U.S. Army Corps of Engineers
St. Paul, Minnesota

U.S. Department of Agriculture Forest Service
Laurentian Ranger District
Superior National Forest
Aurora, Minnesota

Biological Assessment for the Proposed NorthMet Project and Land Exchange

Draft

April 2015

Biological Assessment

NorthMet Project and Land Exchange

U.S. Army Corps of Engineers
St. Paul, Minnesota

U.S. Department of Agriculture Forest Service
Laurentian Ranger District
Superior National Forest
Aurora, Minnesota

April 2015

Executive Summary

Poly Met Mining Inc. (PolyMet) proposes to construct an open pit mine in northern Minnesota to extract low- to medium-quality copper-nickel-PGE minerals with low sulfide content. . This project, called the NorthMet Project (Project), is located in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of the City of Duluth, and 6 miles south of the City of Babbitt, Minnesota. The Project areas include the Mine Site (3,015 acres), Plant Site (4,515 acres), and Transportation and Utility Corridors (120 acres) that connects the Mine Site to the Plant Site.[1]

PolyMet plans to mine and process polymetallic ore from the northwestern portion of the Duluth Complex, a rock formation that forms much of the bedrock of northeastern Minnesota. The ore contains copper, nickel, gold, platinum, palladium, and cobalt. The Project would mine ore for approximately 20 years, using open pit mining methods similar to those currently in use at ferrous metallic mining operations on the Iron Range. The Plant Site was previously used as a taconite processing facility by the LTV Steel Mining Company (LTVSMC). PolyMet would upgrade existing facilities and construct new facilities to produce copper concentrates, nickel concentrates, and base and precious metal precipitates for off-site shipment and treatment. Tailings from ore processing would be placed in a tailings basin built atop the existing LTVSMC taconite tailings basin.

The Mine Site is used by wildlife, including Canada lynx (lynx), gray wolf (wolf), northern long-eared bat, and other species of concern to federal and state agencies. A 2014 Forest Service study also confirmed that northern long-eared bats utilize the Plant Site and Utility Corridor (USDA Forest Service 2014a). About 1,719 acres of the Mine Site would be directly disturbed by mining activities. Of these, 1,667 acres are administered by the Forest Service and 52 acres are privately owned. Habitats that would potentially be affected by the Project include coniferous forest (comprised primarily of black spruce[2], jack pine, tamarack, and balsam fir), deciduous forest (comprised primarily of trembling aspen and paper birch), mixed coniferous/deciduous forest, riparian (dominated by speckled alder, red-osier dogwood, and willow), and wetland (dominated by sedges, cattail, bog Labrador-tea, leatherleaf, and sphagnum moss).

Of the approximately 3,015 acres on the Mine Site, approximately 2,719 acres are owned by the United States (U.S.) Government (Government) and administered by the U.S. Department of Agriculture (USDA) Forest Service (Forest Service). In addition, about 3,776 acres adjacent to the Mine Site are owned by the Government and administered by the Forest Service.

The Forest Service is considering transferring approximately 6,495 acres (federal lands) to PolyMet in exchange for lands (non-federal lands) of similar value that have been offered for consideration by PolyMet. All lands potentially involved in the land exchange would be independently appraised according to the Uniform Appraisal Standards for Federal Land Acquisitions. The appraisals would determine the market value of the properties.

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[1] Acreages given in this report are based on Geographic Information System (GIS) analysis. Acreages associated with the legal descriptions of the lands are based on original surveys performed by the Bureau of Land Management, Government Land Office (GLO) surveyors between 1858 and 1907. As such, GLO acreages are used as part of the project description for the Final Environmental Impact Statement (FEIS being prepared for the Project and would also be used to define the real estate transaction if the Land Exchange Proposed Action was approved. The analysis of effects presented in this Biological Assessment (BA) is based upon GIS data. GIS values indicate the actual size of the lands discussed in this BA, which may be different than the GLO legal acreage.

[2] Common and scientific names of plants and animals given in this report are provided in **Appendix A**.

Information collected during wildlife and wetland functions and values studies would be used by the Forest Service in the land exchange appraisal, and would be used to evaluate impacts to wetlands, and wildlife and their habitats, for a Final Environmental Impact Statement (FEIS) for the Project and land exchange.

Assuming a land exchange occurs, the portions of the Mine Site, Dunka Road and Utility Corridor, and lands adjacent to the Mine Site that are administered by the Forest Service would no longer be part of the National Forest and therefore would not be subject to Forest Service management plans and policies. A land exchange for land adjustment is consistent with the 2004 *Land and Resource Management Plan for the Superior National Forest*.

To fulfill land exchange requirements, PolyMet is proposing to purchase and transfer all or a portion of 7,075 acres of non-federal lands to the Forest Service. The non-federal lands consist of Hay Lake Lands (4,926 acres), Hunting Club Lands (160 acres), Lake County Lands (382 acres), McFarland Lake Lands (31 acres), and Wolf Lands (1,576 acres). All lands are dominated by second-growth deciduous and coniferous forest habitats and a variety of wildlife, including lynx, wolf, and other species of concern, have been observed on or near the non-federal lands.

Assuming a land exchange occurs, the non-federal lands would be administered by the Forest Service. The non-federal lands are associated with four Forest Plan Management Areas, as designated by the Forest Service, which include General Forest, General Forest – Longer Rotation, Riparian Emphasis Area, and Candidate Research Natural Areas. If all or portions of the non-federal lands are acquired by the Forest Service, they would be administered by the Forest Service to meet the goals of these management areas.

The Project would directly impact an estimated 913 acres of wetlands, including about 758 acres at the Mine Site, 147 acres at the Plant Site, and 7.5 acres within the transportation corridors. PolyMet is proposing to purchase 2,169 acres (Wetland Mitigation Sites) as mitigation for wetland impacts from the Project. On the Wetland Mitigation Sites, 1,603 acres would be restored or converted to wetlands and 197 acres would be used as upland buffer.

Section 7 of the federal Endangered Species Act (ESA) requires that federal agencies "insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat of such species." The U.S. Army Corps of Engineers (USACE), Minnesota Department of Natural Resources (MDNR) and Forest Service are co-lead agencies for an FEIS that is evaluating the impacts of the Project on federally listed species and other natural, cultural, and social resources. This Biological Assessment (BA) is prepared in accordance with the ESA and analyzes potential effects to federally listed threatened and endangered species, and species proposed for listing, and their designated critical habitats, as a result of the Project.

The lynx is a federally listed threatened species that has been sighted on and near the Project area. In the Great Lakes region, the lynx is found primarily in mixed forest habitats where snowshoe hare are common. On March 24, 2000, the lynx was federally listed as a threatened species in several states in the Northeast, Great Lakes Region (including Minnesota), and Southern Rockies. On November 9, 2006, the U.S. Department of the Interior (USDOI), U.S. Fish and Wildlife Service (USFWS), designated 319 square miles (mi^2) as critical habitat in Voyageurs National Park. On February 25, 2009, the USFWS re-designated lynx critical habitat to include portions of Cook, Koochiching, Lake, and St. Louis Counties, including most of the federal lands and all of the non-federal lands. A total of 8,065 mi^2 were designated as critical habitat in Minnesota in 2009. The Wetland

Mitigation Sites are not included within designated critical habitat. The federal and non-federal lands and Wetland Mitigation Sites are located near the western edge of the lynx's range in the Great Lakes region. Lynx and/or their sign have been observed on or near the federal and non-federal lands.

The northern long-eared bat is a federally listed threatened species. The listing of the northern long-eared bat as a threatened species was determined by the USFWS on April 2, 2015 (USFWS 2015) The USFWS also announced interim 4(d) rules concurrent with the listing determination. However, the USFWS has deferred designation of critical habitat for northern long-eared bat to a later date.

The wolf was federally listed as an endangered species under the ESA in 1974, and was reclassified as threatened in 1977. On December 28, 2011, the wolf was delisted by the USFWS. However, on December 19, 2014, a federal court reversed the USFWS decision to delist the gray wolf, restoring federal threatened status and critical habitat designation in Minnesota. Approximately 9,800 mi^2 were identified as critical habitat for wolves in Minnesota. The federal and non-federal lands are within, but the Wetland Mitigation Sites are outside, the designated critical habitat zone.

The USACE and Forest Service have initiated consultation with the USFWS seeking concurrence with the determination of effects in this BA. Based on the analysis in this BA, the Project would affect lynx, and those effects would not be insignificant or discountable. Thus, the Project **is likely to adversely affect** Canada lynx. The Project would also directly affect about 1,719 acres of lynx critical habitat within the Mine Site. While project lands are rarely used by lynx, the Project would affect only about 0.03% of lynx designated critical habitat in Minnesota, including Primary Constituent Elements (PCEs) of lynx critical habitat. Suitable lynx habitat could be restored on about 397 acres that would be reclaimed after mining, but due to the time inherent in the successional process, it could be 10 or more years after mining before revegetation results in much suitable habitat for lynx. Thus, the Project **is likely to adversely affect** Canada lynx critical habitat.

Based on analysis in this BA, the Project is **likely to adversely affect the northern long-eared bat.** This because of the potential loss of available summer roost habitat. . There is no effect determination on northern long-eared bat critical habitat, because the USFWS has not designated critical habitat for the species. .

Based on the analysis in this BA, the Project would affect gray wolves, and those effects would not be insignificant or discountable. Thus the Project **is likely to adversely affect gray wolves**. The Project would directly affect approximately 1,719 acres of gray wolf critical habitat. The 1,719 acres directly affected by the Project are about 0.03% of the over 6.3 million acres of wolf critical habitat in Minnesota, but include PCEs for wolf critical habitat. Approximately 397 acres of disturbed lands would be reclaimed after mining and could provide suitable gray wolf habitat 10 to 20 years after mining. Thus, the Project **is likely to adversely affect** gray wolf critical habitat.

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List of Acronyms

ANFO	Ammonium Nitrate and Fuel Oil
BA	Biological Assessment
Barr	Barr Engineering, Inc.
BO	Biological Opinion
BWCAW	Boundary Waters Canoe Area Wilderness
CESA	Cumulative Effects Study Area
C.F.R.	Code of Federal Regulations
dbA	A-weighted decibels
dbh	Diameter-at-breast-height
DPS	Distinct Population Segment
e.g.	Exempli gratia, meaning “for example”
EIS	Environmental Impact Statement
ESA	Endangered Species Act
EIS	Environmental Impact Statement
etc.	et cetera
FEIS	Final Environmental Impact Statement
Forest Service	U.S. Forest Service
FTB	Flotation Tailings Basin
GAP	Gap Analysis Program
GIS	Geographic Information System
GLO	Government Land Office
Government	U.S. Government
HRF	Hydrometallurgical Residue Facility
i.e.	in otherwords
km^2	square kilometers
kV	kilovolts
LAU	Lynx Analysis Unit
LTVSMC	LTV Steel Mining Company
mi^2	Square miles
MIH	Management Indicator Habitat
mg/l	milligrams per liter
MDNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
n	number
NA	Not Applicable
NMFS	National Marine Fisheries Service
NRRI	Natural Resources Research Institute
OML	Objective Maintenance Level
PCE	Primary Constituent Elements
PolyMet	Poly Met Mining Incorporated
Project	NorthMet Project
ROW	Rights-of-Way
SNF	Superior National Forest

SEIS	Supplemental Environmental Impact Statement
SUV	Sports Utility Vehicle
SWPPP	Stormwater Pollution Prevention Plan
U.S.	United States
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of the Interior
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

1.0 Introduction

1.1 Overview

Poly Met Mining Inc. (PolyMet) proposes to construct an open pit mine in northern Minnesota to extract low- to medium-quality copper-nickel-PGE minerals with low sulfide content. . This project, called the NorthMet Project (Project), is located in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of the City of Duluth, and 6 miles south of the City of Babbitt, Minnesota. The Project areas include the Mine Site (3,015 acres), Plant Site (4,515 acres), and Transportation and Utility Corridors (120 acres) that connect the Mine Site to the Plant Site[3] (**Figure 1**).

PolyMet plans to mine and process polymetallic ore from the northwestern portion of the Duluth Complex. The Duluth Complex is an ore complex that forms much of the bedrock of northeastern Minnesota. The ore contains copper, nickel, gold, platinum, palladium, and cobalt. The Plant Site was previously used as a taconite processing facility by the LTV Steel Mining Company (LTVSMC). PolyMet would upgrade existing facilities and construct new facilities to produce copper concentrates, nickel concentrates, and base and precious metal precipitates for off-site shipment and treatment.

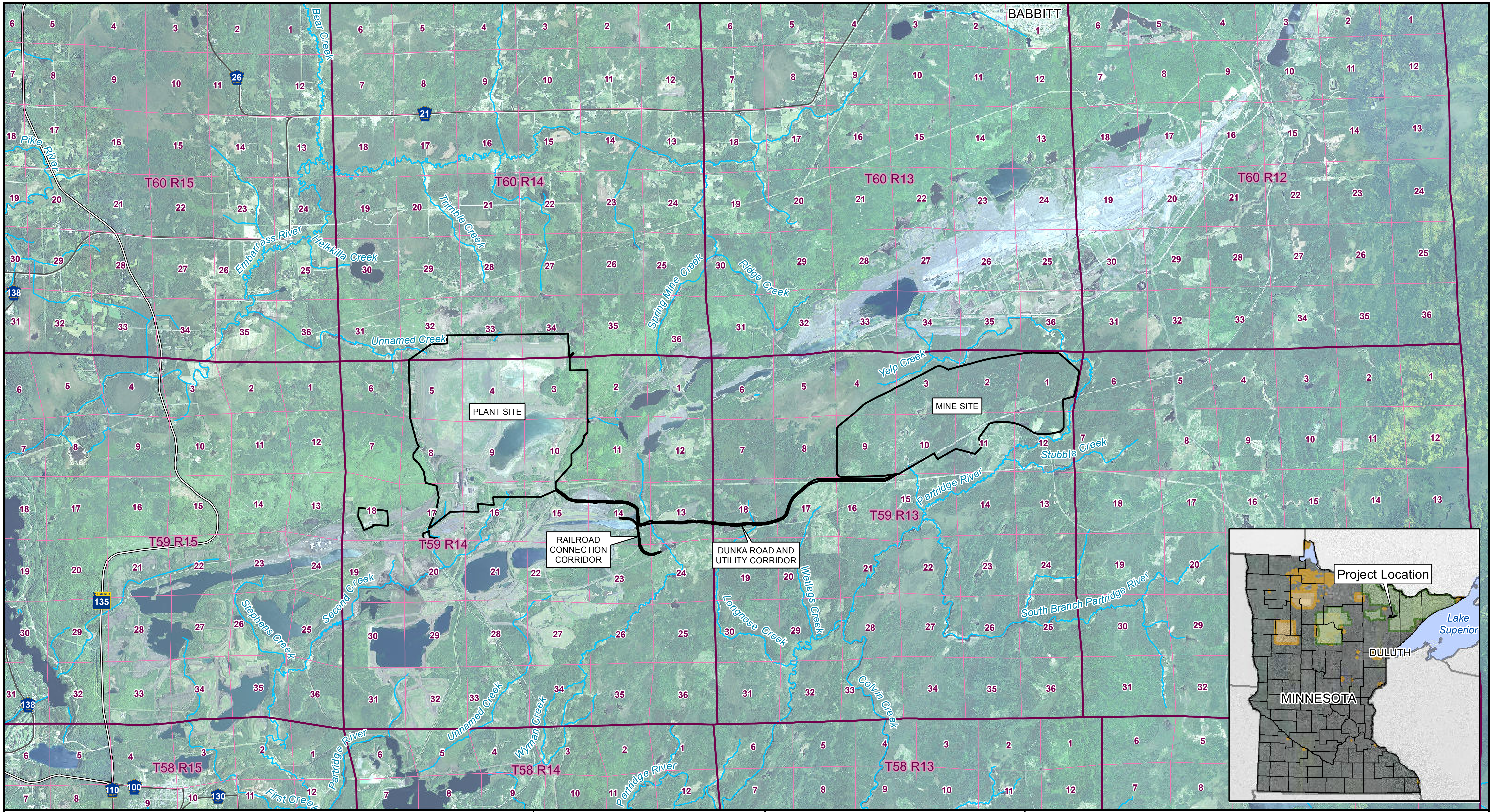
The Mine Site is used by wildlife, including Canada lynx (lynx), gray wolf (wolf), the northern long-eared bat, and other species of concern to federal and state agencies. About 1,719 acres of the Mine Site would be directly disturbed by mining activities. Of these, 1,667 acres are administered by the Forest Service and 52 acres are privately owned. Habitats that would potentially be affected by the Project include coniferous forest (comprised primarily of black spruce[4], jack pine, tamarack, and balsam fir), deciduous forest (comprised primarily of trembling aspen and paper birch), mixed deciduous/coniferous forest, riparian (dominated by speckled alder, red-osier dogwood, and willow), and wetland (dominated by sedges, cattail, bog Labrador-tea, leatherleaf, and sphagnum moss). The Transportation and Utility Corridors are mostly disturbed lands and is little used by wildlife. The Plant Site has been operated as an industrial facility for decades, and also has little value to wildlife.

Of the approximately 3,015 acres on the Mine Site, approximately 2,719 acres are owned by the United States (U.S.) Government (Government) and administered by the U.S. Department of Agriculture (USDA) Forest Service (Forest Service). In addition, about 3,776 acres adjacent to the Mine Site are owned by the Government and administered by the Forest Service.

[3] Acreages given in this report are based on Geographic Information System (GIS) analysis. Acreages associated with the legal descriptions of the lands are based on original surveys performed by the Bureau of Land Management, Government Land Office (GLO) surveyors between 1858 and 1907. As such, GLO acreages are used as part of the project description for the Final Environmental Impact Statement (FEIS) being prepared for the Project and would also be used to define the real estate transaction if the land exchange was approved. The analysis of effects presented in this Biological Assessment (BA) is based upon GIS data. The GIS values indicate the actual size of the lands discussed in this BA, which may be different than the GLO legal acreage.

[4] Common and scientific names of plants and animals given in this report are provided in **Appendix A**.

The Forest Service is considering transferring approximately 6,495 acres (federal lands) to PolyMet in exchange for lands (non-federal lands) of similar value that have been offered for consideration by PolyMet. Assuming a land exchange occurs, the portions of the Mine Site, Dunka Road and Utility Corridor, and



- Project Areas
- Township Lines
- Section Lines
- Rivers & Streams

US Army Corps of Engineers
St. Paul District

0 0.75 1.5 3 Miles

Figure 1

Project Location

Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

lands adjacent to the Mine Site that are administered by the Forest Service would no longer be part of the National Forest and therefore would not be subject to Forest Service management plans and policies. A land exchange for land adjustment is consistent with the 2004 *Land and Resource Management Plan for the Superior National Forest* (2004 Forest Plan; USDA Forest Service 2004a).

To fulfill exchange requirements, PolyMet is proposing to purchase and transfer 7,075 acres of non-federal lands to the Forest Service. The non-federal lands consist of Hay Lake Lands (4,926 acres), McFarland Lake Lands (31 acres), Lake County Lands (382 acres), Hunting Club Lands (160 acres), and Wolf Lands (1,576 acres; **Figure 2**). All non-federal lands are dominated by second-growth deciduous and coniferous forest habitats and a variety of wildlife, including lynx, wolf, and other species of concern, have been observed on or near the non-federal lands.

Assuming a land exchange occurs, the non-federal lands would be administered by the Forest Service. The non-federal lands are associated with four Forest Plan Management Areas, as designated by the Forest Service, which include General Forest, General Forest – Longer Rotation, Riparian Emphasis Area, and Candidate Research Natural Areas. If all or a portion of the non-federal lands are acquired by the Forest Service, they would be administered by the Forest Service to meet the goals of these management areas.

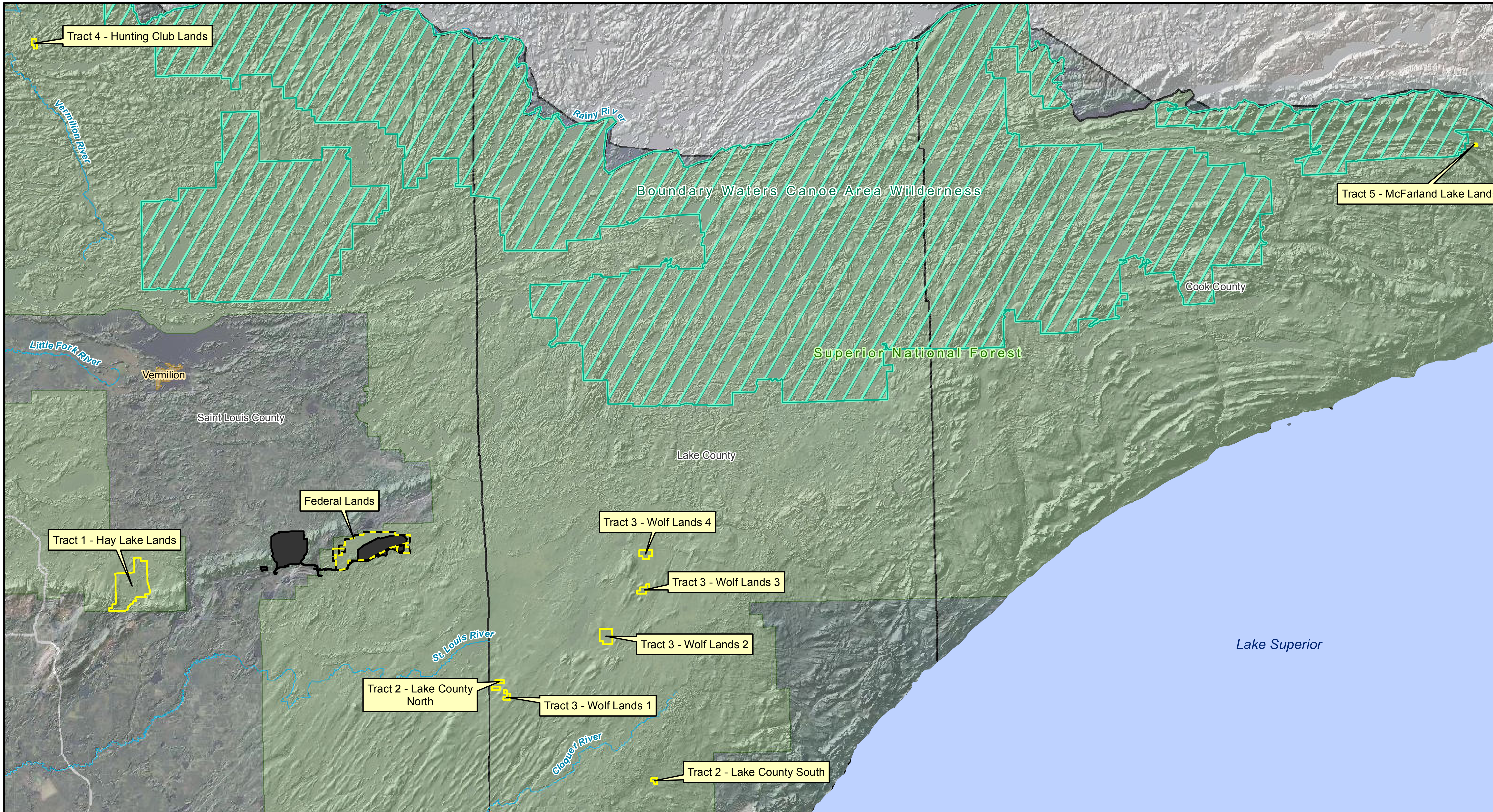
The Regional Forester or other authorized officer must decide if the proposed land exchange complies with the Forest Plan, is a fair value exchange, and is in the public interest. All lands potentially involved in the land exchange would be independently appraised according to the Uniform Appraisal Standards for Federal Land Acquisitions. The appraisals would determine the market value of the properties. Information collected during wildlife and wetland functions and values studies would be used by the Forest Service in the land exchange appraisal, and would be used to evaluate impacts to wetlands, and wildlife and their habitats for a *NorthMet Mining Project and Land Exchange Supplemental Environmental Impact Statement* (SEIS) for the Project and land exchange (Minnesota Department of Natural Resources [MDNR] et al. 2015).

The Project would directly impact an estimated 914 acres of wetlands, mostly within the Mine Site. A U.S. Army Corps of Engineers (USACE) permit would be required under Section 404 of the Clean Water Act for impacts to wetlands and other waters of the U.S., PolyMet is proposing to purchase 2,169 acres (Wetland Mitigation Sites) as mitigation for wetland impacts from the Project. On the Wetland Mitigation Sites, 1,620 acres would be restored or converted to wetlands and 197 acres would be used for upland buffer.

The Project and land exchange constitute the proposed actions of the two federal agencies, USFS and USACE. For convenience in this BA, the Project is referenced as the proposed action. The proposed action is further defined in Section 3.0.

1.2 Purpose for the Biological Assessment

In accordance with Section 7 of the federal Endangered Species Act (ESA) of 1973, as amended (19 United States Code [U.S.C.] §1536 [c], 50 Code of Federal Regulations (C.F.R.) § 402.14[c]), federal agencies must “insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat of such species.” The purpose of the ESA is to provide a means for conserving the ecosystems upon which endangered species and threatened species depend, and to provide a program for protecting these species.



Project Areas
Federal Lands
Non-federal Lands
Boundary Waters Canoe Area Wilderness
National Forest Boundary
Native American Reservation
Major River

US Army Corps of Engineers
St. Paul District

0 3.75 7.5 15 Miles

N W E S

Figure 2
Federal and Non-federal Lands
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

Under Section 7 of the ESA, federal agencies are required to consult with the U.S. Department of the Interior (USDOI) U.S. Fish and Wildlife Service (USFWS), and/or National Oceanic and Atmospheric Administration National Marine Fisheries Service (NMFS; collectively the Services), to: 1) determine what species and critical habitats could be affected by the action; 2) determine what effect the action may have on these species or critical habitats; 3) explore ways to modify the action to reduce or remove adverse effects to the species or critical habitats; 4) determine the need to enter into formal consultation for listed species or designated critical habitats, or conference for species proposed for listing or proposed critical habitats; and 5) explore the design or modification of an action to benefit the species.

The USACE, MDNR, and Forest Service are co-lead agencies for the FEIS that is being prepared to evaluate the adverse and beneficial impacts from the Project, including the land exchange. As federal agencies that would authorize actions under the FEIS Record of Decision for the Project, the USACE and Forest Service must consult with the Services on their respective actions related to the Project and the land exchange.

The purpose of this Biological Assessment (BA) is to evaluate the effects of the Project and the land exchange on federally listed threatened and endangered species, species proposed for listing, and their critical habitats, as a result of the Project. The ESA defines an endangered species as a species that is in danger of extinction throughout all or a major portion of its range. A threatened species is defined as any species that is likely to become an endangered species within the foreseeable future throughout all or a major portion of its range. A species proposed for listing is a species for which the Services have sufficient information on its biological status and threats to propose it as endangered or threatened. Critical habitat is defined as "specific area within the geographical area occupied by the species…on which are found those physical and biological features (a) essential to the conservation of the species and (b) which may require special management considerations or protection" (USDOI USFWS and NMFS 1998).

The lynx is a federally listed threatened species that may use the Project area. The lynx is under the jurisdiction of the USFWS. In the Great Lakes region, the lynx is found primarily in mixed coniferous/deciduous forest habitat where snowshoe hare are common. The Project is located near the western edge of the lynx's range in the region. Lynx have been sighted on and near the Project area. In addition, most of the federal and all of the non-federal lands are part of designated critical habitat for the lynx in Minnesota. The Wetland Mitigation Sites are not included within designated critical habitat.

Because the Project has the potential to modify the physical environment, this BA was prepared to analyze the potential effects of Project activities on the lynx and its designated critical habitat. This BA will be used by the USFWS to facilitate compliance with the requirements of Section 7(c) of the ESA. In addition, the BA will outline conservation measures to minimize or eliminate effects to lynx associated with the proposed action.

The northern long-eared bat is found across much of the eastern and north central United States and all Canadian provinces from the Atlantic coast west to the southern Northwest Territories and eastern British Columbia (USDOI USFWS 2013a). White-nose syndrome, a fungal disease known to affect bats, is currently the predominant threat to the northern long-eared bat, especially throughout the Northeast where the species has declined by up to 99% from pre-white-nose syndrome levels at many hibernation sites. White-nose syndrome has spread rapidly throughout the East and is currently spreading through the Midwest. Although the disease has not yet spread throughout the northern long-eared bat's entire range (white-nose syndrome is currently found in at least 22 of 39 states where the northern long-eared bat occurs), it continues to spread. Other threats to the species include wind energy development, habitat destruction or disturbance (e.g., vandalism to hibernacula, roost tree removal), climate change, and contaminants. Although no significant population declines have been observed due to these threats, they may now be important factors affecting this bat's ability to persist while experiencing dramatic declines caused by white-nose syndrome.

The northern long-eared bat was listed as a federally threatened species on April 2, 2015. The listing determination included announcement of interim 4(d) rules, which will allow certain activities to be excepted from the ESA prohibition of take of northern long-eared bats, provided USFWS-proscribed conservation measures are followed. The April 2, 2015 listing decision deferred designation of critical habitat for northern long-eared bat to a later date.

The wolf is the largest wild member of the dog family (Canidae) and is common on and near the Project area. The wolf was determined to be endangered in 1967 under the Endangered Species Preservation Act of 1966, in response to their vastly declining numbers range-wide at that time. In 1974, the species was formally listed as endangered through the authority of the ESA, and the Minnesota population was reclassified to threatened in 1977. In April 2003, wolf populations in the United States were separated into three Distinct Population Segments (DPS) to more effectively manage the species. The Minnesota population was a designated portion of the Eastern DPS. In 1978, wolf critical habitat was designated for the Eastern DPS. That rule identified critical habitat in Isle Royale National Park, Michigan, and Minnesota wolf management zones 1, 2, and 3. In northeastern and northcentral Minnesota, wolf management zones 1, 2, and 3 comprised approximately 9,800 square miles (mi^2) and included all of the Superior National Forest and portions of the Chippewa National Forest. Hunting Club and McFarland Lake lands were in Zone 1, while the federal lands and other non-federal lands were in Zone 2. The Wetland Mitigation Sites were outside the critical habitat zones.

On December 28, 2011, the USFWS revised the 1978 listing of the Minnesota population of wolf to conform to statutory and policy requirements. The USFWS renamed what was previously listed as the Minnesota population of gray wolf in the Eastern DPS as the Western Great Lakes DPS, and delineated the boundaries of the expanded Minnesota population segment to include all of Minnesota, Wisconsin, and Michigan and portions of the adjacent states. The USFWS December 2011 decision removed the Western Great Lakes DPS from the list of endangered and threatened wildlife. This final rule also removed the designated critical habitat for the gray wolf in Minnesota and Michigan and the special regulations under Section 4(d) of the ESA for wolves in Minnesota.

However, on December 19, 2014, a federal court reversed the USFWS decision to delist the gray wolf, restoring federal threatened status and critical habitat designation in Minnesota. Approximately 9,800 mi^2 were identified as critical habitat for wolves in Minnesota. The federal and non-federal lands are within, but the Wetland Mitigation Sites are outside, the formerly designated critical habitat zone.

2.0 Consultation

The consultation process is designed to assist federal agencies in complying with the ESA. The USACE, Forest Service, and USFWS initiated informal consultation on February 26, 2010, when the agencies met on the Project area to discuss the Project. The USACE met with the USFWS on May 3, 2011. The agencies held a conference call to discuss the project on September 1, 2011. The USACE also met with the USFWS on February 28, 2013. The USACE, USFWS, and Forest Service met in summer 2014 to identify tasks to be accomplished in the development of the BA.

Consultation can either be informal or formal, depending on the determination of effects in the BA. In making the determinations in this BA the following conclusions were considered, based on guidance in the *Endangered Species Consultation Handbook* (USDOI USFWS and NMFS 1998).

No affect – the appropriate conclusion when the action agency determines its proposed action will not affect a listed species or its designated critical habitat.

May affect - the appropriate conclusion when a proposed action may pose any effects on listed species or designated critical habitat. When the Federal agency proposing the action determines that a “may affect” situation exists, then they must either initiate formal consultation or seek written concurrence from the USFWS that the action “is not likely to adversely affect” (see definition below) listed species.

Is not likely to adversely affect – the appropriate conclusion when effects on listed species, or their critical habitat, are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best professional judgment, a person would not: 1) be able to meaningfully measure, detect, or evaluate insignificant effects; or 2) expect discountable effects to occur.

Is not likely to jeopardize proposed species – the appropriate conclusion when the action agency or the USFWS determines that the proposed action is not likely to jeopardize the proposed species or adversely modify the proposed critical habitat.

Is likely to adversely affect – the appropriate finding in a BA (or conclusion during informal consultation) if any adverse effect to listed species, or their critical habitat, may occur as a direct or indirect result of the proposed action or its interrelated or independent actions, and the effect is not discountable, insignificant, or interdependent actions, or beneficial. In the event the overall effect of the proposed action is beneficial to the listed species, but is also likely to cause some adverse effects, then the proposed action “is likely to adversely affect” the listed species. If incidental take is anticipated to occur as a result of the proposed action, then an “is likely to adversely affect” determination should be made.

Is likely to jeopardize proposed species – the appropriate conclusion when the action agency or the USFWS determines that the proposed action is likely to jeopardize the proposed species or adversely modify the proposed critical habitat.

If the BA concludes that the project “is not likely to adversely affect” listed species or critical habitat, the lead federal agencies (USACE and Forest Service) have the discretion to choose either informal or formal consultation. If informal consultation is chosen, the agency asks for written concurrence by the USFWS for the

BA's conclusion. Informal consultation is complete if a concurrence letter is obtained from the USFWS. If the BA concludes that the project is "likely to adversely affect" listed species or critical habitat, the agency must request formal consultation. When formal consultation is requested by the agency, the USFWS prepares and issues a Biological Opinion (BO), which completes the consultation. For proposed species, if the BA determines that the project is "likely to jeopardize a proposed species," the agency must request a conference with the USFWS.

Using information obtained in the BA, the USFWS will provide an opinion in the BO on whether the Project is: 1) "likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat" (a "jeopardy" biological opinion), or 2) "not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat" (a "no jeopardy" biological opinion). If the USFWS issues a "jeopardy" opinion, it must include any "reasonable and prudent alternatives" to the project that would avoid jeopardy. If the USFWS issues a "no jeopardy" opinion, it may include discretionary "conservation recommendations," which are steps the USFWS believes could be taken to further minimize potential effects on listed species or critical habitat.

3.0 Description of the Proposed Action

3.1 Overview

The USACE and the USFS have separate proposed actions on which consultation is occurring. The USACE has an application under the Clean Water Act to impact wetlands and other waters of the U.S. associated with the construction and operation of the NorthMet mine. The USFS is evaluating a land exchange of federal and non-federal lands. For convenience, the impacts are described in terms of the Project and its associated activities.

PolyMet proposes to construct an open pit mine in northern Minnesota to extract low- to medium-quality copper-nickel-PGE minerals with low sulfide content. This Project is located in Sections 5, 6, 8, 9, 13, 14, 15, 16, 17, 23, and 24, Township 58 North, Range 14 West; Sections 1, 2, 3, 4, 9, 10, 11, 12, 15, 16, 17, and 18, Township 59 North, Range 13 West; Sections 3, 4, 5, 8, 9, 10, 11,13, 14, 15, 16, 17, 20, 23, 24, 29, and 32, Township 59 North, Range 14 West; and Sections 32, 33, and 34, Township 60 North, Range 14 West, in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of the City of Duluth, and 6 miles south of the City of Babbitt, Minnesota (**Figure 3**).

This section describes specific Project features that could have effects on lynx, wolf, northern long-eared bat, and lynx and wolf critical habitat. Additional Project features that are not relevant to potential effects on lynx or wolf and their critical habitats are listed in this section, but are not described in detail. Full Project details are available in the FEIS (MDNR et al. 2013).

Ore would be excavated at the Mine Site and hauled by railroad approximately 8 miles west to the Plant Site for processing. Corridors for roads, railroad, utilities, and water pipelines would connect the Mine Site and the Plant Site. The four Project areas are shown on **Figure 3** and include:

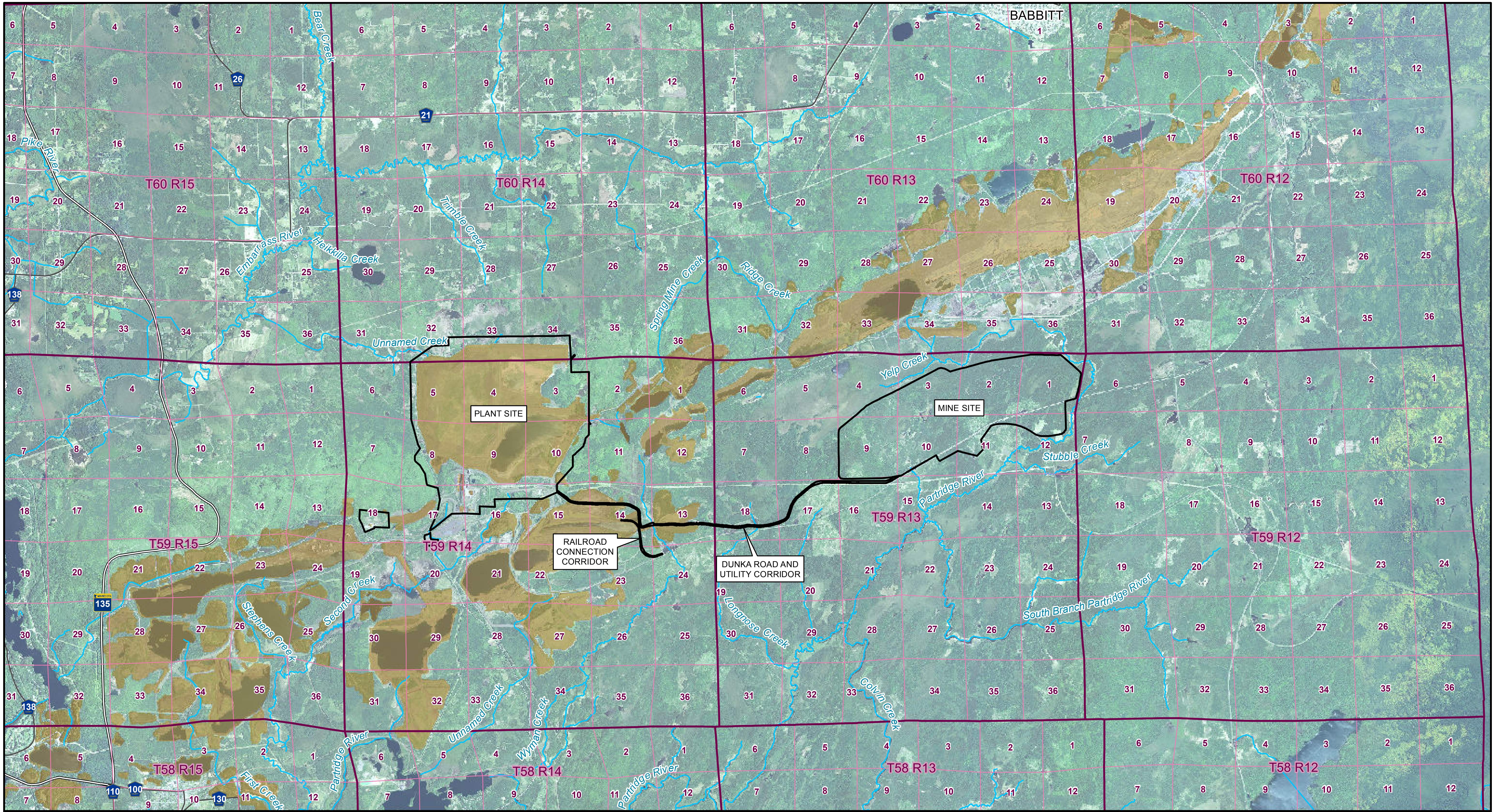
- Mine Site
- Plant Site
- Dunka Road and Utility Corridor
- Railroad Connection Corridor

3.2 Mine Site

The Mine Site, approximately 3,015 acres, would be developed at a greenfield site that has previous disturbance from logging and mining exploration activities. The Project would develop open mine pits (up to 528 acres), stockpiles (up to 794 acres), and supporting infrastructure (up to 397 acres). The location and dimensions of Mine Site features are shown on **Figure 4**. The Project features at the Mine Site would include:

- mine pits;
- ore storage and handling facilities, including an Ore Surge Pile and a Rail Transfer Hopper;

- stockpiles for overburden and waste rock with engineered systems to manage potential water resource impacts (such as liners, covers, and the Category 1 Waste Rock Stockpile Groundwater Containment System);
- a Waste Water Treatment Facility and process water collection systems to collect and treat water from the mine pits, waste rock stockpiles, ore handling facilities, and haul roads,



Project Areas
Township Lines
Section Lines
Mesabi Range (existing mine pits, tailings basins, stockpiles and other mine features)
Rivers & Streams

US Army Corps of Engineers
St. Paul District

0 0.75 1.5 3 Miles

Figure 3
Iron Range and Project Site
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

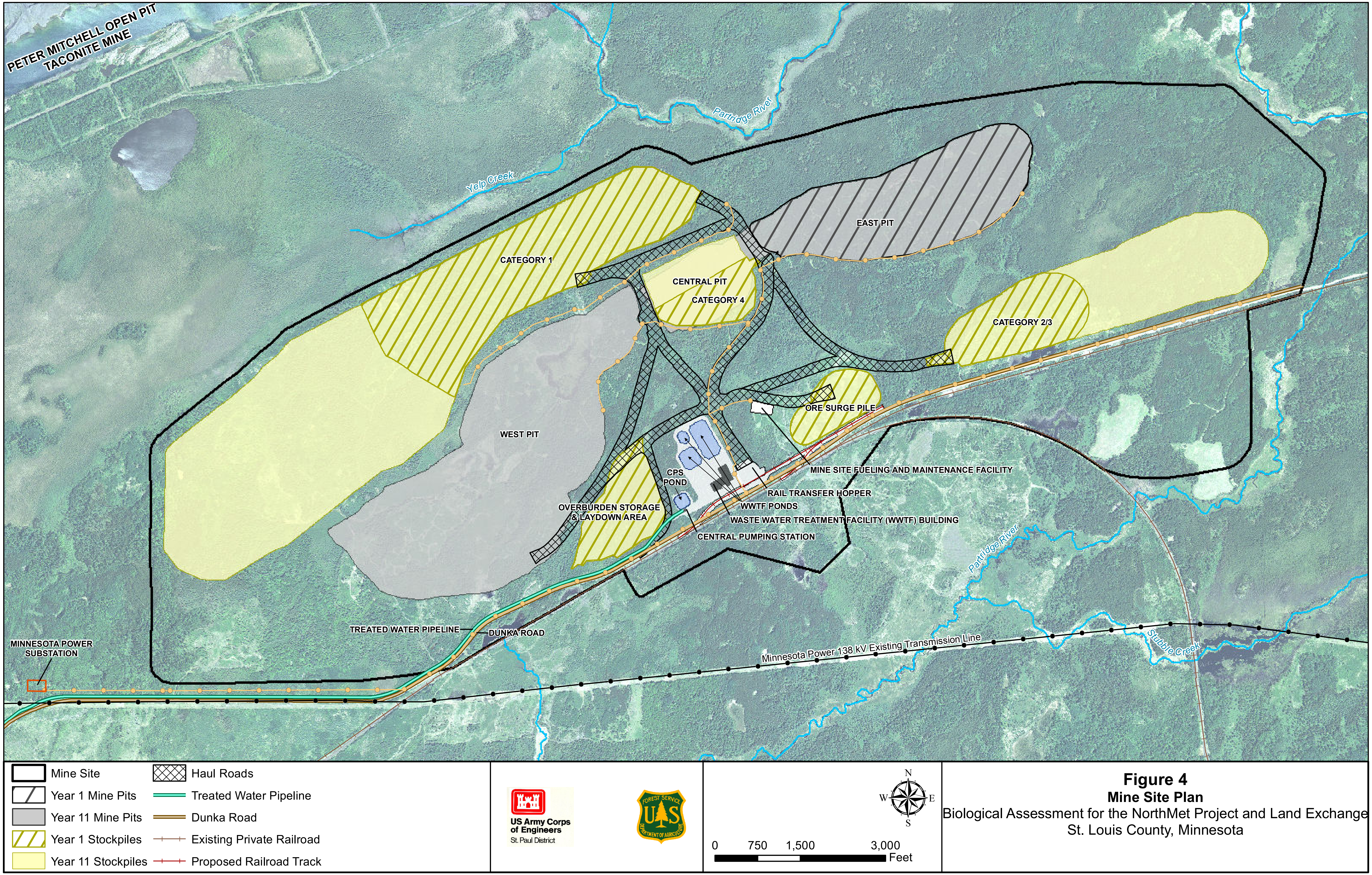


Figure 4
Mine Site Plan
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

- a Central Pumping Station and Treated Water Pipeline to transport water from the Mine Site to the Plant Site; and
- supporting infrastructure (such as roads, electrical supply, rail connections, and fueling and maintenance facilities).

3.2.1 Pre-production Mine Development

Mine Site infrastructure would be constructed during the estimated 12 to 18 months of pre-production mine development. Pre-production mine development would be followed by a gradual ramp-up of ore output over 6 to 12 months. The following Project features would be constructed during pre-production mine development:

- Roads - site access roads, haul roads, and Dunka Road upgrades.
- Railroad infrastructure - the Rail Transfer Hopper, the rail spur connecting the Rail Transfer Hopper with Cliffs Erie railroad track, and the rail spur between the Cliffs Erie railroad track and PolyMet railroad track that serves the Coarse Crusher Building.
- Surface water management features – dikes, ditches, water collection ponds, and sumps.
- Overburden Storage and Laydown Area.
- Stockpile liners and containment systems.
- Waste Water Treatment Facility, Treated Water Pipeline, and Central Pumping Station.
- Substation drop from the 138 kilovolt (kV) Minnesota Power transmission line and a 13.8 kV Mine Site power distribution system.
- Mine Site Fueling and Maintenance Facility.

3.2.2 Mining Activities

PolyMet expects to mine a total of 533 million tons of waste rock and ore over 20 years, which would include 225 million tons of ore and 308 million tons of waste rock. Mining activities include overburden removal, open pit mining, drilling and blasting, excavation and haulage, ore storage and loading for transport to the Process Plant, waste rock stockpiling, and mine site water management.

3.2.2.1 Overburden Removal

The marketable timber would be cleared and the overburden removed from the footprints of the mine pits, the Ore Surge Pile, and the waste rock stockpiles, as necessary. PolyMet would follow the USFWS northern long-eared bat interim guidance for tree removal (USFWS 2014).

Overburden, which has been defined for this Project as the material that lies on top of bedrock, would be stripped incrementally as needed for mine development in order to minimize the amount of bedrock exposed at any one time. After removal of overburden from the initial mining area, additional overburden stripping could take place concurrently with the mining of ore and waste rock. Approximately 32% of the required overburden stripping for the pit development would be done in the first 2 years of mine operation. All of the overburden that needs to be stripped from the pits would be removed by the end of Mine Year 11.

3.2.2.2 Open Pit Mining

The Project would use open pit mining methods similar to those used at ferrous metallic mining operations on the Iron Range. The mine would consist of three separate open pits known as the East, Central, and West pits. For approximately the first 10 years of operations, mining would take place in the East and West pits simultaneously, with the East Pit mining ending in Mine Year 11. The Central Pit mining would occur between Mine Years 11 and 16. During Central Pit mining, the East and Central pits would converge into one pit which would then be referred to as the East Pit.

At its maximum size, each pit is projected to have the approximate maximum area and depth shown in **Table 1**.

Table 1
Maximum Pit Dimensions

Mine Pit	Area (acres)	Maximum Depth (feet below ground surface)
East	155	696
Central	52	356
West	321	630

Drilling and blasting would be conducted to remove waste rock and extract ore. Two conventional electric or diesel powered rotary drilling rigs would be used. Blasting of ore and waste rock is anticipated to take place approximately every 2 to 3 days.

After being drilled and blasted, the ore would be loaded by excavators into haul trucks that would haul the ore to the Rail Transfer Hopper or to the Ore Surge Pile for temporary storage and haul the waste rock to the stockpiles or the East Pit. Up to nine haul trucks would be in service with a maximum speed of 34 miles per hour loaded, however their speed would typically be lower.

Mining operations would be supported by mine auxiliary vehicles (for example [e.g.], water trucks, dozers, graders) traveling on access and haul roads within the Mine Site.

3.2.2.3 Ore Storage and Loading

Ore would be loaded for transport to the Plant Site at the Rail Transfer Hopper. The Rail Transfer Hopper would consist of a raised platform from which haul trucks dump into a hopper over a pan feeder into rail cars. The Rail Transfer Hopper would be located to the south of the mine pits and would be connected to the existing Cliffs Erie main line track by a new spur line (**Figure 4**).

An Ore Surge Pile would be constructed adjacent to the Rail Transfer Hopper to allow for temporary storage of ore until it could fit into the processing schedule or as required by operational delays. Drainage from the Ore Surge Pile would be collected on a liner and routed to a sump for pumping to the Waste Water Treatment Facility.

3.2.2.4 Stockpiling

Waste rock and overburden would be managed according to its geochemical properties as determined using a sampling and analysis program approved by the MDNR. PolyMet has categorized waste rock into four categories defined according to its sulfur content, in ascending order of reactivity. These waste rock categories are summarized in **Table 2**.

The Category 1 Waste Rock Stockpile would be the only permanent stockpile for the Project. During Mine Years 1 through 11, Category 2, 3 and 4 waste rock would be placed on the temporary Category 2/3 or Category 4 Waste Rock Stockpiles (**Figure 4**). When at its maximum size, each stockpile is projected to have the approximate area, height, and elevation shown in **Table 3**.

Table 2
Waste Rock Properties

Waste Rock Categorization	Sulfur Content (percent)[1]	Approximate Percent of Total Waste Rock Produced during Mining (percent)
Category 1	≤ 0.12	70
Category 2	> 0.12 to ≤ 0.31	24
Category 3	> 0.31 to ≤ 0.60	3
Category 4	> 0.6	3

[1]In general, the higher the rock's sulfur content, the higher it's potential for generating acid rock drainage or leaching heavy metals.

Table 3
Maximum Stockpile Dimensions - Approximate

Stockpile	Mine Year of Maximum Footprint	Maximum Footprint (acres)	Maximum Height (feet)	Maximum Elevation (feet above sea level)
Category 1 waste rock	6/21[1]	508/526[1]	280	1,880
Category 2/3 waste rock	6	180	200	1,770
Category 4 waste rock	3	57	180	1,790
Ore Surge Pile	NA[2]	31	120	1,690

[1]The Category 1 Waste Rock Stockpile has a maximum footprint of 508 acres while active. It would reach this size by Mine Year 6. The stockpile would be re-graded as part of reclamation with a final footprint of 526 acres.

[2]The Ore Surge Pile would have ore moving in and out as needed to meet mine and plant operations.

All waste rock stockpiles would be engineered to manage water resource impacts. The temporary Category 2/3 and Category 4 Waste Rock Stockpiles, which have the potential to generate acid rock drainage, would have liner systems to capture water passing through the stockpile. The permanent Category 1 Waste Rock Stockpile, which does not have the potential to generate acid rock drainage, would be constructed with a groundwater containment system to collect stockpile drainage from around the entire stockpile.

3.2.2.5 Progressive Reclamation

Reclamation of the East Pit and the temporary waste rock stockpiles would begin during operations. The temporary Category 2/3 and Category 4 Waste Rock Stockpiles would be relocated to the East Pit starting in

Mine Year 11. The infrastructure associated with the temporary stockpiles (pipes, pumps, liners, et cetera [etc.]) would be removed and the footprint of each area would be reclaimed.

After the temporary stockpiles are reclaimed, all future Category 2, 3, and 4 waste rock would be placed in the East Pit. Most of the Category 1 waste rock mined after Mine Year 12 would also be placed in the East Pit. Ultimately, approximately 45% of the total waste rock mined would be backfilled to the East Pit.

The East Pit would be flooded to keep the waste rock in a subaqueous environment to reduce the environmental impact associated with further oxidation and dissolution of sulfide minerals. If natural inflow of water into the East Pit is insufficient to keep the waste rock submerged, water could be pumped from the Waste Water Treatment Facility. During periods of high precipitation or during spring snowmelt, dewatering (to the Waste Water Treatment Facility and ultimately to the Flotation Tailings Basin) may be required to allow safe placement of the waste rock.

Reclamation of the Category 1 Waste Rock Stockpile would also begin during operations. A cover system would be added incrementally after Mine Year 13 to limit infiltration through the stockpile. The stockpile would be sloped and graded, an engineered geomembrane system would be installed, soil would be placed on top of the cover, and vegetation would be planted to meet the requirements of Minnesota Rules, part 6132.2200, subpart 2, item B. The cover system would be designed to promote runoff with minimal erosion.

3.2.2.6 Mine Site Water Management

This section summarizes information from the Water Management Plan - Mine, which would become part of the MDNR Permit to Mine and Water Appropriations permits and Minnesota Pollution Control Agency (MPCA) National Pollutant Discharge Elimination System/State Disposal System permit. These plans include water management system designs, operating and maintenance plans, water quality monitoring plans, reporting requirements, and adaptive management approach.

In addition to the stockpile liners, the stockpile cover, and the groundwater containment system, water management at the Mine Site would include pit dewatering, stormwater dikes and ditches, and the Waste Water Treatment Facility that would treat water that comes in contact with mining features. During operations, there would be no direct discharge of treated waste water to public waters.

It would be necessary to dewater the pits during mining to remove groundwater flow and precipitation runoff. These waters would be directed to low areas in the pits where it would be collected in sumps and pumped to the Waste Water Treatment Facility.

Non-contact stormwater, the result of precipitation that falls on natural or reclaimed vegetated surfaces, would be routed through sedimentation ponds prior to discharge to a small watercourse that flows to the Partridge River. A system of dikes and ditches constructed at the Mine Site perimeter would minimize the amount of surface water flowing onto the site and into the mine pits, manage the amount of water that comes into contact with mining features, and control non-contact stormwater flowing off the site.

During operations, the Waste Water Treatment Facility would treat water that comes into contact with the waste rock stockpiles, haul roads, Ore Surge Pile, and mine pits. For the first approximately 10 years, all Waste Water Treatment Facility effluent would be pumped to the Plant Site Flotation Tailings Basin Pond for reuse in the beneficiation process. Reuse of the Mine Site process water at the Plant Site would eliminate the need to discharge any process water to surface waters during operations. Starting in Mine Year 11, some Waste Water Treatment Facility effluent would be sent to the East Pit to augment flooding as the pit is backfilled, with the remainder of the effluent continuing to go to the Flotation Tailings Basin. The purpose of the Waste Water Treatment Facility is to maintain water quality in the Flotation Tailings Basin pond at concentrations that do not have an adverse impact on Beneficiation Plant operations or future reclamation of the Flotation Tailings Basin.

Mine Site water would be managed in accordance with a future MPCA National Pollutant Discharge Elimination System/State Disposal System permit, which would include a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP would identify and describe Best Management Practices for the Mine Site to minimize the discharge of potential pollutants in stormwater runoff.

3.2.3 Fueling and Maintenance Facilities

The Mine Site Fueling and Maintenance Facility would consist of two buildings, one for fueling mobile equipment, and one for minor service and repair of mobile equipment. Major scheduled maintenance and repair work lasting several days on most mobile equipment would be done in the refurbished and reactivated former LTVSMC Area 1 Shop. Stationary or slow-moving equipment such as excavators, dozers, drill rigs, and light plants would be fueled in the field using mobile fuel tankers.

The former LTVSMC Area 2 Shop, about 1 mile east of the Process Plant, would be reactivated to provide office space for mining and railroad operations supervision and management, as well as clothes changing facilities, toilets, lunch rooms, first aid facility, emergency response center, and training and meeting rooms for mining and railroad crews. The Area 2 Shop facilities would include a Locomotive Fueling Station, Locomotive Service Building, and Mine Reporting Building.

3.3 Plant Site

The Plant Site was previously used as a taconite processing facility by the LTVSMC. The location and dimensions of Plant Site features are shown on **Figure 5**.

At the Plant Site, the Project would upgrade existing facilities (Beneficiation Plant, Tailings Basin, Area 1 Shop, sewage collection system, rail connections, access roads) and construct new facilities (Hydrometallurgical Plant, Hydrometallurgical Residue Facility, Concentrate Dewatering/Storage Building, Sewage Treatment System Ponds, and Waste Water Treatment Plant) within a brownfield facility. The Flotation Tailings would be stored atop the existing LTVSMC Tailings Basin by staged construction of new dams. The Plant Site also includes supporting infrastructure (e.g., roads, electrical supply, rail connections, Area 1 Shop, and Area 2 Shop).

Plant Site environmental controls would include cover systems to limit infiltration of oxygen and water through the Flotation Tailings Basin dams, beaches, and pond bottom and seepage capture systems to collect seepage from the Flotation Tailings Basin. Most water used in processing would be recycled for use. A Waste Water Treatment Plant would be constructed, including reverse osmosis or similar membrane separation technology, to treat any water that could not be recycled prior to discharge to the environment. If makeup water is needed for processing, it may be provided via the Colby Lake Water Pipeline. No new construction is required for the Colby Lake Water Pipeline.

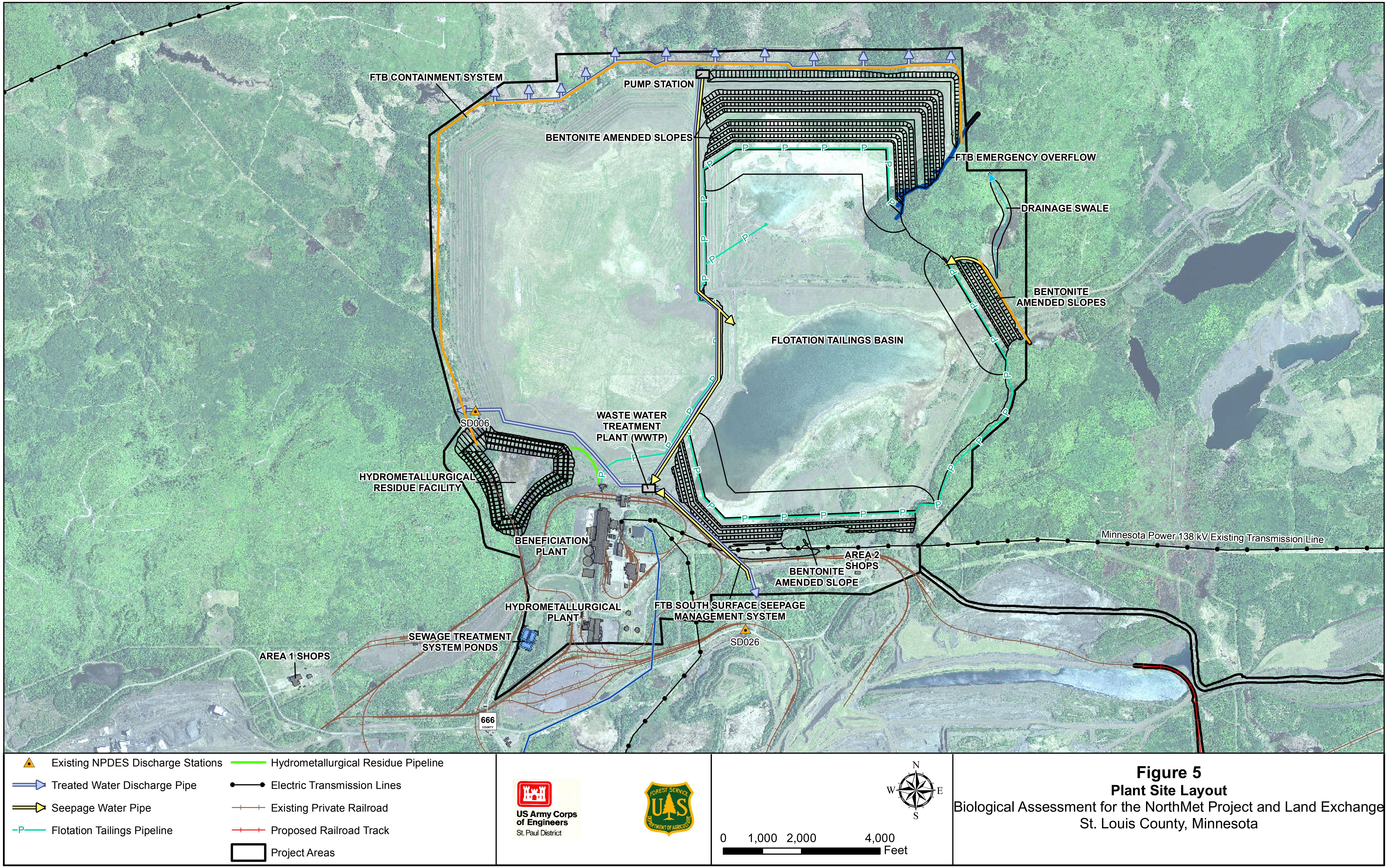


Figure 5

Plant Site Layout

Biological Assessment for the NorthMet Project and Land Exchange

St. Louis County, Minnesota

3.3.1 Ore Processing

A Beneficiation Plant and Hydrometallurgical Plant would process the ore at the Plant Site to recover base metals, gold, and platinum group metals. The purpose of the beneficiation process would be to produce final separate concentrates. One of the separate concentrates would be a copper concentrate. The other separate concentrates would be differing grades of nickel concentrate. The concentrates could be shipped to customers, used as a feedstock to the hydrometallurgical process, or divided for both uses. PolyMet expects that the Beneficiation Plant would be operational several years before the Hydrometallurgical Plant and during that period all concentrates would be shipped to customers. Once the Hydrometallurgical Plant becomes operational, some or all of the nickel concentrates would be feedstock to the hydrometallurgical process. The decision to ship or process concentrates would be based on equipment maintenance schedules, customer requirements, and overall Project economics.

