NorthMet Project

Wetland Replacement Plan

Issue Date: December 2017

This document was prepared for Poly Met Mining, Inc.
by Barr Engineering Co.

PART ONE: Applicant Information

If applicant is an entity (company, government entity, partnership, etc.), an authorized contact person must be identified. If the applicant is using an agent (consultant, lawyer, or other third party) and has authorized them to act on their behalf, the agent's contact information must also be provided.

Applicant/Landowner Name: Poly Met Mining, Inc.
Mailing Address: Poly Met Mining, Inc. Suite 2060, 444 Cedar Street, St. Paul, MN 55110
Phone: 651-389-4108
E-mail Address: jsaran@polymetmining.com

Authorized Contact (do not complete if same as above):
Mailing Address:
Phone:
E-mail Address:

Agent Name:
Mailing Address:
Phone:
E-mail Address:

PART TWO: Site Location Information

County: St. Louis **City/Township:**
Parcel ID and/or Address:
Legal Description (Section, Township, Range): Please see Section 3 of the Wetland Replacement Plan for location information
Lat/Long (decimal degrees):
Attach a map showing the location of the site in relation to local streets, roads, highways. Please see Large Figure 1 of the Wetland Replacement Plan
Approximate size of site (acres) or if a linear project, length (feet): 9,114 acres

If you know that your proposal will require an individual Permit from the U.S. Army Corps of Engineers, you must provide the names and addresses of all property owners adjacent to the project site. This information may be provided by attaching a list to your application [Please see Section 7 and Large Table 4 of the wetland replacement plan]
or by using block 25 of the Application for Department of the Army permit which can be obtained at:

http://www.mvp.usace.army.mil/Portals/57/docs/regulatory/RegulatoryDocs/engform_4345_2012oct.pdf

PART THREE: General Project/Site Information

If this application is related to a delineation approval, exemption determination, jurisdictional determination, or other correspondence submitted ***prior to*** this application then describe that here and provide the Corps of Engineers project number.
USACE File # 1999-5528-JKA

Describe the project that is being proposed, the project purpose and need, and schedule for implementation and completion. The project description must fully describe the nature and scope of the proposed activity including a description of all project elements that effect aquatic resources (wetland, lake, tributary, etc.) and must also include plans and cross section or profile drawings showing the location, character, and dimensions of all proposed activities and aquatic resource impacts.

Please see Sections 4, 5, and 11 of the Wetland Replacement Plan.

PART FOUR: Aquatic Resource Impact[1] Summary

If your proposed project involves a direct or indirect impact to an aquatic resource (wetland, lake, tributary, etc.) identify each impact in the table below. Include all anticipated impacts, including those expected to be temporary. Attach an overhead view map, aerial photo, and/or drawing showing all of the aquatic resources in the project area and the location(s) of the proposed impacts. Label each aquatic resource on the map with a reference number or letter and identify the impacts in the following table.

Please see Section 11 and Large Table 1 and Large Table 2 of the Wetland Replacement Plan.

Aquatic Resource ID (as noted on overhead view)	**Aquatic Resource Type** (wetland, lake, tributary etc.)	**Type of Impact** (fill, excavate, drain, or remove vegetation)	**Duration of Impact** Permanent (P) or Temporary (T)[1]	**Size of Impact**[2]	**Overall Size of Aquatic Resource** [3]	**Existing Plant Community Type(s)** in Impact Area[4]	**County, Major Watershed #, and Bank Service Area #** of Impact Area[5]

[1]If impacts are temporary; enter the duration of the impacts in days next to the "T". For example, a project with a temporary access fill that would be removed after 220 days would be entered "T (220)".
[2]Impacts less than 0.01 acre should be reported in square feet. Impacts 0.01 acre or greater should be reported as acres and rounded to the nearest 0.01 acre. Tributary impacts must be reported in linear feet of impact and an area of impact by indicating first the linear feet of impact along the flowline of the stream followed by the area impact in parentheses). For example, a project that impacts 50 feet of a stream that is 6 feet wide would be reported as 50 ft (300 square feet).
[3]This is generally only applicable if you are applying for a de minimis exemption under MN Rules 8420.0420 Subp. 8, otherwise enter "N/A".
[4]Use *Wetland Plants and Plant Community Types of Minnesota and Wisconsin* 3rd Ed. as modified in MN Rules 8420.0405 Subp. 2.
[5]Refer to Major Watershed and Bank Service Area maps in MN Rules 8420.0522 Subp. 7.

If any of the above identified impacts have already occurred, identify which impacts they are and the circumstances associated with each:

PART FIVE: Applicant Signature

☐ Check here if you are requesting a pre-application consultation with the Corps and LGU based on the information you have provided. Regulatory entities will not initiate a formal application review if this box is checked.

By signature below, I attest that the information in this application is complete and accurate. I further attest that I possess the authority to undertake the work described herein.

Applicant Name: Jennifer Saran　　Title: Director of Environmental Permitting

Signature: ____________________　　Date: 12/11/2017

I hereby authorize ______ to act on my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this application.

[1] **The term "impact" as used in this joint application form is a generic term used for disclosure purposes to identify activities that may require approval from one or more regulatory agencies. For purposes of this form it is not meant to indicate whether or not those activities may require mitigation/replacement.**

Attachment A
Request for Delineation Review, Wetland Type Determination, or Jurisdictional Determination

By submission of the enclosed wetland delineation report, I am requesting that the U.S. Army Corps of Engineers, St. Paul District (Corps) and/or the Wetland Conservation Act Local Government Unit (LGU) provide me with the following (check all that apply):

☒ **Wetland Type Confirmation**

☒ **Delineation Concurrence**. Concurrence with a delineation is a written notification from the Corps and a decision from the LGU concurring, not concurring, or commenting on the boundaries of the aquatic resources delineated on the property. Delineation concurrences are generally valid for five years unless site conditions change. Under this request alone, the Corps will not address the jurisdictional status of the aquatic resources on the property, only the boundaries of the resources within the review area (including wetlands, tributaries, lakes, etc.).

☐ **Preliminary Jurisdictional Determination**. A preliminary jurisdictional determination (PJD) is a non-binding written indication from the Corps that waters, including wetlands, identified on a parcel may be waters of the United States. For purposes of computation of impacts and compensatory mitigation requirements, a permit decision made on the basis of a PJD will treat all waters and wetlands in the review area as if they are jurisdictional waters of the U.S. PJDs are advisory in nature and may not be appealed.

☐ **Approved Jurisdictional Determination**. An approved jurisdictional determination (AJD) is an official Corps determination that jurisdictional waters of the United States are either present or absent on the property. AJDs can generally be relied upon by the affected party for five years. An AJD may be appealed through the Corps administrative appeal process.

In order for the Corps and LGU to process your request, the wetland delineation must be prepared in accordance with the 1987 Corps of Engineers Wetland Delineation Manual, any approved Regional Supplements to the 1987 Manual, and the *Guidelines for Submitting Wetland Delineations in Minnesota* (2013).
http://www.mvp.usace.army.mil/Missions/Regulatory/DelineationJDGuidance.aspx

Attachment B
Supporting Information for Applications Involving Exemptions, No Loss Determinations, and Activities Not Requiring Mitigation

Complete this part ***if*** you maintain that the identified aquatic resource impacts in Part Four do not require wetland replacement/compensatory mitigation OR ***if*** you are seeking verification that the proposed water resource impacts are either exempt from replacement or are not under CWA/WCA jurisdiction.

Identify the specific exemption or no-loss provision for which you believe your project or site qualifies:

Wetland located in the Cliffs Erie LLC (formerly LTVSMC) Permit to Mine permitted boundary of the Tailings Basin in the LTVSMC Coal Ash Landfill is proposed as an incidental wetland under Minnesota Rules, part 8420.0930, Subpt. 1 and Minnesota Rules, part 8420.0105, subpart 2, item D.

Provide a detailed explanation of how your project or site qualifies for the above. Be specific and provide and refer to attachments and exhibits that support your contention. Applicants should refer to rules (e.g. WCA rules), guidance documents (e.g. BWSR guidance, Corps guidance letters/public notices), and permit conditions (e.g. Corps General Permit conditions) to determine the necessary information to support the application. Applicants are strongly encouraged to contact the WCA LGU and Corps Project Manager prior to submitting an application if they are unsure of what type of information to provide:

Under 8420.0930 Mining, Subp. 1. Impacts from mining: Wetlands must not be impacted as part of a project for which a permit to mine is required by Minnesota Statutues, section 93.481, except as approved by the commissioner. Impacts to wetlands that the landowner can demonstrate, to the satisfaction of the local governmental unit, were created by pits, stockpiles, or tailings basins, and by action the purpose of which was not to create the wetland according to part 8420.0105, subpart 2, item D, are not regulated under this chapter."

The wetland was created as a drainage feature for the artificially-created landfill located in a tailings basin area. Under 8420.0105, subpart 2, item D, this area was created in a nonwetland area as a drainage feature for the purpose of drainage and not as part of a wetland replacement process.

Attachment C
Avoidance and Minimization

Project Purpose, Need, and Requirements. Clearly state the purpose of your project and need for your project. Also include a description of any specific requirements of the project as they relate to project location, project footprint, water management, and any other applicable requirements. Attach an overhead plan sheet showing all relevant features of the project (buildings, roads, etc.), aquatic resource features (impact areas noted) and construction details (grading plans, storm water management plans, etc.), referencing these as necessary:

Please see Sections 4 and 5 of the Wetland Replacement Plan.

Avoidance. Both the CWA and the WCA require that impacts to aquatic resources be avoided if practicable alternatives exist. Clearly describe all on-site measures considered to avoid impacts to aquatic resources and discuss at least two project alternatives that avoid all impacts to aquatic resources on the site. These alternatives may include alternative site plans, alternate sites, and/or not doing the project. Alternatives should be feasible and prudent (see MN Rules 8420.0520 Subp. 2 C). Applicants are encouraged to attach drawings and plans to support their analysis:

Please see Section 6 of the Wetland Replacement Plan.

Minimization. Both the CWA and the WCA require that all unavoidable impacts to aquatic resources be minimized to the greatest extent practicable. Discuss all features of the proposed project that have been modified to minimize the impacts to water resources (see MN Rules 8420.0520 Subp. 4):

Please see Section 6 of the Wetland Replacement Plan.

Off-Site Alternatives. An off-site alternatives analysis is not required for all permit applications. If you know that your proposal will require an individual permit (standard permit or letter of permission) from the U.S. Army Corps of Engineers, you may be required to provide an off-site alternatives analysis. The alternatives analysis is not required for a complete application but must be provided during the review process in order for the Corps to complete the evaluation of your application and reach a final decision. Applicants with questions about when an off-site alternatives analysis is required should contact their Corps Project Manager.

Please see Section 6 of the Wetland Replacement Plan.

Attachment D
Replacement/Compensatory Mitigation

Complete this part ***if*** your application involves wetland replacement/compensatory mitigation not associated with the local road wetland replacement program. Applicants should consult Corps mitigation guidelines and WCA rules for requirements.

Replacement/Compensatory Mitigation via Wetland Banking. Complete this section if you are proposing to use credits from an existing wetland bank (with an account number in the State wetland banking system) for all or part of your replacement/compensatory mitigation requirements.

Wetland Bank Account #	County	Major Watershed #	Bank Service Area #	Credit Type (if applicable)	Number of Credits
1609	St. Louis	3	1	NA	1,800

Applicants should attach documentation indicating that they have contacted the wetland bank account owner and reached at least a tentative agreement to utilize the identified credits for the project. This documentation could be a signed purchase agreement, signed application for withdrawal of credits or some other correspondence indicating an agreement between the applicant and the bank owner. *However, applicants are advised not to enter into a binding agreement to purchase credits until the mitigation plan is approved by the Corps and LGU.*

Please see Attachment C of the Wetland Replacement Plan for documentation.

Project-Specific Replacement/Permittee Responsible Mitigation. Complete this section if you are proposing to pursue actions (restoration, creation, preservation, etc.) to generate wetland replacement/compensatory mitigation credits for this proposed project.

WCA Action Eligible for Credit[1]	Corps Mitigation Compensation Technique[2]	Acres	Credit % Requested	Credits Anticipated[3]	County	Major Watershed #	Bank Service Area #

[1]Refer to the name and subpart number in MN Rule 8420.0526.
[2]Refer to the technique listed in *St. Paul District Policy for Wetland Compensatory Mitigation in Minnesota*.
[3]If WCA and Corps crediting differs, then enter both numbers and distinguish which is Corps and which is WCA.

Explain how each proposed action or technique will be completed (e.g. wetland hydrology will be restored by breaking the tile……) and how the proposal meets the crediting criteria associated with it. Applicants should refer to the Corps mitigation policy language, WCA rule language, and all associated Corps and WCA guidance related to the action or technique:

Attach a site location map, soils map, recent aerial photograph, and any other maps to show the location and other relevant features of each wetland replacement/mitigation site. Discuss in detail existing vegetation, existing landscape features, land use (on and surrounding the site), existing soils, drainage systems (if present), and water sources and movement. Include a topographic map showing key features related to hydrology and water flow (inlets, outlets, ditches, pumps, etc.):

Attach a map of the existing aquatic resources, associated delineation report, and any documentation of regulatory review or approval. Discuss as necessary:

For actions involving construction activities, attach construction plans and specifications with all relevant details. Discuss and provide documentation of a hydrologic and hydraulic analysis of the site to define existing conditions, predict project outcomes, identify specific project performance standards and avoid adverse offsite impacts. Plans and specifications should be prepared by a licensed engineer following standard engineering practices. Discuss anticipated construction sequence and timing:

For projects involving vegetation restoration, provide a vegetation establishment plan that includes information on site preparation, seed mixes and plant materials, seeding/planting plan (attach seeding/planting zone map), planting/seeding methods, vegetation maintenance, and an anticipated schedule of activities:

For projects involving construction or vegetation restoration, identify and discuss goals and specific outcomes that can be determined for credit allocation. Provide a proposed credit allocation table tied to outcomes:

Provide a five-year monitoring plan to address project outcomes and credit allocation:

Discuss and provide evidence of ownership or rights to conduct wetland replacement/mitigation on each site:

Quantify all proposed wetland credits and compare to wetland impacts to identify a proposed wetland replacement ratio. Discuss how this replacement ratio is consistent with Corps and WCA requirements:

By signature below, the applicant attests to the following (only required if application involves project-specific/permittee responsible replacement):

- All proposed replacement wetlands were not:
  - Previously restored or created under a prior approved replacement plan or permit
  - Drained or filled under an exemption during the previous 10 years
  - Restored with financial assistance from public conservation programs
  - Restored using private funds, other than landowner funds, unless the funds are paid back with interest to the individual or organization that funded the restoration and the individual or organization notifies the local government unit in writing that the restored wetland may be considered for replacement.
- The wetland will be replaced before or concurrent with the actual draining or filling of a wetland.
- An irrevocable bank letter of credit, performance bond, or other acceptable security will be provided to guarantee successful completion of the wetland replacement.
- Within 30 days of either receiving approval of this application or beginning work on the project, I will record the Declaration of Restrictions and Covenants on the deed for the property on which the replacement wetland(s) will be located and submit proof of such recording to the LGU and the Corps.

Applicant or Representative: Title:

Signature: ______________________________ Date:

Table of Contents

Acronyms, Abbreviations, and Units

Acronym, Abbreviation, or Unit	Description
APE	Area of Potential Effect
BMP	Best Management Practices
BSA	Bank Service Area
BWSR	Board of Water and Soil Resources
CIR	Color Infrared
CPS	Central Pumping Station
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
EAW	Environmental Assessment Worksheet
ECS	Ecological Classification System
EIS	Environmental Impact Statement
ECS	Ecological Classification System
ELT	Ecological Landtype
ELTP	Ecological Landtype Phase
FEIS	Final Environmental Impact Statement
FSA	Farm Services Agency
FTB	Flotation Tailings Basin
GIS	Geographic Information System
GPS	Global Positioning System
HRF	Hydrometallurgical Residue Facility
kV	kilovolt
LEDPA	Least Environmentally Damaging Practicable Alternative
LTVSMC	LTV Steel Mining Company
DNR	Minnesota Department of Natural Resources
MEPA	Minnesota Environmental Policy Act
MOA	Memorandum of Agreement
MPCA	Minnesota Pollution Control Agency
MPP	Mine to Plant Pipelines

Acronym, Abbreviation, or Unit	Description
MSFMF	Mine Site Fueling and Maintenance Facility
NEPA	National Environmental Policy Act
NHIS	Natural Heritage Information System
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
OSLA	Overburden Storage and Laydown Area
OSP	Ore Surge Pile
PGEs	Platinum Group Elements
RFSS	Regional Forester Sensitive Species
RTH	Rail Transfer Hopper
SDEIS	Supplemental Draft Environmental Impact Statement
SDS	State Disposal System
SEIS	Supplemental Environmental Impact Statement
SGCN	Species of Greatest Conservation Need
SNF	Superior National Forest
SWPPP	Stormwater Pollution Prevention Plan
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WCA	Wetland Conservation Act
WWTS	Waste Water Treatment System

Executive Summary

Poly Met Mining, Inc. (PolyMet) is applying for a wetland permit to construct the NorthMet Mine and Ore Processing Facilities Project (Project). The Project, located near Hoyt Lakes Minnesota, will include a Mine Site, a Plant Site, and connecting corridors. PolyMet has leased the mineral rights at the Mine Site, but the U.S. Forest Service (USFS) currently owns surface rights to the majority of the land. PolyMet has purchased or retains options to purchase several privately-held parcels of land within the Superior National Forest (SNF) and proposes to exchange that land with the USFS for land at the Mine Site. PolyMet acquired from Cliffs Erie the LTV Steel Mining Company (LTVSMC) taconite processing facility and Tailings Basin, as well as the necessary easements and rights-of-way for the Transportation and Utility Corridors connecting the Mine Site and the Plant Site. The wetland permit application form is found inside the front cover of this report. Additional details on property ownership are presented in Section 1.0.

