Preliminary Environmental Assessment

For The Proposed Thunder Lake Road East Connection Proposed Road Corridor

Within Sections 25, 26 and 36: T151N, R34W and Sections 31, 32, 33, 34 and 35: T151N, R33W within Red Lake Nation, Beltrami County

2216 Tod Court NW
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For Red Lake Tribal Engineering

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ADMINISTRATIVE SUMMARY

Under the Preferred Alternative for this project, the Red Lake Band of Chippewa proposes to construct the next section of the Thunder Lake Road corridor from its current easterly termination point, east to Indian Service Route 18. The Preferred Alternative would consist of approximately 5.5 miles of new roadway.

The proposed project is to be funded through federal grant dollars.

Four project alternatives, including a “Do Nothing” alternative, were considered for this project. The preferred alternative proposes the construction of the road extension to commence at the current easterly termination point of the existing Thunder Lake Road and will proceed south easterly, angling between wetlands and lakes to the southside of Green Lake. From there the proposed route will commence east to Indian Service Route 18. A round-about will be constructed at the intersection of Indian Service Route 18, IRR 40 and the proposed road. Indian Service Route 18 and IRR 40 will be realigned to enter the round-about. The proposed alternative will improve the intersections of three existing roads that the proposed route will cross. A multi-use path will be constructed parallel to the new road within the right-of-way. The proposed alternative will include the future installation of municipal utilities (sewer and water) within the proposed road corridor as a second phase of the project.

The proposed project has considerable potential to result in positive effects on both the physical and socio-economic environment within the Red Lake Reservation by providing an additional route to more efficiently access the Red Lake and Redby communities, reduction in traffic through densely populated areas and increased access to areas within the reservation where the tribe has plans for future housing development.

The project will have impacts on existing wetlands and will require a United States Army Corp. of Engineers individual permit under section 404 of the Clean Water Act. The tribe will go through the reviewal process, fulfill required mitigation and acquire the permit before commencing with any construction on the proposed project.

While the project is located within the breeding range of the Bald Eagle and Northern Long-eared Bat and the peripheral range of the Gray Wolf and Canada Lynx, it is anticipated that no adverse effect on these Federally listed threatened species is anticipated. However, tribal DNR is currently performing an in-depth review of the project and will provide final a letter of recommendation at the conclusion of the review.

Cultural resource surveys indicated that there are six areas of potential historical significance within the Preferred Alternative. These areas have been identified and reviewed and it has been determined by the Red Lake Band of Chippewa that it is acceptable to cover these areas with fabric followed by common borrow, making sure that earth disturbances are avoided as much as possible, and then construction of the road will occur over the placed borrow.

The project is anticipated to have no other significant adverse effects to aspects of the natural or social environment. This undertaking should therefore have no significant adverse effects on any aspect of the natural or human environment and promises to provide positive effects for the community.

A finding of no significant impact is anticipated.

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PURPOSE AND NEED FOR PROJECT

The need for the extension of Thunder Lake Road is based on the comprehensive land use plan of the tribe along with a desire to increase the safety of the developed portions of the reservation. Adopted through tribal resolution, the comprehensive land use plan lays out long-term land use plans throughout the Red Lake Reservation. One key item addressed within the comprehensive land use plan is which areas are planned for residential development and which areas are set aside for forestry. It has been decided that Thunder Lake Road will be the southern line between forest management use and residential use with everything north of Thunder Lake Road being open for residential use and everything to the south is slated for long term forest management. There is currently a severe housing shortage within the Red Lake Reservation, increasing the need for access to areas that the tribe has designated for residential use. The construction of Thunder Lake Road would allow for access as well as provide a corridor to run future water and sewer utilities in to service existing residents as well as future developments that the tribe develops. The completion of the proposed road corridor will culminate in safer roads through the more densely developed areas of the reservation by opening more direct, alternate routes for residents to travel along as well as provide the tribe with access to much needed housing sites to alleviate the high demand for housing that is currently stressing the existing infrastructure. All these factors were considered while evaluating the individual alternatives while also weighing in the environmental impacts associated each with the intent to minimize any impacts associated with the proposed project to the greatest extent.

a. Health and Safety.

The construction of the Thunder Lake Road extension would provide access to additional housing site for the reservation and the tribal members that live within it, provide a corridor for community sewer and water to be installed within to service existing and future residents and alleviate traffic hazards within both Red Lake and Redby by creating a safer, more direct route for individuals to travel on based on their destination. Currently, Minnesota Highway 1 is the main travel corridor through the southern portion of the reservation, conveying traffic through both Red Lake and Redby. There is a concern for safety within both communities as resident walk along the roadside as well as cross the street going to and from work, to commercial businesses or to school. Construction of the extension of Thunder Lake Road would provide an alternate route for resident and pass through traffic alike. This would lessen the volume of traffic volume within both communities, creating a safer environment for the large pedestrian population.

The alternative to constructing the Thunder Lake Road would be for the tribe to continue to live within the developed area of the reservation as it currently sits. This would put strain on existing residential infrastructure, resulting in overcrowding and destruction of property. As the population within the reservation continues to grow, it would also increase the amount of pedestrians around the major roads, resulting in increased likelihood of vehicular encounters for tribal residents whose main means of transportation is walking or biking.

ALTERNATIVES CONSIDERED

Alternative #1: Do Not Construct The Proposed Thunder Lake Road Extension (Do Nothing)

This alternative would have the least environmental impact associated with the proposed project, as no construction would occur. However, this alternative wouldn't address the need for additional housing areas, create a corridor for future utility installation or alleviate traffic within the existing developed areas of the reservation. Furthermore, a large portion of the road corridor follows existing two track roads resulting in continued environmental degradation to occur through soil disturbance and erosion throughout the proposed project area. Since this alternative did not address the need or purpose of the project and still results in some environmental impacts, it was deemed unacceptable.

Alternative #2: Alternative Corridor 1

Alternative 2 consists of a road corridor that ties into the easterly termination point of the existing Thunder Lake Road and extends east-northeast. The proposed road corridor would cross near the Redby sewer lagoons, run along the south side of Redby, continuing east it would cross through the McBrides housing development before angling southeast across a large section of undeveloped land before tying into Minnesota highway 1. This alternative was found to have the highest amount of known areas of archaeological sites at 3 with 2 additional sites found during a field assessment along with thirty areas of varying size had were categorized as high or intermediate potential to be significant. This alternative also ran into the most conflicts with existing development and infrastructure, with potential issues with the Redby sewer lagoons, conflicts with residential development on the south side of Redby and conflicts with the McBrides housing development. Furthermore, this route was the furthest north of the three alignments looked at and due to that, limited the amount of expansion that could occur with future residential development. Therefore, due to the high levels of conflict with the existing development, high probability of impacting archeologically sensitive areas and the severe limitation this alternative would place on future development, it was deemed unacceptable.

Alternative #3: Alternate Corridor 2

Under this alternative, the proposed road corridor will commence at the current easterly termination point of Thunder Lake Road and extends south easterly, angling between wetlands and lakes to the southside of Green Lake. From there the proposed route will commence east across mud river before it would begin to angle northeast, just before Old Nebish Road (Route 16). The proposed corridor would then cross IRR 40 before following the same corridor as alternative corridor 1 until it tied into Minnesota Highway 1. This alternative was found to have no previously recorded cultural resources sites within it but field assessments found 4 sites along with thirty-one areas of varying size that were categorized as high or intermediate potential to be significant. This alternative was the longest of the three alternatives that were reviewed and also extends through a large white cedar swamp that was located during the initial wetland delineation associated with the planning for the proposed road corridor. Due to the extra length, high likelihood of conflicts with archeologically sensitive areas and high amount of wetland impact associated with this alternative compared to the other alternatives reviewed, it was deemed unacceptable.

Alternative #4   Alternate Corridor 3

Alternate Corridor 3 commences at the current easterly termination point of Thunder lake Road and extends south easterly, angling between wetlands and lakes to the southside of Green Lake. From there the proposed route will commence east to Indian Service Route 18. A round-about will be constructed at the intersection of Indian Service Route 18, IRR 40 and the proposed road. Indian Service Route 18 and IRR 40 will be realigned to enter the round-about. The first two thirds of alternate corridor 3 is the same as alternate corridor 2. This alternative was the shortest of the three proposed road corridors reviewed. No previously recorded cultural resource sites were found to be within this proposed corridor but the field assessments found 5 sites (4 of which are the same ones found within Alternate Corridor 2) along with six areas of varying size that were categorized as high or intermediate potential to be significant. This alternative also provides the tribe with the most opportunities for future housing development compared to the other two alternate corridors that were reviewed. This alternative was deemed the best choice based on the amount of locations it provided for future development, the lower probability of running into areas of cultural significance and the overall smaller footprint it would have on the landscape.

PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

The project proposed is Alternative #4, to construct the Thunder Lake Road extension along the southern most alternate that was reviewed.

This option would consist of construction an approximately 5.5-mile extension of Thunder Lake Road, connecting the existing Thunder Lake Road to Indian Service Route 18. A round-about will be constructed at the east end of the proposed road to safely tie IRR 40, Indian Service Route 18 (both the north/south and east/west segments) and the new road together. Intersections of the proposed road segment and existing roads (three) will be improved for safety purposes to include proper signage and guarantee visibility. A bike trail will be constructed within the right of way to give pedestrians and cyclists a safe location for commuting through the area. Municipal water and sewer will be run down this corridor during future projects as the tribe pursues development to help alleviate the housing shortage within the reservation. These utilities will serve new residents as well as some existing. The installation of Water utilities will tie existing lines together, Which will allow for better circulation and remove any possibilities of stagnant water.

The proposed road corridor follows existing forest roads and two track trails when present and design safety standards allow.

DESCRIPTION OF THE AFFECTED ENVIRONMENT

The Red Lake Indian Reservation in north-central Minnesota is home to over 6,000 members of the Red Lake Band of Chippewa Indians. The land base of the Red lake Band consists of land in several categories of land holdings. The primary, or "Diminished" reservation consists of a contiguous block of 650,000 acres of land in west-central Beltrami County and northern Clearwater County. The next largest block of land held by the Band comprises much of the interior of the Northwest Angle, in extreme northern Lake of the Woods County, consisting of approximately 53,000 acres. The balance of the Red Lake Band's land holdings are in discontinuous parcels of the Restored Ceded Lands, scattered throughout north-central Minnesota in Roseau, Lake of the Woods, Beltrami, Koochiching, and Pennington Counties, and consisting of nearly 100,000 acres in parcels ranging from 40 acres to 640 acres in size. The population of the Red Lake Reservation predominantly resides in four communities: Red Lake (also the seat of tribal government), Redby, Ponemah and Little Rock. The combined population of these communities is 5,400. The remainder of the populace (approximately 200) live outside of these communities, mainly in the southern and eastern portions of the reservation. The northern and western portions of the reservation are only sparsely populated.

The Red Lake Reservation is situated in an area of continental climate, characterized by hot, semi-humid summers and long, cold winters. The maximum recorded temperature is 109o F, and the minimum recorded temperature is -50o F. The mean temperature is 3.7o F in January, and 68.3o F in July. The coldest month is January, with a mean daily maximum temperature of 15o F and a mean daily minimum of -2o F. The hottest month is July with a mean daily maximum of 66o F and a mean daily minimum of 55o F. The average growing season is 114 days between May 25 and September 10. The average precipitation is 22 inches, with the major portion falling as rain during the normal growing season, and the balance falling as snow during the winter months.

Until recently, the primary industries on the reservation have been commercial fishing (on the Red Lakes) and forest products (throughout the reservation and the ceded territories). During the early 1990s, these industries provided approximately 638 jobs each year, and generated sales totaling approximately $8,382,219 per year. A decline in the walleye population in the Red Lakes necessitated a cessation of commercial harvesting in 1997. The commercial fishing ban that lasted approximately ten years has created additional hardships for the residents of the Red Lake Nation.

LAND RESOURCES

Topography

The topography of the Red Lake Nation consists primarily of the level boggy lowlands of the Glacial Lake Agassiz basin in the north and west and the undulating uplands of the Erskine Moraine in the south and east.

The preferred alternative is located between the easterly termination point of the existing Thunder Lake Road east to the intersection of IRR 40 and Indian Service Route 18. The area is approximately 5.5 miles long and two hundred feet wide. Topography within this area was mostly rolling upland with intermixed depressional basins. The corridor encompasses two smaller stream crossings along with the crossing of Mud River, each of which exhibits steep topographic shifts.

Soils

The soils within the project area are generally fine sand with traces of loam within the upper layers of soils.

Geologic Setting and Mineral Resources

The proposed project site is located at the southern margin of the Agassiz Lacustrine Plain geomorphic region. The topography of the Agassiz Plain is level to gently rolling from the action of Glacial Lake Agassiz which covered much of the Red Lake Nation between approximately 11,800 and 11,500 years ago. The study area lies at the point where the basin comes into contact with the Erskine moraine that lies to the south. Due to this setting, the project area exhibits a complex mosaic on lacustrine and ice contact features.

The major mineral resources identified on the Red Lake Reservation to date include vast peat resources to the north of Upper Red Lake and isolated gravel deposits in beach ridges to the west of the lake. None of these or other significant or marketable mineral resources are known to exist in the vicinity of any of the developments proposed under this project.

3.2. WATER RESOURCES

The Red Lake Reservation is rich in water resources. An inventory of water resources was conducted by the tribe in cooperation with the United States Geological Survey in 1991 and is hereby incorporated into the Environmental Assessment by reference. Upper and Lower Red Lakes, together, have an area of approximately 400 square miles within the reservation boundaries. Over seventy small lakes dot the glacial moraine to the south and the old lake basin to the west of the big lakes. Four major Rivers and a half-dozen smaller streams enter the Red Lakes and they drain via the Red Lake River which flows west to the Red River of the North.

The area to the north of Upper Red Lake comprises the vast Red Lake Peatlands, a unique and sensitive wetland ecosystem.

Numerous wetlands also exist in low and poorly drained terrain throughout the boundaries of the reservation.

Individual and municipal water supplies derive from confined ground water aquifers that lie at depths of approximately 100 feet below the ground surface.

A wetland delineation was performed based on United States Army Corps of Engineers standards along the preferred alternate and thirty-eight wetlands were found to be within the review area. Wetlands delineated ranged in size as well as type. Wetlands found within the study corridor were comprised of fringe wetlands around large lakes, riparian wetlands along streams and wetlands located within isolated basins.

3.3. AIR QUALITY

The Red Lake Nation follows the guidance of the federal Clean Air Act administered by the Environmental Protection Agency and the State Implementation Plan (SIP) through which it is implemented. The Red Lake Nation attains the National Ambient Air Quality Standards and is located 150 miles from the nearest "nonattainment" area identified in the SIP.

Air quality is very good within the entire Red Lake Nation. There are no known major sources of air pollution in the area other than minor vehicle emissions on existing roads and streets and normal emissions of domestic and institutional heating plants.

3.4. LIVING RESOURCES

Wildlife

The Red Lake Reservation may have the most diverse assemblage of wildlife populations found anywhere in the state. It is positioned at the transition of 3 major biomes: the northern boreal forest, western prairie, and southeastern hardwoods. Primary habitats include a mixture of upland forests, bog communities, prairie remnants, wetlands, lakes and streams. Many upland forested areas have been recently logged, promoting an abundance of early successional vegetation communities (primarily aspen) and much of the reservation is undeveloped, with poor or no access. Wildlife populations representative of the 3 biomes, as well as those common to transitional habitats, can be found on Red Lake lands. Due to limited financial and human resources, the Band has only recently begun to collect data on the reservation's vast wildlife resource. Currently, management emphasis is placed on those species of cultural importance and those seasonally harvested by Band members.

A wide variety of mammalian species can be found on Red Lake's land holdings, including representatives of 6 mammalian Orders and at least 17 Families. Species most important to Band members include: white-tailed deer, moose, black bear, snowshoe hare, and a variety of furbearers (e.g., beaver, muskrat, fisher, martin, mink, bobcat, raccoon, red fox). Management efforts and population monitoring have been directed primarily towards these species. Several federally protected species occur on Red Lake (gray wolf, Canada Lynx, and mountain lion), but little is known about their population dynamics and species-specific management activities have not been directed towards them.

Avian species are very abundant on Red Lake lands, with 18 Orders and representatives from a minimum of 43 Families making use of available habitats permanently or on a seasonal basis. Management efforts have focused on upland game birds, waterfowl, and to some extent, those species important for cultural and traditional uses. A number of species that breed in available habitats are rare and/or threatened and are protected at the federal and/or state levels (e.g., bald eagle, piping plover, Wilson's phalarope, and horned grebe).

Little is known about Reservation reptile and amphibian populations, however due to an abundance and diversity of available habitats 12 Species of amphibians (3 toads, 6 frogs, and 3 salamanders) and 7 Species of reptiles (3 snakes, 3 turtles, and 1 skink) are likely found on Red Lake lands. Blanding's turtle and snapping turtles are species of management concern.

Vegetation

Vegetation within the Red Lake Nation falls within the transition zone from the Northern Hardwoods forest type to the Boreal Coniferous forest type. In the past the vegetation in this area would have consisted of mixed hardwoods, primarily caused by the microclimatic effects of Lower Red Lake. Typical vegetation further away from this lake effect would more likely have been a mixture of aspen parkland and Red/Jack pine.

The project area consists of a mixture of upland forest with small wetland basins intermixed throughout the area of interest within the preferred alternative. Vegetation within the upland forest area was a mixture of both Northern Hardwoods as well as Boreal Conifers.

Ecosystems and Biological Communities

The project study area is located at the margin of the Agassiz Lowlands and the Chippewa Plains sections of the Laurentian Mixed Forest Province as classified by the Minnesota DNR’s Ecological Classification System.

The predominant and most sensitive ecosystem within the Red Lake Nation is the bog and wetland ecosystem that comprises the Glacial Lake Agassiz basin in the western half of the reservation. This major ecosystem lies outside the limits of the current study area.

Agriculture

No agricultural lands will be affected by this proposed undertaking.

3.5 CULTURAL RESOURCES

Historic, Archaeological, Cultural and Religious Properties

American Indians have occupied Minnesota since soon after the retreat of the last continental ice sheets of the Pleistocene epoch some 12,000 years ago. Centuries of habitation and use of the landscape has resulted in the deposition of a rich mosaic of physical evidence of that American Indian occupation. The material remains of that long occupation include traces of campsites, house sites, large mammal kill sites, tool manufacturing sites, maple sugar camps, cemeteries and many other property types.

Only a handful of American Indian habitation sites have been identified to date within the Red Lake Nation. This fact remains in spite of the fact that the environs of Red Lake and its tributary streams have provided a rich environment for varied flora and fauna and the human groups who relied on them for subsistence since the end of the Pleistocene. To date, only the large multicomponent habitation and burial mound site designated as 21 CE 28 at the outlet of Lower Red Lake has been determined to be eligible for nomination to the National Register of Historic Places.

The terrain in all directions from the boundaries of the Red Lake Nation has yielded rich evidence of long-term use and habitation by various American Indian groups. It is clear that the paucity of American Indian habitation sites is not an accurate representation of human use patterns, but merely the result of sampling error. Very few tracts of land within the Red Lake Nation have been subjected to archaeological reconnaissance of sufficient intensity to identify buried archaeological habitation deposits. There is little doubt that numerous sites of occupation will be found if adequate archaeological survey is done.

Archaeological surveys to date along the south shore of Lower Red Lake have identified evidence of past human occupation in numerous places. So far, most of the archeological deposits identified have been very sparse and ephemeral, suggesting only sporadic and short term use of most areas. Denser concentrations of cultural material have been identified only at the entrances of tributary streams.

The long occupation of the Red Lake Nation by members of the Red Lake Band and those who went before them has resulted in the burial of human remains in vast numbers of gravesites. While a majority of interments now take place in the four platted cemeteries in the villages of Redby and Red Lake, some traditional interment in scattered family plots persists to this day. In an effort to record and protect these gravesites, the Red Lake Tribal Council adopted two chapters regarding cemeteries in the Tribal Code. Chapter 1306 requires registration of all places of interment with the Secretary of the Tribe and also requires Tribal Council consent for the establishment of new cemeteries. Chapter 1307 makes it a felony to "desecrate, defile or alter burial sites or cemeteries within reservation boundaries" and establishes penalties of up the six months imprisonment and/or a $500 fine for such offenses.

In spite of these preservation efforts, very few of the many small cemeteries of the Red Lake Nation have been officially recorded and the knowledge of the very existence of many of them is disappearing with the passage of time and the passing on of the elders. The Red Lake Tribal Council has established the identification and preservation of these cemeteries as a priority. To that end, efforts are now underway to identify as many of the ancient cemeteries and "family plots" as possible before all knowledge of their existence and content is lost. The information gathered in this effort will be included in an official "Cemetery Inventory" that will be maintained by the Tribal Archives, the Tribal Realty Department and the Tribal Historic Preservation Office.

3.6 SOCIOECONOMIC CONDITIONS

Demographic Trends

The Red Lake Band consists of approximately 14,000 enrolled members. Of that total, approximately 7,100 live within the boundaries of the Reservation. Improvements in the tribal economy and quality of life in recent years have resulted in a movement of non-resident band members back onto the reservation. This resident population influx, coupled with a relatively high birth rate has created a significant shortage of affordable housing on the Red Lake Reservation. As a result, over five hundred families are now on the waiting list for safe affordable single family housing units within the Red Lake Nation.

3.7 RESOURCE USE PATTERNS

Subsistence harvesting of fish and wildlife provides a substantial portion of the diet of many band members. In addition to the harvest of deer and moose, ducks and geese, and a variety of fish species, a number of, fur bearing animals such as fisher and beaver are harvested for the fur trade. Gathering of wild foods, and of ceremonial and medicinal herbs, although poorly documented, are practiced by residents. Berries provide a favorite summer-harvest food source. In the fall, wild lake rice is gathered and processed by hand. In April, sugar camps are set up to produce maple syrup.

The primary land use within the Red Lake Nation at the present time is forestry and forest resource extraction. The Red Lake Indian Forest that was designated by congress in 1916 in the southern part of the Red Lake Nation is critical to the maintenance of forestry into the future. The expansion of residential development into the Red Lake Indian Forest has compromised its integrity in recent years. Such encroachment of residential development into the forest is particularly critical at this time as a past court settlement under Public Law 85-794 mandates that the Red Lake Nation must restore 50,000 acres of red and white pine withing 5 years of the settlement date. Preservation of the few landform and soil associations suitable for pine reforestation is therefore of the utmost importance and is a critical element of the Red lake Nation Land Use Plan.

Farming is accomplished on a very limited basis, being generally limited to the extreme western margin of the reservation.

3.8 OTHER VALUES

Wilderness

Much of the Red Lake Nation is remote and undeveloped. The wild lands provide an essential basis of support for the extensive hunting, fishing and gathering economy that persists at Red Lake. Preservation of wilderness in a natural state is an important issue to many tribal members and elected tribal officials.

Sound and Noise

Because most of the Red Lake Reservation remains sparsely populated and in a relatively natural state, little man-made noise can be heard outside the developed areas. Only the distant and intermittent sounds of mechanized forest resource extraction and the truck traffic that traverses the Trunk Highways that pass through the reservation can be heard in many areas. Therefore, intrusions of major noise generating activities could result in adverse effects on the human and natural environment that sustains the Red Lake population.

Public Health and Safety

Public Safety is maintained within the Red Lake Nation by a Tribal Police Force and Tribal Fire Departments. Public Health is maintained by the Indian Health Service that operates a hospital and nursing home in Red Lake.

CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

The proposed project consisting of the construction of 5.5 miles of new roadway, a round-about and adjacent multi-use path as well as approximately 1 mile of rerouting existing roadways and the reconstruction of 3 intersections where the proposed road will intersect existing roadways has minimal potential to result in major environmental consequences. As noted in the discussion of project alternatives above, one of the primary objectives in the alternate selection process was the reduction of adverse effects to the environment. In all aspects, the preferred alternative will result in less effect to the natural and cultural environment, while still addressing the need associated with the proposed project. The aspects of the environment that may be affected by project completion within the preferred alternate plan are discussed below.

4.1. Land Resources

Topography

The topography of the project area is rolling uplands with isolated wetland basins scattered throughout the proposed project corridor. There are two stream crossings as well as a crossing over Mud River. Each of the flowing waterbodies is within a pronounced valley with wetlands located along their banks. The larger topographic area is characterized by level to steeply undulating terrain at the margin of the basin of Glacial Lake Agassiz and the Erskine Moraine. Contact between the margins of two ice sheets at the end of the Pleistocene created a series of tunnel valleys and ice block depressions that form the steepest terrain in the vicinity. The proposed road will follow the existing topography as closely as possible while still meeting all design and safety standards associated with the design criteria of the road. This will minimize disturbances and regrading of the area and thus will not have a major effect on the topographic features of the Red Lake Nation.

Soils

The soils of the project area are generally fine sand with traces of loam within the upper layers of soils. Variable sediments ranging from gravel outwash deposits to silty glacial till underlie the surface soils. The soils are stable and should be conducive to road and utility construction.

Geologic Setting and Mineral Resources

The geologic deposits of the project area consist of approximately 200 feet of glacial till and lake sediment overlying Paleozoic sedimentary bedrock. This setting is geologically stable and should be suitable for the proposed development. There are no known valuable mineral resources in the project area other than gravel that occurs in scattered deposits.

4.2. Water and Related Land Resources

Storm-water runoff

The construction of the proposed road and adjacent multi-use path will increase stormwater runoff due to increased impervious surface area throughout the area of interest. The installation of utilities within the road corridor during a future phase of the project is not anticipated to have any significant or notable impact to stormwater runoff.

During the construction of the proposed project, Best Management Practices (BMPs) will be followed based on the NPDES permit obtained through the EPA as well as the Storm Water Pollution Prevention Plan (SWPPP). Daily and weekly monitoring of the BMPs will occur in order to fix and maintain the BMPs to prevent a discharge of pollutants off site. At the conclusion of the project, the site will be seeded and stabilized with the BMPs remaining in place until proper vegetation is present. Once fully vegetated, the constructed ditches along the roadway will act as vegetated swale that will slow water velocities to increase infiltration and filter and clean stormwater that flows off the proposed road.

Potable Water Supply

The future phase of the project will include the installation of a large transmission water main that will be tied in to the Red Lake/Redby municipal water supply system. The proposed line will help loop the existing water system, alleviating water stagnation and help increase water pressure to existing residence while also providing a tie in point for access to water for future housing developments planned along the proposed road corridor.

Based on a ground water study done by the Red Lake Nation and the U.S. Geological Survey done in 1991 (Report Number 90-4163), the closed aquifer from which the Red Lake Redby water system draws its supply should have adequate capacity to sustain the anticipated water demands for the foreseeable future.

Wastewater Treatment

The future phase of the proposed project will include the installation of sanitary gravity and force mains that will tie future developments along the proposed road corridor into the existing wastewater treatment pond facility that was built in approximately 2009. This will allow future developments to be constructed without individual septic systems which have a history of being neglected and not properly maintained, leading to failure of the system and backing up of sewage into residences. By connecting into the community sanitary sewer network, pollution associated with failing systems will be removed, reducing the environmental impacts associated with desperately needed housing projects on the reservation.

Floodplains

FEMA floodplain maps have not been prepared for the lands of the Red Lake Nation. The proposed project will not involve construction within the floodplain of any surface waters.

Wetlands

Wetlands will be impacted as a result of the proposed project and will require a United State Army Corp of Engineers individual permit. Obtaining the permit and all mitigation requirements associated with the permit will occur prior to the commencement of the construction on the project. During the preliminary phase of the project, a study corridor was delineated to locate all wetlands present in order to avoid as many wetlands as possible and minimize impacts that were unavoidable when laying out the alignment of the proposed road while still abiding by safety standards associated with the design criteria of the proposed road. Additional design modifications were made to further minimalize wetland impacts where they were unavoidable such as constructing the multi-use trail directly off the shoulder of the road when crossing wetlands to reduce impacts, lowering the profile, when possible, to reduce the amount of fill and subsequently the footprint of the proposed road as well as steepen the inslope of the proposed road beyond the safety clear zone, subsequently reducing the fill limits of the proposed road.

4.3. Air Quality

The Red Lake Nation follows the guidance of the federal Clean Air Act administered by the Environmental Protection Agency and the State Implementation Plan (SIP) through which it is implemented. The Red Lake Nation attains the National Ambient Air Quality Standards and is located 150 miles from the nearest "nonattainment" area identified in the SIP. Only parts of two counties, Ramsey and Olmsted in Southeastern Minnesota have been identified as "nonattainment" areas.

Air quality is very good in the project study area and in the entire Red Lake Nation. There are no known major sources of air pollution in the project vicinity other than minor vehicle emissions on existing roads and streets. The introduction of vehicular traffic and wood and fossil fuel burning residential heating plants to a currently unoccupied and roadless part of the reservation may have a very minor effect on air quality. However, this effect is likely to be too small to be measurable.

No substantial long term air quality impacts are expected to result from the construction of the proposed road and it is expected that the vehicles that are utilizing the road will be diverted from other roads within the reservation so no net increase of emissions from vehicles is anticipated to result from the proposed project.

Approximately 100 acres of existing forested land will be cleared for the proposed project and it is anticipated that all non-marketable timber and debris will be piled and burned. All fires will occur based on any guidelines and requirements the Red Lake DNR, Red Lake Forestry and Red Lake Fire Department may have. The fires are anticipated to last for a short period of time, resulting in short-term smoke emissions but the burn sites will be dispersed with burning occurring when winds are unlikely to carry smoke towards residential areas.

4.4. Living Resources

Wildlife/ Threatened and Endangered Species

The Preferred Alternative to construct the proposed project along the southernly reviewed route will result in the loss of approximately 120 acres of habitat. The affected area is comprised predominately of a mix of upland hardwoods and boreal coniferous forest. Due to the abundance and distribution of this habitat type on the Red Lake Band lands and in the region, any impacts are anticipated to be minimal. This is in conjunction with the fact that forest roads and two-track trails currently wind throughout the area, degrading the habitat through noise, dust and the presence of humans.

The Preferred Alternative will potentially impact several species currently classified as “Threatened” on the Federal Endangered Species List. Habitats at the site are suitable for Gray wolves (*Canis lupus*), Canada lynx (*Felis lynx*), Mountain Lion (*Felis concolor*), Northern Long-eared Bat (*Myotis septentrionalis*) and bald eagles (*Haliaeetus leucocephalus*). Due to an abundance of prey species (white-tailed deer and snowshoe hares) associated with these habitat types, wolves, cougars, and lynx may use the area to a limited extent periodically throughout the year. However, these species are and wide ranging and with the amount of quality habitat present within the reservation, removal of approximately 120 acres of mixed forest is expected to have limited impacts to individuals of varying species but not impact the population of any given species. Further, the areas being impacted currently are criss-crossed with forest roads and two-track trails, diminishing their value as habitat.

4.5. Cultural Resources

A preliminary cultural resources investigation of the Preferred Alternative for potential effects to properties eligible for listing on the National Register of Historic Places under the terms of the National Historic Preservation Act was undertaken by the Red Lake Tribal Archeologist Leslie Peterson in conjunction with Soils Consulting. In summary:

All three alternatives were found to have areas of potential archeological importance with alternative #2 having 5 known and located sites within its corridor along with thirty areas with potential for archeological significance. The Preferred Alternative was found to have 4 known and located sites (the same sites as alternate #3) along with six areas with potential for archeological significance. It has been deemed acceptable by the Red Lake Band of Chippewa that if the soil within known areas as well as areas of potential significance is not disturbed through construction activities and are covered with geotextile fabric and buried with fill material, further archeological investigation is not necessary. The proposed road will be designed to increase grade through these areas of potential significance. If, due to design restraints associated with the surrounding topography and safety standards, the grade cannot be raised and these areas need to be excavated, a more in-depth archeological review will occur prior to any construction activity. Further, crews on the site will be made aware of the potential presence of archeologically significant artifacts and sites and will be instructed to halt all construction activity if any artifacts or remains are found anywhere within the proposed road corridor. Construction will not commence until trained and authorized personnel have reviewed the site and cleared it for the commencement of work.

The above findings were derived from the Red Lake Thunder Lake Road Extension Phase 3: Preliminary Cultural Resources Investigation Report dated September 2013, provided by Leslie Peterson (Appendix B).

4.6. Socioeconomic Conditions

The Red Lake Band of Chippewa have historically been an underserved population, resulting in a lack of development and expansion within the reservation. As the population has grown within the reservation, this has put strain on the current transportation and residential infrastructure, resulting in over crowding on the roads and within the existing housing leading to unsafe living conditions for the residents living within the reservation.

The proposed road project will help alleviate traffic by providing a more direct routes through the southern portion of the reservation. The construction of the proposed road will provide an alternative to Mn State Highway 1, one of the busiest roads within the reservation that runs through the villages of Red Lake and Redby, two of the more densely populated areas within the reservation. By providing a more direct route to various areas within the southern portion of the reservation, it is anticipated that there will be a reduction in traffic on the existing roads, especially on routes that are used as cut-across routes to shorten travel distances and times. These cut-across roads are typically through housing developments or around other areas of development. This reduction in traffic will make it safer for pedestrians and motorists to travel within the more densely developed and populated areas of the reservation.

The Red Lake Tribal Council approved the construction of the proposed road when they passed the land use plan that dedicated the land to the south of the road as maintained forest land and the land north of the road as residential use. The future installation of the utilities and subsequent housing developments that will occur north of the road will provide a large number of residential dwellings that are currently needed throughout the entire reservation. The increase in residential dwellings will alleviate the current strain on existing infrastructure as well as reduce overcrowding in existing dwellings where more individuals are currently inhabiting some of the units than they were constructed for. The expansion of housing will lead to safer conditions for residents, allowing them to thrive and enjoy a proper standard of living.

4.7. Resource Use Patterns

Hunting, Fishing, Gathering

The area to be affected by the proposed road project is currently used by tribal members as an area to hunt deer, grouse and small game. The trapping of furbearers also has taken place within the area in the past. The area to the south of the proposed road has been set aside for forest management with restricted development in the Red Lake Land Use Plan. The forest will thus provide more than ample opportunities for tribal members to hunt and trap in close proximity to areas they have traditionally hunted and gathered from should they be displaced as a result of the proposed project (minimal displacement is anticipated to occur with the proposed project, but as future development occurs north of the road, some opportunities will be eliminated). The proposed project will provide improved access to surrounding lakes and forest land that are currently only accessible by ATVs and four-wheel drive vehicles. Thus, opening more opportunities for tribal members that currently are unable to access these areas due to limitations associated with vehicular travel. It is anticipated that, while some opportunities will be impacted or eliminated as a result of the proposed project, the overall result will be a net increase in opportunity and access for all tribal members.

Timber Harvesting

The proposed road is set to be the division line between residential use to the north and manage forest land to the south. Completion of the project will clear over 100 acres of upland forest. However, the area being cleared is currently planned for residential use through the Red Lake Land Use Plan. Therefore, no designated managed forest land is being converted or lost with the proposed project. Any marketable timber within the proposed project area will be removed prior to the clearing of the right of way for the proposed roadway. The removal of these trees will not significantly affect the timber harvesting beneficiaries based on the long-term land use plan that is currently in place.

Agriculture

No agricultural lands exist within the area of effect for the Preferred Alternative. The project will thus result in no conversion of farmlands to other uses.

Mining

It is anticipated that there is a possibility that seams of aggregate conducive for gravel production will be crossed with the proposed road project. However, it is anticipated that any aggregate seams will be minimal in size based on the surrounding geology of the site and the proposed project is within an area that is designated for residential use so development of a mine to access any potential aggregate deposits is not allowed under the current land use plan and therefore no mining potential is being impacted or removed as a result of the proposed project.

Recreation

Completion of the Preferred Alternative will have minimal effect on recreation within the area. Some hunting and OHV activities will be disrupted as a result of existing two track roads and trails will be interrupted or removed as a result of the proposed project. However, the amount of area that will be impacted by the proposed project is insignificant when viewed on a larger overall landscape view of the surrounding reservation land. Further, the proposed road will provide improved access to surrounding lakes and forest land that are currently only accessible by ATVs and four-wheel drive vehicles. This is anticipated to result in increased access to many recreational activities that many of the residents currently are unable to access due to transportation limitations. This increased access will offset the loss associated with the construction of the proposed project and will potentially result in a net gain in recreational opportunities for the reservation as a whole.

Transportation Networks

The Preferred Alternative will have a positive impact on the existing transportation network by alleviating traffic through densely developed areas while at the same time providing more direct routes to areas within the southern portion of the reservation.

4.8. Other Values

Wilderness

While most of the project study area is rural and fairly remote, it does not qualify as wilderness. None of the three Minnesota land areas designated as wilderness within the National Wilderness Preservation System are located within the Red Lake Nation.

Sound and Noise

The long-term increase in noise is anticipated to be minimal and will result from vehicular noise through this area. Further, due to the lack of current development, this increase is expected to have little to no impact on the residents living within the reservation. Future development along the proposed road corridor will expose individuals to this increased noise but a vegetative buffer is expected to remain in place between these developments and the proposed road to help alleviate any sight and sound issues.

A short-term increase in noise will result during the various stages of construction while constructing the proposed project. This noise from heavy equipment and tools will be restricted to a single daytime shift and should not be a major burden on other residents of the Red Lake Nation.

Public Health and Safety

The proposed road will provide a safe and more direct route to areas within the southern portion of the reservation while providing access to areas that have been designated for future residential development. The access to these areas will help address the high demand and need for additional housing within the reservation, resulting in better living conditions for many tribal members. Use of the proposed road will also help alleviate current traffic congestion and rates within the villages of Redby and Red Lake, two of the more developed areas within the reservation. The reduction in traffic through these areas will increase the safety for bicyclists and pedestrians that frequently walk along the shoulder of and cross MN Highway 1. The proposed project will also provide a safe place to travel for pedestrians and bicyclist that travel along the new corridor by providing a designated multi-use trail for them away from the roadway (Where possible). Further, proposed lighting along the trail and roadway will increase safety for individuals traveling along both the road and multi-use trail. Finally, the future installation of new sanitary sewer and water utility lines will provide new utility access to individuals currently not on the municipal system while also eliminating existing dead ends within the existing water system while also providing tie in points for future developments.

Climate change

The current predicted trend within the area of interest of the proposed project is that temperatures will rise subtly over the next 50 to 75 years as well as a slight increase of precipitation. The increase of precipitation and temperatures will bring with it an increase with severe storms. The proposed project is anticipated to remove approximately 100 acres of trees, which will reduce the carbon load that the local area can hold. However, the pervious surfaces within the proposed road corridor will be revegetated, which will provide some carbon banking. Also, on a landscape view, 100 acres of clearing is minimal compared to the surrounding forest land. With the re-establishment of vegetation and the minimal amount of vegetation clearing (based on a landscape wide view), it is not anticipated that the proposed project will have a significant affect on climate change.

Cumulative Impacts

While the proposed project may have minimal or insignificant impacts and other effects or impacts from surrounding activities on the landscape may also have minimal or insignificant impacts, combined the impacts may be more severe on a larger scale. While land use within the reservation is minimal and mostly confined to the more densely developed areas on the reservation, some activities in the more rural are do occur that could contribute to cumulative effects on wildlife and cultural and resources.

Forestry

Forestry is the main land use within the surrounding area. The disturbance to the vegetation and habitat within the area is generally minimal, with most operations occurring within winter months for increased access to stands of timber as well as reduced compaction of the soil. Lands managed for timber are either left to revegetate themselves or are planted with tree species similar to what was recently harvested. Due to the subsequent growth of trees after harvest along with the understory vegetation remaining intact, logging and timber related activities have minimal impact on the surrounding wildlife. In some instances, the cyclical nature of the different aged forest caused by managed logging provide a variety of habitat for differing species, allowing for a more robust wildlife diversity and populations. Further, with most forest activities that require heavy equipment occurring during the winter period, impacts to soils and subsequent cultural resources are greatly reduced. With the minimal effects caused by forestry, there is little risk of increased cumulative impacts to cultural and wildlife resources on a landscape view that will result from the proposed project.

Development

Development is the only other major land use that occurs within the surrounding area. Areas that are expected to be developed outside of the central development areas of Red Lake, Redby, Little Rock and Ponemah will result in the removal of forest habitat. However, these areas are moderate to small in size and on a landscape view. While some individuals of a given species may be impacted, the overall wildlife population is not anticipated to be impacted since the surrounding area is suitable habitat. Therefore, it is anticipated that there is little risk of cumulative impacts to wildlife as a result to the proposed project. The extreme land alteration associated with development also has potential to impact cultural and paleontological resources through earth moving disturbances. While these impacts may be significant should they occur, land disturbance associated with development is heavily scrutinized to help reduce the potential of any impacts occurring, resulting in a very low risk to cultural and paleontological resources and little risk to result in large cumulative impacts across the landscape when viewed in conjunction with the proposed project, which underwent the same review for said resources.

APPENDIX A

EXISTING/PROPOSED FACILITIES MAPS

APPENDIX B

CORRESPONDENCE LESLIE PETERSON, RED LAKE ARCHAEOLOGIST AND SOIL CONSULTING

RED LAKE THUNDER LAKE ROAD EXTENSION PHASE 3:

PRELIMINARY CULTURAL RESOURCES INVESTIGATION

Report prepared for Red Lake Nation and
Northern Engineering & Consulting, Inc.

By

Soils Consulting, Hackensack, MN
Dr. Christy A. H. Caine, PI
Grant E. Goltz, Project Manager
With the assistance of
Leslie Peterson, Red Lake Tribal Archaeologist

September 2013

MANAGEMENT SUMMARY

Red Lake Nation proposes to construct the Phase 3 extension of the Thunder Lake Road. This work will complete a road that crosses the Nation south of Lower Red Lake, running from the road's current eastern terminus southeast of Red Lake Village, eastward six miles to a new junction with MN Trunk Highway 1, southeast of Redby Village. Three 1000 foot wide Alternative Corridors have been defined. They comprise approximately 1700 acres in sections 25, 26, 27, 28, 29 and 30 in T151N, R33W and sections 25, 26, and 36 in T151N, 34W. They have a total length of approximately 14 miles.

The purpose of this report is to: 1) provide a planning tool that will assist in the selection of a preferred corridor and the design of specific road alignments within the selected corridor; and 2) provide the basis for further Phase I Cultural Resource Reconnaissance within the selected corridor.

Work for this project consisted of: 1) background research and the development of a geomorphic model for the three-corridor study area; 2) field assessment of known cultural resources within the study area and testing of the geomorphic model; 3) assessment of relative impacts of the three corridors and recommendations for road designs and further cultural resource studies.

Alternative Corridor 1 contains three previously recorded cultural resource sites, and field assessment of the model located two additional sites. Thirty areas of varying size that intersect the corridor are categorized as high or intermediate potential. If this corridor is chosen, these areas will need intensive survey prior to design of specific road alignments.

Alternative Corridor 2 contains no previously recorded cultural resource sites, and field assessment of the model located four additional sites. Thirty-one areas of varying size that intersect the corridor are categorized as high or intermediate potential. If this corridor is chosen, these areas will need intensive survey prior to design of specific road alignments.

Alternative Corridor 3 follows the alignment of Alternative Corridor 2 for approximately two-thirds of its length. Field assessment of the model located one site within the one-third segment that does not follow Corridor 2. This segment also has six areas categorized as high or intermediate potential. If this corridor is chosen, the areas categorized as high and intermediate potential for both the two-thirds that follows Corridor 2, and the remaining one-third will need intensive survey prior to design of specific road alignments.

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INTRODUCTION

The purpose of this report is to: 1) provide a planning tool that will assist in the selection of a preferred corridor for the construction of Thunder Lake Road Phase 3 and the design of specific road alignments within the selected corridor; and 2) provide the basis for further Phase I Cultural Resource Reconnaissance within the selected corridor.

Two primary federal laws and their implementing regulations govern the identification and protection of cultural resources on Indian lands: the National Historic Preservation Act of 1966, as amended; and the Archaeological Resource Protection Act of 1979. Activities or undertakings that involve federal licenses or permits, federal funding, or federal or Indian lands fall under the requirements of these laws. The present project falls under these laws and regulations.

This report is part of a multi-stage research design which allows for consideration of cultural resource potential during the early phases of planning for alternate project alignments. This is a common approach, particularly during planning for road projects, and has been used by Minnesota Department of Transportation for decades. Assessing the cultural resource potential of alternate corridors will enable more detailed surveys to be efficiently designed for the selected corridor as planning proceeds.

Northern Engineering and Consulting, Inc., contractors for the development of the Phase 3 road extension, contracted with Soils Consulting of Longville, Minnesota to assess the cultural resource potentials of three proposed alternative corridors. Dr. Christy A. Hohman Caine served as Principal Investigator and Grant E. Goltz as Project Manager. Mr. Leslie D. Peterson, Red Lake tribal archaeologist, served as the primary contact person with Red Lake Nation and provided review, project oversight, and assisted with the final report.

As determined by the contract Scope of Work, the project consists of: 1) background research and geomorphic model development for the study area; 2) archaeological/historic assessment and field inspection of alternate corridors including recommendations for intensive Phase I cultural resource reconnaissance for the alternative corridors; 3) a report covering the above and including an assessment of relative impacts of the three corridors on cultural resources.

Artifacts and records generated during this project are the property of Red Lake Nation and will be housed in the Tribal Archives.

PROJECT LOCATION

The project is located in northwestern Minnesota within the boundaries of the diminished Red Lake Reservation (Figure 1). The project consists of an extension to the Thunder Lake Road that crosses the Red Lake Nation south of Lower Red Lake. The extension will run from the road's current eastern terminus southeast of Red Lake Village, eastward six miles to a new junction with MN Trunk Highway 1, southeast of Redby Village (Figure 2).

Three 1000 foot wide Alternative Corridors have been defined for the extension. They comprise approximately 1700 acres in sections 25, 26, 27, 28, 29 and 30 in T151N, R33W and sections 25, 26, and 36 in T151N, 34W. They have a total length of approximately 14 miles (Figure 3, Figure 4, Figure 5).

Alternative Corridor 1
This is the northernmost corridor. It begins at the terminus of the existing Thunder Lake Road, in T151N, R34W, Section 24. It then runs eastward, south of Lake Shemahgun and north of Lake Emerald in Section 25. It continues northeast into T151N, R33W into section 30, north of Smith (Island) Lake. It continues eastward into section 29 immediately south of Redby and crosses the Mud River and across Sections 28 and 27, where it trends southeast until it meets with the easternmost part of Alternative Corridor 2. They both continue east through sections 26 and 25, then meet with Highway 1.

Alternative Corridor 2
The central corridor alternative begins at the terminus of the existing Thunder Lake Road in T151N, R34W, Section 24 and then trends southeast through a corner of Section 36 and across T151N, R33W, Sections 31 and 32, south of Green Lake. It then crosses the Mud River and trends northeast through sections 33, 28, and 27 where it meets with Alternative 1. They both continue east through sections 26 and 25, then meet with Highway 1.

Alternative Corridor 3
The southernmost corridor begins at the terminus of the existing Thunder Lake Road in T151N, R34W, Section 24 and then follows the same corridor as Alternative 2 until it reaches the eastern edge of T151N, R33W, Section 32, shortly before it crosses the Mud River. It then trends nearly directly eastward across Sections 33 and 34, going through Sections 35 and 36 where it meets Highway 1.