3.3.1.1 Beneficiation Plant

The Beneficiation Plant processes would include ore crushing, grinding, flotation, dewatering, storage, and shipping. Crushing and grinding would occur in the existing Coarse Crusher Building, Fine Crusher Building, and Concentrator Building. Flotation would occur in a new Flotation Building located on previously disturbed ground immediately to the west of the Concentrator Building. Dewatering, storage, and shipping would occur in a new Concentrate Dewatering/Storage Building located on previously disturbed ground.

3.3.1.2 Hydrometallurgical Plant

Hydrometallurgical processing technology would be used for the treatment of nickel concentrates. This process would involve high pressure and temperature autoclave leaching followed by solution purification steps to extract and isolate platinum group metals, precious metals, and base metals. All equipment used in the hydrometallurgical process would be located in a new Hydrometallurgical Plant Building. Should spillage of process fluids occur, it would remain within the Hydrometallurgical Plant Building and be returned to the appropriate process streams.

3.3.1.3 Plant Site Infrastructure

Plant Site infrastructure that exists at this site includes:

- County Road 666 ends at the Main Gate for the industrial area that includes the Process Plant, Area 1 Shop, and Area 2 Shop.
- The Canadian National Railroad serves the industrial area that would include the Process Plant. The PolyMet railroad would connect to the Area 1 Shop and the Area 2 Shop.
- Three Minnesota Power Company 138 kV transmission lines serve the Project substation.
- The existing mechanical Sewage Treatment Plant would be replaced with new Sewage Treatment System Ponds, and the existing sewage collection system would be upgraded to meet current construction and performance standards and sized as appropriate.

- The Process Plant potable water treatment plant located near the Plant Reservoir would be refurbished and reactivated. The potable water distribution system extends to the Area 1 Shop and Area 2 Shop. This water would be used for showers and sinks and would be treated (chlorinated) to be drinkable. However, bottled water would be brought in for drinking as well.

- Area 1 Shop and Area 2 Shop.

3.3.2 Flotation Tailings Basin

Flotation Tailings from the flotation process at the Beneficiation Plant would be pumped to the Flotation Tailings Basin, which would be constructed on top of cells 1E and 2E of the existing LTVSMC Tailings Basin. Treated water from the Waste Water Treatment Facility would also be pumped to the Flotation Tailings Basin, enabling it to serve as the primary collection and distribution point for water used in the beneficiation process.

The existing LTVSMC Tailings Basin is unlined and was constructed in stages beginning in the 1950s. It has been inactive since January 2001, except for reclamation activities consistent with a MDNR-approved Closure Plan currently managed by Cliffs Erie.

The future Flotation Tailings Basin perimeter dams would be raised using upstream construction methods. The dams would be constructed using compacted LTVSMC tailings borrowed from the existing Tailings Basin. Once the LTVSMC tailings supply has been completely used for dam construction, offsite borrow from MDNR-approved sources would be utilized. Material from LTVSMC Area 5 would be a likely source, but other sources could also be considered.

Emergency overflow channels would be provided to protect the dams in the unlikely event that freeboard within the Flotation Tailings Basin is not sufficient to contain all water from an extreme storm event. Even though there is a low likelihood of overflow, it is standard practice in dam design to accommodate overflows in a manner that protects the integrity of the dams.

Seepage from the Flotation Tailings Basin would be collected by the Flotation Tailings Basin Containment System located around the northern, western, and portions of the eastern sides of the Tailings Basin and the Flotation Tailings Basin South Surface Seepage Management System located south of Tailings Basin Cell 1E. These two systems are collectively referred to as the Flotation Tailings Basin seepage capture systems. The Flotation Tailings Basin Containment System would include a low permeability cutoff wall so that it can collect seepage (from up-gradient), but avoid drawing in water from down-gradient wetlands.

3.3.3 Hydrometallurgical Residue Facility

The Hydrometallurgical Residue Facility would be constructed to manage residues generated by the hydrometallurgical process. The Hydrometallurgical Residue Facility would consist of one-lined cell located adjacent to the southwest corner of Tailings Basin, on previously disturbed ground (**Figure 5**).

The Hydrometallurgical Residue Facility liner system would be a double liner system consisting of two barrier layers separated by a leakage collection layer. This system would substantially remove all hydraulic head from the lower liner, virtually eliminating leakage from the Hydrometallurgical Residue Facility.

Residue from the Hydrometallurgical Plant would be pumped to the Hydrometallurgical Residue Facility as slurry. A pond would be maintained within the Hydrometallurgical Residue Facility so that the solids in the slurry would settle out. Most of the liquid would be recovered by a pump system and returned to the plant for reuse.

3.3.4 Plant Site Water Management

This section summarizes information from the Water Management Plan - Plant, which is a support document for the MDNR Permit to Mine and Water Appropriations permits and MPCA National Pollutant Discharge Elimination System/State Disposal System permit. These plans include water management system designs, operating and maintenance plans, preliminary water quality monitoring plans, preliminary reporting requirements, and adaptive management approach. Final water quality monitoring and reporting requirements would be determined in the permits.

Water management features at the Plant Site would include the Flotation Tailings Basin and seepage capture systems, Hydrometallurgical Residue Facility, stormwater dikes and ditches, drainage swale, Waste Water Treatment Plant, and stream augmentation. With the exception of the Flotation Tailings Basin seepage containment system, all Plant Site water management features would be located on previously disturbed areas.

3.3.4.1 Waste Water Treatment Plant

The Waste Water Treatment Plant would treat any water collected by the Flotation Tailings Basin seepage capture systems that cannot be reused as process water. It would include a reverse osmosis unit, or similar membrane separation technology, designed to achieve an effluent sulfate concentration that meets the sulfate standard for waters used for the production of wild rice (10 milligrams per liter (mg/l)). Water would be treated to meet appropriate discharge limits, then discharged along the west, northwest, and north perimeter of the Flotation Tailings Basin, beyond the Flotation Tailings Basin Containment System, and to Second Creek at the south end of the Flotation Tailings Basin to replenish the flow to the surrounding wetlands and streams. This discharge strategy would limit the potential for indirect wetland impacts due to reduced seepage from the Tailings Basin to the wetlands.

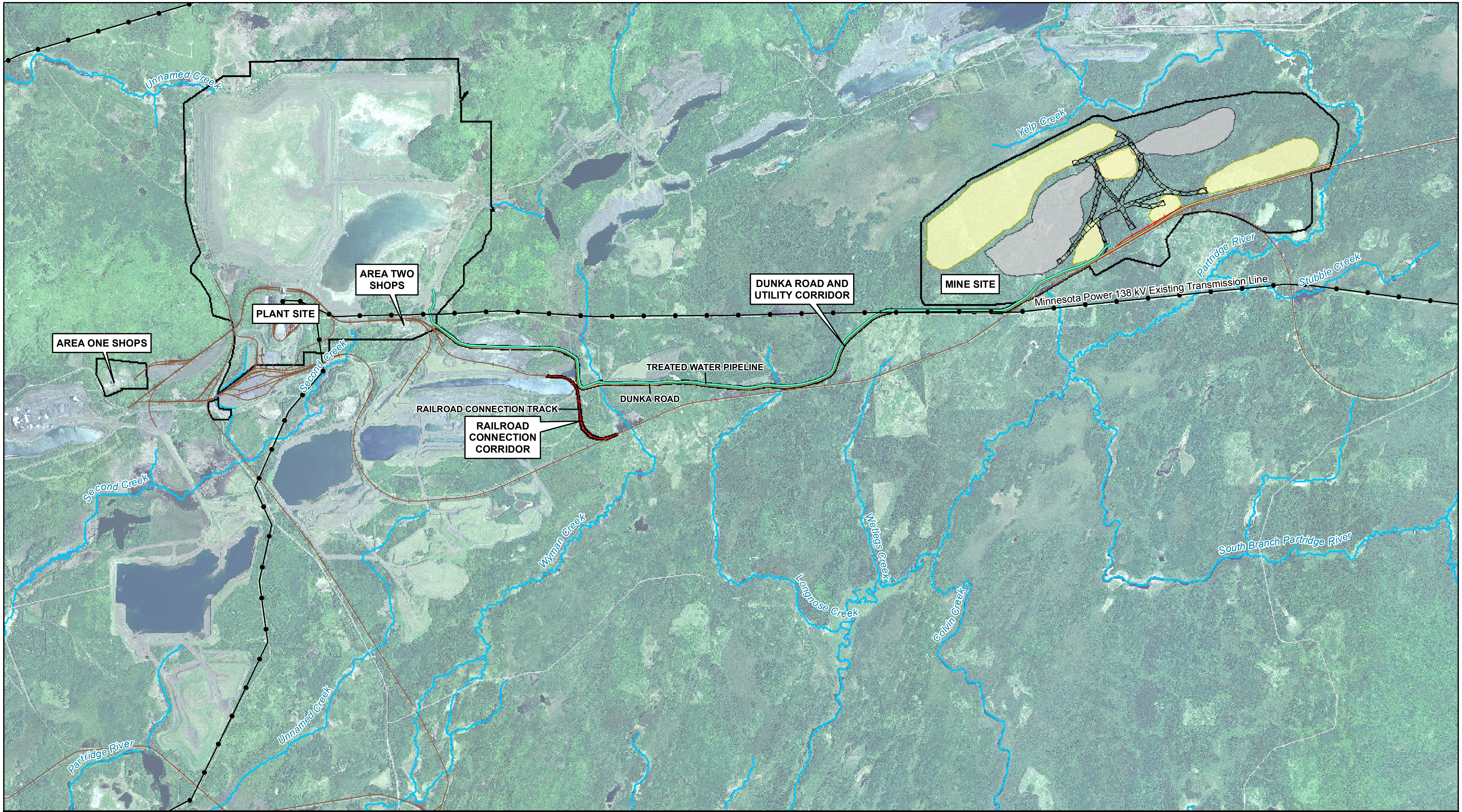
3.3.4.2 Stream Augmentation

Construction of the Flotation Tailings Basin Containment System would reduce the amount of seepage that is currently leaving the existing Tailings Basin. Consequently, the stream flow in the four tributaries around the Tailings Basin (Unnamed Creek, Second Creek, Trimble Creek, and Mud Lake Creek) would be reduced from current levels. Flow to Unnamed Creek, Second Creek, and Trimble Creek would be augmented by treated water from the Waste Water Treatment Plant. Flow to Mud Lake Creek would be augmented by construction of a drainage swale east of the Flotation Tailings Basin.

3.4 Transportation and Utility Corridors

The remaining Project components are linear corridor features, including the following (**Figure 6**):

- Dunka Road and Utility Corridor
- Railroad Connection Corridor



Treated Water Pipeline
Dunka Road
Existing Private Railroad
Proposed Railroad Track
Electric Transmission Lines
Project Areas
Stockpiles
Mine Pits
Haul Roads

US Army Corps of Engineers
St. Paul District

0 2,250 4,500 9,000 Feet

Figure 6
Transportation and Utility Corridor
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

This section describes Project features in the Transportation and Utility Corridors and presents information on the types of traffic that would result from the Project.

3.4.1 Dunka Road and Utility Corridor

Dunka Road is an existing, compacted-gravel, private road that extends from near the LTVSMC Plant Site to the Mine Site, then continues roughly northeast toward Babbitt, Minnesota. The portion of Dunka Road that connects the Plant Site to the Mine Site would be widened. The Treated Water Pipeline would be constructed parallel and adjacent to the Dunka Road in the Utility Corridor to transport treated water from the Mine Site to the Plant Site. The distance along Dunka Road from the Plant Site gate to the Mine Site gate is approximately 6.4 miles. Including the road segments located within the Plant Site and the Mine Site, the total distance from the ore processing area at the Plant Site to the ore loading area at the Mine Site is approximately 8.5 miles.

Traffic on Dunka Road would include light trucks and automobiles, sport utility vehicles (SUVs), fuel trucks, supply and waste trucks, and haul trucks needing maintenance.

- Automobiles, light trucks, or SUVs transporting employees would travel between the Area 2 Shops and the Mine Site each day, at speeds of 30 to 45 miles per hour.
- Trucks carrying fuel and blasting agents would travel to the Mine Site every day, at speeds of 25 to 40 miles per hour. These trucks would travel from County Highway 666 to Dunka Road.
- Trucks transporting supplies and waste to and from the Waste Water Treatment Plant and the Waste Water Treatment facility would travel between the Plant Site and the Mine Site each day, at speeds of 25 to 40 miles per hour.
- Haul trucks would travel from the Mine Site to the Area 1 Shop for maintenance occasionally, at a maximum speed of 35 miles per hour.

3.4.2 Railroad Connection Corridor

The railroad route from the Mine Site to the Plant Site would be from a new spur at the Rail Transfer Hopper, to the existing track on the Cliffs Erie private railroad, to a new approximately 1.1 mile connecting railroad track between the Cliffs Erie railroad track and existing PolyMet track railroad that serves the Coarse Crusher Building at the Process Plant (**Figure 6**).

Each ore train would consist of 16 to 20 100-ton side dumping ore cars and one diesel-electric “Gen-Set” or “Multi-Engine” locomotive. Ore trains would make approximately 22 roundtrips per day delivering ore from the Mine Site to the Plant Site, traveling between 15 to 25 miles per hour.

To minimize the amount of ore that escapes from rail cars, ore would be loaded into the center of the car so that fines would be located at the center of the car and the larger ore pieces would be at the edge. The result would be that fines would be kept from reaching the edge of the car where they would be subject to spillage through the hinge gaps. Large pieces that extend over the edge of the rail car would be pushed into the center of the car using a rubber-tired dozer or a front-end loader. In the event that a large ore piece would fall over the top edge of the cars during transit, it would be recovered during routine track maintenance.

In order to guard against possible adverse impacts from spilled ore, monitoring and mitigation activities can be developed. It is expected that the surface water quality sampling in the two streams traversed by the rail line would be included in permit monitoring. Mitigation measures could include alterations to the stream crossings (bridges or culverts) to collect any spilled material or the physical collection of spilled ore from the top of the rail ballast.

3.5 Traffic

Transportation of Project consumables and products would result in traffic on public roads and commercial railroads. Public roads would also have additional traffic from employees and service providers.

3.5.1 Transport of Consumables and Products

Process consumables and products would be transported to and from the Plant Site by truck and rail. This section describes the traffic on public roads and commercial railroad lines that would result from the Project.

Trucks transporting raw materials needed for the beneficiation process and the hydrometallurgical process would make approximately 80 round trips per month, entering the Plant Site from Highway 135. Trucks transporting copper and nickel concentrates would make up to approximately four round trips per day, also entering the Plant Site from Highway 135.

A locomotive, similar to the locomotives that would be hauling ore from the Mine Site to the Plant Site, would transfer loaded and empty cars carrying process consumables and concentrates to and from the interchange location with the Canadian National Railroad. Cars carrying process consumables and concentrate would meet railroad common carrier requirements.

Product shipment would require an approximately 100-car train once per month and a 30-car train 4 times per month, year-round. Process consumables would require an approximately 100-car train once per week, April through October. It is expected that outgoing PolyMet products would go by rail from the Plant Site to Virginia, Minnesota, with about half going south to Duluth, Minnesota, and the other half going north to International Falls, Minnesota. Product transport beyond Virginia is likely to be a part of the existing commercial rail traffic, with limited potential to generate additional commercial train trips. Process consumables would arrive at the Plant Site from the south from Duluth through Virginia. This movement is likely to be a part of the existing commercial rail traffic, with limited potential to generate additional commercial train trips.

3.5.2 Traffic from Employees and Service Providers

The Project would employee as many as 500 full-time workers over an 18-month period during peak construction period, and about 360 full-time workers during operation. There would be approximately 38 employee vehicles per day and 4 service vehicles per day entering the Main Gate (from County Road 666). In addition, there would be approximately 113 employee vehicles per day and 36 service vehicles per day entering the North Gate (from Highway 135).

3.6 Project Reclamation

Mining is expected to be completed approximately 20 years after operations begin. This section summarizes information from the Reclamation Plan, which is a support document for the MDNR Permit to Mine, and focuses on those aspects of Project Reclamation that have potential effects on lynx, northern long-eared bat, and wolf. Additional information on Project reclamation is available in the FEIS (MDNR et al. 2015).

In general, Project facilities have been designed and would be operated to allow for progressive reclamation, or "mining in a manner that creates areas that can be reclaimed as soon after initiation of the operation as practical and as continuously as practical throughout the life of operation" (Minnesota Rules, part 6132.0100). This would leave a smaller portion of the Project area needing to be reclaimed after closure. Project features that would be progressively reclaimed include the Waste Rock Stockpiles, the East Pit, the exterior slopes of the Flotation Tailings Basin, and the Hydrometallurgical Residue Facility. The Waste Water Treatment Facility and the Waste Water Treatment Plant would remain operative during reclamation and long-term closure[5].

3.6.1 Building and Structure Demolition and Equipment Removal

The buildings and structures would be removed and foundations razed. All mining, dewatering, and electrical equipment would be removed from the mine pit and scrapped, decommissioned, or sold. Debris and equipment would be removed from the Mine Site and Plant Site. Most roads, parking areas, or storage pads built to access these facilities would be demolished. Utility tunnels would be sealed and reclaimed in place. After demolition, these areas would be reclaimed and vegetated according to Minnesota Rules, part 6132.2700. All areas would be stabilized as required for stormwater management.

Demolition waste from structure removal would be disposed of in the existing on-site demolition landfill located northwest of the Area 1 Shop. Most concrete from demolition would be crushed and used for structural fill, placed in the basements of the Plant Site buildings, or placed in the existing on-site industrial landfill. Asphalt from paved surfaces would be removed and recycled or properly disposed of. Railroad track and ties that were not used by common carriers would be removed and recycled. All disturbed areas would be reclaimed and vegetated.

Any roads, including Mine Site access roads that may develop into unofficial off-road vehicle trails, would require a variance from MDNR reclamation rules to allow a 15-foot-wide unpaved, unvegetated track down the centerline of the road. Such approvals would also be coordinated with the St. Louis County Mine Inspector's Office.

Special materials would be disposed of appropriately during reclamation:

- Any ore remaining in the Rail Transfer Hopper, the Ore Surge Pile, or anywhere else in the vicinity of the Rail Transfer Hopper, as well as sediment removed from ditches and process

[5] "Long-term closure" is defined as being the time period when the West Pit has filled with water and the Waste Water Treatment Facility is discharging water to the outlet channel to the Upper Partridge River. This will likely occur during the post-closure maintenance period of reclamation.

water ponds, would be placed in the East Pit.

- Asbestos-containing materials would be removed intact, properly packaged, and disposed of in the on-site demolition landfill. The locations of asbestos-containing materials in the landfill would be noted on the property deed. Any asbestos-containing materials found in utility tunnels would be sealed before the utility tunnel is sealed.
- Fluorescent and sodium halide bulbs, nuclear sources, oil-stained concrete, and partially used paint, chemical, and petroleum products would be removed and recycled or properly disposed of.
- Any materials remaining in storage tanks would be sent to appropriate recycling or waste disposal facility. All storage tanks would be cleaned, disassembled, and recycled or disposed of appropriately. Tank foundations would be removed and all disturbed areas would be vegetated.
- Material remaining in the equipment and process piping would be properly disposed of in the Hydrometallurgical Residue Facility or other MPCA-approved locations.
- On-site sewer and water systems, powerlines, pipelines, and culverts would be closed according to regulatory requirements.

3.6.2 Reclamation of Mine Site

Mine Site reclamation would include building and structure demolition and equipment removal, mine pit reclamation, stockpile reclamation and watershed restoration. Mine Site reclamation would begin as soon as practical throughout mining operations, with reclamation of the East Pit and Waste Rock Stockpiles commencing before mining activities cease.

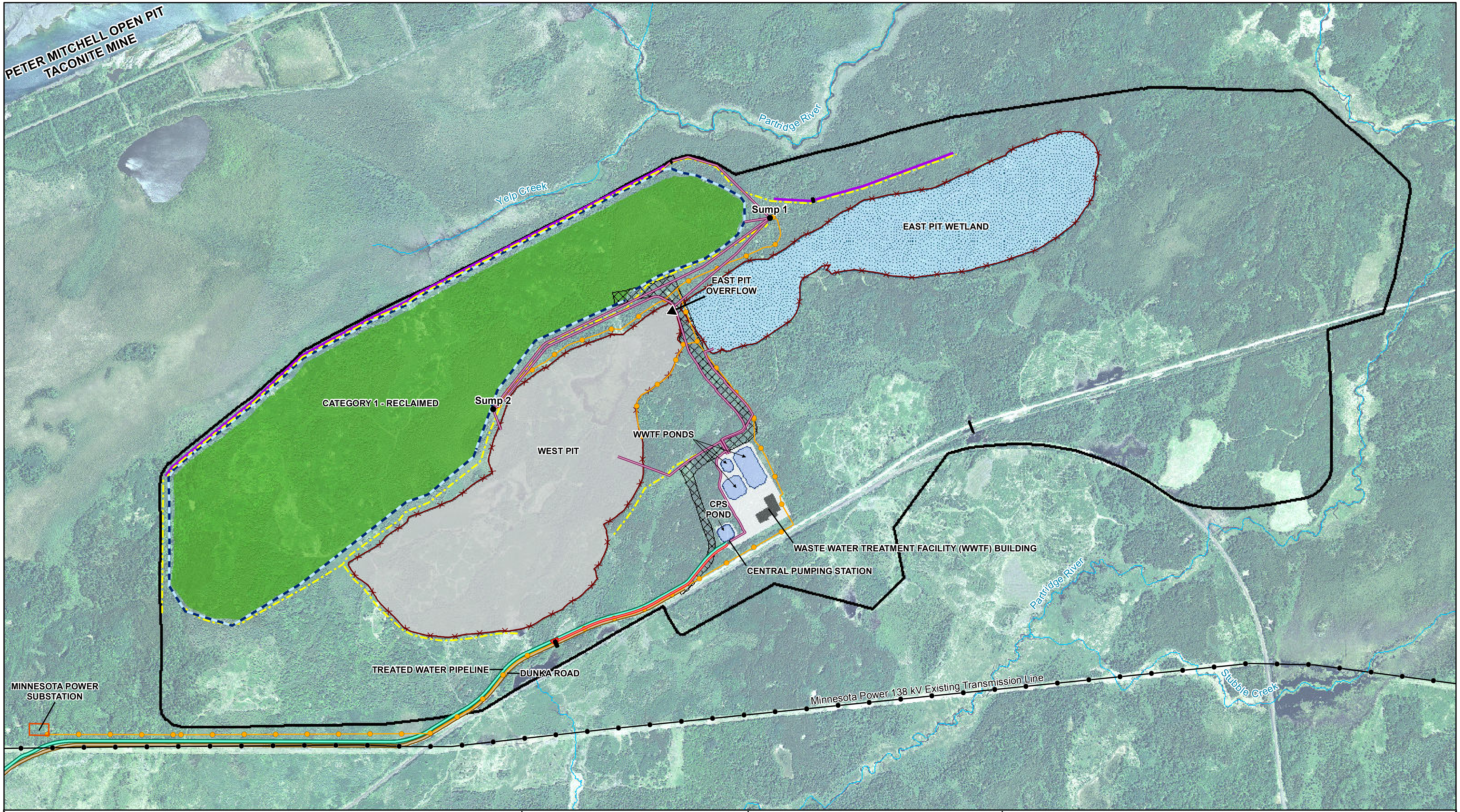
3.6.2.1 Mine Pit Reclamation

Mine pit reclamation would include pit flooding, construction of overflows and outlet control structures, sloping and vegetation of pit walls, and fencing to control access to the pits. East Pit reclamation would begin during operations, while West Pit reclamation would commence when mining activity ceases.

Mine pit dewatering systems would be removed from the pits and the pits would be allowed to flood with water. All areas disturbed during pipe removal would be graded and revegetated. Some temporary pumps may remain in the pits for dewatering that would be performed during pit flooding.

East Pit flooding would start in Mine Year 11 and be completed by Mine Year 20. Overflow from the East Pit would flow to the West Pit through a new ditch. An East Pit outlet structure would be built, which would establish the steady-state water level in the East Pit. The East Pit would be revegetated with wetland vegetation, resulting in approximately 207 acres of wetland (**Figure 7**).

Upon completion of mining operations, the West Pit would begin to flood naturally with groundwater, precipitation, and surface runoff from the tributary watershed. West Pit flooding would be accelerated with treated water from the Plant Site. With the addition of water pumped from the Plant Site to the West Pit, West Pit flooding is projected to be completed between Mine Years 40 and 45. The West Pit would remain an open pit lake (MDNR et al. 2013).



Mine Site
Covered Stockpile
West Pit
East Pit Wetland
Haul Roads
Groundwater Containment System
Process Water Pipe
Stormwater Collection Ditch
Perimeter Dike
Discharge Pipe
Culverts
Fence

US Army Corps of Engineers
St. Paul District

0 750 1,500 3,000 Feet

Figure 7
Mine Site Plan Long-term Closure
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

When the West Pit is full, discharge would be prevented by pumping West Pit water to the Waste Water Treatment Facility for treatment. The Waste Water Treatment Facility would be upgraded to include reverse osmosis or similar membrane separation technology to achieve an effluent concentration that meets the sulfate standard for waters used for the production of wild rice (10 mg/l). After the upgrade, effluent would be discharged through Dunka Road into an existing wetland, and eventually into the Partridge River through an existing tributary channel.

The overburden portions of the pit walls would be sloped, graded, and vegetated in accordance with Minnesota Rules, part 6132.2300. Lift heights would be selected based on the need to protect public safety, the location of the pit wall in relation to the surrounding land uses, the soil types and their erosion characteristics, the variability of overburden thickness, and the potential use of the pit following mining.

A pit perimeter fencing system would be installed consisting of fences, rock barricades, ditches, stockpiles, and berms. The barrier system plan would be submitted to the St. Louis County mine inspector for review and approval before installation. Safe access would be provided to the bottom of each mine pit via selected haul roads built during pit development. The access road would be selected such that, as pit water level rises, there would always be a clear path to the water surface. A gated entrance would be placed at each pit access location.

3.6.2.2 Stockpile Reclamation

Stockpile reclamation would begin during operations. Upon full reclamation of the Category 1 Waste Rock Stockpile, runoff from the top and sides of the stockpile would be classified as non-contact stormwater and discharged into the natural drainage system. The Category 1 Waste Rock Stockpile Groundwater Containment System would continue to collect drainage from the stockpile during reclamation, with drainage treated at the Waste Water Treatment Facility. The Category 1 Waste Rock Stockpile would be reclaimed as a grass/forb community and shrubs and trees would be removed to prevent damaging the liner system. The other stockpiles (Category 2/3 and Lean Ore) would be removed, the areas would be initially planted with grasses, with a successional trajectory towards forest.

3.6.2.3 Watershed Restoration

During mining operations, stormwater runoff from reclaimed stockpile areas and natural (undisturbed) areas would be routed via dikes and ditches to stormwater sedimentation ponds. During reclamation, dikes and ditches that were no longer needed would be removed or filled and ponds would be filled. The reclaimed surfaces would then be scarified, topsoil placed on the surface, and the area revegetated with native species.

Surface runoff inflows would be routed to the mine pits using a combination of existing and new ditches. Some portions of the pit rim dikes may be left in place, if needed, to prevent an uncontrolled flow to or from the pits and potential erosion (head cutting) of the pits walls.

All stormwater ponds, the Overburden Storage and Laydown Area process water pond, haul road process water ponds, and all stockpile sumps and overflow ponds would be filled with overburden and peat (that was removed from the site during construction and stored in the Overburden Storage Area), and covered with topsoil and revegetated, or converted into wetlands. If the process water ponds were converted into wetlands, any sedimentation that occurred within the pond would be evaluated to determine if removal of sediment or covering of the pond would be necessary prior to restoration. Stormwater pond outlet control structures would remain in place as necessary to manage water flows.

3.6.3 Reclamation of Plant Site

Plant Site reclamation would include building and structure demolition and equipment removal, Flotation Tailings Basin reclamation, and Hydrometallurgical Residue Facility reclamation. Similar to the Mine Site,

Plant Site facilities have been designed and would be operated to allow for progressive reclamation. Features that would remain at the Plant Site are shown on **Figure 8**.

The Waste Water Treatment Plant, Flotation Tailings Basin Seepage Management Systems, and Hydrometallurgical Residue Facility Leakage Collection System would continue to operate during reclamation, although seepage and leakage rates would be progressively reduced. Seepage and leakage would be recycled back into the Flotation Tailings Basin Pond or treated at the Waste Water Treatment Plant and pumped to the Mine Site to aid in West Pit flooding, or discharged.

3.6.3.1 Flotation Tailings Basin Reclamation

Permanent vegetation would be established on the Flotation Tailings Basin to control fugitive dust. Flotation Tailings Basin exterior dam surfaces would be reclaimed progressively, while interior areas would be seeded and mulched after closure.

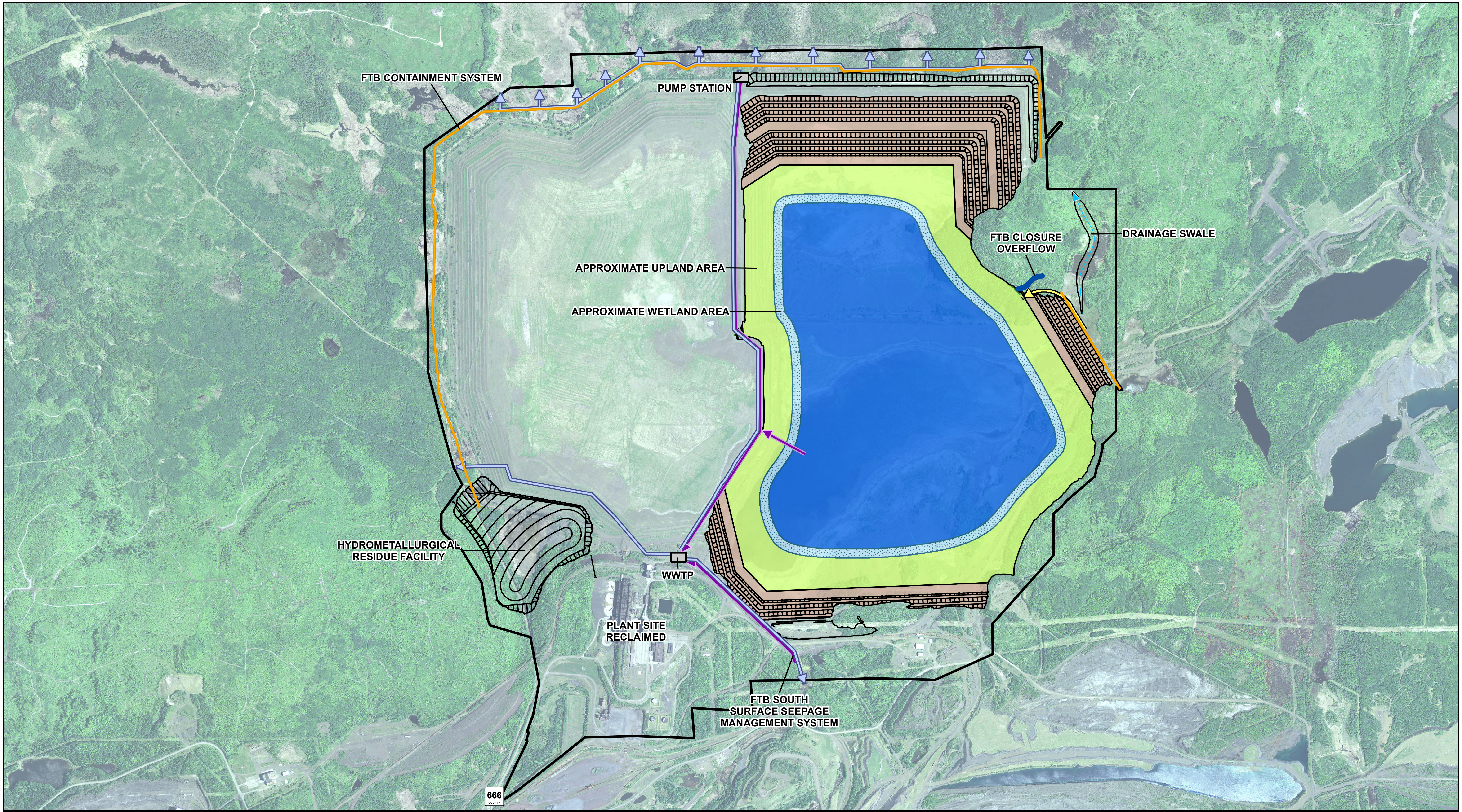
Infiltration would be reduced through the dam faces, beaches, and pond bottom of the Flotation Tailings Basin by bentonite amendment. The exterior face of the dams would be reclaimed progressively, with a bentonite layer added as they are constructed to limit oxygen diffusion. The exposed beaches and dam tops would be amended with a bentonite layer to limit oxygen diffusion. The pond bottom would be covered with a bentonite layer to maintain a permanent pond that would limit oxygen diffusion.

During reclamation, several sources of water from the Flotation Tailings Basin would require management. The sources and a summary of the type of management needed are described as follows:

- Ponded water within the Flotation Tailings Basin – a pond and wetland would remain in the Flotation Tailings Basin. The pond and wetland would receive surface water runoff from the crest and beaches of the basin and natural terrain adjacent to the Flotation Tailings Basin. The pond and wetland would continue to lose water via seepage, but at a reduced rate as compared to during operations as a result of the bentonite augmentation of the Flotation Tailings Basin pond bottom. Excess water would be pumped from the Flotation Tailings Basin pond to the Waste Water Treatment Plant for treatment prior to discharge.

- Stormwater management would include grading to provide a gently sloping surface that effectively routes surface water runoff to the interior of the Flotation Tailings Basin, and to accommodate future differential settlement of the underlying Flotation Tailings.

- An emergency overflow channel would be constructed to carry stormwater from the pond to the adjacent wetland in case of an extreme storm or snowmelt event after reclamation. The conceptual location of the emergency overflow channel is from the combined Cell 1/2E to the adjoining land.



Plant Site
Pond
Wetland Area
Upland Area
Embankment
Treated Water Discharge Pipe
Pipes to Treatment Plant
Seepage Water Pipe
FTB Containment System
Drainage Flow Direction

US Army Corps of Engineers
St. Paul District

N W E S

0 1,000 2,000 4,000
Feet

Figure 8

Plant Site Layout Long-term Closure

Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

3.6.3.2 Hydrometallurgical Residue Facility Reclamation

Reclamation of the Hydrometallurgical Residue Facility cell would include removal of ponded water from the cell surface, removal of pore water from the residue, construction of the cell cover system, establishment of vegetation, and surface water runoff control.

Ponded water remaining in the cell would be removed and treated at the Waste Water Treatment Plant. Drainage would be collected from the base of the cell at the geocomposite drainage system and managed as described for ponded water. The rate of drainage would decrease over time as the pore water within the Hydrometallurgical Residue Facility was collected and removed.

The Hydrometallurgical Residue Facility cell area would be graded into a gently sloping surface, and an engineered cover system would be installed to limit infiltration. Permanent vegetation would be established over the cover system. The turf and final cover would be inspected, mowed once per year or as needed, fertilized if vegetation growth is poor, and repaired as needed.

The cover would slope gently toward the site perimeter to accommodate natural drainage of the runoff. Final cover slopes on the cell interior would be relatively shallow to minimize surface water runoff flow velocity and the associated erosion. Runoff channeled along the cell perimeter would be routed downslope via rip-rapped drainage swales or plug-resistant inlet structures and piping systems. Once runoff was conveyed down the cell exterior dam slope, it would be routed to the surrounding natural drainage system. All runoff would be from reclaimed cover or dam exterior slopes, which would constructed of MDNR-approved material.

3.6.4 Long-Term Closure Activities

Mechanical water treatment systems (the Waste Water Treatment Facility and the Waste Water Treatment Plant) would continue to operate during long-term closure. The water collected by the Category 1 Waste Rock Stockpile Groundwater Containment System and the West Pit water would be treated using the Waste Water Treatment Facility (upgraded to reverse osmosis or similar membrane separation technology) to ensure that the discharge meets applicable water quality discharge limits. The Waste Water Treatment Plant would treat water collected by the Flotation Tailings Basin seepage capture systems, Hydrometallurgical Residue Facility Leakage Collection System, and excess Flotation Tailings Basin pond water, to meet applicable water quality discharge limits. Inspection, water treatment maintenance, and reporting activities would continue while the mechanical treatment systems operated during long-term closure.

Surface water and groundwater quality would be monitored. These long-term closure activities would be expected to be ongoing until such time as the various facility features are deemed environmentally acceptable, in a self-sustaining and stable condition.

Other long-term closure activities would include repair of stockpile and Flotation Tailings Basin dam slope erosion, up-keep of constructed wetlands and outflow structures, removal of shrubs and trees from the Hydrometallurgical Residue Facility and Category 1 Waste Rock Stockpile cover systems, and on-going operation/maintenance and inspection of the seepage capture systems at the Category 1 Waste Rock Stockpile and Flotation Tailings Basin.

When PolyMet has completed all reclamation and long-term closure activities required under the Permit to Mine, a Request for Release per Minnesota Rules, part 6132.1400 would be submitted to the MDNR. This request would provide the Commissioner of the MDNR with detailed information on the final closure status of the Project.

3.7 Federal and Non-federal Lands

3.7.1 Land Exchange Process

The federal lands are in St. Louis County, approximately 70 miles north of the City of Duluth, 20 miles south of the Boundary Waters Canoe Area Wilderness (BWCAW), and 6 miles south of the City of Babbitt. The federal lands are bounded on the north by the Northshore taconite mine and on the south by the Dunka Road and Utility Corridor. The federal lands include a portion of the Mine Site and Dunka Road and Utility Corridor.

The proposed land exchange between the Government, acting through the Forest Service, and PolyMet is an assembled land exchange. The exchange is proposed under the authority of the Weeks Act of March 1, 1911 as amended; General Exchange Act of March 20, 1922; Federal Land Exchange Facilitation Act of 1988; and the Federal Land, Policy and Management Act of October 21, 1976.

The federal lands are located within the General Forest and General Forest - Longer Rotation Management Area. The theme of the General Forest – Longer Rotation Management Area emphasizes land and resource conditions that provide a wide variety of goods, uses, and services. The characteristics and use of the General Forest Management Area are similar to the General Forest – Longer Rotation Management Area, except that harvests are more frequent, more uniform in age, and more extensive. The General Forest Management Area has the highest amount of young forest and the largest-sized timber harvest units.

Land ownership adjustment direction for these Management Areas allows the exchange of federal lands, with the desired condition described as "Land ownership patterns (federal, state, county, corporation and private) are consolidated, promote efficient administration and reduce the costs of managing resources." A detailed discussion of the Land Exchange Process is provided in Chapter 3.3 of the SDEIS.

3.7.2 Federal Lands

The federal lands include approximately 2,719 acres of the 3,015-acre Mine Site and 3,776 acres of lands surrounding the Mine Site that are owned by the Government and administered by the Forest Service. The federal lands are located in Sections 6 and 7, Township 59 North, Range 12 West; Sections 1 to 12 and 16 to 18, Township 59 North, Range 13 West; Sections 1, 12, and 13, Township 59 North, Range 14 West; Section 31, Township 60 North, Range 12 West; and Sections 32 to 36, Township 60 North, Range 13 West. Most of the federal lands are part of the General Forest – Longer Rotation Management Area, while the remainder is within the General Forest Management Area.

The federal lands include a portion of One Hundred Mile Swamp, a large black spruce, tamarack, and northern white cedar wetland, and Mud Lake. Most of One Hundred Mile Swamp will not be affected by the Project. Refer to Figure 4 to see the limits of active mining at the Mine Site. Federal lands, including most of One Hundred Mile Swamp, outside of the active mining areas will not be affected by the Project.Yelp Creek and the Partridge River flow through the federal lands on the north, east, and southeast. Management of the 3,776 acres surrounding the Mine Site may include some upland timber management that could enhance wildlife habitat.

3.7.3 Non-federal Lands

PolyMet has acquired non-federal lands for transfer to the Government that encourage efficient land ownership patterns, with the desired condition of consolidating federal, state, county, corporate and private ownership to promote efficient administration and reduce the cost of managing resources to the Forest Service. The non-federal lands would be incorporated with adjacent federal ownership and managed in accordance with Forest Service's Forest Plan direction for that particular area. Lands with obvious recreational values would be managed to enhance those public recreation opportunities. The non-federal lands are assembled in five different tracts totaling approximately 7,075 acres that consist primarily of forest and wetland habitat (**Figure 2**).

3.7.3.1 Hay Lake Lands

Hay Lake Lands are in central St. Louis County, Minnesota, and are approximately 3 miles west of Biwabik, Minnesota. The lands, located at the eastern end of the Mesabi Iron Range, include approximately 4,926 acres in all or portions of Sections 9, 16, 19, 20, 21, 27, 28, 29, 30, 31, and 32 in Township 59 North, Range 16 West. The lands are moderately hilly and consist predominantly of second- or third-growth deciduous and coniferous forest uplands and emergent, shrub swamp, and forested wetlands. Approximately 59% (2,931 acres) of Hay Lake Lands consists of wetlands. The lands include Hay Lake, identified as a Wild Rice Water by the MDNR, and Little Rice Lake, and are bordered on the east by the Pike River. Forest Service lands border the lands to the north, east, and west. Forest Service lands adjacent to the lands are managed as General Forest and Candidate Research Natural Areas. Research Natural Areas are areas that the Forest Service has designated to be permanently protected and maintained in natural condition. These protected natural areas include unique ecosystems or ecological features; rare or sensitive species of plants and animals and their habitat; and/or high-quality examples of widespread ecosystems. Candidate Research Natural Areas are those areas which are in various stages of review for possible establishment as a Research Natural Area.

3.7.3.2 Hunting Club Lands

Hunting Club Lands are in northern St. Louis County, Minnesota, and includes approximately 160 acres in Section 17, Township 66 North, Range 17 West. The lands are nearly level and consist predominantly of second- or third-growth deciduous and mixed deciduous and coniferous forest uplands and emergent, shrub swamp, and forested wetlands. Approximately 40% (64 acres) of Hunting Club Lands consists of wetlands. The lands are bordered by Forest Service and county lands. Nearby Forest Service lands are managed as General Forest – Longer Rotation.

3.7.3.3 Lake County Lands

Lake County Lands consist of approximately 382 acres, with 265 acres in Sections 5 and 6, Township 57 North, Range 11 West (Lake County Lands North), and 117 acres in Section 17, Township 56 North, Range 9 West (Lake County Lands South) in Lake County, Minnesota. The lands are administered by Lake County. The lands are nearly level and consist predominantly of second- or third-growth mixed coniferous/deciduous forest uplands and bog, emergent, shrub swamp, and forested wetlands. Much of Lake County Lands South was recently logged. Approximately 74% (283 acres) of Lake County Lands consists of wetlands. The lands are bordered by the Superior National Forest. Forest Service lands near Lake County Lands North are managed as Riparian Emphasis Area and General Forest – Longer Rotation. Forest Service lands near Lake County Lands South are managed as General Forest – Longer Rotation. In Riparian Emphasis Areas, riparian ecological functions are actively restored, protected, and enhanced in areas where ecosystem processes are sensitive to degradation. This includes maintaining and restoring native vegetation communities; maintaining and restoring riparian/hydrologic functions such as shoreline stability, wildlife habitat, coarse woody debris recruitment to aquatic and riparian ecosystems, and temperature regulation; and controlling non-native invasive species. Restoration focuses on components of the ecosystem that are not functioning at or within the range of desired conditions. Those components that are functioning properly are protected. These areas are also managed for recreational opportunities and visual quality adjacent to bodies of water.

3.7.3.4 McFarland Lake Lands

McFarland Lake Lands are approximately 31 acres in Section 9, Township 64 North, Range 3 East, in Cook County, Minnesota. These lands are approximately 3 miles west of the U.S. - Canada border and 10 miles north of Hovland, Minnesota. The lands are mostly on a hillslope and consist of second- or third-growth deciduous and coniferous upland forest. McFarland Lake is an entry point to the BWCAW. There are no wetlands on the lands. The lands are bordered by Forest Service land. Forest Service lands near McFarland Lake Lands are managed as General Forest – Longer Rotation.

3.7.3.5 Wolf Lands

Wolf Lands total 1,576 acres and are comprised of 126 acres in Section 8, Township 57 North, Range 11 West (Wolf Lands 1); 769 acres in Sections 15 and 22, Township 58 North, Range 10 West (Wolf Lands 2); 277 acres in Sections 30 and 31, Township 59 North, Range 9 West (Wolf Lands 3); and 405 acres in Sections 7, 8, 15, 17, and 18, Township 59 North, Range 9 West (Wolf Lands 4) in Lake County, Minnesota. The lands are nearly level and consist predominantly of second- or third-growth mixed deciduous and coniferous forest uplands and bog, emergent, shrub swamp, and forested wetlands. Much of Wolf Lands 3 has been recently logged. Approximately 88% (1,392 acres) of Wolf Lands consists of wetlands. Forest Service lands border portions of all of Wolf Lands and are managed as General Forest (Wolf Lands 2, 3, and 4) and General Forest – Longer Rotation (Wolf Lands 1). These lands would supplement National Forest ownership by reducing federal exterior boundaries and would eliminate several private in-holdings.

3.8 Wetland Mitigation Sites

The Project would directly impact an estimated 914 acres of wetlands, mostly within the Mine Site. A USACE permit would be required under Section 404 of the Clean Water Act for impacts to wetlands and other waters of the U.S. The majority of the direct wetland impacts would occur at the Mine Site (about 758 acres) and the Flotation Tailings Basin (141 Acres), with an additional 7 acres associated with Dunka Road and Railroad construction and 7.5 acres at the proposed Hydrometallurgical Facility.

PolyMet is proposing to purchase 2,169 acres (Wetland Mitigation Sites) as mitigation for wetland impacts from the Project. On the Wetland Mitigation Sites, 1,603 acres would be restored or converted to wetlands and 197 acres would be used for upland buffer. Wetland monitoring would be conducted to identify potential indirect impacts to wetlands caused by mining activities. PolyMet would work with USACE and MDNR to mitigate indirect impacts as appropriate.

Compensation for wetland impacts is required under Section 404 of the federal Clean Water Act and the Minnesota Wetland Conservation Act (Minnesota Rules part 8420.0100). The wetland mitigation planning process for the Project relied on the Wetland Conservation Act wetland replacement siting rules (Minnesota

Rules part 8420.0522), state compensatory mitigation requirements under state water quality standards (Minnesota Rules part 7050.0186), and the USACE St. Paul District Policy for Wetland Compensatory Mitigation in Minnesota (USACE 2009), which prioritizes the location of project-specific compensation to first replace lost wetlands on-site, then within the same watershed or county, and finally within adjacent watersheds.

3.8.1 On-site Restoration

In accordance with the USACE St. Paul District Policy for Wetland Compensatory Mitigation in Minnesota and state guidelines, the potential for creating wetlands on-site was considered first. Approximately 102 acres of onsite wetland creation opportunities were identified, which may occur at Project closure (Barr Engineering [Barr] 2012).

3.8.2 Off-site Mitigation

It was not possible to identify sufficient acreage on-site to mitigate for wetland impacts from the Project. Thus, potential wetland mitigation sites were identified and evaluated to determine their relative potential for mitigation, the level of risk and uncertainty, and the likely costs.

Sites were initially eliminated from further consideration due to issues that included unwilling landowners, significant private properties that would be hydrologically impacted by wetland restoration, insufficient agricultural history, insufficient wetland drainage to qualify for restoration credit, considerable existing upstream drainage through the site, or active pursuit of the properties by others. Three sites were identified that had the potential to accomplish compensatory wetland mitigation for the Project. These are the 1,070 acre Aitkin Site, 530 acre Hinckley Site, and the 569 acre Zim Site, which includes Zim North (481 acres) and Zim South (88 acres) (Figure 2; Barr 2007, 2014a, 2014b, 2014c, 2014d). Of these 2,169 acres, about 1,603 acres would be restored to wetland habitat.

3.8.2.1 Aitkin Site

The Aitkin Site is 1,070 acres in Section 6, Township 47 North, Range 26 West, and Section 1, Township 47 North, Range 27 West in Aitkin County, near Aitkin, Minnesota, and within the Mississippi River-Brainerd watershed. The site is a sod farm. PolyMet proposes to restore 808 acres of wetland and preserve 83 acres of upland buffer at the site (Barr 2007, 2014a, 2014d).

Initially, the internal drainage system at the site would be removed and outlets would be constructed to maintain desired hydrological conditions (Barr 2012, 2014a). Once desired hydrological conditions have been achieved, wetland vegetation would be promoted on the site by allowing native species that are present in the seed bank or that may be transported to the area from adjacent wetlands to develop on the site. Diverse, native wetland vegetation is expected to develop in the wetland. Wetland habitats likely to develop on the site include shallow marsh, shrub-carr, hardwood swamp, and coniferous swamp. Non-native and other invasive vegetation on the site would be removed through mechanical means or herbicide application. If vegetation development is not adequate to meet the success criteria, seed may be installed after the first or second growing season.

Hardwood and coniferous swamp would require herbaceous and woody species seedings and plantings.

Vegetation in the upland areas would be managed to promote natural succession of the existing plant communities. The primary maintenance activity would be control of non-native and other invasive species.

At completion of the monitoring period required to establish the wetland credits, the land would be conveyed to the third party that performs the construction to create the wetland mitigation credits. That ownership would also be subject to conservation easements (Pylka 2013a).

3.8.2.2 Hinckley Site

The Hinckley Site is 530 acres in Section 5, Township 39 North, Range 22 West, in Pine County, near Hinckley, Minnesota, and within the Snake River watershed. PolyMet proposes to restore 286 acres of wetlands and preserve 91 acres of upland buffer. The overall objective of the Hinckley restoration plan is to restore the hydrologic connection between upstream watersheds and the restoration site and to disable the internal drainage system on the site (Barr 2007a, 2014b, 2014d).

Initial activities would be focused on developing desired hydrological conditions (Barr 2014b). Restoration of wetlands would follow a similar process as that described for the Aitkin Site and would include the use of native seedbank and seed dispersal mechanisms to establish wetland vegetation on the site. Wetland habitats likely to develop on the site include sedge/wet meadow, shrub-carr, alder thicket, and hardwood swamp. Site management would include control of non-native and other invasive vegetation, and seeding and plantings of coniferous trees.

PolyMet would continue to own the land after the credits are created. At the time the credits were accepted it could be determined that PolyMet keeps the lands or transfers the lands to another third party subject to the conservation easement placed upon the lands for the creation of the credits (Pylka 2013a).

3.8.2.3 Zim North

The Zim North Site is 481 acres in Sections 2, 3, 10, 11, 14, and 15, Township 55 North, Range 18 West, in St. Louis County, approximately 12 miles southwest of Eveleth, and within the St. Louis River watershed. PolyMet proposes to restore the site to coniferous bog and shallow, open water wetland. Approximately 352 acres of coniferous bog and 7 acres of shallow, open water would be created on the Zim North site. In addition, 18 acres of ditches would be filled, 44 acres of partially drained wooded areas would be restored, and 12 acres of forested woodland and 12 acres upland buffer would be preserved. Approximately 36 acres of roads and other lands would not be restored. The overall objectives of the Zim North restoration plan would be to restore the native coniferous bog wetland community, restore the hydrologic connection between upstream watersheds and the restoration site, and disable the internal drainage system on site. Developing a bog community is highly dependent on soil and groundwater parameters that may be difficult to control. Therefore, a coniferous swamp community would be the contingent community if the soil and groundwater conditions are not adequate for bog regeneration. Coniferous bog or swamp is the target for the whole site, however, where trees do not successfully establish, the target community would be a shallow, open water wetland.

3.8.2.4 Zim South

The Zim South Site is 88 acres in Sections 26, 27, 34, and 35, Township 55 North, Range 18 West, in St. Louis County, approximately 16 miles southwest of Eveleth, and within the St. Louis River watershed. PolyMet proposes to restore the site to coniferous bog and shallow, open water wetland. Approximately 50 acres of coniferous bog and 1 acre of shallow, open water would be created on the Zim South site. In addition, 3 acres of ditches would be filled, 5 acres of partially drained wooded areas would be restored, and 17 acres of forested woodland and 10 acres upland buffer would be preserved. Approximately 2 acres of roads and open ditches would not be restored. The overall objectives of the Zim North restoration plan would be to restore the native coniferous bog wetland community, restore the hydrologic connection between upstream watersheds and the restoration site, and disable the internal drainage system on site. As mentioned above, developing a bog community is highly dependent on soil and groundwater parameters that may be difficult to control. Therefore, a coniferous swamp community would be the contingent community if the soil and groundwater conditions are not adequate for bog regeneration. Coniferous bog or swamp is the target for the whole site, however, where trees do not successfully establish, the target community would be a shallow, open water wetland.

Initial activities at both sites would be focused on developing desired hydrological conditions through site grading to fill ditches and break drain tiles (Barr 2014c, 2014d). Restoration of wetlands include finding suitable donor bog materials, transporting materials to the site, spreading bog materials over areas to be restored, spreading fresh straw mulch over bog plant fragments, and applying slow-release fertilizer. Trees and shrubs would be planted 1 to 3 years after spreading of bog materials. In addition, several ponds would be excavated to a depth no greater than 6 feet to allow for development of shallow, open water wetland communities. Site management would include control of non-native and other invasive vegetation.

PolyMet would convey the land to the third party that performs the construction to create the wetland credits upon acceptance of the credits. This ownership is also subject to conservation easements that would be placed upon it during the mitigation period (Pylka 2013a).

4.0 Description of the Lands Affected by the Project

4.1 Federal Lands

The federal lands include approximately 2,719 acres at the 3,015-acre Mine Site and 3,776 acres bordering the Mine Site that are owned by the Government and administered by the Forest Service.

4.1.1 Mine Site

The Mine Site encompasses 3,015 acres; 2,719 acres are Government owned while 296 acres are privately owned. The Mine Site has little topographic relief. It consists of a mosaic of slightly elevated upland areas surrounded by wetlands, and slopes toward the east-northeast, in the direction of the Partridge River. About 57% of the Mine Site is upland habitat, and 43% is wetland habitat. Most upland habitat is associated with the central portion of the Mine Site. One Hundred Mile Swamp, northwest of the Mine Site, is the dominant feature on the landscape. The Partridge River drains this swamp and flows along and outside the northeastern and eastern boundary of the Mine Site (ENSR 2000, 2005).

Habitat observed on the Mine Site is typical of habitats associated with much of the Iron Range. Forest vegetation dominates the Mine Site (**Figure 9**; **Table 4**). Most forest stands contain trees that are 12 inches diameter-at-breast-height (dbh) or less.

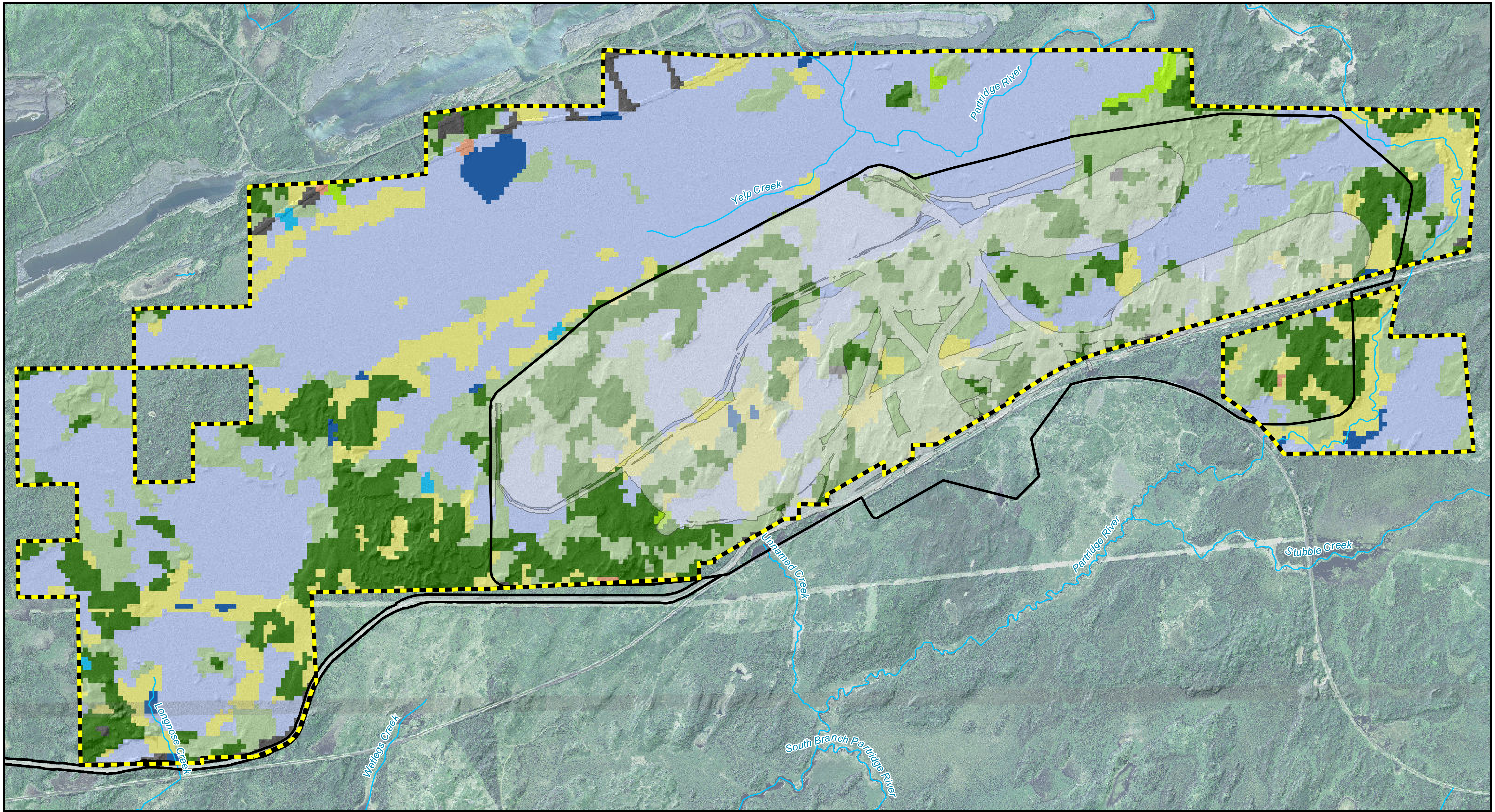
The site can be divided into three general areas. The northwest area is dominated by lowland black spruce, with scattered stands of trembling aspen and balsam fir/trembling aspen; tamarack is also scattered throughout these stands. Most trees are estimated to be 60 years or older (USDA Forest Service 2000). Interspersed within forest stands are brush/young tree stands that were recently logged and provide habitat for white-tailed deer and moose. Young trees are generally up to 4 inches dbh and 10 years of age.

