6.0 CUMULATIVE EFFECTS

6.1 INTRODUCTION

Both NEPA and MEPA require an assessment of potential cumulative effects. The CEQ defines cumulative effects as:

> ...the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other action. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. (40 CFR § 1508.7)

The MEQB's regulations in *Minnesota Rules*, Chapter 4410.0200, subparts 11 and 11a, mirror the CEQ cumulative effects definition. In addition to the regulations, this analysis follows the guidance in the 1997 CEQ guidance presented in *Considering Cumulative Effects under the National Environmental Policy Act* and the USEPA's NEPA review guidance *Consideration of Cumulative Impacts in EPA Review of NEPA Documents* (CEQ 1997 and USEPA 1999, respectively.)

This section presents the resource-specific cumulative effects analysis of the NorthMet Project Proposed Action and Land Exchange Proposed Action that may result when combined with effects from other activities. Each resource has specific spatial (geographic) or temporal (time) boundaries, which are called Cumulative Effects Assessment Areas (CEAAs). The cumulative actions applied to this analysis are those past, present, and reasonably foreseeable activities within the various resource-specific CEAAs that, when combined with the NorthMet Project Proposed Action and Land Exchange Proposed Action, may cause cumulative effects as measured by the evaluation criteria and defined by NEPA and MEPA. In addition to additive effects, cumulative effects may be further magnified by synergisms or cross-interactions in the environment.

This chapter is divided into two major subsections: Section 6.2 describes the cumulative effects of the NorthMet Project Proposed Action and Section 6.3 describes the cumulative effects of the Land Exchange Proposed Action. The analysis does not assess the cumulative effects of the Proposed Connected Actions (i.e., the NorthMet Proposed Action and Land Exchange Proposed Action), which are described in Chapter 7.

Two basic factors are used to quantify how a proposed project may cause cumulative effects. The first summarizes existing environmental conditions, which are the result of actions that have taken place in the past or are subject to present activities. It is not possible, however, to catalogue all past human actions to quantify how the natural environment has been affected by anthropogenic activities. Chapter 4 describes the baseline conditions for the NorthMet Project area and Land Exchange parcels, which may include contributions from past and present activities. Intensive land uses, such as towns, cities, roads, hunting, fishing and trapping, mines, forest practices, farming, and damming of rivers and creation of reservoirs have all had an influence on the natural environment of the region, which has resulted in present day conditions. In addition, natural trends in the environment would be affected into the future by currently

permitted and approved land uses and projects. The direct and indirect effects of the NorthMet Proposed Action and Land Exchange Proposed Action are discussed in Chapter 5.

The second factor in determining how the NorthMet Project Proposed Action would, in combination with other reasonably foreseeable activities, cumulatively affect resources in the future constitutes the *reasonably foreseeable future actions*. The method and set of assumptions for identifying which projects and activities that could contribute to cumulative effects in described below in Section 6.2.1. In addition to the identified cumulative projects and activities, the USFS identified two land exchange and two land acquisition projects that are reasonably foreseeable to be considered in the cumulative effects assessment for the Land Exchange Proposed Action (see Section 6.3).

Throughout this section, we refer to *Past, Present,* and *Reasonably Foreseeable Future Actions* when describing potential cumulative effects. The past and present actions are described in detail in Chapter 4, Affected Environment.

6.2 NORTHMET PROJECT PROPOSED ACTION

6.2.1 Cumulative Effects Analysis Approach

Potential cumulative effects for the NorthMet Project Proposed Action have been assessed at the resource level. The spatial and temporal extents of the CEAAs depend on several resource-specific factors. For example, given that noise effects decrease in direct proportion to the distance between the source and sensitive receptors, the geographic extent is necessarily limited. Conversely, air effects can extend many miles from the source and are conversely much broader. For the purposes of the cumulative effects assessment, the timing or scheduling of specific cumulative actions is also important to the context of the assessment given the overlapping and possibly synergistic effects they may have on some resources, such as sediment loading to waterbodies or dust and particle emissions to visual resources.

For all resources, future temporal boundaries are the expected service life of the mining activities, including closure (years 20 to 40) and post-closure restoration (year 40 and beyond.) The spatial and temporal boundaries for each resource are defined within the respective resources' sections of this analysis.

Resource-specific spatial and temporal boundaries are used to identify past, present, and reasonably foreseeable future actions that would likely affect the same environmental resources as the NorthMet Project Proposed Action. MEQB, CEQ, and USEPA guidance allow for a fairly broad interpretation of "reasonably foreseeable" to accommodate project-specific conditions, but indicate that actions that would be considered "speculative" should be excluded. For the purposes of this assessment, "reasonably foreseeable" actions are defined as those actions that are included in approved planning documents and have approved funding, are permitted, or have a currently active federal or state permit or site plan application under review. The discussion of potential cumulative effects assumes the successful implementation of the best management practices and mitigation measures discussed throughout this SDEIS, as well as compliance with all applicable federal, state, and local regulations and permit requirements.

In addition to other cumulative effects that may be identified through the analysis, Section 6.2.3 also addresses the following cumulative effects topics, identified in the Final SDD (MDNR 2005):

- Hoyt Lakes area projects and air concentrations in Class II areas,
- Class I areas PM_{10} increment,
- ecosystem acidification resulting from deposition of air pollutants,
- mercury deposition and bioaccumulation in fish,
- visibility impairment,
- loss of threatened and endangered plant species,
- loss of wetlands,
- loss or fragmentation of wildlife habitat,
- streamflow and lake level changes,
- water quality changes,
- economic effects, and
- social effects.

These topics are discussed under their respective resource sections below.

6.2.2 Past, Present, and Reasonably Foreseeable Actions and Projects

For the purposes of this analysis, the NorthMet Project Proposed Action may contribute to cumulative effects when considered along with 20 other actions and projects in the region. These projects are shown on Table 6.2-1 and Figure 6.2.2-1, and are further described in Section 6.2.2.1. Air Resources and Wilderness and other Special Designation Areas have unique extents of consideration and the specific actions considered are identified under those resource sections. Existing conditions that may be related to past or present actions on specific environmental resources are fully described in their respective sections in Chapter 4 and the direct and indirect impacts of the NorthMet Proposed Action are described in Chapter 5. Section 6.2.2.1 provides a brief description of the cumulative actions considered in this assessment. Some actions unique to a particular resource are discussed under those resources.

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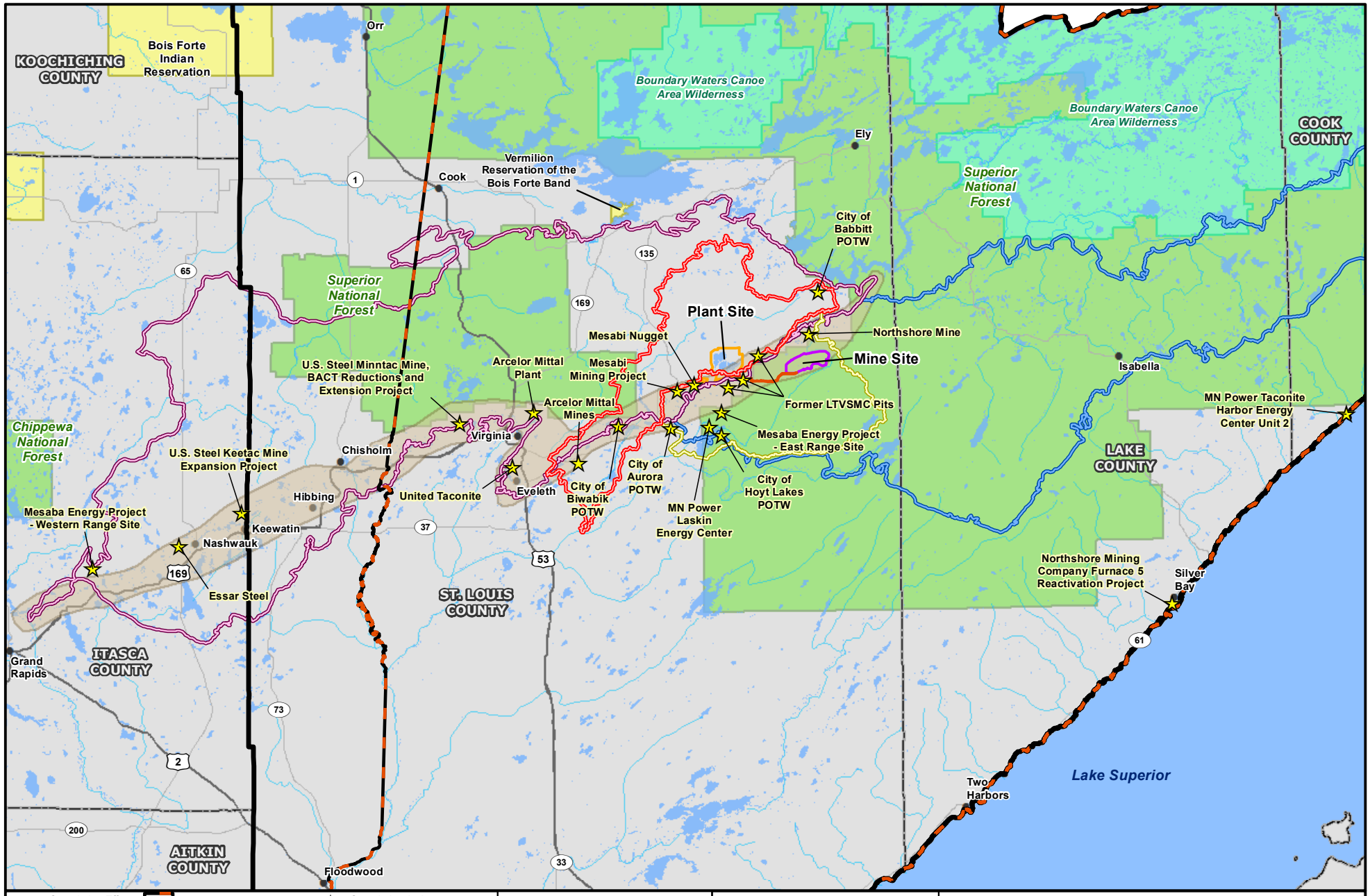

Figure 6.2.2-1
Cumulative Effects Assessment Area
NorthMet Mining Project and Land Exchange SDEIS
Minnesota

November 2013

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Table 6.2-1 Actions Considered and Affected Resources in the Cumulative Effects Assessment

	Activity	Status	Approx. Distance from NorthMet Project Area (Miles)	Resources Affected
1	ArcelorMittal Mines (Laurentian and East Reserve Mines)	Present	18	Land Use, Water, Wetlands, Vegetation, Wildlife, Cultural, Socioeconomics, Recreation and Visual Resources
2	City of Aurora POTW	Present	6	Water
3	City of Babbitt POTW	Present	10	Water
4	City of Biwabik POTW	Present	10	Water
5	City of Hoyt Lakes POTW	Present	7	Water
6	Essar Steel	Present, with Reasonably Foreseeable Modifications	55	Air Quality, Vegetation, Wildlife
7	Former LTVSMC Pits	Present	<1	Water, Wetlands, Vegetation, Wildlife, Aquatic Species, Air Quality, Cultural
8	Mesaba Energy Project – Western Range Site	EIS Preferred Alternative - Reasonably Foreseeable	55	Land Use, Wildlife, Socioeconomics, Cultural, Recreation and Visual Resources
	East Range Site (Alternative Site near Hoyt Lakes, MN)	EIS Alternative[1]	3	Water, Aquatic Species
9	Mesabi Nugget (formerly Mesabi Nugget Phase I)	Present	<1	Water, Vegetation, Aquatic Species, Air Quality, Socioeconomics
10	Mesabi Mining Project (formerly Mesabi Nugget Phase II)	Reasonably Foreseeable	2	Water, Vegetation, Wetlands, Wildlife, Aquatic Species, Air Quality, Cultural, Socioeconomics, Recreation and Visual Resources
11	Minnesota Power Laskin Energy Center	Present	5	Water, Wetlands, Air Quality
12	Minnesota Power Taconite Harbor Energy Center Unit 2, Emission control modifications	Reasonably Foreseeable	48	Air Quality
13	Northshore Mining Company: Furnace 5 Reactivation Project	Present	39[2]	Air Quality
14	Northshore Mine	Present	7	Water, Vegetation, Wildlife, Aquatic Species, Air Quality, Cultural, Socioeconomics
15	U.S. Steel Keetac Mine Expansion Project (Keewatin)	Reasonably Foreseeable	45	Land Use, Vegetation, Wildlife, Cultural, Socioeconomics, Recreation and Visual Resources
16	U.S. Steel Minntac, BACT Reductions	Present	25	Land Use, Vegetation, Wildlife, Aquatic Species, Air Quality, Cultural, Socioeconomics
17	U.S. Steel Minntac Mine Extension Project	Reasonably Foreseeable	25	Water, Wildlife, Vegetation, Cultural, Aquatic, Air Quality, Socioeconomics, Recreation and Visual Resources
18	United Taconite	Present	27	Water

	Activity	Status	Approx. Distance from NorthMet Project Area (Miles)	Resources Affected
19	Community growth and development	Present and Reasonably Foreseeable	Regional, no specific locations	Vegetation, Wildlife, Cultural
20	Forestry practices on public and private lands	Past, Present, and Reasonably Foreseeable	Regional, no specific locations	Vegetation, Wildlife, Cultural

Notes:

[1] The US Department of Energy has not issued a ROD for this EIS. Until a final decision on that project has been completed, this alternative is considered a reasonable alternative for the Mesaba Energy Project, and a reasonably foreseeable project for this cumulative effects assessment.

[2] At closest point to NorthMet Project Proposed Action area.

6.2.2.1 Brief Description of Cumulative Actions Considered

6.2.2.1.1 ArcelorMittal Mines (Laurentian and East Reserve Mines)

ArcelorMittal operates two separate taconite mines, the Laurentian Mine and the East Reserve Mine. These mines are approximately 2 miles apart between Gilbert and Biwabik Minnesota. Both are located approximately 18 miles from the NorthMet Project area.

The Laurentian Mine has been operating since the early 1990s and is 2 miles southwest of the East Reserve mine pits. East Reserve #1 began operations in 2008. A second pit, East Reserve #2, has been permitted but is not expected to open for several years.

Ore from the East Reserve #1 Pit is being blended with, and intended to gradually replace, ore from the Laurentian Mine. It is used to make steel, primarily for the automobile industry and the transportation sector.

6.2.2.1.2 City of Aurora Publicly Owned Treatment Works

To support its POTW, the City of Aurora withdraws water from the St. James Pit, which is a former natural ore pit within the Embarrass River Watershed. The facility drains treated wastewater into Silver Creek, which, in turn, drains into the St. Louis River.

6.2.2.1.3 City of Babbitt Publicly Owned Treatment Works

The City of Babbitt uses several wells, some of which are in the Dunka River Watershed, for its municipal water supply. The City POTW discharges treated wastewater effluent to the Embarrass River. Because some of the discharge originates in the Dunka River Watershed and is transferred to the Embarrass River, the treatment work is assumed to increase the flow in the Embarrass River.

6.2.2.1.4 City of Biwabik Publicly Owned Treatment Works

The City of Biwabik withdraws water from the flooded Canton Mine Pit for its municipal water supply and discharges treated wastewater to a tributary of Embarrass Lake.

6.2.2.1.5 City of Hoyt Lakes Publicly Owned Treatment Works

The City of Hoyt Lakes withdraws water from Colby Lake for municipal potable use and discharges treated wastewater to the Whitewater Reservoir. Most of this water returns to the Partridge River Watershed during droughts, when it is pumped to maintain water levels in Colby Lake or seeps into the Lower Partridge River through a dike.

6.2.2.1.6 Essar Steel

Essar is permitted to construct a new taconite mine and processing plant near Nashwauk, Minnesota, in Itasca County. The project would produce 6.5 million metric tonnes per year (mtpy) of high-flux pellets, or 7.0 million mtpy of low-flux taconite pellets. Essar estimates that, once operational, the modifications would operate at full capacity for up to 15 years. The project is located approximately 55 miles southwest of the NorthMet Project area. Essar has stated that it intends to complete construction and begin operation in 2014.

6.2.2.1.7 LTV Steel Mining Company

LTVSMC mined and processed taconite from the 1950s to 2001, when it went bankrupt. Cliffs Erie LLC (now Cliffs Natural Resources, Inc. [both names for this company are used in this document, depending on the specific context of the citation]) acquired the assets of the former LTVSMC and is currently managing legacy issues through a Consent Decree with the MPCA. The former LTVSMC processing plant and tailings facility is proposed for use by the NorthMet Project Proposed Action. The former LTVSMC mine pits are located to the east of the processing plant and are currently flooding and or are flooded.

- Pit 1: This pit has seasonal (September to March) discharges of up to 5.8 MGD (9.0 cfs) to Second Creek; no discharges occur from April to August. The proposed Mesabi Mining Project would result in the dewatering of this pit to a currently unspecified water at an unspecified rate.
- Pit 2WX: The pit is currently in the process of filling. Within a few years, this pit would overflow to an unnamed creek that discharges to the Partridge River just below Colby Lake.
- Pit 2/2E: This pit is stabilized with no direct discharge. There is likely groundwater flow from this pit to Pit 2W.
- Pit 2W: This pit recently reached the level at which overflow discharge occurs to Second Creek (approximately 5 MGD [7.7 cfs]). It is proposed to receive water from Pit 3 (SD-012) and discharge seasonally (September to March). Pit 2W can be discharged to Second Creek at a maximum of 4,200 gpm (9.4 cfs).
- Pit 3: This pit currently discharges to Wyman Creek at approximately 0.5 MGD (0.8 cfs). It is proposed to pump to Pit 2W, essentially relocating discharge to Second Creek.
- Pit 5S: This pit overflows via “dispersed” discharge, at an unknown rate, to Wyman Creek. No changes are proposed.
- Pit 5N: This pit has an overflow discharge of up to 2 cfs to Spring Mine Creek, a tributary of the Embarrass River.

- Pit 6: This pit currently contributes water via the subsurface to Second Creek. The proposed Mesabi Mining Project would result in the dewatering of this pit to a currently unspecified water at an unspecified rate.
- Pit 9S: This pit is currently stable (with likely groundwater discharge off-site and/or to Pit 6). The proposed Mesabi Mining Project would likely result in some dewatering to an unspecified location at an unspecified rate.
- Pit 9N: This pit is currently stable (with groundwater discharge to Pit 1).
- The Mesaba Energy and Mesabi Mining projects currently withdraw (and propose to continue withdrawing) water from or dewater some of the former LTVSMC mine pits, specifically Pits 1, 2/2E, 2W, 2WX, 6, and/or 9S. The hydrologic effects of these projects are described below. In the near term, those pits that are still filling with water would have the effect of slightly reducing flows to the Partridge River; however, the effects have not been quantified. In the long term, if the pits were allowed to continue filling to equilibrium, the net effect on downstream hydrology would be near zero.

6.2.2.1.8 Mesaba Energy Project

Excelsior Energy is proposing to develop the Mesaba Energy Project, an Integrated Coal Gasification Combined Cycle electric power-generating station. The project would be designed, constructed, and operated in two phases, each phase generally producing 600 megawatts. Excelsior's preferred site is in the Western Iron Range near Taconite, Minnesota, about 55 miles from the NorthMet Project area. Excelsior's alternative site is located within the City of Hoyt Lakes, just north of Colby Lake, about 3 miles from the NorthMet Project area. Although Hoyt Lakes is not the preferred site, it has been included here for purposes of this analysis. The Hoyt Lakes site is within the Partridge River Watershed.

Pit 2/2E, Pit 2W and Pit 3 of the LTVSMC mine (see Section 6.2.2.1.7) could be drawn down as part of the Mesaba Energy project. An FEIS was prepared in 2009 by the USDOE and MDC; however, no ROD related to granting an operating license had been issued as of the publication date of this SDEIS.

6.2.2.1.9 Mesabi Nugget

The Mesabi Nugget facility, located within approximately 2 miles of the NorthMet Project area, is currently producing iron nuggets from iron ore concentrate. The concentrate is mixed, dried, and fed into a rotary hearth furnace and reduced to a metallic iron and slag material. Water is appropriate from Pit 1 and/or Pit 2WX for contact and non-contact cooling and air pollution control equipment. Treated wastewater is discharged into Pit 1, which, in turn, is discharged on a seasonal basis (September through March) into Second Creek.

6.2.2.1.10 Mesabi Mining Project

The Mesabi Mining Project area is located approximately 2 miles from the NorthMet Project area. This facility would involve the reactivation of a taconite mine and construction of a taconite concentration facility near Hoyt Lakes. Under the most recent proposal, Pits 2WX and 6 would be dewatered to access the iron ore and tailings would be disposed into Pit 1. Most of the concentrate generated at the Mesabi Mining Project facility would be used in the Mesabi Nugget facility, and the remainder would be shipped by rail to other facilities for processing. This project

is currently on indefinite hold by the applicant, but would be considered as reasonably foreseeable for this assessment.

6.2.2.1.11 Minnesota Power Laskin Energy Center

The Minnesota Power Laskin Energy Center is a coal-fired power plant on Colby Lake between Aurora and Holt Lakes, about 5 miles from the NorthMet Project area. It withdraws cooling water from Colby Lake and discharges it into the downstream portion of the lake. The plant produces more than 110 megawatts of power with low-sulfur, sub-bituminous coal.

6.2.2.1.12 Minnesota Power Taconite Harbor Energy Center Unit 2, Emission Control Modifications

Minnesota Power is working on emission control modifications to Unit 2 of its Taconite Harbor Center in Schroeder, Minnesota. This facility is located approximately 48 miles east of the NorthMet Project area. The company installed a custom-designed control system that injects sorbents into the combustion process to control SO_2, NO_x, and mercury. Minnesota Power anticipates the system would cut NO_x emissions by more than 60 percent and SO_2 emissions by 65 percent.

The project also included similar retrofits at Minnesota Power's Laskin Energy Center in Hoyt Lakes. Work on these retrofits began in 2006.

6.2.2.1.13 Northshore Mining Company: Furnace 5 Reactivation Project

The Reserve Mining Company opened the facility in Babbitt in the 1950s and operated it until 1986, when the facility closed. Cyprus Minerals acquired and reopened the facility in 1989 and operated it until 1994, when Cliffs Natural Resources, Inc. acquired it. The Northshore Mining Company is a wholly-owned subsidiary of Cliffs Natural Resources, Inc.

In the early 2000s, the Northshore Mining Company reactivated Furnace 5, a pelletizing furnace at its taconite processing facility near Silver Bay on Lake Superior, Minnesota, about 39 miles to the southeast of the proposed NorthMet Mine Site and about 46 miles from the proposed NorthMet Plant Site.

The reactivated equipment included two crushing units and nine ore concentrator sections, as well as the construction of a concentrate handling system and an expansion of the facility's WWTP.

6.2.2.1.14 Northshore Mine

The Northshore Mine (also known as the Peter Mitchell Mine) is an open-pit taconite mine near Babbitt, Minnesota, that opened in 1951, about 4 miles northwest and northeast from the NorthMet Plant Site and about 1 mile north of the NorthMet Mine Site. One of the mine areas currently discharges to the Partridge River. Northshore Mining Company anticipates that mining under their Permit to Mine would cease around 2070. Conceptual post-closure plans for the Northshore Mine pit allow for the pit to flood due to groundwater inflow and runoff. Predicted ultimate outflow from the pit would be from the northeast end of the pit, to the Dunka River in the Rainy River Watershed. No water from mine dewatering would be anticipated to be flowing to the Partridge River post-closure (MDNR 2011s).

The mine is operated by Northshore Mining Company, Inc. the ore and processes it into pellets at Silver Bay, which ships it to steel producing blast furnaces throughout the country.

6.2.2.1.15 U.S. Steel Keetac Mine Expansion Project (Keewatin)

U.S. Steel is permitted to restart an idled production line and expand contiguous sections at the Keetac Mine and taconite processing facility near Keewatin, Minnesota, about 45 miles from the NorthMet Project area, on the boundary between St. Louis and Itasca counties. The project would increase iron pellet production from 6 million to 9.6 million tpy.

The project involved preparation of a joint State-Federal EIS; the ROD was issued in December 2010. The expanded facility is scheduled to begin full operations between 2013 and 2015. U.S. Steel has announced that this project is currently on indefinite hold. Until a final decision is made, this project is considered reasonably foreseeable for the purposes of this assessment.

6.2.2.1.16 U.S. Steel Minntac Mine, Best Available Control Technology Reductions (Mountain Iron)

This project implemented technological modifications to reduce air emissions from the existing facility. In 2008, the MPCA issued a draft permit to U.S. Steel establishing BACT limits for VOCs, CO, and fluorides at the company's Minntac facility in Mountain Iron, Minnesota. The permit addresses potential effects on visibility from NO_x emissions and establishes a procedure to set a BACT limit for NO_x. The draft permits set interim NO_x limits and requires the ongoing testing of control technologies for NO_x, with a goal to reduce emissions more than 70 percent compared to the initial permit limit.

6.2.2.1.17 U.S. Steel Minntac Mine, Extension Project

U.S. Steel is proposing to extend its open pit facilities by 483 acres at the Minntac Mine in Mountain Iron, Minnesota. The project is expected to extend mine life and taconite production to 2031.

The Minntac Mine is a taconite mine and pelletizing operation about 25 miles from the NorthMet Project area. The Minntac plant consists of a series of crushers and screens, a concentrator, an agglomerator, and auxiliary facilities. Taconite produced from the extension would continue to be processed at the existing Minntac facility at the current levels of production.

MDNR issued a ROD on April 11, 2013, stating that the project would not cause significant environmental effects and that an EIS was not required (MDNR 2013f).

6.2.2.1.18 United Taconite

This is a taconite mine that began operations in 1965 and has an annual capacity of approximately 5.2 million gross tons of taconite pellets. It is located about 27 miles west of the NorthMet Project area. The United Taconite mine has six permitted mine pit dewatering discharges, all of which discharge to the St. Louis River Basin. United Taconite make-up water comes from the St. Louis River. No changes in mine operations or discharges are anticipated in the foreseeable future.

6.2.2.1.19 Community Growth and Development

Where community growth and development are assessed, they are based on historical and projected population and economic trends derived from state census data and regional land use plans as described in the appropriate resource sections.

6.2.2.1.20 Forestry Practices on Public and Private Lands

Where forestry practices are assessed, they are based on historical and projected trends derived from state databases and regional forestry plans as described in the appropriate resource sections.

6.2.2.1.21 Speculative Actions

Other projects in the early stages of development by mining companies are considered to be speculative by the Co-lead Agencies. While these projects have been identified to provide an indication of regional development interest, these actions have not been mapped or considered in the cumulative analysis.

Twin Metals

Twin Metals Minnesota Joint Venture (Duluth Metals Limited and Antofagasta PLC) has begun looking at the feasibility of creating an underground copper-nickel-PGE mine near Ely, Lake County, Minnesota. This venture is known as the Twin Metals Project. At this time, a permit application has not been submitted for activities that would require a DA permit pursuant to Section 404 of the CWA. This project would likely require preparation of a joint State-Federal EIS. Preliminary data collection to support environmental review and permitting is underway by the company.

Essar Steel Minnesota

The Essar Steel Minnesota Nashwauk, Itasca County facility was permitted in 2007 and is under construction. The company is proposing a facility expansion of its taconite operations, as well as construction of a legacy scram processing facility. Scram operations produce natural iron ore or iron ore concentrates from previously developed stockpiles, basins, underground workings, or open pits. The legacy scram facility is exempt from state environmental review, but requires state permitting. Expansion of the taconite facility may require preparation of a joint State-Federal EIS.

Rio Tinto (Kennecott Exploration)

Rio Tinto is currently performing exploration drilling of a non-ferrous (copper-nickel) deposit near Tamarack, Aitkin County, Minnesota, about 45 miles west of Duluth, Minnesota. The project may require preparation of a joint State-Federal EIS. Preliminary data collection to support environmental review and permitting is currently underway by the company.

Teck American

Teck American is considering operations to mine the Mesaba deposit near Babbitt, approximately 3 miles east of the NorthMet Mine Site, for non-ferrous metals (copper-nickel). The current phase is exploration and drilling. The project may require a joint State-Federal EIS. Preliminary data collection to support environmental review and permitting is underway.

Cliffs Natural Resources

Cliffs Natural Resources is planning an expansion of its United Taconite mining facility to the northeast. The expansion would require either a State EAW or EIS. Additionally, a portion of Highway 53 (easement since 1960) would need to be relocated to accommodate the expansion of mining operations. The DEIS for the relocation of approximately 1 mile of Highway 53 between Eveleth and Virginia, St. Louis County, Minnesota, is under development and is expected to be released for public comment during the winter/spring of 2014 (MDOT 2013).

North Star Blue Scope Steel

North Star Blue Scope Steel is considering a direct reduced iron (DRI) plant to process iron ore concentrate purchased from others into DRI-grade pellets. A site for the plant has not been selected. The project may require preparation of a joint State-Federal EIS.

ArcelorMittal

The ArcelorMittal facility is an operating iron taconite plant in Virginia, St. Louis County, Minnesota. The company is considering an expansion by initiating mining operations in a central pit, thereby connecting two existing pits. The project may require preparation of a joint State-Federal EIS and reissuance of NPDES permits for the mine and plant sites. The Town of McKinley is located between the two pits.

Cardero Resource Group (Two Projects)

Cardero Resource Group has initiated exploration activities for non-ferrous deposits (titanium) for its Longnose and Titac properties. Although both properties are located near Aurora, St. Louis County, Minnesota, they are separated by approximately 25 miles. The two are considered separate mines and each project may require preparation of a joint State-Federal EIS.

Cooperative Mineral Resources

Cooperative Mineral Resources is a subsidiary of Crow Wing Power located near Emily, Crow Wing County, Minnesota. The project is proposed as a non-ferrous mine with an interest in manganese extraction from deposits 200 to 400 ft bgs. The project proposer has conducted small-scale pilot testing of extraction technology at the site. This project would require preparation of a joint State-Federal EIS.

Encampment Minerals

Encampment Minerals, Inc. is currently exploring the Serpentine copper-nickel deposit. This project would require a State EIS.

Magnetation

Magnetation is currently operating (or co-operating) scram mining operations near Keewatin, Taconite, and Chisholm and has received a permit for a new operation near Coleraine. Magnetation has also considered a similar scram mining operation near Calumet, Minnesota, but has not submitted permit applications for this facility.

6.2.3 Cumulative Effects by Resource

6.2.3.1 Introduction

This section considers cumulative effects by resource area. Only the direct and indirect effects of the NorthMet Project Proposed Action described in Chapter 5 of the SDEIS are considered to potentially cause cumulative effects for the purposes of this analysis. For each of the resources analyzed in this chapter, the specific methodologies used to approach the cumulative analysis, as well as the spatial and temporal boundaries that limit the analysis, are described.

6.2.3.2 Land Use

The NorthMet Project Proposed Action would affect approximately 6,498 acres of land near Hoyt Lakes and Babbitt, in St. Louis County, Minnesota. This area includes public lands in the Superior National Forest, as well as private lands within the municipal boundaries of Hoyt Lakes and Babbitt.

6.2.3.2.1 Approach

The cumulative actions were evaluated against existing land use plans and ordinances. These include the St. Louis County Comprehensive Land Use Plan, provisions of the 1854 Treaty with the Chippewa of Lake Superior as they may affect or be affected by land use, and local (municipal) land use plans and zoning ordinances.

6.2.3.2.2 Cumulative Effects Assessment Area

Spatial

The CEAA for land use includes effects associated with the NorthMet Project Proposed Action combined with other industrial (including mining) or public works projects located within the portion of the Mesabi Iron Range encompassed by St. Louis County (see Figure 6.2.2-1). While changes in land use patterns do not necessarily depend on such projects, historical census data indicate changes in population in St. Louis County have been historically linked to such projects, especially mines. As discussed in Section 4.2.10, the iron deposits associated with the Mesabi Iron Range have been mined on an industrial scale for more than 100 years.

Recreation and natural areas (such as the BWCAW, Voyageurs National Park, and Superior National Forest) are also important economic and land use resources; however, the spatial extent of these designated lands is largely fixed (i.e., they have designated federal boundaries). Changes in use of these resources are due to evolving socioeconomic preferences, such as preferred type and amount of recreational activity.

Temporal

This evaluation focuses on existing and reasonably foreseeable land use patterns within the CEAA. Because mining and public resource management have been historically the primary drivers defining regional development and land use within the CEAA for over 100 years, existing conditions are considered indicative and representative of historical mining and resource management activities.

6.2.3.2.3 Contributing Past, Present, and Reasonably Foreseeable Actions

As noted previously, it is not possible to identify all past activities that may contribute to a cumulative effect. Similarly, all present activities would continue to affect the environment. The impacts of these combined activities are described in Chapter 4, Affected Environment. While not a new project, the Northshore Mine is anticipated to close in 2070.

The foreseeable future actions included in this analysis are discussed in Section 6.2.2. Activities specifically associated with potential cumulative effects on land use include permitted mines and other projects in the portions of the Mesabi Iron Range in St. Louis County where future activities are likely to be different from current activities. These projects include:

- ArcelorMittal Mines (Laurentian and East Reserve Mines),
- Mesaba Energy Project – East Range Site,
- Mesabi Mining Project,
- U.S. Steel Keetac Mine Expansion Project (in Keewatin), and
- U.S. Steel Minntac Mine, Expansion Project.

6.2.3.2.4 Cumulative Effects Assessment

The cumulative actions described in Section 6.2.3.2.3 are largely existing, expanded, or reconfigured mines operating on private land. These activities total approximately 2,650 acres, including more than 2,000 acres at the Keetac mine alone (MDNR and USACE 2010). While much of this land has not previously been mined, all of the cumulative actions are found within the Mesabi Iron Range. Expanded mining in this area does not necessarily reflect a change in land use and is consistent with land use regulations (St. Louis County 2011).

Together, the five projects included in the cumulative assessment would result in about 572 new operations jobs (direct employment), combined with about 360 operations jobs associated with the NorthMet Project Proposed Action. As with the NorthMet Project Proposed Action, this could increase housing demand in the region. A majority of this increased demand could be adsorbed by the substantial available housing stock in St. Louis County (see Section 5.2.10.2.4).

Post-closure, the Northshore Mine pit lake is estimated to be approximately 2,800 acres at an elevation of 1,500 ft amsl. Mitigation for changes to the watershed includes in-pit aquatic habitat development and upland enhancements. Public access to the reclaimed pit lake will be provided (Northshore 2010).

The sources for data regarding cumulative actions include MDNR and USACE 2007, USDOE and MDC 2007, and MDNR and USACE 2010.

6.2.3.3 Water Resources

The Final SDD identified several resources with the potential to be cumulatively affected, including water resources, which would be subjected to a cumulative effects analysis using guidance from the CEQ (CEQ 1997). The Final SDD identified hydrology and water quality as elements with the potential for cumulative effects. The analysis within this SDEIS also identified the potential for cumulative effects on surface water hydrology and water quality. Neither the Final SDD nor this SDEIS identified potential cumulative effects on groundwater. The NorthMet

Project Proposed Action would supplant the existing seepage from the existing LTVSMC Tailings Basin and extend the duration of these effects, but these effects are localized and already incorporated in the groundwater quality models. Although the NorthMet Project Proposed Action would affect groundwater levels, this effect would be very limited geographically and temporally (e.g., groundwater levels would begin to restore once pit dewatering ceases) and not subject to any off-site cumulative effects. The effects of mine pit dewatering are considered in terms of effects on surface water flows. Therefore, the scope of this cumulative effects assessment focuses on the effects of past, present, and reasonably foreseeable future activities on surface water hydrology and quality.

6.2.3.3.1 Cumulative Effects Assessment Areas

In accordance with the CEQ guidance, a cumulative effects assessment should define the spatial and temporal scope of its analysis. These are described below.

Spatial

The Final SDD identified the Partridge River and the Embarrass River as the geographic scope for the hydrology and water quality analyses. The analysis in this SDEIS supports this study area. The St. Louis River was considered for inclusion in the cumulative effects assessment, but not included in the assessment of project-specific impacts for the reasons described below.

First, the NorthMet Project Proposed Action is predicted to only result in minor changes to hydrology within the Partridge River and Embarrass River. In particular, limiting effects in the Embarrass River headwaters and tributaries would require stream flow augmentation. Most of the actions considered in this cumulative effects analysis (see Table 6.2-1) with the potential to cumulatively affect hydrology within the Partridge River and Embarrass River exist and their hydrologic effects are already incorporated into the impact assessment water modeling for the NorthMet Project Proposed Action.

The only two reasonably foreseeable actions with the potential to significantly affect flow within the Partridge River and Embarrass River are the Mesaba Energy Project East Range Alternative Site and the Mesabi Mining Project, which would result in a net increase in Lower Partridge River flow as a result of pit dewatering for the foreseeable future. Further, the NorthMet Project Proposed Action would not contribute to decreased low flows in the Lower Partridge River because PolyMet would offset any water withdrawals by water releases from Whitewater Reservoir, as required under MDNR Water Appropriation Permit 1949-0135. The NorthMet Project is predicted to reduce flows in the Embarrass River by a maximum of 2.1 cfs, which is already incorporated in the NorthMet modelling. There are no other reasonably foreseeable actions within the Embarrass River Watershed that would result in a reduction in flow. Therefore, the effects of all reasonably foreseeable actions with the potential to cumulatively impact low flows in the Partridge River and Embarrass River are already taken into consideration in the NorthMet Project modelling.

