6.0 CUMULATIVE EFFECTS

6.1 SUMMARY

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 regulation at Minnesota Rules, Chapter 4410.0200, subparts 11 and 11a, mirror the CEQ cumulative effects definition and regulation.

This section presents the resource-specific cumulative effects analysis of the NorthMet Project Proposed Action (Section 6.2) and Land Exchange Proposed Action (Section 6.3) that may result when combined with effects from other activities. Each resource may have different spatial (geographic) or temporal (time) boundaries, 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 effects other than those direct or indirect effects associated with the NorthMet Project Proposed Action and Land Exchange Proposed Action. In addition to additive effects, cumulative effects may be further magnified by synergisms or cross-interactions in the environment.

As the following analysis demonstrates, the NorthMet Project Proposed Action and Land Exchange Proposed Action would cause some additive effects on certain resources, such as loss of vegetation and wetlands in the NorthMet Project area, as well changes in water quality and use, air quality, and increased economic activity for the life of the mine. The combined Proposed Actions, along with other past, present, and reasonably foreseeable future activities in the region would not cause effects that would cause cumulative effects, as defined by NEPA or MEPA.

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. Scope of Cumulative Effects Analysis

Environmental resources may or may not be cumulatively affected by the NorthMet Project Proposed Action. The methodology for determining the cumulative effects, to all resources and findings, is detailed below.

6.1.1 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 NorthMet Project Proposed Action to potentially cause cumulative effects. The focus of this analysis will be on those future activities when placed against baseline conditions.
6.2 NORTHMET PROJECT PROPOSED ACTION

6.2.1 Cumulative Effects Analysis Approach

This section was developed with consideration of 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. Potential cumulative effects for the NorthMet Project Proposed Action have been assessed at the resource level. The spatial and temporal extents of the CEAs 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 likewise 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 and post-closure restoration, which is estimated to be 40 years. 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.

As discussed in Chapter 7, the NorthMet Project No Action Alternative would have no direct effect on any area that would otherwise be subject to use by the NorthMet Project Proposed Action. The NorthMet Project No Action Alternative would not contribute to cumulative effects and is not considered in this analysis.

In addition to other cumulative effects that may be identified through the analysis, Section 6.2.3 also addresses the following topics, as directed by the NorthMet Project Proposed Action Final SDD (MDNR 2005):

- Hoyt Lakes area projects and air concentrations in Class II areas;
- Class I areas PM10 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 or Projects

For the purposes of this analysis, the NorthMet Project Proposed Action may contribute to cumulative effects when considered along with 20 other projects or activities 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 a unique extent of consideration and the specific actions considered are specified 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 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.
Figure 6.2.2-1
Cumulative Effects Assessment Area
NorthMet Mining Project and Land Exchange PSDEIS
Minnesota

1854 Ceded Territory
Embarrass River Watershed
Partridge River Watershed
Ecological Subsection
MNDR Ecological Subsection
Chippewa National Forest
Superior National Forest
Boundary Waters Canoe Area Wilderness

This PSDEIS document is a Co-lead Agency provisional draft intended for internal review only. Corrections, revisions, and changes will be made prior to the release of the SDEIS for public review and comment.

DRAFT SUBJECT TO REVISION
May 2013
## Table 6.2-1  Actions Considered and Affected Resources in the Cumulative Effects Assessment

<table>
<thead>
<tr>
<th>Activity</th>
<th>Status</th>
<th>Approx. Distance from NorthMet Project Area (Miles)</th>
<th>Resources Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arcelor Mittal Mines (Laurentian and East Reserve Mines)</td>
<td>Present</td>
<td>18</td>
<td>Water, Wetlands, Vegetation, Wildlife, Aquatic Species, Cultural, Socioeconomics, Recreation, and Visual Resources</td>
</tr>
<tr>
<td>City of Aurora POTW</td>
<td>Present</td>
<td>6</td>
<td>Water</td>
</tr>
<tr>
<td>City of Babbitt POTW</td>
<td>Present</td>
<td>10</td>
<td>Water</td>
</tr>
<tr>
<td>City of Biwabik POTW</td>
<td>Present</td>
<td>10</td>
<td>Water</td>
</tr>
<tr>
<td>City of Hoyt Lakes POTW</td>
<td>Present</td>
<td>7</td>
<td>Water</td>
</tr>
<tr>
<td>Essar Steel</td>
<td>Present, with Reasonably Foreseeable Modifications</td>
<td>55</td>
<td>Air Quality, Vegetation, Wildlife, Cultural</td>
</tr>
<tr>
<td>Former LTVSMC Pits 2/2E/2W, Pit 3 and, Area 5 NW Pit.</td>
<td>Present</td>
<td>&lt;1</td>
<td>Water, Wetlands, Vegetation, Wildlife, Aquatic Species, Air Quality, Cultural</td>
</tr>
<tr>
<td>Mesaba Energy Project – Western Range Site</td>
<td>EIS Preferred Alternative - Reasonably Foreseeable</td>
<td>55</td>
<td>Water, Vegetation, Wildlife, Socioeconomics, Cultural, Recreation, and Visual Resources</td>
</tr>
<tr>
<td>East Range Site (Alternative Site near Hoyt Lakes, MN)</td>
<td>Eliminated from Alternatives</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Mesabi Nugget</td>
<td>Present</td>
<td>&lt;1</td>
<td>Water, Wetlands, Wildlife, Aquatic Species, Air Quality, Cultural, Socioeconomics</td>
</tr>
<tr>
<td>Mesabi Mining Project</td>
<td>Reasonably Foreseeable</td>
<td>2</td>
<td>Water, Vegetation, Wetlands, Wildlife, Aquatic Species, Air Quality, Cultural, Socioeconomics</td>
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<tr>
<td>Minnesota Power Laskin Energy Center</td>
<td>Present</td>
<td>5</td>
<td>Air Quality</td>
</tr>
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<td>Minnesota Power Taconite Harbor Energy Center Unit 2, Emission control modifications</td>
<td>Reasonably Foreseeable</td>
<td>48</td>
<td>Air Quality</td>
</tr>
<tr>
<td>Northshore Mining Company: Furnace 5 Reactivation Project</td>
<td>Present</td>
<td>45</td>
<td>Air Quality</td>
</tr>
<tr>
<td>Northshore Mine</td>
<td>Present</td>
<td>7</td>
<td>Water, Wetlands, Vegetation, Wildlife, Aquatic Species, Air Quality, Cultural, Socioeconomics</td>
</tr>
<tr>
<td>U.S. Steel Keetac Mine Expansion Project (Keewatin)</td>
<td>Reasonably Foreseeable</td>
<td>45</td>
<td>Vegetation, Wildlife, Cultural, Socioeconomics, Recreation, and Visual Resources</td>
</tr>
<tr>
<td>U.S. Steel Minntac, BACT Reductions</td>
<td>Present</td>
<td>25</td>
<td>Water, Wetlands, Vegetation, Wildlife, Aquatic Species, Air Quality, Cultural, Socioeconomics, Recreation, and Visual Resources</td>
</tr>
</tbody>
</table>
### Activity Table

<table>
<thead>
<tr>
<th>Activity</th>
<th>Status</th>
<th>Approx. Distance from NorthMet Project Area (Miles)</th>
<th>Resources Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Taconite</td>
<td>Present</td>
<td>27</td>
<td>Water</td>
</tr>
<tr>
<td>Community growth and development</td>
<td>Present and Reasonably Foreseeable</td>
<td>Regional, no specific locations</td>
<td>Vegetation, Wildlife, Cultural</td>
</tr>
<tr>
<td>Forestry practices on public and private lands</td>
<td>Past, Present, and Reasonably Foreseeable</td>
<td>Regional, no specific locations</td>
<td>Vegetation, Wildlife, Cultural</td>
</tr>
</tbody>
</table>

#### 6.2.2.1 Brief Description of Cumulative Actions Considered

##### 6.2.2.1.1 Arcelor Mittal Mines (Laurentian and East Reserve Mines)

Arcelor Mittal operates two separate taconite mines, the Laurentian Mine and the East Reserve Mine. These mines are approximately 2 miles apart between McKinley 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

The City of Aurora withdraws water to support its POTW 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, as the source for its POTW, and discharges treated wastewater effluent to the headwaters of the Embarrass River. Because some of the discharge originates in the Dunka River Watershed and is transferred to the Embarrass River, the treatment works 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 proposing modifications to a new taconite mine and processing plant near Nashwauk, Minnesota in Itasca County. The project would increase the production of taconite pellets from 3.8 million mtpy of low-flux taconite pellets to 6.5 million mtpy of high-flux pellets, or 7.0 million mtpy of low-flux taconite pellets. This will require the addition of a crusher/concentrator line and the installation of a larger pellet furnace. Essar estimates that once operational the modifications will operate at full capacity for up to 15 years. The project is located approximately 55 miles southwest from the NorthMet Project area.

The project required preparation of a State SEIS; the adequacy decision was issued in December 2011. The expanded facility is scheduled to begin full operations between 2013 and 2014.

6.2.2.1.7 LTV Steel Mining Company

Four former taconite mine pits operated by the LTVSMC in the Partridge River Watershed are naturally flooded or are flooding: Pits 2/2E and 2W; Pit 3; and Area 5. These pits were in operation from the 1950s until 2001.

Water from Pits 2/2E, 2W, and 3 would be withdrawn as part of the Mesaba Energy and Mesabi Nugget and Mesabi Mining projects. Pit 3, formerly operated by the Erie Mining Company, is the only one of these to be completely flooded and overflowing. It flows into the Wyman Creek, a tributary of the Partridge River.

Pit 5 is a flooded former LTVSMC mine pit that overflows into Spring Mine Creek, a tributary of the Embarrass River. Overflows from this pit vary with precipitation, but have resulted in elevated sulfate levels in the middle branch of the Embarrass River. The pit is less than 1 mile from the NorthMet Project area.

6.2.2.1.8 Mesaba Energy Project

Excelsior Energy is developing 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 is assumed that the Mesaba Energy Project would be built there for purposes of this analysis. The Hoyt Lakes site is within the Partridge River Watershed.

An FEIS was prepared in 2009 by the U.S. Department of Energy and Minnesota Department of Commerce, but no ROD related to granting an operating license had been issued as of March 2013.
6.2.2.1.9 Mesabi Nugget

Steel Dynamics, Inc., and Kobe Steel, Ltd., of Japan have partnered to build an iron nugget demonstration mine and new crusher and concentrating plant at the former LTVSMC taconite mine site near Hoyt Lakes. The LTVSMC processing plant closed in 2001. These facilities are located within 2 miles of the NorthMet Project area.

Mesabi Nugget is located less than 1 mile from the NorthMet Project area. This facility would produce iron nuggets from iron ore concentrate processed at the Northshore Mining Company’s taconite facility in Silver Bay, Minnesota, as well as from the proposed Mesabi Mining project nearby. The concentrate would be mixed, dried, and fed into a rotary hearth furnace and reduced to metallic ore and slag material.

Water would be taken from the Area 1 and/or Area 2WX pits for contact and non-contact cooling and processing. The process water would be fed to a wastewater treatment system and then discharged 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. 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 will 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 SO2, NOx, and mercury. Minnesota Power anticipates the system would cut NOx emissions by more than 60 percent and SO2 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 Babbitt facility 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 Cleveland-Cliffs Inc. acquired it. The Northshore Mining Company is a wholly owned subsidiary of Cleveland-Cliffs, Inc.
In the early 2000s, the Northshore Mining Company reactivated Furnace 5, a pelletizing furnace at its taconite processing facility at Babbitt, Minnesota, about 45 miles southwest of the NorthMet Project area.

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 7 miles northwest and northeast from the NorthMet Project area. One of the mine areas discharges to the Partridge River.

The mine is operated by Northshore Mining Company; a subsidiary of Cleveland-Cliffs, Inc. Northshore mines the ore, processes it into pellets at facilities nearby, and then ships the concentrate to facilities in the area, as well as 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 proposing 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 (Keewatin)

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 NOx emissions and establishes a procedure to set a BACT limit for NOx. The draft permits set interim NOx limits and requires the ongoing testing of control technologies for NOx, 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.
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. 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 speculative projects have not been mapped or considered in the cumulative analysis.

Speculative Projects

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-palladium group metals 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 USACE Section 404 permit. This project will likely require preparation of a joint State-Federal EIS; preparation of a State EIS would be mandatory. Preliminary data collection to support environmental review and permitting is underway.

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 that is underway. 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; preparation of a State EIS would be mandatory. Preliminary data collection to support environmental review and permitting is currently underway.

Teck American

Teck American is considering operations to mine the Mesaba deposit for non-ferrous metals (copper-nickel). The current phase is exploration and drilling. The project may require a joint State-Federal EIS; preparation of a State EIS would be mandatory. Preliminary data collection to support environmental review and permitting is underway.

Cliffs Natural Resources

Cliffs Natural Resources is expanding its United Taconite mining facility to the northeast. The expansion will 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 by late 2013 (MDOT 2013).

North Star BlueScope 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; preparation of a State EIS would be mandatory.