The northeastern area is dominated by nearly equal amounts of jack pine and black spruce, with scattered trembling aspen stands and speckled alder swamps (ENSR 2000, 2005). Although there are scattered black spruce stands containing trees greater than 60 years in age, most trees, especially jack pine, are 30 to 70 years in age (USDA Forest Service 2000a). There are a few recently logged areas within this area. Several large wetlands are found in this area. Most shrub/young tree habitat is associated with these wetlands and drainages.

The southern area contains a nearly equal mix of lowland and upland black spruce, jack pine, and trembling aspen, with some balsam fir and paper birch (ENSR 2000, 2005). Most tree stands are from 40 to 80+ years of age, although jack pine tree stands along Dunka Road are from 20 to 40 years of age.

Vegetation in the recently logged areas consists of grasses and ferns with trembling aspen saplings and speckled alder (ENSR 2000, 2005). The areas of more mature upland forests consist of jack pine, balsam fir, and trembling aspen, with lesser amounts of paper birch, red pine, and white pine. The mature lowland areas consist mainly of black spruce and tamarack growing on a bed of sphagnum moss and club moss with speckled alder, bog Labrador-tea, and leatherleaf. The open wetland areas consist of grasses, sedges, cattails, speckled alder, and pussywillow.

Approximately 1,719 acres of the Mine Site would be affected by the Project. **Table 4** shows the cover types that would be affected by the Project, using the MDNR Gap Analysis Program (GAP) land cover types



Federal Lands
Project Areas
Areas Affected by Project Features

GAP Land Cover
Aquatic Environments
Crop/Grass
Lowland Conifer Forest
Lowland Deciduous Forest
Non-vegetated
Shrubland
Upland Conifer Forest
Upland Conifer-Deciduous mix
Upland Deciduous Forest

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St. Paul District

N W E S

0 1,000 2,000 4,000 Feet

Figure 9

GAP Land Cover/Habitat Types - Federal Lands

Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

(MDNR et al. 2013). The GAP land cover system is a hierarchical land classification system that organizes vegetation communities into 1-acre blocks and was developed by the MDNR.

4.1.2 Federal Lands Surrounding the Mine Site

Federal lands surrounding the Mine Site encompass about 3,776 acres and border the Mine Site to the west, north, and east. This area has little topographic relief. The lands consist of a mosaic of slightly elevated upland areas surrounded by wetlands, and slope toward the east-northeast in the direction of the Partridge River. Most (76%) of the area is wetland habitat, including a portion of One Hundred Mile Swamp, although upland habitat (24%) is an important component in the western portions of the area (**Figure 9**). Yelp Creek flows from One Hundred Mile Swamp to the Partridge River, which flows around the northern, eastern, and southeastern edges of the federal lands, outside of the Mine Site (AECOM 2011a). Under the Proposed Action, the areas not disturbed by the Project on the lands adjacent to the Mine Site would be managed for wildlife habitat, including timber management.

Forest vegetation dominates the federal lands. Most forest stands contain trees that are 12 inches dbh or less. The area can be divided into three general parts (AECOM 2011a). The eastern portion is dominated by the Partridge River. Large stands of lowland black spruce with scattered northern white cedar and tamarack are found in low areas associated with the river. Emergent and shrub swamp speckled alder wetland is adjacent to most of the river. Stands of immature (trees from 5 to 11 inches dbh, and from about 10 to 80 years of age) and mature (trees greater than 11 inches dbh and over 80 years of age) mixed coniferous/deciduous forest, coniferous forest dominated by jack pine, and smaller patches of immature deciduous forest, are found at higher elevations (USDA Forest Service 2000a).

Table 4
GAP Cover Types Affected by the Project at the Mine Site

Cover Type	Affected Acres	Non-affected Acres	Total Cover Type Acres	Percent of Cover Type Affected
Upland coniferous forest	742	454	1,196	62
Lowland coniferous forest	437	344	781	56
Upland deciduous forest	355	293	648	55
Shrubland	133	109	242	55
Disturbed	44	84	128	34
Aquatic environments	6	7	13	47
Upland coniferous-deciduous forest	2	1	2	63
Cropland/grassland	<1	5	5	4
Lowland deciduous forest	0	<1	<1	0
Total	**1,719**	**1,296**	**3,015**	**57**

Source: MDNR et al. (2013).

The northern portion of the federal lands surrounding the Mine Site includes a portion of One Hundred Mile Swamp. The swamp is comprised of some young (trees less than 5 inches dbh and 10 years of age), but mostly immature and mature black spruce, northern white cedar, and tamarack forests. Northern white cedar is prevalent in the northcentral portion of the northern area, while black spruce and tamarack are more common in the remaining areas. Scattered stands of speckled alder are associated with the swamp, as are bog and emergent wetlands, especially along the Partridge River.

There are scattered “islands” of mature deciduous and mixed coniferous/deciduous forest. Most of the forest stands are 90 years or older, with many of the remaining stands 70 to 90 years of age (USDA Forest Service 2000a).

The western portion of the federal lands surrounding the Mine Site is dominated by lowland immature black spruce forest in its center, bordered by bog wetlands and wetlands dominated by speckled alder and red-osier dogwood. A large area dominated by cattail is associated with the transmission line rights-of-way (ROW). Upland immature and mature deciduous and mixed coniferous/deciduous forest, with scattered stands of coniferous forest, surround the centrally located black spruce forest. Clearings comprised of grasses, forbs, and shrubs are associated with the transmission line ROW, while scattered low areas, dominated by emergent and shrub swamp wetland vegetation, are interspersed within upland forest habitats.

4.2 Plant Site and Transportation and Utility Corridors

The Plant Site encompasses about 4,515 acres, which includes the former LTVSMC processing plant, existing LTVSMC Tailings Basin, Area 1 Shop, Hydrometallurgical Residue Facility, and administration buildings.

The southwestern corner of the Plant Site, the former LTVSMC processing plant, has almost entirely been disturbed by past mining activities. No wetlands are present within this portion of the Plant Site, although there is a plant reservoir located east of the concentrator that is not regulated as a wetland (Poly Met 2014a). The regulated wetlands within the Plant Site include a total of 52 wetlands covering approximately 245 acres. About 147 acres would be directly impacted by filling or excavation. Approximately 61% (2,756 acres) of the Plant Site is disturbed and supports little vegetation. The remaining areas consist of trembling aspen and trembling aspen-paper birch forest (14%), aquatic habitat (14%), grass/shrubland (7%), upland coniferous forest (2%), and lowland coniferous forest (1%; **Figure 10**; MDNR et al. 2013).

The Dunka Road and Utility Corridor is approximately 108 acres and the Railroad Connection Corridor is approximately 12 acres. Because of prior use during the former LTVSMC taconite mining operation, the Dunka Road and Utility Corridor is now defined as having a “disturbed” cover type. The remaining MDNR GAP land cover types that are not disturbed include cropland/grassland (8%), shrubland (6%), and smaller acreages of the remaining types. A total of 25 wetlands, encompassing approximately 7 acres, have been identified within the Dunka Road and Utility Corridor (MDNR et al. 2013). Approximately 7 acres of wetlands would be directly affected.

4.3 Non-federal Lands

4.3.1 Hay Lake Lands

Hay Lake Lands are approximately 4,926 acres and have moderate topographic relief. The lands consists of a mosaic of slightly elevated upland areas surrounded by wetlands, and slope toward the east-northeast, in the direction of the Pike River (AECOM 2011b).

Most (59%) of Hay Lake Lands is wetland habitat, although upland habitat (41%) is an important component in the central and western portions of the lands (**Figure 11**). The Pike River, Hay Lake, and Little Rice Lake are dominant features of the landscape. The Pike River flows along the eastern boundary of the lands.

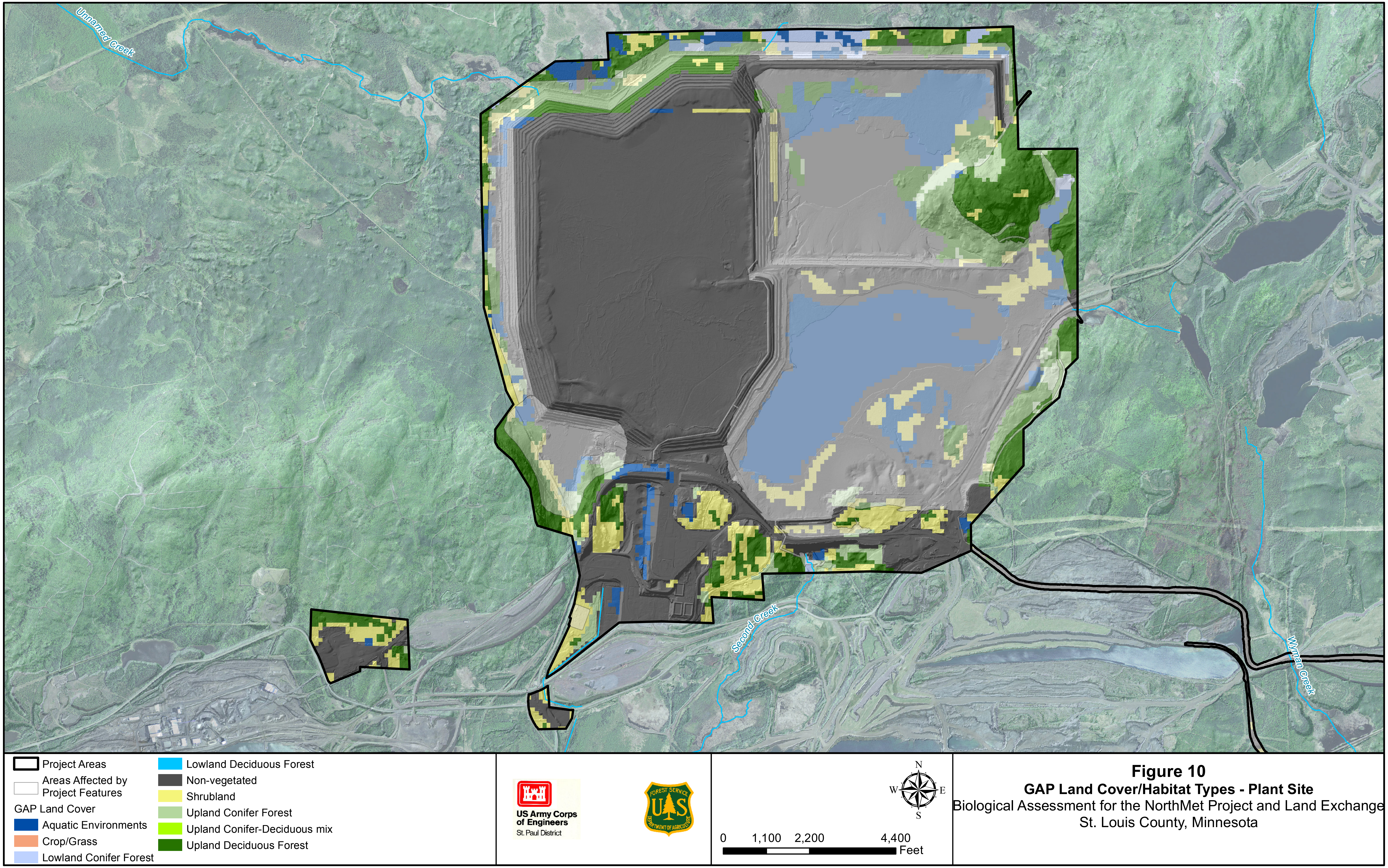


Figure 10
GAP Land Cover/Habitat Types - Plant Site
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

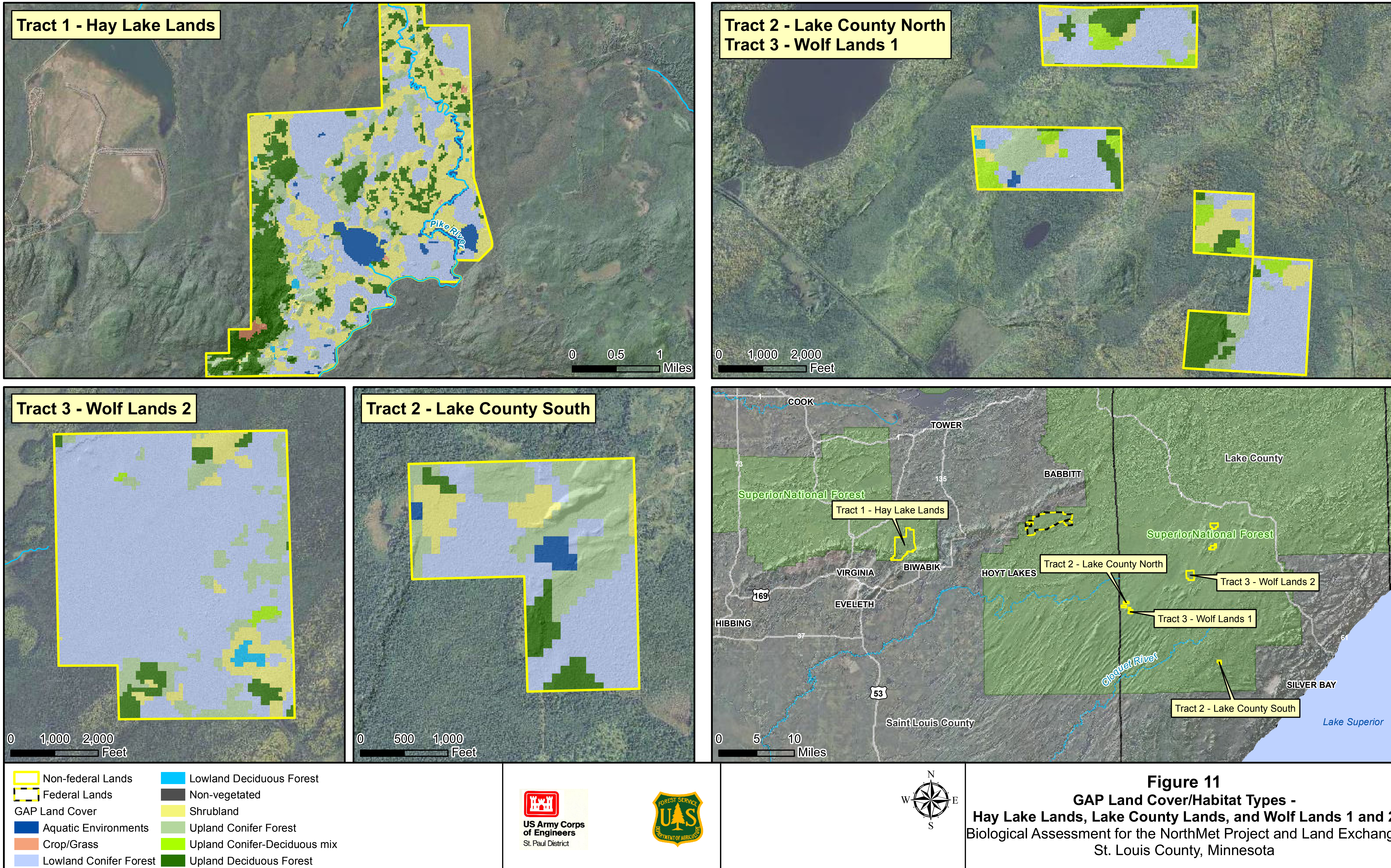


Figure 11
GAP Land Cover/Habitat Types -
Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

Forest vegetation dominates Hay Lake Lands. Nearly all forest stands contain trees that are 12 inches dbh or less, and most of the upland trees are 8 inches dbh or less. The lands can be divided into four general habitats. The eastern portion is dominated by the Pike River. Floodplain associated with river is dominated by emergent wetland with sedge and grass habitat, and shrub swamp wetland with speckled alder habitat. Wetland areas to the west of the river are dominated by lowland black spruce forest, with scattered northern white cedar and tamarack, and shrub swamp wetlands, especially in areas with evidence of past disturbance by logging activities.

Higher elevations in the northern, central, and western portions of the lands are dominated by upland deciduous and mixed coniferous/deciduous forest. Upland forest stands in the northern, central, and southwestern portions of the lands are immature to mature in size and age, while stands in the western portion of the lands are young to immature in size and age, having been harvested in recent years. Most trees are estimated to be 60 years or younger. Two transmission line ROWs are found on the lands. Emergent wetland and upland grassland/shrubland vegetation dominates the ROWs. Abandoned logging roads are also found on the lands. Low areas along roads are dominated by emergent wetland vegetation consisting of sedges and grasses, while upland portions of roads are dominated by grasses and forbs.

4.3.2 Hunting Club Lands

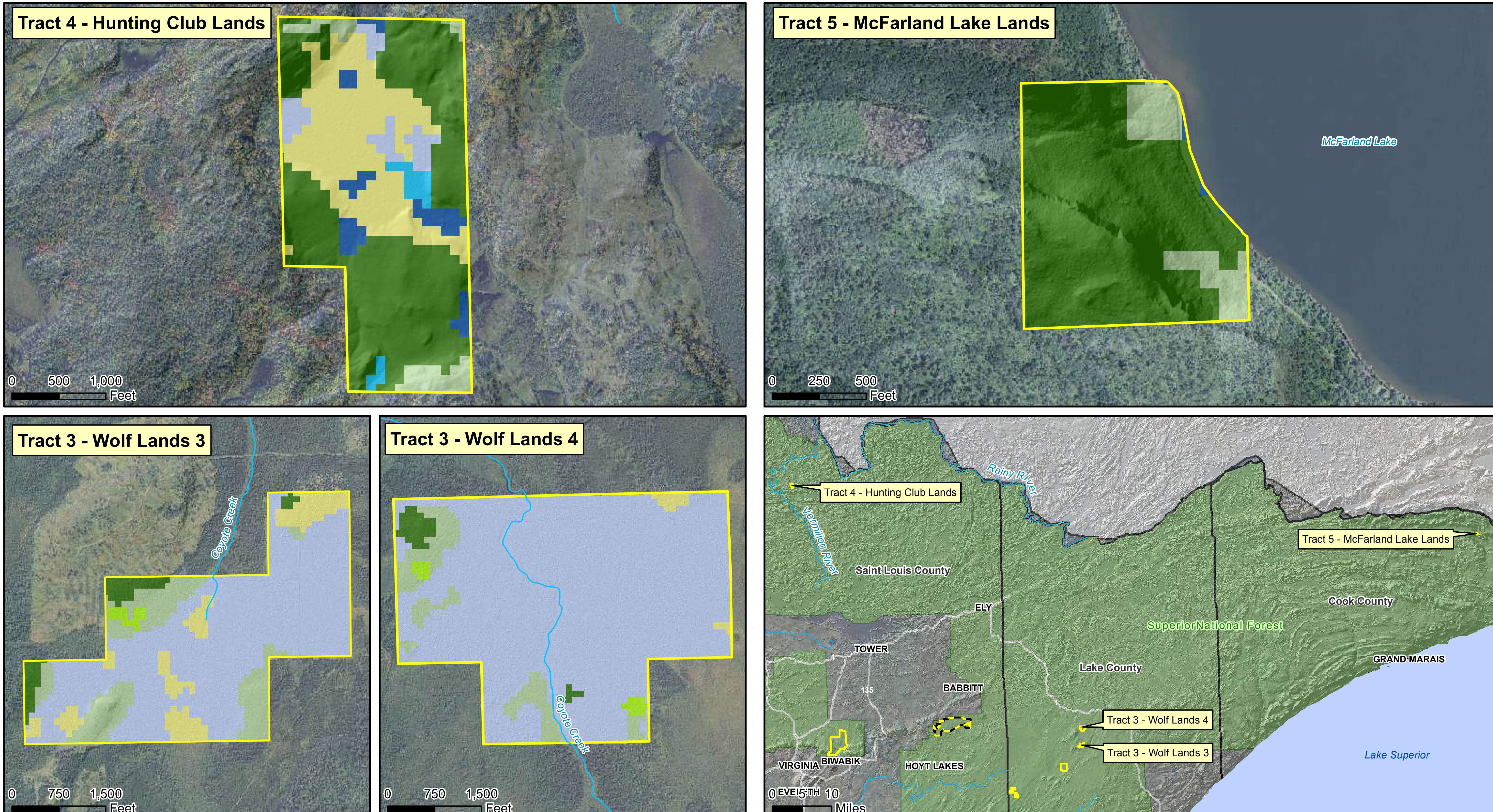
Hunting Club Lands are approximately 160 acres, of which about 64 acres are wetland (**Figure 12**). The lands drain to the north and then northeast via an unnamed creek. Several beaver dams are found along the creek. From this low area, the lands slope upward to the east and west. The lands consist primarily of shrub swamp wetland, with lesser amounts of emergent wetland, and upland immature and mature deciduous forests (AECOM 2011c).

Beaver ponds and dams are the dominant wetland features on the lands. Open water habitat is typical near the dams. Emergent vegetation, consisting of Canada bluejoint, narrow-leaved cattail, and sedges, is found in water from 12 to 24 inches deep, while speckled alder shrub swamp wetlands are found near ponds at water depths from 6 to 18 inches. Speckled alder makes up to 80% of the cover in the shrub swamp wetlands. A large immature black spruce forest is found in the middle of Hunting Club Lands. The midstory consists of speckled alder, while leatherleaf, bog Labrador-tea, and sphagnum moss are found below the speckled alder. Immature black ash is found in a drainage leading to wetlands on the lands.

Habitat in the northwestern and northeastern portions and near the southern boundary of the lands are comprised of upland mature mixed coniferous/deciduous forest, dominated by eastern white pine to 24 inches dbh, and paper birch and trembling aspen to 12 inches dbh. The midstory consists primarily of balsam fir, while beaked hazel is found in the shrub layer.

The eastern and southern portions of the lands consist of patches of upland young and immature trembling aspen. The midstory consists of beaked hazel, with scattered black spruce and balsam fir. There is little ground cover.

An “island” of trembling aspen-eastern white pine forest is found within the young/immature trembling aspen forest. It is mature forest comprised of trembling aspen and eastern white pine to 16 inches dbh and black spruce to 12 inches dbh. There are many downed trees and much woody debris on the ground.



- Non-federal Lands
- Federal Lands

GAP Land Cover
- Aquatic Environments
- Crop/Grass
- Lowland Conifer Forest
- Lowland Deciduous Forest
- Non-vegetated
- Shrubland
- Upland Conifer Forest
- Upland Conifer-Deciduous mix
- Upland Deciduous Forest

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St. Paul District

Figure 12

GAP Land Cover/Habitat Types - Hunting Club Lands, McFarland Lake Lands, and Wolf Lands 3 and 4

Biological Assessment for the NorthMet Project and Land Exchange

St. Louis County, Minnesota

4.3.3 Lake County Lands

Lake County Lands consist of Lake County Lands North and Lake County Lands South.

4.3.3.1 Lake County Lands North

Lake County Lands North is approximately 265 acres, of which about 209 acres are wetland (**Figure 11**). The lands have moderate topography, with the terrain generally sloping toward the southwest and Pine Lake. Lake County Lands North consists of two small areas to the north, and a single, small area to the south that is adjacent to Wolf Lands 1. The lands are comprised of mostly wetland habitat, except for areas of upland habitat on the northern portion of the northern area and on portions of the southern area. Portions of the lands have recently been logged. Wetland habitat consists mostly of immature coniferous forest, with lesser amounts of mature mixed coniferous/deciduous forest and shrubland. Upland habitat is dominated by mature deciduous and immature deciduous forests (AECOM 2011c).

Wetlands are comprised primarily of immature northern white cedar and black spruce with lesser amounts of tamarack, although several drainages also contain black ash. The midstory consists of balsam fir and black spruce, while speckled alder, leatherleaf, and bog Labrador-tea are found in the shrub layer. Club moss and sphagnum moss cover most of the ground.

Shrub swamp and emergent wetland habitats are also found on the lands. Shrub swamp habitat is associated with several drainages, a beaver pond, a bog area, and recently logged areas, while emergent wetland habitat was found near the beaver pond and on recently logged areas. Shrub swamp wetlands are dominated by speckled alder. Vegetation in the emergent wetlands consists of sedges and Canada bluejoint, with scattered black spruce, northern white cedar, tamarack, and speckled alder.

Upland habitats are comprised of immature and mature paper birch and black spruce, while recently logged areas supported young paper birch stands or shrub habitat. The midstory cover is comprised of balsam fir, black spruce, and beaked hazel. Young paper birch with scattered young trembling aspen and scattered immature paper birch are in areas that had been recently logged.

Older forests contain large amounts of downed woody material; this material is mostly absent in logged areas. Tree wind-throw is common in forest stands adjacent to the clearcuts, and walking in these forests is difficult due to downed trees and woody debris, and the dense stand of balsam fir, black spruce, and northern white cedar in the midstory.

4.3.3.2 Lake County Lands South

Lake County Lands South is approximately 117 acres, of which about 74 acres are wetland (**Figure 11**). The lands are relatively flat in the northwestern section, rise in elevation to the northeast, and fall in elevation to the southeast. Water flows from west to east. A series of beaver dams and ponds dominate the landscape. Several areas have been recently logged and shrubland is the dominant upland habitat (AECOM 2011c).

Forested wetlands dominate the western and southeastern portions of the lands and are comprised of immature and mature black spruce and northern white cedar, although immature tamarack is found in some forest stands and immature black ash is an important component of several drainages. The midstory consists of balsam fir and black spruce. Speckled alder, leatherleaf, bog Labrador-tea, and red-osier dogwood are common shrubs, while sphagnum moss covers most of the ground. Forests in the northwestern section contain a dense mix of northern white cedar and black spruce with scattered black ash in the drainages. The northwestern portion of this section is dominated by mature northern white cedar.

Five beaver ponds were found on the lands. These ponds are comprised of open water with scattered dead spruce surrounded by emergent wetland dominated by sedges, narrow-leaved cattail, woolgrass, and Canada bluejoint, or by dense stands of speckled alder in more shallow areas. Shallower drainages, especially in areas that have been logged, are covered by speckled alder, sedges, and narrow-leaved cattail.

Most upland areas have been recently clearcut, with the exception of the southwestern portion of the lands. This area has been partially thinned, leaving areas where mature paper birch, black spruce, jack pine, eastern white pine, and northern white cedar trees remain, ranging from 12 to 24 inches dbh. Balsam fir and beaked hazel are found in the midstory, while forbs and grasses cover the ground layer. Because of recent logging activity, woody debris and large downed trees are abundant.

4.3.4 McFarland Lake Lands

McFarland Lake Lands are about 31 acres on a hillslope that rises from 1,483 feet above mean seal level at McFarland Lake to 1,778 feet above mean seal level on the western boundary of the lands. Rocky cliffs, about 150 feet in height, are found at the top of the hillslope and large boulders are found on the hillslope (AECOM 2011b).

McFarland Lake Lands are dominated by deciduous and mixed coniferous/deciduous forest habitats (**Figure 12**). Tree sizes and ages range from immature to mature. Some logging has occurred at the top of the hillslope along the western boundary of the lands.

4.3.5 Wolf Lands

Wolf Lands total 1,576 acres and consist of four parcels, Wolf Lands 1, 2, 3, and 4.

4.3.5.1 Wolf Lands 1

Wolf Lands 1 is approximately 126 acres, of which about 90 acres are wetland (**Figure 11**). Most upland habitat consists of mature coniferous and deciduous forest, while most wetland habitat consists of immature coniferous forest. The lands are relatively flat but slope gently downward toward the southwest. The lands are adjacent to Lake County Lands North (AECOM 2011c).

Wetland communities are comprised primarily of young and immature forests in nearly equal amounts. Young forests are comprised of black spruce, with scattered northern white cedar and tamarack. Young forests have characteristics of more open bogs, as tree cover is sparse, trees are short, and most of the ground is covered by bog Labrador-tea and leatherleaf, and sphagnum moss. In immature forests, the canopy is dominated by 6 to 10 inches dbh black spruce, with tamarack and northern white cedar also present. The midstory consists of balsam fir and black spruce, while speckled alder, leatherleaf, bog Labrador-tea, and red-osier dogwood dominate the shrub layer. Club moss and sphagnum moss cover most of the ground (AECOM 2011c).

Upland mixed coniferous/deciduous immature and mature forest is found in the southwestern portion of the lands. Paper birch and trembling aspen cover about half of the area, and the midstory consists of mostly balsam fir; beaked hazel, and red-osier dogwood.

4.3.5.2 Wolf Lands 2

Wolf Lands 2 is approximately 769 acres, of which about 706 acres are wetland (**Figure 11**). The lands consist of gently undulating terrain and slope toward the southwest. Water generally flows to the southwest and to Mary Ann Creek, Wenho Creek, and Greenwood Lake. The lands consist primarily of wetlands comprised of immature black spruce and northern white cedar forest, while shrub swamp comprised of speckled alder also is common. Black spruce is the dominant tree in wetlands in the northern and eastern portions of the lands, while northern white cedar is more prevalent in other portions of the lands (AECOM 2011c). Several drainages are dominated by speckled alder or have a black ash component, while emergent wetland habitat is associated with beaver ponds. Most upland habitat consists of immature mixed coniferous/deciduous forest.

Wetland immature forests are of three types: black spruce dominant, a mix of black spruce and northern white cedar, or northern white cedar dominant. Canopy trees range from 4 to 8 inches dbh. The midstory consists of young black spruce, northern white cedar, and balsam fir. Bog Labrador-tea comprises 10 to 30% of the low shrub cover, while sphagnum moss often covers more than 80% of the ground.

Several drainages are dominated by shrub swamp vegetation. These drainages generally have a sparse overstory of black spruce, northern white cedar, and tamarack. Speckled alder and young trees are in the midstory while low shrub cover consists of bog Labrador-tea.

Beaver dams and ponds are found in the southeastern portion of the lands. Typically, open water is adjacent to the dams, with emergent wetland surrounding the open water and shrub swamp wetland upstream of the dams.

Upland habitat in the northern portion of the lands consists of an overstory of young and immature mixed coniferous/deciduous forest over a shrub layer of beaked hazel. Some of the upland area on the northern portion of the lands has been logged. Upland habitat is also found in the southern portion of the lands and is comprised of paper birch, trembling aspen, and black spruce, over a midstory of balsam fir and shrub layer of beaked hazel.

4.3.5.3 Wolf Lands 3

Wolf Lands 3 is approximately 277 acres, of which about 233 acres are wetland (**Figure 12**). The lands are relatively flat and Coyote Creek begins its northward flow within the lands. Wetlands are dominated by shrub swamp and immature coniferous forest habitat, while uplands consist of mostly shrubland and immature deciduous forest (AECOM 2011c).

About half of the lands have been recently logged. Logged wetlands are dominated by grasses, forbs, and low growing shrubs, including red-osier dogwood and speckled alder. In shrub swamp wetlands, speckled alder dominates. Bog Labrador-tea is often thick in areas where there is a dense cover of speckled alder. Vegetation on logged uplands includes grasses, forbs, and beaked hazel.

In the unlogged areas, wetland forests are comprised of immature black spruce. In the northern portion of the lands, black spruce is co-dominant with tamarack; in the rest of the lands, tamarack is present in the canopy but in much lower amounts. The midstory consists of balsam fir and black spruce, while the shrub layer is dominated by bog Labrador-tea, over a ground layer of nearly continuous sphagnum moss with scattered grasses and forbs. There are numerous downed trees and much woody debris associated with tree wind-throw in areas adjacent to the clearings.

Coyote Creek is bordered by emergent sedge meadow wetland comprised of sedges, narrow-leaved cattail, and Canada bluejoint. There are also scattered young tamarack and northern white cedar, as well as scattered patches of speckled alder and bog Labrador-tea. The emergent wetland is bordered by dense speckled alder. Water depth in the emergent and shrub swamp wetlands is about 18 to 24 inches.

Upland areas within the lands have been logged recently. Most of these areas have few trees remaining, though some areas still support paper birch up to 16 inches dbh and scattered balsam fir. The upland habitat along the boundary of the lands consists of both young and mature paper birch with scattered black spruce and northern white cedar, over an understory comprised of balsam fir.

4.3.5.4 Wolf Lands 4

Wolf Lands 4 is approximately 405 acres, of which about 363 acres are wetland (**Figure 12**). Coyote Creek bisects the lands, while the Stony River is found about 2,000 feet northwest of the lands. Timber harvests have recently occurred along the western border of the lands. Wetland habitats are dominated by immature coniferous forest and shrub swamp, while upland habitat consists primarily of mature deciduous forest (AECOM 2011c).

Coniferous forest dominates the wetland habitat. Black spruce forest dominates in the northern half of the lands, while northern white cedar is more prevalent in the southern half of the lands. Immature-size trees prevail over most of the lands, but patches of young black spruce are more common in the northeastern portion of the lands, and young northern white cedar and black spruce are more common in the southwestern portion of the lands. Emergent communities comprised of sedges and Canada bluejoint, and shrub swamp communities comprised primarily of speckled alder, are found in floodplains that border Coyote Creek.

Immature black spruce and black spruce/northern white cedar wetlands are dominated by trees ranging from 4 to 8 inches dbh. Scattered young and immature tamarack is also found in these wetlands. The low shrub layer is nearly continuous, and is comprised of leatherleaf, bog Labrador-tea, and other vegetation. Sphagnum and club mosses cover most of the ground.

Shrub swamp is dominated by speckled alder, with scattered black spruce, tamarack, and northern white cedar in the overstory. Leatherleaf and bog Labrador-tea cover comprise about 40 to 50% of the shrub layer.

Upland habitat consists of immature and mature paper birch and some black spruce. Trees are up to 18 inches dbh, although a 30 inches dbh jack pine and several large red pines to 24 inches dbh are found on the lands. Balsam fir is common in the midstory, while beaked hazel and raspberry are dominant in the shrub layer. In areas that have been logged recently, young paper birch is common over a shrub layer of beaked hazel, raspberry, and bog Labrador-tea.

4.4 Wetland Mitigation Lands

4.4.1 On-site Restoration

In accordance with the USACE *St. Paul District Policy for Wetland Compensatory Mitigation in Minnesota* and state guidelines, the potential for creating wetlands on-site was considered first. Approximately 102 acres of onsite wetland creation opportunities were identified that may occur at Project closure (Barr 2012, 2014d).

4.4.2 Off-site Mitigation

Three sites were identified to develop compensatory wetland mitigation for the Project. These are the 1,070-acre Aitkin Site, the 530-acre Hinckley Site, and the 569-acre Zim Site, which includes 481-acre Zim North (481 acres) and Zim South (88 acres) (**Figure 2**; Barr 2014a, 2014b, 2014c, 2014d). Of these 2,169 acres, about 1,603acres would be restored to wetland habitat.

4.4.2.1 Aitkin Site

The Aitkin Site is a 1,070-acre planned mitigation area with about 876 acres of agricultural production, 46 acres of roads, buildings, and ditches, 48 acres are grassland, and 13 acres of forest (**Figure 13**). The types of habitats that would be restored on the site are discussed in Section 3.8.2.

4.4.2.2 Hinckley Site

The Hinckley Site is a 530-acre planned mitigation area. About 357 acres are in agricultural (sod) production; 95 acres are forestland, shrubland, and wet meadow/sedge wetland; 42 acres are upland forestland; 28 acres are comprised of roads, railroad tracks, buildings, and ditches; and 8 acres are grassland (**Figure 13**). The types of habitats that would be restored on the site are discussed in Section 3.8.2.

4.4.2.3 Zim North

The Zim North Site is approximately 481 acres, including about 393 acres of fields and open areas, 79 acres of woodlands, and 8 acres of buildings, roads, and borrow areas (**Figure 13**). This site primarily is used for sod production (Barr 2014c, 2014d). The types of habitats that would be restored on the site are discussed in Section 3.8.2.

4.4.2.4 Zim South

The Zim South Site is approximately 88 acres, including about 79 acres of fields and open areas, 8 acres of woodlands, and 2 acres of buildings, roads, and borrow areas (**Figure 13**). This site primarily is used for sod production (Barr 2014c, 2014d). The types of habitats that would be restored on the site are discussed in Section 3.8.2.

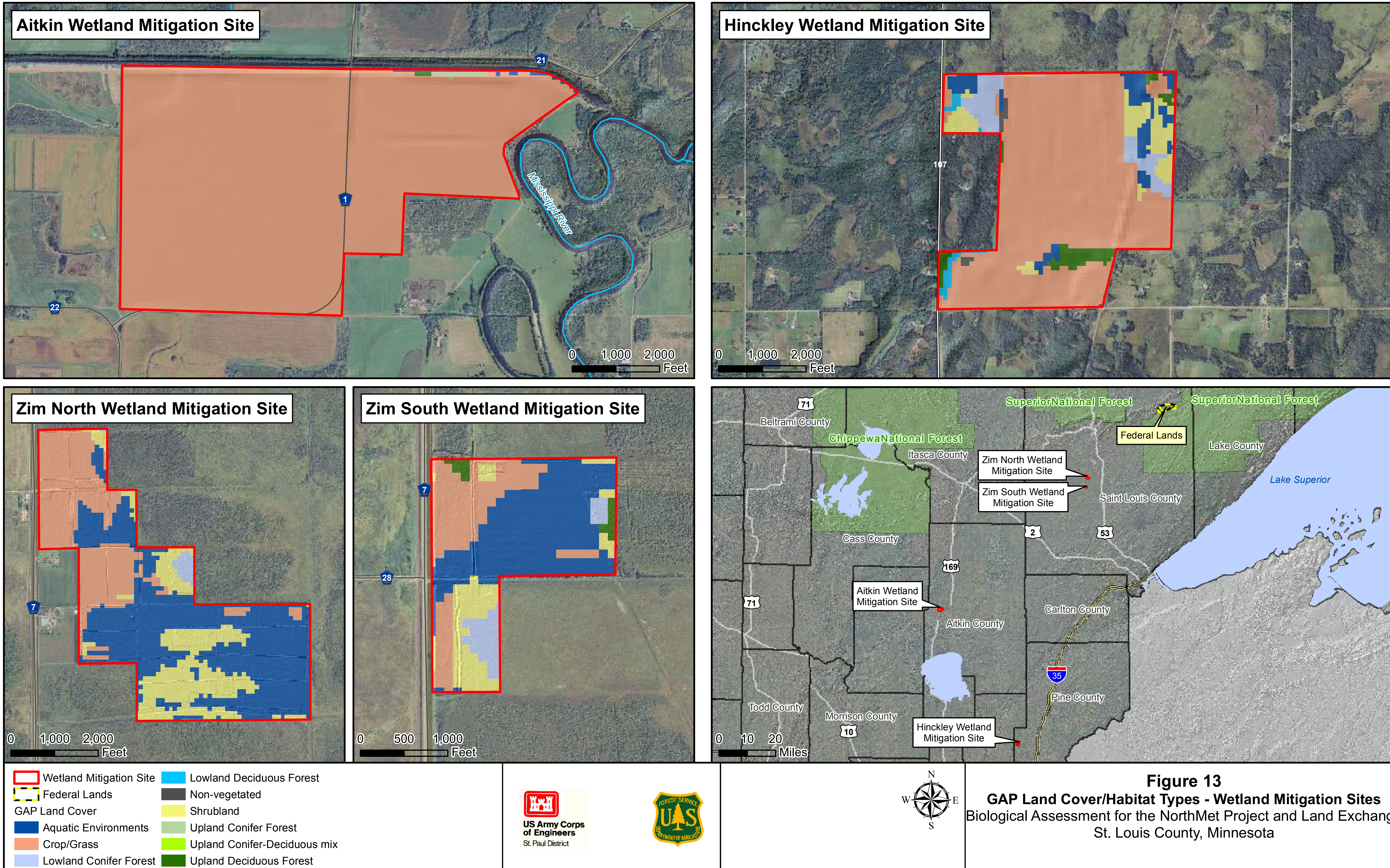

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Figure 13
GAP Land Cover/Habitat Types - Wetland Mitigation Sites
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

5.0 Biological Assessment Methodology

5.1 Literature Review

5.1.1 Biological Assessments and Biological Opinions

Several recent BAs and BOs have been prepared for proposed actions on or near the federal and non-federal lands and provided information that is used in this BA. These are:

- *Federally Listed Threatened and Endangered Species Programmatic Biological Assessment for the Revised Forest Plan Chippewa and Superior National Forests* (2004 Forest Plan BA; USDA Forest Service 2004b) – evaluated potential impacts to lynx and wolf and their critical habitats from proposed vegetation management activities in the Chippewa and Superior National Forests, including federal lands.

- *Biological Opinion for the Revised Land and Resource Management Plans (Forest Plans) for the Chippewa and Superior National Forests* (USDOI USFWS 2004) – provided the USFWS evaluation of the potential effects to lynx and wolf and their critical habitats from proposed vegetation management activities in the Chippewa and Superior National Forests, including Project lands.

- *Whyte Project Biological Assessment* (USDA Forest Service 2006) – evaluated potential impacts to lynx and wolf and their critical habitats from proposed vegetation management activities in areas that include Wolf Lands 2, 3, and 4.

- *Final Biological Assessment for the Proposed Mesaba Energy Project* (AECOM 2009a) – evaluated potential impacts to lynx and wolf and their critical habitats for a proposed electric generating facility about 3 miles southwest of the Plant Site.

- *Tracks Forest Management Project Laurentian Ranger District, Superior National Forest, Biological Assessment* (Tracks Project BA; USDA Forest Service 2010) – evaluated potential effects to special status plants and animals from proposed forest management activities on the Tracks Forest Management Project (Tracks Project) area east of Hoyt Lakes and north of Brimson, Minnesota, in Lake and St. Louis Counties. The Track Project area encompasses about 152,000 acres of land of which approximately 78,000 acres are in the Superior National Forest.

- *Draft Biological Assessment for the Federal Hardrock Mineral Prospecting Permits Draft EIS* (2011 Hardrock Mining BA; USDA Forest Service 2011a) – evaluated potential impacts to lynx and wolf and their critical habitats from proposed hardrock mineral prospecting activities in the Superior National Forest, including the federal land.

- *Programmatic Biological Assessment for Federally-listed Species: Gray Wolf, Canada Lynx, and Their Critical Habitats for the Superior National Forest* (USDA Forest Service 2011b) – evaluated potential impacts to lynx and wolf and their critical habitats from proposed implementation of management direction for the Superior National Forest Plan, including the federal land.

- *Biological Opinion Mesabi Nugget Prevention of Significant Deterioration Permit* (USDOI USWFS 2009a) – evaluated potential impacts to lynx and wolf and their critical habitats from actions at the Mesabi Nugget facility immediately west of the Plant Site.

- *Biological Opinion Northshore Mine Eastern Progressions and CSAH 70 Relocation St. Louis County, Minnesota* (USDOI USFWS 2011a) – evaluated potential impacts to lynx and wolf and their critical habitats from actions east of the Northshore Mine and about 5 miles northeast of the Mine Site.

5.1.2 Other Sources of Information

This section is based on information (and references cited therein) in the following documents:

5.1.2.1 General

- *Consultation Handbook: Procedures for Conducting Consultation and Conference Activities under Section 7 of the Endangered Species Act* (USDOI USFWS and NMFS 1998).

- *Winter 2000 Wildlife Survey for the Proposed NorthMet Mine Site, St. Louis County, Minnesota* (ENSR 2000).

- *Land and Resource Management Plan for the Superior National Forest* (USDA Forest Service 2004a).

- *NorthMet Mine Summer Fish and Wildlife Study* (ENSR 2005).

- *2009 NorthMet Mine/Forest Additional Parcel Northern Goshawk and Owl Survey – Final Report* (AECOM 2009b).

- *2008 NorthMet Mine/Forest Service Additional Parcel Summer Wildlife and Wetland Assessment – Final Report* (AECOM 2011a).

- *2009 Hay Lakes Parcel and McFarland Lake Parcel Summer Wildlife and Wetland Assessment Final Report* (AECOM 2011b).

- *Hunting Club, Lake County, and Wolf Land Parcels Fall 2010 Wildlife and Wetland Assessment Final Report* (AECOM 2011c).

5.1.2.2 Canada Lynx

- *The Scientific Basis for Lynx Conservation* (Ruggiero et al. 2000a).

- *Canada Lynx Conservation Assessment and Strategy* (Ruediger et al. 2000).

- *Ecology and Conservation of Lynx in the United States* (Ruggiero et al. 2000b).

- *Canada Lynx Conservation Agreement* (USDA Forest Service and USDOI USFWS 2000).

- *Endangered and Threatened Wildlife and Plants: Determination of Threatened Status for the Contiguous U.S. Distinct Population Segment of the Canada Lynx and Related Rule; Final Rule* (USDOI USFWS 2000a).
- *Biological Opinion on the Effects of National Forest Land and Resource Management Plans and Bureau of Land Management Land Use Plans on Canada Lynx (Lynx canadensis) in the Contiguous United States* (USDOI USFWS 2000b).
- *Endangered and Threatened Wildlife and Plants: Notice of Remanded Determination of Status for the Contiguous U.S. Distinct Population Segment of the Canada Lynx; Clarification of Findings; Final Rule* (USDOI USFWS 2003a).
- *Endangered and Threatened Wildlife and Plants: Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx* (USDOI USFWS 2006a).
- *Canada Lynx Assessment for the Proposed NorthMet Mine Project* (ENSR 2006).
- *Endangered and Threatened Wildlife and Plants; Revised Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx (Lynx canadensis*; USDOI USFWS 2008a).
- *Canada Lynx in the Great Lakes Region Final Report to USDA Forest Service and U.S. Geological Survey and Minnesota Department of Natural Resources* (Moen et al. 2008).
- *Canada Lynx in the Great Lakes Region 2008 and 2009 Annual Reports* (Moen 2008, 2009).
- *Endangered and Threatened Wildlife and Plants; Revised Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx (Lynx canadensis); Final Rule* (USDOI USFWS 2009a).

5.1.2.3 Northern Long-eared Bat

- *Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Eastern Small-Footed Bat and the Northern Long-Eared Bat as Endangered or Threatened Species; Listing the Northern Long-Eared Bat as an Endangered Species; Proposed Rule* (USDOI USFWS 2013b).
- *Northern long-eared bat interim conference and planning guidance. January, 2014. USFWS Regions 2, 3, 4, 5, & 6* (USFWS 2014).*Summary of Acoustic and Emergence Surveys for Bats in the NorthMet Project Area* (USDA Forest Service 2014a).
- *Summary of the 2014 Minnesota Northern Long-eared Bat Summer Habitat Use in Minnesota Project (Preliminary Report)* (USDA Forest Service 2014b).
- *Endangered and Threatened Wildlife and Plants; Threatened Species Status for Northern Long-Eared Bat with 4(d) Rule; Interim and Final Rule* (USDOI USFWS 2015)

5.1.2.4 Gray Wolf

- *Recovery Plan for the Eastern Timber Wolf* (Wolf Recovery Plan; USDOI USFWS 1992).
- *Minnesota Wolf Management Plan* (MDNR 2001).
- *Wolves: Behavior, Ecology, and Conservation* (Mech and Boitani 2003).
- *Endangered and Threatened Wildlife and Plants; Designating the Western Great Lakes Population of Gray Wolves as a Distinct Population Segment; Removing the Western Great Lakes Distinct Population Segment of the Gray Wolf From the List of Endangered and Threatened Wildlife* (USDOI USFWS 2006b).
- *Final Rule Designating the Western Great Lakes Populations of Gray Wolves as a Distinct Population Segment; Removing the Western Great Lakes Distinct Population Segment of the Gray Wolf From the List of Endangered and Threatened Wildlife* (USDOI USFWS 2007).
- *Endangered and Threatened Wildlife and Plants: Reinstatement of Protections for the Gray Wolf in the Western Great Lakes and Northern Rocky Mountains in Compliance with Court Orders* (USDOI USFWS 2008b).
- *Endangered and Threatened Wildlife and Plants; Final Rule To Identify the Western Great Lakes Populations of Gray Wolves as a Distinct Population Segment and To Revise the List of Endangered and Threatened Wildlife* (USDOI USFWS 2009b).
- *Endangered and Threatened Wildlife and Plants; Reinstatement of Protections for the Gray Wolf in the Western Great Lakes in Compliance With Settlement Agreement and Court Order* (USDOI USFWS 2009c).
- *Endangered and Threatened Wildlife and Plants; Proposed Rule To Revise the List of Endangered and Threatened Wildlife for the Gray Wolf (Canis lupus) in the Eastern United States, Initiation of Status Reviews for the Gray Wolf and for the Eastern Wolf* (*Canis lycaon*; USDOI USFWS 2011b).

5.2 Database Inquiries

The MDNR Natural Heritage Information System Rare Features Database was queried for federally protected species documented within 1 mile of the federal and non-federal lands and Wetland Mitigation Sites (MDNR 2014a). The MDNR lynx database was also reviewed for lynx sightings that have occurred in the vicinity of these areas between 2000 and 2006 (MDNR 2007). The Natural Resources Research Institute (NRRI) lynx website was reviewed for records of radiomarked lynx within the study area (NRRI 2012). The Superior National Forest’s lynx genetic reference database was also reviewed for records of lynx occurrence on or near the federal and non-federal lands and Wetland Mitigation sites.

5.3 Consultation with Biologists with Local Knowledge of the Species

Telephone and in-person interviews were conducted with agency and other personnel with knowledge of lynx in the region, including staff with the MDNR, Forest Service, USFWS, and University of Minnesota. The information received from these contacts was used to gain information on lynx and wolf likely to be found in the areas of interest.

5.4 Field Studies

Canada lynx winter tracking surveys have been conducted in the vicinity of the Mine Site, including a 2006 survey at the Mine Site (ENSR 2006) and at sites about 6 miles east of the Mine Site (Barr 2011).

5.4.1 Project Lynx Survey

A survey was conducted for lynx within a radius of 6 miles of the Project during January through March of 2006. This area was identified by the USFWS as the minimum area that needed to be assessed to identify lynx that could be impacted by the Project (Burke 2006). The USFWS felt that lynx having territories further than 6 miles from the mine project would likely not be directly affected by the Project.

Six hundred sixteen miles of transect were surveyed in seven townships in and around the Project. Tracks and scat of four female lynx were identified during the survey, concentrated in areas approximately 5 miles south and east of the Mine Site. Lynx sign was most common in dense coniferous forests of balsam fir and jack pine. ENSR (2006) concluded that at least three lynx resided near the Mine Site.

5.4.2 Other Lynx Surveys near Project Area

A lynx survey was conducted for the Birch Lake Project and Maturi Project for Franconia Minerals Corporation, which is about 12 miles northeast of the Mine Site. Several lynx were found during the study, based on DNA analysis of scat samples and track locations. Open bog and stunted black spruce forest and jack pine and eastern white cedar cover provided habitat for snowshoe hare and lynx (Barr 2011).

5.4.3 Other Field Surveys

The Forest Service and other biologists with an interest in lynx and wolf have conducted informal track and scat surveys on or near the federal and non-federal lands and Wetland Mitigation Sites, and their data are included in this BA. These included radiotelemetry surveys of lynx conducted by the NRRI (2012) and surveys of wolf conducted by the International Wolf Center (2012).

General wildlife surveys were conducted for the federal lands in 2000, 2004 2008, and 2009 (ENSR 2000, 2005; AECOM 2009, 2011a); and for the non-federal lands in 2009 and 2010 (AECOM 2011b, c). These surveys included track surveys for Canada lynx and the results of these surveys are included in the BA.

Wildlife habitat features on the federal and non-federal lands, including plant species composition and structure and special features (snags, downed woody debris, rock outcrops, wetlands, and deer snow-intercept thermal cover) were recorded during field surveys. In particular, species composition, density, and size (dbh) of trees and shrubs near survey areas were noted, and the use of snags and other special habitat features by wildlife. The location of special features was recorded using Global Positioning System units. This information was recorded on aerial photographs, and, in conjunction with information on shrubs and herbaceous vegetation collected during surveys, was used to prepare habitat maps of the project lands.

The USFS Superior National Forest staff conducted surveys for the northern long-eared bat at three general locations in the Project area in July and August 2014 (USDA Forest Service 2014a). The three Project areas included the Mine Site, the Plant Site, and the Dunka Road and Utility Corridor. Survey methods utilized passive sonic (Anabat) detectors on the Mine Site and Dunka Road and Utility Corridor. At the Plant Site, the methods were primarily direct observation of bat species, supplemented by passive sonic detectors when feasible. The surveys found northern long-eared bats present at the Mine Site, Plant Site, and the Dunka Road and Utility Corridor.

Survey data confirmed that northern long-eared bats utilize the Mine Site and the Dunka Road and Utility Corridor for foraging and travel to and from foraging and roost sites. The Mine Site may also contain roost sites; however, the 2014 Forest Service surveys found no conclusive evidence of roost sites. The direct observations and passive sonic survey data suggested that northern long-eared bats used the Plant Site buildings for foraging, and that the Coarse Crusher and Concentrator Buildings "have potential for limited roost sites" (USDA Forest Service 2014a). No conclusive evidence of roost sites was found in the Plant Site buildings.

In addition, the 2014 USFS surveys and examination of the Mine Site, Plant Site buildings, and the Dunka Road and Utility Corridor found no evidence of northern long-eared bat hibernacula, or conditions suitable for hibernacula (USDA Forest Service 2014a).

In the spring of 2014, the Forest Service Superior National Forest staff and MDNR staff, with additional funding from USFWS, conducted a pilot project to describe summer habitat use by northern long-eared bats in Minnesota. Surveys were conducted at 12 sites, five of which were on the Superior National Forest. The survey captured six of the seven species of bats known to occur in Minnesota; tri-colored bat was the only species not captured. The most frequently captured bats were little brown bats (45%), and northern long-eared bats (22%) (Forest Service 2014b).

Acoustic surveys for bats were conducted as part of wildlife surveys for the federal and non-federal lands (AECOM 2011a, b, c). No effort was made to determine the species of bat making the echolocation. Seven bat species could occur in the Project area—northern long-eared bat, little brown myotis, big brown bat, tri-colored bat, silver-haired bat, eastern red bat, and hoary bat. Echolocations recorded during the surveys could have come from any of these seven bat species.

Echolocation surveys were conducted at five stations on the federal lands, although only four stations gave usable information due to rainfall during the survey at one station. Recordings indicated the presence of bats at all sites, with the greatest number of echolocations occurring at open water sites associated with the Partridge River and an unnamed creek, and the fewest echolocations at emergent wetlands covered with water and some aquatic vegetation.

Recordings on Hay Lake Lands showed that most echolocations occurred at an emergent wetland with open water (814 echolocations, mostly feeding activity). Moderate numbers of echolocations were recorded at the two sites along the Pike River (164 echolocations at the north Pike River site, 230 echolocations at the middle Pike River site; feeding activity was moderate), and at two small emergent wetland ponds with limited open water (64 and 181 echolocations; AECOM 2011b). An echolocation site to the south of Hay Lake Lands was located at a small patch of open water associated with an old beaver pond; 72 echolocations were recorded at this site. No echolocation surveys were made on Hunting Club Lands, Lake County Lands, and Wolf Lands as surveys were conducted in November and bats would have already migrated from the area. Surveys were also not conducted at McFarland Lake Lands, although bats likely forage over McFarland Lake.

Acoustic surveys for bats have also recently been conducted on the federal lands by the Superior National Forest and the NRRI, but analysis has not been completed to determine the species making the calls.

Project effects on lynx, northern long-eared bat, and wolf habitat use were based on habitat classification systems developed by the MDNR and Forest Service. The primary GAP land cover types on the federal lands are lowland coniferous forest (46%), upland coniferous forest (25%), and upland deciduous forest (17%). On the non-federal lands, GAP land cover types include lowland coniferous forest (41%), shrubland (26%), and upland deciduous forest (17%).

The Forest Service designates and maintains data about Management Indicator Habitat (MIH) types on federal lands. The MIHs are based on forest type, including dominant species, stand age class, and stand condition. There are 14 MIHs, of which 13 MIHs pertain to forest habitats and 1MIH pertains to aquatic habitats. A subset of these MIH types was used for the analysis of effects in the BE, including upland forest types (MIH 1; jack pine, red pine, white pine, balsam fir/trembling aspen-paper birch, black spruce-balsam fir, black spruce-jack pine, northern hardwoods, including oak and maple, trembling aspen, paper birch, and trembling aspen-black spruce-balsam fir); upland coniferous forest (MIH 5; all upland conifer and conifer-dominated mixed forest types); lowland black spruce-tamarack forest (MIH 9; all lowland conifer and lowland mixed conifer types dominated by black spruce or tamarack); and aquatic habitats (MIH 14; lakes, rivers, streams, pond, marshes or pools [permanent, intermittent, or seasonal]). A smaller subset of all MIH types were used for this analysis of effects to lynx, northern long-eared bat, and wolf, including upland forest (MIH 1), upland coniferous forest (MIH 5), lowland black spruce-tamarack forest (MIH 9), and aquatic habitats (MIH 14).

6.0 Baseline Analysis and Assessment of Effects

Section 6 includes background information and an analysis of the effects of the Project on lynx, northern long-eared bat, and wolf. The first part of each section provides background information on lynx and wolf abundance and distribution, habitat requirements, reproductive biology and life history, and current status and presence/absence of designated critical habitat. This is followed by a discussion of potential beneficial, direct, indirect, interdependent, and interrelated threats to lynx, northern long-eared bat, and wolf. Effects that are unrelated to the Project and that may result in cumulative effect as a result of the Project, are presented in Sections 6.1.4, 6.2.4, and 6.3.4, Analysis of Cumulative Effects. These effects are defined as follows:

- Beneficial – Effects of an action that are wholly positive, without any adverse effects, on a listed species or designated critical habitat. Determination that an action will have beneficial effects is a “may effect” situation.

- Direct – The direct or immediate effects of the project on the species or its habitat. Direct effects result from the proposed action including the effects of interrelated actions and interdependent actions.

- Indirect – Effects caused by or resulting from the proposed action that are later in time, and are reasonably certain to occur. Indirect effects may occur outside of the area directly affected by the action.

- Interdependent – Effects that result from an activity that has no independent utility apart from the action under consideration.

- Interrelated – Effects that result from an activity that is part of the proposed action and depends on the proposed action for its justification.

- Cumulative – Include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this BA. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA. Cumulative effects are discussed in Sections 6.1.4, 6.2.4, and 6.3.4.

For a more detailed discussion of types of effects, see USDOI USFWS and NMFS (1998).

The effects assessment is based on the following factors:

- dependency of the species on specific habitat components,

- habitat abundance,

- population levels of the species,

- degree of habitat impact, and

- potential to mitigate for an adverse effect.

For the purposes of this assessment, the action area for direct and indirect effects includes those areas within 6 miles of Project, or approximately 250 mi^2. This area was identified by the USFWS as the minimum area that needed to be assessed to identify lynx that could be impacted by the Project (Burke 2006). In addition, we have provided information on lynx and wolf found within about 6 miles of the federal lands, non-federal lands, and Wetland Mitigation Sites.

6.1 Canada Lynx

6.1.1 Environmental Baseline

6.1.1.1 Species Description and Status and Critical Habitat Status

The lynx is a medium-sized cat with long legs. Adult males average 22 pounds in weight and 33.5 inches in length (head to tail), and females average 19 pounds and 32 inches (Quinn and Parker 1987). The lynx's long legs and large feet make it highly adapted for hunting in deep snow.

The bobcat is a North American relative of the lynx. Compared to the lynx, the bobcat has smaller paws, shorter ear tufts, and a more spotted pelage (coat), and only the top of the tip of the tail is black. The paws of the lynx have twice the surface area as those of the bobcat. The lynx also differs from the bobcat in its body proportions; lynx have longer legs, with hind legs that are longer than the front legs, giving the lynx a ''stooped'' appearance (Quinn and Parker 1987). Bobcats are largely restricted to habitats where deep snows do not accumulate (Koehler and Hornocker 1991). Hybridization (breeding) between lynx and bobcat was first documented in 2002 in Minnesota (Schwartz et al. 2004).

Classification of the lynx has been subject to revision. In accordance with Wilson and Reeder (1993), the USFWS currently recognizes the lynx in North America as *Lynx canadensis*. The USFWS previously used the scientific name *L. lynx canadensis* for the lynx (Jones et al. 1992). Other scientific names still in use include *Felis lynx* or *F. lynx canadensis* (Jones et al. 1986, Tumlison 1987).

