

4. Trail Management

Trail Cross-Section Examples

The Camp Ripley/Veterans State Trail is planned to be a multi-use trail accommodating both motorized and non-motorized uses. Figure 21 illustrates trail cross-section examples for a multi-use paved trail, a gravel surface ATV trail and a natural surface equestrian trail. It is anticipated that if side-by-side multi-use alignments are pursued, some buffer area will be required to separate uses and ensure safety and a pleasant experience for all users. Additional detail on the cross-section for the CRVST multi-use trail will be developed as trail development evolves through preliminary engineering/design and construction. Figure 21 is intended for illustrative purposes only at this stage; actual alignments and cross-sections will depend on site conditions.

Projected Trail Use

The Camp Ripley/Veterans State Trail will provide an important link in Minnesota's trail system between the Paul Bunyan State Trail to the north, Little Falls and the Soo Line Regional Trail to the south.

It is anticipated that the number of trail users and patterns will be similar to what is occurring on other state trails, and specifically on the existing Paul Bunyan State Trail. Summer use on the Paul Bunyan State Trail, a 64-mile trail extending from Baxter to the Heartland State Trail, was over 80,000 "user hours" during the summer season in 2007. (A "user hour" is described as a trail user spending one hour on the trail.)

State park attendance figures at nearby parks also indicate the numbers of recreational users in the area.

State Park Annual Attendance

Crow Wing State Park: 2010 – 46,776; 2011 – 30,564

Charles A. Lindbergh State Park: 2010 – 48,213; 2011 – 39,209

Trail use will vary by segment and proximity to communities and area attractions.

Trail Maintenance

Adequate maintenance of state trails is critical to provide and sustain the experience trail users appreciate. Maintenance activities are numerous and diverse, as the following list illustrates:

- Monitoring trail conditions, which includes scheduling and documentation of inspections; monitoring the condition of railings, bridges, trail surfaces, and signage; hazard tree inspection; and removal of debris such as downed trees
- Scheduling of maintenance tasks
- Mowing of vegetation: shoulders, rest areas, and parking lots
- Winter grooming and plowing
- Tree and shrub pruning
- Trash removal

CAMP RIPLEY/VETERANS STATE TRAIL

- Trail repair – fixing washouts and controlling erosion are examples
- Maintaining bridge decking and railings
- Trail drainage control
- Trail surface maintenance
- Repair of animal damage to trail or facilities
- Checking and repairing fence lines and gates
- Mowing and brushing farm crossings
- Cleaning out ditches and culverts, replacing failing culverts
- Controlling invasive species
- Maintaining equipment
- Painting posts and picnic tables
- Graffiti control and vandalism repair, especially to signs
- Maintaining boundary signs, and working to resolve encroachment issues
- Coordination of volunteer efforts
- Training and supervision of employees, Conservation Corps Minnesota, or Sentence to Service crews
- Sweeping asphalt surfaces

In areas with sensitive natural resources, and at any water accesses along the corridor, the Parks and Trails Division would follow the guidelines established under Operational Order #113, "Invasive Species," in consultation with the Division of Ecological and Water Resources. The guidelines prescribe methods for avoiding the introduction or spread of invasive species, and managing and treating infestations of such species.

Maintenance Recommendations

Recommendation 1: Additional maintenance funds will be required to maintain the trail after it is developed.

Recommendation 2: The trail should be seal coated approximately six years after initial development. Research shows that this will prolong the life of the trail.

Recommendation 3: Consideration should be given to mowing remnant and restored prairie once in the fall to retain robust prairie species and reduce the risk of introducing invasive species. Resource management staff will provide additional direction regarding maintenance within Crow Wing State Park.

Recommendation 4: Prescribed burning on prairie areas should be a priority maintenance practice. Portions of the trail may need to be closed during a prescribed burn event.

Information and Education

Trail User Orientation

Trail users must have good information about the trail system so they can make choices about destinations appropriate for their time frame, skill level, need for services such as food and lodging, links to regional or local trails, and the type of scenery and other recreational opportunities available along the route. This type of information should be displayed on information boards at parking areas, in communities and at trail junctions. It should be available on maps, and on the DNR Website. It should include distances



Typical trail signage and interpretive displays

between communities, options for other trail connections and locations of services. If any significant deviation from the typical trail design occurs – e.g., when a trail enters a community – it should be noted on signs or informational kiosks to assist trail users in understanding what the trail experiences will be.

Identification of Services

Trail users benefit from knowing where they can obtain services (medical assistance, telephones, gasoline, food, lodging, restrooms, campgrounds, repair facilities, or other retail) and local businesses benefit from an increase in customers. A listing of the services available in each community developed, maintained and updated by the community could be displayed on information boards at parking areas in each community.

Trail Courtesy and Safety Information

Trail courtesy and safety information aimed at educating trail users about appropriate behavior, promoting safe trail use, and protecting the quality of the trail environment should be developed and posted at trailheads and other key locations.

Volunteer trail ambassadors could be used to distribute information on appropriate trail behavior and etiquette relative to specific problems such as unleashed dogs, passing of other users, and the need to clean equipment to prevent the spread of invasive species.

Interpretation of Natural and Cultural Resources

There are many natural and cultural resources of significance and interest along the trail. These include varied topography, native vegetation, wildlife habitat, wetlands, rivers and lakes. In addition, there are many places that tell the history of the region. Providing information about these resources can add enjoyment to the trial experience.

One or more interpretive themes are identified for state trails during the planning process. The interpretive theme helps tie together spatially separated interpretive sites and provides continuity in the messages presented.

Each state park has interpretive themes, programs, and signs for interpreting its cultural and natural resource setting covering the themes identified for the state trail as well as others. Coordination between park and trail interpretation and programming will benefit park visitors and trail users. The interpretive themes used for the state parks in the region indicate some potential directions for trail interpretation. Themes highlighted at Crow Wing State Park include:

- The park's geographic position in the transition area between the woodlands and prairies of Minnesota
- The park's location at the confluence of the Mississippi and Crow Wing Rivers
- The history of European exploration and settlement of the area including the Red River Oxcart Trail, the Crow Wing townsite, and the Clement Beaulieu House.

Themes highlighted at Charles A. Lindbergh State Park include:

- The international historical significance of Charles A. Lindbergh, Jr., the first person to fly solo and non-stop across the Atlantic Ocean

- Human impacts on vegetation
- Explanations of various animal species populations in the park including beaver, migrating birds, black squirrels, deer, and lack of predator sightings

Both parks also highlight the Mississippi River, the glacial processes that formed the landscapes and different resource management techniques such as the use of fire. Other interpretive elements include geology, plant communities and plant species found in and adjacent to the corridor, and wildlife species likely to be observed by trail users.

Interpretive signs will be developed in consultation with other DNR divisions and the Minnesota Historical Society (MHS). Some initial ideas are listed above. Additional sites will be interpreted over time.

Information and Education Recommendations

Recommendation 1: Develop a kiosk and trail logo design that reflects the interpretive theme for the trail that can be used in communities and at rest areas along the trail. Use of native stone should be used in the design of kiosks and/or sites as they are located.

Recommendation 2: Community services information, trail orientation, trail rules and trail courtesy information should be developed and installed on a kiosk at the same time the trail is developed.

Recommendation 3: Parks and Trails staff should cooperate with schools to use the trail for environmental education purposes.

Recommendation 4: Interpret the natural and cultural features along the trail. Include information on the fishing opportunities of the trail. The Division of Fisheries local offices and MinnAqua staff should be consulted as resources.

Enforcement

Minnesota State Trails are very safe and generate very few complaints. However, adequate enforcement is a vital aspect of maintaining a safe and secure trail environment. User conflicts, unauthorized use of the trail, and trail users leaving the treadway designated for their use are often among the concerns identified during the planning process, and are all likely areas for enforcement.

Enforcement of state trails rules and regulations, information and education, trail design, trail maintenance, and the mix of trail uses are all factors that contribute to the maintenance of a safe, secure trail environment. The DNR has the primary responsibility for law enforcement on DNR-owned and operated recreation areas. Enforcement assistance is also sought from local police departments and county sheriffs as necessary.

The DNR's goal is to deal with issues as they arise and provide an adequate level of enforcement to maintain a safe and secure trail environment, to encourage trail users to understand and obey trail rules and respect other trail users and adjoining properties.

Recommendations for Enforcement

Recommendation 1: Provide an adequate level of enforcement via a multifaceted approach, to help maintain a safe and secure trail environment, and to encourage trail users to understand and obey trail rules, and respect other trail users and adjoining properties.