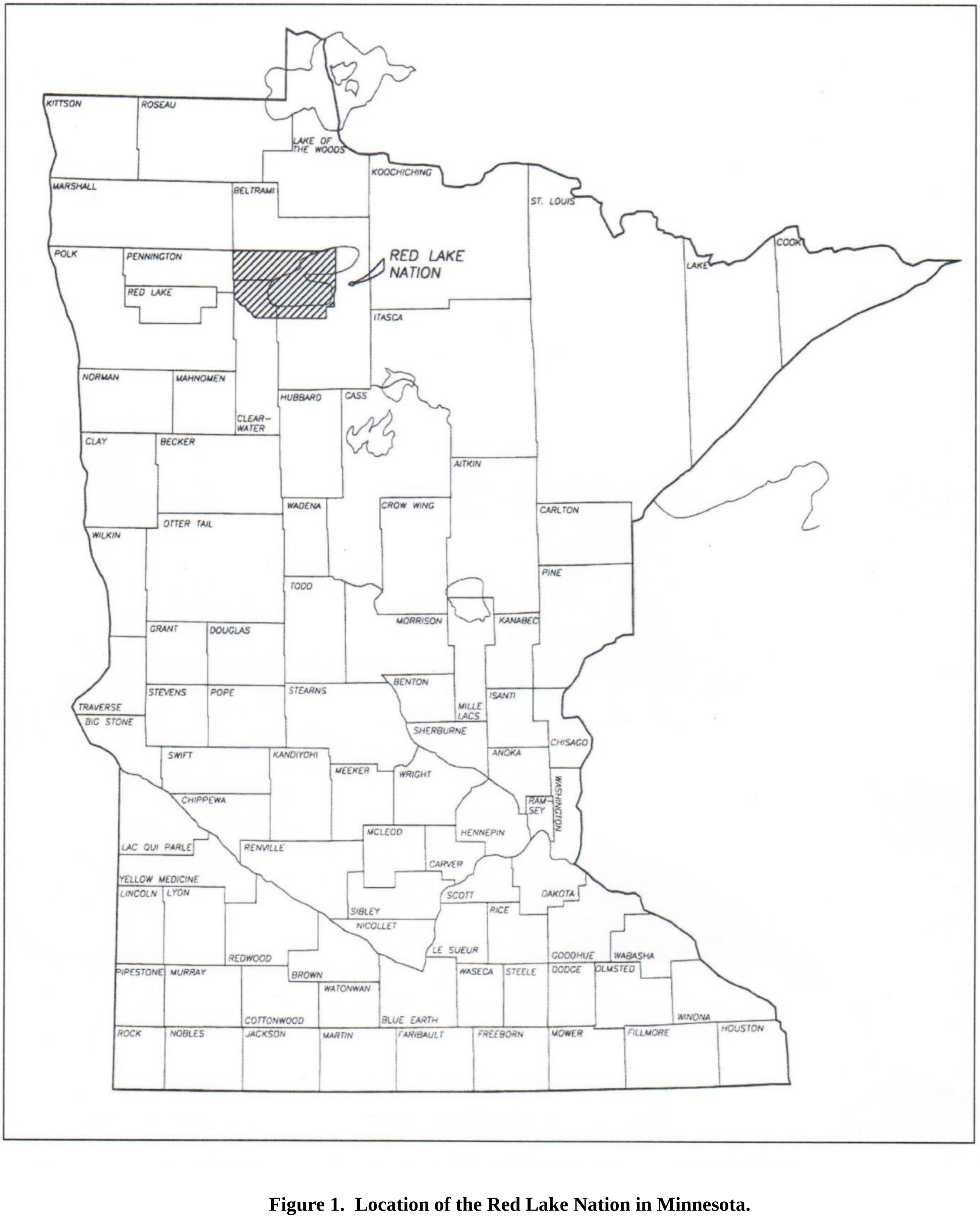

Figure 1. Location of the Red Lake Nation in Minnesota.

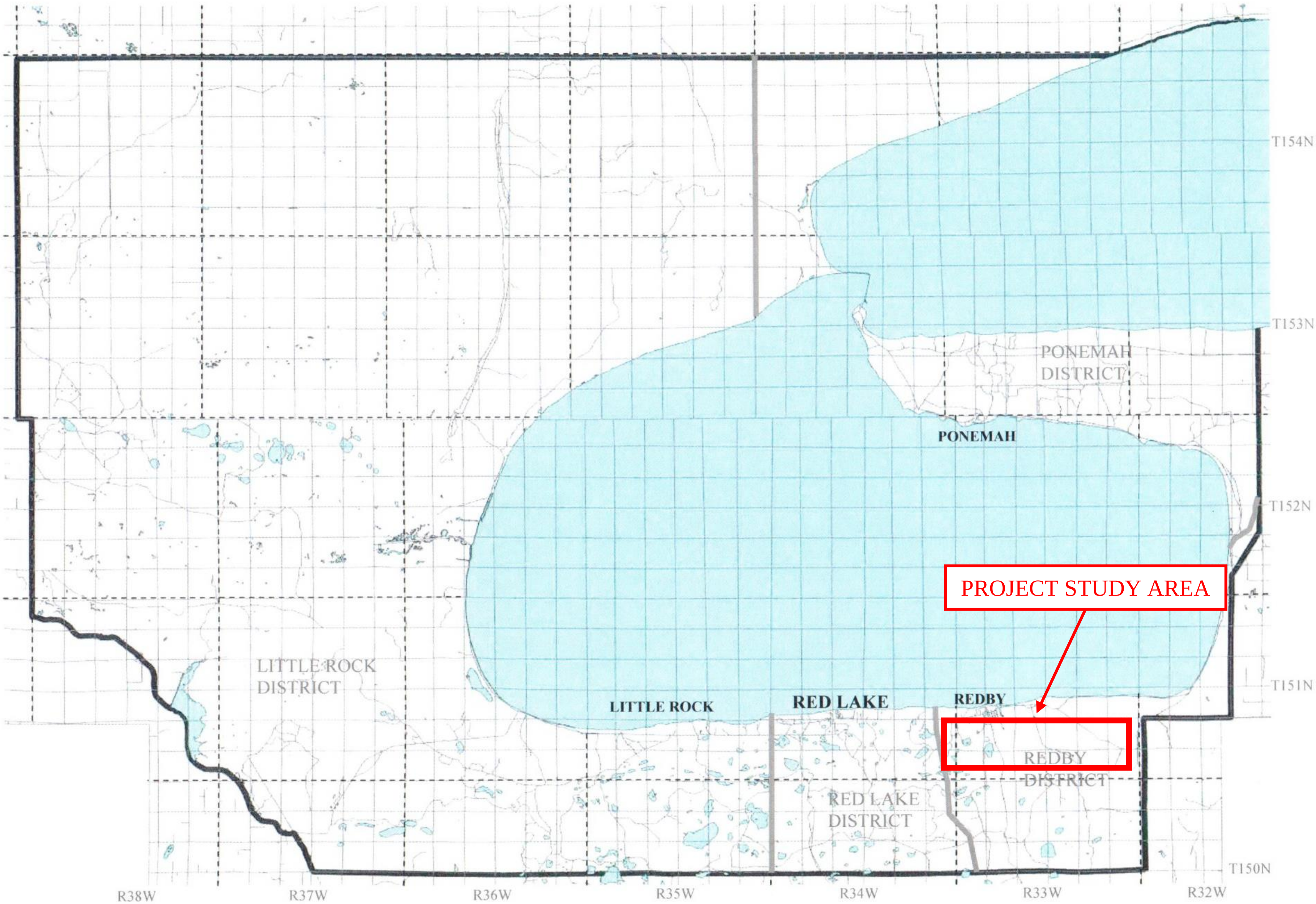

Figure 2. Location of the project study area within the Diminished Red Lake Reservation boundaries.

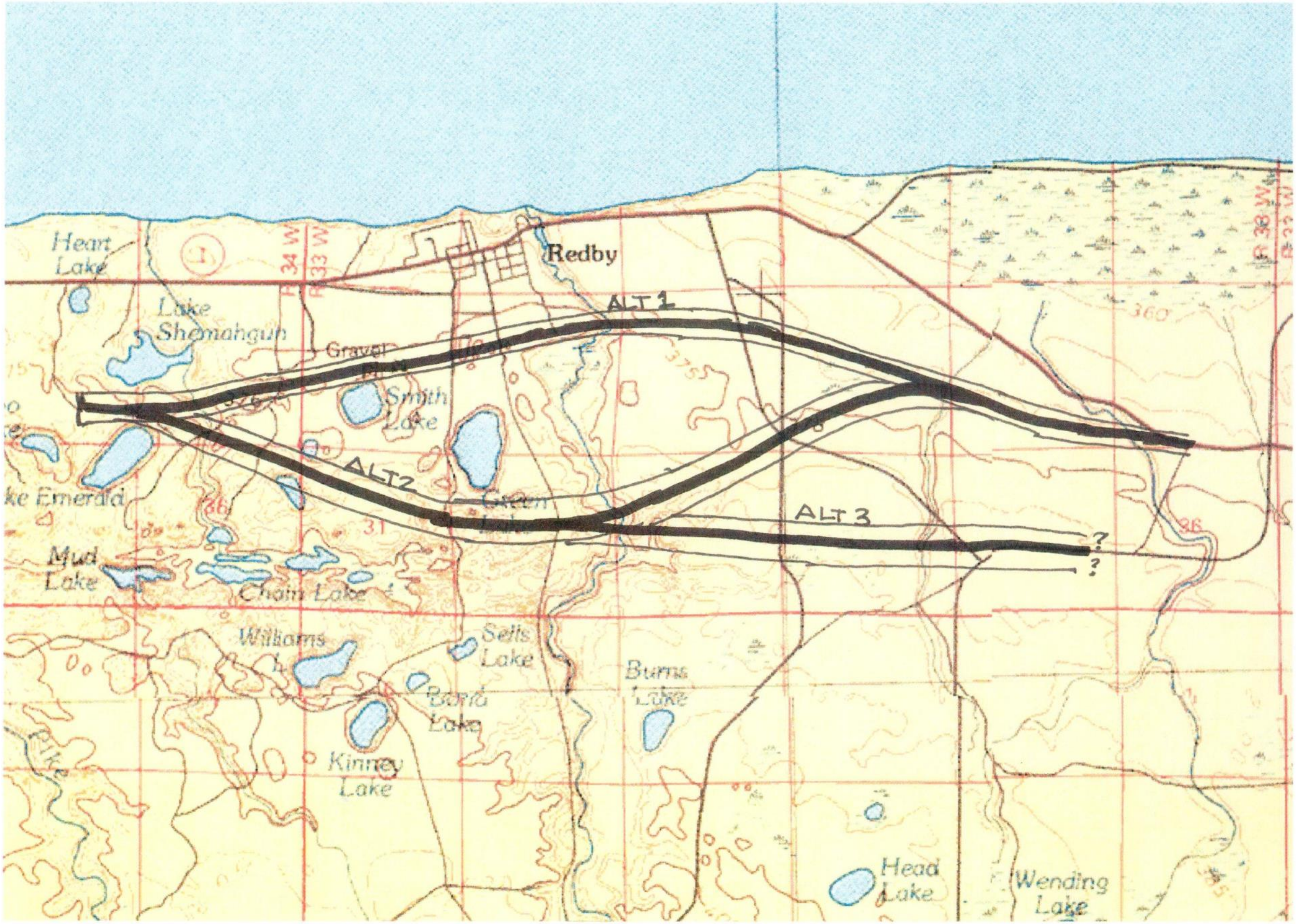

Figure 3. Location of the project alternatives on the 1:100,000 USGS quadrangle.

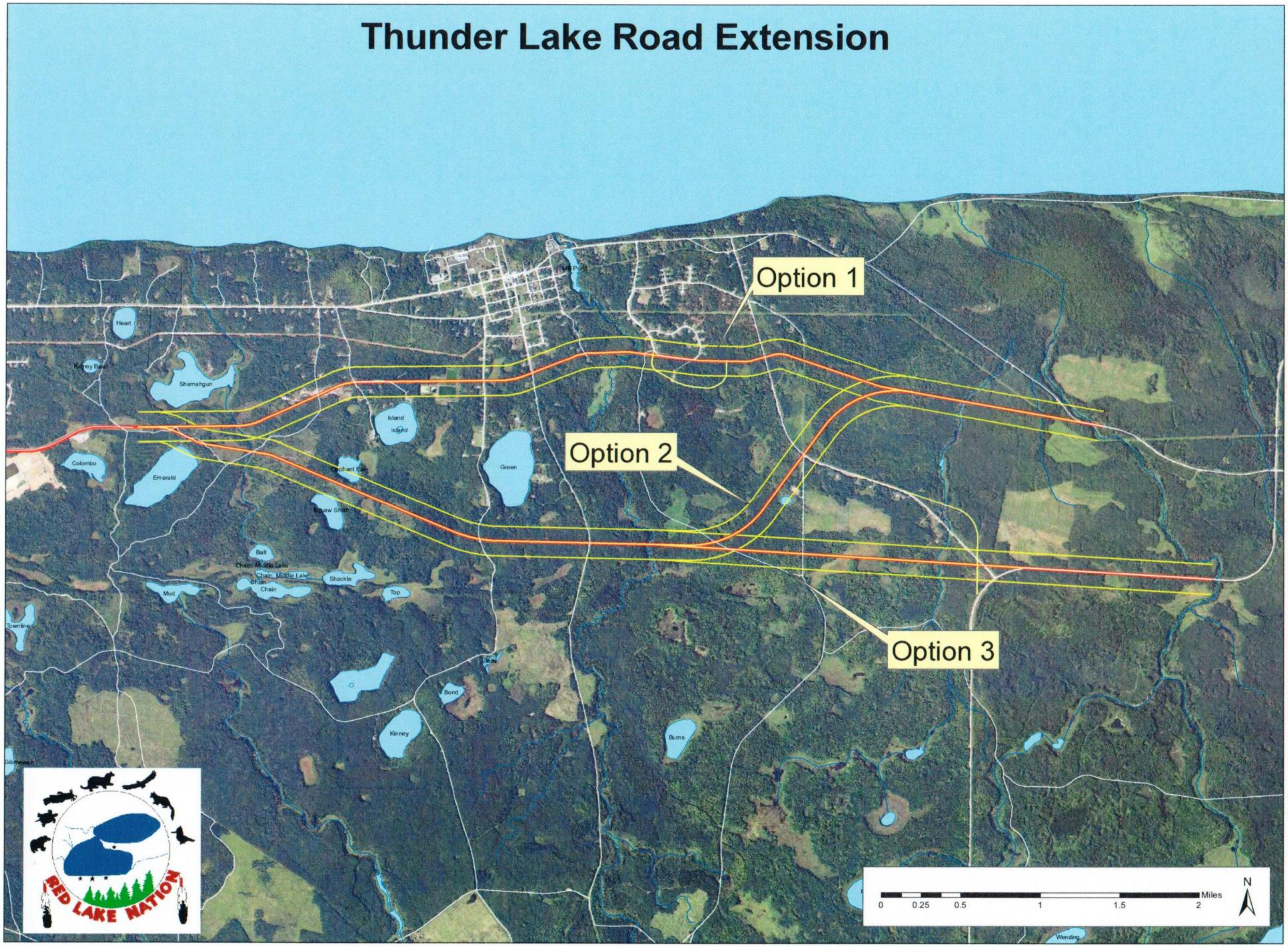

Figure 4. Location of the project alternative corridors on the 2010 FSA Beltrami County aerial photo (courtesy of Red Lake DNR).

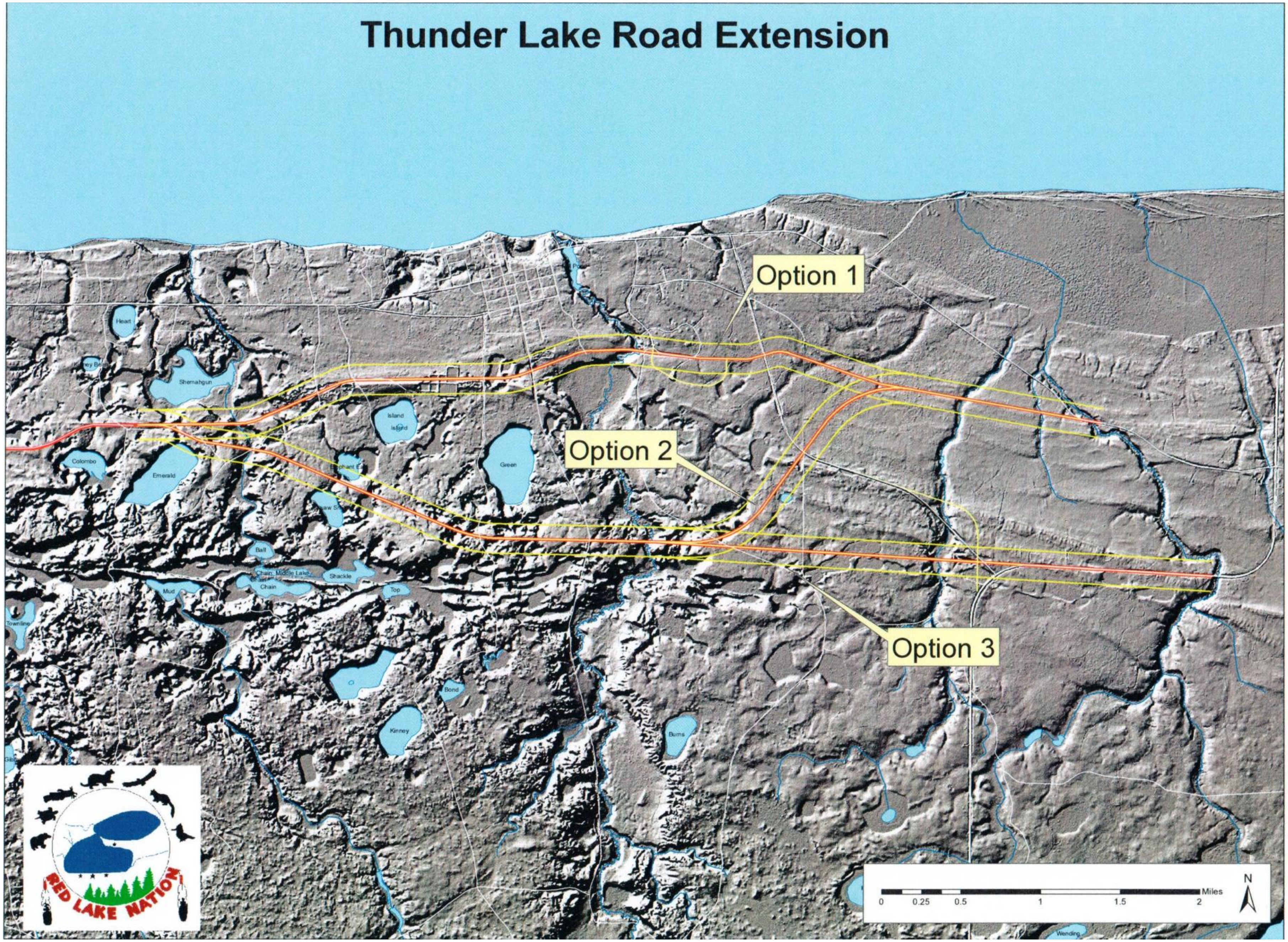

Figure 5. Location of the project alternative corridors on a LiDAR shaded relief map (courtesy of the Red Lake DNR).

DESCRIPTION OF THE ENVIRONMENT

The environment within the project area is described relative to variables important to human habitation. These descriptions include the bedrock geology, glacial history, physiography and landforms, hydrology and drainage, climate, vegetation and fauna. Changing environmental conditions during approximately the past 10,000 years are summarized.

BEDROCK GEOLOGY

While the lack of exposed bedrock within the project area or vicinity limits the significance of the bedrock geology to patterns of past human settlement, these data are nevertheless important in understanding the regional environmental setting. This knowledge relates directly to the question of availability of lithic resources and indirectly to questions of topography, drainage and surficial deposits formed primarily by more recent geologic events.

Because of the lack of known bedrock exposures, information on the bedrock geology within the project area and surrounding region consists only of generalized mapping inferred from gravity and aeromagnetic data. The area is thought to be underlain by a variety of crystalline rocks of Lower Precambrian age. The western edge of the project area consists of felsic-intermediate intrusive rocks probably including some gneisses. The area south and east of Lower Red Lake consists of metavolcanic rocks, probably dominated by mafic-intermediate lavas and hypabyssal intrusive rocks. The extreme southwestern corner of the project area consists of metasedimentary rocks, probably including graywacke, slate, conglomerate and quartzite. The northeastern limit of sedimentary Cretaceous rocks, predominantly shales and sandstones is at the approximate southwestern edge of the project area.

PREVIOUS STUDIES OF GLACIAL HISTORY

The existing terrain within the project area is the result of a long and complex series of glacial and peri-glacial events culminating approximately 10,000 years ago. Deposits and landforms from the earlier glacial advances have been largely obscured and reworked by the more recent advances. These earlier glacial deposits are, however, important since subsequent glacial movements were guided by the patterns of these earlier landforms and materials from earlier deposits were reworked and incorporated into later glacial deposits. Thus, lithic raw materials from early ice advances can consequently be available in present surface deposits.

Research on the glacial history of the region, including the project area, has produced a somewhat broad and generalized summary of glacial events, deposits, and landforms. Perhaps the most encompassing explanation is that presented by Wright in *Geology of Minnesota*, edited by Sims and Morey (1972). The "Geologic Map of Minnesota: Quaternary Geology" (Hobbs and Goebel 1982) provides somewhat more specific information on glacial landforms and materials within the region. The Minnesota Soil Atlas Series, primarily the Bemidji Sheet (UM Agricultural Experiment Station 1972) provides yet another version at a somewhat more detailed level. Since much of the glacial history of the project area relates to the early stages of Glacial Lake Agassiz, numerous publications provide useful information. Most notable is the reinterpretation of the eastern portion of Glacial Lake Agassiz as a separate body, termed Glacial Lake Koochiching (Hobbs 1988). In some respects, this interpretation is not unlike an earlier scenario advanced by soil scientist Nikiforoff (Nikiforoff 1947).

All of the available research, however, suffers from the same deficiency—lack of actual field observational data. Much of the overall framework for the sequence of glacial events and resulting landforms in the region was essentially "locked in stone" even before the availability of adequate topographic maps of the area. Even a cursory study of now existing U.S.G.S. 7.5 minute topographic data suggests significant problems with the earlier, but still widely applied, interpretations. Actual field observation of landforms and glacial materials further compound these problems. Further questions arise when the body of Minnesota research is viewed in light of the well-documented series of glacial moraines mapped on the Canadian side of the border.

Rather than perpetuate these complex problems, the following discussion presents a totally updated paradigm. This paradigm is based on exhaustive studies of available research, aerial photographic and satellite imagery, U.S.G.S. topographic maps and Digital Elevation Model data. These data are further supported by three decades of detailed field observations of glacial landforms and surficial deposits within the region by the project manager, who is a geoscientist.

REGIONAL GLACIAL HISTORY

This discussion is meant to place the present project study area into a broader environmental context.

Existing landscape environments within the study region primarily relate to the most recent, or Wisconsin Age, glacial advances. However, several earlier and largely undefined glacial advances have relevance to settlement and resource procurement systems of aboriginal peoples of the study area.

Perhaps the resource most closely tied to any particular geologic deposit is stone of a quality suitable for the manufacture of tools. The lack of bedrock outcrops meant a total reliance on either materials procured at a great distance from the region or those rocks transported into the region via glacial events. Patterns of ice transport during the Late Wisconsin Glaciation delivered a meager supply of marginally workable materials from the northeast and a somewhat more suitable and workable material, Swan River Chert, from the northwest.

However, a lithic material of significant regional importance, Tongue River Silica, is not connected with these late glacial advances, since the most northerly primary deposits, in north-central North Dakota, were not crossed by any of these ice sheets. The material is, however, relatively common in glacial deposits starting approximately 50 KM south of the project area and can thus be considered a regionally available lithic raw material. Its presence likely relates to an earlier and more extensive glacial advance of the Late Wisconsin Souris Lobe through north central North Dakota and well into central Minnesota.

Late Wisconsin age glacial advances within the region consisted primarily of ice flows from the north and northeast. These ice advances extended to the south and southwest well past the project area leaving a series of prominent glacial moraines including (from south to north) the Alexandria and Itasca moraines as well as the core deposits of the east-west trending moraines just south of the project area boundary. Within the project region these advances deposited the east-west trending moraine between Upper and Lower Red Lakes which forms the core of the Ponemah Peninsula.

While these deposits have traditionally been assigned to a northwestern source and are identified as Wadena Lobe deposits consisting of gray calcareous drift with common limestone clasts (Hobbs and Goebel 1982), field examination has demonstrated few to no limestone clasts and a brown to gray, sometimes weakly calcareous drift with clasts dominated by igneous and metamorphic rocks. Further evidence for a northeastern source comes from examination of the small number of chert pebbles found in the drift. Northwestern source drift should contain "Swan River Chert" from Devonian and possibly Silurian and Ordovician rocks of west central Manitoba. This drift, however, contains chert pebbles characteristic of the limestones of the Hudson Bay area. This drift most closely resembles that of the western end of the Rainy Lobe deposits. A recent re-evaluation of the Wadena Drumlin area to the south of the project area also supports a northeastern source for this glacial drift (Goldstein 1986).

The nature of this drift, coupled with the existence of almost continuously traceable moraines extending from the project area to the highlands of the North Shore of Lake Superior suggests a broad northeastern source ice front extending across the eastern two-thirds of what is now Minnesota. While this ice front advanced primarily as a flanking series of sublobes, often with numerous individual flow zones, rather than one large ice lobe, it is clear from the overall structure of the moraine systems and the associated interlobate depositional landforms that these individual sublobes advanced and melted back in concert and were contemporaneous.

The influence of Late Wisconsin age glacial advances from the northwest on the region occupied by the project area has been substantially overstated in currently available published research. Current maps depicting glacial deposits indicate that the entire project area is mantled by gray calcareous drift with common limestone clasts, associated with the Des Moines ice lobe (Hobbs and Goebel 1982, Wright 1972). In actuality, such deposits do not extend north of the northern shore of the Lower Red Lake basin.

At the time of this ice advance, generally referred to as the St. Louis Sublobe (now sometimes partially referred to as the Koochiching Sublobe) the southern margin of northeastern source ice extended from the Ponemah Point, along the north shore of Lower Red Lake and east-southeast through Northome, and roughly through Wirt and Marcell in Itasca County. The ice advancing from the northwest was forced into a narrow, roughly east-west, path centered on what is now the basin of Lower Red Lake. North of this, the active ice front was an effective barrier and large masses of stagnant ice north of the Itasca Moraine restricted expansion to the south. East of the Lower Red Lake basin, the flow of this narrow ice lobe turned southeast and eventually passed through the narrow lowlands at the present location of Grand Rapids and spread into some of the broad lowlands to the southeast. The extent and nature of these down-ice deposits require no elaboration since they are well beyond the area of the present study. Suffice it to say that there appear to have been a series of meltbacks and rapid short surges, which picked up recently deposited pro-glacial lacustrine sediments and deposited them on the iceward face of moraines further downstream.

During the advance of this northwestern source ice, the northeastern source ice front maintained a relatively static position. The presence of the fresh northwestern ice apparently fostered a colder local environment, which reduced meltback and provided an effective barrier to further advance. The northwestern source ice lobe, as mentioned earlier, operated in a somewhat "feast or famine" mode characterized by cycles of rapid surges and substantial meltbacks. This pattern was likely caused by the passage through the constriction formed by the narrow Lower Red Lake trough which acted as somewhat of a pressure relief valve shutting down ice flow at times until a buildup of pressure from up-ice would break through. An additional late advance of this northwestern source ice into the Rainy River valley and terminating north of Nett Lake did not affect the project area. This small late advance should more properly be called the Koochiching Sublobe.

GLACIAL MELTBACK IN THE PROJECT REGION

For purposes of clarity, the following terminology will be used for glacial ice lobes: northeastern source ice from west to east--West Itasca Sublobe, East Itasca Sublobe, and Wadena Sublobe of the Rainy Lobe; northwestern source ice--St. Louis Sublobe (through Lower Red Lake), Koochiching Sublobe (Rainy River Valley) (see Figure 6).

Just prior to the beginning of glacial meltback in the project area, the St. Louis Sublobe was in equilibrium at a point approximately 30-KM east-southeast of the present eastern end of Lower Red Lake. That portion of the Erskine Moraine east of Island Lake in northwestern Beltrami County was being deposited. The West and East Itasca Sublobe ice front was in a position near that it had maintained for most of the advance of the St. Louis Sublobe.

Glacial meltwaters originating at the juncture of these two ice fronts was flowing to the southeast through channels in stagnant ice and depositing a substantial outwash fan north of present Lake Winnibigoshish. A quite rapid meltback of the St. Louis Sublobe, followed by another period of equilibrium, placed this ice front about 20 KM east southeast of the present eastern end of Lower Red Lake and deposition of the more prominent inner arc of the Erskine moraine, extending from the vicinity of Northome south and west to the vicinity of Blackduck, commenced. At this time the large interlobate sand and gravel delta west of Northome was deposited in a re-entrant between the St. Louis Sublobe and the East Itasca Sublobe.

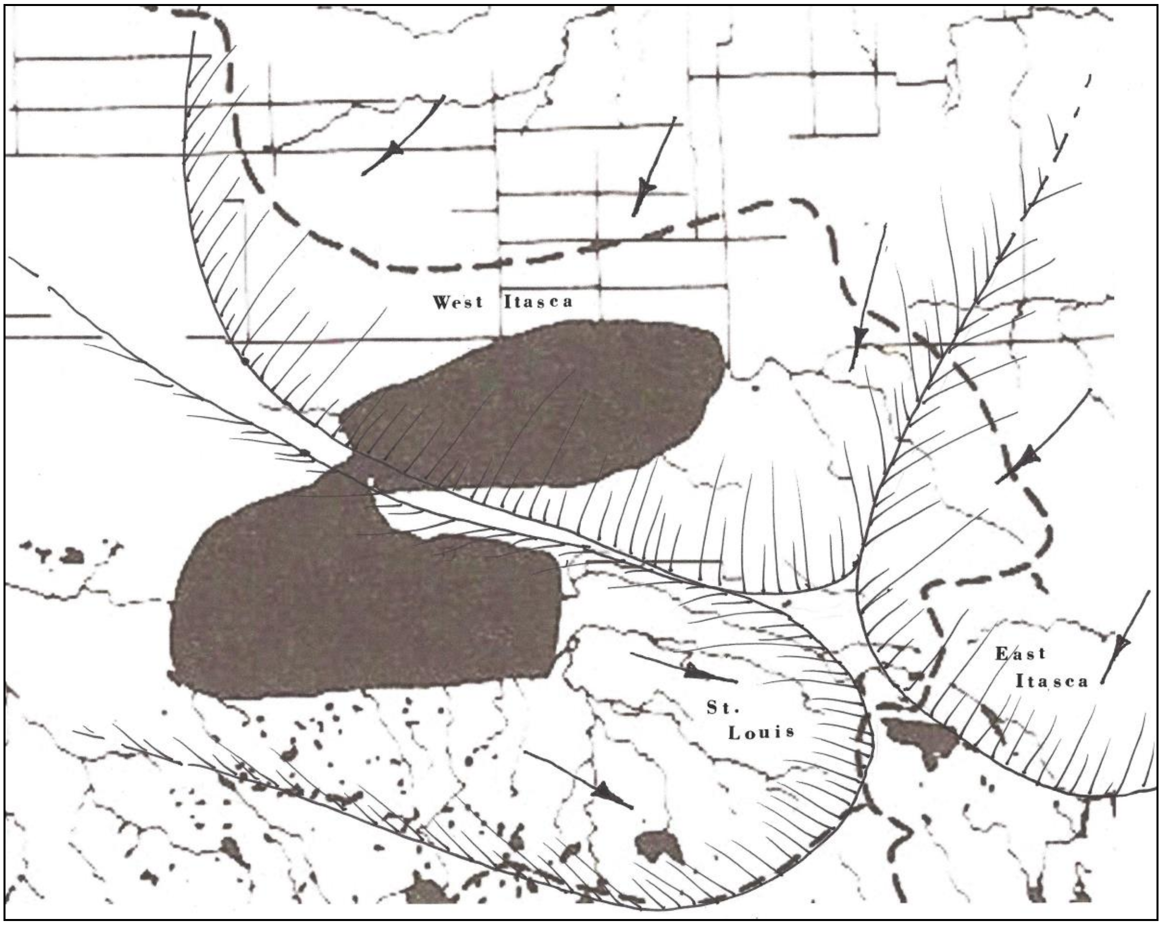

Figure 6. Late Wisconsin glacial lobes affecting the project area.

This was followed by a meltback of the St. Louis Sublobe, probably to near the present basin of Lower Red Lake. Ponded meltwater between the ice front and the Erskine Moraine formed a temporary pro-glacial lake within which silty and clayey lacustrine sediments were deposited. A minor recession of the West Itasca Sublobe allowed another surge of the St. Louis Sublobe to a position against the Erskine Moraine. This deposited a mantle of lacustrine silt and clay enriched till on the inner flank of the Erskine Moraine and obliterated any traces of beach features formed by the earlier pro-glacial lake.

At this point, the stage was set for the final wastage of ice within the project area, including the formation of Glacial Lake Koochiching and related landforms and deposits. East of the Northome area, the East Itasca Sublobe was gradually melting back, while the St. Louis Sublobe maintained a static position against the Erskine Moraine. This meltback exposed a small land area east of the juncture of these two lobes where ponded meltwater formed the initial phase of Glacial Lake Koochiching in the project area vicinity. (It should be noted that similar meltback events were likely forming other initial small pro-glacial lakes further east, all of which can be considered as parts of a series of initial Glacial Lake Koochiching phases. At some point the ice front melted back sufficiently so that these eventually coalesced, forming Glacial Lake Koochiching proper.) A short east-west trending wave-modified beach terrace at an elevation of 1410 feet in the southwest corner of Section 29 and the southeast corner of Section 30, T152N, R28W, and a mile wide segment of wave smoothed terrain to the north marks this event.

A minor amount of ice wastage allowed an expansion of this initial lake segment and movement of the shoreline position about 1 KM northward to an elevation of approximately 1400 feet. Segments of beach features can be found at this elevation as far west as the northeast corner of Section 27, T152N, R29W and as far east as the northwest corner of Section 28, T152N, R28W. At this point beach features turn southeast and extend to the village of Mizpah with a segment continuing to the southeast corner of Section 10, T151N, R28W. This is referred to as the Mizpah Beach of Glacial Lake Koochiching (Hobbs 1983).

While drainage may have been to the southeast via a now obscured connection to Moose Brook, an outlet near the west end of this beach, following the present route of Hoover Creek, and to the west under the ice lobe may have served. This would have initiated the formation of the east-west tunnel valley system south of Lower Red Lake and outleted from the ice front further to the southwest, possibly along a subglacial precursor to the McIntosh spillway.

The extent of this stage of Glacial Lake Koochiching to the north and west is unknown, but the presence of mineable gravel deposits in the east-west portion of this beach suggests at least a moderate sized lake. However, the lack of beach terraces on high uplands between Upper and Lower Red Lakes demonstrates that these areas were likely still ice covered.

Further meltback of the Itasca Sublobes, combined with either additional erosion of the south Red Lake tunnel valley system or a connection to the Prairie River outlet channel further to the east, lowered water elevations to about 1350 feet. A short section of wave-smoothed slopes up to this elevation on the north face of the high upland moraine between Upper and Lower Red Lakes, demonstrates that this lake phase extended west at least to this point. However, unmodified glacial moranic terrain on south and west facing slopes shows that St. Louis Sublobe ice still abutted these slopes.

At this point a description of this high moranic landform that has not been previously studied by geologists is needed. This landform is located primarily in sections 26 through 32 of T153N, R33W and sections 25 and 36 of T153N, R34W. The highest elevation portions are in sections 29 and 30, T153N, R33W with a maximum elevation of just over 1410 feet occurring in the SE part of section 30.

The highest elevations consist of irregular glacial moraine deposits. Below an elevation ranging from 1350 feet on part of the north face, to approximately 1260 feet on the southwest face, the terrain has been modified into a complex series of wave cut scarps, beach terraces, beach ridges, and offshore bars, extending to the present elevation of Red Lakes (1175 feet).

The core of this landform consists of partially sorted gravelly and stony glacial drift, typical of a kame moraine deposit. Clasts are dominated by igneous and metamorphic rocks with less than 1% limestone and occasional pebbles of Hudson Bay Lowland Cherts, consistent with a northeastern drift source. Formation of this landform was likely as an interlobate deposit in a shallow re-entrant between two flow zones in the West Itasca Sublobe. The south face was likely deposited against the northern flank of the narrow, eastern flowing St. Louis Sublobe. Beach deposits on the south and southwestern sides contain abundant limestone pebbles (ca 50% of total clasts). These are absent on north facing beaches, except at low elevations (below 1220 feet), where limestone pebbles are numerous. This may be the result of ice rafting from the St. Louis Sublobe which fronted in Glacial Lake Koochiching to the west and south during these lower lake levels.

Although correlation of contemporaneous beach features across the basin of Glacial Lake Koochiching is often tenuous due to the uncertainties of differential rebound, the series of beach features on this landform records the entire sequence from an elevation of 1350 feet to the present lake level of 1175 feet in a horizontal distance of slightly over one mile. Thus, there is no glacial rebound effect in this record and beach elevations can be directly correlated to each other. This sequence shows a gradual lowering of the elevation of Glacial Lake Koochiching with a continuous series of beach features over a vertical distance of approximately 175 feet. Prominently expressed scarps, terraces, and beach ridges suggest periods of relative stability at elevations of approximately 1350, 1300, 1275-1280, 1250-1255, 1235, 1225, 1205, and 1190 feet. Steep slopes between an elevation of 1275 and 1250 feet suggest a rapid drop in lake level followed by a longer than average period of stability. This occurs again between an elevation of 1225 and 1205 feet.

The 1350-foot elevation of Glacial Lake Koochiching most likely corresponds to the Gemmel Stage (Hobbs 1983), although the configuration of the lake appears to be considerably different than has been previously suggested.

Further meltback of the Itasca Sublobes and a substantial meltback of the St. Louis Sublobe exposed substantially larger areas to inundation. At the same time, increased westward flow through the subglacial tunnel valleys south of Lower Red Lake to the McIntosh spillway lowered lake elevations to near 1300 feet. It is unlikely that an open lake extended west to this spillway as suggested by Hobbs (1983), since both the north and south shores of Lower Red Lake were protected by ice, suggesting that the St. Louis Sublobe continued to fill the basin. There may well have been a smaller, lower elevation (ca 1240 feet) lake in the Trail area at this time, however, but that fact has no relevance to the project area.

By this stage, the north face of the higher upland between Upper and Lower Red Lakes was exposed to increased erosion and smoothing, with eroded sediments being transported eastward and deposited as beaches and offshore bars. The close proximity of the Western Itasca Sublobe which fronted in deep glacial lake waters provided a source of calved-off icebergs, many of which became grounded on the offshore bars and beaches and buried by these eroded sediments. Meltout of these ice blocks later produced numerous crater-like depressions of varying sizes along the higher former beaches and terraces. Recession of the ice front during later stages of Glacial Lake Koochiching removed the source for these icebergs and these features are absent from lower glacial beach terraces.

The 1300-foot elevation of Lake Koochiching has been referred to as the Upper Trail level (Hobbs 1983). The likelihood that this lake at this elevation did not extend southwest of Upper Red Lake and was thus not directly a part of the highest lake levels in the Trail area suggests the need for a different designation. Since a prominent beach from this stage is located close to Ridge, this is designated as the Upper Ridge Stage to distinguish it from a possibly contemporaneous, but likely non-connected lake, near Trail, which would continue to be called the Upper Trail Stage.

Continued erosion of the south Lower Red Lake tunnel valley lowered lake elevations to an elevation near 1275 feet. While the Itasca Sublobes had melted back several kilometers, the St. Louis Sublobe receded only a small amount, exposing the southeastern face of upland between Upper and Lower Red Lakes to just west of the present location of the Ponemah gravel pit. The basin of Lower Red Lake was still likely filled with St. Louis Sublobe ice. Most beach positions had only receded a short distance. Since the shoreline still passed near Ridge, this will be designated as the Lower Ridge Phase.

This was followed by what appears to be a rather rapid drop in water elevation to an elevation near 1250 or 1255 feet. Whether this marks an actual connection to the lake basin in the Trail area or simply a more extensive meltout in the south Red Lake tunnel valley is not clear, but for the first time, at least the eastern third of the Lower Red Lake basin was ice-free. In any case, the south shoreline of Lower Red Lake from the vicinity west of Redby and continuing several miles southwest of the present lake basin was still blanketed by stagnant ice, since beach features are absent. Beaches are, however, continuous around the upland between Upper and Lower Red Lakes. This level is better correlated with an Upper Trail level and can be designated as such.

Continued erosion of the McIntosh spillway lowered lake elevations to around 1225 feet. Lake Koochiching at this time was a contiguous body of water from the McIntosh spillway to northeast of Upper Red Lake. The upland between Upper and Lower Red Lakes was connected by narrow beach ridges to the upland to the east. The western half of the south shore of Lower Red Lake was still blanketed by stagnant ice, preventing the formation of glacial beach features. This phase correlates with the Lower Trail phase (Hobbs 1983).

A continuous quite rapid drop in lake elevation to around 1205 feet occurred after this. This may represent the meltout of ice separating Lake Koochiching from Lake Climax and the formation of Glacial Lake Agassiz proper. After this a gradual lowering continued. Beaches up to an elevation of 1187 feet, and possibly as high as 1207 feet, were re-activated during the Late Holocene.

The origin of a narrow north-south trending ridge northwest of Lower Red Lake is puzzling. The main body of this ridge is 12 miles long with a lower, disconnected three-mile long segment to the north, at which point it ends. It appears to be composed of sand with some gravel. Both east and west sides slope steeply from an elevation of near 1265 feet at the crest, to slightly over 1200 feet at the base. It appears to have formed along the eastern portion of the flow zone of the St. Louis Sublobe north of the flow zone that penetrated the Lower Red Lake Basin and eventually spread into the Grand Rapids area. This more northern flow zone was stopped by the presence of active northeastern ice to the north shore of the Lower Red Lake basin. Whether this represents an initial fluvial deposit at the interface of St. Louis and West Itasca Sublobes, a moraine deposit by St. Louis Sublobe ice in a glacial lake environment, or some combination of both, is unclear.

CHRONOLOGY

The Late Wisconsin glacial chronology within the project area is, at best, poorly understood and can only be derived by correlation with tenuously dated events from outside the project area. The maximum extent of the St. Louis Sublobe has been given a date of approximately 12,000 B.P (Wright 1972). Since this sublobe has been considerably restructured in the previous discussion, this date may or may not be relevant. It is likely, however, that ice still covered the project area at this time. Drainage from Lake Climax into Lake Koochiching during the Gemmel Stage, as defined by Hobbs, is thought to have been occurring about 11,500 years B.P. (Clayton 1983). This is, perhaps, the only relatively firm date for the ice wastage sequence in the project area. Thus, at this time the entire project area would have been ice covered with a narrow segment of Glacial Lake Koochiching extending westward along the southern margin of Upper Red Lake, ending at a short segment of exposed beach on the northeast side of the Ponemah Highland. The end of Glacial Lake Koochiching as a separate entity is interpreted as the beginning of the Lockhart Phase of Lake Agassiz, with a suggested date of somewhat before 11,000 B.P. Consequently, the entire glacial wastage and glacial lake chronology within the project area would have taken place within a span of less than 500 years (perhaps as little as 300 years). The entire sequence of beaches spans a vertical distance of 175 feet and probably consists of at least 50 discretely identifiable stands of the lake level. Given that some of these may have been as short lived as one year, that still leaves major stages of Glacial Lake Koochiching measured in, at most, a few decades.

At this point in time, active glacial ice no longer existed within the project area. Substantial bodies of stagnant ice likely persisted for several hundred years in some areas. A relatively stable landscape, resembling that of today in form, probably existed by around 10,500 B.P.

HOLOCENE ENVIRONMENTS

The approximate 10,500 years since the establishment of the basic glacially derived landforms in the project area have by no means been static. While landform changes have been comparatively minor during the period, consisting of small-scale erosion and deposition along streams and lakeshores, other changes, involving climate, vegetation, and hydrology have been profound.

Climate and vegetation change are closely tied. In fact, most evidence for climatic changes are measured from changes in pollen spectra in dated sequences of sediments. Numerous pollen cores have been examined across northern and north central Minnesota. The most comprehensive study has recently been done at Elk Lake in Itasca State Park, approximately 50 miles south of the project area (Bradbury and Dean 1993). Continuous cores of varved sediments dating back beyond 10,000 years B.P. were analyzed. For most of this core actual annual layers could be counted. A number of parameters in addition to pollen were analyzed to provide multiple data sets relating to changing climate and vegetation. Since climate and vegetation zones in the region change primarily in an east-west direction rather than a north-south direction, the results of these studies should be directly applicable to the project area.

The following summary of climate and vegetation is extracted from the Elk Lake studies with some modification incorporating results of other regional palynological studies (cf Janssen 1967, McAndrews 1966, Webb et. al. 1983).

<u>12,000 to 11,600 B.P.</u> During this late glacial period, most of the project area was still ice covered. Vegetation was likely colonizing newly exposed landscapes to the south and areas of ablational glacial drift on stagnant ice bodies. Much of this likely consisted of a mix of tundra-like conditions and the beginnings of spruce forest and parkland. Climate was cold, but overall was warming rapidly.

<u>11,600 to 11,000 B.P.</u> This period marks the most rapid part of the change from Late Glacial to Early Postglacial conditions. Almost all of the glacial meltback and changing glacial lake configurations within the project area occurred during this period. Spruce forest and parkland was becoming established and remnants of tundra-like conditions were likely present. The climate was cold and dry, with average January temperatures about 5 degrees Celsius colder than present, and average July temperatures about 2.5 degrees Celsius colder than present. Annual precipitation was about 200mm (8 inches) less than at present. While most active ice masses were gone from the project area, substantial areas of buried stagnant ice still persisted, most notable in the uplands south of Lower Red Lake and as buried icebergs on the elevated glacial lakeshore bars and beaches of the Ponemah Peninsula.

<u>11,000 to 10,000 B.P.</u> By the beginning of this period upland vegetation in the project area was dominated by spruce forest and parkland. Landform features were likely similar to those of today, but lake levels in Upper and Lower Red Lakes may have been somewhat higher. Levels of smaller inland lakes were no doubt higher due to lack of

erosion of outlets. The climate was cool and moist with temperatures still somewhat cooler than those of today. Annual precipitation had increased to near present day levels. During the end of this period the spruce forests were in decline and were being gradually replaced by red and jack pine.

<u>10,000 to 8,500 B.P.</u> By the beginning of this period any remnants of buried glacial ice had melted. The climate was cool and moist, similar to the present, but slightly cooler. Red and jack pine forests dominated the regional vegetation. A slightly warmer and drier interval between 9,500 and 9,100 B.P. caused a short-term decline in pine and an increase in birch. There were likely periodic lake level declines in response to this drought. By 9,000 B.P. pine forests were again dominant in response to the return of cool, moist climate.

<u>8,500 to 7,800 B.P.</u> This period marks a major climatic shift toward a drier climatic regime. While average January temperatures decreased slightly, average July temperatures were increasing. Annual precipitation was undergoing an accelerated decrease. There was a marked reduction in pine forests, which were gradually being invaded by prairie from the west. Low lake levels were occurring with increasing frequency and for extended periods. Outflows from the Red Lake basins were significantly reduced, often with periods of no flow.

<u>7,800 to 6,750 B.P.</u> This substage is characterized by cold winters and warm summers, with average July temperatures about 2 degrees Celsius warmer than present. Average annual precipitation was about 100mm (4 inches) lower than present (about twice the reduction that occurred during the "dust bowl" days of the 1930s). These conditions were exacerbated by strong westerly winds. Prairie conditions spread eastward. Extreme low or no flows became the norm for the Red Lake basins where water levels often dropped as much as 30 feet below those of today. Thus, these lakes were frequently dry basins or seasonal marshes. Pine forests disappeared and were replaced with a mix of burr oak and grasslands commonly referred to as "oak savanna". Frequent fires helped maintain these conditions with isolated forest conditions persisting in lower areas and landmasses protected by the natural firebreaks provided by lakes. The Ponemah Point could normally be thought of as such an area; however, low water levels during much of this period likely negated this effect.

