Cumulative Effect Analysis – Aquatic and Forest Resources

Tailings Basin Progression

Prepared for
Northshore Mining Company

October 2019

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Abbreviations

Barr	Barr Engineering Co.
BWSR	Minnesota Board of Soil and Water Resources
CSAH	County State Aid Highway
EIS	Environmental Impact Statement
GIS	Geographic Information System
Northshore	Northshore Mining Company
NEPA	National Environmental Policy Act
NLCD	National Land Cover Data
MNDNR	Minnesota Department of Natural Resources
MNTH	Minnesota Trunk Highway
MnDOT	Minnesota Department of Transportation
NHD	National Hydrography Dataset
NWI	National Wetland Inventory
proposed Project	proposed West Ridge Railroad Relocation and Tailings Basin Progression project
PWI	Public Water Inventory
STIP	State of Minnesota State Transportation Improvement Program
SWCD	Soil and Water Conservation District
USACE	U.S. Army Corps of Engineers
USDA-USFS	U.S. Department of Agriculture-U.S. Forest Service
USDA-FSA	USDA-Farm Service Agency
USGS	United States Geological Survey

1 Introduction

Barr Engineering Co. (Barr) has prepared this Cumulative Effect Analysis on behalf of Northshore Mining Company (Northshore) for its proposed West Ridge Railroad Relocation and Tailings Basin Progression project (proposed Project). The proposed Project area encompasses approximately 1,200 acres and is located about 6 miles west of Silver Bay, in Lake County, Minnesota (Large Figure 1). This analysis is intended to help satisfy the requirements in the letter to Northshore from the U.S. Army Corps of Engineers (USACE; dated May 22, 2019) which will meet National Environmental Policy Act (NEPA) requirements (42 U.S.C. 4321 et seq.). The Council on Environmental Quality, which oversees administration of the NEPA process, has defined cumulative effects in its regulations as:

> [T]he 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 or person undertakes such other actions (40 CFR § 1508.7).

Northshore submitted a wetland permit application June 18, 2018, for a proposed relocation of the West Ridge railroad and progression of the Milepost 7 Tailings Basin. Northshore owns and operates the Peter Mitchell Mine in Babbitt, Minnesota; the EW Davis taconite processing facilities at Silver Bay, Minnesota; and an interconnecting railroad. These facilities have been in operation producing taconite pellets since the 1950s. With the current ore resources and the current rate of mining, production operations at these facilities would continue for approximately 80 years.

The Milepost 7 Tailings Basin at Silver Bay was originally authorized by the Corps after completion of an Environmental Impact Study (EIS) in March 1977, through issuance of the following permits for the life of the Peter Mitchell ore body:

- 76-412B for the construction of Dam 1,
- 76-413B for the construction of Dam 2, and
- 76-422 for the deposition of coarse and fine tails into the tailings basin.

On August 31, 2005, Permit No. 2005-2628-TWP was authorized for deposition of tailings covering an additional 160 acres within the permitted footprint of permit 76-422, expiring on December 31, 2030. That authorization included incorporation of provisions included in permits 76-412B, 76-413B, and 76-422 to accommodate the next 25 years of the basin's use to an elevation of 1252 feet. After reviewing the June 2018 application, the Corps requested the company to complete a watershed assessment, including evaluation of cumulative effects per the guidance in its May 22, 2019 letter to Northshore.

The purpose of this analysis is to consider the aquatic and forest resources available in the past compared to those present currently, and the effects of reasonably foreseeable future actions. The results of this analysis will provide a context for assessing the cumulative effects on wetland, lake and deepwater habitat, stream, and forest resources. The proposed Project, along with the reasonably foreseeable future actions within the study area, will be evaluated to determine the potential for cumulative effects on aquatic and forest resources. The resources evaluated in this analysis include wetlands, lakes and

deepwater habitat, streams, and forests. This analysis also includes the evaluation of the "No Action Alternative" as the baseline against which to compare the cumulative effects on resources, assuming no development of the proposed Project.

2 Project Description

2.1 Proposed Project

The proposed Project area encompasses approximately 1,200 acres, made up of tailings storage area and supporting infrastructure, and is located about 6 miles west of Silver Bay, in Lake County, Minnesota (Figure 4). Some of the proposed Project area consists of lands disturbed by past activities, including depleted borrow pits and access roads. The proposed Project area utilizes the existing tailings storage facility footprint and land adjacent to it, progressing westerly as contemplated in the EIS and original state and federal permits. Tailings would be stored over the existing, approximately 2,100 acre tailings storage area an additional 113 feet in height above the existing permitted basin and a total height of about 233 feet at its highest point. In addition, tailings would be stored within approximately 850 acres of adjacent tailings storage area to an elevation of 1365 feet as the natural topography allows storage to extend generally northwesterly, but excluding about 1,100 acres of the tailings storage area evaluated in the EIS.

2.2 No Action

Under the No Action alternative, the tailings basin could only be operated to the permitted footprint specified by the authorization of permit 2005-2628-TWP, and there would be no progression of the existing tailings basin extents. The No Action alternative would not have adequate tailings storage capacity to meet the project purpose. This alternative would result in no additional wetland impacts beyond those resulting from operation to the existing, permitted tailings basin boundary and railroad alignment.

3 Cumulative Effects Study Area

The study area for evaluating cumulative effects to wetland, lake and deepwater habitat, stream, and forest resources is the HUC 10 Beaver River-Frontal Lake Superior watershed. Some of the primary functions performed by these resources are directly related to watershed processes; therefore, a watershed level analysis was completed. The HUC 10 Beaver River-Frontal Lake Superior watershed was used as the spatial boundary for the cumulative effects assessment since the watershed fully encompasses the proposed Project.

The existing Beaver River watershed covers approximately 150 square miles (96,225 acres; Large Figure 4). The historic Beaver River watershed was approximately 225 acres smaller (Figures 2 and 3). Reserve Mining Company added 225 acres to the watershed during its operation. The proposed Project is located within portions of three subwatersheds including: East Branch Beaver River (30.2 square miles), Beaver River (11.1 square miles), and Thirtynine Creek (9.8 square miles), although less than 50 acres of the proposed Project lies within the Thirtynine Creek subwatershed.

The U.S. Department of Agriculture-U.S. Forest Service (USDA-USFS) Superior National Forest covers 42,714 acres in the northwestern portion of the study area, or approximately 44% of the study area (Large Figure 1). Within the study area, Finland State Forest is located within the USDA-USFS Superior National Forest and encompasses 15,395 acres in the northwestern portion of the study area, or approximately 16% of the study area (Large Figure 1).

The United States Geological Survey (USGS) National Land Cover Data (NLCD; 2016) identifies primary land cover types in the study area as forests and wetlands. Other minor land cover types include developed areas, barren land, cultivated crops/hay/pasture land, and open water.

Existing development, other than the proposed Project, is primarily located in the eastern portion of the study area within the cities of Silver Bay and Beaver Bay. There is minimal development in the remainder of the study area. The population of Silver Bay was 2,068 persons in 2000, 1,887 persons in 2010, and estimated to be 1,776 persons in 2018, which indicates a 14 percent decline since the 2000 census (U.S. Census 2019). The population of Beaver Bay was 175 persons in 2000, 181 persons in 2010, and estimated to be 172 persons in 2018, which indicates a two percent decline since the 2010 census (U.S. Census, accessed 2019).

The major highways within the study area include Minnesota Trunk Highway (MNTH) 61 and County State Aid Highways (CSAH) 3, 4, 5, 15, 31, and 32 (Large Figure 1). There are also numerous local streets and forest roads located within the study area.