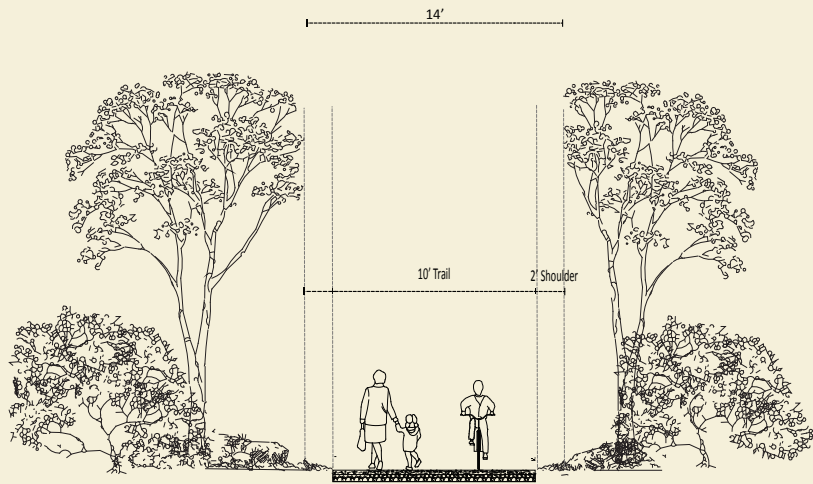
Recommendation 2: Develop on-site information that targets important trail courtesies and rules necessary for a safe and enjoyable experience, specific to uses of a particular segment and problems and conflicts occurring there.

Recommendation 3: Increase visibility of Parks and Trails staff during peak use times for an enforcement effect.

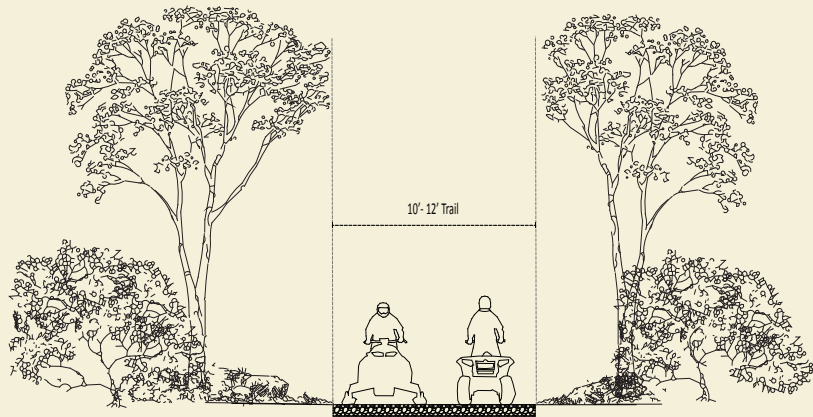
Recommendation 4: Investigate the feasibility of a state trail ambassadors program to communicate with trail users regarding trail safety and etiquette.

Recommendation 5: Parks and Trails will include the cost of enforcement when providing information about the cost of the trail when communicating with legislators, trail advocates, and local government officials.

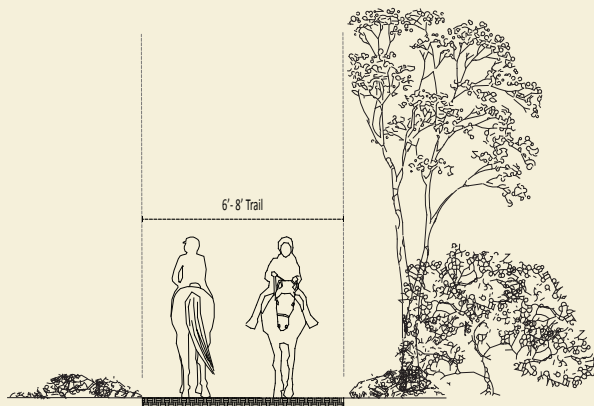
Camp Ripley/Veterans State Trail CORRIDOR STUDY



Non-motorized use



Motorized use



Equestrian use

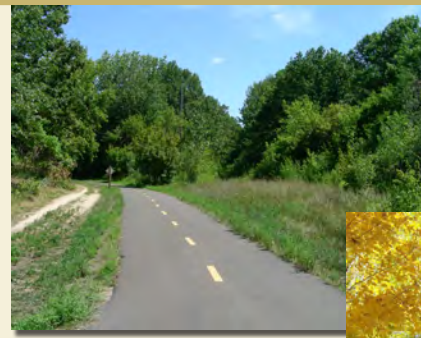


Figure 21

Trail Cross-Section
Examples



5. Trail Corridor Resources

Ecological Classification System

Minnesota lies at the center of North America where the prairie, boreal forest, and eastern deciduous forest meet. There are four major ecological provinces in Minnesota: the Eastern Broadleaf Forest, the Laurentian Mixed Forest, the Prairie Parkland and the Tallgrass Aspen Parklands. These ecological provinces are divided into subsections – distinct landscapes of Minnesota, defined by vegetation, geology and other resource criteria.

The trail search area is unique because it straddles the boundary between the Eastern Broadleaf Forest and Laurentian Mixed Forest ecological provinces, and encompasses four subsections of the Ecological Classification System (ECS): the Hardwood Hills to the south and west, the Pine Moraines and Outwash Plains to the north, the Anoka Sand Plain on either side of the Mississippi River, and the Mille Lacs Uplands to the east. Essentially, the landscape changes from north to south, as conifers give way to deciduous woodlands, and also from west to east, as wooded hills transition into broad level plains bordered by glacial eskers. These diverse landscapes will be a defining feature of this trail. Trail users will experience a great diversity of topography, plant communities and land uses.

A description of the subsections is important for trail planning purposes because it provides the context for the trail alignment, trail development, resource management and interpretation recommendations. The following descriptions are drawn from the DNR website, <http://www.dnr.state.mn.us/ecs/index.html>

Pine Moraines and Outwash Plains Subsection

The northwestern part of Crow Wing County and much of Cass County is located within this subsection. The northernmost part of the trail corridor passes through this subsection, which also includes the west side of Camp Ripley.

This subsection, part of the Laurentian Mixed Forest Province, is named for its mix of end moraines and outwash and till plains and is a resource-rich heavily forested area. The subsection contains sections of the Mississippi River, along with hundreds of lakes. Kettle lakes and wetlands are common on the outwash plains, and aspen, birch and pine forest were the most common on end moraines.

Forest management and tourism are the predominant land uses in this subsection today. The bait industry is also well represented. Motorized recreation is popular in many of the state forests in this area. Agriculture is common in the western part of this subsection.

Landform. This subsection consists primarily of large outwash plains, narrow outwash channels, and relatively large end moraines formed from portions of several glacial lobes. Most of the glacial drift was sandy, but there is loamy drift to the north.

Hydrology. Kettle lakes are common on pitted outwash plains and within stagnation moraines. There are hundreds of lakes within the subsection that have a surface area greater than 160 acres. The headwaters of the Mississippi River (Itasca Lake in Itasca State Park)- is in this subsection. Other large rivers flowing through the outwash plains of the subsection include the Pine and Crow Wing rivers.



Bedrock Geology. Thick glacial drifts cover bedrock over most of the subsection at depths ranging from 200 to over 600 feet, with the greatest depths in the southwestern portion. A diversity of Precambrian rock underlies the glacial drift. There are also iron formations at the southeastern edge of the subsection, along with argillite, siltstone, quartzite and greywacke. Cretaceous marine shale, sandstone, and variegated shale are localized in the southwest of this subsection.

Climate. Total annual precipitation ranges from 23 inches in the northwest to 27 inches in the east, with about 40% occurring during the growing season. Only 12-16% of the annual precipitation falls during the winter months. Growing season length varies from 111 to 131 days.

Natural disturbance. Fire occurred on a 10 to 40 year rotation within much of the subsection, accounting for the dominance by upland conifers and quaking aspen-birch forests.

Conservation concerns. The number of year-round residents in this area is increasing as they convert small lake cabins into larger year-round homes. Near-shore habitat is being lost at a rapid pace, which negatively affects fish and wildlife.

Hardwood Hills Subsection

The Hardwood Hills Subsection, part of the Eastern Broadleaf Forest Province, runs through the heart of the Mississippi River flyway and central Minnesota. The Continental divide splits this subsection; rivers to the north flow to Hudson Bay, and rivers to the south, to the Mississippi. The subsection contains numerous large and small lakes, including prairie potholes, and kettle lakes and wetlands. Before settlement by people of European descent, vegetation included maple-basswood forests interspersed with oak savanna tallgrass prairie, and oak forest.

Western Morrison County falls into this subsection, including the southwest corner of Camp Ripley and much of the western side of the Mississippi River from Camp Ripley south.