<u>6,750 to 6,250 B.P.</u> This period represents a brief interval of warmer and slightly wetter conditions. Lake levels similar to those prior to 7,800 B.P. were likely interspersed with periods of low water. Burr oak forest slightly increased and small amounts of other mesic species, such as ironwood, were present.

<u>6,250 to 5,400 B.P.</u> This period has a return to the drouthy conditions similar to the 7,800 to 6,750 B.P. interval.

<u>5,400 to 4,800 B.P.</u> A significant increase in moisture and an increase in summer temperatures characterize this substage. Average annual precipitation was about 50 mm (2 inches) greater, and July temperatures approximately 1 degree Celsius warmer than the

periods before or after (very similar to those during the “dust bowl” days of the 1930s). Less windy conditions prevailed and oak forests increased. The Red Lake basins were frequently filled enough to allow at least seasonal outflow.

4,800 to 3,800 B.P. This period, again, marked a return to the dry windy conditions similar to before 5,400 B.P. Lake levels were again lower with only intermittent seasonal outflow from the Red Lake basins.

3,800 to 3,000 B.P. The “Prairie Period” that had dominated the region since about 7,800 B.P. ended rather abruptly when a climatic shift to warm and wet conditions began. By 3,500 B.P. average annual precipitation had increased to approximately 100mm (4 inches) above today’s levels. Average July temperatures were approximately 1.5 degrees Celsius warmer than today and average January temperatures approximately 2.0 degrees Celsius warmer than today. A mixed hardwood forest dominated by birch, oak, and ironwood rapidly replaced the mix of oak savanna and prairie that had dominated the region. Lake levels returned to high levels and year-round stream flow became the norm. Peat deposits were developing in the large expanses of wet lowland. Water levels in the Red Lake basins were at higher levels than today, perhaps up to an initial elevation of around 1207 feet, but at least to an elevation of 1197 feet.

3,000 to 2,000 B.P. By 3,000 B.P. hardwood forests had reached their maximum. Erosion of the outlet had lowered the water elevation in the Red Lake basins to at least 1187 feet, dropping to around 1179 feet by the end of the period. By 2,700 B.P., white pine had returned to the region and was beginning to replace some of the hardwood forest. Temperatures were cooling slightly.

2,000 B.P. to Present. By 2,000 B.P., white pine had replaced much of the hardwood forests. Average January temperatures had decreased about 1 degree Celsius from their earlier maximum and average annual precipitation had decreased slightly. Lake levels continued to drop in the Red Lake Basins due to outlet erosion and by the end of the period were below those of the present dammed levels. The cooling trend continued to around 900 B.P. when white pine forests were at their peak, after which they experienced a marked reduction with a corresponding increase in red and jack pine. The environmental conditions of the present time had arrived, with only minor low magnitude climatic shifts and a few significant droughts since. More recent changes in land use and logging have altered the forest vegetation in some locations. Construction of a dam at the outlet of Lower Red Lake has stabilized water levels above those of previous times and changes.

PHYSIOGRAPHY AND LANDFORMS

Landforms within the project area vary greatly. While much of the project area has quite low relief, areas of high relief are present in the moranic uplands beginning about a mile south of the present shore of Lower Red Lake. This area, extending the entire east-west expanse of the project area, is a segment of the north slope of the Erskine/Big Stone moraine. Elevations range from a high of near 1350 feet to low areas of less than 1250 feet. This area is marked by a series of ice-block depression lakes, particularly in the northern portion, and a steep-sided linear east-west ridge and valley system. The landform is interrupted by a series of deeply incised north flowing stream channels at approximate six mile intervals. Both the east-west ridge and valley system and the north-south stream channels offer convenient travel routes, and intersections of these features with small to medium sized "inland" lakes offer sheltered stopping points.

The remainder of the project area has low relief with elevations typically less than 50 feet above Lower Red Lake. Low beach ridges offer linear travel corridors in the northeastern half of the project area (Figure 7).

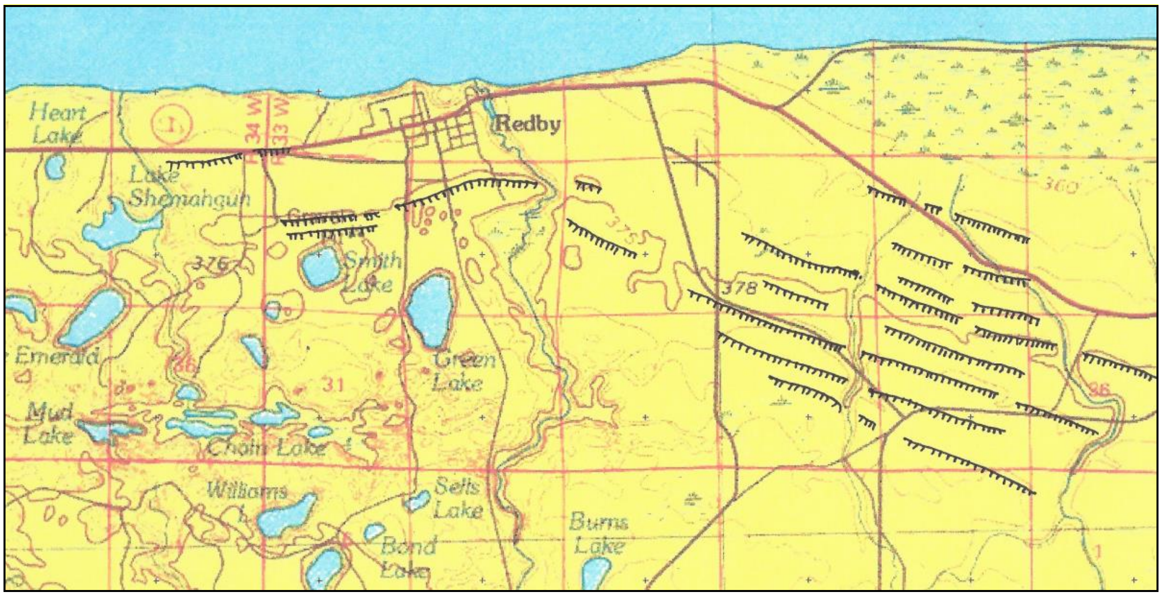

Figure 7. Major glacial beaches in the northeast half of the project area.

HYDROLOGY

The project area contains several small and medium sized lakes and segments of a number of small rivers and streams, and is located just south of Lower and Upper Red Lake, which are remnants of Glacial Lake Koochiching. At 284,262 surface acres this is the largest water body within the State of Minnesota. Although large in size, Upper and Lower Red Lake are both relatively shallow with maximum depths of approximately 35 feet in Lower Red Lake and 18 feet in Upper Red Lake. Water elevations are presently artificially maintained by a dam at the outlet of Lower Red Lake.

Most of the smaller lakes in the moranic landscape south of Lower Red Lake range from small ponds to lakes of approximately 300 acres, although most are less than about 160 acres in size.

The largest stream flowing through the project area is the Mud River, which bisects the project area. Other streams flow through Lake Shemahgun at the western end of the project area, and a series of three streams drain the eastern half of the project area. All flow northerly into Lower Red Lake.

The present drainage pattern within the project area has undergone several changes during the post-glacial period, and these changes are relevant to patterning of land use by early inhabitants of the area. These changes are the result of downward erosion of streambeds over time and have changed the early courses of several streams and lowered the water levels of several lakes within the project vicinity. The most prominent of these former stream channels are those connecting Lake Emerald to Lake Shemahgun and Squaw Smith to Elephant Ear Lake (Figure 8)

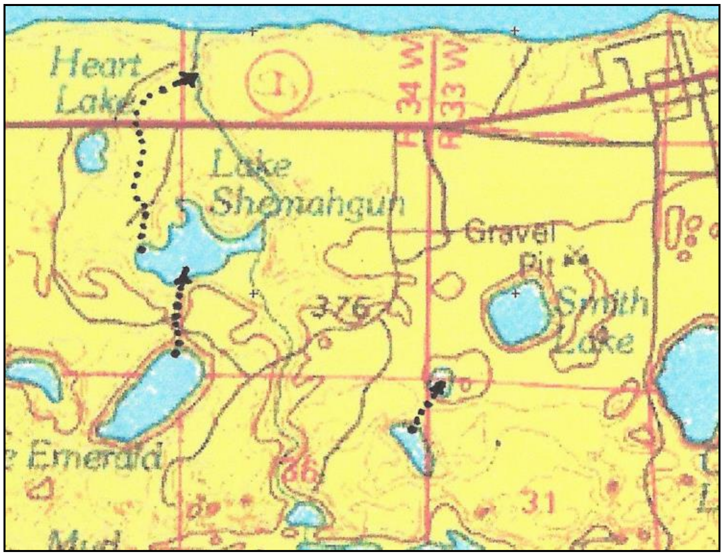

Figure 8. Former stream courses within the project area.

Drainage out of the project area is via the Red Lake River which exits the west end of Lower Red Lake and eventually connects with the Red River of the North. Flows in this river are controlled by a U.S. Army Corps of Engineers dam at the outlet. Portions of the river downstream from this dam flow in artificially dredged channels.

An unknown quantity of water flows to the north out of the Upper Red Lake basin as seepage through the Red Lake Peatland. Flows in this direction during the early Holocene may well have been greater during some periods, particularly when conditions of less peat development coincided with high water elevations in the Red Lakes basins. At times, actual surface streams may have existed, constituting a major outlet.

VEGETATION

Present vegetation within the project area is a mix of northern hardwoods, pine, fir, birch, oak, and aspen on the uplands with small areas of lowland conifers, ash elm, shrub swamp, and open sedge and heath on wetter lowlands.

As discussed previously, there have been large changes in vegetation during the past approximately 10,000 years in response to changing climatic conditions. Details of the exact composition and distribution of these vegetative communities remain unknown. The oldest available information on the approximate pattern of vegetative communities is from the compilation of data from the original public land survey records by Marschner. This shows general conditions at the time of survey, approximately the mid to late 1800s.

While this is often referred to as the “presettlement vegetation,” it should be remembered that the project area has been settled for millennia by Native peoples and has never been “settled” by Euro-American immigrants.

The project area south of Lower Red Lake shows primarily stands of mixed hardwood and pine with some jack pine barrens and openings and occasional aspen-birch with mixed conifers. There is a large area of hardwood forest shown south of the project area, which presumably would contain stands of maple.

FAUNA

Faunal resources within the project area are numerous and varied. Large Artiodactyls (hoofed mammals) include moose and white-tailed deer. Additional species that were present in the past include bison, Wapiti (elk), caribou, mule deer, and probably pronghorn. Numerous species of large, medium and small carnivores are present. Larger rodent species include beaver, porcupine and muskrat, with numerous smaller species. Snowshoe hares and eastern cottontail rabbits are present, and the white-tailed jackrabbit was likely present until quite recently.

Larger resident birds include the ruffed grouse, but migratory species, primarily waterfowl, are numerous.

Upper and Lower Red Lakes support sizeable fish populations, and the adjacent rivers, streams, and smaller lakes offer additional habitat for these and other aquatic fauna. While the species mix and relative abundance has likely varied through time with changing hydrologic conditions, these resources have probably always been plentiful.

CULTURAL RESOURCE OVERVIEW

Background research for the project consisted of a review of all pertinent literature relating to the past environments and cultural history of the project area.

CULTURE HISTORY OF THE RED LAKE REGION

Knowledge about the past can be organized in a number of ways. The Red Lake Anishinaabeg, for example, have oral traditions describing and interpreting their past. They began to occupy the Red Lake area sometime during the late 1700s and early 1800s, and oral tradition traces their migration around the north side of the Great Lakes into what is now northern Minnesota. Because this occupation is recent in terms of overall native occupation of the area, oral tradition does not provide a framework for occupations and events in the area prior to that time.

The general framework currently in use in Minnesota is simply a refinement of the traditional divisions of Minnesota pre-contact history, generally divided into Paleo-Indian, Archaic, Woodland, Mississippian, and Plains village (Anfinson 2000). The State Historic Preservation Office has defined a number of primary State Historic Contexts and broken these down into SHPO Archaeological Research Regions, emphasizing an integration of management and research (Anfinson 1990, 2000).

The State Historic Contexts that are applicable to the project area are discussed below.

<u>Early Prehistoric Period (ca. 11,500 B.P. – 3,000 B.P.)</u>

The Paleo-Indian Tradition (ca. 11,500 B.P. – 8,000 B.P.)

The Paleo-Indian represents the first occupation by humans of what is now the Minnesota area. Landforms in the project area would have been available for occupation during the last waning of the Wisconsin glaciation, as discussed elsewhere in this document. Sites of this era, particularly the Early Paleo-Indian, are extremely rare anywhere in Minnesota, however, and are not known from the project area or the immediately surrounding area. There are some isolated finds of spear points that may be evidence of Late Paleo-Indian use of this area.

Several Paleo-Indian sites have been identified in the Headwaters Reservoirs area to the southeast of the project area, at Winnibigoshish, Leech, Cass, and Round Lakes. Only one of these sites has seen any excavation—the Williams Narrows site (21-IC-23) on the east side of Winnibigoshish—and no Paleo materials were found in good context (Johnson et. al. 1977; Caine and Goltz, personal communication).

Only two Paleo-Indian sites in Minnesota have good radiometric dating. The Bradbury Brook site, located south of Mille Lacs Lake, is a siltstone quarry site radiometrically dated to approximately 9,000 years ago (Malik and Bakken 1993). A similar radiometric date is available for a burial, “Browns Valley Man,” from Big Stone County in western Minnesota.

In northern Minnesota, Paleo-Indian materials have also been recovered at the Pollard, Cedar Creek, and Greenbush sites (Stoltman 1971; Peterson 1973; Allan 1993.

The earliest Paleo-Indian sites are characterized by a variety of lanceolate, fluted points, such as Clovis and Folsom while the late Paleo-Indian points are unfluted. In general, projectile points are characterized by excellent craftsmanship and feature long, evenly spaced, parallel flaking. Paleo-Indian tool kits also include scrapers, knives, drills and "gravers" which are tools for working bone or wood. Although Paleo-Indian tools are characterized by a great deal of homogeneity over large areas, they do show an increasing regionalization of both tool styles and adaptive strategies (Benchley et al. 1997).

Although there is little direct evidence in Minnesota for the social organization and subsistence activities of Paleo-Indian peoples, it is likely that groups were small and highly mobile. The earliest Paleo-Indian probably hunted large game, including a number of now-extinct animals such as mammoth, mastodon, and giant bison. In northern Minnesota, it is assumed that caribou may have been an important resource.

Recorded site types include kill sites, processing locations, lithic quarries, and camps.

The Paleo-Indian Tradition is divided into both temporal and geographic subdivisions or complexes. All of these have been defined from outside the region, primarily from the Plains. Those potentially pertinent to the project area include Clovis (ca. 9500-900 B.C.), Folsom (ca. 9000-8000 B.C.), and Plano (8500-5500 B.C.). The latter encompasses a number of geographic variants (Grigg et al 1996).

The earliest Paleo-Indian complex, the Clovis, has been identified from the Northeastern Plains subarea, to the immediate west of the project area. According to a recent overview by Grigg et al (1996), Clovis artifacts occur at and above the highest levels and maximum extent of glacial Lake Agassiz.

Folsom points are reported from the Northeastern Plains subarea to the west as well as central Minnesota, to the south of the project area (Grigg at al 1996).

The most commonly reported artifacts are from the Late Paleo-Indian Plano complexes. Points such as Hell Gap-Agate Basin have been reported from the Red River Valley region immediately to the west (E. Johnson 1988; Michlovic 1988). The Cody complex, identified by Alberta, Scottsbluff and Eden points as well as Cody knives, has been documented in the Red River valley (Larson et al. 1986) and in numerous locations in central and southern Minnesota .

Complexes with parallel-flaked points, such as Browns Valley, are reported at various locations throughout the plains and woodlands.

The Caribou Lake Complex, which is late in time for the Paleo-Indian Tradition (approximately 5500 to 4500 B.C.) contains lanceolate points and distinctive percussion flaked trihedral adzes (Buchner 1979, 1981). Although not identified yet in the region of the project area, Caribou Lake is pertinent to the project area because it represents a culture with plains-boreal forest adaptations with subsistence based primarily on bison (Buchner 1981). According to investigations along the Assiniboine and Winnipeg rivers, sites are frequently located in areas that are below present day lake levels. It appears that water levels were low during this time due to drought.

The major problem involved with locating Paleo-Indian sites involves identifying intact remnants of the landscape from the Holocene and determining if they are locations that would have been utilized by human groups. During the time of the Paleo-Indian Tradition the project area was subject to major hydrological and climatic changes, summarized previously. A number of studies have examined the correlation of glacial lake stages with temporal cultural changes in the Paleo-Indian Tradition (Pettipas and Buchner 1983). Within the project area, the main concern is to identify remnant Holocene landscapes so that they can be examined for evidence of Paleo-Indian use.

The Archaic Tradition (ca 8,000 B.P. – 3,000 B.P.)

By the end of the Paleo-Indian occupation, the climate in Minnesota had warmed considerably and a variety of new environmental niches came into being. During the Archaic, regional differences in subsistence activities and accompanying technology became more pronounced, reflecting the varied environmental resources available.

Notched or stemmed projectile points replaced the lanceolate points of the Paleo-Indian. New lithic technologies were developed, some of which could accommodate the poorer grade materials locally available. In general, few non-local lithic materials are present, suggesting smaller territories and/or limited trade networks. Stone tools made by pecking and grinding, such as axes, celts, and mauls, were added to the tool kit.

The use of copper is often considered a hallmark of the Archaic in the Upper Great Lakes region, particularly Minnesota and Wisconsin. Deposits in east central Minnesota, Isle Royale, and the Keeweenaw Peninsula were exploited and widely traded. Most copper was fabricated by cold hammering and made into utilitarian items such as projectile points, knives, and awls.

A discussion of the Archaic is severely hampered by imprecise terminology and a lack of the most basic data, not only for the Red Lake area, but for the whole surrounding region. The term "Archaic" is used to mean a time period, a culture, a tradition, or even a stage of development. In addition, the Archaic has been divided into sometimes conflicting and overlapping regional manifestations.

Stoltman, in proposing a new temporal model for eastern prehistory, advocates the separation of periods from traditions or cultures. He defines the Transition I period as 8,000 B.C. to 6,000 B.C. and the Meso-Indian Era as from 6,000 B.C. to 3,000 B.C.

(Stoltman 1978). For Wisconsin, Stoltman divides the Archaic into Early (6,500-3000 B.C.), Middle (3,000-1200 B.C.), and Late 1,200-800/1 B.C.) (Stoltman 1986).

In general, Stoltman sees the period from 6500 to 5500 B.C. as a time of gradual transition from the Paleo to the Archaic Tradition. At the other end of the Archaic, he sees the period from 500 B.C. to 1 A.D. as a period of gradual introduction of pottery which would have been introduced to all the major cultures by 300 A.D. at the latest (in Wisconsin) (Stoltman 1986:211). By "tradition" Stoltman means specific descriptive characteristics, regardless of the age of the culture. He identifies three basic archaeological criteria that define the Archaic Tradition (Stoltman 1986:207-209):

1. subsistence based upon generalized hunting of diverse small game species and collecting of wild plants and plant products (no agriculture)
2. absence of pottery containers
3. absence of burial mounds (burial on knolls or flat cemeteries without earthen structures)

Although the three above criteria provide a minimal definition of the Archaic as a Tradition, some distinctive artifact types are typically associated with the Archaic. Because the minimal criteria for the Archaic involve the absence of certain traits, identifying any particular site as part of the Archaic Tradition may be difficult due to incomplete data or lack of understanding of the patterning and intermeshing of a group of sites. Since both the earlier Paleo-Indian Tradition as well as the Archaic Tradition lack agriculture and both are based on hunting-gathering, a further differentiation between the hunting-gathering lifeway of Paleo-Indian and Archaic peoples is required. As previously noted, it is assumed that Paleo-Indian were primarily hunters of big game such as mammoth, mastodon, caribou, and bison. Making this subsistence distinction clear between the Paleo and the Archaic Traditions allows us to consider the possibility that Paleo and Archaic lifeways could be overlapping in time. It also raises the question of whether Plano peoples (Late Paleo) in the woodlands may have had a significantly different subsistence base, not based on large game.

Mason, for example, calls the Late Paleo or Early Archaic time period the "Interregnum" and supports the notion that "two kinds of cultures, or, at least, projectile-point style traditions" (plano and notched) seem to be present in the great Lakes between 8,000 B.C. and 3,500 B.C. (Mason 1981:111).

The Shield Archaic, a boreal forest adaptation, focuses on caribou hunting and fishing. The Lake Forest Archaic is an adaptation to the mixed coniferous-deciduous forest. The Prairie Archaic is focused on bison hunting, and the Eastern Archaic shows eastern riverine influences.

The first three of these Archaic contexts have direct relevance to the Red Lake research area.

Shield Archaic

The Shield Archaic was first defined by Wright as a "distinctive Archaic population that occupied the major portion of the Canadian Shield-Boreal Forest region of Canada" (Wright 1972:88). Wright sees the Shield Archaic as evolving directly from a Late Paleo-Indian culture base. Mason supports this position and characterizes the Shield Archaic as "suggestive of a deteriorated Late Paleo-Indian or Plano cultural pattern extended into and forced to come to terms with impoverished prospects" (Mason 1981:136).

Projectile points of several styles are common in the Shield Archaic including straight or concave-based lanceolate points derived from the earlier Plano, as well as notched, corner-removed, and stemmed points. End and side-scrapers are also common, whereas ground stone tools—typical expressions of the Archaic elsewhere—are generally absent except for the distinctive trihedral axe or adze. Ovoid cores trimmed to make "heavy duty planes" and flat-based ovoid bifaces are also common.

Some copper implements occur, but both Wright and Mason assert that they were obtained from adjacent groups (Wright 1972, 1979; Mason 1981). More recent work, however, indicates that copper manufacture did take place within the "shield" area. For example, in addition to a classic Old Copper type cremation burial, the LM-8 site, located in the Caribou Lake area, yielded finished copper artifacts, waste material, and a nugget of raw copper, which indicates that tool manufacture took place locally (Buchner 1979b:91).

The Renshaw site, which is located on the North Shore of Lake Superior, appears to be a copper manufacturing site (Arthurs 1979, 1989). In addition, the South Fowl Lake site, east of the Red Lake area, has thousands of copper implements, indicating that the presence or absence of copper may not be an important distinction between Archaic cultures. Ross suggests that the amount of copper on Shield sites has a direct relationship to the distance from copper sources (Bill Ross, personal communication).

The Shield Archaic is a hunting based culture, with sites typically at the narrows of lakes and rivers. Caribou and fish constituted the primary staples, with moose bear, hare, porcupine, muskrat, and beaver as seasonally important (Wright 1972; Mason 1981).

Some researchers have strongly disputed the entire concept of the Shield Archaic Tradition, maintaining that it "does not…constitute a tradition, since the components described do not share a trait or cluster of traits which persist through time" (Buchner 1979a, 1979b). Buchner sees the artifacts identified with the Shield Archaic as far too heterogeneous to represent an identifiable cultural group (Buchner 1979b:110). Outside of Minnesota, two complexes generally considered Late Paleo-Indian and/or Shield Archaic—the Caribou Lake and Lakehead complexes of southeastern Manitoba and northwestern Ontario—are directly pertinent to an understanding of the Late Paleo/Archaic in the Red Lake area.

The Caribou Lake Complex has been defined based on more than 50 sites centered in the Winnipeg area, some 250 miles north of Red Lake (Wheeler 1978; Steinbring and Buchner 1980; Buchner 1979, 1981, 1984). This complex is characterized by crudely made lanceolate projectile points with Agate Basin and Scottsbluff-like forms (but see Buchner 1979:75), a variety of bifaces, including both well-made forms with geometric shapes and rough forms frequently made on massive flakes, and trihedral adzes.

Buchner defines three core artifact traits for the Complex: lanceolate projectile points, often with incipient shoulders on one or both edges, giving a stemmed appearance; large bifaces, particularly an asymmetrical semi-lunate form, and the trihedral adze (Buchner 1979:75). Primarily locally available materials were utilized. Woodworking is suggested by heavy carbon discoloration of many of the adzes, possibly caused by use in the construction of dugout canoes.

The Caribou Lake Complex is focused around the Caribou and Manigotagan Lakes and the Lower Winnipeg River, an area which has been dominated by coniferous vegetation since the earliest postglacial. Buchner suggests that the Caribou Lake complex peoples were adapted to the Boreal Forest and did not include other ecological zones within their season round (Buchner 1979:76) (but see below). People of the Caribou Lake complex appear to have been organized in small, highly mobile groups which relied primarily on moose hunting and fishing near riverine and lacustrine environments during the summer and trapping and hunting inland during the winter (Buchner 1979; Steinbring and Buchner 1980).

The most fully excavated site from the Complex is the Sinnock site, located along the Winnipeg River (Buchner 1981; Pettipas and Buchner 1983). Based on the clustering of lithic artifacts, this site contained an area where bison were killed and butchered, a hide processing area, and an area further away from the river used for camping, food preparation, and tool maintenance. The site dates from approximately 7050 B.P. (Buchner 1984).

The location of this site, at the coniferous forest-oak savanna edge is a pattern that is repeated often in the Caribou Lake Complex. Pettipas, Simpson, and Buchner derive the Complex from the southern Manitoba Sister's Hill manifestation (Pettipas 1982; Simpson 1982; Pettipas and Buchner 1983). As Harrison points out, however, Caribou Lake shows strong similarities to the late Paleo manifestations of the western Lake Superior basin such as the Reservoir Lakes Complex and the Lakehead Complex (Harrison 1995:18).

The Lake head Complex, which displays core traits similar to the Caribou Lake Complex, is focused along the northwestern shore of Lake Superior. The relationship between the two is unknown. Although it has been suggested that the Caribou Lake complex is a westward extension of the Lakehead Complex (Steinbring and Buchner 1980), recent comparative analyses of the two tool kits indicate that they may not be culturally related (Arnold 1985, as reported by Haywood 1989:14). If this is the case, it is possible that Caribou Lake evolves out of the plains-oriented Three sisters Complex.

Two large Lakehead Complex sites, the Brohm site and the Cummins site, show intensive utilization of taconite from the Gunflint formation (MacNeish 1952; Dawson 1982, 1983; Julig 1984, 1988). The earliest occupation at the Cummins site was apparently coterminous with the Minong beach, or approximately 9,500 B.P. The Cummins site also include a cremation burial, dated to 8480+-390 B.P., one of the few radiometric dates available for these complexes.

The Lakehead Complex appears to extend into the Knife Lake area of present Quetico Park, west of Thunder Bay. Artifacts in this area are made primarily of local Knife Lake siltstone, but with some utilization of jasper taconite (Haywood 1989:14). Based on intensive survey in the Lakehead region, a settlement pattern has been defined which includes sites on fossil beaches close to taconite outcrops and inland sites near exposed bedrock, indicating a major focus on lithic procurement (Harrison 1995:21). Other small campsites appear to be lithic workshops where materials from the quarries were further worked. Many of these sites show utilization during both the late Paleo and the Archaic. Harrison notes that materials from these quarries were often formed into blanks that were transported over long distances. One cache found in the Reservoir Lakes area of northeastern Minnesota consisted of blanks made from striated chert quarried near the Kakabeka Falls in Ontario (Harrison 1995:21). Two caches uncovered at the Crane site near Thunder Bay yielded 126 taconite bifaces which Bill Ross suggests reflects specialized knapping for purposes of trade (Ross, personal communication).

Plano points have been found along the Rainy River, intermediate to the Caribou Lakes and Lakehead Complexes (Reid 1980; Haywood 1989). At the Sanmoen site, points similar to the Agate Basin type, a complete biface and the tip of a biface have been recovered (Reid 1980). These artifacts were manufactured from local materials, indicating a familiarity with the resources of the area. Reid suggests that artifacts such as these "establish a fairly firm connection between the Lakehead Complex at the head of Lake Superior and the Plano sites reported for southeastern Manitoba" (Reid 1980:35).

The Rush Bay Road Site, located west of Kenora, yielded debitage and a few tools, including a large lanceolate point of quartzite. This occupation has been dated at 8,450+-500 B.P. The Renshaw Site, located on the west shore of Lake Superior near Thunder Bay, is an Archaic period habitation and copper manufacturing site. Materials recovered included lithic debitage, cores, finished artifacts, faunal material and native copper, representing all stages of copper refining. Pits and hearth features were also present. The patterning of features and artifacts, as well as an arc of post molds suggests the presence of temporary structures (Arthurs 1979:2).

The faunal remains show utilization of fish, including sturgeon, and small game. Artifacts include end scrapers, utilized flakes, large chopping tools, oval and pointed bifaces, a conical copper harpoon, unilaterally barbed and leaf-shaped spearheads, and a triple-grooved net sinker. Only one projectile point was recovered from the site: a large, crude side-notched point (Arthurs 1979:5). Inhabitants made extensive use of locally available materials, mainly Gunflint Formation taconites and cherts (Arthurs 1979, 1989).

Some evidence of ground stone use is seen in two adze bit fragments and a broken piece of ground stone. At least one of the adze bits appears to be from a trihedral adze.

Copper manufacturing on the site shows the complete range from raw materials to finished artifacts. Arthurs suggests that the frequency of modified to unmodified copper fragments indicates that copper was being brought to the site in a partly refined form. The small size of the pieces suggests that drift or float copper was used, rather than copper mined from a primary source (Arthurs 1979:9). Interestingly, many of the copper forms cannot be easily classified by using the “Old Copper” types defined by Wittry for Wisconsin. In particular, the unilaterally barbed harpoons or spears have no parallels in the Wittry typology (Arthurs 1979, 1989).

Four dates are available for Renshaw: three from organic materials removed from contact with copper artifacts, and one charcoal date from a hearth. The hearth date is 3610-1640 B.P., corrected (Arthurs 1979). The three copper-associated dates cluster tightly between 4420 and 4630+-50/60 B.P. (Ross, Superior Basin conference).

For both the Lakehead and Reservoir Complexes, caribou were probably an important element of the diet during the late Paleo, with bison, moose, and deer becoming more common during the warming of the Altithermal, and evidence of exploitation of the fisheries by the Archaic.

In the west, the Caribou Lake Complex is succeeded by the Oxbow, McKean, and Larter/Pelican Lake Phases (Wheeler 1978; Buchner 1979). There appears to be something of a gap between sites which have been defined as Caribou Lake and these later Archaic manifestations (Buchner 1979b). Consequently, the developmental connection between the Late Paleo and the Archaic in this area is unknown.

The Oxbow Complex has been defined based mainly on materials west of the Caribou Lakes region. Buchner notes that the nature of Oxbow assemblages in the eastern woodlands is likely to differ slightly from those defined for the western grasslands (Buchner 1979:81).

The point type diagnostic of Oxbow has definite “ears”, a concave base, strong side-notches, and the occurrence or the greatest width across the base (Buchner 1979b; Dyck 1977). Because these points were frequently reworked, a wide size range is present. The Oxbow assemblage includes the diagnostic point, ovate preforms and knives, discoidal and lanceolate bifaces, small end-scrapers, perforators and drills, unifacial flake knives or side-scrapers, crude choppers, polyhedral cores, and hammerstones and anvil stones. Bone and antler awls, spatulate bone segments, longbone scrapers or beamers, bone flaking tools, and drilled clam shell fragments are also present. Copper artifacts have been found in association with Oxbow points. The Oxbow assemblage and the size and nature of Oxbow sites indicate a nomadic hunting/gathering population with a primary reliance on bison. Buchner sees the other faunal materials associated with the complex as supplemental to a predominantly bison diet, rather than as evidence of a diffuse, unspecialized economy (Buchner 1979b).

The presence of Oxbow points within the Boreal forest, however, raises questions about the nature of the subsistence base and seasonal round. Buchner suggests that Oxbow peoples, as well as later Archaic bison hunting populations may have used both the forest edge ecotone as well as the Boreal forest itself during unsettled climatic times, during which both the movements and availability of bison were affected (Buchner 1979b:87-88).

Oxbow dates from the Whitemouth Falls Site on the Winnipeg River range from 2675 B.C.+-150 to 2910 B.C.+- 150 (Buchner 1979b). Later dates have been obtained from the Harder site, the Moon Lake Site, the Carruthers Site, and the Cherry Point Site, all in Saskatchewan and southwestern Manitoba. These dates, which range from 2150 to 100 B.C. would seem to indicate a particularly long survival of Oxbow. The association of Archaic complexes with copper was previously noted for the Lakehead area. Copper has also been found in a number of locations in the area of the Caribou Lake Complex. The LM-8 Site has technologically Archaic copper artifacts in association with Raddatz points in stratigraphic context between earlier Oxbow Phase materials and a later McKean Phase occupation. This occupation, which includes a cremation burial, appears to be “classic” Old Copper (which see, below). Dates on this occupation at LM-8 are 1920 B.C.+-190 and 1710+-75, which is consistent with Old Copper in Wisconsin (Buchner 1979b).

Buchner feels that this is strong evidence for the occupation of east central Manitoba by Old copper peoples, not simply groups who acquired copper artifacts by means of trade. He feels, however, that this expansion of Old Copper peoples was neither very extensive nor long-lived, but that it could help explain the presence of copper in some of the temporally and geographically overlapping Oxbow occupations (Buchner 1979b:91-92).

The Oxbow Phase is succeeded by the McKean Phase in this area. The McKean complex was originally defined based on sites in northern Wyoming and adjacent states. Materials recovered from actual excavation, as opposed to surface collection, are rare in the areas further east, leading to problems in delineating the complex for these areas. Buchner suggests that McKean as defined for the high plains is not directly referable to areas further east (Buchner 1979b:94). Buchner describes the McKean assemblage for Manitoba as consisting of concave based stemmed points, small end-scrapers, ovoid blanks/bifaces, crude chipping tools, polyhedral cores, utilized flakes, and hammerstones. Bone scrapers and beamers are also present (Buchner 1979b:94).

Dates for eastern McKean cluster between 1240-1780 B.C., with two dates at Cherry Point (880 and 910 B.C.) being somewhat more recent (Buchner 1979b:95). McKean Phase sites in the northern grasslands show primary reliance on bison, supplemented by other species (Buchner 1979b:96-97). Syms associates cervid and beaver with the McKean Phase at Cemetery Point (Syms 1970), but whether McKean occupations in the Boreal Forest represent sporadic seasonal usage by primarily Plains-oriented peoples or the beginning of a pattern of year-round occupation is unknown.

The succeeding Larter/Pelican Lake Phase assemblage is characterized by concave-based barbed/tanged points, unnotched points or blanks, a wide variety of end and side-scrapers, a variety of biface types, side-notched and stemmed bifaces or knives, drills, gravers, chisels, pebble and three-quarter grooved hammerstones, and bone scrapers.

The subsistence base seems to have focused on a seasonal round at the grassland-forest edge, primarily focused around bison, but utilizing a wide variety of other resources including beaver, moose, muskrat, and lake sturgeon. Dates at the Bjorklund Site in southeastern Manitoba range from 775 B.C. to 1175 B.C. Once again, dates at Cherry Point are considerably later than would be expected, from A.D. 910 to 935 (Buchner 1979b:101).

Overall, the picture of adaptation from south-central Manitoba to Lake Superior begins with specialized big-game hunting focused first, on the Boreal Forest of the immediate post-glacial and then, on the grasslands of the warming Archaic. In the west, Late Paleo Caribou Lake Complex hunting cultures evolve into specialized Archaic bison-hunters exploiting both the grasslands and the forest edge. Further to the east, the Lakehead Complex gives way to Boreal and Lake-Forest adaptations that are characterized by diffuse procurement patterns organized into a seasonal round and exploiting a variety of resources. These patterns appear to persist in the whole area into the following ceramic period.

Artifacts which could fit within the characteristics of the Shield Archaic are not uncommon within the broader research area. The Redepenning collection from the reservoir Lakes area northwest of Duluth includes not only Plano projectile point styles but also choppers, bifaces, gouges, and other tools which could fall within the Shield tool definitions (Steinbring 1974:65; Mulholland and Dahl 1988:44; Harrison at al. 1995).

The only excavated site among the numerous Reservoir Lakes sites is the Fish Lake Site (Steinbring and Whelan 1971). This site contains two spatially separated components: Plano and Archaic. The Archaic component is interpreted as late in the Archaic and is seen as similar to Riverside in Michigan, McCollum in Ontario, and Petaga Point in Minnesota (Steinbring 1974:65). There are no dates for either McCollum or Petaga Point, and the McCollum Materials probably represent a burial cache. Riverside, a Red Ochre site, has produced six radiocarbon dates that cluster between 1410+-140 B.C. and A.D. 1+-130. Old Copper artifacts were also found at Riverside and may be associated with a date of 1090+-300 B.C. (Hruska 1967).

Steinbring's "Reservoir Lakes Phase" of the Archaic shares many similarities with what Wright has defined as the Shield Archaic: massive choppers, bifaces, crescent blades, adzes, picks and retouched flakes, and an absence of polished or ground stone tools. In addition, however, it includes the presence of Plano point styles (Steinbring 1974:65-66). More recent analyses by Christina Harrison have provided more detail on the technology and have identified point types similar to agate Basin and Hell Gap types. The use of siltstone and jasper taconite is characteristic of these artifacts (Harrison 1995). Steinbring's comments on the Reservoir Lake Collection in general indicates that he sees apparent association between the Plano style and the “eastern Archaic” on these sites—an observation which fits with mason’s arguments (Steinbring 1974:65). Many archaeologists see the Reservoir Lakes as primarily a Paleo manifestation, however (Superior Basin Workshops 1992, 1993, personal communications). The artifacts from South Fowl Lake, for example, were all recovered from the surface and probably mixed Plano and Archaic components.

Analysis by Harrison of the extensive Redepenning collection raises questions about assuming the contemporaneity for all the materials from Reservoir Lakes. Harrison points out that the lithic assemblages presently known from the Reservoir Lakes “combine the evidence of several distinct early prehistoric cultural manifestations and they should be considered as part of a ‘complex’ rather than a ‘phase’” (Harrison 1995:12).

The Houska Point Site, located near the outlet of the Rainy River from Rainy Lake, is one of the few stratified sites which appears to clearly contain at least two Archaic components. Unfortunately, the site has never been fully reported, but Steinbring’s description has lanceolate and stemmed points in association. Above this level, copper tools occur with scrapers, side-notched points and bifaces. This assemblage is succeeded by Laurel and Blackduck ceramics in association with copper (Steinbring 1974:70-71). Review of the artifacts and field notes from the Houska Point Site, which are curated at the Superior National Forest Cultural Resource Laboratory, shows discrepancies between the original data and the above view of the site as reported in the literature (Gordon Peters, Bill Ross, personal communications). Until the material is reanalyzed and reported in full, the site cannot contribute clearly to this debate.

The Misiano Site, a multicomponent riverine site in the northeastern part of the state contains both Archaic and Paleo-Indian occupations as well as a Late Woodland component. The site shows evidence of the procurement and use of locally available, but poor quality, siltstone, whereas better quality materials from elsewhere were only used, maintained, and occasionally discarded at the site (LeVasseur at al. 1993). This site also contains an oval rock configuration with an interior hearth, which may represent a structural feature such as a dwelling. This feature may be associated with the Paleo-Indian occupation. No dates are available.

Also in northeastern Minnesota, the Bearskin Point site, excavated by Gordon Peters, has yielded a Holcombe-like point, a regional fluted point variant common in Wisconsin. The only date from this site, 6300 B.P. is, however, not consistent with the expected Early Paleo Tradition designation.

Excavations at site 21-SL-165, an Archaic site located on the Birch River in the Border Lakes region, showed distinct internal patterning. Lithic debitage and tools for scraping, cutting and perforating were associated with a series of fire basins. Elsewhere on the site, dense scatters of debitage as well as some finished scraping and cutting tools were uncovered. These work areas showed no evidence of fire features (Harrison 1985:68-70). The debitage on this site is primarily siltstone, but the lack of flakes characteristic of the initial reduction process indicates that siltstone was brought to the site in the form of blanks. Quartz is the second most common lithic material, and the quartz debitage shows the entire reduction sequence, indicating that the material was probably locally available. Jasper taconite is the third most common material. Although some evidence of the initial reduction process is present, overall the flake assemblage indicates that most of the initial reduction probably took place closer to the source. Gunflint Silica and Hudson Bay Lowland Chert also occur, and the preference for these higher grade materials is shown in the high percentage of finished artifacts and modified flakes made of them (Harrison 1985:57-60).

The Greenbush Borrow Pit Site, located west of Red Lake, on the Campbell beach ridge of Glacial Lake Agassiz, appears to have been a stone workshop (Peterson 1973). The site contained a large proportion of stone debitage along with fragmentary projectile points and a small number of cutting and scraping tools. Although the points were fragmentary, they show similarities to Plano types and the McKean complex of the northern Plains. Complete points in private collections from the general area include lanceolate forms and large stemmed points with straight bases. Peterson notes that there are few similarities between the Greenbush materials and those from either the Itasca Bison Site of the Petaga Point Site, but more similarities with the Reservoir Lakes materials and some of those from the Snake River area (Peterson 1973:44-45). The artifact bearing level at Greenbush was directly above the beach gravels, which had been deposited by about 9000 B.P. Based on the geological situation and typological comparisons, Peterson suggests a date of between 7000 and 3000 B.P. for the site (Peterson 1973: 1, 49).

The Plummer Site, located east of the Greenbush site close to the Rainy River in northwestern Koochiching County, also contains a variety of lanceolate projectile points. The Plummer assemblage consists of surface finds of large, well made Agate Basin style points. Siltstone is the primary raw material present. This assemblage bears striking resemblance to that from the Reservoir Lakes Complex to the east (Les Peterson, personal communication).

Dobbs cites only two specific Minnesota sites as part of the Shield context: South Fowl Lake, which is situated on the Minnesota-Ontario border, and the Williams Narrows Site, which is located on the east side of Lake Winnibigoshish in the Mississippi Headwaters (Dobbs n.d.:85). He notes that although other Archaic sites have been reported for northern Minnesota, it is “unclear at the present time which of these should be assigned to the Shield archaic” (Dobbs n.d.:86).

The South Fowl Lake Site yielded copper artifacts, Plano points, and choppers, bifaces and end-scrapers (Steinbring 1970, 1974). A recent date on organic material preserved by copper in the Anderson Collection from South Fowl Lake places the material at 5940+-90 (Superior Basin Conference). The South Fowl Lake materials are all from surface collections, however, and undoubtedly represent mixed Plano and Archaic components.

At the Williams Narrows Site, excavations by the Minnesota State Archaeologist's Office and the Chippewa National Forest have supplemented data from the Karu Collection and from limited tests done by the University of Minnesota in the 1970s (Caine 1990; Johnson, Harrison and Schaaf 1977). Plano, Eden, Hell Gap, and Lamoka-like points, as well as an eastern fluted point are present, along with scrapers, choppers, numerous utilized flakes, and copper artifacts including socketed and conical points and crescent knives.

Although the Williams Narrows site is stratified in the sense that later Woodland components appear above the earlier aceramic components (except where modern disturbance occurs—the site is within a resort complex), no features have been encountered and the relationships among the fluted, Plano, and notched point types as well as the copper artifacts is far from clear (Caine 1990).

Lake-Forest Archaic

The Lake-Forest Archaic represents an adaptation to the mixed deciduous-coniferous forest of the Lake-Forest biome. The artifact assemblage differs from that of the Shield Archaic with the presence of polished and ground stone tools and implements made of copper. Although copper occurs in the Shield Archaic, it is not central to the definition and is seen by many archaeologists as either an import from, or a peripheral influence of, the Lake-Forest Archaic. Since thousands of copper implements are known from South Fowl Lake, and copper manufacture obviously took place at some Shield sites (see above discussion), the presence of copper may not be a very useful distinction between Shield and Lake-Forest manifestations.

Perhaps of more importance is the fact that the Lake-Forest biome appeared to encourage its resident peoples to develop a less specialized, less focal, considerably more diffuse subsistence pattern. Dobbs suggests the possible identification of the Itasca Bison Kill Site, the Petaga Point Site, and some of the central Minnesota Knife Lake sites as Lake-Forest Archaic (Dobbs n.d.:89-90). As previously noted under the discussion of the Paleo-Indian Tradition, the Itasca Bison Kill Site fits chronologically into the Paleo-Indian, although it may have both Archaic and Woodland components as well. Furthermore, the Knife Lake sites, some of the Snake River Archaic sites, and the Bradbury Brook Site, with their large choppers, preforms, and utilized flakes accompanied by Late Paleo points look not unlike much of the Reservoir Lakes and Greenbush site material, all of which may be transitional Late Paleo-Early Archaic.

At the Petaga Point Site, located not far from Bradbury Brook on Lake Ogechie just west of Mille Lacs Lake, an Archaic component was defined, primarily on typological grounds (Bleed 1969) The assemblage consists of large stemmed points, side-notched, concave-based points, eared points, scrapers, knives, choppers, hammerstones, and copper tools, including socketed and conical points, awls, and an ulu knife (Bleed 1969).

The Knife Lake sites, located directly southeast of Mille Lacs and only about 20 miles due east of the Bradbury Brook Site, and the Snake River sites, located 20 miles due east of Mille Lacs, yielded numerous large crude chopping tools, knives and scrapers, as well as evidence of Late Paleo occupations. Most of these materials are from surface collected contexts, however, and no radiometric dating is available.

The Snake River Vach collections contain a Scottsbluff point, a Browns Valley point, and a Plano parallel-flaked point. Folsom points are in another local collection (Caine 1974). Materials which appear to be Archaic include side-notched and stemmed projectile point types and copper artifacts, including rolled conical points, awls, flat stemmed points, fishtail and turkey-tail points, crescents or ulus, knives, needles, and drills. Few heavy copper implements are present, but include a socket spud and a small wedge. Two beads are also in local collections (Caine 1973, 1974). In addition to these more diagnostic materials, the collections also contain numerous large celts or adzes and choppers. Some of the latter have small notches at midsection (Caine 1969).

The Knife Lake Prehistoric District contains a number of sites with apparent Archaic affiliations. Most of the Knife Lake materials were collected from the Knife Lake reservoir during a major draw-down for a fish restoration project. Extensive surface survey and limited excavation resulted in the location of over 50 previously unrecorded sites in the District and the collection of thousands of artifacts representing occupations from probably the Late Paleo through the early Historic. Large choppers, knives and celts or adzes, mainly of siltstone, were found on some sites. Some of the chopping tools are notched, and many are of considerable size. Plano points were also collected as well as a point reminiscent of those from Reservoir Lakes(Caine and Goltz, personal observations).

Closer to the Red Lake area, in the Rainy River drainage, the Archaic component at the Smith Site at the mouth of the Big Fork River, is attributed by Dobbs to the Lake-Forest Archaic (Dobbs n.d.:90). However, according to Birk and George (1976) the diagnostic Archaic points found during the excavations in the upland area of the site were Parkdale Eared/Oxbow types, more characteristic of the Plains or Prairie Archaic. The "sub-Laurel" materials from Ed Lugenbeal's excavations within the habitation area immediately adjacent to the Smith Mounds and from the more recent excavations by Robert Clouse, then at the Minnesota Historical Society, along the river within the mound group are equivocal as to their association (Robert Clouse 1992, personal communication; Lugenbeal 1976:383-389)).

That there could have been multiple occupations of the Smith Site area by culturally different Archaic peoples is, of course, quite possible. Present evidence indicates, however, that the Archaic at the upper terrace at Smith owes more to Plains/Prairie influences than to lake Forest or Shield, and that the presence of Archaic in the floodplain remains unconfirmed.