Arcelor Mittal

The Arcelor Mittal facility is an operating iron taconite plant in Biwabik, St. Louis County, Minnesota. The project proponent is considering expanding operations 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 proposed as separate mines and each project may require preparation of a joint State-Federal EIS; preparation of State EIS would be required.
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 below ground surface. The project proposer has conducted small-scale pilot testing of extraction technology at the site. This project would require a State EIS; preparation of a joint State-Federal EIS may be required.

Encampment Minerals

Encampment Minerals, Inc. is currently exploring a serpentine mineral deposit. This project will require a State EIS.

Magnetation

Cushing Mine Reserve is currently operating a scram operation on previously deposited tailings in Taconite, Itasca County, Minnesota. The proponent is considering a new mine that would require a State EIS.

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. The Band representative(s) identified the 1854 Ceded Territory as a spatial component of the cumulative effects analyses as an issue for consideration in the SDEIS.

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 may affect or be affected by land use, and local (municipal) land use plans and zoning ordinances, where available.
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 (Figure 6.2.2-1). While changes in land use patterns do not necessarily depend on such projects, historical census data indicates changes in population in St. Louis County has 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., designated federal boundaries). Changes in land use from these resources are due to evolving socioeconomic preferences.

**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

The 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:

- Arcelor Mittal 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 district. 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 (Section 5.2.10.2.4).

The sources for data regarding cumulative actions include MDNR and USACE 2007, MDC and USDOE 2007, MDNR 2008, 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 be restored 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. The NorthMet Project Proposed Action is predicted to meet all water quality evaluation criteria or not make concentrations worse. Further, concentrations of sulfate and mercury, two key constituents of concern, are predicted to decrease as a result of the NorthMet Project Proposed Action. The NorthMet Project Proposed Action would also result in only minor changes in hydrology within the Partridge River and Embarrass River. 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.

Temporal

This evaluation will focus on estimated past water quality and use, existing water quality and use available from the mid-1970s to the present as discussed in Chapter 4, and the anticipated future water quality and use within the CEAA.
In terms of temporal scope, this assessment considers 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 considers reasonably foreseeable future activities, which are identified below.
This PSDEIS document is a Co-lead Agency provisional draft intended for internal review only. Corrections, revisions, and changes will be made prior to the release of the SDEIS for public review and comment.
Figure 6.2.3-1
Water Resources Cumulative Effects Assessment Areas
NorthMet Mining Project and Land Exchange PSDEIS
Minnesota

This PSDEIS document is a Co-lead Agency provisional draft intended for internal review only. Corrections, revisions, and changes will be made prior to the release of the SDEIS for public review and comment.

DRAFT SUBJECT TO REVISION
May 2013
6.2.3.3.2 Cumulative Actions
The existing and potential future actions that have the potential, in combination with the NorthMet Project Proposed Action, to cumulatively affect surface water hydrology and quality within the Partridge River and Embarrass River watersheds include the following:

- Arcelor Mittal Mines (Laurentian and East Reserve Mines);
- Northshore Mine;
- Area 5 NW Pit;
- City of Aurora POTW;
- City of Babbitt POTW;
- City of Biwabik POTW;
- City of Hoyt Lakes POTW;
- Cliffs Erie, LLC – Hoyt Lakes Area (former LTV Steel Mining Company);
- Mesabi Nugget Delaware, LLC (formerly Mesabi Nugget Phase I);
- Mesabi Mining, LLC (formerly Mesabi Nugget Phase II);
- 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 would vary by mine phase—about a 5.5 cfs reduction during operations; about 3.8 cfs reduction during reclamation; and about 0.7 cfs net increase in flow during closure.

There are several mines, the City of Hoyt Lakes WWTP, and 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 affect flows in the Partridge River (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 (i.e., 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.
Table 6.2-2  Existing Cumulative Effects on Partridge River Hydrology by Activity

<table>
<thead>
<tr>
<th>Activity</th>
<th>Average Net Hydrologic Effect</th>
<th>Location of Effects</th>
<th>Timing</th>
<th>Magnitude</th>
<th>Future Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northshore Mine</td>
<td>0.0 cfs</td>
<td>Affects entire Partridge River</td>
<td>Intermittent</td>
<td>Varies</td>
<td>&gt;20 years ongoing</td>
</tr>
<tr>
<td>City of Hoyt Lakes</td>
<td>-0.1 cfs</td>
<td>Affects Lower Partridge River</td>
<td>Continuous</td>
<td>Relatively consistent</td>
<td>Long term ongoing</td>
</tr>
<tr>
<td>Former LTVSMC mine pits</td>
<td>0 cfs</td>
<td>Wyman Creek, Second Creek, Partridge River</td>
<td>Varies</td>
<td>Varies</td>
<td>Long term ongoing</td>
</tr>
<tr>
<td>Mesaba Energy Project (proposed)</td>
<td>-7.4 cfs</td>
<td>Primarily affects Lower Partridge River</td>
<td>Continuous</td>
<td>Relatively consistent</td>
<td>Long term potentially beginning ~2015</td>
</tr>
<tr>
<td>Mesabi Nugget</td>
<td>-2.1 cfs</td>
<td>Affects Lower Partridge River</td>
<td>Continuous</td>
<td>Varies</td>
<td>Long term ongoing</td>
</tr>
<tr>
<td>Mesabi Mining Project (formerly Mesabi Nugget Phase II) (proposed)</td>
<td>+11.8 cfs</td>
<td>Affects Lower Partridge River</td>
<td>Continuous</td>
<td>Varies from 7.2 to 33.5 cfs</td>
<td>20 years potentially beginning ~2015</td>
</tr>
<tr>
<td>Minnesota Power Laskin Energy Center</td>
<td>-4.2 cfs</td>
<td>Affects Lower Partridge River</td>
<td>Continuous</td>
<td>Relatively consistent</td>
<td>Long term ongoing</td>
</tr>
</tbody>
</table>

- Northshore Mine – is an open-pit taconite mine. The mine consists of three mining areas, only one of which (Area 003) discharges to the Partridge River. Permitted discharges from Area 003 include seven mine pit dewatering outfalls (SD-006 to SD-012), treated shop drainage and runoff from Crusher 2 (SD-016), and sanitary sewage from Crusher 2 (SD-013), but only the mine pit discharges SD-009 and SD-010 and Crusher 2 discharge SD-016 with a collective maximum permitted discharge to the Partridge River of 29 cfs, are active. In 2012, Area 003 was being actively dewatered (pumped) through SD009 to the Partridge River at up to 9.8 MGD (15 cfs) with a very small passive discharge through SD010 at less than 0.1 MGD (less than ~0.1cfs). These discharges essentially form the origin of the Partridge River. There is currently little or no active mining occurring in Area 003 and none proposed under their current Mine Plan that would result in changes in discharge volumes.

Pit dewatering records for the Northshore Mine from 1976 to approximately 1986 are available and show an annual average discharge to the Partridge River of between 6.8 and 15.1 cfs. Since 1988, the highest reported average monthly discharge from the Northshore Mine to the Partridge River was 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. On average, this discharge is expected to be somewhat higher than natural, pre-mining runoff because of the added, deep groundwater contribution. Inadequate information exists to quantify the increase, so it is assumed for purposes of this cumulative effects analysis that the net contribution is zero.
City of Hoyt Lakes – the City of Hoyt Lakes 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: seasonal (September-March) discharges of up to 5.8 MGD (9.0 cfs) to Second Creek; no discharges occur from April-August.
- Pit 2WX: currently in 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.
- Pit 2/2E: is stabilized with no direct discharge. There is likely groundwater flow from this pit to Pit 2W.
- Pit 2W: recently reached level at which overflow discharge occurs, ~5 MGD (~7.7 cfs) to Second Creek. Proposed to receive water from Pit 3 (SD012) and discharge seasonally (September-March).
- Pit 3: currently discharges to Wyman Creek at ~0.5 MGD (0.8 cfs). Proposed to pump to Pit 2W essentially relocating discharge to Second Creek.
- Pit 5S: overflows via ‘dispersed’ discharge at unknown rate to Wyman Creek. No changes proposed.
- Pit 6: currently ‘discharges’ via the subsurface to Second Creek. Proposed Mesabi Mining Project would result in the dewatering of this pit to a currently unspecified water at an unspecified rate.
- Pit 9S: currently stable (with likely groundwater discharge off site and/or to Pit 6). Proposed Mesabi Mining Project would likely result in some dewatering to unspecified location at unspecified rate.
- Pit 9N: currently stable (with groundwater discharge to Pit 1).

The Mesaba Energy and Mesabi Mining projects currently or 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 will 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 are allowed to continue filling to equilibrium, the net effect on downstream hydrology will be near zero.

Mesaba Energy Project – proposed IGCC electric power generating station with an initial capacity proposed at 602 MW. The U.S. Department of Energy (DOE) in cooperation with the Minnesota Department of Commerce prepared a DEIS for the project in November 2007. 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. Although not the preferred site, for purposes of this cumulative effects analysis, it has been assumed that the Mesaba Energy Project would be built at the East Range Site.

The NorthMet Project Proposed Action 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, NorthMet mine dewatering [although identified as a potential source in the Mesaba Energy EIS, the NorthMet Project Proposed Action would recycle most of its water], and other area pits), and potentially Colby Lake (MDC and USDOE 2007). Approximately 7.4 cfs of this demand would be consumed by evaporative cooling. The extent to which this evaporative loss of 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** – constructed in 2010 with the capacity to produce iron nuggets from iron ore concentrate at a rate of 600,000 mtpy. The project is currently in the process of ramping up production.

The facility has an average and maximum water demand of 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 will be routed to a wastewater treatment system and returned to the Area 1 Pit which in turn is seasonally (September through March) discharged to Second Creek at a rate of 9.0 cfs. The NorthMet Project Proposed Action will have evaporative losses of approximately 2.1 cfs.

- **Mesabi Mining Project** – 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 reevaluated/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 during the 20-year mine period by an average of approximately 11.75 cfs (Barr 2009i).

- **Minnesota Power Laskin Energy Center** – 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 2000, 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 withdrawal, and Laskin Energy Center evaporative losses) is a possible average annual reduction in flow of approximately 6.4 cfs. The average effect of the NorthMet Project Proposed Action would be a further reduction of between 3.8 to 5.5 cfs through year 40, resulting in a net reduction in flow in the Lower Partridge River of 10.2 to 11.9 cfs. After year 40, the NorthMet Project Proposed Action would have an increase in flow of approximately 0.7 cfs, for a total cumulative reduction in flow in the Lower Partridge River of 5.7 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 when the effects of the withdrawals would be the greatest.

At some point in the future (20-plus years), the Mesabi Mining and Mesaba Energy projects may occur, which could result in a net increase of flow of about 4.4 cfs, which would result in a total cumulative reduction in flow in the Lower Partridge River of between approximately 5.8 cfs (if they occur before year 40) or 1.3 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 flows on a daily basis 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 pit dewatering discharges, however, are typically related to either snow melt or large storm events when flows in the Partridge River are high, reducing the significance of these discharges.

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 11.9 cfs (about 12 percent).

**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 1.7 cfs (2.0 percent) decrease in flow during the first seven years of operations until the Mud Lake Creek diversion is constructed, and then about a 1.3 cfs (1.6 percent) decrease during long term while the WWTP is operating. During long term, once the passive treatment proves effective, the net change in average annual flow would be close to zero.

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 significant variation 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 significance 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.

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

<table>
<thead>
<tr>
<th>Activity</th>
<th>Average Net Hydrologic Effect</th>
<th>Location of Effects</th>
<th>Discharge Timing</th>
<th>Magnitude</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Babbitt POTW</td>
<td>+0.1 cfs</td>
<td>Upper and Lower Embarrass River</td>
<td>Continuous</td>
<td>Relatively consistent</td>
<td>Long term Ongoing</td>
</tr>
<tr>
<td>Cliffs Erie (former LTVSMC) Area 5 NW Pit</td>
<td>0.0 cfs</td>
<td>Upper and Lower Embarrass River</td>
<td>Continuous</td>
<td>Varies</td>
<td>Long term Ongoing</td>
</tr>
<tr>
<td>Cliffs Erie (former LTVSMC) Tailings Basin</td>
<td>0.0 cfs</td>
<td>Lower Embarrass River</td>
<td>Continuous</td>
<td>Relatively consistent</td>
<td>Long term Ongoing</td>
</tr>
<tr>
<td>ArcelorMittal Minorca Laurentian Mine</td>
<td>-5.6 cfs</td>
<td>Lower Embarrass River</td>
<td>Continuous</td>
<td>Varies</td>
<td>Ongoing until mid-2010s then ceasing</td>
</tr>
<tr>
<td>ArcelorMittal Minorca East Reserve Mines</td>
<td>9.3 cfs</td>
<td>Lower Embarrass River</td>
<td>Continuous</td>
<td>Varies</td>
<td>Ongoing until ~2025</td>
</tr>
<tr>
<td>City of Aurora</td>
<td>-0.3 cfs</td>
<td>Lower Embarrass River</td>
<td>Continuous</td>
<td>Relatively consistent</td>
<td>Long term Ongoing</td>
</tr>
<tr>
<td>City of Biwabik</td>
<td>0.0 cfs</td>
<td>Lower Embarrass River</td>
<td>Continuous</td>
<td>Relatively consistent</td>
<td>Long term Ongoing</td>
</tr>
</tbody>
</table>

- 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 1.0 cfs, but its flow varies with precipitation and has been measured as low as 0.23 cfs. Since Spring Mine Creek is a small part of the Embarrass River Watershed and outflow from Pit 5NW is a natural (non-manipulated) discharge 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 (former LTVSMC) Tailings Basin – There is 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 (SD003). This mine is expected to close sometime in the mid-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 5.5 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 5.6 cfs until the pit floods.