Currently, much of this subsection is farmed. While many wetlands have been drained, many potholes remain and provide habitat for waterfowl and shorebirds. Important areas of forest and prairie exist throughout the subsection, but they are small and fragmented. About 15 percent of the subsection is forested. Other significant land uses are tourism and outdoor recreation, especially around lakes.

Landform. Ice stagnation moraines, end moraines, ground moraines, and outwash plains are major landforms present in this subsection. Kettle lakes are numerous, both on moraines and outwash deposits. Parent material is primarily calcareous glacial till deposited by the last major glaciations (Wisconsin age) and outwash sediments.

Hydrology. The Alexandria Moraine forms a high ridge that is the headwaters region of many rivers and streams flowing east and west. The drainage network is young and undeveloped throughout this subsection. Major rivers include the Chippewa, the Long Prairie, the Sauk, and the Crow Wing rivers. The Mississippi River forms a portion of the east boundary. The majority of the many lakes in this subsection are found on end moraines and pitted outwash plains.

Bedrock Geology. There are 100 to 500 feet of glacial drift covering most of the bedrock in this subsection, with the thickest drift in the northwestern half. Middle Precambrian granitic bedrock is locally exposed in the southeast, along the Crow River.



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Bedrock underlying the subsection is diverse. Cretaceous shale, sandstone, and clay and Lower Precambrian granite, meta-sedimentary and metaigneous gneiss, schist and migmatite underlie the southern half. To the north are metasedimentary rocks, iron formation, schist, and metavolcanic rocks.

Climate. Total annual precipitation ranges from 24 inches in the west to 27 inches in the east. Growing season precipitation ranges from 10.5 to 11.5 inches. The growing season ranges from approximately 122 days in the north to 140 days in the south.

Natural disturbance. Fire was important in oak savanna development, while windthrow was common in the sugar maple-basswood forests. Tornadoes and other high wind events also created natural disturbances.

Conservation concerns. Increased lakeshore and urban development and wetland loss, fire suppression, and increasing fragmentation of forest and prairie habitat are concerns in this subsection.

Mille Lacs Uplands Subsection

The Mille Lacs Uplands begin at the eastern edge of the trail search corridor and extend eastward to the St. Croix River. The subsection is named after Lake Mille Lacs, well known for its high-quality walleye fishing. Several major rivers run through the area, including the Kettle, Snake, Rum, Ripple, and St. Croix, the latter forming part of the eastern boundary. The subsection contains extensive wetlands and 100 lakes greater than 160 acres in size. Gently rolling hills are the dominant landform. Glaciation has had a major influence on the landscape, and the resulting moraines provide excellent salamander and other wildlife habitat today.

Before settlement by people of European descent, maple-basswood forests were prevalent in the south, and the north was a mix of conifer and hardwood forests. Because of its proximity to the Twin Cities and its vast network of roads, this subsection is under increasing pressure from human activities. Agriculture is concentrated in the western and southern portions, and forestry and recreation are more common in the central and eastern portions.

Landform. This subsection consists primarily of Superior lobe ground moraine, and includes the Brainerd-Pierz and Automba Drumlin fields. The depressions between drumlin ridges contain peatlands with shallow organic material. There are also small areas of Des Moines lobe ground moraine in the southeastern portion of the subsection. A large end moraine in the center of the subsection forms the dam that created Mille Lacs Lake. In the northeast, there is another series of end moraines, which marked later advances and retreats of the Superior Lobe.

Bedrock geology. Glacial drift ranges from 100 to 300 feet in depth over bedrock. Bedrock is locally exposed throughout the northern portion of the subsection, where depths are typically 100 feet or less. Bedrock consists of Middle to Late Archean and Early Proterozoic gneiss, amphibolites, undifferentiated granite and metamorphosed mafic. At the southeastern edge of the subsection are Cretaceous marine shale, sandstone, and variegated shale.

Hydrology. Major rivers running through this subsection include the St. Croix, which forms part of the eastern boundary and the Kettle, Snake, Rum, and Ripple rivers. The drainage network is young and undeveloped, with extensive areas of wetlands present. There are 100 lakes greater than 160 acres in size, most of which occur on end moraines.



Presettlement vegetation. The original vegetation consisted of a mosaic of forest types. Along the southern boundary, maple-basswood forests were prevalent. The rest of the subsection was a vast mix of conifer, hardwood and mixed conifer-hardwood forests. Peatland areas were inhabited by sedge-fen, black spruce-sphagnum, or white cedar-black ash communities.

Present vegetation and land use. Agriculture is concentrated in the western and southern portions of this subsection. Forestry and recreation are the most important land uses in the central and eastern part.

Natural disturbance. Both fire and windthrow were important in determining the vegetation of the subsection. Because dense basal till is present at depths of 20 to 40 inches throughout most of the subsection, rooting depths for trees are shallow and windthrow is common.

Conservation concerns. Fire suppression, wetland loss, and increasing fragmentation of forest habitat due to shoreland and recreational development are concerns in this subsection.

Anoka Sand Plain Subsection

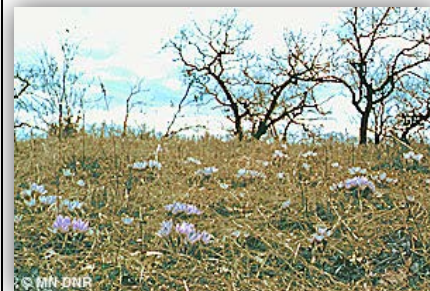
The Mississippi River valley forms the western boundary of the Anoka Sand Plain Subsection. This subsection is located on both sides of the Mississippi throughout the entire trail search corridor. A broad, flat, sandy lake plain dominates the majority of this area and forms its eastern and northern boundaries. Historically, the predominant vegetation was oak savanna and upland prairies surrounded by varied wetland complexes. This subsection stretches across the northern Twin Cities metropolitan area, including St. Cloud to the west and North Branch to the east, and has the second fastest-growing population in the state. Urban development and agriculture (primarily sod and vegetable crops), which occurs in about one-third of the subsection, has resulted in the loss of prairie and savanna and drainage of peatlands.

Landform. The major landform is a broad sandy lake plain, which contains small dunes, kettle lakes, and tunnel valleys. Topography is level to gently rolling. There are small inclusions of ground moraine and end moraine. The other important landform is a series of sandy terraces associated with historic levels of the Mississippi River. Terraces are also associated with major tributaries of the Mississippi.

Bedrock geology. The subsection is underlain by Cambrian and Ordovician dolomite, sandstone, and shale. Bedrock is locally exposed in the St. Cloud area. Surface glacial deposits are usually less than 200 feet thick.

Climate. Total annual precipitation ranges from 27 inches in the west to 29 inches in the east, with growing-season precipitation ranging from 12 to 13 inches. The growing season length ranges from approximately 136 to 156 days, with the longest growing season in the south.

Hydrology. Terraces associated with the Mississippi River form part of the western boundary of the subsection. Most rivers and streams are tributaries of the Mississippi, although some flow east to the St. Croix River, which eventually flows into the Mississippi. Many rivers, streams, and lakes are located in old glacial tunnel valleys. There are 38 lakes larger than 160 acres in area; about 3% of the subsection's surface is covered by water. Peatlands occupy linear depressions of many tunnel valleys.



Presettlement vegetation. The predominant vegetation on the droughty uplands was oak barrens and openings. Characteristic trees included small and misformed bur oak and northern pin oak. Jack pine was present locally along the northern edge of the subsection. Brushland characterized large areas of the sandplain. Upland prairie formed a narrow band along the Mississippi River, as did areas of floodplain forest.

Present vegetation and land use. Sod and vegetable crops are extensively grown on drained peat and muck areas. Urban development is rapidly expanding into the subsection. Species associated with oak openings and oak barrens are abundant in the sandplain although large areas of opening and barrens are uncommon.

