pulpit	<i>Viburnum lentago</i>	Nannyberry
<i>Aster sagittifolius</i>	Arrowleaf aster	<i>Viburnum rafinesquianum</i>	Downy arrowwood
<i>Athyrium filix-femina</i>	Lady fern		
<i>Carex pensylvanica</i>	Pennsylvania sedge		
<i>Caulophyllum thalictroides</i>	Blue cohosh	Trees	
<i>Circaea lutetiana</i>	Enchanter's nightshade	<i>Acer rubrum</i>	Red maple
<i>Desmodium glutinosum</i>	pointed-leaved tick-trefoil	<i>Betula papyrifera</i>	Paper birch
<i>Dioscorea villosa</i>	Wild yam	<i>Carya cordiformes</i>	Bitternut hickory
<i>Eupatorium rugosum</i>	White snakeroot	<i>Celtis occidentalis</i>	Hackberry
<i>Galium aparine</i>	Cleavers	<i>Fraxinus pennsylvanica</i>	Green ash
<i>Galium triflorum</i>	Three-flowered bedstraw	<i>Ostrya virginiana</i>	Ironwood
<i>Geranium maculatum</i>	Wild geranium	<i>Prunus serotina</i>	Black cherry
<i>Geum canadense</i>	White avens	<i>Quercus alba</i>	White oak
<i>Hydrophyllum virginianum</i>	Virginia waterleaf	<i>Quercus rubra</i>	Northern red oak
<i>Maianthemum canadense</i>	Canada mayflower	<i>Tilia americana</i>	American basswood
<i>Mitella diphylla</i>	Two-leaved miterwort	<i>Ulmus americana</i>	American elm
<i>Osmorhiza claytonii</i>	Sweet cicely		
<i>Osmunda claytoniana</i>	Interrupted fern		
<i>Phyrma leptostachya</i>	Lopseed		
<i>Saguinaria canadensis</i>	Bloodroot		
<i>Sanicula marilandica</i>	Black snakeroot		
<i>Thalictrum dioicum</i>	Early meadow-rue		
<i>Uvularia grandiflora</i>	Large-flowered bellwort		
<i>Uvularia sessilifolia</i>	Pale bellwort		
<i>Veronicastrum virginicum</i>	Culver's root		

Southern Dry Prairie Species (UPs13)

While restoring a full complement of species for any type of restoration is not feasible, the following guidelines for a prairie restoration can be used, depending on funding. Species numbers for savanna would be similar, but would have a greater abundance of taller shrubs

Low diversity: 20-30 species (6-8 grasses, 15-20 forbs, 1 low shrub)

Moderate diversity: 35-40 species (9-11 grasses, 25-30 forbs, 2-3 low shrubs)

High diversity: 50-60 species (12-14 grasses, 30-40 forbs, 3-4 low shrubs)

Scientific name

Common name

Forbs

<i>Allium stellatum</i>	Prairie wild onion	<i>Phlox pilosa</i>	Prairie phlox
<i>Anemone cylindrica</i>	Thimbleweed	<i>Potentilla arguta</i>	Tall potentilla
<i>Antennaria sp.</i>	Pussytoes	<i>Pulsatilla nuttalliana</i>	Pasque flower
<i>Artemisia campestris</i>	Wormwood	<i>Ratibida pinnata</i>	Prairie coneflower
<i>Artemisia ludoviciana</i>	Prairie sage	<i>Rudbeckia hirta</i>	Black-eyed susan
<i>Asclepias tuberosa</i>	Butterfly weed	<i>Senecio plattensis</i>	Prairie ragwort
<i>Asclepias verticillata</i>	Whorled milkweed	<i>Solidago speciosa</i>	Showy goldenrod
<i>Asclepias viridiflora</i>	Green milkweed	<i>Solidago missouriensis</i>	Missouri goldenrod
<i>Aster ericoides</i>	Heath aster	<i>Solidago nemoralis</i>	Gray goldenrod
<i>Aster oblongifolius</i>	Aromatic aster	<i>Solidago rigida</i>	Stiff goldenrod
<i>Aster oolentangiensis</i>	Sky-blue aster	<i>Tradescantia occidentalis</i>	Western spiderwort
<i>Aster sericeus</i>	Silky aster	<i>Verbena stricta</i>	Hoary vervain
<i>Astragalus crassicaarpus</i>	Buffalo bean	<i>Viola pedatifida</i>	Prairie violet
<i>Campanula rotundifolia</i>	Harebell	<i>Zizia aptera</i>	golden alexander
<i>Comandra umbellata</i>	Bastard toadflax		
<i>Coreopsis palmata</i>	Prairie coreopsis	Shrubs	
<i>Chrysopsis villosa</i>	Golden aster	<i>Amorpha canescens</i>	Leadplant
<i>Dalea candidum</i>	White prairie-clover	<i>Ceanothus americanus</i>	New Jersey tea
<i>Dalea purpureum</i>	Purple prairie-clover	<i>Rosa arkansana</i>	Prairie rose
<i>Dalea villosa</i>	Silky prairie-clover	<i>Prunus pumila</i>	Sand cherry
		<i>Symphoricarpus occidentalis</i>	Wolfberry
<i>Delphinium virescens</i>	Prairie larkspur		
<i>Euphorbia corollata</i>	Flowering spurge	Grasses	
<i>Gnaphalium obtusifolium</i>	Sweet everlasting	<i>Andropogon gerardii</i>	Big bluestem
<i>Helianthemum bicknellii</i>	Hoary frostweed	<i>Bouteloua curtipendula</i>	Side-oats grama
<i>Helianthus rigidus</i>	Stiff sunflower	<i>Bouteloua hirsuta</i>	Hairy grama
<i>Kuhnia eupatoriodes</i>	False boneset	<i>Calamovilfa longifolia</i>	Sand reedgrass
<i>Liatris aspera</i>	Blazing star	<i>Elymus canadensis</i>	Canada wild rye
<i>Liatris punctata</i>	Dotted blazing star	<i>Eragrostis spectabilis</i>	Purple lovegrass
<i>Linum sulcatum</i>	Yellow flax	<i>Koeleria macrantha</i>	Junegrass
<i>Lithospermum carolinense</i>	Hairy puccoon	<i>Muhlenbergia cuspidata</i>	Plains muhly grass
<i>Lithospermum incisum</i>	Narrow-leaved puccoon	<i>Panicum oligosanthos</i>	Scribner's panic grass
<i>Lobelia spicata</i>	Rough-spiked lobelia	<i>Schizachrium scoparium</i>	Little bluestem
<i>Mirabilis hirsute</i>	Hairy four o'clock	<i>Sorghastrum nutans</i>	Indiangrass
<i>Monarda fistulosa</i>	Bergamot		
	Cleland's evening	<i>Sporobolis heterolepis</i>	Prairie dropseed
<i>Oenothera clelandii</i>	primrose	<i>Sporobolus cryptandrus</i>	Sand dropseed
<i>Onosmodium molle</i>	False gromwell	<i>Stipa spartea</i>	Porcupine grass
<i>Penstemon gracilis</i>	Slender penstemon		
<i>Penstemon grandiflorus</i>	Large-flowered penstemon		
<i>Physallis virginiana</i>	Virginia ground cherry		

