Coon Hill Prairie

Prairie Stewardship Plan

October 30, 2013

Prepared for:

The Scientific and Natural Areas Program
Division of Ecological and Water Resources
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EXECUTIVE SUMMARY

Prairie Stewardship Plans

Prairies are the most endangered major habitat type in Minnesota with less than 1% remaining today of the 18 million acres that once covered Minnesota. Native prairie provides habitat to more than 40% of Minnesota's state-listed species (MN DNR, 2011). Native prairie is defined by the Commissioner of Natural Resources as "land that has never been plowed, with less than ten percent tree cover and with predominately native prairie." Minn. Stat. sec. 84.96, subd. 3 (State of MN, 2013). Because approximately 50 percent of prairie land is privately owned, conservation depends on the ability of private landowners to manage their prairies. The Scientific and Natural Areas Program provides private landowners with Prairie Stewardship Plan writing services and contributes towards the implementation of the management strategies outlined in the plan using a variety of sources.

Natural areas will decline in quality when not properly managed. Long-term preservation of natural areas and their rare features and species requires management of native vegetation, control of invasive species, and providing for appropriate public use. Landowner's of Minnesota's native prairies are encouraged to maintain or improve the habitat condition of these lands. Adaptive management is a systematic process for continually improving management planning, policies and practices by learning the outcomes of operational practices. Assessment and review of the effectiveness of management techniques (fire frequency, time/duration of grazing, invasive species management methods, etc.) will inform future plans and activities and help select the best management techniques.

Management planning is a prerequisite to effective and successful management. This document is part of a planning effort to meet program standards and reporting requirements of various funding sources. It establishes a strategy for stewardship that addresses biological management and monitoring.

The goals of the stewardship plan are to improve quality and consistency of management on remnant native prairie communities and to directly aim that management towards implementation of the State Wildlife Action Plan (SWAP) *Tomorrow's habitat for the Wild and Rare,* 2006, and to fulfill goals outlined in the *Minnesota Prairie Conservation Plan* (Prairie Plan), 2010, and in the DNR's, *A Strategic Conservation Agenda* (SCA), 2009-2013. This management plan specifically addresses the three goals identified in SWAP as: Goal 1-Stabilize and increase SGCN populations, Goal 2-Improve knowledge about SGCN, and Goal 3-Enhance people's appreciation and enjoyment of SGCN. In addition, the information provided by this stewardship plan fulfills the Prairie Plan's approach toward local conservation by permanently protecting native prairie parcels that are located in the agricultural and urban matrix of the prairie lands. Finally, the SCA's goal of conserving and enhancing natural lands and habitats is met through the prairie stewardship assistance provided by this plan. This stewardship plan will also lay the basis for adaptive management and monitoring leading to current and ongoing improvements in processes of habitat management and SGCN and rare resource conservation.

This plan was prepared Veronika Phillips, Landscape Ecologist, 2013.

Site Description: Coon Hill Prairie is located in Goodhue County within the Blufflands Subsection, a landscape characterized by a loess-capped plateau that is highly dissected by large rivers and their associated tributaries. Coon Hill contains an excellent example of Dry Bedrock Bluff Prairie, a distinct plant community found along the Mississippi River bluffs. Coon Hill also contains degraded savanna communities, that have the potential to increase the prairie habitat found at this site.

Preservation Value: To protect and perpetuate lands containing an excellent example of Dry Bedrock Bluff Prairie and containing the state special concern plant species *Physaria ludoviciana* (Bladder Pod) and the state special concern insect species, *Hesperia leonardus* (Leonard's Skipper).

Outline of Management Goals, Objectives, and Activities

Goal 1. Sustain and improve the integrity and biological diversity of the native plant communities, including the existing Dry Bedrock Bluff Prairie (Southern) (UPs13c) and degraded savanna, to support SGCNs and rare and endangered species.

Priority Feature A: Dry Bedrock Bluff Prairie (Southern) (UPs13c) Objectives & Activity Summary:

A. Maintain and improve Dry Bedrock Bluff Prairie (Southern) (UPs13c), habitat, as described in the Field Guide to the Native Plant Communities of Minnesota: Eastern Broadleaf Forest Province (MN DNR 2005), by:
    a. Establishing a field survey protocol to monitor areas mapped as UPs13c, including degraded areas, to document their current condition, and re-sampling these at 5-year intervals to determine management needs;
    b. Implementing a rotational prescribed burn regime (informed by knowledge of fire impacts on known rare plants and SGCNs in the prairie) on designated burn units to stimulate the growth and reproduction of native species and reduce and suppress exotic species and woody invaders;
    c. Reducing encroachment and cover of native and non-native fire-intolerant woody species through mechanical, biological, or chemical control.
B. Maintain and increase populations of rare plant species, including *Physaria ludoviciana* (*Bladder Pod*) by:
    a. Monitoring and mapping existing populations;
    b. Improving suitable habitat through restoration of degraded areas;
    c. Choosing management activities that will avoid potential negative effects on these species.
C. Document occurrences of SGCN and rare animal species, including *Hesperia leonardus* (Leonard's Skipper) and facilitate their conservation by:
    a. Coordinating with DNR Nongame Wildlife Specialists to survey insect populations;
    b. Maintaining records of observations and promptly submitting new sightings to the MN Natural Heritage Program; and
    c. Choosing management activities that will minimize or avoid potential negative effects on these species.
D. Reduce cover of invasive species, including, buckthorn, black locust, oriental bittersweet, aspen, crown vetch, and smooth brome by:
    a. Mapping existing infestations, implementing control measures, and monitoring control method results;
    b. Reporting all field work related to invasive species in the MN DNR's AMSD.

Goal 2. Public use and participation in stewardship of Coon Hill in a safe and environmentally sustainable manner.

Priority Feature B: Sustainable Public Use and Stewardship Objectives & Activity Summary:

A. Increase awareness of invasive species and how they are spread by:
    a. Erecting interpretive signs and boot brushes at designated locations;
    b. Closing non-designated trails to eliminate disturbance related to human activity;
    c. Communicating with site visitors, including rationale for management in relation to invasive species, when encountering visitors during management activities; and
B. Facilitate public knowledge of the prairie and volunteer site stewardship activities by:
    a. Hosting a volunteer invasive species removal event;
    b. Establishing a volunteer site steward to assist in monitoring and restoration activities.

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DEFINITIONS

Climate Change Adaptation Strategies: Activities that reduce the vulnerability of natural and human systems against actual or expected climate change effects. Activities are grouped into three categories: resistance, resilience, and facilitation.

Conditions: are attributes that characterize the Priority Feature and describe the quality, viability, or level of intactness of the priority feature or the suitability of the site to provide for its designated uses. It can include measures of the composition, structure, biotic interactions and population variables or comparable measures for abiotic Priority Features.

Conservation Status Ranks: of a native plant community is designated by a number from 1 to 5 (1 = critically imperiled; 2 = imperiled; 3 = vulnerable to extirpation or extinction; 4 = apparently secure; and 5 = demonstrably widespread, abundant, and secure.), preceded by a letter reflecting the appropriate geographic scale of assessment (G = Global, N = National, and S = Sub-national)

Element Occurrence: An area of land and/or water where a species or ecological community is present and has practical conservation value.

Element Occurrence Ranking: of a native plant community is the occurrence of specific Minnesota natural plant communities as ranked by ecologists on a continuum of "A" through "D" ("A" rank indicates an excellent quality natural community, while "D" indicates a poor quality natural community). Factors are aspects of the environment or human activities that have potential to affect the Condition of the Priority Feature or usage of the site either positively or negatively. Negative factors are also known as 'threats'.

Implementation Plan: A multiple year (typically ten year) implementation plan of activities to meet Objective(s). This template provides a table which provides the list of management activities, target Objective(s), and the timing, personnel, funding, and priority for each activity.

Indicators: are measurable descriptions of Conditions and Factors (with a 1:1 relationship between each Condition or Factor and its particular indicator). They define what is measured to keep track of the status of the Condition or Factor attributes.

Indicator ratings: are used to place the indicator value in an appropriate context or frame of reference to assess current Condition relative to a desired target Condition. Ratings provide a range of values that place indicator in three to four categories such as poor, fair, good, and excellent.

Management Plan: A written document that provides management guidelines specific to a single site (SNA). It includes a description and location of the site; the significance of the site in the landscape or ecological province or subsection; lists significant features related to a site including: rare plants and animals, Species of Greatest Conservation Need (SGCNs), Minnesota Biological Survey (MBS) Sites of Biodiversity Significance, MBS native plant communities, soils and geology, and historic vegetation; provides recommended management practices; outlines on a map locations of development and management needs; and an Implementation Table.

Minnesota County Biological Survey: The Minnesota County Biological Survey (MBS), which is administered by the DNR's Ecological and Water Resources Division, began in 1987 as a systematic survey of Minnesota's rare biological features. The goal of MBS is to identify significant natural areas and to collect and interpret data on the distribution and ecology of rare plants, rare animals, and native plant communities.

Native Plant Community: A unique plant species composition and structure related to geography, to important ecological processes, and linked to abiotic environmental factors.

Objectives: are measurable outcomes, results, or targets that aim to maintain or improve the Condition of the Priority Features and/or maintain or improve a Factor that affects their Condition as well as provision for a site's designated uses. Objectives should be SMART (Specific, Measurable, Achievable, Relevant, Time bound) and relate to the Condition and Factor Indicators as well as directed at the goals or desired future conditions.

Priority Features: are the key (priority) ecological and socioeconomic attributes (features or functions) of the SNA*. This is not an exhaustive list of features on the site, but rather they are key components of the SNA that require management attention and specific objectives. Generally, the site management plan will focus on 3-5 (but no more than about 8) Priority Features.

*An ecological Priority Feature could be the ecosystem, ecological processes, native plant communities, rare

features, groups of species, SGCN-Species of Greatest Conservation Need, Threatened &Endangered species, individual species, other significant natural resources. Typically, they would be directly related to the resources the SNA was designated to conserve.

*Socioeconomic Priority Features are the public, educational and/or research purposes of the SNA as defined in the Designation Order that need management attention. (Note: "management" as used in this context includes development, management, and administrative activities included in this plan.)

Restoration: is defined, in the context of this management plan and in agreement with the AMSD Activity Types, as either the subtype 'reconstruction' or 'rehabilitation'.

Reconstruction: is the conversion of an area where the native plant community has been removed, usually by cultivation for agriculture but sometime for housing or other development.

Rehabilitation: is the enhancement or improvement of an existing native plant community that has endured some degree of disturbance yet still harbors elements of that community.

Rare Species: Rare species status of plants and animals defined in MN statue 84.089: E-endangered, threatened with extinction throughout all or a significant portion of its range; T= threatened, likely to become endangered; SPC= special concern, extremely uncommon in Minnesota or has unique or highly specific habitat requirements; N= no status, but tracked as strong candidates for listing in the near future, F-T = Federally threatened.

Species in Greatest Conservation Need (SGCN): Animal species whose populations are rare, declining, or vulnerable in Minnesota and meet one or more of five criteria listed in Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife, Comprehensive Wildlife Conservation Strategy. Division of Ecological Services, Minnesota Department of Natural Resources 2006. The criteria can be found at the following web address: http://files.dnr.state.mn.us/assistance/nrplanning/bigpicture/cwcs/chapters_appendix/appendix_a.pdf

Vulnerability assessment: Is an assessment of the degree to which an ecosystem, resource or species is susceptible to and unable to cope with the adverse effects of climate change.

INTRODUCTION

This Prairie Stewardship Plan presents the site analysis and management recommendations for the Coon Hill Prairie in Goodhue County, Redwing, Minnesota. The 167 acre Coon Hill contains an excellent example of a Dry Bedrock Bluff Prairie community that fall within the ownership of the City of Red Wing and School District #256. The Dry Bedrock Bluff Prairie is found in four openings on the bluff tops and side slopes of Coon Hill and can be reached from the Billlings-Thomfohr Conservation Area Trail system. Coon Hill is located in The Blufflands Subsection of the Ecological Classification System (ECS). This subsection has the highest ranking of known or predicted number of Species of Greatest Conservation Need (SGCN). Approximately 24% (40 ac) of Coon Hill is comprised of Dry Bedrock Bluff Prairie that, with proper management, can increase by 42% the quality of key habitats provided for SGCN and rare species. Approximately 12% (20 ac) of Coon Hill is degraded savanna that, through the removal of natural disturbance regimes, has developed over the decades into degraded oak woodland.

Priority features include: 1. Dry Bedrock Bluff Prairie (Southern) (Ups13c), and 2.Sustainable Public Use and Stewardship

Specific Goals:

- Goal 1. Sustain and improve the integrity and biological diversity of the native plant communities, including the existing Dry Bedrock Bluff Prairie (Southern) (UPs13c) and degraded savanna, to support SGCNs and rare and endangered species.
- Goal 2. Public use and participation in stewardship of Coon Hill in a safe and environmentally sustainable manner

Plan Purpose:

- Improve management and sustainability of private native prairie lands, especially those providing habitat for Minnesota's Species in greatest Conservation Need.
- Increase the availability of technical information on native prairie management to private landowners.
- Improve integration of prairie lands with the rest of a landowner's lands/land uses.
- Develop landowner capacities to monitor and improve their land management actions.
- Increase cooperative management of prairie and prairie ecosystems across the prairie landscape; especially the integration of private/public land management where private lands are adjacent to public lands.
- Increase the availability and quality of private sector prairie stewardship services.

This Plan Includes:

- Background data on: SGCNs, element occurrences, biodiversity significance, existing vegetation, existing land use, topography, geology, soils, hydrology, historic background, and climate change.
- Detailed evaluation of the site conditions at the time of the survey in August and October 2013
- Priority features and their associated conditions, factors, and objectives
- Management recommendations for development, management, and administrative activities.
- Information gathered from MCBS, correspondence, information research, GIS data analysis
- An implementation plan which is a schedule of management actions with approximate costs, staffing and relationship to ecological objectives of the site
- Map, Figures, and Tables that further interpret information contained in the plan
- Appendices that provide further information

BACKGROUND AND SIGNIFICANCE OF THE SITE

SITE SUMMARY (MAP1)

Purpose for Site Protection:

To protect and perpetuate lands in their natural state containing Dry Bedrock Bluff Prairie (Southern) that supports the state endangered plant species: Bladder Pod (*Physaria ludoviciana*), and to use these lands for educational and research purposes in a manner that will conserve them for future generations.

Size: 56 Prairie Acres

County: Goodhue County

Legal Description: S36, TN113, R 15W; S31, TN113 R14W

Ecological Subsection: The Blufflands

Watershed: Catchment ID:3800400; HU12: Hay Creek

Directions to site:

1) From Redwing continue E on Hwy 61 (Main St) , then 0.5 miles S on West Ave., then 0.4 milesW on College Ave, then 1.3 miles S on West Ave (becomes Twin Bluff Rd) to Twin Bluffs Middle Schools. Park in NE parking lot.

Permitted Uses and Special Rules:

Open to the public for nature observation and general educational and research activities including hiking, snowshoeing, and photography. Bow hunting is allowed during designated times.

Primary Site Administrator & Others with Land Ownership Interests:

Primary Site Administrator:

SNA Program, DNR Central Region HQ, 1200 Warner Rd, St. Paul, MN 55106. (651)-259-5800.

Regional Field Coordinator:

Jaime Edwards, Nongame Wildlife Specialist, DNR, 3555 9th St. NW, Suite 350, Rochester, MN 55901, (507) 206-2820 jaime.edwards@state.mn.us

Land Owners:

City of Redwing: Brian C. Peterson, AICP, Planning Director, 651/385-3617, Brian.Peterson@ci.red-wing.mn.us

Independent School District #256: School Superintendent, Karsten Anderson, klanderson@rwps.org ; School District Director of Building and Grounds/Technology, Kevin Johnson, kdjohnson@rwps.org ; Twin Bluffs Middle School Principal, Chris Palmatier, cjpalmatier@rwps.org

ECOLOGICAL DESCRIPTION

Ecological Classification System (Map 2)

The Minnesota Department of Natural Resources and the U.S. Forest Service have developed an Ecological Classification System (ECS) for ecological mapping and landscape classification in Minnesota. Ecological land classifications are used to identify, describe, and map progressively smaller areas of land with increasingly uniform ecological features. The system uses associations of biotic and environmental factors, including climate, geology, topography, soils, hydrology, and vegetation. ECS mapping enables resource managers to consider ecological patterns for areas as large as North America or as small as a single timber stand and identify areas with similar management opportunities or constraints relative to that scale (MDNR, 2013). There are three levels of ECS units discussed below: Province, Sections, and Subsections.

According to the ECS, three provinces representing three major climatic zones converge in our state: prairie parkland, eastern broadleaf forest and coniferous forest. Each province is further broken down into sections that are defined by the origin of glacial deposits, regional elevation, distribution of plants and regional climate. The sections are further divided into subsections based on glacial land-forming processes, bedrock formations, local climate, topographic relief, and the distribution of plants. Coon Hill Prairie lies within the Eastern Broadleaf Forest (EBF) Province, the Paleozoic Plateau Section (PPL), and The Blufflands Subsection.

The 12 million acres of Minnesota that lie within the EBF province serves as a transition between the semiarid western portions of the state that were historically prairie and the semihumid mixed conifer-deciduous forests to the northeast. Because of the abrupt transition from forest and woodland to open grassland, the western boundary of the EBF province in Minnesota is sharply defined along its length. The northeastern boundary is less distinct because of the gradual transition between eastern broadleaf forests and the mixed conifer-hardwood forests of the north. The EBF province lies in an area of Minnesota were precipitation approximately equals evapotranspiration, a climatic condition that has an important influence on where plants grow. Many forest species reach their western range limits and several prairie species reach their eastern range limits within this EBF province. (MN DNR, 2005)

The Paleozic Plateau (PPL) has a distinct landform unique to the state that is comprised of bluffs and valleys. The once flat plateau comprised of sedimentary rocks has been highly eroded and dissected by the tributaries of the Mississippi River over the last 10,000 years. Loess blankets much of the PPL and is thickest along the Mississippi River. The flat fire-prone western part of the PPL was covered by Prairies with an increase in woody vegetation coinciding with a landform that became increasingly dissected and protected from fire as it moved closer to the Mississippi River. Dry prairies were common on southwest-facing bluffs, with oak woodland developing downslope and northward and eastward along these slopes. Mesic forests were prevalent on north- and east-facing slopes, usually dominated by oak on the upper slopes, with basswood and then sugar maple increasing in importance downslope (MDNR, 2013).

The Blufflands subsection is comprised of a highly dissected plateau covered by loess, a wind-blown silt. The Mississippi River and its associated well developed drainage network comprised of many small streams feeding into major rivers such as the Cannon, Zumbro, Root, and Whitewater form a landscape that is characterized by steep bluffs and deep stream valleys. The primary plant community prior to Euro-American settlement was oak savanna and prairie on the dry upper slopes and ridge tops with forests growing along the river valleys and bottomlands.

Species of Greatest Conservation Need (SGCN) (Appendix A):

The Blufflands Subsection ranks number one out of all the subsections of the state with 156 known or predicted SGCN. Of these, 101 to 781 SGCN have been recorded in the two townships where Coon Hill is located due to the high occurrence of potential key habitats. The most important key habitat in the

subsection is prairie followed closely by oak savanna, both of which either still exist on Coon Hill or have the potential to be restored through active management. Habitat loss and degradation resulting from conversion of prairie and savanna to agricultural production is the primary source of species of greatest conservation need (SGCN) vulnerability or decline in this subsection. There has been a 98% reduction in the number of acres of land in the subsection that had once been covered by Oak Savanna and close to 100% reduction of lands with Prairie cover. Forty one SGCN species found in The Blufflands Subsection use Prairie habitat and forty species use Oak Savanna. One SGCN in particular, the butterfly, Leonard's Skipper (*Hesperia leonardus*) requires dry prairie habitats like those found on Coon Hill. The prairie provides grasses for the eggs to develop and larvae to feed on and nectar sources from prairie forbs such as blazing stars (*Liatris* spp.), goldenrods (*Solidago* spp.), and asters (*Symphyotrichum* spp.) for the adult butterflies to feed on MDNR, 2006).

Table A: Key Habitats for SGCN in The Blufflands Subsection and at Coon Hill Prairie (Appendix A)

KEY HABITATS IN SUBSECTION	IN COON HILL
Prairie	**X** (40 acres existing; 56 potential restoration)

Prairie

The MDNR's native plant community classification system has defined an Upland Prairie (UP) community as an herbaceous plant community dominated by graminoid (grass) species and forb (herbaceous flower) rich. UP communities are further defined into a class that is determined by soil moisture, with dry Southern Dry Prairie (UPs13) and mesic (moist) segments being further classified. Classes in the dry group are characterized by a greater abundance of mid height and short grasses and with a sparser vegetation cover than those in the mesic group. The UPs13 classes are further broken into types based on substrate properties with those on Coon Hill having a substrate of thin soils with abundant rock fragments on steeply sloping bedrock formations thus typed to a Dry Bedrock Bluff Prairie (Southern) community. The (Southern) group is found in the southern floristic region of the state and is determined by differences in species composition (MDNR, 2005).

The vegetation structure and composition of a UPs13 plant community is described as having a patchy to continuous (50% to 100%) graminoid cover that is commonly comprised of little bluestem (*Schizachyrium scoparium*), porcupine grass (*Hesperostipa spartea*) with big bluestem (*Andropogan gerardii*), Indian grass (*Sorghastrum nutans*), side-oats grama (*Bouteloua curtipendula*), Plains muhly (*Muhlenbergia cuspidata*), and Kalm's brome (*Bromus kalmii*) being more important in the UPs13c community type than other dry prairie community types. Forbs cover can be sparse to patchy (5% to 50%) with a species composition that includes gray goldenrod (*Solidago nemoralis*), silky aster (*Symphyotrichum sericeum*), purple prairie clover (*Dalea purpurea*), with flowering spurge (*Euphorbia corollata*), skyblue aster (*Symphyotrichum oolentangiense*), bird's foot coreopsis (*Coreopsis palmata*), and bearded birdfoot violet (*Viola palmate* var. *pedatifida*) being commonly found in the UPs13c type (MDNR, 2005).

Historically, the dry prairie community was comprised of patches of variable size and shape within larger mesic prairies. These patches of Dry Prairie are found in areas where moisture deficits occur through variation in local topography or substrate. Dry prairie is typically found on steep, bedrock-cored bluffs and in other areas with excessively drained, highly permeable soils within the PPL (MDNR, 2005).

The continual existence of any prairie community is dependent on a frequently recurring fire regime. The frequency of fire is in response to climate and to landscape properties such as topography and water features. Because of the dry conditions and lower fertility soils found in dry prairie communities, a lower fire frequency may be adequate to inhibit woody species invasion. But, succession to woodland or forest will rapidly occur if fire is absent from the landscape. In addition to keeping woody species at bay, fire is

important in recycling nutrients bound up in litter and in promoting the flowering and seed production of prairie species. Temporary soil exposure resulting from fire also encourages plant regeneration (MDNR, 2005).

Prio to Euro-American settlement, grazing and trampling by bison and elk were regular occurrences in the Southern Mesic Prairie. It is thought that grazing influenced the relative abundance of different plant species through their effects on regeneration and competition between species. As the bison and elk would move through the prairie they would disperse seed through their droppings. Trampling by their hooves provided critical habitat opportunities for short-lived plant species that cannot otherwise reproduce in the dense canopy of tall grasses and forbs that characterize this community. Grazing also opens up the grass canopy and allows shorter plant species to persist in the prairie community (MDNR, 2005).