On March 24, 2000, the lynx was federally listed as a threatened species in several states in the Northeast, Great Lakes Region (including Minnesota), and Southern Rockies (USDOI USFWS 2000a). On November 9, 2006, the USFWS designated 317 mi^2 as critical habitat in Voyageurs National Park (USDOI USFWS 2006a). On February 25, 2009, the USFWS re-designated lynx critical habitat to include portions of Cook, Koochiching, Lake, and St. Louis Counties, including portions of the federal lands, and all of the non-federal lands. A total of 8,065 mi^2 were designated as critical habitat in 2009 (USDOI USFWS 2009a). However, the designated critical habitat does not include lands immediately north of the Project which are part of the Iron Range and have been disturbed by past and ongoing mining activities (**Figure 14)**. The Wetland Mitigation Sites also are not included within designated critical habitat. Lynx and/or their sign (scat, tracks) have been observed on or near the federal and non-federal lands, but not near the Wetland Mitigation Sites.

6.1.1.2 Distribution

The historical and present range of the lynx, north of the contiguous U.S., includes Alaska and the portion of Canada extending from the Yukon and Northwest Territories south to the U.S. border and east to New Brunswick and Nova Scotia. In the contiguous U.S., lynx historically occurred in the Cascades Range of Washington and Oregon; the Rocky Mountain Range in Montana, Wyoming, Idaho, eastern Washington,

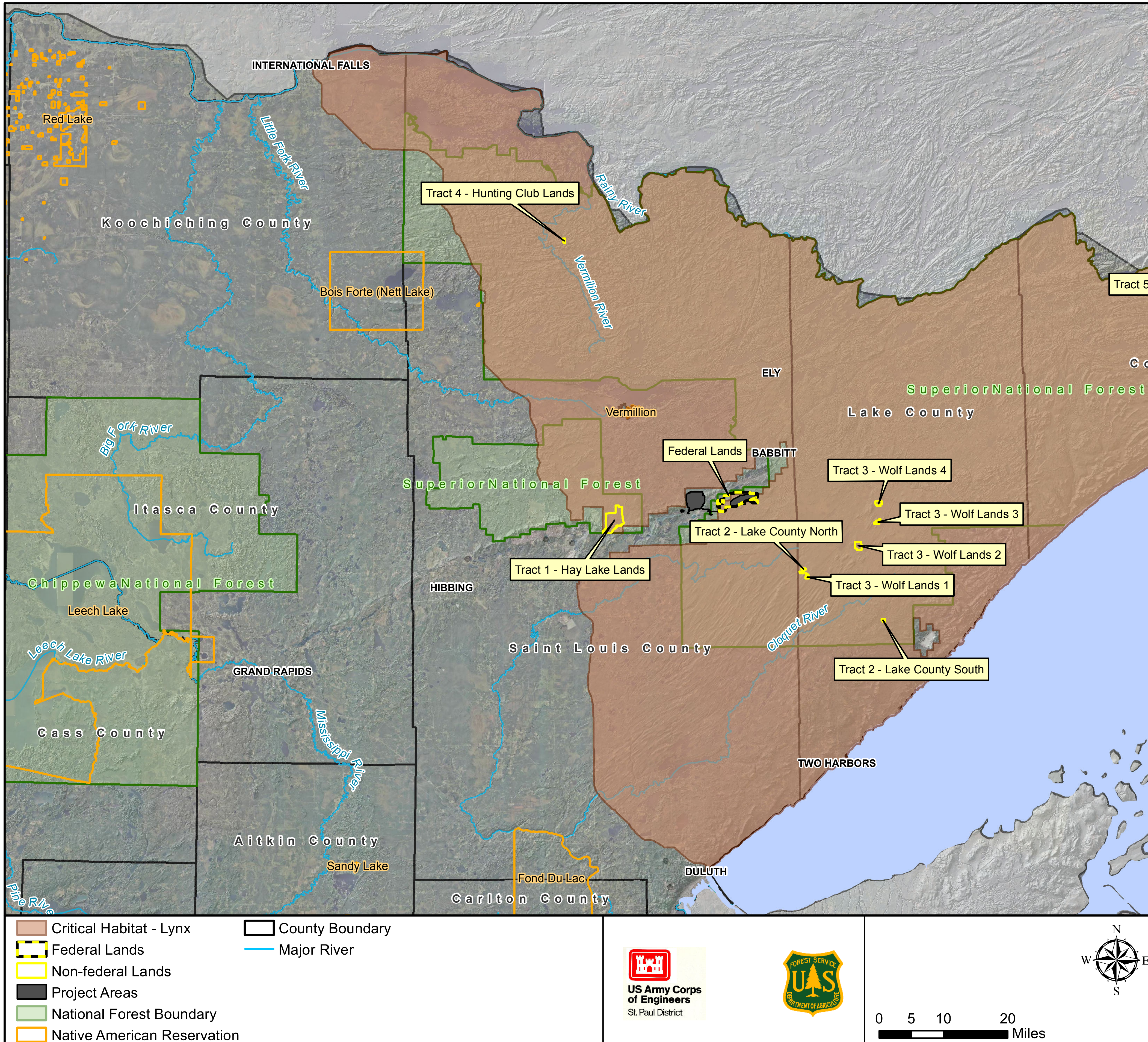


Figure 14
Canada Lynx Critical Habitat
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

eastern Oregon, northern Utah, and Colorado; the western Great Lakes Region; and the northeastern U.S. region from Maine southwest to New York (**Figure 15**; McCord and Cardoza 1982, Quinn and Parker 1987).

In the contiguous U.S., the distribution of the lynx is associated with the southern boreal forest, comprised primarily of subalpine coniferous forest in the West and mixed coniferous/deciduous forest in the East (Aubry et al. 2000). In Canada and Alaska, lynx inhabit the classic boreal forest ecosystem known as the taiga (McCord and Cardoza 1982, Quinn and Parker 1987, Agee 2000, McKelvey et al. 2000a). Within these general forest types, lynx are most likely to persist in areas that receive deep snow, for which the lynx is highly adapted (Ruggiero et al. 2000).

Lynx in the contiguous U.S. are part of a larger metapopulation whose core is located in the northern boreal forest of central Canada; lynx populations emanate from this area (Buskirk et al. 2000a, McKelvey et al. 2000a, b). The boreal forest extends south into the contiguous U.S. along the Cascade and Rocky Mountain Ranges in the West, the western Great Lakes Region, and the Appalachian Mountain Range of the northeastern U.S. At its southern margins, the boreal forest becomes naturally fragmented into patches of varying size as it transitions into other vegetation types. These southern boreal forest habitat patches are small relative to the extensive northern boreal forest of Canada and Alaska, which constitutes the majority of the lynx range. Lynx are considered "not at risk" in Canada (Committee on the Status of Endangered Wildlife in Canada 2006).

Many of these southern boreal forest habitat patches within the contiguous U.S. are able to support resident populations of lynx and their primary prey species. It is likely that some of the habitat patches act as sources of lynx (recruitment is greater than mortality) that are able to disperse and potentially colonize other patches (McKelvey et al. 2000b). Other habitat patches act as ''sinks'' in which lynx mortality is greater than recruitment and lynx are lost from the overall population. The ability of naturally dynamic habitat to support lynx populations may change as the habitat undergoes natural succession following natural or man-made disturbances *(*i.e., fire, clearcutting). In addition, fluctuations in the prey populations may cause some habitat patches to change from being sinks to sources and vice versa. The term ''resident population'' refers to a group of lynx that has exhibited long-term persistence in an area based on a variety of factors, such as evidence of reproduction, successful recruitment into the breeding cohort, and maintenance of home ranges. The word ''transient'' refers to a lynx moving from one place to another within suitable habitat. The word "dispersing'' refers to lynx that have left suitable habitat for various reasons, such as competition or lack of food. When dispersing lynx leave suitable habitat and enter habitats that are unlikely to sustain them, these individuals are considered lost from the metapopulations unless they return to boreal forest.

6.1.1.3 Population Dynamics

Lynx numbers and snowshoe hare densities in the contiguous U.S. generally do not get as high as those in the center of their range in Canada, and there is no evidence they ever did so in the past (Hodges 2000a, b, McKelvey et al. 2000a). It appears that northern and southern snowshoe hare populations have similar cyclic dynamics, but that in southern areas both peak and low densities are lower than in the north (Hodges 2000b). However, it is unclear whether hare populations cycle everywhere in the contiguous U.S. Relatively low snowshoe hare densities at southern latitudes are likely a result of the naturally patchy, transitional boreal habitat at southern latitudes that prevents hare populations from achieving densities similar to those of the expansive northern boreal forest (Wolff 1980, Buehler and Keith 1982, Koehler 1990, Koehler and Aubry 1994). Additionally, the presence of more predators and competitors of hares at southern latitudes may inhibit the potential for high-density snowshoe hare populations with extreme cyclic fluctuations (Wolff 1980). As a result

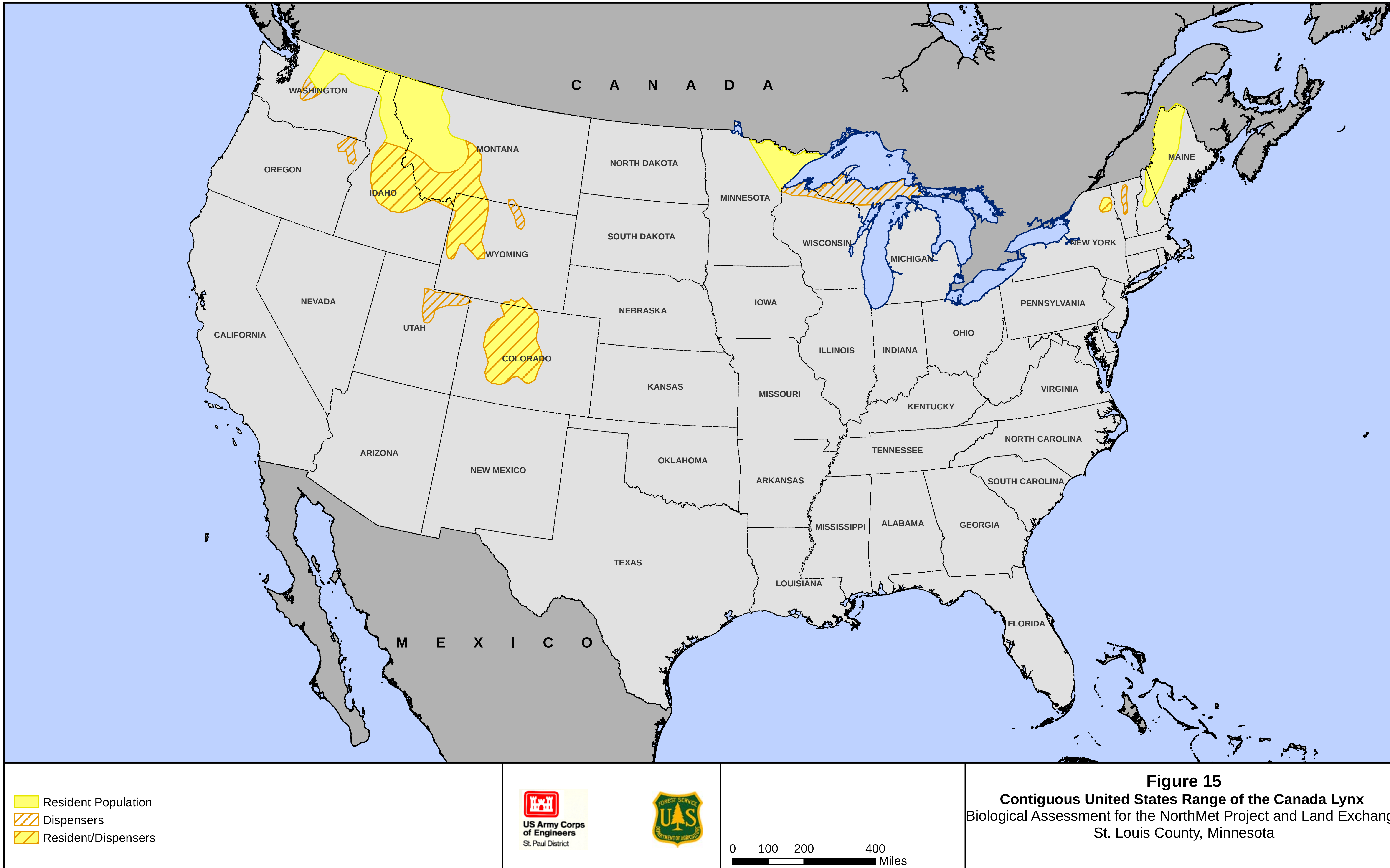


Figure 15
Contiguous United States Range of the Canada Lynx
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

of naturally lower snowshoe hare densities, lynx densities at the southern part of the range rarely achieve the high densities that occur in the northern boreal forest (Aubry et al. 2000).

The density of lynx near the Project area was estimated to range from one lynx per 72 to 86 mi^2 based on lynx surveys conducted on or near the Project (ENSR 2006, Barr 2011). However, Moen (2009) noted that given the low densities of Canada lynx in Minnesota, it may be impossible to provide an accurate population estimate.

6.1.1.4 Lynx and Snowshoe Hare Relationships

The association between lynx and snowshoe hare is considered a classic predator-prey relationship (Saunders 1963, van Zyll de Jong 1966, Quinn and Parker 1987). In northern Canada and Alaska, lynx populations fluctuate on approximately 10-year cycles that follow the cycles of snowshoe hare populations (Elton and Nicholson 1942, Hodges 2000a, b, McKelvey et al. 2000a). Generally, researchers believe that when snowshoe hare populations are at their cyclic high, the interaction of predation and food supply causes the populations to decline drastically (Buehler and Keith 1982, Krebs et al. 1995, O'Donoghue et al. 1997). There is little evidence of regular snowshoe hare cycles in the Northeast, southern Quebec, and Minnesota (Hoving 2001, McCann 2006), but snowshoe hare populations can fluctuate widely in this region. Snowshoe hare fluctuations in this region may be more influenced by forest practices, weather, and other ecological factors.

Snowshoe hare provide the quality prey necessary to support high-density lynx populations (Brand and Keith 1979). Lynx also prey opportunistically on other small mammals and birds, particularly when hare populations decline (Nellis et al. 1972, Brand et al. 1976, McCord and Cardoza 1982, O'Donoghue et al. 1997, 1998a). Red squirrels are an important alternate prey (O'Donoghue et al. 1997, 1998a, Apps 2000, Aubry et al. 2000). However, a shift to alternate food sources may not sufficiently compensate for the decrease in snowshoe hares consumed to be adequate for lynx reproduction and kitten survival (Brand and Keith 1979, Koehler 1990, Koehler and Aubry 1994). When snowshoe hare densities decline, the lower quality diet causes sudden decreases in the productivity of adult female lynx and decreased survival of kittens, if any are born during this time. As a result, recruitment of young into the population nearly ceases during cyclic lows of snowshoe hare populations (Nellis et al. 1972, Brand et al. 1976, Brand and Keith 1979, Poole 1994, Slough and Mowat 1996, O'Donoghue et al. 1997, Mowat et al. 2000).

6.1.1.5 Home Range and Dispersal

Lynx require very large areas containing boreal forest habitat. The size of lynx home ranges varies by the animal's gender and age, abundance of prey, season, and the density of lynx populations (Hatler 1988, Koehler 1990, Poole 1994, Slough and Mowat 1996, Aubry et al. 2000, Mowat et al. 2000). Based on a limited number of studies in northeastern Minnesota, the average home range varied between 11 and 201 mi^2 for males, and 2 and 37 mi^2 for females (Burdett 2007). Male home ranges expanded during the breeding season, perhaps due to males searching for females, while female home ranges contracted (Moen et al. 2008).

Lynx are highly mobile and have a propensity to disperse. Long-distance movements (greater than 60 miles) are characteristic, and are more common among males (Mowat et al. 2000, Burdett 2007). Lynx disperse primarily when snowshoe hare populations decline (Ward and Krebs 1985, Koehler and Aubry 1994, O'Donoghue et al. 1997, Poole 1997). Subadult lynx also disperse even when prey is abundant (Poole 1997), presumably as an innate response to establish home ranges. Lynx also make exploratory movements outside their home ranges. Lynx are capable of moving extremely long distances (greater than 300 miles; Brainerd 1985, Washington Department of Wildlife 1993, Poole 1997, Mowat et al. 2000). While it is assumed lynx would prefer to travel where there is forested cover, the literature contains many examples of lynx crossing large, unforested openings. The ability of both male and female lynx to disperse long distances, crossing unsuitable habitats, indicates they are capable of colonizing suitable habitats and finding potential mates in areas that are isolated from source lynx populations.

Moen et al. (2010) found that lynx in Minnesota disperse outside their home range and travel between Ontario, Canada, and Minnesota. About 40% of radiocollared male and female lynx made long-distance movements outside of their home range. Of those making long distance movements, females tended to move 62 to 124 miles and not return to their original home range, while males moved 31 to 49 miles and went back and forth between Ontario and Minnesota. Travel was generally linear, water was not avoided, and lynx walked around lakes while on long-distance movements. Movements were made across roaded areas, and also across the BWCAW, which has few linear features such as roads, trails, and logging roads that could guide movement by lynx. Observations suggested that geographically or topographically definable movement corridors do not exist for lynx in northeastern Minnesota, or between Minnesota and Ontario (Moen et al.2010).

6.1.1.6 Mortality

Common causes of mortality for lynx include starvation of kittens (Quinn and Parker 1987, Koehler 1990), and trapping (Ward and Krebs 1985, Bailey et al. 1986). Lynx mortality due to starvation has been shown in cyclic populations of the northern taiga, during the first 2 years of snowshoe hare scarcity (Pool 1994, Slough and Mowat 1996). During periods of low snowshoe hare numbers, starvation can account for up to two-thirds of all natural lynx deaths. Trapping mortality may be additive rather than compensatory during the low period of the snowshoe hare cycle (Brand and Keith 1979). Hunger-related stress, which induces dispersal, may increase exposure of lynx to other forms of mortality such as trapping and vehicle collisions (Brand and Keith 1979, Carbyn and Patriquin 1983, Ward and Krebs 1985, Bailey et al. 1986).

Predation on lynx by mountain lion, coyote, wolverine, wolf, and other lynx has been observed (Berrie 1974, Koehler et al. 1979, Poole 1994, Slough and Mowat 1996, O'Donoghue et al. 1997, Apps 2000, Squires and Laurion 2000). Squires and Laurion (2000) reported two of six mortalities of radiocollared lynx in Montana were due to mountain lion predation.

An indirect effect of long-distance movements can be that some lynx are legally harvested in Ontario (USDA Forest Service 2011b). Although this harvest has little effect on the population of lynx in Ontario, it can affect the relatively small Minnesota population of lynx (Moen 2009, Moen et al. 2010).

There are few records of lynx being killed on highways, but direct mortality from vehicular collisions may be detrimental to small lynx populations in the lower 48 states. The MDNR lynx sighting records indicate that six lynx were killed by vehicle collisions in Minnesota between 2000 and 2006, and one lynx was killed by a train (MDNR 2007). Of those killed by vehicles, two occurred on Interstate 35, two on Highway 61, one on a county road, and one on the Gunflint Trail. No lynx-vehicle collisions have been reported on roads associated with mining projects, even though lynx have been observed using mine roads at the Northshore Mine and former Cliffs Erie mine site near the Project (ENSR 2006).

The USFWS Twin Cities Field Office has maintained an incidental take database since 2000. From 2000 to 2012, of 43 animals killed, 15 were from unknown causes, 13 were from trapping (4 due to legal trapping in Ontario, Canada), 7 were killed by vehicles, 6 were shot, and 2 were killed by trains (Rowse 2012). Between

2003 and 2009, the NRRI found that 15 of 19 radiocollared lynx deaths were directly or indirectly associated with human activities (Moen 2009, USDA Forest Service 2011b).

Many resident lynx that make movements into Ontario are harvested, particularly those that go long distances. Three radiocollared animals made 300 to 400 road mile movements to the same area in Ontario (USDA Forest Service 2011b). Lynx that conduct long-distance movements from Minnesota to Ontario are vulnerable to legal harvest in Canada whereas trapping mortality in Minnesota is incidental to trapping for other species because there is no legal trapping of lynx in the U.S. (Moen 2009). Moen et al. (2010) suggested that linear features such as roads benefit lynx from an energetic perspective, but may also be negative if they increase the chance of incidental mortality because of exposure to humans.

6.1.1.7 Recruitment

Lynx reproduction occurs in Minnesota. Based on 6 years of telemetry studies, an estimated 40 to 50 kittens were born to 33 radiocollared females. Only a few kittens survived past 2 years of age. Human factors have led to nearly all deaths, while starvation has been less important. These data suggest that lynx populations in Minnesota are influenced by lynx population dynamics in Ontario, Canada (Moen 2009).

6.1.1.8 Interspecific Relationships with other Carnivores

Buskirk et al. (2000b) described the two major competition impacts to lynx as exploitation (competition for food) and interference (avoidance). Of several predators examined (birds of prey, coyote, gray wolf, mountain lion, bobcat, and wolverine), it was deemed that coyotes were the most likely to pose local or regionally important exploitation impacts to lynx, and coyotes and bobcats were deemed to possibly impart important interference competition effects on lynx. Mountain lions were described as interference competitors, possibly impacting lynx during summer and in areas lacking deep snow in winter, or when high elevation snow packs develop crust in the spring.

In southern portions of snowshoe hare range, predators may limit snowshoe hare populations to lower densities than in the taiga (Dolbeer and Clark 1975, Wolff 1980, Koehler and Aubry 1994). Exploitation competition may contribute to lynx starvation and reduced recruitment. During periods of low snowshoe hare numbers, starvation accounted for up to two-thirds of all natural lynx deaths in the Northwest Territories of Canada (Poole 1994).

Parker et al. (1983) discussed anecdotal evidence of competition between bobcats and lynx. On Cape Breton Island, Nova Scotia, lynx were found to be common over much of the island prior to bobcat colonization. Concurrent with the colonization of the island by bobcats, lynx densities declined and their presence on the island became restricted to the highlands, the one area where bobcats did not become established.

Predation on adult lynx has rarely been observed and recorded in the literature. Predators of lynx include mountain lion, coyote, wolverine, wolf, and other lynx. The magnitude or importance of predation on lynx is unknown.

6.1.1.9 Behavioral Response to Humans

Staples (1995) described lynx as being generally tolerant of humans. Other anecdotal reports also suggest that lynx are not displaced by human presence, including moderate levels of snowmobile traffic (Mowat et al. 2000) and ski area activities (Roe et al. 1999).

In a lightly roaded study area in northcentral Washington, logging roads did not appear to affect habitat use by lynx (McKelvey et al. 2000c). In contrast, six lynx in the southern Canadian Rocky Mountains crossed highways within their home ranges less than would be expected (Apps 2000). The latter study area contained industrial road networks, twin-tracked railway, and 2 to 4-lane highways with average daily traffic volumes of about 1,000 to 8,000 vehicles per day.

6.1.1.10 Habitat Requirements

To understand habitat relationships of lynx one must first understand the habitat relationships of snowshoe hares. Generally, lynx hunt within habitats where snowshoe hare are common or abundant. An essential aspect of habitat is dense coniferous or mixed coniferous/deciduous forest cover that provides security for snowshoe hares. Snowshoe hares have evolved to survive in areas that have deep snow and use black spruce and balsam fir forests with dense understory vegetation that provide forage, cover to escape from predators, and protection during extreme weather (Wolfe et al. 1982, Monthey 1986, Hodges 2000a, b). Generally, earlier succession (younger) forest stages have greater understory structure than do mature forests and, therefore, support higher snowshoe hare densities (Fuller 1999, Hodges 2000a, b). The branches of trees in mature forests also capture more snow than younger forests, resulting in shallower snow in mature and younger forests (ENSR 2005).

Most lynx snowshoe hare kills occur in habitat where young or immature timber is prevalent and where a significant acreage of this habitat type is available. Lynx also hunt snowshoe hares in high stem density deciduous cover, such as speckled alder in riparian areas, and Canada bluejoint, willow, and bog birch in creek bottoms.

Communities used most often by lynx are young jack pine/balsam fir forests. Balsam fir often occurs as inclusions or “pockets” of regenerating trees within other cover types (e.g., in mature jack pine stands or in maturing black spruce/trembling aspen stands), and along forest edges. Lynx also use coniferous or mixed coniferous/deciduous forest patches in regenerating logged areas, including 10- to 25-year-old stands of jack pine or balsam fir/trembling aspen mixed coniferous/deciduous forest. Other important habitat types include black spruce/balsam fir and black spruce/tamarack forests.

Communities used by lynx often originate as a result of natural or “facilitated” regeneration after logging. However, fire and spruce budworm outbreaks also play a role in influencing forest stand composition and age in sites used by lynx. It generally takes 12 to 30 years after a forest thinning or fire before conditions become suitable for snowshoe hare, as forests mature from the young to the immature stage.

Lynx use coniferous forest plantations, especially where large stands of plantation forest occur in proximity to each other. Lynx use white spruce, jack pine, eastern white pine, red pine, and mixed coniferous/deciduous plantations, especially forests ranging from 10 to 30 years in age. Recent studies of snowshoe hare and red squirrel pellet density suggest that snowshoe hare and squirrel numbers are greatest in jack pine, red pine, black spruce, and mixed immature/mature and mature coniferous/deciduous forests; presumably, lynx would be more common in these habitats (Moen et al. 2004). Lynx in Minnesota have been observed hunting snowshoe hare in dense stands of young and mid-sized immature forest, especially balsam fir, black spruce, and jack pine forests. They have been reported avoiding lowland coniferous habitats, while favoring forest edges (Burdett 2007).

6.1.1.11 Diet

Snowshoe hares are the primary prey to lynx, comprising 35 to 97% of the diet throughout the range of the lynx (Koehler and Aubry 1994). Other prey species include red squirrel, several species of grouse, northern flying squirrel, ground squirrel, porcupine, beaver, mice, voles, shrews, fish, and ungulates as carrion or occasionally as prey (Saunders 1963, van Zyll de Jong 1966, Nellis et al. 1972, Brand et al. 1976, Brand and Keith 1979, Koehler 1990, Staples 1995, O'Donoghue et al. 1998b).

Several studies have shown that the importance of other prey species, especially red squirrel, increases in the diet during periods when snowshoe hares become scarce (Brand et al. 1976, O'Donoghue et al. 1998b, Apps 2000, Mowat et al. 2000). Recent research in northeastern Minnesota and northwestern Montana (Burdett 2007, Hanson and Moen 2008, Squires and Ruggerio 2007), however, concluded that red squirrel contributed little to the lynx diet and that lynx made little use of alternative prey species.

Hanson and Moen (2008) investigated the winter diet of lynx in northern Minnesota based on prey remains in lynx scat. Snowshoe hare remains were present in 76% of scats. Hair of white-tailed deer was found in scat, but white-tailed deer remains were used as bait to lure lynx to traps for a radiotelemetry study, and the authors felt that if scat with white-tailed deer hair were eliminated, snowshoe hare remains were found in 97% of scats. The study indicated that alternative prey are an insignificant component of Minnesota lynx diets in winter. No red squirrel remains were found in the analysis.

Most research has focused on the winter diet. Summer diets are poorly understood throughout the range of lynx. Mowat et al. (2000) reported that summer diets consist of less snowshoe hare and more alternate prey species than winter diets.

6.1.1.12 Den Site Selection

Lynx den sites are found where coarse woody debris, such as downed logs and wind-throw, provides denning sites with security and thermal cover for lynx kittens (McCord and Cardoza 1982, Koehler 1990, Koehler and Brittell 1990, Slough 1999, Squires and Laurion 2000). The integral component for all lynx den sites appears to be the amount of downed woody debris present rather than the age of the forest stand (Mowat et al. 2000, Moen and Burdett 2009). In Washington, lynx denned in immature lodgepole pine, black spruce, and subalpine fir forests older than 200 years with an abundance of downed woody debris (Koehler 1990). A den site in Wyoming was located in a mature subalpine fir/immature lodgepole pine forest with abundant downed logs and dense understory (Squires and Laurion 2000).

Based on radiotelemetry studies in Minnesota, most lynx dens are found in tree wind-throw areas with dense vertical and horizontal cover. Dens were often located in an area with foraging habitat and denning cover, and often in small patches of upland within a larger wetland. These are often areas where wind-throw occurs (Moen and Burdett 2009).

Female lynx appear to use a habitat mosaic that includes both foraging habitat and cover for denning. Den sites were often associated with wetland areas where dens were on small patches of upland surrounded by wetter low-lying areas (Moen et al. 2008). Moen and Burdett (2009) speculated that shallow soils in the low-lying areas may increase the chance that wind-throw would occur and provide suitable denning cover. Lynx appear to be adaptable in the selection of habitats to den in, but select specific types of areas based on the prevalence of wind-throw.

Moen et al. (2008) found that all den sites were associated with a downed tree, with disturbance area varying from about 50 square feet to greater than 2.5 acres. They also found that lynx den sites consistently had lower tree stem density than the surrounding area, with greater than 80% of tree stems being coniferous species. Lowland and upland coniferous forest cover types made up greater than 70% of the area within 330 feet of den sites and the percentage of those cover types decreased with greater distance from the den sites. These findings suggest that suitable denning habitat includes both upland and lowland forest 60 to 80 years old or greater depending on forest type (USDA Forest Service 2011b).

Moen et al. (2008), using denning habitat data, developed a model to estimate the spatial distribution of suitable denning habitat in northeastern Minnesota. This model has estimated that about 25% of the landscape in northeastern Minnesota consists of suitable lynx denning habitat. This suggests that lynx denning habitat is abundant and well-distributed in northeastern Minnesota and on the Superior National Forest.

6.1.1.13 Range of Lynx within the Contiguous United States

Within the contiguous U.S., the lynx's range coincides with that of the southern margins of the boreal forest along the Appalachian Mountains in the Northeast, the western Great Lakes, and the Rocky Mountains and Cascade Mountains in the West (**Figure 15**). In these areas, the boreal forest is at its southern limits, becoming naturally fragmented into patches of varying size as it transitions into subalpine forest in the West and deciduous temperate forest in the East (Agee 2000). Because the boreal forest transitions into other forest types to the south, scientists have difficulty mapping its exact boundaries (Elliot-Fisk 1988). Precisely identifying and describing the distribution of lynx habitat also is difficult because there are several vegetation and landform classifications and descriptions that have been published for various parts of North America (USDA Forest Service and Bureau of Land Management 1999). However, the term ‘‘boreal forest’’ broadly encompasses most of the vegetative descriptions of this transitional forest type that makes up lynx habitat in the contiguous U.S. (Agee 2000).

In addition to appropriate vegetation type, delineation of the range of the lynx within the contiguous U.S. must consider snow conditions. Lynx are at a competitive advantage over other carnivores (e.g., bobcats or coyote) in areas that have cold winters with deep snow because of their morphological adaptations for hunting and surviving in such environments. Therefore, lynx populations may not be able to successfully compete and persist in areas with insufficient snow even if suitable forest conditions otherwise appear to be present (Ruediger et al. 2000, Ruggiero et al. 2000b, Hoving 2001). A consistent winter presence of bobcats indicates an area that is not of high quality for lynx.

Lynx in the contiguous U.S. are part of a larger metapopulation whose center is located in the northern boreal forest of central Canada; lynx populations emanate from this area (Buskirk et al. 2000, McKelvey 2000a, b). When there is a high in the lynx population in central Canada, it acts like a wave radiating out to the margins of the lynx range. The magnitude of the lynx population high emanating from the central Canadian boreal forest varies for each cycle. This wave can be produced by local populations reacting to environmental conditions, dispersers, or a combination of these (McKelvey et al. 2000a, b).

An example of the cyclic population ‘‘wave’’ occurred in the 1960s and 1970s, when numerous lynx were reported in the contiguous U.S. far from source populations. These records of dispersing lynx correlate to unprecedented cyclic lynx highs in Canada (Adams 1963, Mech 1973, Gunderson 1978, Thiel 1987, McKelvey et al. 2000a, Mowat et al. 2000). These dispersers frequently were documented in areas, such as Wisconsin, that are close to source populations of lynx in Canada or possibly northeastern Minnesota and that contain some boreal forest. But there also have been a number of occurrences of dispersers in unsuitable habitats far from source populations, such as the North Dakota prairie (Adams 1963, Gunderson 1978, Thiel 1987, McKelvey et al. 2000a).

Lynx populations in the northeastern U.S. and southeastern Canada are separated from those in northcentral Canada by the St. Lawrence River. There is little evidence of regular snowshoe hare or lynx population cycles in this area (Hoving 2001), but wide fluctuations in lynx and snowshoe hare populations do occur. On a smaller scale, fluctuating populations in the core of this area (Quebec's Gaspé Peninsula, western New Brunswick, and northern Maine) can potentially influence lynx distribution up to several hundred miles distant.

Lynx dispersing during periods of population highs will occupy many patches of boreal habitat at the periphery of their range. Some patches will be suitable to maintain a long-term population and some will not. Where the boreal forest habitat patches within the contiguous U.S. are large, with suitable habitat, prey, and snow conditions, resident populations of lynx are able to survive throughout the low period of the approximately 10-year cycle. Most likely the influx of lynx from populations in Canada at the high point of the cycle augments these resident populations. It is likely that some of these habitat patches within the contiguous U.S. are able to act as sources of lynx (where recruitment is greater than mortality) that are able to disperse and potentially colonize other patches (McKelvey et al. 2000b).

In other areas, few lynx may remain after a cyclic population high, or the habitat may be naturally marginal, so they are not able to persist or establish local populations, although some reproduction may occur. Such areas naturally act as population sinks (McKelvey et al. 2000b). Sink habitats are most likely those places on the periphery of the southern boreal forest where habitat naturally becomes patchier and more distant from larger lynx populations. Lynx found in these sink habitats are considered dispersers, but are usually included within the species range. Changes in the habitat conditions or cyclic fluctuations in the prey populations may cause some habitat patches to change from being sinks to sources and vice versa. Through this natural process, local lynx populations in the contiguous U.S. may ''blink'' in and out as the metapopulation goes through the 10-year cycle. Where habitat is of high enough quality and quantity, resident lynx populations are able to become established or existing populations are augmented, aiding in their long-term persistence.

Some maps (e.g., Hall and Kelson 1959) incorrectly portray the range of the lynx by encompassing peripheral records from areas that are not within boreal forest or do not have cold winters with deep snow, such as prairie or deciduous forest. Such maps have led to a misperception that the historic range of the lynx in the contiguous U.S. was once much more extensive than ecologically possible. Records of lynx outside of the southern boreal forest in peripheral habitats that are unable to support lynx represent long-distance dispersers that are lost from the metapopulation unless they return to the boreal forest and contribute to the persistence of a population. These unpredictable and temporary occurrences are not included within either the historic or current range of lynx because they are well outside of lynx habitat. This includes records from Connecticut, Indiana, Iowa, Massachusetts, Nebraska, Nevada, North Dakota, Ohio, Pennsylvania, South Dakota, and Virginia (Hall and Kelson 1959, Burt 1954 *as cited in* Brocke 1982, Gunderson 1978, McKelvey et al. 2000a). States that support some boreal forest and have frequent records of lynx are assumed to be the historic and current species range; these states include Colorado, Idaho, Maine, Michigan, Minnesota, Montana, New Hampshire, New York, Oregon, Utah, Vermont, Washington, Wisconsin, and Wyoming.

6.1.1.14 Range of Lynx within Great Lakes Geographic Region

Lynx are found within several geographic areas within the U.S.—the Cascade Mountains Geographic Area, Northern Rocky Mountains Geographic Area, Southern Rocky Mountains Geographic Area, Great Lakes Geographic Area, and Northeast Geographic Area. These geographic areas are separated from each other by expanses of unsuitable habitats that limit or preclude lynx movement, except the Northern Rockies and Cascades (USDOI USFWS 2000a).

Canada lynx in northern Minnesota are found within the Great Lakes Geographic Area. The Great Lakes Geographic Area encompasses northeastern and northcentral Minnesota, northern Wisconsin, Michigan's Upper Peninsula, and northern portions of Michigan. The majority of lynx occurrence records in the Great Lakes Geographic Area are associated with the mixed coniferous/deciduous habitat type (McKelvey et al. 2000a). Within this general forest type, the highest frequency of lynx occurrences have been in white spruce, balsam fir, jack pine, white pine, red pine, black spruce, and mixed black spruce/tamarack forest types. These forest types are found primarily in northern Minnesota, northern Wisconsin, and Michigan's Upper Peninsula.

About 4.5 million of the 6 million acres of Forest Service-administered lands in the Great Lakes Geographic Area are mapped as primary lynx habitat. These lands comprise about 19% of all lynx habitat within the Great Lakes Geographic Area. About 2 million acres are included within non-developmental land allocations where natural processes are expected to predominate. Private lands account for about 81% of the lynx habitat within the Great Lakes Geographic Area.

Although the mixed coniferous/deciduous forest covers an extensive area in the Great Lakes Region, much of this area may be marginal habitat for lynx because it is a transitional forest type at the edge of the snowshoe hare range. Habitat at the edge of hare range supports lower hare densities that may not be sufficient to support lynx reproduction (Buehler and Keith 1982). Furthermore, appropriate habitat with snow depths that allow lynx a competitive advantage over other carnivores (e.g., coyotes) occur only in limited areas in northeastern Minnesota, extreme northern Wisconsin, and Michigan's Upper Peninsula.

The historic status of lynx in the Great Lakes Region is uncertain. Minnesota has a substantial number of lynx reports (McKelvey et al. 2000a), which is expected because of the connectivity of the boreal forest with that of Ontario, Canada, where lynx occur. As noted earlier, lynx regularly travel between Minnesota and Ontario, Canada (Moen 2009, Moen et al. 2010). Wisconsin and Michigan have substantially fewer records of lynx. Researchers have debated whether lynx in this region are simply dispersing individuals emigrating from Canada, are members of a resident population, or are a combination of a resident population and dispersing individuals. Recent research efforts in Minnesota have confirmed a reproducing population of lynx. Reproduction has been documented in all years since 2001. However, there are a few records of lynx occurrence in Michigan and Wisconsin during this same period.

6.1.1.15 Range of Lynx in Minnesota

The majority of lynx occurrence records are from the northeastern portion of Minnesota; however, dispersing lynx have been found throughout Minnesota outside of typical lynx habitat (Gunderson 1978, Mech 1980, McKelvey et al. 2000a). In northeastern Minnesota, where deep snow accumulates, suitable lynx and snowshoe hare habitat is present. Much of this area is protected as designated wilderness, including the BWCAW. Furthermore, these habitats are contiguous with the boreal forest in southern Ontario. Until 1965, lynx had a bounty placed on them in Minnesota. In 1976, the lynx was classified as a game species, and harvest seasons were established (DonCarlos 1994). Harvest and bounty records for Minnesota are available for 1930 to 1984. Approximate 10-year cycles are apparent in the data, with highs in the lynx cycle in 1940, 1952, 1962, and 1973 (Henderson 1978, McKelvey et al. 2000a). During a 47-year period (1930–1976), the Minnesota lynx harvest was substantial, up to 400 lynx in a year (Henderson 1978). These harvest returns for Minnesota are believed to be influenced by influxes of lynx from Canada, particularly in the 1960s and 1970s (Henderson 1978, Mech 1980, DonCarlos 1994, McKelvey et al. 2000a). When an anticipated lynx cyclic high for the early 1980s did not occur, the harvest season was closed in 1984 (DonCarlos 1994) and remains closed today.

Reproduction and maintenance of home ranges by lynx in Minnesota were documented in the early 1970s (Mech 1973, 1980), which may be evidence of a resident population (but see Section 6.1.1.7; Recruitment). The early 1970s were a period when the second highest lynx harvest returns in the 20th century occurred throughout Canada. The high numbers of lynx trapped in Minnesota during this period likely included immigrants from Canada (McKelvey et al. 2000b). Lynx were consistently trapped over 40 years during cyclic lows, which may indicate that a small resident population occurred historically.

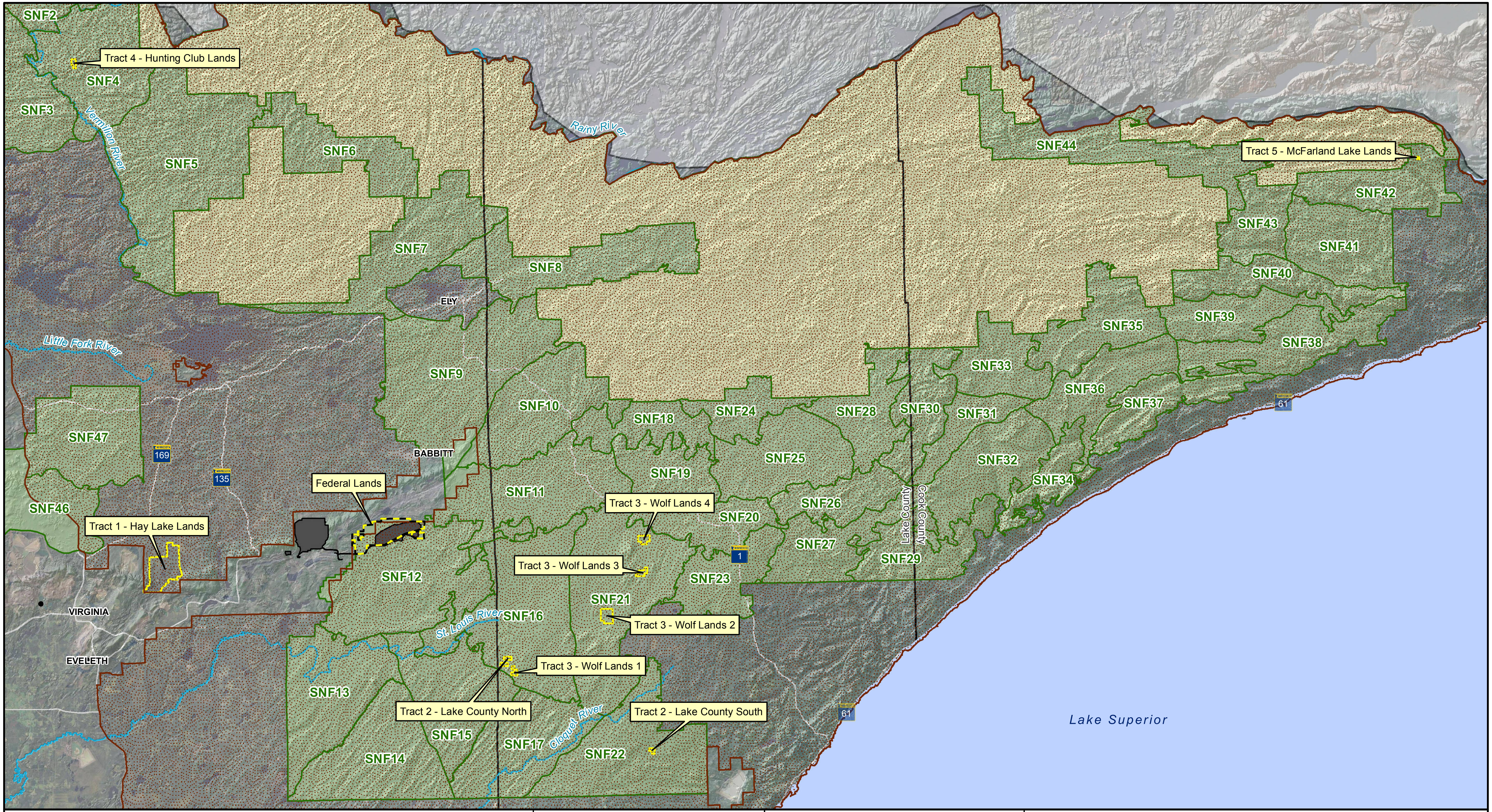
Lynx Analysis Units

The Superior National Forest first established Lynx Analysis Units (LAUs) in 2000 to map lynx habitats in the Superior National Forest using the criteria and procedures developed by the Lynx Science Team and Steering Committee (USDA Forest Service 2000b). Lynx Analysis Units are described in the Lynx Conservation Strategy and Assessment (Ruediger et al. 2000) as the smallest landscape-scale analysis units used to determine direct, indirect, and cumulative effects for lynx. Lynx Analysis Units may contain habitat that may or may not provide habitat or environmental conditions necessary to support lynx reproduction and survival. Lynx habitat outside LAUs exists because those areas did not contain sufficient habitat conditions to be viable LAUs (USDA Forest Service 2000b, 2004b).

In 2004, the LAUs were revised (USDA Forest Service 2004b, c, d) to add new LAUs, refine boundaries of some LAUs, and designate the BWCAW as a refugium for lynx.

The federal lands are in LAU Superior National Forest (SNF) 12. This LAU is 70,980 acres, of which 49,409 acres are on Forest Service-administered lands (Ryan 2013a). Under the proposed land exchange, there would be a loss of 6,495 acres under Forest Service administration within this LAU after transfer of the federal lands from the Forest Service to PolyMet, a 13% reduction in acreage administered by the Forest Service within LAU SNF 12. Under the land exchange, the non-federal lands, except Hay Lake Lands, would be incorporated into LAUs SNF 4, 16, 21, and 42, increasing the acreage of these LAUs administered by the Forest Service by approximately 2,149 acres (**Figure 16**). There is no LAU associated with Hay Lake Lands.

Table 5 shows the total acres of suitable and unsuitable lynx habitat in each LAU. After the land exchange, there would be a net decrease of about 1,719 acres of suitable lynx habitat within LAU SNF 12 due to the effects of the Project, or about a 2% decrease of suitable lynx habitat within the LAU. After reclamation, about 397 acres could provide suitable habitat for lynx in the future; however, due to the successional process, it could be 10 or more years after mining before revegetation results in much suitable habitat for lynx. Under the land exchange, there would be a loss of about 6,495 acres of suitable lynx habitat under Forest Service administration within LAU SNF 12, but a gain of 2,134 acres on other LAUs, for an overall loss of 4,361 acres under Forest Service administration within LAUs (MDNR et al. 2013, Ryan 2013a). However, the Forest Service would gain about 4,675 acres of suitable lynx habitat on Hay Lake Lands, although this acreage is not associated with an



Federal Lands
Non-federal Lands
Project Areas
Lynx Analysis Unit (LAU)
Superior National Forest LAUs
Boundary Waters LAUs
Critical Habitat - Lynx
Major River

US Army Corps of Engineers
St. Paul District

0 2.5 5 10 Miles

Figure 16
Lynx Analysis Units
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

Table 5
Suitable and Unsuitable Lynx Habitat within Lynx Analysis Units (for acreage under all ownerships within the LAU/for acreage administered by the Forest Service within the LAU) before and after the Project for the Federal and Non-federal Lands

Lynx Analysis Unit	Lands	Suitable Lynx Habitat before Land Exchange/Project	Unsuitable Lynx Habitat before Land Exchange/Project	Total Suitable Lynx Habitat after Land Exchange/Project[1]
SNF 12	Federal Lands	69,131/47,908	2,737/31	67,412/41,413
SNF 4	Hunting Club	49,994/28,903	2,470/1,289	49,994/29,054
SNF 16	Lake County North and Wolf Lands 1	70,743/29,316	3,127/350	70,743/29,705
SNF 21	Wolf Lands 2, 3, and 4	69,632/32,984	2,931/272	69,632/34,434
SNF 22	Lake County South	57,107/40,217	913/344	57,107/40,330
SNF 42	McFarland Lake	27,775/19,609	534/13	27,775/19,640
NA	Hay Lake	NA	NA	4,675[2]
Net Gain (Loss) to Federal Estate within LAUs				(4,361)[3]
Net Gain (Loss) to Federal Estate for all exchange lands				314

[1]Acreage may differ slightly from acreage given in FEIS due to rounding.
[2]Gain in acreage in LAUs to Forest Service from land exchange; Hay Lake Lands are not within an LAU.
[3]Value differs from sum of acres due to rounding.
NA = Hay Lake Lands not within an LAU.
Total acreage within the LAU for all land ownerships —LAU SNF 4 = 55,071 acres, SNF 12 = 70,980 acres, SNF 16 = 76,108 acres, SNF 21 = 73,266 acres, SNF 22 = 58,154 acres, and SNF 42 = 32,305 acres; total acreage for lands administered by the Superior National Forest —LAU SNF 4 = 33,321 acres, SNF 12 = 49,409 acres, SNF 16 = 33,679 acres, SNF 21 = 36,082 acres, SNF 22 = 41,210 acres, and SNF 42 = 24,687 acres.
Sources: MDNR et al. (2013), Ryan (2013a).

LAU, resulting in an overall gain of 314 acres of suitable lynx habitat under Forest Service Administration after the land exchange.

Boundary Water Canoe Area Wilderness

The BWCAW serves as an important habitat refugium in northeastern Minnesota that connects with lynx habitat in Ontario, Canada. Moen et al. (2010) found that many lynx in the Superior National Forest portion of northern Minnesota travel through the BWCAW to and from Ontario, Canada. The quality, quantity, and distribution of lynx habitat in the BWCAW is primarily influenced by natural disturbance events and natural succession, although some prescribed fire management activities have occurred within the BWCAW (USDA Forest Service 2004b).

The BWCAW provides large amounts of lynx habitat, including about 755,000 acres of suitable lynx habitat, 667,000 acres of snowshoe hare habitat, and 481,000 acres of lynx denning habitat (USDA Forest Service 2011b:Table 15). The BWCAW is not managed using the LAU approach, and LAU management direction does not apply to the BWCAW. The 2004 Forest Plan BA concluded that the BWCAW refugium met the direction for minimum habitat conditions established for LAUs (USDA Forest Service 200b).

6.1.1.16 Observations of Lynx in the Vicinity of the Project

Minnesota Department of Natural Resources Lynx Database

Of 426 reports from March 2000 to November 2006 in the MDNR lynx sightings database, 323 (76%) of lynx sightings occurred in St. Louis (113 sightings), Cook (109 sightings), and Lake (101 sightings) Counties (**Figure 17**; MDNR 2007). Most sightings are incidental encounters, and as such, tend to be clustered along roads and other places frequented by observant and interested people. Thus, while these reports tell us something about where lynx are, they provide no information about where lynx do not occur. Similarly, we cannot know the relationship between the number of reports and the number of lynx in Minnesota at the time of the reports.

A review of the database revealed that a probable lynx sighting was made by a trained biologist in Section 13 of Township 59 North, Range 16 West, east of Hay Lake Lands, in October 2003. Another lynx sighting was made 1 mile to the west of Hay Lake Lands the same year. Unverified lynx sightings were made in December 2002 and January 2003 in Sections 22 and 27 of Township 64 North, Range 3 West, south of McFarland Lake Lands. There were no records of lynx within 6 miles of the other federal and non-federal lands or Wetland Mitigation Sites.

The relatively high proportion of lynx detected in northeastern Minnesota reflects, in part, the disproportionate survey effort that has occurred within this region as compared to other regions of the state that likely harbor lynx, and the number of lynx sightings may not be representative of the availability of suitable habitat or relative numbers of lynx.

Superior National Forest Genetic Reference Collection

The Superior National Forest's genetic reference collection has 128 DNA sample collection points that have occurred within 6 miles of the Project since February 2004 (**Table 6**; Ryan 2013b). Lynx DNA have also been collected within 6 miles of the federal lands and all of the non-federal lands, except Hunting Club and McFarland Lake Lands; lynx DNA has been found within 10 miles of Hunting Club Lands and McFarland Lake Lands. Lynx DNA has been collected within 10 miles of the Hinckley Wetland Mitigation Site, but not within 10 miles of the other Wetland Mitigation Sites.

Natural Resources Research Institute Radio Telemetry Studies

Since 2003, the NRRI (2012) has captured and radiocollared and tracked 36 lynx in northeastern Minnesota. Four NRRI radiocollared study animals that were not identified in Superior National Forest's reference collection have been recorded within 6 miles of the Project.

Field Surveys

Several surveys have been conducted on and near the Project to determine lynx use based on tracks and scat. The Project lynx survey was conducted during January through March 2006 (ENSR 2006). Tracks and scat of three female lynx were identified during the survey within the study area, concentrated in areas approximately 5 miles east and south of the Mine Site; a fourth female was found adjacent to the study area (**Figure 18**). Lynx sign was most common in dense coniferous forests of balsam fir and jack pine. No evidence of lynx was found on the federal lands or Project areas.

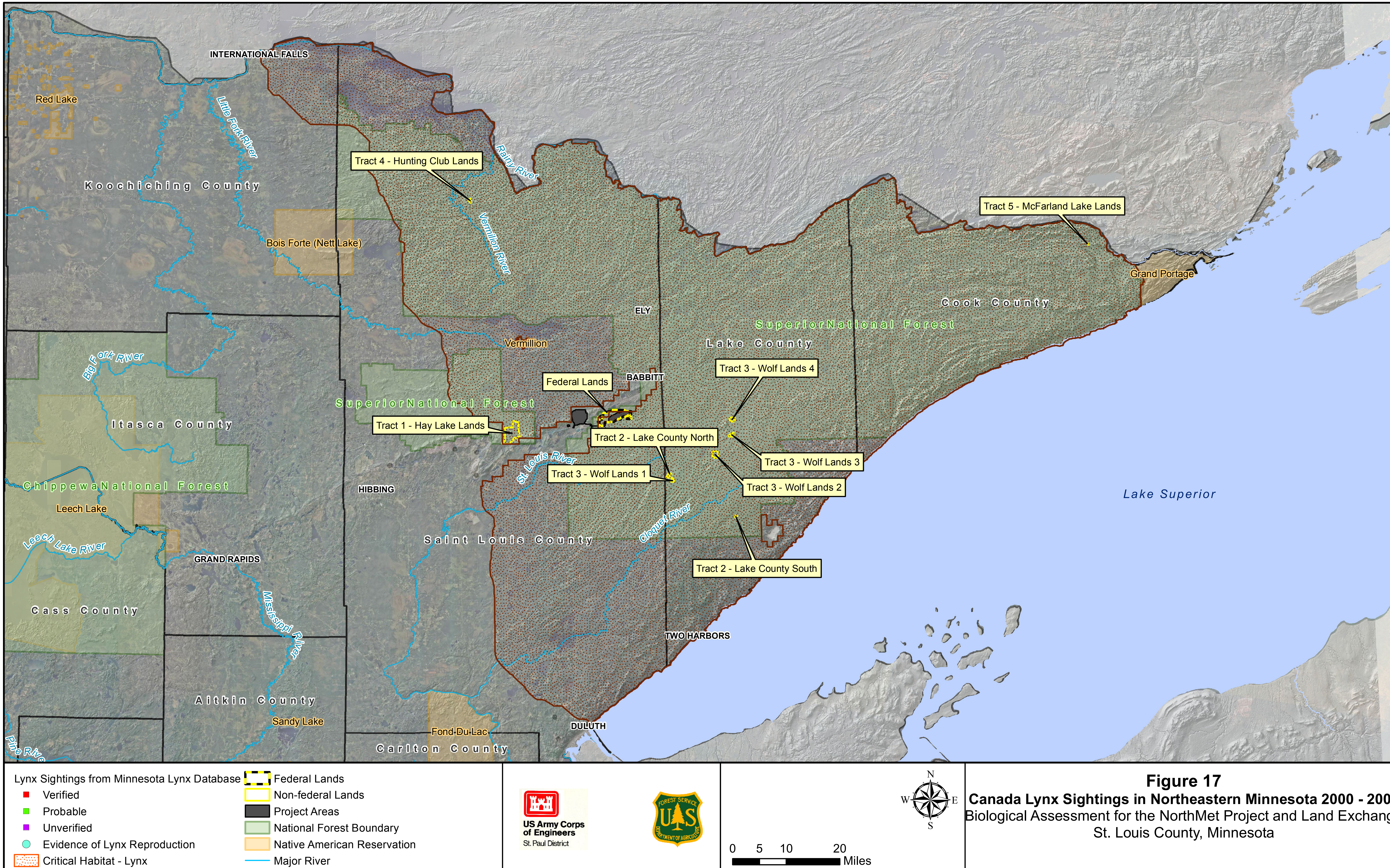
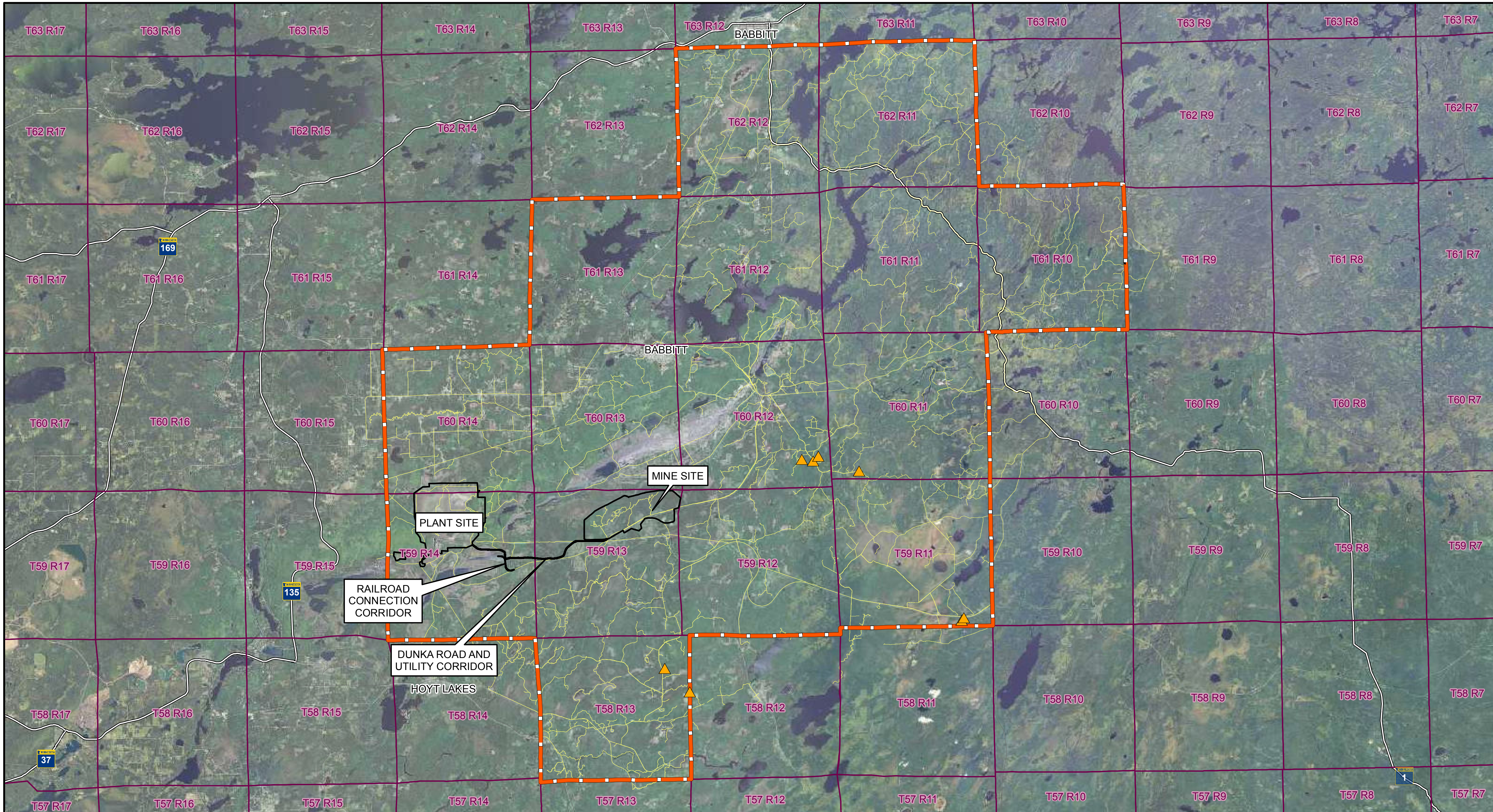


Figure 17

Canada Lynx Sightings in Northeastern Minnesota 2000 - 2006

Biological Assessment for the NorthMet Project and Land Exchange

St. Louis County, Minnesota



Unique Individual Lynx
Lynx Survey Routes
Townships Surveyed For Lynx 2005-2008
Project Areas
Township Lines

US Army Corps of Engineers
St. Paul District

0 1 2 4 Miles

N S E W

Figure 18
Lynx Survey Routes and Lynx Observations Near Project Areas
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

No lynx or their sign were seen on the federal and non-federal lands during wildlife surveys in 2000, 2004, 2008, 2009, and 2010 (ENSR 2000, 2005, AECOM 2009b, 2011a, b, c). However, Forest Service biologists did observe lynx tracks at the proposed Mine Site during a site visit in February 2010 (Ryan 2013c).

Table 6
Superior National Forest Genetic Reference Collection Records

Lands	**Lynx DNA Occurrences Distance from Site**	
	6 Miles	**10 Miles**
Project Areas[1]	128	144
Federal Lands	130	142
Non-federal Lands		
Hay Lake	9	27
Lake County	83	673
Wolf Lands	523	852
Hunting Club	0	2
McFarland Lake	0	1
Wetland Mitigation Sites		
Aitkin	0	0
Hinckley	0	1
Zim	0	0

[1]Some of the Project areas are within the federal lands.
Source: Ryan (2013b).