Southern Dry Savanna (UPs14)

<u>Scientific name</u>	<u>Common name</u>
Forbs	
<i>Anemone cylindrica</i>	Thimbleweed
<i>Antennaria sp</i>	Pussytoes
<i>Asclepias syriaca</i>	Common milkweed
<i>Asclepias tuberosa</i>	Butterflyweed
<i>Artemisia ludoviciana</i>	White sage
<i>Aster ericoides</i>	Heath aster
<i>Aster laevis</i>	Smooth blue aster
<i>Aster oolentangiensis</i>	Sky-blue aster
<i>Campanula rotundifolia</i>	Harebell
<i>Chrysopsis villosa</i>	Golden aster
<i>Coreopsis palmata</i>	Coreopsis
<i>Dalea candida</i>	White prairie clover
<i>Dalea purpurea</i>	Purple prairie clover
<i>Euphorbia corollata</i>	Flowering spurge
<i>Galium boreale</i>	Northern bedstraw
<i>Geranium maculatum</i>	Wild geranium
<i>Hedeoma hispida</i>	Mock pennyroyal
<i>Helianthemum bicknellii</i>	Hoary frostweed
<i>Helianthus pauciflorus</i>	Stiff sunflower
<i>Lespedeza capitata</i>	Round-headed bush
clover	
<i>Liatris aspera</i>	Rough blazing star
<i>Lithospermum carolinense</i>	Hairy puccoon
<i>Penstemon grandiflorus</i>	Large-flowered
penstemon	
<i>Pysalis virginiana</i>	Virginia ground cherry
<i>Prenanthes racemosa</i>	Rattlesnake root
<i>Ratibida pinnata</i>	Yellow coneflower
<i>Smilacina stellata</i>	Starry false Solomon's
seal	
<i>Solidago rigida</i>	Stiff goldenrod
<i>Solidago missouriensis</i>	Missouri goldenrod
<i>Solidago nemoralis</i>	Gray goldenrod
<i>Solidago speciosa</i>	Showy goldenrod
<i>Thalictrum dasycarpum</i>	Tall meadow-rue
<i>Viola pedatifida</i>	Prairie violet
<i>Zizia aptera</i>	Heart-leaved Alexanders

<u>Scientific name</u>	<u>Common name</u>
Graminoids	
<i>Andropogon gerardii</i>	Big bluestem
<i>Bouteloua curtipendula</i>	Sideoats grama
<i>Bouteloua hirsuta</i>	Hairy grama
<i>Calamovilfa longifolia</i>	Sand reedgrass
<i>Carex muhlenbergii</i>	Muhlenberg's sedge
<i>Carex pensylvanica</i>	Pennsylvania sedge
<i>Elymus hystrix</i>	Bottlebrush grass
<i>Eragrostis spectabilis</i>	Purple lovegrass
<i>Koeleria pyramidata</i>	Junegrass
<i>Leptoloma cognatum</i>	Fall witchgrass
<i>Panicum oligosanthes</i>	Scribner's panic grass
<i>Panicum perlongum</i>	Long-leaved panic
	Grass
<i>Panicum virgatum</i>	Switchgrass
<i>Schizachyrium scoparium</i>	Little bluestem
<i>Sorghastrum nutans</i>	Indian grass
<i>Sporobolus heterolepis</i>	Prairie dropseed
<i>Stipa spartea</i>	Porcupine grass
Shrubs	
<i>Amelanchier humilis</i>	Low juneberry
<i>Amorpha canescens</i>	Lead plant
<i>Cornus racemosa</i>	Gray dogwood
<i>Corylus americana</i>	American hazelnut
<i>Juniperus virginiana</i>	Red cedar
<i>Prunus americana</i>	Wild plum
<i>Prunus virginiana</i>	Chokecherry
<i>Rhus glabra</i>	Smooth sumac
<i>Rosa arkansana</i>	Prairie rose
<i>Symphoricarpos occidentalis</i>	Wolfberry
Trees	
<i>Quercus macrocarpa</i>	Bur oak

APPENDIX C

METHODS FOR CONTROLLING INVASIVE EXOTIC TREES AND SHRUBS

Common Buckthorn, Tartarian Honeysuckle, Siberian Elm, and Black Locust are some of the most common woody species likely to invade a native woodland or prairie in Minnesota. Buckthorn and honeysuckle are European species that escaped urban landscapes and invaded woodlands in many parts of the country. They are exceedingly aggressive and, lacking natural disease and predators, can out-compete native species. Invasions result in a dense, impenetrable brush thicket that reduces native species diversity.

Siberian elm, native to eastern Asia, readily grows in disturbed and poor soils with low moisture. Seed germination is high and seedlings establish quickly in sparse vegetation. It can invade and dominate disturbed prairies in just a few years. Black locust is native to the southeastern United States and the very southeastern corner of Minnesota. It has been planted outside its natural range, and readily invades disturbed areas. It reproduces vigorously by root suckering and can form a monotypic stand.

Chemical Control

The most efficient way to remove woody plants that are 1/2 inch or more in diameter is to cut the stems close to the ground and treat the cut stumps with herbicide immediately after they are cut, when the stumps are fresh and the chemicals are most readily absorbed. Failure to treat the stumps will result in resprouting, creating much greater removal difficulty.