Fire and grazing worked in tandem to distribute their effects evenly throughout the prairie and to provide periods of respite for plants and animals from both disturbances. Grazers followed recently burned areas because they preferred the more nutritious and palatable new growth that followed fire. Once grazers moved through a post fire prairie, fuel loads would accumulate until the next fire would move through, to again, be followed by grazers. This cyclical relationship between fire and grazers created the conditions that provided for the entire suite of plants that characterize the upland prairie community. It is not known whether the long-term absence of large grazers will result in the disappearance of certain species that rely on their contributions (MDNR, 2005). The steep landform of Coon Hill may have not been accessible to grazers.

Table A2: SGCN Species Highlight

<table>
<tr><td colspan="2">Hesperia leonardus</td><td>Leonards Skipper</td></tr>
<tr><td>MN Status:
special concern</td><td rowspan="2">Basis for Listing
The habitat for Leonard’s skipper in the eastern Minnesta is severely threatened by residential and commercial development and the succession of their prairie habitat to woodland and forest in the absence of fire or other disturbance. The use of herbicides to control weed and shrubs can eliminate adult nectar sources. Insecticides are a potential threat, especially drift from adjacent cropland. The use of prescribed burn may be harmful unless guidelines are followed to lessen the impact.</td><td> 
</td></tr>
<tr><td>Group: insect
Class: Insecta
Order: Lepidoptera
Family: Hesperiidae
Habitats: Upland Prairie, Savanna</td><td>  </td></tr>
</table>

Table A3: Known Species in Greatest Conservation Need at Coon Hill Prairie (Appendix A)

Scientific Name	Common Name	Information Source
Hesperia leonardus	Leonard's Skipper	8/22/2013 photo taken at Coon Hill by V. Phillips; verification by Chris Smith, DNR Nongame Wildlife Biologist

Element Occurrences (Map3):

Table B1: Native Plant Communities

Plant Community Class and Type	Class Code	S-Rank	Acreage
Dry Bedrock Bluff Prairie (Southern)	UPs13c	3 (vulnerable)	40

Table B2: Rare Species

Scientific Name	Common Name	Status *	Information Source
Animal			
Hesperia leonardus	Leonard's Skipper	SPC	8/22/2013 photo taken at Coon Hill by V. Phillips; verification by Chris Smith, DNR Nongame Wildlife Biologist
Plants			
Physaria ludoviciana	Bladder Pod	SPC	8/31/1990, Releve #0462 H. Dunevitz, DNR Plant Ecologist
Asclepius stenophylla	Narrow Leaved Milkweed	E No record in Goodhue Co.	8/22/2013 field verified by Jaime Edwards, DNR Nongame Wildlife Specialist
Tephrosia virginiana	Goat's Rue	SPC No record in Goodhue Co.	8/22/2013 field verified by Jaime Edwards, DNR Nongame Wildlife Specialist

*** E-endangered, threatened with extinction throughout all or a significant portion of its range; T= threatened, likely to become endangered; SPC= special concern, extremely uncommon in Minnesota or has unique or highly specific habitat requirements; N= no status, but tracked as strong candidates for listing in the near future, F-T = Federally threatened.**

Relationship to Sites of Biodiversity Significance (Map 4)

The Dry Bedrock Bluff Prairie (Southern) located on Coon Hill is ranked by the Minnesota Biological Survey (MBS) as having outstanding biodiversity significance. It is one of ten areas located within the City of Redwing that combined provide over 6,000 acres of outstanding biodiversity significance with 359 acres of those designated as Dry Bedrock Bluff Prairie (Southern) habitat.

EXISTING VEGETATION AND MANAGEMENT

Remnant Native Plant Communities (Map 5, Appendix D)

Dry Bedrock Prairie (Southern) (UPs13c) a total of 40 acres of UPs13c is found at Coon Hill and has a B condition ranking meaning that the prairie has a good estimated viability (MNNHP, 1990).

The UPs13c plant community found at Coon Hill is located in four open areas of a nearly circular flat-topped bluff with a series of peninsular shaped projections with steep side slopes. Prairie opening one is three acres in size and is located on the northwest corner of the bluff on a peninsula that extends west from the center of the bluff. Below the south side of the bluff is a valley with a small new housing development and the Neal Street trailhead for the Billings-Thomfohr Conservation Area (BTCA) trail system. The northern border of the prairie opening turns to mesic hardwood forest as the landform drops steeply to the north. The once single linear prairie opening is become fragmented into three smaller areas

Figure 1. View looking west across UPs13c Prairie 1 (August 2013)

from the invasion of woody species that include the exotic invasive species, common buckthorn (*Rhamnus cathartica*) and black locust (*Robinia pseudoacacia*); the native woody invasives, quaking aspen (*Populus tremuloides*), red cedar (*Juniperus virginiana*; and the exotic invasive vine, Oriental bittersweet (*Celestrus orbiculatus*). Prairie species noted include Indian grass, side-oats grama, rough blazing star (*Liatris aspera*), and leadplant (*Amorpha canescens*). A large mat of the exotic invasive herbaceous species, crown vetch (*Coronilla varia*), is suffocating the native prairie species as it infests one edge of the prairie. The BTCA trail system has a loop that crosses through this prairie opening as and appears to be well used. The forest below the prairie opening on the south facing slope is highly disturbed and is comprised of black locust and aspen making up a large percentage of the canopy cover with a few scattered pin or black oak. A few large open grown bur oak and red oak are found along the upland side of the prairie (Phillips field notes, 2013).

The second prairie opening covers 2 acres and is located on the west side of the bluff on a peninsular landform whose north facing slope forms the south slope of the ravine were the Neal Street trailhead is now located and whose wooded west and south facing slopes lead down to residential areas. This prairie was not inventoried or field surveyed due to the inability to navigate through impenetrable buckthorn thicket to reach the prairie (Phillips field notes, 2013).

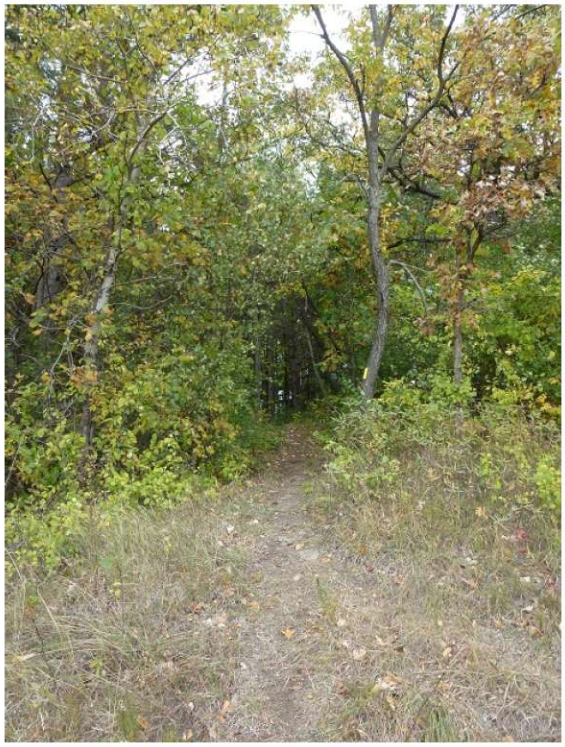

Figure 2. Fragmentation of UPs13c Prairie 1 by invasive species (August 2013)

The third prairie opening is 7 acres in size and is mapped by MBS as one continuous swath extending across the top of the south facing peninsula that has forest growing on the steep slopes that surround it. This prairie opening is reached by a spur trail off the BTCA trail system. Over the last several decades the prairie has become fragmented through the encroachment of aspen and buckthorn. Prairie species noted include Indian grass, prairie dropseed (*Sporobolus heterolepis*), rough blazing star, aromatic aster (*Symphyotrichum oblongifolium*), and leadplant.

The northern section of the prairie has a small grove of young bur oak surrounded by buckthorn seedlings. Oriental bittersweet is beginning to infest the groundlayer and aspen are moving in from the lower slopes along the perimeter. A slash pile of buckthorn from an earlier cutting is located along the path at the entrance to the opening and has buckthorn seedlings growing around and through it. To the south, the prairie is closed off by the invasion of young aspen, with a groundlayer comprised of crown vetch and oriental bittersweet. The most southern tip of prairie three is infested by exotic invasive species that include crown vetch, oriental bittersweet, and common buckthorn. Aspen is encroaching from the outer slopes that surround this bluff top. There are a few scattered Eastern red cedar (*Juniperus virginiana*) and a single red pine (*Pinus resinosa*) (Phillips field notes, 2013).

Figure 3. View looking buckthorn slash pile and buckthorn seedlings at entrance to UPs13c Prairie 3 (August 2013)

Figure 4. View looking north through young aspen trees that are invading UPs13c Prairie 3 (August 2013)

Prairie opening four is the largest with 25 acres mapped by MBS that includes three south facing bluffs that are separated by ravines. The first prairie bluff is located on a small knob that can be reached from a spur trail that extends from the BTCA trail system. Common native prairie species include porcupine

Figure 5. Rock outcrop in UPs13c Prairie 4, Bluff 1 (August 2013)

grass, little bluestem, side oats grama, big bluestem, and rough blazing star. The invasive exotics, crown vetch and scattered buckthorn are found in the opening nearest the adjacent wooded area. A buckthorn slash pile is lying near the entrance and has oriental bittersweet climbing on it. Young bur oak, aspen, and black locust are also found along the upper perimeter. The lower slope has a large infestation of oriental bittersweet along the wooded edge that contains large bur oak and black locust.

Figure 6. View looking south downslope of UPs13c Prairie 4, Bluff 1; note infestation of oriental bittersweet at base of opening with bur oak on slope below (August 2013)

The second prairie bluff is located across the wooded ravine to the east and can be reached by a spur trail that extends from the BTCA trail. An undesignated path leading straight up the bluff from the school is

resulting in erosion of the slope face. This prairie is located on a steep south facing bluff that has a high diversity of prairie species that include the graminoids big bluestem, side-oats grama, little bluestem, indian grass, porcupine grass, plains muhly, prairie dropseed (*Sporobolus heterolepis*), and hairy grama (*Boutelua hirsuta*) (Appendix D).

Figure 7. View looking north from base of UPs13c Prairie 4, Bluff 2; note infestation of oriental bittersweet (bright green) towards base of slope and cottonwood foreground (August 2013)

.

Figure 8. View looking northeast across UPs13c Prairie 4, Bluff 2 at big bluestem with a backdrop of black locust at the woodland margin (August 2013)

A high diversity of forbs were noted throughout the prairie and included prairie sagewort (*Artemisia frigida*) found more frequently in the dryer steeper areas of the slope and rough blazing star growing prolifically farther up on the slope in less rocky areas. The rare butterfly, Leonard's skipper (*Hesperia*

leonardus) was observed feeding on the rough blazing star growing in this area.

The shrub, prairie willow (*Salix humilis*) is scattered throughout the steep bluff. Exotic invasive species include the graminoid, smooth brome (*Bromus inermis*) found along the base of the slope along with large colonies of oriental bittersweet. Black locust is beginning to invade the top of the bluff prairie. (Phillips field notes, 2013 and Appendix D)).

Figure 9. Rough blazing star provides a nectar source for Leonard's skipper (August 2013)

Figure 10. Leonard's skipper (August 2013)

Moving east, a ravine divides the middle and lower slopes of the second bluff from the third bluff. The third bluff can be reached by continuing on the BTCA trail system from the west or the Twin Bluffs

access trail from the east. Overall, the bluff has retained the diversity and structure described twenty years ago by MBS as having a patchy (25% to 50%) graminoid cover with big bluestem and side-oats grama being dominant species, hairy grama and little bluestem as common species, and plains muhly and prairie dropseed as a minor species component. Forb cover is noted as rare (5% to 25%) with aromatic aster and gray goldenrod as the most frequently observed species, followed by prairie sagewort, sky-blue aster, and dotted blazing-star (*Liatris punctata*) (MNNHP, 1990).

Figure 11. Looking east across the top of UPs13c Prairie 4, Bluff 2 towards Bluff 3 (August 2013)

Figure 12. Looking north from base of UPs13c Prairie 4, Bluff 3; note infestation of oriental bittersweet at base of bluff and in patches on bluff slope also monoculture of smooth brome with young oak in foreground (August 2013)

Although the overall prairie has retained much of its diversity, woody species have invaded the upper and lower slopes including the ravines. A monoculture of smooth brome, a large colony of oriental

bittersweet, and scattered sumac and Siberian elm (*Ulmus pumila*) are located at the bottom of the slope above the parking lot. Buckthorn, honeysuckle (*Lonicera tartarica*), Siberian elm, and black locust have infested the lower slope on the south east side of the trail leading up the bluff. Cottonwood and aspen are invading from the wooded edges. Oriental bittersweet is very problematic along a relic fence that traverses the upper slope above the ravine and is found in patches throughout the bluff and near the wooded margin. Overall, buckthorn seedlings are found scattered with a slash pile of buckthorn having significant resprouts. Buckthorn, cherry, basswood, and aspen are found under the powerline that traverses the upper slope of the bluff prior to descending down the ravine to the school (Phillips field notes, 2013). The ravine located in the center of Prairie 4, between Bluff 2 and 3 is described by MBS twenty years ago as having large bur oak and smaller red cedar (MNNHP, 1990). Today this ravine is heavily vegetated with large open grown bur oak being choked out by the invasive species black locust and aspen.

Figure 13. A severe infestation of oriental bittersweet along the Upper bluff of Prairie 4, Bluff 3(August 2013)

Figure 14. Looking East toward Prairie 4 Ravine (August 2013)

Red Oak-White Oak Forest (MHs37a)

A large 81 acre area of Coon Hill is mapped as MHs37a and is comprised of the steeper north-, west- and south-side slopes and the level central area of the bluff excluding the pine plantation in the center. In general, the Southern Dry-Mesic Oak Forest (MHs37) community class is common on thin, loess soils on north-facing aspects on steeper slopes, and on west- or east- facing crests and middle to upper slopes like those found at Coon Hill (MDNR, 2005). The parent material of the soil is a mantle of over 30 inches of stone free loess (wind-deposited silt) over older soils that become very stony as they get closer to the sedimentary bedrock that lies below. It is important to note that historically, the dark upper soil horizon found in a MHs37 community indicates that they may have developed from oak or aspen woodland. This may be the case for some of the areas now mapped as MHs37a at Coon Hill.

The MHs37a plant community type is described as having a structure and composition of a interrupted to continuous (50% to 100%) canopy cover that generally includes northern red oak, white oak, and shagbark hickory as the dominant canopy species. The patchy to interrupted (25% to 75%) subcanopy can include basswood and box elder. The shrub layer is described as having a patchy to interrupted (25% to 75%) cover and can include northern red oak, box elder, basswood, and black cherry along with chokecherry, prickly gooseberry (*Ribes cynosbati*), American hazelnut, red raspberry (*Rubus idaeus*), and poison ivy (*Toxicodendron rydbergii*). The groundlayer can vary from patchy to continuous (25% to 100%) with common forbs of a MHs37 community class being Clayton's sweet cicely (*Osmorhiza claytonia*), pointed-leaved tick trefoil (*Desmodium glutinosum*), commom enchanter's nightshade (*Circaea lutetiana*), wild geranium (*Geranium maculatum*), honewort (*Cryptotaenia Canadensis*), white avens (*Geum canadense*), lopseed (*Phryma letostachya*), and hog peanut (*Amphicarpaea bracteata*). Forbs and shrubs distinctive to a MHs37c community type include round-leaved dogwood (*Cornus rugosa*), red-berried elder (*Sambucus racemosa*), American spikenard (*Aralia racemosa*), woodland sunflower (*Helianthus strumosus*), Canada mayflower (*Maianthemum canadense*), and wild lettuce (*Lactuca* spp.) (MDNR, 2005).

The areas mapped as MHs37a observed during the 2013 field visits show a highly disturbed plant community containing canopy tree species including large red oaks (one in particular had an impressive 91cm dbh), basswood, hackberry, cherry, and shagbark hickory. All of the tree species noted are consistent with a MHs37a community, except with the addition of black locust growing amongst them, in some areas, as the dominant canopy tree. Between the heavy infestation of buckthorn in the subcanopy and shrub layer and black locust in the canopy there is little to no subcanopy trees or groundlayer species typical to a MHs37a. Other invasive species noted were, the shrub, Japanese barberry (*Berberis thunbergii*), and Tartarian honeysuckle.

Some of the areas mapped as MHs37a by MBS were most likely bur oak savanna communities as discussed in the following sections.

Red Oak-Sugar Maple-Basswood- (Bitternut Hickory) Forest (MHs38c)

25 acres of the east facing slope is mapped as MHs38c. the Southern Mesic Oak-Basswood Forest community class (MHs38) is similar to that of MHs37 in that it is also found on loess-covered bedrock bluffs with north-and northeast-facing aspects on steeper slopes. It is important to note that historically, the dark upper soil horizon indicates that a MHs38 community class may have developed from oak or aspen woodland. This may be the case for some of the areas now mapped as MHs38c at Coon Hill.

The MHs38 is similar to a MHs37 community, but a MHs38 is more commonly found on moister sites and usually has abundant sugar maple in the canopy. The MHs38 community is describes as having has vegetation structure and composition of a interrupted to continuous (50% to 100%) canopy cover, a interrupted to continuous (50% to 100%) subcanopy, and a patchy to interrupted (25% to 75%) shrub layer. Northern red oak, sugar maple, and basswood are the most abundant canopy trees. Ironwood and

sugar maple are the most abundant species in the subcanopy, with bitternut hickory being the most common in the subcanopy and shrub layer. The patchy to interrupted (25% to 75%) ground layer of a MHs 38 community class commonly includes zigzag goldenrod (*Solidago flexicaulis*), large-flowered bellwort (*Uvularia grandiflora*), Virginia waterleaf (*Hydrophyllum virginanum*), rue anemone (*Thalictrum thalictroids*), hairy Solomon's seal (*Polygonatum pubescens*) (MDNR, 2005).

The forest area east of the field road on the north facing slope is described twenty years ago by MBS as having a BC (good or fair estimated viability) ranked forest dominated by red oak (*Quercus rubra*) up to approximately 45cm dbh (diameter at breast height) and having tall straight trunks in the canopy along with red elm (*Ulmus rubra*), paper birch (*Betula papyrifera*), basswood (*Tilia americana*), and hackberry (*Celtis occidentalis*) with an understory noted as being quite open. The area west of the field road is noted as having a younger forest with multi-stemmed trunks up to 25cm dbh (Dunovitz, 1990 & 1991). This area was not observed during the 2013 field visit as it does not lie adjacent to any of the prairie openings, but other areas mapped by MBS as a MHs38c do lie adjacent to the most eastern prairie opening and do not contain species consistent with a MHs38c and were most likely bur oak savanna communities as discussed in the following sections.

Black oak-White Oak Woodland (Sand) (FDs27c)

The FDs27c native plant community that once grew at this location as mapped by the MBS has been replaced by a housing development.

Degraded Savanna:

Based on 2013 field observation, 1991 MBS survey notes, and historic record, Coon Hill contains an estimated 20 acres of degraded savanna community. Approximately 16 of those 20 acres is located on the surrounding bluff in the area north of prairie 4.

Figure 15. Degraded savanna showing open grown bur oak among the exotic invasive species, black locust and buckthorn (August, 2013)

Historic photos from 1938 show an open landscape with very limited scattered trees, while present day vegetation consists of large open grown bur oaks in a matrix of black locust. MBS survey notes describe the area bordering the north edge of Prairie 4 as being "disturbed oak savanna (which is densely overgrown with trees, saplings, and shrubs including *Xanthoxylum* and *Rhamnus*)". Further comments refer to the northeast facing ravine on the north side of Prairie 4 as "not maple basswood forest was

probably bur oak savannah. Now widely scattered *Q. macrocarpa* with dense thickets of *Rhus glabra* (with *Rhamnus cathartica*, & other shrubs), *Acer negundo*, *Gleditsia*, and scattered oaks. Class as mixed oak woodland (CD rank)" (Dunovitz, 1990 & 1991).

One other south facing slope adjacent to prairie 3 appears to have once been oak savanna based on historic aerial photos and existing vegetation. Today, the ground and shrub layer of this area is predominately buckthorn with a canopy of aspen and black locust.

Other Land Use (Map 5):

Agriculture/Conifer Plantation (Map 3 and 4)

Approximately 18 acres of woodland/forest formerly located in the center of the bluff have been converted to agricultural land followed by a spruce and pine plantation. This area of land borders the north side of Prairie 1 and Prairie 3 and northwest tip of Prairie 4.

Powerline Cut

A powerline traverses the prairie bluff cutting from east to west along the property line before turning south down the ravine to the school.

Billings-Thomfor Conservation Area (BTCA)

The 96 acre BTCA is city owned land that includes Prairie 1, 2, and parts of 4. An extensive trail system loops through BTCA and is accessed by three points from the surrounding neighborhood.

Existing Surrounding Land Use (Map 5):

Twin Bluffs Middle School

Twin Bluffs Middle School lies adjacent to the south border of Coon Hill and the school district owns much of the native prairie land. An access trail to the prairie is located on the northeast corner of the east parking lot. Playing fields including a baseball and a running track are located at the base of the bluff.

Residential Development

Coon Hill is within Red Wing City limits and is surrounded by residential neighborhoods, excluding the school property bordering the south.

Golf Course

A golf course is located to the northeast across the residential area along Spruce Drive.

SITE GEOLOGY, SOILS, AND TOPOGRAPHY

Geology:

Bedrock Geology (Map 6)

Bedrock is the consolidated sandstone, limestone, and shale that is exposed at the surface or lie directly beneath the unconsolidated deposits of a more recent origin, primarily during the Quaternary Period that began 2 million years ago, considered to be our present period in geologic history. The bedrock of Goodhue County was deposited as sediments in a shallow sea that covered southeastern Minnesota and the surrounding region 520 to 350 million years ago during the Paleozoic Era (Romkel, 1998). Two of the most important events in the history of animal life occurred during the Paleozoic Era: in its beginning, multi-celled animals underwent a dramatic explosion in diversity, with the appearance of almost all of the major groups of animals; and at its end, approximately 90% of all marine animal species were wiped out in a mass extinction (University of California, 1994-2013).