Tracking surveys for lynx were also conducted east of the federal lands. Several lynx were found during the study, based on DNA analysis of scat samples and track locations (Barr 2011). Open bog and stunted black spruce forest and jack pine and eastern white cedar cover provided habitat for snowshoe hare and lynx.

Habitat suitability for lynx and snowshoe hare was determined by the Forest Service for Superior National Forest lands within LAUs. This information is used in this BA to evaluate habitat suitability and impacts to lynx and snowshoe hare habitats from activities on the federal lands.

6.1.2 Analysis of Direct and Indirect Effects to Lynx and Its Critical Habitat

6.1.2.1 Effects to Canada Lynx within the Action Area

The USFWS concluded in the *Endangered and Threatened Wildlife and Plants: Determination of Threatened Status for the Contiguous U.S. Distinct Population Segment of the Canada Lynx and Related Rule; Final Rule* (USDOI USFWS 2000a) that the single biggest factor threatening the lynx in the contiguous U.S. is the inadequacy of existing regulatory mechanisms, specifically the lack of guidance for conservation of the lynx in National Forest and other resource management plans. In addition, the USFWS noted that timber harvest and fire suppression impact lynx in the Great Lakes Geographic Area.

Lands under federal management are necessary to lynx conservation regionally and nationally, as federal lands often provide large amounts of forested habitat needed by lynx and snowshoe hare. Large tracts of National Forest lands are found to the east of the Project. Most of the lands not associated with Mesabi Iron Range mining and related activities are forests. These forestlands could provide important habitat for lynx that use the Project area, and for movement of lynx between the Project area and areas with higher densities of lynx to the northeast.

The Project is within the Superior National Forest and the lynx critical habitat includes the Project area. These forestlands, as well as nearby private forestlands, provide important habitat for lynx that use the Project area, and for movement of lynx between the Project area and areas with higher lynx densities to the northeast of the Project area.

Other Lynx Risk Factors

The *Lynx Conservation Assessment and Strategy* (Ruediger et al. 2000) identified several other risk factors for lynx in the contiguous U.S., which could also apply to lynx in or near the Project area. These factors are considered in the following section on the effects of the Project, and the cumulative effects of the Project and other projects within or near the study area, on lynx. These include (**bolded items** considered important in the Project area).

1. Factors Affecting Lynx Productivity
    a. **Timber management**
    b. **Wildland fire management**
    c. **Recreation**
    d. **Forest/backcountry roads and trails**
    e. Livestock grazing
    f. **Other human developments (mining, power generation, etc.)**

2. Factors Affecting Lynx Mortality
    a. **Trapping**
    b. Predator control
    c. **Incidental or illegal shooting**
    d. **Competition and predation as influenced by human activities**
    e. **Highways (vehicular collisions)**

3. Factors Affecting Lynx Movements
    a. **Highways, roads, and rights-of-ways**
    b. **Land ownership patterns**
    c. Ski areas and large resorts

4. Other Large-scale Risk Factors
    a. **Fragmentation and degradation of lynx refugia**
    b. Lynx movement and dispersal across shrub-steppe habitats
    c. Habitat degradation by non-native invasive plant species

The Project would result in both beneficial and adverse direct and indirect impacts to factors of importance to lynx. This section summarizes effects associated with the lynx risk factors 1 to 3 affected by the Project. The effects of past, present, and future activities on risks to lynx, and issues associated with lynx risk factor 4, are discussed in Section 6.1.4.

Factors Affecting Lynx Productivity

Timber, Wildland Fire, and other Habitat Management

Direct and Indirect Effects

Direct and indirect effects to lynx from timber and other habitat management, and wildland fire, were assessed based on information collected during lynx tracking and radiocollar studies and wildlife habitat surveys on and near the federal and non-federal lands, and from lynx and snowshoe hare habitat assessments conducted on LAUs.

Timber and other Habitat Management

Mine Site

The Forest Service manages the federal lands as a General Forest and General Forest – Longer Rotation Management Area. The General Forest - Longer Rotation Management Area emphasizes land and resource conditions that provide a wide variety of goods, uses, and services. These include wood products, other commercial products, scenic quality, developed and dispersed recreation opportunities, and habitat for a diversity of terrestrial and aquatic wildlife and fish species (USDA Forest Service 2004a). The characteristics and use of the General Forest Management Area are similar to the General Forest – Longer Rotation Management Area, except that harvests are more frequent, more uniform in age, and more extensive. The General Forest Management Area has the highest amount of young forest and the largest sized timber harvest units.

The Forest Service identified vegetative cover, denning habitat, and prey habitat as important habitat elements for lynx (USDA Forest Service 2004b). Open water, highly disturbed, and forested areas less than 4 years (upland) or 9 years (lowland) old were considered unsuitable habitat for lynx. These are general guidelines, as lynx have been seen crossing frozen lakes and highly disturbed areas. For example, a lynx tracked about 5 miles northeast of the Mine Site used mine disturbance areas where shrubs, jack pine, trembling aspen, and paper birch had partially revegetated the landscape, providing habitat for snowshoe hare and ruffed grouse, especially where waste rock talus provided escape cover for snowshoe hares.

Based on Forest Service criteria and wildlife assessments done at the Mine Site, all of the Mine Site could provide suitable habitat for lynx. Most forests consisted of immature/mature-size trees, with tree cover near 80% in younger forests, and 40 to 50% in immature and mature forests. These stands would be favored by lynx for foraging, bedding, and traveling. Small patches of mature forest are found in the central and western portions of the Mine Site that could provide foraging, bedding, traveling, and denning habitat.

Habitat of lesser suitability is primarily limited to roads, railways, clearings, and recent clearcuts near the Dunka Road, and at other scattered locations on the Mine Site. Shrublands and young forests are associated with areas that had been recently logged. Scattered trees (trembling aspen, paper birch, jack pine, and black spruce) are occasionally found in these areas, but shrubs, including speckled alder, beaked hazel, blueberry, and raspberry may cover up to 80% or more of the landscape; percent vegetative cover is much less in more recently logged areas.

Denning habitat typically occurs in more mature forest stands, especially in areas with tree wind-throw, although lynx have been seen denning in immature forests (Moen et al. 2004, 2008, Moen et al. 2008)). There are about 5,393 acres of denning habitat on the federal lands; approximately 1,333 acres of denning habitat are found within the area that would be impacted by mining (MDNR et al. 2013). Most mature forest habitat was in the central and western portions of the Mine Site. The largest trees are up to about 16 inches dbh for both coniferous and deciduous trees. There is little wind-throw in these forests, but large snags (up to 16 inches dbh), stumps, and woody debris are common in mature forest stands and could provide denning habitat for lynx (ENSR 2000, 2005, AECOM 2011a).

About 397 acres of habitat lost to mining would be reclaimed after mine closure, but due to the successional process, it could be 10 or more years after mining before revegetation results in much suitable habitat for lynx. Based on the mine closure plan, most of the 397 acres of the habitat lost to mining that would be reclaimed would be reclaimed as grassland/herbaceous (54%), wetland and/or grassland/herbaceous (27%), and wetland (18%). The West Pit would not be reclaimed, but would remain as a 320-acre open pit lake (MDNR et al. 2013).

Studies of snowshoe hare and red squirrel pellet density suggest that snowshoe hare and red squirrel numbers are greatest in jack pine, red pine, black spruce, and mixed immature/mature forests; presumably, lynx would be more common in these habitats (Moen et al. 2004). Snowshoe hare were seen throughout the Mine Site, but were most common in young and immature coniferous forest dominated by jack pine. Although upland coniferous forests are dominated by jack pine, jack pine is especially abundant in the eastern portion of the Mine Site, as were snowshoe hare.

Three lynx were found within 6 miles of the Mine Site during lynx tracking surveys (ENSR 2006). Important habitat features used by lynx were identified during snow tracking. One lynx hunted snowshoe hares in mature jack pine where balsam fir inclusions in the understory were prevalent and provided dense cover, and in immature jack pine forest, often near lowland edges where balsam fir and other young and immature conifers provided relatively dense cover. This lynx also used lowland coniferous habitats. This lynx stalked three locations where white-tailed deer had bedded and investigated one site where grouse activity had occurred. It used an area where white-tailed deer activity was high, and also followed white-tailed deer trails and hunted snowshoe hare at this location. Two resting beds used by this lynx were found, one in mature jack pine and the other in a recent clearcut near a timbered edge.

A second lynx used mature black spruce swamp and hunted primarily in young and immature jack pine forest regenerating on sites that had been clearcut within 25 years. Snowshoe hare densities were abundant in a small stand of jack pine/balsam fir where the lynx hunted. Two resting beds, within 325 feet of each other, were found in this stand. The lynx pursued a white-tailed deer for a short distance and visited a site where humans had deposited venison trimmings. The lynx also investigated the empty snow roost of a grouse.

Federal Lands Surrounding the Mine Site

The federal lands surrounding the Mine Site would also be transferred to PolyMet under the Proposed Action. PolyMet could include some upland timber management that could enhance wildlife habitat.

Based on Forest Service criteria and wildlife assessments done for the federal lands, nearly all of this area could provide habitat for lynx and snowshoe hare. Forest vegetation dominates the federal lands (88%; **Figure 9; Table 7**). Most forest stands contain trees that are 12 inches dbh or less. Large stands of lowland black spruce with scattered northern white cedar and tamarack are found in low areas, while stands of immature and mature forest dominated by jack pine, and smaller patches of immature deciduous forest are found in upland areas.

The northern area of the federal lands includes a portion of One Hundred Mile Swamp. The swamp is comprised of some young, but mostly immature and mature black spruce, northern white cedar, and tamarack forests. Northern white cedar is prevalent in the northcentral portions of the northern area of the swamp, while black spruce and tamarack are more common in the remaining areas. Most of the forest stands are 90 years or older, with much of the remaining stands 70 to 90 years of age (USDA Forest Service 2000a). Because this area is very wet, it would probably provide little habitat for lynx and snowshoe hare, except perhaps during winter.

Approximately 3,161acres of immature and mature forest habitat are found on the federal lands surrounding the Mine Site. Large downed woody material was seen in these areas that could provide denning habitat for lynx, but there was little tree wind-throw observed on these lands, except along old logging roads in mature white cedar forests.

Transportation and Utility Corridors

Because of prior use during the former LTVSMC taconite mining operation, the Transportation and Utility Corridors are now defined as having a "disturbed" cover type. The remaining MDNR GAP land cover types that are not disturbed include cropland/grassland (8%), shrubland (6%), and smaller acreages of the remaining types. The corridors could be used by lynx for travel between more suitable habitat types.

Plant Site

Of the 2,189 acres that would be disturbed at the Plant Site, approximately 50% (1,103 acres) of the Plant Site is disturbed and supports little vegetation. The remaining areas consist of aquatic environments (26%), upland deciduous forest (13%), shrubland (7%), upland coniferous forest (2%), and lowland coniferous forest (1%; **Figure 10;** MDNR et al. 2013). Development of the Plant Site would have little impact on lynx habitat, as about 75% of the site has been disturbed by LTVSMC taconite mining operations or is aquatic habitat. The remaining habitat may be used by snowshoe hare and provide foraging habitat for lynx. Lynx could also use portions of the site for travel and bedding. Given the amount of existing land disturbance, and noise and other human disturbance that would be associated with Plant Site activities, it is unlikely that the Plant Site would be used by lynx during Plant operations, although the Plant Site could be used by lynx after reclamation.

Non-federal Lands

Under the Proposed Action, approximately 7,075 acres of non-federal lands would be transferred to the Forest Service. The Forest Service and MDNR cover type mapping and field and wildlife habitat surveys were conducted for these lands and give an indication of the suitability of these lands for lynx. Portions of the non-federal lands have been harvested during the past 20 years, with much of the harvest occurring on Lake County Lands North, Lake County Lands South, and Wolf Lands 2 and 3, as indicated by acres of grassland and shrubland habitats shown in **Table 7.** Snowshoe hare and lynx could use these areas, especially if these areas are in proximity to coniferous stands. About 267 acres consists of aquatic habitat, which would not be used by snowshoe hare, red squirrel, or lynx, except perhaps during winter.

Table 7
GAP Cover Type and MIH Habitat (acres) on Federal and Non-federal Lands[1]

Cover Type	Federal Lands	Non-federal Lands									Net Gain (Loss) to Forest Service after Land Exchange[1]
		Hay Lake	Hunting Club	Lake North	Lake South	McFarland Lake	Wolf Lands 1	Wolf Lands 2	Wolf Lands 3	Wolf Lands 4	
MDNR GAP Types											
Aquatic	60	251	10	2	4	0	0	0	0	0	207
Disturbed	64	0	0	0	0	0	0	0	0	0	(64)
Cropland/grassland	6	32	0	0	0	0	0	0	0	0	26
Shrubland	646	1,665	45	28	11	0	7	54	32	4	1,200
Lowland coniferous forest	2,979	1,524	9	133	53	0	75	586	184	357	(58)
Lowland deciduous forest	10	17	4	1	0	0	0	6	0	0	18
Upland coniferous forest	1,619	437	8	33	39	4	13	87	46	32	(920)
Upland deciduous forest	1,092	1,000	85	34	10	27	27	30	12	8	141
Upland mixed coniferous/deciduous forest	21	0	0	34	0	0	4	6	3	4	30
Management Indicator Habitat (MIH) and other Forest Service Habitat Types											
MIH 1	1,330	2,366	89	49	2	26	44	57	41	20	1,364
MIH 5	1,252	54	13	1	0	4	0	8	0	0	(1,172)
MIH 9	3,060	1,818	17	194	46	0	72	627	186	349	249
MIH 14	0	206	10	1	3	1	0	1	1	4	227
Lowland Shrub	492	113	27	21	6	0	10	76	49	31	(159)
Lowland Emergent	186	365	4	0	16	0	0	0	1	0	200
Upland Grass	0	0	0	0	43	0	0	0	0	0	43
MIH Age Class											
Young	271	534	27	24	43	0	2	8	130	10	507
Immature	1,539	3,260	33	75	1	0	76	69	22	5	2,001
Mature	3,854	460	60	145	48	30	38	615	75	354	(2,029)

[1]Acreages may differ slightly from acreages given in FEIS due to rounding.

The majority of habitat on the non-federal lands consists of immature and mature (age class) upland and lowland coniferous and deciduous forest totaling 5,365 acres (76%) that could be used by lynx and snowshoe hare (**Table 7**; MDNR et al. 2013). Mixed coniferous/deciduous forest and lowland shrub swamp and upland shrubland are also important habitat components that could be used by both snowshoe hare and lynx.

Wetland Mitigation Sites

Under the Proposed Action, approximately 2,169 acres of Wetland Mitigation Site lands would be purchased by PolyMet as compensatory mitigation for impacts to wetlands and other waters of the U.S. These lands are used for sod production, but under the Proposed Action would be restored to native wetland and upland vegetation. According to the Wetland Management Plan (Barr 2014d), approximately 1,603acres (this includes the preservation of 29 acres of coniferous bog) of wetland and 197 acres of upland would be restored/created at the off-site Wetland Mitigation Sites. These sites could provide habitat for lynx and snowshoe hare, but there have been no recent records of lynx in the immediate vicinity of these lands.

Wildland Fire Management

Fire, wind, insects, and disease historically played an important role in maintaining the mosaic of forest successional stages that provide habitat for both snowshoe hare and lynx (Bailey et al. 1986, Quinn and Thompson 1987, Koehler and Brittell 1990, Slough and Mowat 1996, Ruediger et al. 2000). For the first few years after a burn, there appears to be a negative correlation between lynx use and the amount of area burned. This short-term effect is likely due to the reduction of snowshoe hare populations, removal of cover, and possibly also to increased competition from coyotes in open habitats (Koehler and Brittell 1990). The lag time until the peak of snowshoe hare population increase is generally about 15 to 30 years (this varies depending on tree species, habitat type, and severity of disturbance). Re-sprouting of deciduous trees occurs more quickly, in 3 to 12 years. Snowshoe hare populations again decrease as the forest canopy develops and shades out the understory. Forest gaps processes, such as large wind-throws, insect infestations, and outbreaks of disease, produce similar effects (Agee 2000).

The Superior National Forest lies within a boreal forest system where natural fire occurrence is common. The Forest also provides for a variety of recreational and management activities which sometimes result in unwanted human-caused fires.

Fire management is an integral part of land and resource management on the Superior National Forest. Fire plays a natural role in achieving long-term goals of ecosystem health. Wildland fire management decisions and resource management decisions go hand-in-hand and are based on approved Fire Management and Land and Resource Management Plans. Wildland fire, as a critical natural process, may be re-introduced into the ecosystem where human life, property, or resource values are not at risk.

In all cases, protection of human life is the first priority in wildland fire management. Property and resource values are the second priority, with management decisions based on values to be protected. Structural fire protection in the wildland/urban interface is the responsibility of tribal, state, and local governments.

Lynx and snowshoe hare favor early successional habitats that occur in the boreal forest about 10 or more years after disturbance. Thus, wildland fire can initiate plant succession to the benefit of lynx and snowshoe hare. Lynx denning habitat would not be available until at least 60 or more years after a wildland fire event (see Sections 6.1.1.10 and 6.1.1.12).

Under the Proposed Action, fire prevention would be a high priority at the Plant Site and on federal lands to protect human life and mine and plant infrastructure. After mine closure, wildland fire may again become part of the natural ecosystem on the federal lands, but would likely not be allowed at the Plant Site due to its close proximity to other mine infrastructure and other private properties.

Wildland fire could occur on the non-federal lands, but would likely be actively controlled to minimize loss of timber on the lands and to minimize the risk to nearby properties. Most habitat management on these lands would primarily be associated with timber management and harvests, and for Wetland Mitigation Sites, wetland and upland restoration under the Proposed Action.

Summary of Impacts to Lynx Habitat

Numerous habitat and human-disturbance factors influence lynx use of an area. Factors most important in the study area include timber management, mining activity, and habitat fragmentation. The mine project would remove forestlands, reduce the amount of available habitat for lynx, and increase habitat fragmentation; much of this habitat would be reclaimed after mine closure. However, large tracts of land associated with the Superior National Forest and adjacent to the Mine Site would be managed for lynx and other wildlife habitat. These lands have the potential to reduce the amount of habitat fragmentation within the region and help to maintain travel corridors between areas of suitable habitat.

Despite the presence of suitable habitat over most of the federal lands, sightings of lynx on the federal lands have been few. Based on tracking surveys on and near the federal lands, lynx density appears to be relatively low near the federal lands (approximately one lynx per 83 square miles) compared to other portions of northeastern Minnesota (ENSR 2006). Lynx sightings were more common a few miles east of the federal lands (Barr 2011). Thus, the loss of habitat due to the mining may have little impact on lynx.

None of the federal lands surrounding the Mine Site would be directly impacted by the Proposed Action. However, noise, light, and other disturbances at the mine site could limit use of the area by lynx, and perhaps to a lesser extent by snowshoe hare.

Lynx have not been recorded on the federal lands associated with the Mine Site, based on tracking surveys, NRRI field studies, Forest Service DNA data (collected from lynx scat), and MDNR lynx records databases. However, lynx tracks were seen on the Mine Site by a Forest Service biologist during February 2010 (Ryan 2013c). Although the lands contain much potential habitat for lynx, they also consist of much wetland habitat that is little used by snowshoe hare and could make lynx travel difficult outside of winter. Thus, the Project may have little direct impact on lynx use of these lands.

Lynx were not observed on the non-federal lands during wildlife studies, but lynx scat has been collected within 6 miles of all of the non-federal lands, except Hunting Club Lands and McFarland Lake Lands; lynx DNA has been found within 10 miles of Hunting Club Lands. The MDNR lynx database showed that lynx have been recorded within a mile of Hay Lake Lands and McFarland Lake Lands, but there were no records of lynx within 6 miles of the other non-federal lands.

The Forest Service would gain additional lands that would provide habitat for lynx and snowshoe hare under the Proposed Action. However, given that these lands would not be directly or indirectly impacted by the Project, would likely not be developed in the near future, and would remain mostly in timber production with limited recreational use, there would likely be little or no adverse or beneficial effects to lynx using the non-federal lands with or without the proposed land exchange.

Although the Forest Service would administer additional habitat for lynx under the land exchange, there would still be a net loss of habitat to lynx and snowshoe hare due to habitat loss at the Mine Site. If the land exchange does not take place, and non-federal lands are not acquired by PolyMet and remain privately owned, non-federal lands would likely be managed primarily for timber production and some recreational use (hunting, fishing, and cabins). Most of the non-federal lands are wetland and lowland coniferous forest and not suitable for most types of recreational development. At this time, there also appears to be little interest in mining these lands or conducting other large scale surface disturbance. Thus, these lands would continue to provide similar acres of habitat for lynx and snowshoe hare with or without the land exchange.

No lynx tracking surveys have been conducted on or near the Wetland Mitigation Sites. Only one lynx scat has been collected within 10 miles of the Wetland Mitigation Sites, and there are no records in the MDNR lynx database of lynx within 6 miles of the Wetland Mitigation Sites. These sites are sod farms that would be restored to wetland and upland habitat. They could provide habitat for lynx in the future, but the beneficial effects to lynx from acquisition of these lands would be minor, if any, as there appears to be little or no use of these sites by lynx.

Recreation

Recreational activities are becoming increasingly widespread across the landscape, but their effects on lynx are little known. Very few studies have investigated the complex interactions between humans and wildlife. Some anecdotal information suggests that lynx are quite tolerant of humans (USDOI USFWS 1992, Staples 1995, Roe et al. 1999, Mowat et al. 2000).

Non-consumptive recreational activities are growing in popularity over the more traditional consumptive recreation uses of hunting and fishing (Duffus and Dearden 1990). Trends indicate that land-based activities occurring within developed recreation sites or near roads involve the greatest number of people.

Roads and trails used for recreation may present several risks to lynx, depending on their distribution over the landscape, their accessibility, the season of use, and the intensity and frequency of use. Management concerns include the potential for increased human use associated with roads and trails, which could increase disturbance at den sites, shooting or trapping of lynx, lynx-vehicle collisions, and compaction of snow that may increase inter-species competition. Dispersed recreation activities seldom result in a direct loss of habitat, but are more likely to impart indirect effects, such as increased competition resulting from snow compaction.

Recreational snowmobile use has expanded dramatically over the past 25 years, and is a common recreational activity in northern Minnesota. The growth of snowmobile use and an expanded trail system over the past 2 to 3 decades has increased human presence in lynx habitat in northern Minnesota and elsewhere in the U.S.

Direct and Indirect Effects

Federal Lands and Plant Site

Access to the Project and federal lands is controlled by a security gate near the Plant Site, and a locked gate prevents vehicle access to the Dunka Road at the Northshore Mine. The Dunka Road is a private road, however, recreationalists could access the Mine Site by using all-terrain vehicles or snowmobiles, or on foot, from the east by traveling along the Dunka Road, and from the south on Forest Service Road 113. The Northshore Mine is north of the federal lands and recreationalists are not allowed to access the Northshore Mine property.

Recreational hunting and all-terrain vehicle/snowmobile use have been observed on or near the federal lands, but use of the site by recreationalists is limited as there is not easy access to the site. During mine operations, access to the Project area would be strictly controlled and recreational activities would not be allowed on the Project area.

Natural population growth, along with an influx of workers to support the Project, would further increase the growth of recreational activity in the Project area and could possibly impact lynx activities. Causes of lynx mortality varies, but Moen (2009) found that most known deaths of lynx were directly or indirectly associated with human activities, both in Minnesota and Ontario, Canada. Dispersed recreation activities seldom result in a direct loss of habitat. However, the road and trail network that is used by dispersed recreation has resulted in a loss of lynx habitat by displacing native vegetation.

Risks to lynx from recreationalists from the Project could increase during mine operations from current levels, as lynx that use the federal lands would be forced into areas surrounding these sites where hunting and other recreational activities are allowed. However, studies have shown that lynx use of the federal lands is uncommon, and thus this risk to lynx would be low. After mine closure, the Project area would remain privately owned and access to the Project area by the public would be prohibited.

If public access to the Project areas and federal lands was no longer restricted, it is likely that recreational use of these lands would increase, to the potential detriment of lynx. However, there is little evidence of lynx use of the Mine Site and Plant Site, with most lynx observations occurring east of the Mine Site. Thus, there should be little impact to lynx if the land exchange does not occur.

Non-federal Lands and Wetland Mitigation Sites

The non-federal lands are privately owned, but some hunting and off-road vehicle use occurs on these lands, except McFarland Lake Lands. Under the Proposed Action, the non-federal lands would be administered by the Forest Service and would be open to public recreation, including hunting and off-road travel. The Wetland Mitigation Sites would be privately owned and hunting and off-road vehicle would not be allowed. It is unlikely that new roads would be constructed to improve access to the non-federal lands and Wetland Mitigation Sites. Thus, risks to lynx from recreational activity would likely not change substantially under the Proposed Action.

If the land exchange does not occur and if the Project is not permitted, non-federal lands and Wetland Mitigation Sites would remain privately owned. Non-federal lands would likely be managed primarily for timber production, and some recreational use (hunting, fishing, and cabins), while the Wetland Mitigation Sites would be managed for agriculture. The level of recreation use and risks to lynx on these areas would not change substantially from current levels.

Forest and Backcountry Roads and Trails

There is a well-established forest and backcountry road and trail system along the Mesabi Iron Range, associated with mining activity, accessing federal, state, county, and privately owned forestlands, and serving recreational areas, private residences, and pasturelands. Roads and trails may present several risks to lynx based on the potential for increased human use in lynx habitat.

Construction of roads may reduce lynx habitat by removing forest cover and increasing the threat of illegal hunting and trapping. On the other hand, in some instances, along less-traveled roads where vegetation provides good snowshoe hare and white-tailed deer habitat, lynx may use the roadbed for travel and foraging (Koehler and Brittell 1990).

Forest backcountry roads and trails may facilitate snowmobile, cross-country skiing, and other human uses in the winter. As described later, snow compaction on roads or trails may allow competing carnivores, such as coyotes and mountain lions, access into lynx habitat (Buskirk et al. 2000). In the absence of roads and trails, snow depths and snow conditions normally limit the mobility of these other predators during midwinter.

Squires et al (2010) found no evidence that lynx are sensitive to forest roads, including roads used by snowmobiles in the winter. This study concluded that seasonal resource-selection patterns of lynx were little affected by forest roads with low vehicular or snowmobile traffic. In densely forested areas, vehicle use was concentrated on roads and trails and lynx were disturbed less than in other more open areas. Lynx were often seen crossing roads near the Mine Site and Northshore Mine during winter lynx surveys in 2006 and 2008 (ENSR 2006, Barr 2011).

Moen et al. (2010) showed that lynx will take advantage of roads when present and that a road and trail network increases habitat connectivity for lynx. In northeastern Minnesota, lynx on long-distance movements traveled within an average distance of less than 656 feet to a road. Lynx use of roads and other linear features is probably based on the energetic efficiency of moving along a road compared to moving through a forest. The northeastern Minnesota landscape is characterized by dense forests, bogs, and lakes of various sizes. Lynx may find that it is more energetically efficient to walk on or alongside of a road, whether within the home range or while on a long-distance movement.

Snowshoe hare densities may be higher along roads and trails due to the juxtaposition of land cover types and ages along these linear routes. The forest edges along forest roads provide preferred habitat for snowshoe hare. Regenerating and young forest is the cover type that has the highest density of snowshoe hares in Minnesota. Therefore, road and trails appear to provide productive snowshoe hare edge habitat that lynx opportunistically utilize (Moen et al. 2008).

Moen et al. (2010) indicated that the road and trail network may increase the connectivity of different parts of the Superior National Forest, and may enable lynx to move further than they would in the absence of a road and trail network. It is also possible that the existing road and trail network would make it easier for immigrating Canada lynx to find parts of the Superior National Forest with adequate snowshoe hare densities.

While linear features such as roads may benefit lynx from an energetic perspective, they may also be negative if they increase the chance of incidental mortality because of exposure to humans. It is unlikely that lynx behavior could be modified to prevent lynx from using linear features such as roads and trails (Moen et al. 2010). Managing the road and trail network can minimize the potential for conflicts. But whether roads and trails are closed to motorized vehicle use or not, it may be impossible to totally eliminate human-lynx conflicts because human use would continue on non-motorized routes. The benefit of reducing mortality risk by managing road networks and densities has to be balanced against the cost of not being able to use linear features on long-distance movements.

Direct and Indirect Effects

Federal Lands, Transportation and Utility Corridors, and Plant Site

Impacts to lynx in and surrounding the Project area may include mortality from collisions with vehicles and trains. Construction and operation of the project, and the influx of workers to the area, would mean an increase in vehicular and rail traffic. The FEIS estimates that the Project would generate up to 1,316 miles per day of vehicle traffic near the Project site, including trips between the Mine Site and the Plant Site, and trips between the Plant Site and the Area 1 Shop. Vehicle traffic would consist primarily of light trucks and maintenance vehicles traveling between 30 and 45 miles per hour (mph), and a few large fuel, waste/supply, and haul trucks traveling between 25 and 40 mph. The Project would also generate 418 total miles per day of rail traffic between the Mine and Plant sites during mine operations. Trains would operate at 15 to 25 miles per hour (MDNR et al. 2013).

Harm or loss of lynx from collisions with vehicles or trains traveling within the Project boundaries cannot be discounted, but the risk would be very small as there is currently little use of the Project area by lynx, and use of the area by lynx would decrease substantially during project operations due to loss of habitat and noise and disturbance associated with Project activities.

In previous BOs for federal actions that are ongoing in Minnesota, including the *Mesaba Nugget Prevention of Significant Deterioration Permit U.S. Environmental Protection Agency* (USDOI USFWS 2009d), and *Northshore Mine Eastern Progression and CSAH 70 Relocation St. Louis County, Minnesota* (USDOI USFWS 2011a), the USFWS anticipated various levels of take, or loss of lynx to collisions with vehicles or other factors. Based on these opinions, the USFWS estimated that several lynx could be killed annually by current ongoing project-related activities in northern Minnesota, although actual take has been substantially less.

A Wisconsin study (Kohn et al. 2000 *cited in* USDOI USFWS 2009d) of wolf deaths by vehicles was used to estimate the number of lynx and wolf that could be killed by collisions with vehicles along the Dunka Road and Utility Corridor. In that study, an estimated 0.01 wolf were killed per mile of road for a traffic volume of 4,700 vehicles per day and a wolf density of 0.006 wolf per square kilometer. For the previous BOs, and this BA, it was assumed that the likelihood of a collision is the same for lynx and wolves, that trains and vehicles are equally likely to hit a lynx or a wolf, and that the collision frequency is related to the density of the species in the Project area and the vehicle/rail miles traveled per year. The USFWS noted that even intensive studies, such as the wolf mortality study in Wisconsin, may not document all road-related mortality within the study area (USDOI USFWS 2009d). Thus, the USFWS assumed that lynx and wolf mortalities due to automobile collision were actually twice the levels reported from the Wisconsin study (0.02 wolf killed per mile of road).

Based on the assumption that there is about 0.0048 lynx/square kilometer (km^2; 1 lynx per 80 mi^2; 1 lynx per 207 km^2; see Section 6.1.1.3); that there would be about 1,316 vehicle and 418 rail miles traveled each day; that vehicle/rail collisions with lynx could occur during the Project ; and that vehicles and trains are equally likely to collide with lynx, it was estimated that approximately 0.006 lynx would be killed annually by vehicle/rail traffic on the road/rail line between the Mine Site and Plant Site, or less than one (0.12) lynx during the estimated 20-year life of the Project (assuming that mortalities due to collisions with vehicles and trains were twice the estimated level). Thus, although risk of loss of lynx due to a collision with a vehicle or train is very small, it could occur during the life of the Project.

After mine operations cease, temporary roads would be closed and reclaimed except for a short road from the Dunka Road to the Waste Water Treatment Facility. The Dunka Road would be retained and would provide access to the Mine Site area after mine closure, but would be a private road and closed to public use. Although roads would be constructed to support mine and plant operations, it is expected that the miles of roads on the Mine and Plant sites would decrease from current levels after Mine Site and Plant Site reclamation, thus benefiting lynx (Pylka 2013b).

Temporary roads have been constructed on the federal lands to support timber harvest activities and within a ROW to support powerline maintenance. Except for recently constructed gravel roads to access timber harvest areas, temporary roads are now overgrown in places with vegetation and are generally only suitable for foot, all-terrain vehicle, and snowmobile travel. Vegetation within the ROW is maintained at a low height for safety purposes, and the ROW is accessible to all-terrain vehicles and snowmobiles. Temporary roads may be constructed to support future management, but roads would be likely closed after their intended use and allowed to revegetate; it is unlikely that permanent roads would be constructed. The miles of temporary roads would likely remain at or below current levels, to the benefit of lynx, and roads would be closed to the public (Pylka 2013b).

Non-federal Lands and Wetland Mitigation Sites

Access onto most of the non-federal lands is by secondary roads that branch off of Forest Service or county roads. Most secondary roads were constructed to support timber harvest activities. There is no road access onto Hunting Club Lands and Wolf Lands 4. Access to McFarland Lake Lands is controlled by a locked gate. If acquired by the Forest Service, the non-federal lands would be managed for General Forest, General Forest-Longer Rotation, Riparian Areas, and Candidate Research Natural Areas (MDNR et al. 2013). If new roads are constructed on the non-federal lands, they would likely be temporary and used to support timber management. There would likely be little change in the number of miles of backcountry roads and trails on the non-federal lands, and the number of miles may decrease if existing roads are closed and revegetated or allowed to revegetate naturally, benefitting lynx.

The Aitkin Wetland Mitigation Site is bisected by County Road 1. The Hinckley Wetland Mitigation Site is bordered on the south by Township Road 56, while the Zim Wetland Mitigation Sites are bordered on the west by County Road 7. Secondary access roads are also associated with the sites, but the sites are in rural areas. It is unlikely that new roads would be constructed within the sites, and some roads may be reclaimed in the future, to the benefit of lynx.

Other Human Developments (mining, power generation, etc.)

Other human developments that may alter lynx habitat near the federal and non-federal lands and Wetland Mitigation Sites include rural development, forestry, agriculture, and mine exploration, development, and operation. These activities affect lynx habitat by changing or eliminating vegetation, and may also contribute to habitat fragmentation. There may be an increased potential for human-caused mortality associated with the developments (Ruediger et al. 2000).

Direct and Indirect Effects

Federal Lands and Plant Site

The Northshore Mine is immediately north of the Mine Site and the Mesaba Nugget Mine Project is immediately west of the Plant Site. Sources of noise at these sites include trucks, bulldozers, rock drills, jack hammers, graders, backhoes, air compressors, and cranes. Noise from these facilities could impact lynx residing in or traveling through the Project area. The impacts of noise on lynx and other wildlife are largely unknown and the assessment of impacts remains subjective. Wildlife are receptive to different sound frequency spectrums, many of which may be inaudible to humans. Wildlife are also known to habituate to noise, especially noises that are steady or continuous, such as noises that would occur near the Project. For example, lynx have been seen within about a quarter mile of loud noise sources and other human disturbance at Northshore Mine facilities, and have been seen by drillers within a few hundred feet of operating exploration drill rigs to the east of the Project.

Disturbance associated with these facilities and associated transportation infrastructure includes lights, glare, and noise. Lynx traveling through the Project area may avoid areas that are active and well lit.

Non-federal Lands and Wetland Mitigation Sites

There are no large developments near the non-federal lands or Wetland Mitigation Sites. The non-federal lands are currently managed primarily for timber and recreation, similar to how these lands would be managed by the Forest Service. The Wetland Mitigation Sites would be restored to wetland and upland wildlife habitat. Lynx observations are rare near the Wetland Mitigation Sites and lynx use of the sites after restoration would be infrequent.

Factors Affecting Lynx Mortality

Trapping and Incidental or Illegal Shooting

Lynx mortality has been monitored in northeastern Minnesota since 2000. From 2000 to 2012, 43 incidents of lynx mortality occurred (Rowse 2012). Nineteen of 28 mortalities in which the cause of death was determined were due to illegal trapping or shooting. The 2004 Forest Plan BA reiterated findings from Ruediger et al. (2000) that incidental or illegal mortality may occur from trapping and hunting/poaching activities. The 2004 Forest Plan BA assumed and reported that mortality from trapping and shooting could and has occurred on lands managed by the Forest Service. Lynx mortality could indirectly or cumulatively occur on National Forest lands based on incidental trapping for other species such as fox, fisher, and gray wolf. This cause and effect relationship has not changed since 2004 (USDA Forest Service 2004b).

Since 2004, two lynx within the Superior National Forest, and four lynx outside the Superior National Forest, were killed due to incidental trapping or shooting. Three lynx were killed due to legal trapping in Canada. Five trapped lynx were released alive from traps during that same period in Minnesota (USDA Forest Service 2011b).

Access to the Project area would be carefully controlled and use of the site by workers would be monitored by security personnel. Workers would also be given training in how to avoid harming or killing lynx while working on the site.

Direct and Indirect Effects

Federal Lands and Plant Site

Hunting and trapping of lynx is illegal in Minnesota and would not be allowed on all lands affected by the Project. The Project area would be closed to all types of hunting and trapping during construction and operations. Project personnel would be trained to not harass lynx in the Project area, and to report dead or injured lynx seen on the property. The Project area would be privately owned and closed to the public after mine closure (Pylka 2013b).

Non-federal Lands and Wetland Mitigation Sites

Hunting and trapping are allowed on the non-federal lands and on nearby Forest Service lands. It is assumed that hunting and trapping would be allowed on the non-federal lands if acquired by the Forest Service. As noted above, two lynx have been illegally trapped or shot within Superior National Forest boundaries since 2004, and lynx could be illegally shot or trapped on the non-federal lands after transfer to the Forest Service. However, the risk of loss of lynx from hunting and trapping would be similar to these risks that now occur on the non-federal lands under private ownership.

Competition and Predation as Influenced by Human Activities

New roads and trails associated with Project activities and the influx of workers may facilitate snowmobile, cross-country skiing, and other human uses in the winter. Snow compaction on roads or trails may allow competing carnivores, such as coyotes and mountain lions, access into lynx habitat. In the absence of roads and trails, snow depths and snow conditions normally limit the mobility of these other predators during mid-winter. It is likely that lynx near the Project area would compete with these competitors and predators for primary lynx prey (Buskirk et al. 2000b).

Lynx and carnivore biologists (Bider 1962, Ozoga and Harger 1966, Murray and Boutin 1991, Koehler and Aubry 1994, Murray et al. 1995, Lewis and Wenger 1998, Buskirk et al. 2000b) have suggested that packed trails created by snowmobiles, all-terrain vehicles, and cross-country skiers may serve as travel routes for potential competitors and predators of lynx, especially coyotes. Buskirk et al. (2000b) hypothesized that the usual spatial segregation of lynx and coyotes may break down where human modifications to the environment increase access by coyotes to deep snow areas. Such modifications include expanded forest openings throughout the range of the lynx.

Fuller and Kittredge (1996) noted that the distribution and numbers of coyotes have dramatically expanded in recent decades. Geir (1975) and Nowak (1979) suggested that coyotes are thought to have originated in areas where snow cover was minimal, and it is only within the last century that they have colonized the boreal forests.

Buskirk et al. (2000b) hypothesized that coyotes may be locally or regionally important competitors for lynx food resources, possibly exerting interference competition pressures on lynx as well. O’Donoghue et al. (1998b) also suggested coyotes exert potentially important exploitation competition pressures on lynx. Predation rates by coyotes on snowshoe hares exceeded those of lynx in the Yukon Territories during periods when snowshoe hare population levels are high. Coyotes then shifted their prey preference from snowshoe hares to carrion because of intolerance to deep snow conditions (Todd et al. 1981). Coyotes have been shown to increase their use of open habitats between November and March due to the increase in packed snow conditions and the load-bearing strength of snow in openings. It is this strong prey- and habitat-switching ability of the coyote that may contribute to its success as a competitor with lynx (Buskirk et al. 2000b).

Murray and Boutin (1991) reported that both lynx and coyotes used travel routes with shallow snow, but that coyotes traveled on harder snow more frequently. They also reported that the use of trails in the snow not only reduced the depth to which an animal sinks into the snow, but aided coyotes and lynx in obtaining additional food. Keith et al. (1977) suggested that during population peaks of snowshoe hares, the density of trails in snow facilitates coyote movement. Murray and Boutin (1991) reported similar results with their study where hare densities were high.

Dispersed recreation activities seldom result in a direct loss of habitat. However, the road and trail network that is used by dispersed recreation has resulted in a loss of lynx habitat by displacing native vegetation on the landscape. Snow compaction can result in increased access by competitors, and increased access for bobcat, thereby increasing the potential for hybridization.

Direct and Indirect Effects

Federal Lands and Plant Site

New roads would be constructed on the Project area. However, these roads would be well traveled and there would be much noise and activity associated with Mine Site and Plant Site activities. In addition, most of the vegetation within the disturbed areas of the Mine Site would be removed, and it may be 10 or more years after mine closure before the Mine Site is reclaimed to wetland, grassland, and shrubland habitat. Coyotes have been seen near the Plant Site, but would be unlikely to use the Project area during operation until after mine reclamation. There could be competition between lynx and coyotes for food resources and other habitat components, but given the low numbers of lynx and coyotes found near the Project area, these effects should be negligible. After mine closure, most roads would be reclaimed; only the Dunka Road and a short road from the Dunka Road to the Waste Water Treatment Facility would remain. These roads would be privately owned and closed to the public (Pylka 2013b).

Non-federal Lands and Wetland Mitigation Sites

As discussed earlier, the non-federal lands and Wetland Mitigation Sites would likely be managed for fish and wildlife habitat, forestry, and recreation with or without the Project. Road densities would remain near current levels. Thus, competition between lynx and coyotes associated with road density should remain near current levels.

Highways (vehicular collisions)

Direct and Indirect Effects

Federal Lands and Plant Site

Direct mortality from vehicular collisions may be detrimental to lynx populations in the lower 48 states (Ruediger et al. 2000). In their 2004 Forest Plan BA, the Forest Service assumed that mortality between high and low standard roads could differ, with potential mortality likely being higher on high standard (high-speed) paved roads that are typically federally, state or county managed highways and lower on low standard (low-speed) non-paved roads that are typically managed by the Forest Service (USDA Forest Service 2004b).

An estimated 42 worker/supply vehicle round trips would be made daily between the Plant Site and Hoyt Lakes, Minnesota, and 156 worker/supply vehicle round trips would be made daily between U.S. Highway 135 and the Plant Site (Barr 2013a). For purposes of analysis, it was assumed that the average distance between Hoyt Lakes and the Plant Site main security gate is 6 miles, and that traffic accessing the Plant from Highway 135 comes from Babbitt to the Plant Site north gate, or about 33 miles on average. Average speed would be about 50 mph between the Plant Site and Hoyt Lakes, and Plant Site and Highway 135. In addition, about seven trains per month would carry supplies and materials to and from the Plant Site and Virginia, Minnesota, a distance of about 30 miles. These trains would continue on to Duluth or International Falls, Minnesota, but would likely be included with other rail traffic and thus not add to the potential for risk of collision with lynx (Barr 2013b).

The USFWS did not assess risks to lynx from off-site vehicle and train collisions for worker and mine/plant supply delivery traffic associated with other projects in northern Minnesota as discussed in earlier BOs (USDOI USFWS 2009d, 2011a); the USFWS requested that these risks be estimated for the Project.

Using the same assumptions and methodology used earlier to estimate lynx mortality on Project roads and railroads (see Forest and Backcountry Roads and Trails), approximately 0.037 lynx would be killed annually by vehicle/rail traffic on off-Project access roads/rail lines to the Plant Site, or about two (0.74) lynx during the estimated 20-year life of the Project (assuming that mortalities due to collisions with vehicles and trains were twice the estimated level).

Increased traffic to and from the Project area would increase the threat of lynx mortality from vehicle collisions in the vicinity of the Project. Harm or loss of lynx from collisions with vehicles within the vicinity of the Project cannot be discounted, but the risk would be very small as MDNR lynx observation records suggest there is little lynx use of areas associated with project access roads, and use of these road corridors would decrease substantially during project operations due to noise and disturbance associated with Project and other nearby mining activities, and activities in Hoyt Lakes. In addition, studies by the USFWS found that the estimated loss of lynx to vehicle traffic, based on the methodology used in this study, was substantially greater (3-fold) than the actual loss of lynx (USDOI USFWS 2009d).

After mine closure, nearly all access roads would be closed. The Dunka Road would remain privately owned and closed to the public. There would be little, if any, rail traffic between the Plant Site and Virginia, Minnesota.

<u>Non-federal Lands and Wetland Mitigation Sites</u>

Lynx have been observed on or near most of the non-federal lands. There are no rail lines on or adjacent to these lands, and limited vehicle access. The lands are primarily used for timber and recreation, and except for Hay Lake Lands, where vehicles travel along the Pike River Road on the eastern boundary of the lands, access to the lands is on logging roads that are primarily used during the hunting season. Access to the lands by vehicles is expected to remain near current levels, with or without the land exchange. No lynx deaths from vehicular collision have been reported on or near the non-federal lands (MDNR 2007). Thus, risks to lynx from vehicular collisions should be negligible.

Some of the Wetland Mitigation Sites are used for sod production. Trucks and other vehicles access the sites for sod production and removal. Under the Proposed Action, these sites would be restored to wetland and upland habitat and except during restoration and monitoring activities, few vehicles would be expected to access the sites. Thus, risks to lynx from vehicular collisions on the Wetland Mitigation Sites may be less under the Proposed Action than under current conditions. Given that lynx have not been reported within 6 miles of these sites, risk to lynx under both use scenarios is negligible.

Other

Hazardous Materials

The Project would use, or generate as waste, the following hazardous materials:

- Fuels, equipment maintenance products, and solvents – diesel fuel, gasoline, oils, grease, lubricants, anti-freeze, solvents, and lead-acid batteries used for equipment operation and maintenance.
- Plant reagents – sodium hydrosulfide, sodium hydroxide, acids, flocculants, and antiscalants used in processing plant applications.
- Mine Site Waste Water Treatment Facility chemicals – calcium hydroxide (hydrated lime), sodium metasilicate, ferric chloride, sodium hydroxide, polymer flocculent, carbon dioxide liquid, citric acid, and sodium hypochlorite.
- Plant Site Waste Water Treatment Plant chemicals – potassium permanganate, antiscalant, carbon dioxide liquid, and calcium hydroxide (hydrated lime).
- Blasting agents – ammonium nitrate/fuel oil (ANFO), emulsions, emulsion blends (a blend of ANFO and emulsion), blasting caps, initiators and fuses, and other high explosives used in blasting.
- Other materials – assay chemicals, and other by-products characterized as hazardous waste.

Mishandling of these materials or wastes could result in spills, accidental release, or discharge into the environment, which could pose risks to lynx. Sections 5.2.13 and 5.3.13 of the FEIS discuss the risks posed to the public and the environment from the transport, handing, storage, and use of hazardous materials. Mitigation measures to prevent releases in transportation, storage, and handling or use of these materials are described in several hazardous material management plans necessary to comply with various regulatory requirements for the Project and in the FEIS. Based on the FEIS analysis, and scarcity of lynx on the areas where there materials would be used, risks to lynx would be negligible and should not result in harm or death to lynx (MDNR et al. 2013).

Factors Affecting Lynx Movements

Highways, Roads, and Rights-of-ways

Moen et al. (2010) observed that lynx movements were made across roaded areas, and also across the BWCAW, which has few linear features such as roads, trails, and logging roads that could guide movement by lynx, in northeastern Minnesota. Observations suggested that geographically or topographically definable movement corridors do not exist for lynx in northeastern Minnesota, nor between Minnesota and Ontario. Moen et al. (2010) suggested that linear features such as roads benefit lynx from an energetic perspective, but may also be negative if they increase the chance of incidental mortality because of exposure to humans.

Direct and Indirect Effects

Federal Lands and Plant Site

As discussed earlier, traffic associated with the Project would be on access roads leading to and from the Project area, along the Dunka Road and Utility Corridor, and on access roads to the Mine Site. Most traffic would travel on existing roads; new roads would be primarily limited to the Mine Site. After mine closure, many of the access roads would be closed to traffic and reclaimed. Traffic on the Dunka Road between the Mine Site and Plant Site during mine construction and operation should discourage use by lynx. However, most traffic within the corridor would likely occur during shift changes. Because lynx rarely use the Mine Site, Plant Site, or Transportation and Utility Corridors, and noise and disturbance associated with the Mine Site and Plant Site would discourage use of these areas by lynx, it would be unlikely that lynx would use these areas during mine construction and operations and effects of traffic on lynx movements would be negligible.

Non-federal Lands and Wetland Mitigation Sites

If lands are exchanged to the Forest Service, it is unlikely that the Forest Service would build new access roads to the lands. It is also unlikely that state or federal agencies would construct new roads near the lands, as these lands are in remote locations and little used by the public. Thus, activities on highways, roads, and ROWs near the non-federal lands, and their effects on lynx movements, would be little changed with or without the land exchange.

Access onto most of the non-federal lands is by secondary roads that branch off Forest Service or county roads. Most secondary roads were constructed to support timber harvest activities. There is no road access onto Hunting Club Lands and Wolf Lands 4. Access to McFarland Lake Lands is controlled by a locked gate. These roads are little used and traffic levels should change little under the land exchange. There would likely be little change in the number of miles of backcountry roads and trails on the non-federal lands, and the number of miles may decrease if existing roads are closed and revegetated or allowed to revegetate naturally, benefitting lynx.

The Aitkin Wetland Mitigation Site bisected by County Road 1. The Hinckley Wetland Mitigation Site is bordered along the south by Township Road 56, while the Zim Wetland Mitigation Sites are bordered on the west by County Highway 7. Because lynx are rarely observed near the wetland mitigation sites, highway and local traffic should have little effect on lynx.

Land Ownership Patterns

Lynx exemplify the need for landscape-level ecosystem management. Land and population management must cross international, federal, state, county, and private land boundaries. Coordination within and between agencies and other landowners has often been difficult. In situations where habitat connectivity is needed to maintain adequate populations, private land development may preclude use by lynx, and may interrupt the

connectivity of habitat and populations. In these situations, it will be important to provide conservation easements, land exchanges, or purchases to maintain adequate lynx habitat and populations.
Habitat fragmentation also may impede lynx movements. This could have negative effects by isolating lynx and/or prey populations, or by retarding movements to other areas (Ruediger 2000).

Contiguous tracts of land in public ownership (national and state forests, wilderness areas) provide an opportunity for management that can maintain lynx habitat connectivity. Throughout most of the lynx range in the lower 48 states, connectivity with habitats and source populations in Canada is critical to conservation of populations in the U.S. The size, amount, and spatial distribution of federal land vary considerably from west to east across the U.S.

The ability to provide connectivity between the two northern Minnesota National Forests is complicated by the lack of contiguous National Forest ownership and varied land use patterns. However, the eastern two thirds of the Superior National Forest is largely federally owned, and the BWCAW refugium remains intact and contiguous with Canada.

Ownership adjustments have occurred on the Superior National Forest since 2004. The largest land exchange, the South Kawishiwi Cabin Group, occurred in 2010. In that land exchange approximately 1,213 acres were acquired by the Forest Service and approximately 425 acres were disposed of, resulting in a net acquisition of 788 acres. All other individual land purchases, donations, and exchanges were less than 100 acres (USDA Forest Service 2011b). The land ownership changes contribute towards Forest-wide lynx habitat but the amounts that have occurred since 2004 have been relatively insignificant compared to the large area of the Superior National Forest (2,125,931 acres).

Direct and Indirect Effects

Federal Lands and Plant Site

The Project would involve the transfer of approximately 6,495 acres of Forest Service-administered lands to PolyMet, in exchange for 7,075 acres of privately owned lands. This land exchange would be the largest land exchange conducted by the Forest Service, and would result in a net acquisition of 580 acres by the Forest Service. The land exchange would help the Forest Service to consolidate ownerships by obtaining non-federal lands that are adjacent to Forest Service lands. However, the exchange would also increase the amount of land converted to mining and unavailable to lynx, at least until the Mine Site is reclaimed. Land reclaimed after mining could provide suitable lynx habitat, but it could be 10 or more years before revegetation, due to the successional process, results in much suitable habitat for lynx.

Although there is little documented use of the Mine Site by lynx, loss of habitat and noise and disturbance from the Project, could influence lynx movements on or near the Mine Site. It is possible that lynx could travel between forestlands to the south of the Mine Site and the Northshore Mine by traveling through the federal lands surrounding the Mine Site, or through forestlands further east of the Mine Site. Given the loss of habitat and increase in disturbance that would be associated with the Mine Site, it seems more likely that lynx would primarily use forestlands to the south and east of the Mine Site and Northshore Mine, and avoid the Mine Site and lands between the Mine Site and Plant Site. That said, lynx, including adults with kittens, have been seen using portions of the Northshore Mine, and could use the federal lands, even during mine construction and operations.

Non-federal Lands and Wetland Mitigation Sites

The transfer of the non-federal lands to the Forest Service should have negligible, if any, effect on lynx movements. Management of these lands would remain relatively unchanged, and lands would primarily be used for timber production and recreation.

Wetland Mitigation Sites would be converted from agricultural uses to wildlife habitat. Although lynx have not been reported on or near these sites, their value to lynx would increase once taken out of agricultural production, and lynx may move onto these sites in the future.

6.1.2.2 Effects to Lynx Critical Habitat

Overview

Primary Constituent Elements of Lynx Critical Habitat

Critical habitat is defined as “specific area within the geographical area occupied by the species…on which are found those physical and biological features (a) essential to the conservation of the species and (b) which may require special management considerations or protection” (USDOI USFWS and NMFS 1998).

On November 9, 2006, the USFWS designated 319 mi^2 as critical habitat in Voyageurs National Park, Minnesota. On February 25, 2009, the USFWS re-designated lynx critical habitat to include portions of Cook, Koochiching, Lake, and St. Louis Counties, Minnesota, including a portion of the federal lands, and all of the non-federal lands. A total of 8,065 mi^2 were designated as critical habitat in 2009 (USDOI USFWS 2009a). The Wetland Mitigation Sites are not included in the designated critical habitat area.

In its 2009 designation of critical habitat for lynx in northeastern Minnesota, including the Project area, the USFWS identified physical and biological features that are essential to the conservation of the species and that may require special management considerations or protections. The physical and biological features are primary constituent elements (PCEs) laid out in a specific quantity and spatial arrangement to be essential to the conservation of the species. The PCEs of critical habitat for lynx are found in boreal forest landscapes supporting a mosaic of differing successional forest stages and containing:

a. Presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs, or overhanging boughs that protrude above the snow, and mature multistoried stands with coniferous boughs touching the snow surface.

b. Winter snow conditions that are generally deep and fluffy for extended periods of time.

c. Sites for denning that have abundant coarse woody debris, such as downed trees and root wads.

d. Matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range.

The Forest Service identified quantitative indicators in the 2004 Forest Plan BA to analyze the impacts of those risk factors that have the most substantive impacts on lynx habitat (USDA Forest Service 2004b). These indicators have been used to assess impacts to lynx critical habitat in this BA. These analysis indicators also serve as appropriate indicators for analysis of effects to critical habitat and its constituent elements. This is because the indicators address relevant PCEs of lynx critical habitat—those physical and biological features that are essential to the conservation of the species.

Table 8 compares the lynx risk analysis indicators to the PCEs and identifies the risk analysis indicators evaluated in this BA. For this analysis, risk analysis indicators are grouped as follows—habitat management, human activity (recreation and roads and trails), and cumulative. The cumulative effects risk analysis indicators are addressed in Section 6.1.4.

The following discussion provides an overview of the direct and potential indirect impacts to PCEs from the Project. It is followed by an analysis of impacts to PCEs based on lynx analysis indicators developed by the Forest Service.

Effects of NorthMet Project on Primary Constituent Elements

Presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs, or overhanging boughs that protrude above the snow, and mature multistoried stands with conifer boughs touching the snow surface.

The Forest Service has determined that there are about 6,365 acres of foraging habitat for snowshoe hare on the federal lands, or about 98% of the federal lands. Although snowshoe hare were seen throughout the federal lands, the largest concentrations of snowshoe hares were seen in the eastern portion of the federal lands in areas dominated by jack pine (ENSR 2000). Based on an assessment of existing conditions and conditions at the closure of the mine, there would be a loss of approximately 1,669 acres of snowshoe foraging habitat due to mining, or about 26% of the federal lands. Approximately 4,696 acres of federal lands owned by PolyMet adjacent to the Mine Site would still provide habitat for snowshoe hare.

In addition, basic foraging habitat, including forbs, grasses and small shrubs could be available to snowshoe hare about 10 years after mine closure due to succession within the disturbed areas, although it is uncertain if snowshoe hare would move from areas outside of the Mine Site to suitable habitat on the Mine Site. More mature snowshoe hare habitat, including young trees and boughs overhanging snow, could be available about 25-30 years after mine closure. Therefore, while about 397 acres of habitat lost to mining would be reclaimed after mine closure, it could be a minimum of 10 years before revegetation results in much suitable habitat for lynx. This is because of the estimated minimum 10-year period for basic snowshoe hare forage habitat (forbs, shrubs) to develop. Based on the mine closure plan, most of the 397 acres of the habitat lost to mining that would be reclaimed would be reclaimed as grassland/herbaceous (54%), wetland and/or grassland/herbaceous (27%), and wetland (18%). Areas reclaimed as wetland would not be suitable habitat for lynx. Snowshoe hare and lynx tracks were seen at the base of waste rock piles with scattered stands of young forest near the Dunka Pit. These rock piles are about 5 miles from undisturbed habitat used by snowshoe hares. Thus, snowshoe hare have shown the ability to re-colonize areas associated with mine development. The West Pit would not be reclaimed to the surface for revegetation, but would remain as a 320-acre open pit lake (MDNR et al. 2013).

Winter snow conditions that are generally deep and fluffy for extended periods of time.

Northeastern Minnesota generally receives approximately 70 inches of snow per year. Snow cover at least 1 inch deep is present between 85 days per year and 140 days per year depending on the part of the state. In general, snow can be found on the federal lands between October and April. Studies of lynx and other wildlife on the federal lands found that the snow is relatively dry, fluffy, and several feet deep during much of the winter (ENSR 2000, 2006). As discussed in Section 6.1.1.10, snowshoe hare favor areas that have deep snow and use black spruce and balsam fir forests with dense understory vegetation that provide forage, cover to escape from predators, and protection during extreme weather (Wolfe et al. 1982, Monthey 1986, Hodges 2000a, b). Generally, earlier succession (younger) forest stages have greater understory structure than do mature forests and, therefore, support higher snowshoe hare densities (Fuller 1999, Hodges 2000a, b). Generally, open areas and areas with earlier succession forest stages have deeper snow depths than areas with more mature forest, as the branches of trees in mature forests capture more snow than younger forests, resulting in shallower snow in mature than younger forests (ENSR 2005).

There are approximately 271 acres of young and 1,539 acres of immature forest on the federal lands. Of these, approximately 1,333 acres (73.6%) would be directly impacted by the mine project and lost to snowshoe hare and lynx during mine operation and closure. As discussed above, approximately 397 acres would be reclaimed, and as these lands change from grassland to shrubland and young/immature forestland, their value to snowshoe hare and lynx would increase.

Sites for denning that have abundant coarse woody debris, such as downed trees and root wads.

Based on radiotelemetry studies in Minnesota, most lynx dens are found in tree wind-throw areas with dense vertical and horizontal cover. Dens were often located in an area with foraging habitat and denning cover, and often in small patches of upland within a larger wetland. These are often areas where wind-throw occurs (Moen and Burdett 2009). Tree age is generally greater than 60 years.

About 5,393 acres of lynx suitable denning habitat are found on the federal lands, or 83% of federal lands. Snags and large woody debris were uncommon in disturbed areas, shrublands, and young and immature forests. Large snags (up to 16 inches dbh), stumps, and woody debris were common in more mature forest stands (ENSR 2005). Little blowdown was observed on the federal lands and generally occurred adjacent to recent forest harvest areas and near roads and transmission lines. Based on an assessment of existing conditions and conditions at closure of the mine, there would be a loss of approximately 1,333 acres of denning habitat due to mining. Thus, there would be a 20% reduction of denning habitat on the federal lands.

Matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range.

Communities used most often by lynx are young jack pine/balsam fir forests. Balsam fir often occurs as inclusions or "pockets" of regenerating trees within other cover types (e.g., in mature jack pine stands or in maturing black spruce/trembling aspen stands), and along forest edges. Lynx also use coniferous or mixed coniferous/deciduous forest patches in regenerating logged areas, including 10- to 25-year-old stands of jack pine or balsam fir/trembling aspen mixed coniferous/deciduous forest. Other important habitat types include black spruce/balsam fir and black spruce/tamarack forests.

Communities used by lynx often originate as a result of natural or "facilitated" regeneration after logging. However, fire and spruce budworm outbreaks also play a role in influencing forest stand composition and age in sites used by lynx. It generally takes 12 to 30 years after a forest thinning or fire before conditions become suitable for snowshoe hare, as forests mature from the young to the immature stage.

Upland forest greater than 4 years of age, and lowland stands with forest greater than 9 years of age, provide suitable lynx cover to support habitat connectivity (USDA Forest Service 2004b). As shown on **Figure 9** and **Table 9**, the Mine Site consists of a mix of lowland and upland conifer and deciduous forest of various ages. Conifer forest habitat dominates the mine site, but other habitat types, including open grasslands and wetlands, deciduous forest, frozen lakes, roads, and utility corridors are found in close proximity to conifer forests and have been used by lynx on or near the Mine Site.

There are about 6,372 acres (98% of federal lands) of lynx habitat with adequate canopy cover on the federal lands. Based on an assessment of existing conditions and conditions at closure of the mine, there would be a loss of approximately 1,669 acres of lynx habitat with adequate canopy cover due to mining, or about 26% of lynx habitat with adequate canopy cover within the federal lands (MDNR et al. 2013).

Risk Analysis Indicators

Habitat Management

Direct and Indirect Effects

The Forest Service has identified five risk analysis indicators to measure loss of habitat that would apply to the Project (Ryan 2011). Parameters used by the Forest Service to identify suitable lynx habitat, and foraging habitat for snowshoe hare, were given in the Forest Plan BA (USDA Forest Service 2004b). In general, snowshoe hare foraging habitat was found in upland forest stands that were 3 to 15 years of age, or older than 60 years of age, while lowland stands are generally 10 years or older. Lynx denning habitat is typically found in forest stands that are 80 years or older and have large down woody material or areas of tree wind-throw. The existing condition of habitat-related indicators and impacts to lynx habitat from actions at the Mine Site and Plant Site for LAUs are provided in **Table 9.** All non-federal lands, except Hay Lake Lands, are within LAUs. Although the land exchange would not increase or decrease the amount of lynx habitat within these LAUs, it would contribute to the amount of lynx habitat administered by the Forest Service. Habitat gains and losses by LAU for lands under Forest Service administration for risk analysis indicators are summarized in **Table 9**.

Indicator 1a – Snowshoe Hare Foraging Habitat

The Mine Site is in LAU SNF 12. The Forest Service determined that there are about 6,365 acres of foraging habitat for snowshoe hare on the federal lands (**Figure 19**). Based on an assessment of existing conditions and conditions at closure of the mine, there would be a loss of approximately 1,669 acres of snowshoe hare foraging habitat due to mining, or about 6% of the snowshoe hare foraging habitat within LAU SNF 12 that is administered by the Forest Service (the Forest Service has not identified snowshoe foraging habitat on those portions of the LAU that are not administered by the Forest Service (MDNR et al. 2013).

The lands adjacent to the Mine Site would still provide habitat for snowshoe hare even though lands would be owned by PolyMet. In addition, foraging habitat could be available to snowshoe hare about 20 years after mine closure due to restoration of disturbed areas, although it is uncertain if snowshoe hare would move from areas outside of the Mine Site to suitable habitat on the Mine Site. Snowshoe hare and lynx tracks were seen at the

Table 8
Lynx Analysis Indicators and Primary Constituent Elements

Lynx Analysis Indicator	Primary Constituent Element
Direct and Indirect Effects	
1a – Snowshoe Hare Foraging Habitat	• Presence of snowshoe hare and hare habitat.
1b – Unsuitable Habitat for Snowshoe Hare	• Presence of snowshoe hare and hare habitat. • Winter snow conditions deep and fluffy. • Sites for denning. • Matrix habitat and habitat connectivity.
2 – Red Squirrel Habitat	• Not analyzed; studies have shown that red squirrel are not important prey for lynx in Minnesota.
3 – Denning Habitat	• Sites for denning.
4 – Lynx Habitat with Adequate Canopy Cover	• Presence of snowshoe hare and hare habitat. • Sites for denning. • Matrix habitat and habitat connectivity.
5 – Miles of Designated All-terrain Vehicle Trails	• Not analyzed. There would be little change in miles of designated all-terrain vehicle trails under the Proposed Action.
6 – Miles of Designated Snowmobile Trails	• Not analyzed. There would be little change in miles of designated snowmobile trails under the Proposed Action.
7 – Miles of Temporary and Objective Maintenance Level (OML) 1 and 2 Roads	• Not analyzed. There would be little change in temporary and OML 1 and 2 roads under the Proposed Action.
8 – Policy of Cross-country Use of All-terrain Vehicles and Snowmobiles	• Not analyzed. There would be no change in policy under the Proposed Action.
9 – Policy on Cross-country Use of All-terrain Vehicles and Snowmobiles on OML 1 and 2 Roads	• Winter snow conditions deep and fluffy.
Cumulative Effects	
10 – Acres and Percent of Lynx Habitat Unsuitable on All Ownerships	• Presence of snowshoe hare and hare habitat. • Sites for denning. • Matrix habitat and habitat connectivity.
11 – Road and Compacted Trail Density	• Winter snow conditions deep and fluffy.

Table 9
Lynx Analysis Indicators for Lands Administered by the Forest Service within the Lynx Analysis Units for Federal and Non-federal Lands for Existing Conditions and under the Proposed Action

Lynx Analysis Indicator	Lands	LAU	Existing Condition	Proposed Action	
			Acres	Acres	Net Gain (Loss) to Forest Service[1]
1a. Snowshoe hare foraging habitat	Federal Lands	SNF 12	30,133	23,768	(6,365)
	Non-federal Lands				
	Hunting Club	SNF 4	20,148	20,299	151
	Lake County North and Wolf Lands 1	SNF 16	19,080	19,469	389
	Wolf Lands 2, 3, and 4	SNF 21	21,968	23,418	1,450
	Lake County South	SNF 22	24,245	24,358	113
	McFarland Lake	SNF 42	12,983	13,014	31
	Hay Lake	NA	NA	4,643	4,643
				Net Gain/(Loss)	**412**
1b. Unsuitable habitat for snowshoe hare	Federal Lands	SNF 12	130	0	(130)
	Non-federal Lands				
	Hunting Club	SNF 4	1,289	1,299	10
	Lake County North and Wolf Lands 1	SNF 16	350	352	2
	Wolf Lands 2, 3, and 4	SNF 21	272	272	0
	Lake County South	SNF 22	344	348	4
	McFarland Lake	SNF 42	13	13	0
	Hay Lake	NA	NA	251	251
Net Gain/(Loss)					**137**

Table 9 (Cont.)
Lynx Analysis Indicators for Lands Administered by the Forest Service within the Lynx Analysis Units for Federal and Non-federal Lands for Existing Conditions and under the Proposed Action

Lynx Analysis Indicator	Lands	LAU	Existing Condition	Proposed Action	
			Acres	Acres	Net Gain (Loss) to Forest Service[1]
3. Denning habitat for lynx in 5 acre or larger blocks of habitat	Federal Lands	SNF 12	20,343	14,930	(5,393)
	Non-federal Lands				
	Hunting Club	SNF 4	13,994	14,986	92
	Lake County North and Wolf Lands 1	SNF 16	11,650	11,984	333
	Wolf Lands 2, 3, and 4	SNF 21	15,219	16,359	1,140
	Lake County South	SNF 22	18,773	18,821	48
	McFarland Lake	SNF 42	9,884	9,914	30
	Hay Lake	NA	NA	3,720	3,720
Net Gain/(Loss)					(**30**)
4. Lynx habitat with adequate canopy cover (suitable habitat)	Federal Lands	SNF 12	69,131/47,908[2]	62,758/41,537[2]	(6,372)
	Non-federal Lands				
	Hunting Club	SNF 4	49,994/28,903[2]	49,994/29,054[2]	151
	Lake County North and Wolf Lands 1	SNF 16	70,743/29,316[2]	70,743/29,705[2]	389
	Wolf Lands 2, 3, and 4	SNF 21	69,632/32,984[2]	69,632/34,434[2]	1,450
	Lake County South	SNF 22	57,107/40,217[2]	57,107/40,330[2]	113
	McFarland Lake	SNF 42	27,774/19,609[2]	27,774/19,640[2]	31
	Hay Lake	NA	NA	4,675	4,675
Net Gain/(Loss)					**437**

[1] Acreages may differ slightly from acreage given in FEIS due to rounding.

[2]Acres under all ownerships within the LAU/acres administered by the Forest Service within the LAU; acreage under all ownerships not available for indicators 1-3.

NA = Acreages do not include Hay Lake Lands, which is not within an LAU.

Total acreage within the LAU for all land ownerships —LAU SNF 4 = 55,071 acres, SNF 12 = 70,980 acres, SNF 16 = 76,108 acres, SNF 21 = 73,266 acres, SNF 22 = 58,154 acres, and SNF 42 = 32,305 acres; total acreage for lands administered by the Superior National Forest —LAU SNF 4 = 33,321 acres, SNF 12 = 49,409 acres, SNF 16 = 33,679 acres, SNF 21 = 36,082 acres, SNF 22 = 41,210 acres, and SNF 42 = 24,687 acres.

Sources: MDNR et al. (2013), Ryan (2013a).

base of waste rock piles with scattered stands of young forest near the Dunka Pit. These rock piles are about 5 miles from undisturbed habitat used by snowshoe hares. Thus, snowshoe hare have shown the ability to re-colonize areas associated with mine development.

Collectively, there about 6,777 acres (96% of available habitat) of snowshoe hare foraging habitat on the non-federal lands (**Figures 20 and 21**). This habitat, which is associated with several different LAUs, and Hay Lake Lands, would be administered by the Forest Service under the Proposed Action (**Table 9**). Based on habitat losses on the federal lands, and gains from the non-federal lands, there would be a net gain of 412 acres of snowshoe hare foraging habitat under Forest Service administration under the Proposed Action (MDNR et al. 2013).

Indicator 1b – Unsuitable Habitat

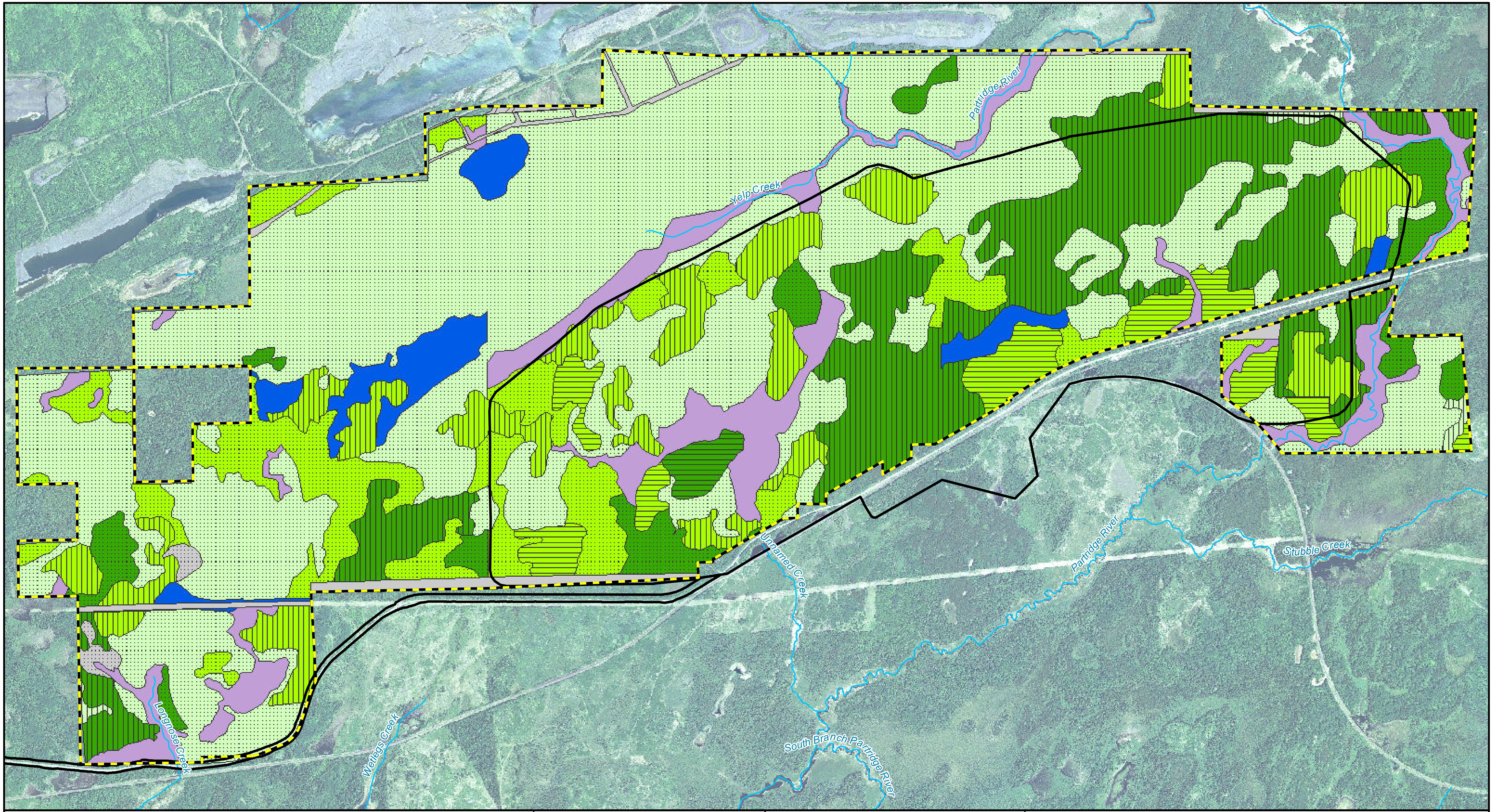
There are about 130 acres of unsuitable habitat for snowshoe hare on the federal lands (MDNR et al. 2013). Unsuitable habitat is defined as areas that are in the initial stages of forest growth where vegetation has not developed sufficiently to support snowshoe hare populations during all seasons (USDA Forest Service 2004b). For purposes of this BA, these are disturbed, cropland/grassland, and aquatic environments based on MDNR cover types (MDNR et al. 2013). Based on an assessment of existing conditions and conditions at mine closure, there would be a gain of approximately 1,669 acres of unsuitable habitat for snowshoe hare due to the Proposed Action**,** as about 50 acres of the disturbance area is already unsuitable for snowshoe hare. Some of this habitat may become suitable for snowshoe hare over time, as discussed above. There would be no change in the amount of unsuitable habitat on the federal lands surrounding the Mine Site due to the Project. However, because unsuitable habitat associated with the federal lands would be transferred from the Forest Service to PolyMet, there were be a reduction in unsuitable habitat for snowshoe hare administered by the Forest Service in LAU SNF 12 from current levels under the Proposed Action.

Collectively, there are about 267 acres of unsuitable habitat for snowshoe hare on the non-federal lands. This habitat, which is associated with several different LAUs and Hay Lake Lands, would be administered by the Forest Service under the Proposed Action (**Table 9**). There would be a gain of 137 acres of unsuitable habitat for snowshoe hare under Forest Service administration under the Proposed Action.

Indicator 3 – Denning Habitat

Based on an assessment of existing conditions and conditions at closure of the mine, there would be a loss of approximately 1,333 acres of denning habitat due to mining. There are about 5,393 acres of lynx suitable denning habitat on the federal lands. Thus, there would be a 7% reduction of denning habitat under in LAU SNF 12 from current levels (MDNR et al. 2013).

Collectively, the non-federal lands would provide about 5,363 acres of denning habitat (76% of all habitats within the non-federal lands). This habitat, which is associated with several LAUs and Hay Lake Lands, would be administered by the Forest Service under the Proposed Action (**Table 9**). Based on habitat losses on the federal lands, and gains from the non-federal lands, there would be a net loss of 30 acres of denning habitat under Forest Service administration under the Proposed Action.



Federal Lands
Project Areas
Management Indicator Habitat
Upland Forest
Upland Coniferous Forest
Lowland Black Spruce
Open Water
Other Lowland Emergent
Other Lowland Shrub
Other Upland Grass
N/A
Age Class
Mature
Immature
Young
N/A

US Army Corps of Engineers
St. Paul District

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

N W E S

0 1,000 2,000 4,000 Feet

Figure 19

Management Indicator Habitat Types and Age Classes - Federal Lands

Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

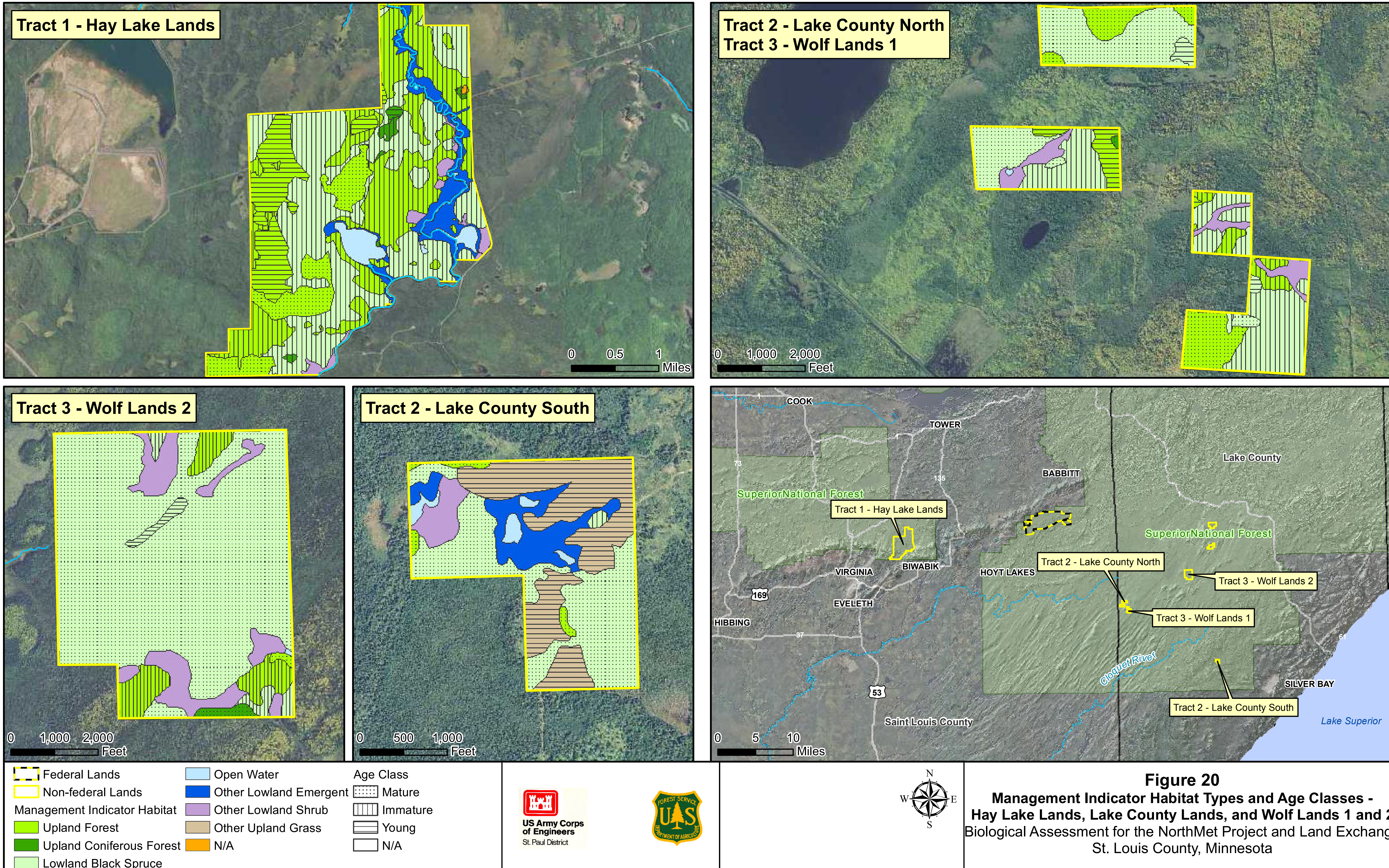
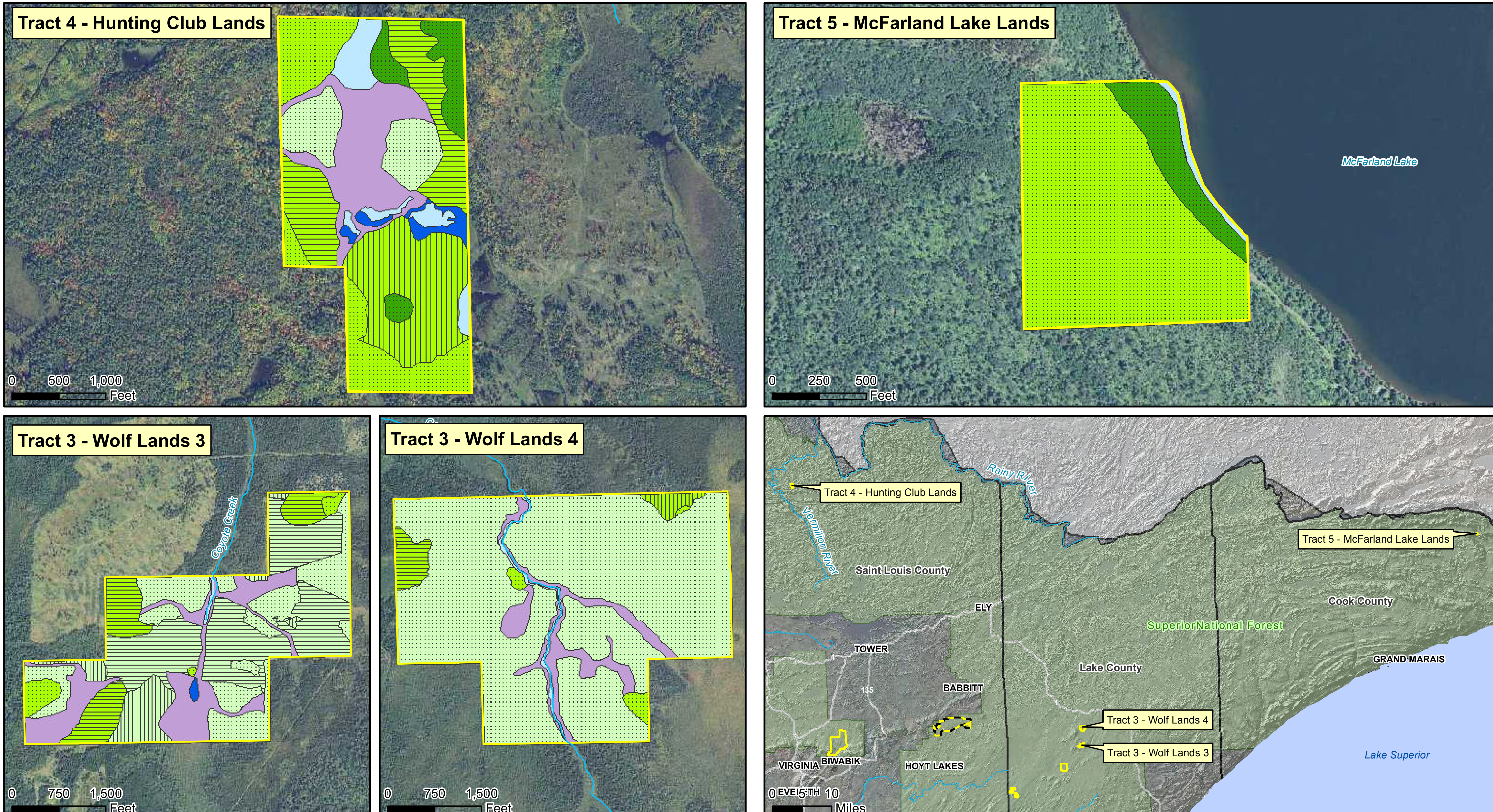


Figure 20

Management Indicator Habitat Types and Age Classes - Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2

Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota



Federal Lands
Non-federal Lands
Management Indicator Habitat
Upland Forest
Upland Coniferous Forest
Lowland Black Spruce
Open Water
Other Lowland Emergent
Other Lowland Shrub
Other Upland Grass
Age Class
Mature
Immature
Young
N/A

US Army Corps of Engineers
St. Paul District

Forest Service
U.S. Department of Agriculture

Figure 21
Management Indicator Habitat Types and Age Classes - Hunting Club Lands, Mc Farland Lake Lands, and Wolf Lands 3 and 4
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

Indicator 4 – Lynx Habitat with Adequate Canopy Cover

Upland forest greater than 4 years of age, and lowland stands with forest greater than 9 years of age, provide suitable lynx cover to support habitat connectivity (USDA Forest Service 2004b).

There are about 6,372 acres of lynx habitat with adequate canopy cover on the federal lands. Based on an assessment of existing conditions and conditions at closure of the mine, there would be a loss of approximately 1,669 acres of lynx habitat with adequate canopy cover due to mining, or about 2% of lynx habitat with adequate canopy cover within LAU SNF 12 (MDNR et al. 2013). Under the land exchange, the Forest Service would no longer administer 6,372 acres of lynx habitat with adequate canopy within LAU SNF 12 (13% loss of suitable habitat administered by the Forest Service in LAU SNF 12), but would gain 2,134 acres of suitable habitat in other LAUs. The Forest Service would also gain an additional 4,675 acres of suitable habitat on Hay Lake Lands, or 6,809 acres in total, for a net gain of 437 acres of lynx habitat with adequate canopy cover under Forest Service administration (MDNR et al. 2013).

Human Disturbance

Recreation

Risk Analysis Indicators

The Forest Service identified four risk analysis indicators to measure risks to lynx from recreational activities.

Indicator 5 – Miles of Designated All-terrain Vehicle Trails

Indicator 6 – Miles of Designated Snowmobile Trails

As discussed in the 2004 Forest Plan BA, one of the key concerns associated with all-terrain vehicles and snowmobile trails is the potential for increased and deeper access for humans into lynx habitat (USDA Forest Service 2004b). Snowmobile and all-terrain vehicle use (or, on some trails, other means of access such as walking or driving other types of vehicles) for trapping, hunting, or other recreational activities may increase the chance for lynx disturbance, harm, or mortality throughout wider areas of the Superior National Forest and on privately owned lands. Because of the lynx's vulnerability to trapping, this potential impact is difficult, if not impossible, to avoid. Because Forest Service plans foster recreation and encourage recreational uses of the Forest, there is an increased potential for negative impacts to lynx on lands administered by the Forest Service.

The 2004 Forest Plan (USDA Forest Service 2004a) provides overall direction for road and trail density in lynx habitat, recommending upper limits for road and trail density of 2 miles/mi^2 and guidance to seek opportunities to reduce density. Direction for designated snow-compacted trails, on the other hand, guides the Forest Service to generally allow for no net increase of winter trails unless they serve to consolidate use.

Another concern with new construction of designated all-terrain vehicle trails and snowmobile trails is the potential for increased snow compaction and access for competitors to lynx habitat. This is not a major issue on Forest Service-administered lands as the 2004 Forest Plan allows no net increase in designated snow-compacting trails unless they effectively consolidate use. However, there may be a concern with new all-terrain vehicle trails because in most locations it is likely that these routes could appear inviting to snowmobiling, and thus may have an unintended result of increasing snow compaction where trails coincide with lynx habitat.

These two indicators were not analyzed in this BA. There are no designated all-terrain vehicle or snowmobile trails on the federal and non-federal lands and Wetland Mitigation sites, except for 0.03 miles of designated trail on Wolf Lands 3. The Forest Service would promote recreational use of the lands it acquires in the land exchange, but is not expected to develop new all-terrain vehicle or snowmobile trails, or improve existing non-designated trails. Thus, all-terrain vehicle and snowmobile use of the non-federal lands is expected to remain near current levels, without or without the land exchange.

Under the Proposed Action, PolyMet would gain control of the federal lands and Wetland Mitigation Sites. Access to the Project area would be strictly controlled during mine operations and PolyMet has no plans to construct designated all-terrain vehicle or snowmobile trails on the federal lands or Wetland Mitigation Sites. Thus, there would be no change in designated trails on federal and non-federal lands with or without the proposed land exchange.

Indicator 8 – Policy of Cross-country Use of All-terrain Vehicles and Snowmobiles

This indicator applies to lands administered by the Forest Service. Cross-country use by all-terrain vehicles and snowmobiles is allowed now and would also be allowed in the future in most management areas on the Superior National Forest. It is difficult to estimate the consequences of this policy. Ruediger et al. (2000) suggested that recent advances in snowmobile technology may allow snowmobiles to travel in deeper snow and to areas that were not accessible with older machines. However, most snowmobiles used on the Superior National Forest are getting larger and are designed for use on maintained system trails, and machines are difficult to take off trails or open areas because of the density of the forest. Places that can currently be traversed cross-country frequently are already used from year to year. For example, rivers or open non-forest lands that provide a long enough travel way can become *de facto* trails, because they are used in most winters and during most of the winter.

Under the Proposed Action, Superior National Forest policies would not apply on the federal lands. As noted above, public access to these areas would be restricted during and after mine operations.

Forest Service policies would apply to the non-federal lands under the Proposed Action. Some cross-country use of these lands occurs now, and would be expected to continue if these lands are administered by the Forest Service. Because there would be few changes under the Proposed Action, and because snowmobilers typically prefer established trails to cross-country travel through forested habitat, there should be little change in impacts to lynx with or without the land exchange. This indicator is not analyzed in this BA.

Indicator 9 – Policy on Cross-country Use of All-terrain Vehicles and Snowmobiles on OML 1 and 2 Roads

The Forest Service generally allows all-terrain vehicles and snowmobile use on all existing Objective Maintenance Level (OML) 1 and 2 roads and on unclassified roads (generally these are former temporary or low standard roads).

Objective Maintenance Level 1 designation is assigned to intermittent service roads when they are closed to street legal motorized vehicular traffic. The closure period must exceed 1 year. Roads receiving OML 1 maintenance would generally be managed at OML 2 during the time they are open for traffic. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns.

Objective Maintenance Level 2 designation is assigned to roads operated for use by high clearance vehicles. Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted (such as log haul), dispersed recreation, or other specialized uses. Log haul may occur at this level. Temporary and newly constructed OML 1 and 2 roads would be effectively closed following their intended management use.

County and temporary or low standard roads are found on the non-federal lands and were constructed to facilitate timber management and recreational access. The effects of the Proposed Action on all-terrain vehicle and snowmobile use of temporary or low standard roads associated with the federal and non-federal lands would be similar to those described for Indicator 8. Thus, this indicator is not analyzed in this BA.

Roads and Trails

Risk Analysis Indicators

The Forest Service has identified one risk analysis indicator to measure impacts from forest and backcountry roads and trails.

Indicator 7 – Miles of Temporary and OML 1 and 2 Roads

Temporary roads are authorized by contract, permit, lease, other written authorization, or emergency operation. They are not intended to be a part of the forest transportation system, and are not necessary for long-term resource management. These roads are not included on the National Forest System road inventory and are decommissioned after use (USDA Forest Service 2004b). Objective Maintenance Level 1 and 2 roads are discussed above under Indicator 9. This indicator is not analyzed in this BA because there would be little or no change in the miles of temporary and OML 1 and 2 roads on federal and non-federal lands under the Proposed Action (Ryan 2013a).

Under the Proposed Action, PolyMet would gain control of the federal lands. There are approximately 5.9 miles of temporary and OML 1 and 2 roads on the federal lands. Temporary roads built to support historic timber management and mine exploration on the proposed Mine Site would be lost to mine development. Access to the Project area would be strictly controlled during mine operations.

These roads would likely have little impact on lynx, as lynx would be discouraged from using the roads due to noise and other disturbances. After mine closure, most access roads would be closed and the property would remain privately owned and closed to public access. Temporary roads may be constructed on the federal lands associated with the Mine Site to support forest management activities, but the number of miles of temporary backcountry roads and trails on the Project area should be similar to, or less than, existing miles of backcountry roads and trails on the federal lands. Roads would be privately owned and closed to public access. (Pylka 2013b).

The Forest Service would primarily manage the non-federal lands for timber production and recreation. If new roads are constructed on the lands, they would likely be temporary and used to support timber management. There would likely be little or no change in the number of miles of backcountry roads and trails on the non-federal lands, and the number of miles may decrease if existing roads are closed and revegetated or allowed to revegetate naturally, benefitting lynx.

6.1.3 Interrelated and Interdependent Effects

No known activities are interrelated or interdependent to the Project that would have the potential to affect Canada lynx. It is possible that future specific programs or projects may have relevant interrelated and interdependent actions (e.g., expansion of the Mine Site due to discovery of new ore bodies) and they would be considered in the context of consultations for those actions.

6.1.4 Cumulative Effects

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the cumulative effects study area (CESA) considered in this BA. Future federal actions that are unrelated to the Proposed Action are not considered in this BA because they require separate consultation pursuant to Section 7 of the ESA.

The CESA includes the Nashwauk and Laurentian Uplands ecological subregions within the Arrowhead Region of Minnesota. This area totals approximately 1.38 million acres in the northeast corner of Minnesota (**Figure 22**; Emmons and Olivier Resources, Inc. 2006). The period for analysis of cumulative effects in this BA was from pre-settlement (approximately 1890) through closure and reclamation of Project facilities (approximately 40 years).

Cumulative effects to plants and animals are discussed in Chapter 6 of the FEIS (MDNR et al. 2013). The impacts discussed in that section were based on an analysis conducted for a 2006 MDNR report titled *Cumulative Effects Analysis on Wildlife Habitat and Travel Corridors in the Mesabi Iron Range and Arrowhead Regions of Minnesota* (Emmons and Olivier Resources, Inc. 2006), and a report titled *Cumulative Effects Analysis of Wildlife Habitat and Threatened and Endangered Wildlife Species* (Barr 2009).

In accordance with Council on Environmental Quality guidance on June 24, 2005 (Council on Environmental Quality 2005), past actions associated with the Project are addressed through their current aggregate effects and have not been provided as a list of individual projects in this BA. The FEIS identifies a number of projects that should be considered reasonably foreseeable future actions and that may contribute to cumulative effects to plants and animals. These include mining and other land development activities, and land management activities such as timber harvest, prescribed fire, and road construction that may be authorized or carried out on nearby federal, state, and private lands and that are likely to have both positive and negative effects to plants and animals.

Based on analysis conducted by Emmons and Olivier Resources, Inc. (2006), approximately 1,700 acres of wildlife habitat were lost from the Arrowhead Region between 1890 and the 1990s, with loss due to forestry and mining accounting for 88% of the loss. In much of the region, forest communities have transitioned from predominately pine- and tamarack-dominated forests to trembling aspen and other non-pine community-dominated forest species. Forest composition has changed, and the Minnesota Forest Resource Council (2003) concluded that forest fragmentation has increased, with decreased forest stand sizes and more miles of forest edge.

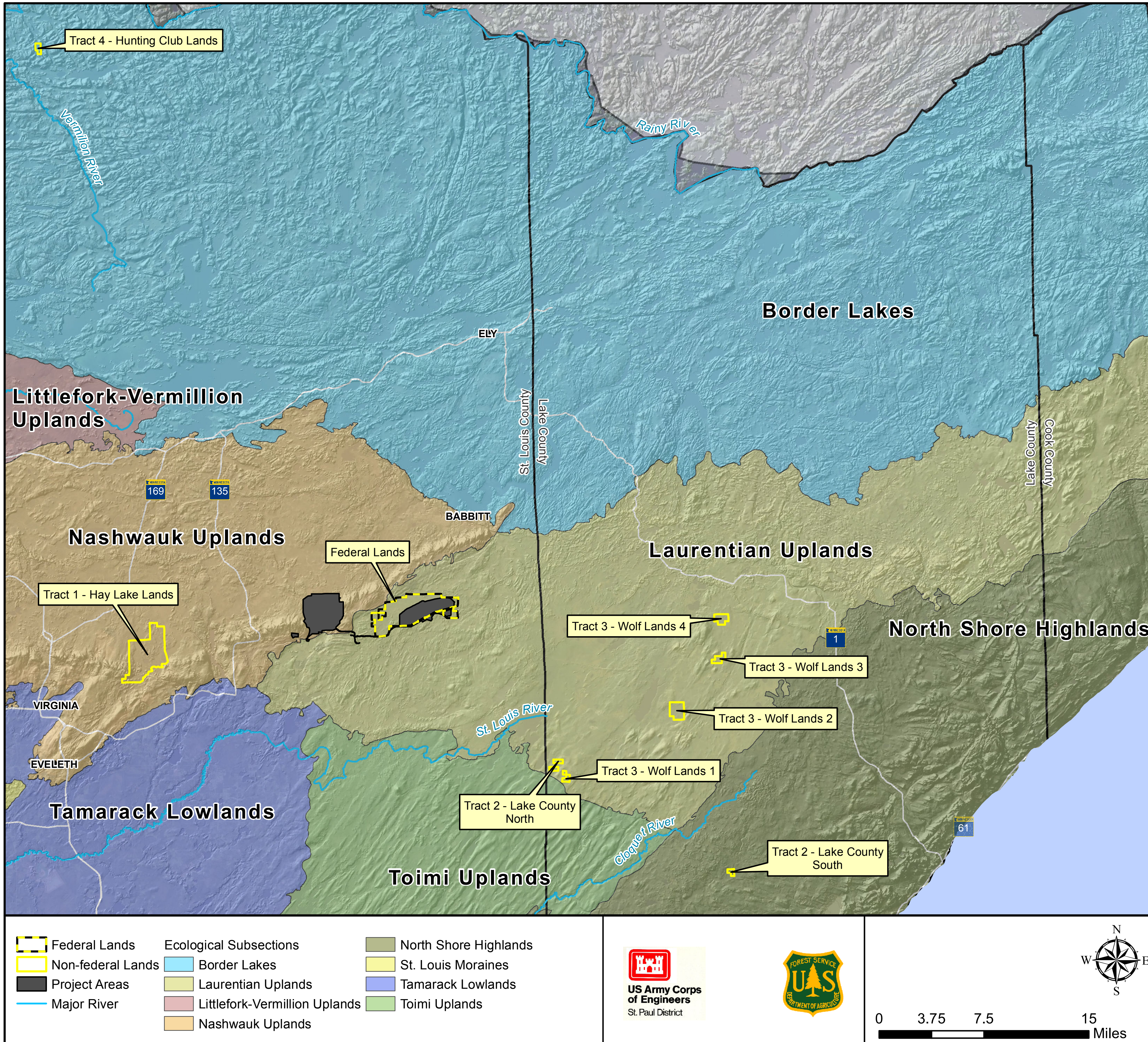


Figure 22
Arrowhead Region of Minnesota and Ecological Subsections
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

Barr (2009) estimated habitat loss due to mining at about 17,000 acres over the next 25 to 30 years. In the future, the rate of habitat losses due to mining would decrease as vegetation establishes on disturbed lands. Potential disturbances to habitat within the Laurentian Uplands ecological subsection would be primarily due to timber harvest and mining, and habitat types most likely to be affected include upland and lowland coniferous forest, upland deciduous forest, and upland shrub/woodland. Within the Nashwauk Uplands ecological subsection, mining activities and urban development would be more likely to affect habitat, with upland deciduous forests and upland shrub/woodland habitats most affected (Emmons and Olivier, Inc. 2006).

Although more land would be impacted by timber management than mining in the future, forestry management offers a greater range of options for lynx, northern long-eared bat, and wolf to co-exist with the practice, as it can mimic natural disturbances, whereas mining represents a complete land conversion that could affect long-term lynx habitat availability. Between 2005 and 2014 within the Laurentian Uplands ecological subregion, an average of approximately 1,034 forest acres were (or would be) harvested annually on state lands (0.2% of the subsection). Between 2010 and 2019 within the Nashwauk ecological subregion, an average of approximately 1,189 forest acres were (or would be) harvested annually on state lands (0.1% of the subsection). On average, 1% of timberland in the Superior National Forest is harvested annually (MDNR et al. 2013). Private timber harvest data are generally not available.

6.1.4.1 Factors Considered in the Cumulative Effects Analysis

The 2004 Forest Plan BA and 2011 Hardrock Mining BA identified several factors to consider when evaluating impacts to lynx in northeastern Minnesota at a landscape level of analysis. These are 1) habitat loss and fragmentation, including loss and fragmentation of lynx critical habitat, 2) human disturbance and access, and 3) habitat connectivity.

6.1.4.2 Cumulative Effects Assessment

Habitat Loss and Fragmentation, including Prey Habitat

The Project and other nearby proposed mine projects would increase the amount of habitat fragmentation in the area, changing wooded/forested and other vegetated habitats to disturbed/developed areas with limited habitat value. Development of iron mines along the Iron Range has made much of this area of limited value to lynx, especially areas with pits, tailings, and waste rock piles. Historic waste rock piles and tailings have begun to revegetate and provide some habitat for lynx and their prey, but their value is greatly reduced compared to habitat that existed in the area prior to mining.

Development of the Plant Site would have little impact on habitat fragmentation, as 61% of the site (2,756 of 4,515 acres) has been disturbed by LTVSMC taconite mining operations and the remaining habitat occurs in scattered tracts on the Plant Site. In addition, most of the land within several miles of the Plant Site have been disturbed by past and ongoing taconite operations, including lands within the Transportation and Utility Corridors.

Activities at the Plant Site would have little impact on lynx, as surveys suggest the Plant Site and nearby areas are avoided or rarely used by lynx, probably due to poor quality habitat and moderate level of human disturbance at or near the Plant Site. Development of the Mine Site would add to habitat fragmentation by converting much of the habitat on the Mine Site to an open water pit lake and waste rock stockpiles of limited value to lynx. Most lynx sightings on or near the Project area have been to the east of the Mine Site, but lynx tracks have been seen on the Mine Site and it is likely that lynx move in an east-west direction between Forest Service and private forestlands in the vicinity of the Mine Site. Development of the Mine Site would force lynx to move further south to travel in an east-west direction to access these forests, and would also force lynx to travel south of the Mine Site, or north of the Mine Site through the federal lands surrounding the Mine Site. Use of the lands adjacent to the Mine Site by lynx may be limited during mine operations due to disturbance associated with the Mine Site and the Northshore Mine to the north. Impacts to lynx from habitat loss and fragmentation may not be great, however, as lynx studies in the area suggest that lynx primarily reside in an area east and southeast of the Mine Site on Superior National Forest lands and the BWCAW, and only occasionally use the Mine Site.

The Mine Site would account for about 1,719 acres, or 10% of the estimated 17,000 acres of habitat impacted by future mining activity within the next 25 to 30 years. It should be noted that while losses to forestry represent the bulk of habitat loss in the region, they are not as permanent or destructive as mining or economic development losses from the perspective of lynx and their prey. Forestry practices remove some or all trees from an area, reducing the value of that area as lynx habitat, but the natural process of succession ensures the regeneration of forest stands that can once again serve as high-quality habitat. Occasional timber harvest may actually promote the growth of dense coniferous stands that are favored by snowshoe hare, the primary prey species of the lynx.

Areas of mine disturbance would be reclaimed and available to lynx about 10 or more years after reclamation. Thus, habitat lost for use by lynx on the Mine Site would be only a small portion of the amount of habitat impacted by forestry and other mining activities. Although impacts to lynx would be expected at the individual level, they would not be expected at the population or species level.

Risk Analysis Indicators

The Forest Service has identified two risk analysis indicators to measure impacts to lynx from cumulative effects associated with habitat loss and fragmentation (**Table 10**).

<u>Indicator 10 – Lynx Habitat Unsuitable on All Ownerships</u>

Indicator 10 was developed by the Forest Service to identify the amount of habitat within a LAU that is unsuitable to lynx. If more than 30% of all lynx habitat within an LAU (all ownerships) is unsuitable,

Table 10
Unsuitable Habitat and Road/Trail Density within the Lynx Analysis Units Affected by the Project

Lynx Analysis Indicator	Lands	LAU	Existing Condition		Proposed Action[1]	
			Acres	Percent[2]	Acres	Percent[2]
10. Lynx Habitat Unsuitable on All Ownerships	Federal Lands	SNF 12	2,737	4.0	4,456	6.4
	Non-federal Lands					
	Hunting Club	SNF 4	2,470	4.9	2,470	4.9
	Lake County North and Wolf Lands 1	SNF 16	3,127	4.4	3,127	4.4
	Wolf Lands 2, 3, and 4	SNF 21	2,931	4.2	2,931	4.2
	Lake County South	SNF 22	913	1.6	913	1.6
	McFarland Lake	SNF 42	534	1.9	534	1.9

	Hay Lake	NA			NA	
Lynx Analysis Indicator	Lands/Parcels	LAU	Existing Condition		Proposed Action[3]	
			Miles within LAU[4]	Density within LAU[3]	Miles within LAU	Density within LAU[5]
11. Road and Snow-Compacted Trail Density	Federal Lands	SNF 12	99	0.9	93	0.8
	Non-federal Lands					
	Hunting Club	SNF 4	185	2.2	185	2.2
	Lake County North and Wolf Lands 1	SNF 16	98	0.9	98	0.9
	Wolf Lands 2, 3, and 4	SNF 21	93	0.8	93	0.8
	Lake County South	SNF 22	105	1.2	105	1.2
	McFarland Lake	SNF 42	70	1.7	70	1.7
	Hay Lake	NA			NA	

[1] After Project closure. Some unsuitable habitat on the Mine Site would become suitable for lynx 10 or more years after reclamation of the Mine Site.

[2] Acres and percent of unsuitable habitat provided by USDA Forest Service (Ryan 2013a). Acres of suitable habitat are: SNF 4 – 49,994; SNF 12 – 69,131; SNF 16 – 70,743; SNF 21 – 69,632; SNF 22 – 57,107; and SNF 42 – 27,775.

[3] After Project closure and reclamation.

[4] Miles of roads and snow-compacted trail density provided by USDA Forest Service (Ryan 2013a).

[5] Density = Miles of road per square mile.

Total acreage within the LAU for all land ownerships —LAU SNF 4 = 55,071 acres, SNF 12 = 70,980 acres, SNF 16 = 76,108 acres, SNF 21 = 73,266 acres, SNF 22 = 58,154 acres, and SNF 42 = 32,305 acres; total acreage for lands administered by the Superior National Forest —LAU SNF 4 = 33,321 acres, SNF 12 = 49,409 acres, SNF 16 = 33,679 acres, SNF 21 = 36,082 acres, SNF 22 = 41,210 acres, and SNF 42 = 24,687 acres.

then no further reduction in suitable condition should occur as a result of vegetation management activities by the Forest Service. **Table 10** shows the amount of unsuitable habitat within LAUs that would be affected by the Project. The amount of unsuitable habitat would increase in LAU SNF 12 to 6.4% from 4.0% due to Mine Site development, but would not exceed 30%. Because habitat management would be little changed due to the proposed transfer of the non-federal lands, the amount of area with unsuitable habitat within the other LAUs should not change with or without the proposed land exchange.

Indicator 11 – Road and Snow-compacted Trail Density

Indicator 11 provides a measure of the Forest Service goal to maintain road and snow-compacting trail densities below 2 miles/mi^2 within LAUs to maintain the natural competitive advantage of lynx in deep snow (**Table 10**). Where total road and regularly-used snow-compacting trail densities are greater than 2 miles/mi^2 and coincide with lynx habitat, effort should be made to prioritize roads for seasonal restrictions or reclamation in those areas, where practical or feasible. "Roads" include all ownerships of classified and unclassified roads and "regularly-used trails" are those that are used most years for most of the snow season. The 2004 Forest Plan allows no net increase in designated snow-compacting trails unless they effectively consolidate use (USDA Forest Service 2004a). However, there may be a concern with new all-terrain vehicle trails because in most locations it is likely that these routes could appear inviting to snowmobiling, and thus may have an unintended result of increasing snow compaction where trails coincide with lynx habitat.

Approximately 5.9 miles of OML 1 roads are on the federal lands, or about 0.6 miles/mi^2. After mine closure, these roads would be reclaimed, except for a short access road from the Dunka Road to the Waste Water Treatment Facility. Public access to the Mine and Plant sites is currently prohibited, and access to the Plant Site and lands adjacent to the Mine Site would be strictly controlled during mine operations. The Project area would remain privately owned after mine closure and public access would be restricted (Pylka 2013b).

There are no designated all-terrain vehicle or snowmobile trails on the federal lands. It is unlikely that new designated trails would be constructed on the federal lands after mine closure.

There are designated and undesignated roads and trails on or bordering the non-federal lands, and recreational use of these roads and trails was evident on these sites. Road density exceeds 2.2 miles/mi^2 in LAU SNF 4. There are historic logging roads on Hunting Club Lands, and it is possible that new logging roads could be constructed in the future, but these would not be regularly used roads. Thus, regular use road density should not increase in LAU SNF 4 due to the land exchange. Road densities are below 2 miles/ mi^2 for the other lands. As noted for Indicator 7, there would be no immediate change in miles of designated and undesignated roads and designated all-terrain vehicle or snowmobile trails within the LAUs with or without the land exchange.

Human Access and Disturbance

Human Access and Traffic

The Project and other nearby proposed projects would increase the amount of human access and disturbance in the area. Increased human populations in the Project area may also lead to increased risk to lynx from collisions with vehicles and trains, increased levels of recreation activities and use of backcountry roads and trails, and increased mortality from illegal hunting and trapping.

There is a well-established road system along the Mesabi Iron Range, associated with mining activity, and to serve nearby towns, recreational areas, private residences, pasturelands, and forestlands. It is expected that the number of miles of roads within the Project area would show little increase during the life of the Project, and some roads could be taken out of service or reclaimed during the life of the Project. The Forest Service estimated that up to 157 miles of temporary roads could be constructed annually within the Superior National Forest from hardrock mining activities and that up to 761 miles could exist at any one time during the period of hardrock mining within the Superior National Forest (USDA Forest Service 2011a). Still, this would be less than the mileage gain estimated to occur under the 2004 Forest Plan, which was based on mileage limits to protect lynx (USDA Forest Service 2004a). Given that the number of miles of roads associated with the Mine Site, Dunka Road and Utility Corridor, Plant Site, and non-federal lands after mining is expected to be similar to or less than current levels, impacts associated with road mileage are not expected to accumulate from the Project.

Human activity associated with the Project, and other ongoing and proposed projects near the Project area, would increase the amount of vehicle and rail traffic in the region and the potential for collisions between lynx and vehicles and trains. Vehicle and rail traffic within and to/from the Project area could result in the loss of a lynx during the 20-year mine operation period, and accumulate with losses of lynx from collisions with trains and vehicles elsewhere in the CESA.

Trapping and Incidental or Illegal Shooting

There is evidence that lynx may be accidentally trapped during furbearer, including bobcat, fisher, gray wolf, and pine marten trapping seasons. Of the 435 records in the MDNR (2007) lynx database for 2000 to 2006, ten records list that the animal was caught in a trap, and of these, three were killed, six were released unharmed, and the status of one is unknown. Based on records kept by the USFWS since from 2000 to 2012, 13 lynx died from trapping incidents (4 were legally trapped in Canada), and another 10 were trapped and released alive (Rowse 2012). It is likely that other lynx have been trapped, but not reported. The magnitude of accidental lynx trapping in the project area and in northern Minnesota is unknown.

Lynx could be shot mistakenly or intentionally by hunters or by poachers. Lynx and wolves may be shot by hunters during deer and other hunting seasons for fun, or lynx may be mistakenly identified as bobcat and shot during the bobcat season. The actual magnitude of lynx shooting in northern Minnesota is unknown. Of the 435 records in the MDNR (2007) lynx database for 2000 through 2006, only 1 record lists that the animal was intentionally shot, while another lynx was accidentally shot; the USFWS database lists six lynx shot since 2000 (Rowse 2012). However, it is likely that lynx shootings are generally not reported. It is unlikely that many lynx would be shot within the Project area due to limited numbers of lynx in the general vicinity of the Project, and because hunting would not be allowed on the Project area during mining, and most likely after mine closure.

The number of people, and potential for trapping and incidental or illegal shooting, would increase in the region due to the Project. Education of the public as to the importance of protecting lynx and other wildlife, however, has helped to reduce the accidental or intentional loss of lynx in recent years. Trapping and illegal or accidental shooting of lynx would be unlikely on the federal lands during mine construction and operation if conservation measures given in Chapter 7 of this BA are followed. Although the Project would cause an increase in the number of people in the region, the cumulative effects of the Project on trapping and illegal or accidental shooting of lynx on the non-federal lands and Wetland Mitigation Sites would be negligible.

Competition and Predation as Influenced by Human Activities

Lynx interact with other carnivores throughout their range. Competition with or predation by coyotes, gray wolves, mountain lions, bobcats, and birds of prey have been inferred or documented throughout the range of the lynx. Some human activities, particularly those related to timber harvest and over-the-snow access routes, have the potential to alter natural relationships between lynx and other predators.

Certain timber harvest practices increase edges and openings within forest stands, which may improve foraging conditions for generalist predators such as coyotes, bobcats, and great horned owls. This in turn increases the potential for both exploitation and interference competition with lynx to occur.

Snow compaction due to resource management or recreation activities may facilitate movement of coyotes and other potential competitors and predators into lynx habitat, making it likely that lynx in the study area would compete with these competitors and predators for primary lynx prey (Buskirk et al. 2000b).

The Forest Service recommends that road and snow-compacting trail densities be kept below 2 miles/mi^2. Where road and snow-compacting trail densities exceed 2 miles/mi^2, the Forest Service would prioritize roads for season restrictions or reclaim some roads. Of the 47 LAUs in northeastern Minnesota, 15 have road and snow-compacting trail densities exceeding 2 miles/mi^2, including LAU SNF 4. Based on road building activities between 2004 and 2010, the Forest Service estimates that about 77 miles of OML 1 and 123 miles of OML 2 roads would be constructed in the Superior National Forest each year. Another 532 to 860 miles of temporary roads could be constructed to support hardrock mining activities (USDA Forest Service 2011a). As noted earlier, however, most, if not all new roads constructed on the Mine Site and Plant Site would be removed or reclaimed after mining ceases, and there would be little or no new road construction on the lands adjacent to the Mine Site and non-federal lands. Thus, competition between lynx and its predators due to an increase in road and snow-compacting trail densities would not accumulate due to the Project long term.

Habitat Connectivity

Much of the habitat for lynx along the Iron Range has been eliminated by mining, other industrial activities, and residential development, and remaining habitat is heavily fragmented. However, large patches of suitable lynx habitat exist on either side of the range, primarily within the Superior National Forest, Chippewa National Forest, and various state forests. To travel between habitat patches on either side of the Iron Range, lynx must find suitable corridors of habitat that traverse the range and allow safe movement. Emmons and Olivier Inc. (2006) identified 13 wildlife travel corridors, while Barr (2009) identified 18 travel corridors, which facilitate movement of wildlife across the Iron Range. Three wildlife travel corridors exist in the vicinity of the Project that could be impacted by the project and other projects in the area (**Figure 23**).

Corridor 16 is a small but important corridor, approximately 0.6 mile wide, which connects large habitat blocks to the east-southeast and north-northwest. The corridor is unlikely to be impacted by the Project because the Plant Site Tailings Basin area would be sited approximately 1 mile to the northwest on the existing LTVSMC Tailings Basin. The Emmons and Olivier, Inc. (2006) report also noted that an area to the southwest has high potential for future growth, which could impact the corridor, but estimated that the corridor would continue to serve as an important connection for wildlife in the future. Lynx have not been reported using this corridor.

Corridor 17 is a 1,200-feet wide strip that is between two open pits operated by the Northshore Mine and is approximately 0.5 mile northwest of the Mine Site. Operations at the Mine Site would indirectly impact the corridor by reducing the size of the large habitat block southeast of the corridor. Noise and mining activity could also discourage lynx use of this corridor. The corridor could be accessed from north of the Mine Site, and from the south and southwest of the corridor. Lynx have been observed using this corridor.

Corridor 18 is about 2,800 feet wide, located at the eastern boundary of the Northshore Mine, about 7 miles northwest of the Mine Site. The corridor follows a river, and several small roads cross this corridor. Recent expansion of the Northshore Mine easterly pit, and a relocation of County State Aid Highway 70 that is east of the pit, has reduced the width of the corridor to about 2,200 feet (USDOI USFWS 2011a). Lynx have been observed using this corridor.

Research conducted by the NRRI indicates that lynx have varied home ranges, and disperse from them within the Superior National Forest, and to and from Canada (Burdett 2007, Moen et al. 2010). Movements were made across roaded areas, and also across the BWCAW, which has few or no linear features such as roads, trails, and logging roads that could guide movement by lynx. When lynx made long distance movements, they often crossed several LAU boundaries without changes in direction.

Moen et al. (2010) suggested that habitat connectivity does not appear to be a limiting factor for lynx in northeastern Minnesota. The combination of low topographic relief, the linear nature of movement paths, and the relative lack of differences in cover conditions indicate that geographically or topographically definable movement corridors do not exist for lynx either within in northeastern Minnesota, or between Minnesota and Ontario, Canada. Because northeastern Minnesota is the southern limit of boreal forest, no connectivity or linkage areas could be managed for lynx movement to the south and west because of unsuitable habitat in those directions.

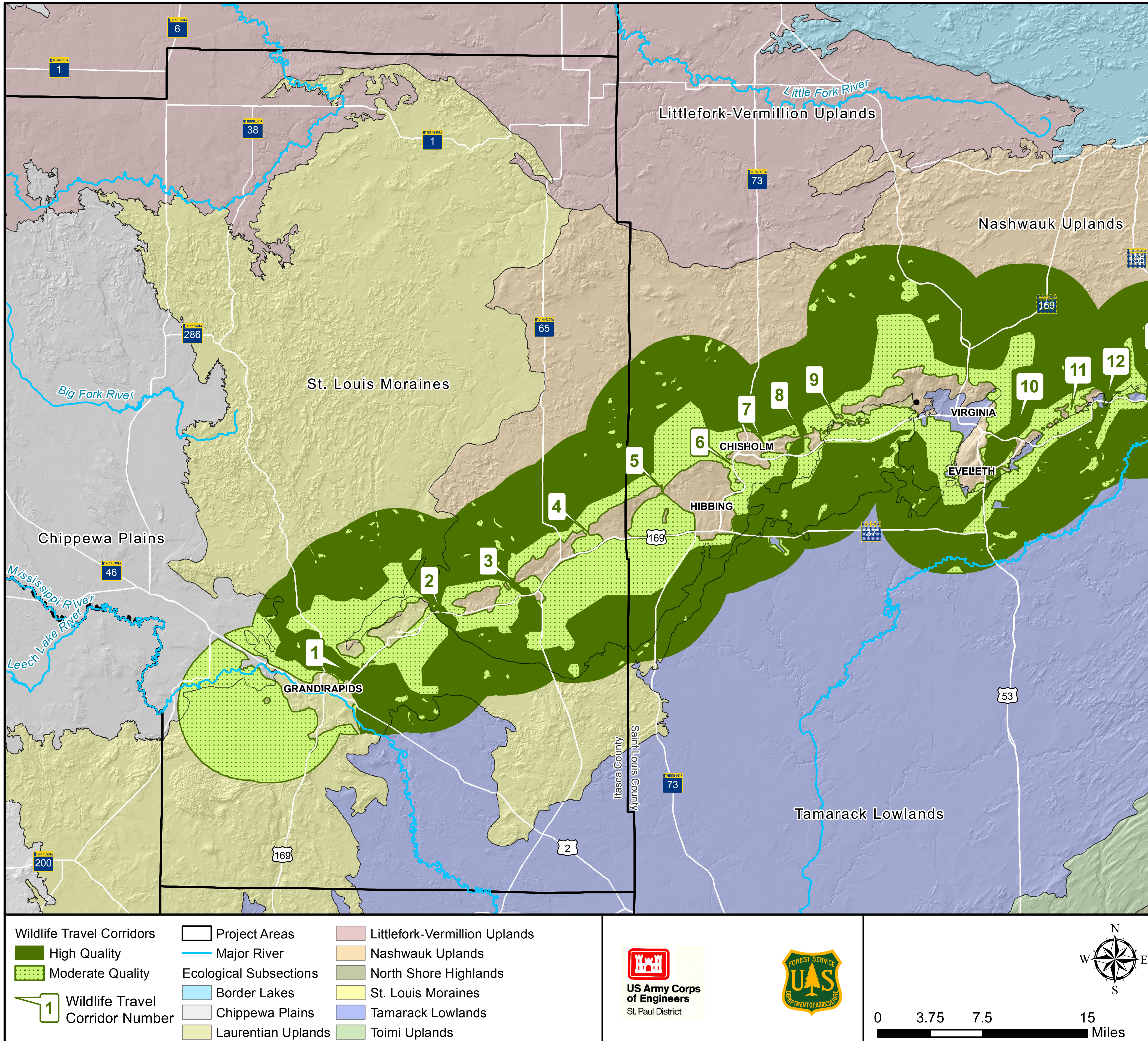


Figure 23
Wildlife Travel Corridors
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

Dense forests occur in northeastern Minnesota, and while forest management activities alter patterns of vegetation community composition and structure at landscape and smaller scales, Ravenscroft et al. (2010) considered northeastern Minnesota forest landscape as largely unfragmented. In addition, Galatowitsch et al. (2009) stated that the BWCWA and the North Shore portion of the Superior National Forest are high quality protection areas.