There are two state parks located within the study area – Tettegouche and Split Rock Lighthouse (Large Figure 1). Tettegouche State Park is located in the northeast portion of the study area, with 5,376 acres of the 9,562 acre park (approximately 56% of the park and encompassing approximately 5.6% of the study area) located within the study area. Split Rock Lighthouse State Park is located in the southeast portion of

the study area, with 1,521 acres of the 2,320 acre park (approximately 66% of the park and encompassing approximately 1.6% of the study area) located within the study area.

Existing aquatic resources (other than wetlands) in the study area include (Large Figure 1):

- One deepwater habitat, Murphy's Pond, which is a non-natural deepwater habitat that has progressively grown in size and depth since before 1980 due to impoundment of a broad valley.
- Two unnamed lakes and eight named lakes including Bean, Bear (2), Drake, Lax, Nicado, Tetagouche, and Water Tank.
- Three constructed ponds that are associated with the Wastewater Treatment Plant in Beaver Bay.
- Six named streams including Beaver River, East Branch Beaver River, West Branch Beaver River, Thirtynine Creek, Big 39 Creek, and Little 39 Creek.
- Many unnamed small ponds, streams, and creeks found throughout the study area.

4 Cumulative Effects Assessment Methods

The extents of wetland, lake and deepwater habitat, stream, and forest resources were estimated for three time periods including: pre-settlement, existing, and the foreseeable future. These extents were used to determine the cumulative effects of direct impacts from all past, present, and reasonably foreseeable future projects on the aquatic and forest resources located within the study area in the context of historic and existing aquatic resources.

4.1 Human Disturbance Areas

The cumulative effects assessment is based on existing impacts and impacts that will potentially occur in the foreseeable future within the study area. Therefore, as a first step, several data sources were analyzed to create a Geographic Information System (GIS) layer containing polygons signifying existing human disturbance areas within the study area.

The data used and types of human disturbances identified included:

1. *2016 USGS NLCD layer*: Land cover classes included barren land, developed high/medium/low intensity, and developed open space.

2. *MNDNR LiDAR building footprints*: Layer was used to identify the footprints of buildings in the rural parts of the study area.

3. *Minnesota Department of Transportation (MnDOT) street and highway layer*: County State Aid Highways (CSAH) were buffered by 25 feet on each side of the road centerline (50 feet total). All other roads were buffered by 15 feet on each side of the road centerline (30 feet total) to document the disturbance area.

4. *MnDOT Statewide railroad layer*: All railroads were buffered with 25 feet on each side of the railroad centerline (50 feet total).

5. *USDA-USFS roads and trails*: Roads/light duty/unspecified composition were buffered with 15 feet on each side of the roadway (30 feet total). Other roads/trails were buffered 7.5 feet on each side of the roadway (15 feet total). The file was also manually reviewed to remove any roadways that were duplicates of the roadways identified in the *Minnesota Department of Transportation (MnDOT) street and highway layer*.

6. *MNDNR snowmobile trails*: Trails were buffered by 7.5 feet on each side of the road centerline (15 feet total).

7. *MNDNR state trails*: Trails were buffered by 7.5 feet on each side of the road centerline (15 feet total).

8. *2017 USDA-Farm Service Agency (FSA) aerial imagery*: Imagery was reviewed to identify any additional roads/trails/transmission line corridors that were not included in the above layers, but were visible on the aerial imagery. The roads and trails were buffered by 7.5 feet on each side of the road centerline (15 feet total). The transmission line corridors were buffered by 45 feet on each side of the corridor (90 feet).

9. *Historic USGS Quadrangle Maps and Historic Aerial Photos:* The original watershed boundary along the shore of Lake Superior was mapped based on the 1954 USGS Silver Bay quadrangle (scale: 1:62,500), the 1956 USGS Illgen City quadrangle (scale 1:24,000), and 1940 aerial photographs.

10. *Northshore Mining Tailings Basin area*: Existing tailings basin features were identified during the permitting process, including: diversion channels, borrow areas, the landfill, seepage recovery facilities, dams, roads, and ancillary facilities.

There are 15 townships that are completely or partially located within the study area (Large Figure 2). Disturbance within these townships ranged from 0 to 59 percent, with approximately 9 percent of the study area (8,360 acres) impacted by human disturbance since settlement of this area (Table 1).

4.2 Pre-Settlement Aquatic and Forest Resources

The pre-settlement time period represents wetland, lake and deepwater habitat, stream, and forest resources as they existed in the late 1800s to early 1900s, prior to mining and urban development. The acreage of aquatic and forest resources estimated for the pre-settlement time period was developed as described in the following sections.

4.2.1 Wetlands

The wetlands within the study area were initially identified using the "Existing" wetlands layer (Section 4.3.1). The wetlands were then edited depending on whether they are located outside or within the Human Disturbance Areas (Large Figure 2). Outside of the Human Disturbance Areas, the "Existing" wetlands represent the "Pre-settlement" wetlands.

Within the Human Disturbance Areas, the "Existing" wetlands were edited in the following locations:

1. Southwest of the existing Northshore Tailings Basin – the "Existing" wetlands were removed within this area and replaced with the historic wetlands as identified by analyzing the 1954 USGS quadrangle for Silver Bay (scale 1:62,500), historic aerial photos from 1969 and 1977, and previous wetland studies.
2. Within the existing Northshore Tailings Basin – the "Existing" wetlands were removed and replaced with wetlands digitized using the 1954 USGS quadrangle (scale 1:62,500) for Silver Bay.
3. Northwest of the existing Northshore Tailings Basin – Murphy's Pond and "Existing" wetlands were removed from the file and replaced with wetlands identified by analyzing the 1954 USGS quadrangle (scale 1:62,500) for Silver Bay, and historic aerial photos from 1969 and 1977.

Wetlands in these areas were merged to create the "Pre-settlement" wetlands within the study area. Next, these wetlands were manually reviewed to identify areas where a road/railroad or other feature either split or truncated a "Pre-settlement" wetland. In these cases, wetlands were re-connected to establish "Pre-settlement" conditions. In addition, the "Pre-settlement" wetlands were reviewed to remove any wetlands that appeared to have formed upstream from a road/railroad or other feature and didn't have a wetland feature associated with it on the other side of the road/railroad, etc. These edits were completed to create the "Pre-settlement" wetlands layer (Large Figure 3).

4.2.2 Lakes and Deepwater Habitats

Lakes and deepwater habitats were initially identified within the study area by querying the MNDNR Public Water Inventory (PWI) shapefile for "PWI Basins" and the MNDNR Hydrography: Lakes, Ponds, and River Features shapefile for "Lake or Pond". This list of lakes was manually reviewed to determine if any represented recently formed beaver ponds or open water wetlands, which were not considered to be defined as lakes. Several polygons were determined to not be lakes and were removed from the "Pre-settlement" lakes and deepwater habitat layer. These edits were completed to create the "Pre-settlement" lakes and deepwater habitat layer in Large Figure 3.

4.2.3 Streams

The streams within the study area were initially identified using the "Existing" streams layer (Section 4.3.1). The streams were then edited depending on whether the stream was located outside or within the Human Disturbance Areas (Large Figure 2). Outside of the Human Disturbance Areas, the "Existing" streams were used as the "Pre-settlement" streams.

Within the Human Disturbance Areas, the "Existing" streams were edited in the following locations:

1. Within the Human Disturbance Areas – streams were digitized using the 1954 USGS quadrangle (scale 1:62,500) for Silver Bay. Streams were classified as perennial or intermittent based on the symbology on the 1954 USGS quadrangle. Only perennial streams were retained in the "Pre-settlement" streams layer.
2. USGS historic quadrangles – Illgen, MN Split Rock Point, and Split Rock Point NE historic quads were reviewed for additional streams, however, none were identified.
3. Within the existing Northshore Tailings Basin – a georeferenced MNDNR 1969 aerial photograph and the 1954 USGS quadrangle map for Silver Bay were used to identify and map streams that previously flowed through the existing tailings basin area.
4. Within the proposed Project area – the PWI versions of Big 39 Creek and Little 39 Creek were used to replace the "Existing" streams.
5. Adjacent to the proposed Project area – the PWI segment for Big Thirtynine Creek was removed between Beaver River and Thirtynine Creek.
6. Adjacent to the proposed Project area – the two diversion ditches were removed.
7. Adjacent to the existing tailings basin – the channel associated with the Northshore Wastewater Treatment Plant was removed.