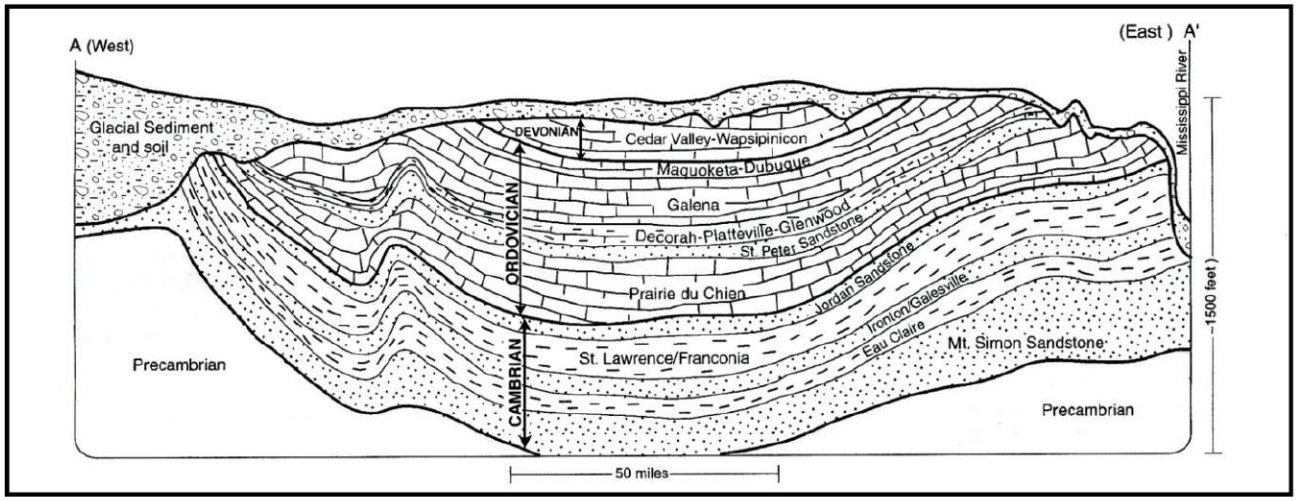

Figure 16. Cambrian Period Bedrock (U of MN, 2000)

The earliest period of the Paleozoic Era is called the Late Cambrian, which is dated at 490 to 543 million years ago. The Late Cambrian period bedrock was deposited in five layered formations of sedimentary rocks beginning with the Mt. Simon Sandstone, and moving upward to the Eau Claire, Ironton/Galesville Sandstone, St. Lawrence/Franconia and at the top Jordan Sandstone. (U of MN, 2000) The bedrock found in the surrounding area at the base of Coon Hill bluff is comprised a 30 to 175 feet thick St. Lawrence /Franconia formation (Csf). The lower bluff of Coon Hill is comprised of Jordan sandstone (Cj) that is generally 30 to 100 feet thick. At the upper reaches of the bluff, Jordan sandstone is replaced by 105 to 200 feet thick Oneota Dolomite (Opd) from the Prairie du Chien Group. This bedrock is more recent in that it was formed during the Ordovician geologic period, between 488 to 444 million years ago. (Romkel, 1998).

The Paleozoic Era deposits occurred during a time when North America ran in an east-west direction along the equator thus creating a tropical climate in what was Minnesota's low-lying flat landscape. During the Cambrian and most of the Ordovician period, sea levels rose and encompassed most of North America, including what is today, southern Minnesota. The shallow sea that covered this area of Minnesota was bordered on the northeast by higher ground called the Wisconsin Dome. For over 200 million years sediments accumulated in flat layers under the sea from the eroding landscape of the Wisconsin Dome. As the sea level fluctuated, its shoreline would change in its position, moving back and forth across southern Minnesota depositing sediments in a texturally graded shelf formation. (U of MN, 2002).

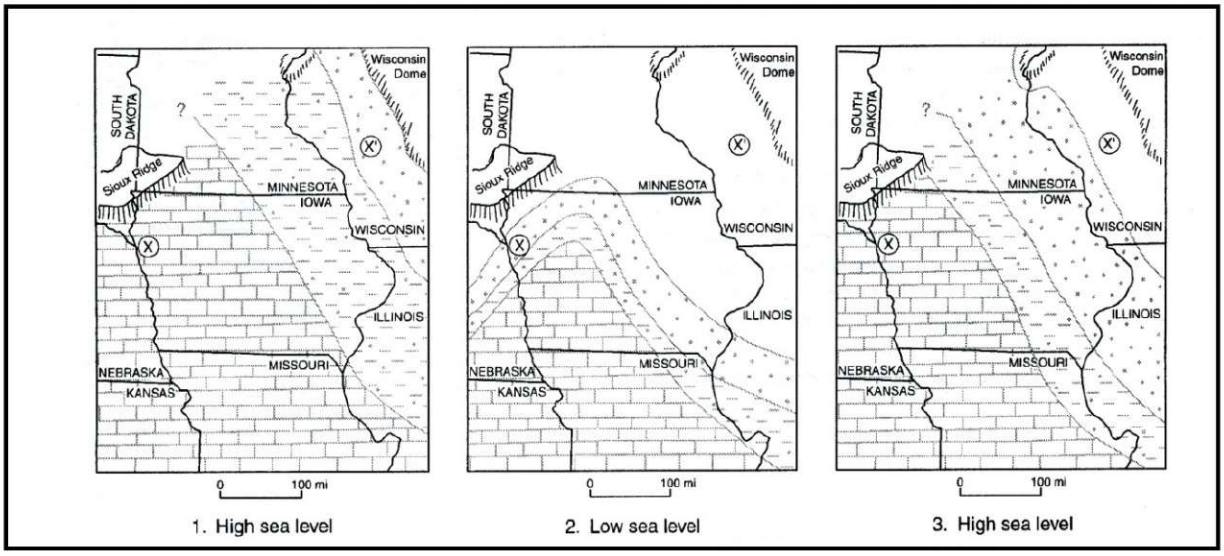

Figure 17. Cambrian Period Sea Deposits (U of MN, 1997)

Different sized sediments would be sorted and deposited by currents to differing depths of the sea. The coarsest sand was deposited in the shallow areas along the shore to form what is today called the Jordan sandstone formations. Past the shore, on a large offshore shelf located in deeper water, finer sand, silt and clay particles were carried out and deposited to form the Franconia formations with the St. Lawrence formation accumulating along the shelf during a period of higher sea levels. The Prairie du Chien group sediments that comprise the Oneota Dolomite were deposited hundreds of miles from the shore in the deepest stillest waters. (University of Minnesota, 1997)

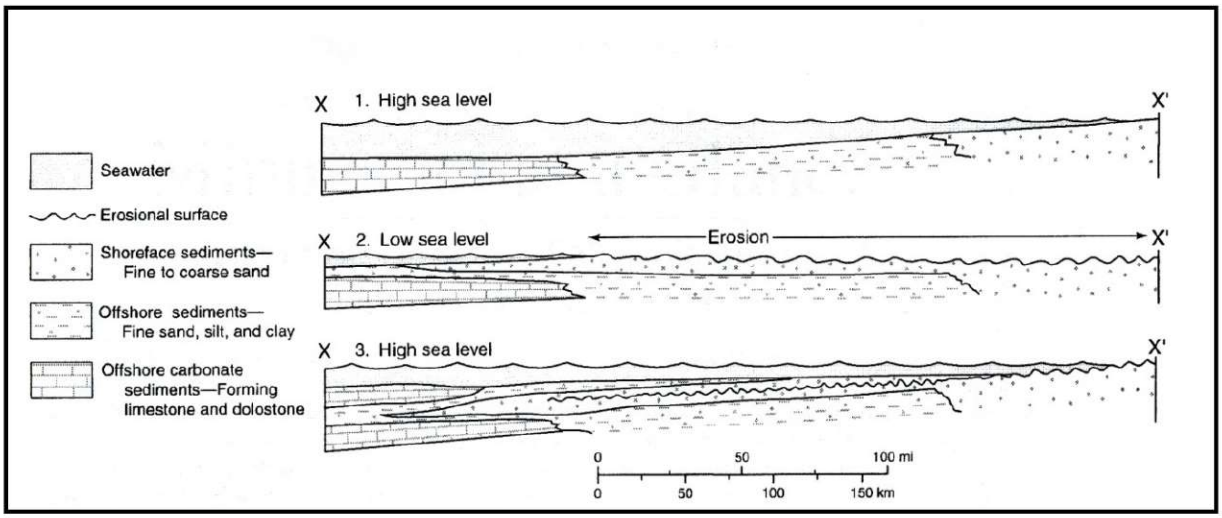

Figure 18. Bedrock Deposition by Cambrian Period Sea (U of MN 1997)

Surficial Geology (Map 7)

75,000 years ago, the Laurentide Ice Sheet advanced for the last time in what is called the Wisconsin Episode. During the periodic growth and decay of the Wisconsin glaciation, lobes of ice extended like tongues and were named according to their respective geographic areas. Most of Goodhue County was free of ice during the Wisconsin Episode. The till and outwash deposits that found in Goodhue County are

much older in origin, left by earlier glaciations that moved in from the northwest from the area that is today Winnipeg, Canada. These deposits older glacial deposits are considerably eroded and display numerous bedrock outcrops on the valley sides. Although glaciers did not enter Goodhue County from the later Wisconsin Episode, the effects from this later glaciation are found in the thin layer of loess that covers the older till and bedrock. As the postglacial winds blew, the fine-textured loess left by the Des Moines Lobe of the Wisconsin episode was re-deposited to the western and southern parts of the state, including, Goodhue County (Ojakangas and Matsch, 1982).

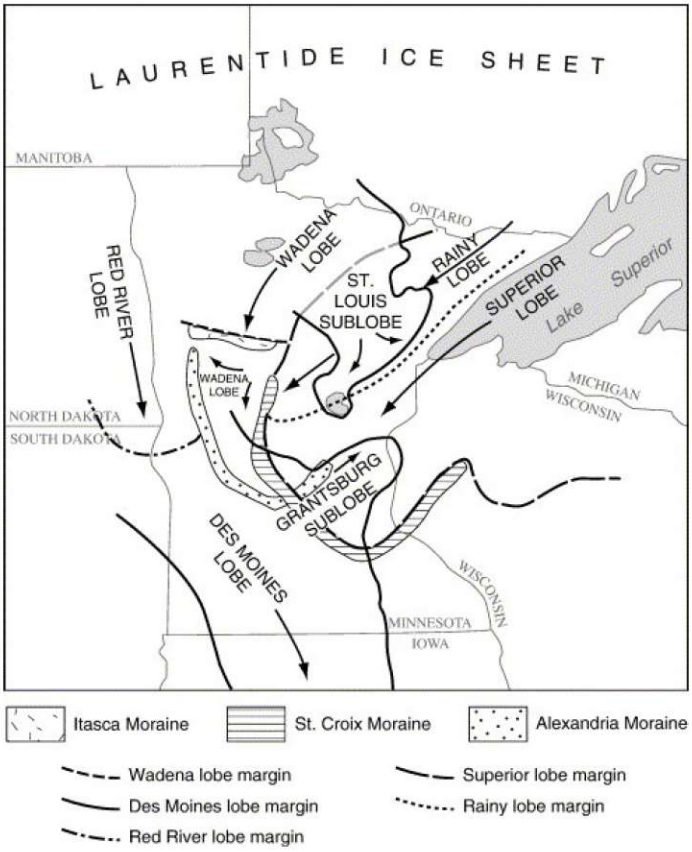

Figure 19. Glacial lobes from the Wisconsin Episode (Jennings, Carrie, 2006)

Coon Hill Bluff has surficial geology that is representative of Goodhue County's geologic history with a composition of bedrock outcrops and bedrock that is generally within 5 feet of the surface, exclusive of the loess (MzPz) on its higher elevations. Coon Hill Bluff side slopes are comprised of Colluvium from hillslope deposits derived from bedrock and from loess upslope (Qmc) that typically consist of two subunits: (1) a rocky lower unit of angular carbonate fragments in a silty to sandy matrix, which is overlain by (2) a unit, primarily composed of silt, that contains a few carbonate fragments. The composition of the lower unit reflects the bedrock upslope; the upper is largely reworked loess. Both strata are thin (less than 5 feet) on the upper parts of the slope than thicken (to a maximum of about 30 feet) as they move downslope. Exposure of bedrock is common, especially on the upper parts of slopes. The surrounding level areas at the base of the bluff consist of Alluvium deposits left by braided streams and sheetfloods in valleys (Qmal) that are predominantly sand, but can include some gravel and finer sediment. These deposits form terraces above the modern floodplain and contain alluvium from the present Hobbs and Setterholm, 1998).

Topography (Map 8):

Coon Hill Prairie is located in the Elba Slopes Landtype Association (LTA) within The Blufflands subsection. (MDNR, 2013). The Elba Slopes LTA is further characterized by a topography that includes steep hill sides and gullies with slope gradients of 20% to 70%. The transition from ridge top to steep side slope is usually very abrupt. Bedrock outcrops are common.

Coon Hill Prairie lies on a large bedrock bluff that rises approximately 160 feet above the surrounding landscape. Steep rocky slopes form a series of bluffs and ravines that circumscribe the perimeter of the level bluff top.

Soils (Map 8):

Coon Hill Bluff consists entirely of upland soils that are typical of the bedrock bluffs found throughout Red Wing. The very summit of the bluff where the topography levels off are Newhouse-Valton complex (N582B, N582C2) silt loams found on slopes ranging from 2% to 12%. These are the only soils on the bluff that are classified as prime farmland and resulted in their conversion to agriculture several decades ago, and more recently to a pine/spruce plantation. Newhouse-Valton complex silt loams with 12% to 18% slopes, moderately eroded (N582D2), are located on the summit of the prairie bluffs in locations that support areas of existing prairie and a historic savanna community. Brodale, flaggy-Bellechester complex, 30% to 70 % slopes (N638G) soils are located on the steep side slopes and are excessively drained with a surface area covered with cobbles, stones or boulders. These loamy sand soils have a depth to the underlying bedrock of 40 to 80 inches and support the majority of the existing prairie community. The silt loams of the Frontenac-LaCrescent Complex, 30% to 70% slopes are located on the north and eastern steep side slopes and presently support a forest community. Ridgeton, sandy substratum-Eden Prairie complex, 12% to 20% slopes, moderately eroded (N586D2) are found at the base of the bluff and are well drained sandy loams. This area is now in residential land use. Chelsea Loamy Sand, 12% to 35% slopes (N594E) are located along the western base of the bluff and are derive from a parent material of eolian sands resulting in excessively drained soils. These soils previously supported a dry oak woodland, but have recently be converted to housing.

Soil types are summarized in Table D. (NRCS, 2013)

HYDROLOGY/WATERSHED

08 Watershed (Map 9)

Coon Hill prairie is in the 3800400 level 08 watershed which encompasses 21,397 acres of the 30,406 acre Hay Creek watershed. Hay Creek is located west of Coon Hill prairie and continues north into the city limits to eventually drain directly into the Mississippi River. The upper reaches of Hay Creek lie just short of the town of Goodhue. Hay Creek is a non-designated trout stream in its upper reaches in areas of flatter topography that support surrounding agricultural land use. As the stream valley becomes increasingly incised, it enters into the Richard J. Dorer Memorial Hardwood Forest where it becomes a designated trout stream. Land use in the watershed is predominately agricultural, residential, and recreation. The 1,500 acre Hay Creek Management Unit is located along Hay Creek and provides valuable protection from the surrounding agricultural land use. There are no lakes in this watershed and wetlands are very few with the exception of Hay Creek. The National Wetland Inventory shows that the Hay Creek stream bottomlands contain numerous wetland habitats along its length.

HISTORICAL BACKGROUND

Historic Vegetation (Map 10 and 11):

At the time of the public land survey in the 1850s, prairie and savanna covered one third of the state,

occupying a wide variety of landforms including steep bluffs like those found along the Mississippi River. 1853 field notes provide a general description of the township as: "Land Rough. 2nd rate timber scattering Bur and Jack Oak. " -Elisha S. Norris 1853

The original public land survey maps and notes by Marshner, show that prairie and oak openings and barrens were the predominant vegetation in Goodhue County. River bottom forest and hardwood forest were located along the major river valleys prior to Euro-American settlement. The rocky dry bluffs found throughout Red Wing provided conditions that supported oak openings and barrens and prairie communities. Areas identified as oak openings and barrens ranged from small groves of trees intermixed with open prairie (oak savanna) to shrubland communities of scrub forest and dense shrub thickets. Bur oak as indicated by the bearing tree records as the dominant tree.

Fire frequency and soil moisture were the determining factors in the structure of these communities. Historically, fire was frequent, with a return interval of less than 10 years and in a bluff setting, its frequency and severity created conditions that prevented trees and shrubs from dominating the underlying herbaceous layer of prairie species, yet allowed some fire-tolerant trees like bur and pin oak to become established. Hot, intense fires were less likely to occur in the dry conditions because of the lower fuel load resulting from less productive soils. (MN DNR, 2005)

1938 Historic Photo (Map 11)

The 1938 aerial photo shows a landscape that most likely resembles the pre-settlement vegetation in this area. The prairie cover in all four prairie openings is much more extensive than it is today. Scattered trees and open prairies are located on the top and north sides of the eastern peninsula that today is comprised of degraded woodland/forest community. The south facing and east facing ravines are much more densely wooded today than what is shown 75 years ago. Agricultural land use is underway on the flat uplands.

Table C: Soils of Coon Hill Prairie

Soil Name	Soil Symbol	Drainage Class	Flood Class	Hydric Rating	Ponding Class	% Slope	Surface Texture
Newhouse-Valton Complex	N582B	Well drained	None	B	None	2 to 6	silt loam
Newhouse-Valton Complex	N582C2	Well drained	None	B	None	6 to 12	silt loam
Newhouse-Valton Complex	N582D2	Well drained	None	B	None	6 to 18	silt loam
Chelsea loamy sand	N594E	Excessively drained	None	A	None	12 to 35	loamy sand fine sand
Brodale, flaggy-Bellecheser Complex	N638G	Excessively drained	None	B	None	30 to 70	channery loam loamy sand,
Frontenac-Lacrescent Complex	N639G	Well drained	None	B	None	30 to 70	silt loam
Ridgeton, sandy substratum-Eden Prairie Complex	N586D2	Well drained	None	B	None	12 to 20	Loam, sandy loam

PRIORITY FEATURES & THEIR CONDITIONS, FACTORS, OBJECTIVES, INDICATORS

Management of this site is focused on the following Priority Features and addressing the Conditions, Factors, Objectives and Indicators that pertain to it or affect it in some way. SMART Objectives are to be used: specific, measurable, attainable, relevant, and time bound. Each Objective is linked to a Goal (page 5) (See also Definitions Section in the beginning of this document)

Table D: Priority Features

Priority	Type	Name
A.	Native Plant Community	Dry Bedrock Bluff Prairie (Southern) (UPs13c)
B.	Public Use	Sustainable Public Use and Stewardship

Table E. Example Conditions Factors, Objectives: Priority A

Project area:	Coon Hill Prairie	A. Priority feature:	UPs13c Dry Bedrock Bluff Prairie (Southern)

Condition attributes:	Condition indicators:	Condition ratings:	Current value (source)	Objectives	Goals P.9
1)Condition rank of remnant NPC	Level of disturbance, species composition and diversity, % invasive species	A excellent, B good, C fair, D poor	B (1991 releve)	1) Over next 5 years, maintain or improve condition ranking to B, by: using prescribed fire to stimulate growth and reproduction of native species & reduce and suppress exotic species and woody invaders; the control of invasive species through mechanical, biological, or chemical control; the collection and broadcasting of seed into areas that have undergone woody species removal; a monitoring regime of every 5 years through an established field survey protocol.	1
2) Native species dominance in 2a) remnant NPC areas 2b) degraded savanna or oak woodland-brushland (wood/brush) areas	Mean percent cover of native species in plots/transects	Good = 90-100%, Fair = 70-90%, Poor <70%	2a) Good (1991 releve) 2b) Poor (2013 field observation)	Over the next 10 years, 2a) increase % cover to Good, by using management techniques described in Objective 1 2b) increase % cover to Fair, by using management techniques described in Objective 1	1
3) Conservative herbaceous spp. frequency in 3a) remnant NPC areas 3b) degraded savanna or woodland-brushland areas	Mean percent frequency of conservative species in plots/transects	Good = >20 %,Fair = 10-20%, Poor = 0-10%	3a) Good (1991 releve) 3b) Poor (2013 field observation)	Over the next 10 years, 3a) increase % frequency to Good, by using management techniques described in Objective 1 3b) increase % frequency to Fair, by using management techniques described in Objective 1	1
4) Plant species diversity in remnant NPC	Number of species per unit area	Good = >40 Fair =<40 - >30, Poor = < 30	Good (1991 releve & 2013 field survey)	4) Over the next 10 years, maintain plant diversity at Good, by using management techniques described in Objective 1	1
5) State listed species presence: *Physaria ludoviciana* (Bladder Pod) **Asclepius stenophylla* (Narrow-leaved Milkweed), **Tephrosia virginiana* (Goat's Rue) **Hesperia leonardus* (Leonard's Skipper)	# of populations of state-listed species	Good= > 3 ; Fair = <3 - >2; Poor = <2	Good(1991 releve& *Poor (2013 field survey)	5) Over the next 10 years, maintain or increase state listed plant and insect species populations to Good and *Fair.	1
6) Presence of SGCN : *Hesperia leonardus* (Leonard's Skipper)	# of populations of state-listed species	Good= > 3 ; Fair = <3 - >2; Poor = <2	Unknown (2013 field survey)	5) Over the next 5 years, survey for populations of SGCN insects.	1

7) Areas of degraded savanna or oak woodland-brushland plant communities	% of total area in lower quality	Good = 0-10 %, Fair = 10 -25%, Poor = 25-50%	Poor (2013 GIS analysis & Field observation& 1991 MBS survey notes)	8) Over the next 10 years, decrease percent of lower quality area to 30%, by using management techniques described in Objective 1	1
8) Invasive species in 9a) remnant NPC: Buckthorn, Black Locust, Oriental Bittersweet, Aspen, smooth brome, crown vetch 9b) degraded savanna or oak woodland-brushland areas: Buckthorn, black Locust, oriental bittersweet, Japanese barberry, Tartarian honeysuckle, Siberian elm	% of area with invasive sp.	Excellent = 0-5%, Good = 5-10%, Fair = 10-25%, Poor=>25%;	9a) Fair 9b) Poor (2013 Field Observation & GIS analysis)	9a) Over the next 10 years, decrease % of cover of invasive species to Good, by using management techniques described in Objective 1 9b) Over the next 10 years, using % of buckthorn as an understory indicator and black locust as canopy indicator, decrease % of invasive species cover to an improved Poor rating by using management techniques described in Objective 1	1
Factor attributes:	**Factor indicators:**	**Factor ratings:**			
10) Protection from invasive species encroaching from perimeter and interior areas 100% adjacent woodland (buckthorn, black locust, honey suckle, Japanese barberry, oriental bittersweet) 10% school grounds(smooth brome, oriental bittersweet, Siberian elm, honeysuckle) Unknown % residential	% of perimeter with invasive species	Good = 0, Fair = 1-10%,Poor = 10-50%	Poor	10) Within 10 years, work with public and private landowners to use management practices to decrease invasive species to an improved poor rating	1
11) Fire disturbance	Fire return intervals	Good = 2 to 4 years, Fair = 4 to 6 years, Poor = >10years; appropriate fire frequency is unit-dependent	Good	11) Continue conducting prescribed burns at appropriate fire frequency : UPs13c: 4 year rotation Highly degraded units 2 to 4 year rotation until exotic herbs and woody species have been reduced to goal rating; than increase to a 4 to 10 year rotation, monitor community	1
12) Destructive public use	Signs of disturbance (SOD) or Direct observation (DO)	SOD: user developed trails DO of rule violation	SOD: Undesignated trails	13) Within 1 year, place signage to redirect users to access path to the east. Place signage at bottom and top access to educate users on erosion issues and invasive species.	1
13) Protect against species loss and changing composition resulting from climate change	Acres of prairie and savanna or oak woodland-brushland	0 to148	May be occurring at this time	14) Improve NPC remnant anddegraded savanna; protect current acres; maintain species diversity, and monitor changes	1

Table F. Example Conditions Factors, Objectives: Priority B

Project area:	Coon Hill Prairie	D. Priority feature:	Sustainable Public Use and Stewardship

Condition attributes:	Condition indicators:	Condition ratings:	Current value (source)	Objectives	Goals P.9
1) Informational signs: Interpretive	Presence of interpretive signs	Good= Adequate Fair = Inadequate Poor = Absent	Poor	1) Within 2 years, erect invasive species interpretive signs and boot brush at Twin Bluff Access Trail and at scenic overlook points.	2
Factor attributes:	**Factor indicators:**	**Factor ratings:**			
2) Local support	Number of volunteer events per year	Good = 1Poor = 0	Poor	2) Over the next 10 years, host an average of 1 volunteer invasive species removal event/ year.	2
3) Destructive public use	Signs of disturbance (SOD)	SOD: Undesignated trails	SOD: Trail on Prairie 4	3) Within 1 year, place signage to redirect users to access path to the east. Place signage at bottom and top access to educate users on erosion issues and invasive species.	2
4) Establish a site steward	Assigned site steward	Yes, No	No	4) Within 1 year, establish a site steward to assist in monitoring and restoration activities	

MANAGEMENT RECOMMENDATIONS

ACTIVITIES

Development Activities (Map 12)

Signs

Install interpretive signs and boot brush stations at Twin Bluffs Access Trail entrance. Install boot brush stations at the three scenic overlook points. The boot brush stations include invasive species interpretation and a boot brush that is used to reduce the spread of invasive species seeds. Interpretive signs at the entrance to Twin Bluffs Access would provide a narrative of the ecological significance of the bluff prairie with some species highlights.