In non-freezing temperatures a 10% glyphosate solution (e.g. Roundup) can be used. Adding a marker dye can help to make treated stumps more visible. In winter months, a triclopyr herbicide must be used (e.g. 10% Garlon 4) mixed with a penetration oil, such as diluent blue. Although the work can be done at any time of year other than during spring sapflow, late Fall is often ideal because buckthorn retains its leaves longer than other species and is more readily identified. Cutting can be accomplished with loppers or handsaws in many cases. Larger shrubs may require brush cutters and chainsaws, used only by properly trained professionals.

Herbicide can also be applied to the foliage of very small plants, resprouted stumps or seedlings. The best time to do that is in the fall, when native plants are dormant. Glyphosate and Krenite (active ingredient – fosamine ammonium) are the most commonly used herbicides for foliar application. Krenite prevents bud formation so the plants do not grow in the spring, whereas glyphosate is a non-specific herbicide that will kill anything green. All herbicides must be applied by licensed applicators and should not be applied on windy days. 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, especially for stump treatment.

Undesirable trees and shrubs can also be destroyed without cutting them down. Girdling is a method suitable for small numbers of large trees. Bark is removed in a band around the tree, just to the outside of the wood. If girdled too deeply, the tree will respond by resprouting

from the roots. Girdled trees die slowly over the course of one to two years. Girdling should be done in late spring to mid-summer when sap is flowing and the bark easily peels away from the sapwood. Herbicide can also be used in combination with girdling for a more effective treatment.

Basal bark herbicide treatment is another effective control method. A triclopyr herbicide such as 10% Garlon 4, mixed with a penetrating oil, is applied all around the base of the tree or shrub, taking care so that it does not run off. If the herbicide runs off it can kill other plants nearby. More herbicide is needed for effective treatment of plants that are four inches or more in diameter.

Mechanical Control

Three mechanical methods for woody plant removal are hand-pulling (only useful on seedlings and only if few in number), weed-wrenching (using a weed wrench tool to pull stems of one to two inches diameter), and repeated cutting. Pulling and weed-wrenching can be done any time when the soil is moist and not frozen. The disadvantage to both methods is that they are somewhat time-consuming as the dirt from each stem should be shaken off. Weed-wrenching also creates a great deal of soil disturbance and should not be used on steep slopes or anywhere that desirable native forbs are growing. The soil disturbance also creates opportunities for weed germination. This method is probably best used in areas that have very little desirable native plant cover.

Repeated cutting consists of cutting the plants (by hand or with a brush cutter) at critical stages in its growth cycle. Cutting in mid spring (late May) intercepts the flow of nutrients from the roots to the leaves. Cutting in fall (about mid-October) intercepts the flow of nutrients from the leaves to the roots. Depending on the size of the stem, the plants typically die within three years, with two cuttings per year.

Stems, Seedlings and Resprouts

Prescribed burning is the most efficient, cost effective, and least harmful way to control very small stems, seedlings, and resprouts of all woody plants. It also restores an important natural process to fire-dependant natural communities (oak forests, for example). Burning can only be accomplished if adequate fuel (leaf litter) is present and can be done in late fall or early spring, depending site conditions.

If burning is not feasible, critical cutting in the spring is also effective, though it can impact desirable herbaceous plants as well. Foliar (leaf) application of a glyphosate herbicide in late Fall is effective. Care must be taken as this method can also affect non-target species, though most natives will be dormant by that time.

Disposal

The easiest and most cost-effective method to handle large amounts of brush is usually to stack it and burn it in winter. In areas where brush is not dense, it can be cut up into smaller pieces and left on the ground where it will decompose in one to three years. This method is especially useful on slopes to reduce erosion potential. Small brush piles can also be left in the woods as wildlife cover. Where there is an abundance of larger trees, cut trees may be hauled and chipped and used for mulch or as a biofuel. Alternatively, the wood can be cut and used for firewood, if a recipient can be found.

APPENDIX D

ECOLOGICAL CONTRACTORS

Following is a list of contractors to consider for implementing the management plans. While this is not an exhaustive list, it does include firms with ecologists who are very knowledgeable with natural resource management. Unless otherwise noted, all firms do prescribed burning. Many other brush removal companies are listed in the yellow pages (under tree care), but most do not have knowledge or understanding of native plant communities. We recommend hiring firms that can provide ecological expertise. Additional firm listings can be found on the DNR website:

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

Friends of the Mississippi River (FMR) has extensive experience working with landowners to implement natural resource management plans. FMR can assist landowners with obtaining funding for restoration and management projects and providing project management, including contractor negotiations, coordinating restoration and management work, and site monitoring and evaluation.

Applied Ecological Services, Inc.

21938 Mushtown Rd
Prior Lake, MN 55372
952-447-1919
www.appliedeco.com

North American Prairies
111754 Jarvis Ave NW
Annandale, MN 55302
320-274-5316
info@northamericanprairies.com

Bonestroo Natural Resources

2335 West Highway 36
St. Paul, MN 55113
651-604-4812
www.bonestroo.com

Prairie Restorations, Inc.
PO Box 305
Cannon Falls, MN 55009
507-663-1091
www.prairieresto.com

Great River Greening

35 West Water St, Suite 201
St. Paul, MN 55107
651-665-9500
www.greatrivergreening.org

Minnesota Native Landscapes, L.L.C.

14088 Highway 95 N.E.
Foley, MN 56329
(320) 968-4222
www.mnnativelandscapes.com

Minnesota Conservation Corps

2715 Upper Afton Road, Suite 100
Maplewood, MN 55119
(651) 209-9900

APPENDIX E

POSSIBLE SOURCES OF COST-SHARE FUNDS

Numerous potential funding sources are available to implement habitat management and restoration. Some of the most likely sources are identified below. In addition, FMR would be happy to continue to work with the landowner to seek funding and to undertake any desired restoration or management activities.

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.

Dakota Farmland and Natural Areas Program (FNAP)

The FNAP program provides cost share for capital improvement projects on a case-by-case basis.

Dakota Soil and Water Conservation District (SWCD)

The Dakota SWCD provides technical and cost share assistance for conservation projects related to stormwater and erosion control. 50% match grants of up to \$4,000 are available.

Metro Conservation Corridors Project

This program, a collaboration of numerous government and non-government agencies, is designed to protect and restore important natural areas in the Twin Cities metro area. Friends of the Mississippi River is a MeCC project partner and could use funds the Lilligren property.