Prairie/Plains Archaic

The Prairie/Plains archaic is oriented toward the tall-grass prairie, and focuses upon bison procurement, supplemented by the utilization of other resources, often at the prairie edge.

The identification of the Archaic component(s) at Smith as Prairie/Plains Archaic rather than Lake-Forest is consistent with the situation at the nearby Long Sault Site in Ontario. Like Smith, Long Sault contains a major burial mound complex which was preceded in time by a late Archaic occupation. Arthurs sees the Archaic at this site as similar to the Larter phase of Pelican Lake (Arthurs 1986:260).

Larter is the easternmost regional variant of Pelican Lake and many of the sites appear to represent "cool season occupations in sheltered valleys along the margins of the aspen parkland, where firewood and water were readily available" (Arthurs 1986:71; see also Buchner 1979). Bison procurement is presumably the primary subsistence base of the Prairie Archaic.

West of the Red Lake area, in the Red River Valley, the influence of the Prairie Archaic is clear at the Canning and Mooney Sites, located along the Red River. The Canning Site yielded a bison bone bed with Knife River Flint tools dating to 3400-3300 years ago. The nearby Mooney Site contained a component dating from 3400 B.P. and showed a light scattering of bison bone associated with Knife River Flint (Michlovic 1985, 1986).

Radiometric dates elsewhere in Minnesota range from 6,390 B.P at YM-47, a bison processing site in the southwest through 3,495 B.P. at the Pederson Site. The Cherokee Sewer Site, located in northwestern Iowa contains occupations from 8,400 to 4,600 B.P. (Hoyer 1980). Throughout this time span the site was used as a specialized bison processing site. No differences were noted between the Paleo and Archaic horizons to suggest changes in economies or adaptive strategies. Stylistic changes took place in projectile points, and milling stones appear during the Early archaic. The investigators suggest that, "These differences are insufficient to support the traditional separation of Paleo-Indian and Archaic cultural stages…." (Anderson et al. 1980:257).

In general, the Plains/Prairie subsistence pattern is a successful adaptation beginning by about 8,500 B.P. and persisting perhaps as late as 800 A.D. (Anderson et al. 1980:265).

Other Archaic Patterns

A number of sites in Minnesota have been associated with the Eastern Archaic Tradition, which is tied to classic definitions of the Archaic in the lower Midwest. Use of riverine resources and deer is characteristic, and tools types include a wide variety of stemmed, notched and bifurcated points along with an extensive ground stone industry and the frequent use of copper (Dobbs n.d.:97). This definition overlaps with that of the Lake-Forest Archaic.

Some sites with a paucity of material, particularly burial sites, might be assigned to the Eastern Archaic, if this is used as an umbrella term for materials which are not extensive or distinctive enough to be assigned to any of the other Archaic contexts.

For example, the Peterson burial from Grant County in west-central Minnesota was dug into glacial gravels and covered with rocks. Artifacts included a long, finely flaked, notched point, a scraper and part of a knife, all of chalcedony, a perforated stone which appeared to be a pendant, a beaver incisor bracelet and disc shell beads.

Within the study area, a series of burials were uncovered at Hay Creek where the creek cuts through a glacial beach ridge as it empties into Red Lake. The burials were in deep pits, approximately 1.5m below the surface. The remains were covered with red ochre and accompanied by beaver teeth, some with perforations, and a fossilized snail shell. Shovel tests in the area produced a low density of lithic materials (Hamline University Osteology Laboratory files).

Patterning of Archaic Sites

Surveys in the Rainy Lake area provide the best overview currently available for Archaic settlement patterns within the broader study area (Gibbon 1976, 1977; Rajnovich 1980; Lynott, Richner and Thompson 1986), and the extensive West Patricia survey project and the Lakehead surveys provide additional data for the area immediately north (Reid 1980).

In general, the paucity of Archaic sites in these surveys is striking, particularly as compared to later time periods. This could be due to a low population density during the Archaic. Rajnovich suggests, however, that past and present water levels of lakes in the Rainy Lake chain have been different, and that most Archaic sites are now inundated (Rajnovich 1980:27).

Differences in lake levels may also have had an effect in central Minnesota, except that the water levels were generally higher during the Archaic (Caine and Goltz 1995).

All existing survey and excavation data for the broader area surrounding Red Lake indicates the likelihood of Archaic occupations with developmental roots in the preceding Late Paleo, rather than the intrusion of populations from elsewhere.

During the Archaic, cultural influences appear to run east west rather than north south. Although the temporal relationship between the shield and Plains/Prairie Archaic is unknown, the two could represent partly contemporaneous cultural complexes that exploited different ecotones. Based on the West Patricia surveys, Reid hypothesizes cultural interaction in the form of people, trade and/or ideas between Shield Archaic and Plains archaic peoples in the southern part of their research area (Reid 1980:225).

Sites are presumed to have been occupied by small bands or segments of bands. Although it is likely that most sites were used only seasonally, there is generally no data to indicate which season. Arthurs hypothesizes that early Archaic peoples in the area may have based their economy on bison hunting, but that by the Late Archaic, the economy had become more diffuse (Arthurs 1983:74). Although fish would have been a readily available source of protein, and fish hooks and gaffs are occasionally present as well as woodworking tools which could have been used for dugout canoe construction, little other evidence of fish procurement is available.

Presumably, during the Archaic small base camps were located close to seasonally available resources, with specialized task groups ranging out from them for hunting and other resource procurement. This collector strategy contrasts with the earlier foraging strategy of the Paleo-Indian tradition. Just when, and how, this transformation came about is unknown, but most investigators put the transition between 10000 and 8000 B.P.

Generally, the lack of data on the Archaic is striking. Even basic data, such as size of site, is usually absent.

The Itasca Bison Site (21-CE-01), located south of the project area at the Headwaters of the Mississippi, dates from the Late Paleo-Early Archaic transition. People ambushed and butchered bison, using a variety of stemmed and notched points and processing tools such as scrapers and knives (Shay 1971).

The Petaga Point site, south of the project area near Mille Lacs Lake, is multicomponent with Archaic and Woodland components. Copper implements and side-notched and stemmed projectile point forms (Bleed 1969) identify the Archaic component.

The Canning site, located along the Red River in Norman County, west of the project area, has an Archaic Plains-oriented component dated between 3,350 and 4,350 years ago. Bison bones were associated with this occupation (Michlovic 1986).

Numerous Archaic points are in collections from both northern and north-central Minnesota, and the state site file identifies numerous small archaic sites throughout the state. Very few have been excavated, however, and most speculation about lifeways is based on data from outside the state.

The Middle Prehistoric Period (3,000 – 900 B.P.)

Changes in cultural characteristics mark the Middle Prehistoric Period. In traditional archaeological taxonomy, this era is the beginning of the Woodland Tradition. In northern Minnesota, only two characteristics of this tradition-- the appearance of ceramics and burial mound construction-- reliably mark this transition. In general, regional differentiation continues with extensive trade networks linking these cultural groups.

Early Woodland (ca. 2,500 – 2,000 B.P.)

Recent research has indicated that the transition from the Archaic to the Woodland in west-central Minnesota may have been some 1,000 years earlier than previously thought, and is marked by the introduction of Brainerd Ware ceramics (Caine and Goltz 1995). Brainerd Ware occurs as part of a tool complex that includes side-notched and stemmed points, end and side scrapers, and a type of splitting tool.

The peoples who produced this complex, the Elk Lake Culture, exploited the prairie/woodland ecotone, continuing an essentially Archaic lifestyle, which eventually adapted to the increasingly cooler and moister environments until approximately 1,700 years ago (Caine and Goltz 1995).

Although Lugenbeal suggested as early as the 1970s that Brainerd Ware was an early to middle Woodland ceramic type, the prevailing paradigm in Minnesota archaeology has placed it in the Late Middle Woodland, and Minnesota has been characterized as lacking an Early Woodland complex (Gibbon 1986). Consequently, once radiometric dates for Brainerd Ware became available, they forced a re-examination of the ceramic chronology of northern Minnesota. In order to address questions about the reliability of dates for Brainerd Ware, a re-evaluation of the age of Brainerd ceramics was undertaken (Caine, Syms and Goltz 2013). This work concluded that the actual age range of Brainerd and related ceramics begins at approximately 2750 BP and ends at approximately 1700 BP, for a span of about 1,000 years. These ceramics represent the earliest ceramics in the region.

The Laurel Culture is the next most commonly identified Early Woodland culture in northern Minnesota, generally dated as beginning about 300 to100 B.C. and extending to 800 A.D. Thus, current information indicates an overlap between Elk Lake and Laurel starting around 300 B.C.

Most archaeological investigations in the past have focused on the distinctive mortuary practices of the Laurel people. The complexes of large Laurel mounds, located on major northern water routes, such as at the junctions of the Big Fork and Little Fork rivers with the Rainy were subjected to numerous curio-seeking expeditions, and a series of excavations beginning in the 1930s and extending into the 1970s (Lugenbeal 1976; Stoltman 1973).

Although the construction of large mounds apparently begins during early Laurel times, the early burial practices are not clear. No undisturbed burials have been excavated for the earliest two phases of the Laurel development, as defined by Stoltman. Late phase Laurel mortuary practices are distinctive, however. They involve elaborate preparation of the body, including the placement of clay plugs in eye sockets, post-mortem dismemberment and bone deformation, differential burial of body parts (such as toros burials) and the liberal use of red ochre (Stoltman 1973, 1974; Lugenbeal 1976; Aufterheide 19).

The Laurel tool assemblage is characterized by Laurel ceramic types, stemmed and notched projectile points, numerous end-scrapers, and a bone industry that includes cut beaver incisors and conical antler harpoons. Copper, primarily in the form of awls and beads is also present.

Laurel ceramics are distinctive, with generally smooth surfaces decorated at the upper rim with a wide variety of stamps. Vessel shape is strongly conoidal, and the pots were formed by the coiling process (Arthurs 1986; Budak 1985).

Laurel is widely distributed: Laurel ceramics have been found in sites ranging from east-central Saskatchewan, across northern and eastern Manitoba, throughout much of Ontario and parts of southern Quebec, and into northern Minnesota and Michigan (Brown 1962; Weirsum and Tisdale 1977; Buchner 1979b; Saylor 1977; Wright 1967; Brose 1970; Janzen 1968; Lugenbeal 1976; McPherron 1967; Stoltman 1973).

Laurel shares many characteristics with other more southeastern cultures of the period. Fitting has used the term "Lake Forest Middle Woodland" to identify what Mason called "northern Tier" cultures, including North Bay, Point Peninsula, and Saugeen (Fitting 1970; Mason 1970). Although some Laurel sites do occur within the Boreal Forest, the vast majority of sites are associated with the southern edge of the Boreal Forest in Canada (Syms 1977).

In Minnesota, Laurel ceramics are found primarily in sites in the Rainy river and Lake Superior drainages. The occur rarely in the upper portions of the Mississippi drainage , where they probably represent sporadic use in the sense that Syms uses the concept (Syms 1977:6-7). To the north, Laurel seems to end just as abruptly at the Hudson Bay Lowlands (Reid 1988).

In addition to the broad geographic area within which Laurel assemblages appear, Laurel also appears to have persisted with only minor changes for nearly 1000 years. Based on a reevaluation of the radiocarbon dates in the late 1970s, Syms suggests an initial date of 100 B.C. and a possible terminal date as late as 1100 A.D. (Syms 1977:81).

The Laurel economy is characterized by a hunting-gathering lifeway, focusing on fish, moose, and beaver (Stoltman 1973). Wild rice was also a part of the diet, at least for some Laurel groups (Peters et al. 1983). The use of wild rice apparently became more focal during the Late Woodland (Gibbon and Caine 1980).

This subsistence base appears to be indicative of a diffuse economy utilizing a variety of environmental zones on a seasonal basis (Buchner 1979b). Large sites that centered around fisheries may have supported summer population aggregates (Fitting 1970; Buchner 1979b). These summer aggregates may also have been responsible for mound-building activities at specified locations, such as that in the Long Sault-Smith-McKinstry area. During the winter, groups probably dispersed into smaller family units and such sites are likely to be found further inland. This settlement pattern is similar to that documented for the Anishinaabeg at the time of Euro-American contact, and indicates a collecting, rather than a foraging, strategy.

Syms defines three regional variations of this hunting-gathering pattern: "(a) seasonally intensive utilization of fish on the Upper Great lakes, followed by diffuse hunting; (b) seasonal shifts across Mixed Conifer-Hardwood and Parkland biomes in Minnesota; and (c) scattered distribution of sites relying on diffused resources in eastern and northern Manitoba and adjacent Ontario" (Syms 1977:83). These regional variations reflect not only variable environments, but imply varying types of social organization (Hamilton 1981:21).

Stoltman has defined three main phases for the Laurel culture: the Pike Bay Phase (circa A.D. 100-300), the McKinstry Phase (circa A.D. 300-500), and the Smith Phase (circa A.D. 500-900) (Stoltman 1973). This terminology is still widely in use and has provided a framework for hypotheses regarding the origins, expansion, and contraction of Laurel. Syms has defined the "Laurel Composite" and views Stoltman's phases as temporal and regional complexes (Syms 1977:80).

These phases or complexes are distinguished mainly on ceramic grounds, and are characterized by differing frequencies of the core Laurel ceramic types, rather than the presence or absence or development of new types. In this respect, Laurel ceramics are notably uninventive over an extremely long period of time; variation seems to occur mainly in preference of one type over another. Geographically, however, there is variability in the importance of ceramic decorative modes and motifs, indicating developing regional differentiation (Buchner 1979b; Hamilton 1981).

The application of Stoltman's ceramic types and phases to other Laurel sites has led to the widely shared hypothesis that Laurel begins in the south and expands northward. Although some researchers feel that Laurel represents an evolution from the Shield Archaic (Wright 1972; Steinbring 1980), neither the location of the earliest Laurel sites nor the comparative lithic traditions of the Shield Archaic and Laurel would seem to give much support to this hypothesis (Buchner 1979a; Lugenbeal 1976).

Buchner suggests more similarities between the Lake Forest Archaic and Laurel in terms of cultural traits, artifact styles, and resource exploitation (Buchner 1979b:110-111). Syms hypothesizes that Laurel represents an actual population movement and displacement into the north (Syms 1977). Buchner likewise argues that the Archaic groups in the area later occupied by Laurel were primarily Prairie-oriented, penetrating the eastern edges of the Aspen Parkland during the Sub-Boreal Climatic Episode. With the onset of the Sub-Atlantic Climatic Episode and the retreat of the grasslands and expansion of the Lake Forest biome, Lake-Forest adapted people rapidly moved into the area (Buchner 1979b:112).

Buchner sees the expansion of wild rice as crucial to this Middle Woodland expansion (Buchner 1979b:113). In support of this contention, wild rice appears in an archaeological context by about 500 B.C. in northern Michigan (Ford and Brose 1975). In Minnesota, excavations at the Big Rice Site near Virginia, yielded a date of A.D. 235-325 for a Laurel wild rice parching pit (Rapp, Allert and Peters 1990).

This process of displacement of indigenous Archaic people can be envisioned using Syms Co-Influence Sphere model: Archaic peoples utilized the area sporadically or primarily during the winter and shifted their mobility patterns westward as the resources shifted in response to climatic change (see Syms 1977:7, for example). As Buchner notes, it is possible that "neither the indigenous… peoples nor the new Laurel peoples were particularly aware of the gradual geographical shifting of their respective seasonal cycles" (Buchner 1979b:114).

At the other end of the continuum, some investigators see Laurel evolving into the subsequent Blackduck culture, whereas others see the two as coeval for at least a few hundred years' duration (Reid 1980). The assertion that Laurel persisted past A.D. 800 has been particularly controversial and the topic of numerous discussions at the Superior Basin meetings since the late 1970s.

Within the Rainy Lake/Rainy River area Lynott et al. identify two different types of Laurel sites (other than mound sites): large sites with a relatively high density of artifacts and a wide range of lithic tools that may be warm season base camps, and small low density sites that may be related to a dispersed aspect of the settlement pattern (Lynott, Richner and Thompson 1986:276). Inhabitants of the Rainy Lake area may have been seasonal users of the Rainy River mound sites (Lynott, Richner and Thompson 1986:277).

An understanding of intrasite patterning has been substantially increased with the recognition of Laurel house patterns (Reid and Rajanovich 1985; Peters, Hunn, Motivans and Okstad 1983). Houses are oval, ranging from 6-8m in length and 3-5m in width. Interior features include a central hearth or hearths and storage pits adjacent to the walls. Activity areas within the house were sometimes discernable, particularly chipping stations. Most of these houses could have sheltered about 10 people, based on ethnographic data and house size. This could be hypothesized to be the smallest social unit of the society, perhaps coterminous with the hunting group (Reid and Rajanovich 1985:8-9).

The recognition of house patterns, as well as other macro-intersite patterning is highly dependent upon excavation technique. Reid and Rajanovich argue strongly for the need to open up large contiguous areas of sites in order to discern intra site patterning (Reid and Rajanovich 1985; Reid 1988).

Transitional Initial to Terminal Woodland

The presence of ceramic wares that appear to occupy the interface between Initial Woodland wares such as Laurel and Late Woodland wares such as Blackduck and Kathio-Clam River has been noted, particularly just south of the study area (Caine 1983). St. Croix stamped pottery is one of the few types recovered in large enough frequencies and reconstructable sections to have been described as a separate pottery type.

Excavations at the Hannaford site clearly demonstrated a cultural strata with pottery and associated artifacts that is immediately pre-Blackduck. These are subconoidal vessels, some coiled and some fabric-impressed. In contrast with Laurel ceramics, these were minimally decorated or undecorated. Decorative modes, when present, utilized a cord-wrapped object. This pre-Blackduck occupation was conclusively dated to the period from A.D. 400 to 600. Small corner notched points were in association. The faunal assemblage consisted mainly of sturgeon.

Terminal Woodland

Although Terminal Woodland sites are the most common type of site in the broader study area, the transition between the previous Laurel Composite and Blackduck, the earliest Terminal Woodland manifestation, remains one of the least understood events. Sometime between approximately A.D. 600 and A.D. 800, a distinctive pottery style and projectile point types appear, and Laurel ceremonialism and pottery styles begin to disappear. This transition mirrors similar transitions elsewhere in the Northeastern Woodlands, as Hopewell declines and regionally distinctive Late Woodland cultures emerge.

This change appears to occur during the later part of the Scandic Episode (A.D. 400 to A.D. 800) and initial part of the Neo-Atlantic Episode (A.D. 800 to A.D. 1250). Both are periods of climatic amelioration marking a westward shift of the prairie and a southward shift of the Boreal Forest (Baerris and Bryson 1965; Bryson and Wendland 1967).

In spite of the widespread use of the term Blackduck to denote, variously, a “culture”, “tradition”, “focus”, or “phase”, Blackduck is essentially identified by the presence of a distinctive pottery. For this reason, Syms prefers to use the term “Blackduck Horizon”, thus keeping open the question of relationships among apparently far-flung groups of people utilizing a variety of environmental zones (Syms 1977:97).

Considering the large number of Blackduck sites recorded, the subsistence base of Blackduck is still poorly understood. Partly this is due to past emphasis upon cemetery, rather than habitation excavation, but lack of fine-scale recovery techniques in earlier excavations, and the frequent multi-component mixing of Blackduck sites also contributes. Single component or stratigraphically separated Blackduck components have been rare.

The Hannaford site is one of the few multi-component, stratified Blackduck sites in northern Minnesota that has clearly separated vertical stratigraphy. The earliest Blackduck component at the site dates from approximately A.D. 790. Analysis of the Blackduck components shows some striking trends including a rapid (within a few hundred years) change in form and decoration of ceramics; a shift from sturgeon exploitation to a mixed fishery; and a change in projectile point styles from small side-notched to unnotched triangular types.

The subsistence base of the Blackduck peoples is assumed to be marked by seasonal exploitation of flora and fauna, indicating a persistence of the collector strategy. The Third River site, a Blackduck fishing station northwest of Lake Winnibigoshish in the Mississippi Headwaters drainage, shows clear exploitation of the spring spawing run, probably through the use of nets and weirs (Caine and Goltz 1998). The Dead River site in Otter Tail County is interpreted as a generalized hunting camp at which fishing was significant (Michlovic 1979).

In addition to fisheries utilization, wild rice is presumed to form an important part of the subsistence base (Johnson 1969; 1979). The association of wild rice with Blackduck has not been conclusively demonstrated, although the location of many sites would lead to this logical conclusion. Unfortunately, mixing of later Sandy Lake (Wanikan or Psinomani culture) materials with Blackduck on many of these sites prevents conclusive understanding of Blackduck wild rice procurement practices (Gibbon 1990:20).

Populations are presumed to have increased markedly during the transitional phase to the Terminal Woodland as well as during the Early Terminal Woodland itself (Gibbon 1991:6). Gibbon suggests that the social organization was a segmentary lineage system that grew and fissioned throughout this period (Gibbon 1990:20). This would help account for the stylistic similarities uniting Blackduck.

Blackduck is apparently associated with a burial pattern that includes the interment of partially flexed primary burials in a sitting or semi-sitting position within small circular mounds or intrusive into older Laurel mounds. Artifact types associated with Blackduck include small triangular and small triangular side-notched points, oval and lunate knives, side scrapers, trapezoidal end scrapers, thumbnail scrapers, tubular-shaped drills, pipes, bone awls, unilaterally barbed harpoons, flakers, bone spatulas, cut beaver incisors, bear canine ornaments, and fishooks, gorges, and beads of copper.

At the Hannaford site, although unilaterally barbed bone harpoons were common with the Late Middle Woodland Transitional component, none were associated with the Blackduck levels. Projectile points associated with the Blackduck changed from side-notched triangular at A.D. 790-800 to unnotched triangular by A.D. 900.

Lugenbeal notes that at the Smith Site, one of the few other excavated sites with unambiguous association of Blackduck pottery with non-ceramic artifacts, the most diagnostic artifacts in the Blackduck occupations are the small triangular and side-notched projectile points and the unilaterally barbed harpoons (Lugenbeal 1976, 1979). At the Third River Site in the Mississippi Headwaters, Blackduck pottery was found in features in direct association with small triangular projectile points and socketed conical points (not harpoons) made of antler (Caine and Goltz 1998). Excavations in Ontario and Manitoba have confirmed the association of bone spatulas, fleshers, awls, and unilaterally barbed harpoons with Blackduck, and have suggested that the lithic inventory may be more varied in some areas and include stemmed and notched forms of points as well (Tisdale 1978; Buchner 1982).

Blackduck ceramics appear to be part of a continuum that links Late Woodland globular cord-impressed decorated pottery types from Wisconsin, central Minnesota, the Mississippi Headwaters, the Rainy River, and southern Ontario and Manitoba (Ready 1979; Caine 1983; Caine 1990).

Johnson has noted that the terminological distinction between Blackduck and Kathio ceramics is due primarily to the problems associated with the development of taxonomy (Johnson 1986). Wilford excavated sites in the Mille Lacs area where he designated Kathio as the “type site” for the Kathio focus, and in northern Minnesota where Blackduck was designated the “type site” for the Blackduck focus. His later excavations showed that sites intermediate in geographic location also produced intermediate ceramics. According to Johnson, “rather than suggesting the Blackduck and Kathio ceramics (and perhaps cultures) formed a geographic continuum extending from southeast to northwest along the prairie-forest edge”, due to the typological approach that he took, he left these ceramics out, “thus introducing a rigidity to the classification reflecting more a mind set than cultural realities” (Johnson 1986:6).

Although this typological distinction remains today, numerous investigators have attempted other approaches to analyzing these Late Woodland ceramics. None of these approaches, however, have been widely adopted or particularly successful in delineating temporal and geographic differences (MacNeish 1958; Evans 1961; McPherron 1967; Lugenbeal 1976, 1978; Caine 1983).

Lenius and Olinyk have more recently presented revisions to the prevailing Late Woodland taxonomic approaches, noting that the models in use over the last thirty years have yielded few insights into the origins and development of Blackduck (Lenius and Olinyk 1990).

Lugenbeal’s work, however, has been the most widely known and used, at least within Minnesota (Lugenbeal 1976, 1978, 1979). His work at the Smith Site and comparisons with other Blackduck collections have suggested a number of hypotheses regarding Blackduck.

At the Smith Site Lugenbeal felt that he could clearly distinguish Early from Late Blackduck on both stratigraphic and typological grounds. One of the major distinctions between the early and late phases was a shift from cord-marking of exterior ceramic surfaces to fabric-impressing, which he feels need more detailed study in Blackduck collections because these two treatments “represent two kinds of Blackduck with distinct temporal or geographic distribution” (Lugenbeal 1979:28, 1978).

Lugenbeal’s “Late Blackduck”, with its fabric-impressed surfaces, is what Canadian archaeologists have long defined as “Selkirk” ceramics. Unfortunately, the continuing use of Lugenbeal’s typology has resulted in the obscuring of Selkirk with the Blackduck classification. This lumping has further resulted in the obscuring of important geographic and temporal variation on the American side of the border, whereas it is an issue of explicit study north of the border.

Lugenbeal, when comparing the two Blackduck phases he has defined at Smith with other sites, hypothesizes that southern Blackduck sites are the earliest and that there are some distinct differences between southern and northern Blackduck (Lugenbeal 1978). Many researchers, including Lugenbeal, view the Mississippi Headwaters as the early “home” of Blackduck. Lugenbeal also hypothesizes that late phase Blackduck (fabric impressed or Selkirk) is absent from much of the southern range of Blackduck, including the Headwaters, where Blackduck is replaced by Sandy Lake wares relatively early (Lugenbeal 1978). Late phase Blackduck (Selkirk) has it orientation northward, rather than southward.

Based on these comparisons, Lugenbeal hypothesizes "competition between two distinct populations within a single floristically and faunally relatively homogeneous geographic area. Consequently, the case for population replacement seems plausible" (Lugenbeal 1978).

Because Blackduck and Selkirk are so close to the ethnographic horizon, various arguments have placed the identification of Blackduck as ancestral Assiniboine (Wilford 1945; Ray 1972; Bishop and Smith 1975), while others have just as vigorously championed its identification with Algonquian groups (Dawson 1974; Syms 1974, 1977). Arthurs argues that the identification of Selkirk pottery with the Cree and Sandy Lake ware with the Assiniboine seems to fit known population movements immediately pre and post contact with Europeans (Arthurs 1986:263-265).

Post-Contact Era

Regardless of the ethnic identification of groups occupying this area at the beginning of the period of European contact, the Anishinaabeg or Ojibwe peoples occupied the area by the mid 18th century. They moved westward from their original homelands to the east and eventually various groups occupied much of the Hudson Bay drainage, northern Wisconsin and Minnesota, and the upper peninsula of Michigan. Ancestors of the Red Lake Anishinaabeg migrated around the northern end of Lake Superior, in contrast to most of the other groups that migrated around the southern shore of the lake. The Anishinaabeg groups served as intermediaries between other tribes, such as the Dakota, and the Europeans involved with the fur trade. A period of sporadic warfare followed as the previously resident tribal groups, including the Siouan-speaking Dakota, were pushed out by the Anishinaabeg.

The Anishinaabeg of Red Lake were fairly isolated from many European influences. Explorers, fur traders, and missionaries met them at villages on Red Lake, which were typically located at the mouths of the rivers entering into the lake. Trading posts and missions were eventually established, once again in similar locations. The interior areas probably saw very little European impact until later in the mid-1800s.

As the second wave of European population arrived in the region, Anishinaabeg lands came under pressure as non-Indians demanded access to timber and land for agriculture. A complicated history of land treaties followed. The Red Lake Reservation was established by treaty in 1863, and its acreage was diminished through the Nelson Act of 1889, and further diminished boundaries were established in 1902-1904.

The first Government Land Office surveys took place in the late 1800s. Most of the area encompassing the present project was surveyed in 1891-1892. These maps show the locations of intruded European institutions, including a government school and churches along the south shore of Lower Red Lake (Figures 9 and 10). These structures, along with roads to Fosston and Red Lake Falls, indicate connections with the non-Anishinaabeg world.

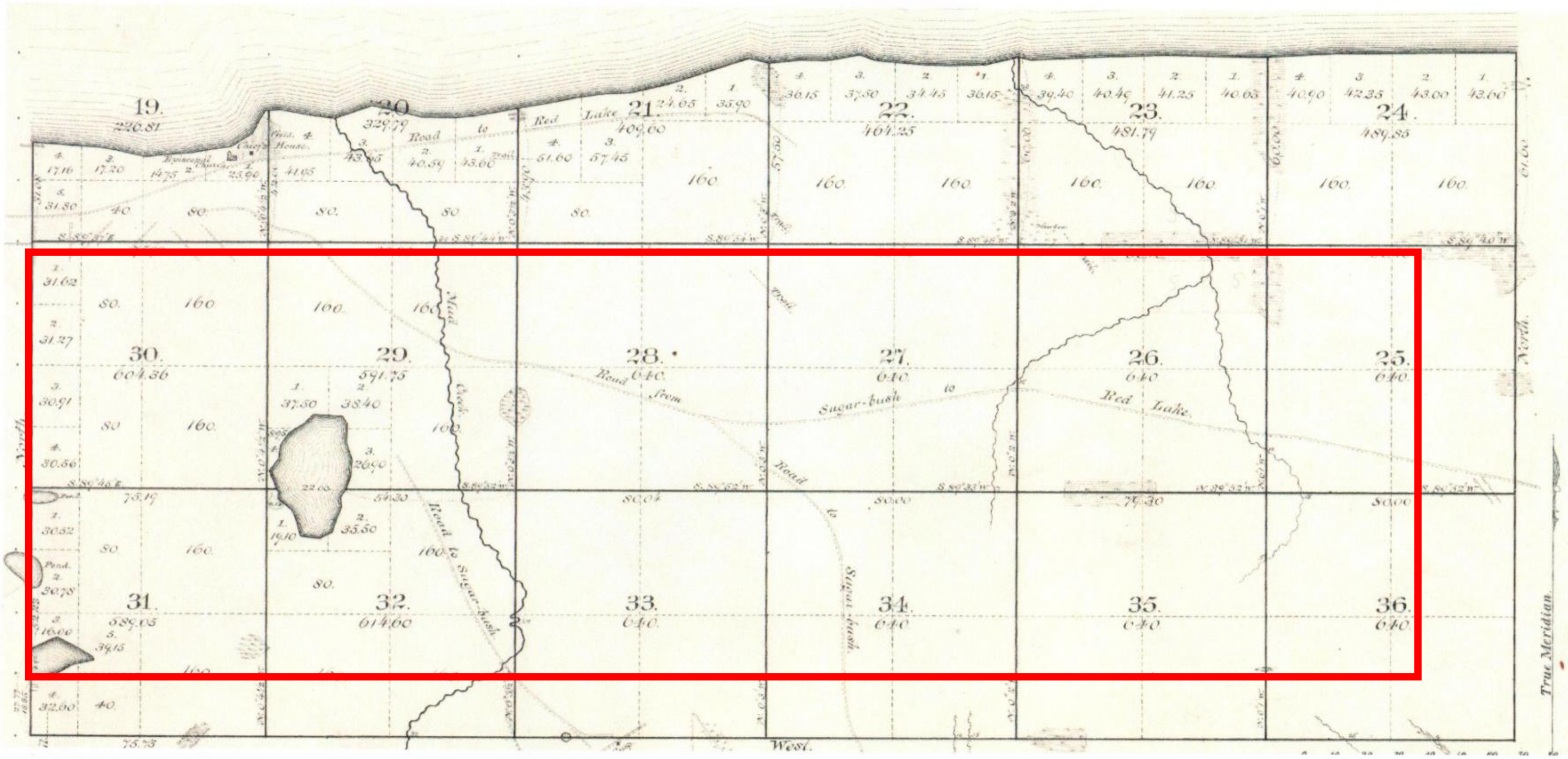

Figure 9. Location of the project study area on the 1892 General Land Office plat for T151N, R33W.

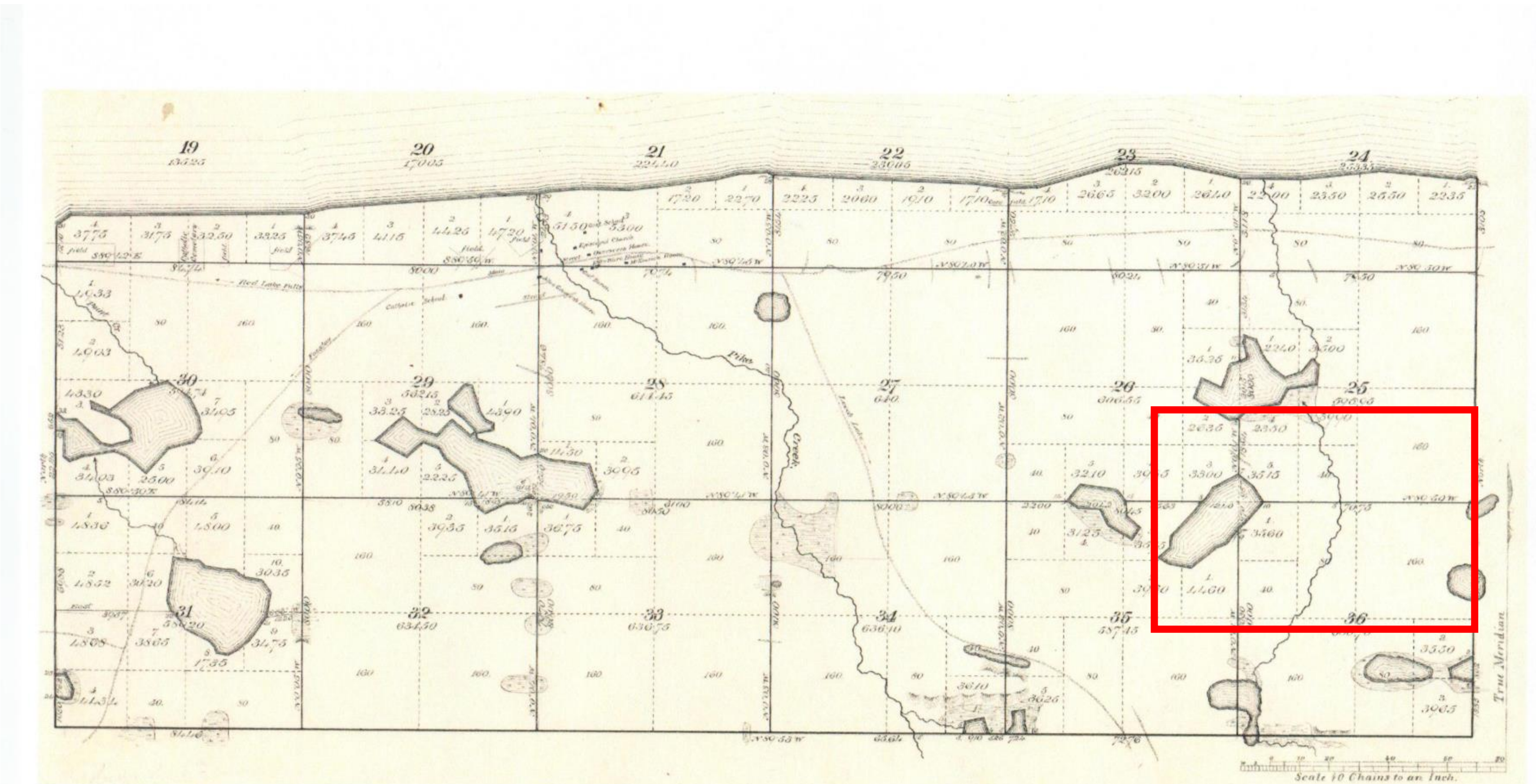

Figure 10. Location of the porject study area on the 1892 General Land Office plat for T151N, R34W.

On the same maps, however, we see a number of roads indicating persisting traditional patterns, including what were apparently major trails or roads to sugar bush south of Lower Red Lake (GLO maps for T151N R33 & 34W, 1892). The large area of hardwood forest, previously mentioned in the discussion of Marshner's map of "presettlement" vegetation, would probably contain maple stands that could be used for sugaring. Most of this traditional sugarbush would be south of the project area.

In 1897 the Department of Interior, which had oversight on Indian lands, gave permission to construct a "temporary" railroad across the Reservation. This line went from the Nebish area south of the Reservation to the landing at what is now Redby. Much of this route followed the Leech Lake Trail, a long established connection between Red Lake and Leech Lake. This now abandoned railroad line crosses the project area and is currently a gravel road.

The area that will be impacted by the present road project has good potential to contain logging features and perhaps sites related to continued traditional uses by Red Lake Anishinaabeg.

CULTURAL RESOURCE SITE PATTERNING

PREVIOUS INVESTIGATIONS

Archaeological survey reports on file at the office of the Tribal Archaeologist were reviewed for the project area. Although archaeological sites have been reported from the area as early as the 1880s (Babbitt 1881), the earliest archaeological reports date from a century later in the 1980s.

Most surveys were undertaken in connection with the development of roads or the construction of houses and associated septic systems. In addition, one area within the project was tested as part of a preliminary model of site location for Red Lake Nation. This work has resulted in the survey of less than five percent of the 1700 acre project area. Because survey has been mainly project driven, it does not represent a sample of the various past or present environments within the project area.

The following reports are on record for the project area:

> "Red Lake Paleoenvironmental Reconstruction and Archaeological Sampling", Caine and Goltz 1999
>
> "Phase I Cultural Resource Survey of Redby Family Rental Housing 1 Project, Red Lake Reservation, Beltrami County, Minnesota," Caine, Goltz, and Peterson 2005
>
> "Revised Phase I Cultural Resource Survey of Red Lake Highlands Housing Phase 2 Project, Red Lake Nation, Beltrami County, Minnesota," Caine, Goltz, and Peterson 2012
>
> "Phase I Cultural Resource Survey of Red Lake Heart Lake Housing Project, Red Lake Nation, Beltrami County, Minnesota," Caine, Goltz, and Peterson 2012

Prior to the present project, less than 40 sites had been reported overall within Red Lake Nation. Of these, three are located within the project area.

All three known sites within the project area are located within Alternative Corridor 1. They are the Mud River Site, the Upper Terrace Site, and the Redby CCC Camp site.

The Mud River Site is located in the NW SE NE of Section 29, T151N, R33W. It is a small site, approximately 20 x 20 meters in size and situated on a small low terrace (Figure SL-1 and inset, APPENDIX A, Alignment 1, Sheets 3 and 4). Materials recovered include two lithic flakes (1 jasper taconite and 1 siltstone) and seven burned bone fragments (Caine and Goltz 1999).

The Upper Terrace Site is located in the N ½ SE NE of Section 29, T151N, R33W. This site extends from a narrow point at the north to approximately 150 meters along the terrace to the south (Figure SL-1 and inset, APPENDIX A, Alignment 1, Sheets 3 and 4). Artifacts recovered consisted of lithic debitage, lithic tools, one ceramic sherd, and fire-cracked rock. Lithic debitage totaled 27 flakes (21 Swan River Chert, 2 Tongue River Chert, 2 Siltstone, 1 quartz, and 1 Red River Chert). The two artifacts are 1 utilized flake of Red River Chert and 1 scraper of Swan River Chert. The single ceramic body sherd is grit tempered but has an exfoliated exterior and cannot be identified further (Caine, Goltz and Peterson 2005).

The Redby CCC Camp is located just north of the Upper Terrace Site (Figure SL-1 and inset, APPENDIX A, Alignment 1, Sheet 3). The Camp consists of two building berms, a leveled area, and a large dump with numerous metal and glass artifacts. The area south of the two building berms appears to have been artificially leveled and three east-west trending berms constructed at approximate 50 foot intervals (Caine, Goltz and Peterson 2005).

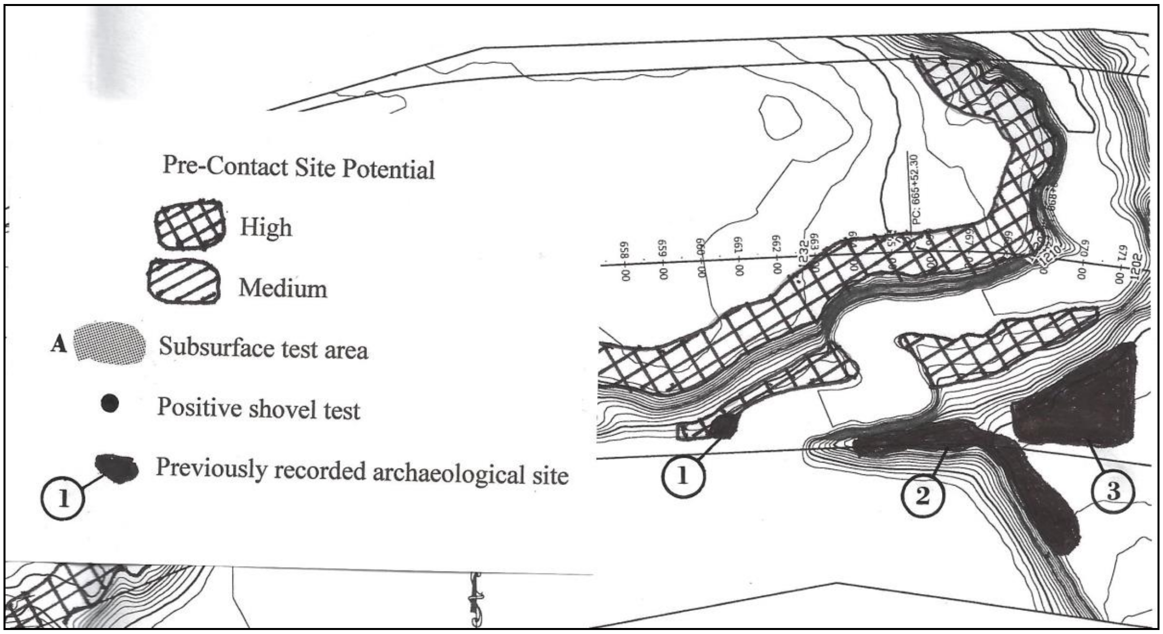

Figure SL-1: Locations of previously recorded sites in Alternative Corridor1; 1 Mud River Site, 2 Upper Terrace Site, 3 Redby CCC Camp

Based on known site locations, the previously recorded pre-contact sites can be usefully classified as either lake-oriented sites or interior sites. These two categories of sites exhibit not only different locational patterning, but other characteristics as well.

Lake-oriented sites, such as those at the mouths or immediately upstream of the rivers flowing into Lower Red Lake, are larger and more diverse in terms of cultural materials.

An example of such a lake-oriented site is the Sandy River Bridge site, located along the west side of Lower Red Lake (Peterson, Caine and Goltz 2009). This site was characterized by a variety of Woodland ceramics and a high density of faunal materials.

Some of the lake-oriented sites are completely or partially inundated because of post-contact manipulation of lake levels. An artifact collection from the area at the mouth of the Battle River, on the east side of Lower Red Lake, is a good example. Large numbers of artifacts and faunal materials have been collected from the beach area. These materials cover the whole chronological and cultural range of occupation of the region, including probable Paleo, archaic, and woodland projectile points and lithic tools, ceramics typical of the entire Woodland ceramic sequence, and gunflints from the post-contact period (Bruce White Collection, photographs in the Red Lake Archives).

Sites located away from the big lake show an entirely different pattern. These interior sites are small, of low density, and located on micro-topographic features.

Although many of the interior sites have yielded only lithic materials, there are a number of sites with ceramics in these locations as well. It is difficult to place these interior sites within the chronological sequence due to lack of diagnostic artifacts. None of these sites have been extensively tested or excavated.

CULTURAL RESOURCE POTENTIALS OF THE ALTERNATIVE CORRIDORS

The cultural resource potentials for the alternative Thunder Lake Road corridors were developed in two stages: a preliminary model that was then field tested; and a final model based on the results of the testing, combined with the previously discussed overviews.

PRELIMINARY MODEL AND RESULTS

A model indicating high, medium, and low potential for the presence of pre-contact cultural resource sites was developed based on the information previously discussed. Post-contact potentials are based primarily on information gleaned from GLO maps and aerial photographs (1939) and an understanding of the post-contact development of the Reservation.

The preliminary model of cultural resource potential for the alternative corridors was field tested during August of 2013. At this time the locations of previously recorded sites within the corridors were also confirmed.

A sample of nine different landforms was located on the ground and shovel-tested. Shovel tests were approximately 40-45cm in diameter and 50cm deep. All matrix was screened through ¼" mesh. Shovel tests were numbered consecutively during testing.
The results of this testing were incorporated into a determination of the potentials within each proposed corridor, and maps were then prepared showing these potentials.

Five of the landforms tested were positive for the presence of pre-contact cultural resources. In addition, one post-contact logging feature was also recorded.

Three test areas contained only lithics, based on the preliminary shovel-testing. No diagnostic lithics were recovered. Two test areas were ceramic with non-diagnostic Woodland body sherds. Shovel testing was not conducted to the intensity needed to determine site boundaries.

Test Landform A (positive)

This landform is located near the north edge of the Alternative 1 corridor at station 516.00 (Figure TL-1 and inset, APPENDIX A, Alignment 1, Sheet 1). This is on a high west-facing terrace overlooking a former stream entrance into Lake Shemahgun from Lake Emerald.

Three positive shovel tests on this landform yielded 1 tool fragment of Swan River Chert, 3 flakes of Swan River Chert, and 1 flake of quartz.

Positive shovel tests are as follows:

ST #1: 1 parallel flaked tool fragment, heat-treated Swan River Chert
1 flake, heat-treated Swan River Chert
ST #3: 1 flake, heat-treated Swan River Chert
ST #4: 1 flake, quartz

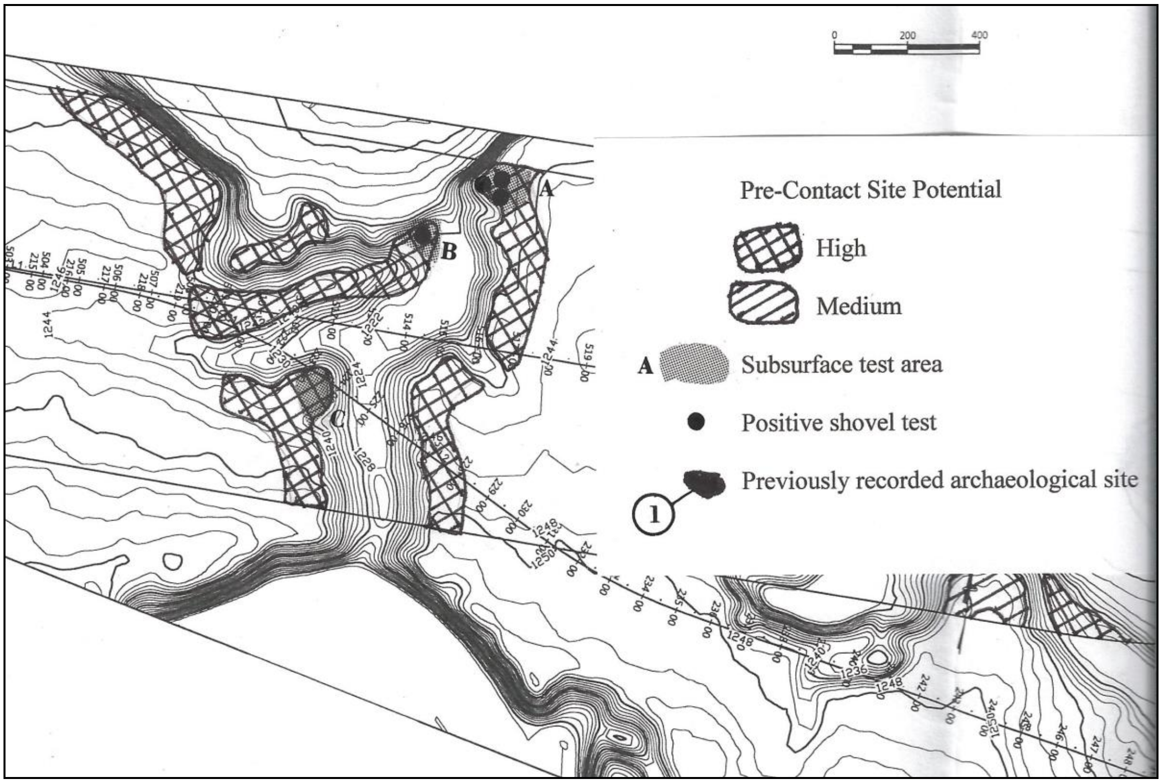

Figure TL-1: Test landforms A, B and C, Alternative Corridor 1

Test Landform B (positive)
This landform is located in the north central part of Alternative Corridor 1 at station 514.00 (Figure TL-1). This would also be along the north edge of Alternative Corridor 2 at station 224.00. This is on a low east-facing terrace overlooking a former stream entrance into Lake Shemahgun.