PolyMet initially submitted its wetland permit application for the Project to the U.S. Army Corps of Engineers (USACE) in July 2004. This permit application was part of an assessment of the potential scope of environmental review under the National Environmental Protection Act (NEPA) and the Minnesota Environmental Protection Act (MEPA). A joint state and federal Environmental Impact Statement (EIS) was initiated under the authority of NEPA (United States Code 1976, title 42, sections 4321 to 4361) and MEPA (Minnesota Rules, chapter 116D). The NEPA/MEPA activities are collectively referred to in this application as the Environmental Review Process. Because the Project was modified significantly after publication of a Draft Environmental Impact Statement in 2009, PolyMet submitted a revised wetland permit application to the USACE in August 2013. A Supplemental Draft Environmental Impact Statement (SDEIS) was issued in November 2013 and a Final Environmental Impact Statement (FEIS) was issued in November 2015 (Reference (1), Reference (2)). This Wetland Replacement Plan is being submitted to the Minnesota Department of Natural Resources (DNR) to fulfill its requirements under the Wetland Conservation Act (WCA) of 1991 (Minnesota Rules, chapter 8420) and the Permit to Mine (Minnesota Rules, part 6132.5300). The Wetland Replacement Plan provides updated information that is consistent with the FEIS (Reference (2)).

Information, in addition to that provided in this application, can be found in the environmental impact statement (EIS) (and record thereof) prepared by the DNR, the USACE, and the USFS, in cooperation with the U.S. Environmental Protection Agency, Bois Forte Band of Chippewa (Bois Forte Band), Grand Portage Band of Chippewa (Grand Portage Band), and the Fond du Lac Band of Lake Superior Chippewa (Fond du Lac Band) under the authority of NEPA (United States Code 1976, title 42, sections 4321 to 4361) and MEPA (Minnesota Rules, chapter 116D). The EIS was jointly prepared with the DNR under Minnesota Rules, part 4410.4400. The Minnesota Pollution Control Agency (MPCA) and Minnesota Department of Health assisted the DNR pursuant to Minnesota Rules, part 4410.2200.

Project Location and Setting

The Project is located in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of Duluth, 6 miles south of Babbitt. The Project location is shown on Large Figure 1, and the Project areas, including the Mine Site and the Plant Site, are shown on Large Figure 2. The Mine Site is located within the SNF and drains to the Upper Partridge River. A small portion of the Plant Site also falls in the Upper Partridge River watershed, but most of the Plant Site drains to the Embarrass River. The Upper Partridge River and the Embarrass River are tributaries of the St. Louis River. Large Figure 3 shows Project area watersheds. In the Project areas, a thin veneer of heterogeneous unconsolidated deposits is underlain by bedrock. The depth to groundwater is typically less than 10 feet, and wetlands are common.

Large Figure 4 shows wetlands in the Project vicinity. For the Project, approximately 1,862 acres of wetland were identified (Large Table 1 and Large Table 2). The Mine Site has been extensively logged, and is currently in varying stages of regeneration. The Plant Site includes the former LTVSMC taconite processing plant and Tailings Basin, which includes the LTVSMC tailings basin and the proposed NorthMet Flotation Tailings Basin (FTB). Most of the surface area at the Plant Site has been previously disturbed by mining activities and is largely devoid of natural vegetation. Additional details on Project location are presented in Section 3.0 and are shown on the general environmental setting are presented in Section 11.1.

Project Purpose

The Project purpose is to develop a mining facility using the existing LTVSMC infrastructure that will extract and process polymetallic ore from the NorthMet ore body, to supply copper, nickel, cobalt, gold and Platinum Group Elements (PGEs), such as platinum and palladium, to the world market. The Project is needed to exercise valid mineral rights and help meet domestic and international demand for these metals which are used in the electrical power, steel, aircraft, automotive, electronics, and medical device industries. The Project will provide substantial economic benefits to the local and state economy, providing an estimated 360 full-time jobs, more than 600 indirect jobs, and tens of millions of dollars annually in taxes. Additional detail on the purpose of the Project is presented in Section 4.0 and Section 1.3 of Reference (2).

Project Description

PolyMet expects to mine a total of 225 million tons of ore and 308 million tons of waste rock over 20 years. Ore will be excavated at the Mine Site and hauled by railroad approximately 6 miles west to the Plant Site for processing. Corridors for roads, railroad, utilities, and water pipelines will connect the Mine Site and the Plant Site. Project areas are shown on Large Figure 2.

The Mine Site will occupy approximately 3,015 acres. The Project will develop open mine pits (up to 528 acres), stockpiles (up to 740 acres), and supporting infrastructure (up to 451 acres). The location and dimensions of Mine Site features are shown on Large Figure 5. Mine Site environmental controls will include, among other features, liners and containment systems to collect seepage from stockpiles, a cover to limit infiltration through the permanent stockpile after closure, and an Equalization Basin Area to collect water that comes in contact with mining features. Water collected from pit dewatering will be pumped to the Plant Site for treatment at the WWTS, then routed to the FTB Pond for use in ore processing. During operations, there will be no direct discharge of treated waste water from the Mine Site to waters of the U.S. or Minnesota public waters.

The Plant Site is a "brownfields" location which occupies approximately 4,417 acres. At the Plant Site, the Project will upgrade existing facilities (Beneficiation Plant, Tailings Basin, Area 1 Shop, Sanitary Treatment Plant, rail connections, access roads) and construct new facilities, including Hydrometallurgical Plant, Hydrometallurgical Residue Facility (HRF), Concentrate Dewatering/Storage Building, and Waste Water Treatment System (WWTS) on previously disturbed areas. The Flotation Tailings will be placed atop the existing LTVSMC tailings basin by staged construction of new dams. The location and dimensions of Plant Site features are shown on Large Figure 6.

Plant Site environmental controls during mining operations will include: cover systems to limit infiltration of oxygen and water through the Tailings Basin dams and seepage capture systems to collect seepage from the Tailings Basin. During reclamation and long-term closure, these environmental controls will continue to operate, and additional cover systems will be added to the Tailings Basin beaches and pond bottom. Water used in processing, and some tailings basin seepage will be returned to the Tailings Basin Pond for reuse. The WWTS will use reverse osmosis to treat any tailings basin seepage that cannot be recycled prior to discharge to the environment. If makeup-water is needed for processing, it will be provided via the Colby Lake Pipeline Corridor. Additional detail on the Project description is presented in Section 5.0 and Chapter 3 of Reference (2).

Project Alternatives

Project alternatives have been described in detail in the documents prepared during the Environmental Review Process. The No Action Alternative was evaluated during the Environmental Review Process. Under the No Action Alternative, PolyMet will be required to reclaim surface disturbances at the Mine Site associated with exploratory and development drilling. At the Plant Site, Cliffs Erie will be required to complete closure and reclamation activities. PolyMet did not prefer the No Action Alternative as it does not fulfill the purpose of the Project.

The Environmental Review Process resulted in Project modifications that avoid and minimize impact to aquatic resources and other environmental concerns. The Project, as initially proposed for the scoping Environmental Assessment Worksheet (EAW) in 2005, was estimated to result in 1,257 acres of direct wetland impacts. PolyMet has modified the Project considerably since that time, incorporating multiple changes for avoiding and minimizing wetland impacts. The changes incorporated into the refined Project include: avoiding wetlands by using brownfield lands at the

Plant Site; avoiding water quality impacts by the collection and treatment of contact waters; minimizing the footprint and optimizing the placement of mining features such as the mine pits, stockpiles, and haul roads; and increased in-pit stockpiling.

Large Table 3 summarizes the reduced aquatic ecosystem impacts based on the refinements completed during the evaluation of Alternatives. The cumulative effect of Project modifications is that wetland impacts have been reduced from 1,257 acres to 932 acres. Large Figure 7 and Large Figure 8 illustrate how Project modifications have evolved at the Mine Site and Plant Site, respectively. Additional detail on the Alternatives Analysis is presented in Section 6.0 and in Chapter 3 of Reference (2). Ownership of the Project site and adjacent property owners is provided in Large Table 4.

Summary of Wetlands

Wetlands were delineated using established methods according to the Routine On-Site Determination Method specified in the *U.S. Army Corps of Engineers 1987 Wetlands Delineation Manual* (Reference (3)), the *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: NorthCentral and Northeast Region* (Reference (4)), and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: NorthCentral and Northeast Region* (Reference (5)). The delineation was conducted across the Project areas between 2004 and 2012. The delineated wetlands were classified using the Eggers and Reed Plant Community Classification System (Reference (6)), the USFWS Circular 39 Classification System (Reference (7)), and the USFWS Cowardin Classification System (Reference (8)). The following references summarize wetland delineations conducted between 2004 and 2012 (Reference (9), Reference (10), Reference (11), Reference (12), Reference (13), Reference (14), Reference (15), and Reference (16)). The delineation was discussed with the Wetland IAP Workgroup, and the delineation was approved by the co-lead agencies as part of the Wetland IAP Workgroup process on March 30, 2011. PolyMet is requesting wetland delineation concurrence for WCA regulatory purposes.

Approximately 1,862 acres of wetland were identified across the Project areas (Mine Site, Plant Site, Railroad Connection Corridor, Dunka Road and Utility Corridor, Colby Lake Pipeline, and Second Creek area (Large Table 1; Large Figure 4). The percentage (based on acreage) of Eggers and Reed (Reference (6)) wetland types identified in the Project areas include: coniferous bog (47%); alder thicket (17%); shallow marsh (14%), coniferous swamp (9%); deep marsh (8%); hardwood swamp (2%); sedge meadow (1%); open bog (1%); wet meadow (1%); shrub-carr (less than 1%); and shallow, open water (less than 1%).

Description of Wetland Impacts

The Project activities are expected to result in direct and fragment (indirect) impacts to 127 wetlands, covering a total of approximately 930.2 acres (Large Table 2). Wetlands are counted as directly impacted if they will be excavated or filled by Project activities or located between the toe of the Tailings Basin and the Flotation Tailings Basin Seepage Containment System. The

Project will also result in 26.9 acres of fragmented wetlands. Fragmented wetlands are remnants of a directly impacted wetland. The determination of fragmentation is based on an analysis of wetland type, source of hydrology, size of remaining wetland, location in the current watershed, location in the future watershed, connectivity to other wetlands, and direction of flow in the area.

The majority of direct and fragment wetland impacts will occur at the Mine Site (84%), followed by the Plant Site (16%) (Large Table 2). Road, railroad, and utility corridors account for less than 1% of wetland impacts. Wetland impacts will occur in the following wetland types (based on acreage): coniferous bog (56%), alder thicket (12%), coniferous swamp (9%), shallow marsh (8%), deep marsh (8%), sedge meadow (3%), wet meadow (2%), hardwood swamp (1%), open bog (1%), and shrub-carr (less than 1%). Additional details on direct wetland impacts are presented in Section 11.4.

Project direct wetland impacts will occur at the Mine Site (Large Figure 9), the Plant Site (Large Figure 10), and in the Transportation and Utility Corridors (Large Figure 11). Impacts from wetland fragmentation will occur at the Mine Site (Large Figure 9) and the Plant Site (Large Figure 10). The Project will result in impacts to 57 wetlands covering approximately 778 acres at the Mine Site, 45 wetlands covering a total of approximately 145 acres at the Plant Site, and 25 wetlands covering a total of approximately 7 acres in the Transportation and Utility Corridors connecting the Mine Site and Plant Site. Impacts are due to fill (89 acres), excavation (133 acres), both fill and excavation (593 acres), or installation of the Tailings Basin seepage capture system (88 acres). Approximately 62% of the directly impacted wetlands are rated high quality, 6% are rated as moderate quality, and 32% are rated as poor quality. The inventory of all wetlands in the Project areas is presented in Large Table 1 and wetland impacts are detailed in Large Table 2.

The Project may also cause indirect wetland impacts due to potential wetland fragmentation, or potential changes in wetland watershed areas, stream flow, groundwater drawdown, or wetland water quality related to dust or rail car spillage. The documents prepared during the Environmental Review Process describe the range of possible indirect impacts for wetlands located within and around the Project area (Section 5.2.1.2.2 and Large Figure 14 of Attachment A; Attachment B; and Section 5.2.3 of Reference (2)). Additional detailed descriptions of wetland impacts are presented in Sections 2.0 and 11.5 and in Section 5.2.3 of Reference (2).

Special Considerations

PolyMet conducted database searches and field surveys to evaluate the presence of federal or state-protected wildlife and plant species in the vicinity of the Project; however, only state-listed species are discussed in this document.

No state endangered or threatened wildlife species were documented during the field surveys conducted in 2000 and 2004 in the vicinity of the Project. Additional details on these wildlife surveys are presented in Section 12.1 and Section 5.2.5 of Reference (2).

One vascular plant species that is listed by the State of Minnesota as endangered, *Caltha natans* (floating marsh marigold), was identified in the Project area during surveys conducted between 1999 and 2017. Additional details on plant surveys are presented in Section 12.1.2 and Section 5.2.4 of Reference (2).

Take of a state threatened or endangered vascular plant species, such as *Caltha natans*, may require a permit from DNR under Minnesota Rules, part 6212.1800. Because impacts are unavoidable in one Project location that currently supports a state endangered vascular plant species population, *Caltha natans*, a takings permit application was submitted to the DNR in November 2017 (Reference (17)). PolyMet will work with the DNR and other appropriate agencies to determine acceptable mitigation for directly impacted species.

The Co-lead Agencies have conducted a review of effects on historic properties in the Area of Potential Effect (APE) under Section 106 of the National Historic Preservation Act (NHPA). After historical research, archaeological and architectural history surveys, oral interviews to identify historical properties of religious and cultural significance to the Bois Forte Band of Minnesota Chippewa, the Fond du Lac Band of Lake Superior Chippewa, and the Grand Portage Band of Lake Superior Chippewa (Consulting Bands) and extensive consultation, the Co-lead Agencies determined that the following historic properties in the APE are eligible for listing in the National Register for Historic Places (NRHP) and will be adversely affected by the NorthMet Project: the Erie Mining Company Hoyt Lakes Mining Landscape Historic District, which includes multiple contributing mining features within the APE (such as the Concentrator Building), as well as areas outside of the APE, such as Hoyt Lakes and Taconite Harbor, the Partridge River Segment of the Beaver Bay to Lake Vermillion Trail, the Partridge River section of Mesabe Widjiu, and the Spring Lake Mine Sugarbush. An MOA resolving adverse effects to eligible properties was executed and the NHPA process was completed on December 27, 2016. Additional details on historic properties are presented in Section 12.2 and Sections 4.2.9 and 5.2.9 of Reference (2).

Wetland Mitigation

Wetlands that are directly impacted and impacted by fragmentation will be replaced and mitigated by credit purchase from an off-site wetland bank #1609 in the St. Louis River watershed (#3), in Bank Service Area (BSA) #1, in St. Louis County, prior to construction of the Project. The option agreement for the wetland credits is provided in Attachment D.

Preference for the bank selection followed the preferential sequencing for compensatory mitigation per the USACE St. Paul District Policy for Compensatory Mitigation in Minnesota (Reference (18)). Under that policy, the preference is that wetland mitigation banks under consideration for this Project be located in the BSA #1, which is the BSA where the Project wetland impacts would occur.

Wetland Monitoring Plan

Wetland monitoring is being conducted at the NorthMet Site to provide baseline data to use in identifying potential indirect impacts to wetlands caused by mining activities. Monitoring is currently being conducted within wetlands containing a potential indirect wetland impact factor rating of 3, 4, or-5 and a sampling of those wetlands with factor ratings of 1 and 2 as shown in Large Figure 9 through Large Figure 11 and described in Section 11.5. To determine if indirect impacts occur, hydrology, vegetation, and wetland boundaries will be monitored, documented, and compared with baseline monitoring and reference wetlands. A total of 56 monitoring wells and five reference wells have been installed to collect baseline hydrology data and to document potential indirect wetland impacts. The monitoring protocol is described in Section 15.0. If it is determined that certain wells are not providing useful information, the monitoring may be modified with the concurrence of the USACE and DNR.

1.0 Introduction

Poly Met Mining, Inc. (PolyMet) is a private Minnesota corporation that is the wholly-owned subsidiary of PolyMet Mining Corporation. For additional information, please see Chapter 2 of the Permit to Mine Application (Reference (19)).

PolyMet initially submitted its wetland permit application for the Project to the U.S. Army Corps of Engineers (USACE) in July 2004 (USACE File # 1999-5528-JKA) to fulfill the requirements of Sections 401 and 404 of the Clean Water Act (CWA). This wetland permit application initiated an assessment of the potential scope of environmental review under the National Environmental Protection Act (NEPA) and the Minnesota Environmental Protection Act (MEPA). A joint state and federal Environmental Impact Statement (EIS) was conducted under the authority of NEPA (United States Code 1976, title 42, sections 4321 to 4361) and MEPA (Minnesota Rules, chapter 116D). The NEPA/MEPA activities are collectively referred to in this application as the Environmental Review Process.