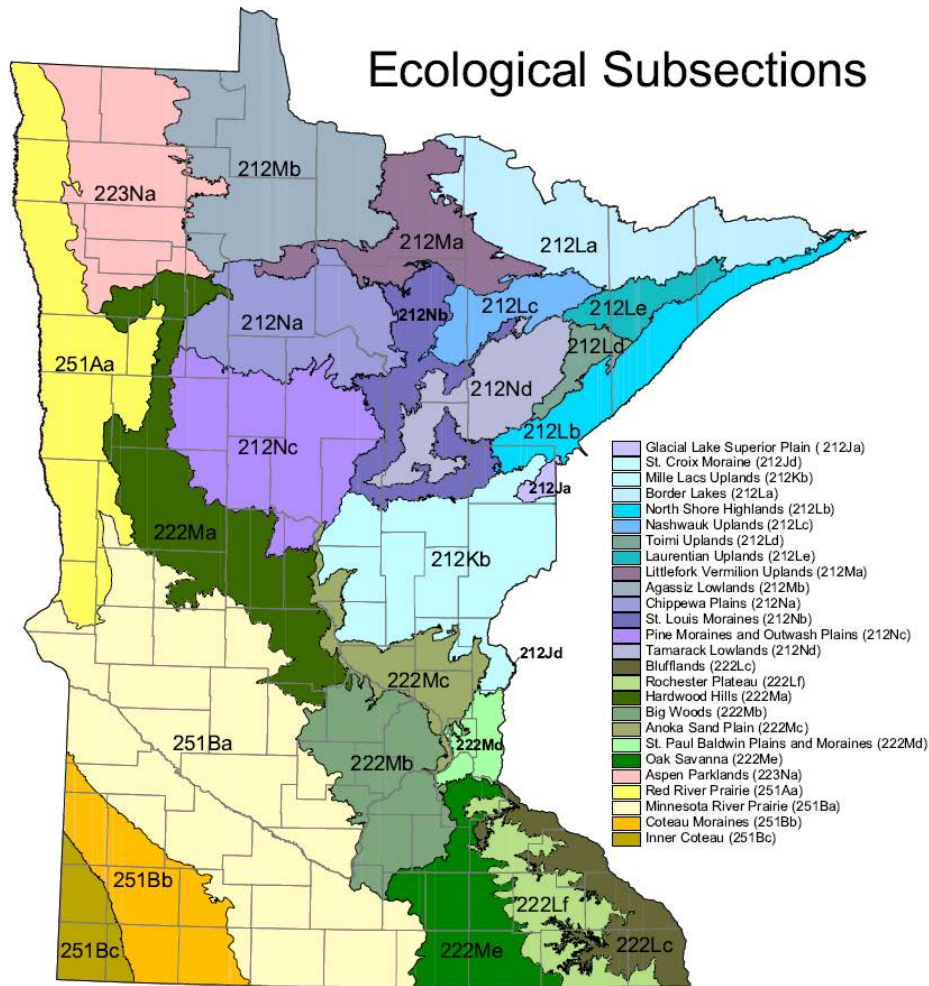
Natural disturbance. Fire and drought were important factors impacting the vegetation of the sand plain. Drought was found to cause mortality for two of the dominant species of the oak barrens and savannas, northern pin oak and bur oak. During severe periods of drought, vegetation cover was greatly reduced on portions of the sand plain, resulting in wind erosion and sand dune movement.

Conservation concerns. Urban development and agriculture (primarily sod and vegetable crops), which occurs in about one-third of the subsection, have resulted in the loss of prairie and savanna and drainage of peatlands.

Climate

The climate in north-central Minnesota is like that of the rest of the state, continental with extremes in temperature from summer to winter. According to the Midwestern Regional Climate Center, the northern portion of the trail corridor at Brainerd has an average temperature ranging from 5.5°F in January to 68.6°F in July. The average temperature in the southern portion of the trail corridor at Little Falls ranges from 9.8°F in January to 71.7°F in July.

The majority of the search corridor receives between 26 to 28 inches of precipitation annually, with the northern section in Brainerd receiving the most at 27.71 inches. The majority of the precipitation falls between April and October. Mean annual snowfall ranges from 50.4 inches in Little Falls to 46.8 inches in Brainerd. The average growing season is 131 to 143 days.



Vegetation

Presettlement Vegetation

Presettlement vegetation in the trail corridor is based on Marschner’s interpretation of the Public Land Survey records from 1853-1854. A variety of vegetation types were found in the area at that time. Oak openings and barrens dominated the eastern portion of the search area (the Anoka Sand Plain Subsection) with areas of prairie mixed in. The remainder of the search area was primarily made up of different mixes of pines and hardwoods, including aspen, birch, oak, maple, basswood, white pine, red pine and jack pine. Some areas of river bottom forests were found at the confluence of the Crow and Mississippi Rivers (see Figures 22 and 23).

Present Day Vegetation

Four ecological subsections converge within the trail search area, leading to a landscape with a variety of vegetation types, including both coniferous and deciduous forests, grasslands, croplands and wetlands. A majority of the current land cover

throughout much of the trail search area is forestland interspersed with small amounts of agricultural land. The southeast portion of the search corridor primarily consists of agricultural land. Significant areas of wetlands can be found along the Crow Wing and Mississippi Rivers in the northern portion of the search area and near the southwestern corner of Camp Ripley.

A variety of important native plant communities have been identified through the Minnesota Biological Survey (MBS) and are shown in Figures 22 and 23. The largest concentration of these communities is within and around Camp Ripley, which functions as a nature preserve as well as a training facility. The Army National Guard places a high value on protection of these resources.

Vegetation Management Recommendations

Recommendation 1: *Avoid threatened, endangered or special concern species.*

Recommendation 2: *Avoid high quality plant communities or rare (S1, S2 or S3) native plant communities, as defined by the Minnesota Biological Survey (MBS) maps.*

Recommendation 3: *Avoid or minimize impacts to MBS Sites of Outstanding or High Biodiversity Significance. If avoidance is not possible then impacts to the features that make the site of outstanding or high biodiversity significance are minimized.*

Recommendation 4: *Avoid or minimize impacts to Key Habitats as defined in Tomorrow's Habitat for the Wild & Rare – An Action Plan for Minnesota Wildlife. If avoidance is not possible then impacts to the features that make the plant community a Key Habitat are minimized. This may include avoiding certain times of year for construction activities to avoid critical nesting periods, for example.*

Recommendation 5: *Develop a vegetation inventory and management plan for the trail.*

Recommendation 6: *Restore, or if necessary, establish native woodland, prairie or wetland plantings using prairie plugs and seedlings along the trail in order to minimize maintenance, minimize the use of pesticides, control invasive species, and enhance natural species abundance and biodiversity, and enhance user experience as a result.*

Recommendation 7: *Use native plant species, from a locally collected seed source, to revegetate existing natural plant communities as well as areas disturbed by erosion, overuse or construction. Native plants should also be used in windbreak plantings and in the landscaping of parking areas and waysides.*

Water Resources

The Camp Ripley/Veterans Trail search area falls completely within the Upper Mississippi River Basin. Numerous smaller watersheds, including some that drain directly to the Mississippi River, fall within this basin. The trail search area includes portions of the Crow Wing River, Long Prairie River and Mississippi River – Brainerd watersheds (see <http://www.dnr.state.mn.us/watersheds/map.html>).

Major rivers in the trail search area include the Mississippi, Crow Wing and Nokasippi Rivers.

Major Water Bodies

Mississippi River

The Upper Mississippi River Basin extends from the river's source in Lake Itasca to its confluence with the St. Croix River. The Mississippi completes its circuit around the highlands of northern Minnesota as it approaches Brainerd from the northeast. The river flows out of the forests and wetlands of northern Minnesota and into a narrow valley, bounded by broad sandplains. The river's main channel is quite broad, but broken up by islands.

From Brainerd through the south end of the trail search corridor, the Mississippi River flows relatively quietly and supports exceptional populations of game fish including muskellunge, walleye, smallmouth bass and northern pike. Agriculture is a major land use along the river in the search corridor, although much of the river banks remain undeveloped, providing high scenic quality. Water quality is good for water-based recreation. The only water quality impairments identified in this river segment are for mercury in fish tissue, a statewide air quality related problem.

Stream channels have been altered along much of the river in this area and sedimentation can be an issue in the lower portion of this river section. Four dams are located on the Mississippi River between Brainerd and Little Falls along with several water access sites.

Crow Wing River

The Crow Wing River begins in the Crow Wing chain of lakes in southern Hubbard County and flows 90 miles southeast where it meets with the Mississippi River in Crow Wing State Park, just southwest of Brainerd. A wing-shaped island at the mouth gives the Crow Wing River its name. In the trail search area, the land around the Crow Wing River is primarily made up of a mix of hardwood and pine forests and woody wetlands with very little development.

Although the Crow Wing River is rarely more than three feet deep, it is deep enough for canoeing for nearly its entire length and is a popular "wilderness" canoe route. Because of its shallow depth, sandy bottom and minimal cover, the Crow Wing River is not known for its game fishing. Water quality is good.

Gull River

The Gull River flows south from Gull Lake, one of the largest and most popular lakes in the Brainerd area, about 11 miles until it meets the Crow Wing River at the Sylvan Dam. This portion of the river is dammed to form the Sylvan Reservoir (see below). Available data for the Gull River indicate a thriving community of fish and other aquatic organisms.