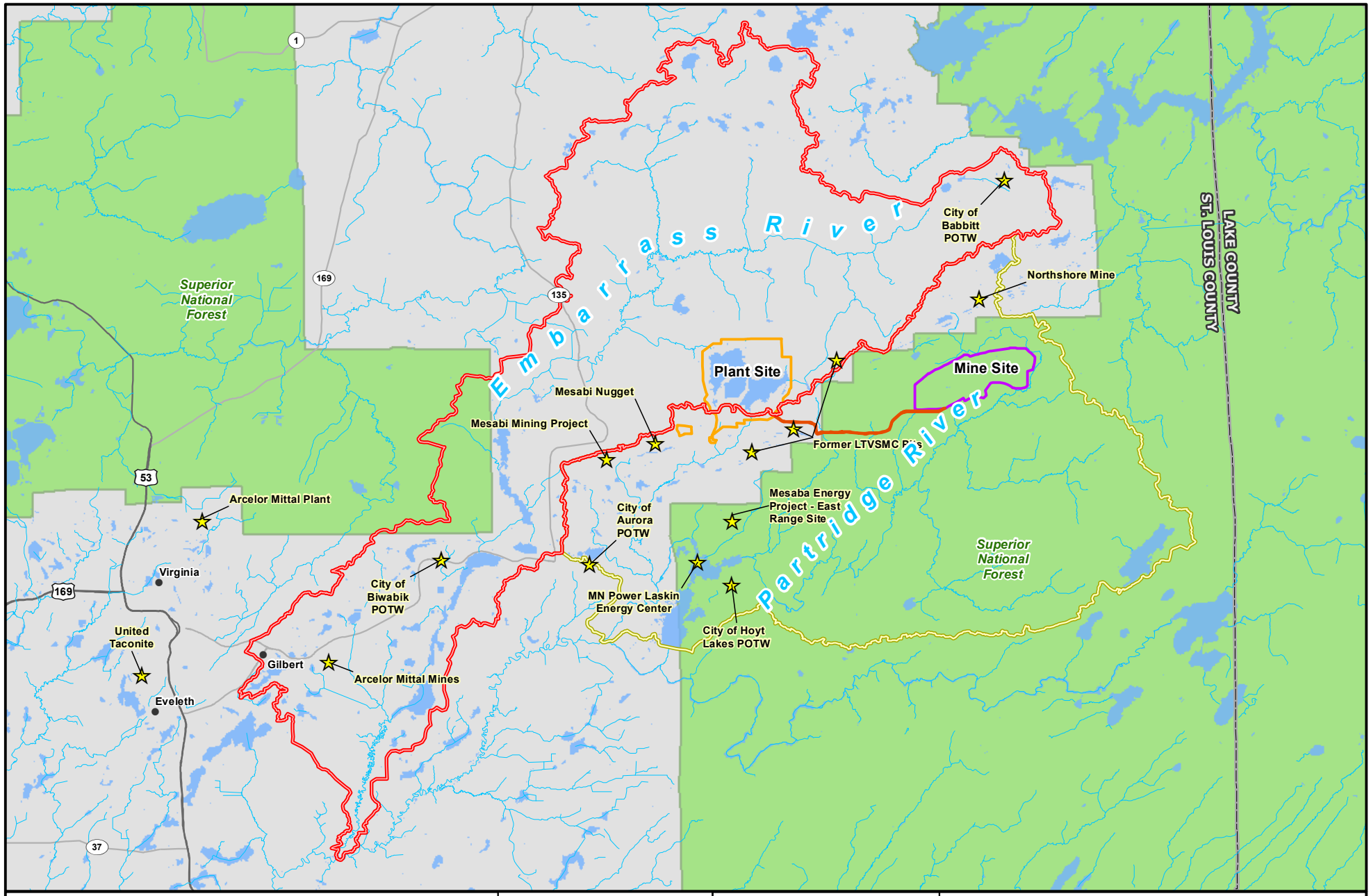
Second, the impact assessment water quality modeling for the NorthMet Project Proposed Action already takes into consideration low flow conditions, and even during low flows, it is not predicted to result in any direct exceedances of water quality evaluation criteria, although achieving this would require long term water treatment and WWTF/WWTP maintenance. Other reasonably foreseeable actions may also increase metal and other solute loadings downstream, but it is assumed that these other actions would also be required to meet federal and state water

quality requirements, including nondegradation. Therefore, the potential for exceedances of water quality evaluation criteria as a result of cumulative effects from the NorthMet Project Proposed Action and other reasonably foreseeable actions is considered unlikely.

Although not expected to result in any direct exceedances of water quality evaluation criteria, the NorthMet Project Proposed Action, in combination with other reasonably foreseeable actions, would increase metal and other solute loadings to the Partridge River and Embarrass River, and further downstream in the St. Louis River. These loadings would, however, be diluted as the solutes are transported downstream (i.e., average annual flow in the St. Louis River at the confluence with the Embarrass River is approximately four times more than in the Partridge and Embarrass rivers alone). Further, the MPCA will review the NorthMet Project Proposed Action for consistency with the State's non-degradation requirements prior to any permitting, as it would also do at the time of permitting for any other reasonably foreseeable actions.

Finally, sulfate and mercury loadings, two key constituents of concern, are predicted to decrease overall as a result of the NorthMet Project Proposed Action. Although sulfate loadings are predicted to increase slightly in the Partridge River Watershed (0.1 percent) as a result of the NorthMet Project Proposed Action, this is offset by a large decrease in the Embarrass River Watershed (21 percent at PM-13), resulting in a significant net decrease in overall sulfate loadings to the St. Louis River as a result of the NorthMet Project Proposed Action. Similarly, mercury loadings are predicted to increase slightly in the Embarrass River Watershed (3 percent) as a result of the NorthMet Project Proposed Action, but this is offset by a larger decrease (5 percent) in the Partridge River Watershed, resulting in a net decrease in overall mercury loadings to the St. Louis River as a result of the NorthMet Project Proposed Action.

Therefore, the NorthMet Project Proposed Action is not considered to have the potential for cumulative effects on hydrology and water quality in the St. Louis River. As a result, the CEAA for surface water is defined by the Partridge River and Embarrass River watersheds as shown on Figure 6.2.3-1.



Mine Site
Plant Site
Transportation and Utility Corridor
Embarrass River Watershed
Partridge River Watershed
Cumulative Actions See Table 6.2-1
Stream/River
Lakes
National Forest

US Army Corps of Engineers St. Paul District

N W E S

0 1 2 4 6 Miles

Figure 6.2.3-1
Water Resources Cumulative Effects Assessment Areas
NorthMet Mining Project and Land Exchange SDEIS
Minnesota

November 2013

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Temporal

In terms of temporal scope, this assessment considered past and present effects on flow and water quality in the Partridge River and Embarrass River as reflected in existing baseline hydrologic and water quality conditions. Limited flow data are available back to the 1940s for the Embarrass River and 1970s for the Partridge River. Limited water quality data are available dating back to the 1970s. In addition to the NorthMet Project Proposed Action, this assessment considered reasonably foreseeable future activities, which are identified below.

6.2.3.3.2 Contributing Past, Present, and Reasonably Foreseeable Actions

It is not possible to identify all past activities that may contribute to a cumulative effect. Similarly, all present activities would continue to affect the environment. The impacts of these combined activities are described in Chapter 4, Affected Environment. Existing and potential future actions, in combination with the NorthMet Project Proposed Action, which could cumulatively affect surface water hydrology and quality within the Partridge River and Embarrass River watersheds, include the following:

- ArcelorMittal Mines (Laurentian and East Reserve Mines),
- Northshore Mine,
- City of Aurora POTW,
- City of Babbitt POTW,
- City of Biwabik POTW,
- City of Hoyt Lakes POTW,
- Cliffs Erie, LLC – Hoyt Lakes Area (former LTVSMC),
- Cliffs Erie, LLC – Area 5 NW Pit,
- Mesabi Nugget,
- Mesabi Mining Project,
- Mesaba Energy Project – East Range Site (Alternative Site near Hoyt Lakes, Minnesota), and
- Minnesota Power Laskin Energy Center.

6.2.3.3.3 Cumulative Effects on Hydrology

This section discusses cumulative effects on the hydrology of the Partridge River and the Embarrass River.

Partridge River

The effect of the NorthMet Project Proposed Action on average annual flow in the Partridge River downstream of Colby Lake would vary by mine phase—about a 5.5-cfs reduction during operations; about a 3.8-cfs reduction during reclamation; and about a 0.5-cfs net increase in flow during closure, as measured downstream of Colby Lake.

There are several mines, the City of Hoyt Lakes WWTP, and the Minnesota Power's Laskin Energy Center (a power plant) that have withdrawn or discharged water in the past and/or are

currently withdrawing or discharging water that affects flows in the Partridge River (see Figure 4.2.2-9). Table 4.2.2-10 summarizes the NPDES/SDS discharges to and surface water withdrawals from the Partridge River and its tributaries. Most of these outfalls do not discharge continuously, and many, although still "active" in terms of permit status, have not discharged for many years (such as various mine pit dewatering discharges).

There are seven other past, present, and reasonably foreseeable activities that could affect the hydrology of the Partridge River. The existing or predicted future hydrologic effects of these activities are briefly described below and summarized in Table 6.2-2. The average net hydrologic effect listed reflects the extent to which the listed activity impacts natural average annual flow in the Partridge River. For example, flooded pit overflows (without artificial management) are assumed to generally reflect natural flow contributions.

Table 6.2-2 Cumulative Effects on Partridge River Hydrology by Activity

Activity	Average Net Hydrologic Effect	Location of Effects	Timing	Magnitude	Future Duration
Northshore Mine	0.0 cfs	Entire Partridge River	Intermittent	Varies	>20 years ongoing
City of Hoyt Lakes POTW	-0.1 cfs	Lower Partridge River	Continuous	Relatively consistent	Long term ongoing
Former LTVSMC mine pits and SD026	0.0 cfs	Wyman Creek, Second Creek, Partridge River	Varies	Varies	Long term ongoing
Mesaba Energy Project	-7.4 cfs	Primarily Lower Partridge River	Continuous	Relatively consistent	Long term – timing uncertain
Mesabi Nugget	-3.0 cfs	Lower Partridge River	Continuous	Varies	Long term ongoing
Mesabi Mining Project	+11.8 cfs	Lower Partridge River	Continuous	Varies from 7.2 to 33.5 cfs	20 years potentially beginning ~2015
Minnesota Power Laskin Energy Center	-4.2 cfs	Lower Partridge River	Continuous	Relatively consistent	Long term ongoing
NorthMet Mine	-5.5 cfs (operations) +0.5 cfs (closure)	Entire Partridge River	Varies	Varies	Long term potentially beginning ~2015

- Northshore Mine – This is an open-pit taconite mine. The mine consists of three mining areas, only one of which (water appropriation permit Area 003) discharges to the Partridge River. There are several permitted discharges from Area 003, but only two mine pit discharges and a crusher discharge, with a collective maximum water appropriation-permitted discharge to the Partridge River of 29 cfs, are active. In 2012, Area 003 was being actively dewatered (pumped) to the Partridge River at up to 9.8 MGD (15 cfs) with a very small passive discharge at less than 0.1 MGD (less than 0.1 cfs). These discharges essentially form the origin of the Partridge River. There is currently little or no active mining occurring in Area 003 and none is proposed under their current Mine Plan that would result in changes in discharge volumes.

Pit dewatering records for the Northshore Mine are incomplete and can only provide a rough estimate of daily discharge. Available records show an average annual discharge to the Partridge River ranging from between 6.8 and 15.1 cfs, with a highest reported monthly discharge of 34 cfs (Barr 2008f). Over the past several years (2004 to present), the average annual daily discharge from the Northshore Mine has been approximately 5.8 cfs, but is quite variable, ranging from zero (mostly during the winter and summer droughts) to as high as approximately 20 cfs. As of 2012, Northshore had not been mining Area 003; however, they have been dewatering the easternmost mine pit in Area 003 and discharging to the Partridge River. During operations, the Northshore Mine would not have an effect on average annual flows in the Partridge River, although it may have an effect on average daily flows depending on its operations and the timing of its discharges. After closure, Northshore Mining would discontinue discharging water to the Partridge River, thus reducing the average annual flow in the Partridge River due to a permanent reduction of contributing watershed of approximately 7 square miles. Flow reduction in the uppermost portion may be reduced up to 100 percent relative to current conditions due to the Northshore Mine closure (Barr 2008o; MDNR 2013g).

- City of Hoyt Lakes POTW – The City of Hoyt Lakes is authorized to withdraw up to 2.3 cfs, but currently withdraws approximately 0.6 cfs of water from Colby Lake for municipal potable use, and discharges approximately 0.5 cfs of treated wastewater from its POTW to Whitewater Reservoir. Most of this water is returned to the Partridge River Watershed either via pumping during droughts to maintain water levels in Colby Lake or via seepage through its northwest dike to the Lower Partridge River. For purposes of this cumulative effects analysis, a consumptive loss of 0.1 cfs is assumed from the Partridge River Watershed.
- Former LTVSMC – The status of the nine former LTVSMC pits are as follows:
  - Pit 1: This pit has seasonal (September to March) discharges of up to 5.8 MGD (9.0 cfs) to Second Creek; no discharges occur from April to August.
  - Pit 2WX: The pit is currently in the process of filling. Within a few years, this pit will overflow to an unnamed creek that discharges to the Partridge River just below Colby Lake. The proposed Mesabi Mining Project would result in the dewatering of this pit to a currently unspecified water body at an unspecified rate.
  - Pit 2/2E: This pit is stabilized with no direct discharge. There is likely groundwater flow from this pit to Pit 2W.
  - Pit 2W: This pit recently reached the level at which overflow discharge occurs to Second Creek (approximately 6 MGD [9.4 cfs]). It is proposed to receive water from Pit 3 (SD-012) and discharge seasonally (September to March).
  - Pit 3: This pit currently discharges to Wyman Creek at approximately 0.5 MGD (0.8 cfs). It is proposed to pump to Pit 2W, essentially relocating discharge to Second Creek.
  - Pit 5S: This pit overflows via “dispersed” discharge, at an unknown rate, to Wyman Creek. No changes are proposed.
  - Pit 6: This pit currently “discharges” via the subsurface to Second Creek. The proposed Mesabi Mining Project would result in the dewatering of this pit to a currently unspecified receiving water at an unspecified rate.

  - Pit 9S: This pit is currently stable (with likely groundwater discharge off site and/or to Pit 6). The proposed Mesabi Mining Project would likely result in some dewatering to an unspecified location at an unspecified rate.
  - Pit 9N: This pit is currently stable (with groundwater discharge to Pit 1 and the surficial aquifer). In addition to these pits, there is an active seep discharging from the LTVSMC Tailings Basin, referred to as SD026, which forms the headwaters of Second Creek. This seep is currently discharging at approximately 0.4 cfs, but is captured and pumped back to the Tailings Pond, pursuant to the Cliffs Erie Consent Order. Under the NorthMet proposed flow augmentation program, this lost flow would be replaced, resulting in no net change in flow in Second Creek.

- The Mesaba Energy and Mesabi Mining projects currently propose to withdraw water from or dewater some of the former LTVSMC mine pits, specifically Pits 1, 2/2E, 2W, 2WX, 6, and/or 9S. The hydrologic effects of these projects are described below. In the near term, those pits that are still filling with water would have the effect of slightly reducing flows to the Partridge River, although the effects have not been quantified. In the long term, if the pits were allowed to continue filling to equilibrium, the net effect on downstream hydrology would be near zero.

- Mesaba Energy Project – This is a proposed integrated gasification combined cycle electric power-generating station with an initial capacity proposed at 602 megawatts. The USDOE, in cooperation with the MDC, prepared an FEIS for the project in November 2009. The DEIS identifies a preferred West Range Site located in the City of Taconite and outside the geographic scope of this cumulative effects analysis, as well as an alternative East Range Site located within City of Hoyt Lakes, just north of Colby Lake.

  The USDOE has not completed the NEPA process by issuing a ROD for the Mesaba Energy Project, and there has been no further public action regarding this project since 2009. Additionally, the preferred site for the Mesaba Energy Project is not within the CEAA for the NorthMet Project. Nevertheless, for purposes of this cumulative effects analysis, it has been assumed that the Mesaba Energy Project would be built at the East Range Site, although there is more uncertainty around this activity. The Mesaba Energy Project would have average and peak water demands of 16.1 and 22.3 cfs, respectively, for cooling water, which could be withdrawn from various mine pits (i.e., Pits 1, 2E, 2W, 3, 6, 9S, and other area pits), and potentially Colby Lake (USDOE and MDC 2007). The extent to which the evaporative loss of cooling water would affect flow in the Partridge River is unclear, as some of the water may be withdrawn from former mine pits (e.g., Pits 2E/W/WX) that are still flooding and not presently contributing to surface flows. For purposes of this cumulative effects analysis, it is assumed that the Mesaba Energy Project would result in an evaporative loss of up to 7.4 cfs under average flow conditions in the Lower Partridge River.

- Mesabi Nugget – This facility was constructed in 2010 with the capacity to produce iron nuggets from iron ore concentrate at a rate of 600 million tpy. The project is currently in the process of ramping up production.

  The facility has an average and maximum water demand of up to approximately 4.5 cfs and 11.1 cfs, respectively, for contact and non-contact cooling and process water. This water is withdrawn from the Area 1 and/or Area 2WX pits. The process water would be routed to a wastewater treatment system with part of the treated water recycled to the process and the

rest returned to the Area 1 Pit, which, in turn, is seasonally discharged (from September to March) to Second Creek at a rate of up to 9.0 cfs. At current and anticipated future operating levels, the Mesabi Nugget facility would have evaporative and other losses ranging from approximately 2.6 cfs to 3.0 cfs.

- Mesabi Mining Project – This is a proposed project involving reactivation of a taconite mine and construction of a new taconite concentration facility. The iron ore concentrate would be used as feedstock for the Mesabi Nugget facility, with the remaining balance shipped by rail for use in other facilities. The project underwent some NEPA and MEPA review from 2009 to 2011, but that work is currently in suspension while the project is revaluated/redesigned.

  As previously proposed, the project would discharge water during mining operations to Second Creek, Partridge River, or directly to the St. Louis River from Area 1, Area 6, and Area 2WX pits. The water management strategy for this facility is still in the process of development; however, a preliminary estimate is that the Mesabi Mining Project is expected to increase flows in the Partridge River by an average of approximately 11.75 cfs (Barr 2011e).

- Minnesota Power Laskin Energy Center – This is a coal-fired power plant that withdraws cooling water from Colby Lake. It discharges once-through, non-contact cooling water to the downstream portion of Colby Lake, but has a 4.2-cfs evaporative loss of water to the atmosphere. No changes to its current mode of operation are anticipated for the foreseeable future.

In general, from the mid-1950s, when the LTVSMC and Northshore mines began operations, until around the year 2001, mining has probably increased average flow in the Partridge River as a result of pit dewatering, although at various times it may have had temporary decreased flows depending on the stage of the mines' development. Discharge records for these mines are not available for most of this period, making it difficult to draw firm conclusions. The net effect of the ongoing activities in the Partridge River (i.e., Northshore Mine discharge, City of Hoyt Lakes POTW withdrawal, Mesabi Nugget withdrawal, and Laskin Energy Center evaporative losses) is a possible average annual reduction in flow of approximately 7.3 cfs.

The hydrology of the Upper Partridge River is primarily affected by discharges from the Northshore Mine. These discharges are highly variable and approximate natural average annual flow. They are expected to continue until around 2070, when the Northshore Mine is planned to close. The NorthMet Project Proposed Action would reduce flow in the Upper Partridge River during mine operations by about 5 percent (average flow conditions) to 8 percent (low-flow conditions), although the absolute reduction would be small (approximately 0.1 cfs for low flows). After closure in approximately 2060, the NorthMet Project Proposed Action is predicted to have no effect on average flows and a negligible effect on low flows in the headwaters of the Partridge River (upstream of SW-004a), and slightly increase flow downstream of the WWTF discharge (downstream of SW-004a). Around 2070, the Northshore Mine is expected to close and would stop discharging to the Partridge River, resulting in a permanent loss of drainage to the Partridge River from an area of approximately 7 square miles. By 2070, the NorthMet Project Proposed Action is predicted to have no effects on average flows and negligible effects on low flows. The NorthMet Project Proposed Action would not have measureable cumulative effects in combination with the closure of the Northshore Mine.

For the Lower Partridge River, the average effect of the NorthMet Project Proposed Action would be a reduction of up to 5.5 cfs through year 40, resulting in a maximum net reduction in flow in the Lower Partridge River of 12.8 cfs when combined with other existing and foreseeable activities. In closure (after year 40), the NorthMet Project Proposed Action would result in an increase in flow of approximately 0.5 cfs, for a total cumulative reduction in flow in the Lower Partridge River of 6.8 cfs. This probably overstates the effect on low flow in the Lower Partridge River, as the Whitewater Reservoir was constructed to augment flow in the Partridge River during low flows. The Whitewater Reservoir essentially could offset the NorthMet Project Proposed Action's water withdrawals during low flows (i.e., when Colby Lake water levels are below 1,439 ft, which equates to a flow of approximately 13 cfs), when the effects of the withdrawals would be the greatest. Around 2070, the Northshore Mine would close and reduce flow to the Lower Partridge River. By this time, however, mining operations for the NorthMet Project Proposed Action would be complete, resulting in a slight increase in flow in the Lower Partridge River. Therefore, the NorthMet Project Proposed Action would not combine with the Northshore Mine closure to create cumulative effects on hydrology within the Lower Partridge River.

The Mesabi Mining and Mesaba Energy projects are more uncertain, but may occur, which could result in a net increase of flow of about 4.4 cfs, for a total cumulative reduction in flow in the Lower Partridge River of approximately 8.4 cfs (if they occur before year 40) or a cumulative increase in flow of 2.4 cfs (if they occur after year 40). It is important to note that this discussion of the effects of various activities on average flow masks important temporal and spatial differences. The uncertain probability of development of the Mesabi Mining and the Mesaba Energy projects, and associated timing of mine discharges, makes quantifying the effects of these activities on streamflow very difficult. For example, the dewatering pumps at the Northshore Mine do not operate continuously and this factor alone can affect daily flows in the Partridge River by as much as 20 cfs, based on recent operations, and as much as 29 cfs, based on authorized discharges. These large Northshore Mine pit dewatering discharges, which would end around 2070, are typically related to either snow melt or large storm events when flows in the Partridge River are high.

In summary, the maximum cumulative effects of the NorthMet Project Proposed Action, plus present and reasonably foreseeable future actions on the hydrology of the Partridge River, would be expected to reduce average annual flow in the Lower Partridge River at any time during operations by no more than 8.4 cfs (about 8 percent) and 2.4 cfs (2 percent) during closure of the NorthMet Project Proposed Action, based on average annual flow of 112 cfs at USGS gaging station 04016000 downstream of Colby Lake.

Embarrass River

The effect of the NorthMet Project Proposed Action on average annual flow in the Embarrass River (as measured at PM-13) would be about a 2.1-cfs (2 percent) decrease in flow during the first 7 years of operations, until the Mud Lake Creek diversion is constructed, and then about a 0.9-cfs (1 percent) decrease during long-term closure.

In general, flows in the Embarrass River have been affected to a minor extent by municipal water withdrawals and wastewater discharges, and, since the mid-1950s, by mining (e.g., seepage from the existing LTVSMC Tailings Basin). Most of these discharges are relatively continuous, although there can be wide variations in the magnitude of the discharges, most of which are

attributable to precipitation trends. Larger discharges tend to coincide with either snow melt or large storm events when flows in the Embarrass River are typically high, thereby reducing the magnitude of these discharges. On the other hand, there can be less discharge during drier periods when river flows are lower. Including the NorthMet Project Proposed Action, there are seven past, present, and reasonably foreseeable future activities that could affect the hydrology of the Embarrass River. The existing or predicted future hydrologic effects of these activities are briefly described below and summarized in Table 6.2-3. The average net hydrologic effect listed reflects the extent to which the particular activity impacts natural average annual flow in the Embarrass River. For example, flooded pit overflows (without artificial management) are assumed to generally reflect natural flow contributions.

Table 6.2-3 Existing Cumulative Effects on Embarrass River Hydrology by Activity

Activity	Average Net Hydrologic Effect	Location of Effects	Discharge Timing	Magnitude	Duration
City of Babbitt POTW	+0.1 cfs	Upper and Lower Embarrass River	Continuous	Relatively consistent	Long term On-going
Cliffs Erie (former LTVSMC) Area 5 NW Pit	0.0 cfs	Upper and Lower Embarrass River	Continuous	Varies	Long term On-going
Cliffs Erie (former LTVSMC) Tailings Basin	0.0 cfs	Lower Embarrass River	Continuous	Relatively consistent	Long term On-going
ArcelorMittal Minorca Laurentian Mine	5.0 cfs	Lower Embarrass River	Continuous	Varies	On-going until mid-2010s then ceasing
ArcelorMittal Minorca East Reserve Mines	+9.3 cfs	Lower Embarrass River	Continuous	Varies	On-going until ~2025
City of Aurora	-0.3 cfs	Lower Embarrass River	Continuous	Relatively consistent	Long term On-going
City of Biwabik	0.0 cfs	Lower Embarrass River	Continuous	Relatively consistent	Long term On-going
NorthMet Project	-0.9 to -2.1cfs	Upper and Lower Embarrass River	Continuous	Relatively consistent	Long term On-going

- City of Babbitt – The City of Babbitt uses several wells, some of which are in the Dunka River Watershed, as its water supply source, and discharges 0.33 cfs of treated wastewater effluent to the headwaters of the Embarrass River. Since some of this discharge is Dunka River Watershed water, it is estimated that the City of Babbitt provides an annual average net increase of 0.1 cfs to the Embarrass River.
- Cliffs Erie Pit 5NW – Pit 5NW overflows to Spring Mine Creek, a tributary of the Embarrass River. It contributes an average of approximately 1.85 cfs, but its flow varies with precipitation and has been measured as low as 0.23 cfs. Since outflow from Pit 5NW is a natural (non-manipulated) release that varies with precipitation, it is assumed for purposes of this cumulative effects analysis to have a net flow contribution of 0 cfs.
- Cliffs Erie (existing LTVSMC) Tailings Basin – There are approximately 4.5 cfs of seepage from the Cliffs Erie Tailings Basin, but monitoring suggests that the facility has reached a

steady state and seepage reflects natural precipitation and not the effects of tailings discharge. Therefore, the net hydrologic effect of the Cliffs Erie Tailings Basin is currently considered zero.

- ArcelorMittal Minorca Laurentian Mine – This is a taconite mine that has been in operation since approximately 1993. The mine has three permitted dewatering discharges to an unnamed tributary of the Lower Embarrass River (immediately downstream of Esquagama Lake), but only one is actively used (SD-003). This mine is expected to close sometime in the late 2010s, at which time pit dewatering would stop, and flow to the Embarrass River would be reduced until the pit floods.

  Pit dewatering discharges averaged approximately 5.0 cfs annually between 2010 and 2012 (Laurentian Mine Discharge Monitoring Reports Summary Reports, 2010, 2011, and 2012). Discharges were reasonably constant over the period, with most monthly values ranging between 4.5 and 6.0 cfs. Flows similar to these are expected until the mine closes, at which time pit dewatering and discharge to the Embarrass River would stop. This would result in a net reduction in flow to the Embarrass River of approximately 5.0 cfs until the pit floods.

- ArcelorMittal East Reserve Mine – This is an open-pit taconite mine, which began operations (East Reserve #1) in 2008. The second pit (East Reserve #2) is permitted and is expected to begin operations about the same time the Laurentian Mine closes.

  The first pit has a single permitted dewatering discharge (SD-005) to an unnamed tributary of the Lower Embarrass River (immediately downstream of Esquagama Lake). Pit dewatering discharges from East Reserve #1 averaged approximately 3.0 cfs from 2010 to 2012, but this discharge would likely gradually increase as the pit gets deeper. When discharging, the flow rate is constant, but currently there are several months of the year (primarily in winter) when no discharge occurs. At some yet-to-be-determined point, East Reserve #2 would be opened and pit dewatering would begin through a second permitted discharge (SD-006). The East Reserve Mine (Pit 1 and Pit 2) would have a combined permitted discharge to the Lower Embarrass River of up to 9.3 cfs, though the actual discharge would likely vary seasonally, and as the mines are developed, at a rate somewhat lower than that. As with the Laurentian Mine, it is important to note that a substantial portion of the permitted discharge replaces natural runoff that is captured by the pit watershed.

- City of Aurora – The City of Aurora withdraws approximately 0.32 cfs from the St. James Pit, a former natural ore pit within the Embarrass River Watershed, and discharges approximately 0.31 cfs of treated wastewater to Silver Creek, which drains to the St. Louis River. Therefore, this withdrawal represents a loss of water from the Embarrass River Watershed of 0.32 cfs.

- City of Biwabik – The City of Biwabik withdraws approximately 0.25 cfs from the Canton Pit for municipal water supply and discharges treated wastewater to a tributary of Embarrass Lake at approximately the same rate. There is effectively no net loss of water associated with the City's water usage.

The net effect of these hydrologic changes would be an approximately 4.1-cfs increase in flow, plus about a 0.9 cfs (closure) to 2.1 cfs (operations) reduction as a result of the NorthMet Project Proposed Action, for a total increase in flow of between 2.0 and 3.2 cfs at the confluence with the St. Louis River, or about 3 percent of average annual flow (assuming an average annual flow

of about 117 cfs for a 180.8 square mile watershed with an average annual flow of 0.65 cfs/square mile based on flow at the McKinley gage).

6.2.3.3.4 Cumulative Effects on Surface Water Quality

This section discusses cumulative effects on water quality for the Partridge River and the Embarrass River.

Partridge River

Water quality in the Partridge River has been affected by discharges from the Northshore Mine, discharges/overflows from several former LTVSMC pits, and two permitted discharges from Minnesota Power's Laskin Energy Center for decades. As mentioned in Section 5.2.2, the NorthMet Project Proposed Action does not propose any surface water discharges (other than flow augmentation to Second Creek) until the West Pit overflows and the WWTF begins discharging around year 40. However, non-contact stormwater runoff, unrecoverable groundwater seepage from the five groundwater flow paths (i.e., from the waste rock stockpiles, pits, Ore Surge Pile, WWTF, and Overburden Storage and Laydown Area), and the WWTF discharge would all serve as potential contaminant sources. Stormwater from undisturbed areas of the proposed Mine Site would be similar in chemistry to current runoff from the proposed Mine Site area. The WWTF discharge would be permitted under the NPDES permitting program.

The NorthMet Project Proposed Action is predicted to meet all surface water quality evaluation criteria at all evaluation locations for the entire 200-year modeling period within the Partridge River watershed, other than for constituents that already exceed the criteria (e.g., aluminum, iron, manganese). The NorthMet Project Proposed Action would degrade water quality by raising ambient concentrations for several parameters, but these concentrations would remain below surface water evaluation criteria, even after closure of the Northshore Mine.

Since the NorthMet Project Proposed Action and other cumulative projects' contributions would not cause or increase an exceedance of the water quality evaluation criteria, cumulative effects are not expected. As a result, the cumulative effects analysis focuses on sulfate (because of its relationship with mercury methylation and wild rice) and mercury (because it is the only parameter on the Partridge River 303(d) list). Mercury is only discussed from a water quality perspective; the potential cumulative effects of the NorthMet Project Proposed Action on the bioaccumulation of methylmercury in fish are discussed in Section 6.2.3.7.

Sulfate

Sulfate is a concern along the Partridge River because of the presence of waters supporting the production of wild rice immediately downstream of the NorthMet Project area (including evaluation points SW-005 and SW-006 immediately above Colby Lake and the portion of the river below Colby Lake). According to available surface water monitoring data, including sulfate sampling conducted as part of recent wild rice field surveys (Barr 2009b, 2011a, 2012a, and 2013m), sulfate concentrations in the Upper Partridge River range from 0.5 to 25.7 mg/L, which are slightly elevated relative to baseline conditions, assumed to be similar to values in the South Branch of the Partridge River reported in the 1970s (average of 5.2 mg/L). Recent sampling in Colby Lake found a mean concentration of 33.8 mg/L. Downstream of Colby Lake, sulfate concentrations increase as the result of groundwater seepage from inactive mine pits (e.g., Pit 6,

with an average flow of about 4.7 cfs and sulfate concentration of 1,217 mg/L), overflow from inactive mine pits (i.e., Pit 2W, with an average flow of around 7 cfs and sulfate concentration of approximately 120 mg/L), and dewatering (i.e., Pit 1, with an average flow of 8.9 cfs and sulfate concentration of 385 mg/L). Sulfate concentrations increase to an average of approximately 150 mg/L downstream of the confluence with Second Creek at the County Road 110 Bridge (Mesabi Nugget monitoring location MNSW12). The wild rice surveys found sulfate concentrations as high as 289 mg/L below Second Creek during a relatively dry period.

The baseline sulfate concentrations found in the Partridge River reflect the effects of discharges from existing activities within the watershed. Table 6.2-4 summarizes the relative sulfate load contributions from the various identified activities in the watershed. In terms of historic increases in Lower Partridge River sulfate concentration, three important existing loads of sulfate to the Lower Partridge River include the Mesabi Nugget operation, the previous SD-026 seep from the Cliffs Erie Tailings Basin, and the Mesabi Mining Pit 6 seepage, all entering Lower Partridge River via Second Creek.

Table 6.2-4 Cumulative Sulfate Loadings to the Partridge River by Activity

Activity	Average Discharge/ Release Rate (cfs)	Representative Sulfate Concentration (mg/L)	Average Sulfate Load (kg/d)
Northshore Mine	5.8	57	809
City of Hoyt Lakes POTW	0.5	~0[1]	~0
Mesaba Energy Project	16.1	487	19,185
Mesabi Nugget	8.9 (7 mo.)	385	4,890
Mesabi Mining Project	11.8	146.3	4,224
Laskin Energy Center	194	No change in loading	No addition to ambient load
Cliffs Erie Pits 2E/2W	7.7	120	2,260
Cliffs Erie Pit 3	0.8	79	155
NorthMet Project Proposed Action	1.2 (WWTF)	9 (WWTF)	5

Source: MPCA Discharge Monitoring Reports; USDOE and MDC 2009, Table 5.3-4

[1] Sulfate concentration of discharge is unknown.

The NorthMet sulfate load to the Partridge River would total an average of about 5 kg/d, which represents a 0.1 percent increase over existing loads, but is not predicted to result in an increase in the magnitude of exceedance. Therefore, the NorthMet Project Proposed Action should not adversely affect downstream waters that support the production of wild rice. The potential cumulative effect of sulfate on mercury methylation in the Partridge River Watershed is discussed below.

Mercury

Based on sampling in studies done for PolyMet, it is estimated that current total mercury concentrations average about 3.3 ng/L in the Upper Partridge River (Barr 2011a) and between 4.8 and 6.0 ng/L in Colby Lake.

Details of the effect of the NorthMet Project Proposed Action on mercury concentrations are discussed in Section 5.2.7. Table 6.2-5 summarizes the relative mercury contributions from the

various identified activities in the watershed. Research has found that taconite tailings are effective in sequestering mercury from seepage. Analog data from natural lakes and mine pit lakes in northeastern Minnesota suggest that mercury concentrations generally remain below the 1.3-ng/L standard, despite precipitation averaging approximately 9.8 ng/L mercury. Mercury in surface waters undergoes transformations when exposed to sunlight, which can limit its concentration in lakes. For example, methylmercury degrades to soluble oxidized mercury in sunlight, which in turn degrades to elemental mercury, which evades from lakes. Further, much of the mercury in lakes associates with particulate matter, which often settles to the bottom.

The NorthMet Project Proposed Action is predicted to result in a net decrease in mercury loadings to the Partridge River from 24.2 grams per year to 23.0 grams per year. This would primarily be a result of a decrease in natural runoff (with a total mercury concentration of 3.6 ng/L) and a proportional increase in water discharged from the West Pit via the WWTF (with a total mercury concentration of 1.3 ng/L). As discussed above, sulfate concentrations and loadings from the NorthMet Project Proposed Action to the Partridge River are predicted to remain about the same as existing conditions, so the NorthMet Project Proposed Action would not be contributing additional sulfate that could promote mercury methylation. Therefore, the NorthMet Project Proposed Action would not contribute to cumulative effects on mercury loading in the Partridge River.

Table 6.2-5 Cumulative Mercury Loadings to the Partridge River by Activity

Activity	Average Discharge/ Release Rate (cfs)	Representative Mercury Concentration (ng/L)	Average Mercury Load (kg/d)
Northshore Mine[1]	5.8	1	1.42E-04
City of Hoyt Lakes POTW	0.5	7.6	9.30E-05
Mesaba Energy Project	16.1	Unknown	na[2]
Mesabi Nugget	8.9	0.75	1.63E-04
Mesabi Mining Project	11.8	0.46	1.33E-04
Laskin Energy Center	194	No change in loading	0.00E+00
LTVSMC Pits 2E/2W	7.7	1	1.88E-04
LTVSMC Pit 3	0.8	0.65	1.27E-05
NorthMet Project Proposed Action – Mine Site (closure)	1.2	0.9	2.64E-05

Source: MPCA 2012d

[1] Discharge Monitoring Reports from 2004 to 2009.
[2] na = data not available

Embarrass River

Section 5.2.2.3.3 contains a detailed discussion of modeled water quality changes in the Embarrass River at PM-13. Overall, the concentration of several metals, specifically arsenic, cobalt, copper, lead, nickel, selenium, and zinc would increase slightly, but would all remain below their associated surface water quality evaluation criterion. However, because solute-loading would increase, there would be potential for cumulative effects. The placement of the Embarrass River headwaters and Spring Mine Creek on the MPCA 2012 Impaired Waters list

indicates that aquatic biota are already under stress in this system. Although stressors have not been identified, the water quality change predicted under the NorthMet Project Proposed Action would have potential to add to these stressors. Therefore, this cumulative effects analysis focuses on sulfate (because of its relationship with mercury methylation and wild rice) and mercury (because it is the only parameter on the 303(d) list). Mercury is only discussed here from a water quality perspective; the potential cumulative effects of the NorthMet Project Proposed Action on the bioaccumulation of methylmercury in fish are discussed in Section 6.2.3.7.

Sulfate

Sulfate is a concern within the Embarrass River because of the presence of waters supporting the production of wild rice downstream of PM-13. Present sulfate concentrations in the Embarrass River downstream of the NorthMet Project area are elevated well above natural background levels and currently exceed the wild rice sulfate standard of 10 mg/L. Median sulfate concentration at PM-12, upstream of any historic mining activity, is about 3 mg/L compared to a median of about 27 mg/L at PM-13. This increase in sulfate concentrations is primarily attributable to the Pit 5NW overflow (average flow of 1.85 cfs and sulfate concentration of 1,046 mg/L) and seepage from the existing LTVSMC Tailings Basin (average seepage of 4.5 cfs and sulfate concentration of 228 mg/L). The combined effects of the Tailings Basin groundwater containment system and stream augmentation would reduce the predicted P90 sulfate concentration (see Section 5.2.2.1.3) at PM-13 by about 35 percent relative to the Continuation of Existing Conditions Scenario model results.