The Environmental Review Process produced a Draft Environmental Impact Statement (DEIS) in 2009. Because the Project was modified significantly after publication of the DEIS (Reference (20)), a revised wetland permit application was submitted to the USACE in August 2013 (Reference (21), which supplemented the 2004 application with the updated Project plans. A Supplemental Draft Environmental Impact Statement (SDEIS) (Reference (1) was issued in November 2013 and a Final Environmental Impact Statement (FEIS) was issued in November 2015 (Reference (2)). The Wetland Replacement Plan is being submitted to the Minnesota Department of Natural Resources (DNR) to fulfill its requirements under the Wetland Conservation Act (WCA) of 1991. The Wetland Replacement Plan provides updated information that is consistent with the FEIS (Reference (2)) and PolyMet's application for a Permit to Mine.

PolyMet proposes to construct an open pit, low grade, polymetallic mineral mine in northern Minnesota. The project, called the NorthMet Mine and Ore Processing Facilities Project (Project), is located in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of Duluth, and 6 miles south of Babbitt, Minnesota. The Project location is shown on Large Figure 1 and the Project areas are shown on Large Figure 2. The Project is located in the Partridge River and Embarrass River watersheds (Large Figure 3). Wetlands within the Project are identified on Large Table 1 and shown on Large Figure 4.

The Project will mine and process polymetallic ore from the northwest portion of the Duluth Complex, which is an ore complex that forms much of the bedrock of northeastern Minnesota. The ore contains copper, nickel, cobalt, gold, and Platinum Group Elements (such as platinum and palladium, known collectively as PGEs). PolyMet plans to refurbish and operate the former LTV Steel Mining Company (LTVSMC) taconite processing facility near Hoyt Lakes, Minnesota to produce copper concentrates, nickel concentrates, and base and precious metal precipitates for off-site shipment and processing.

A brief history of the Project site is provided here. The NorthMet deposit has been subject to several episodes of exploration and drilling since its discovery in 1969 by U.S. Steel. Fleck Resources Ltd. (a precursor to PolyMet Mining Corporation) undertook exploration of the deposit in 1989. PolyMet (first generation) commissioned a pre-feasibility study in 2001 which did not contemplate reusing the LTVSMC facilities. The Project was restarted in 2003 when PolyMet (2nd generation) acquired the LTVSMC plant.

At the Mine Site, PolyMet has leased the mineral rights that are needed for the Project, but the USFS currently owns surface rights to the majority of the land. PolyMet and the USFS disagree on whether PolyMet can exercise the mineral rights. In part to avoid this disagreement, the USFS has initiated a land exchange with PolyMet under which PolyMet would provide surface rights to several privately-held parcels of land within the SNF which the USFS would exchange for land at the Mine Site. The USFS issued a Final Record of Decision (ROD) in January 2017 (Reference (22). Additional details on the land exchange are presented in Section 3.1.2, 4.3, and 5.3 of Reference (2).

PolyMet acquired from Cliffs Erie the LTVSMC taconite processing facility and Tailings Basin, as well as the necessary easements and rights-of-way for the Transportation and Utility Corridors connecting the Mine Site and the Plant Site. Some of this land is additional acreage that would serve as buffer beyond the Project boundary. As described in Section 6.3, under the No Action Alternative, current permits with Cliffs Erie as the permittee would remain in effect. PolyMet also acquired the necessary surface licenses, easements and rights-of-way (e.g., roadways, railroad, electrical service, gas pipeline and water facilities) to enable production at the Plant Site.

To connect the Plant Site and the Mine Site, PolyMet has acquired the necessary easements and rights-of-way to use an 8-mile segment of Dunka Road. PolyMet has also acquired ownership or the right to use additional lands and other railroad assets to secure the rail access between the Mine Site and the Plant Site.

2.0 Summary of Wetland Impacts

The Project activities are expected to result in direct and fragment (indirect) impacts to 127 wetlands, covering a total of approximately 930.2 acres (Large Table 2). Wetlands are directly impacted if they will be excavated or filled by Project activities or located between the toe of the Tailings Basin and the Flotation Tailings Basin (FTB) Seepage Containment System. The Mine Site will contain the majority of direct wetland impacts (83%), followed by the FTB (16%), HRF (less than 1%), Dunka Road and Utility Corridor (less than 1%), and the Railroad Corridor (less than 0.1%). There will be no direct impacts in the Colby Lake Pipeline Corridor or the Second Creek area.

Using the Eggers and Reed Wetland Plant Community type (Reference (6)) and the Circular 39 wetland type (Reference (8)), the types of wetlands that will be directly impacted (based on acreage) include: coniferous bog (Type 8; 56%), alder thicket (Type 6; 12%), coniferous swamp (Type 7; 9%), shallow marsh (Type 3; 8%), deep marsh (Type 4; 8%), sedge meadow (Type 2; 3%), wet meadow (Type 2; 2%), hardwood swamp (Type 7; 1%), open bog (Type 8; 1%), and shrub-carr (Type 6; less than 1%).

The Project will also result in 26.9 acres of fragmented wetlands. Fragmented wetlands are remnants of a directly impacted wetland. The determination of fragmentation is based on an analysis of wetland type, source of hydrology, size of remaining wetland, location in the current watershed, location in the future watershed, connectivity to other wetlands, and direction of flow in the area; more details on fragmentation are provided in Section 5.2.1.1 of Attachment A. As agreed upon with the Co-Lead Agencies during the EIS process, the acreage of fragmented wetlands will be treated as if directly impacted and included in the compensatory mitigation needed for the Project's direct impacts.

There will be 903.3 acres of direct wetland impacts and 26.9 acres of fragmented wetlands, for a total of 930.2 acres of wetland impacts treated as direct impacts. Wetland impacts, the methods used to determine the impacts, and the estimated timing of impacts are detailed in Section 11.4.

3.0 Project Location

The Project is located in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of Duluth, and 6 miles south of Babbitt, Minnesota. The Project location is shown on Large Figure 1, and the Project areas, including the Mine Site and the Plant Site, are shown on Large Figure 2. The Project areas include 7,600 acres.

The NorthMet ore body (Mine Site) is in the SNF near the western end of a belt of copper-nickel deposits on the northwestern contact of the Duluth Complex. The NorthMet ore body is in relative proximity to a number of existing mines including the Peter Mitchell open pit taconite mine, which is located approximately 2 miles north of the Mine Site. The Plant Site, which is the former LTVSMC taconite plant property, is located approximately 8 miles west of the ore body. The Mine Site and Plant Site are connected by the existing Dunka Road. Access to the Project area is located approximately 5 miles northeast of Hoyt Lakes at the intersection of Country Road 666 and Dunka Road.

Specifically, the Project is located in Sections 5 and 6 , Township 58 North, Range 14 West; Sections 1, 2, 3, 4, 9, 10, 11, 12, 16, 17, and 18, Township 59 North, Range 13 West; Sections 2, 3, 4, 5, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 20, 23, 24, 29, and 32, Township 59 North, Range 14 West; and Sections 32, 33, and 34, Township 60 North, Range 14 West, in St. Louis County, Minnesota.

The Project is located near the headwaters of the Partridge River and Embarrass River (Large Figure 3). The Partridge River and the Embarrass River are both tributary to the St. Louis River, which is located within the Lake Superior Basin. The Project is located within the major watershed – St. Louis River Watershed (#3); the minor watersheds include Sabin Lake (Embarrass River; #3153), Second Creek (#3150), Wyman Creek (#3148), and Partridge River (#3146, 3149, and 3155) (Large Figure 3). Additional details on the Project area hydrology and hydrogeology are found in Section 11.1.1.

4.0 Project Purpose and Need

The Project purpose is to develop a mining facility using the existing LTVSMC infrastructure that will extract and process polymetallic ore from the NorthMet ore body, to supply copper, nickel, cobalt, gold and Platinum Group Elements (PGEs), such as platinum and palladium, to the world market. The Project is needed to exercise valid mineral rights and will help meet domestic and international demand for these metals which are vital in the electrical power, steel, aircraft, automotive, electronics, and medical device industries. The mining activities will result in long-term jobs for the region. Environmental objectives are also intrinsic to the Project, which has been modified to avoid, minimize, and mitigate environmental impacts by reusing previous mining facilities, and constructing state of the art environmental controls.

The Project is needed for many reasons. The U.S. is a major importer of all the metals that PolyMet plans to extract from the NorthMet ore body. According to numbers from the U.S. Department of the Interior's Geological Survey National Minerals Information Center, the U.S. imports approximately 30-40% of its copper (comparable to the percentage of oil imported) – the annual numbers vary because there is an efficient copper recycling business in place. There are currently no operating nickel or cobalt mines in operation in the U.S., although recycled metal represents a significant supply source. The U.S. also imports 75-95% of its PGEs – there is only one PGE mining operation in the U.S. despite the critical need for PGEs in environmental control technologies and other strategic technological applications. The PGEs are regarded as strategic metals because of their specialized applications in the automotive, agriculture, chemical, petroleum, electrical, electronic, dental, medical, and aerospace industries. They also have important uses in environmentally-related technologies, such as catalytic converters and fuel cells.

On an annual basis, PolyMet expects to produce approximately:

- Copper - 36,000 tons of concentrate will be produced. Copper is an extremely good conductor of electricity and heat. Its major use is in power generation and transmission (including renewable energy), and in residential, commercial, industrial and automotive electrical systems.

- Nickel - 7,700 tons of concentrate will be produced. Nickel is used in production of stainless steel, high quality corrosion resistant steel alloys, rechargeable batteries, and in high-tech engineering applications such as aerospace.

- Cobalt - 360 tons of concentrate will be produced. Cobalt is a hardening agent in steel alloys and is used in super alloys, aircraft engines, rechargeable batteries, and common hand tools.

- PGEs - 97,000 troy ounces of concentrate will be produced. The primary use of PGEs is in catalytic converters, which clean-up car exhaust emissions. The PGEs are also used in electronics, medical devices, fuel cells, and jewelry.

- Gold – 9,000 troy ounces of concentrate will be produced. Gold is primarily used for jewelry, investment, and electronics.

The Project will provide substantial economic benefits to the local and state economy, providing hundreds of jobs, millions of dollars of indirect economic activity, and tens of millions of dollars in taxes. The construction phase will engage the equivalent of about 500 skilled construction workers over a three-year period (Reference (2)). Over approximately 20 years of planned operations, the Project will create approximately 360 full-time jobs with an estimated annual payroll and benefits of $36 million. In addition to the direct economic benefits, a study by the University of Minnesota-Duluth Labovitz School of Business and Economics (Reference (23)) estimates that more than 600 indirect jobs will be created in St. Louis County alone, generating annual economic benefit of about $515 million including products and services. Furthermore, the Project is expected to generate tens of millions of dollars annually in federal, state, and local taxes.

PolyMet has evaluated and developed the Project using very conservative assumptions about metals prices. The Definitive Feasibility Study completed in 2006 (Reference (24)) and updated in 2008 demonstrated that the Project will be sustainable even during downturns in the global metal markets. These conservative assumptions help buffer the community from potential economic impacts associated with volatility in the metals markets.

Society's continuing need for copper, nickel, cobalt, gold, and PGEs, combined with use of proven mining techniques and processing methods, reuse of previous mining facilities, and installation of extensive environmental controls, make the Project economically feasible and environmentally responsible. The Project is designed to generate sufficient income to cover operating cost (which includes but is not limited to the cost of mining, processing, transportation, and waste management), capital cost (needed to build and sustain facilities), an adequate return to investors, reclamation and closure costs, and taxes. The open pit mining plan applies best engineering practices based on the size, shape, geometry, grade, location, and geotechnical characteristics of the ore body and the site such that the highest degree of operational certainty is achieved. Ore processing and tailings storage will make use of the existing LTVSMC plant and tailings basin, minimizing impacts to previously disturbed land. Extensive environmental controls will be installed at both the Mine Site and the Plant Site, focused on avoiding, minimizing, and mitigating water impacts, including wetlands impacts.

5.0 Project Description

This section describes specific Project features that will potentially result in wetland impacts. Additional Project features that have no potential wetland impacts are listed in this section, but are not described in detail. For a detailed description of Project features, refer to the FEIS, Reference (2) and PolyMet's application for a Permit to Mine.

The Project includes five areas:

- Mine Site
- Plant Site, including the Process Plant area, the Tailings Basin and the Hydrometallurgical Residue Facility (HRF)
- Dunka Road and Utility Corridor
- Railroad Connection Corridor
- Colby Lake Pipeline Corridor

These areas are shown on Large Figure 2. For each of these Project areas, specific features that will potentially result in wetland impacts are described.

5.1 Project Schedule

Table 5-1 provides a summary of the Project schedule.

Table 5-1 Summary of Project Schedule

Time period	Description of Activities
Construction Phase (18-24 month period prior to Mine Year 1)	Mine Site land clearing and overburden removal, Plant Site renovation and construction, construction associated with the Tailings Basin, Mine Site construction, construction and renovation along the Transportation and Utility Corridors, and utility upgrades.
Mine Year 1	Production begins
Mine Years 1-2	Gradual ramp-up of ore output for 6-12 months
Mine Years 1-20	Mining of waste rock and ore
Mine Years 1-8	Build out Mine Site as necessary: remove additional overburden from the pit areas and other areas on - site as necessary for foundation construction; construct extensions to the liners and containment systems for OSP and waste rock stockpiles; construct additional water management features (dikes, ditches, ponds); build out additional haul roads; build out FTB dams and HRF

Time period	Description of Activities
Mine Years 1-11	Mining in the East Pit
Mine Years 2-20	Mining in the West Pit
Mine Years 1-10	Mine water will be pumped to the Plant Site FTB Pond for reuse
Mine Year 11	East Pit mining ends; Category 4 Waste Rock stockpile is completely backfilled into the East Pit
Mine Year 11	Some treated mine water will be sent to the East Pit to augment flooding as the pit is backfilled
Mine Years 11-16	Mining in the Central Pit; the Central Pit will converge into the East Pit, the combined pit will be called the East Pit; excavated Category 2, 3, and 4 waste rock will be placed directly in the East Pit
Mine Years 12-19	Category 2/3 Waste Rock Stockpile is backfilled into the East Pit
after Mine Year 13	All additional Category 1 waste rock excavated from the pits will be placed in the East Pit; Cover system will incrementally be added to the Category 1 Waste Rock Stockpile
Mine Years 16-20	Temporarily-stockpiled Category 2/3 and 4 waste rock will be placed in the Central Pit

5.2 Mine Site

The Project will use open pit mining methods, similar to those used at nearby taconite mines. The location and dimensions of Mine Site features are shown on Large Figure 5. The Project features at the Mine Site will include:

- supporting infrastructure (such as roads, electrical supply, rail connections, fueling facilities, and maintenance facilities)
- an Overburden Storage and Laydown Area (OSLA) to provide space to sort and store overburden used for construction and reclamation
- mine pits
- ore handling facilities, including an Ore Surge Pile (OSP) and a Rail Transfer Hopper (RTH)
- waste rock stockpiles with engineered systems to manage potential water resource impacts (such as liners, covers, and a Groundwater Containment System)
- mine water collection systems to collect and treat water from the mine pits, the stockpiles, the ore handling facilities, and the haul roads

- an Equalization Basin Area that will store mine water collected at the Mine Site before it is pumped to the Waste Water Treatment System (WWTS) for treatment
- a Central Pumping Station (CPS) and Mine to Plant Pipelines (MPP) to transport water between the Mine Site and the Plant Site
- stormwater management systems

5.2.1 Construction Phase

Mine Site infrastructure will be constructed over an estimated 18 to 24 months. As described in Section 3.2.2.1.3 of Reference (2), these activities will include:

- infrastructure - upgrading the existing Dunka Road, constructing site access and haul roads, installing railroad connections and spur, and constructing the Mine Site Fueling and Maintenance Facility (MSFMF)
- removing overburden from the pit area and other areas on-site, as necessary
- constructing the RTH
- constructing the liners and containment systems for the OSP and waste rock stockpiles
- constructing water management features, including the Equalization Basin Area, CPS, and MPP, as well as dikes, ditches, and ponds to manage stormwater
- constructing the substation drop from the 138 kilovolt (kV) transmission line and installation of a 13.8 kV Mine Site power distribution system

Most of the direct wetlands impacts at the Mine Site will occur during construction. When blasting begins, in Mine Year 1, ore output will gradually ramp-up over 6 to 12 months.

5.2.2 Mining Activities

PolyMet expects to mine a total of 533 million tons of waste rock and ore over 20 years, which will include 225 million tons of ore and 308 million tons of waste rock. After the initial ramp up period, the planned maximum annual average ore production rate will be 32,000 tons per day. Ore will be shipped to the Plant Site, as described below, and waste rock will be managed as described in Section 5.2.3.

Mining activities include overburden removal (pre-stripping), open pit mining, pit dewatering, drilling and blasting, excavation and haulage, stockpiling, ore loading for transport to the Process Plant via the RTH, and temporary ore storage in the OSP. Drilling, blasting, excavation, haulage, and ore loading for transport to the Process Plant via the RTH are mining activities that will not result in wetland impacts, and are not discussed further here. Overburden removal, open pit mining, temporary ore storage, and waste rock and overburden stockpiles will result in wetland impacts, and are described further below.

5.2.2.1 Overburden Removal

The marketable timber will be cleared and the overburden removed from the footprints of the mine pits, the OSP, and the waste rock stockpiles, as necessary.

Overburden will be stripped incrementally as needed for mine development in order to minimize the amount of bedrock exposed at any one time. After removal of overburden from the initial mining area, additional overburden stripping could take place concurrently with the mining of ore and waste rock.

The OSLA will be constructed to temporarily store peat and unsaturated mineral overburden while it is screened and sorted prior to being used for construction, wetland restoration, or reclamation. Overburden has been defined for this Project as the material that lies on top of the underlying bedrock.