Sylvan Reservoir

Sylvan Reservoir is located at the confluence of the Crow Wing and Gull Rivers. It is a riverine lake formed by the Sylvan Dam. The reservoir is 321 acres in size with a maximum depth of 31 feet. The Reservoir is a popular location for both boat and shore fishing. Shore fishing for bluegill is popular at the boat access and near the bridge over the Gull River. The area around the bridge has been improved to provide fishing access. Boat anglers commonly fish for northern pike, walleye, black crappie and largemouth bass. Sylvan Reservoir is stocked for walleye.

According to the most recent Lake Management Plan developed by the DNR Division of Fisheries, approximately 90% of Sylvan Reservoir's shoreline is classified as undeveloped forest. It is considered a eutrophic (nutrient-rich) lake with summer Secchi depth readings between four and six feet.

Placid Lake

Placid Lake is located near the city of Pillager and is formed by the Pillager Power Dam on the Crow Wing River. The lake is 537 acres with a maximum depth of 25 feet and is characterized by fast drop-offs along the shore, sunken bars and vegetation beds and islands. Gamefish species found in the lake include northern pike, walleye, largemouth bass, and smallmouth bass. According to the most recent Lake Management Plan, the shoreline is moderately developed, with 60% being classified as undeveloped forest. Sixty-one homes were counted during the 2008 survey. Summer Secchi depth readings are generally between four and six feet. The lake is classified as eutrophic based on its total phosphorous and chlorophyll A concentrations (MPCA). Sedimentation and nutrient loading have significant impacts on the condition of the lake.

Nokasippi River

The Nokasippi River drains the lowlands of southern Crow Wing County. It begins in Clearwater Lake, about 15 miles northeast of Brainerd and generally flows southwesterly. On its course, it flows through several lakes, including Eagle, Nokay, Pointon, South Long and Round Lakes. The river flows through the Little Nokasippi River Wildlife Management Area before flowing into the Mississippi River just north of Fort Ripley.

Gull Lake

Gull Lake is one of the largest lakes in the Brainerd area at 9,947 acres. The lake has a maximum depth of 80 feet, with 30% of the lake being 15 feet deep or less. The shallow areas of Gull Lake have a primarily sandy or gravel bottom and diverse aquatic vegetation. Walleye, northern pike and yellow perch can be found in Gull Lake. The lake is very popular and extensively developed, with over 25 homes/cabins per shoreline mile and a number of resorts. Summer recreational use on Gull Lake is high, with boating and angling being among the most popular activities. The lake is home to several fishing tournaments throughout the year.

Green Prairie Fish Lake

Green Prairie Fish Lake is a shallow lake located about six miles north of Little Falls near the border of Camp Ripley. The lake is 180 acres in area with a maximum depth of 22 feet. The lake has a sandy bottom with vegetation concentrated closer to the shore. The most recent Lake Management Plan characterizes the shoreline as heavily

developed. A state-owned public access and township-owned park are located on the southwest corner of the lake. Swimmer's itch has been a concern of lake users. Fishing pressure is moderate, with anglers primarily seeking black crappie, walleye and largemouth bass. The management goals for the lake focus on largemouth bass, northern pike, walleye, and bluegills.

Lake Alexander

Lake Alexander is located north of Randall near Camp Ripley and has an area of 2,709 acres with a maximum water depth of 64 feet. The shoreline of the lake is very heavily developed with homes/cottages, resorts and three public accesses. The Lake Andrew Preserve is located along the southern shore of the lake and is owned by the Nature Conservancy.

According to the most recent Lake Management Plan, the primary target fish species is walleye, which account for over 39% of angler pressure. Lake Alexander is managed secondarily for northern pike, muskellunge, largemouth bass and smallmouth bass.

The lake is classified as mesotrophic (having moderate nutrient levels) by the MPCA. Eurasian Watermilfoil, an invasive aquatic plant, is present in Lake Alexander so boaters should be diligent about cleaning their boats.

Wetlands

A variety of wetland types are found within or near the trail search corridor including both Public Waters Inventory (PWI) wetlands, regulated by the DNR, and non-PWI wetlands, regulated by local governments under the Wetland Conservation Act. Wetlands provide important wildlife and fisheries habitat, flood and erosion control, and ground water recharge. The largest wetlands in the search area are concentrated near the Crow Wing River just south of Pillager and in the southern part of Camp Ripley. The three primary wetland types are shrub swamps, bogs with small segments of wooded swamps.

Water Resource Management Recommendations

Recommendation 1: *Where the trail is close to the Mississippi or Crow Wing Rivers or their tributary streams, provide a permanent vegetative buffer strip and/or other stormwater best management practices (BMPs) between the paved trail and the river. Riparian zones will be planted with grasses, shrubs and trees to help stabilize banks.*

Recommendation 2: *Avoid impacts to bluff impact zones, where present. (For lands within a Shoreland Management District the "bluff impact zone" is the first 20 feet of the 30-foot setback for structures proposed to be built in bluff areas that are located immediately adjacent to an 18 percent or steeper slope. This 20-foot bluff impact area should not be disturbed either by removing the vegetation or by excavation.)*

Recommendation 3: *Strive to limit water crossings and obtain permits for any crossings.*

Recommendation 4: *Efforts will be made to avoid impacting wetlands, however, wetlands will be inventoried and a wetland mitigation plan prepared to address any identified impacted wetlands.*

Recommendation 5: *Avoid impacts to wetlands with MBS Sites of Outstanding or High Biodiversity Significance.*

Recommendation 6: Avoid impacts to rare (S1, S2, S3) wetland native plant communities.

Recommendation 7: Avoid impacts to wetlands with rare species.

Wildlife

The trail search area is home to many different species of wildlife. The presence of four different ecological subsections makes the trail search area an important transition zone. The many rivers, lakes and wetlands provide habitat for aquatic and bird species. Wildlife management areas, state parks, waterfowl production areas and scientific and natural areas protect many habitats needed to sustain the diverse wildlife present in the trail area.

Mammals

Common mammal species in the area include: white-tailed deer, coyote, fox, badger, black bear, raccoon, mink, squirrels, skunks, opossum and weasels. Beaver, muskrat and river otter may be seen near water. The diverse landscape in the search area provide habitat for many different types of mammal species.

Birds

The Mississippi flyway is a heavily used route for migrating waterfowl that follows the Mississippi River to the Gulf of Mexico. Birds of prey such as bald eagle, red-shouldered hawks and owls can be seen in the area. Habitat for some special concern species such as warblers, northern goshawk, sandhill crane, upland sandpiper, yellow rail, American bittern can be found in the search area.

Both Crow Wing and Charles A. Lindbergh State Parks provide habitat for many different types of birds. At Crow Wing State Park, eagles and hawks can be seen flying in the riverway. Many species of waterfowl make their home in the wetlands and waterways. In Charles A. Lindbergh State Park, the Mississippi River provides habitat for waterfowl such as mallard, teal, wood duck, mergansers, goldeneye and Canada geese. Warblers and other songbirds can be found along the Mississippi River and Pike Creek shorelines.

Reptiles and Amphibians

Turtle species in the search area including the common snapping turtle (a special concern species in Minnesota), painted turtle, northern map turtle and spiny softshell turtle. The Blanding's turtle, a threatened species in Minnesota, can also be found in the search area. Blanding's turtles are most threatened by habitat loss and degradation of uplands and wetlands and road mortality. Population growth for Blanding's turtle is also limited by the fact that the species has relatively low mobility, high juvenile mortality rate, and low reproductive potential. Gravel disturbance during the nesting period is also a factor.

Numerous snakes can be found in the trail search area. Some of the common snake species include plains hog-nosed snakes, eastern hog-nosed snakes (a special concern species), red-bellied snakes, plains gartersnakes and common gartersnakes. The prairie skink can also be found in the area. Prairie skinks are often found along stream banks or openings in pine barrens, oak savannas and grasslands.

Amphibians in the area include the eastern tiger salamander, blue spotted salamander, American toad, eastern newt and eight species of frogs. Northern leopard frogs are commonly found near water bodies and wetlands. Other frog species in the area include Cope's grey treefrogs, grey treefrogs, spring peepers, boreal chorus frogs, green frogs, mink frogs and wood frogs.

Fish

Good water quality in the Upper Mississippi River supports great game fish populations including muskellunge, northern pike, smallmouth bass, and walleye. Largemouth bass, bluegill, black crappie, yellow perch and white sucker among many other fish populations can also be found in the Mississippi River within the trail study area.

The Crow Wing River is not generally known as a good game fish river due to its sandy bottom and limited cover. The two most common fish species found are northern redhorse and white sucker, both rough fish. Walleye fry are stocked in Sylvan reservoir. Populations of northern pike, smallmouth bass, bluegill, black crappie are among some of the fish populations that can be found in the Crow Wing River.