Place signage to discourage use of undesignated trail going up Prairie 4, Bluff 2 by redirecting users to access path to the east.

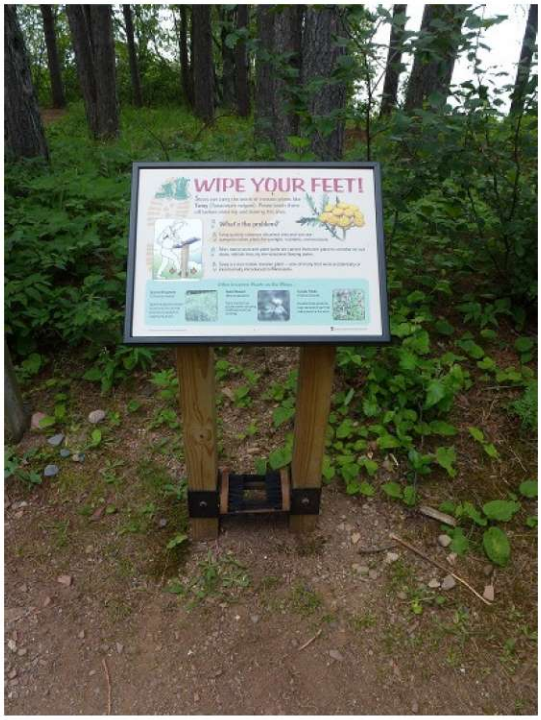

Figure 20. Example of boot brush station with invasive species interpretation (Phillips, 2012)

Management Activities (Map 12)

Coon Hill is organized into management units in an effort to prioritize activities and provide a realistic timeframe for their implementation. Because of their size and quality, management units 3, 4, and 5 are priority. Management unit one would follow as it still retains some good quality areas, but will require intensive invasive woody species removal to regain lost acreage. Management units 6, 7, and 8 are lowest in priority as they will entail intense invasive woody species removal that will require extensive resources to complete and have retained little of the community composition and structure. Management unit 2 will require further inventory to assess its suitability for management.

Dry Bedrock Bluff Prairie (Southern) (UPs13c)

The UPs13c community is divided up into 6 management units based on location and topography. The

management units are comprised of a remnant UPs13c community as mapped by MBC with additional acres included that are closer aligned with the historic prairie vegetation found on Coon Hill prior to the removal of a natural disturbance regime and the influx of invasive species. The plant community goal for the UPs13c is to improve or maintain the condition ranking of B in having: a sparse shrub cover (<5%); vegetation comprised of native species with an occasional bur oak or black oak; a full complement of dry prairie grasses with a diverse mix of dry prairie forbs and shrubs; the presence of forb species sensitive to disturbance; and very few to no exotic species present (Minnesota Natural Heritage Program, 1995). A visual benchmark regarding prairie cover is the 1938 aerial photo shown in Map 11.

Dry Bedrock Bluff Prairie (Southern) UPs13c

Management Unit 1 is comprised of 8 acres with an existing 3 acre area designated as UPs13c. Five additional acres have been added to this unit. The perimeter of the existing prairie and the additional 5 acres is heavily wooded, requiring intensive management with methods of woody species removal prior to a prescribed fire regime. The herbaceous areas cleared of woody invasive species may require seeding of locally gathered seed.

Management Unit 2 is 4 acres in size doubling the area that is now shown as UPs13c. This unit has one record of Bladder Pod.

Management Unit 3 is 13 acres in size and is comprised of 7 acres of a designated UPS13c community. Woody species removal will be needed on the perimeter slopes and interior areas of this unit prior to a prescribed burn. The herbaceous areas cleared of woody invasive species may require seeding of locally gathered seed. This unit shows a record of five Bladder Pod populations, all located on the perimeter or just outside the mapped UPs13c community, but lying within the proposed prairie boundary.

Management Unit 4 is 14 acres in size and is comprised of two bluffs and their associated side slopes. This unit requires intensive woody species removal along the side slopes and on the bluff top prior to a burn. The herbaceous areas cleared of woody invasive species may require seeding of locally gathered seed. This unit is known to provide habitat for Leonard's Skipper and is recorded as having Bladder Pod growing on both bluffs.

Management Unit 5 is 11 acres in size and has been mapped as a UPs13c community in its entirety. The ravine, upper and lower slopes, and the wooded margins will require woody species removal prior to a burn. The herbaceous areas cleared of woody invasive species may require seeding of locally gathered seed. This unit is recorded as having one Bladder Pod population.

Management Unit 6 is 6 acres in size and includes the mapped UPs13c community along the southern section between the existing trail and property boundary. The northern portion of this unit has a cover of large woody invasive species that will require other methods of management prior to a burn.

Degraded Savanna or Oak Woodland-Brushland

Two additional management units comprised of the proposed savanna plant community that will require intensive woody invasive species removal by a number of methods prior to a regime of prescribed burning

Management Unit 7 is located on the south facing bluff below Prairie 3 and has a heavy cover of woody invasive species. This unit will require intense management of the woody species prior to a burn regime.

Management Unit 8 is 15 acres in size and will require intensive management of the woody invasives that have infested this once open savanna land. Prescribed fire in conjunction with other management techniques will be used to eradicate the invasive species and open up the canopy.

<u>Invasive Species Control</u>

Native Woody Invasive Species

Smooth sumac (*Rhus glabra*) is the least problematic invasive species in the remnant UPs13c

communities at this time, but will definitely need to be monitored and managed when necessary.

Aspen (*Populus tremuloides*) will need to be managed by mechanical means of either girdling or frilling. Aspen are native trees but are undesirable species of prairies and oak savannas as they are capable of spreading rapidly and crowding out other vegetation. Although aspens grow from seeds, the primary spread is asexual by underground runners that form a clone of many trees whose roots are interconnected. If an aspen is cut or injured it will respond by sending up new shoots.

Aspen is found throughout Coon Hill and is most problematic in Prairie 3 and along the Twin Bluffs access trail.

Exotic Invasive Species

Common buckthorn (*Rhamnus cathartica*) is native to Eurasia and was introduced before and during the early 1800s by colonists from Europe, primarily as an ornamental hedge plant. It subsequently escaped cultivation and has silently and perniciously invaded native habitats in Minnesota. The sale of common buckthorn was halted in the 1930s after it was discovered that it is an alternate host to oat crown rot, a fungal disease of oat crops. Common buckthorn is on the restricted noxious weeds list which means that plants are widely distributed in Minnesota and are detrimental to human or animal health, the environment, public roads, crops, livestock or other property, but whose only feasible means of control is to prevent their spread by prohibiting the importation, sale, and transportation of their propagating parts in the state.

Figure 21. Common Buckthorn Keys to Identification include black berries and shining leaves (left) (Wikipedia, 2013), corky bark (middle) (MDNR, 2013), and terminal thorn (right)(PCA Alien Plant (Working Group, 2013).

Common buckthorn grow aggressively and out-compete native vegetation for space, light, water and nutrients. The growing season is much longer than native plants with a very early bud break in the spring and active growth well into late fall when native trees and shrubs have lost their leaves and stopped photosynthesizing. Buckthorn thickets are so dense that native plants in the herbaceous and shrub layer are outcompeted and disappear resulting indestruction of habitat and diminished diversity. Due to its laxative nature, wildlife receive no nutritional value from eating it and the fruit is dispersed unharmed and ready to sprout.

Common Buckthorn is a tall understory shrub or small tree up to 25feet high with a spreading loosely branched crown, often multiple stems at the base. The brown bark has silver corky protrusions; the stems

and leaves can grow in an opposite or alternate pattern; the simple leaves are glossy and finely toothed with 3 to 5 pairs of curved leaf veins. Stems often end in a small sharp thorn. Fruit is black berry clusters that ripen in late summer.

Buckthorn continues to be problematic in the more heavily wooded areas surrounding the prairie openings and is found along the margins of several of the openings. Common buckthorn will require continual management throughout Coon Hill using a variety of control measures.

Asian bush honeysuckle (*Lonicera tartarica, L. maacii, L. morrowii*) was introduced as early as the 1700s. Certain species were promoted by the USDA for wildlife habitat and shelterbelts in the 1890's. These shrubs leaf out early in the season and retain their leaves longer than most native shrubs, resulting in a reduction of available sunlight and soil moisture for surrounding native plants. The seeds of Asian bush honeysuckle are dispersed over long distances by the wildlife that feed on them. There is indications that some species of Asian bush honeysuckle are allelopathic (having chemicals that inhibit the growth of other nearby plants).

Asian bush honeysuckles are upright deciduous shrubs that are 5 to 12 feet high. Older stems have shaggy bark and stems area hollow. The simple, untoothed leaves are opposite, flowers bloom in spring and can vary from white, pink, and red in color. The red or yellow fruit develop in pairs in the leaf axils

Figure 22. Honeysuckle identification paired fruit at base of opposite leaves (left) hollow stem (right) (Forest Invasive Plants Resource Center, 2013)

Asian bush honeysuckles are located on the east side of the Twin Bluffs access trail in the area that historically was prairie, but with the removal of natural disturbance has developed into a scrubby wooded area. Asian bush honeysuckle will require continual management throughout Coon Hill using a variety of control measures.

Black locust (*Robinia pseudoacacia*) is native to the Appalachia region of the United States. Black locust was introduced to Minnesota primarily for its use as a landscape tree, but its highly invasive qualities has resulted in its invasion into disturbed habitats such as degraded woodlands, forests, and old fields. Black locust form single species stands through its extensive fibrous root system and ability to spread vegetatively through root suckering and runners. It competes and crowds out native vegetation in prairies, savannas, and upland forests.

Black locust is a fast growing tree that can reach 75 feet in height with deeply furrowed bark. On young branches the bark is smooth and greenish to brown in color. The stems are crooked and angular with stout, single, thorns. Leaves are alternate and pinnately compound (leaflets on both sides of a common

stalk) and have a pair of short, sharp thorns at the base of each leaf were it is attached to the twig. Fragrant drooping white flowers are arranged in clusters that appear in spring. Seed pods appear in fall and are 2 to 4 inches long.

Figure 23. Black Locust Keys to Identification (from left clockwise): furrowed bark, pinnately compound leaves, thorns on branch, thorns at base of leaf, white flower, seed pod. (Iowa State University, 2013)

Black locust has become dominant in the canopy throughout the wooded areas of Coon Hill, including the ravines located in Prairie 4. Seedlings are present along the margins of many of the prairie openings. Black locust requires intense management using herbicide.

Siberian elm (*Ulmus pumila*) was introduced to the U.S. in 1860 and is still sold commercially for its hardiness, fast growth, and its ability to grow in a variety of environmental conditions. With its high germination rate and quick establishment of seedlings Siberian elm can invade and dominate a prairie community in just a few years.

Siberian elm is a deciduous tree that can grow 30 to 60 feet high. The mature tree has dark gray and shallowly furrowed bark. The silver gray twigs are in zig-zag pattern and hold a leaf bud at each turn. The alternate, small, toothed, elliptic shaped leaves are slightly uneven at the base. The green flowers appear in drooping clusters prior to leaf development. The smooth, round, winged fruit of Siberian elm hangs in clusters.

Figure 24. Siberian Elm Identification (left to right) flower, fruit, and leaf (WI DNR, 2013)

Siberian elm is found scattered along the margins of the prairie openings, especially noted along the access trail from the school parking lot. Control methods vary depending on the level of infestation.

Oriental bittersweet (*Celestrus orbicultatus*) was brought into the United States from Asia in the mid-1800's, most likely for ornamental uses. It has become naturalized throughout the eastern United States and is now moving into Minnesota. Oriental bittersweet is a prohibited noxious weed on the eradicate list. This means that all of the above and below ground parts of the plant must be destroyed, as required by Minnesota law. Additionally, no transportation, propagation, or sale of these plants is allowed.

It is especially difficult to control oriental bittersweet because it reproduces by both seeds and rhizomes. Seeds are widely distributed throughout the landscape by birds and animals that eat the fruit and eliminate the seeds and by humans who use this plant for decorative purposes. The roots of oriental bittersweet are rhizomatous and the plant will send up new shoots, eventually forming a large impenetrable colony. Oriental bittersweet can thrive in a variety of habitats ranging from shaded forests to open prairies. The vines of oriental bittersweet will girdle and smother the trees they use for support. When they reach the canopy they reduce the light that can penetrate below thus reducing and preventing the growth of the understory species. In the winter months, the mass of vines can accumulate snow and ice and result in the snapping of the supporting trees and shrubs. In open areas, oriental bittersweet grows in large colonies eventually displacing prairie species.

Oriental bittersweet is a deciduous vine that grows up to 66 ft. long and supports itself by winding around a tree or other support structure. The vine has whitish, raised lenticels, alternate round to oblong shaped leaves with rounded teeth on the margins. Small green-yellow flowers are produced in the spring and are located along the stem in clusters at the leaf axils. The round fruit changes from green and splits to a bright red fruit with a yellow capsule in September.

Figure 25. Comparison images of American bittersweet (left top, bottom) versus Oriental bittersweet (right top, bottom) (Minnesota Department of Agriculture, 2013)

Oriental bittersweet is sometimes mistakenly identified as American bittersweet (*Celastrus scandens*) then sold and planted. Oriental bittersweet outcompetes and displaces the native plant, American bittersweet. Distinguishing characteristics of the two species are: American bittersweet has orange capsules around red fruits, Oriental bittersweet has yellow capsules around red fruits and American bittersweet flowers and fruits are only found at the terminal ends of stems, Oriental bittersweet flowers and fruits are found all along the stem at leaf axils.

Oriental Bittersweet is found throughout Coon Hill with large infestations located along the prairie margins and smaller distinct patches scattered throughout the side slopes, especially in Prairie 4. This exotic invasive species requires intensive management using a variety of methods.

Herbaceous Invasive Species

Smooth brome (*Bromus inermis*) is a Eurasian grass that was introduced to the United States in 1884 as a forage crop for livestock and erosion control along streams. It has become a problematic species in the maintenance of prairies and savanna plant communities because of its early season growth and aggressive spreading nature. Smooth brome will out-compete many of the warm season native grasses for water and nutrients and hinder the emergence of native species through its sod forming root system (Sather, 1987).

Smooth brome is a long-lived perennial, 1.5 to 3 feet tall, rhizomatous and commonly producing a dense sod. It begins growth in early spring, flowers in June, reproduces from seeds, tillers, and rhizomes. It may regrow and reflower in the fall if moisture is sufficient. The seedhead is compact to somewhat open panicle, 4 to 8 inches long; panicle branches in whorls that turn brown at maturity. Leaves are smooth or occasionally hairy, particularly on the sheaths, blades are 8 to 15 inches long, ¼ to ½ inch wide, flat. Ligules are up to 1/8 inch long, rounded, and membranous. (Appendix E).

Figure 26. The characteristics that most easily identify smooth brome is the 'M' constriction found midway between the base and tip of the blade and the non-prominent ligule with ragged hairs. (U of WI Extension, 1996) (Photo by Stephen K. Barnhart, Iowa State Press (1997).

Smooth brome is predominantly found at the base of the slope of Prairie 4 and it is a monoculture that either was planted or volunteered, likely after the disturbance resulting from the construction of the school building. It may be advantageous to control this in the near future to prevent its spread further up the slope into the higher quality areas of this prairie. If conditions do not warrant prescribed burn control it

may be necessary to use chemical treatment to reduce the size or set back its encroachment. Reestablishment of native grasses in the areas chemically treated or post burning should occur as soon as possible to eliminate the possibility of soil erosion.

Crown vetch (*Coronilla varia*) was introduced from Europe, southwest Asia and northern Africa and extensively planted along the interstate highway system as a measure to control erosion on steep slopes. It is a serious threat to natural areas because of its rapid vegetative spreading rhizomes and prolific seeding ability. Crown vetch has rhizomes up to10 feet long which allow the plant to spread rapidly, killing all other plants by smothering them with its thick monotypic vegetative blanket.

Crown vetch has compound leaves, each with 15 to 25 leaflets and an umbel of pink flowers that bloom from spring through summer. The flowers develop into narrow, flattened pods that contain poisonous seeds. Do not confuse crown vetch with the native prairie plant, Goat's rue (*Tephrosia virginiana*). Goat's rue is distinguished by its pink and yellow flowers and hairy stems leaves.

Figure 27. Crown Vetch Identification: Developing seed pod (left)(radfordpl.org, 2013); growth habit (right)(Minneflora.com, 2013).

Crown vetch has infested several of the prairie openings and in some instances has killed large areas of prairie. Areas that have significant infestations are prairie opening 1, 3, and 4. A variety of control measures may be utilized.

Table G: Invasive Species Control Methods

Invasive Species	Burning	Grazing	Girdling/Frilling	Mechanical Control		Chemical Control
				Hand Pulling/ Weed Wench	Forestry Mower	
Aspen			X	X		X
Smooth Sumac	X	X		X	X	
Common Buckthorn	X	X		X	X	X
Asian Bush Honeysuckle	X	X		X	X	X
Black Locust						X
Siberian Elm	X	X	X	X	X	X
Oriental Bittersweet	?	X		X	X	X
Smooth Brome	X	X				X
Crown Vetch	X	X		X		X

For further information regarding Invasive Species Control go http://mipncontroldatabase.wisc.edu/

Prescribed Burning

Prepare Burn Break

The MDNR, in partnership with Conservation Corps Minnesota and the City of Red Wing, will be responsible for all activities related to prescription burning of the prairie areas only. A burn break will be established prior to burning to protect the school grounds to the south and any surrounding residential areas. The burn break will be created using a wetline or backfire created the day of the burn.

Conduct Burns

The DNR will be responsible for writing a burn plan, and obtaining the required burn permits. The City of Red Wing will notify neighbors. The prescribed burn will take place on a day when weather conditions are suitable to conduct a safe and effective burn and when school is not in session. Generally, burns should not take place when winds exceed 12 to 15 miles per hour, humidity is lower than 25 percent, and the temperature is above 80 degrees. (MDNR, 1994). Records of burns will be promptly entered and maintained in the Adaptive Management Spatial Database (AMSD). There is no record of prescribed fire being used on Coon Hill for past management.

In dry prairie habitat it is important to carefully plan prescribed fire to safeguard the habitat and life of rare butterfly species such as Leonard's Skipper. Best management practices recommended by the MDNR include: leaving unburned refugia (refuge habitat) within a specified unit or parcel, leave refugia containing larval host plants and nectaring sources (in this case grasses and blazing star); divide lands into several burn units of about equal size; do no not use restored habitats (savanna) as refugia; use a minimum 4-year fire rotation and extending it to 5 or 6-year rotation when feasible; increase the patchiness of fires within a burn unit; avoid fall burns (at this time, the management of woody species on this site overrides this guideline); reduce fuel loads (MDNR, 2013).

Because bladder pod is very vulnerable to fire when it emerges in early spring prescribed burns should be

conducted in very early spring prior to its emergence or very late in the fall, well after it has fruited in August.

The use of prescribed fire to control Oriental bittersweet is not well understood, but because of its ability to reproduce vegetatitvely and its high seed production, prescribed fire may actually increase resprout and growth. An early spring or late fall burn may lower the carbohydrate reserves of Oriental bittersweet, top kill large vines and reduce fruit production. Prescribed fire may be used in conjunction with other control methods, as fire may help reduce the vine density or cover to allow for more efficient access and application of herbicide or other management application. Prescribed burning has been an effective management tool for the control of smooth brome when native warm season grasses comprise greater than 20% of the vegetation. In areas managed for smooth brome, annual burns will be timed to be of most benefit in reducing smooth brome and will be conducted until the smooth brome has decreased to a cover of 1% to 5%. The prescribed burn will take place in late April to early May and will coincide with tiller elongation of smooth brome, prior to heading (Willson and Stubbendieck, 2000).

In UPs13c communities, begin with, a 4-year burn rotation with one or two units being burned per year. Additional methods of invasive woody species removal will need to be incorporated along with prescribed burning to reach management goals. Once community objectives have been met, a 4 to10 year prescribed fire interval is recommended.

In the degraded savanna and prairie areas that harbor little native prairie vegetation, an annual burn may initially be needed to clear the groundlayer until a 2 to 4 year burn rotation is determined to be adequate. Once community objectives have been met, a 4 to10 year interval burn cycle is recommended for long-term management to stimulate growth and reproduction of native prairie species that may still be present in the seed bank and to continue to suppress exotic species and woody invaders.

Grazing

In certain situations, Meat goats can be used in the control of buckthorn or other undesirable vegetation in natural areas. Meat goats will eat stems up to 2 in. to 3 in. in diameter from the groundlayer to about five feet high, and higher if they can get a perch. Goats avoid grass, but will eat most everything else. Goats prefer buckthorn that is at least knee high. Goats have been noted to enjoy American bittersweet so it is hopeful that they would take a liking to Oriental bittersweet as well. Grazing can occur anytime during the growing season, but prior to plants going to seed. A portable electric fence of woven wire is used to paddock the heard of goats in the control area. One trailer load, or 60 to 80 goats can control a one acre area in 3 to 4 days. The use of goats versus other control measures is cost effective when the area covered is greater than 20 acres and depends on the number of paddocks. Using goats at Coon Hill may provide an opportunity for neighborhood or school participation in daily watering and checking of the goats and their paddock.

Grazing can also be used for herbaceous control. To prevent seed set and weaken smooth brome grass, grazing should be done early (when the stem begins to elongate, usually in early May), then allowed to rest for a short time (usually less than 20 days) and then grazed again. It is important that the smooth brome grass is not fall grazed.

Girdling and Frilling

Girdling involves cutting a groove through the underlying cambium and phloem layer of the bark to interrupt the flow of sap between the roots and the crown of the tree. Phloem are the vessels that translocate sugars and other nutrients to the roots, so if the phloem tubes are broken, the roots become starved of food. The cut must completely surround the trunk of the tree and should cut into the wood to a depth of at least ½ inch. The xylem has vessels that translocate water to the leaves and are not affected by

girdling, but if the xylem is damaged by cutting too deep then the tree will send up shoots. Always girdle below the last living branch, especially in smaller diameter trees.