5.2.2.2 Open Pit Mining

The Project will use open pit mining methods similar to those currently in use at ferrous metallic mining operations on the Iron Range. The mine will consist of three separate open pits known as the East, Central, and West Pits, as shown in Large Figure 5. For approximately the first 10 years of operations, mining will take place in the East and West Pits simultaneously, with the East Pit mining ending in Mine Year 11. The Central Pit mining will occur between Mine Years 11 and 16. During Central Pit mining, the East and Central pits will converge into one pit, which will then be referred to as the East Pit.

At maximum size, each pit is projected to have the approximate maximum area and depth as shown in Table 5-2.

Table 5-2 Maximum Pit Dimensions - Approximate

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

5.2.2.3 Ore Surge Pile (OSP)

The OSP will be constructed near the RTH to store ore temporarily until it can fit into the processing schedule or as needed based on operational delays (Large Figure 5). Use of the OSP will allow for delivery of a steady annual flow of ore and assist in providing a uniform grade of ore to the Plant Site. Ore will flow into and out of this pile during the life of the mine as needed to meet mine and plant operating conditions.

The OSP will be constructed with an engineered foundation system comprised of, from the bottom up, a foundation underdrain system, an impermeable composite liner barrier, and an overliner drainage layer. Drainage from the OSP will be collected on the liner and routed to a sump for pumping to the Equalization Basin Area. The OSP will be removed at the completion of mining activities.

5.2.3 Waste Rock and Overburden Management

5.2.3.1 Overburden Management

Three types of overburden are present at the Mine Site; unsaturated mineral overburden, saturated mineral overburden, and peat. Each type of overburden will be managed according to its characteristics.

Unsaturated mineral overburden is the mineral material located above the natural water table surface. Waste characterization studies have demonstrated that unsaturated mineral overburden has been weathered long enough for geochemical reactions to be relatively complete, so it will be usable for general on-site construction material. Excess unsaturated mineral overburden that is not needed for immediate construction and reclamation needs will be stored in unlined overburden stockpiles at the OSLA.

Saturated mineral overburden is the mineral material located below the natural water table surface. It has not been exposed to air and is therefore not weathered; so it will only be usable for specific on-site construction applications as approved by the DNR. Saturated mineral overburden not used for construction will be combined with waste rock in the membrane-lined temporary waste rock stockpiles.

Peat, which is an organic soil, will be used for restoration and reclamation activities at the Mine Site. This may include the development of wetlands in the East Pit and within the reclaimed temporary stockpile footprints. Peat will also be mixed with unsaturated mineral overburden to increase the organic content for restoration soil material across the Mine Site, including over the geomembrane cover of the Category 1 Waste Rock Stockpile. Peat that is not needed for immediate construction and reclamation needs will be stored in unlined overburden stockpiles at the OSLA.

5.2.3.2 Waste Rock Management

Waste rock will be managed according to its geochemical properties as determined using a sampling and analysis program approved by the DNR. PolyMet has categorized waste rock into four categories defined according to the geochemical and associated acid-producing and metals-leaching properties of the waste rock, in ascending order of reactivity. These waste rock categories are summarized in Table 5-3.

Table 5-3 Summary of Waste Rock Properties

Waste Rock Categorization	Sulfur Content (%S)(1)	Approximate % of Waste Rock Mass	Applications(2)
Category 1	%S ≤ 0.12	70%	Construction and East Pit Backfill
Category 2	0.12 < %S ≤ 0.31	24%	East Pit Backfill
Category 3	0.31 < %S ≤ 0.6	3%	East Pit Backfill
Category 4(3)	%S > 0.6	3%	East Pit Backfill

(1) In general, the higher the rock's sulfur content, the higher its potential for generating acid rock drainage (ARD) or leaching heavy metals.
(2) Applications include uses of the material other than stockpile storage
(3) Includes all Virginia formation rock

The Category 1 Waste Rock Stockpile will be the only permanent stockpile for the Project. During Mine Years 1 through 11, Category 2, 3, and 4 waste rock will be placed on the temporary Category 2/3 or Category 4 Waste Rock Stockpiles (Large Figure 5). When at its maximum size, each stockpile is projected to have the approximate area, height, and elevation shown in Table 5-4.

Table 5-4 Maximum Stockpile Dimensions - Approximate

Stockpile	Mine Year of Maximum Footprint	Max Footprint (acres)	Max Height (feet)	Max Elevation (feet above sea level)
Category 1 Waste Rock	21	526	240	1,880
Category 2/3 Waste Rock	6	180	200	1,770
Category 4 Waste Rock	3	57	180	1,790
Ore Surge Pile	N/A(1)	31	120	1,690

(1) The ore surge pile will have ore moving in and out as needed to meet mine and plant conditions.

Starting in Mine Year 11, when mining in the East Pit ends, the temporary Category 2/3 and Category 4 Waste Rock Stockpiles will be relocated to the East Pit, and all future Category 2, 3, and 4 waste rock will be placed in the East Pit or the Central Pit, once mining ceases in the Central Pit after Mine Year 16. By placing Category 2, 3, and 4 waste rock into the East Pit and Central Pit, it will be stored in a subaqueous environment to reduce the environmental impact associated with further oxidation and dissolution of sulfide minerals. Furthermore, this in-pit stockpiling avoids and minimizes wetland impacts. Most of the Category 1 waste rock mined after Mine Year 12 will also be placed in the East Pit. Ultimately, approximately 45% of the total waste rock mined will be backfilled to the East and Central pits.

All waste rock stockpiles will be engineered to manage water resource impacts. The temporary Category 2/3 and Category 4 Waste Rock Stockpiles, which have the potential to generate acid rock drainage (which in turn mobilizes trace metals), will have liner systems to capture water passing through the stockpile. The permanent Category 1 Waste Rock Stockpile, which does not have the potential to generate acid rock drainage, will be constructed with a Groundwater Containment System to collect stockpile drainage from around the entire stockpile. The containment system will consist of a cutoff wall (a low permeability compacted soil cutoff wall) combined with a drainage collection system surrounding the perimeter of the stockpile near the stockpile toe. A cover system will be added incrementally on the Category 1 Waste Rock Stockpile starting in Mine Year 13 to reduce the volume of stockpile drainage.

5.2.4 Mine Site Water Management

Water management at the Mine Site will include pit dewatering, stormwater dikes and ditches, the stockpile liners, a stockpile cover, a groundwater containment system, and the Equalization Basin Area. During operations, mine water from the waste rock stockpiles, haul roads, OSP, and mine pits will be pumped from the Equalization Basin Area to the Waste Water Treatment System (WWTS) at the Plant Site. For the first approximately 10 years, all treated mine water will be pumped to the Plant Site FTB Pond for reuse in the beneficiation process. Reuse of the treated mine water at the Plant Site will eliminate the need for any discharge of treated mine water to surface waters at the Mine Site during operations. Starting in Mine Year 11, some treated mine water will be sent to the East Pit to augment flooding as the pit is backfilled, with the remainder continuing to go to the FTB.

Mine Site water will be managed in accordance with a future Minnesota Pollution Control Agency (MPCA) National Pollutant Discharge Elimination System (NPDES)/ State Disposal System (SDS) permit, which will include a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP will identify and describe Best Management Practices (BMP) for the Mine Site to minimize the discharge of potential pollutants in stormwater runoff. For a detailed discussion of Mine Site water management, refer to Reference (2), as well as PolyMet's Permit to Mine and NPDES/SDS permit applications.

5.3 Plant Site

The Plant Site was previously used as a taconite processing facility by LTVSMC. The Project will upgrade existing facilities and construct new facilities within the existing brownfield facility. The location and dimensions of Plant Site features are shown on Large Figure 6. Plant Site features are grouped into three areas for the wetlands analysis and Wetland Replacement Plan, as follows:

- Process Plant area
  - supporting infrastructure (e.g., roads, electrical supply, rail connections, Area 1 Shop, and Area 2 Shop)
  - a Beneficiation Plant which will use existing buildings for crushing and concentration operations and new buildings for flotation and concentrate dewatering
  - a Hydrometallurgical Plant
  - a Waste Water Treatment System (WWTS)
- FTB area
  - the existing former LTVSMC tailings basin (Tailings Basin), with a new FTB constructed atop the east side
  - FTB seepage capture systems
- HRF area

5.3.1 Flotation Tailings Basin (FTB)

Flotation Tailings from the flotation process at the Beneficiation Plant will be pumped to the FTB, which will be constructed on top of cells 1E and 2E of the existing former LTVSMC tailings basin. (Large Figure 6). In this document, the "FTB" means the newly constructed NorthMet Flotation Tailings Basin, the "LTVSMC tailings basin" means the existing former LTVSMC tailings basin, and the "Tailings Basin" means the combined LTVSMC tailings basin and the FTB. Treated water from the WWTS will also be pumped to the FTB, enabling the FTB to serve as the primary source of water for the Beneficiation Plant.

The LTVSMC tailings basin is unlined and was constructed in stages beginning in the 1950s. It has been inactive since LTVSMC operations were shut down in January 2001, except for reclamation activities consistent with a DNR-approved Closure Plan and Dam Safety permits currently managed by Cliffs Erie, and MPCA-approved NPDES/SDS and Air Quality permits managed by Cliffs Erie.

There is a coal ash landfill (landfill) located on the east side of the former LTVSMC tailings basin (Large Figure 6). This landfill was operated by LTVSMC to accept coal ash from LTV's Taconite Harbor facility, and coal contaminated soil from the LTVSMC abandoned coal yard. The landfill was closed per the "Closure Plan for the Tailings Basin Coal Ash Disposal Area" (Plan) prepared for LTVSMC in May 2000, and filed with the MPCA. The landfill ceased accepting coal ash for land disposal on approximately August 1, 2000. According to the Plan, final closure activities were to have been completed by September 22, 2000. The contents of the landfill will be relocated to the HRF prior to time period when the current landfill area will be inundated by NorthMet flotation tailings (Reference (25)).

The future FTB perimeter dams will be raised using upstream construction methods. The dams will be constructed using compacted LTVSMC tailings borrowed from the existing LTVSCM tailings basin. As necessary, off-site borrow from DNR-approved sources will be utilized. Material from LTVSMC Area 5 will be a likely source, but other sources could also be considered.

Emergency overflow channels will be provided to protect the dams in the unlikely event that freeboard within the FTB is not sufficient to contain all water from an extreme storm event. Analysis indicates that such extreme rainfall events have a low likelihood of occurring during the life of the basin (Reference (2)). Even though there is a low likelihood of overflow, it is standard practice in dam design to accommodate overflows in a manner that protects the integrity of the dams.

5.3.2 Flotation Tailings Basin Seepage Capture Systems

Seepage from the Tailings Basin will be collected by the FTB Seepage Containment System located around the northern, western, and portions of the eastern sides of the Tailings Basin, and the FTB South Seepage Management System located south of Tailings Basin Cell 1E; these two systems are collectively referred to as the FTB seepage capture systems.

Seepage at the south toe of Tailings Basin Cell 1E that is contributing to discharge monitored at SD026 is planned to continue to be collected and managed using the existing seepage containment system and/or an improved system potentially located further south but still within the PolyMet property boundary. The objective of modifications to or replacement of the existing seepage capture system is to capture as much as practical of the small increment of overall seepage at this location not collected by the existing system. The existing seepage collection system and/or an improved system will constitute the FTB south seepage containment system.

The FTB Seepage Containment System is shown on Large Figure 6. Large Figure 10 shows the wetlands that would be impacted between the toe of the Tailings Basin and the FTB Seepage Containment System. Details are shown on Large Figure 9 of Attachment A and discussed in Section 5.2.3.2.3 of Reference (2). Details on the FTB South Seepage Management System are provided in Section 2.3.3.2, Large Figure 3, and Large Figure 4 of Volume V of the NPDES Permit Application (Reference (26)). Final designs will be provided to the agency when complete.

The FTB Seepage Containment System will be the primary cause of direct wetland impacts at the Plant Site. The FTB Seepage Containment System will consist of a cutoff wall combined with a seepage capture system. The cutoff wall will minimize the amount of water that the seepage capture system draws into the seepage capture system from adjacent wetlands.

5.3.3 Hydrometallurgical Residue Facility (HRF)

The HRF will be constructed to manage residues generated by the hydrometallurgical process. The HRF will consist of one lined cell located adjacent to the southwest corner of Tailings Basin Cell 2W, at the site of the Emergency Basin used in the former LTVSMC operations (Large Figure 6).

The Emergency Basin is constructed in a topographic low area. Its southern tip initiates near the central portion of the proposed HRF, widening and deepening into a former ravine that trended to the north. The original purpose of the Emergency Basin was to contain taconite tailings discharge from the main LTVSMC Tailings Thickeners in the event of a power failure. Accidental overflows, spillage, and floor drainage from the former LTVSMC Concentrator Building also reached the Emergency Basin. These materials were deposited hydraulically through an underground Emergency Tunnel terminating at the southeast side of the Emergency Basin. Overflow from sumps in LTVSMC booster pump house Number 1 was also directed into the Emergency Basin. Material flowed by gravity into the Emergency Basin and was placed hydraulically. Material in the basin consists of slimes, fine tailings, and coarse tailings (Section 3.1 of Reference (27)).

The HRF will be double-lined to minimize release of water that has contacted the hydrometallurgical residue. The composite liner system will consist of a geomembrane liner above a geosynthetic clay liner with a second geomembrane/geosynthetic clay liner placed above the first, separated by a leakage collection system, this system will substantially remove all hydraulic head from the lower liner; therefore virtually eliminating leakage from the HRF.

The HRF will be filled by pumping the combined hydrometallurgical residue (Residue) as slurry from the Hydrometallurgical Plant. A pond will be maintained within the HRF so that the solids in the slurry will settle out. Most of the liquid will be recovered by a pump system and returned to the plant for reuse.

5.3.4 Plant Site Water Management

Water management at the Plant Site will include the FTB, the HRF, stormwater dikes and ditches, FTB seepage capture systems, the WWTS, and stream augmentation. With the exception of the FTB Seepage Containment System, all Plant Site water management features will be located on previously disturbed areas.

A portion of the tailings basin seepage collected by the seepage capture systems will be returned to the FTB Pond for reuse in mineral processing, and a portion will be routed to the WWTS. Tailings basin seepage will be treated to meet appropriate discharge limits, then discharged beyond the FTB seepage capture systems to wetlands in the headwater areas of Trimble Creek and Unnamed Creek and to the headwaters segment of Second Creek, to replenish the flow to the surrounding wetlands and streams. This discharge strategy will limit the potential for indirect wetland impacts due to reduced seepage from the Tailings Basin to the wetlands.

Construction of the FTB seepage capture systems will reduce the amount of seepage that currently flows from the existing LTVSMC tailings basin to the headwater areas of Unnamed Creek, Trimble Creek, Unnamed (Mud Lake) Creek, and Second Creek. Reduced streamflow levels could affect ecological functions, and during environmental review, the agencies indicated that PolyMet will be required to maintain streamflow within ±20% of baseline flow levels on an average annual basis. Baseline flows are the conditions before implementation of the tailings basin pumpback systems as part of the Cliffs Erie Consent Decree.

To meet this requirement, PolyMet will distribute WWTS discharge to the headwater areas of Trimble Creek, Unnamed Creek, and Second Creek in proportion to the amount of water that the FTB seepage capture systems will block from flowing to each creek’s watershed. A Drainage Swale will be constructed east of the Tailings Basin to route non-contact stormwater to Unnamed (Mud Lake) Creek. The drainage swale is shown on Large Figure 2, Large Figure 6, and Large Figure 10. Large Figure 10 shows the wetlands that would be impacted by the drainage swale. Details are also shown on Large Figure 9 of Attachment A and in Section 2.4.3, Large Figure 3, and Large Figure 4 of the Reference (26). These water management activities, referred to as “stream augmentation,” are designed to prevent significant ecologic impacts in wetlands and creeks that currently (or previously) received flow of seepage from the LTVSMC tailings basin.

The location and preliminary layout of the proposed drainage swale is shown on Drawings FTB-004, FTB-011, and FTB-012 of the Permit to Mine Permit Application Support Drawings – Flotation Tailings Basin (Appendix 6 of Reference (19)). The purpose of the swale is two-fold: to divert surface water runoff that may otherwise flow into tailings basin and, to prevent ponding of water at the toe of the proposed future dam at the northeast corner of tailings basin Cell 1E. Final design of the swale (selection of final alignment, cross-section configuration, and depths) will occur as part of preparation of construction plans and specifications for contractor bidding of swale construction. In general, the swale will be configured to achieve a low maintenance or maintenance-free configuration that drains the area by gravity flow rather than having to rely on any pumping or piping systems. Final construction plans will be provided for agency reference when they become available.

The Plant Site water will be managed in accordance with a future MPCA NPDES/ SDS permit, which will include SWPPPs. The SWPPPs will identify and describe BMPs at the Plant Site to minimize the discharge of potential pollutants in stormwater runoff. For a detailed discussion of Plant Site water management, refer to Reference (2), as well as PolyMet's Permit to Mine and NPDES/SDS permit applications.

5.4 Road, Utility, Railroad, and Water Pipeline Corridors

The remaining Project components are linear corridor features, including the following:

- Dunka Road and Utility Corridor
- Railroad Connection Corridor
- Colby Lake Pipeline Corridor

5.4.1 Dunka Road and Utility Corridor

Dunka Road is an existing, compacted-gravel, private road that extends from near the existing LTVSMC Plant Site to the Mine Site, then continues roughly northeast toward Babbitt, Minnesota. The portion of Dunka Road that connects the Plant Site to the Mine Site will be widened and pipelines will be constructed parallel and adjacent to the existing Dunka Road. Dunka Road will be utilized to transport mine equipment between the Mine Site and the Area 1 Shop, as well as mine personnel between the Mine Site and the Area 2 Shop (Large Figure 2).