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, although 1:2 match is recommended as it is a very competitive program.

State Cost-Share

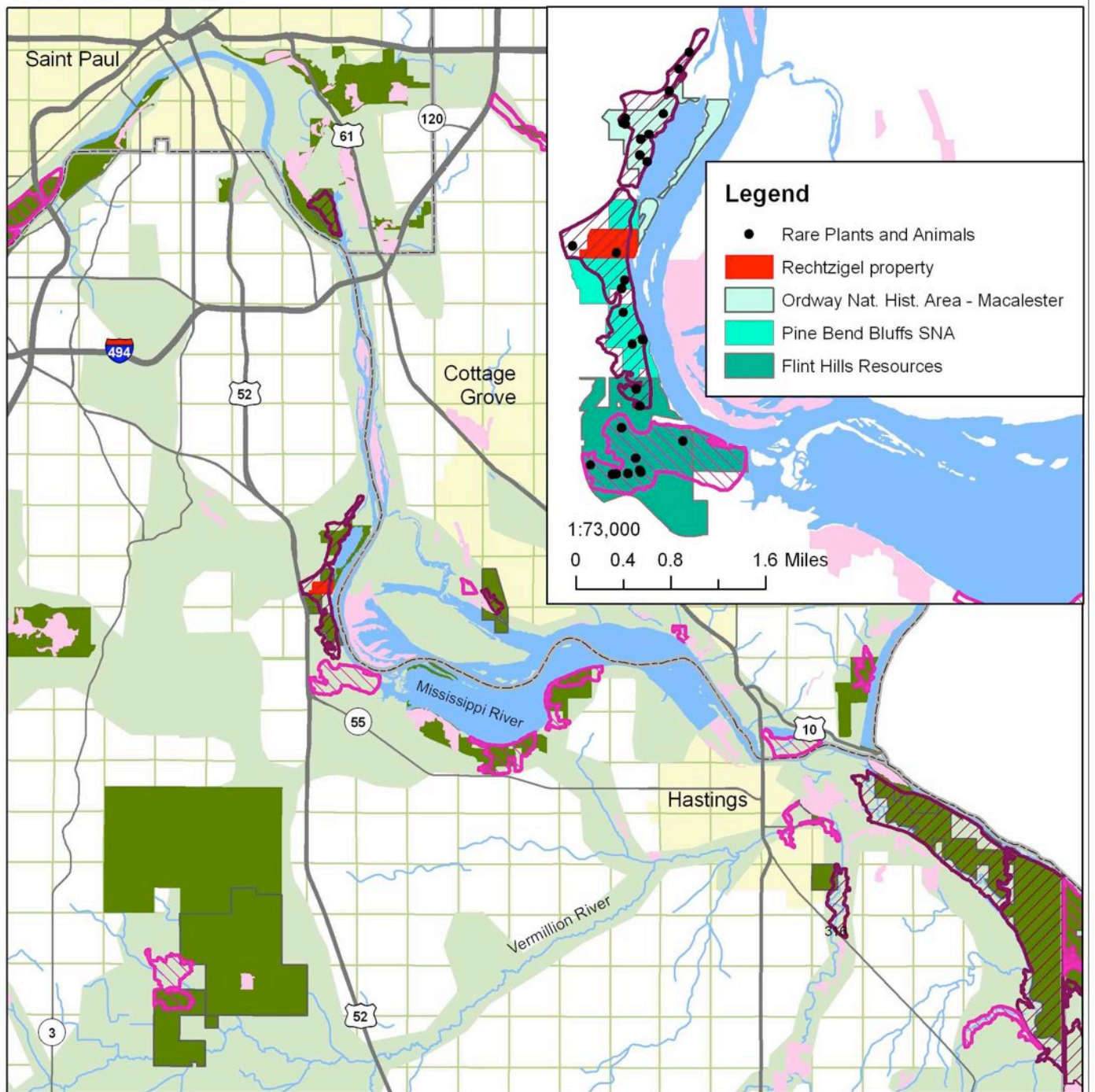
The State Cost Share program, administered by the Dakota SWCD, provides technical, design, construction, and financial assistance to land owners to solve erosion and water quality problems. The program can provide up to 75% of the total project costs.

The Wildlife Habitat Improvement Program (WHIP)

This is a federal cost-share program of the Natural Resources Conservation Service (NRCS) to improve wildlife habitat on private lands. Contact the Washington Conservation District or the local NRCS office for more information.

Natural Resources Management Plan
 Rechtzigel Property
 10620 Courthouse Blvd.
 Inver Grove Heights, MN 55077
 T27N R22W Section 27