Frilling is a variation of girdling that leaves the partially severed bark attached. Although frilling may be less work, frills can heal over more easily, making this method sometimes less effective.

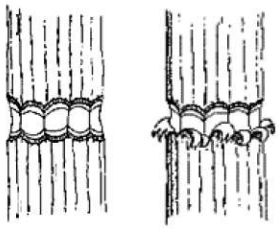

Figure 28 Girdling (left) and Frilling (right) using a hatchet

With either girdling or frilling, the upper part of the tree still remains alive, since photosynthesis can continue. Eventually, however, the roots die, and the whole tree dies. For large areas of encroachment, the whole clone must be girdled or resprouts will happen.

The first year after girdling or frilling, the tree may appear unharmed, but by the second year the tree usually dies. The dead trunks can then be cut and removed without stimulating resprouting. Tree resprouts can be cut with a hand clippers and treating with glyphosate. The most effective time to girdle or frill trees is May or early June when the bark is easily cut and the girdled bark stripped off.

Figure 29. Technique of aspen girdling (Savanna Oak Foundation , Inc, 2013)

Mechanical Control

Hand Pulling/ Weed Wrench

If stems are less than ½ inch in diameter hand pulling is effective since the whole root system is likely to be removed. This method works best if the soil is moist, not wet, and should not be tried in dried soil. It is necessary to shake soil off the exposed root system and tamp loose soil back into place to protect the treated area from erosion. If possible replace the organic matter and leaf litter. Plant back any native plants that were dislodged during pulling. Repeat treatments may be necessary as clearing the area may result in new seedlings from any existing seed bank

A weed wrench may be used for plants that are hard to pull or dig, up to 2.5 inches in diameter. This is a specially designed lever that grabs the base of the stem so it can be pulled out. As above, replace soil, organic matter and leaf litter and replant uprooted desirable plants as much as possible.

Forestry Mower

A forestry mower may be a viable option along prairie/woodland margins were buckthorn and black locust have heavy infestations. Forestry mowers use low ground pressure and high speed mulching to clear unwanted trees and underbrush in an efficient manner with minimal soil disturbance and compaction. Surrounding desirable trees are free from root damage. The forestry mower mulches the vegetation eliminating the need for hauling, dumping, or burning.

Many of the invasive species will resprout following mowing, providing opportune grazing conditions for goats, or an even layer of plant growth for more efficient herbicide application. Repeated mowing can damage the root collar of woody vegetation enough to kill the plant

To reduce the vigor of smooth sumac, cut two times per year in summer (mid-July) followed by another cut in late summer, early fall (Aug./Sept).

Chemical Control

Herbicide application is hazardous. Trained and certified applicators should be employed for herbicide application.

Woody Control

Stump Cut/Basal Bark

The most effective time for chemical application for stump cut and basal bark treatments is mid-summer through winter (July to March) when the plant is moving sugars to the roots or is dormant.

Apply Triclopyr, Glyphosate or other recommended herbicide to the cut trunk or stripped stems immediately or within 2 hours after cutting. The minimum length of the cut stump is 2 inches and the maximum is 6 inches. Cut all stems present 2 to 6 inches above the base of the trunk. The chemical can be applied with a squirt bottle, low volume sprayer, a wick or wand, or a paint brush. A spray bottle set to 'stream' with the nozzle placed against the cut end with a gentle squeeze will apply the herbicide effectively without delivering a spray to surrounding plants. The most efficient and effective placement is to target the ring of cambium (green layer) just inside the bark. For buckthorn, some applicators have found it more effective to treat the cut stump, and also down the side of the stump to cover the root collar.

Avoid applying at temperatures below freezing or if snow covers the base of the plants.

Any woody invasive species will be cut and treated in the winter, all slash is to be removed unless spreading invasive seed is an issue, then stacking and burning may be an alternative. Repeated cutting will be needed in these areas to control new seedlings and any resprouts of invasive species.

Herbaceous Control

Spot Spraying

Spot spray affected areas, (after re-greening from a burn or mowing), with recommended herbicide plus a surfactant plus a dye. Follow up treatment with herbicide may be required to control any surviving stems or new seedlings. Use caution in quality natural areas when using clopyralid herbicide for the treatment of crown vetch as it affects native plants of the sunflower and pea family as well. (USDA, 2006)

Wicking

Wick affected areas, (after re-greening from a burn or mowing), with recommended herbicide. Herbicides should be wiped when the height difference between smooth brome grass and native grasses is greatest. This is generally when smooth brome grass stems have elongated or are in early boot stage. When smooth brome grass stems are elongating, there is also greater movement of the herbicide to the roots.

Plant Community Restoration/Enhancement

Collect Seed

To increase native plant species in the existing property the landowner can collect seed prior to a burn or the year after a burn. Use collected seed from native plant species found growing on Coon Hill prairie only. Seed can be hand broadcast over areas that are recovering from smooth brome invasion.

Every genus and species of plants with seed that is collectable is different and each varies through the season with the environment. Experience and time are the two factors to consider when collecting seeds. First, observe the plants; watch the life and growth cycle of each species. This is important because it is the best way to find out when plants bloom and when the seeds are ready for collection. Second, compile a record of observations for future seasons and collecting. Together, these two processes will help to overcome the most difficult part of seed collection, timing.

Seed collection of prairie plants and wildflowers is done primarily by hand. This is because most plants to be harvested don't grow in pure stands and the topography varies limiting mechanical equipment use. Collecting the seeds of most grasses can be done by stripping the culms (the flowering shoot) off the stem by hand. Taking one third (or less) of the seed ensures that the plant will sustain itself for future enjoyment and harvest.

Basic equipment needed to collect seeds includes gloves, boots, drop cloths, pruning shears, boxes, baskets, and paper or canvas bags (plastic bags will allow the seeds to get moldy more easily). A tray of some kind (like a flat cake pan) can be used to collect the seeds of herbaceous wildflowers.

Timing of harvest is important because if seeds are collected too early, the seeds will be immature and have low seed viability. If seeds are collected too late, they can dehisce quickly and be lost. Another potential timing problem is that seeds often do not ripen uniformly over the same flower stalk. Prolonged flowering and different stages of seed maturity limit uniform seed collection. Observation is the best way to determine when seeds should be collected. Plants that have seeds that ripen in pods should be collected just as the pods are beginning to open. Collecting the entire pod is advisable because this allows the seed to continue ripening in the pod as it dries. Plants that dehisce (break open and dispel seeds) can be contained by placing a paper sack over the seed head and closing the open end with a twist tie, breaking the seedhead of the stem. This method allows for collection once at the end of seed maturation. Seeds that are mature are often dark in color, firm and dry. Fleshy seeds often turn color as they mature and become ripe. These seeds should be collected as they change color.

Method for harvesting seeds depends on the type of plant. Grass seeds and wildflowers with seeds in a spike-like inflorescence (the flowering shoot) are collected by stripping the flowering culms off the stems. The seeds are inside the inflorescence of the flowering culm. Running your fingers up the stem is usually

the easiest way to collect grass seeds. See Figure 1. (Regents of U of MN, 2006).

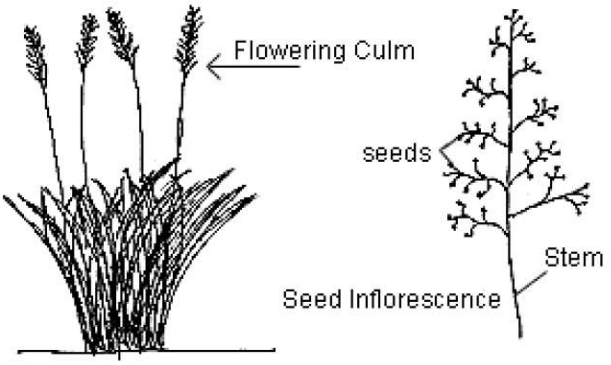

Figure 1. Native Grass Morphology
Original Drawing

Figure 30. Prairie plants and wildflowers that have spiny thistle-like seeds should be collected as an entire seed head. See Figure 2. (Regents of U of MN, 2006).

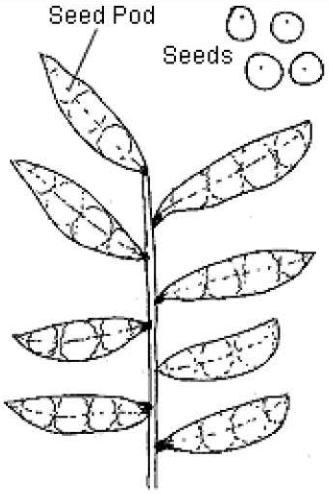

Figure 3. The seed pods of
Lupinus sp. original drawing.

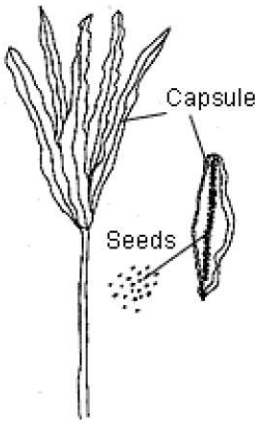

Figure 4. The seed capsules of
Aquilega sp. adapted from Tom
Tilton,1989

Figure 31. Prairie plants and wildflowers with seeds in pods or capsules are easily collected by collecting the entire pod or capsule or by shaking the inflorescence over a tray to catch the seeds (Regents of U of MN, 2006).

Store seeds in paper bags. This allows air circulation and prevents mold. Low and constant humidity and temperature (less than 50 degrees Fahrenheit and less than 50% humidity) is ideal. Fleshy seeds should be planted as soon as possible and kept moist once clean. If these seeds dry out, they will lose their viability or could possibly germinate. (Regents of U of MN, 2006).

Administration Activities

Planning

Prescribed burn plans will be prepared and submitted for approval on an annual basis and in a timely manner.

Technical Assistance

Establish a volunteer site steward to assist in monitoring and restoration activities.

Host an invasive species removal work day with neighbors and public landowners that include the City of Redwing.

Host a seed gathering work day with the middle school for prairie enhancement post invasive species control.

Monitor

Site Use
Site boundary and access-ways are periodically monitored and any evidence of harmful public use is reported to the city of Redwing and the school district.

Invasive Species
Monitor annually for the presence of invasive species to determine management needs. Document invasive species control activities including the date, control method used, specific location of control activity, and the response to the control activity in the AMSD database.

Monitor annually for the presence of invasive species on the perimeter private land that borders Coon Hill to determine management needs and communicate those needs with the landowner.

SGCN and Element Occurrences
Establish a field survey protocol in each of the following: (UPs13c) native plant community; degraded savanna community to set a benchmark for future management and its response to climate change.

Using established field survey protocols monitor each of the following: (UPs13c) native plant community; degraded savanna community; every 5 years to inform management needs, document its response to climate change, and to ensure habitat needs for SGCN and rare species are being realized.

Coordination

Other DNR divisions and programs will be contacted on issues that pertain to their expertise. Non-game wildlife will be consulted regarding the impact a prescribed burn will have on ground nesting SGCN. MCBS ecologists will be needed for future evaluation of savanna composition and structure. Depending on funding, and the entities involved in prescribed burn implementation and invasive species management, partners outside of the DNR may need to be consulted regarding the cost and scope of services they will provide.

IMPLEMENTATION PLAN

The multiple year plan for implementing the activities above is presented in Table J. It lays out the activities needed to implement this management plan along with each activity's target objective, timeline (phases), personnel expected to be the lead in implementation as well as estimated cost, funding source and priority. Each Activity must link to an Objective. Unless otherwise directed by DNR, the implementation table is for actions expected to occur or commence within the next ten years. Whenever possible the Activity Descriptions should be quantified – this is necessary for contractor or SNA Program to do cost estimate.

Table H. Implementation Plan for Coon Hill Prairie

Note: As other parcels are acquired, management needs will be added

#	Activity Type	Activity Description (map feature #)	Target Objective (Priority feature-Objective)	Phase I Year 1-2 (2014-2015)	Phase II Year 3-5 (2016-2020)	Phase III Year 6-10 (2021-2025)	Ongoing (every year or as scheduled)	Proposed Personnel	Cost Estimate	Proposed Funding	Priority
DEVELOPMENT ACTIVITIES *(ref Map#)*											
1a	Signs	Develop and install (3) interpretive/boot brush stations	A8,9 B1		X						1
1b	Signs	Develop and install (1) directional sign	A8,9 B1	X							1
MANAGEMENT ACTIVITIES (ref Map#)											
1a	Invasive Species Control	Control woody invasives (e.g. smooth sumac, aspen, buckthorn, Siberian elm, black locust, Oriental bittersweet, Asian Honeysuckle); Document invasive species control activities including the date, control method used, specific location of control activity, and the response to the control activity in the AMSD database	A1-9,11 B1	X			X				1
1b	Invasive Species Control	Control herbaceous invasives (e.g., crown vetch and smooth brome) Document invasive species control activities including the date, control method used, specific location of control activity, and the response to the control activity in the AMSD database.	A1-9, 11 B1	X			X				1
2a	Prescribed Burn	8 Burn units with rotational burns every 2 to 4 years, or 4 to 10 years	A1-9, 11	X			X				1
3a	Plant Material collection	Collect seed for prairie enhancement	A1-9 B2		X						2
ADMINISTRATION ACTIVITIES											
1a	Planning	Complete annual burn plan and obtain permits	A10	X			X				1
2a	Technical Assistance	Recruit and develop work program for site steward	A1-9, 11,12 B1-3	X			X				1
2a	Technical Assistance	Host a work day to remove invasive species with neighbors and public landowners	A1-9, 11,12 B2	X			X				1
2b	Technical Assistance	Host work day to gather seed with middle school	A1-9, 11,12 B2		X	X					2
3a	Monitor	Periodically monitor for harmful pubic use	A12 B3	X			X				1
3b	Monitor	Monitor for invasive species on an annual basis on prairie openings.	A1-11 B3	X			X				1
3c	Monitor	Monitor for invasive species on an annual basis around perimeter of prairie openings.	A1-11 B3	X			X				1
3d	Monitor	Establish field survey protocols for UPs13c and degraded savanna communities to set benchmark for future management	A1-12 B4	X							1
3e	Monitor	Monitor using established field survey protocols for UPs13c and degraded savanna communities to document response to management and inform future needs	A1-12 B4		X	X	X				1
4	Coordination	Coordinate as needed with other DNR staff and contractors on an as needed basis	All				X				1

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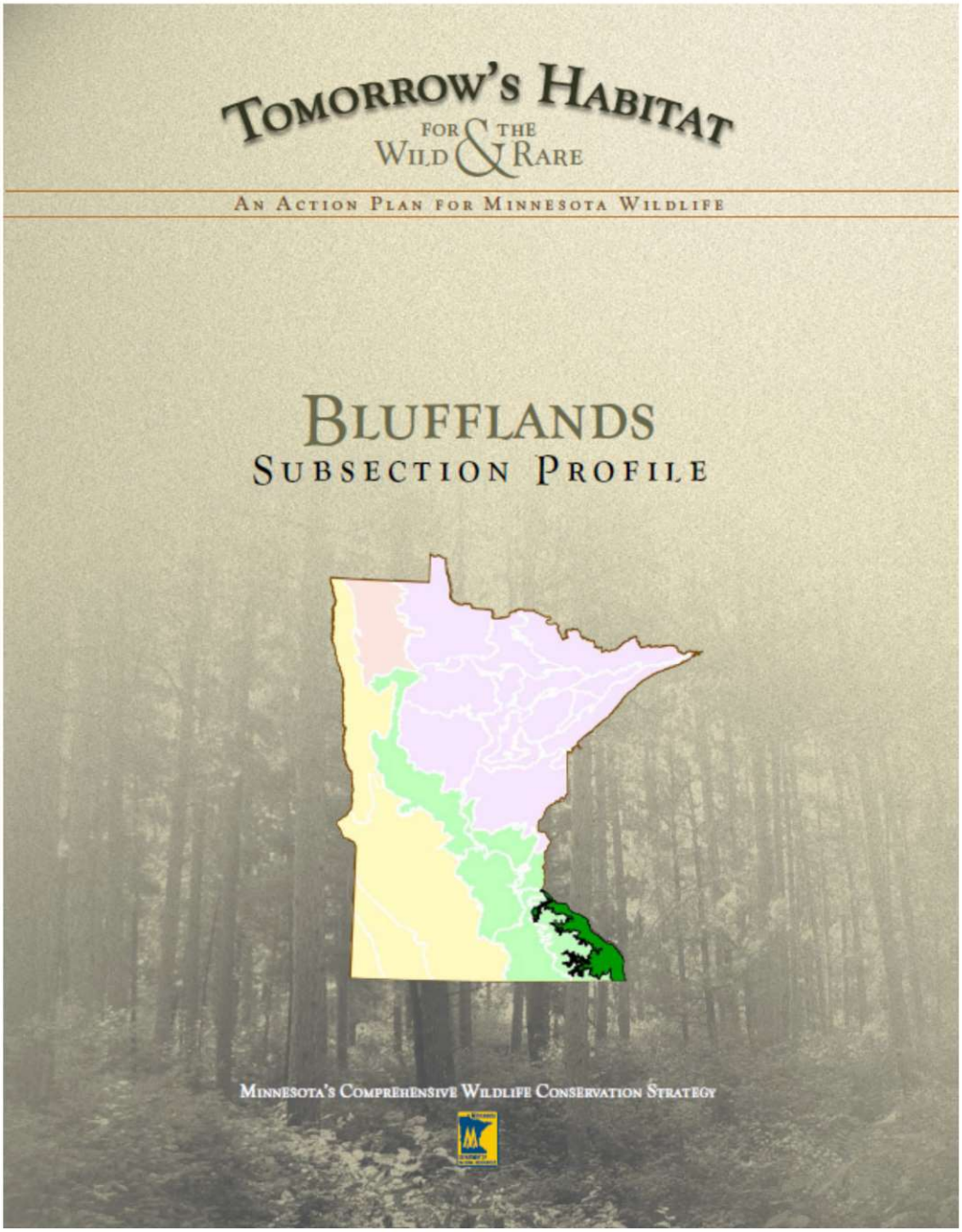
Appendix A: The Blufflands Subsection SGCN



Blufflands

SUBSECTION OVERVIEW

The Blufflands Subsection in southeastern Minnesota, dominated by the Mississippi River, is characterized by bluff prairies, steep bluffs, and stream valleys, often 500 to 600 feet deep. Numerous cold-water trout streams feed major rivers such as the Root, Whitewater, Zumbro, and Cannon. Rich hardwood forests grow along the river valleys, and river-bottom forests grow along major streams and backwaters. There are few lakes.

Agriculture, both row crops and pastures, takes place in former savanna and prairie areas and is the most prominent land use in this subsection. Forestry is also an important land use, and outdoor recreational opportunities abound, with significant amounts of public lands along the river corridor. Retaining or restoring the health of stream systems is an important conservation objective in this subsection.

Quick facts

Acres: 1,287,434 (2.4% of state)

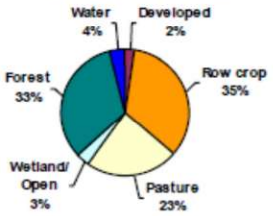
Ownership

Public	Private	Tribal
11.2%	88.8%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
58.7	+3.1

Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

156 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Blufflands – the most of all the subsections in Minnesota. These SGCN include 82 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 9 mammal SGCN are known or predicted to occur in the Blufflands, approximately 41% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	3	50.0	Pickerel frog
Birds	53	54.6	Blue-winged warbler
Fishes	26	55.3	Crystal darter
Insects	14	25.0	Karner blue butterfly
Mammals	9	40.9	Northern myotis
Mollusks	32	82.1	Hubricht's vertigo
Reptiles	16	94.1	Timber rattlesnake
Spiders	3	37.5	*P. apacheanus*

HIGHLIGHTS

- The Blufflands provides a critical migratory corridor for forest songbirds, raptors, and waterfowl. It is the most important subsection for reptiles and one of the most important subsections for mollusks.
- It is an important area for birds such as Henslow's sparrows, prothonotary warblers, red-shouldered hawks, Louisiana waterthrushes, and peregrine falcons. It is also an important area for Karner blue butterflies and Blanding's turtles.
- Reptiles, amphibians, snails, mussels, and fish are special features of this landscape, including timber rattlesnakes, milk snakes, paddlefish, shovelnose sturgeon, pallid shiners, American eels, pirate perch, skipjack herrings, and several Pleistocene snails.
- Areas important for SGCN include the Whitewater, Gores Pool, and McCarthy Lake WMAs; Upper Mississippi River NWR; Kellogg-Weaver Dunes, Great River Bluffs, John Latsch, Whitewater, and Frontenac SPs; and Cannon River Turtle Preserve and Mound Prairie SNAs.

SPECIES SPOTLIGHT

Timber rattlesnake ***(Crotalus horridus)***

Distribution Blufflands of SE Minnesota along the Mississippi River and its tributaries.

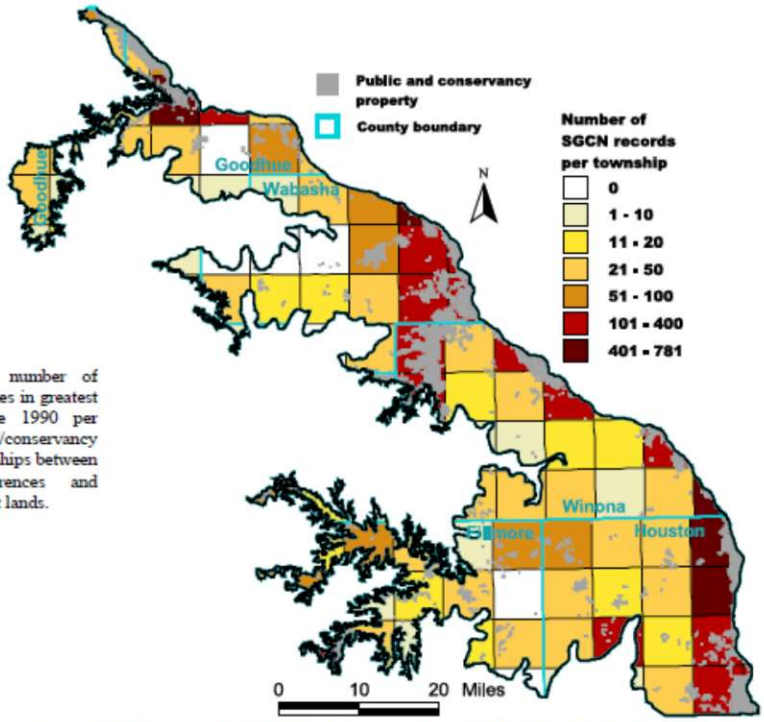
Abundance Uncommon, with spotty distribution in some DNR state parks, WMAs, and private lands.

Legal Status State list-Threatened.

Comments This snake is benefiting from legal protection, DNR education workshops for landowners and law enforcement officials, and the federal Landowner Incentive Program, a state-administered voluntary program that provides funding to private landowners to implement habitat management projects benefiting "at-risk" species.

Photo by Barney Oldfield

SGCN ELEMENT OCCURRENCES BY TOWNSHIP



This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands.

Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	82
Habitat Degradation in MN	88
Habitat Loss/Degradation Outside of MN	27
Invasive Species and Competition	29
Pollution	35
Social Tolerance/Persecution/Exploitation	23
Disease	1
Food Source Limitations	4
Other	21

Blufflands

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in RED in the graph for that analysis. Those habitats that do not meet the criteria are shaded in GOLD. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	A	B	C	D	E
Oak Savanna	X		X		
Prairie	X	X	X		
Wetland-Nonforest			*		
Shoreline-dunes-cliff/talus		X			
River-Headwater to Large				X	X
River-Very Large (Mississippi River)				X	X

*Wetlands do not represent more than 5% of the 1890s or 1990s landcover, but the 1984 Anderson & Craig study indicates wetlands have declined by greater than 50% in this subsection.

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

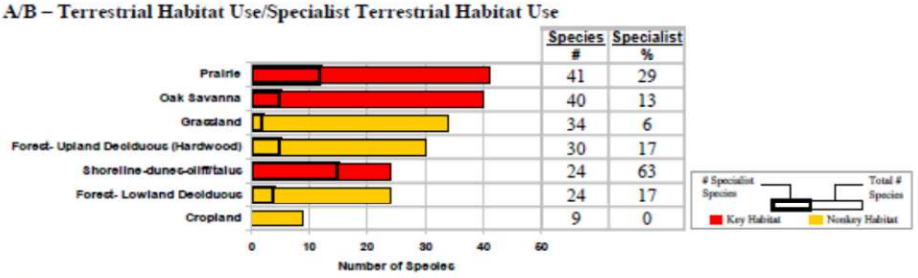
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

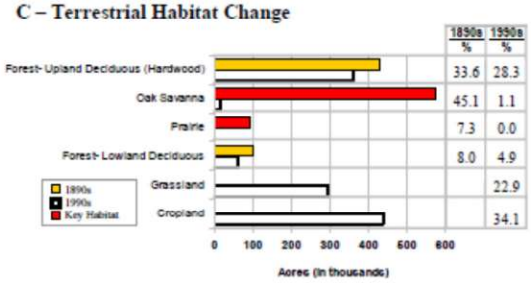
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

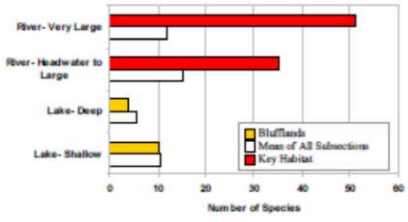
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



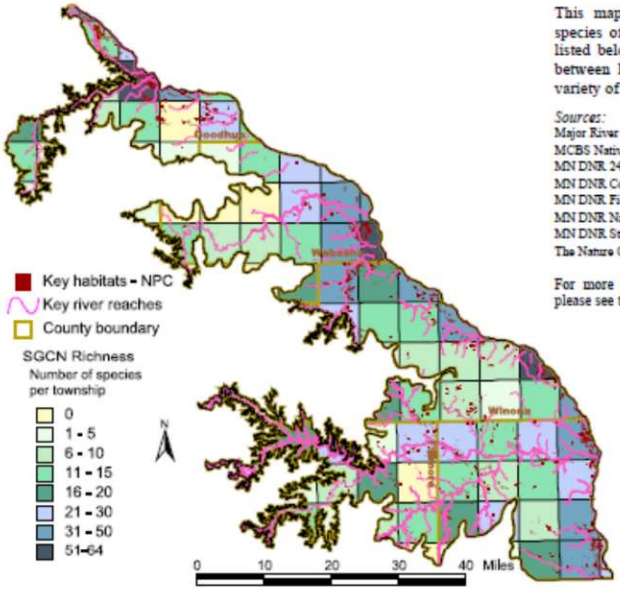
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Major River Centerline Traces in Minnesota, 1984
MCBS Native Plant Communities (NPC), 2005
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fishes	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Cropland	N/A	34.0		5			3		1		9
Forest-Upland Deciduous (Hardwood)	33.6	28.3		15		3	5	1	6		30
Grassland	N/A	22.9		15			8		11		34
Forest-Lowland Deciduous	8.0	4.9	1	15			4		3	1	24
Developed	N/A	2.4		5		2	5		1		13
Lake-Deep	N/A	2.3	1	1	1				1		4
Lake-Shallow	N/A	1.4		7	1				2		10
Oak Savanna	45.1	1.1		16		5	8		11		40
Wetland-Nonforest	1.1	1.1	2	23		1	2		3		31
Forest-Lowland Coniferous	0.0	0.8		7			1				8
Forest-Upland Coniferous	0.0	0.8		13		2	3		7		25
Forest-Upland Deciduous (Aspen-oak)	1.6	0.0		13			3				16
Prairie	7.3	0.0		13		7	7		11	3	41
Shoreline-dunes-cliff/talus	N/A	N/A	1	11		1		5	6		24
Shrub-Lowland	N/A	N/A	1	14			2		2		19
River-Headwater to Large	N/A	N/A	2	3	14	3		9	4		35
River-Very Large (Mississippi River)	N/A	N/A	2	2	19			24	4		51

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Blufflands

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat

Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. Oak savanna habitats, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain savanna
   c. Encourage oak savanna restoration efforts
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
2. Native prairie habitats, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain prairie
   c. Manage grasslands adjacent to native prairie to enhance SGCN habitat
   d. Encourage prairie restoration efforts
   e. Provide technical assistance and protection opportunities to interested individuals and organizations
3. Nonforested wetlands, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
4. Cliff and bluff habitats, actions include:
   a. Support the protection of cliff and bluff habitats from damaging development
   b. Enhance cliff and bluff habitats to support SGCN
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
5. Stream habitats, actions include:
   a. Maintain good-water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions

Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed

Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Appendix B: Releve #0462

MINNESOTA NATURAL HERITAGE & NONGAME RESEARCH PROGRAM
Department of Natural Resources
500 Lafayette Road
Saint Paul, Minnesota 55155
(651) 259-5100

FINAL REPORT - MNDNR RELEVE DATABASE

GENERAL INFORMATION
DNR Releve #0462
Surveyor's Releve #G-7001
Surveyor: Hannah L. Dunevitz (HLD)
Date: 31 AUG 1990
CBS Site #0
Site Name: Coon Hill
DNR Ownership Code: 00
EO Rec #11763
NC Code: DPSEBB (DRY PRAIRIE (SOUTHEAST) BEDROCK BLUFF SUBTYPE)
Community Ranking in Releve: B
Stand typical of Community Type:
Releve typical of Stand:

LOCATIONAL INFORMATION
State Code: Minnesota (MN)
County Code: Goodhue (25)
Quad Codes DNR: T19D Universal: Red Wing (44092E5)
PLSS: SE SW Section 31 T113N R14W
Geographic coordinates (NAD27): 44° 32′ 46″ N, 92° 32′ 36″ W
Geographic coordinates (NAD83):
Projected coordinates (UTM 15N meters, NAD83) 536260, 4932629

RELEVE INFORMATION
Releve Size (m2): 100
Elevation (ft): 990
Slope: 32S
Slope Position: SSR
ECS Subsection: The Blufflands (24)
Minnesota Soil Atlas Mapping Unit:
Geomorphic Unit:

Remarks: Soil sandy loam. Numerous loose pieces of rock, together with areas of exposed intact bedrock, cover about 15 % of surface.

OTHER DATA COLLECTED
Soils: N
Forestry: N (O=old growth Y=forestry)
Water Chemistry: N
Publication: N

(E 1-2 B) Woody Needleleaf Evergreen, Height: .0-.5m, Cover barely present
R.1 Juniperus virginiana (Red cedar)

(D 4-4 B) Woody Broadleaf Deciduous, Height: 2-5m, Cover barely present
R.1 Fraxinus pennsylvanica (Green ash)

(D 1-3 B) Woody Broadleaf Deciduous, Height: .0-2m, Cover barely present
+.2 Prunus americana (Wild plum) [#1]
+.1 Rhus glabra (Smooth sumac)
R.1 Ulmus americana (American elm)

(G 1-3 P) Graminoid, Height: .0-2m, Cover patchy
2.1 Andropogon gerardii (Big bluestem)
2.1 Bouteloua curtipendula (Side-oats grama)
1.2 Bouteloua hirsuta (Hairy grama)
1.1 Schizachyrium scoparium var. frequens (Little bluestem)
+.1 Muhlenbergia cuspidata (Plains muhly)
+.2 Sporobolus heterolepis (Prairie dropseed)

(H 1-2 R) Forb, Height: .0-.5m, Cover rare
2.1 Aster oblongifolius var. oblongifolius (Aromatic aster)
2.1 Solidago nemoralis var. nemoralis (Gray goldenrod)
1.2 Artemisia frigida (Prairie sagewort)
1.1 Aster oolentangiensis (Sky-blue aster)
1.1 Liatris punctata (Dotted blazing-star)
+.1 Agalinis aspera
+.1 Ambrosia artemisiifolia (Common ragweed)
+.1 Asclepias verticillata
+.1 Aster [#4]
+.1 Aster sericeus (Silky aster)
+.1 Campanula rotundifolia (Harebell)
+.1 Comandra umbellata (Bastard toad-flax)
+.1 Croton glandulosus (Northern croton) [#2]
+.1 Erigeron strigosus var. strigosus (Daisy fleabane)
+.1 Hedeoma hispida (Mock pennyroyal)
+.1 cf. Penstemon gracilis (Slender beard-tongue) [#3]
+.1 Petalostemon purpureum (Purple prairie-clover)
+.1 Physalis virginiana var. virginiana
+.1 Verbena stricta (Hairy blue vervain)
R.1 Oenothera biennis (Common evening-primrose) [OP]

R.1 Smilacina stellata (Starry false Solomon's-seal)

Selected Remark Codes
[DD] = dead
[DY] = dying
[GE] = germinating
[SD] = seedling
[SP] = sprout (coppice)
[FR] = fruiting
[OP] = outside plot (<2m)
[##] = specimen collection #

Report run: Monday, August 26, 2013

Appendix C: Releve #0462 Notes

SITE SURVEY SUMMARY
GOODHUE COUNTY, MINNESOTA

SITE NO: 70
QUAD CODE: T19d

SITE NAME: Coon Hill
QUAD NAME: Red Wing

LEGAL DESCRIPTION: T113N, R14W, Sect. 31 (SW 1/4), Sect 36 (E1/2SE1/4)
SITE ACRES: 100

OWNER INFO: Ind. school District #256 (S1/2 SW1/4); Mildred Billings

SURVEY Type codes: P = Air Photo Interpretation A = Aerial Survey G = Ground Survey

Date: Feb-Mar 1990	Type: P	Surveyor: H. Dunevitz, B. Delong	
Date: 8/31/90	Type: G	Surveyor: Hannah Dunevitz	
Date: 8/28/91	Type: G	Surveyor: Hannah Dunevitz	
Date:	Type:	Surveyor:	
Date:	Type:	Surveyor:	
Date:	Type:	Surveyor:	

PHOTOS: #4- just west of relevé plot 1, just above Lesquerella. 36- school, bluff prairie
#5,6 Lesquerella ludoviciana 33- Artemisia frigida, other pts. bluff prairie

EXISTING SITE INFORMATION (Sources, Dates, Notes, Contact persons)

AIR PHOTO INTERPRETATION (Photo Type and Date, Notes)
see attached map, notes
-color infra-red 1:58,000 5/1/81

ELEMENT INDEX

Element Name	EO Rank	EO Acres	EOR Complete? Y/N	Collection Number	Releve Date	Plant List Date
Bluff Prairie	B	40	Y		8/31/90	
Mixed Oak Forest (Mesic)	BC		Y			
Lesquerella ludoviciana (001)			Y (old)			
Croton glandulosa				(HUO) 305		

SITE ACTION RECOMMENDATION:
(e.g., Additional Survey, Acquisition, Addition, SNA...)
TNC preserve, or some conservation arrangement with school; need to stabilize eroding trails, begin prescribed burning.

~~Need to visit, inventory oak forest~~

Codes: Species frequencies
Dom = dominant or co-dominant
A = abundant
C = common
U = uncommon
R = rare

DBH
Numbers after species names are DBH in cm.
~ = approximate

Site Description 2

Describe the site to convey a mental image of its features. Discuss and entitle in order, the following categories: 1) Landform and Topography, 2) Soils/Aquatic features, 3) Vegetation, 4) Disturbance-natural, or unnatural (livestock grazing, logging, mining, buildings, cultivation, exotics), 5) Threats to site and management implications.

(1) LANDFORM + TOPOGRAPHY - NEARLY CIRCULAR, MESA-LIKE BLUFF COMPLEX, WITH STEEP SLOPES ALL THE WAY AROUND + A SMALL FLAT CREST. Red Wing - La Crescent Geomorphic Area.

(2) SOILS - Boone + Gotham fine sands on south slopes; Frontenac silt loams on north slopes.

(3) VEGETATION - Diverse, good-quality bluff prairie on south slopes; dry mesic forest dominated by Quercus rubra on north slopes - some good quality, little disturbance; other parts younger.

Area (A) - toward east edge of bedrock bluff prairie, completed a relevé. Thatch moderate, many areas of loose rock, others of intact bedrock, Bluff prairie diverse, good quality, very dry on steep 31° slope. Andropogon gerardii and Bouteloua curtipendula are dominant. Bouteloua hirsuta and Artemisia frigida occur in crevices of exposed bedrock. Scattered, mostly small, shrubs and trees.

Draws with large Quercus macrocarpa and small Juniperus virginiana Usnea Ludoviciana in rocky area ~50 feet east of relevé plot in rocky area just east of wooded draw. 3 plants, with old fruits, with Bouteloua hirsuta, B. curtipendula, Artemisia frigida, Aster oblongifolius.

Walking west, come to power line and fence (see drawing). Additional species in prairie include Sorghastrum, Amorpha canescens, Euphorbia corollata, Spiranthes magnicamporum

(B) Bluff prairie to west - similar to area (A). Also here: Viola pedata

Trail comes up to top here - badly eroding gully. Could use restoration. Bare areas indicate heavy use on this knoll, but prairie is intact.

(C) Old field with young planted pines throughout, reached by continuing on trail through disturbed oak savanna (which is densely overgrown with trees, saplings, + shrubs including Zanthoxylum + Rhamnus

SITE SURVEY SUMMARY
GOODHUE COUNTY, MINNESOTA

SITE NO: 70
QUAD CODE: _____

SITE NAME: _____ QUAD NAME: _____

LEGAL DESCRIPTION: _____ SITE ACRES: _____

OWNER INFO: _____

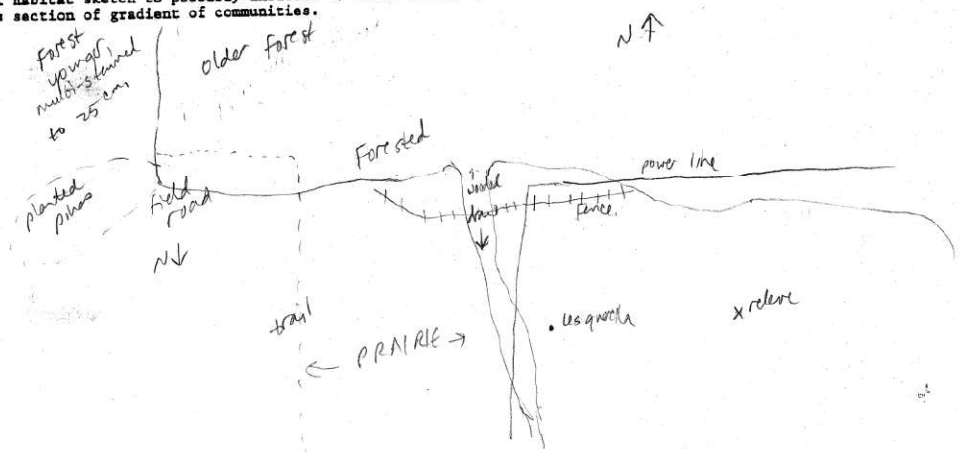
Site Description (Continued)

(1) Forest on north-facing slope nice - dom. by Quercus rubra to about 45 cm. Also with Ulmus rubra, Betula papyrifera, Tilia, Celtis. Steep slope. Understory quite open.

(4-5) DISTURBANCE - THREATS

Trails through bluff prairie + forest exist - on prairie, some erosion is occurring on main trail. Will increase without some stabilization. Field road through forest; area of planted pines near top of bluff. Powerline cuts across site. Brush encroachment on prairie; needs burning. Foot traffic may have reduced Asclepias sq.

Optional habitat sketch to possibly include: 1) Route taken, 2) Element locations at a finer scale, 3) Disturbance features, 4) Cross section of gradient of communities.



ATTACHMENTS

Base map(s): Code a copy of the topo map, aerial photo or other map as follows:

Circle access point to site. Indicate surrounding land use (Ag., recreational, buildings)

_ _ _ _ Natural Community Boundaries

_____ Site Boundary

— — — Tract (ownership) Boundaries

. Special Plant or Animal EO's

+ Releve' Location

Woodhue #70

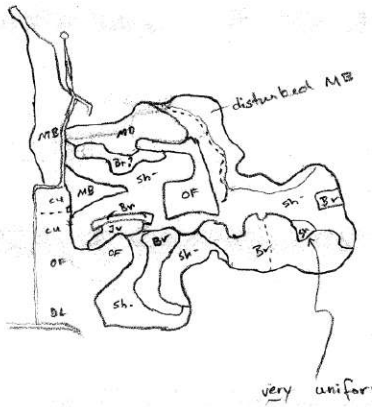
Site Description (Continued)

8/28/91 (E) Ridgetop above bluff prairie was probably bur oak savannah, now widely scattered Q. macrocarpa with dense thickets of Rhus glabra (with Rhamnus cathartica + other shrubs), Acer negundo, Gleditsia + other woodies (Marked "sh" on aerial photo drawing)

(F) Drove up to base of slope - not maple basswood forest but overgrown savannah/woodland, with much Populus tremuloides, Gleditsia and scattered oaks. Class as mixed oak woodland (C9 rank).

Red Wing – Coon Hill

Air photo interp. by B. Delaney



trails – many, pink in sh- areas
homes
sh- mixed brush and trees

MB- pink, not large canopies

Igeet OF w/ pink margins – a shrub
-hetero interior but clearly OF

Br: very uniform gray-gr: I suspect Bromus

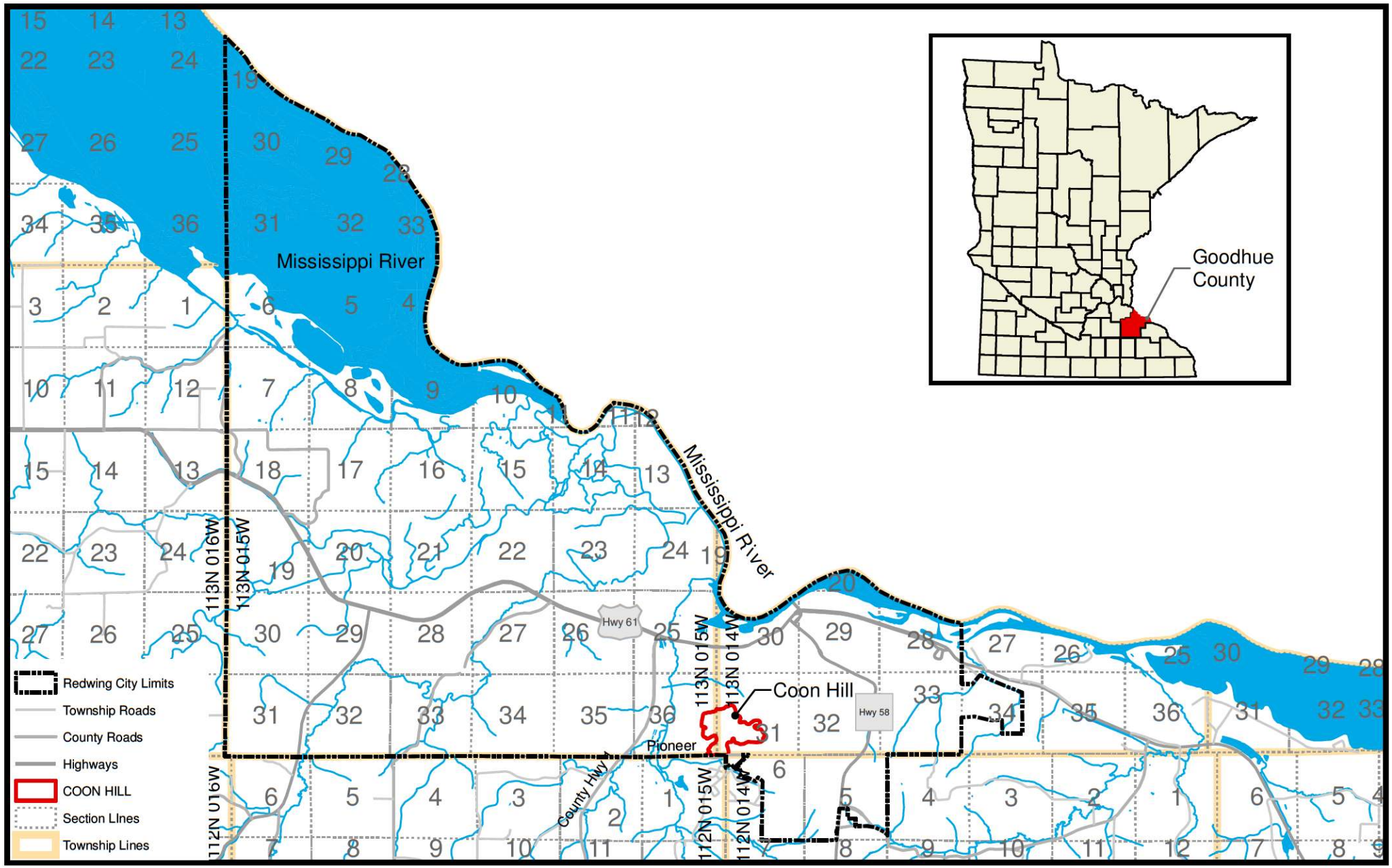
very uniform, low, dk gray-green


GOODHUE
Sewage
Disposal
Carlson
Little
Island
River
Substa
Pucketville
RIVER
Park
Bay Point
Park
Light
Red Wing
Bay
St Johns
Cem
PACIFIC
4 LANE
MAIN
City
Hall
High Sch
Courthouse
Colvill
Colvill
Civic Center
Park
RED WING
Jefferson
Sch
Red Wing
Country Club
Birchwood
Park
South
Park
Maple
Park
Sunnyside
Sch
Res
Trailer
Park
Sewage
Disposal
Twin Bluffs
Jr High Sch
Substa
Radio Tower
Radio Tower
(KCUE)
Red Wing Area
Vocational Tech Institute
CORPORATE
Water
Tank
BOUNDARY
Bullard
Hay
Creek
HAY CREEK