Considering cumulative downstream effects, the Embarrass chain of seven lakes tend to attenuate the sulfate concentrations by dilution and biological uptake, with concentrations gradually declining in a downstream direction from 21.3 mg/L in Embarrass Lake to 17.1 mg/L at the outlet from Esquagama Lake.

The existing sulfate concentrations in the Embarrass River reflect the effects of discharges from existing activities within the watershed. Table 6.2-6 summarizes the relative sulfate load contributions from the various identified activities in the watershed.

Table 6.2-6 Cumulative Sulfate Loadings to the Embarrass River by Activity

Activity	Average Discharge/ Release Rate (cfs)	Representative Sulfate Concentration (mg/L)	Average Sulfate Load (kg/d)
City of Babbitt POTW	0.33	37.4	30.2
Cliffs Erie Area 5 NW Pit	1.85	1,046	4,730
Cliffs Erie Tailings Basin	4.5	228	2,510
ArcelorMittal Mine (Laurentian and East Reserve Mine)	9.3	186	4,232
NorthMet Plant Site Uncaptured Groundwater	0.025	310	19
NorthMet Plant Site WWTP Effluent	3.4	9.0	75

Source: MPCA 2012d; Barr 2013f; Clark, MPCA, Pers. Comm., April 29, 2013.

The NorthMet Project Proposed Action would reduce the sulfate load from the existing LTVSMC Tailings Basin as a result of the capture of tailings seepage by the groundwater containment system and subsequent treatment via the WWTP before discharge as part of the tributary stream flow augmentation. This NorthMet Project Proposed Action would result in a 21 percent overall reduction in sulfate loading at PM-13 and would have a positive effect on reducing the sulfate concentration in the Embarrass River downstream of PM-13 (where wild rice is present), the chain of lakes, and the Lower Embarrass River.

Mercury

The Embarrass River is not on the 303(d) list of impaired waters for mercury impairment; however, several lakes downstream of the NorthMet Project along the Embarrass River are listed for "mercury in fish tissue" impairment, including Sabin, Wynne, Embarrass, and Esquagama lakes. These lakes are not covered by the statewide mercury TMDL, but are impaired waters and in need of a TMDL pollution reduction study. These waters are not included in Minnesota's regional mercury TMDL because the mercury concentrations in fish are too high to be returned to Minnesota's mercury water quality standard through reductions in mercury emissions from Minnesota sources alone. Based on limited sampling in studies done for PolyMet, it is estimated that total mercury concentrations in the Embarrass River averaged 4.7 ng/L at monitoring station PM-12 and 4.0 ng/L at monitoring station PM-13 from 2004 to 2012. Methylmercury concentrations in the Embarrass River averaged 0.6 ng/L at PM-12 and 0.4 ng/L at PM-13 over the same period (see Section 4.2.2.1.4). The overall average total mercury concentration at two discharge locations at the existing LTVSMC Tailings Basin (SD-026 and SD-004) over a 5-year period was 1.1 ng/L, indicating relatively low mercury concentrations in the seepage from this basin. All monitoring results were well below average concentrations in precipitation (approximately 9.8 ng/L), suggesting that some mercury appears to be sequestered in the existing LTVSMC tailings.

As discussed in Section 5.2.2.3.4, mercury would be released from the Tailings Basin via seepage, discharge from the WWTP, and volatilization from the Tailings Basin pond. As with the Mine Site, quasi-analog and mass balance approaches were used to estimate future mercury concentrations. Table 6.2-7 summarizes the relative mercury contributions from the various identified activities in the watershed. As discussed in Section 5.2.2.3.4 and above, research indicates that mining itself is not expected to appreciably affect total mercury discharges; rather, the greater concern is the potential for sulfate discharges/releases to promote mercury methylation.

Table 6.2-7 Cumulative Mercury Loadings to the Embarrass River by Activity

Activity	Average Discharge/ Release Rate (cfs)	Representative Mercury Concentration (ng/L)	Average Total Mercury Load (kg/d)
City of Babbitt POTW	0.33	3.0	2.4E-06
Area 5 NW Pit	1.0	0.74	1.8E-06
ArcelorMittal Mines (Laurentian and East Reserve Mine)	9.3	2.5	5.7E-05
NorthMet Project Proposed Action – Tailings Basin	7.5 (operations) 2.9 (closure)	1.1 – 1.3	1.6 E-6

Source: MPCA 2012d; Barr 2013f; Clark, MPCA, Pers. Comm., April 29, 2013.

The NorthMet Project Proposed Action is predicted to result in a net increase in mercury loadings to the Embarrass River of up to 0.6 grams per year (from 22.3 grams per year to 22.9 grams per year), which represents about a 3 percent increase. This increase is primarily attributable to the redirection of surface runoff in the vicinity of the East Dam from the Tailings Basin (where the seepage averages 1.1 ng/L) directly to Mud Lake Creek (with an assumed mercury concentration of 3.5 ng/L); and the Tailings Basin Containment System, which collects seepage from the Tailings Basin, with an estimated mercury concentration of 1.1 ng/L, routes it to the WWTP, which discharges with an assumed mercury concentration of 1.3 ng/L, for a net increase of 0.2 ng/L of mercury as a result of wastewater treatment, which is a conservative assumption.

Overall, the NorthMet Project Proposed Action is predicted to result in a net decrease of mercury-loadings of approximately 0.6 grams per year (i.e., a net decrease of 1.2 grams per year in the Partridge River and a net increase of 0.6 grams per year in the Embarrass River), which is too small to distinguish from natural background variability using available laboratory methods. Therefore, the NorthMet Project Proposed Action would not contribute to cumulative effects on mercury loading to the St. Louis River.

6.2.3.4 Wetlands

The cumulative effects analysis for wetlands focuses on direct effects from all past, present, and reasonably foreseeable future projects to wetlands, lakes, and deepwater resources (i.e., mine pits) located in the Partridge River and Embarrass River watersheds (PolyMet 2013b). Three time periods were used in the effects analysis, including pre-settlement, existing, and the foreseeable future.

6.2.3.4.1 Approach

An estimate of pre-settlement wetland, lake, and deepwater (i.e., mine pits) acreages within the Partridge River and Embarrass River watersheds was developed using the USFWS NWI maps and the original survey maps developed using data from the original Government Land Surveys (PolyMet 2013b).

Existing wetland, lake, and deepwater resources were estimated using wetland delineations completed in the area, NWI maps, USGS National Hydrograph Dataset (to estimate lacustrine waterbodies), and MDNR Mesabi Mining features in combination with 2010 LiDAR data and

aerial photographs from 2003, 2008, 2009, and 2010 to estimate deepwater or mine pit waterbodies (PolyMet 2013b).

Federal, state, and local agencies were contacted to identify foreseeable future actions within the Partridge River and Embarrass River watersheds. Agency officials were asked to identify actual or potential development projects that may occur in these two watersheds during the life of the NorthMet Project Proposed Action. The projects and their proposed mitigation for this assessment are provided below (PolyMet 2013b):

- The NorthMet Project Proposed Action, located in the Embarrass and Partridge River watersheds, would directly affect 912.5 acres of wetlands located within the NorthMet Project area over the next 20 years (see Table 6.2-8). Wetland restoration of 101.8 acres is planned on site in the Partridge River Watershed as part of the NorthMet Project Proposed Action mitigation plan. In addition, 321 acres of deepwater habitat is planned at the Mine Site at the conclusion of the NorthMet Project Proposed Action.
- The proposed Mesabi Mining Project, located in the Partridge River Watershed, has identified the potential for approximately 267 acres of direct wetland impact over the life of the project (see Table 6.2-8). Approximately 1,601 acres of deepwater habitat is planned at the conclusion of the project, resulting in an increase of 49 acres from existing 1,552 acres of deepwater habitat (see Table 6.2-8).
- The Laskin Energy Park is located in the Partridge River Watershed and south of the Minnesota Power Laskin Energy Center (see Table 6.2-8). It is located adjacent to Colby and Whitewater Lakes, near the City of Hoyt Lakes. If every lot in the 220-acre industrial park was fully developed, the potential direct wetland impacts could range from zero to seven acres. The amount of wetland mitigation that may be conducted in the Partridge River Watershed is unknown at this time.
- St. Louis County Public Works would be conducting 8 bridge replacements in the Partridge River and Embarrass River watersheds over the next 10 years. Bridge replacements generally directly impact 10,000 square feet of wetlands or less, so the maximum direct wetland impact from the bridge projects would be 1.8 acres (see Table 6.2-8).
- The 3.5-mile extension of CR 4 north of Biwabik in the Embarrass River Watershed may impact an unknown number of wetlands. The road construction project is slated to begin in 2018, and analysis of wetland impacts would begin in 2016, according to St. Louis County Public Works.

Table 6.2-8 Comparison of Future Conditions for Wetland and Deepwater Habitat Resources

Project Name	Wetland Impact (acres)	Proposed Wetland Mitigation (acres)	Net Change in Wetlands (acres)	Existing Deepwater Habitat (acres)	Future Deepwater Habitat (acres)	Net Change in Deepwater (acres)
Partridge River Watershed[1]						
NorthMet Project Proposed Action	-767.6	101.8	-665.8	0.0	321.0	321.0
Mesabi Mining Project	-266.8	0.0	-266.8	1,552.0	1,601.0	49.0
Laskin Energy Park - worst case scenario	-6.8	0.0	-6.8	0.0	0.0	0.0
St. Louis County Public Works Bridge Replacement	-0.9	0.0	-0.9	0.0	0.0	0.0
Total - Partridge River Watershed with Project	**-1,042.1**	**101.8**	**-940.3**	**1,552.0**	**1,922.0**	**370.0**
Total - Partridge River Watershed without Project	**-274.5**	**0.0**	**-274.5**	**1,552.0**	**1,601.0**	**49.0**
Embarrass River Watershed[1]						
NorthMet Project Proposed Action	-144.9	0.0	-144.9	0.0	0.0	0.0
NorthMet Project Proposed Action	-28.59[2]	NA[2]	-28.6	0.0	0.0	0.0
St. Louis County Public Works Bridge Replacement	-0.9	0.0	-0.9	0.0	0.0	0.0
Total - Embarrass River Watershed with Project	**-174.4**	**0.0**	**-174.4**	**0.0**	**0.0**	**0.0**
Total - Embarrass River Watershed without Project	**-0.9**	**0.0**	**-0.9**	**0.0**	**0.0**	**0.0**

Source: PolyMet 2013b

[1] The (-) represents a loss of water resources acres and the (+) represents a gain of water resources acres.
[2] These wetlands as exempt because the wetlands are located within the LTVSMC Permit to Mine Ultimate Tailings Basin Limit boundary and are not regulated by state and federal wetland regulations (see Section 5.2.3).

To estimate the future projected wetland, lake, and deepwater resource effects from the NorthMet Project Proposed Action, the Mesabi Mining Project, the Laskin Energy Park project, and the St. Louis County bridge replacement, the maximum effect acreages were used to calculate total acreages. The projected foreseeable future conditions were estimated by calculating the net change in wetlands, lakes, and deepwater resources (see Table 6.2-8) and then adding this future projected development of wetland, lake, and deepwater resources to the existing resource totals (PolyMet 2013b).

6.2.3.4.2 Cumulative Effects Assessment Area

Spatial

The Partridge River and Embarrass River watersheds were used as the spatial boundary for wetland cumulative effects, as these are the only watersheds in which proposed direct and indirect wetland effects would occur. A qualitative analysis of cumulative wetland effects for the St. Louis River below the ordinary high water mark from its confluence with the Embarrass

River to Lake Superior was also evaluated based on a qualitative estimate of flow changes in the river.

Temporal

The pre-settlement condition time period represents wetland, lake, and deepwater resources as they existed prior to mining and urban development in the late 1800s to early 1900s. The existing conditions time period represents those resources as they exist today, prior to the development of the NorthMet Project Proposed Action. The future conditions time period represents wetland, lake, and deepwater resources expected to be present following the conclusion and long-term closure of the NorthMet Project Proposed Action. It was assumed that the future conditions represent the time period after the conclusion of the future projects when the mine pits would have flooded with water (PolyMet 2013b).

6.2.3.4.3 Cumulative Actions

This assessment included physical cumulative effects on wetland, lake, and deepwater resources associated with the current and foreseeable mining actions listed below (PolyMet 2013b). The following reasonably foreseeable cumulative actions were included in the cumulative effects assessment for wetlands:

- Mesabi Mining Project,
- Minnesota Power Laskin Energy Park, and
- St. Louis County Public Works.

6.2.3.4.4 Cumulative Effects Assessment

Pre-settlement Wetland and Water Resources

A relationship (ratio) was developed between the NWI mapping and pre-settlement mapping of wetland, lake, and deepwater resources to serve as an adjustment factor. This factor converted the original survey data to the standards of the NWI data for estimating the pre-settlement wetland, lake, and deepwater resources within disturbed areas of each watershed.

Partridge River Watershed

Using the disturbance at the township level (0.2 percent in the entire township and 0.4 percent for the portion within the watershed), the ratio of NWI to pre-settlement wetlands, lakes, and deepwater resources was calculated to be 1.21 for the least-disturbed township in the Partridge River Watershed. This ratio indicates there were approximately 21 percent more wetlands, lakes, and deepwater resources identified on the NWI maps than on the pre-settlement maps for the Partridge River Watershed (PolyMet 2013b).

Disturbance in the townships located within the Partridge River Watershed ranged between 0.4 and 52 percent, with approximately 15 percent of the entire Partridge River Watershed containing substantial human disturbance since settlement of the area. The disturbance types in the watershed consisted of: mining features such as stockpiles, mine pits, roads, and other infrastructure (82 percent of the disturbed areas); municipal/residential development (e.g., cities of Aurora and Hoyt Lakes) with some barren land and cultivated crops (13 percent of the

disturbed areas); and roads and railroads (5 percent of the disturbed areas). Approximately 85 percent of the Partridge River Watershed was deemed to be relatively undisturbed; therefore, NWI mapping was used in these areas to represent pre-settlement conditions for wetlands, lakes, and deepwater resources (PolyMet 2013b).

Based on the original survey maps, approximately 2,991 acres of wetland were mapped within the disturbed areas in the Partridge River Watershed. This wetland acreage was adjusted to 3,620 acres using the 1.21 adjustment factor. After accounting for the disturbed areas, a total of 33,601 acres of wetlands were identified in the 101,812-acre watershed, comprising 33 percent of the watershed (see Table 6.2-9).

Based on the original survey maps, 24 acres of lake were mapped within the disturbed areas in the Partridge River Watershed. This lake acreage was adjusted to 29 acres using the 1.21 adjustment factor. After accounting for the disturbed areas, a total of 2,688 acres of lake were identified in the 101,812-acre watershed, comprising 3 percent of the watershed (see Table 6.2-9).

No deepwater resources were identified in the watershed for the pre-settlement conditions (see Table 6.2-9).

Table 6.2-9 Pre-settlement Wetland and Water Resources by Watershed

Watershed	Total Land Area (Acres)	Wetland Area		Lake Area		Deepwater Area	
		Acres	% of Watershed	Acres	% of Watershed	Acres	% of Watershed
Partridge River	101,812	33,601	33	2,688	3	0	0
Embarrass River	116,797	34,650	30	3,121	3	0	0

Source: PolyMet 2013b.

Embarrass River Watershed

Using the disturbance at the township level (0.6 percent in the entire township and 0.7 percent for the portion contained within the watershed), the ratio of NWI to original survey wetlands, lakes, and deepwater resources was calculated to be 0.85 for the least-disturbed township in the Embarrass River Watershed. Based on this analysis, the ratio of NWI to original survey wetlands, lakes, and deepwater resources was calculated to be approximately 15 percent fewer wetlands, lakes, and deepwater resources identified on the NWI maps than the original survey maps for the Embarrass River Watershed (PolyMet 2013b).

Disturbance in the portions of townships located within the Embarrass River Watershed range between 0.7 percent and 63 percent, with approximately 12 percent of the entire Embarrass River Watershed containing substantial human disturbance since settlement of the area. The disturbance types in the watershed consisted of: mining features including stockpiles, mine pits, roads, and other infrastructure (61 percent of the disturbed areas); municipal/residential development (e.g., cities of Babbitt, Biwabik, Gilbert, and McKinley) with some barren land and cultivated crops (27 percent of the disturbed areas); and roads and railroads (12 percent of the disturbed areas). Approximately 88 percent of the Embarrass River Watershed was deemed to be

relatively undisturbed; therefore, NWI mapping was used in these areas to represent pre-settlement conditions for wetlands, lakes, and deepwater resources (PolyMet 2013b).

Based on the original survey maps, approximately 2,388 acres of wetland were mapped within the disturbed areas of the Embarrass River Watershed. This wetland acreage was adjusted to 2,030 acres using the 0.85 adjustment factor. After accounting for the disturbed areas, a total of 34,650 acres of wetlands were identified in the 116,797-acre Embarrass River Watershed, comprising approximately 30 percent of the watershed (see Table 6.2-9).

Based on the original survey maps, 224 acres of lake were mapped within the disturbed areas in the Embarrass River Watershed. This lake acreage was adjusted to 190 acres using the 0.85 adjustment factor. After accounting for the disturbed areas, a total of 3,121 acres of lakes were identified in the 116,797-acre watershed, comprising less than 3 percent of the watershed (see Table 6.2-9).

No deepwater resources (i.e., mine pits) were identified in the watershed for the pre-settlement conditions (see Table 6.2-9).

Existing Wetland and Water Resources

Partridge River Watershed

A total of 31,318 acres of existing wetlands were identified in the 101,812-acre watershed, comprising 31 percent of the land area (see Table 6.2-10). There has been a decrease of approximately 2,283 acres of wetland; this represents a 7 percent reduction in wetland area compared to pre-settlement conditions (PolyMet 2013b).

A total of 3,194 acres of lakes were identified in the 101,812-acre watershed, comprising 3 percent of the land area (see Table 6.2-10). There has been an increase of approximately 506 acres of lakes; this represents a 19 percent increase in lake area compared to pre-settlement conditions (PolyMet 2013b).

A total of 3,146 acres of deepwater resources (i.e., mine pits) were identified in the 101,812-acre watershed, comprising 3 percent of the land area (see Table 6.2-10). There has been an increase of 3,146 acres of deepwater resources in the watershed compared to no deepwater resources present under pre-settlement conditions (PolyMet 2013b).

The change in wetland, lake, and deepwater acreage has resulted primarily from mining projects, development of municipalities, and construction of transportation infrastructure such as roads and railroads.

Table 6.2-10 Existing Wetland and Water Resources by Watershed

Watershed	Total Land Area (Acres)	Wetland Area		Lake Area		Deepwater Area	
		Acres	% of Watershed	Acres	% of Watershed	Acres	% of Watershed
Partridge River	101,812	31,318	31	3,194	3	3,146	3
Embarrass River	116,797	34,249	29	2,904	3	977	1

Source: PolyMet 2013b.

Embarrass River Watershed

A total of 34,249 acres of existing wetlands were identified in the 116,797-acre watershed, comprising 29 percent of the land area (see Table 6.2-10). There has been a decrease of approximately 401 acres of wetlands; this represents a 1 percent reduction in wetland area compared to pre-settlement conditions (PolyMet 2013b).

A total of 2,904 acres of lakes were identified in the 116,797-acre watershed, comprising 3 percent of the land area (see Table 6.2-10). There was a decrease of approximately 217 acres of lakes in the watershed; this represents a 7 percent reduction in lake area compared to pre-settlement conditions (PolyMet 2013b).

A total of 977 acres of deepwater resources (i.e., mine pits) were identified in the 116,797-acre watershed, comprising less than 1 percent of the land area (see Table 6.2-10). There has been an increase of 977 acres of deepwater resources in the watershed compared to no deepwater resources present under pre-settlement conditions (PolyMet 2013b).

The change in wetland, lake, and deepwater acreage has resulted primarily from mining projects, development of municipalities, and construction of transportation infrastructure such as roads and railroads.

Future Wetland and Water Resources

Partridge River Watershed

The NorthMet Project Proposed Action in combination with present and reasonably foreseeable future projects would likely result in the following cumulative wetlands effects:

- Approximately 30,378 acres of wetlands are projected to be present in the 101,812-acre watershed in the foreseeable future, comprising 30 percent of the land area (see Table 6.2-11). The change in wetlands, as a proportion of all wetlands within the study area, would be a 10 percent reduction from pre-settlement conditions and a 3 percent reduction compared to existing conditions (PolyMet 2013b).
- Approximately 3,194 acres of lakes are projected to be present in the 101,812-acre watershed in the foreseeable future, comprising 3 percent of the land area (see Table 6.2-11). The change in lakes, as a proportion of the total study area, would be a 19 percent increase from pre-settlement conditions and there would be no changes compared to existing conditions (PolyMet 2013b).
- Approximately 3,516 acres of deepwater resources are projected to be present in the 101,812-acre watershed in the foreseeable future, comprising 3 percent of the land area (see Table 6.2-11). The change in deepwater resources, as a proportion of the total study area, would be an introduction of 3,516 acres of new deepwater resources (compared to zero pre-settlement) and a 12 percent increase compared to existing conditions (PolyMet 2013b).

Some of these projects would include mitigation of wetlands, lakes, and deepwater resources in the Partridge River Watershed.

Table 6.2-11 Future Wetland and Water Resources by Watershed under the NorthMet Project Proposed Action

Watershed	Total Land Area (Acres)	Wetland Area		Lake Area		Deepwater Area	
		Acres	% of Watershed	Acres	% of Watershed	Acres	% of Watershed
Partridge River	101,812	30,378	30	3,194	3	3,516	3
Embarrass River	116,797	34,074	29	2,904	3	977	1

Source: PolyMet 2013b.

Under the NorthMet Project No Action Alternative, development of other projects (and associated effects on and mitigation of wetlands, lakes, and deepwater resources in the Partridge River Watershed) would still occur under the foreseeable future conditions.

Under the NorthMet Project No Action Alternative, approximately 31,044 acres of wetlands have been projected to be present in the 101,812-acre watershed in the foreseeable future, comprising 30 percent of the land area (see Table 6.2-12). The change in wetlands, as a proportion of all wetlands within the study area, would be an 8 percent reduction from pre-settlement conditions and a 1 percent reduction compared to existing conditions (PolyMet 2013b).

Similar to under the NorthMet Project Proposed Action, under the NorthMet Project No Action Alternative, approximately 3,194 acres of lakes are projected to be present in the 101,812-acre watershed in the foreseeable future, comprising 3 percent of the land area (see Table 6.2-12). The change in lakes, as a proportion of the total study area, would be a 19 percent increase from pre-settlement conditions and there would be no changes compared to existing conditions (PolyMet 2013b).

Under the NorthMet Project No Action Alternative, approximately 3,195 acres of deepwater resources are projected to be present in the 101,812-acre watershed in the foreseeable future, comprising 3 percent of the land area (see Table 6.2-12). The change in deepwater resources, as a proportion of the total study area, would be an introduction of 3,195 acres of new deepwater resources (compared to zero pre-settlement) and a 2 percent increase compared to existing conditions (PolyMet 2013b).

Table 6.2-12 Future Wetland and Water Resources by Watershed under the NorthMet Project No Action Alternative

Watershed	Total Land Area (Acres)	Wetland Area		Lake Area		Deepwater Area	
		Acres	% of Watershed	Acres	% of Watershed	Acres	% of Watershed
Partridge River	101,812	31,044	30	3,194	3	3,195	3
Embarrass River	116,797	34,248	29	2,904	3	977	1

Source: PolyMet 2013b.

Embarrass River Watershed

The NorthMet Proposed Project, in combination with present and reasonably foreseeable future projects, would likely result in the following cumulative wetlands effects:

- Approximately 34,074 acres of wetlands are projected to be present in the 116,797-acre watershed in the foreseeable future, comprising 29 percent of the land area (see Table 6.2-11). The change in wetlands, as a proportion of all wetlands within the study area, would be a 2 percent reduction from pre-settlement conditions and less than 1 percent reduction compared to existing conditions (PolyMet 2013b).
- Approximately 2,904 acres of lakes are projected to be present in the 116,797-acre watershed in the foreseeable future, comprising 3 percent of the land area (see Table 6.2-11). The change in lakes, as a proportion of the total study area, would be a 7 percent reduction from pre-settlement conditions and there would be no changes compared to existing conditions (PolyMet 2013b).
- Approximately 977 acres of deepwater resources are projected to be present in the 116,797-acre watershed in the foreseeable future, comprising less than 1 percent of the land area (see Table 6.2-11). There would be an introduction of 977 acres of new deepwater resources (compared to zero pre-settlement) and there would be no changes in deepwater resources compared to existing conditions (PolyMet 2013b).

Under the NorthMet Project No Action Alternative, development of other projects (and associated effects on and mitigation of wetlands, lakes, and deepwater resources in the Partridge River Watershed) would still occur under the foreseeable future conditions.

Under the NorthMet Project No Action Alternative, approximately 34,248 acres of wetlands have been projected to be present in the 116,797-acre watershed in the foreseeable future, comprising 29 percent of the land area (see Table 6.2-12). The change in wetlands, as a proportion of all wetlands within the study area, would be a 1 percent reduction from pre-settlement conditions and less than 1 percent reduction compared to existing conditions (PolyMet 2013b).

Similar to under the NorthMet Project Proposed Action, under the NorthMet Project No Action Alternative, approximately 2,904 acres of lakes are projected to be present in the 116,797-acre watershed in the foreseeable future, comprising 3 percent of the land area (see Table 6.2-12). The change in lakes, as a proportion of the total study area, would be a 7 percent reduction from pre-settlement conditions and there would be no changes compared to existing conditions (PolyMet 2013b).

Similar to the NorthMet Project Proposed Action, under the NorthMet Project No Action Alternative, approximately 977 acres of deepwater resources are projected to be present in the 116,797-acre watershed in the foreseeable future, comprising less than 1 percent of the land area (see Table 6.2-12). The change in deepwater resources, as a proportion of the total study area, would be an introduction of 977 acres of new deepwater resources (compared to zero pre-settlement) and there would be no changes in deepwater resources compared to existing conditions (PolyMet 2013b).

St. Louis River below the Ordinary High Water Mark from Its Confluence with the Embarrass River to Lake Superior

The XP-SWMM model developed for the Partridge River identified that the changes in average annual flow (and therefore stage) of the Partridge River would be within the naturally occurring annual variation for the Partridge River. Section 5.2.2 provides more details on the XP-SWMM model. Therefore, no potential indirect cumulative wetland effects are identified for the wetlands abutting the Partridge River.

The St. Louis River is located downstream of the Partridge River. Effects on flows (and, by extension, water surface elevations) generated by the NorthMet Project Proposed Action are anticipated to be less than those estimated for the Partridge River and within the natural variation of flow within the St. Louis River (e.g., less than 1 percent reduction in average annual flow as measured at the confluence of the Embarrass River with the St. Louis River). Therefore, no potential indirect cumulative wetland effects are identified for the wetlands within the St. Louis River below the ordinary high water mark, from its confluence with the Embarrass River to Lake Superior.

6.2.3.5 Vegetation

The cumulative effects analysis for vegetation focuses on potential losses of vegetative cover types, plant communities, MBS Sites of Biodiversity Significance, and ETSC plant species. As described below, the NorthMet Project Proposed Action would contribute to a loss of vegetative cover and ETSC plant species populations, which would combine with other past, present, and reasonably foreseeable future actions in the CEAA. Given the risk to the viability of ETSC species and their sensitivity to changes to their habitat from development projects, the analysis focuses on these species. Wildlife habitat is addressed in Section 6.2.3.6.

6.2.3.5.1 Approach

The GIS data presented in Sections 4.2.4 and 5.2.4 was compared to other actions within the CEAA, and the cumulative effects were assessed. Specifically, GIS data were obtained from the MDNR regarding the GAP, which is vegetation land cover types derived from satellite imagery, and listed ETSC plant species within the NHIS database.

GIS analysis was used to calculate effects on the resources described above. The effects were calculated for habitat types, classifications, and species where they physically overlap tailings piles, mine pits, tailings basins, roads, buildings, or other new infrastructure associated with the cumulative actions below.

NorthMet Project Proposed Action-related effects on the 11 state-listed ETSC plant species that may be present in the NorthMet Project area were identified and evaluated in Section 5.2.4.2. As discussed below, of these 11, three have a distribution that may be subject to cumulative effects. No federally listed ETSC plant species would be affected by the NorthMet Project Proposed Action (see Section 5.2.4.2). Because six of the ETSC species are also RFSS plants, the analysis below also applies to the known RFSS plants in the NorthMet Project area.

This section evaluates the potential cumulative effects of the NorthMet Project Proposed Action on these 11 ETSC plant species. Potential future effects were identified by analyzing Take Permits (issued by the USFWS or MDNR to authorize activities resulting in the loss of federally

or state-listed species), as well as GIS information from the MDNR, to determine the extent of expected losses from recently permitted projects.

6.2.3.5.2 Cumulative Effects Assessment Area

The NorthMet Project Proposed Action's CEAA boundary for vegetation is described below, both spatially and temporally.

Spatial

The CEAA for evaluation of cumulative effects on vegetation is defined geographically by the portion of the Mesabi Iron Range encompassed by the Nashwauk Uplands and Laurentian Uplands ecological subsections (see Figure 6.2.2-1). The ecological subsections are described in detail in Section 4.2.4.1. The area has been limited to the Mesabi Iron Range as it is a definable physiographic region encompassing the region's mining, which represents the largest and most influential land use within a reasonable distance from the NorthMet Project area.

Temporal

Overall habitat composition changes in the ecological subsections were evaluated as the temporal area of assessment, based on pre-settlement conditions (approximately 1890) through the present day (1990 to present). These timespans are indicative of past and relatively current trends in regional habitat changes relevant to the CEAA. An estimate of future trends would be based on estimated development/habitat loss, direct loss of species and individuals, and the regulatory requirements for protected species and habitats (i.e., approximately 40 years, which is consistent with the life of the NorthMet Project Proposed Action, including construction, operations, and closure).

6.2.3.5.3 Contributing Past, Present, and Reasonably Foreseeable Actions

As noted previously, it is not possible to identify all past activities that may contribute to a cumulative effect. Similarly, all present activities would continue to affect the environment. The impacts of these combined activities are described in Chapter 4, Affected Environment. This assessment includes physical cumulative effects on vegetation cover types and protected ETSC plant species associated with current and foreseeable mining actions listed below. The following reasonably foreseeable projects, described further in Section 6.2.2, are included in the cumulative effects assessment for vegetation:

- ArcelorMittal Mines (Laurentian and East Reserve mines),
- Community growth and development,
- Essar Steel,
- Forestry on public and private lands, and
- U.S. Steel Keetac Mine Expansion Project.

This analysis also looked at the four actions listed below:

- LTVSMC,
- Mesabi Nugget and Mesabi Mining Project,

- Northshore Mine, and
- U.S. Steel Minntac Mine and Processing.

The NHIS data and MDNR take permit data were reviewed and no vegetation records were available for these actions. As a result, these actions are not considered in the cumulative effects analysis for vegetation.

6.2.3.5.4 Cumulative Effects Assessment

Evaluation Criteria

The cumulative effects assessment on vegetation is guided by evaluation criteria, which are outlined below:

- Direct effects on vegetative cover types, plant communities, MBS Sites of Biodiversity Significance, and rare species would occur through clearing, filling, and other construction activities. Direct effects would include the removal of vegetation in the construction, operation, maintenance, or closure of the NorthMet Project Proposed Action when an ETSC plant species is removed (i.e., taking of an individual plant or entire plant populations).
- An indirect effect occurs on vegetation when a change in conditions results in a change over time in cover type, plant community, or MBS Sites of Biodiversity Significance, or a rare species experiences a change in vegetative composition. Indirect effects on vegetation may include changes in hydrology, deposition of particulate matter (dust), changes in successional stage, alteration of microclimate (e.g., tree removal resulting in drier soil conditions, rise or fall in water table, loss of pollinators, or loss of fungal associates in the rooting zone), new or increased erosion and sedimentation, and invasion of non-native species.

Existing Baseline Conditions and Past Losses

As discussed in detail in Chapter 4, past changes in cover types show a mixed pattern of gains and losses from the 1890s to the 1990s (see Table 6.2-13). These trends are continuing today and would be expected to continue into the future. In the Laurentian Uplands subsection, few cover types discussed below have decreased. In the Nashwauk Uplands subsection, many of the cover types have experienced declines over this period, with the largest percentage decline to upland coniferous forests and upland conifer-deciduous mixed forests. Among the ETSC plant species that occur within the NorthMet Project area boundaries, Ternate, or St. Lawrence, grapefern (*Botrychium rugulosum*) is most likely to occur in the upland coniferous type (see Table 6.2-14). Floating marsh marigold (*Caltha natans*) and least grapefern (*Botrychium simplex*) are most likely to occur in the lowland deciduous type. Floating marsh marigold occupies edges of ponds, lakes, and streams in the lowland deciduous type; consequently, a loss in lowland deciduous types is a less accurate reflection of trends in this species habitat. While it appears the Laurentian Uplands subsection lost a large portion of shrublands, it is likely that habitat type was allowed to grow older, which explains the increases in upland coniferous and deciduous forests. The opposite is true for the Nashwauk Uplands subsection. Upland forest types were likely harvested in this subsection, which resulted in the increase of younger stands and shrubland habitat types.

Table 6.2-13 Changes in Habitat Acreage between 1890 and 1990 by Ecological Subsection

Habitat Type	Percentage of Laurentian Uplands Gain/(Loss)	Percentage of Nashwauk Uplands Gain/(Loss)
Lowland coniferous forest	7	(4)
Lowland deciduous forest	<1	2
Upland coniferous forest	4	(8)
Upland deciduous forest	2	(1)
Upland conifer-deciduous mixed forest	<1	(5)
Shrubland	(15)	9
Aquatic environments	1	<1
Disturbed[1]	Na	na
Cropland/Grassland[1]	Na	na

Source: MDNR 2006a.

[1] "na" indicates that insufficient data were available to determine percent coverage within the ecological subsections, although these habitat types likely occurred at low levels.

This conclusion should be qualified by the understanding that the mapped habitat type does not precisely match the habitat actually used by an ETSC or RFSS plant species. Because these plant species occupy preferred habitats within larger mapped habitat types, the effect of habitat loss may not directly correlate on a 1:1 basis to the effect on a plant species. Given this lack of precision and uncertainty, the analysis assumed that large losses in mapped habitat types represent a trend in losses of preferred habitat types for these ETSC or RFSS plant species.

Table 6.2-14 Preferred Habitat for State-listed ETSC/RFSS Plant Species and Most Likely Associated Habitat Types

Species	Preferred Plant Species Habitat	Corresponding Map Habitat Type
Botrychium campestre	Prairies, dunes, railroad sidings, fields	Disturbed; Cropland/ Grassland
Botrychium pallidum[1]	Open, disturbed habitats, log landings, roadsides, dunes, sandy gravel pits	Disturbed; Cropland/ Grassland
Botrychium rugulosum[1]	Generally open habitats, such as old log landings and edges of trails	Disturbed; Upland coniferous
Botrychium simplex[1]	Generally open habitats, such as old log landings, roadside ditch, trails, open fields, base of cliff, railroad rights of way	Disturbed; Lowland deciduous
Caltha natans[1]	Shallow water of pools, ditches, sheltered lake margins, slow moving creeks, sloughs/oxbows, pools in shrub swamps	Aquatic environments; Lowland coniferous; Lowland deciduous
Eleocharis nitida[1]	Mineral soil of wetlands, often with open canopy and disturbance, such as logging roads/ditches through wetlands	Lowland coniferous; Disturbed
Juncus stygius var. *americanus*[1]	Shallow pools in non-forested peatlands, often in a sedge-dominated community	Lowland coniferous
Platanthera clavellata	Coniferous swamps, fens	Lowland coniferous
Ranunculus lapponicus	Lowland conifer forests and peat bogs	Lowland coniferous
Sparganium glomeratum	Sedge meadow, bogs, lakeshores	Aquatic environments; Lowland coniferous
Torreyochloa pallida	Pond/stream margins, lowland coniferous forest	Aquatic environments; Lowland coniferous

Source: MDNR 2011f; USFS 2010d.

[1] These species are also RFSS plants as tracked by the USFS.

Environmental Consequences of Reasonably Foreseeable Actions on ETSC and RFSS Plant Species

Future effects on ETSC and RFSS plant species were evaluated by comparing ETSC plant species Take Permits from the MDNR to the reasonably foreseeable actions within the cumulative spatial boundary. In addition, MDNR minerals division data were combined with data that identified all known populations of ETSC plant species. Populations are defined as a number of individuals of a species within proximity to each other and within a defined habitat that can be self-sustaining under current conditions. Populations that match the ETSC Take Permits from the MDNR or are contained within them are presented below for the cumulative discussion. These populations can contain from a few to thousands of individual plants. Of the 11 ETSC plant species present in the NorthMet Project area, three species would also be affected by other cumulative projects within the CEAA (see Table 6.2-15). Cumulative effects on each of the state-listed ETSC species known to occur on the Mine Site are discussed below. As discussed in Section 5.2.4.2, no federally listed ETSC plant species would be affected by the NorthMet Project Proposed Action.

Table 6.2-15 Potential Future Effects on ETSC or RFSS Plant Species Populations Occurring from Reasonably Foreseeable Activities[1,2]

Species[1]	Other Projects Direct Effect (Populations)	Other Projects Indirect Effect (Populations)	NorthMet Project Proposed Action Total Effect (Populations)	Total Known Statewide Populations[3]	Percent of Known Statewide Populations Affected
Botrychium pallidum[4]	4	0	1	99	5
Botrychium rugulosum[4]	5	0	1	72	8
Botrychium simplex	3	0	3	210	3

Notes:

1 Species upon which no other actions besides the NorthMet Project Proposed Action are expected to have effects are discussed in the "Proposed Action" section.