One positive shovel test on this landform yielded 2 flakes (1 each of Knife River Flint and chert), and 1 fire-cracked rock

ST #5: 1 flake, Knife River Flint
1 flake, low-grade chert
1 FCR

Test Landform C (negative)
This landform is located in the south-central part of Alternative Corridor 1 at station 512.00 (Figure TL-1). This would also be on the centerline of Alternative Corridor 2 at station 223.00. This is on a high east-facing terrace overlooking a former stream between Lake Emerald and Lake Shemahgun.

Shovel Tests #6 and 7 were negative on this landform.

Test Landform D (negative)
This landform is located in the north-central part of Alternative Corridor 2 at station 252.00 (Figure TL-2 and inset, APPENDIX A, Alignment 2, Sheet 1). It is on a west-facing high terrace overlooking an existing stream.

Shovel Tests #8 and 9 were negative on this landform.

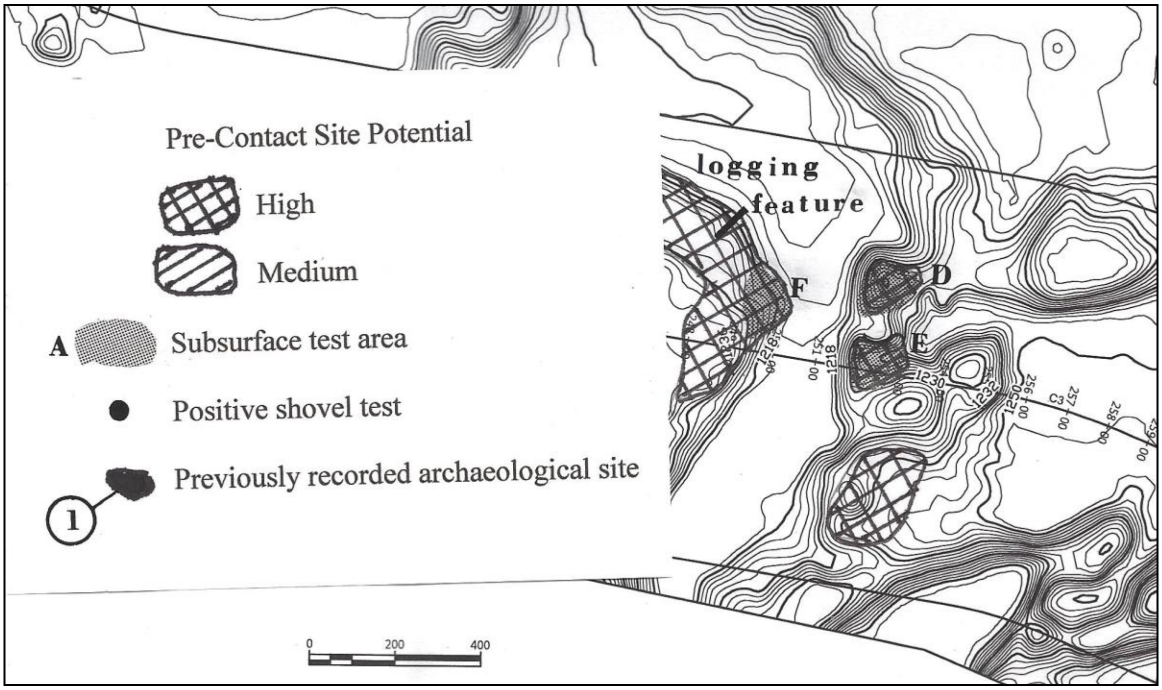

Figure TL-2: Test landforms D, E and F, Alternative Corridor 2

Test Landform E (negative)

This landform is located on the centerline of Alternative Corridor 2 at station 252.00 (Figure TL-2 and inset, APPENDIX A, Alignment 2, Sheet 1). It is on a west-facing high terrace overlooking an existing stream.

Shovel Test #10 was negative on this landform.

Test Landform F (negative)

This landform is located just north of the centerline of Alternative Corridor 2 at station 250.00 (Figure TL-2 and inst, APPENDIX A, Alignment 2, Sheet 1). It is on a low east-facing terrace overlooking an existing stream.

Shovel Tests #11 and 12 were negative on this landform.

An early logging related feature, possibly an ice road for transporting logs into the stream, was found just north of the shovel-tested area.

Test Landform G (positive)

This landform is located south of the centerline of Alternative Corridor 2 at station 229.00 (Figure TL-3, and inset, APPENDIX A, Alignment 2, Sheet 1). It is on a high terrace overlooking the exit of a former stream from Lake Emerald.

The three positive shovel tests located on this landform yielded 3 fabric-impressed ceramic body sherds, 1 quartz flake, and 1 fragment of FCR.

ST #13 1 body sherd, fabric impressed (horizontally corded??)
1 flake, quartz

ST #14 1 body sherd, fabric impressed

ST #15 1 body sherd, fabric impressed
1 FCR fragment

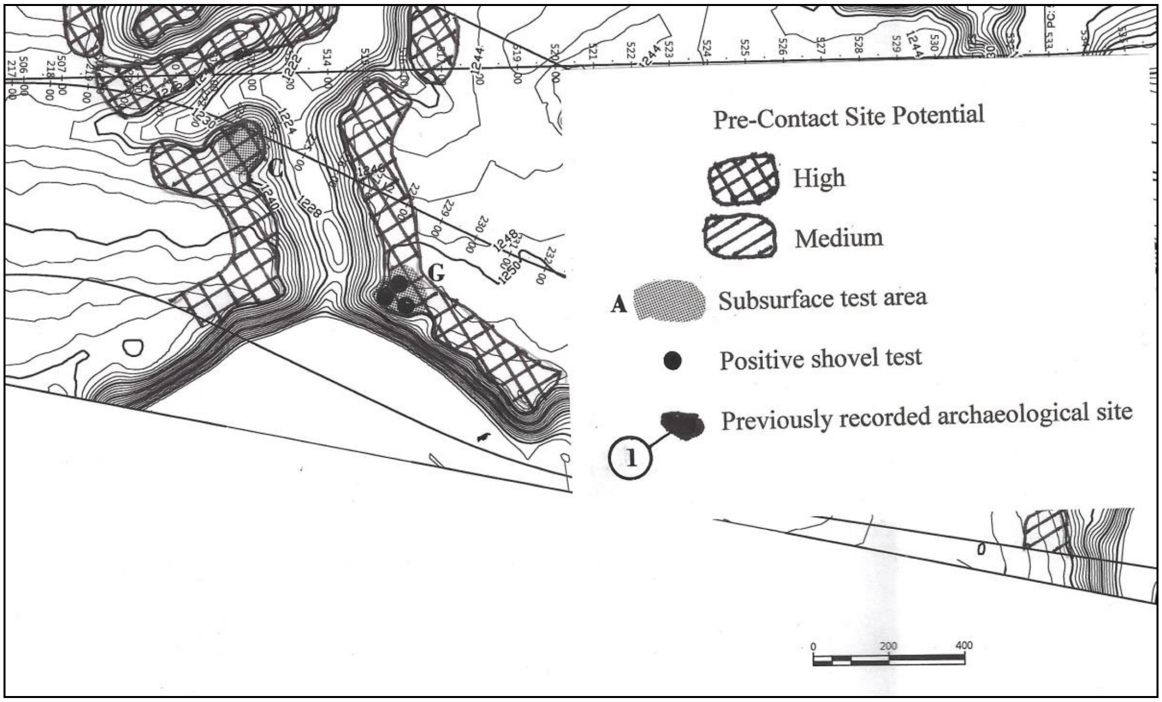

Figure TL-3: Test landform G, Alternative Corridor 2

Test Landform H (positive)
This landform is located along the centerline of Alternative Corridor 3 at station 940.00 (Figure TL-4 and inset, APPENDIX A, Alignment 3, Sheet 2). It is located on an east-facing mid-level terrace straddling the entrance of a small drainage into an existing stream.

One positive shovel test located on this landform yielded 1 chert flake.

ST #18 1 flake, chert (unidentified chert)

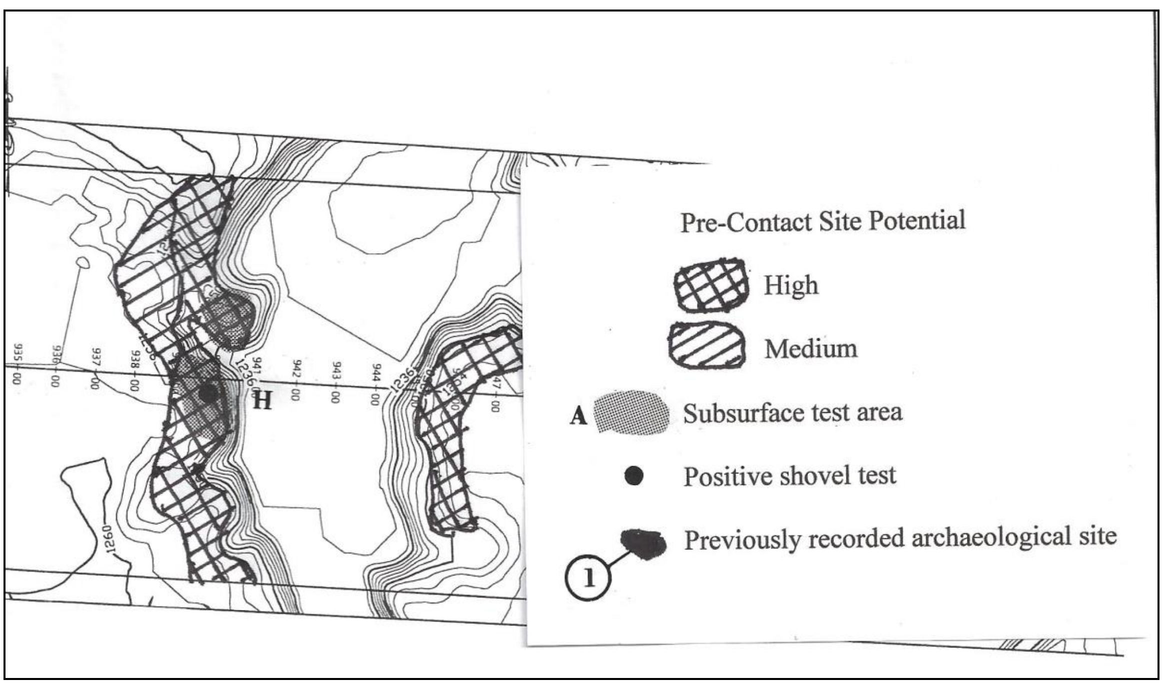

Figure TL-4: Test landform H, Alternative Corridor 3

Test Landform I (positive)
This landform is located north of the centerline of Alternative Corridor 2 at station 387.00 (Figure TL-5 and inset, APPENDIX A, Alignment 2, Sheet 4). It is on an east-facing terrace overlooking the Mud River.

Two positive shovel tests on this landform yielded 3 flakes (2 of Swan River Chert, 1 of siltstone), and 1 unidentifiable/exfoliated body sherd.

ST #20 1 ceramic body sherd, unidentifiable/exfoliated
1 flake, Swan River Chert
1 flake, siltstone

ST #22 1 flake, Swan River Chert

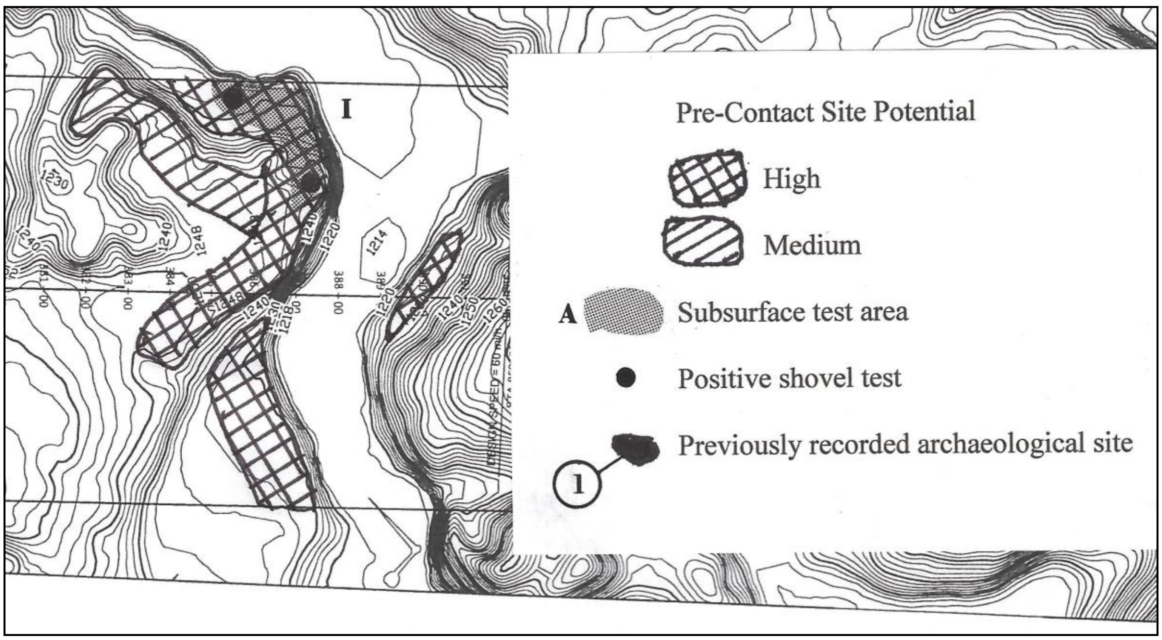

Figure TL-5: Test landform I, Alternative Corridor 2

FINAL MODEL OF SITE POTENTIAL

The site potential for each of the three corridors includes the delineation of areas of high, medium, and low potential (all areas not delineated as high or medium) for the presence of pre-contact resources. In addition, all known sites in the corridors are listed.

The potential for post-contact sites cannot be adequately predicted for any of the corridor alternatives. Examination of 1939 aerial photographs does not reveal any areas such as openings, that might be indicative of post-contact sites. Trails shown on the GLO maps indicate that the area was used, certainly for travelways, but no other features are evident. A logging feature was encountered during the model testing and other logging features are likely, but their locations cannot be predicted with present data.

The best tool for potentially identifying post-contact alterations prior to actual field survey, would be LiDAR. Further recommendations are given in the Conclusions and Recommendations section of this report.

Maps showing site potentials and known sites for each Alternative Corridor are in Appendix A.

Alternative Corridor 1
Thirty areas in this alternative are identified as having high or medium potential for containing pre-contact archaeological sites.

- Six of these are along a major former drainage channel between Emerald and Shemahgun Lakes
- Nine of these are along drainages southeast of Shemahgun Lake
- One medium potential area is along a glacial beach ridge between stations 572.00 and 596.00
- Two of these are on glacial beaches between stations 622.00 and 630.00
- Four areas border drainages in the eastern quarter of the corridor (Seven of these are also in Alternative Corridor 2)

Two previously identified pre-contact sites (Mud River Site and Upper Terrace Site) and one post-contact site (Redby CCC Camp) are located within this corridor. Two additional pre-contact site areas were located during field work for this model.

Alternative Corridor 2
Thirty-one areas within this alternative are identified as having high or medium potential for containing pre-contact archaeological sites.

- Six of these are along a major old drainage channel between Emerald and Shemahgun Lakes
- Six of these are along drainages southeast of Shemahgun Lake
- Two of these are along an old drainage between Squaw Smith and Elephant Ear Lakes
- Five areas border the Mud River
- Three areas are on terraces between stations 410.00 and 432.00
- Two areas are on glacial beaches between stations 447.00 and 450.00
- Seven areas border drainages in the eastern quarter of the corridor (These are also in Alternative Corridor 1)

No previously identified sites are within this corridor. Three pre-contact site areas and one logging-related site were located during field work for this model.

Alternative Corridor 3
Six areas within this alternative were identified as having high or medium potential for containing pre-contact archaeological sites.

These all border a drainage between stations 938.00 and 953.00. If this corridor is chosen, those high and medium potential areas in the western two-thirds of Alternative Corridor 2 would also need to be addressed.

No previously identified sites are within this corridor. One pre-contact site area was located during field work for this model.

CONCLUSIONS AND RECOMMENDATIONS

Only three archaeological sites (two pre-contact and one post-contact) were previously recorded within the project area. However, only a small percentage of this area has been previously surveyed for archaeological sites. Of the nine landform areas sampled during field testing for this project, five tested positive for archaeological materials. In addition, one logging era feature was found. This indicates that a substantial number of previously unrecorded archaeological sites are likely present within the project area.

Numerous landforms having a high to medium potential for containing archaeological sites are present in each of the proposed alternative corridors. Thus, no single alternative appears significantly more favorable to avoid sites. However, since the study corridors are 1,000 feet wide, careful selection of a final centerline for the road could avoid many of these landforms and reduce the magnitude of needed archaeological survey work.

Archaeological sites that occur within the project area will be "interior sites", as described earlier in this report. These can be expected to be small and with a low density of artifacts. They are important, however, for understanding overall settlement and use patterns.

Because of their size and low density such sites will be difficult to locate using standard archaeological survey techniques. Typical 15-meter shovel test intervals could miss many such sites. Close interval shovel testing with attention to micro-topographic features is recommended. A minimum shovel test diameter of 40cm should be used. Even then, many positive tests can be expected to contain only one or two artifacts unless they fall within a small activity area.

Conditions during the field testing for this project were adverse for the location of post-contact site features. Dense vegetation severely limited visibility for the identification of berms, depressions, and other evidence of human use. Survey for post-contact sites must be conducted in spring or fall when the leaf cover is low or absent.

We recommend the use of good resolution LiDAR maps to review the corridors for unusual features prior to field examination. Unusual patterns that may be indicative of roads or berms may be detected using this method and can then be ground-truthed.

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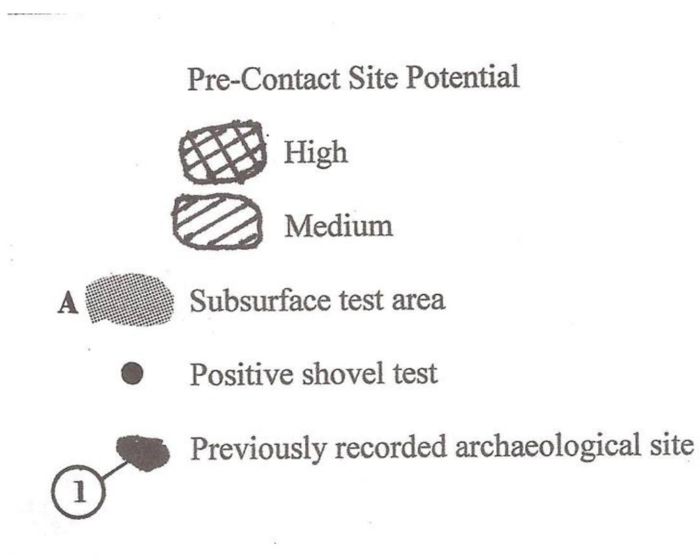
APPENDIX A

SITE POTENTIAL MAPS

Legend for Site Potential Maps



APPENDIX C

CORRESPONDENCE WITH RED LAKE DNR

APPENDIX D
WETLAND DELINEATION REPORTS

WETLAND DELINEATION REPORT

Prepared for the Red Lake Band Of Chippewa for the Thunder Lake Road East Connection Proposed Road Corridor

Delineated and Prepared by: Patrick Reardon, CMWP Number: 1295

Delineated October 2023

Northern Engineering & Consulting, Inc.

2216 Tod Court NW
Bemidji, Minnesota 56601

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SECTION I

Intent of report

The intent of this report is to describe the wetland resources found within the area of interest during the field visits in October 2023. This report displays the data found and describes the areas of wetland resources and the upland transition areas around these wetlands and how this transition line was determined.

Area of Interest

The area of interest is comprised of three sections with the first consisting of an approximately 2-mile long, 250-foot-wide corridor, starting a half mile west of the Old Nebish Road (Route 16) and extending east to the point of tangent of the curve along Indian Service Route 18, just north of the intersection with IRR 40. The second section of the area of interest was comprised of a 200-foot-wide corridor that stretched north from the point of curvature along the aforementioned curve, intersecting the first area of interest perpendicularly along will all of the curve along Indian Service Route 18. The final section of the area of interest consists of an approximately 300 foot wide, half mile long corridor following IRR 40 to the northwest from the intersection with Indian Service Route 18 (please see wetland delineation map for visual reference).

Current Use

The area of interest is mostly comprised of undeveloped upland forest with wetland basins intermixed throughout. The forest land is currently managed for timber resources. Forest roads and two track trails bisect the proposed corridor periodically through the undeveloped forest. The only development present is in the form of IRR 40 and Indian Service Route 18 at the east end of the area of interest. The portions of the roads within the corridor are used as throughway travel only, with no residential use present along these sections of road.

Vegetation

The vegetation within the upland areas at the sample locations were comprised of *Populus tremuloides* (Quaking Aspen), *Betula papyrifera* (Paper Birch), *Ostrya virginiana* (Ironwood), *Quercus macrocarpa* (Bur Oak), *Acer rubrum* (Red Maple), *Pinus resinosa* (Red Pine), *Fraxinus nigra* (Black Ash), *Populus balsamifera* (Balsam Poplar), *Tilia americana* (Basswood), *Abies balsamea* (Balsam Fir), *Ulmus americana* (American Elm) and *Acer saccharum* (Sugar Maple) in the tree stratum, *Corylus americana* (American Hazelnut), *Populus tremuloides* (Quaking Aspen), *Cornus sericea* (Red Osier Dogwood), *Fraxinus nigra* (Black Ash), *Acer saccharum* (Sugar Maple), *Salix bebbiana* (Bebb's Willow), *Populus balsamifera* (Balsam Poplar), *Cornus rugosa* (Round-leaved Dogwood), *Betula papyrifera* (Paper Birch), *Abies balsamea* (Balsam Fir), *Rosa blanda* (Smooth Wild Rose), *Acer saccharum* (Sugar Maple) and *Ostrya virginiana* (Ironwood) in the shrub stratum and *Dievilla lonicera* (Northen Honeysuckle), *Pteridium aquilinum* (Bracken Fern), *Thalictrum dioicum* (Early Meadow-Rue), *Abies balsamea* (Balsam Fir), *Eurybia macrophylla* (Large-leaved Aster), *Bromus ciliatus* (Fringe Brome), *Oryzopsis asperifolia* (Rough-leaved Rice Grass), *Anemone americana* (Round-lobed Hepatica), *Fragaria virginiana* (Wild Strawberry), *Bromus inermis* (Smooth Brome), *Melilotus officinalis* (Yellow Sweet Clover), *Phleum pratense* (Timothy), *Agrostis perennans* (Autumn Bentgrass), *Centaurea stoebe* (Spotted Knapweed), *Pastinaca sativa* (Wild Parsnip), *Carex pensylvanica* (Pennsylvania Sedge), *Athyrium filix-femina* (Lady Fern), *Trifolium repens* (White Clover), *Taraxacum officinale* (Common Dandelion), *Acer rubrum* (Red Maple), *Quercus macrocarpa* (Bur Oak), *Maianthemum racemosum* (False Solomon's Seal), *Cornus rugosa* (Round-leaved Dogwood), *Pyrola elliptica* (Shinleaf), *Galium triflorum* (Fragrant Bedstraw), *Equisetum pratense* (Meadow Horsetail) and *Osmorhiza claytonii* (Sweet Cicely) in the herb stratum.

The vegetation within the wetland areas was comprised of *Salix bebbiana* (Bebb's Willow), *Fraxinus nigra* (Black Ash), *Populus tremuloides* (Quaking Aspen) and *Acer rubrum* (Red Maple), in the tree stratum, *Salix petiolaris* (Meadow Willow), *Fraxinus nigra* (Black Ash), *Spiraea alba* (White Meadowsweet), *Salix bebbiana* (Bebb's Willow), *Cornus sericea* (Red Osier Dogwood), *Populus tremuloides* (Quaking Aspen), *Alnus incana* (Speckled Alder) and *Populus balsamifera* (Balsam Poplar) in the shrub stratum and *Carex lacustris* (Lake Sedge), *Scirpus cyperinus* (Woolgrass), *Fragaria virginiana* (Wild Strawberry*), Calamagrostis canadensis* (Canada Bluejoint), *Glyceria striata* (Fowl Manna Grass), *Plantgo Major* (Common Plantain), *Abies balsamea* (Balsam Fir), *Phalaris arundinacea* (Reed Canary Grass), *Typha angustifolia* (Narrowleaf Cattail), *Symphyotrichum lanceolatum* (Panicled Aster), *Taraxacum officinale* (Common Dandelion), *Pastinaca sativa* (Wild Parsnip), *Cirsium arvense* (Canada Thistle), *Bromus inermis* (Smooth Brome), *Toxicodendron radicans* (Eastern Poison Ivy), *Salix petiolaris* (Meadow Willow), *Equisetum pratense* (Meadow Horsetail), *Petasites frigidus* (Sweet Coltsfoot), *Equisetum praealtum* (Scouring Rush), *Rubus idaeus* (Wild Red Raspberry), *Carex tuckermanii* (Tuckerman's Sedge), *Persicaria lapathifolia* (Nodding

Smartweed), *Lathyrus ochroleucus* (Cream Pea), *Ranunculus pensylvani*ca (Pennsylvania Buttercup), *Carex atherodes* (Slough Sedge), *Cardamine pensylvanica* (Pennsylvania Bittercress), *Bidens frondosa* (Devil's beggarticks) and *Bromus ciliatus* (Fringe Brome) in the herb stratum.

Description of the Area

The area of interest is comprised of a proposed road corridor along with sections of two existing road corridors. The proposed road corridor is approximately 2 miles long, extending west from Indian Service Route 18, just north of the intersection of Indian Service Route 18 and IRR 40. This area is comprised mostly of upland forest with wetland basins located in low points throughout. The topography within this area is moderately rolling with several large deep basins and a stream corridor that runs bisects the corridor. The land is undeveloped with the primary use of the area being forestry with an emphasis of logging (evidence of past logging was found in the form of landscape alterations from large equipment as well as areas of different aged forest.) There are two track roads that cross throughout the area, used by local residents for hunting and other forest access. A section of Indian Service Route 18 and a section of IRR 40 are encompassed within the area of interest. There is no residential use along these sections of road, with the use being strictly for through traffic.

Weather

The weather over the past three months prior to visiting the site was considered **dry.** There was less than normal amounts of precipitation the month prior to the visit, less than normal amounts of precipitation two months prior to the visit and less than average amounts of precipitation three months prior to the visit. Surface water was present within most of the wetland basins during the site visit.

Hydrology

The Upper/Lower Red Lake watershed # 09020302, covers 1,263,678 acres. Located in Northern Minnesota, this watershed is home to Upper and Lower Red Lakes, the two largest bodies of water within the state. The watershed is by both flow volume and surface area the largest drainage basin of the Red River. Its major tributaries are the Red Lake River and Grand Marais Creek, which empty directly into the Red River, and the tributaries of the Red Lake River (the Thief, Clearwater, Hill, Lost, and Poplar Rivers).

Methods

Prior to a site visit, the National Wetland Inventory Mapper was used to check for any known wetlands located within the area of interest. The Web Soil Survey was used to look for soil types and possible changes that occurred on the site. And contours were gathered from the Beltrami County GIS Mapping website to help indicate all areas that needed to be investigated within the area of interest.

Sites were inspected for the three parameters described in the 1987 Corps of Engineers Wetlands Delineation manual. The delineation was also performed based on the guidance laid out within the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region. A representative area was located for each wetland and field notes, samples and photos were collected at these spots. The wetland was flagged with purple flagging and plot sites were marked with lath and purple flagging.

SECTION II

Wetland Descriptions

Wetland 100 is a palustrine scrub-shrub broad-leaved deciduous seasonally flooded/saturated wetland (PSS1E). The wetland is located is large basin that is several feet lower in elevation than the surrounding topography. The area around the basin has been logged in the past and it appears that heavy equipment left ruts and depression around the edge of the wetland in places that it has expanded into. The vegetation within the wetland plot was comprised of *Salix bebbiana* (Bebb's Willow) and *Fraxinus nigra* (Black Ash) in the tree stratum, *Salix petiolaris* (Meadow Willow), *Fraxinus nigra* (Black Ash), *Spiraea Alba* (White Meadowsweet) and *Salix bebbiana* (Bebb's Willow) in the shrub stratum and *Carex lacustris* (Lake Sedge) in the herb stratum. Wetland soils within the sample plot consisted of eleven inches of 10YR 2/1 loam followed by three inches of 95% 10YR 4/2 sandy clay with 5% 10YR 5/8 concentrations within the matrix. The hydric soil indicator was Depleted Below Dark Surface (A11). The upland vegetation at the sample plot consisted of *Populus tremuloides* (Quaking Aspen), *Betula papyrifera* (Paper Birch) and *Ostrya virginiana* (Ironwood) in the tree stratum, *Corylus americana* (American Hazelnut) in the shrub stratum and *Dievilla lonicera* (Northen Honeysuckle), *Pteridium aquilinum* (Bracken Fern), *Thalictrum dioicum* (Early Meadow-Rue), *Abies balsamea* (Balsam Fir), *Eurybia macrophylla* (Large-leaved Aster) and *Bromus ciliatus* (Fringe Brome) in the herb stratum. The upland soils consisted of seven inches of 10YR 2/2 sandy loam followed by five inches of 10YR 3/4 sand followed by two inches of 10YR 3/4 clay. The wetland was flagged based on a shift from an upland based plant community to a wetland based plant community with a shift from *Corylus americana* (American Hazelnut), *Eurybia macrophylla* (Large-leaved Aster) and *Pteridium aquilinum* (Bracken Fern) to *Salix bebbiana* (Bebb's Willow) and *Fraxinus nigra* (Black Ash) used as an indicator of this shift. This shift correlated closely with the toe of the subtle slope leading down to the wetland edge for the surrounding upland.

Wetland 101 is a palustrine emergent persistent temporarily flooded wetland (PEM1A). The wetland is located in a slight depression within the surrounding upland and based on the sharp edges and indentations within the depression, it appears that it may have been formed when heavy logging equipment created ruts and compacted soils during the last time the area was logged. The vegetation within the wetland plot was comprised of *Salix bebbiana* (Bebb's willow) in the tree stratum, *Cornus sericea* (Red Osier Dogwood) and *Fraxinus nigra* (Black Ash) in the shrub stratum and *Scirpus cyperinus* (Woolgrass), *Fragaria virginiana* (Wild Strawberry*), Calamagrostis canadensis* (Canada Bluejoint), *Glyceria striata* (Fowl Manna Grass), *Plantgo Major* (Common Plantain) and *Abies balsamea* (Balsam Fir) in the herb stratum. Wetland soils within the sample plot consisted of three inches of 10YR 3/4 loamy sand followed by eleven inches of 50% 10YR 5/3 and 15% 10YR 3/4 clay with 5% 10YR 5/2 pockets of sand and 30% 10YR 5/8 concentrations within the matrix. The hydric soil indicator was Stripped Matrix (S6). The upland vegetation at the sample plot consisted of *Populus tremuloides* (Quaking Aspen), *Betula papyrifera* (Paper Birch) and *Ostrya virginiana* (Ironwood) in the tree stratum, *Corylus americana*

(American Hazelnut) in the shrub stratum and *Dievilla lonicera* (Northen Honeysuckle), *Pteridium aquilinum* (Bracken Fern), *Thalictrum dioicum* (Early Meadow-Rue), *Abies balsamea* (Balsam Fir), *Eurybia macrophylla* (Large-leaved Aster) and *Bromus ciliatus* (Fringe Brome) in the herb stratum. The upland soils consisted of seven inches of 10YR 2/2 sandy loam followed by five inches of 10YR 3/4 sand followed by two inches of 10YR 3/4 clay. The wetland was flagged based on the distinct edge where the subtle depression began. This correlated closely with the shift from and upland based plant community to a wetland based plant community, with a shift from *Corylus americana* (American Hazelnut), *Eurybia macrophylla* (Large-leaved Aster) and *Pteridium aquilinum* (Bracken Fern) to *Salix bebbiana* (Bebb's Willow) and *Scirpus cyperinus* (Woolgrass) used as an indicator of this shift. The vegetation shift was used to flag areas where the edge of the depression was more subtle and obscure.

Wetland 102 is a palustrine emergent persistent seasonally flooded/saturated wetland (PEM1E). The wetland is located within a large basin and appears to be hydrologically connected to wetland 104 through a centerline culvert under Indian Service Route 18. The wetland drains to the northwest into wetland 109 through a wetland complex with a shallow, seasonal creek flowing through middle of it. The vegetation within the wetland plot was comprised of no vegetation within the tree and shrub stratums and *Carex lacustris* (Lake Sedge), *Phalaris arundinacea* (Reed Canary Grass), *Typha angustifolia* (Narrowleaf Cattail) and *Symphyotrichum lanceolatum* (Panicled Aster) in the herb stratum. Wetland soils consisted of seventeen inches of 10YR 2/1 mucky loam followed by three inches of 10YR 4/1 coarse sand. The hydric soil indicator was Loamy Mucky Mineral (F1). The upland vegetation at the sample plot consisted of *Quercus macrocarpa* (Bur Oak), *Acer rubrum* (Red Maple), *Populus tremuloides* (Quaking Aspen), *Ostyra virginiana* (Ironwood) and *Betula papyrifera* (Paper Birch) in the tree stratum, *Populus tremuloides* (Quacking Aspen), *Cornus sericea* (Red Osier Dogwood), *Fraxinus nigra* (Black Ash), *Corylus americana* (American Hazelnut) and *Acer saccharinum* (Sugar Maple) in the shrub stratum and *Pteridium aquilinum* (Bracken Fern), *Oryzopsis asperifolia* (Rough-leaved Rice Grass), *Anemone americana* (Round-lobed Hepatica), *Fragaria virginiana* (Wild Strawberry), *Eurybia macrophylla* (Large-leaved Aster) and *Thalictrum dioicum* (Early Meadow-rue) in the herb stratum. The upland soils consisted of six inches of 10YR 2/2 sand/fine sand followed by five inches of 60% 10YR 4/3 and 40% 10YR 2/2 sand/fine sand followed by three inches of 10YR 4/3 sand/fine sand. The wetland was flagged based on the shift from an upland based plant community to a wetland based plant community with a shift from *Corylus americana* (American Hazelnut), *Pteridium aquilinum* (Bracken Fern) and *Oryzopsis asperifolia* (Rough-leaved Rice Grass) to *Typha angustifolia* (Narrowleaf Cattail) and *Carex lacustris* (Lake Sedge) used as an indicator of this shift. This was in conjunction with the toe of the surrounding slopes, which correlated closely to this shift.

Wetland 103 is a palustrine emergent persistent temporarily flooded wetland (PEM1A). The wetland is located in a the bottom of a ditch along Indian Service Route 18. It appears that the ditch is graded flat and that the approach culvert that would allow the water to flow through the ditch is partially blocked and installed too high, resulting in water ponding in this portion of the ditch frequently enough to create wetland soils and support hydrophytic vegetation. The vegetation within the wetland plot was recently mowed prior to the site visit and was comprised of no vegetation within the tree stratum, *Salix bebbiana* (Bebb's Willow) and *Salix petiolaris* (Meadow Willow) in the shrub stratum and *Carex lacustris* (Lake Sedge), *Plantago major* (Common Plantain) and *Taraxacum officinale* (Common Dandelion) in the herb stratum. Wetland soils consisted of three inches of 10YR 2/1 fine sandy loam followed by fifteen inches of 63% 10YR 5/2 clay with 20% 10YR 5/6 and 2% 2.5YR 4/8 concentrations within the matrix and 15% 10YR 7/1 depletions within the matrix. The hydric soil indicator was Depleted Below Dark Surface (A11). The upland vegetation at the sample plot consisted of *Pinus resinosa* (Red Pine), *Populus tremuloides* (Quaking Aspen) and *Betula papyrifera* (Paper Birch) in the tree stratum, *Salix bebbiana* (Bebb's Willow) in the shrub stratum and *Bromus inermis* (Smooth Brome), *Melilotus officinalis* (Yellow Sweet Clover), *Phleum pratense* (Timothy), *Agrostis perennans* (Autumn Bentgrass), *Centaurea stoebe* (Spotted Knapweed) and *Pastinaca sativa* (Wild Parsnip) in the herb stratum. The upland soils consisted of seven inches of 10YR 2/2 followed by seven inches of 55% 10YR 6/3 and 5% 10YR 2/2 sand with 30% 10YR 4/6 and 10% 10YR 5/8 coated sand grains within the matrix. The wetland was flagged based on the shift from an upland based plant community to a wetland based plant community with a shift from *Bromus inermis* (Smooth Brome) to *Carex lacustris* (Lake Sedge) used as an indicator of this shift. The wetland boundary was a little higher than the toe of the ditch and with the elevation of the wetland boundary remaining relatively consistent around the entire wetland.

Wetland 104 is a palustrine forested broad-leaved deciduous/emergent persistent seasonally flooded wetland (PFO1/EM1C). The wetland is located on the east side of Indian Service Route 18 in a depressional bowl. There is a swale or channel on the east side of the depression that the wetland follows before expanding into a larger area offsite. There is a centerline culvert that hydrologically connects wetland 102 with wetland 104. The adjacent ditch to the wetland possesses wetland characteristics due to minimal slope and elevation similarities and was included in the boundary of the wetland since there was no way to distinguish the original wetland from potential incidental characteristics created within the ditch. The vegetation within the wetland plot was comprised of *Fraxinus nigra* (Black Ash) in the tree stratum, no vegetation within the shrub stratum and *Phalaris arundinacea* (Reed Canary Grass), *Carex lacustris* (Lake Sedge), *Typha angustifolia* (Narrowleaf Cattail), *Pastinaca sativa* (Wild Parsnip) and *Symphyotrichum lanceolatum* (Panicled Aster) in the herb stratum. Wetland soils consisted of five inches of 10YR 2/1 mucky loam followed by nine inches of 80% 10YR 2/1 mucky loam and 20% 10YR 4/2 coarse sand. The hydric soil indicator was Loamy Mucky Mineral (F1). The upland vegetation at the sample plot consisted of *Fraxinus nigra* (Black Ash), *Populus balsamifera* (Balsam Poplar), *Populus tremuloides* (Quaking Aspen) and *Quercus macrocarpa* (Bur Oak) in the tree stratum, *Corylus americana* (American Hazelnut*), Fraxinus nigra* (Black Ash) and *Populus balsamifera* (Balsam Poplar) in the shrub stratum and *Carex pensylvanica* (Pennsylvania Sedge), *Eurybia macrophylla* (Large-leaf Aster) and *Athyrium filix-femina* (Lady Fern) in the herb stratum. The upland soils consisted of six inches of 10YR 2/1 sand followed by eight inches of 60% 10YR 4/3 and 30% 10YR 3/2 clay with 5% 10YR 4/6 sand and 5% 10YR 5/8 concentrations within the matrix. The wetland was flagged based on evidence of frequent hydrology with water-stained leaves and some water marks used as indicators of this. This was in conjunction with the shift from an upland based plant community to a wetland based plant community with a shift from *Carex lacustris* (Lake Sedge), *Phalaris arundinacea* (Reed Canary Grass) and *Fraxinus nigr*a (Black Ash) to *Carex pensylvanica* (Pennsylvania Sedge) and *Corylus americana* (American Hazelnut) used as an indicator of this shift. This correlated closely to the toe of the slopes surrounding the wetland basin.

Wetland 105 is a palustrine scrub-shrub broad leaved deciduous seasonally flooded wetland (PSS1C). The wetland is located on the north side of Indian Service Route 18 in a shallow depression that extends north of the area of interest. The adjacent ditch to the wetland possesses wetland characteristics due to minimal slope and elevation similarities and was included in the boundary of the wetland since there was no way to distinguish the original wetland from potential incidental characteristics created within the ditch. The vegetation within the wetland was comprised of *Fraxinus nigra* (Black Ash) and *Populus tremuloides* (Quaking Aspen) in the tree stratum, *Populus tremuloides* (Quaking Aspen), *Cornus sericea* (Red Osier Dogwood), *Fraxinus nigra* (Black Ash), *Alnus incana* (Speckled Alder), *Salix bebbiana* (Bebb's Willow) and *Populus balsamifera* (Balsam Poplar) in the shrub stratum and *Carex lacustris* (Lake Sedge), *Calamagrostis canadensis* (Canada Bluejoint), *Pastinaca sativa* (Wild Parsnip) and *Cirsium arvense* (Canada Thistle) in the herb stratum. Wetland soils consisted of nine inches of 10YR 2/1 of sandy loam followed by five inches of 80% 10YR 5/3 sandy clay with 15% 10YR 5/8 concentrations and 5% 10YR 7/1 depletion within the matrix. The hydric soil indicator was Depleted Below Dark Surface (A11). The upland vegetation at the sample plot consisted of no vegetation within the tree and shrub stratums and *Trifolium repens* (White clover), *Bromus inermis* (Smooth Brome), *Melilotus officinalis* (Yellow Sweet Clover), *Pastinaca sativa* (Wild Parsnip), *Plantago major* (Common Plantain) and *Taraxacum officinale* (Common Dandelion) in the herb stratum. The upland soils consisted of an inch of 10YR 3/2 sand followed by thirteen inches of 70% 10YR 4/6 fine sandy loam and 30% 10YR 2/1 coarse sand. The wetland was flagged based on the shift from an upland based plant community to a wetland based plant community with a shift from *Bromus inermis* (Smooth Brome) and *Trifolium repens* (White Clover) (along with to *Corylus americana* (American Hazelnut) in other areas around the wetland) to *Carex lacustris* (Lake Sedge), *Fraxinus nigra* (Black Ash) and *Salix bebbiana* (Bebb's Willow) used as an indicator of this shift. This correlated closely with the toe of the ditch along with the roadway and subtle rises of elevation as the wetland extended away from the road into the adjacent wooded area.

Wetland 106 is a palustrine emergent persistent seasonally flooded wetland (PEM1C). The wetland is located in a moderate sized basin, surrounded by upland with no hydrological connection to any adjacent wetlands. A portion of the wetland extends into the ditch of IRR 40. It appears that historically, the wetland used to flow into wetland 102 when water elevations within the basin exceeded a certain level but the construction of IRR 40 has since cut off that overland flow connection. The vegetation within the wetland plot was comprised of *Acer rubrum* (Red Maple), *Fraxinus nigra* (Black Ash), *Salix bebbiana* (Bebb's Willow) and *Populus tremuloides* (Quaking Aspen) in the tree stratum, *Spiraea alba* (White Meadow Sweet), *Fraxinus nigra* (Black Ash), *Populus tremuloides* (Quaking Aspen) and *Cornus* *sericea* (Red Osier Dogwood) in the shrub stratum and *Carex lacustris* (Lake Sedge), *Calamagrostis canadensis* (Canada Bluejoint) and *Scirpus cyperinus* (Woolgrass) in the herb stratum. Wetland soils consisted of six inches of 10YR 2/1 mucky sand followed by eight inches of 75% 10YR 5/3 and 20% 10YR 3/2 loamy sand with 5% 10YR 5/8 concentrations within the matrix. The hydric soil indicator was Sandy Mucky Mineral (S1). The upland vegetation at the sample plot consisted of *Tilia americana* (Basswood), *Acer rubrum* (Red Maple) and *Ostrya virginiana* (Ironwood) in the tree stratum, *Corylus americana* (American Hazelnut) and *Cornus rugosa* (Round-leaved Dogwood) in the shrub stratum and *Carex pensylvanica* (Pennsylvania Sedge), *Acer rubrum* (Red Maple), *Quercus macrocarpa* (Bur Oak), *Abies balsamea* (Balsam Fir), *Anemone americana* (Round-lobed Hepatica), *Maianthemum racemosum* (Canada Mayflower) and *Oryzopsis asperifolia* (Rough-leaved Rice Grass) in the herb stratum. The upland soils consisted of seven inches of 10YR 2/1 sand followed by two inches of 60% 10YR 4/3 and 40% 10YR 2/1 sand followed by five inches of 10YR 4/3 sand. The wetland was flagged based on the shift from an upland based plant community to a wetland based plant community with a shift from *Carex pensylvanica* (Pennsylvania Sedge) and *Corylus americana* (American Hazelnut) to *Carex lacustris* (Lake Sedge), *Calamagrostis canadensis* (Canada Bluejoint) and *Fraxinus nigra* (Black Ash) used as an indicator of this shift. This correlated closely with the toe of the surrounding slopes and toe of the ditch where the wetland abuts IRR 40.

Wetland 107 is a palustrine emergent persistent temporarily flooded wetland (PEM1A). The wetland is located in the bottom of a ditch alongside IRR 40. It appears that the ditch is poorly graded with no proper outlet in place to allow water to flow away from it before ponding and inundation occurs. Proper grading and an approach culvert installed at the proper elevation under the approach to the northwest of the wetland would allow water to flow into wetland 106, as it appears was the original intent for the drainage. The vegetation within the wetland was comprised of no vegetation within the tree and shrub stratums and *Carex lacustris* (Lake sedge), *Typha angustifolia* (Narrowleaf Cattail), *Bromus inermis* (Smooth Brome), *Cirsium arvense* (Canada Thistle), *Taraxacum officinale* (Common Dandelion) and *Toxicodendron radicans* (Eastern Poison Ivy) in the herb stratum. Wetland soils consisted of thirteen inches of 93% 10YR 2/2 loamy sand with 5% 10YR 3/6 concentrations and 2% 2.5Y 7/2 depletions within the matrix followed by three inches of 70% 10YR 6/2 sandy clay with 30% 10YR 5/8 concentrations within the matrix. The hydric soil indicator was Sandy Redox (S5). The upland vegetation at the sample plot consisted of *Populus tremuloides* (Quaking Aspen) in the tree stratum, *Corylus americana* (American Hazelnut), *Populus tremuloides* (Quaking Aspen) and *Cornus rugosa* (Round-leaved Dogwood) in the shrub stratum and *Bromus inermis* (Smooth Brome), *Cornus rugosa* (Round-leaved Dogwood), *Carex pensylvanica* (Pennsylvania Sedge) and *Anemone americana* (Round-lobed Hepatica) in the herb stratum. The upland soils consisted of eight inches of 10YR 2/2 loamy sand followed by six inches of 10YR 4/4 sand. The wetland was flagged based on the shift from an upland based plant community to a wetland based plant community with a shift from *Bromus inermis* (Smooth Brome) to *Carex lacustris* (Lake Sedge) and *Typha angustifolia* (Narrowleaf Cattail) used as an indicator of this shift. This correlated closely to the toe of the inslope and backslope of the ditch.