The MPP will be constructed in the Utility Corridor to transport mine water between the Mine Site and the Plant Site.

5.4.2 Railroad Connection Corridor

An approximately 1.1 mile length of new railroad will be constructed to connect the existing Cliffs Erie private railroad to the existing PolyMet railroad track that serves the Coarse Crusher Building at the Process Plant (Large Figure 2).

5.4.3 Colby Lake Pipeline Corridor

The FTB Pond will supply most of the water needed for the milling and flotation circuits. Make-up water for the Beneficiation Plant and the Hydrometallurgical Plant will be drawn from the Plant Reservoir, which will be supplied from Colby Lake using an existing pump station and pipeline. The Colby Lake Pipeline will be evaluated and repaired if necessary before it is recommissioned (Large Figure 2).

6.0 Project Alternatives: Avoiding and Minimizing Wetland Impacts

Regulations implementing the federal CWA and the WCA require that impacts to wetlands be avoided and minimized to the extent practicable. Avoiding and minimizing wetland impacts accordingly was one of the objectives of Project during the Environmental Review Process.

This section analyzes the alternatives considered during the Environmental Review Process that affect the Project's direct wetland impacts. For a comprehensive analysis of the full range of alternatives explored and evaluated during the Environmental Review Process, see Section 3.0 of Reference (2).

This section first outlines the sequencing of steps taken by PolyMet to modify the project to avoid adverse impacts, and incorporate measures to minimize adverse impacts. It then discusses how alternatives were developed and evaluated. Finally, it describes the alternatives, including the No Action Alternative, and minimization alternatives at the Mine Site, the Plant Site, and in the Transportation and Utility Corridors.

6.1 Sequencing

This section describes the reasonable and practicable avoidance, minimization, and compensatory mitigation practices that have been and will be implemented as part of the Project.

The Project was modified through the process described above to have the fewest impacts practicable to waters of the U.S., as well as to other biological resources (e.g., vegetation, wildlife, threatened and endangered species, etc.). In addition, to assess alternatives and possible additional environmental management and mitigation measures, the co-lead agencies prepared a final FEIS for the project in November of 2015 (Reference (2)).

Final regulations and guidelines associated with Section 404 of the CWA require that project proponents eliminate or reduce adverse impacts to waters of the U.S. by taking certain specific steps during the project planning:

- Modify the project to avoid adverse impact
- Incorporate measures to minimize adverse impacts;

- Compensate for unavoidable adverse impacts through restoration, enhancement, creation, or preservation.

6.1.1 Avoidance

The Project is not a water dependent project; however, it is not possible to avoid all waters of the U.S., including wetlands. The project has been modified to avoid wetlands to the extent practicable.

Geology dictates the location and dimension of the mine pits. The polymetallic ore bodies of the NorthMet deposit can be developed only where the mineral resource exists in economically minable quantities. Extensive exploration programs have been conducted to define the resource, which has allowed a refinement of the pit locations. These studies indicate that the ore reserves identified as the East Pit, Central Pit, and West Pit are the areas where polymetallic ore quality and the distribution and amount of waste rock make mining economically feasible. Mining in other areas of the deposit cannot currently be supported based on these studies.

6.1.2 Minimization

Although avoidance of impacts to waters of the U.S. is impossible, the project will employ numerous methods to minimize impacts.

Alternatives to minimize wetland impacts at the Mine Site, Plant Site, and Transportation and Utility Corridors are described in Sections 6.4, 6.5, and 6.6 respectively. Minimization alternatives use the following general strategies:

- minimize the footprint and optimize the placement of mining features, mainly at the Mine Site
- maintain a smaller disturbance footprint by re-using existing infrastructure, mainly at the Plant Site brownfield site
- utilize existing facilities and structures, to the extent practicable, to support ongoing activities
- maintain future tailings disposal in a single location and within the existing watershed where the current facility is located
- expand the existing tailings disposal site upward, to the extent geotechnically practicable, thus disturbing less surface area while allowing more material to be placed in the same footprint
- divert runoff upgradient of facilities into undisturbed drainages
- install culverts to facilitate flow across wetland areas

- maintain a SWPPP, using BMPs, to prevent site erosion and subsequent downstream sedimentation
- collect and treat runoff and other contact water
- implement interim, concurrent (as practicable) and permanent reclamation at the site

6.1.3 Reclamation

After Project closure, Project areas will be reclaimed according to the approved reclamation plans (Reference (2)). The Reclamation Plans for the Mine Site include creation of wetlands in areas where some wetlands were directly impacted (Reference (2)). For example, at the Mine Site, wetlands may be developed in the footprints of the temporary Category 2/3 Waste Rock Stockpile and the OSLA (Section 5.2.3.1).

6.1.4 Compensation

Wetland mitigation will be accomplished by purchasing compensatory mitigation credits from a wetland bank. Preference for the bank selection follows the preferential sequencing for compensatory mitigation per the USACE St. Paul District Policy for Compensatory Mitigation in Minnesota (Reference (18)). Under that policy, the preference is that wetland mitigation banks under consideration be located in the Bank Service Area (BSA) #1, which is the BSA where the Project wetland impacts will occur.

Wetlands that are directly impacted and impacted by fragmentation will be replaced and mitigated by credits purchased from an off-site wetland bank as described in Section 14.0. PolyMet will purchase wetland bank credits in BSA #1, in the St. Louis River watershed, prior to construction of the Project.

6.2 Alternative Development and Evaluation

Alternatives were developed and evaluated in four stages during the Environmental Review Process; the scoping stage, the DEIS stage, the SDEIS stage, and the FEIS stage. Aspects of the proposed action that were considered included alternate locations, alternate configurations of Project features and alternate mitigation measures and summarized in Sections 6.4, 6.5, and 6.6. The alternatives are discussed in the FEIS (Reference (2)). Some alternatives would have less adverse impacts to waters of the U.S., including wetlands, and some would have greater adverse impacts. Alternatives with smaller and larger areal coverage, as well as alternatives sited in different locations were considered. The Environmental Review Process evaluated the potential environmental impacts of the alternatives, including wetland impacts, during each stage of alternative development.

The practicability of the alternatives, including cost, technical factors, and logistical factors were evaluated. Practicable alternatives and mitigation measures that were identified to offer substantial environmental benefits, and to meet the Project purpose and need, were incorporated into the draft alternative (Project Proposed Action).

Alternatives were eliminated if they failed to meet one of the following criteria:

- meet the Project purpose and need
- technical feasibility
- economic feasibility
- availability of resources (e.g., surface rights, mineral rights, technologies)
- significant environmental or socioeconomic benefits compared to other alternatives

The first stage of alternative development and screening took place during project scoping in 2005. The second stage of alternative development and evaluation took place with the 2009 Draft EIS (DEIS) (Reference (20)). Alternatives considered during project scoping and DEIS development are summarized in the 2009 DEIS (Table 3.2-4 of Reference (20)). For each alternative that was eliminated, this table indicates the rationale.

In June 2010, the co-lead agencies decided that a SDEIS would be completed for the Project in order to build upon the alternatives and issues identified in the 2009 DEIS, to address subsequent public comments, and to incorporate new information.

The third stage of alternative development and evaluation was completed for the SDEIS (Reference (1)). As an initial step in developing the SDEIS, the co-lead agencies developed and approved a process to identify, analyze, and assist PolyMet in developing revisions to its proposal that responded to the concerns raised under the Environmental Review Process. The objective of this process was to have a revised draft alternative that would minimize potential environmental impacts to the extent practicable. An additional goal of the draft alternative development was to support federal and state permitting decision making, including the USACE's need to identify a Least Environmentally Damaging Practicable Alternative (LEDPA) for the Section 404 Wetland Permit Record of Decision and the Section 7 Endangered Species Act consultation with the U.S. Fish and Wildlife Service (USFWS).

The process for evaluating the draft alternatives was included in the SDEIS and involved topic-focused workgroups which discussed key issues that needed to be closely examined. These workgroups included representatives from the co-lead agencies, cooperating agencies, other regulating agencies, and PolyMet. These workgroups participated in the impact assessment planning process, which led to the development of work plans for data packages and management plans. The workgroups discussed evaluation criteria, methodologies for analysis, potential effects, and possible mitigation measures.

A workgroup was also established to discuss issues related to the project modifications, alternatives (predominantly the Mine Site and Tailings Basin Alternatives addressed in the DEIS), the wild rice standard, and various potential mitigation measures identified by the topic-focused workgroups. PolyMet modified the Project in response to workgroup discussions, comments on the DEIS and evolving MPCA water quality guidance (Reference (28)), resulting in the development of a draft Project alternative that the co-lead agencies felt was appropriate for the SDEIS. Throughout 2011, the co-lead agencies sought input from the cooperating agencies, other involved agencies, and PolyMet and its consultants.

Impact analysis was performed for the draft alternative (as the Project) in the SDEIS using probabilistic modeling programs, GIS and special data analysis and other impact assessment calculations. These estimated effects are described in Section 5 of Reference (2).

Alternatives considered during the development of the Project are summarized in the SDEIS (Reference (1)). For each alternative that was eliminated, Table 3.2-17 of Reference (1) indicates the rationale for why it was eliminated from further consideration. This alternatives evaluation included both evaluation of new alternatives developed subsequent to the DEIS, and re-evaluation of several alternatives that had been eliminated. After the 2013 SDEIS, the Project was further refined, as described in Section 3.2.3.3.4 of Reference (2). Large Table 3 shows a summary of the refinements to the Project that occurred based on the alternatives considered, evaluated, and incorporated into the draft alternative. For each refinement, the associated reduced environmental impact is noted. Additional information is provided in Chapter 3 of Reference (2).

6.3 No Action Alternative

The No Action Alternative was evaluated during the Environmental Review Process. The FEIS addressed the No Action Alternative and described the consequences to the applicant and to the public of not implementing the Project (Reference (2)). Under the No Action Alternative, PolyMet would be required to reclaim surface disturbances at the Mine Site associated with exploratory and development drilling. At the Plant Site, Cliffs Erie would be required to complete closure and reclamation activities. PolyMet did not prefer the No Action Alternative as it would not fulfill the purpose of the Project.

6.4 Mine Site Minimization Alternatives

The Mine Site will be developed at a greenfield site that has previous disturbance from logging and mining exploration activities. Alternatives for avoiding and minimizing wetland impacts at the Mine Site use various strategies to minimize the footprint and optimize the placement of mining features such as the mine pits, waste rock and overburden stockpiles, haul roads, water management systems, and supporting infrastructure.

6.4.1 Mining Method Alternatives

The alternative of conducting underground mining, rather than open pit mining, was considered during the Environmental Review Process for the DEIS, the SDEIS, and FEIS, as it could have minimized wetland impacts at the Mine Site. As part of the Environmental Review Process, the co-lead agencies eliminated the underground mining alternative, however, finding that, among other things, it would not be economically viable, and would not meet the Purpose and Need for the Project (Reference (29)). The same information supports the conclusion that underground mining is not a practicable alternative under the Section 404 regulations. Therefore, there are no further practicable or feasible alternatives for avoiding or minimizing the impacts to wetlands that occur within the limits of the economically minable polymetallic ore reserves.

6.4.2 Alternative Mine Site Layouts

Given that underground mining was found not to be a practicable alternative, the Environmental Review Process evaluated numerous alternatives for open pit mining with the objective of avoiding and minimizing wetland impacts. Through the Environmental Review Process, the mine site minimization alternatives have been configured into three alternative Mine Site layouts, which vary in the extent to which they incorporate the minimization strategies described in Sections 6.4.2.1 and 6.4.2.2. Large Figure 7 illustrates the three alternative Mine Site layouts.

- Scoping EAW Mine Site Layout: One large open pit with three permanent stockpiles occupying most of the site surface area east and west of the pit. Another stockpile placed southeast of the pit.

- DEIS Mine Site Layout: Three distinct pit areas. Six smaller, permanent stockpiles, with waste rock segregated by type. Southeast stockpile eliminated. Haul roads planned to connect mine pits and stockpiles were more localized on the Mine Site.

- SDEIS and FEIS Mine Site Layout: Three pit areas including the East Pit, Central Pit, and West Pit. One permanent stockpile (Category 1 Waste Rock Stockpile). Three temporary stockpiles: Category 4 Waste Rock Stockpile is sited on the area that will become the Central Pit; and Category 2 and Category 3 waste rock are combined in one temporary stockpile that will later be relocated to the mined out Central and East Pits. After Mine Year 13, The Category 1, 2, 3 and 4 materials mined from the West Pit would be directly placed into the Central and East Pits as backfill. With this more compact layout, the haul roads are located within a smaller area so avoid wetland impacts.

The Mine Site Layout for the Permit to Mine application moved the WWTS to the south of Dunka Road. This change resulted in an additional reduction of direct wetland impacts at the Mine Site (Table 6-1; Large Figure 7).

Direct wetland impacts at the Mine Site have been reduced in the FEIS (Reference (2)) alternative, compared to the EAW and DEIS alternatives, as shown in Table 6-1.

Table 6-1 Summary of Direct Wetland Impacts Throughout Project

Proposed Mine Site Layout	Direct Wetland Impacts at Mine Site (acres)
Scoping EAW	1,257
DEIS	804
FEIS	758
Permit to Mine	752

6.4.2.1 Minimization Strategies for Mine Pits and Supporting Infrastructure

Mining will necessitate construction of new haul roads and ore handling facilities. As Project modifications have progressed since the Scoping EAW, the road and facility layouts have been altered as shown in Large Figure 7 to reduce the direct wetland impacts, as well as the fragmentation and water quality impacts to the wetlands. The water containment system along the haul roads and at the ore handling facilities will capture runoff and transport it to the Equalization Basin Area. Overall, PolyMet has located Mine Site infrastructure in order to extract the ore efficiently and minimize wetland impacts to the extent possible.

PolyMet will rely on the advantages obtained by operating large-scale mining equipment. Utilizing large-scale mining equipment minimizes costs, but also requires that adequately sized working areas be maintained for loading faces, haul roads, and stockpile sites. In most cases, the operation of large-scale mining equipment makes it necessary to use contiguous tracts of land. This reduces the direct wetland impact by consolidating the operations in select areas rather than throughout the Mine Site, as was the case with the EAW Mine Site Project layout as shown in Large Figure 7.

6.4.2.2 Minimization Strategies for Stockpiles

Mining economics dictate that surface overburden, lean ore, and waste rock materials be removed and stockpiled in the proper sequence to allow efficient access to the underlying polymetallic ores. In order to minimize haulage costs and maintain operating efficiencies, surface overburden, lean ore, and waste rock stockpiles must be located in or adjacent to the mining area.

Because previously it has not been economically feasible to make use of the polymetallic ore resource at the NorthMet Site, there are no existing stockpiles in the vicinity of the site. Alternatives for stockpiling within the mine pits, stockpiling on disturbed areas, and alternative stockpile designs are addressed in the sections that follow.

In-Pit Stockpiling

Stockpiling lean ore, waste rock, and possibly surface overburden in mined-out pits has benefits in that it involves short haul distances and minimizes impacts to undeveloped lands and wetlands. This method is also favorable with respect to the requirements of the CWA, the WCA and portions of the DNR reclamation rules.

The Project in the Scoping EAW did not include in-pit stockpiling. The Project evaluated in the DEIS included in-pit stockpiling, proposing that Category 1 and 2 waste rock generated after Mine Year 11would be backfilled directly to the East Pit. All other overburden and waste rock was to be placed in three permanent, lined/covered stockpiles as shown in Large Figure 7.

For the FEIS Project, in-pit stockpiling is considerably expanded from the Project evaluated in the DEIS. All of the Category 2, 3, and 4 waste rock, along with some Category 1 waste rock and saturated mineral overburden, will be placed in the East Pit for subaqueous storage. Two temporary stockpiles will be created, however one of them will be placed in a location that will subsequently be mined as the Central Pit (Category 4 Waste Rock Stockpile). This alternative in-pit stockpiling plan increases the volume of waste rock placed in mine pits, and reduces direct wetland impacts. It has been identified as a reasonable and practical alternative to the original plan, and is currently incorporated in the Project as shown in Large Figure 7.

Another in-pit stockpiling alternative was evaluated during the Environmental Review Process that called for placing Category 1 waste rock in a temporary stockpile, then relocating it to the West Pit during reclamation. This approach would not have reduced direct wetland impacts, although it would have offered the opportunity to restore wetlands during reclamation. This alternative was eliminated by the co-lead agencies because, among other things, it would encumber deeper mineral resources in violation of PolyMet's mineral leases (page 8-10 and 8-11 in Reference (2)).

Stockpiling on Disturbed Areas

Disturbed areas are favorable for stockpiling activities because impacts to previously undeveloped lands will be minimized, including wetlands; however, existing stockpiles and tailings disposal areas are not present at the Mine Site. Mine development will result in some disturbance to lands outside of the actual mine pit areas for construction of haul roads and other infrastructure as well as stockpiles. The Environmental Review Process evaluated the alternative of using some saturated mineral overburden and Category 1 waste rock during Mine Site construction, as approved by the DNR. This alternative minimizes wetland impacts because it reduces the volume of material to be stockpiled on undeveloped areas, and it has been incorporated in the Project.