2 Data included here were provided by the Division of Ecological Resources, MDNR, and were current as of March 13, 2013. These data are not based on an exhaustive inventory of the state. The lack of data for any geographic area shall not be construed to mean that no significant features are present.

3 Statewide population data provided by Lisa Joyal (MDNR) on March 26, 2013.

4 These species are also RFSS plants as tracked by the USFS.

Pale moonwort (*Botrychium pallidum*) is widely distributed across five Canadian provinces and eight U.S. states (Colorado, Maine, Michigan, Minnesota, Montana, South Dakota, Wisconsin, and Wyoming). The NorthMet Project Proposed Action would directly affect one population. The cumulative actions within the CEAA would directly affect four additional populations, while no populations are expected to be indirectly affected. In total, approximately 5 percent of the known populations in Minnesota would be directly affected by the NorthMet Project Proposed Action and other present or reasonably foreseeable activities (see Table 6.2-15). Due to its small size, the species is easily overlooked and additional populations may yet be located. *B. pallidum* was listed as a state endangered species in 1996 when there were just six documented occurrences in Minnesota. By 2009, the number had risen to 65 (MDNR 2011f). Its relatively short lifespan (emergence to senescence within 4 weeks) may account for the few populations documented to date. Given its preference for disturbed sites, the cumulative effects of the NorthMet Project Proposed Action and other reasonably foreseeable activities are not expected to jeopardize the presence of *B. pallidum* in Minnesota or in North America.

Ternate, or St. Lawrence, grapefern (*Botrychium rugulosum*) is widely distributed across three Canadian provinces and six U.S. states (Connecticut, Michigan, Minnesota, New York, Vermont, and Wisconsin). The NorthMet Project Proposed Action would directly affect one population of the species (see Section 5.2.4.2). Other reasonably foreseeable activities would directly affect five populations; no populations would be indirectly affected. In total, approximately 8 percent of the known populations in Minnesota would be directly affected by the NorthMet Project Proposed Action and other reasonably foreseeable activities (see Table 6.2-15). *B. rugulosum* was listed as a state threatened species in Minnesota in 1996 (MDNR 2011f). This species' tolerance for disturbance in early successional communities allows it to establish in areas previously disturbed by human activity. Because of this habitat preference, and the early successional habitats that develop around disturbed areas, the cumulative effects of the NorthMet Project Proposed Action and other reasonably foreseeable activities are not expected to jeopardize the presence of *B. rugulosum* in Minnesota or in North America.

Least grapefern (*Botrychium simplex*) is widely distributed across 34 U.S. states and 11 Canadian provinces. The NorthMet Project Proposed Action would directly affect three populations of the species. Other reasonably foreseeable activities would directly affect three populations; no populations would be indirectly affected. In total, approximately 3 percent of the known populations in Minnesota would be directly affected. Given its tolerance for disturbance and that the species is considered "secure," the cumulative effects of the NorthMet Project Proposed Action and other reasonably foreseeable activities are not expected to jeopardize the presence of *B. simplex* in Minnesota or in North America.

In addition to past, present, and reasonably foreseeable activities, other future changes in habitat types may affect ETSC plant populations. Forestry management generally has a greater influence on habitat acreage within the range of these ETSC plant species than does mining and other land development. It should be noted, however, that forestry management offers a greater range of options for ETSC plant species to co-exist with the practice, as it can mimic natural disturbances, whereas mining represents a complete land conversion that could affect long-term ETSC habitat availability. Between 2005 and 2014, the average annual forest acres within the Laurentian Uplands subsection that were or will be harvested on state lands was approximately 1,034 acres (0.2 percent of the subsection) (MDNR 2006b). Between 2010 and 2019, the average annual forest acres within the Nashwauk Uplands subsection that were or will be harvested on state lands was approximately 1,189 acres (0.1 percent of the subsection) (MDNR 2010b). On average, 1 percent of timber land in the Superior National Forest is harvested annually (Deckard, Pers. Comm., April 26, 2012). Private timber harvest data is generally not available. The potential cumulative effects on the three state-listed ETSC species identified by this assessment are small relative to the extent of the populations and distribution within the Superior National Forest and within the state.

Effects from Acid (NO_2/SO_2) and Mercury Deposition

Acid (sulfuric and nitric) and mercury deposition from air sources could also affect vegetation and ETSC species. The sources and analysis are described in Section 6.2.3.8.5. These depositions may have an adverse effect on the overall biodiversity of terrestrial ecosystems, including forested habitats, cover types, and plant communities. These pollutants may travel long distances and contribute to complex chemical and physical reactions within a variety of forested habitats, which could contribute to increased vulnerability of sensitive vegetation. Additionally, these pollutants can be carried by precipitation into nearby lakes and rivers, which sustain some vegetation and forested habitats. The lakes (and their associated watersheds) in the vicinity of the CEAA include Heikkila Lake, Colby Lake, Sabin Lake, Wynne Lake, and Whitewater Lake.

As described in Section 6.2.3.8.5, since the NorthMet Project Proposed Action would have relatively low emissions of SO_2 and NO_2 and potential deposition of sulfate would be below both the Minnesota standard threshold value and the federal Class I threshold values, in combination with the overall reduction in sulfate and nitrate-producing emissions cumulatively since 2008, the actions and projects would not likely cause a cumulative effect on the ecosystems. The MPCA estimated that over 90 percent of the mercury deposition within Minnesota is a result of other states and countries (MPCA 2013e). For more information on the cumulative analysis of acid and mercury deposition associated with air emissions, see Section 6.2.3.8.5.

6.2.3.6 Wildlife

The cumulative effects analysis for wildlife focuses on potential losses of sensitive wildlife species (federally and state-listed species and Species of Special Concern, SGCN, RFSS, and other wildlife species), effects on wildlife habitat, and effects on wildlife travel corridors. The analysis reveals that, while some loss and fragmentation of wildlife habitat would occur as a result of the NorthMet Project Proposed Action and other cumulative projects in the CEAA, these actions would not further threaten special status wildlife species. See Section 6.2.3.5 for the discussion of potential cumulative effects from loss of vegetation cover types.

6.2.3.6.1 Approach

Cumulative effects on wildlife may include the loss and/or fragmentation of habitat and encroachments into critical wildlife travel corridors. Similar to the direct and indirect effects for the NorthMet Project Proposed Action, analysis was also conducted for cumulative effects on sensitive species such as federally or state-listed species, SGCN, and RFSS. These effects were assessed by evaluating the effects of the NorthMet Project Proposed Action with other past, present, and reasonably foreseeable future federal, state, and private actions.

Analysis of cumulative effects on wildlife was assessed both qualitatively and quantitatively using the following methods:

- MCWCS Action Plan, *Tomorrow's Habitat for the Wild & Rare* (MDNR 2006d);
- Marschner's Original Pre-settlement Vegetation Map of Minnesota as interpreted and analyzed by researchers, the Minnesota Forest Resources Council, and at the subsection level in the MCWCS approach by the MDNR (MFRC 2003a; MDNR 2006d); and
- reports on mining, infrastructure, and forestry effects (e.g., Emmons & Olivier 2006; USFS 2004b); state timber harvest reports (MDNR 2006b; MDNR 2010b).

The MCWCS is a central component of MDNR's strategy for managing wildlife populations in the state; use of the strategy is therefore appropriate as the basis for assessing cumulative effects on wildlife habitat loss and fragmentation.

6.2.3.6.2 Cumulative Effects Assessment Boundary

Spatial

The spatial CEAA for wildlife includes the portions of the Mesabi Iron Range located within the Nashwauk Uplands and Laurentian Uplands ecological subsections (see Figure 6.2.3-2). The area has been limited to the Mesabi Iron Range, as it is a definable physiographic region encompassing the region's mining, which represents an influential land use in regards to wildlife and wildlife habitat.

Temporal

Overall habitat composition changes in the ecological subsections were evaluated as the temporal area of assessment, based on pre-settlement conditions (approximately 1890) through the present day (1990 to present). These timespans are indicative of past and relatively current trends in regional habitat changes relevant to the CEAA. An estimate of future trends is based on estimated development/habitat loss, direct loss of species and individuals, and the regulatory

requirements for habitat and protected species (e.g., approximately 40 years, which is consistent with the life of the NorthMet Project Proposed Action, including construction, operations, and closure).

6.2.3.6.3 Past, Present, and Reasonably Foreseeable Future Actions

The following projects and actions, described in Section 6.2.2, have been included in the cumulative effects analysis due to their potential effects on wildlife across the Laurentian Uplands and Nashwauk Uplands ecological subsections:

- ArcelorMittal Mines (Laurentian and East Reserve Mines),
- Northshore Mine,
- LTVSMC,
- U.S. Steel Minntac Mine and Processing,
- U.S. Steel Keetac Mine Expansion Project,
- Mesabi Nugget and Mesabi Mining Project,
- Essar Steel,
- Mesaba Energy Project – East and West Range Sites,
- Community growth and development (regional), including road construction and expansion projects, and
- Forestry practices (regional).

6.2.3.6.4 Cumulative Effects Assessment

Wildlife Habitat

The study area for loss and fragmentation of habitat is the 810,000-acre Nashwauk Uplands and the 567,000-acre Laurentian Uplands ecological subsections. Forest composition changes from the pre-settlement period through current conditions are indicative of wildlife habitat trends. The MCWCS approach uses Marschner pre-settlement mapping as a baseline for describing changes taking place in vegetation types/ecosystems since the 1800s, using recent land cover data from the Minnesota GAP land cover data and reported by ecological subsection (MDNR 2006d). The effects on wildlife were evaluated by noting the change in amount of each Marschner habitat type in terms of the effect on wildlife species that use that habitat type.

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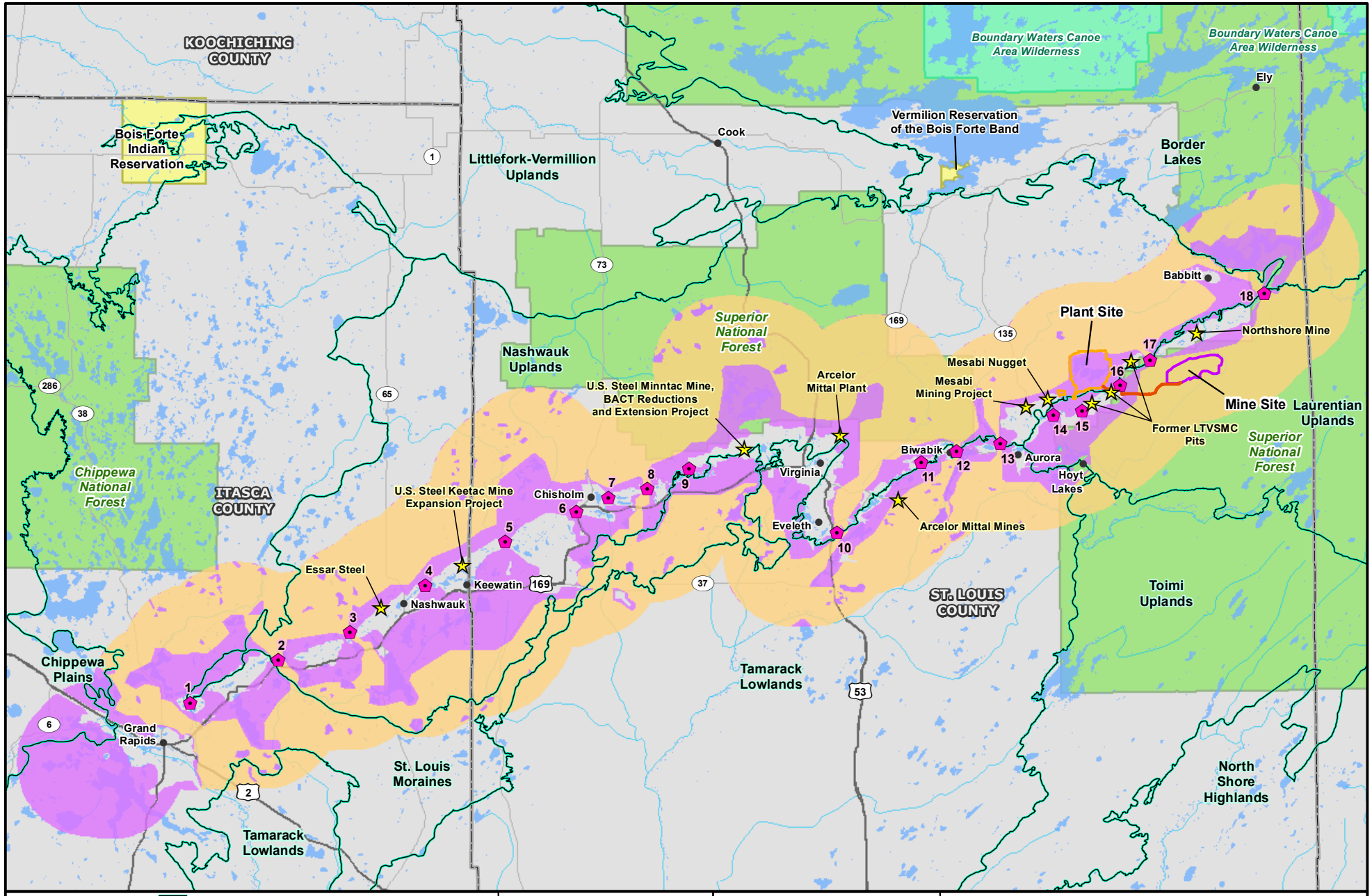

Wildlife Travel Corridors
Cumulative Actions See Table 6.2-1
Mine Site
Plant Site
Transportation and Utility Corridor
Ecosystem Subsections
Native American Reservation
High Quality Wildlife Corridor
Moderate Quality Wildlife Corridor
Streams/Rivers
Lakes
National Forest
Boundary Waters Canoe Area Wilderness

US Army Corps of Engineers
St. Paul District

N
W E
S

0 2.5 5 10 Miles

Figure 6.2.3-2
North-South Wildlife Travel Corridors
NorthMet Mining Project and Land Exchange SDEIS
Minnesota

November 2013

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Wildlife habitats that decreased in acreage from pre-settlement to current conditions present a higher risk of future SGCN population decreases and are in greater need of conservation in Minnesota.

The changes in habitat types in the Nashwauk Upland and Laurentian Upland subsections from pre-settlement through today are presented in Section 6.2.3.5.4, in Table 6.2-13. These data indicate an overall decrease in upland and lowland forest types in the Nashwauk Uplands ecological subsection during these periods. Forest types increased in the Laurentian Uplands.

In the majority of the region, forest communities have transitioned from predominately pine- and tamarack-dominated forests to aspen and other non-pine community-dominated forest species. Further, research indicates that current mature forest represents only about 4.4 percent of the old growth acreage that existed in the 1800s (Jaakko Poyry 1994). Forest composition has changed, and the MFRC (2003b) concluded that forest fragmentation has increased, with decreased patch sizes and more miles of forest edge.

Within the Laurentian Uplands and Nashwauk Uplands subsections, agricultural land use is minimal. Developed land including mined lands, non-mine related industrial use, commercial and residential use, cropland, and pasture total 11 percent of the Nashwauk Uplands and 1 percent of the Laurentian Uplands. The balance is higher quality wildlife habitat, including forest, wetlands, and open water.

Some wildlife species in northeast Minnesota are sensitive to habitat changes and may be adversely affected by change. Disturbance (such as fire and forestry) produces a landscape pattern that contains less habitat for species needing large habitat patches, such as ovenbirds, and poorer quality habitat for species requiring older and more diverse forest vegetation, such as northern goshawks (MFRC 2003a). Some wildlife populations are more affected by timber harvest and forest composition than others, and species whose habitat range edges are affected by forest composition changes are more likely to be affected (Jaakko Poyry 1994).

An assessment of future cumulative effects through 2014 from forestry, and for an unstated near-term period from mining and non-mining development, was completed for the 12.5 million-acre Arrowhead Region, which includes the Laurentian Uplands and Nashwauk Uplands ecological subsections (Emmons & Olivier 2006). Potential disturbances to wildlife habitat within the Laurentian Uplands ecological subsection were primarily due to timber harvest and mining, and habitat types most likely to be affected included upland and lowland coniferous forest, upland deciduous forest, and upland shrub/woodland. Within the Nashwauk Uplands ecological subsection, mining activities and urban development were more likely to affect wildlife habitat, with upland deciduous forests and upland shrub/woodland habitats most affected (Emmons & Olivier 2006).

A subsequent study for the Keetac Expansion Project (Barr 2009a) expanded on a previous wildlife corridor and habitat analysis and quantified the effects on habitat from reasonably foreseeable mining and urban/development projects along the Iron Range (Emmons & Olivier 2006). The study differentiated between “high-impact” and “moderate-impact” features as related to mining and other urban/development. High-impact features create physically impenetrable barriers to wildlife including mining pits, in-pit activities, and operations plants and buildings. Moderate-impact features are areas that experience a change in topography, community structure, diversity, and function but would not be physically impenetrable for many

species, such as stockpiles, tailings basins, borrow areas, settling ponds, and haul roads. Moderate-impact areas may naturalize and revegetate over time (Barr 2009a).

Wildlife Travel Corridors

Wildlife could be affected by the NorthMet Project Proposed Action and other actions through a cumulative disruption of their travel corridors. These actions could pose additional barriers to wildlife movement by increasing the number of isolated patches of suitable habitat, increasing mortality during transit, and physically blocking travel. This may lead to increased population and genetic isolation and decreased meta-population dynamics, which in turn could lead to decreases in overall population stability and persistence. Two studies have examined the potential cumulative effects of mining operations on wildlife movement along the Iron Range, the conclusions of which form the base of cumulative effect analysis in this SDEIS: Emmons & Olivier (2006) supplemented with additional findings from Barr (Barr 2009a).

As noted in Chapter 4, there are 13 major wildlife travel corridors connecting large roadless blocks along the Mesabi Iron Range. These corridors ranged from less than 0.1 mile to over 3.2 miles wide, with a total combined length of 20.2 miles.

Barr Engineering (2009a) also analyzed wildlife corridors along the Mesabi Iron Range, identifying five additional corridors (for a total of 18) along the same extent and differentiating between mine features that precluded wildlife movement (high-impact features) and mine features that were still passable and would potentially revegetate over time (moderate-impact features) (see Figure 6.2.3-2).

Effects on wildlife travel corridors were classified as: 1) direct loss of habitat inside the corridor, 2) fragmentation of habitat inside the corridor, 3) isolation of a corridor by the creation of a barrier inside or near its termini, and 4) direct loss or fragmentation of large habitat blocks outside the corridor, which are the presumed destinations of the animals using the corridors. This analysis included the following projects that could potentially represent barriers to wildlife travel:

- Essar Steel,
- U.S. Steel Keetac Mine Expansion Project,
- ArcelorMittal Mines (Laurentian and East Reserve Mines),
- Northshore Mine,
- Mesabi Nugget and Mesabi Mining Project,
- Mesaba Energy Power Generation Station, and
- ArcelorMittal Mines (Laurentian and East Reserve Mines).

Of the 13 large mammal wildlife crossing corridors identified by Emmons & Olivier, two are in the vicinity of the Mine Site or Plant Site. The first is located approximately 1 mile southeast of the existing Plant Site (see Figure 6.2.3-2). Though small, this corridor has been identified as important (Emmons and Oliver 2006) and of moderate quality (Barr 2009a). The existing LTVSMC Tailings Basin is located within the corridor, but does not obstruct the entire width of it. The Tailings Basin provides poor habitat and is not likely to be heavily used by wildlife.

Because current use is already limited, increased activity at the Tailings Basin would have minimal effect on wildlife movement through the corridor.

The second corridor is located approximately 0.5 mile northwest of the Mine Site. Operations at the Mine Site would indirectly affect the corridor by reducing its size and acting as a source of noise and activity near the large habitat block southeast of the corridor. Though the Transportation and Utility Corridor is outside the wildlife corridors identified by Emmons & Olivier, it runs parallel to the corridors and would potentially affect wildlife use.

The other reasonably foreseeable projects may also affect the 18 wildlife travel corridors mapped by Emmons & Olivier and Barr (see Table 6.2-16 and Figure 6.2.3-2) (Emmons & Olivier 2006; Barr 2009a). These effects may include blocking or encroachment into the mapped wildlife corridors, which affects adjacent habitat that may make the corridor less valuable to wildlife, and increasing traffic along new or existing roads through the corridor. The effects on these corridors include complete loss (depending upon final extent of activities), habitat isolation, fragmentation, and/or minimal effect.

Table 6.2-16 Cumulative Effects on Wildlife Travel Corridors in the Mesabi Iron Range

Wildlife Travel Corridor	Project	Type of Effect
1	Urban Development, Highway Traffic	Minimal habitat isolation; may restrict wildlife travel through corridor due to roads, railroads, and potential expansion of the City of Grand Rapids.
2	Highway Traffic	Habitat isolation; may restrict wildlife travel through corridor due to highway traffic (US 169), which may increase over time.
3	Urban Development, Essar Steel	Direct loss of travel corridor; wildlife travel through the western half of the corridor is currently restricted by historical mining effects, eastern half of corridor would be directly affected by the Essar Steel project, resulting in overall loss of the corridor.
4	Highway Traffic, Essar Steel, U.S. Steel Keetac	Habitat isolation; may restrict wildlife travel through the corridor due to the Keetac Expansion Project, which would be south of the corridor, and the Essar Steel Project, which would be west of the corridor.
5	U.S. Steel Keetac	Direct loss of travel corridor; wildlife travel through this corridor would be restricted by the U.S. Steel Keetac Project and existing Hibbing Taconite, resulting in a direct loss of this low-quality corridor.
6	Highway Traffic, Urban Development, U.S. Steel Keetac	Fragmentation and direct loss of travel corridor; wildlife travel through this corridor is restricted by Hibbing Taconite to the west of the corridor, highway traffic on State Highway 73, and fragmentation of travel corridor habitat may occur due to urban development of Chisholm (on the northern end of the corridor) and Hibbing (on the southern end of the corridor).
7	Urban Development	Habitat isolation; though no mining projects are expected to affect this small travel corridor, eastward expansion of Chisholm may restrict wildlife travel through this corridor.

Wildlife Travel Corridor	Project	Type of Effect
8	Highway Traffic, U.S. Steel Minntac	Habitat isolation; may restrict wildlife travel through corridor due to highway traffic (US 169) south of the corridor, U.S. Steel Minntac may affect habitat to the northeast of the corridor.
9	U.S. Steel Minntac	Direct loss of travel corridor; the U.S. Steel Minntac mine pit expansion would eliminate eastern end of corridor.
10	Urban Development	Minimal effect; wildlife travel through this corridor may be restricted by expansion of Eveleth or Gilbert and associated roads.
11	ArcelorMittal	Habitat isolation and direct loss; wildlife travel through this corridor may be restricted by ArcelorMittal's Project, which would prevent access between northern and southern blocks of the corridor.
12	Urban Development	Minimal effect; wildlife travel through this corridor may be restricted by expansion of the City of Biwabik.
13	Mesabi Nugget, Mesabi Mining Project, Urban Development	Minimal effect; wildlife travel through this corridor may be restricted by westward expansion of the City of Aurora, and likely increase in traffic/noise due to the Mesabi Nugget Project.
14	Mesabi Nugget and Mesabi Mining Project	Minimal effect; wildlife travel through this corridor may be restricted by the Mesabi Nugget Project, which would reduce the corridor width, but not eliminate use.
15	Mesabi Nugget and Mesabi Mining Project	Minimal effect; wildlife travel through this corridor may be restricted by the Mesabi Nugget Project, which would reduce the corridor width, but not eliminate use.
16	NorthMet Project Proposed Action	Minimal effect; wildlife travel through this corridor may be restricted by noise and activities at the NorthMet Project Proposed Action Plant Site, which would be located northwest of the corridor.
17	NorthMet Project Proposed Action and Northshore Mine	Direct loss and fragmentation; the NorthMet Project Proposed Action would reduce habitat to southeast of the corridor. The NorthMet Project Proposed Action would not physically encroach into the corridor, but noise and activities at the NorthMet and Northshore mine operations could discourage use during mine operations.
18	Northshore Mine	Direct loss and fragmentation; possible expansion of Northshore mine eastward may block or fragment this corridor.

Sources: Emmons & Olivier 2006; Barr 2009a.

Special Status Species

In addition to habitat fragmentation and loss and effects on wildlife crossing corridors, wildlife species of concern in the Nashwauk Uplands and Laurentian Uplands ecological subsections are subject to other stressors that could result in cumulative effects. Traffic and activity related to mining projects, urban development, forestry, tourism, and road expansions all increase the risk for special status wildlife species and, as such, could result in cumulative effects.

While the gray wolf has been delisted by the federal government, it remains a Minnesota species of concern. The wolf had rebounded sufficiently that the state held a limited hunting season in 2012. A 2007 to 2008 winter survey by the MDNR (Erb 2008) estimated that 2,921 gray wolves were present in Minnesota, which, along with the 2012 hunt, indicates that populations have

stabilized to the point that the wolf in Minnesota is viable. The NorthMet Project Proposed Action and other cumulative actions may increase pressures from loss of habitat and disruptions in travel corridors which may affect the total numbers of animals in the future.

Effects from Acid (NO_2/SO_2) and Mercury Deposition

Acid depositions from sulfate (from SO_2 emissions) and nitrate (from NO_2 emissions) can have an adverse effect on terrestrial ecosystems, including forested wildlife habitat. These pollutants may travel long distances and contribute to complex chemical and physical reactions within a variety of habitats. These reactions could contribute to increased vulnerability of sensitive wildlife species and their habitats. Additionally, these pollutants can be carried by precipitation into nearby lakes and rivers, which wildlife species rely upon for food and water.

As described in Section 6.2.3.8.5, emissions from the NorthMet Project Proposed Action, in combination with other projects, would emit increased amounts of SO_2 and NO_2 emissions, resulting in a potential increase in acid deposition that may be too small to measure. However, the projects would not likely cause a cumulative effect on the ecosystems due to the NorthMet Project Proposed Action having relatively low emissions of SO_2 and NO_2 and potential deposition of sulfate and nitrate that are below both the Minnesota standard threshold value and the federal Class I threshold values, in combination with the overall reduction in sulfate and nitrate-producing emissions cumulatively since 2008.

6.2.3.7 Aquatic Species

The NorthMet Proposed Project Action could affect aquatic physical habitat and species via changes in flow and water quality in the Partridge River and Embarrass River. The analysis found the NorthMet Project Proposed Action would meet all Class 2B (aquatic life) water quality standards with the exception of aluminum and lead. For aluminum, ambient water quality already exceeds the Class 2B standard in both the Partridge River and Embarrass River, but would increase in several tributaries to the Embarrass River as a result of the NorthMet Project Proposed Action because of a decrease in Tailings Basin seepage with low aluminum concentrations and a proportional increase in natural runoff with higher aluminum concentrations. In terms of lead, the predicted exceedances would also occur in two tributaries to the Embarrass River and are a result of a reduction in hardness as a result of the proposed groundwater containment system. The aggregate of these and other solutes, primarily metals, has the potential to impact aquatic biota.

Although there is historic and current mining in the area, the water quality of these watersheds is generally good, with some exceptions. One exception involves portions of the Embarrass River that are included on the 303(d) list as impaired for “Fishes Bioassessment” (non-supportive of aquatic life and indicative of habitat stressors that limit aquatic life). Another exception relates to some lakes through which the Partridge River and Embarrass River flow that are on the 303(d) list of impaired waters for “mercury in fish tissue.” The MDH has issued fish consumption advisories for the “mercury in fish tissue” impaired waters to provide site-specific consumption guidance on the quantity and frequency of fish species consumed. The following sections provide a quantitative and semi-quantitative analysis of the potential cumulative effects of the NorthMet Project Proposed Action and other activities in the Partridge River and Embarrass River watersheds.

Both the Partridge River and Embarrass River are tributaries to the St. Louis River, which flows through the Fond du Lac Indian Reservation and empties into Lake Superior near Duluth. A qualitative assessment of the cumulative effects to aquatic resources in St. Louis River has been included.

The St. Louis River is not included within the spatial scale of the NorthMet Project's cumulative effects analysis for these reasons:

- The NorthMet Project Proposed Action would not have any direct effects (i.e., habitat disturbance) on the St. Louis River, or even perennial waterbodies within the Partridge River and Embarrass River watersheds.
- The NorthMet Project Proposed Action would not pose any obstructions to fish movement between the St. Louis River and the Partridge River or Embarrass River.
- The NorthMet Project Proposed Action would result in about a 2 percent (about 6 cfs) reduction in average annual flow in the St. Louis River at the confluence with the Embarrass River during operations, and less than 1 percent reduction during closure. The NorthMet Project Proposed Action effects would be even less during low flows because of flow augmentation from Whitewater Reservoir once water levels in Colby Lake fall below 1,439 ft, which equates to a flow of approximately 13 cfs).
- With the proposed design modifications and engineering controls, the water quality model predicts that the NorthMet Project Proposed Action would not cause or increase any exceedances of the surface water quality evaluation criteria. There are existing natural exceedances of the aluminum and manganese secondary water quality standards at several of the evaluation locations, but the NorthMet Project Proposed Action would not increase these concentrations in any measurable way.
- The NorthMet Project Proposed Action would result in a net decrease in mercury loadings to the St. Louis River.

Therefore, the NorthMet Project Proposed Action would not have any direct effects on aquatic habitat in the St. Louis River and would not have any measureable indirect effects on fish or aquatic invertebrates as a result in changes in flow or water quality, and, therefore, it would not contribute any measureable cumulative effects to the St. Louis River.

The NorthMet Proposed Project Action could affect aquatic physical habitat and species via changes in flow and water quality in the Partridge River and Embarrass River. The analysis found that changes in water chemistry would not exceed water quality evaluation criteria.

Temporal

The evaluation focused on the potential cumulative effects of the NorthMet Project Proposed Action, in combination with other existing and reasonably foreseeable projects, on aquatic habitat. The NorthMet Project would have little direct effect on perennial streams and aquatic habitat within the vicinity of the NorthMet Project Proposed Action. Effects would likely be limited to changes in the seasonal hydrograph of the upper reaches of the Partridge and Embarrass Rivers, with no direct effect on aquatic habitat for other downstream areas within the CEAA.

6.2.3.7.1 Past, Present, and Reasonably Foreseeable Future Actions

The assessment discusses potential cumulative effects on surface water habitats and aquatic species associated with the following current and future actions listed below in conjunction with the NorthMet Project Proposed Action:

- Northshore Mine,
- LTVSMC, and
- Mesabi Nugget and Mesabi Mining Project.

These activities, along with the NorthMet Project area, are located within or adjacent to the CEAA. The aquatic habitats and species associated with the Embarrass River and Partridge River watersheds should be very similar in that they both contain headwaters (first-order streams which develop, downstream, into larger second- and third-order streams, as determined by the Strahler Stream Order classification). Section 4.2.6 indicates that baseline studies performed within these watersheds exhibited species typical for this region and these species can be assumed to occur within the streams and rivers affected by the NorthMet Project Proposed Action.

6.2.3.7.2 Cumulative Effects Assessment

Water Quality Effects

As described in Section 5.2.6.2, the NorthMet Project Proposed Action is not predicted to cause or increase any short- or long-term exceedances of surface water chronic standards in the Partridge River, Colby Lake, or the Embarrass River, even under low-flow conditions during operations and closure. Nevertheless, while the NorthMet Project Proposed Action would not cause any exceedances of water quality evaluation criteria, it could combine with other past, present and reasonably foreseeable future activities to create cumulative effects within the CEAA. The analysis below describes these combined effects to arrive at a finding that the NorthMet Proposed Action would not cause cumulative effects on aquatic resources within the CEAA. However, there is potential for cumulative effects on aquatic biota due to changes in water quality, especially in impaired waters for the Embarrass River, and in the Upper Partridge River from cessation of Northshore Mine dewatering post-closure.

The Class 2B standards were developed to be protective of aquatic life and to promote the "propagation and maintenance of a healthy community of cool or warm water sport or commercial fish and associated aquatic life, and their habitats" (*Minnesota Rules*, part 7050.0222). The chronic standards are restrictive standards and reflect "the highest water concentration of a toxicant to which organisms can be exposed indefinitely without causing chronic toxicity" (*Minnesota Rules*, part 7050.0218, subpart 3, item I).

The NorthMet Project Proposed Action, in combination with other reasonably foreseeable projects, could increase solute concentrations for many constituents in the Partridge River and Embarrass River, although not above water quality evaluation criteria. This change in existing water quality and the interactions between effects from a number of projects in the area, natural conditions, and current and future hydrology could be addressed as part of the non-degradation analysis for the NorthMet Project Proposed Action in permitting. The NorthMet Project Proposed Action, in particular, but to some extent in combination with other existing and reasonably foreseeable projects, would shift maintenance of water quality in the Partridge River

and Embarrass River from natural systems (i.e., essentially an ecosystem service) to mechanical systems (e.g., the NorthMet Project Proposed Action WWTF and WWTP).

Physical Habitat Effects

Hydrologic changes are often one of the major sources of effects on fish and macroinvertebrate habitat. While many aspects of the hydrologic regime can be important to the maintenance of fish and macroinvertebrate assemblages, reduction in baseflow (the portion of streamflow from groundwater) is particularly relevant because it represents a change or even a loss of habitat.

Section 5.2.6.2 concluded that the NorthMet Project Proposed Action would reduce flow upstream of Colby Lake and in the Embarrass River by very small amounts from the current baseline habitat conditions. Although the change would be small, alterations due to multiple projects in the Second Creek Watershed along with the planned supplementation of Second Creek due to the NorthMet Project Proposed Action may contribute to cumulative effects on aquatic habitat.

After 2070, when Northshore Mine dewatering discharge is predicted to end, there may be effects on the headwater Partridge River instream habitat due to loss of flow. The NorthMet Project Proposed Action, however, would not be expected to contribute measurably to this cumulative effect.

Effects from Mercury Deposition

The NorthMet Project Proposed Action, along with other reasonable foreseeable projects have the potential for adverse effects from mercury deposition on nearby lakes, including the Heikkila, Colby, Sabin, Wynne, and Whitewater lakes, the Partridge River and Embarrass River watersheds, and the aquatic biota within these waterbodies.

The cumulative analysis conducted by Barr assessed the effects of mercury from the NorthMet Project Proposed Action and other proposed projects on risks to fish consumption. The MPCA Mercury Risk Estimation Method (MMREM) was used to evaluate the risk for the following five lakes:

- Heikkila Lake,
- Colby Lake,
- Sabin Lake,
- Wynne Lake, and
- Whitewater Lake.

The cumulative analysis used mercury in fish concentration data (Barr 2012b) as a baseline to assess the increase in mercury deposition from the NorthMet Project Proposed Action and the Mesabi Nugget Large Scale Demonstration Plant emissions over existing risks. These two projects were assessed because they are the only “reasonable foreseeable” projects within 25 km of the NorthMet Project Proposed Action. It is assumed that increased deposition of mercury is directly proportional to increased mercury concentration in fish. The assessment showed that projected increase in mercury concentrations from the two sources in the fish for the five lakes ranges from 0.3 to 1.8 percent, in which the increased percentage from the NorthMet Project Proposed Action alone ranges from 0.2 to 1.8 percent (approximately 58 to 92 percent of the

cumulative increase). The NorthMet Project Proposed Action alone contributes very little mercury to the lakes. The highest impact in fish concentration was at Wynne Lake where the estimated increase to fish tissue mercury concentration is 0.016 ppm. The NorthMet Project Proposed Action's increase to fish tissue mercury concentrations at the remaining four lakes was at or below 0.012 ppm (Barr 2013c).

The Hazard Quotient is the ratio of the mercury concentration in fish to a health-based target of 0.2 ppm; a Hazard Quotient greater than 1 exceeds the health-based target. The maximum incremental cumulative Hazard Quotient from the two projects over existing fish mercury concentrations is 0.08 for recreational anglers, 0.61 for subsistence/tribal anglers, and 0.54 for subsistence fishers. The NorthMet Project Proposed Action contributes approximately 59 to 92 percent of the incremental cumulative Hazard Quotient. However, the current fish tissue concentration in the five lakes results in Hazard Quotients that exceed 1, leading to the need for the fish consumption advisories currently in effect (see Scenario 1 results in Figure 5 Barr 2012b).

The MPCA Statewide Mercury TMDL is intended to provide the long-term framework to reduce mercury in fish within Minnesota lakes, including the five lakes targeted in this assessment. The MPCA and industries emitting mercury into the atmosphere are working to reduce Minnesota sources' contribution to fish contamination. Minnesota is relying on actions by other states and the USEPA to address deposition from long-range sources.

In the period of time between completion of the cumulative effects analysis background study for Minnesota Steel and the development of this SDEIS, Minnesota stakeholders created an implementation plan for Minnesota's mercury TMDL. Within the implementation plan, there is a process for assessing new and expanding sources of mercury in Minnesota. It is important to assess sources so that while existing sources reduce emissions, new sources do not interfere or confound the state's progress in reducing mercury emissions overall. At the recommendation of the Minnesota stakeholders, MPCA has developed guidance for new and modified sources of mercury in Minnesota (MPCA 2013d). The guidance requires sources to: employ best controls to reduce mercury emissions and apply emissions limits to permit conditions. MPCA has conducted a review of the NorthMet Project Proposed Action mercury emissions and has determined that it would not impede the reduction goals (MPCA 2013c). Thus, no minimization and mitigation plan would be required for the NorthMet Project Proposed Action (see Section 5.2.7.2.5).

6.2.3.8 Air Quality

Several components of the NorthMet Project Proposed Action would combine with other past, present, and reasonably foreseeable proposed actions to cause cumulative effects on air quality. Of particular concern are the effects on Class I and Class II areas, especially with respect to acid deposition, particulates, and visibility impairment. Both direct and indirect effects of the NorthMet Project Proposed Action were used to calculate its effects in combination with those of other emission sources. Given the public's concern over air quality in the BWCAW and Voyageurs National Park, the analysis modeled how emissions from the NorthMet Project Proposed Action and other projects in the airshed would affect air quality and visibility in these areas.