Wetland 108 is a palustrine emergent persistent seasonally flooded/saturated beaver influenced wetland (PEM1Eb). The wetland is located between the toe of the surrounding slopes and a small/medium sized creek that flows north towards Lower Red Lake. Hydrology within the wetland is impacted both by precipitation as well as beaver activity that appears to occur frequently along the stream corridor. The vegetation within the wetland was comprised of no vegetation within the tree stratum, *Salix petiolaris* (Meadow Willow) and *Alnus incana* (Speckled Alder) in the shrub stratum and *Carex lacustris* (Lake Sedge), *Salix petiolaris* (Meadow Willow), *Equisetum pratense* (Meadow Horsetail), *Phalaris arundinacea* (Reed Canary Grass), *Bromus ciliatus* (Fringed Brome), *Symphyotrichum lanceolatum* (Panicled Aster) and *Petasites frigidus* (Sweet Coltsfoot) in the herb stratum. Wetland soils consisted of seven inches of 10YR 2/1 mucky sand followed by nine inches of 10YR 4/1 coarse sand. The hydric soil indicator was Sandy Mucky Mineral (S1). The upland vegetation at the sample plot consisted of *Abies balsamea* (Balsam Fir), *Populus tremuloides* (Quaking Aspen), *Betula papyrifera* (Paper Birch) and *Ulmus americana* (American Elm) in the tree stratum, *Corylus americana* (American Hazelnut), *Cornus rugosa* (Round-leaved Dogwood), *Betula papyrifera* (Paper Birch), *Fraxinus nigra* (Black Ash), *Populus tremuloides* (Quaking Aspen), *Abies balsamea* (Balsam Fir) and *Rosa blanda* (Smooth Rose) in the shrub stratum and *Carex pensylvanica* (Pennsylvania Sedge), *Bromus inermis* (Smooth Brome), *Abies balsamea* (Balsam Fir), *Pyrola elliptica* (Shinleaf) and *Galium triflorum* (Fragrant Bedstraw) in the herb stratum. The upland soils consisted of eleven inches of 10YR 2/2 sand followed by five inches of 10YR 3/3 sand. The wetland was flagged based on the shift from an upland based plant community to a wetland based plant community with a shift from *Corylus americana* (American Hazelnut) and *Carex pensylvanica* (Pennsylvania Sedge) to *Alnus incana* (Speckled Alder), *Salix petiolaris* (Meadow Willow) and *Carex lacustris* (Lake Sedge) used as an indicator of this shift. The shift in vegetation correlated closely to the toe of the surrounding slopes.

Wetland 109 is a palustrine emergent persistent seasonally flooded/saturated beaver influenced wetland (PEM1Eb). The wetland is located between the toe of the surrounding slopes and a small/medium sized creek that flows north towards Lower Red Lake. Hydrology within the wetland is impacted both by precipitation as well as beaver activity that appears to occur frequently along the stream corridor. The vegetation within the wetland was comprised of no vegetation within the tree stratum, *Cornus sericea* (Red Osier Dogwood), *Salix petiolaris* (Meadow Willow) and *Fraxinus nigra* (Black Ash) in the shrub stratum and *Calamagrostis canadensis* (Canada Bluejoint), *Carex lacustris* (Lake Sedge), *Petasites frigidus* (Sweet Coltsfoot), *Equisetum praealtum* (Scouring Rush), *Rubus idaeus* (Wild Red Raspberry) and *Symphyotrichum lanceolatum* (Panicled Aster) in the herb stratum. Wetlands soils consisted of six inches of 10YR 2/1 mucky fine sand followed by eight inches of 98% 2.5Y 4/1 fine sandy clay with 2% 10YR 3/6 concentrations within the matrix. The hydric soil indication was Sandy Mucky Mineral (S1). The upland vegetation at the sample plot consisted of *Acer saccharum* (Sugar Maple) and *Quercus macrocarpa* (Bur Oak) in the tree stratum, *Acer saccharum* (Sugar Maple) and *Corylus americana* (American Hazelnut) in the shrub stratum and *Carex pensylvanica* (Pennsylvania Sedge), *Equisetum pratense* (Meadow Horsetail) and *Oryzopsis asperifolia* (Rough-leaved Rice Grass) in the herb stratum. The upland soils consisted of three inches of 10YR 2/1 sand followed by thirteen inches of 10YR

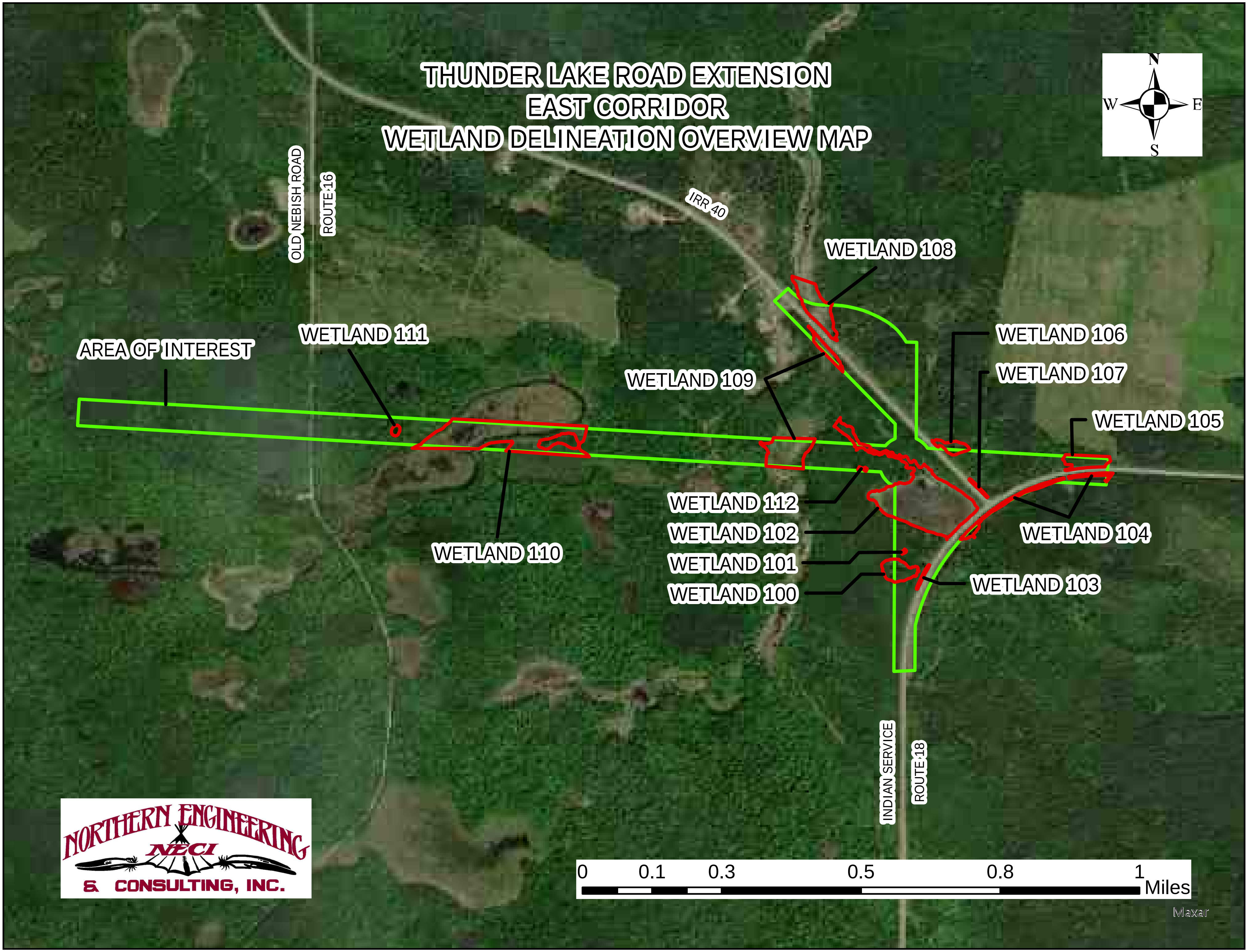
4/3 sand/ fine sand. The wetland was flagged based on the shift from an upland based plant community to a wetland based plant community with a shift from *Corylus americana* (American Hazelnut) and *Carex pensylvanica* (Pennsylvania Sedge) to *Fraxinus nigra* (Black Ash), *Salix petiolaris* (Meadow Willow) and *Carex lacustris* (Lake Sedge) used as an indicator of this shift. The shift in vegetation correlated closely to the toe of the surrounding slopes.

Wetland 110 is a palustrine emergent persistent/ scrub-shrub broad-leaved deciduous seasonally flooded/saturated wetland (PEM1/SS1D). The wetland is located in a large sprawling basin that is at the center of a large wetland complex. There is active beaver activity around the edge of the wetland, with standing water present. The center of the wetland appears to be comprised of sedge and cattails mixed with some *Larix laricina* (Tamarack). The vegetation within the first wetland plot was comprised of *Salix bebbiana* (Bebb's Willow) in the tree stratum, *Alnus incana* (Speckled Alder), *Salix bebbiana* (Bebb's Willow) and *Cornus sericea* (Red Osier Dogwood) in the shrub stratum and *Carex tuckermanii* (Tuckerman's Sedge) and *Carex lacustris* (Lake Sedge) in the herb stratum. Wetland soils within the first sample plot consisted of nine inches of 10YR 2/1 mucky fine sand followed by seven inches of 60% 10YR 5/1 and 40% 10YR 3/1 fine sandy clay. The hydric soil indicator was Sandy Mucky Mineral (S1). The vegetation within the second wetland plot was comprised of *Salix bebbiana* (Bebb's Willow) in the tree stratum, *Spiraea alba* (White Meadowsweet), *Cornus sericea* (Red Osier Dogwood) and *Fraxinus nigra* (Black Ash) in the shrub stratum and *Carex lacustris* (Lake Sedge), *Calamagrostis canadensis* (Canada Bluejoint), *Equisetum praealtum* (Scouring Rush), *Persicaria lapathifolia* (Nodding Smartweed) and *Lathyrus ochroleucus* (Cream Pea) in the herb stratum. Wetland soils within the second sample plot consisted of five inches of 10YR 3/1 mucky peat followed by eleven inches of 10YR 4/1 sand. The hydric soil indicator was 5cm Mucky Peat or Peat (S3). The upland vegetation at the first sample plot consisted of *Acer saccharum* (Sugar Maple), *Tilia americana* (Basswood) and *Ostrya virginiana* (Ironwood) in the tree stratum, *Acer saccharum* (Sugar Maple), *Corylus americana* (American Hazelnut) and *Ostrya virginiana* (Ironwood) in the shrub stratum and *Eurybia macrophylla* (Large-leaved Aster), *Oryzopsis asperifolia* (Rough-leaved Rice Grass), *Carex pensylvanica* (Pennsylvania Sedge) and *Anemone americana* (Round-lobed Hepatica) in the herb stratum. The upland soils at the first sample plot consisted of four inches of 10YR 2/1 sand followed by thirteen inches of 10YR 5/3 sand. The upland vegetation at the second sample plot consisted of *Acer saccharum* (Sugar Maple), *Ostrya virginiana* (Ironwood), *Tilia americana* (Basswood), *Betula papyrifera* (Paper Birch) and *Quercus macrocarpa* (Bur Oak) in the tree stratum, *Acer saccharum* (Sugar Maple) and *Corylus americana* (American Hazelnut) in the shrub stratum and *Carex pensylvanica* (Pennsylvania Sedge), *Oryzopsis asperifolia* (Rough-leaved Rice Grass) and *Anemone americana* (Round-lobed Hepatica) in the herb stratum. The upland soils at the second sample plot consisted of three inches of 10YR 2/1 loamy fine sand followed by nine inches of 70% 10YR 5/4 and 30% 10YR 5/6 clay. The wetland was flagged based on evidence of hydrology, which was present in the form of subtle erosion created by annual rising and receding water levels. This correlated closely with the toe of the surrounding slopes and was in conjunction with the shift from an upland based plant community to a wetland based plant community with a shift from *Carex pensylvanica* (Pennsylvania

Sedge), *Oryzopsis asperifolia* (Rough-leaved Rice Grass) and *Corylus americana* (American Hazelnut) to *Carex lacustris* (Lake Sedge) and *Salix bebbiana* (Bebb's Willow) used as an indicator of this shift.

Wetland 111 a palustrine emergent persistent temporarily flooded wetland (PEM1A). The wetland is located in a small, clay lined basin located within an upland ridge. The vegetation within the wetland was comprised of *Fraxinus nigra* (Black Ash) in the tree stratum, *Fraxinus nigra* (Black Ash) in the shrub stratum) and *Persicaria lapathifolia* (Nodding Smartweed), *Ranunculus pensylvanicus* (Pennsylvania Buttercup), *Carex atherodes* (Slough Sedge), *Cardamine pensylvanica* (Pennsylvania Bittercress) and *Bidens frondosa* (Devil's Beggarticks) in the herb stratum. Wetland soils consisted of five inches of 10YR 2/1 mucky peat/organic duff followed by ten inches of 10YR 4/1 fine sandy clay. The hydric soil indicator was 5 cm Mucky Peat or Peat (S3). The upland vegetation at the sample plot consisted of *Acer saccharum* (Sugar Maple), *Ostrya virginiana* (Ironwood), *Tilia americana* (Basswood), *Betula papyrifera* (Paper Birch) and *Quercus macrocarpa* (Bur Oak) in the tree stratum, *Acer saccharum* (Sugar Maple) and *Corylus americana* (American Hazelnut) in the shrub stratum and *Carex pensylvanica* (Pennsylvania Sedge), *Oryzopsis asperifolia* (Rough-leaved Rice Grass) and *Anemone americana* (Round-lobed Hepatica) in the herb stratum. The upland soils at the sample plot consisted of three inches of 10YR 2/1 loamy fine sand followed by nine inches of 70% 10YR 5/4 and 30% 10YR 5/6 clay. The wetland was flagged based on evidence of hydrology with watermarks on trees and water-stained leaves used as indicators. This correlated closed with a shift from an upland based plant community to a wetland based plant community with a shift from *Corylus americana* (American Hazelnut) and *Carex pensylvanica* (Pennsylvania Sedge) to *Fraxinus nigra* (Black Ash) used as an indicator of this shift.

Wetland 112 a palustrine emergent persistent temporarily flooded wetland (PEM1A). The wetland is located in a small, clay lined subtle depression located within an upland ridge. When water levels exceed a certain elevation, water flows overland into an adjacent ravine and flows down to wetland 109. The vegetation within the wetland was comprised of *Populus tremuloides* (Quaking Aspen) and *Fraxinus nigra* (Black Ash) in the tree stratum, *Fraxinus nigra* (Black Ash) in the shrub stratum and *Bromus ciliatus* (Fringed Brome) in the herb stratum. Wetland soils consisted of five inches of 10YR 2/2 loamy sand followed by nine inches of 65% 10YR 5/3 loamy sand with 20% 10YR 5/8 and 15% 10YR 3/6 coated sand grains within the matrix. The hydric soil indicator was Stripped Matrix (S6). The upland vegetation at the sample plot consisted of *Populus tremuloides* (Quaking Aspen), *Ostrya virginiana* (Ironwood), *Tilia americana* (Basswood) and *Fraxinus nigra* (Black Ash) in the tree stratum, *Fraxinus nigra* (Black Ash) in the shrub stratum and *Carex pensylvanica* (Pennsylvania Sedge), *Oryzopsis asperifolia* (Rough-leaved Rice Grass), *Eurybia macrophylla* (Large-leaved Aster), *Thalictrum dioicum* (Early Meadow Rue), *Bromus ciliatus* (Fringed Brome) and *Osmorhiza claytonii* (Sweet Cicely) in the herb stratum. The upland soils at the sample plot consisted of eleven inches of 10YR 2/2 loamy sand followed by five inches of 98% 10YR 5/3 loamy sand with 2% 10YR 5/8 coated sand grains within the matrix. The wetland was flagged based on a shift from an upland based plant community to a wetland based plant community with a shift from *Carex pensylvanica* (Pennsylvania Sedge) and *Oryzopsis asperifolia* (Rough-leaved Rice Grass) to *Fraxinus* *nigra* (Black Ash) used as an indicator of this shift. This correlated closely with signs of hydrology, with of the perimeter of the sparsely vegetated concave surface and water-stained leaves used as indicators for hydrology.


THUNDER LAKE ROAD EXTENSION
EAST CORRIDOR
WETLAND DELINEATION OVERVIEW MAP
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IRR 40
WETLAND 108
WETLAND 111
AREA OF INTEREST
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WETLAND 109
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TYPE 2
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WETLAND 112
TYPE 1
PEM1A
TRANSECT LOCATION
TRANSECT LOCATION
IRR 40
AREA OF INTEREST
WETLAND 107
TYPE 1
PEM1A
INDIAN SERVICE ROUTE 18
WETLAND 102
TYPE 3
PEM1E
TRANSECT LOCATION
WETLAND 101
TYPE 1
PEM1A
WETLAND 104
TYPE 7/TYPE 2
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WETLAND 100
TYPE 6
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THUNDER LAKE ROAD EXTENSION
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TRANSECT
LOCATION
WETLAND 105
TYPE 6
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IRR 40
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TYPE 1
PEM1A
INDIAN SERVICE ROUTE 18
WETLAND 104
TYPE 7/TYPE 2
PFO1/EM1C
WETLAND 102
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THUNDER LAKE ROAD EXTENSION
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THUNDER LAKE ROAD EXTENSION
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TYPE 3
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WETLAND 112
TYPE 1
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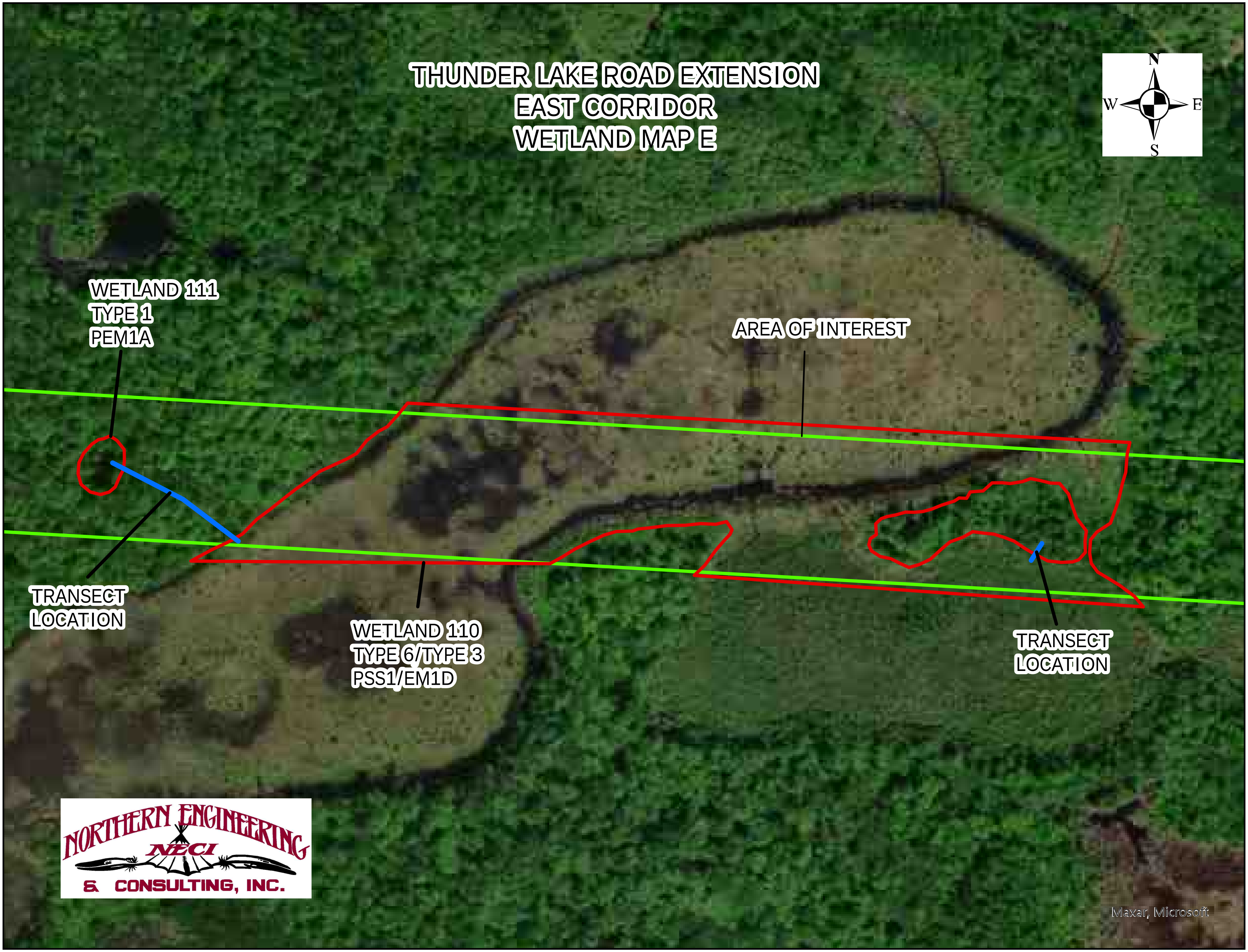
Maxar, Microsoft


THUNDER LAKE ROAD EXTENSION
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WETLAND 111
TYPE 1
PEM1A
AREA OF INTEREST
TRANSECT
LOCATION
WETLAND 110
TYPE 6/TYPE 3
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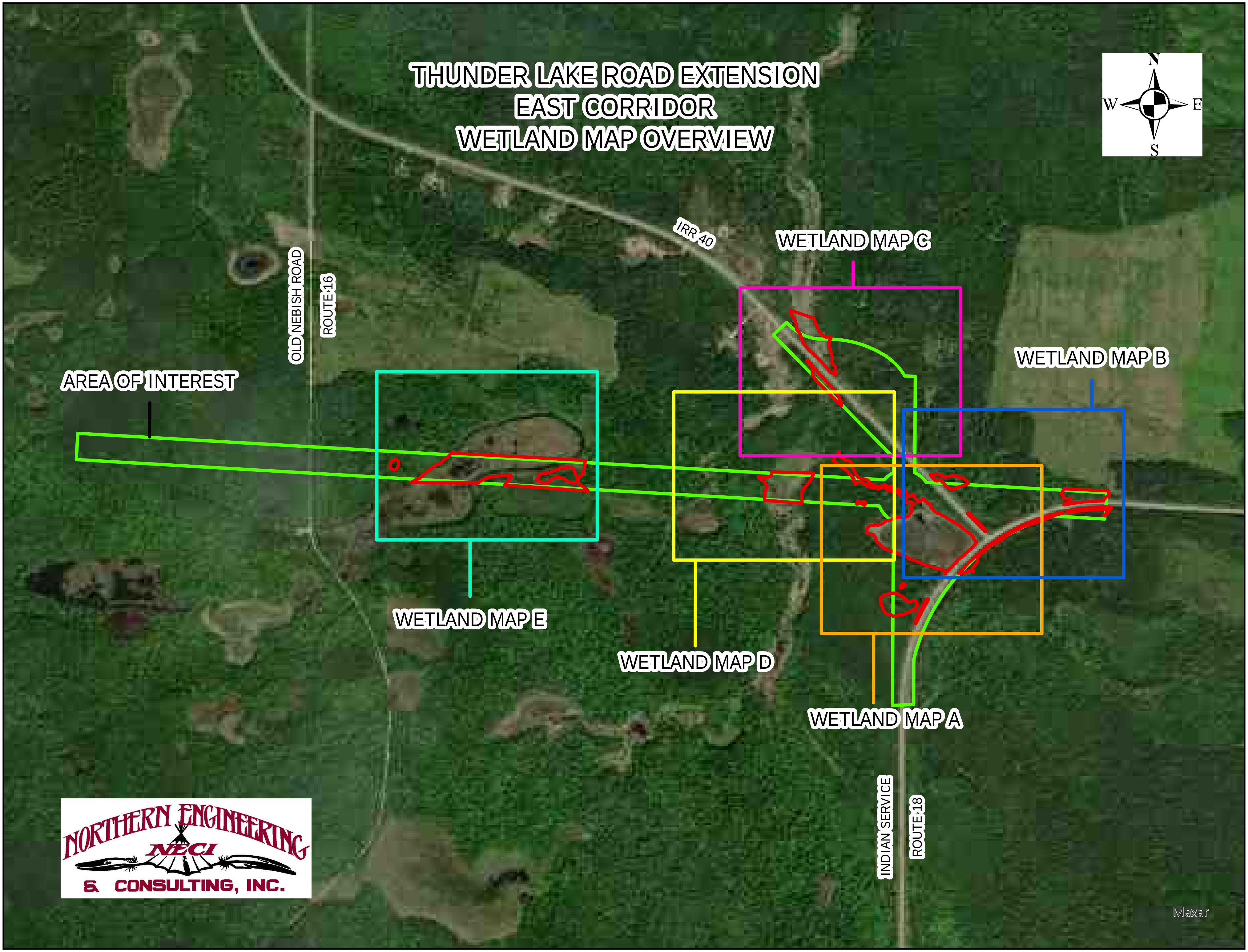
THUNDER LAKE ROAD EXTENSION
EAST CORRIDOR
WETLAND MAP OVERVIEW
N
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IRR 40
WETLAND MAP C
WETLAND MAP B
OLD NEBISH ROAD
ROUTE 16
AREA OF INTEREST
WETLAND MAP E
WETLAND MAP D
WETLAND MAP A
INDIAN SERVICE
ROUTE 18
NORTHERN ENGINEERING
NECI
& CONSULTING, INC.
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WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-23-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W100P1

Investigator(s): Patrick Reardon Section, Township, Range: 34/35, 151, 33

Landform (hillside, terrace, etc.): Subtle Upland Rise Local relief (concave, convex, none): Convex Slope (%): 10

Subregion (LRR or MLRA): LRR K Lat: 47.849454 Long: -94.849836 Datum: ____

Soil Map Unit Name: Egglake-Spooner, till substratum complex, 0 to 2 percent slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No X	**Is the Sampled Area within a Wetland?**	**Yes** ____ **No** X
Hydric Soil Present?	Yes ____ No X		
Wetland Hydrology Present?	Yes ____ No X	If yes, optional Wetland Site ID:	____

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): -	
Water Table Present?	Yes ____	No X	Depth (inches): -	
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): -	**Wetland Hydrology Present? Yes ____ No X**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W100P1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Populus tremuloides*	80	Yes	FAC
2. *Betula papyrifera*	15	No	FACU
3. *Ostrya virginiana*	5	No	FACU
4.			
5.			
6.			
7.			
	100	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Corylus americana*	15	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	15	=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Diervilla lonicera*	80	Yes	UPL
2. *Pteridium aquilinum*	15	No	FACU
3. *Thalictrum dioicum*	10	No	FACU
4. *Abies balsamea*	10	No	FAC
5. *Eurybia macrophylla*	10	No	UPL
6. *Bromus ciliatus*	10	No	FACW
7.			
8.			
9.			
10.			
11.			
12.			
	135	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	90	x 3 =	270
FACU species	60	x 4 =	240
UPL species	90	x 5 =	450
Column Totals:	250 (A)		980 (B)

Prevalence Index = B/A = 3.92

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W100P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR 2/2	100					Loamy/Clayey	
7-12	10YR 3/4	100					Sandy	
12-14	10YR 3/4	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-23-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W100P2

Investigator(s): Patrick Reardon Section, Township, Range: 34/35, 151, 33

Landform (hillside, terrace, etc.): Shallow, Depressional Basin Local relief (concave, convex, none): Concave Slope (%): 5

Subregion (LRR or MLRA): LRR K Lat: 47.849454 Long: -94.849836 Datum: ____

Soil Map Unit Name: Egglake-Spooner, till substratum complex, 0 to 2 percent slopes NWI classification: PEM1D

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?**	**Yes** X **No** ____
Hydric Soil Present?	Yes X No ____		
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID:	Wetland 100

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

____ Surface Water (A1)	X Water-Stained Leaves (B9)	
____ High Water Table (A2)	____ Aquatic Fauna (B13)	
X Saturation (A3)	____ Marl Deposits (B15)	
____ Water Marks (B1)	____ Hydrogen Sulfide Odor (C1)	
____ Sediment Deposits (B2)	____ Oxidized Rhizospheres on Living Roots (C3)	
____ Drift Deposits (B3)	____ Presence of Reduced Iron (C4)	
____ Algal Mat or Crust (B4)	____ Recent Iron Reduction in Tilled Soils (C6)	
____ Iron Deposits (B5)	____ Thin Muck Surface (C7)	
____ Inundation Visible on Aerial Imagery (B7)	____ Other (Explain in Remarks)	
____ Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- X Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____ No X	Depth (inches): -	
Water Table Present?	Yes ____ No X	Depth (inches): -	
Saturation Present? (includes capillary fringe)	Yes X No ____	Depth (inches): 12	**Wetland Hydrology Present? Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W100P2

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Salix bebbiana*	30	Yes	FACW
2. *Fraxinus nigra*	15	Yes	FACW
3.			
4.			
5.			
6.			
7.			
	45	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Salix petiolaris*	40	Yes	FACW
2. *Fraxinus nigra*	10	No	FACW
3. *Spiraea alba*	10	No	FACW
4. *Salix bebbiana*	5	No	FACW
5.			
6.			
7.			
	65	=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Carex lacustris*	80	Yes	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	80	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	80	x 1 =	80
FACW species	110	x 2 =	220
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	190 (A)		300 (B)

Prevalence Index = B/A = 1.58

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W100P2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-11	10YR 2/1	100					Loamy/Clayey	Soils heavily coated in Organics
11-14	10YR 4/2	95	10YR 5/8	5	C	M	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** X **No** ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-23-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W101P1

Investigator(s): Patrick Reardon Section, Township, Range: 34/35, 151, 33

Landform (hillside, terrace, etc.): Subtle Upland Rise Local relief (concave, convex, none): Convex Slope (%): 10

Subregion (LRR or MLRA): LRR K Lat: 47.849856 Long: -94.849616 Datum: ____

Soil Map Unit Name: Egglake-Spooner, till substratum complex, 0 to 2 percent slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X
Hydric Soil Present?	Yes ____	No X
Wetland Hydrology Present?	Yes ____	No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): -
Water Table Present?	Yes ____	No X	Depth (inches): -
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): -

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W101P1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Populus tremuloides*	80	Yes	FAC
2. *Betula papyrifera*	15	No	FACU
3. *Ostrya virginiana*	5	No	FACU
4.			
5.			
6.			
7.			
	100	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Corylus americana*	15	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	15	=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Diervilla lonicera*	80	Yes	UPL
2. *Pteridium aquilinum*	15	No	FACU
3. *Thalictrum dioicum*	10	No	FACU
4. *Abies balsamea*	10	No	FAC
5. *Eurybia macrophylla*	10	No	UPL
6. *Bromus ciliatus*	10	No	FACW
7.			
8.			
9.			
10.			
11.			
12.			
	135	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	90	x 3 =	270
FACU species	60	x 4 =	240
UPL species	90	x 5 =	450
Column Totals:	250 (A)		980 (B)

Prevalence Index = B/A = 3.92

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W101P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR 2/2	100					Sandy	
7-12	10YR 3/4	100					Sandy	
12-14	10YR 3/4	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-23-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W101P2

Investigator(s): Patrick Reardon Section, Township, Range: 34/35, 151, 33

Landform (hillside, terrace, etc.): Subtle Clay Lined Depression Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR or MLRA): LRR K Lat: 47.849856 Long: -94.849616 Datum: ____

Soil Map Unit Name: Egglake-Spooner, till substratum complex, 0 to 2 percent slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	Is the Sampled Area within a Wetland?	Yes X No ____
Hydric Soil Present?	Yes X No ____	If yes, optional Wetland Site ID:	Wetland 101
Wetland Hydrology Present?	Yes X No ____		

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit. Wetland is located within a small shallow basin with rigid edges in places, appearing that it could have been potentially created during the last round of logging in the area by large equipment leaving indentations and ruts.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

____ Surface Water (A1)	X Water-Stained Leaves (B9)	
____ High Water Table (A2)	____ Aquatic Fauna (B13)	
____ Saturation (A3)	____ Marl Deposits (B15)	
____ Water Marks (B1)	____ Hydrogen Sulfide Odor (C1)	
____ Sediment Deposits (B2)	____ Oxidized Rhizospheres on Living Roots (C3)	
____ Drift Deposits (B3)	X Presence of Reduced Iron (C4)	
____ Algal Mat or Crust (B4)	____ Recent Iron Reduction in Tilled Soils (C6)	
____ Iron Deposits (B5)	____ Thin Muck Surface (C7)	
____ Inundation Visible on Aerial Imagery (B7)	____ Other (Explain in Remarks)	
____ Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- X Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): -
Water Table Present?	Yes ____	No X	Depth (inches): -
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): -

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W101P2

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Salix bebbiana*	5	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	5	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Cornus sericea*	20	Yes	FACW
2. *Fraxinus nigra*	10	Yes	FACW
3.			
4.			
5.			
6.			
7.			
	30	=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Scirpus cyperinus*	15	Yes	OBL
2. *Fragaria virginiana*	15	Yes	FACU
3. *Calamagrostis canadensis*	15	Yes	OBL
4. *Glyceria striata*	15	Yes	OBL
5. *Plantago major*	10	No	FACU
6. *Abies balsamea*	5	No	FAC
7.			
8.			
9.			
10.			
11.			
12.			
	75	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 85.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	45	x 1 =	45
FACW species	35	x 2 =	70
FAC species	5	x 3 =	15
FACU species	25	x 4 =	100
UPL species	0	x 5 =	0
Column Totals:	110 (A)		230 (B)

Prevalence Index = B/A = 2.09

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W101P2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/4	100					Sandy	
3-14	10YR 5/3	50	10YR 5/8	30	C	M	Loamy/Clayey	Prominent redox concentrations
	10YR 3/4	15						
	10YR 5/2	5						Sandy

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
X Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** X **No** ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-23-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W102P1

Investigator(s): Patrick Reardon Section, Township, Range: 34/35, 151, 33

Landform (hillside, terrace, etc.): Top Of Hillslope Local relief (concave, convex, none): Convex Slope (%): 10

Subregion (LRR or MLRA): LRR K Lat: 47.851114 Long: -94.848762 Datum: ____

Soil Map Unit Name: Egglake-Spooner, till substratum complex, 0 to 2 percent slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X
Hydric Soil Present?	Yes ____	No X
Wetland Hydrology Present?	Yes ____	No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): -
Water Table Present?	Yes ____	No X	Depth (inches): -
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): -

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W102P1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Quercus macrocarpa*			FACU
2. *Acer rubrum*			FAC
3. *Populus tremuloides*			FAC
4. *Ostrya virginiana*			FACU
5. *Betula papyrifera*			FACU
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Populus tremuloides*	30	Yes	FAC
2. *Cornus sericea*	20	Yes	FACW
3. *Fraxinus nigra*	10	No	FACW
4. *Corylus americana*	10	No	FACU
5. *Acer saccharum*	5	No	FACU
6.			
7.			
	75	=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Pteridium aquilinum*	50	Yes	FACU
2. *Oryzopsis asperifolia*	20	Yes	UPL
3. *Anemone americana*	10	No	
4. *Fragaria virginiana*	10	No	FACU
5. *Eurybia macrophylla*	10	No	UPL
6. *Thalictrum dioicum*	5	No	FACU
7.			
8.			
9.			
10.			
11.			
12.			
	105	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	30	x 2 =	60
FAC species	30	x 3 =	90
FACU species	80	x 4 =	320
UPL species	30	x 5 =	150
Column Totals:	170 (A)		620 (B)

Prevalence Index = B/A = 3.65

Hydrophytic Vegetation Indicators:

__ 1 - Rapid Test for Hydrophytic Vegetation

__ 2 - Dominance Test is >50%

__ 3 - Prevalence Index is ≤3.0[1]

__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** __ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W102P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/2	100					Sandy	
6-11	10YR 4/3	60					Sandy	
	10YR 2/2	40						
11-14	10YR 4/3	100					Sandy	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ? Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________

Depth (inches): ________

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-23-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W102P2

Investigator(s): Patrick Reardon Section, Township, Range: 34/35, 151, 33

Landform (hillside, terrace, etc.): Large, Deep Basin Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR or MLRA): LRR K Lat: 47.851114 Long: -94.848762 Datum: ____

Soil Map Unit Name: Egglake-Spooner, till substratum complex, 0 to 2 percent slopes NWI classification: PEM1Cb

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____
Hydric Soil Present?	Yes X	No ____
Wetland Hydrology Present?	Yes X	No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

If yes, optional Wetland Site ID: Wetland 102

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

____ Surface Water (A1)	X Water-Stained Leaves (B9)
X High Water Table (A2)	____ Aquatic Fauna (B13)
X Saturation (A3)	____ Marl Deposits (B15)
____ Water Marks (B1)	____ Hydrogen Sulfide Odor (C1)
____ Sediment Deposits (B2)	____ Oxidized Rhizospheres on Living Roots (C3)
____ Drift Deposits (B3)	____ Presence of Reduced Iron (C4)
____ Algal Mat or Crust (B4)	____ Recent Iron Reduction in Tilled Soils (C6)
____ Iron Deposits (B5)	____ Thin Muck Surface (C7)
X Inundation Visible on Aerial Imagery (B7)	X Other (Explain in Remarks)
____ Sparsely Vegetated Concave Surface (B8)	

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): -
Water Table Present?	Yes X	No ____	Depth (inches): 12
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W102P2

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Carex lacustris*	40	Yes	OBL
2. *Phalaris arundinacea*	40	Yes	FACW
3. *Typha angustifolia*	25	Yes	OBL
4. *Symphyotrichum lanceolatum*	10	No	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	115	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	65	x 1 =	65
FACW species	50	x 2 =	100
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	115 (A)		165 (B)

Prevalence Index = B/A = 1.43

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W102P2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-17	10YR 2/1	100					Mucky Loam/Clay	
17-20	10YR 4/1	100					Sandy	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
X Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** X **No** ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-23-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W103P1

Investigator(s): Patrick Reardon Section, Township, Range: 35, 151, 33

Landform (hillside, terrace, etc.): Backslope Of Ditch Local relief (concave, convex, none): Concave Slope (%): 33

Subregion (LRR or MLRA): LRR K Lat: 47.849233 Long: -94.848843 Datum: ____

Soil Map Unit Name: Egglake-Spooner, till substratum complex, 0 to 2 percent slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation X , Soil X , or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____ , Soil ____ , or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		
Hydric Soil Present?		X
Wetland Hydrology Present?		X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit. Sample location is within the road corridor. Soils have been disturbed by earth movement with construction of the road. Vegetation is mowed periodially throughout the growing season and appears to be comprised of introduced species from revegetation efforts after construction was completed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?		X	-
Water Table Present?		X	-
Saturation Present? (includes capillary fringe)		X	-

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W103P1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Pinus resinosa*	5	Yes	FACU
2. *Populus tremuloides*	5	Yes	FAC
3. *Betula papyrifera*	5	Yes	FACU
4.			
5.			
6.			
7.			
	15	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Salix bebbiana*	5	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	5	=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Bromus inermis*	80	Yes	UPL
2. *Melilotus officinalis*	15	No	FACU
3. *Phleum pratense*	5	No	FACU
4. *Agrostis perennans*	5	No	FACU
5. *Centaurea stoebe*	5	No	UPL
6. *Pastinaca sativa*	5	No	UPL
7.			
8.			
9.			
10.			
11.			
12.			
	115	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 40.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	5	x 3 =	15
FACU species	35	x 4 =	140
UPL species	90	x 5 =	450
Column Totals:	135 (A)		615 (B)

Prevalence Index = B/A = 4.56

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W103P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR 2/2	100					Sandy	
7-14	10YR 6/3	55	10YR 4/6	30	CS	M	Sandy	
	10YR 2/2	5	10YR 5/8	10	CS	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** X

Remarks:
Soils appear like they could potentially be mixed/disturbed from prior road construction.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-23-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W103P2

Investigator(s): Patrick Reardon Section, Township, Range: 35, 151, 33

Landform (hillside, terrace, etc.): Ditch Bottom Local relief (concave, convex, none): Concave Slope (%): 5

Subregion (LRR or MLRA): LRR K Lat: 47.849233 Long: -94.848843 Datum: ___

Soil Map Unit Name: Egglake-Spooner, till substratum complex, 0 to 2 percent slopes NWI classification: ___

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation X , Soil X , or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ___ No X

Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ___	**Is the Sampled Area**	
Hydric Soil Present?	Yes X No ___	**within a Wetland?**	**Yes** X **No** ___
Wetland Hydrology Present?	Yes X No ___	If yes, optional Wetland Site ID:	Wetland 103

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit. Wetland is located within a ditch bottom. Soils have been mixed and compacted during construction, vegetation has been introduced with revegetation activities that occured at the end of the construction project. Hydrology has been manipulated and funneled into this centralized location. The approach culvert downstream was installed at too high of an elevation, thus restricting flow and causing ponding and inudation within the ditch following seasonal melt and large precipitation events. It appears that wetland conditions would dissipate if proper flow would be restored.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)	X Water-Stained Leaves (B9)	
___ High Water Table (A2)	___ Aquatic Fauna (B13)	
___ Saturation (A3)	___ Marl Deposits (B15)	
___ Water Marks (B1)	___ Hydrogen Sulfide Odor (C1)	
___ Sediment Deposits (B2)	___ Oxidized Rhizospheres on Living Roots (C3)	
___ Drift Deposits (B3)	X Presence of Reduced Iron (C4)	
___ Algal Mat or Crust (B4)	___ Recent Iron Reduction in Tilled Soils (C6)	
___ Iron Deposits (B5)	___ Thin Muck Surface (C7)	
___ Inundation Visible on Aerial Imagery (B7)	___ Other (Explain in Remarks)	
___ Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): -
Water Table Present?	Yes ___	No X	Depth (inches): -
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): -

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The surrouding area has been graded so that overland flow will drain into the ditch bottom (low point). Outlet culvert is partially plugged and installed to high, creating ponding within the ditch before water can continue to flow into wetland 102.

VEGETATION – Use scientific names of plants.