8. Within the study area – the stream segments intersecting the "Pre-settlement" lakes and deepwater habitat layer were removed from the layer.

These edits were completed to create the "Pre-settlement" streams layer (Large Figure 3).

4.2.4 Forest

Forests were assumed to be present throughout the entire study area either as mature or successional forests. Polygons that represent the open water of the "Pre-settlement" lakes and deepwater habitat (Section 4.2.2) were removed to create the "Pre-settlement" forest layer (Large Figure 3).

4.3 Existing Aquatic and Forest Resources

The existing time period represents wetland, lake and deepwater habitat, stream, and forest resources as they exist today, prior to the development of the proposed Project. The Beaver River watershed for existing conditions is larger than under Pre-settlement conditions due to additional land area along the shore of Lake Superior at the EW Davis taconite processing facility (Figure 4). The acreage of aquatic and forest resources estimated for the existing time period was developed as described in the following sections.

4.3.1 Wetlands

The wetlands within the study area were initially identified using the 2016 MNDNR National Wetland Inventory (NWI) Northeast Update shapefile. The wetlands were then edited depending on whether the wetland was located either outside or within the Human Disturbance Areas (Large Figure 2). The wetlands outside of the Human Disturbance Areas were reviewed to determine if the NWI identified any polygons as a lake; if the polygon was defined as a lake, it was removed.

Within the Human Disturbance Areas, the NWI wetlands were edited in the following locations:

1. Within the proposed Project area – a wetland delineation was conducted in 2015. The extent of the wetland delineation was defined by a "delineated wetland study area". The NWI wetlands within the "delineated wetland study area" were clipped from the layer and replaced with the delineated wetlands.
2. Within the Northshore Bear Lake Outlet project – a wetland delineation was conducted in 2006. The extent of the wetland delineation was defined by a "delineated wetland study area". The NWI wetlands within the "delineated wetland study area" were clipped from the layer and replaced with the delineated wetlands.
3. Within the Silver Bay Business Park – a wetland delineation was conducted in 2013 (Hayes 2013). The extent of the wetland delineation was defined by a "delineated wetland boundary". The NWI wetlands within the "delineated wetland boundary" were clipped from the layer and replaced with the project-specific wetlands (18 acres).
4. Within the study area – the "Existing" lakes and deepwater habitat were clipped out to remove any potential overlap.

These edits were completed to create the "Existing" wetlands layer in the study area (Large Figure 4).

4.3.2 Lakes and Deepwater Habitat

The lakes and deepwater habitat within the study area were initially identified using the "Pre-settlement" lakes and deepwater habitat layer (Section 4.2.2). The lakes and deepwater habitat were then edited depending on whether the lake or deepwater habitat was located either outside of or within the Human Disturbance Areas (Large Figure 2). Outside of the Human Disturbance Areas, this layer was used as the "Existing" lakes and deepwater habitat.

Within the Human Disturbance Areas, the lakes and deepwater habitat were edited in the following locations:

1. Within the proposed Project area – Murphy's Pond, a non-natural deepwater habitat, was added using the field mapping data.
2. Beaver Bay Wastewater Treatment ponds – three ponds were added to the layer using the polygons from the NWI.

These edits were completed to generate the "Existing" lakes and deepwater habitat layer (Large Figure 4).

4.3.3 Streams

The streams within the study area were initially identified using the MNDNR PWI layer and the flowlines from the USGS National Hydrography Dataset (NHD) within the study area. The NHD file was queried to only show the perennial streams in the study area. The PWI were revised by adding those NHD flowline segments that were not already in the PWI layer, thereby eliminating data redundancy. The streams were then edited depending on whether the stream was located outside or within the Human Disturbance Areas (Large Figure 2). Outside of the Human Disturbance Areas, the revised PWI was used as the "Existing" streams.

Within the Human Disturbance Areas, the PWI streams were edited in the following locations:

1. Within the proposed Project area – the extents of the Big Thirtynine Creek and Little Thirtynine Creek were removed from the PWI layer and the extents were updated using 2017 field mapping of the streams.
2. Within the existing Tailings Basin – the 2005 diversion channel was added using field mapping data.
3. Within the Human Disturbance Areas – the channel associated with the Northshore Wastewater Treatment Plant (Section 4.3.3) was added.
4. Within the study area – the "Existing" stream segments that intersect the "Existing" lakes and deepwater habitat layer were removed.

These edits were completed to generate the "Existing" streams layer (Large Figure 4).

4.3.4 Forest

Forests are present throughout the study area outside of the Human Disturbance Areas and lakes and deepwater habitat. Polygons that represent the open water of the "Existing" lakes and deepwater habitat (Section 4.3.2) and the Human Disturbance Areas (Section 4.1) were removed from this layer to create the "Existing" forest layer (Large Figure 4).

4.4 Foreseeable Future Aquatic and Forest Resources

The future time period represents wetland, lake and deepwater habitat, stream, and forest resources expected to be present following the conclusion and reclamation of the proposed Project. The acreage of aquatic and forest resources estimated for the future time period was developed as described in the following sections.

4.4.1 Cumulative Actions

This assessment included efforts to identify foreseeable future actions as described below. Relevant agencies were contacted to identify any foreseeable future actions within the study area. Agency officials were asked to identify actual or potential development projects that may occur in the study area. Public officials from city, county, state and federal agencies were contacted as follows:

1. City of Silver Bay
    a. City Administrator (contact: Lana Fralich) – identified the following projects:
        i. Black Beach Campground (Large Figure 5) – no wetland impacts but tree clearing will occur.
        ii. Sanitary Trunk Line Improvement Project (Large Figure 5) – less than one acre of temporary wetland impact and some tree clearing anticipated.
        iii. Multimodal Trailhead Center (Large Figure 5) – minor temporary wetland impact and minimal tree clearing anticipated.
        iv. Housing Development Project (Large Figure 5) – located on Penn Avenue with no wetland impacts or tree clearing anticipated.
        v. Silver Bay Business Park (Large Figure 5) – includes water, sewer, utilities, and roadway extension with up to 18 acres of wetland impact and some tree clearing anticipated.
        vi. Highway 61 – looping project for water break with no wetland or tree impacts anticipated.
        vii. MNDNR forestry grant – planting of 200 trees in summer of 2019 anticipated.
        viii. Replacement of all streets with no wetland or tree impacts anticipated.
        ix. Ditch maintenance project with minor temporary wetland impacts anticipated.
2. City of Beaver Bay
    a. City Administrator (contact: Tim Anderson) – no projects identified that would impact wetland, lake and deepwater habitat, stream, or forest resources.
3. Lake County

a. Forestry/Land Department (contact: Nate Eide) – no projects identified that would impact wetland, lakes and deepwater habitat, stream, or forest resources.
b. Highway Department (contact: Krysten Foster) – the Lake County Road and Bridge Five-Year Plan lists several projects occurring in Lake County through 2022. See PDF at https://www.co.lake.mn.us/Highway/2018%205%20year%20plan.pdf. No information on potential impacts to wetland, lake and deepwater habitat, stream, or forest resources is available at this time.
c. Soil and Water Conservation District (SWCD) (contact: Derrick Passe) – identified the following projects:
    i. Several restoration projects have been completed, with the East Branch, Beaver River Restoration Project nearing completion in the summer of 2019 (Large Figure 5), which, according to the associated Environmental Assessment Worksheet , will have approximately 0.3 acres of wetland impact and a gain in 0.6 acres of forest.
    ii. Also mentioned that the Beaver River watershed is a high priority area in the Lake Superior North One Watershed One Plan, which has a reforestation goal of 20 acres of coniferous trees per year in the Lake Superior North watershed (https://www.co.lake.mn.us/document_center/SWCD_Doc_Center/One%20Watershed%20One%20Plan%20Lake%20Superior%20North%201.pdf).