Map 1. Regional Context



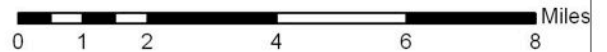
Legend

DNR Biodiversity Significance

- Outstanding
- High
- Moderate

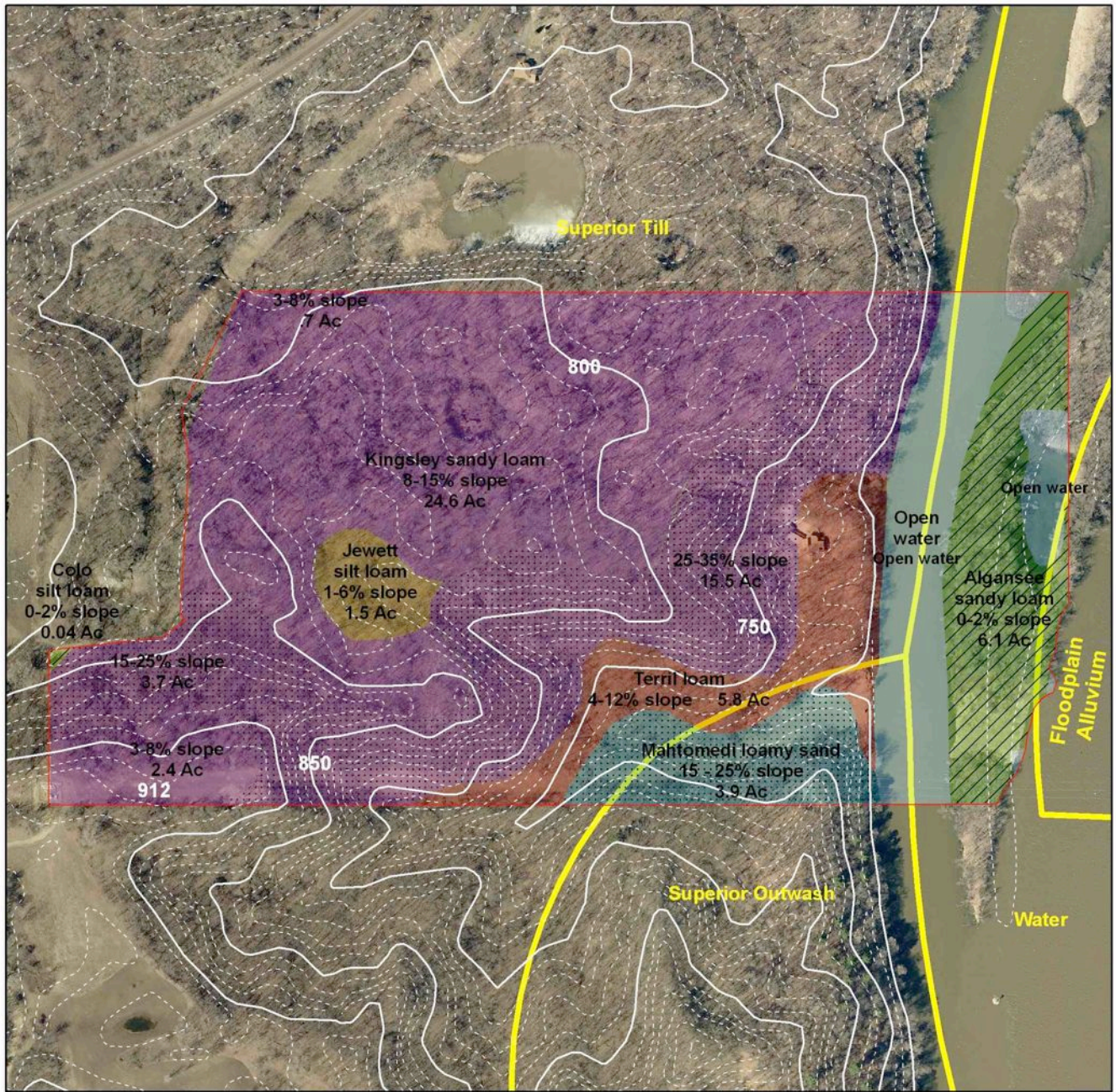
- Rechtzigel property
- Parks, WMAs, SNAs, etc
- Metro Conservation Corridors
- Land Survey sections

1:170,500
 1 in = 3 miles



Map 2. Geology & Soils



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 Inver Grove Heights, MN



Source: Dakota County soil survey, Soil Conservation Service, 1980
 2008 leaf off aerial, MN DNR



Legend

-  Hydric soils
-  Erodible soils

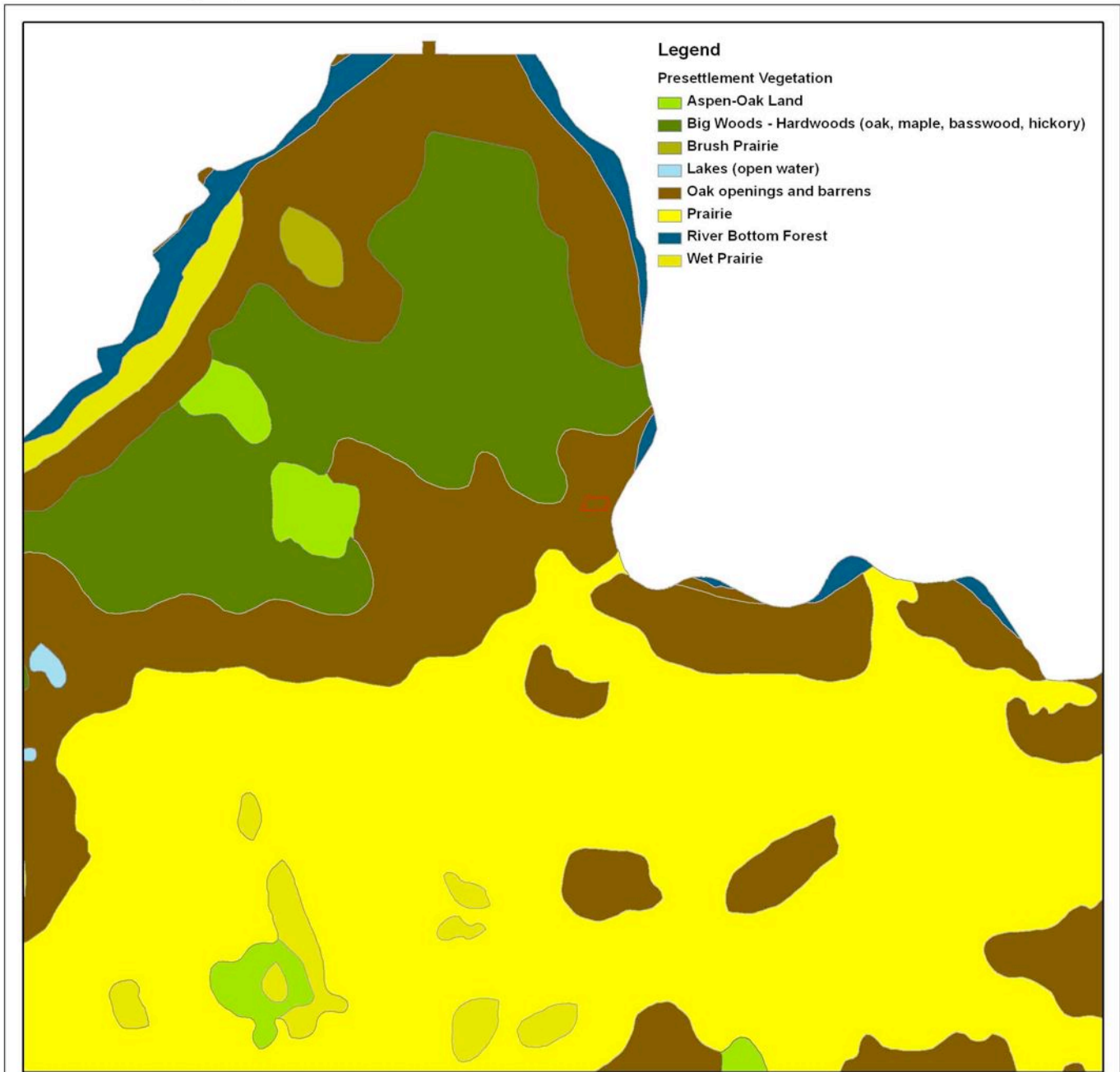
1:4,500

1 inch = 375 feet



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Map 3. Presettlement Vegetation