• Arcelor Mittal 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 (SD005) 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 will likely gradually increase as the pit gets deeper when discharging the flow rate is constant, but there are several months of the year (primarily in winter) when no discharge occurs. At some yet to be determined point, East Reserve #2 will be opened and pit dewatering will begin through a second permitted discharge (SD006). The East Reserve Mine (Pit #1 and 2) would have a combined permitted discharge to the Lower Embarrass River of up to 9.3 cfs, though the actual discharge will likely vary seasonally and as the mines are developed at a rate somewhat less 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 2.1 cfs reduction in flow at a point near the confluence of the Embarrass River with the St. Louis River. The NorthMet Project Proposed Action would reduce flow to the Embarrass River at PM-13 by about 1.3 cfs to 1.7 cfs, for a total reduction in flow of between 3.4 and 3.8 cfs at the confluence, or less than 5 percent of average annual flow.
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, PolyMet does not propose any surface water discharges until the West Pit overflows 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.

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, other than for constituents that already exceed the criteria (e.g., aluminum, iron, manganese). The project would degrade water quality by raising ambient concentrations for several parameters, but these concentrations would remain well below surface water evaluation criteria.

Since the NorthMet Project Proposed Action is not expected to have the potential for synergistic cumulative effects, this cumulative effects analysis focuses on sulfate (because of its relationship with mercury methylation and wild rice) and mercury (only parameter on 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. For the NorthMet Project Proposed Action, the Band representative(s) identified sulfate concentrations in receiving waters, especially those used for the production of wild rice and/or for subsistence fishing, as an issue for consideration in the SDEIS.

**Sulfate**

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 (approximately 5 to 10 mg/L during the wild rice surveys and average 6 to 10 mg/L during historic monitoring) are generally slightly elevated with the baseline conditions found in the South Branch of the Partridge River in the 1970s (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 SD026 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  Existing and Proposed Cumulative Sulfate Loadings to the Partridge River by Activity

<table>
<thead>
<tr>
<th>Activity</th>
<th>Average Discharge/Release Rate (cfs)</th>
<th>Representative Sulfate Concentration (mg/L)</th>
<th>Average Sulfate Load (kg/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northshore Mine</td>
<td>5.8</td>
<td>57</td>
<td>809</td>
</tr>
<tr>
<td>City of Hoyt Lakes</td>
<td>0.5</td>
<td>0~11</td>
<td>0~11</td>
</tr>
<tr>
<td>Mesaba Energy Project</td>
<td>16.1</td>
<td>487</td>
<td>19,185</td>
</tr>
<tr>
<td>Mesabi Nugget</td>
<td>8.9 (7 mo.)</td>
<td>385</td>
<td>4,890</td>
</tr>
<tr>
<td>Mesabi Mining Project</td>
<td>11.8</td>
<td>146.3</td>
<td>4,224</td>
</tr>
<tr>
<td>Laskin Energy Center</td>
<td>194</td>
<td>No change in loading</td>
<td>No addition to ambient load</td>
</tr>
<tr>
<td>Cliffs Erie Pits 2E/2W</td>
<td>7.7</td>
<td>120</td>
<td>2,260</td>
</tr>
<tr>
<td>Cliffs Erie Pit 3</td>
<td>0.8</td>
<td>79</td>
<td>155</td>
</tr>
</tbody>
</table>

Source: MPCA Discharge Monitoring Reports; USDOE and MN Department of Commerce 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 41 kg/d, which represents a 0.1 percent increase over existing loads. 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 limited sampling in studies done for PolyMet, it is estimated that current total mercury concentrations average about 3.6 ng/L in the Upper Partridge River (Barr 2011a) and between 4.8 and 6.0 ng/L in Colby Lake. As discussed in Section 5.2.2.3.4, mercury was not included in the GoldSim model as insufficient data and a general lack of definitive understanding of mercury dynamics prevented modeling mercury like the other solutes.

Table 6.2-5 summarizes the relative mercury contributions from the various identified activities in the watershed. Tests using local rainfall found that contact with Duluth Complex rock actually decreased total mercury concentrations (SRK 2007b). Other 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 over 10 ng/L mercury serving as their primary water source. One reason for this is that much of the mercury in a water body associates with particulate matter, which often settles to the bottom sediments out of the water column.
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.

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

<table>
<thead>
<tr>
<th>Activity</th>
<th>Average Discharge/Release Rate (cfs)</th>
<th>Representative Mercury Concentration (ng/L)</th>
<th>Average Mercury Load (kg/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northshore Mine¹</td>
<td>5.8</td>
<td>~1</td>
<td>4.3E-05</td>
</tr>
<tr>
<td>City of Hoyt Lakes</td>
<td>0.5</td>
<td>7.6</td>
<td>9.3 E-04</td>
</tr>
<tr>
<td>Mesaba Energy Project</td>
<td>16.1</td>
<td>Unknown</td>
<td>na</td>
</tr>
<tr>
<td>Mesabi Nugget</td>
<td>8.9 (7 mo.)</td>
<td>~0.75</td>
<td>9.5</td>
</tr>
<tr>
<td>Mesabi Mining Project</td>
<td>11.8</td>
<td>0.46</td>
<td>1E-05</td>
</tr>
<tr>
<td>Laskin Energy Center</td>
<td>194</td>
<td>No change in loading</td>
<td>0</td>
</tr>
<tr>
<td>LTVSMC Pits 2E/2W</td>
<td>7.7</td>
<td>&lt;1</td>
<td>&lt;0.002</td>
</tr>
<tr>
<td>LTVSMC Pit 3</td>
<td>0.8</td>
<td>0.65</td>
<td>1.3 E-04</td>
</tr>
</tbody>
</table>

Source: MPCA 2012d  
¹ DMR from 2004 to 2009.  
² This load has been removed from the Partridge River by LTVSMC pumping seepage back into Tailing Basin Cell 1E under the Consent Decree. PolyMet would continue this practice and augment flow with WWTP effluent.  
³ Average mercury concentration during West Pit flooding (years 20-40) is 0.3 ng/L and after flooding (year 40) is approximately 0.5 ng/L.

### 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.

Since the NorthMet Project Proposed Action is not expected to have the potential for synergistic cumulative water quality effects, this cumulative effects analysis focuses on sulfate (because of its relationship with mercury methylation and wild rice) and mercury (only parameter on 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. For the NorthMet Project Proposed Action, the Band representative(s) identified sulfate concentrations in receiving waters, especially those used for the production of wild rice and/or for subsistence fishing, as an issue for consideration in the SDEIS.
Sulfate

Present sulfate concentrations in the Embarrass River downstream of the NorthMet Project area are elevated well above natural background levels. Median sulfate concentration at PM-12, upstream of any historic mining activity, is about 3 mg/L compared to a median of about 32 mg/L at PM-13. This increase in sulfate concentrations is primarily attributable to the Pit 5NW overflow (average flow of 1.0 cfs and sulfate concentration of 1,046 mg/L) and seepage from the existing LT-VSMC 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 concentration (see Section 5.2.2.1.3) at PM-13 by about 35 percent relative to the No Action (continuation of existing conditions) 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 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

<table>
<thead>
<tr>
<th>Activity</th>
<th>Average Discharge/Release Rate (cfs)</th>
<th>Representative Sulfate Concentration (mg/L)</th>
<th>Average Sulfate Load (kg/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Babbitt POTW</td>
<td>0.33</td>
<td>37.4</td>
<td>30.2</td>
</tr>
<tr>
<td>Cliffs Erie Area 5 NW Pit</td>
<td>~1.0</td>
<td>1,046</td>
<td>2,559</td>
</tr>
<tr>
<td>Cliffs Erie Tailings Basin</td>
<td>4.5</td>
<td>228</td>
<td>2,510</td>
</tr>
<tr>
<td>ArcelorMittal Mine (Laurentian and East Reserve Mine)</td>
<td>9.3</td>
<td>186</td>
<td>4,232</td>
</tr>
</tbody>
</table>


The NorthMet Project Proposed Action would reduce the existing sulfate load from the existing LT-VSMC Tailings Basin significantly as a result of the capture of tailings seepage by the Tailings Basin groundwater containment system and subsequent treatment via the WWTP before discharge as part of the tributary stream flow augmentation. This reduction in NorthMet Project Proposed Action sulfate load would result in a 31 percent overall reduction in sulfate 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), in the chain of lakes, and in Lower Embarrass River.

Mercury

The Embarrass River is not on the 303(d) list of impaired waters, however, several lakes downstream of the project through which the Embarrass River flows are listed for “mercury in fish tissue” impairment, including Sabin, Wynne, Embarrass, and Esquagama lakes (Figure 4.1-1). These lakes are not covered by the Statewide Mercury TMDL, but are impaired waters...
and are still 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 atmospheric mercury deposition alone.

Based on limited sampling in studies done for PolyMet, it is estimated that total mercury concentrations in the Embarrass River averaged 4.3 ng/L at monitoring station PM-12 and 3.2 ng/L at monitoring station PM-13 from 2004 to 2011. Methylmercury concentrations in the Embarrass River average 0.6 ng/L at PM-12 and 0.4 ng/L at PM-13 over the same period (Section 4.2.2.1.4). The overall average total mercury concentration at two discharge locations at the Tailings Basin (SD026 and SD004) over a 5 year period was 1.1 ng/L, indicating relatively low mercury concentrations in the existing LTVSMC Tailings Basin seepage. All monitoring results were well below average concentrations in precipitation (13 ng/L), so most 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 result in significant discharges of total mercury; 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

<table>
<thead>
<tr>
<th>Activity</th>
<th>Average Discharge/Release Rate (cfs)</th>
<th>Representative Mercury Concentration (ng/L)</th>
<th>Average Total Mercury Load (kg/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Babbitt POTW</td>
<td>0.33</td>
<td>3.0</td>
<td>2.4E-06</td>
</tr>
<tr>
<td>Area 5 NW Pit</td>
<td>1.0</td>
<td>0.74</td>
<td>1.8E-06</td>
</tr>
<tr>
<td>NorthMet Project Proposed Action</td>
<td>4.5</td>
<td>1.1</td>
<td>1.1E-05</td>
</tr>
<tr>
<td>Arcelor Mittal Mines (Laurentian and East Reserve Mine)</td>
<td>9.3</td>
<td>2.5</td>
<td>5.7E-05</td>
</tr>
</tbody>
</table>


The NorthMet Project Proposed Action is predicted to result in a net increase in mercury loadings to the Embarrass River from 22.3 grams per year to 22.9 grams per year. This is primarily attributable to the redirection of flow associated with the construction of the East Dam as part of the Tailings Basin expansion to the Embarrass River. If the mercury load associated with this redirection is removed, the NorthMet Project Proposed Action would result in a net decrease in NorthMet Project Proposed Action -related mercury load to the Embarrass River. Further, as described above, the NorthMet Project Proposed Action would result in a 31 percent reduction in sulfate loads at PM-13, so the NorthMet Project Proposed Action would be reducing the potential for mercury methylation. Therefore, the NorthMet Project Proposed Action would not contribute to cumulative effects on mercury. Regarding mercury, the Band representative(s) identified that all increases in mercury contributions to the environment constitute a risk to human and ecosystem health an issue for consideration in the SDEIS.
6.0 CUMULATIVE EFFECTS

6.2.3.4 Wetlands

The cumulative effects analysis for wetlands focuses on cumulative effects of 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 2013a). 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 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 2013a).

Existing wetland, lake, and deepwater resources were estimated using the following sources of data: 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 water bodies (PolyMet 2013a).

Federal and state agencies and local governments 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 during the life of the NorthMet Project Proposed Action. For the projected future conditions, the acreage of wetland, lake, and deepwater resources was estimated by subtracting the future projected wetland effects and adding the future projected development of wetland, lake, and deepwater resources to the existing resource totals (PolyMet 2013a).

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.

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 those resources expected to be present following the conclusion and long-term closure of the NorthMet Project Proposed Action (PolyMet 2013a).
6.2.3.4.3 Cumulative Actions

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

- Mesabi Mining Project;
- Minnesota Power Laskin Energy Park;
- St. Louis County Public Works; and
- County Road 4 Extension Project.

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 original survey 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 original survey maps for the Partridge River Watershed (PolyMet 2013a).

Disturbance in the Townships located within the Partridge River Watershed range between 0.4 percent and 52 percent, with approximately 15 percent of the entire Partridge River Watershed containing significant 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 (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 2013a).

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 (Table 6.2-8).
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 (Table 6.2-8).

No deepwater resources were identified in the watershed for the pre-settlement conditions (Table 6.2-8).