4. Minnesota Board of Soil and Water Resources (BWSR)
    a. Wetland Specialist for Duluth Office (contact: David Demmer) – indicated that there are a few projects in the study area and that most are near Lake Superior and mentioned some of the projects noted above that are occurring in Silver Bay.
        i. Lakeshore Residential Development – a proposed 5-lot residential development within the study area along Lake Superior; indicated that wetland impacts are unlikely but tree clearing may occur (Large Figure 5).
5. MnDOT
    a. State of Minnesota State Transportation Improvement Program (STIP; 2018 https://bwsr.state.mn.us/sites/default/files/2019-01/WCA_WCA_BWSR_Wet_Spec_Work_Areas.pdf) lists several projects occurring in Lake County through 2022 (https://www.co.lake.mn.us/Highway/2018%205%20year%20plan.pdf). No information on potential impacts to wetland, lake and deepwater habitat, stream, and forest resources is available at this time.
6. MNDNR
    a. Lands and Minerals (contact: Margi Coyle) – no information is available at this time regarding potential projects within the study area.
    b. Forestry (contact: Northeast Region office) – no information is available at this time regarding potential projects within the study area.
    c. Waters (contact: Cliff Bentley) – no information is available at this time regarding potential projects within the study area.

d. Tettegouche State Park (contact: Jason Peterson) – identified a few projects, all of which are located outside of the study area.
e. Finland State Forest (contact: Simon Keene) – identified a road project which is located outside of the study area.

7. USDA-USFS
    a. Superior National Forest (Contact: Connie Cummins) – no information is available at this time regarding potential projects within the study area.
8. Northshore Proposed Project
    a. Wetlands
        i. The wetland replacement plan (Barr 2019) identified 267.43 acres of direct impact wetland impacts. In addition, 10.42 acres of wetland will be removed that are not regulated under either the Minnesota Wetland Conservation Act or the Section 404 of the Clean Water Act.
    b. Lakes and deepwater habitat
        i. Murphy's Pond (29.57 acres) will be impacted.
        ii. Two future deepwater habitats (80.29 acres) will be created in the area.
    c. Streams/Channels
        i. The 2005, manmade diversion channel (1.1 miles) will be removed.
        ii. Several future MP7 manmade channels (~2.2 miles) will be created with the proposed Project to ensure continued drainage from existing, unimpacted wetlands adjacent to the Project.
        iii. Within the extent of the proposed Project, remnant segments of Big 39 Creek (5,150 feet) and Little 39 Creek (3,420 feet) will be removed.
        iv. The stream segments that intersected the "Foreseeable Future" lakes and deepwater habitat layer were removed from this layer.
        v. Northshore is currently evaluating several potential stream restoration projects on the Beaver River and East Branch Beaver River as part of planning for the proposed Project, but no details are currently publically available.
    d. Forest
        i. Approximately 235 acres of forest will be cleared for railroad and dam construction and 613 acres of forest will be slowly filled with tailings as the basin expands over the years for a total of 848 acres.

4.4.2 Wetlands

Foreseeable future projects identified that may affect wetlands include the proposed Project (277.85 acres), Silver Bay Business Park project (18 acres), East Branch Beaver River Restoration Project (0.3 acres), and some minor temporary wetland impacts (unknown acres), as described in Section 4.4.1.

4.4.3 Lakes and Deepwater Habitats

Foreseeable future projects that may affect lakes and deepwater habitat include only the proposed Project, with a loss of 29.57 acres of deepwater habitat and the creation of 80.29 acres of deepwater

habitat for a net gain of 50.72 acres of deepwater habitat. No other foreseeable future projects were identified that would potentially impact lakes or deepwater habitat in the study area.

4.4.4 Streams

Foreseeable future projects that may affect streams include only the proposed Project with a loss of 1.6 miles of remnant natural streams, the loss of 1.1 miles of manmade channels, and the creation of 2.2 miles of manmade channel. Northshore is currently evaluating several potential stream restoration projects within the study area, but none are expected to substantially increase stream length. No other foreseeable future projects were identified that would potentially impact streams in the study area.

4.4.5 Forest

Foreseeable future projects that may affect forest include the proposed Project with 235 acres of forest physically removed and 613 acres that will slowly be inundated by tailings storage over many years for a total of 848 acres affected. In addition, one project would add 0.6 acres of forest and up to 20 acres could be reforested each year, otherwise no other foreseeable future projects were identified that would substantially impact forest resources in the study area.

5 Cumulative Effects Assessment Results

5.1 Pre-settlement Conditions

A total of 24,051 acres of wetlands were identified in the 96,000 acre watershed comprising 25.1 percent of the watershed (Table 3; Large Figure 3).

A total of 523 acres of lakes and deepwater habitat were identified in the 96,000 acre watershed comprising 0.5 percent of the watershed (Table 4; Large Figure 3).

A total of 186.6 miles of streams were identified in the 96,000 acre watershed (Table 5; Large Figure 3).

A total of 95,518 acres of forests were identified in the 96,000 acre watershed comprising 99.5 percent of the watershed (Table 6; Large Figure 3).

5.2 Existing Conditions

A total of 23,047 acres of wetlands were identified in the 96,225 acre watershed comprising 24.0 percent of the land area (Table 3; Large Figure 4). There has been a decrease of approximately 1,000 acres of wetland, or about a 4 percent decrease in the wetland area compared to pre-settlement conditions (Table 7).

A total of 559 acres of lakes and deepwater habitat were identified in the 96,225 acre watershed comprising 0.6 percent of the land area (Table 4; Large Figure 4). There was an increase of 36 acres of deepwater habitat in the watershed compared to the pre-settlement conditions due to the establishment of Murphy's Pond and the Beaver Bay Wastewater Treatment ponds (Table 8). It should be noted that from pre-settlement to existing conditions, the land area draining to Lake Superior (Beaver River watershed) has increased in size by 225 acres due to operations of Reserve Mining Company (Large Figure 3 and Large Figure 4). That shoreline development resulted in the loss of about 216 acres of Lake Superior, which represents 0.001 percent of the 20,288,000 acre lake.

A total of 182.2 miles of streams were identified in the 96,225 acre watershed (Table 5; Large Figure 4). There has been a decrease of 4.4 miles of streams in the watershed compared to the pre-settlement conditions, representing a 2.4 percent decrease (Table 9).

A total of 87,352 acres of forests were identified in the 96,225 acre watershed comprising 90.8 percent of the land area (Table 6; Large Figure 4). There has been a decrease of approximately 8,165 acres of forest, or an 8.5 percent decrease in the forest area compared to pre-settlement conditions (Table 10).

5.3 Future Foreseeable Conditions

5.3.1 No Action Alternative

The No Action Alternative assumes no development of the proposed Project. Under this alternative, development of other identified projects would occur under the foreseeable future conditions (Table 2).

Without the proposed Project, there are projected to be approximately 23,027 acres of wetlands in the foreseeable future, which would comprise about 23.9 percent of the watershed (Table 3). Wetland acreage would be reduced by 4.3 percent compared to pre-settlement conditions and reduced by 0.1 percent compared to existing conditions (Table 7).