6.2.3.8.1 Approach

Cumulative effects have been evaluated to assess the potential effects from other foreseeable projects that have been approved by regulatory agencies, but have not been implemented or accounted for in existing air quality conditions. The assessments of these projects, in combination with the NorthMet Project Proposed Action, were conducted to evaluate the overall effects on the NAAQS/MAAQS, the USEPA PSD Class I and Class II standards, and the USEPA Class I Visibility and Regional Haze criteria.

6.2.3.8.2 Cumulative Effects Assessment Area

Spatial

The CEAA for air quality is defined as those areas that are beyond the boundaries of the Plant Site, Mine Site, the Mesabi Nugget Ambient Air Boundary, and the Northshore Mine (labeled as St. Louis County Tax Records) identified on Figure 6.2.3-3. The cumulative receptors on the figure (in blue) provide spatial projection of the closest receptors used in the modeling that are at or beyond the four boundary areas identified above.

Temporal

Based on the approved model's limitations, this evaluation used a qualitative baseline of industrial growth within the Arrowhead Regional Airshed as indicative of the historical and more recent effects on air quality resulting in the current ambient conditions.

6.2.3.8.3 Past, Present, and Reasonably Foreseeable Future Actions

The air quality modeling used existing background to represent the cumulative effects from all past and current actions that affect air quality in the region.

6.2.3.8.4 Cumulative Effects Assessment

Air quality modeling analyses were conducted to assess cumulative effects on NAAQS, MAAQS, PSD Class II Increments, and Class I Increments using a similar modeling approach discussed in Section 5.2.7.2.1. However, relative to NAAQS, MAAQS, and PSD Class II Increments, the receptor locations were restricted to areas at and beyond the former LTVSMC ambient air boundary as defined in the Final SDD. However, the Class II modeling report for the Plant Site included a more detailed and up-to-date assessment of combined effects at the Plant Site. For PSD Class I Increments, the cumulative analysis was conducted by adding the maximum effects from the NorthMet Project Proposed Action to the maximum effects from the cumulative analysis prepared for the Minnesota Steel EIS (MDNR and USACE 2007), in order to assess overall cumulative effects. The following sections describe the results of these assessments.

Cumulative Ambient Air Quality Effects (NAAQS/MAAQS)

As stated earlier, an assessment of the Plant Site was conducted using the same modeling approach as presented in Section 5.2.7, except that receptor locations were limited to the Plant Site's boundary combined with the shared properties of the Mesabi Nugget and Cliffs Erie Pellet Yard (using the former LTVSMC processing plant boundary) as the ambient air boundary. It

should be noted that the NorthMet Project Proposed Action emissions were evaluated on both Mesabi Nugget and Cliffs Erie property. Figure 6.2.3-3 shows the ambient air boundary for the former LTVSMC processing plant. The cumulative analysis included potential emissions for all NorthMet Project Proposed Action sources, nearby sources as defined in the Final SDD, and additional sources agreed upon with the MPCA, as identified above.

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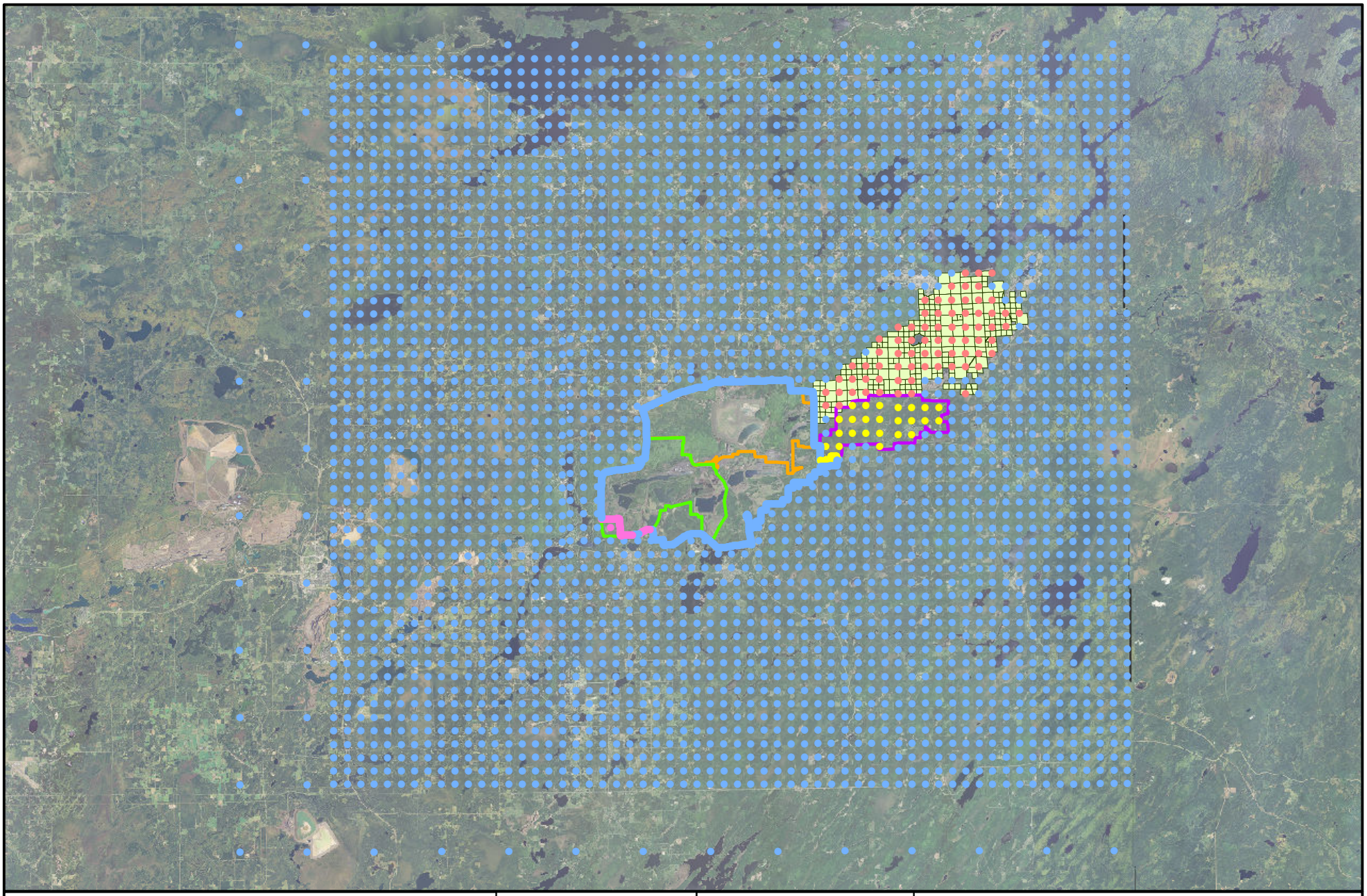

- Cumulative Receptors
- Mesabi Nugget
- NorthMet Project Mine Site
- NorthShore Mine
- Mesabi Nugget Ambient Air Boundary
- Mine Site Ambient Air Boundary
- Plant Site Ambient Air Boundary
- St Louis County Tax Records

US Army Corps of Engineers
St. Paul District

N W E S

0 1.5 3 6 Miles

Figure 6.2.3-3
Ambient Air Boundary - EIS Cumulative NAAQS/Increment Receptor Grid NorthMet Plant Site EIS Class II Modeling Report
NorthMet Mining Project and Land Exchange SDEIS
Minnesota

November 2013

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Table 6.2-17 summarizes the results of the cumulative NAAQS/MAAQS model analysis. Except for the cumulative 1-hour SO_2 and 1-hour NO_2 effects, all other maximum cumulative effects were below the respective NAAQS and MAAQS, ranging from 24 percent to 97 percent of their respective standards. In order to compare with the applicable standards, the following calculated maximum concentrations were defined, as defined in Section 5.2.7, by the "highest nth high" concentration (HnH) as follows:

- 24-hour PM_{10} – H6H,
- 24-hour $PM_{2.5}$ and 1-hour NO_2 – H8H,
- 1-hour SO_2 – H4H,
- 3-hour and 24-hour SO_2 – H2H, and
- all annual – maximum.

Ambient air background concentrations were added to modeled concentrations to determine compliance with NAAQS and MAAQS. Background concentrations represent the 2008 to 2010 values from the Blaine-Anoka Airport Monitor (the nearest monitoring station available for model input), Rosemont Monitor, and Virginia Monitoring Stations for NO_2, SO_2, and PM_{10}/$PM_{2.5}$, respectively.

The maximum predicted ambient 1-hour NO_2 concentration was 292 μg/m^3, which was predicted to occur to the southwest portion of the ambient air quality boundary, and exceeded the 1-hour NO_2 NAAQS (188 μg/m^3). The Plant Site modeled contribution at the location of maximum effect was 0.002 μg/m^3. Other receptors where concentrations were lower than the maximum but exceeded the 1-hour NO_2 NAAQS were predicted primarily on the western half of the receptor grid and were due to the nearby sources (see Figure 6.2.3-4). For all receptors that exceeded the 1-hour NO_2 NAAQS, the contributions from the Plant Site sources were less than the 1-hour NO_2 Significance Threshold of 7.5 μg/m^3 and are considered to have no significant contribution to the predicted exceedances.

Similarly, the maximum 1-hour SO_2 ambient concentration was predicted at the southwestern border of the ambient boundary with a value of 893 μg/m^3 and exceeded the 1-hour SO_2 NAAQS of 196 μg/m^3 (see Figure 6.2.3-5). The Plant Site maximum modeled contribution to this maximum was 0.002 μg/m^3, well below the 1-hour SO_2 SIL threshold of 7.8 μg/m^3. For all receptors that exceeded the 1-hour SO_2 NAAQS, the contributions from the Plant Site sources were less than the 1-hour SO_2 Significance Threshold, thus having no cumulative effect on any predicted exceedances.

It should be noted that modeled NAAQS exceedances do not mean that the region is in non-attainment for these standards. NAAQS attainment is determined by measuring the actual concentration of pollutants in the air by monitoring. There is no monitoring data in the region that indicates that NAAQS standards are not being met. The NAAQS model results represent the maximum allowable emissions from NorthMet and all of the nearby sources, not the actual emission rates or actual pollutant concentrations, which are lower. In addition, the model results represent worst case meteorological conditions and background pollutant concentrations. Because the NorthMet Project Proposed Action is considered a synthetic minor PSD source and is not culpable for the modeled exceedances, per EPA guidance, permits can be issued for the project without addressing the modeled exceedances.

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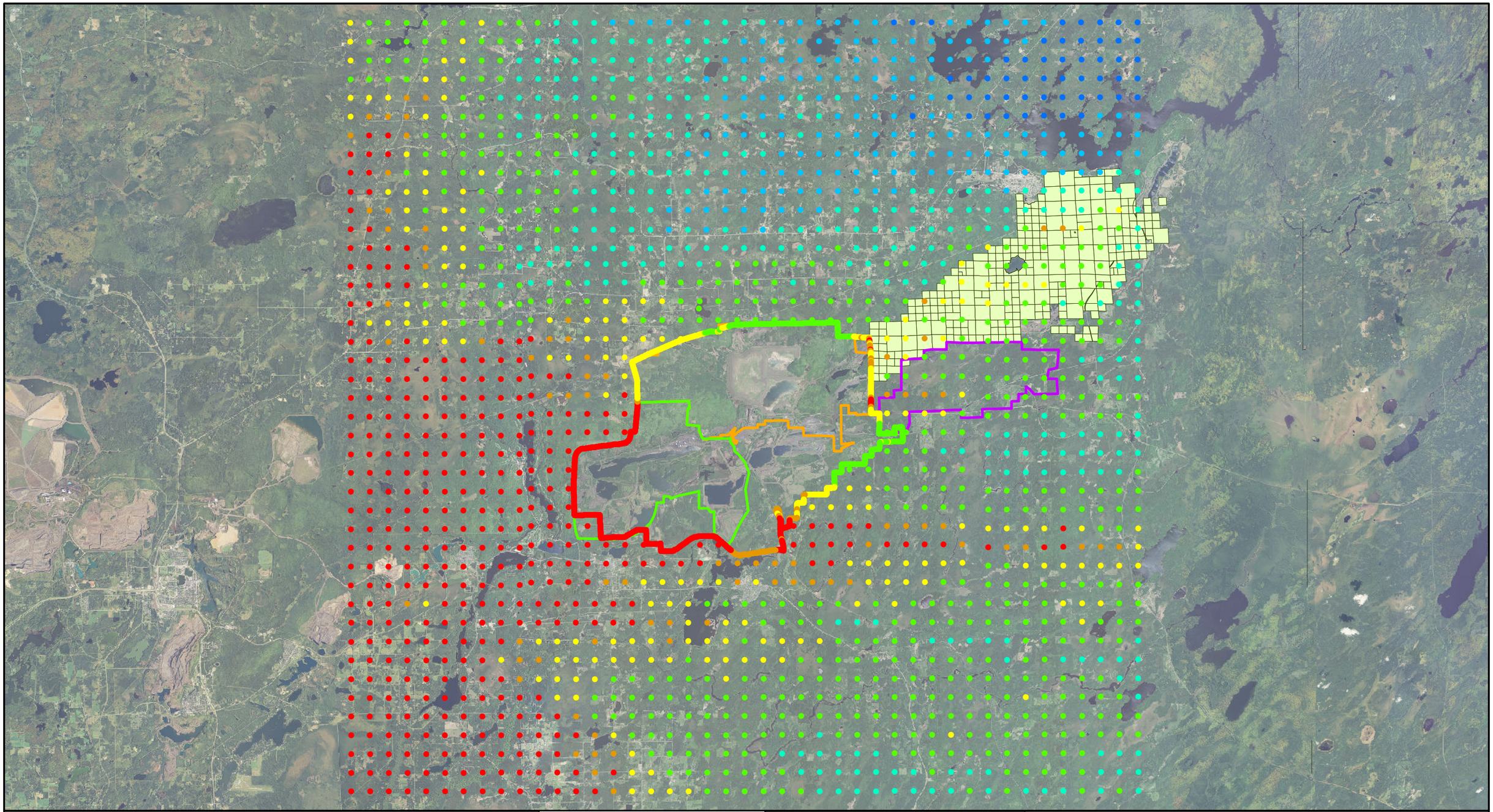

H8H Concentration ug/m

- 142 - 149
- 150 - 159
- 160 - 169
- 170 - 179
- 180 - 185
- 186 - 188
- 189 - 292

Mesabi Nugget Ambient Air Boundary
Mine Site Ambient Air Boundary
Plant Site Ambient Air Boundary
St Louis County Tax Records

US Army Corps of Engineers
St. Paul District

N W E S

0 1 2 4 6 Miles

Figure 6.2.3-4
1 Hour NO_2 Cumulative Effect NAAQS Results
NorthMet Mining Project and Land Exchange SDEIS
Minnesota

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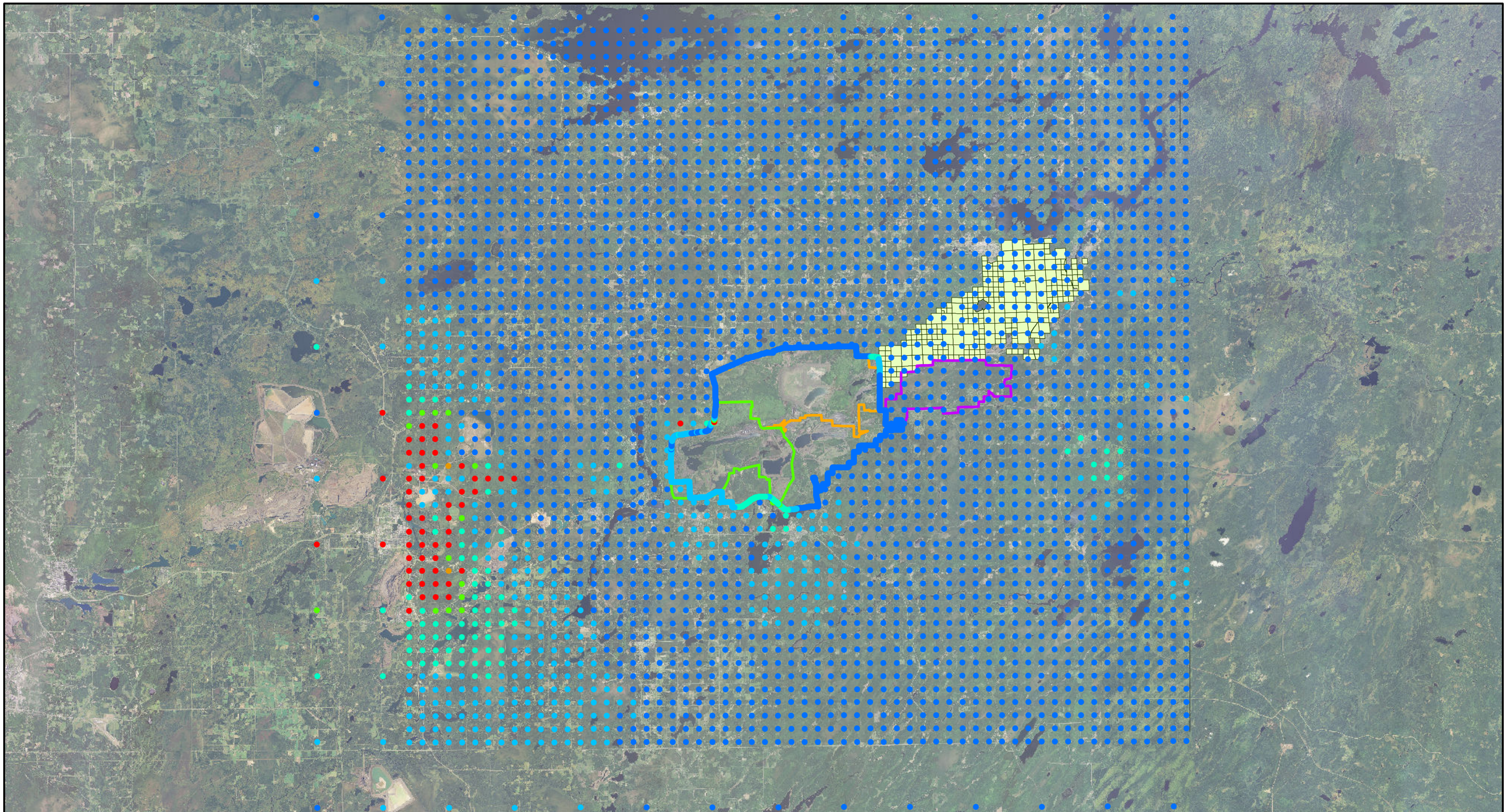

H4H Concentration ug/m

- 61 - 100
- 101 - 130
- 131 - 160
- 161 - 180
- 181 - 190
- 191 - 196
- 197 - 925

Mesabi Nugget Ambient Air Boundary
Mine Site Ambient Air Boundary
Plant Site Ambient Air Boundary
St Louis County Tax Records

US Army Corps of Engineers
St. Paul District

N W E S

0 2 4 8 Miles

Figure 6.2.3-5
1 Hour SO_2 Cumulative Effect NAAQS Results
NorthMet Mining Project and Land Exchange SDEIS
Minnesota

November 2013

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The MPCA is, however, taking actions to reduce emissions from taconite facilities with a goal to evolve controls at these facilities. Specifically, the Long Term Strategy contained in Minnesota's Regional Haze State Implementation Plan to protect visibility in National Parks and Wilderness Areas relies on demonstration of compliance with the 1-hour NOx and 1-hour SO_2 NAAQS at the nearby taconite facilities. The MPCA has issued administrative orders to the existing taconite facilities requiring modeling that demonstrates compliance with the NO_2 and SO_2 one-hour standards, submittal of proposed emission limits that show they no longer contribute to modeled noncompliance, and submittal of a description of any emission controls that would be needed. It is likely that additional actions may be needed to reduce pollutants from other large emitters in the region, including power plants, to address any modeled noncompliance.

Table 6.2-17 Results of Cumulative Class II NAAQS Modeling

Pollutant	Averaging Time	Maximum Modeled Concentration (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS/ MAAQS (µg/m^3)
SO_2	1-hour	887	6	**893**	196/1300
	3-hour	772	12	784	NA/915
	24-hour	249	6	255	NA/365
	Annual	24	1	25	NA/40
PM_{10}	24-hour	41	36	77	150/150
	Annual	5	14	19	NA/50
$PM_{2.5}$	24-hour	17	17	34	35/65
	Annual	4	6	10	15/15
NO_2	1-hour	202	90	**292**	188/NA
	Annual	6	18	24	100/100

Note: Concentrations in **Bold** indicate exceedance with standard.

Cumulative Class II Increment Effects

Cumulative Class II Increment analysis was completed for PM_{10}, NO_X, and SO_2 for all increment consuming NorthMet sources at both the Mine Site and Plant Site. The modeling included all sources at maximum emission rates plus all nearby increment-consuming (and expanding) emissions sources identified above. Increment consuming (or expanding) sources are all sources with emission increases (or decreases) after the PSD Major Source baseline date for that pollutant. The results of the increment analyses are shown in Table 6.2-18, along with a comparison to the allowable Class II PSD increments.

The data in Table 6.2-18 summarize the PSD Class II Increment modeling results and demonstrate that the NorthMet Project Proposed Action, in conjunction with all other neighboring PSD sources, would satisfy all state and federal increment limits.

Table 6.2-18 Results of Cumulative Class II PSD Increment Analysis

Pollutant	Averaging Time	Cumulative Modeled Concentrations (µg/m^3)	PSD Increment Limits (µg/m^3)
SO_2	3-hour	11	512
	24-hour	1.9	91
	Annual	0.2	20
PM_{10}	24-hour	18	30
	Annual	3	17
NO_X	Annual	0.9	25

Cumulative Class I Increment Effects

Based upon the analysis presented in Section 5.2.7, the only modeling analysis with results above the acceptable screening thresholds was the 24-Hour Class I SIL for PM_{10} at BWCAW, which triggers a cumulative modeling assessment. The PM_{10} maximum modeled effect was below the SIL at Voyagers National Park, but Voyagers National Park receptors were included at the request of MPCA. The NorthMet Project Proposed Action is not a major source; however, a cumulative assessment was prepared following the same methodology that is used for assessing effects from major sources. A cumulative assessment requires modeling of all PSD increment consuming and expanding facilities within 300 km of BWCAW. The cumulative emission inventory, containing increment consuming and expanding sources, was obtained from MPCA. No other major sources within the region have submitted permit applications since the inventory was prepared. Recently permitted new sources, which have not begun operation or have recently begun operation, are also included in the inventory, as are certain minor sources near the Class I areas selected by MPCA.

The April 2006 FLM guidance suggests that area and mobile sources may be included in the cumulative effect assessment. However, PM_{10} emissions from these sources is small in the region due to its rural nature; furthermore, total population in the nearby counties has decreased since the minor source baseline trigger date. Therefore, no increase in area and mobile sources emissions are expected to have occurred, and these emissions are not included in the increment assessment.

Modeling was conducted to assess the 24-hour average PM_{10} concentrations within the Class I areas from the cumulative source inventory, and compared to effects from the NorthMet Project Proposed Action alone. The maximum concentration from project emissions was added to the maximum 24-hour PM_{10} concentration from the comprehensive cumulative analysis. This is a conservative approach, since the maximum modeled concentration due to the project sources is not at the same location and time as the maximum from the comprehensive assessment. Table 6.2-19 summarizes the results of the analysis, showing that the cumulative Class I 24-hour PM_{10} is below the Class I PSD increment, indicating that the full increment has not been consumed. Furthermore, sufficient increment remains in the area to allow for future growth.

Table 6.2-19 Results of Cumulative Class I PSD PM_{10} Increment Analysis

Class I Area	Averaging Time	Maximum Modeled Air Concentration For NorthMet Modeled Emissions (µg/m^3)	Maximum Modeled Air Concentration For Cumulative Modeled Emissions (µg/m^3)	Total Cumulative Modeled Air Concentration (µg/m^3)	PSD Increment Limit (µg/m^3)
BWCAW	24-hour	0.33	1.76	2.09	8
Voyageurs National Park	24-hour	0.13	0.22	0.35	8

6.2.3.8.5 Cumulative Effects of Acid Deposition on Ecosystems

The potential for cumulative effects of acid deposition on ecosystems was evaluated in terms of the potential increased acidification on the terrestrial and aquatic systems within a six county area (Carlton, Itasca, St. Louis, Koochiching, Lake, and Cook counties) from 1980 to 2015, as defined in the Final SDD (MDNR 2005). The pollutants of consideration included both sulfate depositions from air quality SO_2 emissions to the air and nitrate deposition from NO_2 emissions. Both of these pollutants can be exposed to long-range transport and are subject to complex chemical and physical reactions prior to being washed out by precipitation into lakes and rivers. MPCA has estimated that over 90 percent of the acid deposition within Minnesota is a result of out-of-state emissions from long-range transport (State of Minnesota 1985). Findings from other states and NAPAP (Mahoney 1998) led the USEPA to develop the federal Acid Deposition Control Program.

Based upon the most recent information available at the time this cumulative analysis was conducted by PolyMet in January 2012, there are approximately 11 new projects for the six-county area, including the NorthMet Project Proposed Action. Collectively, without accounting for recent past reductions or expected future reductions, these sources could emit up to an additional 6,635 tons per year NO_x and 2,807 tons per year SO_2, if all were constructed and operated (Barr 2012x). This represents approximately a 12 percent and 7 percent increase, respectively, in the estimated emissions for the two pollutants in the six county "zone of interest" through 2009 (Carlton, Itasca, St. Louis, Koochiching, Lake, and Cook counties). However, due to the projected decreases in emissions from the Minnesota Power Arrowhead Regional Emission Abatement proposal in combination with various federal programs, including the implementation of the taconite and electric utility Maximum Achievable Control Technologies (MACTs), Best Achievable Retrofit Technology (BART) on Regional Haze Program and Clean Fuels Regulations, the overall emissions would be reduced by 5,503 tpy and 3,292 tpy for NO_2 and SO_2 respectively, since 2009 (Barr 2012x). In addition, supplemental decreases in emissions from the two pollutants are expected to occur due to other reasonably foreseeable actions.

As such, the emissions from the NorthMet Project Proposed Action, in combination with other projects, would emit increased amounts of SO_2 and NO_2 emissions, resulting in a potential increase in acid deposition that may be too small to measure. However, due to the NorthMet Project Proposed Action having relatively low emissions of SO_2 and NO_2 and potential deposition of sulfate and nitrate are below both the Minnesota standard threshold value and the federal Class I threshold values, in combination with the overall reduction in sulfate and nitrate-

producing emissions cumulatively since 2008, the projects would not likely cause a cumulative effect on the ecosystems.

6.2.3.8.6 Cumulative Visibility Effects

A cumulative effects analysis assessing the potential visibility effects on Federal Class I areas was performed to provide information for the DEIS (Barr 2006h). Also, in addition to the quantitative assessment of cumulative PM_{10} increment consumption in the BWCAW described in Section 6.2.3, a semi-quantitative assessment of potential cumulative PM_{10} air concentrations and the potential effect on increment consumption in Minnesota Class I areas was also completed (Barr 2012x).

6.2.3.8.7 Cumulative Effects Analysis – Class I Visibility

To help determine the potential effects on visibility impairment in the Class I areas in Minnesota from the NorthMet Project Proposed Action when combined with all other concurrent projects, a cumulative effects analysis for visibility was performed by PolyMet. The semi-quantitative analysis took into account the NorthMet Project Proposed Action along with other projects that were recently permitted or are currently in the permitting or environmental review process. The results of the analysis were described in a technical report – *Cumulative Impacts Analysis Minnesota Iron Range Industrial Development Projects; Assessment of Potential Visibility Impacts in Federal Class I Areas in Minnesota* (hereafter called the '2006 Visibility Class I Study' [Barr 2006h]). An updated report was also submitted in 2012 (Barr 2012x). The 2006 Visibility Class I Study addresses the effects of the NorthMet Project Proposed Action and all other past and "reasonably foreseeable" proposed projects consistent with the SDD. This analysis focused on a four-county project area (Itasca, St. Louis, Lake, and Cook counties).

The analysis presented here represents an update to the study previously prepared for the DEIS (Barr 2006h). The updated analysis includes a six-county project area (two additional counties added: Koochiching and Carlton), additional projects, and updated information on some projects included in the 2006 study (Barr 2012x). These updates were incorporated to make the analysis consistent with the work done in Minnesota to address the federal Regional Haze Rule since the 2006 Visibility Class I Study was submitted to the state agencies.

6.2.3.8.8 Background on the Regional Haze Rule

The USEPA published regulations in July 1999 intended to improve visibility in the nation's Class I areas. On June 15, 2005, the USEPA issued final amendments to the July 1999 rule. This rule and amendments are referred to as the Regional Haze Rule. Minnesota has two Class I areas—the BWCAW and Voyageurs National Park. In addition, emissions from Minnesota contribute to visibility impairment to Michigan's Isle Royale National Park Class I area. The rule requires that by year 2064, visibility in the Class I areas reflect no man-made impairment and also requires the installation of BART emission controls that reduce visibility impairment, for certain industrial facilities emitting air pollutants. The MPCA submitted a SIP to the USEPA in 2009, updated in 2012, that describes a 2018 visibility goal that makes reasonable progress towards the ultimate 2064 goal. Minnesota's Regional Haze SIP outlines the 2018 visibility goal and includes a target for 30 percent reduction in combined NOx and SO_2 emissions by 2018 from 2002 levels from point sources in Northeast Minnesota that emit over 100 tons per year of either NOx and SO_2 (MPCA 2009a).

Minnesota has been included in the Cross-State Air Pollution Rule (CSAPR), as described in 40 CFR 52.1240-1241. In 2011, the USEPA proposed that the emissions reductions in CSAPR achieved greater reasonable progress than source-specific BART determinations for power plants. As such, Minnesota has submitted a Regional Haze SIP Supplement (MPCA 2012g) to substitute CSAPR for BART for power plants. On June 12, 2012, the USEPA partially approved the SIP supplement. The partial approval allowed the substitution of CSAPR for BART of power plants; however, it failed to approve the BART emission limits for the taconite facilities. The partially approved plan also includes the identification of Class I areas, calculating baseline and natural visibility, establishing reasonable progress goals, adopting a long-term strategy for progress toward visibility goals, providing a monitoring strategy, and consulting with other states and FLMs prior to development of a regional haze plan. On August 21, 2012, the U.S. Circuit Court vacated the CSAPR. As such, unless the Supreme Court reverses the lower court decision, MPCA would be required to make source-by-source BART determinations for the power plants. On February 6, 2013, the USEPA issued a Federal Implementation Plan to set emissions standards for the six taconite facilities in Minnesota (and one in Michigan) that is designed to reduce NO_x emissions by 22,000 tpy and SO_2 by 2,000 tpy.

Summary of the 2006 Visibility Class I Study Scope (Updated in 2011) – Background

Regional Haze and Visibility Impairment

The USEPA defines "regional haze" as visibility impairment caused by the cumulative air pollutant emissions from numerous sources over a wide geographic area (USEPA 2003). The primary pollutants that are contributing to regional haze in Minnesota's Class I areas are anthropogenic emissions of fine particulate matter ($PM_{2.5}$). $PM_{2.5}$ includes ammonium sulfate, ammonium nitrate, and organic carbon matter (MPCA 2009a). Each of these components can be naturally occurring or can be the result of human activity. The natural levels of these species result in some level of visibility impairment in the absence of any human influences, and would vary with season, daily meteorology, and geography (USEPA 2003).

There are two categories of fine particulates: primary and secondary. Fine particulates, 2.5 microns or less in diameter, that are placed directly into the atmosphere are called primary particulates. Secondary particulates are formed as a secondary pollutant by the chemical transformation of NOx, SO_2, or VOC. Secondary particulates are the main contributor to regional haze. Both categories of fine particulates (primary and secondary) can be transported long distances.

Coarse particles between 2.5 and 10 microns in diameter do contribute to light extinction. However, these particles tend to settle out from the air more rapidly than fine particles and can be found relatively close to their emission sources (USEPA 2004, MPCA 2005), so emissions from the NorthMet Project Proposed Action in this size range are not likely to impact Class I areas.

Measuring Visibility

Visibility is characterized by the light extinction coefficient and haze index. Additional description on these two measures of visibility is provided below.

Light Extinction Coefficient

The light extinction coefficient is the sum of the atmospheric concentration of each species of interest multiplied by a corresponding coefficient. The light extinction coefficient is referred to as b_{ext} and has units of 10^{-6} m^{-1} or $(10^6 m)^{-1}$, or as typically labeled, inverse megameters (Mm^{-1}). Data from the Interagency Monitoring of Protected Visual Environments (IMPROVE) network is used to calculate light extinction coefficients for those Class I areas where monitoring is conducted.

Haze Index (Deciview)

The haze index or deciview (dv) was developed to address the issue that light extinction coefficients are non-linear with respect to human perception of visual changes. The dv is derived from calculated light extinction, and is designed such that uniform changes in haze correspond approximately to uniform incremental changes in perception, across the entire range of conditions, from pristine to highly impaired (40 CFR Part 51.301).

Visibility Impairment "Cumulative Impact" Approach

The scope of the updated cumulative effects on visibility for the NorthMet Project Proposed Action was completed in essentially four general steps:

- Assess the IMPROVE data for Voyageurs National Park and the BWCAW to provide the current status of particulate air concentrations and haze index including a trends analysis where there is sufficient data. PM_{10} concentrations are used to assess particulate concentration trends.
- Assess available information from the Regional Haze State SIP that identifies emission sources and/or emission source regions as significant contributors to ambient air concentrations in the Class I areas located in Minnesota.
- Evaluate local, statewide, and national SO_2, NOx, and PM_{10} emissions and trends using existing emission inventory data.
- Evaluate the cumulative effects from the proposed projects based on the potential increases in SO_2, NOx, and PM_{10} emissions and concurrent reductions from current and reasonably foreseeable projects and the expected decrease in state and national emissions.

Analysis Boundaries

The following boundaries were identified to define the extent of the analysis for the visibility cumulative effects study:

- The timeframe for the trends analysis, both past and future.
- The timeframe for this analysis is 1990 to 2035.
- Other "reasonably foreseeable" actions to be assessed in addition to the NorthMet Project Proposed Action.

The following projects and actions are considered to be underway or "reasonably foreseeable":

- Proposed Projects:
  - Excelsior Energy, Mesaba Energy Project, Coal Gasification Power Plant;
  - Mesabi Nugget, Large Scale Demonstration Plant;
  - Mesabi Mining Project;
  - Essar Steel Minnesota LLC (formerly Minnesota Steel Industries), Mining/Taconite/DRI/Steel Plant;
  - Essar Steel Minnesota LLC, Project Modifications;
  - Northshore Mining Company, Furnace 5 Reactivation Project;
  - NorthMet Mining Project;
  - SAPPI Cloquet Plant Expansion;
  - UPM/Blandin Paper Mill Expansion, Project Thunderhawk;
  - U.S. Steel Keetac Expansion Project; and
  - United Taconite Green Production Project.
- Emission Reduction Projects:
  - Minnesota Power Taconite Harbor Energy Center Unit 2, Emission Control Modifications;
  - Minnesota Power Laskin Energy Center Unit 2, NOx Reductions;
  - Minnesota Power Boswell Energy Center Unit 3;
  - U. S. Steel Minntac BACT Reductions;
  - Hill Wood Products major modification amendment;
  - Northshore Mining Company: BART Reductions; and
  - United Taconite BART Reductions.
- Regulatory and other actions:
  - Implementation of the Regional Haze Rule and BART Rule; and
  - Implementation of the CSAPR (40 CFR parts 52.1240-1241).
- On-road mobile source programs:
  - Fuel blending standards; and
  - Tier II/Low-sulfur gasoline.
- Non-road mobile source programs:
  - Non-road diesel rule;
  - Control of emissions from unregulated non-road engines;

- Locomotive/marine engine reductions; and
- Updates and additions to the NAAQS for SO_2, NO_2, $PM/PM_{2.5}$, and ozone, including 1-hour NO_2 and SO_2 standards.

Geographic Area that May be Affected ("Zone of Impact")

The "zone of impact" is defined as the area of concern to be evaluated for potential cumulative effects due to the above-listed actions. Based on the scope defined in the SDD for the NorthMet Project Proposed Action, the selected zone of impact is defined as Voyageurs National Park and the BWCAW. Voyageurs National Park is primarily located in St. Louis County, while the BWCAW encompasses parts of St. Louis, Lake, and Cook counties.

Assessment of Existing Conditions

An assessment of the baseline visibility conditions for Minnesota's Class I areas is based on monitoring data from the IMPROVE program. Monitor sites from both the BWCAW (monitor ID: BOWA1) and Voyageurs National Park (monitor ID: VOYA2) were included in the analysis. The IMPROVE website (http://vista.cira.colostate.edu/improve/Default/htm) along with the Visibility Information Exchange Web System (VIEWS) (http://vista.cira.colostate.edu/views/Web/Data/DataWizard.aspx), provide ambient air concentrations for particulate speciated by chemical and relative humidity data. Although another site collected data at Voyagers National Park (VOYA1), it was not used in the trend analysis due to a lack of continuous measurements and change in monitoring location, a comparison with VOYA2 was made. The VIEWS website provides the total light extinction coefficient from aerosol measurements and relative humidity.

The data for the BOWA1 location indicates a downward trend for haze index (visibility improvement) from 1992 to 2009 for the 20 percent best days, 20 percent worst days, and the median days. The data for VOYA2, representing a shorter time period from 2000 to 2009, showed a lesser visibility improvement trend in the haze index for the 20 percent best days, 20 percent worst days, and median days (-14 percent, +1 percent, -9 percent, respectively) in the rolling 5-year average data, primarily due to 2009 levels. It should be noted that the comparison of the average HI median concentration dvs between VOYA1 (1988-1993) and VOYA2 (2000-2009) showed a 17 percent decrease in dvs between the two sites.

Natural, local, state, national, and international emission sources contribute to visibility impairment in Minnesota's Class I areas. Minnesota's Regional Haze SIP recognizes that international pollution is a contributor to visibility impairment in Minnesota's Class I areas.