Lake Alexander is a popular lake for boating and fishing. It supports large populations of many different trophy species. Within the last ten years the lake has been stocked with muskellunge, walleye and tullibee, although the tullibee stocking appears to have had little effect on the population. Black crappie are a popular species for winter angling. Populations of northern pike, smallmouth bass, largemouth bass, yellow perch and many panfish can also be found in Lake Alexander.

Two designated trout streams can be found in or near the search area. These streams include Nelson Hay Creek and Camp Ripley Brook. Nelson Hay Creek is not actively managed for any species. Brook trout can be found in Camp Ripley Brook.

Invertebrates

Freshwater mussels play a vital role in marine ecosystems in Minnesota. These mollusks live on river and lake bottoms and filter oxygen and particles from the water. They modify the habitat around them to make it more suitable for both themselves and other aquatic organisms. These invertebrates are also an important food source for many other animals such as several species of fish, muskrats and raccoons.

Mussel populations in Minnesota are threatened by dams fragmenting river connections; stream channelization, dredging and streambed destabilization; commercial harvesting; non-point and point water pollution and sedimentation due to erosion; and zebra mussel infestations in the Mississippi River.² Four mussel species of special concern have been found in the search area, the Black Sandshell, Creek Heelsplitter, Mucket and Spike.

Species in Greatest Conservation Need

Species in Greatest Conservation Need (SGCN) have been identified and are classified as such on a statewide basis. "Key habitats" are the habitats or native plant communities that SGCN rely on; these are defined by ECS subsection. SGCN include only animal species that meet the following criteria:

² <http://www.dnr.state.mn.us/mussels/index.html>

- Species whose populations are identified as being rare, declining, or vulnerable in Minnesota, including species with legal protection status (federal or state endangered or threatened species);
- Species at risk because they depend upon rare, declining, or vulnerable habitats;
- Species subject to specific threats that make them vulnerable (i.e. invasive species);
- Species with certain characteristics that make them vulnerable (i.e. highly localized distribution);
- Species with stable populations in Minnesota that are declining outside of Minnesota.

There are 89 SGCN in the Pine Moraines and Outwash Plains subsection, including 29 species that are federal or state endangered, threatened or of special concern. Nearly two-thirds of these species are birds; reptiles, mammals and insects are also well-represented. This subsection is one of the most important areas in Minnesota for red-shouldered hawks. Areas near the search area such as State Parks, State Forests, Scientific and Natural Areas and Wildlife Management Areas are important for SGCN. Key habitats in this subsection include coniferous forest, shrub or wooded upland, nonforested wetland, and rivers.

In the Hardwood Hills subsection, there are 85 SGCN, 28 of which are listed as federal or state endangered, threatened or of special concern. The majority of these are bird species; mammals and reptiles are also common. This subsection is an important migratory corridor for forest birds and waterfowl and includes numerous state WMAs and federal WPAs that are important for SGCN. Key habitats include upland deciduous forests (oak, aspen and hardwood), oak savanna, shrub or wooded upland, nonforested wetland, shallow lakes, and rivers.

There are 97 SGCN in the Anoka Sand Plains subsection, including 39 species that are federal or state endangered, threatened or of special concern. Fifty-six of the 97 SGCN in this subsection are birds; mammals, reptiles and insects are also well-represented. Dry prairie associated with wetlands, rivers and streams provides important habitat for Blanding's turtles and hognose snakes. Other key habitats include oak savanna, nonforested wetlands, grassland, dune and cliff/talus shorelines, shallow lakes and rivers.

The Mille Lacs Uplands subsection contains 128 SGCN, including 58 species that are federal or state endangered, threatened or of special concern. The majority are birds, but mammals, amphibians, reptiles and insects are also common. Only a small portion of the western edge of this subsection lies within the search corridor. Key habitats include upland deciduous and coniferous forest, lowland coniferous forest, nonforested wetlands, dune and cliff/talus shorelines, deep lakes and rivers.

A complete list of SGCN and key habitats by subsection is included in *Minnesota's State Wildlife Action Plan: Tomorrow's Habitat for the Wild and Rare* (see <http://www.dnr.state.mn.us/cwcs/index.html>).

Threatened, Endangered and Special Concern Species

The Minnesota Natural Heritage Information database was used to identify animal and plant species that are threatened, endangered or of special concern within the vicinity of the trail search area, as well as native plant community occurrences that are

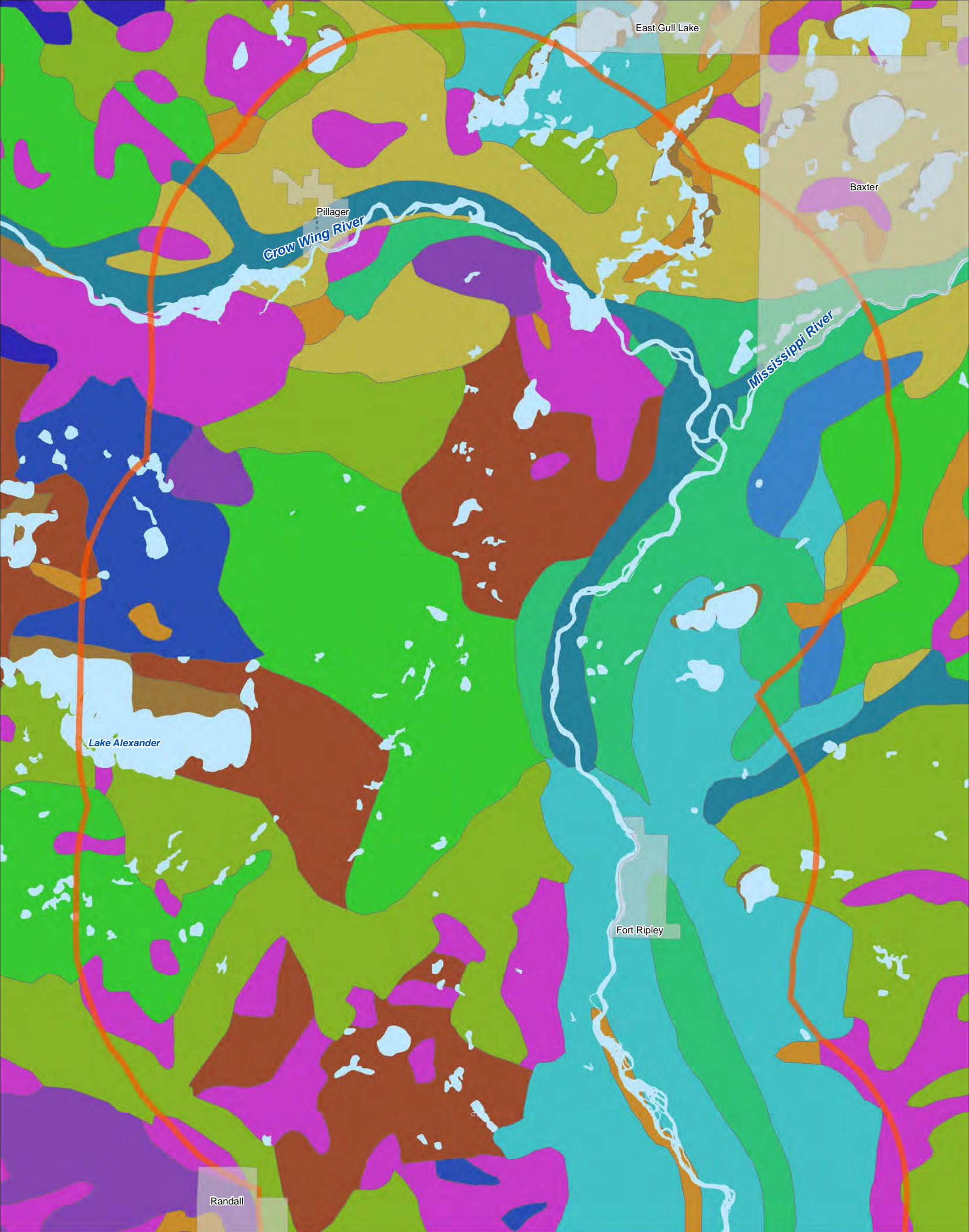
recorded in the Natural Heritage Information System. These species are protected by state law, and protecting their habitat must be considered during trail planning, development and maintenance. These plant and animal species, along with terrestrial plant communities and animal assemblages of concern are listed in Appendix A.