The Project also developed an alternative location for the Category 4 Waste Rock Stockpile. Originally, it was proposed as a permanent stockpile located on an undeveloped area located south of the East Pit (Large Figure 7). An alternative approach was identified, which temporarily stockpiles the Category 4 waste rock in the area that will subsequently be mined as the Central

Pit (Large Figure 2 and Large Figure 5). This alternative eliminates one stockpile from undeveloped areas, and has been incorporated into the project.

6.4.3 Dewatering

It is necessary to dewater the pits during operation to remove groundwater and runoff and maintain safe access to the mine pits and ore. Therefore, no alternatives to the mine pit dewatering were proposed during the Environmental Review Process. Dewatering has been identified as a factor that may potentially indirectly impact wetlands. Wetland hydrology will be monitored to document any potential indirect wetland impacts from dewatering activities.

Water generated by dewatering will be treated at the WWTS and pumped to the FTB Pond for use in mineral processing. This alternative, which reuses groundwater that must be extracted to facilitate mining, is environmentally beneficial because it minimizes the amount of water that will be appropriated from other waters of the state for use in mineral processing.

6.5 Plant Site Minimization Alternatives

The Plant Site will use the existing LTVSMC facility which is located on a brownfield site. There are no wetlands on the processing facilities area of the Plant Site. An alternative process plant site would not have environmental benefits over the existing plant site. Reuse of an existing plant site and infrastructure reduces environmental impacts. An evaluation of alternative plant sites was not proposed by the USACE and DNR during the Environmental Review Process.

Plant Site minimization alternatives generally involve balancing direct wetland impacts with indirect wetland impacts and overall impacts on the environment. Minimization alternatives for some Plant Site features slightly increase direct wetland impacts, but they are included in the Project because they were identified to offer substantial overall environmental benefits.

6.5.1 Flotation Tailings Basin (FTB)

Minimization alternatives evaluated for the FTB include options for alternative locations, alternative sources for dam construction materials, and alternative environmental controls.

Two alternative locations were considered for the FTB, a greenfield site to the west of the existing LTVSMC tailings basin, and vertical expansion atop the existing LTVSMC tailings basin. The alternative of constructing the FTB on a greenfield site to the west of the existing LTVSMC tailings basin was considered during the Environmental Review Process. This alternative was eliminated early in the process because of the additional environmental and wetland impacts associated with it. PolyMet proposes to place the Flotation Tailings atop the existing LTVSMC tailings basin by building the basin vertically as tailings are produced. Use of the existing brownfield site for the FTB significantly reduces the acreage of direct wetland impacts. The development of alternative layouts for the FTB is illustrated in Large Figure 8. Vertical expansion will require an expansion of the active tailings basin footprint for additional buttressing to reinforce the tailings basin dams as required by the DNR to address dam stability requirements. The slightly expanded footprint of the FEIS Tailings Basin layout is shown in right panel of Large Figure 8.

One concern about a taller Tailings Basin is that it may generate more fugitive dust because of greater wind erosion across the surface of the basin. However, the Project has incorporated measures to minimize fugitive dust from the Tailings Basin, as described in Section 5.2.7.5.3 of Reference (2).

Construction material for the FTB dams will be borrowed from the existing LTVSMC tailings basin. Buttress material will be sourced from the former LTVSMC waste rock stockpiles. These alternatives avoid procuring construction materials from more distant sources with potentially greater adverse environmental impacts.

Environmental controls proposed for the FTB also affect wetland impacts. The FEIS alternative plant layout includes the addition of the FTB Seepage Containment System. The FTB Seepage Containment System consists of a cutoff wall and a collection trench. As described in Section 5.3.2, the FTB Seepage Containment System offers significant overall environmental benefits. It will reduce surface water impacts and minimize potential indirect impacts to wetlands north of the Plant Site due to seepage from the FTB. This approach was selected during the Environmental Review Process because it has environmental benefits of limiting ground and surface water impacts, however it does result in the expansion of the Tailings Basin footprint into previously undeveloped areas. The combined effects of the FTB Seepage Containment System and the expanded buttress footprint result in direct impacts to approximately 140 acres of wetlands (Attachment A).

An alternative containment system design, using groundwater extraction wells instead of the cutoff wall, was eliminated because the well pumping tests indicated the number of wells needed to collect the volume of seepage necessary to limit water quality impacts was infeasible and there was a potential for indirect wetland impacts by drawing down water levels in adjacent wetlands. The proposed FTB Seepage Containment System is expected to decrease groundwater flow from the existing Tailings Basin to the adjacent wetlands and streams. To mitigate these potential indirect impacts, PolyMet will supplement wetland water levels and stream flow using treated water from the WWTS.

6.5.2 Hydrometallurgical Residue Facility (HRF)

Minimization alternatives evaluated for the HRF include options for alternative locations. The originally proposed location of the HRF was atop the existing LTVSMC Tailings basin Cell 2W (see Large Figure 8 for the location of Cell 2W). This alternative of siting the HRF within the existing Tailings Basin was eliminated during the Environmental Review Process due to concerns over constructability and HRF liner issues. An alternative HRF location was identified in the existing Emergency Basin southwest of Cell 2W (Large Figure 8). A portion of the existing wetland in the alternative HRF area is identified as not subject to this Wetland Replacement Plan based on information provided in Section 5.3. Locating the HRF within the

Cliffs Erie LLC (formerly LTVSMC) Permit to Mine Ultimate Tailings Basin Limit boundary minimizes direct wetland impacts, as well as avoiding additional impacts to undeveloped areas.

6.6 Transportation and Utility Corridors Minimization Alternatives

Two corridors are needed to connect the Mine Site and the Plant Site. The Rail Connection Corridor will permit rail transport of ore to the Plant Site. The Dunka Road and Utility corridor will contain the MPP alongside the existing Dunka Road.

To transport ore from the Mine Site to the Plant Site, PolyMet will use the existing Cliffs Erie (former LTVSMC) railroad. Trains will run on a new spur developed on the Mine Site to the existing railroad. There will be a new approximately 5,750-foot connecting track constructed between the Cliffs Erie railroad and existing PolyMet railroad that serves the Process Plant. Reuse of the existing railroad minimizes direct wetland impacts. The configurations for the new spur and the connector track were selected to avoid sensitive wetland areas, and while the layout was modified from the DEIS to the FEIS, the direct wetland impact is similar (0.3 acres and 0.44 acres, respectively). The alternative of ore transport by truck to the Plant Site was evaluated during Project scoping, but eliminated by the co-lead agencies in the Final Scoping Decision (Reference (30)) because it would not likely provide significant environmental benefit over rail transport.

The project will upgrade the existing Dunka Road and install the MPP alongside it. The layout of the MPP was refined from the DEIS to the FEIS, which reduced the direct wetland impacts from 10.2 acres to 6.76 acres. The FEIS alternative reuses previously disturbed areas and minimizes impacts to wetlands while providing access necessary for mining operations.

7.0 Adjoining Property Owners

There are 39 property owners adjacent to the Project. Large Table 4 identifies the complete mailing addresses of all the property owners.

8.0 Portion of Work Completed

Project work has not commenced. Project activities will not be initiated until appropriate approvals and permits have been obtained.

9.0 Status of Other Approvals

Other permits, reviews, and approvals related to the Project are currently in progress (Table 9-1 and Section 1.4.4 of Reference (2). The DNR will review this Wetland Replacement Plan concurrently with the submittal of the Permit to Mine application, which was also submitted to the DNR, pursuant to the Minnesota Nonferrous Metallic Mineral Mining Rules (Minnesota Rules, chapter 6132).

The Permit to Mine and WCA are administered by the DNR Division of Lands and Minerals, Section 404 of the CWA is administered by the USACE, and Section 401 of the CWA (Water Quality Certification) is administered by the MPCA. PolyMet’s mining plans will also take into account the DNR Nonferrous Metallic Mineral Mineland Reclamation Rules (Minnesota Rules, chapter 6132).

Table 9-1 Summary of Project Permits and Approvals

Unit of Government	Type of Permit/Approval/Action	Status
Federal		
U.S. Army Corps of Engineers	Section 404 Permit for Wetland Impacts	Submitted August 2013
	Section 106 Consultation (MN Historic Preservation Office)	Consultation completed on December 27, 2016
U.S. Fish and Wildlife Service	Section 7 Endangered Species Act (ESA) Consultation	Consultation completed February 2016
U.S. Forest Service	Land Exchange	In progress
	Section 106 NHPA Compliance	Consultation completed on December 27, 2016
State		
Minnesota Department of Natural Resources	Permit to Mine	Submitted November 2016
	Endangered Species Taking Permit (if required)	Submitted October 2017
	Water appropriations permit for pits and tailings basins, and mine dewatering	Submitted July 2016
	Water appropriations permit for plant makeup-water	Submitted January 2017
	Water appropriations permit for potable water well for mine site administration building	To be applied for if needed
	Dam Safety Permit	Submitted July 2016
	Permit for work in public waters, possible modifications and diversions of local streams	Submitted June 2017
	Permit for wetland modifications under Wetland Conservation Act (as part of Wetland Mitigation Plan for Permit to Mine)	Submitted November 2016
	Burning Permit (possibly needed for construction or land clearing)	To be applied for if needed

Unit of Government	Type of Permit/Approval/Action	Status
Minnesota Pollution Control Agency	Section 401 Water Quality Certification/Waiver	Reinitiated August 2017
	SDS/NPDES permit for site operations (discharge to surface or groundwater), construction stormwater (activity that would disturb one acre or more of land), and industrial stormwater activity	Submitted July 2016
	Solid Waste Permit for construction debris	To be applied for
	Minnesota Air Emissions Permit	Submitted August 2016
	Minnesota Waste Tire Storage Permit	To be applied for
	General Storage Tank Permit (fuel tanks)	To be applied for
Minnesota Department of Health	Radioactive Material Registration (for low-level radioactive materials in measuring instruments)	To be applied for if needed
	Permit for Non-Community Public Water Supply System (serving an average of at least twenty-five individuals daily at least 60 days out of the year) and wellhead protection plan	To be applied for if needed
	Permit for Public On-site Sewage Disposal System	To be applied for if needed
Local		
St. Louis County	Zoning Permit – to acknowledge Project is an allowable use within the zoned district	To be applied for
City of Hoyt Lakes	Zoning Permit – to acknowledge Project is an allowable use within the zoned Mining District	To be applied for
City of Babbitt	Building Permit - for new construction on Project areas within the incorporated Babbitt City limits.	To be applied for

10.0 Signed Signature Blocks

The signed signature blocks are in Part Five of the Minnesota Local/State/Federal Application for Water/Wetland Projects, which is located inside the front cover of this Wetland Replacement Plan.

11.0 Description of Wetlands and Wetland Impacts

This section provides a description of the overall environmental setting, including hydrogeology, vegetation, and soils for the Project. The methods used to delineate, classify, and assess the wetlands are documented and wetlands are described for each Project area. An accounting of the direct and potential indirect wetland impacts is provided for the Project and shown in Large Figure 9, Large Figure 10, and Large Figure 11. Mitigation for these impacts is discussed in Section 14.0, with crediting information provided in Large Table 5 and Large Table 6.

11.1 General Environmental Setting

The Project is located at the foot of the Laurentian Divide, within the Nashwauk Uplands and Laurentian Uplands subsections of the Northern Superior Uplands section in the Laurentian Mixed Forest Province, as described in the Ecological Classification System (ECS) developed by the DNR and USFS (Reference (31)). Landforms in both subsections are characterized by till and outwash plains and moraines, with peatlands also common in the Laurentian Uplands subsection.

Historically, the Nashwauk Uplands subsection consisted of forested communities dominated by red and white pine, balsam fir, white spruce, and aspen and birch. The Laurentian Uplands subsection historically consisted of forests dominated by aspen and birch, jack pine, red pine, and white pine in the uplands, and coniferous bogs and swamps in the lowlands. At present, aspen is the most dominant tree species in both the Laurentian Uplands and Nashwauk Uplands subsections (Reference (31)). Elevations within the Project range from approximately 1,475 feet to 1,850 feet above mean sea level.

11.1.1 Hydrology and Hydrogeology

The Project area is located near the headwaters of the Partridge River and Embarrass River watersheds (Large Figure 3). The Partridge River and the Embarrass Rivers are both tributary to the St. Louis River, which is located within the Lake Superior Basin. The Mine Site, portions of the Plant Site, Dunka Road and Utility Corridor, Railroad Connection Corridor, and Colby Lake Pipeline Corridor are located within the Upper Partridge River Watershed. The majority of the Plant Site is located in the Embarrass River watershed (Large Figure 3).

11.1.1.1 Partridge River Watershed

The Partridge River upstream of the St. Louis River flows through Colby Lake and Whitewater Reservoir, both of which are located in the Colby-Whitewater Watershed (Large Figure 3). Watersheds upstream of Colby Lake include the Upper Partridge River and Wyman Creek. Watersheds downstream of Colby Lake include Second Creek and the Lower Partridge River.

The Mine Site is located in the Upper Partridge River watershed approximately 17 miles upstream of Colby Lake. Upstream of the U.S. Geological Survey (USGS) gage 04015475 (located above Colby Lake and Wyman Creek), the Partridge River watershed covers approximately 103 square miles, including portions of the Peter Mitchell Mine. Tributaries to the

Partridge River upstream of Colby Lake and Wyman Creek include Wetlegs Creek, Colvin Creek, Longnose Creek, Yelp Creek, Stubble Creek, and the South Branch of the Partridge River (Large Figure 3).

Under existing conditions, runoff from the northernmost area of the Mine Site generally drains north into the One Hundred Mile Swamp and associated wetlands along the Partridge River. These wetlands form the headwaters of the Partridge River, which meanders around the east end of the Mine Site before turning southwest. Runoff from the majority of the Mine Site naturally drains to the south through culverts under Dunka Road and the adjacent rail line, into the Partridge River downstream of the Dunka Road crossing. The Partridge River hydrology is affected by the periodic and variable dewatering of the Peter Mitchell Mine near the headwaters of the Partridge River, upstream of the proposed Mine Site.

The railroad corridor connecting the Mine Site and Plant Site crosses Wetlegs Creek, Longnose Creek, and Wyman Creek. Small portions of the Plant Site are located in the headwaters of Second Creek. Second Creek drains to the Partridge River downstream of Colby Lake, approximately 3 miles upstream of the confluence with the St. Louis River (Large Figure 3).

The hydrogeologic setting of the Partridge River watershed consists of a thin veneer of heterogeneous unconsolidated deposits (glacial till) underlain by fractured bedrock (Duluth Complex in most of the Mine Site area and Virginia Formation in the northern portion of the area). In the Mine Site area, saturated conditions exist within the unconsolidated deposits and bedrock and the depth to groundwater is typically less than 10 feet. The water table is generally a subdued replica of the land surface, with groundwater divides in the area expected to roughly coincide with surface water divides. Wetlands are common, covering approximately 43% of the Mine Site.

The degree of hydraulic connection between the wetland areas and adjacent unconsolidated deposits and bedrock at the Mine Site is expected to be variable, depending on the characteristics of the wetlands and the localized hydraulic conductivity and degree of bedrock fracturing. The hydraulic conductivity of the bedrock and surficial deposits have been estimated at the Mine Site by a variety of methods, including conducting aquifer tests and using grain-size distribution data from soil borings and ranges over several orders of magnitude. Data collected during a 30-day pumping test at the Mine Site showed a small amount of drawdown in the deep wetland piezometer nearest the pumping well, but no detectable drawdown at other water table or deep wetland piezometers, indicating that the connection between the bedrock, unconsolidated deposits, and wetlands may be relatively weak. Virtually all water movement in peat wetlands occurs horizontally in the upper layers of peat. The deeper, more decomposed peat soils limit vertical seepage because of the low hydraulic conductivities (~0.0028 feet/day) and the wetland hydrology is simply perched on the relatively impermeable peat layer. Vertical seepage losses from wetlands without peat soils will only have the potential to occur in isolated areas of contiguous, high hydraulic conductivity bedrock faults and fracture zones located under isolated areas of high hydraulic conductivity glacial till and aligned with wetlands containing high hydraulic conductivity soils.

11.1.1.2 Embarrass River Watershed

The Plant Site is primarily located within the Embarrass River watershed, upstream of the Embarrass River chain of lakes (Large Figure 3). The FTB occupies approximately 4 square miles along the southern side of the watershed. A small portion of the Plant Site, including stormwater from the Process Plant area, drains south to Second Creek.

The Embarrass River watershed covers approximately 88 square miles upstream of USGS gage 04017000 (Large Figure 3) and approximately 112 square miles upstream of Project monitoring location PM-13 (the downstream extent of the Plant Site water quality monitoring). Tributaries to the Embarrass River, located between the Tailings Basin and the Embarrass River, which may potentially be affected by the Project, include (east to west) Unnamed (Mud Lake) Creek, Trimble Creek, and Unnamed Creek. Other tributaries located between the Tailings Basin and the Embarrass River that are not expected to be affected by the Project include (east to west) Spring Mine Creek, which drains LTVSMC's former Mine Area 5N, an unnamed creek, and Heikilla Creek (Large Figure 3). Bear Creek drains to the Embarrass River from the north, and is not anticipated to be impacted by the Project.

Under existing conditions, groundwater and surface water seepage from the FTB drain towards Unnamed (Mud Lake) Creek to the north, Trimble Creek to the northwest, and Unnamed Creek to the west. Runoff from the outer slopes of the FTB is tributary to the surrounding creeks; precipitation falling within the FTB is contained in the basin.