Source: MnDNR Data Deli

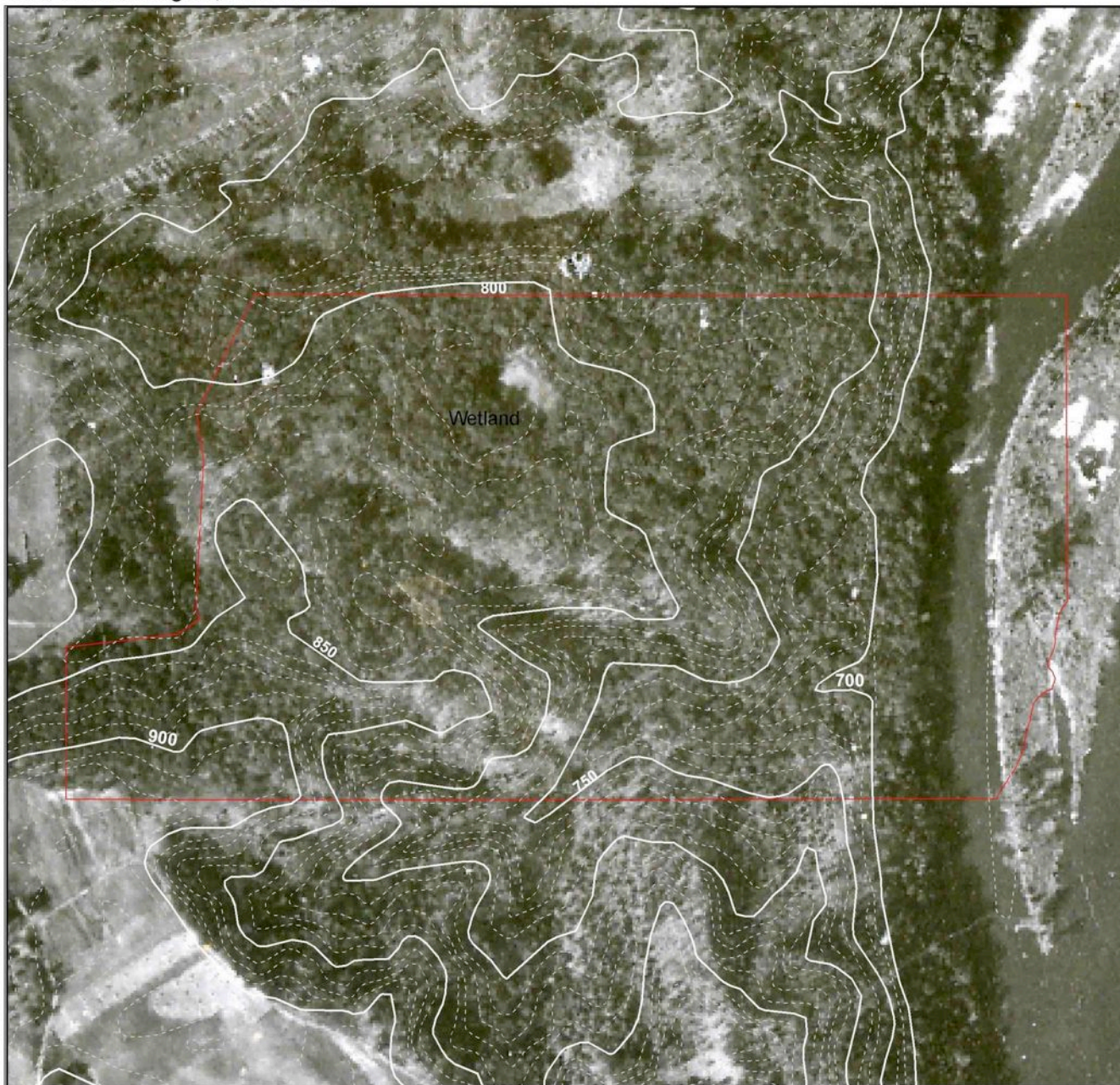


1:170,500
1 inch = 14,208 feet



Map 4. 1937 Aerial Photo

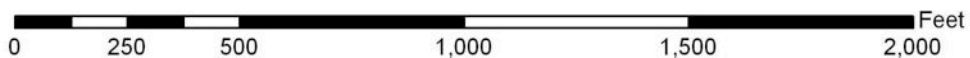
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Source: University of MN Borchert Map Library, Sept. 21, 1937