Without the proposed Project, there are projected to be approximately 559 acres of lakes and deepwater habitat in the foreseeable future, which would comprise about 0.6 percent of the watershed (Table 4). Lake and deepwater habitat acreage would be increased by 6.9 percent compared to pre-settlement conditions and there would be no change compared to existing conditions (Table 8).

Without the proposed Project, there are projected to be approximately 182.2 miles of streams in the foreseeable future (Table 5). Stream length would be reduced by 2.4 percent compared to pre-settlement conditions and there would be no change compared to existing conditions (Table 9).

Without the proposed Project, there are projected to be approximately 87,352 acres of forests in the foreseeable future, which would comprise about 90.8 percent of the watershed (Table 6). Forest acreage would be reduced by 8.5 percent compared to pre-settlement conditions and there would be no change compared to existing conditions (Table 10).

5.3.2 Proposed Action

The Proposed Action assumes development of the proposed Project. Under this alternative, development of other projects (including associated wetland and stream impacts in the Beaver River watershed) would occur under the foreseeable future conditions.

A total of approximately 22,749 acres of wetlands are projected to be present in the watershed in the foreseeable future comprising 23.6 percent of the land area (Table 3; Large Figure 5). The change in wetlands, as a proportion of all wetlands within the study area, will be a 5.4 percent reduction from pre-settlement conditions and a 1.3 percent reduction compared to existing conditions (Table 7).

A total of approximately 610 acres of lakes and deepwater habitat are projected to be present in the watershed in the foreseeable future, comprising 0.6 percent of the land area (Table 4; Large Figure 5). The change in lakes and deepwater habitat, as a proportion of the total study area, will be a 16.6 percent increase from pre-settlement conditions and a 9.1 percent increase compared to existing conditions (Table 8).

A total of approximately 181.8 miles of streams and channels are projected to be present in the watershed in the foreseeable future (Table 5; Large Figure 5). The change in stream length, as a proportion of the total study area, will be a 2.6 percent decrease from pre-settlement conditions and a 0.2 percent reduction compared to existing conditions (Table 9).

A total of approximately 86,505 acres of forests are projected to be present in the watershed in the foreseeable future, comprising 89.9 percent of the land area (Table 6; Large Figure 5). The change in

forests, as a proportion of the total study area, will be a 9.4 percent decrease from pre-settlement conditions and a 1.0 percent reduction compared to existing conditions (Table 10).

6 Cumulative Effects Assessment Discussion

The study area is unique in contrast to the historical loss of wetlands in the United States. Between the 1780s and the 1980s, the lower 48 states have lost about 53 percent of the pre-settlement wetland habitat (EPA 2019). Minnesota and Wisconsin have lost 42 and 50 percent of their original wetlands, respectively. Relatively few northeastern Minnesota wetlands have been negatively affected or lost compared to wetland loss in the rest of the state or country (Dahl 2011).

6.1 Wetlands

6.1.1 Cumulative Effects Study Area

Wetlands in the study area are similar in type and function to wetlands found throughout northeastern Minnesota. Most naturally-occurring wetland types in the study area are forested swamp, shrub carr, and alder thicket (MNDNR 2016). Wetlands currently comprise nearly 24 percent of the land area in the study area.

Nearly 99 percent of the existing wetlands in the study area will not be affected by the proposed Project or other foreseeable future development (Table 7).

Compared to pre-settlement conditions, the net decrease in wetland resources under future conditions with all foreseeable future projects in the study area is approximately 1,302 acres or 5.4 percent of the pre-settlement wetlands in the study area (Table 3). Approximately 77 percent of the 1,302-acre decrease is due to past actions in the study area.

Compared to existing conditions, the net decrease in wetland resources associated with all foreseeable future projects in the study area, will be approximately 298 acres, of which the proposed Project would contribute 93 percent (277.8 acres). The net change of wetlands associated with all foreseeable future projects represents 1.3 percent of the existing wetland resources within the study area (Table 7).

6.2 Lakes and Deepwater Habitat

Lakes and deepwater habitat currently comprise 0.6 percent of the land area in the study area (Table 4). The existing deepwater habitat that will be impacted by the proposed Project is Murphy's Pond. The rest of the existing lakes in the study area will not be affected by the proposed Project or other foreseeable future development (Table 8).

Compared to pre-settlement conditions, there will be a net increase in lake and deepwater habitat resources under future conditions with all foreseeable future projects in the study area of approximately 87 acres or 17 percent of the pre-settlement lakes and deepwater habitat in the study area (Table 4). Most of the change is due to Northshore operations and all of the changes are due to human-induced deepwater habitats.

Compared to existing conditions, the net increase in lake and deepwater habitat resources associated with all foreseeable future projects in the study area, would be approximately 51 acres, of which the proposed

Project would contribute 100 percent (25.97 acres removed; 80.29 acres created). The net change of lakes and deepwater habitat associated with all foreseeable future projects represents about a 9 percent increase from the existing lake and deepwater habitat resources within the study area (Table 8).

6.3 Streams

Streams currently comprise 186.6 miles within the study area (Table 5). Approximately 99 percent of the existing streams in the study area will not be affected by the proposed Project or other foreseeable future development (Table 9).

Compared to pre-settlement conditions, the net decrease in stream resources under future conditions with all foreseeable future projects in the study area is approximately 4.8 miles or 2.6 percent of the pre-settlement streams in the study area (Table 5). Approximately 92 percent of the 4.8 miles is due to past actions in the study area. Compared to existing conditions, the net decrease in stream resources associated with all foreseeable future projects in the study area, would be approximately 0.4 miles, of which the proposed Project would contribute 100 percent. The net change of streams associated with all foreseeable future projects represents less than one percent of the existing stream resources within the study area.

6.4 Forests

Forests currently comprise 90.8 percent of the land area in the study area (Table 6). Approximately 99 percent of the existing forests in the study area will not be affected by the proposed Project or other foreseeable future development (Table 10).

Compared to pre-settlement conditions, the net decrease in forest resources under future conditions with all foreseeable future projects in the study area is approximately 9,013 acres or 9 percent of the pre-settlement forests in the study area (Table 6). Over 90 percent of the 9,013 acres is due to past actions in the study area. Compared to existing conditions, the net decrease in forest resources associated with all foreseeable future projects in the study area, would be approximately 848 acres, of which the proposed Project would contribute 100 percent. The net change of forests associated with all foreseeable future projects represents only about 1 percent of the existing forest resources within the study area.

6.5 Conclusions

Within the study area:

- More than 98 percent of the existing wetlands in the study area will not be directly impacted by the proposed Project or other foreseeable future projects. Cumulatively, approximately 5 percent of pre-settlement wetlands within the watershed will be impacted when considering all foreseeable future projects, including the Northshore proposed Project.

- Lake and deepwater habitat will increase by about 9 percent from existing conditions in the study area when considering the proposed Project and other foreseeable future projects. Cumulatively, lake and deepwater habitat within the watershed will increase by less than 17 percent compared

to pre-settlement conditions when considering all foreseeable future projects, including the Northshore proposed Project.

- More than 99 percent of the existing streams in the study area will not be directly impacted by the proposed Project or other foreseeable future projects. Cumulatively, less than 3 percent of pre-settlement streams and perennial channels within the watershed will be impacted when considering all foreseeable future projects, including the Northshore proposed Project.

- Approximately 99 percent of the existing forests in the study area will not be directly impacted by the proposed Project or other foreseeable future projects. Cumulatively, approximately 9 percent of pre-settlement forests within the watershed will be impacted when considering all foreseeable future projects, including the Northshore proposed Project.