Therefore, large portions of northeastern Minnesota provide excellent connectivity habitat. There is no indication that lynx use defined linkage areas, and they appear to move freely across the landscape throughout the Superior National Forest, and north into Canada. Although actions associated with the Project could impact Corridors 16 and 17, and these impacts would accumulate with impacts to nearby corridors from other projects in the region, there is good habitat connectivity within designated critical habitat and the Project area.

6.2 Northern Long-eared Bat

6.2.1 Environmental Baseline

The following baseline information is from *Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Eastern Small-Footed Bat and the Northern Long-Eared Bat as Endangered or Threatened Species; Listing the Northern Long-Eared Bat as an Endangered Species; Proposed Rule* (USDOI USFWS 2013b) and references cited therein. A full description of references cited in this rule is available at URL: http://www.regulations.gov/#!documentDetail;D=FWS-R5-ES-2011-0024-0002. Any additional information that is not from one of these sources is cited in the text.

6.2.1.1 Species Description and Status and Critical Habitat Status

The northern long-eared bat belongs to the order Chiroptera, suborder Microchiroptera, family Vespertilionidae, subfamily Vesperitilionae, genus Myotis, subgenus Myotis. The northern long-eared bat was considered a subspecies of Keen’s long-eared myotis (*Myotis keenii*), but was recognized as a distinct species by van Zyll de Jong (1979).

A medium-sized bat species, the northern long-eared bat adult body weight averages 0.2 to 0.3 ounces, with females tending to be slightly larger than males. Average body length ranges from 3.0 to 3.7 inches. Fur colors include medium to dark brown on its back, dark brown, but not black, ears and wing membranes, and tawny to pale-brown fur on the ventral side. The northern long-eared bat is distinguished from other *Myotis* species by its long ears (average 0.7 inches), that, when laid forward, extend beyond the nose. Within its range, the northern long-eared bat can be confused with the little brown myotis or the western long-eared myotis. The northern long-eared bat can be distinguished from the little brown myotis by its longer ears, tragus, slightly longer tail, and less glossy pelage. The northern long-eared bat can be distinguished from the western long-eared myotis by its darker pelage and paler membranes (Caceres and Barclay 2000:1).

White-nose syndrome, a fungal disease known to affect bats, is currently the predominant threat to the northern long-eared bat, especially throughout the Northeast where the species has declined by up to 99% from pre-white-nose syndrome levels at many hibernation sites (hibernacula; USDOI USFWS 2013a). White-nose syndrome has spread rapidly throughout the East and is currently spreading through the Midwest. Although the disease, caused by the fungal species *Pseudogymnoascus destructans*, has not yet spread throughout the northern long-eared bat’s entire range (white-nose syndrome is currently found in at least 22 of 39 states where the northern long-eared bat occurs), it continues to spread. Other threats to the species include wind energy development, habitat destruction or disturbance (e.g., vandalism to hibernacula, roost tree removal), climate change, and contaminants. Although no significant population declines have been observed due to these threats, they may now be important factors affecting this bat's ability to persist while experiencing dramatic declines caused by white-nose syndrome.

The northern long-eared bat was proposed for listing as an endangered species by the USFWS on October 2, 2013. The USFWS also determined that critical habitat for the northern long-eared bat is not determinable at this time.

6.2.1.2 Distribution

The northern long-eared bat is found across much of the eastern and northcentral United States and all Canadian provinces from the Atlantic coast west to the southern Northwest Territories and eastern British Columbia (USDOI USFWS 2013a).

Historically, the species has been most frequently observed in the northeastern United States and in Canadian Provinces, Quebec and Ontario, with sightings increasing during swarming and hibernation. However, throughout the majority of the species' range it is patchily distributed, and historically was less common in the southern and western portions of the range than in the northern portion of the range.

Although they are typically found in low numbers in inconspicuous roosts, most records of northern long-eared bats are from winter hibernacula surveys. More than 780 hibernacula have been identified throughout the species' range in the United States, although many hibernacula contain only a few (1 to 3) individuals. Eleven hibernacula sites with one or more winter records are known from Minnesota.

The northern long-eared bat is commonly encountered in summer mist-net surveys throughout the majority of the Midwest and is considered fairly common throughout much of the region. However, the species is often found infrequently and in small numbers in hibernacula surveys throughout most of the Midwest. In northeastern Minnesota, this species has been detected in St. Louis, Lake, and Cook Counties based on records in the MDNR Natural Heritage Information System database of element occurrences (MDNR 2014a). In Minnesota, the Tower/Soudan Underground Mine State Park in St. Louis County contains a large number of individuals, possibly over 3,000; however, this is a very rough estimate because the majority of the mine cannot be safely accessed for surveys (Nordquist et al. 2006, USDOI USFWS 2013b). The mine is about 15 miles northwest of the Project area.

Additionally, northern long-eared bats have been detected in six caves along the North Shore of Lake Superior. These caves are within the Superior National Forest proclamation boundary but outside of federal surface ownership. Mist-net surveys conducted by Superior National Forest biologists confirmed the presence of northern long-eared bats at five of the eight sites surveyed in St. Louis and Lake Counties during the summer of 2013 (Grandmaison et al. 2013). While these data are far from providing an estimate of abundance on the Superior National Forest, they do suggest that northern long-eared bats can be detected, albeit at low numbers, across much of the forest where surveys are conducted.

6.2.1.3 Life History

Hibernation

The northern long-eared bat hibernates during the winter months to conserve energy from increased thermoregulatory demands and reduced food resources. In general, northern long-eared bats arrive at hibernacula in August or September, enter hibernation in October and November, and leave the hibernacula in March or April. Northern long-eared bats have shown a high degree of philopatry (using the same site multiple years) for a hibernaculum, although they may not return to the same hibernaculum in successive seasons.

Typically, northern long-eared bats are not abundant and compose a small proportion of the total number of bats hibernating in a hibernaculum. Although usually found in small numbers, the species typically inhabits the same hibernacula with large numbers of other bat species, and occasionally are found in clusters with these other bat species. Other species that commonly occupy the same habitat include little brown myotis, big brown bat, eastern small-footed bat, tri-colored bat, and Indiana bat.

Northern long-eared bats often move between hibernacula throughout the winter, which may further decrease population estimates. Though northern long-eared bats fly outside of the hibernacula during the winter, they do not feed; hence the function of this behavior is not well understood. However, it has been suggested that bat activity during winter could be due in part to disturbance by researchers. Northern long-eared bats exhibited significant weight loss during hibernation. Whitaker and Hamilton (1998:101) reported a weight loss of 41 to 43% over the hibernation period for northern long-eared bats in Indiana.

Migration and Homing

While the northern long-eared bat is not considered a long-distance migratory species, short migratory movements between summer roost and winter hibernacula between 35 to 55 miles have been documented Several studies show a strong homing ability of northern long-eared bats in terms of return rates to a specific hibernaculum, although bats may not return to the same hibernaculum in successive winters.

Summer Roosts

During the summer, northern long-eared bats typically roost singly or in colonies underneath bark or in cavities or crevices of both live trees and snags. Northern long-eared bats switch roosts often. In Missouri, the longest time spent roosting in one tree was 3 nights; however, up to 11 nights spent roosting in a man-made structure has been documented. Bats switch roosts for a variety of reasons, including, temperature, precipitation, predation, parasitism, and ephemeral roost sites, Timpone et al. (2010:118) radiotracked 13 northern long-eared bats to 39 roosts and found the mean distance between the location where captured and roost tree was 1.1 miles.

Some studies have found tree roost selection to differ slightly between male and female northern long-eared bats. Male northern long-eared bats have been found to more readily use smaller diameter trees for roosting than females, suggesting males are more flexible in roost selection than females. In New Brunswick, Canada, Broder and Forbes (2004:606-607) found that there was spatial segregation between male and female roosts, with female maternity colonies typically occupying more mature, shade-tolerant deciduous tree stands and males occupying more conifer-dominated stands. In northeastern Kentucky, males do not use colony roosting sites and are typically found occupying cavities in live hardwood trees, while females form colonies more often in both hardwood and softwood snags.

Reproduction

Breeding occurs from late July in northern regions to early October in southern regions and commences when males begin to swarm hibernacula and initiate copulation activity. Copulation occasionally occurs again in the spring. Hibernating females store sperm until spring, exhibiting a delayed fertilization strategy. Ovulation takes place at the time of emergence from the hibernaculum, followed by fertilization of a single egg, resulting in a single embryo. Gestation is approximately 60 days.

Maternity colonies, consisting of females and young, are generally small, numbering from about 30 to 60 individuals, although one group of 100 adult females was observed in Vermilion County, Indiana. Adult females give birth to a single pup. Birthing within the colony tends to be synchronous, with the majority of births occurring around the same time. Female roost site selection, in terms of canopy cover and tree height, changes depending on reproductive stage. Relative to pre- and post-lactation periods, lactating northern long-eared bats have been shown to roost higher in tall trees situated in areas of relatively less canopy cover and tree density.

Adult longevity is estimated to be up to 18.5 years, with the greatest recorded age of 19 years. Most mortality for northern long-eared and many other species of bats occurs during the juvenile stage.

Foraging Behavior and Home Range

The northern long-eared bat has a diverse diet including moths, flies, leafhoppers, caddisflies, and beetles. The most common insects found in the diets of northern long-eared bats are lepidopterans (moths) and coleopterans (beetles), with arachnids (spiders) also being a common prey item.

Foraging techniques include hawking (catching insects in flight) and gleaning in conjunction with passive acoustic cues. Northern long-eared bats have the highest frequency call of any bat species in the Great Lakes area. Gleaning allows this species to gain a foraging advantage for preying upon moths because moths are less able to detect these high frequency echolocation calls. Emerging at dusk, most hunting occurs above the understory, 3 to 10 feet above the ground, but under the canopy. This coincides with data indicating that mature forests are an important habitat type for foraging northern long-eared bats. Occasional foraging also takes place over forest clearings and water, and along roads. Foraging patterns indicate a peak activity period within 5 hours after sunset followed by a secondary peak within 8 hours after sunset.

Female home range size may range from 47 to 425 acres. Owen et al. (2003:353) estimated average maternal home range size to be 161 acres. Home range size of northern long-eared bats in this study site was small relative to other bat species, but this may be due to the study's timing (during the maternity period) and the small body size of northern long-eared bat.

6.2.1.4 Habitat

Winter Habitat

Northern long-eared bats predominantly overwinter in hibernacula that include caves and abandoned mines. Hibernacula used by northern long-eared bats are typically large, with large passages and entrances, relatively constant, cooler temperatures (32 to 48 degrees Fahrenheit), and with high humidity and no air currents. The sites favored by northern long-eared bats are often in very high humidity areas, to such a large degree that droplets of water are often observed on their fur. Caire et al. (1979:405) and Whitaker and Mumford (2009:208) commonly observed individuals exiting caves with mud and clay on their fur, also suggesting the bats were roosting in tighter recesses of hibernacula. They are also found hanging in the open, although not as frequently as in cracks and crevices.

To a lesser extent, northern long-eared bats have been found overwintering in other types of habitat that resemble cave or mine hibernacula, including abandoned railroad tunnels, more frequently in the northeast portion of the range. In 1952, three northern long-eared bats were found hibernating near the entrance of a storm sewer in central Minnesota (Goehring 1954:435).

Summer Habitat

During the summer, northern long-eared bats typically roost singly or in colonies underneath bark or in cavities or crevices of both live trees and snags. Males and non-reproductive females' summer roost sites may include cooler locations, including caves and mines. Northern long-eared bats have also been observed roosting in colonies in man-made structures, such as buildings, barns, a park pavilion, sheds, cabins, under eaves, behind window shutters, and in bat houses.

The northern long-eared bat appears to be somewhat opportunistic in tree roost selection, selecting varying roost tree species and types of roosts throughout its range, including tree species such as black oak, northern red oak, silver maple, black locust, American beech, sugar maple, sourwood, and shortleaf pine. Northern long-eared bats most likely are not dependent on a certain species of trees for roosts throughout their range; rather, certain tree species will form suitable cavities or retain bark and the bats will use them opportunistically.

Many studies have documented the northern long-eared bat's selection of live trees and snags, with a range of 10 to 53% selection of live roosts found. In tree roosts, northern long-eared bats are typically found beneath loose bark or within cavities and have been found to use both exfoliating bark and crevices to a similar degree for summer roosting habitat.

Canopy coverage at northern long-eared bat roosts has ranged from 56% in Missouri to greater than 84% in Kentucky. Studies in New Hampshire and British Columbia have found that canopy coverage around roosts is lower than in available stands. Females tend to roost in more open areas than males, likely due to the increased solar radiation, which aids pup development. Fewer trees surrounding maternity roosts may also benefit juvenile bats that are starting to learn to fly. However, in southern Illinois, northern long-eared bats were observed roosting in areas with greater canopy cover than in random plots. Roosts are also largely selected below the canopy, which could be due to the species' ability to exploit roosts in cluttered environments; their gleaning behavior suggests an ability to easily maneuver around obstacles.

Female northern long-eared bats typically roost in tall, large-diameter trees. Studies have found that the dbh and height of northern long-eared bat roost trees was greater than random trees. Lacki and Schwierjohann (2001:486) have also found that northern long-eared bats roost more often on upper and middle slopes than lower slopes, which suggests a preference for higher elevations due to increased solar heating.

6.2.1.5 Factors Affecting the Welfare of Northern Long-eared Bat

Several factors affect northern long-eared bats. These include: 1) modification to hibernacula, human disturbance during hibernation, loss of summer roosting habitat, and loss of habitat from other disturbance factors, including mining projects and prescribed burning; 2) loss of bats due to diseases such as rabies and encephalitis, and from contaminants; 3) predation from hawks, raccoons, skunks, and snakes; 4) lack of federal, state, and local regulations to address threats to northern long-eared bats, although the northern long-eared bat is a species of special concern in Minnesota; 5) wind energy development; and 6) climate change. However, these activities alone are not likely to have significant population-level effects (USDOI USFWS 2013b). PolyMet would follow the USFWS northern long-eared bat interim guidance for removal of marketable timber across the Project (USFWS 2014). Disturbance from noise and vibration is discussed in Section 6.2.2.1.

The most severe and immediate threat to the long-term persistence of this species is the infectious disease known as white-nose syndrome. White-nose syndrome is responsible for unprecedented mortality rates observed in the northeastern United States and poses an increasing threat to bat populations throughout North America. White-nose syndrome has spread rapidly throughout the northeast where an estimated 5.7 to 6.7 million bats have died, and is currently spreading through the Midwest. The causative fungal species for white-nose syndrome, *Pseudogymnoascus destructans*, is known to occur in Minnesota, including the Tower/Soudan Underground Mine State Park, which is 15 miles northwest of the Project area and serves as the largest known hibernaculum for Myotine bats in Minnesota.

<u>White-Nose Syndrome</u>

Since its first documented appearance in New York in 2006, white-nose syndrome has spread rapidly throughout the Northeast and is expanding through the Midwest. As of August 2013, white-nose syndrome has been confirmed in 22 States (Alabama, Connecticut, Delaware, Georgia, Illinois, Indiana, Kentucky, Maine, Maryland, Massachusetts, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia, and West Virginia) and 5 Canadian provinces (New Brunswick, Nova Scotia, Ontario, Prince Edward Island, and Quebec). Four additional States (Arkansas, Iowa, Minnesota, and Oklahoma) are considered suspect for white-nose syndrome based on the detection of the causative fungus on bats within those States, but with no associated disease to date. U.S. Fish and Wildlife Service biologists and partners estimate that at least 5.7 million to 6.7 million bats of several species have now died from white-nose syndrome.

The pattern of spread has generally followed predictable trajectories along recognized migratory pathways and overlapping summer ranges of hibernating bat species. Therefore, Kunz and Reichard (2010:12) assert that white-nose syndrome is spread mainly through bat-to-bat contact; however, evidence suggests that fungal spores can be transmitted by humans, and bats can also become infected by coming into contact with contaminated cave substrate. Six North American hibernating bat species (little brown myotis, Indiana bat, northern long-eared bat, eastern small-footed bat, big brown bat, and tri-colored bat), are known to be affected by white-nose syndrome.

White-nose syndrome is caused by the recently described psychrophilic (cold-loving) fungus, currently known as *Pseudogymnoascus destructans*. *Pseudogymnoascus destructans* may be non-native to North America, and only recently arrived on the continent. The fungus grows on and within exposed tissues of hibernating bats, and the diagnostic feature is the white fungal growth on muzzles, ears, or wing membranes of affected bats, along with epidermal (skin) erosions that are filled with fungal hyphae (branching, filamentous structures of fungi). Bats that are found in more humid regions of hibernacula may be more susceptible to white-nose syndrome.

In addition to the presence of the white fungus, initial observations showed that bats affected by white-nose syndrome were characterized by some or all of the following: 1) Depleted fat reserves by mid-winter; 2) a general unresponsiveness to human disturbance; 3) an apparent lack of immune response during hibernation; 4) ulcerated, necrotic, and scarred wing membranes; and 5) aberrant behaviors, including shifts of large numbers of bats in hibernacula to roosts near the entrances or unusually cold areas, large numbers of bats dispersing during the day from hibernacula during mid-winter, and large numbers of fatalities, either inside the hibernacula, near the entrance, or in the immediate vicinity of the entrance.

Although the exact process by which white-nose syndrome leads to death remains undetermined, it is likely that the immune function during torpor compromises the ability of hibernating bats to combat the infection. Other factors that could cause death include loss of fat stores during winter, alternation of normal arousal cycles in hibernating bats, and loss of wing-dependent physiological functions.

Due to white-nose syndrome, the northern long-eared bat has experienced a sharp decline in the northeastern part of its range, as evidenced in hibernacula surveys. The northeastern United States is very close to saturation (white-nose syndrome found in majority of hibernacula) for the disease, with the northern long-eared bat being one of the species most severely affected by the disease. In hibernacula surveys in New York, Vermont, Connecticut, and Massachusetts, hibernacula with larger populations of northern long-eared bats experienced greater declines, suggesting a density-dependent decline due to white-nose syndrome.

Long-term (including pre- and post- white-nose syndrome) summer data for the northern long-eared bat are somewhat limited; however, the available data parallel the population decline exhibited in hibernacula surveys. Summer data can corroborate and confirm the decline to the species seen in hibernacula data. Summer surveys from 2005 to 2011 near Surry Mountain Lake in New Hampshire showed a 99% decline in capture success of northern long-eared bats post- white-nose syndrome, which is similar to the hibernacula data for the State (a 95% decline).

Because white-nose syndrome has already had a substantial effect on northern long-eared bats in the core of its range and is likely to spread throughout the species' entire range within a short time, the USFWS considers white-nose syndrome to be the predominant threat to the species rangewide.

6.2.2 Analysis of Direct and Indirect Effects to Northern Long-eared Bat

6.2.2.1 Effects to Northern Long-eared Bat within the Action Area

As discussed in Section 6.2.1.5, the USFWS identified several factors affecting the welfare of northern long-eared bat. Of these, loss of habitat from the Project could be a direct effect to northern long-eared bats. Forest management activities, including timber harvest and prescribed burning, could occur on federal and non-federal lands in the reasonably foreseeable future under the Proposed Action and could result in cumulative effects to northern long-eared bats due to habitat modification.

In addition, the Forest Service (USDA Forest Service 2013b) has identified three analysis indicators for northern long-eared bat:

1. acres of upland forest (MIH 1),
2. presence of known hibernacula, and
3. presence of known summer roost sites.

Analysis indicators 2 and 3 are not evaluated in this BA because there are no known hibernacula or summer roost sites on the federal or non-federal lands. The 2014 Forest Service surveys indicated that summer roost sites may be present on the Mine Site; however, there have been no field surveys to identify roost trees in the Project area.

Federal Lands

Northern long-eared bats have been found in the winter in Minnesota in natural caves, sand mines, and deep iron mines, but these habitats are not found on the federal or non-federal lands. During warmer months of the year, northern long-eared bats primarily roost and forage in forests, especially more mature forests and forests near wetlands. There are approximately 233 acres of young, 540 acres of immature, and 557 acres of mature upland forest habitat (MIH 1), and 3,737 acres of wetlands, within the federal lands that could provide roosting, foraging, and drinking habitat for northern long-eared bat.

The 2014 Forest Service surveys confirmed that northern long-eared bats utilize the Mine Site for foraging and travel to and from foraging and roost sites. The 2014 Forest Service surveys also suggested that the Mine Site may contain roost sites; however, there have been no surveys specifically conducted for the identification of roost sites. Bats were also observed using wetlands in the vicinity of the Mine Site, although they were not identified to species (AECOM 2011a). The Project would result in the loss of about 532 acres of upland forest habitat (MIH 1) and 634 acres of wetlands due to mining. Based on the mine closure plan, about 397 acres of the habitat lost to mining would be reclaimed as grassland/herbaceous (54%), wetland and/or grassland/herbaceous (27%), and wetland (18%). Wetland habitat created would have lesser habitat value for northern long-eared bat. The West Pit would not be reclaimed, but would remain as a 321-acre open pit lake (MDNR et al. 2013). Young upland forest habitat could occur on reclaimed lands about 10 years after mine reclamation. As this forest habitat matures, it could be used by northern long-eared bats. Because northern long-eared bats can utilize trees with a minimum diameter of 3”, the time to maturation of basic usable forest habitat would be approximately 10-15 years. Wetland and open water habitat on reclaimed lands could be used for foraging and drinking by northern long-eared bats; however, in general wetland habitats are less utilized be northern long-eared bats.

Transportation and Utility Corridors

The Dunka Road and Utility Corridor is approximately 108 acres and the Railroad Connection Corridor is approximately 12 acres. Because of prior use during the former LTVSMC taconite mining operation, the Dunka Road and Utility Corridor is now defined as having a “disturbed” cover type (94 acres). The remaining MDNR GAP land cover types that are not disturbed include cropland/grassland (10 acres), shrubland (8 acres), and smaller acreages of the remaining types, including 5 acres of upland forest and 3 acres of aquatic habitat

(MDNR et al. 2013). The 2014 Forest Service surveys confirmed that northern long-eared bats utilize the upland forest habitats for foraging.

Plant Site

Of the 4,515 acres at the Plant Site Area, 2,756 acres have been disturbed by LTVSMC taconite mining operations. Of the remaining 1,760 acres, approximately 648 acres are upland deciduous forest, 637 acres are aquatic habitat, 334 acres are shrubland, 100 acres are upland coniferous forest, and 42 acres are lowland coniferous forest (totals don't add because acreages are rounded). About 48% of the Plant Site would be impacted by plant construction and operations, with only about 422 acres of forest habitat remaining after construction. It is assumed that the majority of this forested habitat meets the minimum criteria for roosting and/or foraging value for northern long-eared bat. Construction of the processing facilities would have little impact on bat habitat, as over half of the site has been previously disturbed by LTVSMC taconite mining operations (MDNR et al. 2013). The 2014 Forest Service surveys confirmed that northern long-eared bats utilize the Plant Site for foraging. Driving transects identified the northern long-eared bat being present near the forest/open edge to the east of the Tailings Basin and southwest of the former LTVSMC processing buildings, but this species was not identified to be present within the Tailings Basin itself (Forest Service 2014a, Figure 4). The surveys found no evidence of roost sites at the Plant Site.

Non-federal Lands

Under the Proposed Action, approximately 7,075 acres of non-federal lands would be transferred to the Forest Service. The Forest Service has not determined the suitability of these lands to provide habitat for northern long-eared bat. However, wildlife habitat surveys conducted on these lands have shown that bats forage and drink on the non-federal lands, although bats were not identified to species during the surveys (AECOM 2011b, c). There are 591 acres of mature and 2,104 acres of young and immature upland forest habitat (MIH 1) on the non-federal lands that could provide habitat for northern long-eared bats. The non-federal lands would not be affected by the Project, but should benefit from Forest Service management that favors longer harvest rotations than typically occurs on private forestlands and from activities that promote development of snags. There are approximately 4,254 acres of wetlands on the non-federal lands that could provide habitat for northern long-eared bats.

Wetland Mitigation Sites

Under the Proposed Action approximately 2,169 acres of Wetland Mitigation Site lands would be purchased by PolyMet as compensatory mitigation for impacts to wetlands and other waters of the U.S.. These lands are used for sod production, but under the Proposed Action would be restored to native wetland and upland vegetation. After restoration, the combined total of wetland and upland acreage for these sites would be about 1,603 acres and 197 acres, respectively. These sites could provide habitat for northern long-eared bats and would be privately owned (Pylka 2013b).

Other

Noise and Vibration

Existing ambient steady equivalent noise levels for most of the Mine Site are in the range of 35 to 45 decibels (dBA), which is a range comparable to secluded woods or a quiet bedroom (MPCA 1999). The Peter Mitchell

Mine, north of the Mine Site, and traffic along Dunka Road and the existing railway, along the south edge of the Mine Site, also contribute brief, episodic noise impacts.

The primary sources of Project noise from the Mine Site would be blasting, haul trucks, and train horns, with noise levels ranging from 89-115 dBA. Equipment such as graders, bull dozers, and support trucks would be less dominant sources of noise, ranging from 75-95 dBA (Environmental Protection Agency 1971). Blasting at the Mine Site is expected to occur once every two to three days. Typically, rock blasting generates a single event noise level ranging from 111- 115 dBA at 50 feet from the blasting site (Table 5.5-7 of Madera County 2005). Within most of the Mine Site, the sound from the blast would be similar to a loud clap of thunder.

Noise associated with mining activities, including noise from vehicle and rail traffic, would likely have some effect on the behavior of northern long-eared bats. These effects would vary depending on the distance between the noise source and any roost trees in use at the time. Construction and routine operational noise would have a lesser impact on northern long-eared bats, because these noise sources would be more continuous and lower volume. Effects due to acute noise (such as blasting) are not well studied, but may cause northern long-eared bats to startle and may interrupt roosting activities; however, blasting would be more episodic and less continuous than other noise sources, and would therefore be a less-frequent impact. Noise and blasting effects may extend beyond the proposed Mine Site to nearby northern long-eared bat roost sites. However, noise and blasting effects on roosting would be ameliorated by the fact that northern long-eared bats typically utilize several spatially-distinct roosting tree areas (Kunz and Lumsden 2003). As a result, bats startled by noise from one roost area would likely move to another nearby known roost area (Kunz and Lumsden 2003). Section 6.3.2.1 provides further discussion on the noise levels for the NorthMet Project area. Though northern long-eared bats are likely to be sensitive to changes in noise levels, there are no local, national, or international standards or limits that are applicable to the NorthMet Project Proposed Action.

Hazardous Materials

Mishandling of hazardous materials or wastes could result in spills, accidental release, or discharge into the environment, which could pose risks to northern long-eared bats. Sections 5.2.13 and 5.3.13 of the FEIS discuss the risks posed to the public and the environment from the transport, handing, storage, and use of hazardous materials. Mitigation measures to prevent releases in transportation, storage, and handling or use of these materials are described in several hazardous material management plans necessary to comply with various regulatory requirements for the Project and in the FEIS. Based on this analysis, and limited use by northern long-eared bats of the areas where there materials would be used, risks to northern long-eared bats would be negligible and should not result in harm or death to northern long-eared bats (MDNR et al. 2013).

Potential Indirect Effects from Project Stormwater and Process Water Ponds

As previously mentioned, the northern long-eared bat primarily forages in forested areas on moths, flies, leafhoppers, caddisflies, and beetles. Occasional foraging in small forest canopy gaps, over forest clearings, riparian areas of waterways (with preference for streams protected by canopy closure), and along roads has also been observed. In a forest-agriculture landscape it was found that northern long-eared bats avoided the large agricultural openings (fields) and had preferential travel patterns that followed wooded streams and wooded edges including hedgerows (Henderson and Broders 2008). The same researchers found that foraging areas for the northern long-eared bat were typically within the forested parcels along creeks, providing a higher concentration of prey species and drinking areas than in upland open areas such as agricultural fields (Henderson and Broders 2008). Sources of drinking water for northern long-eared bat include open water areas within forested areas such as woodland vernal pools (Francl 2005, 2008) and open water areas in wetlands (e.g., beaver ponds) (Taylor 2006).

A portion of the Mine Site would be cleared of vegetation to accommodate the mine pits and associated infrastructure (e.g., haul roads, stockpile, stormwater ponds, waste water ponds) and would become a large open area during operations. The existing Plant Site is primarily an open area dominated by the LTVSMC Tailings Basin and would continue as an open area during Project operations. As a forest specialist, the northern long-eared bat is unlikely to use large upland open areas (Henderson and Broders 2008; Jantzen 2012). Chapman et al. (2014) identify that the northern long-eared bat seldom forages outside the forest or over water bodies and Jantzen (2012) identified that most bat activity occurs within 40 meters of the forest edge, with a maximum distance from the forest edge of about 120 meters. Francl (2005, 2008) identifies the importance of palustrine habitats (bogs, fens, beaver ponds) for bat species usage and that woodland vernal pools are an important drinking water source for several species including the northern long-eared bat. Overall, the peer-reviewed literature identifies the northern long-eared as an obligate forest species (Ford et al. 2005; Buckman-Sewald et al. 2014) that has a strong preference to forage and roost and drink within the forest area (Henderson and Broders 2008; Francl 2008; Chapman et al. 2014) and that it is rare for this species to roost in man-made structures (Henderson and Broder 2008).

The 2014 Forest Service bat surveys indicated that northern long-eared bats were present and foraging at the Plant Site, with driving transect data identifying this species as being present at the forest/open edge area to the east of the Tailings Basin (within 50 meters of the road) and near the LTVSMC process buildings, but not within the Tailings Basin itself (USDA Forest Service 2014a, Figure 4). Currently, forest vegetation at the east side of the Tailings Basin is more than 300 meters from the existing pond. Emergence surveys indicated the northern long-eared bat was also present in areas adjacent to the existing LTVSMC process buildings, with forest vegetation being within about 140 to 150 meters on the west side of the concentrator building and within 30 to 50 meters southeast of the coarse crusher building (USDA Forest Service 2014a, Figure 5).

While other bat species may use open upland areas for foraging and ponds in open terrain for drinking (e.g., little brown bat), it seems unlikely for the northern long-eared bat to use these areas (Jantzen 2012; Chapman et al. 2014). Based on the 2014 Forest Service bat survey data (e.g., driving transects) and the weight of evidence in the peer-reviewed literature, it seems unlikely for the northern long-eared bat to use the open areas at the Tailings Basin or the cleared Mine Site, or the ponds within those open araeas, to any great extent because they do not meet its habitat and foraging requirements. Therefore, the northern long-eared bat is likely to have a low potential exposure to water in mining-related ponds and minimal consumption of aquatic insects that may use the stormwater or process water ponds at the Mine Site or the Plant Site during operations, and no significant indirect effects to this species from the Project are likely to occur.

The Project's water management further limits the potential exposure of the northern long-eared bat to indirect effects from the various water features at the Plant Site or Mine Site and consumption of insects that may use these water features. Project water features include stormwater ponds, process water ponds, water in active mine pits, constructed wetlands, the Hydrometallurgical Facility pond (operations), the Flotation Tailings Basin Pond and wetland (reclamation and long-term closure), and the West Pit lake (long-term closure). Each water feature is qualitatively evaluated for potential indirect effects to northern long-eared bats.

1. Stormwater from precipitation and runoff would be directed to sedimentation ponds to remove total suspended solids (TSS) prior to being discharged off-site. Water in the ponds prior to

discharge is expected to reflect background concentrations of water quality parameters (including metals and mercury) and any aquatic insects inhabiting stormwater ponds should have metal and mercury concentrations that reflect background conditions, and therefore, similar to existing conditions. Therefore, any consumers of aquatic insects (including the northern long-eared bat) from Project stormwater ponds should not be exposed to metal or mercury concentrations in those insects above background levels.

2. Process water would be collected and stored in a number of ponds at the Mine Site (e.g., Overburden Storage and Laydown Area Pond) and the Flotation Tailings Basin Pond and Hydrometallurgical Residue Facility Pond at the Plant Site and be actively managed for re-use. The probability of insects inhabiting or using a process water pond as a source of drinking water is expected to be low because: 1) these ponds would tend to be turbid and limit the establishment and growth of plants and in turn limit organic materials and the establishment of macroinvertebrates (Nelms et al. 2012); 2) mining-related water is low in organic carbon (Berndt and Bavin 2012) and nutrients and would limit growth and reproduction of algae, macroinvertebrates, and other biota (Nelms et al. 2012; Seger et al. 2012) ; 3) the use of liners and/or compacted bottoms to maximize water retention would not likely provide a suitable substrate for the larval stages of most aquatic insects (Flake and Cieminski 1996); and 4) fine mineral sediments that have little silt or clay are poor media for plant establishment and growth (Nelms et al. 2012) and further limits the presence of aquatic insects that require organic materials for food (Seger et al. 2012). The above listed factors likely limit the aquatic life in process water ponds and insects from Project process water ponds would likely represent a very small percent of the diet of consumers of aquatic insects. Limited pond productivity and the preference of the northern long-eared bat for forest areas further reduces the potential effect of process water ponds on this bat species.

   Similar to taconite processing, mercury in process water sent to the Flotation Tailings Basin Pond and the Hydrometallurgical Residue Facility Pond is expected to be associated with the solids and sequestered with those solids in the respective ponds and result in relatively low concentrations of mercury in the water column (Barr Eng. 2007b; PolyMet 2015). Mercury associated with solids such as tailings is sequestered within the basin and is typically not released from the basin (Berndt 2003) and not readily bioavailable. The continual deposition of solids in these ponds is likely to limit sediment-dwelling organisms (Nelms et al. 2012), as would the lack of organic material for food (Flake and Cieminski 1996; Nelms et al. 2012). Limited pond productivity, sequestration of mercury with solids, and the preference of the northern long-eared bat for forest areas also reduces the potential effect of process water ponds on this species.

3. Mine pit dewatering would occur during Mine Years 1 through 20 and this water would be routed to the Waste Water Treatment Facility for initial treatment and then pumped to the Flotation Tailing Basin Pond for use in ore processing (Poly Met 2014c). A minimal amount of water is expected to be present in an active mine pit, therefore the probability of aquatic insects inhabiting or using a sump area is low. The continual removal of water is likely to limit the presence of aquatic organisms (Nelms et al. 2012), as would the lack of organic material for food (Flake and Cieminski 1996; Nelms et al. 2012). Limited productivity and the preference of the northern long-eared bat for forest areas reduces the potential effect of mine pit watering on

this species.

4. As part of reclamation, some stormwater ponds and process water ponds would be filled and converted to terrestrial habitat (.e.g., Hydrometallurgical Residue Facility Pond) (Poly Met 2014b; 2014e; 2014f). Ponds filled and reclaimed to terrestrial vegetation would have the potential to produce runoff water that would be expected to reflect background conditions. Reclaiming ponds to terrestrial vegetation is not expected to produce runoff that would adversely affect aquatic insects.

   A part of the East Pit (after backfilling is completed) and some stormwater and process water ponds would be converted to wetlands (Poly Met 2014b, 2014c, 2014d). These constructed wetlands are expected to receive precipitation and stormwater runoff. The accumulating water should reflect background concentrations for various parameters (including mercury). Any aquatic insects inhabiting a constructed wetland or using it as a source of drinking water should have metal or mercury concentrations that reflect background conditions. Therefore, any consumers of these aquatic insects (including the northern long-eared bat) should not be exposed to metal or mercury concentrations in those insects above background levels.

   In regard to the backfilling of the East Pit, the water level would be maintained below the level of the fill material to facilitate truck hauling (Poly Met 2014b). No visible ponding of water is expected during backfilling. Therefore, backfilling of the East Pit would have no potential to affect aquatic organisms.

   The Flotation Tailings Basin Pond would be present after Mine Year 20 and a wetland would be constructed around the perimeter of the pond. The pond and wetland are expected to be present into long-term closure. After Mine Year 20, the Beneficiation Plant and Mine Site would no longer contribute water and the largest source of water to the pond would be precipitation and runoff (PolyMet 2015). In long-term closure, the water in the pond would be primarily from precipitation and runoff (PolyMet 2015) and would be expected to reflect background conditions and parameter concentrations (including mercury). Any aquatic insects inhabiting the Flotation Tailings Basin Pond or using it as a source of drinking water during long-term closure should have metal or mercury concentrations that reflect background conditions. Therefore, any consumers of these aquatic insects (including the northern long-eared bat) should not be exposed to metal or mercury concentrations in those insects above background levels.

5. The depth of the West Pit at the end of mining will be more than 600 feet. Flooding of the pit would result in rapid water level increases that are predicted to average about 17 feet per year (PolyMet 2014g). Rapidly rising water levels likely limits the aquatic life that would inhabit the lake during the years of pit flooding (Nelms et al. 2007). In addition, the probability of the northern long-eared bat, an obligate forest species (Jantzen 2012; Chapman et al. 2014), to use a body of water more within a large open area is very low. Therefore, the potential exposure of the northern long-eared bat to any insects that might inhabit or use the West Pit lake during the early years of flooding is likely very low.

   The majority of water used to flood the West Pit would be primarily from precipitation and stormwater runoff (Poly Met 2014g) and as the pit fills the parameter concentrations in the upper portion of the water column (i.e., the epilimnion) should reflect background (including mercury). Flooding of the West Pit would produce a pit lake that is approximately 320 acres in size with a maximum depth of 630 feet (Poly Met 2014b). As an oligotrophic system with a small littoral area, aquatic insects diversity and numbers in the West Pit lake would be limited (Nelms et al. 2012; Gray et al. 2012). Data for pit lakes identifies they have low densities and diversity of invertebrates (MDNR 1989). In addition, pit lake waters are typically low in phosphorus, limiting primary production (MDNR 1989). For the above reasons, overall, the potential population of aquatic insects in the West Pit lake is expected to be small. In addition, these insects would likely represent only a small portion of the diet of consumers of aquatic insects. Therefore aquatic insects inhabiting the West Pit lake or using it as a source of drinking water would likely have no significant effect on insect consumers such as the northern long-eared bat.

With regard to mercury, the West Pit lake is estimated to have a total mercury concentration of 0.3 to 0.9 ng/L during flooding and in long-term closure (Poly Met, 2014g). Because precipitation would be the main input of water to the West Pit lake, metal concentrations in long-term closure would likely reflect background conditions. Therefore, any aquatic insects inhabiting the West Pit lake or drinking from the West Pit lake would be exposed to background concentrations. Any consumers of these aquatic insects (including the northern long-eared bat) should not be exposed to metal or mercury concentrations in those insects above background levels.

Because existing wetlands at the Plant Site (e.g., north of the tailings basin) and the Mine Site (e.g., 100 Mile Swamp) would be providing an abundant supply of insects, the northern long-eared bat and other consumers of insects would likely be focused in these areas and would not likely be relying on the Project water features for any significant portion of their food supply. Therefore, any insects inhabiting Project water features or using them as sources of drinking water are not expected to have a significant effect on the consumers of insects. Overall, no adverse indirect effects on the northern long-eared bat from the Project's water features are anticipated.

6.2.3 Effects of Interrelated and Interdependent Actions

No known activities are interrelated or interdependent to the Project that would have the potential to affect northern long-eared bat. It is possible that future specific programs or projects may have relevant interrelated and interdependent actions (e.g., expansion of the Mine Site due to discovery of new ore bodies) and they would be considered in the context of consultations for those actions.

6.2.4 Cumulative Effects

The methods used to analyze cumulative effects, and the temporal and spatial domains, are the same for northern long-eared bat as for lynx, as discussed in Section 6.1.4. Forest management and habitat fragmentation are reasonably foreseeable future actions that could affect northern long-eared bat.

6.2.4.1 Habitat Management and Fragmentation

Forest Management and Habitat Fragmentation

Forest management activities, such as timber harvest and road building, could occur on the federal and non-federal lands in the reasonably foreseeable future and these activities could result in habitat modification and fragmentation.

Northern long-eared bats roost predominantly in trees and to a lesser extent in man-made structures. Although there is still much to learn about the effects of forest removal on northern long-eared bats and their associated summer habitat, studies to date have found that the northern long-eared bat shows a varied degree of sensitivity to forest management practices. Several studies have found that the species uses a wide range of tree species for roosting, suggesting that forest succession may play a larger role in roost selection (than tree species). Studies have found that female bat roosts are more often located in areas with partial harvesting, which may be due to trees located in more open habitat receiving greater solar radiation and therefore speeding development of young. In the Appalachians of West Virginia, diameter-limit harvests (70 to 90 year-old stands, with 30 to 40% of the basal area removed in the past 10 years) rather than intact forest was the habitat type most selected by northern long-eared bats. Cryan et al. (2001:49) found several northern long-eared bat roost areas in recently harvested (less than 5 years) stands in the Black Hills of South Dakota, although the largest colony (n=41) was found in a mature forest stand that had not been harvested in over 50 years.

It is possible that this flexibility in roosting habits allows northern long-eared bats to be adaptable in managed forests. However, the northern long-eared bat has shown a preference for contiguous tracts of forest cover for foraging. Jung et al. (2004:333) found that it is important to retain snags and provide for recruitment of roost trees during selective harvesting in forest stands that harbor bats. If roost networks are disturbed through timber harvesting, there may be more dispersal and fewer shared roost trees, which may lead to less communication between bats in addition to less disease transmission. In the Appalachians, Ford et al. (2006:20) assessed that northern long-eared bats may be a suitable management indicator species for assessing mature forest ecosystem integrity, because they found male bats using roosts in mature forest stands of mostly second growth or regenerated forests.

Perry and Thill (2007:225) found that male northern long-eared bats seem to prefer more dense stands for summer roosting, with 67% of male roosts occurring in unharvested sites versus 45% of female roosts. The greater tendency of females to roost in more open forested areas than males may be due to greater solar radiation experienced in these openings, which could speed growth of young in maternity colonies. Lacki and Schwierjohann (2001:487) stated that silvicultural practices could meet both male and female roosting requirements by maintaining large-diameter snags, while allowing for regeneration of forests. However, Broders and Forbes (2004:608) found that timber harvest may have negative effects on female bats because they use forest interiors at small scales (less than 1.2 miles from roost sites). They also found that males are not as limited in roost selection and they do not have the energetic cost of raising young; therefore males may be less affected than females. Henderson et al. (2008:1,825) also found that forest fragmentation effects northern long-eared bats at different scales based on sex; females require a larger unfragmented area with a large number of suitable roost trees to support a colony, whereas males are able to use smaller areas (more fragmented).

The Project would result in habitat loss and fragmentation on about 1,166 acres at the Mine Site for about 20 years (until the Project is reclaimed). Impacts from habitat and fragmentation may continue beyond the onset of reclamation, but these impacts would be expected to diminish as the target reclamation habitats develop along the expected successional trajectories. High-quality forested vegetation would begin to return to the site over the long-term successional trajectory (approximately 30 years), except in areas where trees and other deep-rooted vegetation would be excluded to protect stockpile liners.

Under the Proposed Action, PolyMet would acquire the federal lands from the Forest Service and would manage lands outside of the Mine Site for wildlife habitat, including some timber management. The non-federal lands would be managed for General Forest, General Forest-Longer Rotation, Riparian Areas, and Candidate Research Natural Areas (MDNR et al. 2013). If new roads are constructed on the federal or non-federal lands, they would likely be temporary and used to support timber management. Although these actions would result in some short-term loss of habitat for northern long-eared bats, long-term protection and management of forests would retain and promote high-quality forest habitat for northern long-eared bats that should result in a long-term cumulative benefit.

Prescribed Fire

Prescribed fire could be used on federal and non-federal lands to reduce hazardous fuels in the reasonably foreseeable future. Eastern forest-dwelling bat species, such as the northern long-eared bats, likely evolved with fire management of mixed-oak ecosystems. A recent review of prescribed fire and its effects on bats (U.S. Forest Service 2012:182) generally found that fire had beneficial effects on bat habitat. Fire may create snags for roosting and creates more open forests conducive to foraging on flying insects, although gleaners such as northern long-eared bats may readily use cluttered understories for foraging. Cavity and bark roosting bats, such as northern long-eared bat, use previously burned areas for both foraging and roosting. In Kentucky, the abundance of prey items for northern long-eared bats increased after burning, and more roosts were found in post-burn areas. Burning may create more suitable snags for roosting through exfoliation of bark, mimicking trees in the appropriate decay stage for roosting bats. Low-intensity burns may not kill taller trees directly but may create snags of smaller trees and larger trees may be injured, resulting in vulnerability of the tree to pathogens that cause hollowing of the trunk, which provides roosting habitat. Prescribed burning also opens the tree canopy, providing more canopy light penetration, which may facilitate faster development of juvenile bats.

Under the Proposed Action, prescribed fire would be used on a limited basis, primarily on non-federal lands administered by the Forest Service, and should have long-term benefit on forest health and habitat availability for northern long-eared bat.

6.3 Gray Wolf

6.3.1 Environmental Baseline

6.3.1.1 Species Description and Status and Critical Habitat Status

Gray wolves are the largest wild members of the dog family (Canidae) with adults ranging from 40 to 175 pounds, depending on sex and subspecies (Mech 1974). Wolves have a gray fur coat that can vary from pure white to coal black. Wolves may look similar to coyotes and some domestic dogs, such as the Siberian husky (*C. familiaris*; USDOI USFWS 2003b). Currently, three wolf species are recognized with ranges in the conterminous U.S.—*Canis lupus, Canis lycaon,* and *Canis rufus. Canis lycaon* is primarily found in Canada and the western Great Lakes, and *C. rufus* in the southeastern U.S. *Canis lupus* is found in the western Great Lakes and western U.S. The ranges of *C. lupus* and *C. lycaon* overlap in the western Great Lakes region.

In response to their vastly declining numbers, the gray wolf was determined to be endangered in 1967 (USDOI USFWS 1967) under the Endangered Species Preservation Act of 1966. In 1974, the species was formally listed as endangered through the authority of the ESA (USDOI USFWS 1974), and the Minnesota population was reclassified to threatened in 1977 (USDOI USFWS 1977). In 1978, critical habitat was designated for the Eastern DPS of gray wolf (USDOI USFWS 1978). That rule (50 C.F.R. § 17.95[a]) identified critical habitat at Isle Royale National Park, Michigan, and Minnesota wolf management zones 1, 2, and 3, as delineated in 50 C.F.R. § 17.40(d)(1). Wolf management zones 1, 2, and 3 comprise approximately 9,800 mi^2 in northeastern and northcentral Minnesota and include all of the Superior National Forest and portions of the Chippewa National Forest. Hunting Club Lands and McFarland Lake Lands are in Zone 1, while the federal lands, and other non-federal lands are in Zone 2. The Wetland Mitigation Sites are outside the wolf zones (**Figure 24**).

In April 2003, gray wolf populations in the U.S. were separated into three DPS' (USDOI USFWS 2003b) to more effectively manage the species; the Minnesota population was a designated portion of the Eastern DPS. In March 2006, the USFWS proposed to designate gray wolves in the Western Great Lakes region as a DPS under the ESA and to remove wolves in Minnesota, Wisconsin, and Michigan from listing under the ESA. The Western Great Lakes DPS included Minnesota, Wisconsin, and Michigan as well as parts of North Dakota, South Dakota, Iowa, Illinois, Indiana, and Ohio (USDOI USFWS 2006b). In March 2007, the USFWS removed the gray wolf from the endangered species list (USDOI USFWS 2007).

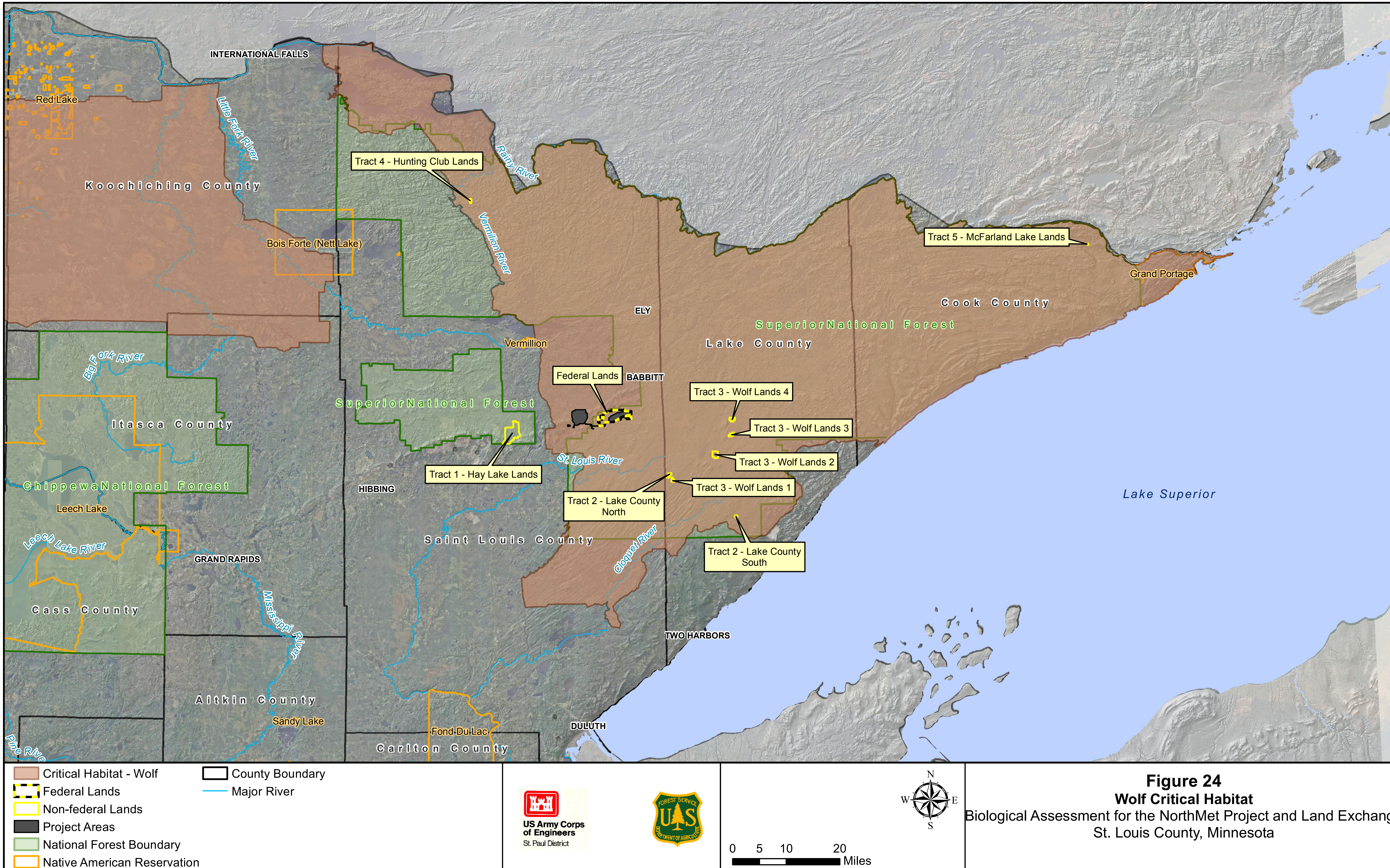


Figure 24
Wolf Critical Habitat
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

0 5 10 20 Miles

N E S W

In September 2008, the U.S. District Court for the District of Columbia overturned the USDOI's decision to remove the Great Lakes DPS of the gray wolf from federal ESA protection; the USFWS issued a rule in December 2008 to comply with court orders reinstating regulatory protections for the gray wolf in the western Great Lakes and northern Rocky Mountains (USDOI USFWS 2008b). In April 2009, the USFWS issued a rule to identify the Western Great Lakes DPS of the gray wolf, and to remove this DPS from the list of threatened and endangered species (USDOI USFWS 2009b). In July 2009, the USFWS withdrew its request to delist the Western Great Lakes DPS and in September 2009 the USFWS reinstated protections for the Western Great Lakes DPS (United States District Court for the District of Columbia 2009, USDOI USFWS 2009c). In May 2011, the USFWS again proposed to identify and remove the Western Great Lakes DPS of gray wolf from federal ESA protection. The USFWS also proposed to remove federal designation of critical habitat for the species in Minnesota and Michigan, and to remove the gray wolf special rule in Minnesota, which defined the circumstances when gray wolves can be taken in Minnesota (USDOI USFWS 2011b).

On December 28, 2011, the USFWS revised the 1978 listing of the Minnesota population of gray wolf to conform to statutory and policy requirements. The USFWS renamed what was previously listed as the Minnesota population of the gray wolf as the Western Great Lakes DPS, and delineated the boundaries of the expanded Minnesota population segment to include all of Minnesota, Wisconsin, and Michigan and portions of the adjacent states. The USFWS removed the Western Great Lakes DPS from the list of endangered and threatened wildlife. The USFWS took this action because the best available scientific and commercial information indicated that the Western Great Lakes DPS does not meet the definitions of threatened or endangered under the ESA. This final rule also removed the designated critical habitat for the wolf in Minnesota and Michigan and the special regulations under Section 4(d) of the ESA for wolves in Minnesota. On December 19, 2014, a federal court reversed the USFWS decision to delist the gray wolf, restoring federal threatened status and critical habitat designation in Minnesota.

6.3.1.2 Distribution

The gray wolf historically occurred across most of North America, Europe, and Asia. The only areas of the conterminous U.S. that apparently lacked gray wolf populations since the last ice age are parts of California and portions of the eastern and southeastern U.S. (an area occupied by the red wolf; *Canis lupus rufus*). Wolf research and the expansion of wolf range over the last 3 decades have shown that wolves can successfully occupy a wide range of habitats, and they are not dependent on wilderness areas for their survival. In the past, for instance, wolf populations occupied nearly every type of habitat north of mid-Mexico that contained large ungulate prey species, including bison, elk, white-tailed deer, mule deer, moose, and woodland caribou. Inadequate prey density or high levels of human-caused mortality appear to be the only factors that limit wolf distribution (USDOI USFWS 2011b).

Widespread persecution of wolves began following European settlement of North America (Boitani 1995). Poisons, trapping, and shooting spurred by federal, state, and local government bounties extirpated this once widespread species from more than 95% of its historic range. In the late 1960s, a diminished population (several hundred) of wolves was known to occur in northeastern Minnesota and on Isle Royale, Michigan; a few scattered wolves also may have occurred in Michigan's Upper Peninsula, Montana, and the southwest U.S. Today, wolves have expanded their range to include much of the U.S, including the Pacific Northwest, Northern Rockies, Upper Midwest, and eastern U.S. Wolves that comprised the Western Great Lakes DPS are found in Minnesota, Wisconsin, and Michigan.

6.3.1.3 Population Status in North America

Wolves once occupied all of North America, and today occupy only between 5 and 10% of this historic range. The wolves occupying Minnesota are part of a meta-population of 60,000 to 80,000 covering most of Canada, the Lake States of Minnesota, Wisconsin, and Michigan, portions of the northern Rocky Mountains, with smaller reintroduced populations in Wyoming (Yellowstone National Park), central Idaho, and Arizona/New Mexico (USDA Forest Service 2011b).

6.3.1.4 Life History

Wolves are carnivorous predators that prefer a diet of medium and large mammals. Wild prey species in Minnesota include white-tailed deer, moose, beaver, and snowshoe hare, with small mammals, birds, and large invertebrates sometimes being taken (Mech 1974, Wisconsin DNR 1999). Wolves are habitat generalists that do not depend on the type, age, or structure of vegetation, instead, they are indirectly influenced by vegetative condition through the distribution of their primary prey species.

Wolves are social animals, normally living in packs of 2 to 30 wolves, although about 15% of the population may be composed of loners and dispersers (Fuller 1989). In Minnesota, packs range in size from 4.9 to 5.6 (Erb and Benson 2004, Erb 2008). Packs are primarily family groups consisting of a breeding pair, their pups from the current year, offspring from the previous year, and occasionally an unrelated wolf. Packs typically occupy, and defend from other packs and individual wolves, territories of 42 to 100 mi^2 in the Great Lakes region and about 40 mi^2 in Minnesota (Fuller 1989, Erb and Benson 2004, Erb 2008).

Normally, only the top-ranking (alpha) male and female in each pack breed and produce pups. Litters are born from early April to May and range from 1 to 11 pups, but generally include 4 to 8 pups (Fuller 1989, Michigan DNR 1997, USDOI USFWS 1992). Normally a pack has a single litter annually, but the production of two or three litters in 1 year has been documented in Yellowstone National Park (USDOI USFWS et al. 2002). Yearling wolves frequently disperse from their natal packs, although some remain with their natal pack. Yearlings may range over large areas as lone animals after leaving their natal pack or they may locate suitable unoccupied habitat, pair with a member of the opposite sex, and begin their own pack. Dispersal distances of over 500 miles have been documented (Fritts 1983); individual wolves have recently traveled from central Wisconsin to east-central Indiana (400 miles) and northern Illinois, from the Upper Peninsula of Michigan to northern Missouri (600 miles), and from the Minnesota-Wisconsin-Michigan population to east central Nebraska.

6.3.1.5 Wolf Habitat, including Prey Habitat

Potential and favorable wolf habitat is defined by several elements such as human population density, sufficient prey density, road density, vegetation cover, and special landscape patterns (Mladenoff et al. 1995). Gray wolves are generalists that can live in most any habitat that supports ungulate prey. Wolf densities are directly related to the densities of their primary ungulate prey (Fuller 1989), thus forested areas occupied by white-tailed deer and moose are critical. Additionally, the habitat should be suitable for smaller prey such as beaver and snowshoe hare which may be seasonally important (Mech 1970). Moose, deer, and snowshoe hare tend to forage in areas of regenerating upland forest, and coniferous forest is an important component of thermal cover for all. Riparian trembling aspen forest is important for beavers. Patch structure is only important in that it may alter prey densities or include areas of high road and human densities thereby indirectly altering wolf distribution (Fuller 1997).

Wolf density is heavily dependent on prey availability (Fuller 1989). Conservation of primary wolf prey, such as white-tailed deer, is clearly a high priority for the MDNR, which typically manages ungulates to ensure a harvestable surplus for hunters and non-consumptive users, and to minimize conflicts with humans. To ensure a harvestable surplus for hunters, the agency must account for all sources of natural mortality, including loss to wolves, and adjust hunter harvest levels when necessary.

White-tailed deer, moose, and beaver, the primary prey species for wolf, are closely associated with forage from young upland forest less than 10 years old. White-tailed deer and moose rely on upland immature (10 to 80 years old) and mature (80+ years old) conifer for thermal and hiding cover.

Moose Populations

Population estimates from aerial surveys in northeastern Minnesota, conducted since 1959, suggest that the moose population gradually began to increase in the 1970s and 1980s to a peak of 6,900 in 1988, then dropped to 3,700 by 1990, and then stabilized between 3,500 and 4,000 animals, or approximately 0.7 moose/mi^2, between 1996 and 2001. Due to a change in MDNR survey methods in 2004, population estimates from surveys conducted in 2005 and afterwards are not directly comparable to prior surveys. An estimated 8,106 moose occurred in northeastern Minnesota in 2005, 7,890 in 2008, 5,700 in 2010, but only 2,760 moose occurred in January 2013, a 52% decline between 2010 and 2013. Both the cow to calf ratio and the percent calves has exhibited a steady decline over the past 9 years (DelGiudice 2013). There is currently a moratorium on moose hunting in Minnesota due to low population numbers (MDNR 2013a).