The Regional Haze SIP includes a modeling analysis of the potential contributions to light extinction for ammonium sulfate and ammonium nitrate on the 20 percent worst days by Minnesota and surrounding states for the projection year 2018 for BWCAW and Voyageurs National Park. The analysis indicates that Minnesota is the single largest contributor to visibility impairment at approximately 30 percent. The remaining 70 percent of the estimated contribution is from surrounding states such as Iowa, Illinois, and Wisconsin, as well as other distant areas. Northeast Minnesota sources make up approximately 50 percent of the contribution of visibility impairment coming from Minnesota (MPCA 2009a) or about 15 percent of the total from all sources.

6.2.3.8.9 Summary of Emission Trends

Table 6.2-20 shows the estimated potential emissions of SO_2, NOx, and PM_{10} from each of the proposed projects included in this analysis. Concurrent emission reductions are provided for comparison to the emissions estimated for the proposed projects. Proposed projects were included only if they were not operating for most of 2009. This cutoff date was chosen since the monitoring and emission inventory data used to assess the past or existing conditions includes information up to 2009. Any sources not operating during most of 2009 were not included in the analysis of the existing conditions and therefore need to be considered in the assessment of future cumulative effects.

Emissions of both NO_x and SO_2 have been reduced in northeast Minnesota by reductions from power generation facilities. However, both power generation facilities and the mining facilities contribute to visibility impairment in the area. As discussed in the *Background on Regional Haze* section above, the MPCA currently has a Regional Haze SIP goal to reduce combined NO_x and SO_2 emissions from northeast Minnesota from 2002 levels by 30 percent by 2018. Current MPCA estimates indicate that emission reductions at power generation facilities and additional reasonably foreseeable projects in northeast Minnesota are not enough to meet the current Regional Haze SIP goal; however, they are on track to meeting the reduction goal. Therefore, additional mitigation or reductions may be necessary.

Even though there is a net increase in PM_{10} for all the proposed projects combined, direct PM_{10} emissions are not considered to be a concern for visibility impairment in the BWCAW or Voyageurs National Park as described in Minnesota's Regional Haze SIP (MPCA 2009a).

Table 6.2-20 Maximum Potential SO_2, NO_x, and Particulate Emissions from the Proposed Projects in the Six-County Project Area CEAA in Comparison to Emission Reductions

Project	City/County	SO_2 (tpy)	NO_x (tpy)	PM_{10}[18] (tpy)	BACT/ MACT[18]
Increases					
Excelsior Energy, Mesaba Energy Project[1]	Taconite or Hoyt Lakes, St. Louis or Itasca County	1,390	2,872	532	Yes
Mesabi Nugget LSDP[2]	Hoyt Lakes, St. Louis County	417	955	587	Yes
Mesabi Mining Project [3]	Hoyt Lakes, St. Louis County	7	298	1,260	Yes
Essar Steel Minnesota LLC (formerly Minnesota Steel)[4]	Nashwauk, Itasca County	421	1,505	1,354	Yes
Essar Steel Minnesota LLC Project Modifications[5]	Nashwauk, Itasca County	146	-69	-90	Yes
Northshore Mining Company, Furnace 5 Reactivation[6]	Silver Bay, Lake County	56	200	149	Yes
PolyMet Mining, NorthMet Project[7]	Hoyt Lakes, St. Louis County	40	473	1,186	No
SAPPI Cloquet[12]	Cloquet, Carlton County	1	162	29	Yes
UPM/Blandin Paper Mill Expansion, Project	Grand Rapids, Itasca County	213	169	-7	Yes

Project	City/County	SO_2 (tpy)	NO_x (tpy)	PM_{10}[18] (tpy)	BACT/ MACT[18]
Thunderhawk[8]					
U. S. Steel Keewatin, Keetac, Expansion[9]	Keewatin, Itasca and St. Louis County	81	35	1,284	Yes
United Taconite Green Production Project[13]	Forbes, St. Louis County	35	35	-10	No[13]
Total Increases		2,807	6,635	6,274	--
Reductions					
Minnesota Power Taconite Harbor Energy Center Unit 2, Emission Control Modifications for SO_2, NO_x and mercury [11]	Schroeder, Cook County	-1,549	-423	--	--
Minnesota Power Laskin Energy Center Unit 2, NO_x Reductions[10][11]	Hoyt Lakes, St. Louis County	0	0	--	--
Minnesota Power Boswell Energy Center Unit 3[11]	Cohasset, Itasca County	-4,224	-6,372	--	--
U. S. Steel Minntac BACT Reductions[15]	Mtn. Iron, St. Louis County	--	-1,973	--	--
Hill Wood Products[14]	Cook, St. Louis County	--	--	-14	--
Northshore Mining Company: BART Reductions[11][17]	Silver Bay, Lake County	-583	-1,159	--	--
United Taconite BART Reductions[11][17]	Forbes, St. Louis County	-1,954	--	--	--
Total Reductions		-8,310	-9,927	-14	--
Net Reductions/Increase		**-5,503**	**-3,292**	**6,260**	--

Prepared January 2012:

1 Emission estimates (Phase I and Phase II) based on emissions used in the air quality analysis in the draft EIS, website: http://nepa.energy.gov/documents/EIS-0382_Mesaba_FEIS_Vol_1.pdf. Accessed on May 5, 2011.

2 Mesabi Nugget's Proposed Large Scale Demonstration Plant (LSDP): No crushing/grinding at the site; receive concentrate from offsite. Technical Support Document for MPCA permit 13700318-003. Included in Northeast Minnesota Plan Project Tracking for MPCA SIP, version 1-20-2011.

3 Preliminary emission estimates Barr Engineering, as of 1/29/2011.

4 Baseline emission from Potential to emit from Technical Support Document for Minnesota Steel (MPCA permit #06100067-002).

5 Project modifications preliminary emission estimates Barr Engineering, emission estimate from EI Spreadsheet submitted to MPCA on 4/5/2011.

6 Northshore Mining's Furnace 5 Project: reactivating 2 crushing lines, 9 concentrating lines, one pellet furnace (Furnace 5); new sources emissions only (MPCA permit #07500003-003). Although construction for the project was completed prior to the January 1, 2009 cut-off date for this analysis, due to plant turnaround and current demand, the furnace has not yet operated at a capacity reflecting the expected increase and is therefore included in this evaluation.

7 PolyMet Mining's Proposed Facility: crushing/grinding of ore, reagent and materials handling, flotation, hydrometallurgical processing, mobile emissions. Emission estimates from Barr Engineering reports dated November 2008 Stationary and Mobile Source Emission Calculations for the NorthMet Project – Combined Report (RS57), submitted to MDNR and updated 3/5/2012.

8 Net Emission Increase from Blandin Project Thunderhawk MPCA permit #06100001-009. No change in emissions for -010 or -011. Note that this project was not built.

9 U. S. Steel Keewatin, Keetac mine expansion and restart of taconite processing line – preliminary emission calculations, Barr Engineering. Submitted to MPCA in May 2011 permit application. NOx emission increase is from the baseline actual emissions used to determine PSD applicability. Although there would be a small increase in actual emissions, there would be a decrease in the allowable emissions.

10 Minnesota Power completed installation of the Low NOx burner system project in Spring 2010. Although actual 2009 emissions already show reductions in excess of the anticipated reductions from 2002 levels, additional reductions are expected to result from the use of the low NOx burners in 2010 and future years. A reduction of zero is used in this analysis because the actual future restrictions are unknown.

[11] Emission estimates provided by the MPCA from the "Northeast Minnesota Plan Emission Tracking Spreadsheet" 1-20-2011. Reductions are the estimated reduction from 2002 emissions minus any reduction in actual emissions that has occurred between 2002 and 2009.

[12] Net emission change estimates from final EAW dated 5/1/2009. Plant expansion, new paper machine, new boiler.

[13] United Taconite Green Production Project – Involves fuel changes and improvements to concentrator and the Line 1 pellet plant to increase pellet production and was a PSD minor project. Because it was a PSD minor project, specific considerations for BACT/MACT were not required. However, the Line 1 pellet plant has an existing wet scrubber to control particulate and SO_2 emission, Emissions estimates are taken from the Technical Support Document of Permit Number 13700113-005 authorizing the project on August 19, 2010.

[14] Net emissions increase from TSD of Air Emission Permit No. 13700030-003.

[15] Reductions calculated based on data in "US Steel Minntac Line 7 Low NOx Main Burner Final Testing Report", May 13, 2011 of 3,990 ton per year goal for NOx emissions and the 2009 actual emissions provided in the MPCA "Northeast Minnesota Plan Emissions Tracking Spreadsheet" 1-20-2011.

[16] PM10 emissions estimates include stationary and fugitive emissions for all sources at a facility.

[17] The MPCA RH SIP is still being reviewed by the USEPA for approval including the recommended BART determinations for affected facilities. Actual BART requirements are pending discussions with the MPCA and have not yet been implemented.

[18] Abbreviations:
tpy = tons per year
BACT = Best Available Control Technology
MACT = Maximum Achievable Control Technology
SO_2 = sulfur dioxide
PM_{10} = particulate matter less than 10 micrometers in size
NO_x = nitrogen oxides
NA = not applicable

Summary of Visibility Cumulative Effects Analysis

The following items outline the results and environmental consequences of the 2011 Visibility Class I Study and newly released IMPROVE data:

1. **Class I Area Visibility Gradually Improving or Showing No Trend.** Between 1992 and 2010, visibility in the BWCAW on the 20 percent worst days showed a downward trend in haze index (improvement in visibility), based on a rolling 5-year average. The trend since 2000 is also of interest because this reflects the timeframe of the regional haze requirements. This trend was assessed based on latest IMPROVE data through 2010. The annual 20 percent best and 20 percent worst haze index values for the BWCAW shows an improved visibility trend from 2005 to 2010. The 5-year averages from 2006 to 2010 are also lower than the baseline averages from 2000 to 2004. The National Park Service has concluded that through 2005, there was not a trend either improving or declining for Voyageurs National Park. Based on the latest IMPROVE data, there is no clear trend for Voyageurs National Park. Although visibility on the 20 percent worst days is improved from 2005 to 2010 (6-year period) for Voyageurs National Park, the 2006 to 2010 rolling 5-year average for the 20 percent worst days is higher than the baseline average (indicating greater visibility impairment for this timeframe). However, for the 20 percent best days, the 2006 to 2010 5-year rolling average shows improvement.

2. **Sulfate and Nitrate Particles Are Largest Contributor to Visibility Impairment.** Ammonium sulfate, ammonium nitrate, and organic carbon matter particulates are the largest contributors to visibility impairment in both Class I areas. The ammonium sulfate and nitrate are due to emissions of SO_2 and NO_x, respectively. Each of these components can be naturally occurring or the result of human activity.

3. **Overall Emissions Decreases in Pollutants that are Precursors to Sulfate and Nitrate Particulates.** When the emissions from the proposed projects in northeast Minnesota are viewed together with the concurrent emission reduction projects of SO_2 and NO_x from power generation facilities in northeast Minnesota, there is a net decrease in emissions of both pollutants in the six-county area of northeast Minnesota. As noted in the Environmental Consequences section above, current MPCA estimates indicate that emission reductions at power generation facilities and additional "reasonably foreseeable" projects in northeast Minnesota are not enough to meet the current Regional Haze SIP goal. Therefore, additional mitigation or reductions may be necessary to reach the 2018 goal.
4. **15 Percent of 2018 Visibility Impairment Projected to be Due to Northeast Minnesota Emissions.** Predictive modeling done in support of the Minnesota Regional Haze SIP shows that Minnesota sources are expected to contribute approximately 30 percent of the visibility impairment at Minnesota's Class I areas and approximately 14 percent of the visibility impairment at Isle Royale (MPCA 2009a). Of the visibility impairment in the Minnesota Class I Areas, Northeast Minnesota sources contribute about half of the total from Minnesota sources or 15 percent overall. The remainder is likely due to sources in other states and Canada. Emissions from Minnesota are the single largest contributor to regional haze at its own Class I areas.
5. **Net Effect from Proposed Projects.** The net effect from the proposed projects, the voluntary reductions of power generation facilities, and the foreseeable regulatory actions shown in Table 6.2-18 would likely reduce emissions of SO_2 and NO_x in Minnesota. However, as addressed above, the MPCA has developed Regional Haze SIP goals to reduce combined NO_x and SO_2 from 2002 levels. The reduction is 20 percent by 2012 and 30 percent by 2018. Based on current projections including the NorthMet Project Proposed Action, the reductions addressed in this section are not projected to be enough to meet the 2018 goal. The reductions would be enough to meet the 2012 goal.

In the event that additional emission reduction measures are required by the MPCA to meet Regional Haze SIP goals, emissions from the NorthMet Project Proposed Action may be included for reduction consideration through the MPCA's Regional Haze Rule and permitting programs.

6.2.3.8.10 Climate Change

As noted in Section 5.2.7, and in this cumulative effects assessment, the construction and operation of the NorthMet Proposed Action would emit gases known to contribute to global climate change. For an in-depth discussion of global climate change, please refer to the Keetac Project EIS published in 2010 (MDNR and USACE 2010). That EIS's cumulative effects assessment provided an exhaustive discussion of the state of scientific knowledge and policy framework regarding global climate change and has been incorporated by reference to this EIS as background information provided by the CEQ regulations (40 CFR 1502.21.)

The Keetac EIS found the following:

- global GHG emissions increased by about 19.6 percent between 1990 and 2004;
- U.S. GHG emissions increased by about 17 percent between 1990 and 2007; and
- Minnesota GHG emissions (for all economic sectors) increased by about 16.2 percent between 1990 and 2006.

It should be noted that for the global figure, a portion of the increase in GHG emissions can be attributed to deforestation and biomass decay. Nevertheless, these numbers show a definite increasing trend in anthropogenic sources of GHGs, which the IPCC has determined is contributing to an increase in global temperatures (MDNR and USACE 2010).

As noted in Section 5.2.7, the NorthMet Proposed Action would directly produce approximately 196,342 mtpy of GHG. Table 6.2-21 shows the amount of GHG that the NorthMet Proposed Action would produce in comparison to global, national, and Minnesota GHG emissions. It shows that the NorthMet Proposed Action's direct GHG emissions would be several orders of magnitude lower than total global, national, and even statewide GHG emissions.

Table 6.2-21 Greenhouse Gas Emissions

	Total GHG Emissions (million mtpy)	Proposed Action GHG Emissions as a Proportion of Total
Global	49,000	0.00038%
National	7,282	0.0026%
Minnesota	159.4	0.12%
NorthMet	0.1963	

Source: Barr 2012s.

Given the minor GHG contribution of the NorthMet Proposed Action to global GHG emissions, it is impossible to predict how much the NorthMet Proposed Action would factor into climate change, as noted in the Keetac EIS on Page 5-35. In general, increased GHG emissions from the NorthMet Project Proposed Action contribute to a cumulative adverse effect on the earth's climate. Based on the science available, there is the potential that climate change could have a significant effect on terrestrial and aquatic systems and economies worldwide. However, determining the significance of any single project is beyond the capabilities of current science.

6.2.3.8.11 Potential Cumulative Inhalation Risk Assessment

A cumulative risk assessment was conducted to assess the estimated potential cumulative inhalation risk to a potential resident receptor which included background, non-Project air emissions. Potential projects considered for inclusion in the cumulative risk analysis were those within about 10 kilometers (about 6 miles) of the NorthMet Project Proposed Action and included the Mesabi Mining Project for particulate metals and NO_2 and the Minnesota Power Laskin Plant for NO_x

A summary of the maximum estimated potential cumulative inhalation risk to a potential resident receptor from background exposure (calculated by the MPCA from ambient air monitoring data), non-NorthMet Project Proposed Action air emissions (Mesabi Mining Project and the existing Minnesota Power Laskin Plant), and NorthMet Project Proposed Action air emissions (the incremental risk estimated from the Mine Site and the Plant Site) are summarized in

Table 6.2-22. The estimated cumulative risk is compared to the incremental risk guideline values for a single facility or project, since there are no guideline values for cumulative risk, and is intended to provide a broad context for reviewing the results.

The potential incremental risk from the NorthMet Mine Site and Plant Site together contribute about 57 percent of the estimated potential cumulative acute risk. Total cumulative inhalation acute risk does not exceed the incremental acute risk guideline value of one. Potential incremental risk from the NorthMet Mine Site and Plant Site accounts for only 7 percent of the estimated potential total cumulative chronic noncancer risk. Potential cumulative noncancer chronic risks do not exceed the incremental chronic noncancer guideline value of one and are predominately from risks based on monitored background air concentrations. Potential incremental risk from the NorthMet Mine Site and Plant Site accounts for only 9 percent of the estimated potential total cumulative cancer risk (4E-05). Cancer risk from monitored background air concentrations (3E-05) is greater than the incremental cancer risk guideline value of 1E-05, thus cumulative risk is also above this value.

Table 6.2-22 Summary of Cumulative Inhalation Risks

Estimated Potential Inhalation Risk[1]	Cancer	Noncancer Chronic	Noncancer Acute
Background[2]			
Ambient Air (calculated by MPCA)	3E-05	1	0.4
Laskin Energy Center	NA	NA	0.01
Total Background	3E-05	1	0.4
Incremental[3]			
Mine Site and Plant Site	3E-06	0.1	0.6
Mesabi Mining Project	NA	0.1	0.02
Total Incremental	3E-06	0.2	0.6
Cumulative[4]			
Total Cumulative Inhalation Risk	4E-05	1	1
Report Calculated Values as Percentages	0.9	0.7	57

Source: Supplemental Air Emission Risk Analysis – Plant Site (Barr 2013k).

[1] The maximum potential cumulative risk represents the highest risk from the four receptors evaluated in the supplemental analysis for the Plant Site (Barr 2013k).
[2] Background risks were calculated by the MPCA based on MPCA 2008-2010 monitoring data from Virginia, Ely and Cloquet.
[3] As per USEPA (2005) HHRAP guidance, all reported risk values are rounded to one significant digit. Totals, however, are calculated from unrounded values (i.e., two or more significant figures) and may differ from the value obtained by adding the rounded values shown in the table.
[4] LSDP = Large-Scale Demonstration Plant (Mesabi Nugget).

6.2.3.9 Noise and Vibration

As described in Section 5, there would be a long-term increase in the levels and duration of noise above ambient levels throughout the construction, operation, and reclamation period in the vicinity (approximately 0.5 mile) of the Mine Site and Plant Site. There are no other past, present, or reasonably foreseeable actions within the half mile radius of the Mine Site and Plant Site that would interact in such a way as to have a cumulative effect on the receptors identified in Sections 4 and 5, and no further evaluation of cumulative noise effects has been conducted.

6.2.3.10 Cultural Resources

The cumulative effects analysis for cultural resources focuses on past, present, and potential future effects on historic properties and 1854 Treaty resources. This section provides a qualitative analysis of cumulative effects on historic properties eligible for listing on the NRHP, as well as 1854 Treaty resources. The approach to the analysis of cumulative effects on historic properties and 1854 Treaty resources has been informed through discussions and consultation between the Co-lead Agencies and the Bands.

6.2.3.10.1 Approach

Cumulative effects on cultural resources were assessed by evaluating the effects of the NorthMet Project Proposed Action in conjunction with other past, present, and reasonably foreseeable future federal, state, and private actions within the CEAA for cultural resources. The cumulative effects on cultural resources are described below in Section 6.2.3.10.2. The baseline conditions of cultural resources, as directly and indirectly affected by past actions, are described in Section 4.2.9, and direct and indirect effects from the NorthMet Project Proposed Action are described in Section 5.2.9.

Assessment of effects on cultural resources is done specific to the cultural resources identified within the CEAA. Although cultural resources surveys have been conducted within the Project area, no cultural resource surveys for the entire CEAA have been completed (cultural resource surveys are conducted on a project-by-project basis reflective of an individual project area. For cumulative effects analysis areas, generally the areas are too large and expansive to warrant a Section 106 equivalent cultural resources field survey. In such cases, therefore, a cumulative effects analysis is performed using a quantitative analysis of the cumulative effects analysis area for comparison purposes.). Section 4.2.9 provides background information on existing conditions as a result of field surveys and investigations; however, there is no similar level of data specific to the entire CEAA to allow an impact assessment comparable to the one found in Section 5.2.9. Therefore, cumulative effects on cultural resources were analyzed qualitatively according to cultural resource types typically found within the CEAA.

Cultural resources may be destroyed by erosion, construction, excavation, data collection, and looting; through the removal of artifacts from their surrounding contexts, moving the material such that it loses context; or through the removal or redeposition of artifacts and their surrounding context to another location. Cultural properties—including camps, structures, hunting and fishing sites, graves, and areas of particular religious or traditional importance—lose their integrity, and thus their potential eligibility for the NRHP, when they become degraded as a result of natural or human disturbance processes, or when the groups, such as the Ojibwe Bands, who value these places, can no longer access them, thus losing their cultural connection to the site or place over time.

The determination of effects for cultural resources is based on a resource's eligibility for inclusion on the NRHP. It should be noted that the NRHP status of some cultural resources within the proposed CEAA remain undetermined, and surveys would be required to determine if these resources would be eligible for inclusion in the NRHP. Effects on cultural resources listed in the NRHP, considered to be eligible for listing in the NRHP, or identified but unevaluated would be avoided or mitigated to the degree practicable as required by Section 106 of the NHPA of 1966 during implementation of federal undertakings. For all cultural resources listed in the

NRHP, considered to be eligible for listing in the NRHP, or unevaluated, avoidance would continue to be the preferred mitigation strategy. For any historic properties unavoidably and adversely affected by a proposed project, mitigation measures would be developed as part of a Treatment Plan for that project.

In determining how the Bands have traditionally conducted their usufructuary rights on or near the NorthMet Project area, interviews of individual Band members of Bois Forte, Fond du Lac, and Grand Portage were conducted. Only the results of interviews with Bois Forte were made available. There is little specific information concerning the use of natural resources by the Bands in the NorthMet Project area. This likely reflects limited subsistence gathering in the NorthMet Project area due to general inaccessibility. This lack of data also precludes the quantitative analysis of how Band members would be affected socioeconomically by effects on 1854 Treaty resources, as discussed in Section 5.2.10. The primary source of data for assessing effects from the NorthMet Project Proposed Action on 1854 Treaty resources is from the analysis of the environment discussed in detail in Section 4.2.9 of this EIS.

6.2.3.10.2 Cumulative Effects Assessment Area

The NorthMet Project Proposed Action's CEAA for cultural resources is described below, both spatially and temporally.

Spatial

The CEAA for cultural resources is defined as the area of the Mesabi Iron Range that is within the 1854 Ceded Territory (see Figures 6.2.2-1 and 1-1). The area has been limited to the Mesabi Iron Range as it is a definable region encompassing the region's mining, which represents the largest and most influential land use within a reasonable distance from the NorthMet Project area. Additionally, the area is further limited to the 1854 Ceded Territory as it is an area of cultural importance to the Bands.

Temporal

This evaluation includes a qualitative discussion of land use and public resource management developments within the 1854 Ceded Territory since the development and use of timber/mineral resources began as a result of European settlement in the area, from roughly the 1850s on.

6.2.3.10.3 Cumulative Actions

This assessment includes direct and indirect cumulative effects on cultural resources associated with current and foreseeable actions listed below. The following reasonably foreseeable projects, described in Section 6.2.2, are included in the cumulative effects assessment for cultural resources:

- ArcelorMittal Mines (Laurentian and East Reserve Mines),
- Community growth and development,
- Forestry practices (regional),
- LTVSMC,
- Mesaba Energy Project – West Range Site (Preferred Alternative near Taconite, Minnesota),

- Mesaba Energy Project – East Range Site (Alternative Site near Hoyt Lakes, Minnesota),
- Mesabi Nugget and Mesabi Mining Project,
- Northshore Mine,
- Road construction and expansion projects (regional), and
- U.S. Steel Minntac Mine and Processing.

6.2.3.10.4 Cumulative Effects Assessment

The NorthMet Project Proposed Action would result in both direct and indirect effects on historic properties and culturally important resources. The historic properties affected by the NorthMet Project Proposed Action are part of a thematically related group of properties associated with Ojibwe land use patterns. Cumulative effects on natural resources of cultural significance to the Bands are addressed in more detail in the specific natural resources sections and are only summarized in this section.

Cumulative effects on historic properties may be both direct and indirect and result in the physical loss of properties or changes to location, setting, design, materials, craftsmanship, feeling, or associations. Similar to the analysis of the direct and indirect effects of the NorthMet Project Proposed Action, analysis was conducted for the cumulative effects on historic properties and natural resources of significance to the Bands. Cumulative effects were assessed by evaluating the effects of the NorthMet Project Proposed Action with other past, present, and reasonably foreseeable future federal, state, tribal, and private actions.

There have not been comprehensive cultural resource surveys of the defined CEAA. However, given the nature of the properties affected (i.e., a thematic group of properties associated with Ojibwe land use patterns), and the geographically extensive nature of the specific properties affected, it is possible to discuss qualitatively cumulative effects on those properties. For the purposes of this cumulative effects discussion, it should be understood that the *Mesabe Widjiu* runs the length of the Mesabi Iron Range and is not confined to the 1854 Ceded Territory.

Past Actions

The Ojibwe called the hills *Missabe*, the “sleeping giant”—land that lay undisturbed for millennia until the demand for iron drew prospectors to the area in the 1800s. On the Mesabi Range, stretching 100 miles from Grand Rapids to Babbitt, soft ore lay close to the surface, where it could be scooped from open pit mines. Prospectors came to Lake Vermilion in the 1860s to search for gold (Lamppa 2004). It was the discovery of iron ore on the Vermilion Range, however, that led vast tracts of land to be purchased (Risjord 2005). Explorations in 1890 by the Merritt brothers of Duluth—known as the “Seven Iron Men”—laid the groundwork for their Mountain Iron Mine, which marked the opening of the great Mesabi Range. Their second mine, opened at Biwabik in 1891, secured the Mesabi Range’s future legacy in rich hematite ore. The Merritt brothers’ railroad, the Duluth, Mesabi & Northern, carried its first carload of ore in 1892 to ore docks in Superior, Wisconsin, across the bay from Duluth, itself a major shipping port (Minnesota Historical Society 2008). A decade later, the Mesabi Range boasted over 100 open pit mines. From 1900 to 1980, the Mesabi Range contributed about 60 percent of the country’s total iron ore output. Production peaked in the 1940s, when about 600,000,000 tons were shipped to serve the nation’s needs during World War II. Production remained high in the

1950s, and then began to decline. It had taken less than 100 years for industrial demand to deplete the supply of high-grade ore (Risjord 2005).

In addition to the mining industry, thick forests of pine, fir, spruce, cedar, birch, and aspen covered much of what is now the Mesabi Range when the first Europeans arrived in Northern Minnesota. In the early 1860s, sawmills in Duluth, Superior City (modern-day Superior), and Beaver Bay found a growing market for timber, shipping lumber to other towns on the Lake and beyond. By 1870, there were 207 saw mills in Minnesota. In 1877, a law allowing sale of timber off state lands further opened the state for logging. The logging boom had tapered off by the early 1900s (Risjord 2005).

Both the mining and logging industries would forever change the relatively pristine environment that existed at the time of contact between Native Americans and Europeans in the mid-1600s. The historic effects of these industries, prior to the development of historic preservation legislation in the 1960s (i.e., prior to NHPA), occurred with little analysis of cultural resource effects. Areas logged (such as past forestry practices), mined (such as the LTVSMC), roaded (such as past road construction and expansion projects), or otherwise subjected to extensive ground disturbance (such as past community growth and development) resulted in undocumented and unregulated effects on cultural resources. Cultural properties tend to degrade over time due to natural forces; however, many survive for hundreds or thousands of years. Modern human activity tends to exacerbate the damage and as a consequence cultural resources are being damaged and disappearing at an increasing rate. Many of the recorded cultural resources in the CEAA exhibit effects as a result from modern use of the land. Cultural resources are likely to have sustained damage from previous mining, logging, road construction, recreation, wildfires and erosion resulting from these activities. Although difficult to quantify, the paucity of artifacts at some sites may be due to removal by artifact collectors.

Many specific use areas exist, or have existed, along the *Mesabe Widjiu.* Throughout the length of the Mesabi Iron Range, which includes a large portion of the *Mesabe Widjiu*, the setting and associated use areas have been affected by alterations to the landscape brought about by mining, community growth, road construction, and logging. Use of the *Mesabe Widjiu* and surrounding areas has changed as past development mines expanded and consumed areas once used by the Ojibwe. The setting of the *Mesabe Widjiu* and the association of the use areas and trails with the *Mesabe Widjiu* contribute to its significance.

Along the *Mesabe Widjiu* exists an interconnected system of trails, as discussed in Section 4.2.9. Some of the trails are documented in the GLO surveys and some have no specific information available, but are shown on historic maps. Past mining operations have directly affected this trail system and are visible along parts of these trails. Past mining operations, therefore, have affected the setting that was otherwise largely unchanged at the time of contact between Native Americans and Europeans in the mid-1600s.

The specifics of cumulative effects on historic properties of traditional religious and cultural significance to the Ojibwe Bands are relatively unknown throughout the CEAA. However, historic documentation and oral history, as demonstrated through the Band member interviews conducted for the NorthMet Project Proposed Action, document Ojibwe occupation and use of the area throughout the CEAA. The Bands have ancestral ties to the CEAA and the Trygg Maps document a trail system and occupation sites at the time of the United States GLO surveys in the mid- to late 1800s. Landscapes such as the *Mesabe Widjiu* are part of Ojibwe oral history and

traditional practices. From the signing of treaties in the 19th century to the expansion of mining operations today, mining activities in the Mesabi Iron Range likely have had substantial cumulative effect on historic properties of traditional religious and cultural significance to the Ojibwe Bands; however, the details concerning these effects are not well understood.

Current and Future Actions

Known or newly identified cultural resources, as part of current and future projects, are evaluated for their eligibility for listing on the NRHP based on their integrity at the time of documentation and evaluation. The combination of the implementation of an Unanticipated Discovery Plan (minimizing effects on unknown cultural resources that may be inadvertently encountered), as well as associated mitigation measures, and/or a Treatment Plan would mitigate cumulative effects on cultural resources. As discussed in Sections 4.2.9 and 5.2.9, identified cultural resources would be evaluated and avoided or minimized to the degree practicable as required by Section 106 of the NHPA during implementation of the NorthMet Project Proposed Action. Although continued current development could affect cultural resources, considerations such as these conducted through the NEPA and NHPA processes would help to mitigate many of the effects caused by currently proposed projects. However, cumulative effects on cultural resources could include reasonably foreseeable incremental effects in the form of unauthorized artifact collection and inadvertent disturbance in the CEAA caused by increased human activity.

Potential current and future effects from projects, such as the ArcelorMittal Mines, Essar Steel Project, Mesabi Nugget and Mesabi Mining Project, Northshore Mine, and U.S. Steel Minntac Project, would largely be grouped by similar types of direct and indirect impacts. Generally, these types of large mining and energy projects are going to have similar direct and indirect effects, although how they affect the significance of that property (i.e., the reason for their potential eligibility in the NRHP) could be different. It is important to note that, while the Mesaba Energy projects are outside of the CEAA, they are located immediately adjacent to it. Because many historic properties of traditional religious and cultural significance are not as readily documented for the cultural resources practitioner and the physical boundaries of properties, such as *Mesabe Widjiu*, for example, generally consist of a subjective boundary-based social, cultural, or traditional perceptions or perspectives of the property, these projects will be included within the CEAA for analysis purposes. Larger categories of current and future regional projects, such as forestry practices, road construction and expansion projects, and community growth and development would not generally be expected to have unmitigated adverse impacts to historic properties due to the requirements of Section 106 of the NHPA for federal undertakings and various other local and state historic preservation requirements. There could be effects to historic properties, however, due to projects occurring on private lands where no local, state, or federal permits are required.

Landscape properties can be exposed to a number of potential direct and indirect effects. Not all effects to a landscape property, such as *Mesabe Widjiu*, will result in an adverse effect. For instance, larger landscape properties may allow for changes in landscape to a non-contributing portion of the property or minor changes to the landscape or setting. Factors to consider would include the scale of the landscape, the prominence of the affected elements, the magnitude of the proposed project, and the permanency of the change.

For large-scale natural landscapes, such as the *Mesabe Widjiu*, the relationship of landscape characteristics and integrity is complex, as discussed in Section 4.2.9 and 5.2.9. As is the case in

Northern Minnesota, the compatibility of the *Mesabe Widjiu* and historic and modern mining presents change, an inescapable part of any landscape. In the case of the *Mesabe Widjiu*, direct impacts can come from new construction or incompatible land uses, such as modern logging, mining, growth or development of commercial or residential areas, transportation construction, or other activities that reshape the land or disturb significant aspects of the landscape.

For the *Mesabe Widjiu*, setting is an essential component of its use by Band members. Once pristine in nature, peacefulness and solitude contribute to its cultural significance as a traditional and sacred location. Indirect effects outside the *Mesabe Widjiu's* boundaries can constitute intrusions when such changes introduce incompatible visible, audible, or atmospheric elements. Ultimately, such effects could result in an interruption in the continuity of its historic integrity or use. More directly, changes in land ownership or segregation of the landscape or a specific use area could result in inaccessibility for Band members to experience the property for the very factors that made it eligible.

In the case of Native American trails, anticipated direct and indirect effects would come in the form of continuing segmentation and disassociation of once-related sites and resources. In particular, changes to the trail system due to expanded mining operations, would also have residual effects on this and potentially other cultural resources. Visual effects on these trails would also continue indefinitely and are considered to be cumulative, as well. There would also be continued cumulative visual intrusions (shape of the landscape) and noise effects on this type of cultural resource, as the NorthMet Project Proposed Action and other current and future projects are visible along the trails.

Direct and indirect effects on the Sugarbush and other more finite historic properties of traditional religious and cultural significance would be similar to those described above for the *Mesabe Widjiu* and Native American trails. In addition to those mentioned above, effects could result from increases in human access leading to subsequent disturbance (e.g., looting, vandalism, and trampling) of historic properties and features. These effects could result from the establishment of corridors or facilities in otherwise intact and inaccessible areas, or increased human access. Additionally, historic properties with natural resources components, such as the Sugarbush, could be exposed to other indirect effects such as those related to water, air, and invasive species.

Additionally, within the CEAA, there are significant historic mining properties that have both archaeological and structural components. Reuse of the Erie Mining Company Concentrator Building and Railroad as part of the NorthMet Project Proposed Action are examples of known mining properties that exist and would be affected within the CEAA. A mining landscape still being worked may retain integrity if modern extraction methods and character are similar to those practiced historically, important physical elements remain, and comparable properties are less intact. Continued use of a property also may destroy it, such as modern mining, which obliterates all traces of earlier mining activity. Continued mining on the Mesabi Iron Range has and would continue to eliminate, or alter, the landscape or structures resulting from prior mining activity, which may qualify for the NRHP. This is a cumulative effect of mining on historic mining properties that is inherent in the mining industry itself.

1854 Treaty Resources

Given the broad range of resources under the term "1854 Treaty resources," the reader should reference the appropriate natural resource sections for detail regarding cumulative effects on specific natural resources of concern.

As discussed in Section 5.2.9.2.2, the NorthMet Project Proposed Action could have effects on 1854 Treaty resources, that is, those plant and animal species that are traditionally or culturally important to the Bands. Band members' use of the NorthMet Project area, and the entire CEAA, is not well-defined through research, and did not emerge through interviews. Construction and operation of the NorthMet Project Proposed Action and other past, present, and reasonably foreseeable future projects are not likely to reduce overall availability of 1854 Treaty resources that are typically part of subsistence activities in the 1854 Ceded Territory. However, noise and other consequences of operations could affect migration or other animal species behavior.

Additionally, the NorthMet Project Proposed Action could affect the availability of 1854 Treaty resources for some Band members through increased bioaccumulation of mercury in fish tissue, including species associated with subsistence. Effects on the environment, including those from increased mercury, are all expected to meet the standards and regulations set forth by the appropriate state or federal agency or program. These laws are intended to protect important natural and cultural resources and include but are not limited to the ESA, the CWA, and the CAA. Effects on 1854 Treaty resources are difficult to quantify when the effects are within environmental standards yet above current baseline conditions. As such, cultural effects on the Bands would be difficult to quantify in regards to such incremental increases below standards or effects on species where appropriate mitigation is used.

6.2.3.11 Socioeconomics

Socioeconomics includes demographic characteristics of population, employment, income, market composition, public finance, housing, public services, and the economic characteristics of subsistence activities. The cultural aspects of subsistence, specifically for Native American populations, are discussed in the Cultural Resources section of Chapter 5. Individual subsistence products (e.g., wild rice, game animals, etc.) are discussed in appropriate resource-specific sections.

The assessment found that, while the NorthMet Project Proposed Action and other past, present, and reasonably foreseeable future actions would generate economic activity within the CEAA, the combined actions would not cause cumulative socioeconomic effects.

6.2.3.11.1 Approach

As discussed in Chapter 5, many of the socioeconomic effects of the NorthMet Project Proposed Action—such as increased population, housing demand, and effects on public facilities and services—are functions of the jobs and revenue that the NorthMet Project Proposed Action would create, as modeled using IMPLAN. Conclusions in this analysis were drawn using readily available data for the cumulative actions under consideration and IMPLAN estimations for the NorthMet Project Proposed Action.