Table 6.2-8  Pre-settlement Wetland and Water Resources

<table>
<thead>
<tr>
<th>Watershed</th>
<th>Total Land Area (Acres)</th>
<th>Wetland Area</th>
<th>Lake Area</th>
<th>Deepwater Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acres</td>
<td>% of Watershed</td>
<td>Acres</td>
<td>% of Watershed</td>
</tr>
<tr>
<td>Partridge River</td>
<td>101,812</td>
<td>33</td>
<td>2,688</td>
<td>3</td>
</tr>
<tr>
<td>Embarrass River</td>
<td>116,797</td>
<td>30</td>
<td>3,121</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: PolyMet 2013a.

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 2013a).

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 significant 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 2013a).

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 (Table 6.2-8).

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 (Table 6.2-8).

No deepwater resources (i.e., mine pits) were identified in the watershed for the pre-settlement conditions (Table 6.2-8).

**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 (Table 6.2-9). 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 2013a).

A total of 3,194 acres of lakes were identified in the 101,812-acre watershed, comprising 3 percent of the land area (Table 6.2-9). 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 2013a).

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 (Table 6.2-9). There has been an increase of 3,146 acres of deepwater resources (100 percent increase) in the watershed compared to no deepwater resources present under pre-settlement conditions (PolyMet 2013a).

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 6.2-9 Existing Wetland and Water Resources by Watershed**

<table>
<thead>
<tr>
<th>Watershed</th>
<th>Total Land Area (Acres)</th>
<th>Wetland Area</th>
<th>Lake Area</th>
<th>Deepwater Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acres</td>
<td>% of Watershed</td>
<td>Acres</td>
<td>% of Watershed</td>
</tr>
<tr>
<td>Partridge River</td>
<td>101,812</td>
<td>31,318</td>
<td>3,194</td>
<td>3,146</td>
</tr>
<tr>
<td>Embarrass River</td>
<td>116,797</td>
<td>34,249</td>
<td>2,904</td>
<td>977</td>
</tr>
</tbody>
</table>

Source: PolyMet 2013a.

**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 (Table 6.2-9). There has been a decrease of approximately 401 acres of wetland; this represents a 1 percent reduction in wetland area compared to pre-settlement conditions (PolyMet 2013a).

A total of 2,904 acres of lakes were identified in the 116,797-acre watershed, comprising 3 percent of the land area (Table 6.2-9). 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 2013a).
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 (Table 6.2-9). There has been an increase of 977 acres of deepwater resources (100 percent increase) in the watershed compared to no deepwater resources present under pre-settlement conditions (PolyMet 2013a).

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**

In addition to the NorthMet Project Proposed Action, development of other projects (and associated effects on and mitigation of wetlands, lakes, and deepwater resources in the Partridge River Watershed) would occur under the foreseeable future conditions.

Approximately 30,937 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 (Table 6.2-10). 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 2013a).

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 (Table 6.2-10). 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 2013a).

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 (Table 6.2-10). The change in deepwater resources, as a proportion of the total study area, would be a 100 percent increase from pre-settlement conditions and a 12 percent increase compared to existing conditions (PolyMet 2013a).

<table>
<thead>
<tr>
<th>Watershed</th>
<th>Total Land Area (Acres)</th>
<th>Wetland Area Acres</th>
<th>% of Watershed</th>
<th>Lake Area Acres</th>
<th>% of Watershed</th>
<th>Deepwater Area Acres</th>
<th>% of Watershed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partridge River</td>
<td>101,812</td>
<td>30,937</td>
<td>30</td>
<td>3,194</td>
<td>3</td>
<td>3,516</td>
<td>3</td>
</tr>
<tr>
<td>Embarrass River</td>
<td>116,797</td>
<td>34,074</td>
<td>29</td>
<td>2,904</td>
<td>3</td>
<td>977</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: PolyMet 2013a.

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 (Table 6.2-11). 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 2013a).

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 (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 2013a).

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 (Table 6.2-11). The change in deepwater resources, as a proportion of the total study area, would be a 100 percent increase from pre-settlement conditions and a 2 percent increase compared to existing conditions (PolyMet 2013a).

<table>
<thead>
<tr>
<th>Watershed</th>
<th>Total Land Area (Acres)</th>
<th>Wetland Area</th>
<th>Lake Area</th>
<th>Deepwater Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acres</td>
<td>% of Watershed</td>
<td>Acres</td>
<td>% of Watershed</td>
</tr>
<tr>
<td>Partridge River</td>
<td>101,812</td>
<td>31,044</td>
<td>30</td>
<td>3,194</td>
</tr>
<tr>
<td>Embarrass River</td>
<td>116,797</td>
<td>34,248</td>
<td>29</td>
<td>2,904</td>
</tr>
</tbody>
</table>

Source: PolyMet 2013a.

**Embarrass River Watershed**

In addition to the NorthMet Project Proposed Action, development of other projects (and associated effects on and mitigation of wetlands, lakes, and deepwater resources in the Embarrass River Watershed) would occur under the foreseeable future conditions.

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 (Table 6.2-10). 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 2013a).

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 (Table 6.2-10). 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 2013a).

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 (Table 6.2-10). There would be a 100 percent increase from pre-settlement conditions and there would be no changes in deepwater resources compared to existing conditions (PolyMet 2013a).
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 (Table 6.2-11). 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 2013a).

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 (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 2013a).

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 (Table 6.2-11). The change in deepwater resources, as a proportion of the total study area, would be a 100 percent increase from pre-settlement conditions and there would be no changes in deepwater resources compared to existing conditions (PolyMet 2013a).

**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**

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. 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. 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, significant biodiversity sites, 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.
6.0 CUMULATIVE EFFECTS

6.2.3.5.1 Approach
The GIS data presented in Sections 4.2.4 and 5.2.4 were 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 (Section 5.2.4.2).

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 (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 significant radius of 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 time spans are indicative of past and relatively current trends in regional habitat changes relevant to the CEAA. An estimate of future trends will 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

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:

- Arcelor Mittal 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 assessment will be guided by evaluation criteria, which are outlined below.

- Direct effects on vegetative cover types, plant communities, significant biodiversity sites, and rare species would occur through clearing, filling, and other construction activities. Direct effects 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, significant biodiversity site, or 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 (Table 6.2-12). 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 (Table 6.2-13). 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 6.2-12  Changes in Habitat Acreage between 1890 and 1990 by Ecological Subsection

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Percentage of Laurentian Uplands</th>
<th>Percentage of Nashwauk Uplands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowland coniferous forest</td>
<td>7</td>
<td>(4)</td>
</tr>
<tr>
<td>Lowland deciduous forest</td>
<td>&lt;1</td>
<td>2</td>
</tr>
<tr>
<td>Upland coniferous forest</td>
<td>4</td>
<td>(8)</td>
</tr>
<tr>
<td>Upland deciduous forest</td>
<td>2</td>
<td>(1)</td>
</tr>
<tr>
<td>Upland conifer-deciduous mixed forest</td>
<td>&lt;1</td>
<td>(5)</td>
</tr>
<tr>
<td>Shrubland</td>
<td>(15)</td>
<td>9</td>
</tr>
<tr>
<td>Wetland</td>
<td>1</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Disturbed</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Cropland/Grassland</td>
<td>na</td>
<td>na</td>
</tr>
</tbody>
</table>

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 plant species. Because ETSC 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 plant species.
Table 6.2-13  Preferred Habitat for State-listed ETSC Plant Species and Most Likely Associated Habitat Types

<table>
<thead>
<tr>
<th>Species</th>
<th>Preferred Plant Species Habitat</th>
<th>Corresponding Map Habitat Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botrychium campestre</td>
<td>Prairies, dunes, railroad sidings, fields</td>
<td>Disturbed; Cropland/Grassland</td>
</tr>
<tr>
<td>Botrychium pallidum</td>
<td>Early successional, roadides, disturbed areas</td>
<td>Disturbed; Cropland/Grassland</td>
</tr>
<tr>
<td>Botrychium rugulosum</td>
<td>Conifer forests, openings, disturbed areas</td>
<td>Upland coniferous</td>
</tr>
<tr>
<td>Botrychium simplex</td>
<td>Disturbed areas, lowland hardwood forest</td>
<td>Disturbed; Lowland deciduous</td>
</tr>
<tr>
<td>Caltha natans</td>
<td>Lakeshores, pond edges, and streams in deciduous and coniferous forests, wet meadows</td>
<td>Lowland coniferous; Lowland deciduous</td>
</tr>
<tr>
<td>Eleocharis nitida</td>
<td>Acid bogs, streams, disturbed wetland edges, roadides and trails</td>
<td>Lowland coniferous; Disturbed</td>
</tr>
<tr>
<td>Juncus stygius var. americanus</td>
<td>Wet zones of bogs and fens</td>
<td>Lowland coniferous</td>
</tr>
<tr>
<td>Platanthera clavellata</td>
<td>Coniferous swamps, fens</td>
<td>Lowland coniferous</td>
</tr>
<tr>
<td>Ranunculus lapponicus</td>
<td>Lowland conifer forests and peat bogs</td>
<td>Lowland coniferous</td>
</tr>
<tr>
<td>Sparganium glomeratum</td>
<td>Sedge meadow, bogs, lakeshores</td>
<td>Aquatic environments</td>
</tr>
<tr>
<td>Torreyochloa pallida</td>
<td>Pond/stream margins, lowland coniferous forest</td>
<td>Lowland coniferous</td>
</tr>
</tbody>
</table>

Source: MDNR 2011f.

Environmental Consequences of Reasonably Foreseeable Actions on Endangered, Threatened, and Special Concern Plant Species

Future effects on ETSC 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 (Table 6.2-14). 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 6.2-14  Potential Future Effects on ETSC Plant Species Populations Occurring from Reasonably Foreseeable Activities

<table>
<thead>
<tr>
<th>Species</th>
<th>Other Projects Direct Effect (Populations)</th>
<th>Other Projects Indirect Effect (Populations)</th>
<th>NorthMet Project Proposed Action Total Effect (Populations)</th>
<th>Total Known Statewide Populations Affected</th>
<th>Percent of Known Statewide Populations Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botrychium pallidum</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>99</td>
<td>5</td>
</tr>
<tr>
<td>Botrychium rugulosum</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>72</td>
<td>8</td>
</tr>
<tr>
<td>Botrychium simplex</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>210</td>
<td>3</td>
</tr>
</tbody>
</table>

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.

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

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 (Table 6.2-14). 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 (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 (Table 6.2-14). *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 within the Laurentian Uplands subsection, the average annual forest acres that were or will be harvested on state lands is approximately 1,034 acres (0.2 percent of the subsection) (MDNR 2006b). Between 2010 and 2019 within the Nashwauk Uplands subsection, the average annual forest acres that were or will be harvested on state lands is 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 (NO₂/SO₂) and Mercury Deposition**

Acid (sulfate and nitrate) and mercury deposition from air sources could also affect vegetation and ETSC species. The sources and analysis are described in Section 6.2.3.7.4. 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 Heikkilla Lake, Colby Lake, Sabin Lake, Wynne Lake, and Whitewater Lake.

The MPCA estimated that over 90 percent of the mercury deposition within Minnesota is a result of out-of-state emissions from long-range transport (MPCA 1985). For more information on the cumulative analysis of acid and mercury deposition associated with air emissions, see Section 6.2.3.7.4.

### 6.2.3.6 Wildlife

The cumulative effect 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 and 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 (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 will be 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:

- Arcelor Mittal 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.
Figure 6.2.3-2
North-South Wildlife Travel Corridors
NorthMet Mining Project and Land Exchange PSDEIS
Minnesota
May 2013

This PSDEIS document is a Co-lead Agency provisional draft intended for internal review only. Corrections, revisions, and changes will be made prior to the release of the SDEIS for public review and comment.

<table>
<thead>
<tr>
<th>Wildlife Travel Corridors</th>
<th>Ecosystem Subsections</th>
<th>Streams/Rivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative Actions</td>
<td>Native American Reservation</td>
<td>Lakes</td>
</tr>
<tr>
<td>Mine Site</td>
<td>High Quality Wildlife Corridor</td>
<td>National Forest</td>
</tr>
<tr>
<td>Plant Site</td>
<td>Moderate Quality Wildlife Corridor</td>
<td>Boundary Waters</td>
</tr>
<tr>
<td>Transportation and Utility Corridor</td>
<td>Superior Canoe Area Wilderness</td>
<td>Canoe Area Wilderness</td>
</tr>
</tbody>
</table>

DRAFT SUBJECT TO REVISION
This PSDEIS document is a Co-lead Agency provisional draft intended for internal review only. Corrections, revisions, and changes will be made prior to the release of the SDEIS for public review and comment.
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 and Laurentian Upland subsections from pre-settlement through today are presented in Section 6.2.3.5.4, in Table 6.2-12. 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 and 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 and 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 and 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 and 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) (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;
- Arcelor Mittal Mines (Laurentian and East Reserve Mines);
- NorthMet Project Proposed Action;
- Northshore Mine;
- Mesabi Nugget and Mesabi Mining Project;
- Mesaba Energy Power Generation Station; and
- Arcelor Mittal Mines (Laurentian and East Reserve Mines).