Based on the effects from the proposed Project and other foreseeable future actions, the cumulative effects on the wetlands, lakes and deepwater habitats, streams, and forest resources in the study area are likely not significant. The cumulative loss of approximately 5 percent of pre-settlement wetlands, or 1.5 percent of the watershed land area comprised by wetlands, will have little to no effect on their functioning for flood storage and maintaining water quality in the watershed. A study conducted in central Minnesota (Johnston et al., 1990) found that when wetland and lake area, as a percent of the watershed, is reduced below 10 percent, flood flows can increase greatly. However, watersheds with 10 to 50 percent wetlands and lakes have nearly the same flood flow per unit area (Johnston et al., 1990). A similar relationship was found for suspended solids as a measure of water quality (Oberts, 1981). Oberts (1981) found that watersheds with 10 to 20 percent wetlands had relatively constant rates of suspended solids generation per unit area of watershed. Therefore, because the HUC 10 Beaver River-Frontal Lake Superior watershed will maintain nearly 24 percent wetlands, by area, with the proposed Project and all reasonably foreseeable future projects, flooding and water quality characteristics will not be adversely affected.

Within the HUC 10 Beaver River-Frontal Lake Superior watershed, approximately 70 percent of the cumulative wetland loss has occurred and will occur proximate to the area of the existing and future Northshore tailings basin. Potential effects of the cumulative wetland loss on flooding and water quality will be minimized by the proposed Project. The proposed tailings basin will provide about 3,000 acres of flood storage and water quality treatment capacity through the collection of rainfall and runoff within the project area and processing of excess water through the Northshore wastewater treatment plant prior to discharge. The wastewater treatment plant has been documented to remove suspended solids consistently to well below water quality standards. In addition, the wastewater treatment plant has documented discharge rates below what would be considered flood flows in the Beaver River. Therefore, with approximately three times more flood storage than was present historically, and proven water quality treatment, the proposed Project and all reasonably foreseeable future projects will not adversely affect flooding or water quality within the Beaver River watershed. Furthermore, the cumulative effects on wetlands in the study area are significantly less than in other parts of the state and country.

7 References

Barr Engineering Co. 2019. *Joint Permit Application and Wetland Replacement Plan*. West Ridge Railroad Relocation and Tailings Basin Progression. Prepared for Northshore Mining Company. April 2019.

Dahl, T.E. 2011. *Status and Trends of Wetlands in the Conterminous United States 2004 to 2009*. U.S. Department of the Interior; Fish and Wildlife Service, Washington, D.C.

Hayes Surveying and Mapping. 2013. *Wetland Delineation Report*. Silver Bay Business Park. Conducted for the City of Silver Bay, Minnesota. June 9, 2013.

Johnston, C.A., N.E. Detenbeck, and G.J. Niemi. 1990. The cumulative effect of wetlands on stream water quality and quantity: a landscape approach. Biogeochemistry 10:105-141.

Minnesota Department of Natural Resources. 2016. National Wetland Inventory Update for Minnesota. www.dnr.state.mn.us/eco/wetlands/nwi_proj.html

Oberts, G.L. 1981. Impact of wetlands on watershed water quality. P. 213-226. *In* B. Richardson (ed.) Selected Proceedings of the Midwest Conference on Wetland Values and Management. Freshwater Society, Navarre, MN, USA.

United States Census. *American Fact Finder*. Accessed June 27, 2019. https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

U.S. Environmental Protection Agency. *How does EPA keep track of the status and trends of wetlands in the US?* Accessed June 27, 2019. https://www.epa.gov/wetlands/how-does-epa-keep-track-status-and-trends-wetlands-us.

Tables

Table 1. Townships in the study area.

Township	Range	Township Area within the Watershed (ac)	Area of Human Disturbance in Township (ac)[1]	Percent of Impacted Area in Township
54N	8W	737	42	5.7%
54N	9W	3	0	0 to %
55N	7W	576	350	60.7%
55N	8W	16,373	2,599	15.9%
55N	9W	5,283	445	8.4%
56N	7W	7,791	1,185	15.2%
56N	8W	22,737	3,255	14.3%
56N	9W	20,604	261	1.3%
56N	10W	437	7	1.6%
57N	7W	10	0	0.0%
57N	8W	6,545	68	1.0%
57N	9W	14,080	116	0.8%
57N	10W	50	6	12.5%
58N	8W	13	1	6.1%
58N	9W	985	15	1.5%
Total		96,224	8,351	8.7%

[1] Human disturbance includes mining features, roads, railroads, barren land, rural and municipal residental, and municipal development.

Table 2. Changes in wetland, lake and deepwater habitat, stream, and forest resources in the foreseeable future.

Project Name	Wetland (acre)	Lake and Deepwater Habitat (acre)[1]	Stream (miles)	Forest (acre)
Proposed Project (Northshore)	-277.9	51	-0.4	-848
Silver Bay Business Park[2]	-18	0	0	NA[4]
Miscellaneous projects in the watershed[3]	-2	0	0	NA[4]

[1]As part of Northshore's proposed Project, Murphy's Pond (25.97 acres) will be impacted and two open water areas will be created (80.29 acres), resulting in a net gain in deepwater area.

[2]Assumes worst case scenario where all wetlands identified in the project area would be impacted.

[3]Maximum impact that could occur from additional projects identified in Section 4.4.1.

[4]It is not known how much tree clearing will occur for these small projects; however, tree planting efforts through a MnDNR forestry grant in Silver Bay and reforestation efforts in the Beaver River watershed should offsett forest removal associated with these projects.

Table 3. Total wetland area (acres) for pre-settlement, existing, and future conditions.

	Presettlement Conditions			Existing Conditions			Foreseeable Future Conditions with the Proposed Project			Foreseeable Future Conditions without the Proposed Project (No Action Alternative)	
Watershed	Total Land Area (ac)	Area (ac)	% of Watershed	Total Land Area	Area (ac)	% of Watershed	Total Land Area	Area (ac)	% of Watershed	Area (ac)	% of Watershed
Beaver River	96,000	24,051	25.1%	96,225	23,047	24.0%	96,225	22,749	23.6%	23,027	23.9%

Table 4. Total lake and deepwater habitat area (acres) for pre-settlement, existing, and future conditions.

		Presettlement Conditions		Existing Conditions			Foreseeable Future Conditions with the Proposed Project			Foreseeable Future Conditions without the Proposed Project (No Action Alternative)	
Watershed	Total Land Area (ac)	Area (ac)	% of Watershed		Area (ac)	% of Watershed		Area (ac)	% of Watershed	Area (ac)	% of Watershed
Beaver River	96,000	523	0.5%	96,225	559	0.6%	96,225	610	0.6%	559	0.6%

Table 5. Total stream length (miles) for pre-settlement, existing, and future conditions.

		Presettlement Conditions		Existing Conditions			Foreseeable Future Conditions with the Proposed Project			Foreseeable Future Conditions without the Proposed Project (No Action Alternative)	
Watershed	Total Land Area (ac)	Length (mi)	% of Watershed		Length (mi)	% of Watershed		Length (mi)	% of Watershed	Length (mi)	% of Watershed
Beaver River	96,000	186.6	NA	96,225	182.2	NA	96,225	181.8	NA	182.2	NA

Table 6. Total forest area (acres) for pre-settlement, existing, and future conditions.

		Presettlement Conditions		Existing Conditions			Foreseeable Future Conditions with the Proposed Project			Foreseeable Future Conditions without the Proposed Project (No Action Alternative)	
Watershed	Total Land Area (ac)	Area (ac)	% of Watershed		Area (ac)	% of Watershed		Area (ac)	% of Watershed	Area (ac)	% of Watershed
Beaver River	96,000	95,518	99.5%	96,225	87,352	90.8%	96,225	86,505	89.9%	87,352	90.8%

Table 7. Summary of future known changes in wetland resources for the study area [1].