Evaluation of socioeconomic cumulative effects is based largely on the number of new full-time (or full-time equivalent) jobs created by operation of the cumulative actions. While specific

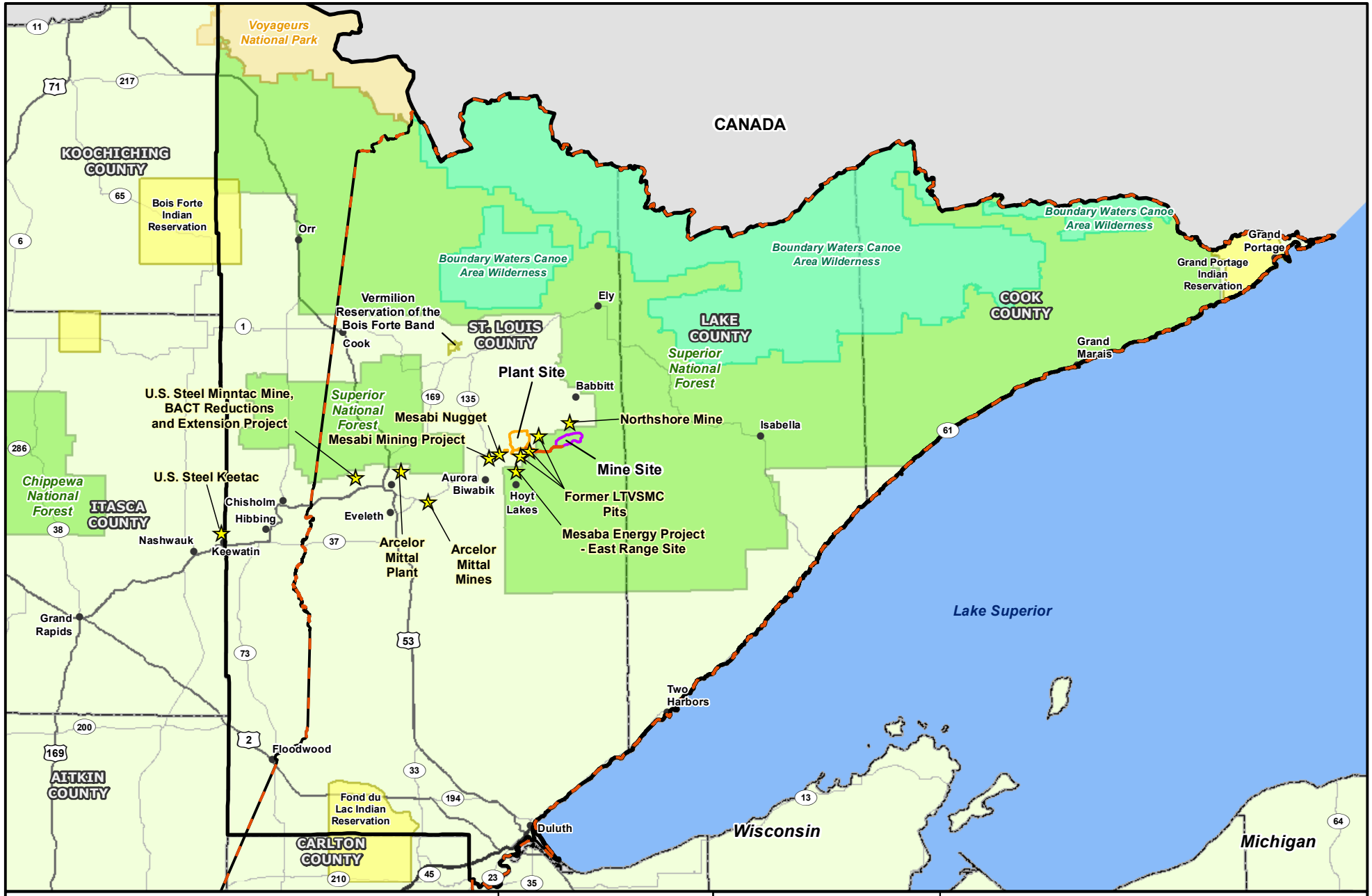
factors may vary, other socioeconomic effects (earnings, value added, demand for housing and community services, etc.) are presumed to vary proportionally with employment changes.

6.2.3.11.2 Cumulative Effects Assessment Area

Spatial

The CEAA for socioeconomics includes effects associated with the NorthMet Project Proposed Action, combined with other industrial (including mining) projects located within the portion of the Mesabi Iron Range encompassed by St. Louis, Lake, and Cook counties (see Figure 6.2.3-6). As with the NorthMet Project Proposed Action (see Section 5.2.10), iron, taconite, and precious metal mining in the Mesabi Iron Range have helped to define the region's socioeconomic conditions for decades. While mining activity has decreased greatly from its peak in the middle of the 20th century, it remains an important economic factor.

Tourism and other economic activity associated with the region's high-quality recreation and natural areas (such as BWCAW) are also important economic and land use drivers. These economic contributions are based largely on socioeconomic preferences (e.g., retirees choosing to live in the region to be close to recreational resources), rather than definable projects or activities. The CEAA for socioeconomics includes many of the largest and most important recreational and tourist resources in northeastern Minnesota.



Assessment Area
Mine Site
Plant Site
Transportation and Utility Corridor
Cumulative Actions See Table 6.2-1
1854 Ceded Territory
Native American Reservation
Boundary Waters Canoe Area Wilderness
National Forest
National Park

US Army Corps of Engineers St. Paul District

N W E S

0 5 10 20 Miles

Figure 6.2.3-6
Socioeconomics Cumulative Effects Assessment Area
NorthMet Mining Project and Land Exchange SDEIS
Minnesota

November 2013

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Temporal

This evaluation focused on the existing and anticipated future use of the CEAA. Because mining and public resource management (including recreation and natural resource tourism) have been the primary drivers defining regional socioeconomic development within the CEAA for over 100 years, existing conditions are considered indicative and representative of historical mining and resource management activities.

6.2.3.11.3 Past, Present, and Reasonably Foreseeable Future Actions

For the purposes of this assessment, cumulative actions are those current and permitted mine projects located in the portion of the Mesabi Iron Range within St. Louis, Lake, and Cook counties. The socioeconomic effects of the region's recreation and tourism resources are discussed in Section 5.2.10, and no specific cumulative actions or activities related to these resources have been identified. These projects, described in Section 6.2.2, are listed below.

- ArcelorMittal Mines (Laurentian and East Reserve Mines),
- Mesaba Energy Project – East Range Site,
- Mesabi Nugget and Mesabi Mining Project,
- Northshore Mine,
- U.S. Steel Keetac (in Keewatin), and
- U.S. Steel Minntac Mine and Processing.

The locations of these actions relative to the NorthMet Project Proposed Action are shown on Figure 6.2.3-6.

6.2.3.11.4 Cumulative Effects Assessment

Table 6.2-23 summarizes the anticipated cumulative effects of the NorthMet Project Proposed Action and cumulative actions. Existing studies, approved NEPA documents, and other information about the cumulative actions did not include detailed economic modeling—such as the IMPLAN model conducted for the Proposed Action. As shown in Table 6.2-23, these existing documents do estimate direct employment from some of the cumulative actions, but there are no substantive data or estimates of output and value added (as defined in Section 5.2.10.1). As a result, much of the analysis in this section is largely qualitative in nature.

Table 6.2-23 Summary of Socioeconomic Cumulative Effects

Project	Temporal Scale	New Direct Employment	
		Construction	Operation
NorthMet Project Proposed Action[1]	Future	764	360
ArcelorMittal Mines (Laurentian and East Reserve Mines)	Future	0	0
Mesaba Energy Project – East Range Site[2]	Future	1,067	182
Mesabi Nugget	Future	Undetermined	Undetermined
Mesabi Mining Project[3]	Future	250	220
Northshore Mine	Future	0	0
U.S. Steel Keetac (in Keewatin)[4]	Future	500	170
U.S. Steel Minntac Mine, Expansion Project	Future	Undetermined	0
Total, Cumulative Projects Only		**1,817**	**572**

Notes:

[1] Operations employment reflects typical year of operations.
[2] Construction employment includes future year (2012 and 2013) estimations only.
[3] Indicates the maximum typical construction employment.
[4] Reflects peak of 4-year construction period.

Construction of the above-mentioned projects would generate approximately 1,817 new jobs directly in the CEAA, 2 percent of the total existing study area employment. Given the timing of these projects, the effects are likely to be experienced across different geographies over time.

The operational phases of the cumulative actions would generate approximately 572 new jobs in the CEAA, about one percent of the area's total current employment. Including indirect and induced employment, this figure could triple (based on multipliers associated with the NorthMet Project Proposed Action), resulting in approximately 1,716 total new jobs. Added to the NorthMet Project Proposed Action, cumulative effects on employment could surpass 2,700 total new jobs in the three-county study area.

Earnings and value added from the cumulative actions would likely be generated at a lower rate (per new employee) than the NorthMet Project Proposed Action, in part because the Mesaba Energy Project would not generate the same type of taxes listed in Section 5.2.10 and other revenue. Nevertheless, as an order-of-magnitude estimate, the economic contribution of the cumulative actions, together, would likely match (and could exceed) that of the NorthMet Project Proposed Action.

Demand for housing and public services due to the cumulative actions would also likely match that of the NorthMet Project Proposed Action, although these demands would likely occur in cities and towns not evaluated in Section 5.2.10, such as Mountain Iron, Chisholm, and cities in other counties to the west, which would be in commuting distance to the cumulative actions, but that are not within commuting distance of the NorthMet Project Proposed Action. As of 2011, there were approximately 700 vacant, non-seasonal housing units in Itasca County (as well as 6,900 seasonal units, some of which could conceivably be converted or marketed for full-year use).

As with the NorthMet Project Proposed Action, some portion of these new employees are likely to already be residents of the CEAA, while some indirect and induced jobs may be filled by spouses or children of cumulative project employees. By comparison, St. Louis and Itasca counties have approximately 245,000 residents and 130,000 housing units (vacant and occupied) (US Census Bureau 2010b). Increases in population and housing demand to the cumulative

actions would likely represent less than one percent of these figures. Such increases would not likely strain overall service capacity in the region due to existing capacity (see Section 5.2.10), but could create localized pressures on housing markets or public service agencies.

The cumulative actions would all occur in areas already affected by mining (except for the Mesaba Energy Project, which would affect essentially the same area as the NorthMet Project Proposed Action), and many are, in fact, expansions of previous mining projects. These projects are largely on private land already zoned or otherwise designated for such activities. While EJ effects could occur on properly zoned land, there is no evidence that these cumulative actions would generate EJ effects associated with economic factors.

Increases of mercury in waterbodies from the NorthMet Project Proposed Action are discussed in section 5.2.2.3.4, and cumulative increases are discussed in Section 6.2.3.3.4. Cumulative increases in mercury concentrations and the resultant increased mercury concentrations in fish tissue could constitute an EJ impact for Band members and other subsistence consumers of fish.

6.2.3.12 Recreation and Visual Resources

The NorthMet Project Proposed Action (including the Mine Site, Transportation and Utility Corridor, and Plant Site), occupies 6,454.4 acres of land near Hoyt Lakes and Babbitt, in St. Louis County, Minnesota. This includes public lands in the Superior National Forest, as well as private lands within the municipal boundaries of Hoyt Lakes and Babbitt.

6.2.3.12.1 Approach

The cumulative actions are evaluated to determine whether they would directly affect recreational lands or activities, or whether they would cause direct or indirect changes in recreational patterns or views on a regional scale.

6.2.3.12.2 Cumulative Effects Assessment Area

Spatial

The CEAA for recreation and visual resources includes the portion of the Mesabi Iron Range within St. Louis County (see Figure 6.2.2-1). The Mesabi Iron Range encompasses the region's mining activity, which has the greatest potential to affect recreational resources and activities.

This analysis also recognizes the Arrowhead Region's substantial existing high-quality recreational resources, such as BWCAW, Voyageurs National Park, and Superior National Forest. Changes in recreational activity associated with these sources are typically associated with socioeconomic preferences (e.g., increased population and/or changes in recreational preferences and patterns).

Temporal

This evaluation focused on existing and anticipated future activities that would affect recreation and visual resources within the CEAA. Existing conditions are considered indicative and representative of historical mining and resource management activities. Some additional qualitative consideration has been given to the pre-historic viewshed conditions documented by regional tribes in their cultural and religious teachings.

6.2.3.12.3 Contributing Past, Present, and Reasonably Foreseeable Actions

As noted previously, it is not possible to identify all past activities that may contribute to a cumulative effect. Similarly, all present activities would continue to affect the environment. The impacts of these combined activities are described in Chapter 4, Affected Environment. Activities included with the NorthMet Project Proposed Action for the assessment of cumulative effects are shown on Figure 6.2.2-1 and described in Section 6.2. Activities specifically associated with potential cumulative effects on recreation include permitted mines and other projects in portions of the Mesabi Iron Range in St. Louis County where future activities would likely be different from current activities. These projects include:

- ArcelorMittal Mines,
- Mesaba Energy Project – East Range Site,
- Mesabi Mining Project,
- U.S. Steel Keetac Mine Expansion Project (in Keewatin), and
- U.S. Steel Minntac Mine, Expansion Project.

6.2.3.12.4 Cumulative Effects Assessment

The cumulative actions described in Section 6.2.3.12.3 are largely existing, expanded, or reconfigured mines on private land, totaling approximately 2,650 acres. Sources for the data regarding cumulative actions include MDNR and USACE 2007, USDOE and MDC 2007, and MDNR and USACE 2010.

Recreation

None of the cumulative actions would directly affect recreational lands such as local or state parks. The public's enjoyment of recreational activities in the region—such as hunting, fishing, boating, hiking, and winter sports—is tied in part to visual resources, as well as to factors such as the availability and quality of fish and other aquatic species, vegetation, and wildlife (particularly game species), noise, air quality, water quality, and wetlands. Direct and indirect effects on these resources are presented in their respective sections in Chapter 5.

The cumulative actions would all occur on or in close proximity to existing or previously mined land. Excluding effects related to noise, fisheries, air quality, and other effects described elsewhere in Chapters 5 and 6, and given the proximity of active and past mining and industrial activity to high-quality recreational activity in the Arrowhead Region (such as the BWCAW), there is no evidence that the activities as part of the NorthMet Project Proposed Action, in and of themselves, would directly affect the public's ability to hunt, fish, and conduct other recreational activities, or affect their overall recreational experience in the Arrowhead Region as a whole.

Visual Resources

Changes in visual conditions associated with the cumulative actions are expected to be comparable to those described for the NorthMet Project Proposed Action in Section 5.2.11.2.1. Whereas portions of the NorthMet Project Proposed Action would occur on previously unmined land, the mining-related cumulative actions would occur in areas where mine pits and processing facilities are already part of the visual landscape. The Mesaba Energy Project would introduce a

new industrial element to the undeveloped landscape between Hoyt Lakes and the Plant Site. New visual elements associated with this project would include cooling towers and other structures, security lighting, warning lights, and plumes of water vapor from cooling towers (USDOE and MDC 2007).

Whereas the mining activities included in the cumulative actions would only be visible from limited viewpoints (as is the case with the NorthMet Project Proposed Action), the structures and plumes associated with the Mesaba Energy Project would likely be visible from a greater distance, including portions of Superior National Forest, Colby Lake, and the Town of Hoyt Lakes.

6.2.3.13 Wilderness and Other Special Designation Areas

6.2.3.13.1 Approach

The Mine Site, Plant Site, and surrounding federal lands are not located within or adjacent to any wilderness areas, nor are there any special designation areas within or adjacent to the NorthMet Project area. For the purposes of analysis, the study area is an approximate 25-mile radius of the NorthMet Project area as described below (see Figure 4.2.12-1).

For the purposes of this analysis, the term “wilderness” is defined by the Wilderness Act of 1964 (Public Law 88-577) (16 USC §1131–1136). Other special-designated areas are identified by Presidential Designation, Congressional Designation, or Administrative Designation and define lands that are considered to have remarkable ecological, paleontological, historic, scenic, recreational, geologic, or fish and wildlife value. They include wilderness areas, wilderness study areas, research natural areas, national scenic or historic trails, wild or scenic rivers, unique biological areas, national natural landmarks, national historic landmarks, and national monuments, among others. They fall under the management jurisdiction of the federal land management agencies, including the MDNR, USFS, National Park Service, and USFWS.

Designated Wilderness Areas within the study area:

- BWCAW – 20 miles north of the NorthMet Project area.

National Park System Units within the study area:

- Voyageurs National Park – 50 miles northwest of the NorthMet Project area.

State Parks within the study area:

- Soudan Underground Mine State Park – 18 miles west of the NorthMet Project area,
- Lake Vermilion State Park – 16 miles northeast of the NorthMet Project area,
- Bear Head Lake State Park – 11 miles northeast of the NorthMet Project area, and
- Iron Range Off-Highway Vehicle State Park – 17 miles northeast of the NorthMet Project area.

Established and Candidate Research Natural Areas (cRNAs) within the study area:

- The Big Lake-Seven Beavers Area – 12 miles east of the NorthMet Project area,
- Keeley Creek Natural Area – 25 miles northeast of the NorthMet Project area, and

- Dragon Lake – 25 miles east of the NorthMet Project area.

Unique Biological Areas (UBAs) within the study area:

- Little Isabella River – 25 miles east of the NorthMet Project area and
- Harris Lake National Natural Landmark – 20 miles northeast of the NorthMet Project area.

National Historic Landmarks within the study area:

- Soudan Iron Mine –18 miles northwest of the NorthMet Project area.

Scenic Byways within the study area:

- Superior National Forest Scenic Byway – a portion of the trail is 9 miles southwest of the NorthMet Project area.

Designated Recreation Trails within the study area:

- Taconite State Trail – a portion of the trail is 15 to 17 miles north of the NorthMet Project area.

The cumulative actions have been evaluated against Class I air modeling to determine potential visual effects of haze from the NorthMet Project Proposed Action.

6.2.3.13.2 Cumulative Effects Assessment Area

Spatial

The CEAA for Wilderness and Other Special Designation Areas includes those effects associated with the Proposed Action and combined with other industrial (including mining) or public works projects located within the portion of the Mesabi Iron Range encompassed by St. Louis County (see Figure 6.2.2-1). While no direct effects on wilderness character are anticipated, there may be measurable indirect cumulative air effects associated with the NorthMet Project Proposed Action. The CEAA for assessment of potential air effects on designated wilderness and other designated areas is the boundary of measurable air effects identified in Chapter 5.

Temporal

This evaluation includes a brief discussion of documented air quality degradation in the designated areas since the establishment of these wilderness or other designated areas.

6.2.3.13.3 Contributing Past, Present, and Reasonably Foreseeable Actions

As noted previously, it is not possible to identify all past activities that may contribute to a cumulative effect. Similarly, all present activities would continue to affect the environment. The impacts of these combined activities are described in Chapter 4, Affected Environment. Activities included with the NorthMet Project Proposed Action for the assessment of cumulative effects are shown on Figure 6.2.2-1 and described in Section 6.2.2. Activities specifically associated with potential cumulative effects on wilderness and other special designated areas include permitted mines and other projects in the portions of the Mesabi Iron Range in St. Louis County where future activities would likely be different from current activities. These projects include:

- Mesabi Nugget and Mesabi Mining Project;
- LTVSMC;
- Minnesota Power Laskin Energy Center;
- Minnesota Power Taconite Harbor Energy Center Unit 2, Emission control modifications;
- Northshore Mining Company;
- Northshore Mine; and
- U.S. Steel Minntac.

6.2.3.13.4 Cumulative Effects Assessment

The cumulative actions described in Section 6.2.3.13.3 are largely existing, expanded, or reconfigured mines on private land.

Based on the detailed visibility analysis presented in the Air Quality Section (6.2.3.8), even though there would be a net increase in PM_{10} from the cumulative actions, these emissions would not impair visibility in the BWCAW or Voyageurs National Park as described in Minnesota's Regional Haze SIP (USFS 2008b).

6.2.3.14 Hazardous Materials

As described in Chapters 4 and 5, hazardous materials are a site-specific issue; however, there could be a small likelihood of cumulative effects associated with increased traffic carrying hazardous materials.

6.2.3.15 Geotechnical Stability

This topic relates to the waste material storage facilities (Tailings Basin, waste rock stockpiles, and Hydrometallurgical Residue Facility). The stability of these facilities is guided by local geology and design (operation and maintenance) and would not interact with other similar facilities outside of the NorthMet Project area. Given the discrete nature of these facilities, it has been concluded that no cumulative geotechnical effects would occur as a result of the NorthMet Project Proposed Action.

6.3 LAND EXCHANGE PROPOSED ACTION

The Land Exchange Proposed Action would involve exchange of a single 6,650.2-acre (GLO) tract of federal land (encompassing most of the Mine Site) with up to 6,722.5 acres (GLO) of privately owned, non-federal lands located within five different tracts throughout the proclamation boundary of the Superior National Forest within St. Louis, Lake, and Cook counties of northeastern Minnesota. The Land Exchange tracts are shown on Figure 6.3.2-1.

As discussed in the NorthMet Project Proposed Action cumulative effects introduction, some resources would not be cumulatively affected under any Land Exchange Proposed Action alternative because the effects would be contained wholly within the spatial and temporal boundaries of the tracts. These topics include noise, cultural/historic resources, geotechnical stability, wilderness and other special designated areas, and hazardous materials and are not analyzed for cumulative effects.

6.3.1 Baseline Conditions

The resource discussions in Chapter 4 provide the baseline conditions of the natural and human environment affected by past and present actions. Future actions—also called reasonably foreseeable projects—are those activities that could combine with the Land Exchange Proposed Action to potentially cause cumulative effects. The focus of this analysis is on those future activities when placed against baseline conditions that include the effects of past and present activities.

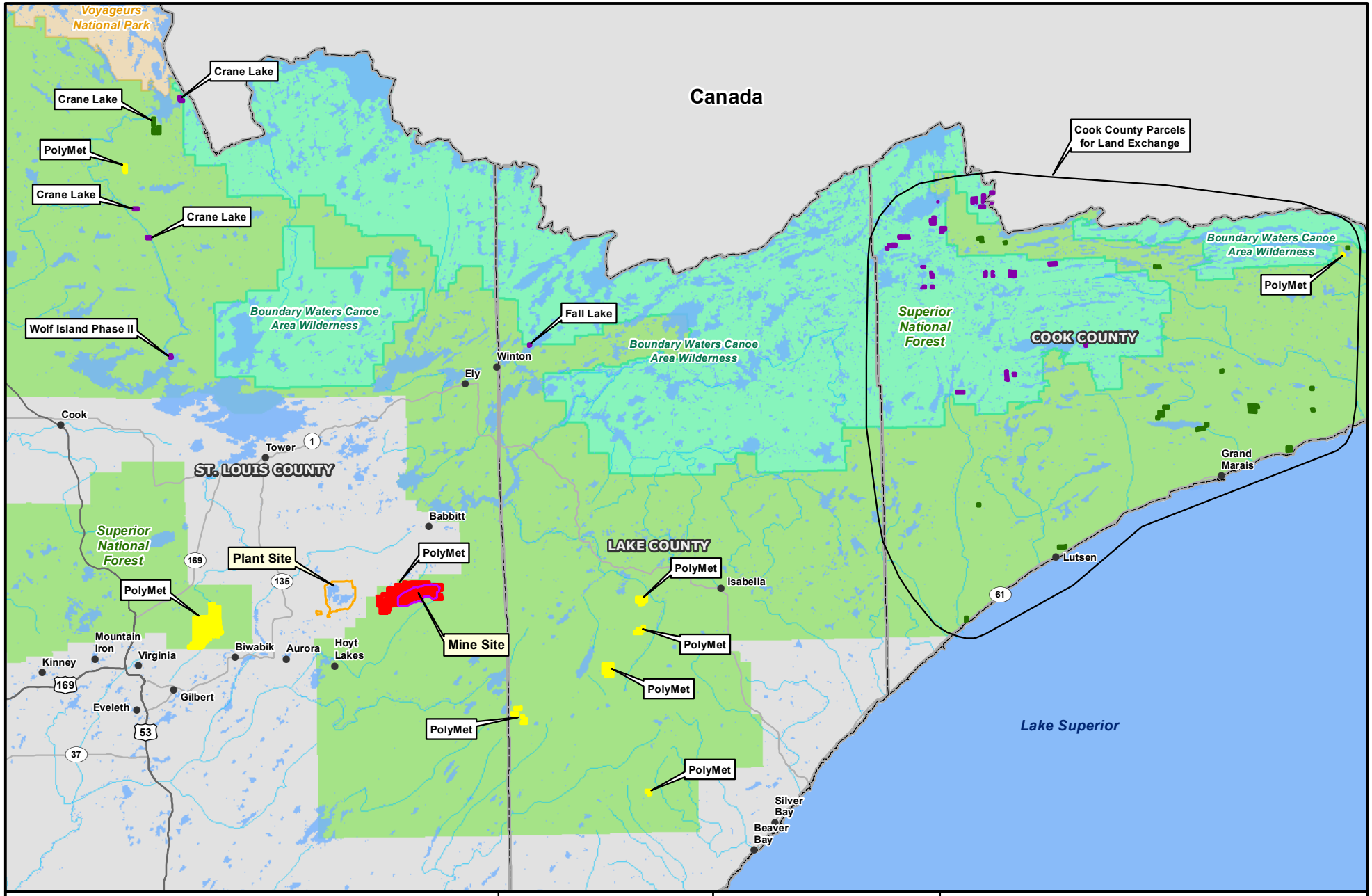

Figure 6.3.2-1
Parcels Involved in Proposed USFS Land Exchanges
NorthMet Mining Project and Land Exchange SDEIS
Minnesota

November 2013

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6.3.2 Cumulative Forest Service Land Actions

Because past land exchange and land acquisition actions through 2011 have been incorporated into the existing Superior National Forest boundaries and the subsequent area and resource calculations, it is assumed that the aggregate effect of these past land exchange actions has been absorbed into and are represented in the current Superior National Forest baseline data. Based on this assumption, the Land Exchange Proposed Action and other current and foreseeable land exchange and land acquisition actions are evaluated as cumulative actions.

The USFS identified the following four current and reasonably foreseeable land exchange and land acquisition actions that would be cumulative to the Land Exchange Proposed Action:

- Cook County Land Exchange,
- Crane Lake Land Exchange,
- Fall Lake Land Acquisition, and
- Wolf Island Phase 2 Land Acquisition.

A brief description of each of the current and reasonable foreseeable land exchange and land acquisition actions is presented below.

6.3.2.1 Cook County Land Exchange

The USFS proposes to exchange up to 1,620 acres for 1,911 acres of Cook County lands within the BWCAW to assist in meeting the goals and objectives of the BWCAW elements of the Forest Plan. The federal lands consist of 41 parcels located throughout Cook County and would be conveyed to Cook County to allow for sustainable development. The lands the USFS would receive would consolidate National Forest System land within the BWCAW.

6.3.2.2 Crane Lake Land Exchange

This land exchange proposal involves federal land located within and adjacent to the Town of Crane Lake for private land in the general vicinity of Crane Lake and the BWCAW. Under the land exchange, the United States would acquire approximately 265 acres of non-federal land in exchange for up to approximately 352 acres of federal land. The federal lands to be conveyed are adjacent to the Town of Crane Lake in T67N, R17W, Sections 23 and 26. The non-federal lands proposed for exchange include three separate parcels in the general vicinity of Crane Lake and some distance south of the town.

The USFS's purpose is to acquire and consolidate land adjoining the BWCAW, the Vermilion River, and other existing National Forest System lands. The Town of Crane Lake's purpose is to acquire land that would better allow for sustainable municipal development and management of municipal facilities by the Town of Crane Lake.

6.3.2.3 Fall Lake Land Acquisition

The Trust for Public Land purchased two properties totaling approximately 27 acres between 2009 and 2011 and is holding the title to these properties until the USFS has received funds to acquire these properties from Trust for Public Land in order to consolidate them into the Superior National Forest. The request for funds to purchase these properties was included in the

USFS's 2012 Land and Water Conservation Fund request with funding anticipated in 2014. The two properties include Duvall (11 acres of Fall Lake) and Laur (17 acres on Fall Lake).

The properties are located on the shores of Fall Lake, across from the Fall Lake boat landing/campground and within 0.5 mile of the Fall Lake entry to the BWCAW.

6.3.2.4 Wolf Island Phase 2 Land Acquisition (Domine Phase 2)

The Trust for Public Land purchased this 27.54-acre property in 2007 and is holding title until Congress appropriates funds to purchase the land. The request for funds to purchase this property was included in the USFS's 2012 Land and Water Conservation Fund request with funding anticipated in 2013.

This parcel represents the northern portion of Wolf Island in the northern arm of Lake Vermilion, 1 mile from the head of the Vermilion River. The USFS acquired the southern portion of Wolf Island in 2010. This purchase would consolidate the entire island under the USFS. Acquisition of the remainder of Wolf Island would result in public ownership of the entire 60-acre island and approximately 10,500 ft of lakeshore on Lake Vermilion. The island provides riparian habitat for sensitive species, including bald eagles and other resident and migratory birds such as osprey, loons, and blue herons.

6.3.3 Approach

Land exchanges are property purchase and transfer transactions, whereas land acquisitions are only property purchases. The land exchange and property acquisition actions described in this section are designed to consolidate and enhance the functional boundaries of the Superior National Forest. The effects measure the net increase or decrease of each specific resource that would result from the Land Exchange Proposed Action and other cumulative actions in context of the entire Superior National Forest system.

In addition to the Land Exchange Proposed Action, two alternatives have been carried forward: Land Exchange Alternative B and the Land Exchange No Action Alternative. A description of these alternatives is presented in Chapter 3.

6.3.4 Resource-Specific Assessment

6.3.4.1 Land Use

The cumulative effects analysis for land use for the Land Exchange Proposed Action focused on potential changes in the land area and boundary length of the Superior National Forest; changes in land fragmentation (i.e., size of patches of federal and non-federal properties) that would occur that could affect USFS management of the forest; changes in the extent or types of designated land uses, as defined by management area designations, where known; and changes in the potential for additional lands open to public use.

6.3.4.1.1 Approach

This section compared the types of data presented in Sections 4.3.1 and 5.3.1, for each of the projects within the CEAA Land Exchange Proposed Action boundary. Projects within the CEAA Land Exchange Proposed Action boundary were evaluated based on the most current available

Superior National Forest land ownership GIS data, as well as the other datasets used in the land use discussions in Sections 4.3.1 and 5.3.1.

6.3.4.1.2 Cumulative Assessment Boundary

The CEAA Land Exchange boundary for land use is described below, both spatially and temporally.

Spatial

The CEAA for Land Exchange effects on land use was the entire Superior National Forest.

Temporal

This evaluation focused on the existing and anticipated future use of the CEAA for the life of the NorthMet Project Proposed Action (approximately 40 years). This includes the approximate 15-year life of the Superior National Forest Plan, which would extend through approximately 2019. Because Superior National Forest was established in 1909, existing conditions are considered indicative and representative of historical resource management activities.

6.3.4.1.3 Cumulative Assessment

The cumulative assessment for the Land Exchange Proposed Action portion focused on the net increase or decrease of land ownership, boundary managed, fragmentation, and management areas. Effects were evaluated by comparing GIS shapefiles of the Superior National Forest before any exchanges or acquisitions to GIS shapefiles of the Superior National Forest after all cumulative actions and the NorthMet Project Proposed Action alternatives occur.

The cumulative actions would result in a net increase in lands within the Superior National Forest. All of the lands that would be acquired are within the 1854 Ceded Territory and would thus replace the Mine Site lands with an equal or greater number of acres available for traditional land use by the Bands. Table 6.3-1 shows the management area designations that would result from the cumulative actions.

Table 6.3-1 Potential Increase/Decrease of Management Area Allocations Occurring from the Cumulative Actions

	Existing Superior National Forest	Superior National Forest – Land Exchange Proposed Action Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange Alternative B Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange No Action Alternative but other Exchanges and Acquisitions	
Management Area[1,2]	**Acres**	**Acres**	**Net Increase (Decrease)[3]**	**Acres**	**Net Increase (Decrease)[3]**	**Acres**	**Net Increase (Decrease)[3]**
Eligible Wild, Scenic, and Recreational Rivers	32,298.8	32,340.4	41.6	32,340.4	41.6	32,340.4	41.6
General Forest	640,907.0	646,485.7	5,578.7	645,054.5	4,147.5	640,800.2	(106.8)
General Forest - Longer Rotation	411,825.7	405,369.5	(6,456.2)	406,630.3	(5,195.4)	411,097.2	(728.5)
Potential RNAs/cRNAs	19,006.8	19,296.8	290.0	19,296.8	290.0	18,990.1	(16.7)
Primitive Wilderness	300,786.3	301,226.1	439.8	301,226.1	439.8	301,226.1	439.8
Pristine Wilderness	114,380.0	114,494.1	114.1	114,494.1	114.1	114,494.1	114.1
Recreation Use in a Scenic Landscape	157,044.2	156,134.6	(909.6)	156,134.6	(909.6)	156,134.6	(909.6)
RNAs	3,170.1	3,170.1	0.0	3,170.1	0.0	3,170.1	0.0
Riparian Areas	17,893.5	18,081.2	187.7	17,860.3	(33.2)	17,860.3	(33.2)
Semi-primitive Motorized Recreation	68,733.6	68,733.7	0.1	68,733.6	0.0	68,733.7	0.1
Semi-primitive Motorized Wilderness	53,529.1	53,529.2	0.1	53,529.2	0.1	53,529.2	0.1
Semi-primitive Non-motorized Recreation	4,564.9	4,564.9	0.0	4,564.9	0.0	4,564.9	0.0
Semi-primitive Non-motorized Wilderness	343,149.2	344,561.3	1,412.1	344,561.3	1,412.1	344,561.3	1,412.1
UBAs	2,495.4	2,495.4	0.0	2,495.4	0.0	2,495.4	0.0
Unidentified	0.1	0.1	0.0	0.1	0.0	0.1	0.0
Total[4]	2,169,784.7	2,170,483.2	698.5	2,170,091.8	307.1	2,169,997.8	213.1

Notes:

1 See definitions of USFS management areas in Section 4.2.3.
2 Developed based off of Table 5.3.1-1.
3 Calculated as (Cumulative Action) minus (Existing Superior National Forest).
4 Totals may not match overall project area acreages due to rounding and/or due to inconsistencies in GIS data layers.

Table 6.3-2 summarizes the Superior National Forest boundary, acreage, and fragmentation involved in each of the cumulative actions.

Table 6.3-2 Potential Increase/Decrease of Superior National Forest Boundary, Acreage, and Fragmentation Occurring from the Cumulative Actions

	Existing Superior National Forest	**Superior National Forest – Land Exchange Proposed Action Plus other Exchanges and Acquisitions**		**Superior National Forest – Land Exchange Alternative B Plus other Exchanges and Acquisitions**		**Superior National Forest – Land Exchange No Action Alternative but other Exchanges and Acquisitions**	
		Acres	**Net Increase (Decrease)**	**Acres**	**Net Increase (Decrease)**	**Acres**	**Net Increase (Decrease)**
Acreage in Superior National Forest controlled by USFS	2,171,603.9	2,172,310.6	706.7	2,171,926.5	322.6	2,171,832.5	228.6
Boundary length (linear miles)	10,054.8	10,006.8	(48.0)	10,037.3	(17.5)	10,048.4	(6.4)
Fragmentation (linear miles per acre)	0.005	0.005	0.0	0.005	0.0	0.005	0.0

The cumulative effects of the Land Exchange Proposed Action, Land Exchange Alternative B, and the Land Exchange No Action Alternative would all result in an increase to the federal estate by adding acreage to the 2,171,603.9 acres of USFS-managed land within the Superior National Forest. Furthermore, the cumulative actions would all result in net reduction of the perimeter around the USFS-managed portions of the Superior National Forest. None of the cumulative actions would alter the existing ratio of fragmentation in the Superior National Forest of approximately 0.005 linear mile of boundary per acre of USFS-managed Superior National Forest land (see Table 6.3-2).

The Land Exchange and the cumulative projects would also include the following net land use effects:

- consolidation of federal ownership of land within Superior National Forest, specifically of land abutting Fall Lake and on Wolf Island, resulting in decreased fragmentation and easier access by Forest Service managers;
- reduced mineral, residential, and commercial development potential within Superior National Forest and decreased conflict related to split surface and subsurface ownership;
- increased opportunities for public use of Superior National Forest, including recreational activities associated with stream and lake shoreline;
- contribution to local land use and economic goals such as growth and development of the Town of Crane Lake and School Trust Land revenue; and
- minimal net effect on land available for tribal use under the 1854 Treaty.

Land Exchange Alternative B would have similar effects, but to a lesser degree. Under the Land Exchange No Action Alternative, none of the effects described above would occur.

6.3.4.2 Water Resources

6.3.4.2.1 Surface Water

The cumulative effects analysis for water resources for the Land Exchange Proposed Action focused on the potential increases or decreases of water resources, including lakes, streams, and wild rice beds.

6.3.4.2.2 Approach

The cumulative projects were evaluated against water resources including the acreages and miles of shoreline for lakes, miles of public streams, and wild rice beds. This section evaluated the cumulative effects on water resources similar to those resources included in Section 5.3.2.

This section compared the types of data presented in Sections 4.3.2 and 5.3.2, but for each of the projects within the CEAA Land Exchange Proposed Action boundary. The GIS data obtained for the sections mentioned above were compared to projects within the CEAA Land Exchange Proposed Action boundary, and effects were determined based on this proximity. Specifically, NWI GIS data was used to determine the analysis.

6.3.4.2.3 Cumulative Effects Assessment Area

The project's CEAA Land Exchange Proposed Action boundary for water resources is described below, both spatially and temporally.

Spatial

The spatial boundary includes the Superior National Forest. The net increase or decrease of waterways that result from the Land Exchange Proposed Action and other cumulative actions has been examined in the context of the entire forest.

Temporal

The temporal boundary includes the present through 2024 (the end of the second decade of the Forest Plan).

6.3.4.2.4 Cumulative Effects Assessment

The cumulative assessment for the Land Exchange Proposed Action portion focused on the net increase or decrease of water resources (acres/miles of shoreline for lakes, acreages of wild rice beds, and miles of streams). Effects were evaluated by comparing GIS shapefiles of the Superior National Forest before any exchanges or acquisitions to the Superior National Forest after all cumulative actions and alternatives occur.

Table 6.3-3 summarizes the amount and type of water resources in each of the cumulative actions.