The hydrogeologic setting of the Embarrass River watershed is broadly similar to the Partridge River watershed, although the unconsolidated deposits are generally thicker and more continuous north of the Plant Site area along the Embarrass River valley. The Plant Site is located north of the Laurentian Divide and the area is underlain by granitic rocks of the Giants Range batholith. Although these rocks may be fractured to some extent, they are expected to have significantly lower hydraulic conductivity than the bedrock units at the Mine Site. As is the case at the Mine Site, wetlands are abundant in the Plant Site and saturated conditions generally exist less than 10 feet below the ground surface. As at the Mine Site, the degree of hydraulic connection between the wetland areas and adjacent unconsolidated deposits and bedrock at the Plant Site is expected to be variable, depending on the characteristics of the wetlands and the localized hydraulic conductivity and degree of bedrock fracturing. Given the very low hydraulic conductivity of the underlying bedrock, there is minimal potential for hydraulic connection between bedrock and wetlands.

11.1.2 Vegetation

Vegetation communities in much of the Project area have been altered by previous mining and logging activities. In addition, beaver activities have led to the transition of some forested wetlands to open, emergent marshes and wet meadows. Aside from areas disturbed from mining and logging activities, the Project vicinity is currently a mosaic of upland and wetland native vegetation community types, which is typical of northeastern Minnesota.

While the Mine Site is located in an area that has not been directly disturbed by previous mining activities, extensive logging has occurred throughout the area. The USFS owns the surface rights at the Mine Site, and has managed the area for timber production. Logging activities have changed the vegetative character across the Mine Site, with shrublands and/or early and mid-successional forest replacing mature upland forest. These logged areas are currently in varying stages of regeneration and consist mostly of young aspen stands. Aside from logging and associated roads, the Mine Site is largely undeveloped, with a variety of natural vegetation communities present. These communities include coniferous and deciduous forests in the uplands and wetlands such as shrub swamps, marshes, forested swamps, and bogs in the lowlands. The more mature upland forested areas at the Mine Site are dominated by quaking aspen, jack pine, balsam fir, black spruce, and white spruce with lesser amounts of paper birch, red pine, and white pine.

The Plant Site was previously used as a taconite processing facility by LTVSMC and is largely devoid of natural vegetation. In addition, the road and railroad corridors are existing infrastructure and therefore previously disturbed areas.

11.1.3 Soils

The Mine Site is situated on land mapped by both the USFS SNF (94% of the area) and the St. Louis County Natural Resources Conservation Service (NRCS) (6% of the area) (Large Figure 12). The USFS mapped soil types are based on the Ecological Land Classification System, which divides land areas into Ecological Landtypes (ELT). The ELTs are areas of land with a distinct combination of natural, physical, chemical, and biological properties. In the hierarchical framework, ELTs are further broken down into Ecological Landtype Phases (ELTPs); these ELTPs can be correlated to NRCS mapping units (Reference (32)).

Approximately 55% of the Mine Site is mapped as ELT 16 (Upland Shallow Loamy Dry). Within ELT 16, soils are mapped as ELTPs 18A (1% to 6% slopes, well drained) and 18B (6% to 18% slopes, well drained) (Large Figure 12). The second most dominant soil type at the Mine Site is ELT 6 (Lowland Organic Acid to Neutral), which represents approximately 30% of the Mine Site. Within ELT 6, soils are primarily mapped as ELTP 24 (poorly drained) (Large Figure 12). Additional, less dominant soil types are also mapped at the Mine Site, as shown on Large Figure 12 and in Large Table 7. Poorly drained/Hydric and somewhat poorly drained/partially hydric soils make up approximately 43% of the Mine Site (Large Figure 12, Large Table 7).

The Plant Site is primarily situated on land disturbed from previous mining activities. As such, almost 80% of the soils in the Plant Site are mapped by the St. Louis County NRCS soil survey as the two disturbed soils, “Tailings Basin” map unit (1050; hydric status is unknown) and “Udorthents, loamy” map unit (1003B; hydric status is unknown) (Large Figure 12), Large Table 8). Udorthents are areas that have been stripped and are highly disturbed, such as cut-and-fill operations. Only 9% of the soils in the Plant Site are mapped as hydric or partially hydric; the hydric soil status is unknown for approximately 90% of the Plant Site (Large Table 8).

The St. Louis County NRCS mapped two soil types in the Railroad Connection Corridor. The Udorthents, loamy NRCS soil map unit (1003B, hydric status is unknown) represents approximately 79% of the Railroad Connection Corridor and the Pits, iron mine soil map unit (1049, hydric status is unknown) represents the remaining 21% of the Railroad Connection Corridor (Large Figure 12 and Large Table 9).

Five St. Louis County NRCS soil map units comprise over 70% of the Dunka Road and Utility Corridor, these include the Eaglesnest-Babbitt complex (F12B, partially hydric), Pits, iron mine (1049, hydric status is unknown), Eaglesnest-Wahlsten complex (F2B, hydric status is unknown), Dumps, iron mine (1048, hydric status is unknown), Udorthents, loamy (1003B, hydric status is unknown), and Babbitt boulder-Aquepts rubbly complex (F13A, partially hydric) (Large Table 9, Large Figure 12). Approximately 40% of the soils mapped within the Colby Lake Pipeline Corridor are hydric or partially hydric; the hydric soil status is unknown for approximately 54% of the corridor (Large Table 9).

Three main St. Louis County NRCS soil map units comprise over 75% of the Colby Lake Pipeline Corridor, these include the Eaglesnest-Babbitt complex (F12B, partially hydric), Udorthents, loamy (1003B, hydric status is unknown), and Tailings Basin (1050, hydric status is unknown) (Large Table 10). Additional soils mapped in the Colby Lake Pipeline Corridor units were found within this project area (Large Figure 12). Approximately 40% of the soils mapped within the Colby Lake Pipeline Corridor are hydric or partially hydric; the hydric soil status is unknown for approximately 51% of the corridor (Large Table 10).

11.2 Wetland Delineation and Classification Methods

Delineation and functional assessment of wetlands were conducted within each of the following Project areas: the Mine Site, Plant Site, Dunka Road and Utility Corridor, Railroad Connection Corridor, and the Colby Lake Pipeline Corridor (Large Figure 4).

Wetlands were delineated across the Project areas between 2004 and 2012; the following references summarize wetland delineations conducted throughout this time period (Reference (9), Reference (10), Reference (11), Reference (12), Reference (13), Reference (14), Reference (15), Reference (16)). Wetland delineations were performed according to the Routine On-Site Determination Method specified in the USACE Wetlands Delineation Manual (1987 Edition) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Reference (5)), and the requirements of the Minnesota Wetland Conservation Act (WCA) of 1991 (Reference (3), Reference (5)). The delineation was discussed with the Wetland IAP Workgroup, and the delineation was approved by the co-lead agencies as part of the Wetland IAP Workgroup on March 30, 2011 (Reference (33)).

Prior to conducting the various field delineations, numerous sources of existing information were gathered and reviewed to assist in developing a strategy for evaluating wetlands within the Project areas (Reference (14), Attachment A). Aerial photographs and other data were compiled for the area, some of which included:

- Farm Services Administration (FSA) true color aerial photographs between 2003 and 2010.
- FSA color infrared aerial photographs (2003 and 2008)
- USFWS National Wetland Inventory (NWI) Maps
- USFS Ecological Landtype soils data (where available)
- NRCS soils data for St. Louis County (where available)
- SNF USFS stand data Geographic Information System (GIS) shapefile (for the Mine Site)
- USGS topographic maps and digital elevation models
- DNR 2005 Color Infrared (CIR) photography stereo pairs with 60% overlap

Topographic contours and NWI maps were overlaid on true color and CIR FSA aerial photographs along with previously completed off-site preliminary wetland mapping. Attempts were made to field evaluate all areas mapped as wetlands by the NWI or by preliminary off-site mapping. Depressional areas and areas with relatively flat slopes were also evaluated to determine if wetlands were present.

Soil borings were placed in most of the wetlands to a depth of 6 to 18 inches below the ground surface. Representative soil samples from each boring were examined for hydric soil indicators. Soil colors (e.g., 10YR 4/2, etc.) were determined with the aid of a Munsell® soil color chart and noted on the Wetland Data Forms. In addition, vegetation data were collected within each wetland and adjacent upland.

Wetland boundaries were mapped in the field on large-scale (1-inch = 600 feet) FSA true color and CIR aerial photographs. Data points were collected with a Global Positioning System (GPS) where possible to verify wetland delineation locations, particularly in areas where aerial photo signatures were not distinct. The wetland boundaries were later digitized using ArcView© Geographic Information System software.

The delineated wetlands were classified using the Eggers and Reed Plant Community Classification System (Reference (6)), the USFWS Circular 39 Classification System (Reference (7)), and the USFWS Cowardin Classification System (Reference (8)).

11.3 Wetland Descriptions and Functional Assessment

Approximately 1,862 acres of wetland were identified across the Project areas (Mine Site, Plant Site, Railroad Connection Corridor, Dunka Road and Utility Corridor, Colby Lake Pipeline, and Second Creek (Large Table 1; Large Figure 4; Attachment A). The percentage (based on acreage) of Eggers and Reed (Reference (6)) wetland types identified in the Project areas include: coniferous bog (47%); alder thicket (17%); shallow marsh (14%); coniferous swamp (9%); deep marsh (8%); hardwood swamp (2%); sedge meadow (1%); open bog (1%); wet meadow (1%); shrub-carr (less than 1%); and shallow, open water (less than 1%).

11.3.1 Mine Site

A total of 87 wetlands covering approximately 1,297.8 acres have been identified within the Mine Site (Large Table 1; Large Figure 4; Attachment A). A total of seven wetlands, each over 50 acres in size within the Project area, comprise approximately 774 acres of wetlands within the Mine Site. There are an additional five wetlands, each over 20 acres in size within the Mine Site. Together, these 12 wetlands comprise 72% of the wetland area within the Mine Site.

The wetlands (based on acreage) in the Mine Site include coniferous bog (67%), alder thicket (13%), coniferous swamp (10%), shallow marsh (3%), sedge meadow (2%), open bog (1%), wet meadow (1%), hardwood swamp (1%), shrub-carr (less than 1%), and deep marsh (<1%).

Approximately 92% of the wetlands in the Mine Site are of high quality and 8% of wetlands are of moderate quality. High quality wetlands have low disturbance levels and high vegetative diversity and integrity. Moderate quality wetlands have impounded open water because of beaver dams and downstream culverts under Dunka Road or the railroad, are located adjacent to USFS roads, the Dunka Road Corridor, or the Railroad Connection Corridor.

11.3.2 Plant Site

The Plant Site includes the areas shown in Large Figure 6. Nearly the entire Plant Site has been disturbed by past mining activities.

11.3.2.1 Process Plant Area

No wetlands are present in the Process Plant area, which is typically called the plant at a mine that includes the buildings involved in the processing of materials and the surrounding area; this area encompasses both the Beneficiation and Hydrometallurgical processing buildings. There is a Plant Reservoir located east of the concentrator which is a concrete-lined basin located in an upland area at the north end of the Colby Lake pipeline. Its purpose was (and will be) to store and provide additional water for use at the Plant Site (Reference (14)).

11.3.2.2 Flotation Tailings Basin Area

A total of 52 wetlands covering approximately 257.8 acres were identified within the FTB area (Large Table 1; Large Figure 4). The wetlands (based on acreage) in the FTB area include deep marsh (49%), shallow marsh (39%), coniferous swamp (6%), alder thicket (5%), shrub-carr (1%), wet meadow (less than 1%), sedge meadow (less than 1%), hardwood swamp (less than 1%), and shallow, open water (less than 1%).

In the FTB, the landfill was closed by placing layers of LTVSMC tailings, a liner, and soil on top of the coal ash with the final covered area seeded and mulched. There is shallow drainage that flows on the southeastern side of the landfill, which was artificially created to facilitate drainage off the landfill (Large Figure 6). This 0.3-acre area is proposed as an incidental wetland under Minnesota Rules, part 8420.0930, subpart1 and Minnesota Rules, part 8420.0105, subpart 2, item D.

The wetlands in the FTB area have been previously impacted by LTVSMC tailings deposition, roads, and impoundment. The majority (88%) of wetlands within the FTB area are currently rated as low quality with low vegetative diversity/integrity. Approximately 12% of the wetlands are rated as moderate quality.

11.3.2.3 Hydrometallurgical Residue Facility

One shallow marsh wetland, covering 0.62 acres, was identified within the HRF area (Large Table 1; Large Figure 4).

In the HRF, there is a 28.56-acre area that was used during LTVSMC operations as an emergency process material storage basin for the Plant Site. The sediments in this basin consist of slimes, fine tailings, coarse tailings, and concentrate (Section 3.1 of Reference (27)). Because this area was used as area to contain taconite tailings discharge from the main LTVSMC Tailings Thickeners, and to contain accidental overflows, spillage, and floor drainage from the former LTVSMC Concentrator Building, this area is not classified as wetland.

An unpaved, gravel road is located along the north side of these wetlands along with small buildings and associated facilities used in the former LTVSMC operations.

11.3.3 Railroad Connection Corridor

A total of four wetlands covering 0.44 acres have been identified within the Railroad Connection Corridor (Large Table 1; Large Figure 4). Based on acreage, a total of 45% of the wetlands are alder thicket, 23% are shrub-carr, 16% are coniferous swamp, and 16% are shallow marsh.

All of the wetlands in the Railroad Connection Corridor are high quality. While these wetlands are moderately impacted by either a haul road or an existing railroad, they have high vegetative diversity/integrity.

11.3.4 Dunka Road and Utility Corridor

A total of 21 wetlands, encompassing 6.76 acres, have been identified within the Dunka Road and Utility Corridor (Large Table 1; Large Figure 4). The wetlands in the corridor (based on acreage) include alder thicket (56%), coniferous swamp (23%), coniferous bog (13%), and shallow marsh (8%).

These wetlands are currently located adjacent to Dunka Road and some of the wetlands have been previously logged. Wetlands in the western half of the corridor are located within areas previously disturbed by mining activities in the former LTVSMC operations. All of the wetlands are of high quality.

11.3.5 Colby Lake Pipeline Corridor

A total of 14 wetlands covering 6.99 acres were identified within the Colby Lake Pipeline Corridor (Large Figure 4). The wetlands in the corridor (based on acreage) include shallow marsh (37%), shrub-carr (24%), wet meadow (19%), deep marsh (14%), and alder thicket (6%).

The wetlands are located adjacent to an unpaved, gravel road and within a previously disturbed corridor. The majority of wetlands in this corridor are rated as low quality (93%), with the remaining wetland rated as moderate quality (7%).

11.3.6 Second Creek Area

The Second Creek area (Large Figure 9) overlaps parts of the FTB area and the Colby Lake Pipeline Corridor area (Large Figure 11 of Attachment A). An analysis of the Second Creek area was completed at the request of the Co-Lead Agencies during the FEIS. Of the 30 wetlands located in the Second Creek area, only 22 wetlands are unique to the Second Creek area (Large Figure 9). The remaining eight wetlands were discussed in Section 11.3.2 and Section 11.3.5.

A total of 22 unique wetlands covering 291.79 acres were identified within the Second Creek area (Large Figure 8 of Attachment A). The wetlands include alder thicket (44%), shallow marsh (36%), hardwood swamp (7%), deep marsh (5%), coniferous swamp (6%), shrub-carr (2%), and shallow, open water (less than 1%).

The wetlands are located adjacent to paved and unpaved, gravel roads within a disturbed area. All of the wetlands in the area are rated as low quality.

11.4 Wetland Impact Areas

Wetlands will be directly impacted within the construction footprint for the Project. The activities within this footprint will include construction of the features and supporting infrastructure as described in Section 5.2, Section 5.3, and Section 5.4.

Direct wetland impacts are defined as activities that result in filling or excavation within the boundaries of a wetland. Direct wetland impacts are summarized in this section; additional information is provided in Attachment A, Attachment B, and in the FEIS.

Direct Project impacts are expected to occur in 127 wetlands, covering approximately 903 acres (Large Table 2; Attachment A). The Mine Site will contain the majority of direct wetland impacts (83%), followed by the FTB area (16%), HRF (1%), Dunka Road and Utility Corridor (1%), and the Railroad Connection Corridor (less than 0.1%). No direct impacts are associated with the processing facilities area, the Colby Lake Pipeline Corridor, or the Second Creek area.

The direct Project wetland impacts will occur in the following Eggers and Reed wetland types (Reference (6)): coniferous bog (56%), alder thicket (12%), coniferous swamp (9%), shallow marsh (8%), deep marsh (8%), sedge meadow (3%), wet meadow (2%), hardwood swamp (1%), open bog (1%), and shrub-carr (less than 1%).

Indirect wetland impacts from wetland fragmentation by Project features (open pits, stockpiles, haulroads, etc.) were determined based on an analysis of the various factors that may contribute to potential fragmentation (Attachment A). Approximately 26.9 acres of wetland fragments were identified in the Mine Site and 0.5 acres of wetland fragments were identified in the FTB area (Table 5-1 and Table 5-2).

The majority of the wetland fragments in the Mine Site consist of coniferous bog (78%), followed by alder thicket (14%), coniferous swamp (7%), open bog (less than 1%), and sedge meadow (less than 1%). (Large Table 2). The majority of wetland fragments in the FTB area consist of shallow marsh (60%), followed by deep marsh (36%), coniferous swamp (4%), and alder thicket (less than 0.01%).