Wildlife and Habitat Recommendations

Recommendation 1: *Avoid threatened and endangered species and minimize any impacts to special concern species in trail planning, development and maintenance. Parks and Trails staff will keep current with Natural Heritage data, consult with regional plant ecologists and land managers, and perform on-the-ground surveys during appropriate identification times when an exact trail alignment is proposed.*

Recommendation 2: *Wildlife may be affected by the trail and recreational uses. Species with limited mobility, sensitive habitat requirements, or that are vulnerable to disturbance or exploitation require consideration in trail planning. A trail bisecting otherwise intact habitat can be both a barrier to movement that could fragment populations of smaller species (salamanders, invertebrates, etc) and a significant source of mortality for others (Blanding's turtles, various snake species). Design considerations may include:*

- *Avoiding critical habitats;*
- *Installing bridges or culverts in upland settings to provide wildlife travel ways;*
- *Considering fish and wildlife needs when designing water crossings,*
- *Using wildlife-friendly erosion mesh rather than nylon, especially in locations with existing habitat that hosts vulnerable species such as snakes, birds, and small mammals;*
- *Managing and enhancing habitats along the proposed trail corridor, and*
- *Using native species, consistent with the natural communities of the area, when re-vegetating areas disturbed by trail construction and maintenance.*

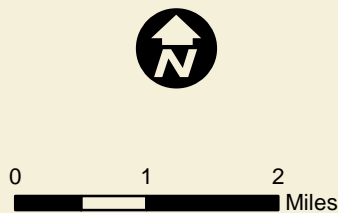


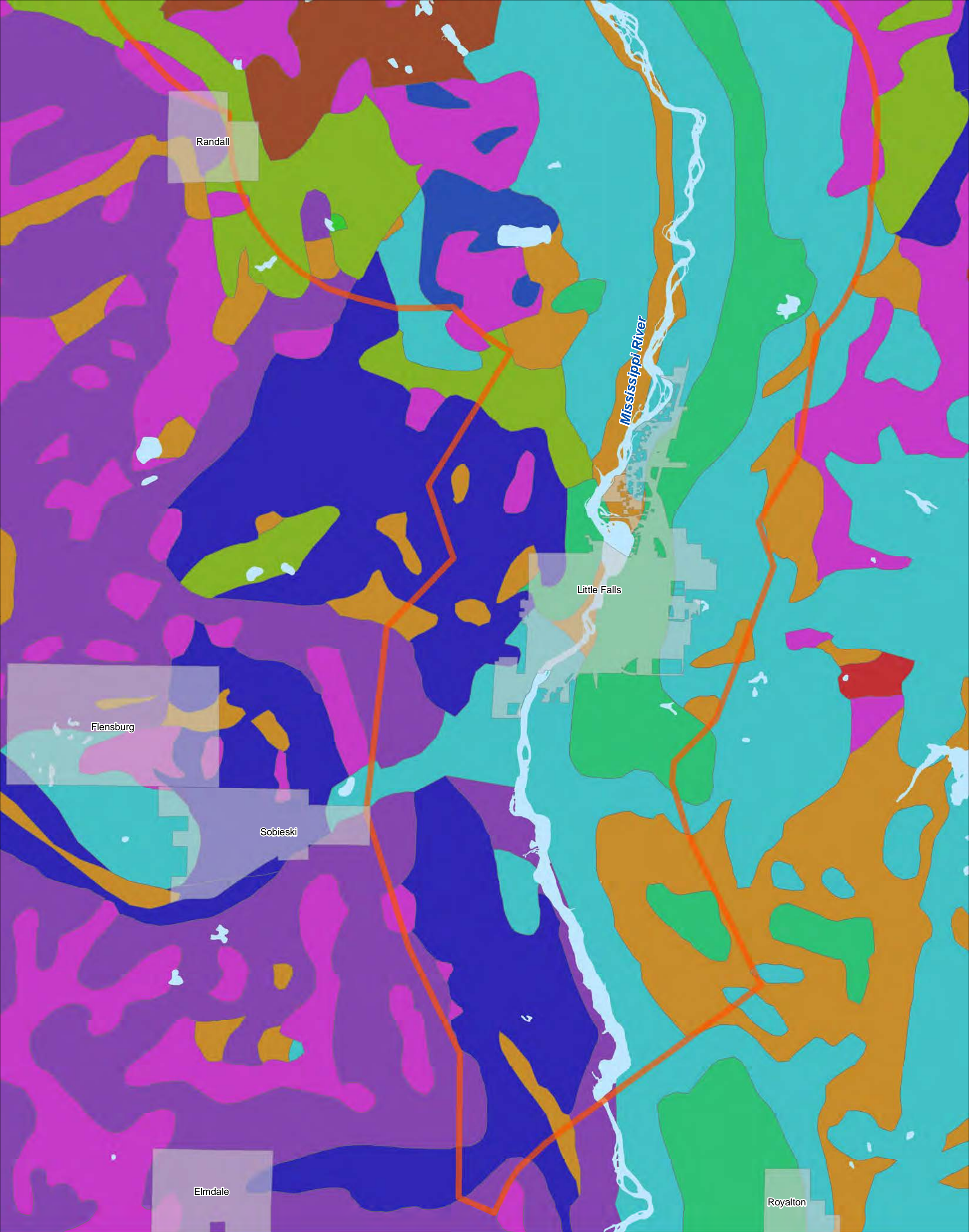
Legend

- Prairie
- Wet Prairie
- Brush Prairie
- Aspen-Oak Land
- Aspen-Birch (trending to Conifers)
- Oak Openings and Barrens
- Big Woods - Hardwoods (Oak, Maple, Basswood, Hickory)
- Mixed Hardwood and Pine (Maple, White Pine, Basswood, etc.)
- White Pine
- Mixed White Pine and Red Pine
- Jack Pine Barrens and Openings
- Conifer Bogs and Swamps
- River Bottom Forest
- Lakes (open water)

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Figure 22: Marschner's Presettlement Vegetation



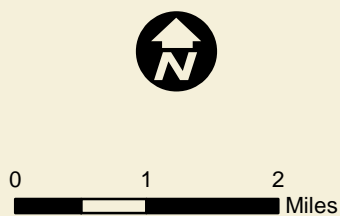


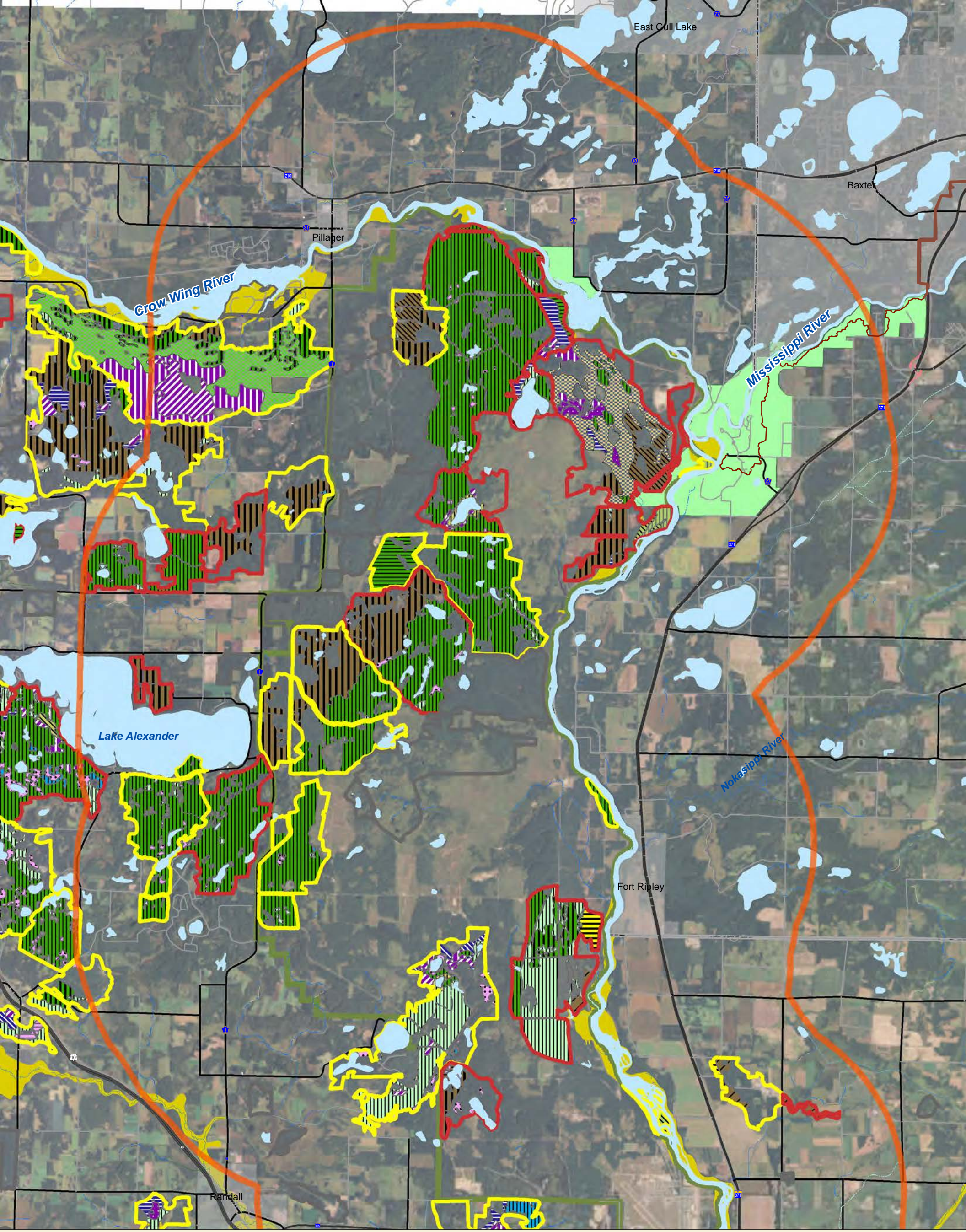
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Figure 23: Marschner's Presettlement Vegetation