Appendix D: 2013 Plant List

Coon Hill Plant List August 22, 2013 (surveyed by V. Phillips and J. Edwards)	
Forbs, Ferns and Fern Allies *Not documented in Goodhue Co. ; E=State Endangered, SC = State Special Concern; I = Exotic Invasive Species; NN= Non-native	
Scientific Name	**Common Name**
Agalinis aspera	Rough False foxglove
Ambrosia psilostachya	Western Ragweed
Anemone cylindrica	Long-headed Thimbleweed
Anemone patens	Pasque Flower
Artemisia frigida	Sage Wormwood
Asclepius stenophylla (*; E)	Narrow Leaved Milkweed
Asclepius verticillata	Whirled Milkweed
Asclepius viridiflora	Green Milkweed
Antennaria sp.	Pussytoes
Campanula rotundifolia	Harebell
Castilleja sessiliflora	Downy Paint Brush
Cirsium sp.	Thistle
Comandra umbellata	Bastard Toadflax
Coreopsis palmata	Birds Foot Coreopsis
Coronilla varia (I)	Crown Vetch
Dalea candida	White Prairie Clover
Dalea purpurea	Purple Prairie Clover
Euphorbia corollata	Flowering Spurge
Euphorbia cyathophora	Painted Leaf
Equisetum arvense	Field Horsetail
Lactuca canadensis	Wild Lettuce
Liatris aspera	Rough Blazing Star
Liatris cylindracea	Cylindric Blazing Star
Lilium philadelphicum	Prairie/Wood Lily
Linum sulcatum	Grooved Yellow Flax
Lithospermum sp.	Puccoon
Lobelia spicata	Pale-Spiked Lobelia
Melilotus officinalis	Sweet Clover
Monarda fistulosa	Wild Bergamot
Oenothera biennis	Common Evening Primrose
Scutellaria parvula	Prairie Scullcap
Silene sp.	Catchfly
Solidago nemoralis	Gray Goldenrod
Solidago ptarmicoides	Upland White Aster
Solidago rigida	Stiff Goldenrod
Symphyotrichum oblongifolium	Aromatic Aster
Symphyotrichum oolentangiense	Sky Blue Aster
Symphyotrichum sericeum	Silky Aster
Tephrosia virginiana (*; SC)	Goat's Rue
Verbena stricta	Hoary Vervain

Viola sp.	Violet
Zigadenus elegans	Death Camas
Grasses	
Andropogon gerardii	Big Bluestem
Bouteloua curtipendula	Side-Oats Grama
Bouteloua hirsuta	Hairy Grama
Bromus inermus (I)	Smooth Brome
Dichanthelium sp.	Panic Grass
Hesperostipa spartea	Porcupine Grass
Muhlenbergia cuspidata	Plains Muhly
Schizachyrium scoparium	Little Bluestem
Sorghastrum nutans	Indian Grass
Sporobolus heterolepis	Prairie Dropseed
Climbing Vines	
Celestrus orbiculatus (I)	Oriental Bittersweet
Parthenocissus quinguefolia	Virginia Creeper
Vitis riparia	Wild Grape
Semi-Shrubs	
Amorpha canescens	Leadplant
Shrubs	
Aronia melanocarpa	Black Chokeberry
Cornus racemosa	Gray Dogwood
Juniperus virginiana	Eastern Red Cedar
Lonicera tartarica (I)	Tartarian Honeysuckle
Prunus x cistena (NN)	Purple Sand Cherry
Prunus virginiana	Chokecherry
Rhamnus cathartica (I)	Common Buckthorn
Salix humilis	Prairie Willow
Trees	
Populus tremuloides	Quaking Aspen
Robinia pseudoacacia (I)	Black Locust
Ulmus pumila (I)	Siberian Elm



Coon Hill Prairie Stewardship Plan

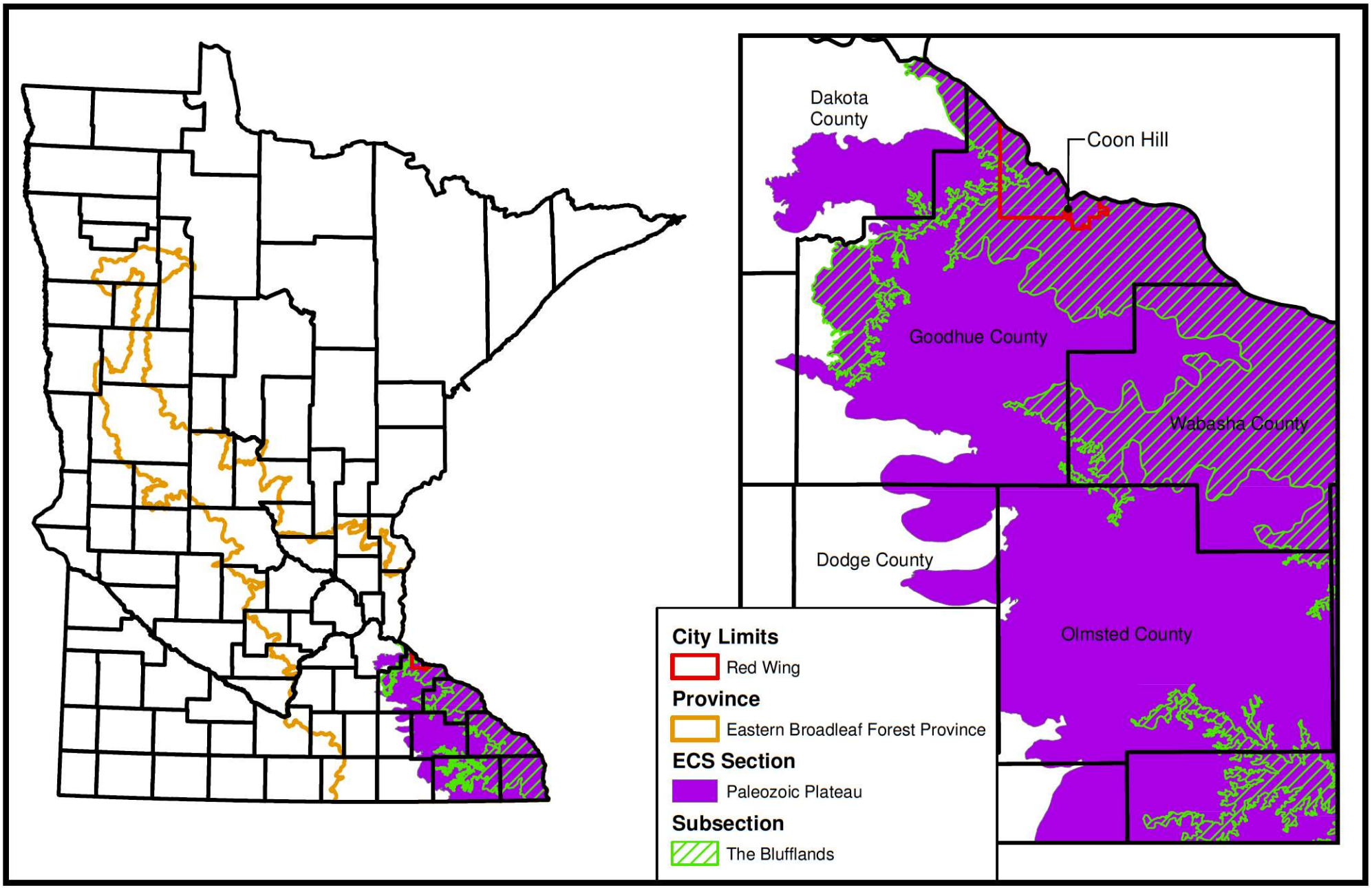
Legal Description and Location

November 1, 2013

0 0.75 1.5 3 Miles

N

Map 1

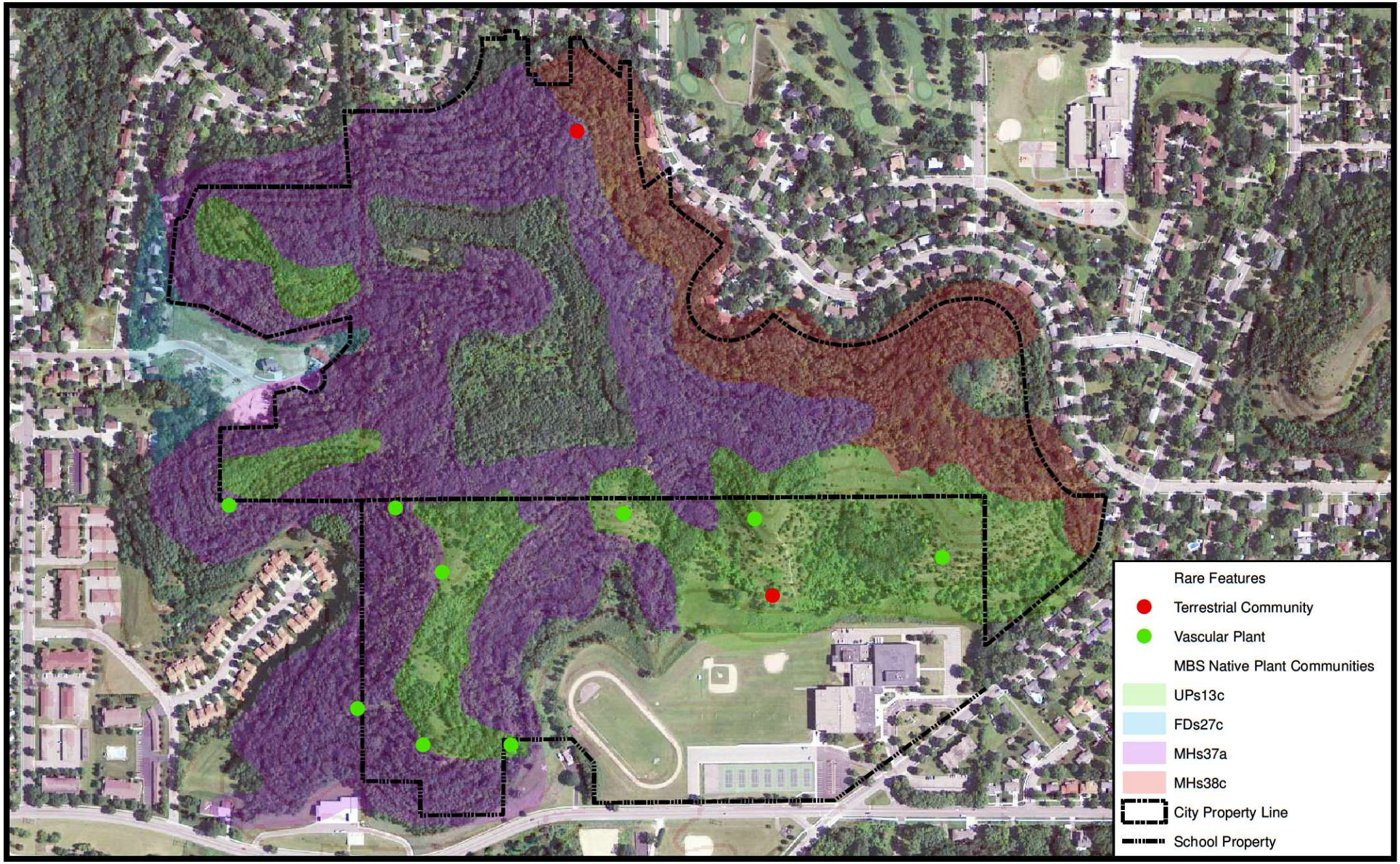


Coon Hill Prairie Stewardship Plan
Ecological Classification System
November 1, 2013

0 50 100 200 Miles

N

Map 2



Coon Hill Prairie Stewardship Plan

Element Occurence

November 1, 2013

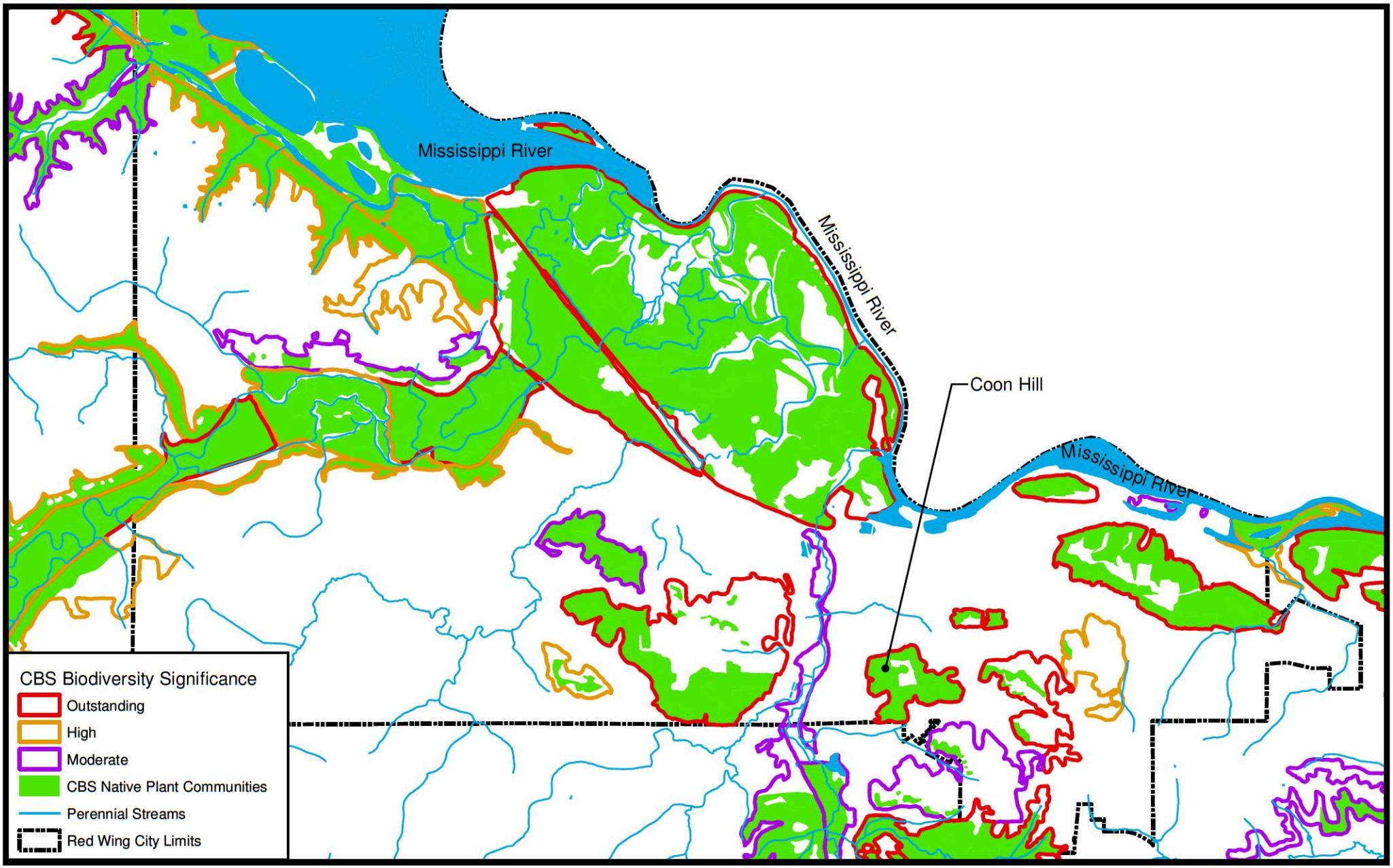
Data included here were provided by the Division of Ecological and Water Resources, Minnesota Department of Natural Resources (DNR), and were current as of December 2012.

2011.0.5m Orthophoto Imagery. DNR & Partners.

0 250 500 1,000 Feet

N

Map 3



Coon Hill Prairie Stewardship Plan

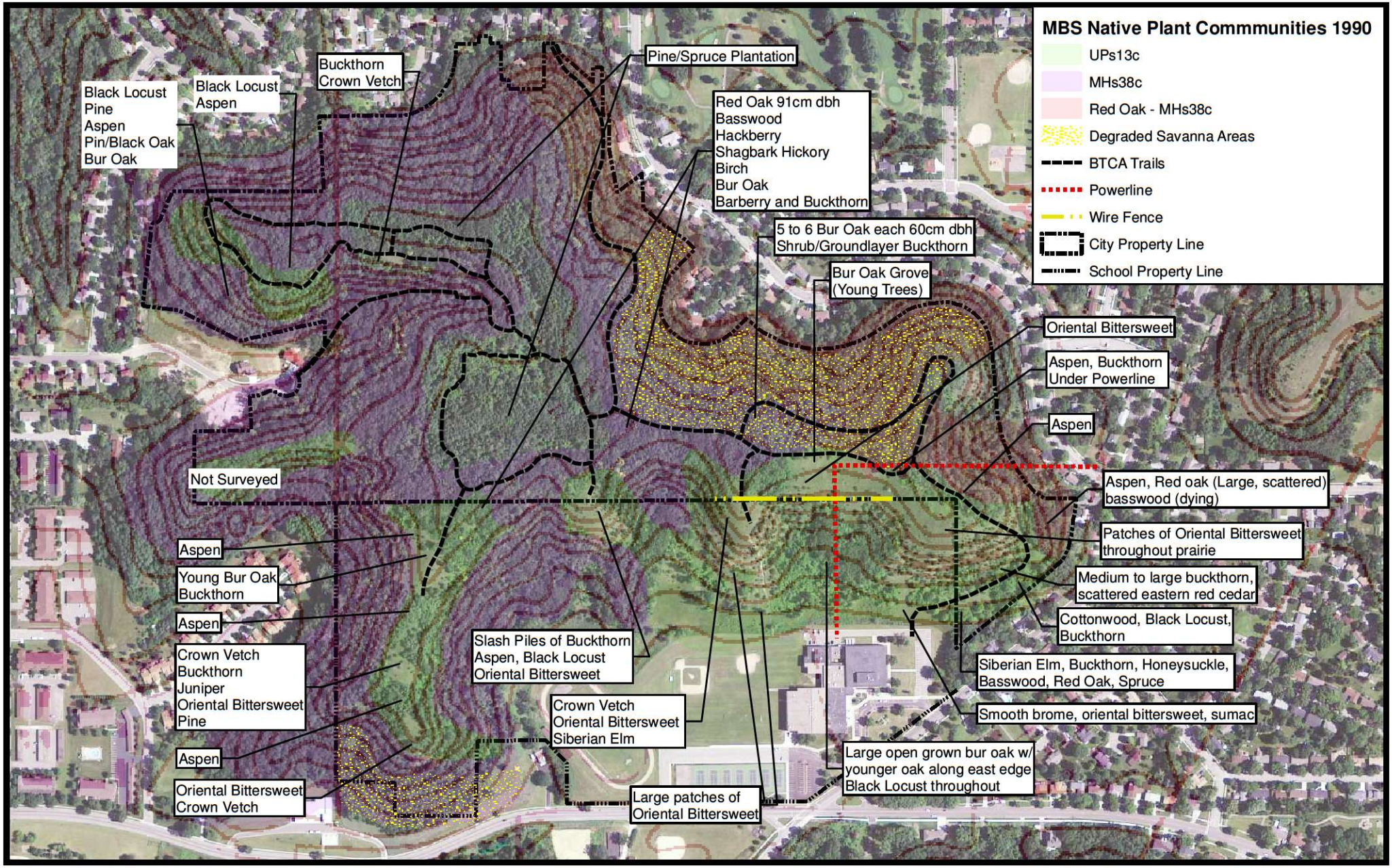
Regional Context and Ecological Significance

November 1, 2013

0 0.5 1 2 Miles

N

Map 4



Coon Hill Prairie Stewardship Plan

Existing Conditions

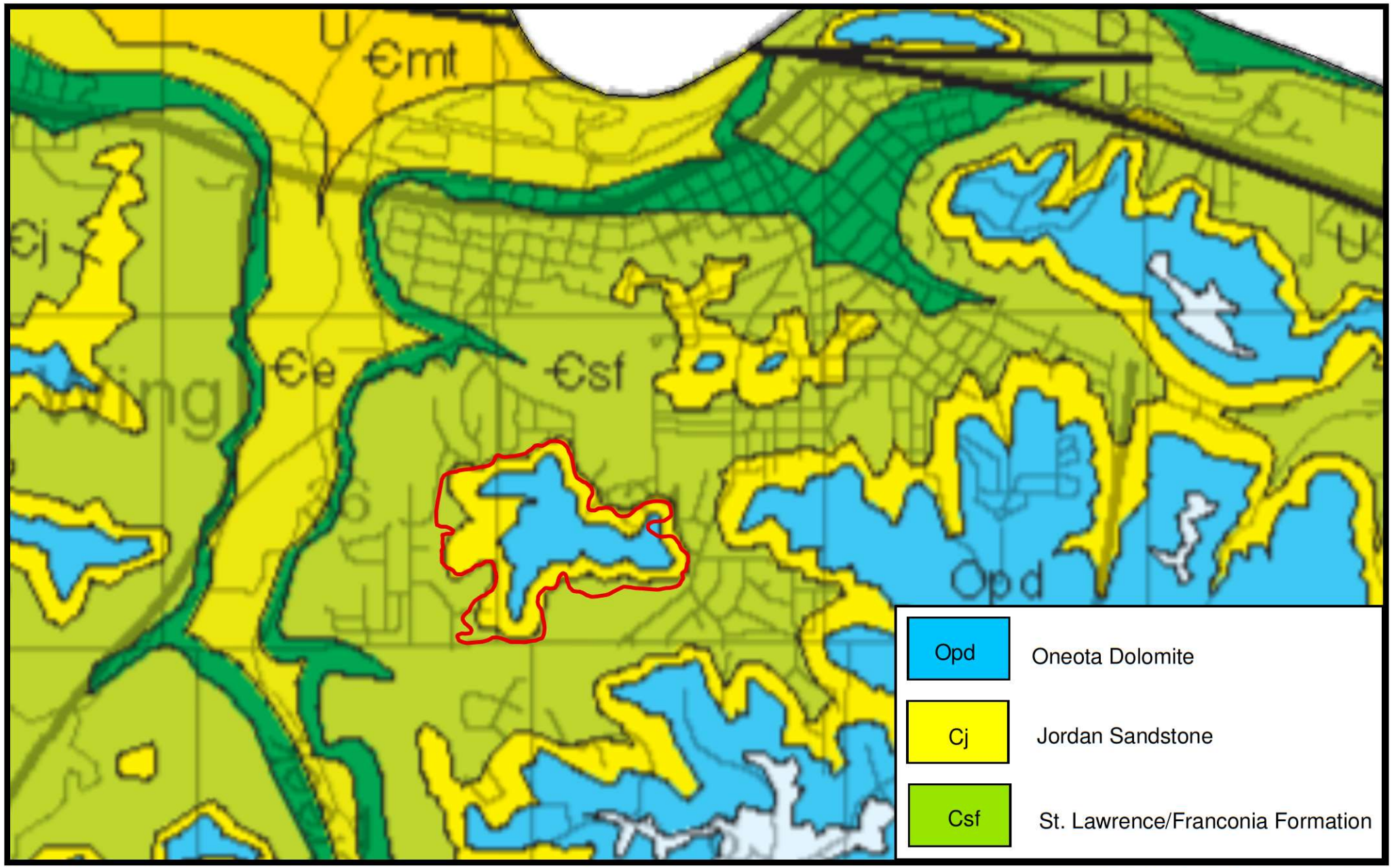
August 21, 2013

2011. 0.5m Orthophoto Imagery. DNR & Partners.