Watershed	Pre-settlement Conditions		Existing Conditions		% Change from Pre-settlement to Existing Conditions	Forseeable Future Conditions with the Proposed Project		% Change from Pre-settlement to Future Conditions with the Proposed Project	% Change from Existing to Future Conditions with the Proposed Project	Forseeable Future Conditions with the No Action Alternative		% Change from Pre-settlement to Future Conditions with the No Action Alternative	% Change from Existing to Future Conditions with the No Action Alternative
	Total Land Area (ac)	Wetland Area (ac)	Total Land Area (ac)	Wetland Area (ac)		Total Land Area (ac)	Wetland Area (ac)			Total Land Area (ac)	Wetland Area (ac)		
Beaver River	96,000	24,051	96,225	23,047	-4.2%	96,225	22,749	-5.4%	-1.3%	96,225	23,027	-4.3%	-0.1%

[1]The (-) represents a loss of acres and the (+) represents a gain of acres.

Table 8. Summary of future known changes in lake and deepwater habitat resources for the study area [1].

Watershed	Pre-settlement Conditions		Existing Conditions		% Change from Pre-settlement to Existing Conditions	Forseeable Future Conditions with the Proposed Project		% Change from Pre-settlement to Future Conditions with the Proposed Project	% Change from Existing to Future Conditions with the Proposed Project	Forseeable Future Conditions with the No Action Alternative		% Change from Pre-settlement to Future Conditions with the No Action Alternative	% Change from Existing to Future Conditions with the No Action Alternative
	Total Land Area (ac)	Lake and Deepwater Habitat Area (ac)	Total Land Area (ac)	Lake and Deepwater Habitat Area (ac)		Total Land Area (ac)	Lake and Deepwater Habitat Area (ac)			Total Land Area (ac)	Lake and Deepwater Habitat Area (ac)		
Beaver River	96,000	523	96,225	559	6.9%	96,225	610	16.6%	9.1%	96,225	559	6.9%	0.0%

[1]The (-) represents a loss of acres and the (+) represents a gain of acres.

Table 9. Summary of future known changes in stream length for the study area [1].

Watershed	Pre-settlement Conditions		Existing Conditions		% Change from Pre-settlement to Existing Conditions	Forseeable Future Conditions with the Proposed Project		% Change from Pre-settlement to Future Conditions with the Proposed Project	% Change from Existing to Future Conditions with the Proposed Project	Forseeable Future Conditions with the No Action Alternative		% Change from Pre-settlement to Future Conditions with the No Action Alternative	% Change from Existing to Future Conditions with the No Action Alternative
	Total Land Area (ac)	Stream Length (mi)	Total Land Area (ac)	Stream Length (mi)		Total Land Area (ac)	Stream Length (mi)			Total Land Area (ac)	Stream Length (mi)		
Beaver River	96,000	186.6	96,225	182.2	-2.4%	96,225	181.8	-2.6%	-0.2%	96,225	182.2	-2.4%	0.0%

[1] The (-) represents a loss of linear feet and the (+) represents a gain of linear feet.

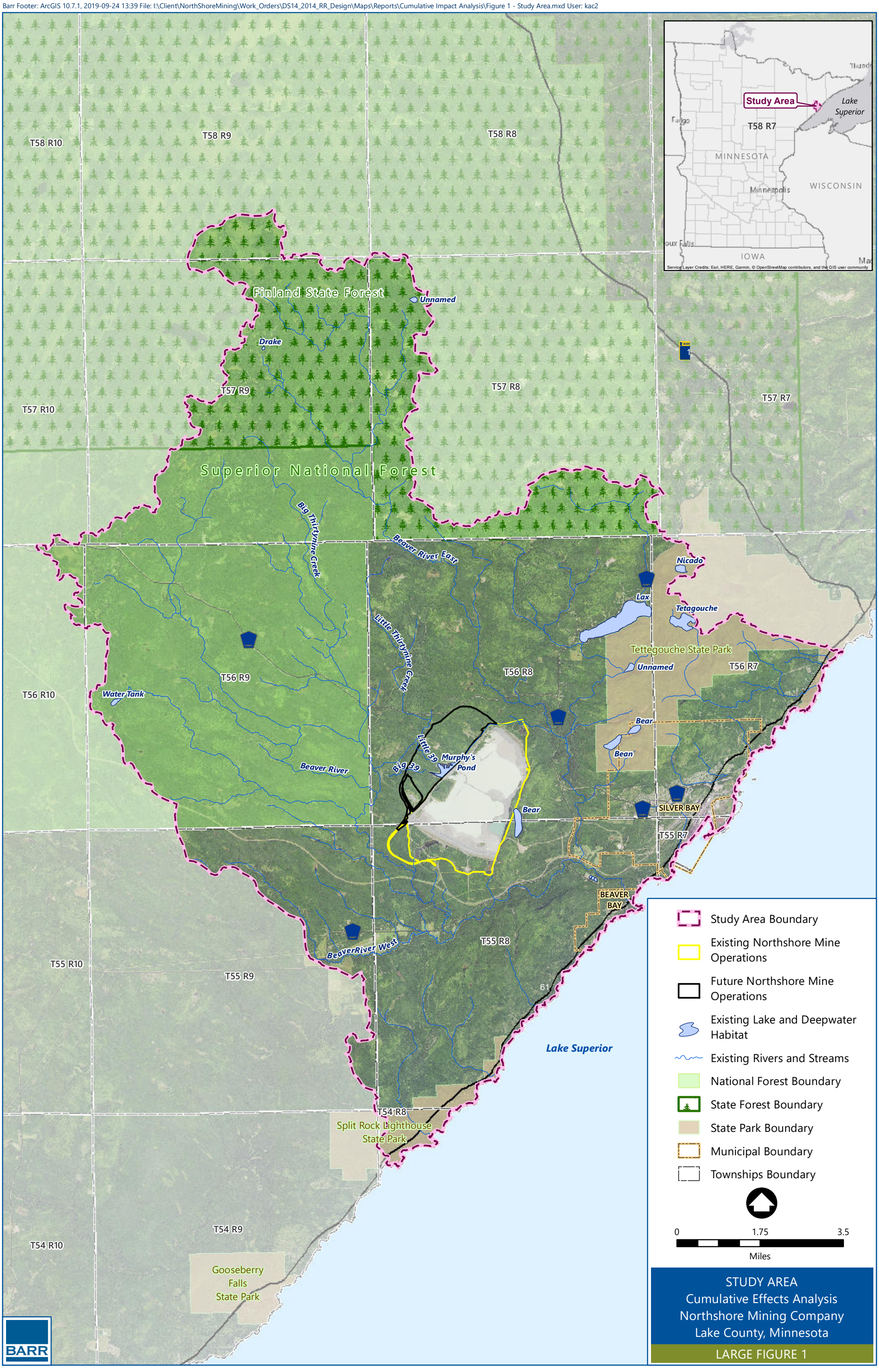
Table 10. Summary of future known changes in forest area for the study area [1].