Of the 13 large mammal wildlife crossing corridors identified by Emmons and 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 (Figure 6.2.3-2). The existing LTVSMC Tailings Basin provides poor habitat, is not likely to be heavily used by wildlife, and currently obstructs animal movement.
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 and 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 and Olivier and Barr (see Table 6.2-9 and Figure 6.2.3-2) (Emmons and 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 6.2-15 Cumulative Effects on Wildlife Travel Corridors in the Mesabi Iron Range**

<table>
<thead>
<tr>
<th>Wildlife Travel Corridor</th>
<th>Project</th>
<th>Type of Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Urban Development, Highway Traffic</td>
<td>Minimal habitat isolation; may restrict wildlife travel through corridor due to roads, railroads, and potential expansion of the City of Grand Rapids.</td>
</tr>
<tr>
<td>2</td>
<td>Highway Traffic</td>
<td>Habitat isolation; may restrict wildlife travel through corridor due to highway traffic (US 169), which may increase over time.</td>
</tr>
<tr>
<td>3</td>
<td>Urban Development, Essar Steel</td>
<td>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.</td>
</tr>
<tr>
<td>4</td>
<td>Highway Traffic, Essar Steel, U.S. Steel Keetac</td>
<td>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.</td>
</tr>
<tr>
<td>5</td>
<td>U.S. Steel Keetac</td>
<td>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.</td>
</tr>
<tr>
<td>6</td>
<td>Highway Traffic, Urban Development, U.S. Steel Minntac</td>
<td>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).</td>
</tr>
<tr>
<td>7</td>
<td>Urban Development</td>
<td>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.</td>
</tr>
<tr>
<td>Wildlife Travel Corridor</td>
<td>Project</td>
<td>Type of Effect</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------</td>
<td>----------------</td>
</tr>
<tr>
<td>8</td>
<td>Highway Traffic, U.S. Steel Minntac</td>
<td>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.</td>
</tr>
<tr>
<td>9</td>
<td>U.S. Steel Minntac</td>
<td>Direct loss of travel corridor; the U.S. Steel Minntac mine pit expansion would eliminate eastern end of corridor.</td>
</tr>
<tr>
<td>10</td>
<td>Urban Development</td>
<td>Minimal effect; wildlife travel through this corridor may be restricted by expansion of Eveleth or Gilbert and associated roads.</td>
</tr>
<tr>
<td>11</td>
<td>Arcelor Mittal</td>
<td>Habitat isolation and direct loss; wildlife travel through this corridor may be restricted by Arcelor Mittal’s Project, which would prevent access between northern and southern blocks of the corridor.</td>
</tr>
<tr>
<td>12</td>
<td>Urban Development</td>
<td>Minimal effect; wildlife travel through this corridor may be restricted by expansion of the City of Biwabik.</td>
</tr>
<tr>
<td>13</td>
<td>Mesabi Nugget, Urban Development</td>
<td>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.</td>
</tr>
<tr>
<td>14</td>
<td>Mesabi Nugget</td>
<td>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.</td>
</tr>
<tr>
<td>15</td>
<td>Mesabi Nugget</td>
<td>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.</td>
</tr>
<tr>
<td>16</td>
<td>NorthMet Project Proposed Action</td>
<td>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.</td>
</tr>
<tr>
<td>17</td>
<td>NorthMet Project Proposed Action, Northshore Mine</td>
<td>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.</td>
</tr>
<tr>
<td>18</td>
<td>Northshore Mine</td>
<td>Direct loss and fragmentation; possible expansion of Northshore mine eastward may block or fragment this corridor.</td>
</tr>
</tbody>
</table>

Sources: Emmons and 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 (SO₂/NO₂) and Mercury Deposition**

As described in Section 6.2.3.7.4, there is a potential for acid depositions from sulfate (from SO₂ emissions) and nitrate (from NO₂ emissions). There is also potential for the deposition of mercury. These depositions may 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.

The MPCA estimated that over 90 percent of the acid deposition within Minnesota is the result of out-of-state emissions from long-range transport (MPCA 1985). For more information of the cumulative analysis of acid and mercury deposition from emissions, see Section 6.2.3.7.4.

**6.2.3.7 Aquatic Species**

Aquatic species are sensitive to elevated levels of pollutants and changes in their habitats. As discussed in Section 5.3.6, aquatic resources would be subject to effects from changes in physical habitat, water levels, and discharges of certain pollutants, especially mercury. Given that the region’s aquatic environment currently has impaired water quality, any additions from the cumulative actions, including the NorthMet Project Proposed Action, could exacerbate the problem.

**6.2.3.7.1 Approach**

Numerous mining operations and industries exist within the Mesabi Iron Range and many are, like the NorthMet Project areas, located within the vicinity of potential fish and aquatic macroinvertebrate habitat located within streams and lakes of the region. This section describes the potential cumulative environmental effects of the NorthMet Project Proposed Action, and other past and future projects within the vicinity of the NorthMet Project area, on fish and aquatic macroinvertebrate communities associated with waterbodies found in the vicinity of the NorthMet Project area, including the Mine Site, Transportation and Utility Corridor, and Plant Site.

**6.2.3.7.2 Cumulative Effects Assessment Area**

**Spatial**

The CEAA for evaluation of cumulative aquatic species effects is the same as Section 6.2.3.3 and is defined as the Partridge River and Embarrass River watersheds from their headwaters to a point approximately 15.5 miles downstream of the NorthMet Project Proposed Action activities where the rivers form the St. Louis River (Figure 6.2.3-1).
Temporal

This evaluation will focus on existing and anticipated water quality and future water resources within the CEAA.

Water quality and quantity effects results and conclusions, as presented in Sections 4.2.3 and 5.2.3, were used in combination with data for baseline aquatic biota conditions, as discussed in Section 4.2.7, to determine potential effects on aquatic biota in surface water bodies located in the spatial area of the NorthMet Project area.

6.2.3.7.3 Past, Present, and Reasonably Foreseeable Future Actions

This assessment will discuss 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 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 indicated that baseline studies performed within these watersheds exhibited species typical for this region and can be assumed to occur within the streams and rivers affected by the NorthMet Project Proposed Action.

6.2.3.7.4 Cumulative Effects Assessment

Cumulative Water Quality Effects

The NorthMet Project Proposed Action is not predicted to result in any short- or long-term exceedances of surface water chronic standards in the Partridge River, Colby Lake, or the Embarrass River, even under extreme low-flow conditions during operations, as discussed in Section 5.2.6.2. Given that finding no cumulative effects on aquatic resources are predicted within the CEAA.

The Class 2 standards specifically 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 the most 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).

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 no effects on current baseline habitat conditions would result from the NorthMet Project Proposed Action; therefore, no cumulative effects are anticipated from the NorthMet Project Proposed Action.

**Adverse 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 Heikkilla, Colby, Sabin, Wynne, Whitewater, and St. Louis lakes and the Partridge 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 MMREM was used to evaluate the risk for the following five lakes:

- Heikkilla Lake;
- Colby Lake;
- Sabin Lake;
- Wynne Lake; and
- Whitewater Lake.

The cumulative analysis used fish concentration data (Barr 2012c) as a baseline to assess the increase in mercury deposition from the NorthMet Project Proposed Action and the Mesabi Nugget LSDP emissions over existing risks. These two projects were assessed because they are the only “reasonable foreseeable” projects within 25km of the PolyMet Project Proposed Action. 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 (see Scenario 1 results in Table Revised Table 4B – Barr 2013. Regarding mercury, the Band representative(s) identified that all increases in mercury contributions to the environment constitute a risk to human and ecosystem health that is an issue for consideration in the EIS.

The Hazard Quotient (HQ) is the ratio of the mercury concentration in fish to health-based target of 0.2 ppm; an HQ greater than 1 exceeds the health-based target. The maximum incremental cumulative HQ from the two projects over existing fish mercury concentrations from the two projects 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 HQ. However, the current fish tissue concentration in the
five lakes results in HQs that exceed 1, leading to the need for the fish consumption advisories currently in effect (see Scenario 1 results in Figure 5 Barr 2012c).

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 EPA to address deposition from long-range sources. Mercury bioaccumulation in fish, with subsequent subsistence fishers consuming locally caught fish, has been raised by the Band representative(s) as an issue for consideration in the EIS.

In the period of time between the 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 2013). The guidance requires sources to: employ best controls to reduce mercury emissions; apply emissions limits to permit conditions; and if the facility’s emissions are greater than 3 lbs/yr after controls and the MPCA has determined that the facility’s mercury emissions will impede reduction goals within the mercury TMDL implementation plan, requirement a MPCA-approved site-specific mitigation plan.

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 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 modelling that are at or beyond the four boundary areas identified above.

**Temporal**

Based on the approved model’s limitations, this evaluation will use 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 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 (Barr 2012), as identified above.
This PSDEIS document is a Co-lead Agency provisional draft intended for internal review only. Corrections, revisions, and changes will be made prior to the release of the SDEIS for public review and comment.
Table 6.2-16 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 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.

Predicted cumulative exceedances of the 1-hour SO$_2$ standard occur on the western portion of the grid; however, the contribution from the NorthMet Project Proposed Action at all of these locations is below the federal SIL level of 7.83 µg/m$^3$. Locations of cumulative predicted exceedances are on the western half of the modeling grid and all modeled contributions at these locations from the NorthMet Project Proposed Action are below the federal 1-hour NO$_2$ SIL of 7.52 µg/m$^3$. By definition of federal significance criteria, these are not considered to significantly contribute to the overall concentration.

### Table 6.2-16 Results of Cumulative Class II NAAQS Modeling

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Averaging Time</th>
<th>Maximum Modeled Concentration ($\mu$g/m$^3$)</th>
<th>Background ($\mu$g/m$^3$)</th>
<th>Total ($\mu$g/m$^3$)</th>
<th>NAAQS/MAAQS ($\mu$g/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO$_2$</td>
<td>1-hour</td>
<td>887</td>
<td>6</td>
<td>893</td>
<td>196/1300</td>
</tr>
<tr>
<td></td>
<td>3-hour</td>
<td>772</td>
<td>12</td>
<td>784</td>
<td>NA/915</td>
</tr>
<tr>
<td></td>
<td>24-hour</td>
<td>249</td>
<td>6</td>
<td>255</td>
<td>NA/365</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>24</td>
<td>1</td>
<td>25</td>
<td>NA/40</td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>24-hour</td>
<td>41</td>
<td>36</td>
<td>77</td>
<td>150/150</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>5</td>
<td>14</td>
<td>19</td>
<td>NA/50</td>
</tr>
<tr>
<td>PM$_{2.5}$</td>
<td>24-hour</td>
<td>17</td>
<td>17</td>
<td>34</td>
<td>35/65</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>15/15</td>
</tr>
<tr>
<td>NO$_2$</td>
<td>1-hour</td>
<td>202</td>
<td>90</td>
<td>292</td>
<td>188/NA</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>6</td>
<td>18</td>
<td>24</td>
<td>100/100</td>
</tr>
</tbody>
</table>

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 PolyMet 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 6.2-17, along with a comparison to the allowable Class II PSD increments.

The data in Table 6.2-17 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 6.2-17  Results of Cumulative Class II PSD Increment Analysis

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Averaging Time</th>
<th>Cumulative Modeled Concentrations (µg/m$^3$)</th>
<th>PSD Increment Limits (µg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO$_2$</td>
<td>3-hour</td>
<td>11</td>
<td>512</td>
</tr>
<tr>
<td></td>
<td>24-hour</td>
<td>1.9</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>0.2</td>
<td>20</td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>24-hour</td>
<td>18</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>NO$_X$</td>
<td>Annual</td>
<td>0.9</td>
<td>25</td>
</tr>
</tbody>
</table>

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 VPN, but VPN receptors were included at the request of MPCA. The project 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 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 project alone. The maximum concentration due to 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 6.2-18 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 6.2-18 Results of Cumulative Class I PSD PM$_{10}$ Increment Analysis

<table>
<thead>
<tr>
<th>Class I Area</th>
<th>Averaging Time</th>
<th>Maximum Modeled Air Concentration For NorthMet Modeled Emissions ($\mu g/m^3$)</th>
<th>Maximum Modeled Air Concentration For Cumulative Modeled Emissions ($\mu g/m^3$)</th>
<th>Total Cumulative Modeled Air Concentration ($\mu g/m^3$)</th>
<th>PSD Increment Limit ($\mu g/m^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BWCAW</td>
<td>24-hour</td>
<td>0.33</td>
<td>1.76</td>
<td>2.09</td>
<td>8</td>
</tr>
<tr>
<td>VPN</td>
<td>24-hour</td>
<td>0.13</td>
<td>0.22</td>
<td>0.35</td>
<td>8</td>
</tr>
</tbody>
</table>

### 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, Saint 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 (MPCA 1985). Findings from other states and NDPAP (Washington 1990) lead 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 November 2011, there are approximately 11 new projects for the six-county area, including the NorthMet Project. 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 2011). This represents approximately a 12 percent and 7 percent increase in the estimated emissions for the two pollutants in the six county “zone of interest” through 2008 (Carlton, Itasca, St. Louis, Koochiching, Lake, and Cook Counties), respectively. However, due to the projected decreases in emissions from the Minnesota Power AREA 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 3,555 tpy and 1,279 tpy for NO$_2$ and SO$_2$ respectively, since 2008 (Barr 2011). In addition, supplemental decreases in emissions from the two pollutants are expected to occur due to.