Legend

- Undefined
- Prairie
- Wet Prairie
- Aspen-Oak Land
- Aspen-Birch (trending to hardwoods)
- Aspen-Birch (trending to Conifers)
- Oak Openings and Barrens
- Big Woods - Hardwoods (Oak, Maple, Basswood, Hickory)
- Mixed Hardwood and Pine (Maple, White Pine, Basswood, etc.)
- White Pine
- Mixed White Pine and Red Pine
- Conifer Bogs and Swamps





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Figure 24: Native Plant Communities

Native Plant Communities

- Other
- APn81b, Poor Tamarack - Black Spruce Swamp
- APn91a, Low Shrub Poor Fen
- APn91b, Graminoid Poor Fen (Basin)
- FDC23a2, Jack Pine - (Yarrow) Woodland: Bur Oak - Aspen Subtype
- FDC24a, Jack Pine - (Bush Honeysuckle) Woodland
- FDC25b, Oak - Aspen Woodland
- FDC34a, Red Pine - White Pine Forest
- FDC34b, Oak - Aspen Forest
- FFn57a, Black Ash - Silver Maple Terrace Forest
- FFn67a, Silver Maple - (Sensitive Fern) Floodplain Forest
- FFn73a, Alder - (Maple - Loosestrife) Swamp
- FFn82, Northern Rich Tamarack Swamp (Western Basin)
- FFs63a, Tamarack Swamp (Southern)
- LKI54a, Clay/Mud Shore (Inland Lake)
- MHc26, Central Dry-Mesic Oak-Aspen Forest
- MHc36, Central Mesic Hardwood Forest (Eastern)
- MHc47a, Basswood - Black Ash Forest
- MMS_CX, Meadow - Marsh - Fen-Swamp Complex
- MRn83, Northern Mixed Cattail Marsh
- MSM_CX, Meadow - Shrub Swamp - Marsh - Wet-Mesic Hardwood Complex
- OPn81a, Bog Birch - Alder Shore Fen
- OPn92, Northern Rich Fen (Basin)
- OW, Other Water Body
- UPs13b, Dry Sand - Gravel Prairie (Southern)
- UPs14b, Dry Sand - Gravel Oak Savanna (Southern)
- WFn55, Northern Wet Ash Swamp
- WFn64, Northern Very Wet Ash Swamp
- WMn82a, Willow - Dogwood Shrub Swamp
- WMn82b, Sedge Meadow

Source:

Areas of Biodiversity Significance

- High
- Moderate
- Below





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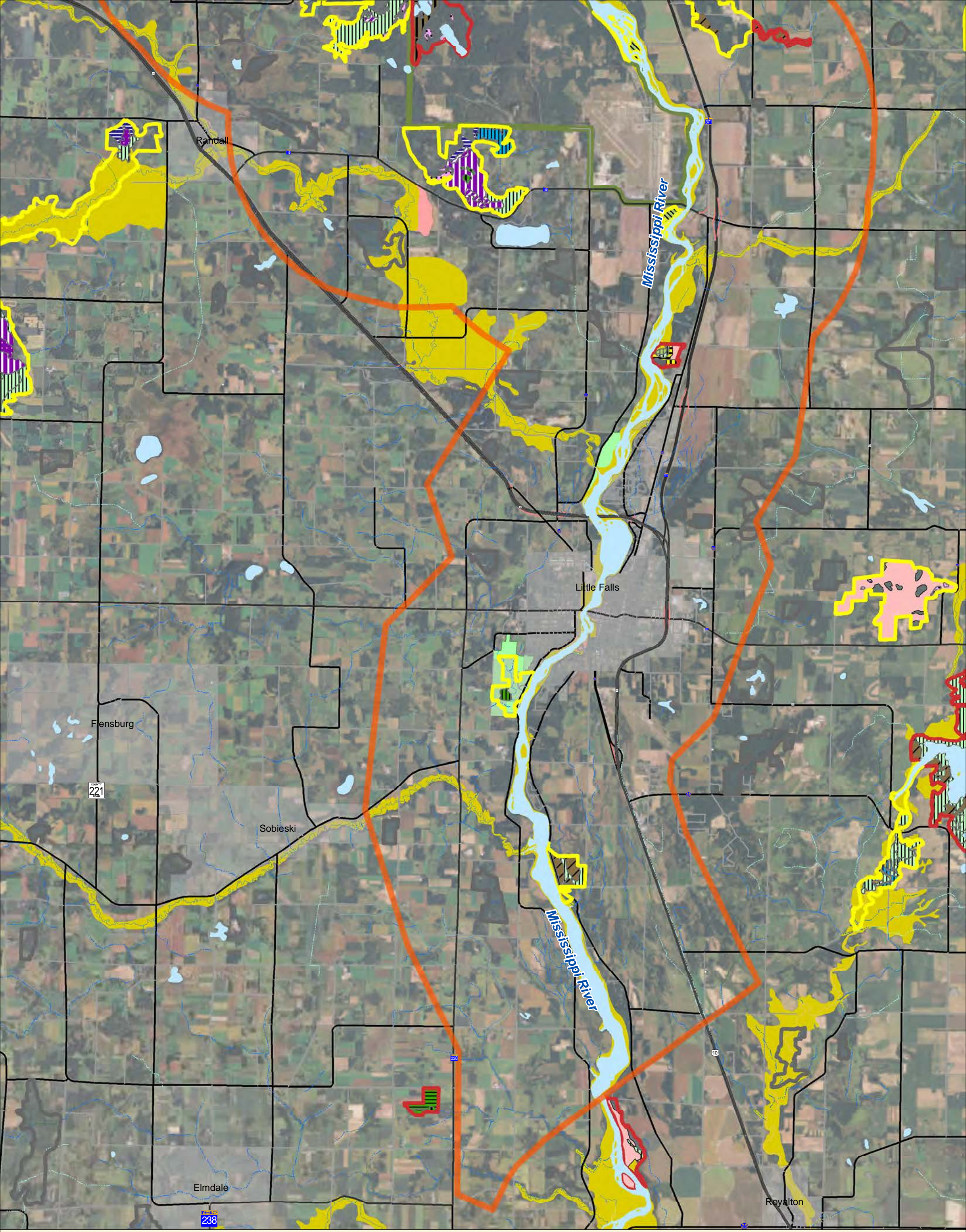




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Figure 25: Native Plant Communities

Legend

<p>Native Plant Communities</p> <ul style="list-style-type: none"> Other APn91a, Low Shrub Poor Fen APn91b, Graminoid Poor Fen (Basin) FDc23a2, Jack Pine - (Yarrow) Woodland: Bur Oak - Aspen Subtype FDc25b, Oak - Aspen Woodland FDc34a, Red Pine - White Pine Forest FDc34b, Oak - Aspen Forest FFn57a, Black Ash - Silver Maple Terrace Forest FFn67a, Silver Maple - (Sensitive Fern) Floodplain Forest FPn73a, Alder - (Maple - Loosestrife) Swamp 	<ul style="list-style-type: none"> FPn82, Northern Rich Tamarack Swamp (Western Basin) FPs63a, Tamarack Swamp (Southern) MHc26, Central Dry-Mesic Oak-Aspen Forest MHc36, Central Mesic Hardwood Forest (Eastern) MHc47a, Basswood - Black Ash Forest MRn83, Northern Mixed Cattail Marsh UPs13b, Dry Sand - Gravel Prairie (Southern) UPs14b, Dry Sand - Gravel Oak Savanna (Southern) WFn55, Northern Wet Ash Swamp WMn82a, Willow - Dogwood Shrub Swamp WMn82b, Sedge Meadow
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Areas of Biodiversity Significance

Source: ■ High ■ Moderate ■ Below