Sampling Point: W103P2

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	

Sapling/Shrub Stratum (Plot size: 15)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Salix bebbiana*	5	Yes	FACW
2. *Salix petiolaris*	5	Yes	FACW
3.			
4.			
5.			
6.			
7.			
	10	=Total Cover	

Herb Stratum (Plot size: 6)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Carex lacustris*	60	Yes	OBL
2. *Plantago major*	5	No	FACU
3. *Taraxacum officinale*	5	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	70	=Total Cover	

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	60	x 1 =	60
FACW species	10	x 2 =	20
FAC species	0	x 3 =	0
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	80 (A)		120 (B)

Prevalence Index = B/A = 1.50

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
The ditch had been recently mowed prior to the site visit, identification was difficult due to impacts associated with road maintenace

SOIL

Sampling Point: W103P2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 2/1	100					Loamy/Clayey	
3-18	10YR 5/2	63	10YR 5/6	20	C	M	Loamy/Clayey	Prominent redox concentrations
			10YR 7/1	15	D	M		
			2.5YR 4/8	2	C	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:
Soils appear to be mixed/distrubed and compacted from road construction.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-23-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W104P1

Investigator(s): Patrick Reardon Section, Township, Range: 35, 151, 33

Landform (hillside, terrace, etc.): Upland slope above wetland Local relief (concave, convex, none): Concave Slope (%): 5

Subregion (LRR or MLRA): LRR K Lat: 47.850409 Long: -94.846985 Datum: ____

Soil Map Unit Name: Egglake-Spooner, till substratum complex, 0 to 2 percent slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No	
Hydrophytic Vegetation Present?		X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?		X	
Wetland Hydrology Present?	X		If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- X Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?		X	-
Water Table Present?		X	-
Saturation Present? (includes capillary fringe)		X	-

Wetland Hydrology Present? Yes X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W104P1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Fraxinus nigra*	20	Yes	FACW
2. *Populus balsamifera*	20	Yes	FACW
3. *Populus tremuloides*	15	Yes	FAC
4. *Quercus macrocarpa*	15	Yes	FACU
5.			
6.			
7.			
	70	=Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Corylus americana*	40	Yes	FACU
2. *Fraxinus nigra*	10	No	FACW
3. *Populus balsamifera*	10	No	FACW
4.			
5.			
6.			
7.			
	60	=Total Cover	
Herb Stratum (Plot size:)			
1. *Carex pensylvanica*	100	Yes	UPL
2. *Eurybia macrophylla*	10	No	UPL
3. *Abies balsamea*	5	No	FAC
4. *Athyrium filix-femina*	5	No	UPL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	120	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	60	x 2 =	120
FAC species	20	x 3 =	60
FACU species	55	x 4 =	220
UPL species	115	x 5 =	575
Column Totals:	250 (A)		975 (B)

Prevalence Index = B/A = 3.90

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W104P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/1	100					Sandy	Traces Of Loam
6-14	10YR 4/3	60	10YR 5/8	5	C	M	Loamy/Clayey	
	10YR 3/2	30						
	10YR 4/6	5						Pockets of Sand Intermixed

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)

___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________

Depth (inches): ________

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-23-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W104P2

Investigator(s): Patrick Reardon Section, Township, Range: 35, 151, 33

Landform (hillside, terrace, etc.): Wetland Basin Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR or MLRA): LRR K Lat: 47.850409 Long: -94.846985 Datum: ____

Soil Map Unit Name: Egglake-Spooner, till substratum complex, 0 to 2 percent slopes NWI classification: PSS1C

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID: Wetland 104

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

____ Surface Water (A1)	X Water-Stained Leaves (B9)
____ High Water Table (A2)	____ Aquatic Fauna (B13)
X Saturation (A3)	____ Marl Deposits (B15)
X Water Marks (B1)	____ Hydrogen Sulfide Odor (C1)
____ Sediment Deposits (B2)	____ Oxidized Rhizospheres on Living Roots (C3)
____ Drift Deposits (B3)	____ Presence of Reduced Iron (C4)
____ Algal Mat or Crust (B4)	____ Recent Iron Reduction in Tilled Soils (C6)
____ Iron Deposits (B5)	____ Thin Muck Surface (C7)
____ Inundation Visible on Aerial Imagery (B7)	X Other (Explain in Remarks)
____ Sparsely Vegetated Concave Surface (B8)	

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- X Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): -
Water Table Present?	Yes ____	No X	Depth (inches): -
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Soils contain a muck component

VEGETATION – Use scientific names of plants. Sampling Point: W104P2

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Fraxinus nigra*	20	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	20	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Phalaris arundinacea*	90	Yes	FACW
2. *Carex lacustris*	15	No	OBL
3. *Typha angustifolia*	5	No	OBL
4. *Pastinaca sativa*	5	No	UPL
5. *Symphyotrichum lanceolatum*	5	No	FACW
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	120	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	20	x 1 =	20	
FACW species	115	x 2 =	230	
FAC species	0	x 3 =	0	
FACU species	0	x 4 =	0	
UPL species	5	x 5 =	25	
Column Totals:	140	(A)	275	(B)

Prevalence Index = B/A = 1.96

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W104P2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 2/1	100					Mucky Loam/Clay	
5-14	10YR 2/1	80					Mucky Loam/Clay	
	10YR 4/2	20						Coarse Sand

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- X Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-23-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W105P1

Investigator(s): Patrick Reardon Section, Township, Range: 35, 151, 33

Landform (hillside, terrace, etc.): Ditch Inslope Local relief (concave, convex, none): Concave Slope (%): 25

Subregion (LRR or MLRA): LRR K Lat: 47.852173 Long: -94.842495 Datum: ____

Soil Map Unit Name: Ricelake-Blomford complex, mlra 88, 0 to 3 percent slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation X , Soil X , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ___ No X

Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No X	**Is the Sampled Area**	
Hydric Soil Present?	Yes ___	No X	**within a Wetland?**	**Yes** ___ **No** X
Wetland Hydrology Present?	Yes ___	No X	If yes, optional Wetland Site ID:	___

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit. Sample location taken in ditch inslope, soils are a mix of native and imported soils, vegetation is comprised of species associated with revegetation efforts that occurred after construction.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)	___ Water-Stained Leaves (B9)	
___ High Water Table (A2)	___ Aquatic Fauna (B13)	
___ Saturation (A3)	___ Marl Deposits (B15)	
___ Water Marks (B1)	___ Hydrogen Sulfide Odor (C1)	
___ Sediment Deposits (B2)	___ Oxidized Rhizospheres on Living Roots (C3)	
___ Drift Deposits (B3)	___ Presence of Reduced Iron (C4)	
___ Algal Mat or Crust (B4)	___ Recent Iron Reduction in Tilled Soils (C6)	
___ Iron Deposits (B5)	___ Thin Muck Surface (C7)	
___ Inundation Visible on Aerial Imagery (B7)	___ Other (Explain in Remarks)	
___ Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): -
Water Table Present?	Yes ___	No X	Depth (inches): -
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): -

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W105P1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Trifolium repens*	60	Yes	FACU
2. *Bromus inermis*	40	Yes	UPL
3. *Melilotus officinalis*	20	No	FACU
4. *Pastinaca sativa*	10	No	UPL
5. *Plantago major*	5	No	FACU
6. *Taraxacum officinale*	5	No	FACU
7.			
8.			
9.			
10.			
11.			
12.			
	140	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	90	x 4 =	360
UPL species	50	x 5 =	250
Column Totals:	140 (A)		610 (B)

Prevalence Index = B/A = 4.36

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W105P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-1	10YR 3/2	100					Sandy	
1-14	10YR 4/6	70					Loamy/Clayey	
	10YR 2/1	30						Coarse Sand

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)

___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:
Soils appear to be fill placed during the construction of the road

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-23-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W105P2

Investigator(s): Patrick Reardon Section, Township, Range: 35, 151, 33

Landform (hillside, terrace, etc.): Large, Subtle Depression Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR or MLRA): LRR K Lat: 47.852173 Long: -94.842495 Datum: ____

Soil Map Unit Name: Ricelake-Blomford complex, mlra 88, 0 to 3 percent slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____		**Is the Sampled Area**
Hydric Soil Present? Yes X No ____		**within a Wetland? Yes X No ____**
Wetland Hydrology Present? Yes X No ____		If yes, optional Wetland Site ID: Wetland 105

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

____ Surface Water (A1)	X Water-Stained Leaves (B9)	
____ High Water Table (A2)	____ Aquatic Fauna (B13)	
____ Saturation (A3)	____ Marl Deposits (B15)	
____ Water Marks (B1)	____ Hydrogen Sulfide Odor (C1)	
____ Sediment Deposits (B2)	____ Oxidized Rhizospheres on Living Roots (C3)	
____ Drift Deposits (B3)	X Presence of Reduced Iron (C4)	
____ Algal Mat or Crust (B4)	____ Recent Iron Reduction in Tilled Soils (C6)	
____ Iron Deposits (B5)	____ Thin Muck Surface (C7)	
____ Inundation Visible on Aerial Imagery (B7)	____ Other (Explain in Remarks)	
____ Sparsely Vegetated Concave Surface (B8)		

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- X Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- X Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): -
Water Table Present?	Yes ____	No X	Depth (inches): -
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): -

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W105P2

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Fraxinus nigra*	5	Yes	FACW
2. *Populus tremuloides*	5	Yes	FAC
3.			
4.			
5.			
6.			
7.			
	10	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Populus tremuloides*	40	Yes	FAC
2. *Cornus sericea*	15	Yes	FACW
3. *Fraxinus ngira*	10	No	
4. *Alnus incana*	10	No	FACW
5. *Salix bebbiana*	5	No	FACW
6. *Populus balsamifera*	5	No	FACW
7.			
	85	=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Carex lacustris*	40	Yes	OBL
2. *Calamagrostis canadensis*	35	Yes	OBL
3. *Pastinaca sativa*	5	No	UPL
4. *Cirsium arvense*	5	No	FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	85	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	75	x 1 =	75
FACW species	40	x 2 =	80
FAC species	45	x 3 =	135
FACU species	5	x 4 =	20
UPL species	5	x 5 =	25
Column Totals:	170 (A)		335 (B)

Prevalence Index = B/A = 1.97

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W105P2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-9	10YR 2/1	100					Loamy/Clayey	Coated in Organics
9-14	10YR 5/3	80	10YR 5/8	15	C	M	Loamy/Clayey	Prominent redox concentrations
			10YR 7/1	5	D	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Clay

Depth (inches): 9

Hydric Soil Present? **Yes** X **No** ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-23-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W106P1

Investigator(s): Patrick Reardon Section, Township, Range: 35, 151, 33

Landform (hillside, terrace, etc.): Subtle slope above wetland basin Local relief (concave, convex, none): Concave Slope (%): 15

Subregion (LRR or MLRA): LRR K Lat: 47.852509 Long: -94.847673 Datum: ____

Soil Map Unit Name: Wurtsmith-Meehan complex, 0 to 4 percent slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)	___ Water-Stained Leaves (B9)
___ High Water Table (A2)	___ Aquatic Fauna (B13)
___ Saturation (A3)	___ Marl Deposits (B15)
___ Water Marks (B1)	___ Hydrogen Sulfide Odor (C1)
___ Sediment Deposits (B2)	___ Oxidized Rhizospheres on Living Roots (C3)
___ Drift Deposits (B3)	___ Presence of Reduced Iron (C4)
___ Algal Mat or Crust (B4)	___ Recent Iron Reduction in Tilled Soils (C6)
___ Iron Deposits (B5)	___ Thin Muck Surface (C7)
___ Inundation Visible on Aerial Imagery (B7)	___ Other (Explain in Remarks)
___ Sparsely Vegetated Concave Surface (B8)	

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): -
Water Table Present?	Yes ____	No X	Depth (inches): -
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): -

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W106P1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Tilia americana*	25	Yes	FACU
2. *Acer rubrum*	20	Yes	FAC
3. *Ostrya virginiana*	5	No	FACU
4.			
5.			
6.			
7.			
	50	=Total Cover	

Sapling/Shrub Stratum (Plot size: 15)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Corylus americana*	70	Yes	FACU
2. *Cornus rugosa*	15	No	UPL
3.			
4.			
5.			
6.			
7.			
	85	=Total Cover	

Herb Stratum (Plot size: 6)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Carex pensylvanica*	60	Yes	UPL
2. *Acer rubrum*	5	No	FAC
3. *Quercus macrocarpa*	5	No	FACU
4. *Abies balsamea*	5	No	FAC
5. *Anemone americana*	5	No	
6. *Maianthemum racemosum*	5	No	FACU
7. *Oryzopsis asperifolia*	5	No	UPL
8.			
9.			
10.			
11.			
12.			
	90	=Total Cover	

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	30	x 3 =	90
FACU species	110	x 4 =	440
UPL species	80	x 5 =	400
Column Totals:	220 (A)		930 (B)

Prevalence Index = B/A = 4.23

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W106P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR 2/1	100					Sandy	Traces of Loam
7-9	10YR 4/3	60					Sandy	
	10YR 2/1	40						
9-14	10YR 4/3	100					Sandy	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-23-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W106P2

Investigator(s): Patrick Reardon Section, Township, Range: 35, 151, 33

Landform (hillside, terrace, etc.): Small Depression Basin Local relief (concave, convex, none): Concave Slope (%): 5

Subregion (LRR or MLRA): LRR K Lat: 47.852509 Long: -94.847673 Datum: ____

Soil Map Unit Name: Wurtsmith-Meehan complex, 0 to 4 percent slopes NWI classification: PEM1C

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?**	**Yes** X **No** ____
Hydric Soil Present?	Yes X No ____		
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID:	Wetland 106

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ____ High Water Table (A2)
- X Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- X Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X No ____	Depth (inches):	Remarks
Water Table Present?	Yes ____ No X	Depth (inches):	-
Saturation Present? (includes capillary fringe)	Yes X No ____	Depth (inches):	0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Standing water within center of wetland basin, approximately 20 feet from sample pit

VEGETATION – Use scientific names of plants.

Sampling Point: W106P2

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	10	Yes	FAC
2. *Fraxinus nigra*	5	Yes	FACW
3. *Salix bebbiana*	5	Yes	FACW
4. *Populus tremuloides*	5	Yes	FAC
5.			
6.			
7.			
	25	=Total Cover	

Sapling/Shrub Stratum (Plot size: 15)			
1. *Spiraea alba*	15	Yes	FACW
2. *Fraxinus nigra*	10	Yes	FACW
3. *Populus tremuloides*	10	Yes	FAC
4. *Cornus sericea*	5	No	FACW
5.			
6.			
7.			
	40	=Total Cover	

Herb Stratum (Plot size: 6)			
1. *Carex lacustris*	80	Yes	OBL
2. *Calamagrostis canadensis*	25	Yes	OBL
3. *Scirpus cyperinus*	5	No	OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	110	=Total Cover	

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 9 (A)

Total Number of Dominant Species Across All Strata: 9 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiply by:	
OBL species	110	x 1 =	110	
FACW species	40	x 2 =	80	
FAC species	25	x 3 =	75	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	175	(A)	265	(B)

Prevalence Index = B/A = 1.51

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W106P2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/1	100					Mucky Sand	
6-14	10YR 5/3	75	10YR 5/8	5	C	M	Sandy	Prominent redox concentrations
	10YR 3/2	20						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
X Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-25-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W107P1

Investigator(s): Patrick Reardon Section, Township, Range: 35, 151, 33

Landform (hillside, terrace, etc.): Top Of Backslope Local relief (concave, convex, none): Convex Slope (%): 5

Subregion (LRR or MLRA): LRR K Lat: 47.851523 Long: -94.846707 Datum: ___

Soil Map Unit Name: Ricelake-Cutaway complex, mlra 88, 1 to 4 percent slopes NWI classification: ___

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X

Is the Sampled Area within a Wetland? **Yes** ___ **No** X

If yes, optional Wetland Site ID: ___

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?		X	-
Water Table Present?		X	-
Saturation Present? (includes capillary fringe)		X	-

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W107P1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Populus tremuloides*	20	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	20	=Total Cover	

Sapling/Shrub Stratum (Plot size: 15)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Corylus americana*			FACU
2. *Populus tremuloides*			FAC
3. *Cornus rugosa*			UPL
4.			
5.			
6.			
7.			
		=Total Cover	

Herb Stratum (Plot size: 6)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Bromus inermis*	15	Yes	UPL
2. *Cornus rugosa*	10	Yes	UPL
3. *Carex pensylvanica*	5	No	UPL
4. *Anemone americana*	5	No	
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	35	=Total Cover	

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	20	x 3 =	60
FACU species	0	x 4 =	0
UPL species	30	x 5 =	150
Column Totals:	50 (A)		210 (B)

Prevalence Index = B/A = 4.20

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W107P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 2/2	100					Sandy	
8-14	10YR 4/4	100					Sandy	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-25-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W107P2

Investigator(s): Patrick Reardon Section, Township, Range: 35, 151, 33

Landform (hillside, terrace, etc.): Ditch Bottom Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR or MLRA): LRR K Lat: 47.851523 Long: -94.846707 Datum: ___

Soil Map Unit Name: Ricelake-Cutaway complex, mlra 88, 1 to 4 percent slopes NWI classification: ___

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation X , Soil X , or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ___ No X

Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ___	**Is the Sampled Area**
Hydric Soil Present? Yes X No ___	**within a Wetland? Yes** X **No** ___
Wetland Hydrology Present? Yes X No ___	If yes, optional Wetland Site ID: Wetland 107

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit. Wetland is located in the bottom of the ditch where soils have been imported or mixed, vegetation apppears to be comprised of introduced species mixed from the revegetatin process mixed with native species. Vegetation is mowed/disturbed regularly during the growing season. Hydrology is manipuled by artifically creating a low point on the landscape and funneling overland flow into this location. Ditch is poorly graded, so water tends to pond rather than flow to adjacent wetlands.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- X Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): -
Water Table Present? Yes ___ No X Depth (inches): -
Saturation Present? Yes ___ No X Depth (inches): -
(includes capillary fringe)

Wetland Hydrology Present? Yes X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Proper grading and the installation of an approach culvert on the west end of the wetland would allow the ditch to flow into wetland 106

VEGETATION – Use scientific names of plants. Sampling Point: W107P2

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Carex lacustris*	80	Yes	OBL
2. *Typha angustifolia*	40	Yes	OBL
3. *Bromus inermis*	30	No	UPL
4. *Cirsium arvense*	10	No	FACU
5. *Taraxacum officinale*	10	No	FACU
6. *Toxicodendron radicans*	5	No	FAC
7.			
8.			
9.			
10.			
11.			
12.			
	175	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	120	x 1 =	120
FACW species	0	x 2 =	0
FAC species	5	x 3 =	15
FACU species	20	x 4 =	80
UPL species	30	x 5 =	150
Column Totals:	175 (A)		365 (B)

Prevalence Index = B/A = 2.09

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W107P2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-13	10YR 2/2	93	10YR 3/6	5	C	M	Sandy	Prominent redox concentrations
			2.5Y 7/2	2	D	M		
13-16	10YR 6/2	70	10YR 5/8	30	C	M	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
X Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Sandy Clay

Depth (inches): 13

Hydric Soil Present? **Yes** X **No** ___

Remarks:

Soils may have been imopacted (mix, fill, compacted during the construction of the roadway

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-25-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W108P1

Investigator(s): Patrick Reardon Section, Township, Range: 34, 151, 33

Landform (hillside, terrace, etc.): Creek Bank Hillslope Local relief (concave, convex, none): Concave Slope (%): 25

Subregion (LRR or MLRA): LRR K Lat: 47.856258 Long: -94.853087 Datum: ____

Soil Map Unit Name: Fluvaquents, frequently flooded-Hadludalfs complex 0 to 35 percent slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X
Hydric Soil Present?	Yes ____	No X
Wetland Hydrology Present?	Yes ____	No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): -
Water Table Present?	Yes ____	No X	Depth (inches): -
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): -

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W108P1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Abies balsamea*	20	Yes	FAC
2. *Populus tremuloides*	10	Yes	FAC
3. *Betula papyrifera*	5	No	FACU
4. *Ulmus americana*	5	No	FACW
5.			
6.			
7.			
	40	=Total Cover	

Sapling/Shrub Stratum (Plot size: 15)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Corylus americana*	40	Yes	FACU
2. *Cornus rugosa*	10	Yes	UPL
3. *Betula papyrifera*	10	Yes	FACU
4. *Fraxinus nigra*	5	No	FACW
5. *Populus tremuloides*	5	No	FAC
6. *Abies balsamea*	5	No	FAC
7. *Rosa blanda*	5	No	FACU
	80	=Total Cover	

Herb Stratum (Plot size: 6)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Carex pensylvanica*	60	Yes	UPL
2. *Bromus inermis*	10	No	UPL
3. *Abies balsamea*	5	No	FAC
4. *Pyrola elliptica*	5	No	FACU
5. *Galium triflorum*	5	No	FACU
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	85	=Total Cover	

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	45	x 3 =	135
FACU species	70	x 4 =	280
UPL species	80	x 5 =	400
Column Totals:	205 (A)		835 (B)

Prevalence Index = B/A = 4.07

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W108P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-11	10YR 2/2	100					Sandy	
11-16	10YR 3/3	100					Sandy	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-25-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W108P2

Investigator(s): Patrick Reardon Section, Township, Range: 34, 151, 33

Landform (hillside, terrace, etc.): Creek Terrace/Fringe Wetland Local relief (concave, convex, none): Concave Slope (%): 5

Subregion (LRR or MLRA): LRR K Lat: 47.856258 Long: -94.853087 Datum: ____

Soil Map Unit Name: Fluvaquents, frequently flooded-Hadludalfs complex 0 to 35 percent slopes NWI classification: PEM1Cb

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?**	**Yes** X **No** ____
Hydric Soil Present?	Yes X No ____		
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID:	Wetland 108

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

X Surface Water (A1)	X Water-Stained Leaves (B9)
X High Water Table (A2)	____ Aquatic Fauna (B13)
X Saturation (A3)	____ Marl Deposits (B15)
____ Water Marks (B1)	____ Hydrogen Sulfide Odor (C1)
____ Sediment Deposits (B2)	____ Oxidized Rhizospheres on Living Roots (C3)
____ Drift Deposits (B3)	____ Presence of Reduced Iron (C4)
____ Algal Mat or Crust (B4)	____ Recent Iron Reduction in Tilled Soils (C6)
____ Iron Deposits (B5)	____ Thin Muck Surface (C7)
____ Inundation Visible on Aerial Imagery (B7)	X Other (Explain in Remarks)
____ Sparsely Vegetated Concave Surface (B8)	

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- X Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X No ____	Depth (inches): 0	
Water Table Present?	Yes X No ____	Depth (inches): 0	
Saturation Present? (includes capillary fringe)	Yes X No ____	Depth (inches): 0	**Wetland Hydrology Present? Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Soils contain a mucky component

VEGETATION – Use scientific names of plants.

Sampling Point: W108P2

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Salix petiolaris*	60	Yes	FACW
2. *Alnus incana*	5	No	FACW
3.			
4.			
5.			
6.			
7.			
	65	=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Carex lacustris*	60	Yes	OBL
2. *Salix petiolaris*	10	No	FACW
3. *Equisetum pratense*	10	No	FACW
4. *Phalaris arundinacea*	5	No	FACW
5. *Bromus ciliatus*	5	No	FACW
6. *Symphyotrichum lanceolatum*	5	No	FACW
7. *Petasites frigidus*	5	No	FACW
8.			
9.			
10.			
11.			
12.			
	100	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	60	x 1 =	60
FACW species	105	x 2 =	210
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	165 (A)		270 (B)

Prevalence Index = B/A = 1.64

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W108P2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR 2/1	100					Mucky Sand	
7-16	10YR 4/1	100					Sandy	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
X Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-25-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W109P1

Investigator(s): Patrick Reardon Section, Township, Range: 34, 151, 33

Landform (hillside, terrace, etc.): Hillslope Above Creek Local relief (concave, convex, none): Concave Slope (%): 40

Subregion (LRR or MLRA): LRR K Lat: 47.854252 Long: -94.854252 Datum: ____

Soil Map Unit Name: Graycalm-Grettum complex, 1 to 8 percent slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X
Hydric Soil Present?	Yes ____	No X
Wetland Hydrology Present?	Yes ____	No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): -
Water Table Present?	Yes ____	No X	Depth (inches): -
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): -

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W109P1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer saccharum*	80	Yes	FACU
2. *Quercus macrocarpa*	5	No	FACU
3.			
4.			
5.			
6.			
7.			
	85	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Acer saccharum*	30	Yes	FACU
2. *Corylus americana*	10	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	40	=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Carex pensylvanica*	15	Yes	UPL
2. *Equisetum pratense*	5	Yes	FACW
3. *Oryzopsis asperifolia*	5	Yes	UPL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	25	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 16.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	0	x 3 =	0
FACU species	125	x 4 =	500
UPL species	20	x 5 =	100
Column Totals:	150 (A)		610 (B)

Prevalence Index = B/A = 4.07

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W109P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 2/1						Sandy	
3-16	10YR 4/3						Sandy	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-25-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W109P2

Investigator(s): Patrick Reardon Section, Township, Range: 34, 151, 33

Landform (hillside, terrace, etc.): Creek Terrace/ Toe Of Slope Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR or MLRA): LRR K Lat: 47.854252 Long: -94.854252 Datum: ____

Soil Map Unit Name: Fluvaquents, frequently flooded-Hadludalfs complex 0 to 35 percent slopes NWI classification: PEM1Cb

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____ , Soil ____ , or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____ , Soil ____ , or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____
Hydric Soil Present?	Yes X	No ____
Wetland Hydrology Present?	Yes X	No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

If yes, optional Wetland Site ID: Wetl;and 109

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- X Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): Remarks
Water Table Present?	Yes X	No ____	Depth (inches): 3
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Standing Water wihin 5' of sample pit. Soils are comprised partially of muck.

VEGETATION – Use scientific names of plants. Sampling Point: W109P2

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Cornus sericea*			FACW
2. *Salix petiolaris*			FACW
3. *Fraxinus nigra*			FACW
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Calamagrostis canadensis*	40	Yes	OBL
2. *Carex lacustris*	30	Yes	OBL
3. *Petasites frigidus*	10	No	FACW
4. *Equisetum praealtum*	10	No	FAC
5. *Rubus idaeus*	10	No	FAC
6. *Symphyotrichum lanceolatum*	5	No	FACW
7.			
8.			
9.			
10.			
11.			
12.			
	105	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	70	x 1 =	70
FACW species	15	x 2 =	30
FAC species	20	x 3 =	60
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	105 (A)		160 (B)

Prevalence Index = B/A = 1.52

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W109P2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/1	100					Mucky Sand	
6-14	2.5Y 4/1	98	10YR 3/6	2	C	M	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
X Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Fine Sandy Clay

Depth (inches): 6

Hydric Soil Present? **Yes** X **No** ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-25-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W110P1

Investigator(s): Patrick Reardon Section, Township, Range: 34, 151, 33

Landform (hillside, terrace, etc.): Upland Ridge Local relief (concave, convex, none): Convex Slope (%): 5

Subregion (LRR or MLRA): LRR K Lat: 47.852951 Long: -94.865488 Datum: ____

Soil Map Unit Name: Fluvaquents, frequently flooded-Egglake-Sax complex, 0 to 2 percent slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?		X	-
Water Table Present?		X	-
Saturation Present? (includes capillary fringe)		X	-

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W110P1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer saccharum*	60	Yes	FACU
2. *Tilia americana*	20	Yes	FACU
3. *Ostrya virginiana*	10	No	FACU
4.			
5.			
6.			
7.			
	90	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Acer saccharum*			FACU
2. *Corylus americana*			FACU
3. *Ostrya virginiana*			FACU
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Eurybia macrophylla*	15	Yes	UPL
2. *Oryzopsis asperifolia*	10	Yes	UPL
3. *Carex pensylvanica*	5	No	UPL
4. *Anemone americana*	5	No	
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	35	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	90	x 4 =	360
UPL species	30	x 5 =	150
Column Totals:	120 (A)		510 (B)

Prevalence Index = B/A = 4.25

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W110P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 2/1	100					Sandy	Traces of loam
4-17	10YR 5/3	100					Sandy	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)

___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-25-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W110P2

Investigator(s): Patrick Reardon Section, Township, Range: 34, 151, 33

Landform (hillside, terrace, etc.): Edge of Large Wetland Basin Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR or MLRA): LRR K Lat: 47.852951 Long: -94.865488 Datum: ____

Soil Map Unit Name: Fluvaquents, frequently flooded-Egglake-Sax complex, 0 to 2 percent slopes NWI classification: PSS1D/PEM1D

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID: Wetland 110

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

X Surface Water (A1)	X Water-Stained Leaves (B9)
X High Water Table (A2)	___ Aquatic Fauna (B13)
X Saturation (A3)	___ Marl Deposits (B15)
___ Water Marks (B1)	___ Hydrogen Sulfide Odor (C1)
___ Sediment Deposits (B2)	___ Oxidized Rhizospheres on Living Roots (C3)
___ Drift Deposits (B3)	___ Presence of Reduced Iron (C4)
___ Algal Mat or Crust (B4)	___ Recent Iron Reduction in Tilled Soils (C6)
___ Iron Deposits (B5)	___ Thin Muck Surface (C7)
X Inundation Visible on Aerial Imagery (B7)	___ Other (Explain in Remarks)
___ Sparsely Vegetated Concave Surface (B8)	

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): Remarks
Water Table Present?	Yes X	No ____	Depth (inches): 5
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Standing water within 5' of sample pit at time of field obsevation

VEGETATION – Use scientific names of plants.

Sampling Point: W110P2

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Salix bebbiana*	70	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	70	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Alnus incana*	30	Yes	FACW
2. *Salix bebbiana*	30	Yes	FACW
3. *Cornus sericea*	15	Yes	FACW
4.			
5.			
6.			
7.			
	75	=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Carex tuckermanii*	15	Yes	OBL
2. *Carex lacustris*	5	Yes	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	20	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	145	x 2 =	290
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	165 (A)		310 (B)

Prevalence Index = B/A = 1.88

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W110P2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-9	10YR 2/1	100					Mucky Sand	
9-16	10YR 5/1	60					Loamy/Clayey	
	10YR 3/1	40						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** X **No** ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-25-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W110P3

Investigator(s): Patrick Reardon Section, Township, Range: 34, 151, 33

Landform (hillside, terrace, etc.): Upland Ridge Local relief (concave, convex, none): Convex Slope (%): 5

Subregion (LRR or MLRA): LRR K Lat: 47.852951 Long: -94.865488 Datum: ____

Soil Map Unit Name: Ricelake-Cutaway complex, mlra 88, t to 4 percent slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X
Hydric Soil Present?	Yes ____	No X
Wetland Hydrology Present?	Yes ____	No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): -
Water Table Present?	Yes ____	No X	Depth (inches): -
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): -

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W110P3

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer saccharum*	60	Yes	FACU
2. *Ostrya virginiana*	10	No	FACU
3. *Tilia americana*	10	No	FACU
4. *Betula papyrifera*	5	No	FACU
5. *Quercus macrocarpa*	5	No	FACU
6.			
7.			
	90	=Total Cover	

Sapling/Shrub Stratum (Plot size: 15)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer saccharum*	10	Yes	FACU
2. *Corylus americana*	5	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	15	=Total Cover	

Herb Stratum (Plot size: 6)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Carex pensylvanica*	15	Yes	UPL
2. *Oryzopsis asperifolia*	10	Yes	UPL
3. *Anemone americana*	5	No	
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	30	=Total Cover	

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	105	x 4 =	420
UPL species	25	x 5 =	125
Column Totals:	130 (A)		545 (B)

Prevalence Index = B/A = 4.19

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W110P3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 2/1	100					Sandy	
3-12	10YR 5/4	70					Loamy/Clayey	
	10YR 5/6	30						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-25-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W110P4

Investigator(s): Patrick Reardon Section, Township, Range: 34, 151, 33

Landform (hillside, terrace, etc.): Toe of Inslope/Wetland Basin Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR or MLRA): LRR K Lat: 47.852951 Long: -94.865488 Datum: ____

Soil Map Unit Name: Fluvaquents, frequently flooded-Egglake-Sax complex, 0 to 2 percent slopes NWI classification: PSS1D/PEM1D

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ___ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ___	**Is the Sampled Area within a Wetland?** **Yes** X **No** ___
Hydric Soil Present?	Yes X No ___	
Wetland Hydrology Present?	Yes X No ___	If yes, optional Wetland Site ID: Wetland 110

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- X Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- X Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X No ___	Depth (inches): 0	
Water Table Present?	Yes X No ___	Depth (inches): 0	
Saturation Present? (includes capillary fringe)	Yes X No ___	Depth (inches): 0	**Wetland Hydrology Present?** **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Peat present at sample location

VEGETATION – Use scientific names of plants. Sampling Point: W110P4

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Salix bebbiana*	10	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	10	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Spiraea alba*	30	Yes	FACW
2. *Cornus sericea*	30	Yes	FACW
3. *Fraxinus nigra*	15	Yes	FACW
4.			
5.			
6.			
7.			
	75	=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Carex lacustris*	15	Yes	OBL
2. *Calamagrostis canadensis*	5	Yes	OBL
3. *Equisetum praealtum*	5	Yes	FAC
4. *Persicaria lapathifolia*	5	Yes	FACW
5. *Lathyrus ochroleucus*	5	Yes	UPL
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	35	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 8 (A)

Total Number of Dominant Species Across All Strata: 9 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 88.9% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	90	x 2 =	180
FAC species	5	x 3 =	15
FACU species	0	x 4 =	0
UPL species	5	x 5 =	25
Column Totals:	120 (A)		240 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W110P4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 3/1	100					Mucky Peat	Mucky Sand Intermixed
5-16	10YR 4/1	100					Sandy	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- X 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-25-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W111P1

Investigator(s): Patrick Reardon Section, Township, Range: 34, 151, 33

Landform (hillside, terrace, etc.): Upland Ridge Local relief (concave, convex, none): Convex Slope (%): 5

Subregion (LRR or MLRA): LRR K Lat: 47.852999 Long: -94.869192 Datum: ____

Soil Map Unit Name: Ricelake-Cutaway complex, mlra 88, t to 4 percent slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X
Hydric Soil Present?	Yes ____	No X
Wetland Hydrology Present?	Yes ____	No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): -
Water Table Present?	Yes ____	No X	Depth (inches): -
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): -

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W111P1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer saccharum*	60	Yes	FACU
2. *Ostrya virginiana*	10	No	FACU
3. *Tilia americana*	10	No	FACU
4. *Betula papyrifera*	5	No	FACU
5. *Quercus macrocarpa*	5	No	FACU
6.			
7.			
	90	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Acer saccharum*	10	Yes	FACU
2. *Corylus americana*	5	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	15	=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Carex pensylvanica*	15	Yes	UPL
2. *Oryzopsis asperifolia*	10	Yes	UPL
3. *Anemone americana*	5	No	
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	30	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	105	x 4 =	420
UPL species	25	x 5 =	125
Column Totals:	130 (A)		545 (B)

Prevalence Index = B/A = 4.19

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W111P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 2/1	100					Sandy	
3-12	10YR 5/4	70					Loamy/Clayey	
	10YR 5/6	30						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-25-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W111P2

Investigator(s): Patrick Reardon Section, Township, Range: 34, 151, 34

Landform (hillside, terrace, etc.): Small Basin Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR or MLRA): LRR K Lat: 47.852999 Long: -94.869192 Datum: ____

Soil Map Unit Name: Ricelake-Cutaway complex, mlra 88, t to 4 percent slopes NWI classification: PEM1A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?**	**Yes** X **No** ____
Hydric Soil Present?	Yes X No 0		
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID:	Wetland 111

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- X Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- X Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- X Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X No ____	Depth (inches):	Remarks
Water Table Present?	Yes X No ____	Depth (inches):	12
Saturation Present? (includes capillary fringe)	Yes X No ____	Depth (inches):	0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Standing water approximately 10 to 15 feet from sample pit

VEGETATION – Use scientific names of plants.

Sampling Point: W111P2

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Fraxinus nigra*	5	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	5	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Fraxinus nigra*	5	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	5	=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Persicaria lapathifolia*	20	Yes	FACW
2. *Ranunculus pensylvanicus*	20	Yes	OBL
3. *Carex atherodes*	15	Yes	OBL
4. *Cardamine pensylvanica*	15	Yes	FACW
5. *Bidens frondosa*	15	Yes	FACW
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	85	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	35	x 1 =	35
FACW species	60	x 2 =	120
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	95 (A)		155 (B)

Prevalence Index = B/A = 1.63

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W111P2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 2/1	100					Mucky Peat	
5-15	10YR 4/1	100					Sandy	Mixed with clay, highly compacted

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
_X_ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes _X_ **No** ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Thunder Lake Road- East Extension City/County: Redby/Beltrami Sampling Date: 10-26-23

Applicant/Owner: Red Lake Band Of Chippewa State: MN Sampling Point: W112P1

Investigator(s): Patrick Reardon Section, Township, Range: 34, 151, 33

Landform (hillside, terrace, etc.): Subtle Upland Ridge Local relief (concave, convex, none): Convex Slope (%): 0

Subregion (LRR or MLRA): LRR K Lat: 47.852022 Long: -94.851187 Datum: ____

Soil Map Unit Name: Egglake-Spooner, till substratum complex, 0 to 2 percent slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)
Climatic conditions have been drier than normal for the three months prior to the site visit

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): -
Water Table Present?	Yes ____	No X	Depth (inches): -
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): -

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: W112P1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Populus tremuloides*	40	Yes	FAC
2. *Ostrya virginiana*	20	Yes	FACU
3. *Tilia americana*	15	No	FACU
4. *Fraxinus nigra*	10	No	FACW
5.			
6.			
7.			
	85	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Fraxinus nigra*	10	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	10	=Total Cover	
Herb Stratum (Plot size: 6)			
1. *Carex pensylvanica*	40	Yes	UPL
2. *Oryzopsis asperifolia*	10	No	UPL
3. *Eurybia macrophylla*	5	No	UPL
4. *Thalictrum dioicum*	5	No	FACU
5. *Bromus ciliatus*	5	No	FACW
6. *Osmorhiza claytonii*	5	No	FACU
7.			
8.			
9.			
10.			
11.			
12.			
	70	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	25	x 2 =	50
FAC species	40	x 3 =	120
FACU species	45	x 4 =	180
UPL species	55	x 5 =	275
Column Totals:	165 (A)		625 (B)

Prevalence Index = B/A = 3.79

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W112P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-11	10YR 2/2	100					Sandy	
11-16	10YR 5/3	98	10YR 5/8	2	CS	M	Sandy	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ High Chroma Sands (S11) (**LRR K, L)**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________

Depth (inches): ________

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

Wetland 100

Wetland 101

Wetland 102

Wetland 103

Wetland 104

Wetland 105

Wetland 106

Wetland 107

Wetland 108

Wetland 109

Wetland 110

Wetland 111

Wetland 112

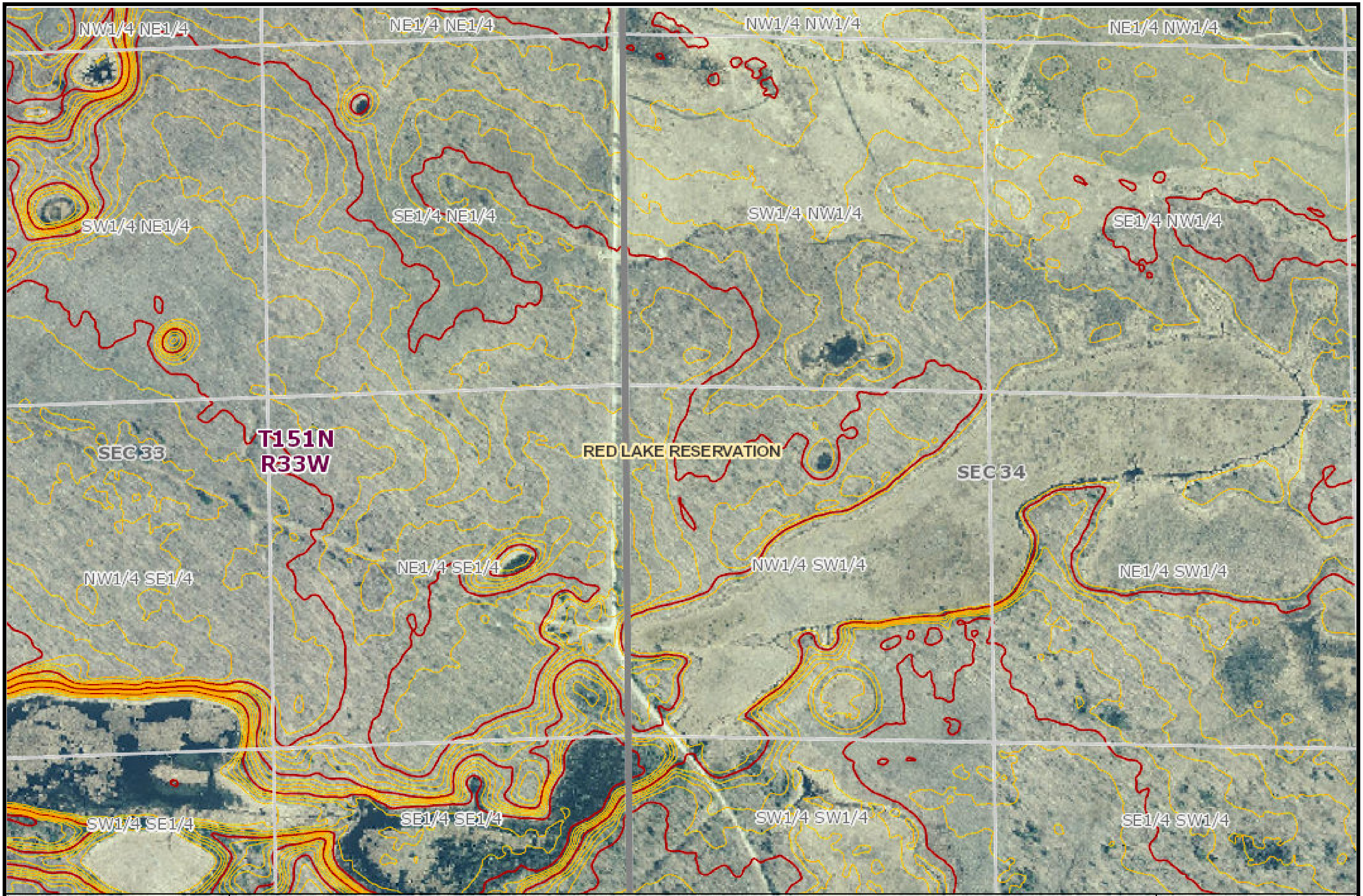
Precipitation Worksheet Using Gridded Database

Precipitation data for target wetland location:	
county: **Beltrami**	township number: **151N**
township name: **Green Lake**	range number:**33W**
nearest community: **Redby**	section number: **34**

Aerial photograph or site visit date:
Monday, October 23, 2023

Score using 1991-2020 normal period

(values are in inches)	first prior month: **September 2023**	second prior month: **August 2023**	third prior month: **July 2023**
estimated precipitation total for this location:	**1.64R**	**2.27R**	**2.39R**
there is a 30% chance this location will have less than: *	2.06	2.30	2.70
there is a 30% chance this location will have more than: *	2.98	3.49	4.42
type of month: dry normal wet	**dry**	**dry**	**dry**
monthly score	**3 * 1 = 3**	**2 * 1 = 2**	**1 * 1 = 1**
multi-month score: 6 to 9 (dry) 10 to 14 (normal) 15 to 18 (wet)	**6 (Dry)**		



These data are provided on an "AS-IS" basis, without warranty of any type, expressed or implied, including but not limited to any warranty as to their performance, merchantability, or fitness for any particular purpose.

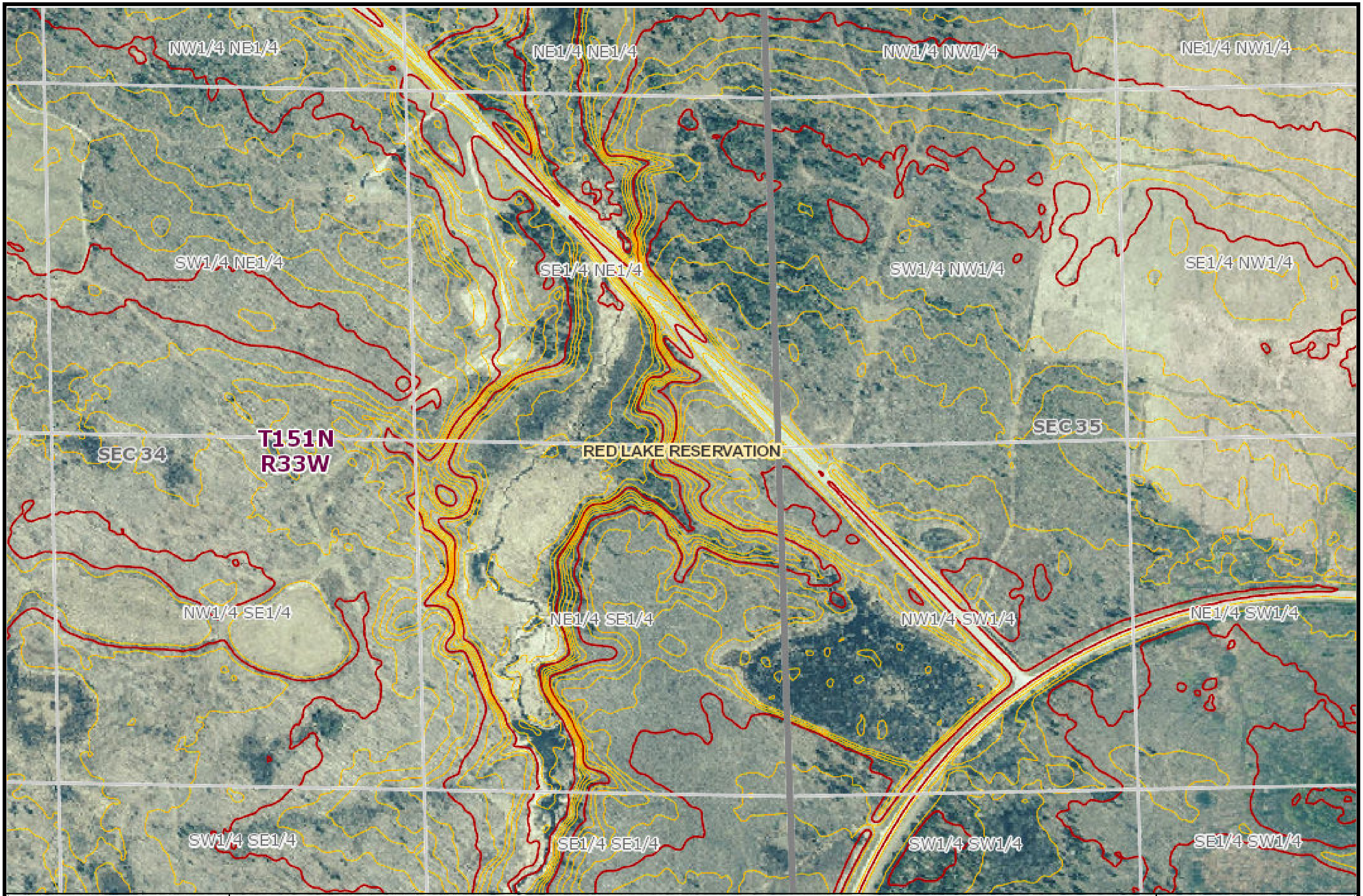
1:8,451

Date: 11/29/2023

This map is not a substitute for accurate field surveys or for locating actual property lines and any adjacent features.

Beltrami County
Minnesota

N



These data are provided on an "AS-IS" basis, without warranty of any type, expressed or implied, including but not limited to any warranty as to their performance, merchantability, or fitness for any particular purpose.

1:8,451

Date: 11/29/2023

This map is not a substitute for accurate field surveys or for locating actual property lines and any adjacent features.