As such, the emissions from the project, 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 \( \text{SO}_2 \) and \( \text{NO}_2 \) 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 significant 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 Proposed Project DEIS (Barr 2006h). Also, in addition to the quantitative assessment of cumulative \( \text{PM}_{10} \) increment consumption in the BWCAW described in Section 6.2.3, a semi-quantitative assessment of potential cumulative \( \text{PM}_{10} \) air concentrations and the potential effect on increment consumption in Minnesota Class I areas was also completed (Assessment of Potential Visibility Cumulative Impacts on Federal Class I Areas in Minnesota, Barr 2011f).

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’). An addendum to this report was also submitted in 2011 (Assessment of Potential Visibility Cumulative Impacts on Federal Class I Areas in Minnesota, Barr 2011f). 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 project (Barr 2006h). The updated analysis presented here 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 (Assessment of Potential Visibility Cumulative Impacts on Federal Class I Areas in Minnesota, Barr 2011f). 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 must submit a State Implementation Plan (SIP) to USEPA 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 SO2 emissions by 2018 from 2002 levels from point sources in Northeast Minnesota that emit over 100 tons per year of either NOx and SO2.

Minnesota’s Draft Regional Haze SIP (MPCA 2008, Minnesota Draft Haze SIP – FLM Review Copy) relied on implementation of the Federal Clean Air Interstate Rule (CAIR) to substitute for BART for power plants and in predictions of future emissions. CAIR was vacated by the DC Circuit Court of Appeals, in July 2008, but on re-hearing the Court decided simply to remand the rule to the USEPA. As one of the issues raised was whether Minnesota should be included in the CAIR region, the USEPA has indicated that it intends to stay the effectiveness of CAIR in Minnesota. In the revised 2009 Draft Regional Haze SIP, MPCA included BART determinations for affected power plants for which it had previously relied on CAIR to reduce emissions. Since then, Minnesota has been included in the Cross-State-Air-Pollution-Rule (CSAPR), as described in 40 CFR §2.1240-1241. In 2011, USEPA proposed that the emissions reductions in CSAPR than site-specific BART determinations for power plants. As such, Minnesota has submitted a Regional Haze SIP Supplement (MPCA 2012d) to substitute CSAPR for BART for power plants. On June 12, 2012, USEPA has partially approved the SIP supplement.

**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 will 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, SO2, 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, The Particle Pollution Report; MPCA 2005, Annual Pollution Report to the Legislature), so emissions from the project 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 (106 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 deciview 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 project was completed in essentially four general steps:

- Assess the IMPROVE data for Voyageurs National Park and the Boundary Waters Canoe Area 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$_2$, NO$_x$, 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$_2$, NO$_x$, 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 Proposed Project.
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 Company, Large Scale Demonstration Plant;
  - Mesabi Nugget Company, Phase II 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;
  - PolyMet Mining, NorthMet 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; and
  - Northshore Mining Company: BART Reductions.

- **United Taconite BART Reductions Regulatory and other actions:**
  - Implementation of the Regional Haze Rule and BART Rule;
  - Implementation of the CAIR Rule or NOx SIP call (40 CFR parts 51, 72, 75, 96);
  - Implementation of the Taconite MACT;
  - USEPA Proposed Rule for NOx in Class I Areas (Fed. Register, Vol. 70, No. 35);
  - State acid rain rule and statewide SO2 emissions cap; and
  - Title IV of the 1990 Clean Air Act Amendments.

- **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;
  − RACT requirements under the Wisconsin and Michigan PM$_{2.5}$ and ozone SIPS;
  − 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; and
  − Xcel Energy’s Riverside plant re-powering project.

**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 VNP (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 2010 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 2010, showed a lesser visibility improvement trend in the haze index for the 20 percent best days, 20 percent worst days, and median days (-18 percent, -9 percent, -10 percent, respectively) in the rolling 5-year average data, primarily due to 2010 levels. It should be noted that the comparison of the average HI median concentration deciviews between VOYA1 (1988-1993) and VOYA2 (2000-2010) showed a 17 deciview decrease 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 6.2-19 shows the estimated potential emissions of SO$_2$, NO$_x$, 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 2008. This cutoff date was chosen since the monitoring and emission inventory data used to assess the past or existing conditions includes information up to 2008. Any sources not operating during most of 2008 were not included in the analysis of the existing conditions and therefore need to be considered in the assessment of future cumulative effects.

#### Table 6.2-19 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

<table>
<thead>
<tr>
<th>Project</th>
<th>City/County in Minnesota</th>
<th>SO$_2$ (tpy)</th>
<th>NO$_x$ (tpy)</th>
<th>PM$_{10}$ (tpy)</th>
<th>BACT/MACT$^{(16)}$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Increases</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excelsior Energy, Mesaba Energy Project$^{(1)}$</td>
<td>Taconite or Hoyt Lakes, St. Louis or Itasca County</td>
<td>1,390</td>
<td>2,872</td>
<td>532</td>
<td>Yes</td>
</tr>
<tr>
<td>Mesabi Nugget LSDP$^{(2)}$</td>
<td>Hoyt Lakes, St. Louis County</td>
<td>417</td>
<td>955</td>
<td>587</td>
<td>Yes</td>
</tr>
<tr>
<td>Mesabi Mining Project$^{(3)}$</td>
<td>Hoyt Lakes, St. Louis County</td>
<td>7</td>
<td>298</td>
<td>1,260</td>
<td>Yes</td>
</tr>
<tr>
<td>Essar Steel Minnesota LLC (formerly Minnesota Steel)$^{(4)}$</td>
<td>Nashwauk, Itasca County</td>
<td>421</td>
<td>1,505</td>
<td>1,354</td>
<td>Yes</td>
</tr>
<tr>
<td>Essar Steel Minnesota LLC Project Modifications$^{(5)}$</td>
<td>Nashwauk, Itasca County</td>
<td>146</td>
<td>-69</td>
<td>-90</td>
<td>Yes</td>
</tr>
<tr>
<td>Northshore Mining Company, Furnace 5 Reactivation$^{(6)}$</td>
<td>Silver Bay, Lake County</td>
<td>56</td>
<td>200</td>
<td>149</td>
<td>Yes</td>
</tr>
<tr>
<td>PolyMet Mining, NorthMet Project$^{(7)}$</td>
<td>Hoyt Lakes, St. Louis County</td>
<td>40</td>
<td>473</td>
<td>1,186</td>
<td>No</td>
</tr>
<tr>
<td>SAPPI Cloquet$^{(12)}$</td>
<td>Cloquet, Carlton County</td>
<td>1</td>
<td>162</td>
<td>29</td>
<td>Yes</td>
</tr>
<tr>
<td>UPM/Blandin Paper Mill Expansion, Project Thunderhawk$^{(8)}$</td>
<td>Grand Rapids, Itasca County</td>
<td>213</td>
<td>169</td>
<td>-7</td>
<td>Yes</td>
</tr>
<tr>
<td>U. S. Steel Keewatin, Keetac, Expansion$^{(9)}$</td>
<td>Keewatin, Itasca and St. Louis County</td>
<td>81</td>
<td>35</td>
<td>1,284</td>
<td>Yes</td>
</tr>
<tr>
<td>United Taconite Green Production Project$^{(13)}$</td>
<td>Forbes, St. Louis County</td>
<td>35</td>
<td>35</td>
<td>-10</td>
<td>No$^{(8)}$</td>
</tr>
<tr>
<td><strong>Total Increases</strong></td>
<td></td>
<td>2,807</td>
<td>6,635</td>
<td>5,274</td>
<td></td>
</tr>
</tbody>
</table>

Reductions
6.0 CUMULATIVE EFFECTS

This PSDEIS document is a Co-lead Agency provisional draft intended for internal review only.
Corrections, revisions, and changes will be made prior to the release of the SDEIS for public review and comment.

<table>
<thead>
<tr>
<th>Project</th>
<th>City/County in Minnesota</th>
<th>SO₂ (tpy)</th>
<th>NOₓ (tpy)</th>
<th>PM₁₀⁽¹⁵⁾ (tpy)</th>
<th>BACT/MACT⁽¹⁶⁾</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minnesota Power Taconite Harbor Energy Center Unit 2, Emission Control Modifications for SO₂, NOₓ and mercury⁽¹⁰⁾⁽¹¹⁾</td>
<td>Schroeder, Cook County</td>
<td>-1,549</td>
<td>-1,149</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minnesota Power Laskin Energy Center Unit 2, NOₓ Reductions⁽¹¹⁾</td>
<td>Hoyt Lakes, St. Louis County</td>
<td>-143</td>
<td>-1,381</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minnesota Power Boswell Energy Center Unit 3⁽¹¹⁾</td>
<td>Cohasset, Itasca County</td>
<td>-11,952</td>
<td>-9,683</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U. S. Steel Minntac BACT Reductions⁽¹¹⁾</td>
<td>Mt. Iron, St. Louis County</td>
<td></td>
<td>-7,624</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hill Wood Products⁽¹⁴⁾</td>
<td>Cook, St. Louis County</td>
<td></td>
<td>-14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northshore Mining Company: BART Reductions⁽¹¹⁾</td>
<td>Silver Bay, Lake County</td>
<td>-583</td>
<td>-1,159</td>
<td></td>
<td></td>
</tr>
<tr>
<td>United Taconite BART Reductions⁽¹¹⁾</td>
<td>Forbes, St. Louis County</td>
<td>-2,240</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Reductions</td>
<td></td>
<td>-16,467</td>
<td>-20,996</td>
<td>6,260</td>
<td></td>
</tr>
<tr>
<td>Net Reductions/Increase</td>
<td></td>
<td>-13,660</td>
<td>-14,361</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Prepared November and December 2008:

4. Baseline emission from Potential to emit from Technical Support Document for Minnesota Steel (MPCA permit #06100067-002).
5. Project modifications preliminary emission estimates by 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 cutoff 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.
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 tannicot 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 will be a small increase in actual emissions, there will be a decrease in the allowable emissions.
10. Facility shutdown. Emission reduction estimate based on average emissions for last 5 years of operation from MPCA emission inventory database.
11. Emission estimates provided by the MPCA from the “Northeast Minnesota Plan Emission Tracking Spreadsheet” 1-20-2011.
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 plant has an existing wet scrubber to control particulate and SO₂ emissions. Emissions estimates are taken from the Technical Support Document of Permit Number 13700113-005 authorizing the project on August 19, 2010.
14. PM₁₀ emission estimates include point and fugitive emissions for all sources at a facility.
Emissions of both NO\textsubscript{x} and SO\textsubscript{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\textsubscript{x} and SO\textsubscript{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\textsubscript{10} for all the proposed projects combined, direct PM\textsubscript{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 (USFS 2009a, Technical Comments on Minnesota Regional Haze State Implementation Plan).

**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\textsubscript{2} and NO\textsubscript{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\textsubscript{2} and NO\textsubscript{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 2008, Minnesota Draft Haze SIP – FLM Review Copy). 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 6.2-19 will likely reduce emissions of SO₂ and NOx in Minnesota. However as addressed above, the MPCA has developed Regional Haze SIP goals to reduce combined NOx and SO₂ from 2002 levels. The reduction is 20 percent by 2012 and 30 percent by 2018. Based on current projections including the Proposed Project, the reductions addressed in this section are not projected to be enough to meet the 2018 goal. The reductions will 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 Project 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 2010b). 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 as provided by the CEQ regulations (40 CFR 1502.21.)

The Keetac EIS found that:

- 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 186,342 mtpy of GHG. Table 6.2-20 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 6.2-20  Greenhouse Gas Emissions

<table>
<thead>
<tr>
<th></th>
<th>Total GHG Emissions (million mt(\text{py}))</th>
<th>Proposed Action GHG Emissions as a Proportion of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td>49,000</td>
<td>0.00038%</td>
</tr>
<tr>
<td>National</td>
<td>7,282</td>
<td>0.0026%</td>
</tr>
<tr>
<td>Minnesota</td>
<td>159.4</td>
<td>0.12%</td>
</tr>
<tr>
<td>NorthMet</td>
<td>0.1864</td>
<td></td>
</tr>
</tbody>
</table>

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 on current science.

6.2.3.8.11  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 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.

6.2.3.9  Cultural Resources

The cumulative effects analysis for cultural resources focuses on potential effects on historic properties and 1854 Treaty resources. This section provides a qualitative analysis of cumulative effects on 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.

Given the broad range of resources under the term “cultural resources,” the reader should reference the appropriate natural resource sections for detail regarding cumulative effects on specific natural resources of concern. This section focuses primarily on cumulative effects on properties that qualify as historic properties and summarizes cumulative effects on other culturally important resources.

6.2.3.9.1  Approach

Cumulative effects on cultural resources would be those direct and indirect effects on historic structures, effects on archaeological resources, and effects on properties of traditional religious
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 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. These effects 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.

This section compares the types of data presented in Sections 4.2.9 and 5.2.9, but for each type of project (past, present, or future) within the defined CEAA. Assessment of effects on cultural resources is done specific to the cultural resources identified within the CEAA. No cultural resource field surveys for the entire CEAA have been completed to date. 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 in comparison to past, present, or future projects.

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 with the proposed CEAA remains undetermined, and surveys would be required to determine if the undetermined resources were eligible for inclusion in the NRHP. Effects on cultural resources listed in the NRHP, considered to be eligible for listing in the NRHP, or unevaluated that are identified 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, the Bands conducted interviews of individual members of Bois Forte, Fond du Lac, and Grand Portage, although 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, further 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.