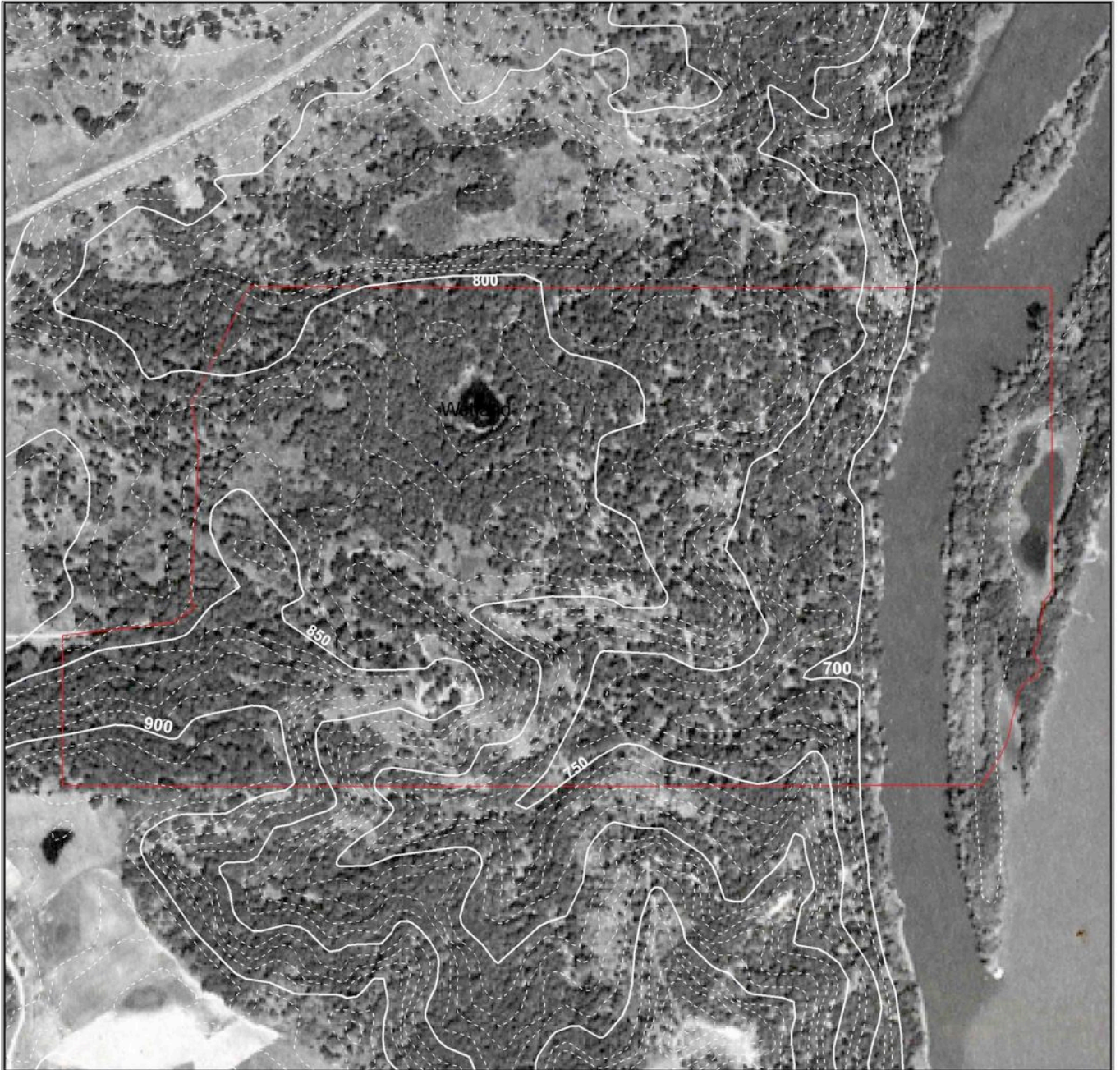


1:4,500
1 inch = 375 feet



Map 5. 1951 Aerial Photo

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Inver Grove Heights, MN 55077

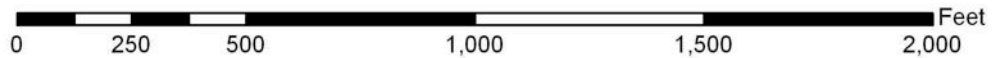


Source: University of MN Borchert Map Library, 1951



1:4,500

1 inch = 375 feet



Map 6. 2003 Aerial Photo

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Rechtzigel Property
10620 Courthouse Blvd.
Inver Grove Heights, MN 55077