Table 6.3-3 Potential Increase/Decrease of Water Resources Occurring from Cumulative Actions

Water Resource Types	Existing Superior National Forest	Superior National Forest – Land Exchange Proposed Action Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange Alternative B Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange No Action Alternative but other Exchanges and Acquisitions	
		Acres	Net Increase (Decrease)	Acres	Net Increase (Decrease)	Acres	Net Increase (Decrease)
Public Water Lakes, Acres	73,307.8	73,642.5	334.7	73,654.4	346.6	73,537.0	229.2
Public Water Lakes, Miles of Shoreline	5,232.2	5,246.2	14.0	5,246.5	14.3	5,243.9	11.7
Public Water Streams, Miles	2,196.0	2,201.3	5.3	2,200.2	4.2	2,195.5	(0.5)
Wild Rice Beds, Acres	10,452.4	10,629.8	177.4[1]	10,629.8	177.4[1]	10,501.3	48.9

Notes:

[1] Excludes area of wild rice stands in Pike River. Presence of wild rice in the Pike River, which runs through Little Rice Lake, was noted in Barr's surveys (Barr 2010a, 2011a, and 2012a) but the area of rice was not calculated.

The Land Exchange Proposed Action, Land Exchange Alternative B, and Land Exchange No Action Alternative cumulative effects would all result in an increase to water resource areas within the Superior National Forest, with the exception of a 0.5 mile reduction in PWI streams under the Land Exchange No Action Alternative.

6.3.4.3 Wetlands

The cumulative effects analysis for wetlands for the Land Exchange Proposed Action focused on the potential increases or decreases of wetland acres and wetland types.

6.3.4.3.1 Approach

The cumulative projects were evaluated against wetland acres and wetland types. This section evaluated effects on wetland resources similar to Chapter 5.

This section compared the types of data presented in Sections 4.3.3 and 5.3.3, but for each of the projects within the CEAA Land Exchange Proposed Action boundary. The GIS data obtained for the sections mentioned above were compared to projects within the CEAA Land Exchange Proposed Action boundary and effects were determined based on this proximity. Specifically, NWI GIS data was used to determine the analysis. Floodplain data for the CEAA Land Exchange

Proposed Action boundary was not available for all areas; therefore, an analysis was not performed.

6.3.4.3.2 Cumulative Effects Assessment Area

The project's CEAA Land Exchange Proposed Action boundary for wetlands is described below, both spatially and temporally.

Spatial

The spatial boundary included the Superior National Forest. The net increase or decrease of wetland resources that result from the Land Exchange Proposed Action and other cumulative actions has been examined in context of the entire forest.

Temporal

The temporal boundary included the present through 2024 (the end of the second decade of the Forest Plan).

6.3.4.3.3 Cumulative Effects Assessment

The cumulative assessment for the Land Exchange Proposed Action portion focused on the net increase or decrease of wetland resources (acres of wetlands and acres of wetland types). Effects were evaluated by comparing GIS shapefiles of the Superior National Forest before any exchanges or acquisitions to the Superior National Forest after all cumulative actions and the NorthMet Project Proposed Action alternatives occur.

Table 6.3-4 summarizes the amount and type of wetland resources in each of the Cumulative Actions.

Table 6.3-4 Potential Increase/Decrease of Wetland Resources Occurring from Cumulative Actions

	Existing Superior National Forest	Superior National Forest – Land Exchange Proposed Action Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange Alternative B Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange No Action Alternative but other Exchanges and Acquisitions	
	Acres	**Acres**	**Net Increase (Decrease)**	**Acres**	**Net Increase (Decrease)**	**Acres**	**Net Increase (Decrease)**
Net Change in Wetlands	532,851.2	537,833.8	4,982.6	533,042.1	190.9	532,648.6	(202.6)
Wetland Types							
Freshwater Emergent Wetland	35,852.6	35,582.6	(270.0)	35,571.1	(281.5)	35,552.6	(300.0)
Freshwater Forested/Shrub Wetland	427,440.8	428,129.2	688.4	427,570.0	129.2	427,313.7	(127.1)
Freshwater Pond	14,609.8	14,633.4	23.6	14,634.7	24.9	14,634.1	24.3
Lake	51,763.1	52,064.2	301.1	52,076.3	313.2	51,960.5	197.4
Other	38.2	38.2	0.0	38.2	0.0	38.2	0.0
Riverine	3,146.7	3,151.8	5.1	3,151.8	5.1	3,149.4	2.7

The cumulative effects of the Land Exchange Proposed Action, Land Exchange Alternative B, and Land Exchange No Action Alternative would mostly result in an increase to wetland resource areas, as well as wetland types. There would be a decrease to the “freshwater emergent” category for all three alternatives and the “freshwater forested/shrub” category for the Land Exchange No Action Alternative on the Superior National Forest.

6.3.4.4 Vegetation

The cumulative effects analysis for vegetation for the Land Exchange Proposed Action focused on potential increases or decreases of land cover types, landscape ecosystems, MBS Sites of Biodiversity Significance, and ETSC plant species. Other comparisons that cannot be fully made include MIH types, age classes, mature patches, RFSS plants, and invasive non-native species.

6.3.4.4.1 Approach

This section compared the types of data presented in Sections 4.3.4 and 5.3.4, but for each of the projects within the CEAA Land Exchange Proposed Action boundary. The GIS data obtained for the sections mentioned above were compared to projects within the CEAA Land Exchange Proposed Action boundary, and effects were determined based on this proximity. Specifically, GIS data were obtained from the MDNR regarding GAP land cover types and listed ETSC plant species within the NHIS database. Data were obtained from the USFS MIH types, forest stand age classes, landscape ecosystems, RFSS plants, and invasive non-native species.

6.3.4.4.2 Cumulative Effects Assessment Area

The CEAA Land Exchange Proposed Action boundary for vegetation is described below, both spatially and temporally.

Spatial

The spatial boundary included the Superior National Forest. The net increase or decrease of vegetation categories mentioned below that result from the Land Exchange Proposed Action and other cumulative actions has been examined in context of the entire forest. For state-listed ETSC plant species and RFSS species, federal and non-federal lands proposed for exchange are also analyzed in ecological context of the subsection.

Temporal

The temporal boundary includes the present through 2024 (the end of the second decade of the Forest Plan). The Forest Plan establishes management objectives for the landscape ecosystems (Forest Plan pages 2-61 through 2-78) primarily for composition (forest type) and age class distribution. All of these may be subject to change in a future plan revision (post-2019), but the second decade would incorporate this timeframe.

6.3.4.4.3 Cumulative Effects Assessment

The cumulative assessment for the Land Exchange Proposed Action portion focused on the net increase or decrease of vegetation cover types, MIH types, age classes, mature patches, landscape ecosystems, ETSC plant species, RFSS plants, and invasive non-native species. For all analyses, effects were evaluated by comparing GIS shapefiles of the Superior National Forest before any exchanges or acquisitions to the Superior National Forest after all cumulative actions and the NorthMet Project Proposed Action alternatives occur.

Effect of Cumulative Actions on Gap Analysis Program Land Cover Types

Effects were based on a net increase or decrease basis of GAP land cover type acres (see Table 6.3-5).

Table 6.3-5 Potential Increase/Decrease of GAP Land Cover Types Occurring from Cumulative Actions

Cover Types	Existing Superior National Forest	Superior National Forest – Land Exchange Proposed Action Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange Alternative B Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange No Action Alternative but other Exchanges and Acquisitions	
	Acres	Acres	Net Increase (Decrease)	Acres	Net Increase (Decrease)	Acres	Net Increase (Decrease)
Aquatic environments	90,559.8	91,022.7	462.8	91,035.8	475.9	90,811.2	251.4
Cropland/ Grassland	8,639.8	8,647.6	7.8	8,651.9	12.2	8,622.6	(17.1)
Disturbed	3,599.5	3,510.4	(89.1)	3,559.4	(40.1)	3,593.7	(5.8)
Lowland coniferous forest	288,212.4	288,202.0	(10.4)	287,681.8	(530.6)	288,286.9	74.5
Lowland deciduous forest	9,303.4	9,319.5	16.1	9,314.0	10.6	9,301.2	(2.2)
Shrubland	239,549.4	240,729.1	1,179.6	240,763.0	1,213.6	239,534.5	(15.0)
Upland conifer-deciduous mixed forest	94,636.8	94,622.6	(14.1)	94,575.4	(61.4)	94,586.5	(50.3)
Upland coniferous forest	443,125.9	442,795.8	(330.1)	442,828.7	(297.3)	443,747.7	621.7
Upland deciduous forest	993,698.8	993,181.6	(517.2)	993,237.2	(461.6)	993,068.8	(630.0)
Total[1]	2,171,326.0	2,172,031.3	705.4	2,171,647.2	321.3	2,171,553.2	227.2

Notes:

[1] Totals may not match overall project area acreages due to rounding and/or due to inconsistencies in GIS data layers.

There would be a decrease in disturbed areas on the Superior National Forest under the Land Exchange Proposed Action and all other exchanges and acquisitions, which would be the largest percentage decrease of cover types to the federal estate. Acres of lowland coniferous forest, upland coniferous forest, upland conifer-deciduous mixed forest, and upland deciduous forest would also decrease on the Superior National Forest. There would be an increase of aquatic environments, shrubland, lowland deciduous forest, and cropland/grassland.

Generally, the effects of the Land Exchange Alternative B would be less pronounced than those of the Land Exchange Proposed Action since less land would be exchanged, but all other exchanges and acquisitions would continue. Disturbed land cover types would still be the largest percentage decrease (to the Superior National Forest), but upland conifer-deciduous mixed forest, lowland coniferous forest, and upland coniferous forest would also decrease. There would be an increase of aquatic environments, shrubland, lowland deciduous forest, upland deciduous forest, and cropland/grassland.

There would be very small changes to cover types under the Land Exchange No Action Alternative with all other exchanges and acquisitions occurring.

Effect of Cumulative Actions on Landscape Ecosystems

Effects were based on a net increase or decrease basis of landscape ecosystem acres (see Table 6.3-6).

Table 6.3-6 Potential Increase/Decrease of Landscape Ecosystems Occurring from Cumulative Actions

	Existing Superior National Forest	**Superior National Forest – Land Exchange Proposed Action Plus other Exchanges and Acquisitions**		**Superior National Forest – Land Exchange Alternative B Plus other Exchanges and Acquisitions**		**Superior National Forest – Land Exchange No Action Alternative but other Exchanges and Acquisitions**	
Landscape Ecosystem	**Acres**	**Acres**	**Net Increase (Decrease)**	**Acres**	**Net Increase (Decrease)**	**Acres**	**Net Increase (Decrease)**
Dry-Mesic Red and White Pine	257,939.5	258,450.5	511.0	258,361.0	421.5	257,777.7	(161.8)
Jack Pine-Black Spruce	869,304.9	868,797.3	(507.6)	869,450.3	145.4	870,862.7	1,557.8
Lowland Conifer	398,395.6	399,378.0	982.4	398,838.7	443.1	398,438.3	42.7
Lowland Hardwood	25,754.6	25,825.3	70.7	25,760.8	6.2	25,760.8	6.2
Mesic Birch-Aspen-Spruce-Fir	376,587.2	375,799.1	(788.1)	375,499.0	(1,088.2)	375,498.1	(1,089.1)
Mesic Red and White Pine	185,392.5	185,782.0	389.5	185,767.0	374.5	185,245.2	(147.3)
Sugar Maple	56,390.0	56,430.7	40.7	56,394.7	4.7	56,394.7	4.7
Total[1]	2,169,764.4	2,170,462.9	698.5	2,170,071.5	307.1	2,169,977.5	213.1

Notes:

[1] Totals may not match overall project area acreages due to rounding and/or due to inconsistencies in GIS data layers.

There would be very small changes to landscape ecosystems on the Superior National Forest as a result of the Land Exchange Proposed Action and all exchanges and acquisitions.

Land Exchange Alternative B, with all other exchanges and acquisitions, and the Land Exchange No Action Alternative, with all other exchanges and acquisitions, would both have similar changes.

Effect of Cumulative Actions on Minnesota Biological Survey Sites of Biodiversity Significance

Effects were based on a net increase or decrease basis of landscape ecosystem acres (see Table 6.3-7).

Table 6.3-7 Potential Increase/Decrease of MBS Sites of Biodiversity Significance Occurring from Cumulative Actions

	Existing Superior National Forest	Superior National Forest – Land Exchange Proposed Action Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange Alternative B Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange No Action Alternative but other Exchanges and Acquisitions	
MBS Sites	**Acres**	**Acres**	**Net Increase (Decrease)**	**Acres**	**Net Increase (Decrease)**	**Acres**	**Net Increase (Decrease)**
High Biodiversity Significance	127,903.3	121,846.9	(6,056.4)	123,247.2	(4,656.1)	127,858.6	(44.7)
Moderate Biodiversity Significance	111,250.4	111,775.8	525.4	111,024.3	(226.1)	111,024.3	(226.1)
Total	239,153.7	233,622.6	(5,531.1)	234,271.5	(4,882.2)	238,882.9	(270.8)

There would be a decrease in MBS Sites of "High" Biodiversity Significance on the Superior National Forest, and an increase of Sites of "Moderate" Biodiversity Significance under the Land Exchange Proposed Action and all exchanges and acquisitions.

Under Land Exchange Alternative B, and all exchanges and acquisitions, there would be a decrease to MBS Sites of "High" and "Moderate" Biodiversity Significance on the Superior National Forest.

There would be very small changes to MBS Sites under the Land Exchange No Action Alternative with all other exchanges and acquisitions occurring, but generally there would be a decrease to MBS Sites of "High" and "Moderate" Biodiversity Significance on the Superior National Forest.

Effect of Cumulative Actions on Management Indicator Habitat Types

Generally, the non-federal lands do not have any MIH types identified on them, as it is a federal designation. Additionally, not all federal lands have been fully mapped for MIH types. As a result, an MIH comparison cannot be made for the Superior National Forest before and after all exchanges and acquisitions. Additionally, age classes and mature patches cannot be fully analyzed since they are a subset of the MIH data.

Effect of Cumulative Actions on Endangered, Threatened, and Special Concern Plant Species

Effects on ETSC plant species were evaluated by comparing the MDNR NHIS database for the Superior National Forest before and after all exchanges or acquisitions would occur. Effects were based on a net increase or decrease basis of number of species to federal land holdings. No federally listed ETSC plant species would be affected by the Land Exchange Proposed Action. The Land Exchange Proposed Action and all exchanges and acquisitions would not result in the decrease or absence to the Superior National Forest of any of the 13 ETSC plant species listed for the NorthMet Project Proposed Action.

Land Exchange Alternative B, and all exchanges and acquisitions, would not result in a decrease or absence to the Superior National Forest of any of the 13 ETSC plant species listed for the NorthMet Project Proposed Action.

The Land Exchange No Action Alternative, and all exchanges and acquisitions, would not result in a decrease or absence to the Superior National Forest of any of the 13 ETSC plant species listed for the NorthMet Project Proposed Action.

Effect of Cumulative Actions on Regional Foresters Sensitive Species Plants

Effects on RFSS plants were evaluated by comparing the federal RFSS GIS layer on the Superior National Forest before and after all exchanges and acquisitions. Effects were based on a net increase or decrease basis of species to the federal estate. Based on the GIS layer alone, there would be no change to RFSS plants on the Superior National Forest due to all exchanges and acquisitions. However, RFSS plants have not been identified on all federal and non-federal lands, and so a true comparison cannot be made.

Effect of Cumulative Actions on Invasive Non-native Species

Effects on the federal estate regarding invasive non-native plant species were evaluated by comparing the federal invasive non-native species GIS layer on the Superior National Forest before and after all exchanges and acquisitions. Based on the GIS layer alone, there would be no change to invasive non-native plant species on the Superior National Forest due to all exchanges and acquisitions. However, invasive non-native species have not been identified on all federal and non-federal lands, and so a true comparison cannot be made.

6.3.4.5 Wildlife

The cumulative effects analysis for wildlife for the Land Exchange Proposed Action focused on potential increases or decreases of habitat availability and occurrences of ETSC wildlife species.

6.3.4.5.1 Approach

This section evaluated effects on species similar to Chapter 5, but for the CEAA Land Exchange Proposed Action boundary. Land cover type GIS data from the MDNR, discussed in Section 6.3.2.4, determined available habitat for wildlife species. Federally and state-listed wildlife species were identified in the NHIS database. Data obtained from the USFS identified miles of roads and trails available for use by Canada lynx.

6.3.4.5.2 Cumulative Effects Assessment Area

The CEAA Land Exchange Proposed Action boundary for wildlife is described below, both spatially and temporally.

Spatial

Effects on the Canada lynx were analyzed at the LAU level, or by critical habitat if not located within an LAU.

State-listed species were analyzed on the federal and non-federal lands proposed for exchange.

All other species were analyzed on the federal and non-federal lands proposed for exchange.

Temporal

The temporal boundary includes the present through 2019.

6.3.4.5.3 Cumulative Effects Assessment

The cumulative assessment for the Land Exchange Proposed Action portion focused on the net increase or decrease of habitat types, of road and snow trail miles (for Canada lynx), and of ETSC and RFSS wildlife species occurrences.

Environmental Consequences of Reasonably Foreseeable Actions on Wildlife Habitat

Effects on key habitat type were evaluated by comparing GIS shapefiles of the Superior National Forest before any exchanges or acquisitions to GIS shapefiles of the Superior National Forest after all cumulative actions and the NorthMet Project Proposed Action alternatives occur. Effects were based on a net increase or decrease of habitat acres types to the federal estate (see Table 6.3-8).

Table 6.3-8 Potential Increase/Decrease of Key Habitat Types Occurring from Cumulative Actions

Increase or (Decrease) of Acres of Key Habitat Types	Existing Superior National Forest	Superior National Forest – Land Exchange Proposed Action Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange Alternative B Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange No Action Alternative but other Exchanges and Acquisitions	
	Acres	Acres	Net Increase (Decrease)	Acres	Net Increase (Decrease)	Acres	Net Increase (Decrease)
Mature Upland Forest, Continuous Upland/Lowland Forest (MIH1-13)	1,828,977.4	1,828,121.7	(855.7)	1,827,637.1	(1,340.3)	1,828,991.1	13.8
Open Ground, Bare Soils (no MIH)	3,599.5	3,510.4	(89.1)	3,559.4	(40.1)	3,593.7	(5.8)
Grassland and Brushland, Early Successional Forest (no MIH)	248,189.2	249,376.6	1,187.4	249,415.0	1,225.8	248,157.1	(32.1)
Aquatic Environments (MIH 14)	90,559.8	91,022.7	462.8	91,035.8	475.9	90,811.2	251.4
Total[1]	2,171,326.0	2,172,031.3	705.4	2,171,647.2	321.3	2,171,553.2	227.2

Notes:

[1] Totals may not match overall project area acreages due to rounding and/or due to inconsistencies in GIS data layers.

The cumulative effect of the Land Exchange Proposed Action, plus other exchanges and acquisitions, would result in an increase of wildlife habitat on the federal estate. While grassland/ shrubland and aquatic habitats would increase, there would be a decrease in habitat acres for

mature forest and disturbed areas. The cumulative effect of Land Exchange Alternative B plus other exchanges and acquisitions would result in an increase in wildlife habitat. Similar to the Land Exchange Proposed Action, grassland/shrubland and aquatic habitats would increase and mature forest and disturbed areas would decrease. The Land Exchange No Action Alternative, plus other exchanges and acquisitions, would result in an increase of wildlife habitat on the federal estate.

Environmental Consequences of Reasonably Foreseeable Actions on Special Status Wildlife Species

Effects on special status wildlife species were evaluated by comparing GIS shapefiles of the Superior National Forest before any exchanges or acquisitions to the Superior National Forest after all cumulative actions and the NorthMet Project Proposed Action alternatives occur. Effects on special status wildlife species were evaluated by comparing the MDNR NHIS database for the Superior National Forest before and after all exchanges or acquisitions would occur. Effects were based on a net increase or decrease basis of species to the federal estate.

Based upon the MDNR NHIS database information, there would be no net increase or decrease of special status wildlife species to the federal estate due to the Land Exchange Proposed Action or any of its alternatives. Special status species studies have not been completed for all federal and non-federal lands; therefore, a true comparison cannot be made.

There are 18 terrestrial wildlife species on the Superior National Forest RFSS list. These species are not legally protected and species studies have not been completed. Similar to the special status species studies mentioned above, a true comparison of the increase or decrease of RFSS species occurrences cannot be made.

The gray wolf was added to the RFSS list following the federal delisting of the species in January 2012. The species and their habitat are common in the Superior National Forest and, in 2012, a hunting season was established to control gray wolf populations. Like other RFSS species, population studies have not been completed and a true comparison cannot be made.

Environmental Consequences of Reasonably Foreseeable Actions on the Federally Listed Canada Lynx

The Superior National Forest, where the Land Exchange Proposed Action included in the CEAA is located, includes lynx habitat and habitat for lynx prey species. As discussed in Section 5.3.5.2.1, lynx habitat includes a wide variety of upland and lowland habitats and forest types/ages, shrubland, and grasslands, but excludes aquatic environments. Denning habitat is typically found in mature forest and is generally more dependent on forest age classes, with trees older than saplings and with a dbh greater than 5 inches. Snowshoe hare are the primary prey species for the Canada lynx, and hare habitat includes all types and age classes of forest and shrubland, but not aquatic environments, disturbed areas, or grassland/croplands. Unsuitable habitat includes aquatic environments.

The effects on lynx habitat were evaluated by comparing GIS shapefiles of the Superior National Forest before any exchanges or acquisitions to the Superior National Forest after all cumulative actions and the NorthMet Project Proposed Action alternatives occur. Effects were based on a net increase or decrease of habitat acres to the federal estate (see Table 6.3-9).

Table 6.3-9 Potential Increase/Decrease of Suitable Habitat Types for Canada Lynx and Prey Species Occurring from Cumulative Actions

Suitable Habitat for Lynx and Prey Species	Existing Superior National Forest	Superior National Forest – Land Exchange Proposed Action Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange Alternative B Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange No Action Alternative but other Exchanges and Acquisitions	
	Acres	Acres	Net Increase (Decrease)	Acres	Net Increase (Decrease)	Acres	Net Increase (Decrease)
General Suitable Lynx Habitat (acres)	2,077,166.6	2,077,498.3	331.7	2,077,052.0	(114.5)	2,077,148.2	(18.3)
Suitable Denning Habitat (acres)	748,762.1	744,036.3	(4,725.8)	745,046.2	(3,715.9)	747,703.6	(1,058.5)
Suitable Snowshoe Hare Forage Habitat (acres)	2,068,526.8	2,068,850.7	323.9	2,068,400.1	(126.7)	2,068,525.6	(1.2)
Unsuitable Lynx Habitat (acres)	94,159.4	94,533.1	373.7	94,595.2	435.8	94,404.9	245.6

All three actions (Land Exchange Proposed Action, Land Exchange Alternative B, and Land Exchange No Action Alternative) plus other exchanges and acquisitions would result in some decreases in general suitable lynx habitat, denning habitat, and snowshoe hare forage habitat. The Land Exchange Proposed Action plus other exchanges and acquisitions would result in an increase in general suitable lynx habitat and snowshoe hare forage habitat. All three actions would result in increases in unsuitable habitat.

Lynx utilize snow pack trails and roads as travel corridors. The effects on lynx travel corridors were evaluated by comparing GIS shapefiles of the Superior National Forest before any exchanges or acquisitions to GIS shapefiles of the Superior National Forest after all cumulative actions and the NorthMet Project Proposed Action alternatives occur. Effects were based on a net increase or decrease of miles of snow pack trails and established roads to the federal estate (see Table 6.3-10).

Table 6.3-10 Potential Increase/Decrease of Lynx Travel Corridors on the Federal Estate Resulting from the Land Exchange Proposed Action

Travel Corridor Type	Existing Superior National Forest	Superior National Forest – Land Exchange Proposed Action Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange Alternative B Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange No Action Alternative but other Exchanges and Acquisitions	
	Miles	Miles	Net Increase (Decrease)	Miles	Net Increase (Decrease)	Miles	Net Increase (Decrease)
Established Snow Pack Trails	1,818.7	1,787.7	(31.0)	1,787.7	(31.0)	1,787.7	(31.0)
Established Roads	3,167.3	3,037.2	(130.1)	3,037.4	(129.9)	3,041.2	(126.1)

All three actions (Land Exchange Proposed Action, Land Exchange Alternative B, and Land Exchange No Action Alternative), plus other exchanges and acquisitions, would result in a decrease in established road and established snow pack trails available for lynx use.

6.3.4.6 Aquatic Species

The cumulative effects analysis for aquatic species for the Land Exchange Proposed Action focused on the potential increases or decreases of surface water area and available shoreline, as these parameters are the limiting factors that determine the available aquatic species habitat.

6.3.4.6.1 Approach

The cumulative projects were evaluated against stream shoreline frontage, lake surface area, and lake shoreline frontage. This section evaluated effects on aquatic species available habitat similar to Chapter 5.

This section compared the types of data presented in Sections 4.3.6 and 5.3.6, but for each of the projects within the CEAA Land Exchange Proposed Action boundary. The GIS data obtained for the sections mentioned above were compared to projects within the CEAA Land Exchange boundary, and effects were determined based on this proximity. Specifically, DNR 24K Lakes and DNR 24K Streams GIS data were used to determine the analysis; however, a shoreline frontage index was not analyzed, as in Section 5.3.6, due to limited data availability.

The surface water features analyzed were assumed to correlate to available aquatic species habitat.

6.3.4.6.2 Cumulative Effects Assessment Area

The CEAA Land Exchange Proposed Action boundary for aquatic species habitat is described below, both spatially and temporally.

Spatial

The spatial boundary included the Superior National Forest. The net increase or decrease of surface water features or SGCN species that result from the Land Exchange Proposed Action and other cumulative actions has been examined in context of the entire Superior National Forest.

Temporal

The temporal boundary included the present through 2024 (the end of the second decade of the Forest Land and Resource Management Plan).

6.3.4.6.3 Cumulative Effects Assessment

The cumulative assessment for the Land Exchange Proposed Action portion focused on the net increase or decrease of surface water features and federal/state sensitive aquatic species (SGCN, ETSC, and RFSS species). Effects were evaluated by comparing GIS shapefiles of the Superior National Forest before any exchanges or acquisitions to GIS shapefiles of the Superior National Forest after all cumulative actions and the NorthMet Project Proposed Action alternatives occur.

Effect of Cumulative Actions on Net Increase/Decrease of Surface Water Features

Table 6.3-11 summarizes the surface water area and shoreline linear distance in each of the cumulative actions. For this qualitative assessment, it is assumed that the surface water features provide aquatic species habitat; however, the quality of that habitat could not be assessed or compared.

The effects of the cumulative actions would increase the lake area, lake shoreline distance, and riverine shoreline distance for each scenario summarized. This increase, however, is negligible when compared to the existing surface water features currently present within the Superior National Forest.

Table 6.3-11 Potential Increase/Decrease of Surface Water Resources Occurring from Cumulative Actions

	Existing Superior National Forest	**Superior National Forest – Land Exchange Proposed Action Plus other Exchanges and Acquisitions**		**Superior National Forest – Land Exchange Alternative B Plus other Exchanges and Acquisitions**		**Superior National Forest – Land Exchange No Action Alternative but other Exchanges and Acquisitions**	
	Total	**Total**	**Net Increase (Decrease)**	**Total**	**Net Increase (Decrease)**	**Total**	**Net Increase (Decrease)**
Lake (acres)	80,885.0	81,263.6	378.6	81,277.0	392.0	81,158.0	273.1
Lake (shoreline miles)	7,145.6	7,163.0	17.4	7,163.8	18.2	7,160.9	15.3
Riverine (miles)[1]	7,293.3	7,302.8	9.4	7,301.6	8.2	7,298.4	5.0

Notes:

[1] River miles calculated used both shorelines to derive total.

Environmental Effects of Cumulative Actions on Special Status Aquatic Species

Effects on special status aquatic species (federal and state ETSC, SGCN, and RFSS) were evaluated by comparing GIS shapefiles of the Superior National Forest before any exchanges or acquisitions to GIS shapefiles of the Superior National Forest after all cumulative actions and the alternatives to the Land Exchange occur. GIS analysis indicated no special status aquatic species were found within any of the lands relinquished or acquired by the Superior National Forest. However, it is likely that habitat does exist on some of these lands for special status aquatic species to be present, but the limited available data does not allow for an accurate comparison.

6.3.4.7 Socioeconomics

The cumulative effects analysis for socioeconomics for the Land Exchange Proposed Action focused on changes to revenue streams, timber harvesting, employment related to forestry and timber activities, recreation, and amount of accessible 1854 Ceded Territory area and resources.

6.3.4.7.1 Approach

Criteria for evaluating the socioeconomic cumulative effects of the Land Exchange Proposed Action include:

- changes in revenue streams (taxes, payment in lieu of taxes) and assessed market value associated with transfers of land from non-federal to federal ownership;
- changes in the amount and value of land available for timber harvest and employment related to forestry and timber activities;
- changes in visitation, recreational tourism spending to the Superior National Forest; and
- changes in the amount of accessible 1854 Ceded Territory land and the availability of treaty resources (e.g., wild rice, fish, and game).

6.3.4.7.2 Cumulative Effects Assessment Area

The CEAA Land Exchange Proposed Action boundary for socioeconomics is described below, both spatially and temporally.

Spatial

The CEAA for socioeconomic effects of the Land Exchange Proposed Action is the portions of Superior National Forest in St. Louis, Lake, and Cook counties.

Temporal

This evaluation focuses on the existing and anticipated future use of the CEAA for the life of the NorthMet Project Proposed Action (approximately 20 years). This includes the approximate 15-year life of the Forest Plan, which would extend through approximately 2019. Because Superior National Forest was established in 1909, existing conditions are considered indicative and representative of historical resource management activities.

6.3.4.7.3 Cumulative Effects Assessment

The net socioeconomic effects of the Crane Lake Land Exchange would be a marginal increase in recreational activity (and thus regional tourism revenue) in the Superior National Forest, and increased economic benefit to the Town of Crane Lake due to additional development (consistent with existing plans).

The net socioeconomic effects of the Cook County Land Exchange would include increased revenue to Cook County through management activities (timber and development) on newly acquired parcels and reduced cost of federal management of the Superior National Forest and BWCAW.

The Fall Lake land acquisition would open additional areas of land to potential public use (as well as exercise of usufructuary rights under the 1854 Treaty) in an area that already experiences recreational activity (see Section 6.2.3.12). Any increases in economic activity associated with this expansion would be minimal. The Wolf Island Phase 2 land acquisition would also open additional areas of land to potential public and tribal use and would consolidate Forest Service ownership of Wolf Island and its documented historical resources. Any increases in economic activity associated with this acquisition would be minimal.

In summary, the Land Exchange Proposed Action and cumulative actions would consolidate federal ownership within the Superior National Forest and BWCAW, thus reducing costs associated with management activities. At the same time, the Land Exchange Proposed Action and cumulative actions would provide more land to federal and county governments that could generate economic activity (for those entities and for the region as a whole) through timber, development, or increased recreational use. Increased activity could result in increased employment related to timber, development, and/or recreation.

Net change in public land available under the 1854 Treaty would increase due to the NorthMet Proposed Action and Land Exchange Proposed Action; although the federal lands proposed for exchange would no longer be available. The Land Exchange Proposed Action would dispose 6,650.2 acres of USFS administered land to PolyMet for the NorthMet Project Proposed Action mine and acquire up to 6,722.5 acres of private land for administration by the USFS. The proposed land exchange is a discrete action for the sole purpose of resolving the instant conflict between surface and subsurface rights and would not spur additional conversion of land from private to public ownership.

There is no evidence that the land exchanges in question would create EJ effects.

Land Exchange Alternative B would have similar effects, although to a lesser degree.

Under the Land Exchange No Action Alternative, none of the effects described above would occur.

6.3.4.8 Recreation and Visual Resources

The cumulative effects analysis for recreation and visual resources for the Land Exchange Proposed Action focused on potential increases or decreases in recreation opportunities between recreation opportunity spectrum classes and in scenic integrity objective designated lands.

6.3.4.8.1 Approach

This section compared the types of data presented in Sections 4.3.11 and 5.3.11, for each of the projects within the CEAA Land Exchange Proposed Action boundary. Effects were determined based on GIS data for these projects, including USFS mapping of ROS classes and SIO designated lands.

ROS classes (see Section 4.2.11.1.1) were defined for the Superior National Forest by the USFS (1982). Likely ROS classes for the non-federal lands were identified by the USFS through the SDEIS process, and are generally the same as the existing mapped ROS classes on surrounding adjacent federal lands. GIS analysis was employed to determine the net change in acreage by ROS class.

SIOs (see Section 4.2.11.1.2) were defined for Superior National Forest by the USFS (1995). As with the ROS classes, likely SIO designations for the non-federal lands were identified through the SDEIS process and generally match the existing mapped SIO designations on surrounding adjacent federal lands. GIS analysis was employed to determine the net change in acreage by SIO.

6.3.4.8.2 Cumulative Effects Assessment Area

The CEAA Land Exchange Proposed Action boundary for recreation and visual resources is described below, both spatially and temporally.

Spatial

The spatial boundary for recreational resources included the Superior National Forest. The spatial boundary for visual resources included the Superior National Forest, including the viewshed of the federal tract. The net gain or loss of recreation and visual resources from the exchange and other foreseeable activities was examined in context of the entire forest.

Temporal

This evaluation focuses on the existing and anticipated future use of the CEAA for the life of the NorthMet Project Proposed Action (approximately 20 years). This includes the approximate 15-year life of the Forest Plan, which would extend through approximately 2019. Because Superior National Forest was established in 1909, existing conditions are considered indicative and representative of historical resource management activities.

6.3.4.8.3 Cumulative Effects Assessment

The cumulative assessment for the Land Exchange Proposed Action portion focused on the net increase or decrease of recreation opportunity spectrum classes and SIO-designated lands. For all analyses, effects were evaluated by comparing GIS shapefiles of the Superior National Forest before any exchanges or acquisitions to GIS shapefiles of the Superior National Forest after all cumulative actions and the NorthMet Project Proposed Action alternatives occur.

Table 6.3-12 summarizes the net increase or decrease of recreation opportunity spectrum classifications in each of the cumulative actions.

Table 6.3-12 Potential Increase/Decrease of Recreation Opportunity Spectrum Classifications Occurring from Cumulative Actions

Recreation Opportunity Spectrum	Existing Superior National Forest	Superior National Forest – Land Exchange Proposed Action Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange Alternative B Plus other Exchanges and Acquisitions		Superior National Forest – Land Exchange No Action Alternative but other Exchanges and Acquisitions	
	Acres	Acres	Net Increase (Decrease)	Acres	Net Increase (Decrease)	Acres	Net Increase (Decrease)
Primitive	481,022.1	481,862.4	840.3	481,862.4	840.3	481,862.4	840.3
Roaded Natural	314,667.2	314,284.3	(382.9)	314,754.7	87.5	313,786.2	(881.0)
Rural	9,838.0	9,442.5	(395.5)	9,442.5	(395.5)	9,442.5	(395.5)
Semi-Primitive Motorized	954,020.3	951,357.1	(2,663.2)	950,646.5	(3,373.8)	953,678.7	(341.6)
Semi-Primitive Non-motorized	411,717.2	415,025.2	3,308.0	414,881.2	3,164.0	412,723.4	1,006.2
Urban	93.2	93.2	0.0	93.2	0.0	93.2	0.0
Total[1]	2,171,357.9	2,172,064.7	706.8	2,171,680.5	322.6	2,171,586.5	228.6

Notes:

[1] Totals may not match overall project area acreages due to rounding and/or due to inconsistencies in GIS data layers.

The cumulative actions from the Land Exchange Proposed Action would result in an increase to primitive and semi-primitive non-motorized classes while there would be a decrease in roaded natural, rural, and semi-primitive motorized classes. The Land Exchange Alternative B would result in an increase to primitive, roaded natural, and semi-primitive non-motorized classes while there would be a decrease in rural and semi-primitive motorized classes. The Land Exchange No Action Alternative would result in a decrease to roaded natural, rural, and semi-primitive motorized classes, but an increase to primitive and semi-primitive non-motorized classes.

The Cook County Land Exchange action would consolidate federal ownership of land within BWCAW, but would not change recreational opportunities within BWCAW. The Fall Lake land acquisition action would result in federal acquisition of tracts with recreational value along Fall Lake. The properties are located on the shores of Fall Lake, across from the Fall Lake boat landing/campground and within 0.5 mile of the Fall Lake entry to the BWCAW. The Wolf Island Phase 2 land acquisition action would result in federal acquisition of the northern portion of Wolf Island, and consolidation of federal ownership of the entire island. The island has documented historical resources, and is close to the BWCAW (TPL 2012).

In summary, the cumulative actions would increase the amount of public land available and accessible for recreational activity without diminishing any specific high-value recreational opportunities.

Table 6.3-13 summarizes the net increase or decrease of SIO classifications in each of the cumulative actions.

Table 6.3-13 Potential Increase/Decrease of Scenic Integrity Objectives Classifications Occurring from Cumulative Actions

	Existing Superior National Forest	**Superior National Forest – Land Exchange Proposed Action Plus other Exchanges and Acquisitions**		**Superior National Forest – Land Exchange Alternative B Plus other Exchanges and Acquisitions**		**Superior National Forest – Land Exchange No Action Alternative but other Exchanges and Acquisitions**	
SIO Classifications	**Acres**	**Acres**	**Net Increase (Decrease)**	**Acres**	**Net Increase (Decrease)**	**Acres**	**Net Increase (Decrease)**
High	344,508.1	344,637.8	129.7	344,525.4	17.3	344,507.5	(0.6)
Moderate	798,922.5	800,651.5	1,729.0	800,334.3	1,411.8	799,026.6	104.1
Low	158,944.9	157,895.6	(1,049.3)	157,652.8	(1,292.1)	158,847.1	(97.8)
Unclassified	22,177.12	22,087.5	(89.6)	22,143.5	(33.7)	22,151.4	(25.7)
Total	1,324,553.0	1,325,272.4	719.4	1,324,655.9	102.9	1,324,532.7	(20.3)

The cumulative actions from the Land Exchange Proposed Action, Land Exchange Alternative B, and Land Exchange No Action Alternative would result in a net increase to the federal estate of acres of land with a High and Moderate SIO, with the exception of the high SIO on the Land Exchange No Action Alternative. The actions would result in a net decrease to the federal estate of acres of Low and Unclassified SIO.