0 250 500 1,000 Feet

N

Map 5



Coon Hill Prairie Stewardship Plan

Bedrock Geology

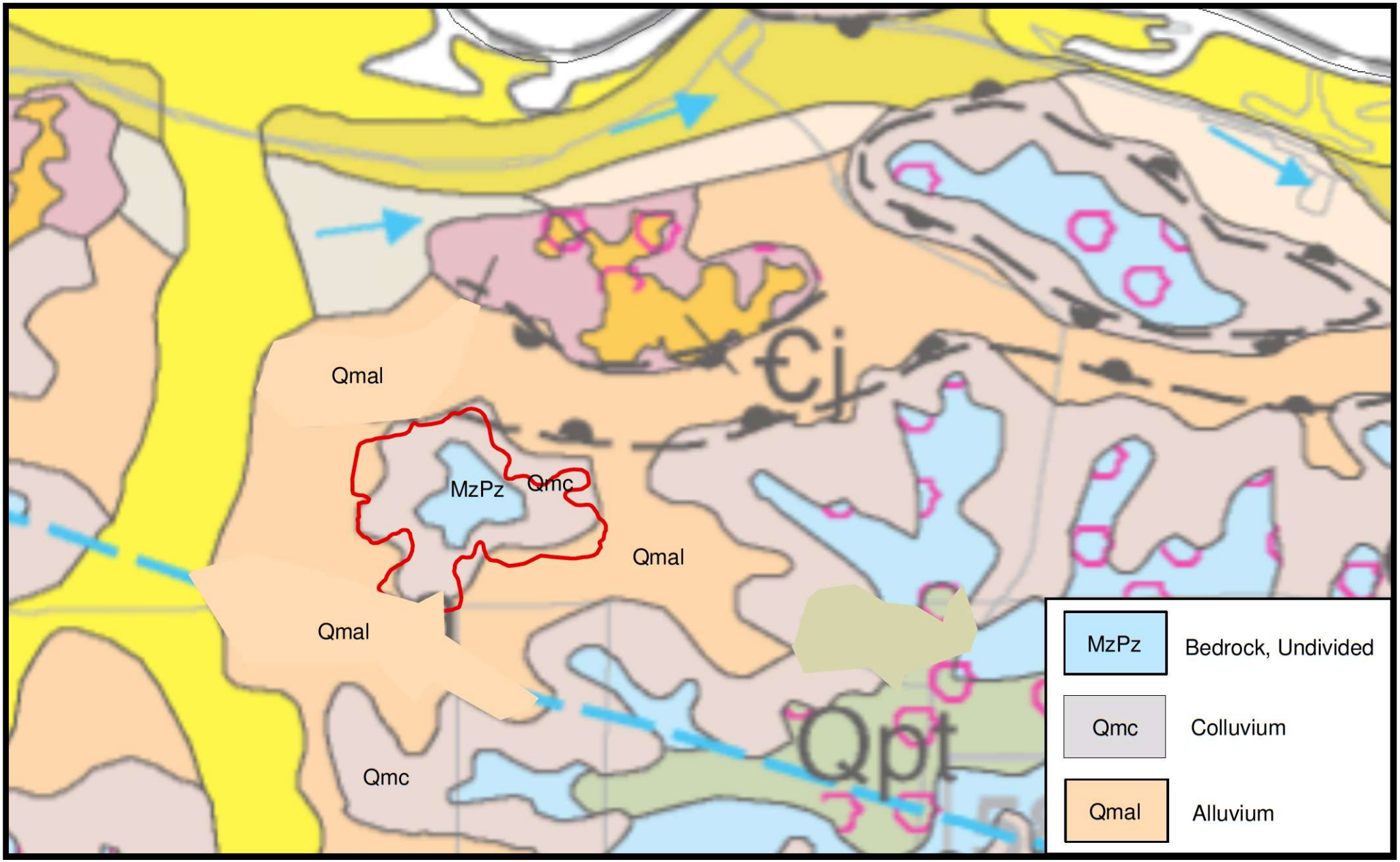
November 1, 2013

Mnnesota Geological Survey, Regents of the U of MN

0 1,500 3,000 6,000 Feet

N

Map 6



Coon Hill Prairie Stewardship Plan

Surficial Geology

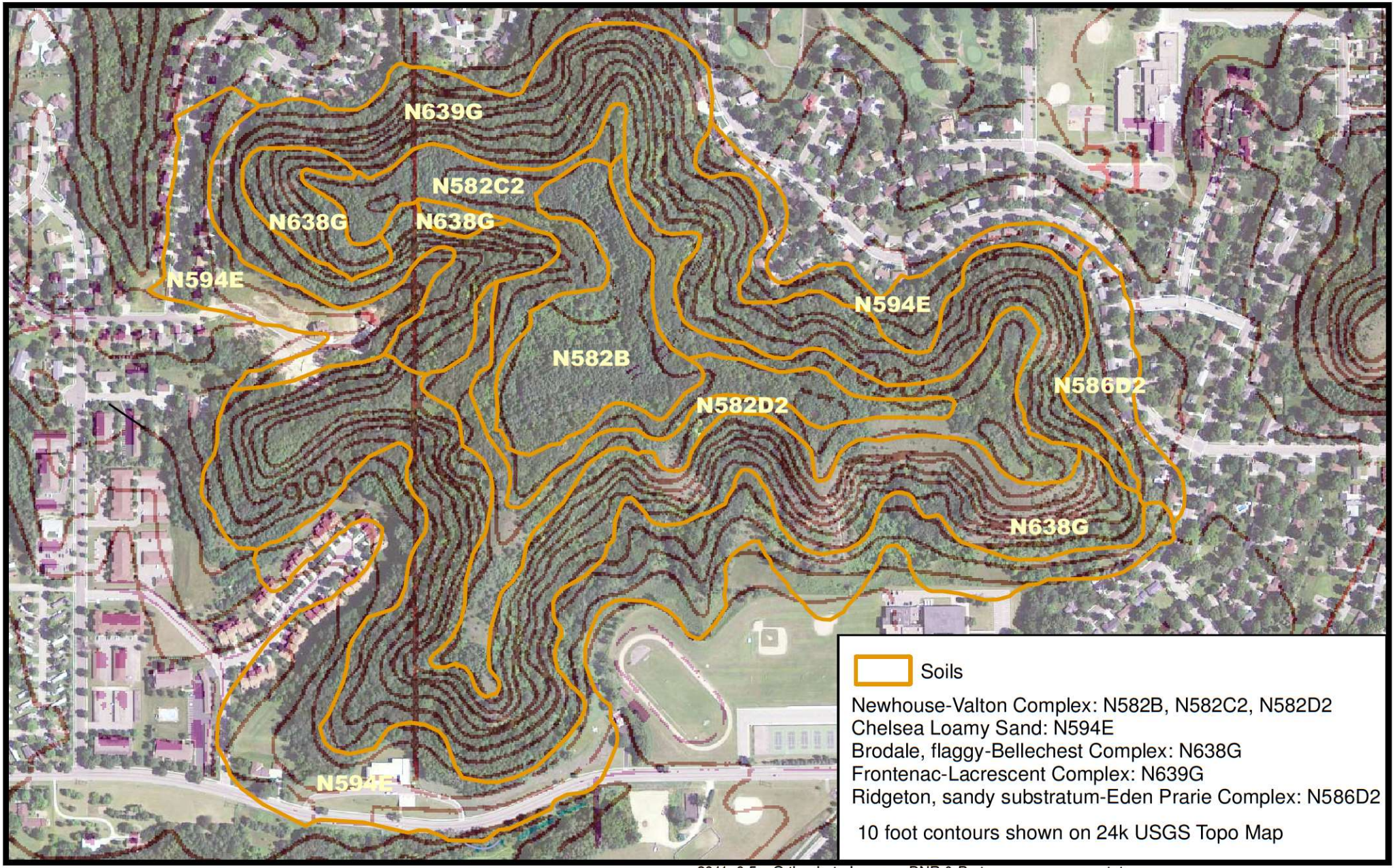
November 1, 2013

Data online from Mnnesota Geological Survey, U of MN
http://www.mngs.umn.edu/index.html

0 1,250 2,500 5,000 Feet

N

Map 7



Coon Hill Prairie Stewardship Plan

Topography and Soils

November 1, 2013

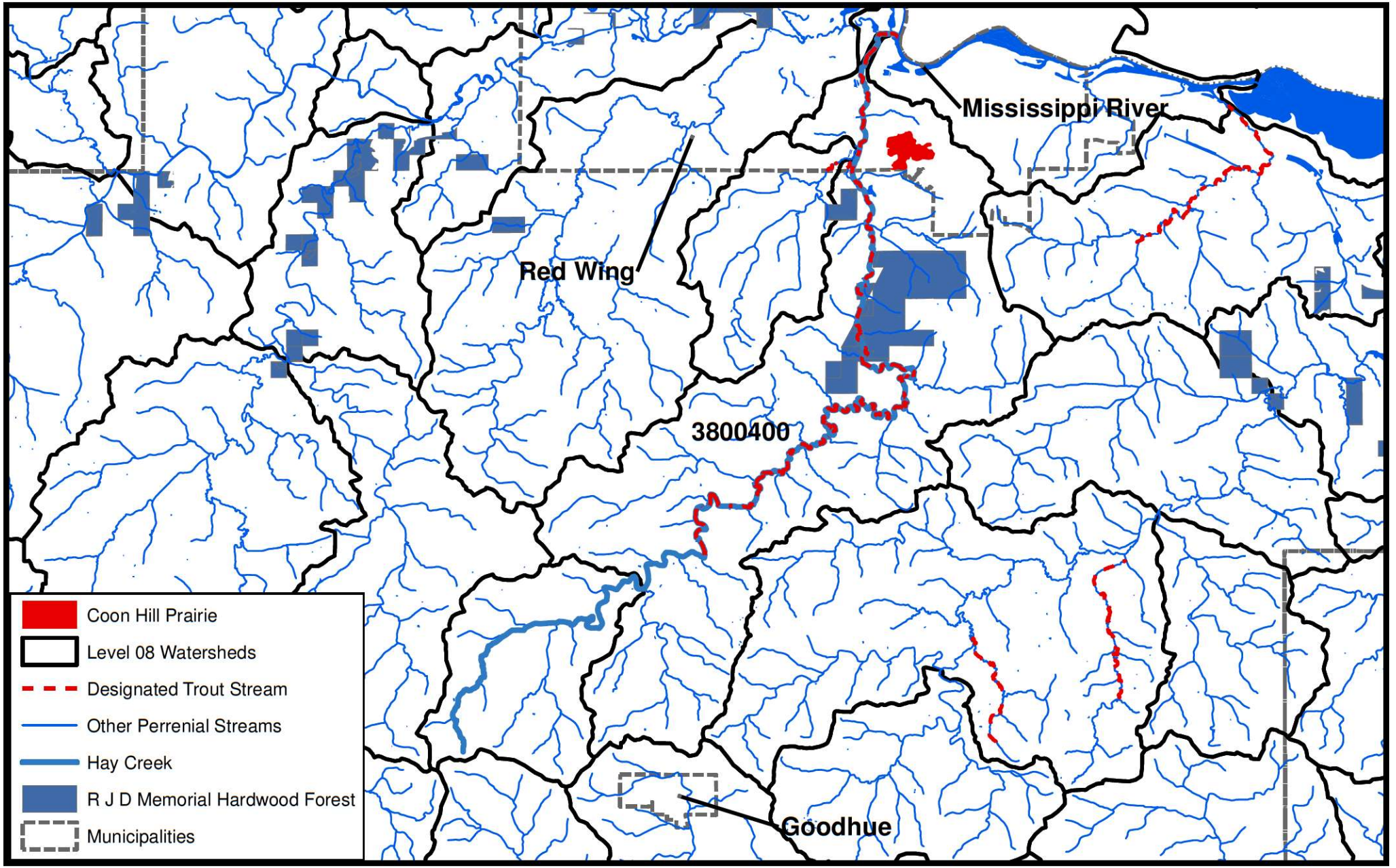
2011. 0.5m Orthophoto Imagery. DNR & Partners www.mngeo.state.mn,us

Natural Resources Conservation Service (NRCS). 2013. Custom Soil Resource Report for Goodhue County, Minnesota. United States Department of Agriculture. http://websoilsurvey.nrcs.usda.gov/app/HomePage.html

0 250 500 1,000 Feet

N

Map 8



Coon Hill Prairie Stewardship Plan

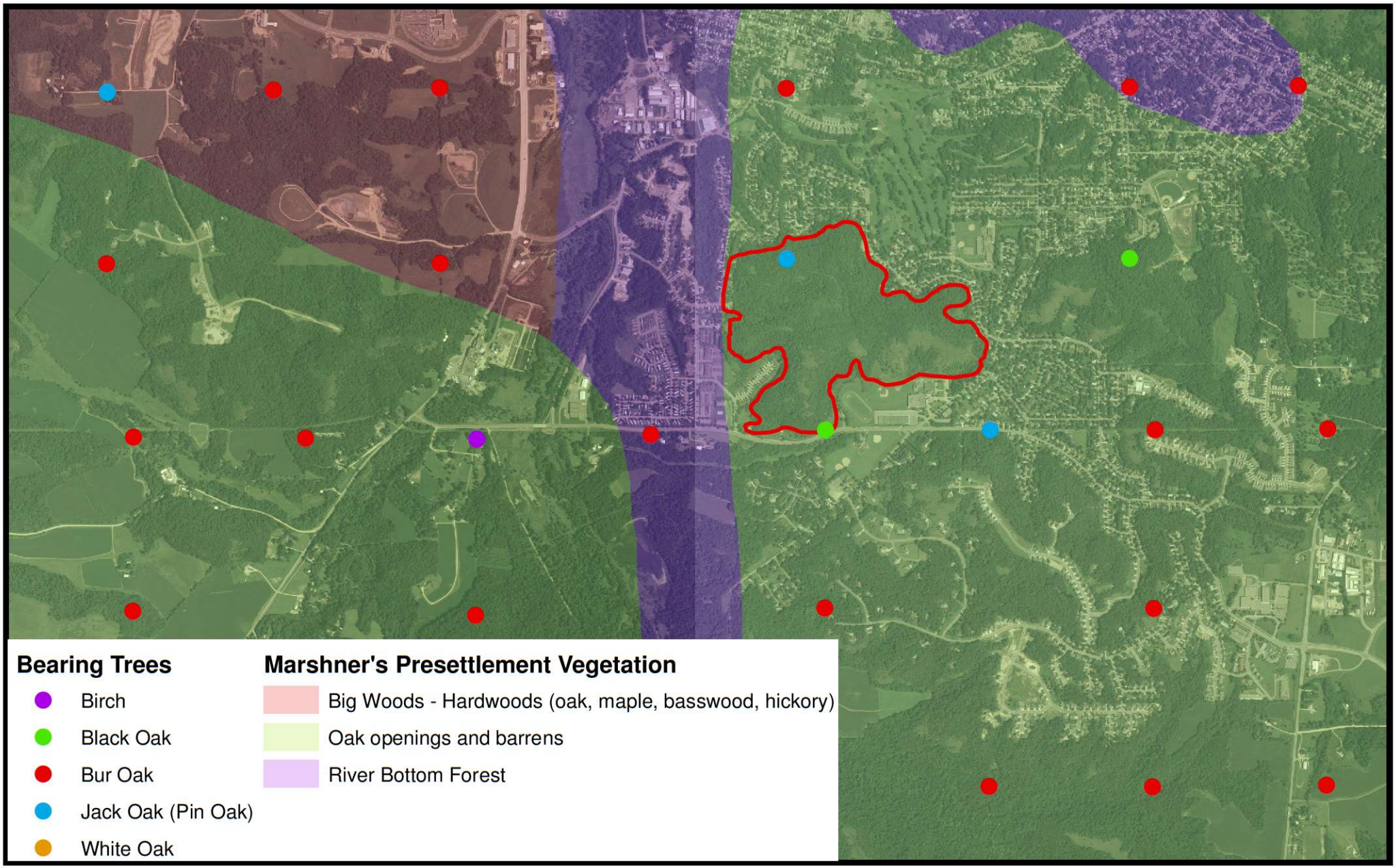
Hydrology

August 21, 2013

0 1 2 4 Miles

N

Map 9



Coon Hill Prairie Stewardship Plan

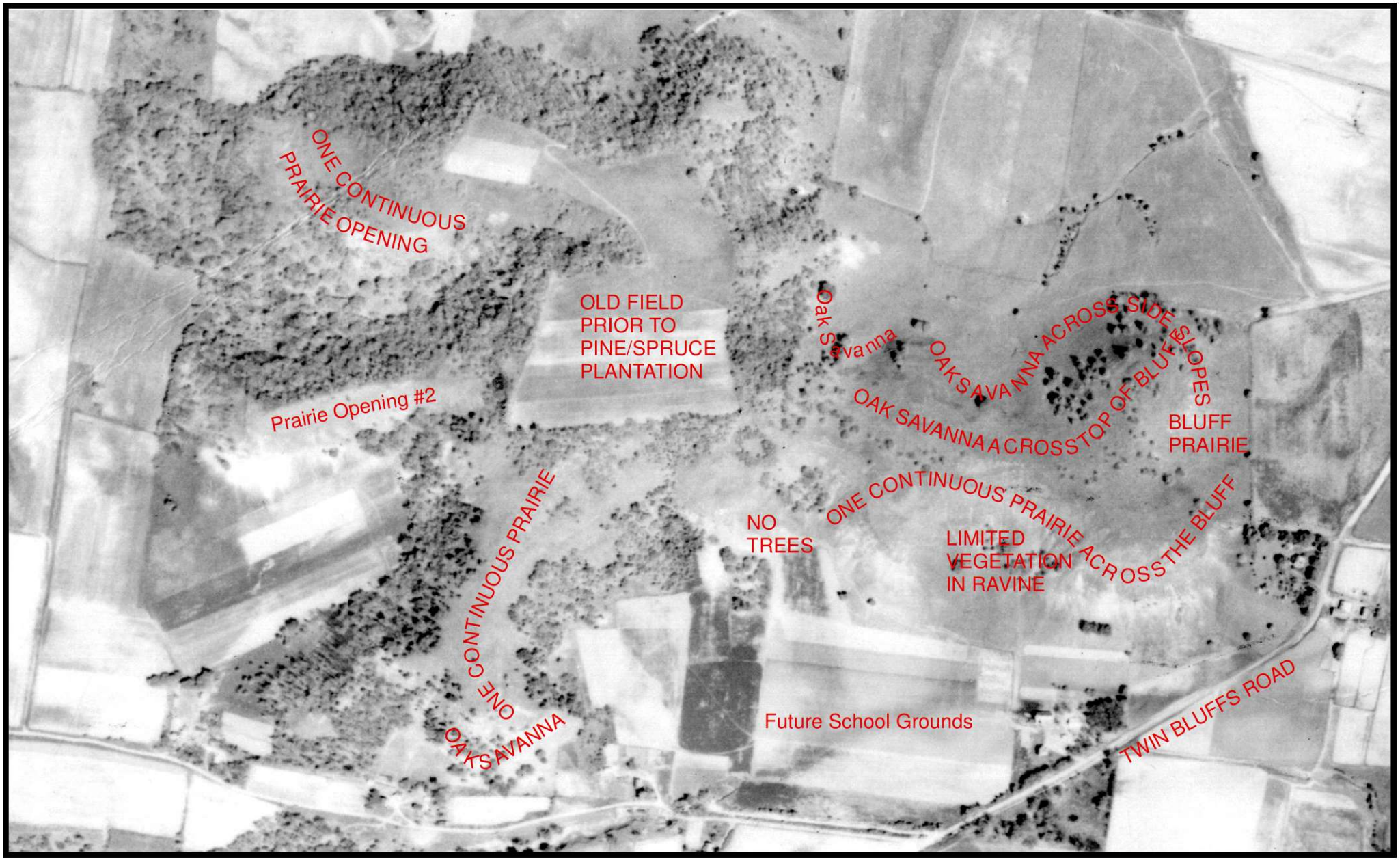
Historic Vegetation

November 1, 2013

0 1,250 2,500 5,000 Feet

N

Map 10



Coon Hill Prairie Stewardship Plan

Historic Vegetation: 1938

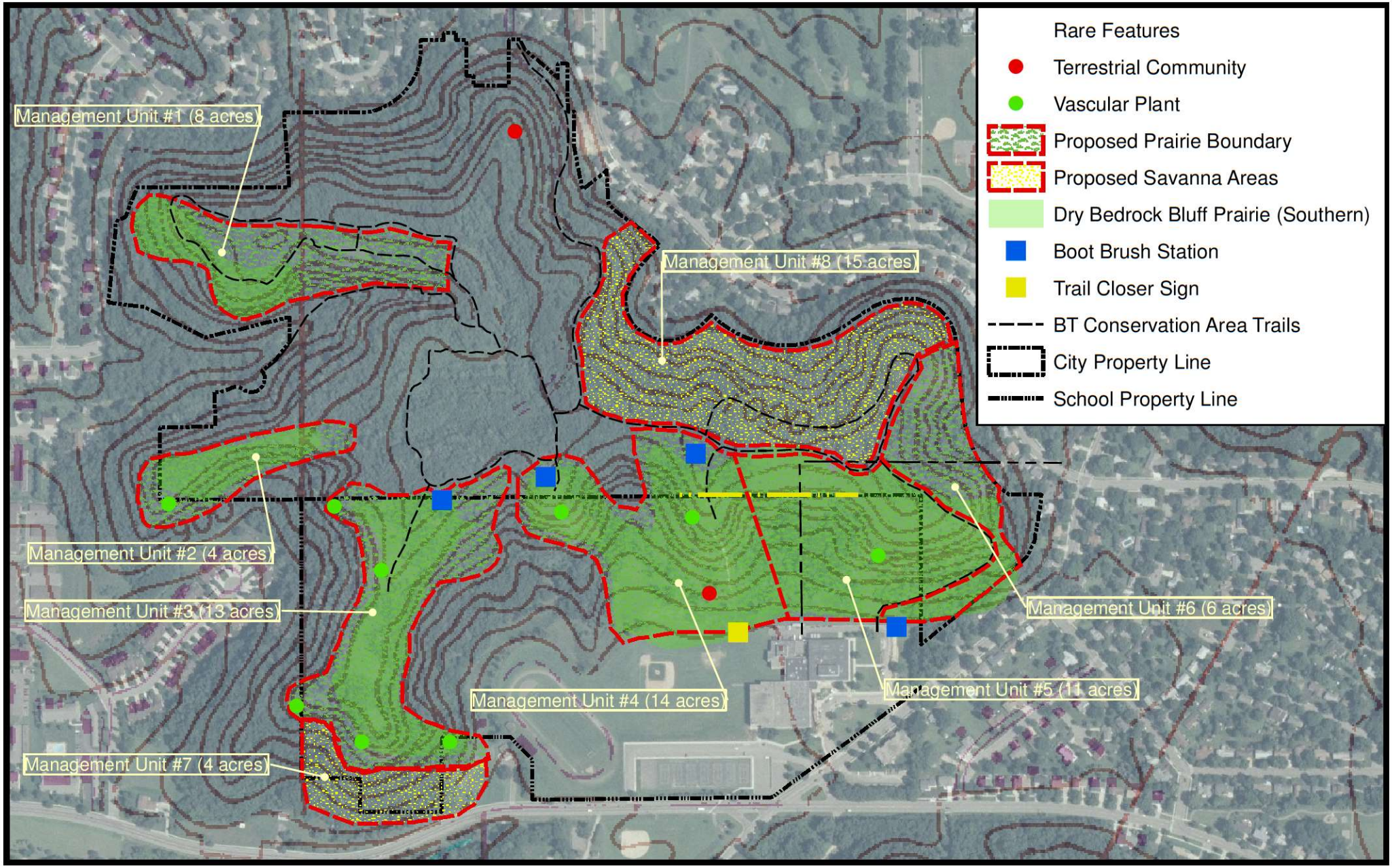
November 1, 2013

1938 ASCS 20,000 Historic Aerial Photo

0 250 500 1,000 Feet

N

Map 11



Coon Hill Prairie Stewardship Plan

Proposed Management

November 1, 2013

0 250 500 1,000 Feet

N

Map 12