6.2.3.9.2  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 (Figure 6.2.2-1).

**Temporal**

This evaluation will include 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. A more specific discussion of cumulative effects will be limited to that portion of the Mesabi Iron Range that is within the 1854 Ceded Territory.

6.2.3.9.3  Cumulative Actions

This assessment will include 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 cumulative resources:

- Arcelor Mittal Mines (Laurentian and East Reserve Mines);
- Community growth and development;
- Essar Steel;
- 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);
- U.S. Steel Keetac Mine Expansion Project; and
- U.S. Steel Minntac Mine and Processing.

6.2.3.9.4  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 of importance primarily to the Bands and are part of a thematically related group of properties associated with Ojibwe land use patterns and cumulative effects on those resources are discussed in this section. Cumulative effects on natural resources of cultural significance to the Bands are addressed in more detail in the specific natural resources sections and 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 more than 600,000 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, mined, roaded, or otherwise subjected to extensive ground disturbance experienced 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 Land Office 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 ethnographic studies conducted for the NorthMet Project Proposed Action, clearly document Ojibwe occupation and use of the area throughout the CEAA. The Bands have ancestral ties to the CEAA and the Trygg Maps document an extensive 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 significant cumulative effects 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 those 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.

Resources such as the Mesabe Widjiu, Native American trails, and other historic properties of traditional religious and cultural significance have been affected by past projects within the CEAA. Other anticipated residual direct and indirect effects on these cultural resources would come in the form of continuing segmentation and disassociation of the once-related sites and resources. In particular, changes to the trail system, especially the direct effects and dissection of historic trails due to expanded mining operations, would also have residual effects on these cultural resources. Visual effects on these trails and historic properties of traditional religious and cultural significance 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 these types of cultural resources, as the NorthMet Project Proposed Action and other current and future projects are visible along the trails and within proximity to other historic properties of traditional religious and cultural significance.

Additionally, within the CEAA, there are significant historic mining properties that have both archaeological and structural components. The reuse of the Erie Mining Company Concentrator Building and Railroad as part of the NorthMet Project Proposed Action is an example of the known mining properties that exist within the CEAA. Continued mining on the Mesabi Iron Range has and will 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

As discussed in Section 5.2.9.2.2, the NorthMet Project Proposed Action could have effects on 1854 Treaty resources—i.e., 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 is 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, 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.

### 6.2.3.10 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 contribute to cumulative socioeconomic effects.

#### 6.2.3.10.1 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.

#### 6.2.3.10.2 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 (Figure 6.2.3-4). 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 significant recreational and tourist resources in northeastern Minnesota.
Figure 6.2.3-4
Socioeconomics Cumulative Effects Assessment Area
NorthMet Mining Project and Land Exchange PSDEIS
Minnesota

This PSDEIS document is a Co-lead Agency provisional draft intended for internal review only. Corrections, revisions, and changes will be made prior to the release of the SDEIS for public review and comment.

May 2013
Temporal

This evaluation will focus on the existing and anticipated future use of the CEAA. Because mining and public resource management (including recreation and natural resource tourism) have historically 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.

6.2.3.10.3 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.

- Arcelor Mittal 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 6.2.3-4.

6.2.3.10.4 Cumulative Effects Assessment

Table 6.2-21 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 modelling—such as the IMPLAN model conducted for the Proposed Action. As shown in Table 6.2-21, 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 6.2-21  Summary of Socioeconomic Cumulative Effects

<table>
<thead>
<tr>
<th>Project</th>
<th>Temporal Scale</th>
<th>New Direct Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Construction</td>
</tr>
<tr>
<td>NorthMet Project Proposed Action</td>
<td>Future</td>
<td>764</td>
</tr>
<tr>
<td>Arcelor Mittal Mines</td>
<td>Future</td>
<td>0</td>
</tr>
<tr>
<td>(Laurentian and East Reserve Mines)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mesaba Energy Project – East Range Site</td>
<td>Future</td>
<td>1,067</td>
</tr>
<tr>
<td>Mesabi Nugget</td>
<td>Future</td>
<td>Undetermined</td>
</tr>
<tr>
<td>Mesabi Mining Project</td>
<td>Future</td>
<td>250</td>
</tr>
<tr>
<td>Northshore Mine</td>
<td>Future</td>
<td>0</td>
</tr>
<tr>
<td>U.S. Steel Keetac (in Keewatin)</td>
<td>Future</td>
<td>500</td>
</tr>
<tr>
<td>U.S. Steel Minntac Mine, Expansion Project</td>
<td>Future</td>
<td>Undetermined</td>
</tr>
<tr>
<td><strong>Total, Cumulative Projects Only</strong></td>
<td></td>
<td><strong>1,817</strong></td>
</tr>
</tbody>
</table>

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 2011). 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. As a result, the cumulative actions are not expected to generate any environmental justice effects (US Census Bureau 2011).

6.2.3.11 Recreation and Visual Resources

The NorthMet Project Proposed Action (including the Mine Site, Transportation and Utility Corridor, and Plant Site), would affect approximately 6,498 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.

6.2.3.11.1 Approach

The cumulative actions will be 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.

6.2.3.11.2 Cumulative Effects Assessment Area

*Spatial*

The CEAA for recreation and visual resources will include the portion of the Mesabi Iron Range within St. Louis County (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 due to socioeconomic preferences (e.g., increased population in the region and increased visitation), rather than definable projects.

*Temporal*

This evaluation will focus on existing and anticipated future land use within the CEAA. Existing conditions are considered indicative and representative of historical mining and resource management activities. Some additional qualitative consideration will be given to the pre-historic viewshed conditions documented by regional tribes in their cultural and religious teachings.

6.2.3.11.3 Contributing Past, Present, and Reasonably Foreseeable Actions

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 the portions of the Mesabi Iron Range in St. Louis County where future activities would likely be different from current activities. These projects include:
- Arcelor Mittal 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.

**6.2.3.11.4 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, MDC and USDOE 2007, MDNR 2008, 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 the 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 (MDC and USDOE 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 SNF, Colby Lake, and the Town of Hoyt Lakes.
6.2.3.12 Wilderness and Other Special Designation Areas

6.2.3.12.1 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 (Figure 4.2.13-1).

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 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.

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 trails is 9 miles southwest of the NorthMet Project area.

National 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 will be evaluated against Class I air modeling to determine potential visual effects of haze from the NorthMet Project Proposed Action.

6.2.3.12.2 Cumulative Effects Assessment Area

**Spatial**

The CEAA for Wilderness and Other Special Designation Areas will include 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 (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 will be the boundary of measurable air effects identified in Chapter 5.

**Temporal**

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

6.2.3.12.3 Contributing Past, Present, and Reasonably Foreseeable Actions

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;
- U.S. Steel Minntac; and
- Virginia Public Utilities.
6.2.3.12.4 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 PM10 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, Technical Comments on Minnesota Regional Haze State Implementation Plan).

6.2.3.13 Hazardous Materials

As described in Chapters 4 and 5, hazardous materials are a site-specific issue and the NorthMet Project Proposed Action would have no contributing cumulative effects related to hazardous materials. If regulated hazardous materials, such as solvents, acids, or other chemicals, would cumulatively affect other resources, the effects are discussed under the respective resource sections.

6.2.3.14 Geotechnical Stability

This topic relates to the waste material storage facilities (tailings stockpiles, which are largely made from the waste rock created as a byproduct of mining at the Mine Site). The stability of these stockpiles and potential effects in the case of their failure would be restricted to the NorthMet Project area and would not affect other locations outside of the NorthMet Project area. Given the discrete nature of any geotechnical instability, 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-acre (GLO) tract of federal land (encompassing most of the Mine Site) with up to 6,722 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 will not be 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 NorthMet Project...
Proposed Action to potentially cause cumulative effects. The focus of this analysis will be on those future activities when placed against baseline conditions.
Figure 6.3.2-1
Parcels Involved in Proposed USFS Land Exchange
NorthMet Mining Project and Land Exchange PSDEIS
Minnesota

This PSDEIS document is a Co-lead Agency provisional draft intended for internal review only. Corrections, revisions, and changes will be made prior to the release of the SDEIS for public review and comment.

Property to Be Acquired by USFS (PolyMet)
Property to Be Relinquished by USFS (PolyMet)
Property to Be Acquired by USFS (Other Projects)
Property to Be Relinquished by USFS (Other Projects)
Boundary Waters Canoe Area Wilderness
National Park
National Forest
Streams/Rivers
Lakes
City/Town

May 2013
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 will be 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 will 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 change 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  Increase/Decrease of Management Area Allocations Occurring from the Cumulative Actions

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Eligible Wild, Scenic, and Recreational Rivers</td>
<td>32,298.8</td>
<td>32,340.4</td>
<td>32,340.4</td>
<td>32,340.4</td>
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<td>General Forest</td>
<td>640,907.0</td>
<td>646,485.7</td>
<td>645,054.5</td>
<td>640,800.2</td>
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<tr>
<td>General Forest - Longer Rotation</td>
<td>411,825.7</td>
<td>405,369.5</td>
<td>406,630.3</td>
<td>411,097.2</td>
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<tr>
<td>Potential RNAs/cRNAs</td>
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<td>19,296.8</td>
<td>19,296.8</td>
<td>18,990.1</td>
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<td>Primitive Wilderness</td>
<td>300,786.3</td>
<td>301,226.1</td>
<td>301,226.1</td>
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<tr>
<td>Pristine Wilderness</td>
<td>114,380.0</td>
<td>114,494.1</td>
<td>114,494.1</td>
<td>114,494.1</td>
</tr>
<tr>
<td>Recreation Use in a Scenic Landscape</td>
<td>157,044.2</td>
<td>156,134.6</td>
<td>156,134.6</td>
<td>156,134.6</td>
</tr>
<tr>
<td>RNAs</td>
<td>3,170.1</td>
<td>3,170.1</td>
<td>3,170.1</td>
<td>3,170.1</td>
</tr>
<tr>
<td>Riparian Areas</td>
<td>17,893.5</td>
<td>18,081.2</td>
<td>17,860.3</td>
<td>17,860.3</td>
</tr>
<tr>
<td>Semi-primitive Motorized Recreation</td>
<td>68,733.6</td>
<td>68,733.6</td>
<td>68,733.6</td>
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<td>Semi-primitive Motorized Wilderness</td>
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<td>53,529.2</td>
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</tr>
<tr>
<td>Semi-primitive Non-motorized Recreation</td>
<td>4,564.9</td>
<td>4,564.9</td>
<td>4,564.9</td>
<td>4,564.9</td>
</tr>
<tr>
<td>Semi-primitive Non-motorized Wilderness</td>
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<td>344,561.3</td>
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<tr>
<td>UBAs</td>
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<td>2,495.4</td>
<td>2,495.4</td>
<td>2,495.4</td>
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<tr>
<td>Unidentified</td>
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<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
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<td>2,170,483.2</td>
<td>2,170,091.8</td>
<td>2,169,997.8</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Acreage in SNP</td>
<td>2,171,603.9</td>
<td>2,172,310.6 (706.7)</td>
<td>2,171,926.5 (322.6)</td>
<td>2,171,832.5 (228.6)</td>
</tr>
<tr>
<td>Boundary length (linear miles)</td>
<td>10,054.8</td>
<td>10,006.8 (48.0)</td>
<td>10,037.3 (17.5)</td>
<td>10,048.4 (6.4)</td>
</tr>
<tr>
<td>Fragmentation (linear miles per acre)</td>
<td>0.005</td>
<td>0.005</td>
<td>0.005</td>
<td>0.005</td>
</tr>
</tbody>
</table>

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  Increase/Decrease of Water Resources Occurring from Cumulative Actions

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td>Net Increase (Decrease) Acres</td>
<td>Net Increase (Decrease) Acres</td>
<td>Net Increase (Decrease) Acres</td>
<td>Net Increase (Decrease) Acres</td>
</tr>
<tr>
<td>Public Water Lakes,</td>
<td>73,307.8</td>
<td>73,642.5</td>
<td>73,654.4</td>
<td>73,537.0</td>
</tr>
<tr>
<td>acres</td>
<td></td>
<td>334.7</td>
<td>346.6</td>
<td>229.2</td>
</tr>
<tr>
<td>Public Water Lakes,</td>
<td>5,232.2</td>
<td>5,246.2</td>
<td>5,246.5</td>
<td>5,243.9</td>
</tr>
<tr>
<td>miles of shoreline</td>
<td></td>
<td>14.0</td>
<td>14.3</td>
<td>11.7</td>
</tr>
<tr>
<td>Public Water Streams,</td>
<td>2,196.0</td>
<td>2,201.3</td>
<td>2,200.2</td>
<td>2,195.5</td>
</tr>
<tr>
<td>miles</td>
<td></td>
<td>5.3</td>
<td>4.2</td>
<td>(0.5)</td>
</tr>
<tr>
<td>Wild Rice Beds,</td>
<td>10,452.4</td>
<td>10,629.8</td>
<td>10,629.8</td>
<td>10,501.3</td>
</tr>
<tr>
<td>acres</td>
<td></td>
<td>177.4</td>
<td>177.4</td>
<td>48.9</td>
</tr>
</tbody>
</table>