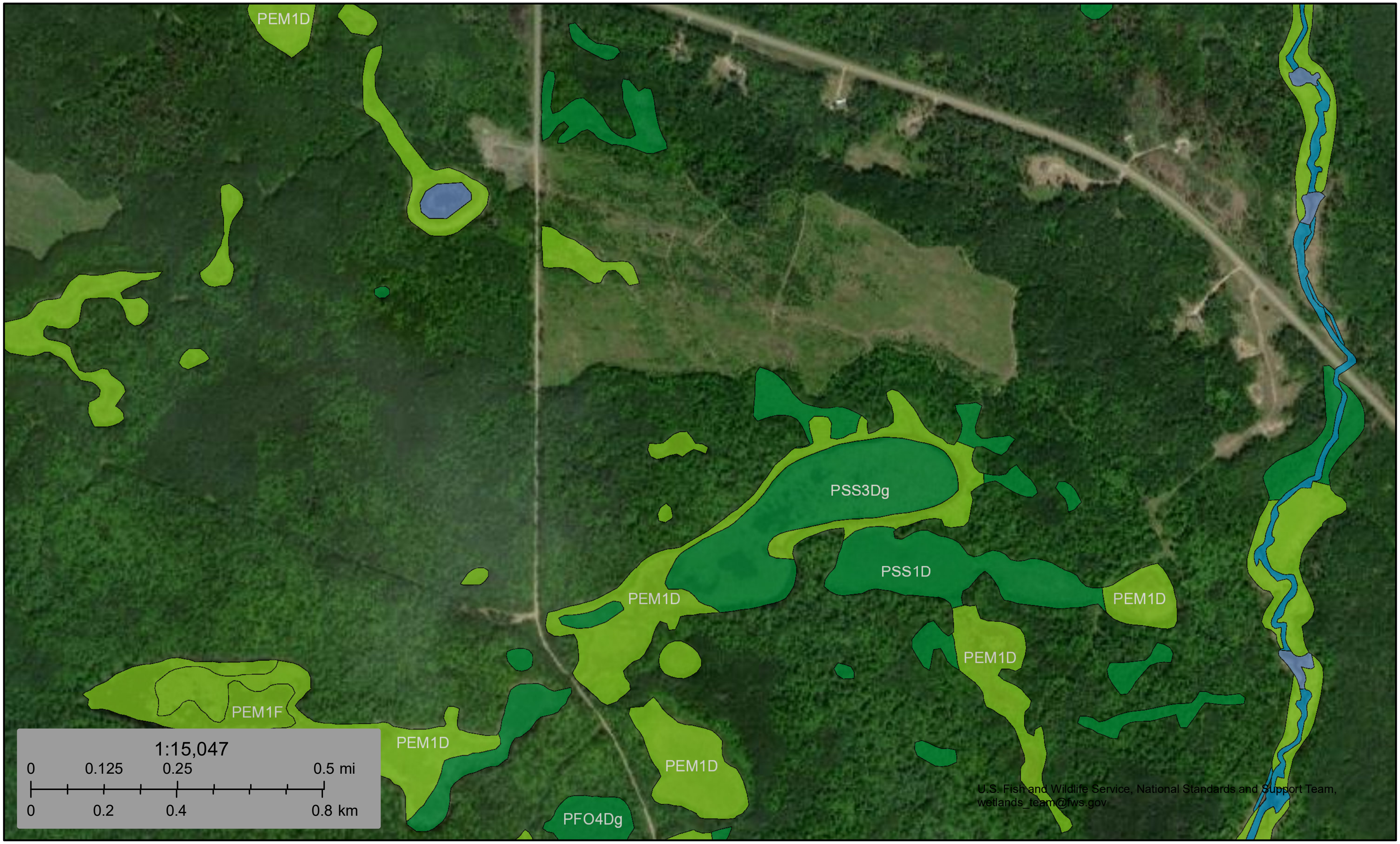
Beltrami County
Minnesota

N

U.S. Fish and Wildlife Service

National Wetlands Inventory

Wetlands



November 29, 2023

Wetlands

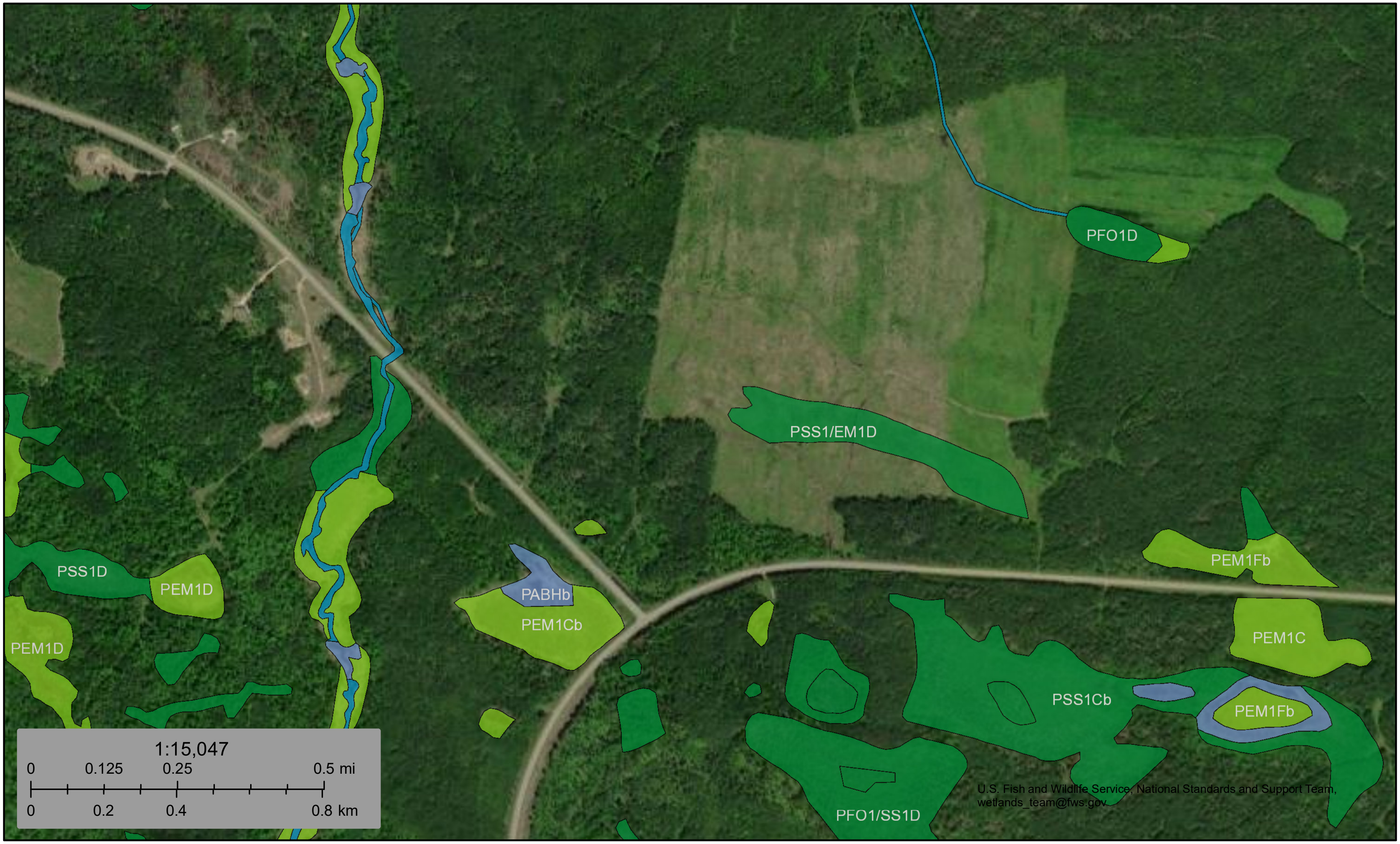
- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

U.S. Fish and Wildlife Service
National Wetlands Inventory

Wetlands



November 29, 2023

Wetlands

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United States Department of Agriculture

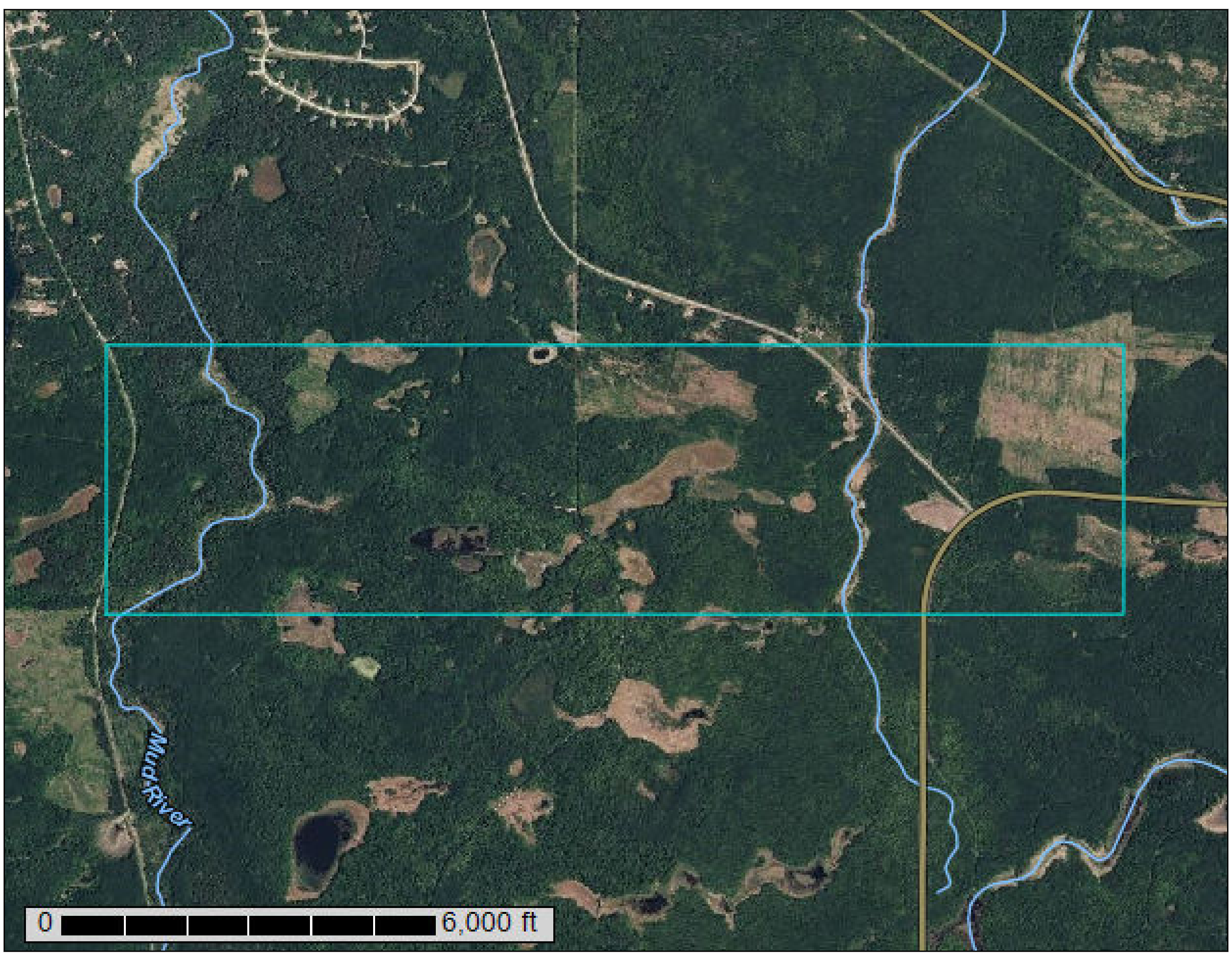
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Beltrami County, Minnesota



October 23, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

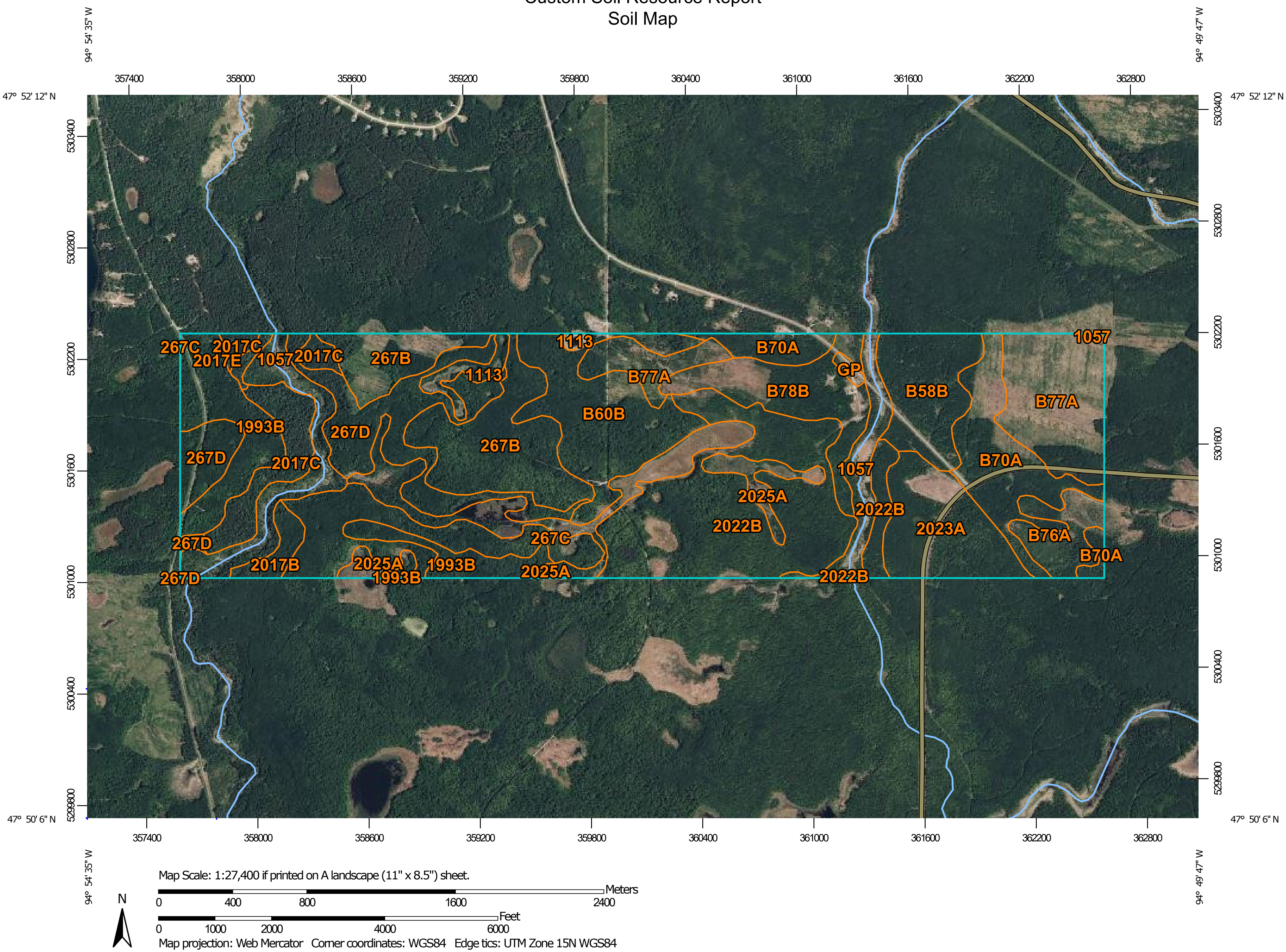
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Beltrami County, Minnesota
Survey Area Data: Version 19, Sep 9, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 1, 2021—Oct 1, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
267B	Snellman sandy loam, 1 to 8 percent slopes	146.3	9.0%
267C	Snellman sandy loam, 8 to 15 percent slopes	90.3	5.5%
267D	Snellman sandy loam, 15 to 30 percent slopes	128.3	7.9%
1057	Fluvaquents, frequently flooded-Hapludalfs complex, 0 to 35 percent slopes	99.6	6.1%
1113	Haslie, Seelyeville, and Cathro soils, frequently ponded, 0 to 1 percent slopes	17.4	1.1%
1993B	Snellman-Wykeham complex, 1 to 8 percent slopes	99.8	6.1%
2017B	Zimmerman-Andrusia complex, 1 to 8 percent slopes	15.7	1.0%
2017C	Zimmerman-Andrusia complex, 8 to 15 percent slopes	58.5	3.6%
2017E	Zimmerman-Andrusia complex, 15 to 30 percent slopes	4.7	0.3%
2022B	Wykeham-Baudette, till substratum complex, 1 to 4 percent slopes	225.4	13.8%
2023A	Egglake-Spooner, till substratum complex, 0 to 2 percent slopes	86.3	5.3%
2025A	Fluvaquents, frequently flooded-Egglake-Sax complex, 0 to 2 percent slopes	101.1	6.2%
B58B	Wurtsmith-Meehan complex, 0 to 4 percent slopes	74.2	4.6%
B60B	Ricelake-Cutaway complex, mlra 88, 1 to 4 percent slopes	119.3	7.3%
B70A	Ricelake-Blomford complex, mlra 88, 0 to 3 percent slopes	112.3	6.9%
B76A	Deford-Leafriver complex, 0 to 2 percent slopes	37.0	2.3%
B77A	Meehan-Deford complex, 0 to 3 percent slopes	127.9	7.9%
B78B	Graycalm-Grettum complex, 1 to 8 percent slopes	79.4	4.9%
GP	Pits, gravel-Udipsamments complex	3.7	0.2%
Totals for Area of Interest		**1,627.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Beltrami County, Minnesota

267B—Snellman sandy loam, 1 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2v0lj
Elevation: 590 to 2,030 feet
Mean annual precipitation: 24 to 30 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 110 to 160 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Snellman and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Snellman

Setting

Landform: Moraines
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Coarse-loamy till

Typical profile

A - 0 to 2 inches: sandy loam
E - 2 to 16 inches: loamy sand
Bt - 16 to 31 inches: sandy clay loam
C - 31 to 79 inches: sandy loam

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Forage suitability group: Sloping Upland, Acid (G057XN006MN)
Other vegetative classification: Sloping Upland, Acid (G057XN006MN)
Hydric soil rating: No

Minor Components

Wykeham

Percent of map unit: 10 percent
Landform: Moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F057XY021MN - Loamy Upland Moist Hardwood Forest
Other vegetative classification: Sloping Upland, Acid (G057XN006MN)
Hydric soil rating: No

Leaflake

Percent of map unit: 5 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Sloping Upland, Neutral (G057XN002MN)
Hydric soil rating: No

Egglake

Percent of map unit: 5 percent
Landform: Moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: F057XY015MN - Wet Mixed Forest
Other vegetative classification: Level Swale, Neutral (G057XN001MN)
Hydric soil rating: Yes

Snellman, rolling

Percent of map unit: 3 percent
Landform: Moraines
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Sloping; Fine Texture (G057XN023MN)
Hydric soil rating: No

Cathro, frequently ponded

Percent of map unit: 2 percent
Landform: Depressions on moraines
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R102AY037SD - Deep Marsh
Other vegetative classification: Not Suited (G057XN024MN)
Hydric soil rating: Yes

267C—Snellman sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2v0lk
Elevation: 590 to 2,030 feet
Mean annual precipitation: 24 to 30 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 110 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Snellman and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Snellman

Setting

Landform: Moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Coarse-loamy till

Typical profile

A - 0 to 2 inches: sandy loam
E - 2 to 16 inches: loamy sand
Bt - 16 to 31 inches: sandy clay loam
C - 31 to 79 inches: sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Forage suitability group: Sloping; Fine Texture (G057XN023MN)

Other vegetative classification: Sloping; Fine Texture (G057XN023MN)
Hydric soil rating: No

Minor Components

Wykeham

Percent of map unit: 5 percent
Landform: Moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F057XY021MN - Loamy Upland Moist Hardwood Forest
Other vegetative classification: Sloping Upland, Acid (G057XN006MN)
Hydric soil rating: No

Leaflake

Percent of map unit: 3 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Sloping Upland, Neutral (G057XN002MN)
Hydric soil rating: No

Egglake

Percent of map unit: 3 percent
Landform: Moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: F057XY015MN - Wet Mixed Forest
Other vegetative classification: Level Swale, Neutral (G057XN001MN)
Hydric soil rating: Yes

Cathro, frequently ponded

Percent of map unit: 2 percent
Landform: Depressions on moraines
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R102AY037SD - Deep Marsh
Other vegetative classification: Not Suited (G057XN024MN)
Hydric soil rating: Yes

Snellman

Percent of map unit: 2 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Steep; Fine Texture (G057XN017MN)
Hydric soil rating: No

267D—Snellman sandy loam, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: 2v0ll
Elevation: 590 to 2,030 feet
Mean annual precipitation: 24 to 30 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 110 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Snellman and similar soils: 88 percent
Minor components: 12 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Snellman

Setting

Landform: Moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Coarse-loamy till

Typical profile

A - 0 to 2 inches: sandy loam
E - 2 to 16 inches: loamy sand
Bt - 16 to 31 inches: sandy clay loam
C - 31 to 79 inches: sandy loam

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: F057XY018MN - Steep Sandy Upland Forest
Forage suitability group: Steep; Fine Texture (G057XN017MN)

Other vegetative classification: Steep; Fine Texture (G057XN017MN)
Hydric soil rating: No

Minor Components

Egglake
Percent of map unit: 3 percent
Landform: Moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: F057XY015MN - Wet Mixed Forest
Other vegetative classification: Level Swale, Neutral (G057XN001MN)
Hydric soil rating: Yes

Cathro, frequently ponded
Percent of map unit: 3 percent
Landform: Depressions on moraines
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R102AY037SD - Deep Marsh
Other vegetative classification: Not Suited (G057XN024MN)
Hydric soil rating: Yes

Leaflake
Percent of map unit: 2 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Sloping Upland, Neutral (G057XN002MN)
Hydric soil rating: No

Wykeham
Percent of map unit: 2 percent
Landform: Moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F057XY021MN - Loamy Upland Moist Hardwood Forest
Other vegetative classification: Sloping Upland, Acid (G057XN006MN)
Hydric soil rating: No

Snellman, steep
Percent of map unit: 2 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Not Suited (G057XN024MN)
Hydric soil rating: No

1057—Fluvaquents, frequently flooded-Hapludalfs complex, 0 to 35 percent slopes

Map Unit Setting

National map unit symbol: 2ml29
Elevation: 660 to 1,970 feet
Mean annual precipitation: 25 to 31 inches
Mean annual air temperature: 36 to 45 degrees F
Frost-free period: 80 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Fluvaquents, frequently flooded, loamy, and similar soils: 50 percent
Hapludalfs and similar soils: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fluvaquents, Frequently Flooded, Loamy

Setting

Landform: Flats on flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 6 inches: mucky silt loam
Cg - 6 to 80 inches: stratified silt loam to loamy coarse sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: RareNoneFrequentOccasional
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: B/D
Ecological site: F088XY006MN - Floodplain Forest Wet
Forage suitability group: Not Suited (G088XN024MN)
Other vegetative classification: Not Suited (G088XN024MN)
Hydric soil rating: Yes

Description of Hapludalfs

Setting

Landform: Flood plains
Landform position (two-dimensional): Backslope, shoulder, summit
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Till

Typical profile

A - 0 to 4 inches: loam
E - 4 to 7 inches: silt loam
B/E - 7 to 11 inches: silty clay loam
Bt - 11 to 39 inches: silty clay
BC - 39 to 80 inches: clay loam

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C/D
Ecological site: F088XY014MN - Clayey Upland Wet-Mesic Hardwood Forest
Forage suitability group: Steep; Fine Texture (G088XN017MN)
Other vegetative classification: Steep; Fine Texture (G088XN017MN)
Hydric soil rating: No

Minor Components

Fluvaquents, frequently flooded

Percent of map unit: 5 percent
Landform: Flats on flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F088XY006MN - Floodplain Forest Wet
Other vegetative classification: Frequently Flooded (G088XN016MN)
Hydric soil rating: Yes

1113—Haslie, Seelyeville, and Cathro soils, frequently ponded, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2w8f2
Elevation: 590 to 2,130 feet
Mean annual precipitation: 22 to 33 inches
Mean annual air temperature: 37 to 48 degrees F
Frost-free period: 110 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Haslie, frequently ponded, and similar soils: 31 percent
Seelyeville, frequently ponded, and similar soils: 29 percent
Cathro, frequently ponded, and similar soils: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Haslie, Frequently Ponded

Setting

Landform: Depressions
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Herbaceous organic material over coprogenic material

Typical profile

Oa - 0 to 30 inches: muck
Lco - 30 to 79 inches: coprogenous silt loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 18.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: C/D
Ecological site: R057XY001MN - Marsh

Forage suitability group: Not Suited (G057XN024MN)
Other vegetative classification: Not Suited (G057XN024MN)
Hydric soil rating: Yes

Description of Seelyeville, Frequently Ponded

Setting

Landform: Depressions
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Herbaceous organic material

Typical profile

Oa1 - 0 to 10 inches: muck
Oa2 - 10 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 23.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: A/D
Ecological site: R057XY001MN - Marsh
Forage suitability group: Not Suited (G057XN024MN)
Other vegetative classification: Not Suited (G057XN024MN)
Hydric soil rating: Yes

Description of Cathro, Frequently Ponded

Setting

Landform: Depressions
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Herbaceous organic material over till

Typical profile

Oa - 0 to 26 inches: muck
Cg - 26 to 79 inches: loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent

Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 15.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: B/D
Ecological site: R057XY001MN - Marsh
Forage suitability group: Not Suited (G057XN024MN)
Other vegetative classification: Not Suited (G057XN024MN)
Hydric soil rating: Yes

Minor Components

Nidaros, frequently ponded

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R057XY005MN - Open Peatland
Other vegetative classification: Not Suited (G057XN024MN)
Hydric soil rating: Yes

Water

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Unranked

Endoaquolls, frequently ponded

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F057XY015MN - Wet Mixed Forest
Other vegetative classification: Ponded If Not Drained (G057XN013MN)
Hydric soil rating: Yes

1993B—Snellman-Wykeham complex, 1 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t4sz
Elevation: 590 to 2,030 feet
Mean annual precipitation: 24 to 30 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 110 to 160 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Snellman and similar soils: 55 percent
Wykeham and similar soils: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Snellman

Setting

Landform: Moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Coarse-loamy till

Typical profile

A - 0 to 2 inches: sandy loam
E - 2 to 16 inches: loamy sand
Bt - 16 to 31 inches: sandy clay loam
C - 31 to 79 inches: sandy loam

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Forage suitability group: Sloping Upland, Acid (G057XN006MN)
Other vegetative classification: Sloping Upland, Acid (G057XN006MN)
Hydric soil rating: No

Description of Wykeham

Setting

Landform: Moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Coarse-loamy till

Typical profile

A - 0 to 7 inches: fine sandy loam

E - 7 to 11 inches: fine sandy loam
BE - 11 to 19 inches: fine sandy loam
Bt - 19 to 28 inches: sandy clay loam
C - 28 to 79 inches: sandy loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 22 to 49 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2c
Hydrologic Soil Group: C
Ecological site: F057XY021MN - Loamy Upland Moist Hardwood Forest
Forage suitability group: Sloping Upland, Acid (G057XN006MN)
Other vegetative classification: Sloping Upland, Acid (G057XN006MN)
Hydric soil rating: No

Minor Components

Leaflake

Percent of map unit: 2 percent
Landform: Moraines
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Sloping Upland, Neutral (G057XN002MN)
Hydric soil rating: No

Bemidji

Percent of map unit: 2 percent
Landform: Moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Sloping Upland, Acid (G057XN006MN)
Hydric soil rating: No

Egglake

Percent of map unit: 1 percent
Landform: Moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear

Across-slope shape: Concave
Ecological site: F057XY015MN - Wet Mixed Forest
Other vegetative classification: Level Swale, Neutral (G057XN001MN)
Hydric soil rating: Yes

2017B—Zimmerman-Andrusia complex, 1 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2qkj4
Elevation: 1,000 to 1,600 feet
Mean annual precipitation: 22 to 27 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 90 to 130 days
Farmland classification: Not prime farmland

Map Unit Composition

Zimmerman and similar soils: 45 percent
Andrusia and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Zimmerman

Setting

Landform: Hillslopes on moraines
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Outwash

Typical profile

A - 0 to 3 inches: loamy fine sand
E - 3 to 16 inches: fine sand
Bw - 16 to 35 inches: fine sand
E and Bt - 35 to 60 inches: fine sand

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 19.99 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: A
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Forage suitability group: Sandy (G057XN022MN)
Other vegetative classification: Sandy (G057XN022MN)
Hydric soil rating: No

Description of Andrusia

Setting

Landform: Hillslopes on moraines
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Outwash

Typical profile

A - 0 to 3 inches: loamy sand
E - 3 to 29 inches: sand
Bt - 29 to 39 inches: gravelly sandy loam
C - 39 to 60 inches: sand

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Forage suitability group: Sloping Upland, Low AWC, Neutral (G057XN004MN)
Other vegetative classification: Sloping Upland, Low AWC, Neutral (G057XN004MN)
Hydric soil rating: No

Minor Components

Grettum

Percent of map unit: 10 percent
Landform: Hillslopes on moraines
Landform position (two-dimensional): Footslope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F057XY018MN - Steep Sandy Upland Forest
Other vegetative classification: Sloping Upland, Low AWC, Acid (G057XN008MN)
Hydric soil rating: No

Leaflake

Percent of map unit: 5 percent

Landform: Hillslopes on moraines
Landform position (two-dimensional): Summit, shoulder
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Sloping Upland, Neutral (G057XN002MN)
Hydric soil rating: No

Andrusia, hilly

Percent of map unit: 3 percent
Landform: Hillslopes on moraines
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Steep; Coarse Texture; Low AWC (G057XN018MN)
Hydric soil rating: No

Leafriver

Percent of map unit: 2 percent
Landform: Depressions on moraines
Landform position (two-dimensional): Toeslope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F057XY003MN - Peatland
Other vegetative classification: Organic (G057XN014MN)
Hydric soil rating: Yes

2017C—Zimmerman-Andrusia complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2qkjp
Elevation: 1,000 to 1,600 feet
Mean annual precipitation: 22 to 27 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 90 to 130 days
Farmland classification: Not prime farmland

Map Unit Composition

Zimmerman, rolling, and similar soils: 45 percent
Andrusia, rolling, and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Zimmerman, Rolling

Setting

Landform: Hillslopes on moraines

Landform position (two-dimensional): Shoulder, backslope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Outwash

Typical profile

A - 0 to 3 inches: loamy fine sand
E - 3 to 16 inches: fine sand
Bw - 16 to 35 inches: fine sand
E and Bt - 35 to 60 inches: fine sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 19.99 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): 6s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Forage suitability group: Sandy (G057XN022MN)
Other vegetative classification: Sandy (G057XN022MN)
Hydric soil rating: No

Description of Andrusia, Rolling

Setting

Landform: Hillslopes on moraines
Landform position (two-dimensional): Backslope, shoulder
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Outwash

Typical profile

A - 0 to 3 inches: loamy sand
E - 3 to 29 inches: sand
Bt - 29 to 39 inches: gravelly sandy loam
C - 39 to 60 inches: sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Forage suitability group: Sloping Upland, Low AWC, Neutral (G057XN004MN)
Other vegetative classification: Sloping Upland, Low AWC, Neutral (G057XN004MN)
Hydric soil rating: No

Minor Components

Andrusia, hilly

Percent of map unit: 10 percent
Landform: Hillslopes on moraines
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Steep; Coarse Texture; Low AWC (G057XN018MN)
Hydric soil rating: No

Leaflake

Percent of map unit: 5 percent
Landform: Hillslopes on moraines
Landform position (two-dimensional): Shoulder, summit
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Sloping Upland, Neutral (G057XN002MN)
Hydric soil rating: No

Grettum

Percent of map unit: 3 percent
Landform: Hillslopes on moraines
Landform position (two-dimensional): Footslope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F057XY018MN - Steep Sandy Upland Forest
Other vegetative classification: Sloping Upland, Low AWC, Acid (G057XN008MN)
Hydric soil rating: No

Leafriver

Percent of map unit: 2 percent
Landform: Depressions on moraines
Landform position (two-dimensional): Toeslope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F057XY003MN - Peatland
Other vegetative classification: Organic (G057XN014MN)
Hydric soil rating: Yes

2017E—Zimmerman-Andrusia complex, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: 2qkjq
Elevation: 1,000 to 1,600 feet
Mean annual precipitation: 22 to 27 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 90 to 130 days
Farmland classification: Not prime farmland

Map Unit Composition

Zimmerman, hilly, and similar soils: 45 percent
Andrusia, hilly, and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Zimmerman, Hilly

Setting

Landform: Hillslopes on moraines
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Outwash

Typical profile

A - 0 to 3 inches: loamy fine sand
E - 3 to 16 inches: fine sand
Bw - 16 to 35 inches: fine sand
E and Bt - 35 to 60 inches: fine sand

Properties and qualities

Slope: 12 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 19.99 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: F057XY018MN - Steep Sandy Upland Forest
Forage suitability group: Steep; Coarse Texture; Low AWC (G057XN018MN)

Other vegetative classification: Steep; Coarse Texture; Low AWC (G057XN018MN)
Hydric soil rating: No

Description of Andrusia, Hilly

Setting

Landform: Hillslopes on moraines
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Outwash

Typical profile

A - 0 to 3 inches: loamy sand
E - 3 to 29 inches: sand
Bt - 29 to 39 inches: gravelly sandy loam
C - 39 to 60 inches: sand

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: F057XY018MN - Steep Sandy Upland Forest
Forage suitability group: Steep; Coarse Texture; Low AWC (G057XN018MN)
Other vegetative classification: Steep; Coarse Texture; Low AWC (G057XN018MN)
Hydric soil rating: No

Minor Components

Zimmerman

Percent of map unit: 12 percent
Landform: Hillslopes on moraines
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Sandy (G057XN022MN)
Hydric soil rating: No

Leaflake

Percent of map unit: 5 percent
Landform: Hillslopes on moraines
Landform position (two-dimensional): Shoulder, summit

Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Sloping Upland, Neutral (G057XN002MN)
Hydric soil rating: No

Redby

Percent of map unit: 2 percent
Landform: Hillslopes on moraines
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: R057XY012MN - Sandy Prairie
Other vegetative classification: Level Swale, Low AWC, Acid (G057XN007MN)
Hydric soil rating: No

Leafriver

Percent of map unit: 1 percent
Landform: Depressions on moraines
Landform position (two-dimensional): Toeslope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F057XY003MN - Peatland
Other vegetative classification: Organic (G057XN014MN)
Hydric soil rating: Yes

2022B—Wykeham-Baudette, till substratum complex, 1 to 4 percent slopes

Map Unit Setting

National map unit symbol: 2qkjc
Elevation: 1,000 to 1,600 feet
Mean annual precipitation: 22 to 27 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 90 to 130 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Wykeham and similar soils: 40 percent
Baudette, till substratum, and similar soils: 35 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wykeham

Setting

Landform: Rises on moraines
Down-slope shape: Convex
Across-slope shape: Convex

Parent material: Till

Typical profile

A - 0 to 7 inches: fine sandy loam
E - 7 to 11 inches: fine sandy loam
BE - 11 to 19 inches: fine sandy loam
Bt - 19 to 28 inches: sandy clay loam
C - 28 to 71 inches: fine sandy loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 22 to 49 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: C
Ecological site: F057XY021MN - Loamy Upland Moist Hardwood Forest
Forage suitability group: Sloping Upland, Acid (G057XN006MN)
Other vegetative classification: Sloping Upland, Acid (G057XN006MN)
Hydric soil rating: No

Description of Baudette, Till Substratum

Setting

Landform: Hillslopes on moraines
Landform position (two-dimensional): Footslope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Silty glaciolacustrine deposits over till

Typical profile

A - 0 to 4 inches: silt loam
E - 4 to 8 inches: very fine sandy loam
Bt - 8 to 35 inches: silty clay loam
C - 35 to 50 inches: silt loam
2C - 50 to 60 inches: fine sandy loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 26 to 45 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: C
Ecological site: F057XY020MN - Fine Upland Moist Hardwood Forest
Forage suitability group: Sloping Upland, Neutral (G057XN002MN)
Other vegetative classification: Sloping Upland, Neutral (G057XN002MN)
Hydric soil rating: No

Minor Components

Littleswan, till substratum

Percent of map unit: 10 percent
Landform: Hillslopes on moraines
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: F057XY017MN - Steep Loamy Upland Forest
Other vegetative classification: Level Swale, Neutral (G057XN001MN)
Hydric soil rating: No

Egglake

Percent of map unit: 7 percent
Landform: Swales on moraines
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: F057XY015MN - Wet Mixed Forest
Other vegetative classification: Level Swale, Neutral (G057XN001MN)
Hydric soil rating: Yes

Spooner, till substratum

Percent of map unit: 5 percent
Landform: Swales on moraines
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: F057XY015MN - Wet Mixed Forest
Other vegetative classification: Level Swale, Acid (G057XN005MN)
Hydric soil rating: Yes

Snellman

Percent of map unit: 3 percent
Landform: Hillslopes on moraines
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Sloping Upland, Acid (G057XN006MN)
Hydric soil rating: No

2023A—Egglake-Spooner, till substratum complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2qkjd
Elevation: 1,000 to 1,600 feet
Mean annual precipitation: 22 to 27 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 90 to 130 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Egglake and similar soils: 40 percent
Spooner, till substratum, and similar soils: 35 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Egglake

Setting

Landform: Swales on moraines
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Till

Typical profile

A - 0 to 4 inches: loam
E - 4 to 9 inches: fine sandy loam
Btg - 9 to 25 inches: sandy clay loam
Cg - 25 to 80 inches: fine sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 30 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: F057XY015MN - Wet Mixed Forest
Forage suitability group: Level Swale, Neutral (G057XN001MN)
Other vegetative classification: Level Swale, Neutral (G057XN001MN)

Hydric soil rating: Yes

Description of Spooner, Till Substratum

Setting

Landform: Swales on moraines
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Silty glaciolacustrine deposits over till

Typical profile

A - 0 to 4 inches: silt loam
E - 4 to 7 inches: very fine sandy loam
Btg - 7 to 25 inches: silty clay loam
Cg - 25 to 50 inches: silt loam
C - 50 to 80 inches: fine sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 0 to 30 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: High (about 11.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: F057XY015MN - Wet Mixed Forest
Forage suitability group: Level Swale, Acid (G057XN005MN)
Other vegetative classification: Level Swale, Acid (G057XN005MN)
Hydric soil rating: Yes

Minor Components

Littleswan, till substratum

Percent of map unit: 12 percent
Landform: Hillslopes on moraines
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: F057XY017MN - Steep Loamy Upland Forest
Other vegetative classification: Level Swale, Neutral (G057XN001MN)
Hydric soil rating: No

Wykeham

Percent of map unit: 9 percent
Landform: Rises on moraines
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F057XY021MN - Loamy Upland Moist Hardwood Forest
Other vegetative classification: Sloping Upland, Acid (G057XN006MN)

Hydric soil rating: No

Sax, depressional

Percent of map unit: 4 percent
Landform: Depressions on moraines
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F057XY003MN - Peatland
Other vegetative classification: Not Suited (G057XN024MN)
Hydric soil rating: Yes

2025A—Fluvaquents, frequently flooded-Egglake-Sax complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2qkjw
Elevation: 1,000 to 1,600 feet
Mean annual precipitation: 22 to 27 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 90 to 130 days
Farmland classification: Not prime farmland

Map Unit Composition

Fluvaquents, frequently flooded, and similar soils: 40 percent
Egglake and similar soils: 25 percent
Sax, depressional, and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fluvaquents, Frequently Flooded

Setting

Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

A - 0 to 16 inches: fine sandy loam
Cg - 16 to 80 inches: stratified loamy sand to silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: FrequentNoneRare
Frequency of ponding: Frequent

Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A/D
Ecological site: F057XY016MN - Flood Plain Forest
Forage suitability group: Frequently Flooded (G057XN016MN)
Other vegetative classification: Frequently Flooded (G057XN016MN)
Hydric soil rating: Yes

Description of Egglake

Setting

Landform: Swales on moraines
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Till

Typical profile

A - 0 to 4 inches: loam
E - 4 to 9 inches: fine sandy loam
Btg - 9 to 25 inches: sandy clay loam
Cg - 25 to 80 inches: fine sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 30 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: F057XY015MN - Wet Mixed Forest
Forage suitability group: Level Swale, Neutral (G057XN001MN)
Other vegetative classification: Level Swale, Neutral (G057XN001MN)
Hydric soil rating: Yes

Description of Sax, Depressional

Setting

Landform: Depressions on moraines
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Organic material over silty glaciolacustrine deposits

Typical profile

Oa - 0 to 13 inches: muck
A - 13 to 15 inches: silt loam

Bg - 15 to 36 inches: silt loam
Cg - 36 to 80 inches: silt loam

Properties and qualities
Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Very high (about 14.6 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: B/D
Ecological site: F057XY003MN - Peatland
Forage suitability group: Not Suited (G057XN024MN)
Other vegetative classification: Not Suited (G057XN024MN)
Hydric soil rating: Yes

Minor Components

Littleswan, till substratum
Percent of map unit: 10 percent
Landform: Hillslopes on moraines
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: F057XY017MN - Steep Loamy Upland Forest
Other vegetative classification: Level Swale, Neutral (G057XN001MN)
Hydric soil rating: No

Water
Percent of map unit: 5 percent

B58B—Wurtsmith-Meehan complex, 0 to 4 percent slopes

Map Unit Setting
National map unit symbol: 2pg47
Elevation: 980 to 1,610 feet
Mean annual precipitation: 25 to 27 inches
Mean annual air temperature: 36 to 39 degrees F
Frost-free period: 90 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition

Wurtsmith and similar soils: 45 percent
Meehan and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wurtsmith

Setting

Landform: Rises on outwash plains
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Sandy outwash

Typical profile

A - 0 to 3 inches: loamy sand
Bw - 3 to 18 inches: sand
BC - 18 to 33 inches: sand
C - 33 to 80 inches: sand

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)
Depth to water table: About 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F088XY013MN - Dry Sandy Upland Coniferous Forest
Forage suitability group: Sloping Upland, Low AWC, Acid (G088XN008MN)
Other vegetative classification: Sloping Upland, Low AWC, Acid (G088XN008MN)
Hydric soil rating: No

Description of Meehan

Setting

Landform: Rises on outwash plains
Parent material: Sandy outwash

Typical profile

A - 0 to 3 inches: loamy sand
Bw1 - 3 to 12 inches: loamy sand
Bw2 - 12 to 47 inches: sand
C - 47 to 80 inches: coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained

Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)
Depth to water table: About 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A/D
Ecological site: F088XY011MN - Moist Sandy Mixed Forest
Forage suitability group: Level Swale, Low AWC, Acid (G088XN007MN)
Other vegetative classification: Level Swale, Low AWC, Acid (G088XN007MN)
Hydric soil rating: No

Minor Components

Friendship

Percent of map unit: 10 percent
Landform: Rises on outwash plains
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F088XY013MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Sloping Upland, Low AWC, Acid (G088XN008MN)
Hydric soil rating: No

Roscommon

Percent of map unit: 5 percent
Landform: Swales on outwash plains
Ecological site: F088XY008MN - Wet Mixed Forest
Other vegetative classification: Level Swale, Low AWC, Acid (G088XN007MN)
Hydric soil rating: Yes

B60B—Ricelake-Cutaway complex, mlra 88, 1 to 4 percent slopes

Map Unit Setting

National map unit symbol: sfwx
Elevation: 980 to 1,610 feet
Mean annual precipitation: 25 to 27 inches
Mean annual air temperature: 36 to 39 degrees F
Frost-free period: 90 to 120 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ricelake and similar soils: 60 percent
Cutaway and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ricelake

Setting

Landform: Moraines on flats
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Sandy outwash over till

Typical profile

A - 0 to 2 inches: loamy sand
E - 2 to 23 inches: loamy sand
Bt - 23 to 30 inches: sandy loam
Bw - 30 to 35 inches: sand
2C - 35 to 80 inches: clay loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: About 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: F088XY015MN - Loamy Upland Wet-Mesic Mixed Forest
Forage suitability group: Level Swale, Low AWC, Acid (G088XN007MN)
Other vegetative classification: Level Swale, Low AWC, Acid (G088XN007MN)
Hydric soil rating: No

Description of Cutaway

Setting

Landform: Rises on moraines
Down-slope shape: Convex
Across-slope shape: Linear

Typical profile

A - 0 to 3 inches: loamy sand
E - 3 to 14 inches: loamy sand
E/B - 14 to 31 inches: loamy sand
2Bt - 31 to 39 inches: clay loam
2Bk - 39 to 50 inches: clay loam
2C - 50 to 80 inches: clay loam

Properties and qualities

Slope: 2 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)

Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C/D
Ecological site: F088XY015MN - Loamy Upland Wet-Mesic Mixed Forest
Forage suitability group: Sloping Upland, Low AWC, Acid (G088XN008MN)
Other vegetative classification: Sloping Upland, Low AWC, Acid (G088XN008MN)
Hydric soil rating: No

Minor Components

Blomford

Percent of map unit: 10 percent
Landform: Drainageways on moraines
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: F088XY008MN - Wet Mixed Forest
Other vegetative classification: Level Swale, Acid (G088XN005MN)
Hydric soil rating: Yes

B70A—Ricelake-Blomford complex, mlra 88, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: sfx5
Elevation: 980 to 1,610 feet
Mean annual precipitation: 25 to 27 inches
Mean annual air temperature: 36 to 39 degrees F
Frost-free period: 90 to 120 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ricelake and similar soils: 60 percent
Blomford and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ricelake

Setting

Landform: Flats on moraines
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Sandy outwash over till

Typical profile

A - 0 to 2 inches: loamy sand
E - 2 to 23 inches: loamy sand
Bt - 23 to 30 inches: sandy loam
Bw - 30 to 35 inches: sand
2C - 35 to 80 inches: clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: About 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: F088XY015MN - Loamy Upland Wet-Mesic Mixed Forest
Forage suitability group: Level Swale, Low AWC, Acid (G088XN007MN)
Other vegetative classification: Level Swale, Low AWC, Acid (G088XN007MN)
Hydric soil rating: No

Description of Blomford

Setting

Landform: Drainageways on moraines

Typical profile

A - 0 to 5 inches: loamy fine sand
Eg - 5 to 23 inches: loamy fine sand
2Btg - 23 to 55 inches: clay loam
2BCg - 55 to 65 inches: silty clay loam
2Cg - 65 to 80 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Ecological site: F088XY008MN - Wet Mixed Forest

Forage suitability group: Level Swale, Acid (G088XN005MN)
Other vegetative classification: Level Swale, Acid (G088XN005MN)
Hydric soil rating: Yes

Minor Components

Cutaway

Percent of map unit: 10 percent
Landform: Rises on moraines
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F088XY015MN - Loamy Upland Wet-Mesic Mixed Forest
Other vegetative classification: Sloping Upland, Low AWC, Acid (G088XN008MN)
Hydric soil rating: No

B76A—Deford-Leafriver complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: sfxv
Elevation: 980 to 1,610 feet
Mean annual precipitation: 25 to 27 inches
Mean annual air temperature: 36 to 39 degrees F
Frost-free period: 90 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition

Deford and similar soils: 55 percent
Leafriver and similar soils: 25 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Deford

Setting

Landform: Flats on beach ridges
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

A - 0 to 4 inches: fine sand
C - 4 to 32 inches: fine sand
Cg - 32 to 80 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)

Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Ecological site: F088XY008MN - Wet Mixed Forest
Forage suitability group: Level Swale, Low AWC, Acid (G088XN007MN)
Other vegetative classification: Level Swale, Low AWC, Acid (G088XN007MN)
Hydric soil rating: Yes

Description of Leafriver

Setting

Landform: Depressions on beach ridges
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Herbaceous organic material over sandy glaciofluvial deposits

Typical profile

Oa - 0 to 9 inches: muck
A - 9 to 14 inches: sandy loam
Cg - 14 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A/D
Ecological site: F088XY007MN - Wet Depressional Forest
Forage suitability group: Ponded If Not Drained (G088XN013MN)
Other vegetative classification: Ponded If Not Drained (G088XN013MN)
Hydric soil rating: Yes

Minor Components

Deford, depressional

Percent of map unit: 10 percent
Landform: Depressions on beach ridges
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F088XY007MN - Wet Depressional Forest
Other vegetative classification: Ponded If Not Drained (G088XN013MN)

Hydric soil rating: Yes

Meehan

Percent of map unit: 5 percent
Landform: Outwash plains, beach ridges
Ecological site: F088XY011MN - Moist Sandy Mixed Forest
Other vegetative classification: Level Swale, Low AWC, Acid (G088XN007MN)
Hydric soil rating: No

Markey

Percent of map unit: 5 percent
Landform: Depressions on beach ridges
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F088XY003MN - Open Peatland
Other vegetative classification: Not Suited (G088XN024MN)
Hydric soil rating: Yes

B77A—Meehan-Deford complex, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: sfxw
Elevation: 980 to 1,610 feet
Mean annual precipitation: 25 to 27 inches
Mean annual air temperature: 36 to 39 degrees F
Frost-free period: 90 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition

Meehan and similar soils: 60 percent
Deford and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Meehan

Setting

Landform: Beach ridges, outwash plains
Parent material: Sandy glaciofluvial deposits

Typical profile

A - 0 to 3 inches: loamy sand
Bw1 - 3 to 12 inches: loamy sand
Bw2 - 12 to 47 inches: sand
C - 47 to 80 inches: coarse sand

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained

Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)
Depth to water table: About 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A/D
Ecological site: F088XY011MN - Moist Sandy Mixed Forest
Forage suitability group: Level Swale, Low AWC, Acid (G088XN007MN)
Other vegetative classification: Level Swale, Low AWC, Acid (G088XN007MN)
Hydric soil rating: No

Description of Deford

Setting

Landform: Swales on beach ridges, flats on beach ridges
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

A - 0 to 4 inches: fine sand
C - 4 to 32 inches: fine sand
Cg - 32 to 80 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Ecological site: F088XY008MN - Wet Mixed Forest
Forage suitability group: Level Swale, Low AWC, Acid (G088XN007MN)
Other vegetative classification: Level Swale, Low AWC, Acid (G088XN007MN)
Hydric soil rating: Yes

Minor Components

Wurtsmith

Percent of map unit: 7 percent
Landform: Knolls on beach ridges
Down-slope shape: Convex
Across-slope shape: Convex

Ecological site: F088XY013MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Sloping Upland, Low AWC, Acid (G088XN008MN)
Hydric soil rating: No

Deford, depressional

Percent of map unit: 3 percent
Landform: Depressions on beach ridges
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F088XY007MN - Wet Depressional Forest
Other vegetative classification: Ponded If Not Drained (G088XN013MN)
Hydric soil rating: Yes

B78B—Graycalm-Grettum complex, 1 to 8 percent slopes

Map Unit Setting

National map unit symbol: sfxx
Elevation: 980 to 1,610 feet
Mean annual precipitation: 25 to 27 inches
Mean annual air temperature: 36 to 39 degrees F
Frost-free period: 90 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition

Graycalm and similar soils: 60 percent
Grettum and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Graycalm

Setting

Landform: Beach ridges
Landform position (two-dimensional): Shoulder, summit
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

A - 0 to 3 inches: sand
Bw - 3 to 22 inches: sand
E - 22 to 35 inches: sand
E and Bt - 35 to 60 inches: sand
C - 60 to 80 inches: sand

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained

Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F088XY012MN - Very Dry Sandy Upland Coniferous Forest
Forage suitability group: Sandy (G088XN022MN)
Other vegetative classification: Sandy (G088XN022MN)
Hydric soil rating: No

Description of Grettum

Setting

Landform: Beach ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

A - 0 to 3 inches: loamy sand
Bw - 3 to 31 inches: sand
E and Bt - 31 to 74 inches: sand
C - 74 to 80 inches: sand

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B
Ecological site: F088XY013MN - Dry Sandy Upland Coniferous Forest
Forage suitability group: Sloping Upland, Low AWC, Acid (G088XN008MN)
Other vegetative classification: Sloping Upland, Low AWC, Acid (G088XN008MN)
Hydric soil rating: No

Minor Components

Wurtsmith

Percent of map unit: 5 percent
Landform: Beach ridges
Landform position (two-dimensional): Summit, shoulder, backslope

Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F088XY013MN - Dry Sandy Upland Coniferous Forest
Other vegetative classification: Sloping Upland, Low AWC, Acid (G088XN008MN)
Hydric soil rating: No

Meehan

Percent of map unit: 3 percent
Landform: Beach ridges, outwash plains
Ecological site: F088XY011MN - Moist Sandy Mixed Forest
Other vegetative classification: Level Swale, Low AWC, Acid (G088XN007MN)
Hydric soil rating: No

Deford

Percent of map unit: 2 percent
Landform: Drainageways on beach ridges
Landform position (two-dimensional): Toeslope
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: F088XY008MN - Wet Mixed Forest
Other vegetative classification: Level Swale, Low AWC, Acid (G088XN007MN)
Hydric soil rating: Yes

GP—Pits, gravel-Udipsamments complex

Map Unit Setting

National map unit symbol: 2p2d3
Elevation: 660 to 1,640 feet
Mean annual precipitation: 27 to 33 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 135 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Pits, gravel: 80 percent
Udipsamments and similar soils: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits, Gravel

Setting

Landform: Stream terraces, outwash plains, moraines
Parent material: Outwash

Description of Udipsamments

Setting

Landform: Stream terraces, outwash plains, moraines
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Outwash

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Ecological site: F057XY023MN - Dry Sandy Upland Coniferous Forest

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