Watershed	Pre-settlement Conditions		Existing Conditions		% Change from Pre-settlement to Existing Conditions	Forseeable Future Conditions with the Proposed Project		% Change from Pre-settlement to Future Conditions with the Proposed Project	% Change from Existing to Future Conditions with the Proposed Project	Forseeable Future Conditions with the No Action Alternative		% Change from Pre-settlement to Future Conditions with the No Action Alternative	% Change from Existing to Future Conditions with the No Action Alternative
	Total Land Area (ac)	Forest Area (ac)	Total Land Area (ac)	Forest Area (ac)		Total Land Area (ac)	Forest Area (ac)			Total Land Area (ac)	Forest Area (ac)		
Beaver River	96,000	95,518	96,225	87,352	-8.5%	96,225	86,505	-9.4%	-1.0%	96,225	87,352	-8.5%	0.0%

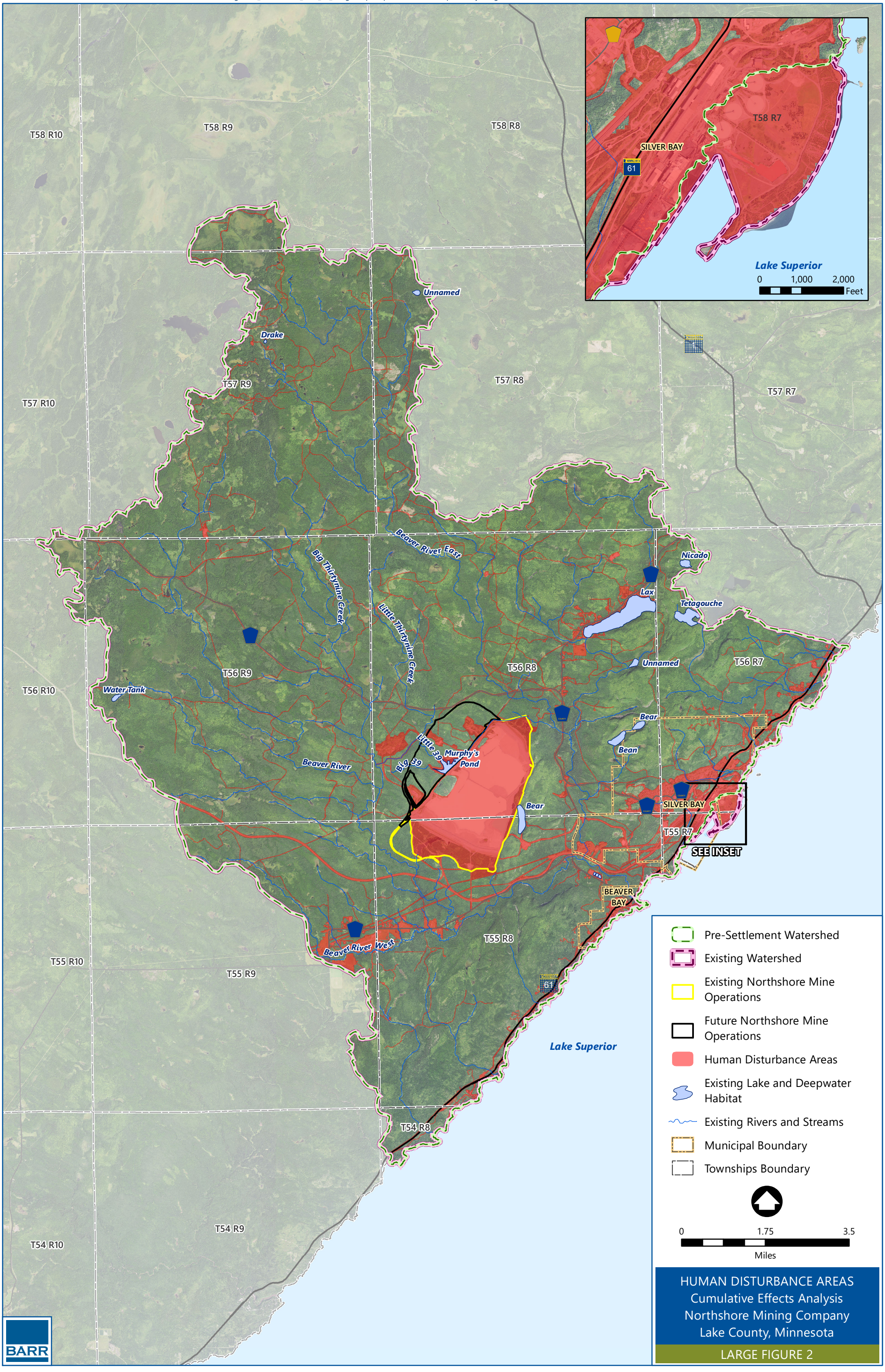
[1]The (-) represents a loss of acres and the (+) represents a gain of acres.

Large Figures

Barr Footer: ArcGIS 10.7.1, 2019-09-24 13:39 File: I:\Client\NorthShoreMining\Work_Orders\DS14_2014_RR_Design\Maps\Reports\Cumulative Impact Analysis\Figure 1 - Study Area.mxd User: kac2



Barr Footer: ArcGIS 10.7.1, 2019-10-17 16:36 File: I:\Client\NorthShoreMining\Work_Orders\DS14_2014_RR_Design\Maps\Reports\Cumulative Impact Analysis\Figure 2 - Human Disturbance Areas.mxd User: kac2



Legend

- Pre-Settlement Watershed
- Pre-settlement Subwatersheds
- Pre-Settlement Rivers and Streams
- Pre-Settlement Lakes and Deepwater Habitat
- Future Northshore Mine Operations
- Existing Northshore Mine Operations
- Pre-Settlement Forest Cover
- Municipal Boundary
- Pre-Settlement Wetlands

0 1.75 3.5

Miles

PRE-SETTLEMENT RESOURCES
Cumulative Effects Analysis
Northshore Mining Company
Lake County, Minnesota

LARGE FIGURE 3

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Drake
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Big Thirtynine Creek
Little Thirtynine Creek
Big Thirtynine Creek
Nicado
Lax
Tetagouche
Unnamed
Water Tank
Beaver River East
Lake Superior
Bear
Bean
Little 39
Big 39
Murphy's Pond
Beaver River
Beaver River
Bear
SILVER BAY
Treatment Ponds
BEAVER BAY
West Branch Beaver River
BeaverRiver West
61
Lake Superior
Lake Superior

Legend

- Existing Watershed
- Existing Subwatersheds
- Existing Rivers and Streams
- Existing Lakes and Deepwater Habitat
- Municipal Boundary
- Future Northshore Mine Operations
- Existing Northshore Mine Operations
- Townships Boundary
- Existing Forest Cover
- Existing Wetlands

0 1.75 3.5
Miles

EXISTING RESOURCES
Cumulative Effects Analysis
Northshore Mining Company
Lake County, Minnesota

LARGE FIGURE 4

BARR

Barr Footer: ArcGIS 10.7.1, 2019-10-30 10:29 File: I:\Client\NorthShoreMining\Work_Orders\DS14_2014_RR_Design\Maps\Reports\Cumulative Impact Analysis\Figure 5 - Future Resources_v2.mxd User: maj

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T53 R9

Unnamed
Drake
Nicado
Lax
Tetagouche
Unnamed
Water Tank
Unnamed
Unnamed
Bear
Bean
Unnamed
Bear
Treatment Ponds

Big Thirtynine Creek
Little Thirtynine Creek
East Branch Beaver River
Beaver River East
Lake Superior
Beaver River
Beaver River
West Branch Beaver River
BeaverRiver West
Lake Superior
Lake Superior

SILVER BAY
BEAVER BAY

Housing Development Project
Silver Bay Business Park
Black Beach Campground
Sanitary Trunk Line Improvement Project
Multimodal Trailhead Center
East Branch, Beaver River Restoration Project
Lakeshore Residential Development

5
61
MINNESOTA

Legend

- Foreseeable Future Projects
- Future Watershed
- Future Northshore Mine Operations
- Existing Northshore Mine Operations
- Future Subwatersheds
- Future Rivers and Streams
- Future Lakes and Deepwater Habitat
- Municipal Boundary
- Townships Boundary
- Future Forest Cover
- Future Wetlands

0 1.75 3.5
Miles

FORESEEABLE FUTURE RESOURCES
Cumulative Effects Analysis
Northshore Mining Company
Lake County, Minnesota

LARGE FIGURE 5

BARR