Source: Farm Service Administration July 18, 2003



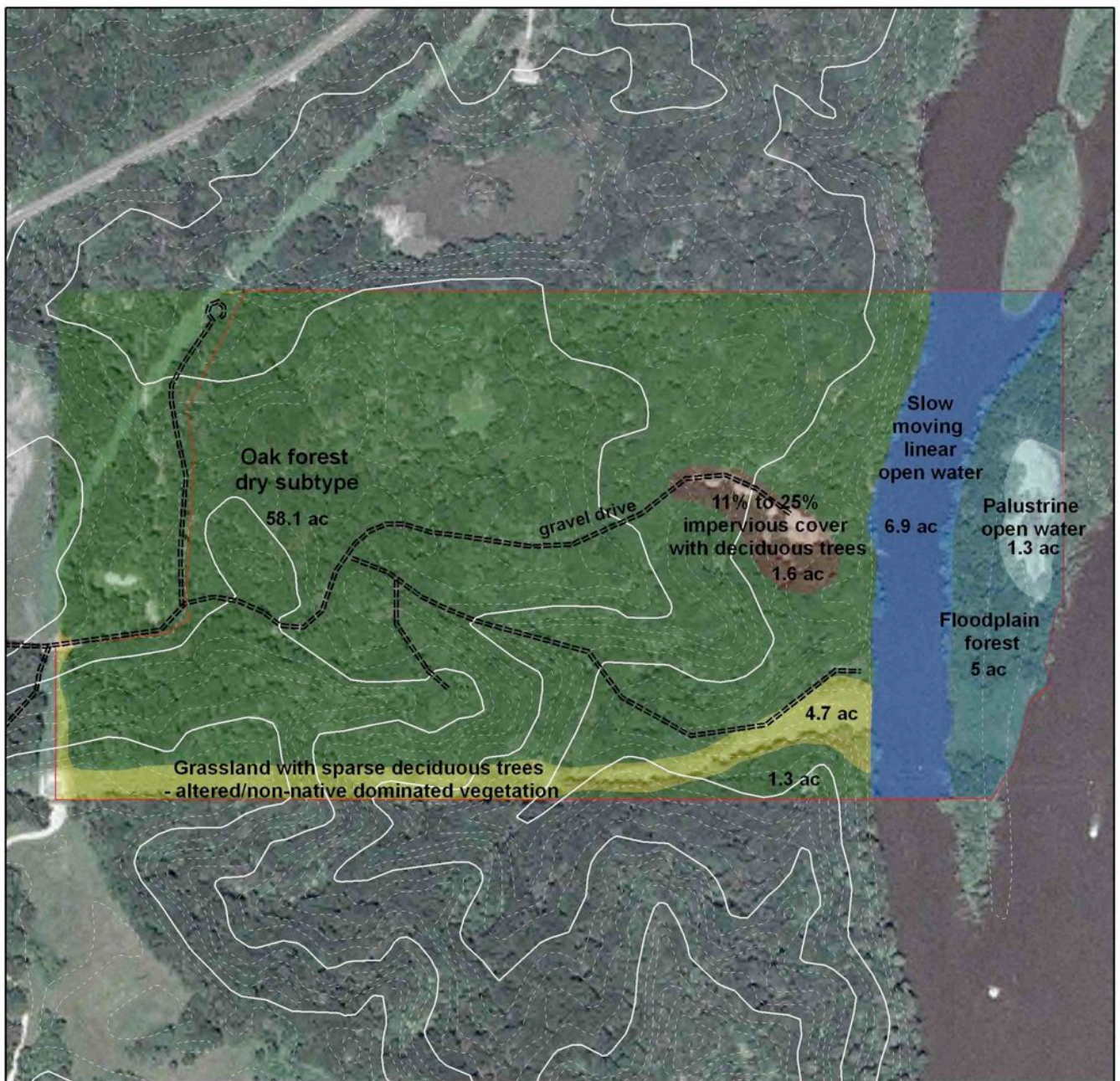
1:4,500

1 inch = 375 feet

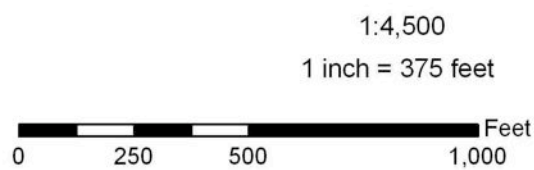


Map 7. Land Cover

Minnesota Land Cover
Classification System (MLCCS)



Source: Minnesota Dept. of Natural Resources 2004 MLCCS
Farm Service Association 2003 aerial photo



Map 8. Site Features & 1993 CBS Survey Areas



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 Inver Grove Heights, MN 55077



Source: Dakota County, 2008 aerial photo

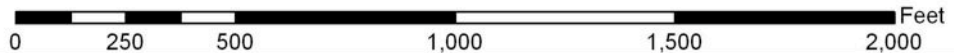


Legend

-  Photo points
-  Structures
-  Property boundary
-  1993 CBS Survey Areas

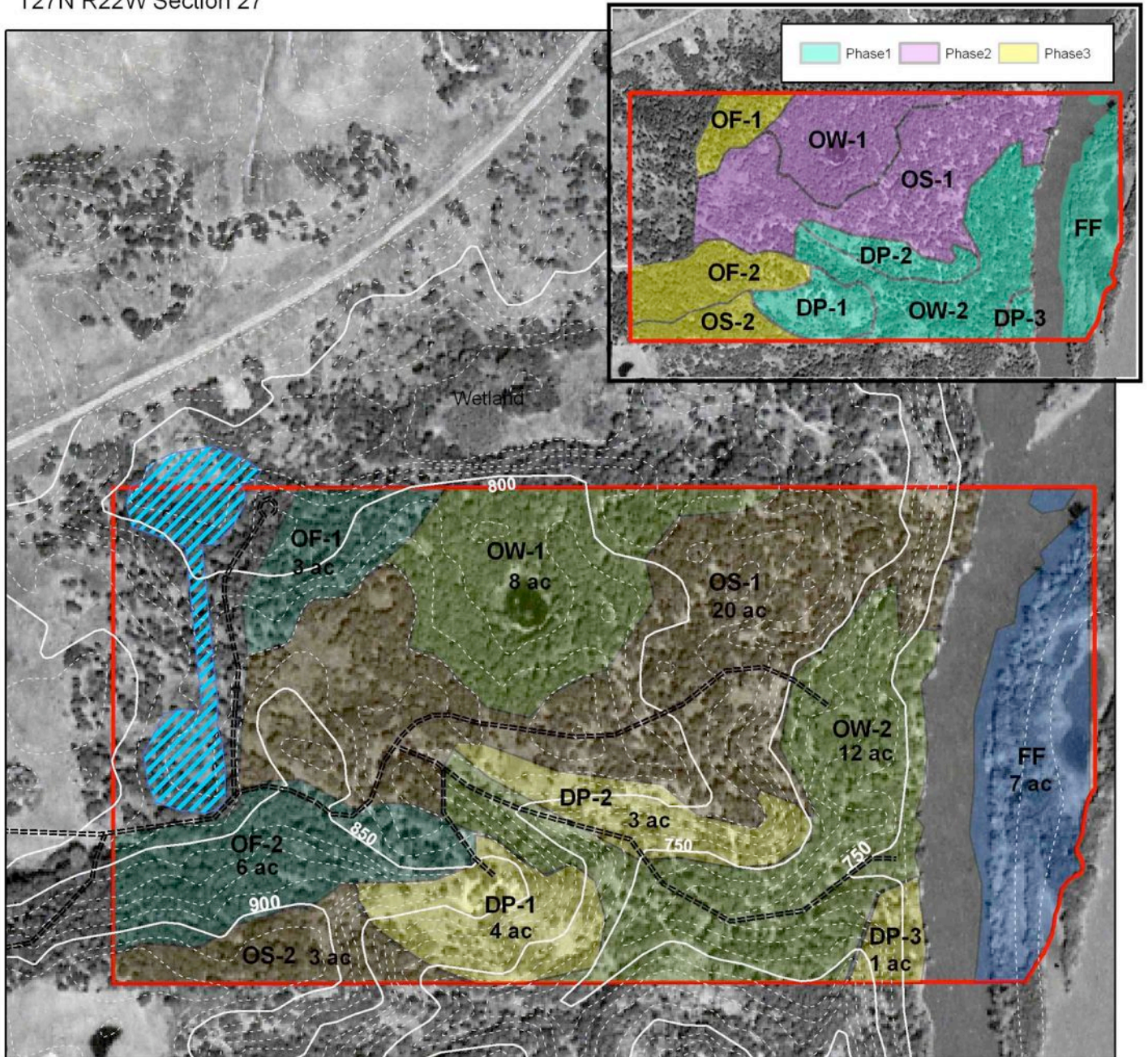


1:4,500
 1 inch = 375 feet



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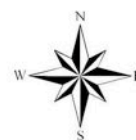
Map 9. Management Units & Target Communities



Source: Borchert Map Library, 1951

Legend

- | | | |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Target community | ==== | Roads and trails |
| DP dry prairie | | Property boundary |
| FF floodplain forest | | Stormwater ponds |
| OF oak forest | | |
| OS oak savanna | | |
| OW oak woodland | | |



1:4,500

1 inch = 375 feet