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  Increase/Decrease of Wetland Resources Occurring from Cumulative Actions

<table>
<thead>
<tr>
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<tr>
<td></td>
<td>Acres</td>
<td>Net Increase (Decrease)</td>
<td>Acres</td>
<td>Acres</td>
</tr>
<tr>
<td>Net Change in Wetlands</td>
<td>532,851.2</td>
<td>4,982.6</td>
<td>533,042.1</td>
<td>532,648.6</td>
</tr>
<tr>
<td>Net Change in Wetland Types</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshwater Emergent Wetland</td>
<td>35,852.6</td>
<td>(270.0)</td>
<td>35,571.4</td>
<td>35,552.6</td>
</tr>
<tr>
<td>Freshwater Forested/Shrub Wetland</td>
<td>427,440.8</td>
<td>688.4</td>
<td>427,570.0</td>
<td>427,313.7</td>
</tr>
<tr>
<td>Freshwater Pond</td>
<td>14,609.8</td>
<td>23.6</td>
<td>14,634.7</td>
<td>14,634.1</td>
</tr>
<tr>
<td>Other</td>
<td>38.2</td>
<td>0.0</td>
<td>38.2</td>
<td>38.2</td>
</tr>
<tr>
<td>Riverine</td>
<td>3,146.7</td>
<td>5.1</td>
<td>3,151.8</td>
<td>3,149.4</td>
</tr>
</tbody>
</table>

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 Land and Resource Management 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 (Table 6.3-5).
### Table 6.3-5  Potential Increase/Decrease of GAP Land Cover Types Occurring from Cumulative Actions

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acres</td>
<td>Net Increase (Decrease)</td>
<td>Acres</td>
<td>Net Increase (Decrease)</td>
</tr>
<tr>
<td>Aquatic environments</td>
<td>90,559.8</td>
<td>462.8</td>
<td>91,035.8</td>
<td>475.9</td>
</tr>
<tr>
<td>Cropland/Grassland</td>
<td>8,639.8</td>
<td>7.8</td>
<td>8,651.9</td>
<td>12.2</td>
</tr>
<tr>
<td>Disturbed</td>
<td>3,599.5</td>
<td>(89.1)</td>
<td>3,559.4</td>
<td>(40.1)</td>
</tr>
<tr>
<td>Lowland coniferous forest</td>
<td>288,212.4</td>
<td>(10.4)</td>
<td>287,681.8</td>
<td>(530.6)</td>
</tr>
<tr>
<td>Lowland deciduous forest</td>
<td>9,303.4</td>
<td>16.1</td>
<td>9,314.0</td>
<td>10.6</td>
</tr>
<tr>
<td>Shrubland</td>
<td>239,549.4</td>
<td>1,179.6</td>
<td>240,763.0</td>
<td>1,213.6</td>
</tr>
<tr>
<td>Upland conifer-deciduous mixed forest</td>
<td>94,636.8</td>
<td>(14.1)</td>
<td>94,575.4</td>
<td>(61.4)</td>
</tr>
<tr>
<td>Upland coniferous forest</td>
<td>443,125.9</td>
<td>(330.1)</td>
<td>442,828.7</td>
<td>(297.3)</td>
</tr>
<tr>
<td>Upland deciduous forest</td>
<td>993,698.8</td>
<td>(517.2)</td>
<td>993,237.2</td>
<td>(461.6)</td>
</tr>
<tr>
<td>Total</td>
<td>2,171,326.0</td>
<td>705.4</td>
<td>2,171,647.2</td>
<td>321.3</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acres</td>
<td>Acres (Net Increase/Decrease)</td>
<td>Acres (Net Increase/Decrease)</td>
<td>Acres (Net Increase/Decrease)</td>
</tr>
<tr>
<td>Dry-Mesic Red and White Pine</td>
<td>257,939.5</td>
<td>258,450.5 (511.0)</td>
<td>258,361.0 (421.5)</td>
<td>257,777.7 (161.8)</td>
</tr>
<tr>
<td>Jack Pine-Black Spruce</td>
<td>869,304.9</td>
<td>868,797.3 (507.6)</td>
<td>869,450.3 (145.4)</td>
<td>870,862.7 (1,557.8)</td>
</tr>
<tr>
<td>Lowland Conifer</td>
<td>398,395.6</td>
<td>399,378.0 (982.4)</td>
<td>398,838.7 (443.1)</td>
<td>398,438.3 (42.7)</td>
</tr>
<tr>
<td>Lowland Hardwood</td>
<td>25,754.6</td>
<td>25,825.3 (70.7)</td>
<td>25,760.8 (6.2)</td>
<td>25,760.8 (6.2)</td>
</tr>
<tr>
<td>Mesic Birch-Aspen-Spruce-Fir</td>
<td>376,587.2</td>
<td>375,799.1 (788.1)</td>
<td>375,499.0 (1,088.2)</td>
<td>375,498.1 (1,089.1)</td>
</tr>
<tr>
<td>Mesic Red and White Pine</td>
<td>185,392.5</td>
<td>185,782.0 (389.5)</td>
<td>185,767.0 (374.5)</td>
<td>185,245.2 (147.3)</td>
</tr>
<tr>
<td>Sugar Maple</td>
<td>56,390.0</td>
<td>56,430.7 (40.7)</td>
<td>56,394.7 (4.7)</td>
<td>56,394.7 (4.7)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,169,764.4</strong></td>
<td><strong>2,170,462.9 (698.5)</strong></td>
<td><strong>2,170,071.5 (307.1)</strong></td>
<td><strong>2,169,977.5 (213.1)</strong></td>
</tr>
</tbody>
</table>

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

<table>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acres</td>
<td>Acres</td>
<td>Net Increase (Decrease)</td>
<td>Acres</td>
</tr>
<tr>
<td>High Biodiversity Significance</td>
<td>127,903.3</td>
<td>121,846.9</td>
<td>(6,056.4)</td>
<td>123,247.2</td>
</tr>
<tr>
<td>Moderate Biodiversity Significance</td>
<td>111,250.4</td>
<td>111,775.8</td>
<td>525.4</td>
<td>111,024.3</td>
</tr>
<tr>
<td>Total</td>
<td>239,153.7</td>
<td>233,622.6</td>
<td>(5,531.1)</td>
<td>234,271.5</td>
</tr>
</tbody>
</table>

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, determine 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 (Table 6.3-8).

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

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td>Acres</td>
<td>Net Increase (Decrease)</td>
<td>Acres</td>
<td>Net Increase (Decrease)</td>
</tr>
<tr>
<td>Mature Upland Forest, Continuous Upland/Lowland Forest (MIH-13)</td>
<td>1,828,977.4</td>
<td>1,828,121.7 (855.7)</td>
<td>1,827,637.1 (1,340.3)</td>
<td>1,828,991.1 13.8</td>
</tr>
<tr>
<td>Open Ground, Bare Soils (no MIH)</td>
<td>3,599.5</td>
<td>3,510.4 (89.1)</td>
<td>3,559.4 (40.1)</td>
<td>3,593.7 (5.8)</td>
</tr>
<tr>
<td>Grassland and Brushland, Early Successional Woodland (no MIH)</td>
<td>248,189.2</td>
<td>249,376.6 1,187.4</td>
<td>249,415.0 1,225.8</td>
<td>248,157.1 (32.1)</td>
</tr>
<tr>
<td>Aquatic Environments (MIH 14)</td>
<td>90,559.8</td>
<td>91,022.7 462.8</td>
<td>91,035.8 475.9</td>
<td>90,811.2 251.4</td>
</tr>
<tr>
<td>Total</td>
<td>2,171,326.0</td>
<td>2,172,031.3 705.4</td>
<td>2,171,647.2 321.3</td>
<td>2,171,553.2 227.2</td>
</tr>
</tbody>
</table>

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 Cumulative Area of Analysis 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 (Table 6.3-9).
Table 6.3-9  Potential Increase/Decrease in Suitable Habitat Types for Canada Lynx and Prey Species Occurring from Cumulative Actions

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>General Suitable Lynx Habitat (Acres)</td>
<td>2,077,166.6</td>
<td>2,077,498.3</td>
<td>2,077,052.0</td>
<td>2,077,148.2</td>
</tr>
<tr>
<td>Suitable Denning Habitat (Acres)</td>
<td>748,762.1</td>
<td>744,036.3 (4,725.8)</td>
<td>745,046.2 (3,715.9)</td>
<td>747,703.6 (1,058.5)</td>
</tr>
<tr>
<td>Suitable Snowshoe Hare Forage Habitat (Acres)</td>
<td>2,068,526.8</td>
<td>2,068,850.7 (323.9)</td>
<td>2,068,400.1 (126.7)</td>
<td>2,068,525.6 (12)</td>
</tr>
<tr>
<td>Unsuitable Lynx Habitat (Acres)</td>
<td>94,159.4</td>
<td>94,533.1 (373.7)</td>
<td>94,595.2 (435.8)</td>
<td>94,404.9 (245.6)</td>
</tr>
</tbody>
</table>

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 packed 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 (Table 6.3-10).
Table 6.3-10  Increase or Decrease of Lynx Travel Corridors on the Federal Estate Resulting from the Land Exchange

<table>
<thead>
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</thead>
<tbody>
<tr>
<td></td>
<td>Miles</td>
<td>Net Increase (Decrease) Miles</td>
<td>Net Increase (Decrease) Miles</td>
<td>Net Increase (Decrease) Miles</td>
</tr>
<tr>
<td>Established Snow Pack Trails</td>
<td>1,818.7</td>
<td>1,787.7 (31.0)</td>
<td>1,787.7 (31.0)</td>
<td>1,787.7 (31.0)</td>
</tr>
<tr>
<td>Established Roads</td>
<td>3,167.3</td>
<td>3,037.2 (130.1)</td>
<td>3,037.4 (129.9)</td>
<td>3,041.2 (126.1)</td>
</tr>
</tbody>
</table>

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 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 Increase/Decrease of Surface Water Resources Occurring from Cumulative Actions

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total (acres)</td>
<td>Total</td>
<td>Net Increase (Decrease)</td>
<td>Total</td>
</tr>
<tr>
<td>Lake</td>
<td>80,885.0</td>
<td>81,263.6</td>
<td>378.6</td>
<td>81,277.0</td>
</tr>
<tr>
<td>Lake (shoreline miles)</td>
<td>7,145.6</td>
<td>7,163.0</td>
<td>17.4</td>
<td>7,163.8</td>
</tr>
<tr>
<td>Riverine (miles)</td>
<td>7,293.3</td>
<td>7,302.8</td>
<td>9.4</td>
<td>7,301.6</td>
</tr>
</tbody>
</table>

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; and
- 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 will focus 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 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 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.

The Land Exchange Proposed Action and cumulative actions would result in a net gain in the amount of public land that is accessible, and there is no evidence that the land exchanges in question would create environmental justice 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 Forest Service 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 generally match 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 will focus 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 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.

### 6.3.4.8.3 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

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td>Acres</td>
<td>Net Increase (Decrease)</td>
<td>Acres</td>
<td>Net Increase (Decrease)</td>
</tr>
<tr>
<td>Primitive</td>
<td>481,022.1</td>
<td>840.3</td>
<td>481,862.4</td>
<td>840.3</td>
</tr>
<tr>
<td>Roaded Natural</td>
<td>314,667.2</td>
<td>(382.9)</td>
<td>314,284.3</td>
<td>87.5</td>
</tr>
<tr>
<td>Rural</td>
<td>9,838.0</td>
<td>(395.5)</td>
<td>9,442.5</td>
<td>(395.5)</td>
</tr>
<tr>
<td>Semi-Primitive Motorized</td>
<td>954,020.3</td>
<td>(2,663.2)</td>
<td>950,646.5</td>
<td>(3,373.8)</td>
</tr>
<tr>
<td>Semi-Primitive Non-motorized</td>
<td>411,717.2</td>
<td>3,308.0</td>
<td>414,881.2</td>
<td>3,164.0</td>
</tr>
<tr>
<td>Urban</td>
<td>93.2</td>
<td>0.0</td>
<td>93.2</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>2,171,357.9</td>
<td>706.8</td>
<td>2,171,680.5</td>
<td>322.6</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acres</td>
<td>Net Increase (Decrease) Acres</td>
<td>Net Increase (Decrease) Acres</td>
<td>Net Increase (Decrease) Acres</td>
</tr>
<tr>
<td>High</td>
<td>344,508.1</td>
<td>344,637.8</td>
<td>344,525.4</td>
<td>344,507.5</td>
</tr>
<tr>
<td>Moderate</td>
<td>798,922.5</td>
<td>800,651.5</td>
<td>800,334.3</td>
<td>799,026.6</td>
</tr>
<tr>
<td>Low</td>
<td>158,944.9</td>
<td>157,895.6</td>
<td>157,652.8</td>
<td>158,847.1</td>
</tr>
<tr>
<td>Unclassified</td>
<td>22,177.12</td>
<td>22,087.5</td>
<td>22,143.3</td>
<td>22,151.4</td>
</tr>
<tr>
<td>Total</td>
<td>1,324,553.0</td>
<td>1,325,272.4</td>
<td>1,324,655.9</td>
<td>1,324,532.7</td>
</tr>
</tbody>
</table>

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.