There is no documentation expressing a correlation between the wolf and moose population fluctuations on the Superior National Forest, although as discussed below for white-tailed deer, there has been a decline in wolf populations concurrent with declines in white-tailed deer and moose populations in recent years.

White-tailed Deer Populations

Land management carried out by other public agencies and by private landowners in Minnesota's wolf range, including timber harvest and prescribed fire, improves habitat for white-tailed deer, the primary prey for wolves in the State. The success of these measures is apparent from the continuing high white-tailed deer densities in the Forest Zone of Minnesota, and with a white-tailed deer harvest averaging about 215,000 deer over the last 5 years. However, numbers of white-tailed deer harvested has declined slowly since a peak harvest of 290,000 deer in 2003 (MDNR 2012). Approximately one-half of the Minnesota deer harvest is in the Forest Zone, which encompasses most of the occupied wolf range in the State. The decline in white-tailed deer numbers may be depressing wolf abundance in Minnesota's core wolf range, as wolf numbers have declined statewide from 2,900 in 2009 to about 2,200 in 2012 (Erb and Samson 2013). Since 2007, Minnesota's Forest Zone white-tailed deer population is estimated to have declined by 25% (Grund and Walberg 2012). Erb and Samson (2013) believe that reduced prey density largely explains the 13% increase in wolf pack territory size they observed during the 2012-13 wolf survey, the first such increase in territory size since surveys began, and the decline in wolf populations in Minnesota. The harvest of wolves in Minnesota may also explain some of the decline in wolf populations. Nevertheless, current estimated density remains near the upper end of densities reported from other regions of North America where density of self-sustaining wolf populations has been estimated over a large area.

6.3.1.6 Human Access and Disturbance and Wolf Mortality

Human settlement and roads are considered to be major determinants in gray wolf distribution. These activities have multiple effects, including increased human presence causing an increase in illegal poaching and legal predator control, increased chance of introduced diseases and parasites via pets (e.g., canine parvovirus), and potential deterrence to colonization of otherwise suitable habitat (Mech 1995, Gogan et al. 1997).

Road Density

To a large extent, road density has been adopted as the best predictor of habitat suitability for wolves in the Midwest due to the connection between roads and human-related wolf mortality. Recent studies have used road density to predict probabilities of persistent wolf pack presence in an area. Areas with road densities less than 0.7 miles/mi^2 are estimated to have a greater than 50% probability of wolf pack colonization and persistent presence, and areas where road density exceeds 1 mile/mi^2 have less than a 10% probability of occupancy (Mladenoff et al. 1995, 1999).

Studies of wolf populations in Minnesota, Michigan, and Wisconsin indicate that wolf populations usually fail to sustain themselves in areas where rural roads open to the public have densities exceeding 0.93 linear miles of road/mi^2. The Wolf Recovery Plan recommends that density of higher standard roads remain below 1 mile/mi^2 in critical habitat to limit the extent of associated effects to wolves (USDOI USFWS 1992).

Roads lead to wolf-vehicle collisions and an increase in access by hunters and trappers, and can be barriers to movement (USDOI USFWS 1992). However, wolves may tolerate road densities as high as 1.2 miles/mi^2 if roaded areas are adjacent to large roadless areas, such as the Superior National Forest.

The Wolf Recovery Plan addresses the impact of low standard roads, but does not recommend a density threshold for such roads. Low standard roads may have a greater potential for human impact on wolves than high standard roads due to the potential for human access for trapping and shooting. These roads typically are accessed by recreational motor vehicles or on foot. Illegal killing of wolves may result from a variety of reasons. Some of these killings are accidental (e.g., wolves are hit by vehicles, mistaken for coyotes and shot, or caught in traps set for other animals) and may be reported to state, tribal, and federal authorities. Most illegal killings, however, likely are intentional and are never reported to authorities (Mech 1995). The MDNR receives approximately two to six reports of wolves killed by vehicle collision annually. While human habitation and the associated network of roads and vehicle traffic increase, wolf mortality from vehicle collisions is expected to continue both in actual numbers and as a percent of total diagnosed mortality in Minnesota.

As wolf populations have continued to expand, however, the road density threshold has been questioned. Wolves can be expected to expand their range into areas with more roads and humans, “as more tolerant attitudes toward wolves increase and depredations by wolves are controlled.” “Given the current status of wolves, reducing current levels of high standard road access is not necessary to increase either wolf density or distribution. However, in areas of sufficient size to sustain one or more wolf packs, land managers should be cautious about adding new road access that could exceed a density of 1 mile/mi^2 without considering the potential effect on wolves” (MDNR 2001 *in* USDA Forest Service 2011b). Thus, the focus of wolf protection is now on maintaining large blocks of habitat relatively free of human access even in areas where the road density exceeds 1 mile/mi^2.

Human-caused Mortality Factors

A study conducted in between 1980 to1986 within northcentral Minnesota found human-caused mortality occurred at a rate of 29%, a figure which includes 2% mortality from legal depredation control actions (Fuller 1989). The MDNR conducted a radiotelemetry study of wolves and white-tailed deer, and of 32 wolves fitted with radio collars between 1993 and 2005, 11 of 16 documented mortalities were attributed to humans (USDA Forest Service 2011b). This includes one wolf accidentally snared, two vehicle collisions, and eight that were shot.

A smaller mortality dataset is available from a 1987 to 1991 study of wolves in and adjacent to Minnesota's Voyageurs National Park. Natural causes of mortality among radiomarked wolves included intraspecific strife (n = 4) and starvation (2). Confirmed human-induced causes of mortality among radiomarked wolves included shooting (2), trapping or snaring (2), and unknown method (2). Natural causes of mortality among non-radiomarked wolves included intraspecific strife (1) and starvation (1). Confirmed human-induced causes of mortality among non-radiomarked wolves included automobile collisions (3), shooting (3), and trapping or snaring (2). All mortalities within the boundaries of Voyageurs National Park were attributed to natural causes. Six of eight confirmed mortalities among instrumented wolves and eight deaths of non-instrumented wolves beyond the boundaries of Voyageurs National Park were human caused (Gogan et al. 2004).

The USDA Animal and Plant Health Inspection Service Wildlife Services found that from 1996 to 2009, an average of 146 wolves were taken annually for depredation control in Minnesota (USDA Forest Service 2011a).

Illegal mortality can often be estimated through radiotelemetry studies (Fuller 1989), however only a few radiotelemetry studies have taken place in Minnesota. Northcentral Minnesota data from 16 diagnosed mortalities of radiocollared wolves over a 12-year period (1994 to 2005) show that human-causes resulted in 69% of the diagnosed mortalities (USDA Forest Service 2011b).

Minnesota's wolves transitioned from federal protection under the ESA to state management by the Minnesota Department of Natural Resources on January 27, 2012. Minnesota's Wolf Management Plan will ensure the wolf's long-term survival. The plan gives owners of livestock and domestic pets more protection from wolf depredation. It splits the state into two management zones with more protective regulations in the northern third, considered the wolf's core range. The MDNR has not established a maximum population goal and wolves are allowed to naturally expand their range. A statewide winter population of 1,600 wolves is the minimum goal. If Minnesota's wolf population falls below this minimum, the MDNR will take immediate and appropriate management actions to reverse the decline and restore the population to its minimum level in the shortest possible time. The MDNR implemented a conservative and regulated hunting and trapping season in fall 2012. Hunters and trappers harvested 413 wolves in 2012 (MDNR 2013b). The MDNR expects the 2013 season to follow a similar framework with a harvest goal of 220 wolves (MDNR 2013c).

The MDNR (2001) and the Forest Service (2004b) use a variety of methods to encourage and support education of the public about the history and ecology of wolves in the state and the effects wolves on livestock, wild ungulate populations, and human activities. Public outreach efforts have been in effect for years in Minnesota, and while these efforts may not further reduce illegal take of wolves from existing levels, these measures may be crucial in ensuring that illegal mortality does not increase. Illegal take of wolves is likely related to road and human population densities, but changing attitudes towards wolves may provide for their survival in areas where road and human densities were previously thought to be too high (Fuller et al. 2003). It is important to note that despite the difficulty in measuring the extent of illegal killing of wolves, all sources of wolf mortality, including legal (e.g., depredation control, hunting, trapping) and illegal human-caused mortality, have not been of sufficient magnitude to stop the growth of the wolf population in Minnesota, or for Minnesota to have a hunting season for wolves.

6.3.1.7 Disease

Disease such as canine distemper, canine parvovirus, Lyme's disease, mange, and blastomycosis have been observed in Minnesota wolves. However, the usual high annual replacement of dying wolves by a high number of pups produced (Mech 1977 *in* Mech 2002) may be attenuated by canine parvovirus mortality of young pups (Mech and Goyal 1995 i*n* Mech 2002). On the Superior National Forest, wolf population density has been stable or increasing for many years probably indicating that the main effect of canine parvovirus is to reduce the number of dispersing wolves (Mech 2002).

Wolves in Minnesota may have been exposed to canine parvovirus as early as 1973 (Mech and Goyal 1993, 1995). The population impacts of canine parvovirus are believed to be via diarrhea-induced dehydration leading to abnormally high pup mortality (Wisconsin DNR 1999). Despite the presence of canine parvovirus, wolf abundance and range in Minnesota have stabilized above recovery goal levels and there is no evidence that canine parvovirus has caused a population decline in the Minnesota wolf population. In the Superior National Forest, Mech and Goyal (1995) found high canine parvovirus prevalence during the same years in which wolf pup numbers were low, however they concluded that these pup mortalities only replaced deaths that would have occurred from other causes, particularly starvation. They theorized that canine parvovirus prevalence would cause a wolf population decline when 76% of the adult wolves consistently test positive for canine parvovirus exposure. Their data indicate that canine parvovirus prevalence in adult wolves in their study area increased by an annual average of 4% during 1979 to 1993 and was at least 80% during the last 5 years of their study.

6.3.1.8 Population Numbers and Dynamics in Minnesota and Great Lakes Distinct Population Segment

In the western Great Lakes region, wolves in the densely forested northeastern corner of Minnesota have expanded into the more agricultural portions of central and northwestern Minnesota, northern and central Wisconsin, and the entire Upper Peninsula of Michigan. Habitats currently being used by wolves span the broad range from the mixed coniferous/deciduous forest wilderness area of northern Minnesota, through sparsely settled, but similar habitats in Michigan's Upper Peninsula and northern Wisconsin, and into more intensively cultivated and livestock-producing portions of central and northwestern Minnesota and central Wisconsin.

Five comparable surveys of wolf numbers and range in Minnesota have been carried out since 1979. These surveys estimated that in Minnesota there were 1,235 wolves in 1979; 1,500 to 1,750 in 1989; 2,440 in 1998; 3,020 in 2004; and 2,920 in 2008 (Berg and Kuehn 1982, Fuller et al. 1992, Erb 2008). The 1998 and later surveys revealed that the number of wolves in Minnesota was 2 times greater than the planning goal (1,400 wolves) as specified in the Recovery Plan for Minnesota. However, the 2012 survey showed that wolf numbers have declined statewide from 2,900 in 2008 to about 2,200 in 2012 (Erb and Samson 2013).

Based on analysis of 34 radiomarked wolves, average territory size was about 62 mi^2 in 2012, an increase from 54 mi^2 during the previous two surveys. Wolf observations were greatest in the vicinity of the Chippewa National Forest, in the Superior National Forest near Virginia, Minnesota, and in Voyageurs National Park (Erb 2008, Erb and Sampson 2013). The Superior National Forest's wolf population was estimated to be about 484 wolves, or about one wolf per 10 mi^2 (one wolf per 25.9 km^2; 0.04 wolf per km^2), based on radiotelemetry studies during 2003 to 2008 (Mech 2004, 2008, USDA Forest Service 2004b, 2011b). Both Forests are operated and managed through the 2004 Forest Plan in conformance with standards and guidelines that follow the 1992 Wolf Recovery Plan's recommendations for the wolf.

As wolves increased in numbers, they also expanded their range. In the early 1950s, the wolf range was approximately 12,000 mi^2, or 14% of the state. By the late 1990s, it was estimated at 34,000 mi^2, or about 40% of the state, with an occupied range of about 27,612 mi^2, but since then has shown little expansion (Erb 2008, Erb and Sampson 2013).

Wolves were considered to have been extirpated from Wisconsin by 1960, and no formal attempts were made to monitor that state's wolf population from 1960 until 1979. During that time, individual wolves and an occasional wolf pair were reported. There is no documentation, however, of any wolf reproduction occurring in Wisconsin, and the wolves that were reported may have been animals dispersing from Minnesota. Wolf population monitoring by the Wisconsin DNR began in 1979 and a statewide population of 25 wolves was estimated at that time. This population remained relatively stable for several years, and then declined to approximately 15 to 19 wolves in the mid-1980s. In the late 1980s, the Wisconsin wolf population began an increase that has continued to date. In 2002, wolf numbers in Wisconsin alone surpassed the planning goal as specified in the Wolf Recovery Plan for a second population near Minnesota (100 wolves for a minimum of 5 consecutive years; geographically isolated populations should have 200 wolves for a minimum of 5 years). Approximately 540 wolves were in Wisconsin in 2008 and 815 in 2012 (Wydeven and Wiedenhoeft 2008, Wisconsin DNR 2012).

Michigan wolves were extirpated as a reproducing population long before they were listed as endangered in 1974. Before 1991, and excluding Isle Royale, the last known breeding population of wild Michigan wolves occurred in the mid-1950s. As wolves began to reoccupy northern Wisconsin, the Michigan DNR began noting single wolves at various locations in the Upper Peninsula of Michigan. In the late 1980s, a wolf pair was verified in the central Upper Peninsula and was known to have produced pups in 1991. Since that time, wolf packs have spread throughout the Upper Peninsula, with immigration occurring from both Wisconsin to the west and Ontario to the east. They now are found in every county of the Upper Peninsula. When the wolf population estimates of Wisconsin and Michigan are combined, the total population has exceeded the second population recovery goal, as specified in the Wolf Recovery Plan, of 200 wolves for 5 consecutive years for a geographically isolated wolf population. The two state wolf population, excluding Isle Royale wolves, has exceeded 200 wolves since late winter 1995-1996. An estimated 510 wolves were in Michigan in 2007 and 687 in 2010 (Michigan Department of Natural Resources 2008, USDOI USFWS 2013c).

6.3.1.9 Observations of Gray Wolf in the Vicinity of the Project

Gray wolf tracks, scat, and signs of wolf kills were seen during wildlife studies on the federal lands, Transportation and Utility Corridors, and Plant Site during 2000, 2004, 2008, and 2009 (ENSR 2000, 2005, AECOM 2009b, 2011a). Tracks were commonly seen on the Dunka Road, on mine exploration roads, along railroad grades and utility rights-of-ways, and north of the Mine Site on Northshore Mine roads during all seasons. In addition, several wolves responded to calls from the Mine Site during 2004. The wolves were located to the south of the calling station, and likely south of the property boundary based on call intensity and direction.

Gray wolf tracks and scat were recorded on Hay Lake Lands, Wolf Lands 3 and 4, and Lake County Lands North during the surveys. Wolf scat was seen on several abandoned logging roads. No wolves or their sign were seen on the other non-federal lands, although conditions for surveys were not favorable for detecting tracks and scat at Hunting Club Lands.

Until 2012, International Wolf Center posted on their website a database summary of wolf radiotelemetry observations in northeastern Minnesota. Of the over 11,000 records in the monitoring database between 1994 and 2010, 10 records were for wolves recorded on the federal lands; however, there were no records for the Plant Site or Transportation and Utility Corridors (International Wolf Center 2012). Radiocollared wolves have been recorded on the townships of Hay Lake Lands. A wolf was observed in Section 6 of Township 58 North, Range 16 West in September 1994, just south of Hay Lake. Wolves were observed in Sections 1, 19, 22, and 23 of Township 59 North, Range 16 West, in and around Hay Lake Lands, between 1994 and 1997. Radiocollared wolves have been recorded in the vicinity of Wolf Lands 2 and 3. There are no recorded observations of wolves in the township of McFarland Lake Lands, although McFarland Lake Lands and other non-federal lands that would be involved in the land exchange or Wetland Mitigation Sites are within the current range of the wolf (Erb and Sampson 2013).

6.3.2 Analysis of Direct and Indirect Effects to Gray Wolf

6.3.2.1 Effects to Gray Wolf within the Action Area

The Wolf Recovery Plan (USDOI USFWS 1992) and the *Minnesota Wolf Management Plan* (MDNR 2001) identify habitat factors considered as essential for a recovering and recovered wolf population (including maintenance or improvement of critical habitat). Those that may be affected by the Project are prey habitat and human access and disturbance. In addition, disease can impact wolf populations. The Project would result in both beneficial and adverse direct and indirect impacts to factors of importance to wolves.

<u>Factors Affecting Prey Habitat</u>

Federal Lands

The primary impacts to gray wolf prey habitat from the Project would result from habitat loss and disturbance. The Forest Service manages the Mine Site as a General Forest and General Forest – Longer Rotation Management Area. The General Forest – Longer Rotation Management Area emphasizes land and resource conditions that provide a wide variety of goods, uses, and services. These include wood products, other commercial products, scenic quality, developed and dispersed recreation opportunities, and habitat for a diversity of terrestrial and aquatic wildlife and fish species (USDA Forest Service 2004a). The characteristics and use of the General Forest Management Area are similar to the General Forest – Longer Rotation Management Area, except that harvests are more frequent, more uniform in age, and more extensive. The General Forest Management Area has the highest amount of young forest and the largest sized timber harvest units.

The Forest Service identified young upland forest that is less than 10 years old as providing important foraging habitat for wolves (USDA Forest Service 2004b). Based on Forest Service and MDNR cover type mapping criteria and wildlife assessments done on the federal lands, only about 271 acres on the federal lands provide these habitats, although some suitable coniferous stands are found in mixed coniferous/deciduous forest habitats (**Table 11**; MDNR et al. 2013). Immature and mature coniferous forest habitat provides important cover habitat for wolves. There are about 5,393 acres of cover habitat on the federal lands (MDNR et al. 2013). The typical home range for gray wolf is approximately 161 square kilometers, or just under 40,000 acres (MDNR 2014b). The area of disturbance at the Mine Site is 1,719 acres, which is less than 10% of a gray wolf's home range. There is also abundant suitable habitat adjacent to the Mine Site.

Wolves used the federal lands, and wolf calls were heard to the south of the Mine Site during 2004 surveys (ENSR 2000, 2005). Wolf packs with radiocollared individuals have been observed several miles to the north and northeast of the Mine Site. It is likely that the federal lands include much of the territory of a wolf pack comprised of three or more individuals. Wolf tracks were seen along Dunka Road. Interestingly, wolf tracks were not observed on the study area during January 2000, when a drill rig was operating, but only during March 2000 and June 2004, when the rig was not in operation. Thus, noise and activity associated with drilling activities may have discouraged wolves from using the area in the immediate vicinity of the exploration area. Wolf tracks were seen along trails in the federal lands surrounding the Mine Site, and carcasses of two deer were found on these lands that appeared to be wolf kills (AECOM 2009b, 2011a).

White-tailed deer are common on the Mine Site. White-tailed deer tracks were primarily observed in the western and southern portions of the Mine Site during field studies in 2000 and 2004, especially in recently logged areas and shrublands near mixed coniferous/deciduous and coniferous immature/mature and mature forest habitats. White-tailed deer were common on the federal lands surrounding the Mine Site. White-tailed deer tracks and droppings were commonly found on the Project area in virtually all habitat types, and several white-tailed deer were seen along roads within the land. White-tailed deer tracks were primarily observed in the western portion of the federal lands surrounding the Mine Site during 2008 surveys.

Moose sightings were common in logged areas with abundant shrubs and near mature forest habitat, and in sedge and willow wetlands. Moose primarily used the western half of the federal lands (ENSR 2005, AECOM 2011a). Moose populations in the Superior National Forest have fluctuated considerably since the early 1900s and have shown their greatest increases during periods of intense timber harvest (Huempfner 1978). As noted above, however moose populations have declined by about 52% in Minnesota since 2010.

Beaver are common residents on the federal lands. Many large open water and emergent wetlands on the federal lands are the result of beavers damming streams on the site. Beavers also block culverts under road and railroad grades to create lake habitat. Beaver lodges and tree cuttings are common in areas used by beavers.

Based on a cover type mapping of the Mine Site, about 181 acres of wolf foraging habitat and 1,333 acres of wolf cover habitat would be lost on the Mine Site. Loss of this habitat would reduce the amount of prey and cover available to gray wolf traveling through the Project area. Loss of habitat would also make it less likely that a gray wolf pack would establish a territory within the Project area, especially areas directly impacted by the Project.

About 397 acres would be reclaimed after mine closure, but it would be 10 or more years before re-vegetation resulted in much suitable habitat for wolves.

Table 11
Gray Wolf Habitat on the Federal and Non-federal Lands

Lands	Foraging Habitat	Cover Habitat
Federal Lands	271	5,393
Non-federal Lands		
Hay Lake	534	3,720
Hunting Club	27	93
Lake County Lands North	24	220
Lake County Lands South	43	49
McFarland Lake	0	30
Wolf Lands 1	2	114
Wolf Lands 2	8	684
Wolf Lands 3	130	97
Wolf Lands 4	10	360
Net Gain (Loss) to Forest Service after Land Exchange	507	(26)

Source: MDNR et al. (2013).

Transportation and Utility Corridors

The Dunka Road and Utility Corridor is approximately 108 acres and the Railroad Connection Corridor is approximately 12 acres. Because of prior use during the former LTVSMC taconite mining operation, the Dunka Road and Utility Corridor is now defined as having a "disturbed" cover type (94 acres). The remaining MDNR GAP land cover types that are not disturbed include cropland/grassland (10 acres), shrubland (8 acres), and smaller acreages of the remaining types, including 5 acres of upland forest and 3 acres of aquatic habitat (MDNR et al. 2013).

Plant Site

Of the 4,515 acres at the Plant Site Area, 2,756 acres have been disturbed by LTVSMC taconite mining operations. Of the remaining 1,760 acres, approximately 648 acres are upland deciduous forest, 637 acres are aquatic habitat, 334 acres are shrubland, 100 acres are upland coniferous forest, and 42 acres are lowland coniferous forest (totals do not add because acreages are rounded). About 48% of the Plant Site would be impacted by plant construction and operations, with only about 422 acres of forest habitat remaining after construction. Construction of the processing facilities would have little impact on wolf habitat, as over half of the site has been previously disturbed by LTVSMC taconite mining operations (MDNR et al. 2013).

Non-federal Lands

Under the Proposed Action, approximately 7,075 acres of non-federal lands would be transferred to the Forest Service. The Forest Service has not determined the suitability of these lands to provide habitat for wolves or their prey. However, wildlife habitat surveys conducted on these lands give an indication of the suitability of these lands for wolves. Portions of the non-federal lands have been harvested for timber during the past 20 years, with much of the harvest occurring on Lake County Lands North, Lake County Lands South, and Wolf Lands 2 and 3; there are about 778 acres of wolf foraging habitat on the non-federal lands. In addition, the non-federal lands contain about 5,366 acres of upland immature and mature forest greater than 9 years old that can provide cover for wolf prey (**Table 7**; MDNR et al. 2013).

Wolf howling surveys were conducted at night on Hay Lake Lands and McFarland Lake Lands. No gray wolves were heard during howling surveys, but sign of gray wolf was seen on Hay Lake Lands. Wolf scat was seen on several abandoned logging roads. Radiocollared wolves have been recorded on Hay Lake Lands (AECOM 2011b).

Gray wolf tracks were seen on Wolf Lands 3 and 4 and Lake County Lands North during the surveys. A review of the International Wolf Center (2012) Minnesota Wolf Telemetry Database revealed that radiocollared wolves have been recorded in the vicinity of Wolf Lands 2 and 3 (AECOM 2011c).

Beaver dams or sign of beaver were found on or near all the lands. Several beaver dams were observed on Hunting Club Lands and Lake County Lands South. Open water bodies on the lands were created by beaver dams, and beaver lodges were also seen on large water bodies (AECOM 2011c).

Beaver dams were found in several ponds and wetlands, and along the Pike River, on Hay Lake Lands, with recent cuttings found at several locations. Several large open water bodies on the site were created by beaver dams, and beaver lodges were seen on large water bodies. Beaver cuttings were also seen on McFarland Lake Lands near McFarland Lake (AECOM 2011b).

White-tailed deer are common on the non-federal lands. White-tailed deer tracks and droppings were commonly found in the study areas in virtually all habitat types, and several white-tailed deer were seen along roads, in shrublands, and bedding along the Pike River on Hay Lake Lands. Deer were especially common in recently logged areas and shrublands near mixed coniferous/deciduous and coniferous immature and mature forest habitats (AECOM 2011b).

Moose sign (droppings, tracks, and evidence of browsing) were observed on Hay Lake Lands in areas with abundant shrubs and in shrub swamp speckled alder wetlands. Moose sign were also observed on Wolf Lands 3 and 4 and Lake County Lands South in areas with abundant upland shrubs and in shrub swamp speckled alder wetlands (AECOM 2011c).

Wetland Mitigation Sites

Under the Proposed Action approximately 2,169 acres of Wetland Mitigation Site lands would be purchased by PolyMet as compensatory mitigation for impacts to wetlands and other waters of the U.S. These lands are used for sod production, but under the Proposed Action would be restored to native wetland and upland vegetation. After restoration, the combined total of wetland and upland acreage for these sites would be about 1,603 acres and 197 acres, respectively. These sites could provide habitat for wolves and would be privately owned (Pylka 2013b).

Summary of Prey Habitat Impacts to Wolves

Numerous habitat and human-disturbance factors influence wolf and wolf prey use of an area. Factors most important in the study area include timber management, mining activity, and habitat fragmentation. The mine project would remove forestlands, reduce the amount of available habitat for wolves and their prey, and increase habitat fragmentation; some of this habitat would be reclaimed after mine closure. However, large tracts of land associated with the Superior National Forest and adjacent to the mine project would be managed to provide wolf habitat. These lands would also help to maintain wolf travel corridors between areas of suitable habitat.

Despite the presence of wolf tracks on the Mine Site, there is little suitable foraging habitat for wolves, and it appears that only a few wolves use the Mine Site at any one time. Thus, the loss of habitat on the Mine Site may have little impact on wolves. To conserve wolves in the area, PolyMet would reclaim the Mine Site, maintain vegetated buffers around the Project area, close the Project area to public access, minimize the number of roads constructed in the Project area and reclaim roads after mine closure, and educate workers on the need to observe speed limits and take measures to protect wolves and other wildlife.

The land adjacent to the Mine Site would not be directly impacted by the Proposed Action. However, noise, light, and other disturbances at the Mine Site could limit use of the area by wolves and their prey. Wolves have been recorded using this area, and appeared to have preyed upon white-tailed deer in the western portion of the federal lands. Still, based on number of tracks observed during field studies, few wolves appear to use the land at any one time (AECOM 2009b, 2011a). Thus, the Project may have little direct impact on wolf use of this area.

Wolves have been recorded on most of the non-federal lands based on radiotelemetry and wildlife studies. The Forest Service would gain additional lands that would provide habitat for wolves under the Proposed Action. However, given that these lands would not be directly or indirectly impacted by the Project, would likely not be developed, and would remain mostly in timber production with limited recreational use, there would likely be little or no adverse or beneficial effects to wolves using the non-federal lands with or without the Proposed Action.

Although the Forest Service would administer additional habitat for wolves under the Proposed Action, there would still be a net loss of habitat to wolves and their prey from the Project. If the land exchange does not take place, and non-federal lands are not acquired by PolyMet and remain privately owned, non-federal lands would likely be managed primarily for timber production, and some recreational use (hunting, fishing, and cabins). Much of the habitat on the non-federal lands is wetland and is not suitable for most types of development. At this time, there also appears to be little interest in mining these lands or conducting other large scale surface disturbance. Thus, these lands would continue to provide similar acres of habitat for wolves and their prey with or without the land exchange.

No wolf surveys were conducted on or near the Wetland Mitigation Sites. These sites are agricultural farms that would be restored to wetland and upland habitat. They could provide habitat for wolves in the future, but the beneficial effects to wolves from acquisition of these lands would be minor.

Human Access and Disturbance

Federal Lands and Plant Site

Human-related Disturbance

The Project would generate as many as 500 full-time workers over an 18-month during peak construction period, and about 360 full-time workers during operation. It is estimated that about 80% of construction workers, but only about 25% of operations workers, would commute from population centers such as Duluth, Hibbing, and Virginia to the Project area on a daily or weekly basis, while remaining workers would be local hires. The Project would employ about 360 full-time workers during operation. When accounting for family members, the total population influx from direct, indirect, and induced employment would be about 400 people. A small number of workers would be needed during mine closure (MDNR et al. 2013). New housing and other infrastructure would be required to support many of these new workers and could indirectly affect wolves through loss of habitat and human disturbance. However, new housing for workers may be constructed in nearby municipalities, such as Hoyt Lakes, Aurora, and Babbitt. It is not anticipated that new housing centers would be constructed that would result in additional townships exceeding a human density of more than four humans per square kilometer (2.5 humans per square mile). The MDNR criteria for a wolf-occupied township is a human density of fewer than four humans per square kilometer and a road density of fewer than 0.7 kilometers per square kilometer (0.4 miles per square mile). The Mine Site and Federal Lands are located within Township 59 North (35 square miles) and there are 3.3 miles of Forest Road 113 and 77.5 miles of other Forest Service roads and trails within the township. The road density for Township 59 North is 0.1 mile per square mile, considering only Forest Road 113, and 2.2 miles per square mile considering all roads and trails.

Disturbance associated with the facility and associated transportation corridors would include lights, glare, and noise. The Project is expected to operate 24 hours a day, 365 days a year, for a minimum of 20 years. Lights and glare would primarily be associated with the Mine Site, Plant Site, and Transportation and Utility Corridors. Wolves traveling through the study area would likely avoid areas that are active and well lit.

<u>Noise</u>

Sources of noise during the construction phase include trucks, bulldozers, rock drills, jack hammers, graders, backhoes, air compressors, and cranes. The loudest noise sources during the operational phase of the project include blasting, haul trucks, and train horns at the Mine Site, and crushers at the Plant Site. Estimated noise levels from blasting at receptors located 50 feet from the noise source are estimated to range from 111 to 115 a-weighted decibels (dBA; MDNR et al. 2013), while noise levels for drill rigs, excavators, and crushers range from 109 to 121 dBA near the noise source. Noise from the Mine Site and Plant Site could impact wolves residing in or traveling through the Project area. The impacts of noise on wolves and other wildlife are largely unknown and the assessment of impacts remains subjective. Wildlife are receptive to different sound frequency spectrums, many of which may be inaudible to humans. Wildlife are also known to habituate to noise, especially noises that are steady or continuous, such as noises that would occur at the Project. For example, wolves have been seen within about a quarter mile of loud noise sources and other human disturbance at Northshore Mine facilities north of the Mine Site.

Under the Proposed Action, the areas not disturbed by the Project on the lands adjacent to the Mine Site would be managed for wildlife habitat, including timber management. During mine operations, few, if any wolves would use this area due to noise and other disturbance associated with the adjacent Mine Site. After mine closure, wolf use of this area could return to the current level of use. But with a large area of new mine disturbance between much of this area and areas to the east where wolves are more common, it is unlikely that wolf use of this area would increase from current levels.

<u>Roads</u>

Impacts to wolves on and surrounding the Project may include mortality from vehicle collisions and trains. Construction and operation of the project, and the influx of workers to the area, would mean an increase in the number of roads and rail lines, as well as an increase in vehicular traffic volume along transportation corridors. The FEIS estimates that the Project would generate a total of up to 1,316 miles per day of vehicle traffic near the Project site, including trips between the Mine Site and the Plant Site, and trips between the Plant Site and the Area 1 Shop. Vehicle traffic would consist primarily of light trucks and maintenance vehicles traveling between 30 and 45 miles per hour (mph), and a few large fuel, waste/supply, and haul trucks traveling between 25 and 40 mph. The Project would also generate 418 total miles of train traffic each day during mine operations. Trains would operate at 15 to 25 mph (MDNR et al. 2013).

Harm or loss of wolves from collisions with vehicles or trains traveling within the Project boundaries cannot be discounted, but the risk would be very small as there is currently little use of the Project area by wolves, and use of the site by wolves would decrease substantially during project operations due to loss of habitat and noise and disturbance associated with Project activities.

The potential for wolves to be killed from vehicle/rail collisions was estimated using the methodology described in Section 6.1.2.1 for lynx. Assuming that there is about 0.04 wolf/km^2 (see Section 6.2.1.8), that vehicle/rail collisions could occur along the 8-mile Transportation and Utility Corridors and railroad, and that vehicles and rail traffic have equal potential for collisions with wolves, it was estimated that approximately 0.05 wolf could be killed annually by vehicle/train traffic between the Mine Site and Plant Site, or about one wolf during the estimated 20-year life of the Project (assuming that mortalities due to collisions with vehicles and trains were twice the estimated level).

Using the same assumptions and methodology used to estimate wolf mortality on Project roads and railroads, approximately 0.3 wolf could be killed annually by vehicle/train traffic on off-Project access roads/rail lines to the Plant Site, or about six wolves during the estimated 20-year life of the Project (assuming that mortalities due to collisions with vehicles and trains were twice the estimated level).

These losses are probably overestimated, however, based on wolf mortality estimates done for other projects in northern Minnesota by the USFWS. Thus, although risk of loss of wolves due to a collision with a Project-related vehicle or train traffic is very small, it could occur during the life of the Project.

In addition to potential harm from vehicle/train/wolf collisions, road density influences wolf use of habitat. The Wolf Recovery Plan recommends that density of higher standard roads remain below 1 mile/mi^2 in critical habitat to limit the extent of associated effects to gray wolves (USDOI USFWS 1992, 2011a). However, wolves may tolerate road densities as high as 1.2 miles/mi^2 if roaded areas are adjacent to large roadless areas, such as the Superior National Forest. Current road density is 0.5 miles of road/mi^2 for the Mine Site. After mine operations cease, temporary roads would be closed and reclaimed and would remain closed to the public.

Temporary roads have been constructed on the federal lands to support timber harvest activities and within a ROW to support powerline maintenance. Except for recently constructed roads, temporary roads are now overgrown in places with vegetation and are generally only suitable for foot, all-terrain vehicle, and snowmobile travel. Vegetation within the ROW is maintained at a low height for safety purposes, and the ROW is accessible to all-terrain vehicles and snowmobiles. Temporary roads may be constructed to support future management, but roads would be likely closed after their intended use and allowed to revegetate; it is unlikely that permanent roads would be constructed. The number of miles of temporary roads would likely remain at or below current levels, to the benefit of wolves. These roads would be privately owned and closed to the public after mine closure.

Non-federal Lands and Wetland Mitigation Sites

The non-federal lands would be transferred to the Forest Service. The non-federal lands are currently managed primarily for timber and recreation, similar to how these lands would be managed by the Forest Service. The

Wetland Mitigation Sites would be restored to wetland and upland wildlife habitat. Wolf observations are rare near the Wetland Mitigation Sites and wolf use of the sites after restoration would be infrequent. Thus, there would be few beneficial effects to wolves from the land exchange and wetland mitigation.

Access onto most of the non-federal lands is by secondary roads that branch off Forest Service or county roads. Most secondary roads were constructed to support timber harvest activities, and wolves were observed using these roads on several lands. There is no road access onto Hunting Club Lands and Wolf Lands 4. Access to McFarland Lake Lands is controlled by a locked gate. If acquired by the Forest Service, the lands would be managed for General Forest, General Forest-Longer Rotation, Riparian Areas, and Candidate Research Natural Areas. If new roads are constructed on the lands, they would likely be temporary and used to support timber management. There would likely be little change in the number of miles of backcountry roads and trails on the non-federal lands, and the number of miles may decrease if existing roads are closed and re-vegetated or allowed to re-vegetate naturally, benefitting wolves.

Other

Hazardous Materials

Mishandling of hazardous materials or wastes could result in spills, accidental release, or discharge into the environment, which could pose risks to wolves. Sections 5.2.13 and 5.3.13 of the FEIS discuss the risks posed to the public and the environment from the transport, handing, storage, and use of hazardous materials. Mitigation measures to prevent releases in transportation, storage, and handling or use of these materials are described in several hazardous material management plans necessary to comply with various regulatory requirements for the Project and in the FEIS. Based on this analysis, and limited use by wolves of the areas where there materials would be used, risks to wolves would be negligible and should not result in harm or death to wolves (MDNR et al. 2013).

6.3.2.2 Effects to Wolf Critical Habitat

Overview

Primary Constituent Elements of Wolf Critical Habitat

No specific primary constituent elements (PCE) have been formalized for the gray wolf. However, in general, primary constituent elements for gray wolf may include the following:

1. space for population growth;
2. normal behavior, nutritional or physiological requirements;
3. shelter and breeding habitats, and
4. habitats representing appropriate species distribution.

In addition, the USFWS (1992) has identified five main factors critical to the long-term survival of gray wolf:

1. large tracts of wild land with low human densities and minimal accessibility by humans
2. ecologically sound management
3. availability of adequate wild prey;
4. adequate understanding of wolf ecology and management, and
5. maintenance of populations that are either free of, or resistant to, parasites and diseases new to wolves or are large enough to successfully contend with their adverse effects.

Additional detail on the presence of general PCEs and factors critical to the long-term survival of gray wolf is provided in Section 6.3.1, Gray Wolf Environmental Baseline. Potential impacts to the general PCEs and to factors critical to the long-term survival of gray wolf are described in Section 6.3.2, Analysis of Direct and Indirect Effects to Gray Wolf. Further detail on impacts to gray wolf prey habitat is provided below.

The Forest Service identified quantitative indicators in the 2004 Forest Plan BA, and in the *Programmatic Biological Assessment: Gray Wolf, Canada Lynx, and Their Critical Habitats for the Superior National Forest* (USDA Forest Service 2011b), to analyze the impacts of those risk factors that have the most substantive impacts on wolf habitat. These indicators have been used to assess impacts to wolf critical habitat, if it was implemented in Minnesota in the future, in this BA. **Table 12** lists risk indicators and identifies those that apply to the Project.

Risk Analysis Indicators

Prey Habitat

The Forest Service has identified two risk analysis indicators to measure the effects to prey habitat that would apply to the Project. Parameters used by the Forest Service to identify suitable wolf prey habitat were given in the *Federally Listed Threatened and Endangered Species for the Revised Forest Plans: Chippewa and Superior National* Forests (USDA Forest Service 2004b) and *Programmatic Biological Assessment: Gray Wolf, Canada Lynx, and Their Critical Habitats for the Superior National Forest* (USDA Forest Service 2011a).

Indicator 1 – Acres and Percent of Young Upland Forest < 10 Years Old

This indicator represents potential habitat for moose, white-tailed deer, and beaver, important prey items for wolves, by acres of young upland forest. Acreage dedicated to coniferous plantations, clearcuts, areas of prescribed burns, and shelterwood harvests all provide significant forage biomass. Lowland conifer is not included. Even though the correlation between habitat and populations appears to be weak, this indicator provides an overall analysis of potential prey forage habitat.

There are about 271 acres of young upland forest on the federal lands (**Figure 9**, **Table 7**). Based on Management Indicator Habitat mapping done by the Forest Service, about 181 acres of young upland forest would be lost to mining. Although young upland forest vegetation would be lost on the Mine Site, the lands adjacent to the Mine Site would still provide young upland forest for wolf prey even though lands would be owned by PolyMet, as these lands would be managed to provide wildlife habitat and would not be developed. About 10 or more years after mine reclamation, approximately 397 acres of young upland forest could be available to wolf prey, although it is uncertain if wolf prey would move from areas outside of the Mine Site to suitable habitat on the Mine Site.

Collectively, the non-federal lands have about 778 acres (11% of available habitat) of young upland forest. Under the Proposed Action, this habitat would be administered by the Forest Service. Wetland Mitigation Sites would provide additional young upland forest. Based on young upland forest losses at the federal lands, and gains from the non-federal lands, there would be a net gain of 507 acres of young upland forest under Forest Service administration under the Proposed Action (MDNR et al. 2013).

Table 12
Wolf Risk Analysis Indicators

Risk Analysis Indicators[1]	Analyzed	Rationale for Exclusion
1. Acres and Percent of Young Upland Forest <10 years Old (MIH 1, Young)	Yes	
2. Acres and Percent of Upland Conifer (Spruce and Pine) > 9 years Old on All Uplands (MIH 5, All but Young)	Yes	
3. Miles of High Standard Roads (OML 3, 4, and 5)	No	Miles of high standard roads would not change under the Proposed Action.
4. Cross-country Use Policy for Designated All-terrain Vehicle and Snowmobile Trails	No	Policy would not change under the Proposed Action. There are 0 miles of designated trails on the federal lands, and 0.3 miles on the non-federal lands.
5. Miles of Temporary and OML 1 and 2 Roads	No	There would be little or no change in the miles of Temporary and OML 1 and 2 roads on federal and non-federal lands under the Proposed Action (Ryan 2013a).

Source: USDA Forest Service (2004b).

Indicator 2 – Acres and Percent of Upland Forest > 9 Years Old on all Uplands

This indicator represents potential winter thermal and hiding cover for white-tailed deer and moose provided by relatively dense occurrence of immature and mature coniferous forest in planted/seeded stands. Coniferous forest also provides important summer thermal cover (from heat) for moose.

There are about 5,393 acres of immature and mature upland coniferous forest on the federal lands (**Figure 19**, **Table 7**). About 1,333 acres of immature and mature upland coniferous forest would be lost to mining based on Management Indicator Habitat mapping done by the Forest Service. Although forest vegetation would be lost on the Mine Site, the federal lands would still provide immature and mature upland coniferous forest for wolf prey even though lands would be owned by PolyMet, as these lands would be managed to provide wildlife habitat and would not be developed. About 20 or more years after mine reclamation, approximately 397 acres of immature and mature upland coniferous forest could be available to wolf prey for cover, although it is uncertain if wolf prey would move from areas outside of the Mine Site to suitable habitat on the Mine Site.

Collectively, the non-federal lands have about 5,366 acres (76% of available habitat) of immature and mature upland coniferous forest. Under the Proposed Action, this habitat would be administered by the Forest Service. Wetland Mitigation Sites would provide additional immature and mature upland coniferous forest. Based on immature and mature upland coniferous forest losses at the federal lands, and gains from the non-federal lands, there would be a net loss of 26 acres of immature and mature upland coniferous forest under Forest Service administration under the Proposed Action.

Human Access and Disturbance

The Forest Service identified three indicators that apply to human access and disturbance. These are:

Indicator 3 – Miles of High Standard Roads (OML 3, 4, and 5)

Indicator 4 – Cross-country Use Policy for Designated All-terrain Vehicle and Snowmobile Trails

Indicator 5 – Miles of Temporary and OML 1 and 2 Roads

Indicators 4 and 5 were not analyzed for reasons given for Indicators 7 and 9 for lynx. Indicator 3 was not analyzed because there are no High Standard Roads (OML 3, 4, and 5) on the federal and non-federal lands, and none are proposed to be built under the Proposed Action. Objective Maintenance Level 3 roads are those roads open and maintained for travel by a prudent driver in a passenger car. User comfort and convenience are not considered priorities. Roads are typically low speed, single lane with turnouts and have only spot surfacing. Objective Maintenance Level 4 roads provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. Objective Maintenance Level 5 roads provide a high degree of user comfort and convenience. The roads are normally double lane, paved facilities (USDA Forest Service 2004a).

Under the Proposed Action, PolyMet would gain control of the federal lands. There are approximately 5.9 miles of temporary and OML 1 and 2 roads on the federal lands. Most temporary roads were built to support historic timber management and mine exploration on the proposed Mine Site and would be lost to mine development. Access to the federal lands would be strictly controlled during mine operations.

These roads would likely have little impact on wolves as wolves would not likely use the federal lands during mining due to noise and other disturbances. After mine closure, roads would be reclaimed (except for a short road from the Dunka Road to the Waste Water Treatment Facility; Pylka 2013b) and closed to vehicle access. Temporary roads may be constructed on the lands adjacent to the Mine Site to support forest management activities, but number of miles of temporary backcountry roads and trails on the lands should be similar to, or less than, existing miles of backcountry roads and trail on the lands. After mine closure, the federal lands would remain in private ownership and the public would not be allowed to use the roads to access the lands (Pylka 2013b).

The Forest Service would manage the non-federal lands for timber production and recreation. If new roads are constructed on the lands, they would likely be temporary and used to support timber management. There would likely be little or no change in the number of miles of backcountry roads and trails on the non-federal lands, and the number of miles may decrease if existing roads are closed and re-vegetated or allowed to re-vegetate naturally, benefitting wolves.

6.3.3 Effects of Interrelated and Interdependent Actions

No known activities are interrelated or interdependent to the Project that would have the potential to affect gray wolves. It is possible that future specific programs or projects may have relevant interrelated and interdependent actions (e.g., expansion of the Mine Site due to discovery of new ore bodies) and they would be considered in the context of consultations for those actions.

6.3.4 Cumulative Effects

The methods used to analyze cumulative effects, and the temporal and spatial domains, are the same for wolves as for lynx, as discussed in Section 6.1.4.

6.3.4.1 Prey Habitat

The types of cumulative effects to wolf prey habitat and habitat fragmentation, and to wolf travel corridors, would be similar to those effects to lynx as discussed in Section 6.1.4. However, given that more wolves are found in the CESA, more wolves could be impacted than lynx. Although the Project would result in habitat loss and fragmentation on about 1,719 acres at the Mine Site for about 20 years (until the Project is reclaimed), in the context of available habitat, and habitat that would be available to wolves in the reasonably foreseeable future, cumulative effects of the Project on habitat loss and fragmentation would be minor.

6.3.4.2 Human Access and Disturbance

Human Access and Traffic

The Project and other nearby proposed projects would increase the amount of human access and disturbance in the area. Effects from loss of habitat and disturbance associated with human activities from the Project are discussed above. However, increased human populations in the Project area may also lead to increased risk to wolves from collisions with vehicles and trains, increased levels of recreation activities and use of backcountry roads and trails, and increased mortality from illegal hunting and trapping.

See Section 6.1.4.2, Human Access and Traffic, for a discussion of the road system in the area. Given that the number of miles of roads associated with the federal and non-federal lands after mining is expected to be similar to or less than current levels, impacts associated with road mileage are not expected to accumulate from the Project.

Trapping and Legal and Illegal Taking

An influx of worker and their families into the region to support the Project and other development would increase the potential for illegal harvest of wolves. The USDA Animal and Plant Health Inspection Service Wildlife Services maintains records on the legal taking of wolves in Minnesota. From 1996 to 2009, an average of 146 wolves was taken annually as a result of depredation control in Minnesota (USDA Forest Service 2011b).

Hunting and trapping of wolves would not be allowed on lands administered by PolyMet. Thus, there should be no illegal or accidental take due to the Project. Loss of wolves to illegal trapping and hunting should remain near current levels on the non-federal lands, while the number of wolves harvested on non-federal lands during legal hunting and trapping seasons will vary based on wolf population levels. Thus, there should be negligible or no cumulative effect to legal, illegal, and accidental take of wolves from the Project and land exchange.

7.0 Conservation Measures

Seven conservation measures are recommended to reduce potential impacts to lynx, northern long-eared bat, and wolf from the Project. These measures are based, in part, on conservation measures identified by the Forest Service during its review of the Project, measures in the *Lynx Conservation Assessment and Strategy* (Ruediger et al. 2000) that are applicable to lynx populations throughout the contiguous U.S. and could therefore apply to lynx in and around the Project area; measures identified in the *Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Eastern Small-Footed Bat and the Northern Long-Eared Bat as Endangered or Threatened Species; Listing the Northern Long-Eared Bat as an Endangered Species; Proposed Rule* (USDOI USFWS 2013b); and measures identified in the *Minnesota Wolf Management Plan* (MDNR 2001) that can benefit wolves in Minnesota.

7.1 Reclaim Project Area

PolyMet would reclaim about 397 acres to wetland and upland habitat at the Mine Site, including the Waste Rock Stockpiles, the Overburden Storage and Laydown Area, and the Ore Surge Pile. The stockpiles would be revegetated using a mixture of native grasses and forbs. Areas revegetated with grasses and forbs would initially provide little habitat value for lynx, northern long-eared bat, and wolf and their prey, primarily due to lack of hiding cover. Over time, reclaimed areas may be used by lynx, northern long-eared bats, and wolves and their prey as coniferous and deciduous forests establish on the sites through plant succession. Lynx tracking surveys at waste rock stockpiles east of the Project found that lynx hunt for snowshoe hare that reside in early successional shrubland and forestland habitats that have established on waste rock stockpiles. As disturbed areas are reclaimed, they would also improve habitat connectivity with forestlands in the vicinity of the Project.

When feasible, PolyMet should progressively reclaim disturbance areas to allow reclaimed areas to revegetate sooner than if the areas were not reclaimed until after mine operations cease.

7.2 Maintain Vegetated Buffers

The facility should be designed to reduce impacts to lynx, northern long-eared bats, and wolves by minimizing the disturbance area and new road construction, and reclaiming any areas where Project activities cease. Where feasible, a vegetative buffer should be retained around the perimeter of the facility to reduce light and noise effects on lynx, northern long-eared bat, and wolf. In addition, existing and newly constructed roads (built to access the Project area) should be reclaimed or obliterated after facility closure, where feasible.

7.3 Limit Public Access to Project Area

Public access to the Project area should be limited to the extent possible during development, operation, and reclamation. Users of any snowmobile or all-terrain vehicle trails on public lands near the Project area should be encouraged to stay on the trail and avoid travel into other areas. After closure and reclamation, activities that compact snow should be minimized.

7.4 Minimize Road Construction and Reclaim Unused Roads

Where feasible and appropriate, dirt and gravel roads traversing lynx and wolf habitat within the Project area should not be paved or otherwise upgraded (e.g., straightening of curves, widening of roadway, etc.) in a manner that is likely to lead to significant increases in traffic speeds or increased width of the cleared ROW, or would foreseeably contribute to development or increases in human activity in lynx and wolf habitat within the Project area.

Plowed roads and groomed over-the-snow routes may allow competing carnivores such as coyotes to access lynx and wolf habitat in the winter, increasing competition for prey (Buskirk et al. 2000). However, plowed or created snow roads would be necessary to access the facility during construction and operation, and are necessary to access other lands within the vicinity of the Project.

Several studies suggest that lynx may not avoid roads, except at high traffic volumes. Therefore, at this time, there is no compelling evidence to recommend management of road density to conserve lynx. There is evidence, however, that road density can impact wolf use of an area. Thus, the number of new roads constructed in support of the Project should be minimized and roads reclaimed/obliterated where feasible and appropriate.

7.5 Educate Workers and Public

Direct mortality from vehicular collisions has been detrimental to lynx and wolf in northern Minnesota. It is unlikely that lynx and wolves would travel close to the Project area due to disturbance and lack of habitat. Still, to benefit lynx, wolf, and other wildlife, speed limits should be enforced along access roads to reduce the risk of wildlife-vehicle collisions. Workers should be given training to make them aware of the importance of the area to wildlife, to request that employees report sick or dying wildlife along roads or at facilities, to ensure that employees do not dump wastes or other harmful materials off the site, and to make employees aware of other actions that could be harmful to wildlife or their habitats.

Lynx and wolf may be mistakenly trapped or shot outside the legal wolf hunting season by legal predator hunters seeking bobcats or other furbearers. Prey species, such as snowshoe hares, may also be affected by legal and illegal trapping and shooting. To reduce or eliminate the incidence of illegal trapping and shooting of lynx and wolf, PolyMet could work with the MDNR and local conservation groups to initiate information and education efforts to protect the lynx and wolf and to ensure that trappers check their traps at frequent intervals and release lynx and wolf that are still alive. Trailhead posters, magazine articles, and news releases could be used to inform the public of the possible presence of lynx and wolf within or near the Project area.

7.6 Lynx Monitoring

Because limited research has been conducted on lynx in the contiguous U.S., PolyMet would continue to follow studies of lynx conducted by the Forest Service, NRRI, MDNR, and other conservation agencies and groups to better understand lynx use of the study area during the Project's construction and operation, and to identify specific reclamation measures that could be implemented to restore lynx habitat to the area after facility closure.

7.7 Preserve and Protect Habitat

Lynx, northern long-eared bat, and wolf would benefit from habitat protection on lands adjacent to the Mine Site. These lands would be managed by PolyMet and provide habitat for use by lynx, northern long-eared bat, wolf, and other wildlife.

Forestlands in this area would likely be harvested periodically, but could be managed to provide early successional habitat favored by snowshoe hare, while wetlands could be left relatively untouched. Wetlands and forestlands could be used by lynx and wolf as a travel corridor between lands to the east and west of the Mine Site, and for foraging and roosting habitat by northern long-eared bat. Based on observations of lynx and wolf on and near disturbance areas at the Northshore Mine, lynx and wolf could use this area as a travel corridor during mine operations, and would likely use this area as a travel corridor after mine operations cease.

8.0 Determination of Effects

Lynx and wolf have been observed on and near the federal lands, and at several of the non-federal lands. The northern long-eared bat has been observed on the federal lands. Bats have been observed on the non-federal lands, although they were not identified to species. The primary effects to lynx and their critical habitat, and to wolf, would be from loss and fragmentation of habitat, to habitat connectivity, and from fatalities associated with vehicle and rail traffic on the Mine Site, Transportation and Utility Corridors, Plant Site, and access roads and railroads to the Project area. The primary effect to northern long-eared bat would be loss of habitat.

Collision with vehicles and trains is a documented cause of lynx and wolf mortality in Minnesota. Vehicle and rail traffic would include road and rail access to and within the Project area. Increased traffic is expected in the vicinity of the Project area. Although there is little likelihood that lynx or wolf would be killed by vehicle and rail traffic associated with the Project, based on studies at several other mine sites, this risk of the loss of lynx and wolf cannot be discounted.

Critical habitat for the lynx has been designated in the Project area. The Mine Site and a portion of the Dunka Road and Utility Corridor are within lynx critical habitat. Not all areas within the mapped boundaries of designated habitat are considered critical habitat. Only areas that contain the primary constituent elements required by the species are considered critical habitat. Primary constituent elements are the physical and biological features of a landscape that a species needs to survive and reproduce (USDOI USFWS and NMFS 1998). The Mine Site contains habitat elements that facilitate lynx survival and reproduction.

Habitat loss and fragmentation would be unavoidable effects to lynx, northern long-eared bat, and wolf from the Project, and additional impacts from other proposed projects in the area are expected. In addition, Project noise and other disturbances could disrupt lynx and wolf use of travel corridors near the Project area. The types of habitat that provide suitable habitat for lynx and their prey and would be lost to the Project are common in northeastern Minnesota, however, and lands along the Iron Range are already highly fragmented.

The Project would affect about 0.03% of lynx critical habitat in Minnesota, including Primary Constituent Elements (PCEs) of lynx critical habitat. Less than 0.03% of wolf critical habitat, including PCEs for wolf, would be directly affected by mining. In addition, of the 1,719 acres that would be directly affected by mining, about 397 acres (23%) would be reclaimed to habitats that could be used by lynx and wolf about 10 or more years after reclamation. It is unlikely that habitat loss and fragmentation resulting from the Project would represent a significant impact to lynx and wolf habitat from a regional perspective.

Based on the analysis in this BA, the Project would affect lynx, and those effects would not be insignificant or discountable. Thus, the Project **is likely to adversely affect** Canada lynx. As noted above, the Project would directly impact only about 0.03% of lynx critical habitat, including PCEs of lynx habitat. Some of this habitat would be reclaimed and available for use by lynx and their prey about 10 or more years after reclamation. However, not all of the reclaimed areas would restore the lost PCEs nor would they likely return to the quality of the habitat removed from the site. Thus, the Project **is likely to adversely affect** Canada lynx critical habitat.

Based on analysis in this BA, the Project is **likely to adversely affect** the continued existence of northern long-eared bat. This is because of the loss of available summer roost habitat. Impacts on northern long-eared bats from the Project would not preclude both the survival and recovery of the population as a whole.

Based on the analysis in the BA, the Project would affect gray wolves, and those effects would not be insignificant or discountable. Thus the Project **is likely to adversely affect gray wolves**. The Project would directly impact only 0.03% of wolf critical habitat, including PCEs, in Minnesota. Some of this habitat would be reclaimed and available for use by gray wolves and their prey about 10 or more years after reclamation. Thus, the Project **is likely to adversely affect** gray wolf critical habitat.

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APPENDIX A

Common and Scientific Names of Plants and Animals Given in this Biological Assessment

Common Name	Scientific Name
Plants	
American Beech	*Fagus grandifolia*
Balsam Fir	*Abies balsamea*
Beaked Hazel	*Corylus cornuta*
Black Ash	*Fraxinus nigra*
Black Locust	*Robinia pseudoacacia*
Black Oak	*Quercus velutina*
Black Spruce	*Picea mariana*
Blueberry	*Vaccinium angustifolium*
Bog Birch	*Betula pumila*
Bog Labrador-tea	*Ledum groenlandicum*
Canada Bluejoint	*Calamagrostis canadensis*
Cattail	*Typha* spp.
Club Moss	*Lycopodium* spp.
Eastern White Pine	*Pinus strobus*
Jack Pine	*Pinus banksiana*
Leatherleaf	*Chamaedaphne calyculata*
Lodgepole Pine	*Pinus contorta*
Narrow-leaved Cattail	*Typha latifolia*
Northern Red Oak	*Quercus rubra*
Northern White Cedar	*Thuja occidentalis*
Paper Birch	*Betula papyrifera*
Pussywillow	*Salix discolor*
Raspberry	*Rubus* spp.
Red-osier Dogwood	*Cornus stolinifera*
Red Pine	*Pinus resinosa*
Sedge	*Carex* spp.
Shining Club Moss	*Lycopodium lucidulum*
Shortleaf Pine	*Pinus echinata*
Silver Maple	*Acer Saccharinum*
Small-fruited Bog Cranberry	*Vaccinium oxycoccus*
Sourwood	*Oxydendrum arboreum*
Speckled Alder	*Alnus rugosa*
Sphagnum Moss	*Sphagnum* spp.
Subalpine Fir	*Abies lasiocarpa*
Sugar Maple	*Acer saccharum*
Tamarack	*Larix laricina*

APPENDIX A (Cont.)

Common and Scientific Names of Plants and Animals Given in the Report

Common Name	Scientific Name
Plants (Cont.)	
Trembling Aspen	*Populus tremuloides*
White Pine	*Pinus strobus*
White Spruce	*Picea glauca*
Willow	*Salix* spp.
Woolgrass	*Scirpus cyperinus*
Animals	
Beaver	*Castor canadensis*
Big Brown Bat	*Eptesicus fuscus*
Bison	*Bison bison*
Bobcat	*Lynx rufus*
Canada Lynx	*Lynx canadensis*
Coyote	*Canis latrans*
Eastern Red Bat	*Lasiurus borealis*
Eastern Small-footed Myotis	*Myotis leibii*
Elk	*Cervus candensis*
Fisher	*Martes pennanti*
Gray Wolf	*Canis lupus*
Hoary Bat	*Lasiurus cinereus*
Indiana Bat	*Myotis sodalis*
Keen's Long-eared Myotis	*Myotis keenii*
Little Brown Myotis	*Myotis lucifugus*
Moose	*Alces alces*
Mountain Lion	*Puma concolor*
Mule Deer	*Odocoileus hemionus*
Northern Flying Squirrel	*Glaucomys sabrinus*
Northern Long-Eared Bat	*Myotis septentrionalis*
Pine Marten	*Martes americana*
Porcupine	*Erethizon dorsatum*
Red Squirrel	*Tamiasciurus hudsonicus*
Ruffed Grouse	*Bonasa umbellus*
Siberian Husky	*Canis familiaris*
Silver-haired Bat	*Lasionycteris noctivagans*
Snowshoe Hare	*Lepus canadensis*
Spruce Budworm	*Choristoneura fumiferana*
Tri-colored Bat	*Perimyotis subflavus*
Western Long-eared Myotis	*Myotis evotis*

APPENDIX A (Cont.)

Common and Scientific Names of Plants and Animals Given in the Report

Common Name	Scientific Name
Animals (Cont.)	
White-tailed Deer	*Odocoileus virginianus*
Wolverine	*Gulo gulo*
Woodland Caribou	*Rangifer tarandus*