The Project is expected to result in direct and fragment (indirect) impacts to 127 wetlands, covering approximately 930.2 acres (Large Table 2). These wetland impacts within the Project areas consist of coniferous bog (56%), alder thicket (12%), coniferous swamp (9%), shallow marsh (8%), deep marsh (8%), sedge meadow (3%), wet meadow (2%), hardwood swamp (1%), open bog (1%), and shrub-carr (less than 1%).

11.4.1 Mine Site

Wetlands will be directly impacted within the construction footprint at the Mine Site. The activities within this footprint will include construction of the features and supporting infrastructure as described in Section 5.2 and Section 5.2.1.

There are 57 directly impacted or fragmented wetlands located in the Mine Site covering approximately 778 acres (Large Table 2; Large Figure 9). The total directly impacted wetlands include fill (37%), excavation (24%), or both fill and excavation (39%). Thirty-nine percent of the directly impacted wetlands are also impacted by wetland fragmentation. Based on acreage, three wetland types comprise 90% of the direct and fragmented wetland impacts in the Mine Site and include 523 acres of coniferous bog (67%), 99 acres of alder thicket (13%), and 72 acres of coniferous swamp (9%). In addition, 24 acres of sedge meadow (3%), 23 acres of shallow marsh (3%), 14 acres of wet meadow (2%),13 acres of hardwood swamp (2%), 8 acres of open bog (1%), less than 1 acre of shrub-carr (less than 1%), and less than 1 acre of deep marsh (less than 1%) will also be directly impacted or fragmented.

Approximately 95% of the impacted wetlands are rated high quality. Approximately 5% of the impacted wetlands are rated as moderate quality with the disturbances in these wetlands related to impoundment and proximity to roads.

11.4.2 Plant Site

Wetlands will be directly impacted within the construction footprint at the Plant Site. The activities within this footprint will include construction of the features and supporting infrastructure as described in Section 5.3.

11.4.2.1 Flotation Tailings Basin Area

Wetlands will be directly impacted within the construction footprint at the FTB area. The activities within this footprint will include construction of the features and supporting infrastructure as described in Section 5.3.1.

There are 44 directly impacted or fragmented wetlands located in the FTB area covering approximately 144 acres (Large Table 2). The wetland types that will be directly impacted or fragmented include 76 acres of deep marsh (52%), 46 acres of shallow marsh (32%), 12 acres of coniferous swamp (8%), 8 acres of alder thicket (5%), 1 acre of shrub-carr (1%), 1 acre of wet meadow (1%), less than 1 acre of sedge meadow (less than 1%), and less than 1 acre of hardwood swamp (less than 1%).

Wetlands in this area have been disturbed by previous mining activities in the former LTVSMC operations or by impoundments caused by beaver activity throughout the area. All of the directly impacted wetlands are disturbed by impoundment, fill, or ditches, and are low or moderate quality wetlands.

11.4.2.2 Hydrometallurgical Residue Facility

One wetland will be directly impacted within the construction footprint at the HRF. The activities within this footprint will include construction of the features and supporting infrastructure as described in Section 5.3.3.

There is one directly impacted wetland located in the HRF covering 0.62 acres (Large Figure 10). The type of direct wetland impact includes fill (100%). The wetland type that will be directly impacted includes shallow marsh (100%) which is a low quality wetland.

11.4.3 Railroad Connection Corridor

Wetlands will be directly impacted within the construction footprint at the Railroad Connection Corridor. The activities within this footprint will include construction of the features and supporting infrastructure as described in Section 5.4.2.

There are four directly impacted wetlands located in the Railroad Connection Corridor covering 0.44 acres (Large Table 2; Large Figure 11). The type of direct wetland impact is fill (100%). The wetland types that will be directly impacted include alder thicket (45%), shrub-carr (23%), coniferous swamp (16%), and shallow marsh (16%).

These wetlands have been moderately impacted by either a haul road or an existing railroad. All of the wetlands in this area are high quality.

11.4.4 Dunka Road and Utility Corridor

Wetlands will be directly impacted within the construction footprint at the Dunka Road and Utility Corridor. The activities within this footprint will include construction of the features and supporting infrastructure as described in Section 5.4.1.

There are 21 directly impacted wetlands located in the Dunka Road and Utility Corridor covering 6.76 acres (Large Table 2; Large Figure 11). The type of direct wetland impact is fill (100%). The wetland types that will be directly impacted include alder thicket (56%), coniferous swamp (23%), coniferous bog (13%), and shallow marsh (8%).

Some of the wetlands have been previously logged and wetlands in the western half of the corridor are located within areas previously disturbed by mining activities in the former LTVSMC operations. All of the wetlands are of high quality.

11.5 Potential Indirect Wetland Impacts

Potential indirect wetland impacts are summarized in this section; additional information is provided in Attachment A), and Attachment B, and in Reference (2). An analysis was conducted to establish an estimate of potential indirect wetland impacts; this analysis was based on the following six factors:

- Changes in wetland watershed areas (during operation and long-term closure)
- Groundwater drawdown resulting from open pit mine dewatering
- Groundwater drawdown resulting from operation of the FTB including groundwater seepage containment
- Changes in stream flow near the Mine Site and FTB and associated impacts to wetlands abutting the streams (during operation and long-term closure)

- Wetland fragmentation from Project elements such as open pits, stockpiles, haul roads, etc.
- Potential change in wetland water quality related to atmospheric deposition of dust and rail car spillage associated with Mine Site and FTB operations

The potential indirect wetland impact analysis was completed for the Mine Site, the Plant Site, the Dunka Road and Utility corridor, Railroad Connection Corridor, the Colby Lake Pipeline Corridor, and Second Creek between the toe of the Tailings Basin and County Road 666. Wetlands that were previously identified as directly impacted were excluded from this analysis. The methods used for the potential indirect wetland impact analysis are described in Attachment A and Attachment B. The change in wetland hydrology from groundwater drawdown at the Mine Site was assessed using two different methodologies; potential indirect wetland impacts are presented here using both methodologies. The "Attachment A" method is based on wetlands crossing analog impact zones (Attachment B), while the "Alternate" method is based on wetlands within analog impact zones (Section 5.2.1.2.2 of Attachment A and Section 5.2.3 of Reference (2)).

Each wetland was assessed to determine whether it could potentially be affected by any of the six factors listed above. A wetland could potentially be indirectly impacted by none of the factors, or up to a maximum of six factors. A potential indirect impact rating was developed based on the number of factors that may potentially affect a wetland – from No Impact (0 factors) to 6 (all six factors potentially indirectly impacting the wetland). Using this approach, no wetlands were rated as a 6 in this analysis. Wetlands potentially indirectly impacted by one or more factor are shown on Large Figure 9 through Large Figure 11 and in Section 5.2.3 of Reference (2).

The analysis was conducted in order to help identify wetlands that would be the focus of monitoring for potential indirect impacts. Therefore, wetlands selected for inclusion in the monitoring plan for the Project (Section 15.0) reflect the results of the potential indirect wetland impact analysis.

12.0 Special Considerations

This section provides information regarding the special considerations identified in Minnesota Rules, part 8420.0515.

12.1 Endangered and Threatened Species

PolyMet conducted database searches and field surveys to evaluate the presence of federal or state-protected wildlife and plant species in the vicinity of the Project; however, only state-listed species are discussed in this document. Special consideration may be necessary when evaluating Project impacts on individual species and/or their habitats. The database and field surveys conducted for the Project are further described in the following sections.

12.1.1 Wildlife

Wildlife surveys were conducted to assess the presence of federal or state-listed species in the vicinity of the Project; however, only state-listed (endangered and threatened) species are discussed here. Additional information on federally listed or state-special concern wildlife species documented during wildlife surveys is summarized in Reference (34) and Reference (2).

In the winter of 2000, wildlife surveys were conducted within the Mine Site and a one-mile radius surrounding the Mine Site, as shown on Figure 2-1 of Reference (35). Results of the winter 2000 wildlife surveys did not identify any state endangered or threatened wildlife species in the survey area.

In the summer of 2004, wildlife surveys were conducted on the Mine Site, north of Dunka Road, as identified on Figure 2-1 of Reference (36). Results of the summer 2004 wildlife surveys did not identify any state endangered or threatened wildlife species in the survey area.

Because no state endangered or threatened wildlife species have been documented within the Project area, adverse impacts to state endangered or threatened wildlife species are not anticipated.

12.1.2 Plant Species

PolyMet conducted several botanical studies in the vicinity of the Project to identify vascular plant species listed by the State of Minnesota as endangered or threatened. Species with these designations may involve special consideration or permitting if the Project should impact their populations and/or habitats. Take of a state threatened or endangered species may require a permit from DNR under Minnesota Rules, part 6212.1800. PolyMet will work with the DNR and other appropriate agencies to determine acceptable mitigation for directly impacted species.

Foth & Van Dyke and Associates, Inc. conducted a rare plant survey in Sections 2, 3, and 10 of Township 59N and Range 13W (Large Figure 2), in 1999, prior to on-site mineral exploration by PolyMet (Reference (37)). No state endangered or threatened vascular plant species were identified during this survey. Additional information on this vascular plant survey is available in Reference (37)) and Reference (2).

Professional botanist Cindy Johnson-Groh conducted surveys in Sections 2, 3, 10, 11, and 16 of Township 59N and Range 13W in July 2004 to assess the presence of *Botrychium* species in the vicinity of the Project (Large Figure 2) and (Reference (38)). No state endangered or threatened vascular plant species were identified during this survey. Additional information on this vascular plant survey, including the survey location and presence of state-special concern plant species, is available in Reference (38) and Reference (2).

Deborah Pomroy also completed a rare plant survey on the Mine Site in spring 2004, focusing on Sections 3, 4, 9, and 10 of Township 59N and Range 13W (Large Figure 2) (Reference (39)). No state endangered or threatened vascular plant species were identified during this survey. Additional information on this vascular plant survey is available in Reference (39) and Reference (2).

Gary Walton also completed a rare plant survey on the Mine Site in spring 2004, focusing on Sections 1, 2, 11, and 12 of Township 59N and Range 13W (Large Figure 2) (Reference (40)). This survey documented one state endangered vascular plant species, *Caltha natans* (floating marsh marigold). *Caltha natans* was documented in five locations in the Mine Site (Sections 1, 10, and 12 of Township 59N, Range 13W) and in eight locations adjacent to the Mine Site (Sections 1, 11, and 12 of Township 59N, Range 13W). One *Caltha natans* population is located in the south end of the Category 2/3 Waste Rock Stockpile (Large Figure 2); as such, adverse impacts to this *Caltha natans* population is likely and PolyMet may need a permit from the DNR under Minnesota Rules, part 6212.1800 for direct impacts to this *Caltha natans* population. PolyMet will work with the DNR and other appropriate agencies to determine acceptable mitigation for directly impacted species. Additional information on this vascular plant survey, including the presence of state-special concern plant species, is available in Reference (40) and Reference (2).

Daniel Jones of Barr completed a field survey for *Botrychium* species along the internal road network at the Mine Site and along Dunka Road for the length of the Mine Site (Large Figure 16 of Reference (41)). No state endangered or threatened vascular plant species were identified during this survey. Additional information on this vascular plant survey, including the presence of state-special concern plant species, is available in Reference (41) and Reference (2).

Daniel Jones of Barr conducted a sensitive plant survey in June and July 2008 along Dunka Road and the proposed pipeline alignment from the west end of the Mine Site to the Plant Site (Large Figure 5 and Large Figure 6 of (Reference (42)). No state endangered or threatened vascular plant species were identified during this survey. Additional information on this vascular plant survey, including the presence of state-special concern plant species, is available in Reference (42) and Reference (2).

Midwest Natural Resources Inc. (MNRI) completed rare plant surveys in 2008 in Sections 3, 4, 5, and 9 of Township 59N and Range 13W (Large Figure 2 of (Reference (43)). No state endangered or threatened vascular plant species were identified during this survey. Additional information on this vascular plant survey, including the presence of state-special concern plant species, is available in Reference (43) and Reference (2).

Daniel Jones of Barr completed a field survey for *Botrychium* species around the tailings basin at the Plant Site in 2017 (Large Figure 2 of Reference (44). No state endangered or threatened vascular plant species were found at the Plant Site.

Barr queried the DNR Natural Heritage Information System (NHIS) database in June 2017 to determine whether any additional state threatened or endangered species had been recorded in the Project areas. The NHIS database indicates that *Caltha natans* is the only state threatened or endangered species documented in the Project areas.

Because impacts are unavoidable in one Project location that currently supports a state endangered vascular plant species population, *Caltha natans*, a takings permit application was submitted to the DNR in October 2017 (Reference (17)).

12.2 Historic Resources

As part of the NHPA Section 106 review process for the Project, historic properties were identified within the APE (Large Figure 13). All properties identified within the APE have been evaluated to determine their eligibility for inclusion in the NRHP. The Erie Mining Company Mining Landscape Historic District is eligible for inclusion in the NRHP and is generally comprised of Hoyt Lakes (the company town), the Plant Site, the Taconite Harbor shipping facility, as well as other infrastructure such as rail lines. The part of the District that lies within the APE includes contributing and individually eligible properties, such as the Concentrator Building.

Spring Mine Lake Sugarbush, the Partridge River segment of the Beaver Bay to Lake Vermillion Trail, and the Partridge River section of Mesabe Widjiu are eligible for inclusion in the NRHP. It has been determined that the Project would have an adverse effect on the Erie Mining Company Mining Landscape Historic District, the Spring Mine Lake Sugarbush, the Partridge River Segment of the Beaver Bay to Lake Vermillion Trail, and the Partridge River section of Mesabe Widjiu.

Measures to resolve adverse effects are being developed through consultation. An MOA resolving adverse effects was executed on December 27, 2016 and the NHPA process was completed prior to issuance of federal approvals for the Project (Reference (45)). Additional details on historic resources are presented in Sections 4.2.9 and 5.2.9 of Reference (2).

12.3 Rare Natural Communities

In February 2017, DNR and Board of Water and Soil Resources (BWSR) jointly issued Technical Guidance (Reference (46)) on the application of the term "rare natural communities" as employed in Minnesota Rules, part 8420.0515, subpart 3. The Technical Guidance was updated in November 2017 (Reference (47)). PolyMet applied the Technical Guidance to determine whether any of the wetland communities at the Mine Site qualified as rare natural communities and, if so, how any effects on those communities could be mitigated.

12.3.1 Identification of Rare Natural Communities

The Mine Site is located in the Laurentian Mixed Forest Province (Reference (48); Large Figure 14). Within the Laurentian Mixed Forest Province, the Mine Site is situated in the Northern Superior Uplands section and the Laurentian Uplands subsection (Reference (48); Large Figure 14). The DNR has mapped upland and wetland native plant communities across approximately 8% (506,771 acres) of the Northern Superior Uplands section and approximately 23% (128,142 acres) of the Laurentian Uplands subsection (Reference (49) and Reference (50); Large Figure 14). The DNR has mapped native plant communities across approximately 75% (2,270 acres) of the Mine Site (Reference (50); Large Figure 14).

The DNR data (Reference (50)) indicates that there are 13 ecological systems (e.g., Acid Peatland System; APn) mapped across the Northern Superior Uplands section and Laurentian Uplands Subsection. Within those 13 ecological systems, the DNR has mapped 47 native plant community classes (e.g., APn80) across the Northern Superior Uplands section and 34 native plant community classes across the Laurentian Uplands subsection (Reference (50)). The DNR has also mapped several native plant community complexes (e.g., Alder Swamp/Forested Peatland Complex) across the Northern Superior Uplands section and the Laurentian Uplands subsection (Reference (50)).

Within the Mine Site, the DNR mapped four ecological systems, containing eight native plant community classes, as well as three native plant community complexes (Reference (50)). Table 12-1 summarizes the acreage of each of these native plant community classes and complexes at the Mine Site and across the Northern Superior Uplands section and Laurentian Uplands Subsection. These eight native plant community classes and three native plant community complexes represent approximately 70% of the native plant communities mapped across the Northern Superior Uplands section and approximately 87% of the native plant communities mapped across the Laurentian Uplands Subsection.

Table 12-1 Native Plant Community Classes and Complexes Common to the Northern Superior Uplands Section, Laurentian Uplands Subsection, and the Mine Site

Native Plant Community Classes Mapped by the DNR on the Mine Site	Northern Superior Uplands Section (DNR acres mapped)	Laurentian Uplands Subsection (DNR acres mapped)	Mine Site (DNR acres mapped)
APn80/81 (Northern Spruce Bog/Northern Poor Conifer Swamp)(1)	53,040.5	22,045.9	482.3
APn91 (Northern Poor Fen)	8,377.4	5,317.3	1.6
FDn32/43 (Northern Poor Dry-Mesic Mixed Woodland/Northern Mesic Mixed Forest)(2)	197,790.4	44,887.1	1,342.1
FPn62 (Northern Rich Spruce Swamp)	23,602.1	16,223.0	225.0
FPn63 (Northern Cedar Swamp)	19,393.2	6,673.5	0
FPn73 (Northern Rich Alder Swamp)	12,364.7	1,373.8	50.1
WFn55 (Northern Wet Ash Swamp)	4,150.6	340.3	0
WMn82 (Northern Wet Meadow/Carr)	7,924.5	2,309.0	0.2
Complex Community: Beaver Wetland/Marsh(3)	12,035.5	1,705.8	59.6
Complex Community: Forested Peatland/Upland Transition	8,703.0	7,367.2	91.9
Complex Community: Alder Swamp/Forested Peatland	8,362.6	3,576.4	17.6
Impervious	0	0	0
Unmapped	5,463,309	439,151	746
Total Area(4)	5,970,080	567,293	3,015

(1) APn80 and APn81 were grouped during mapping.
(2) FDn32 and FDn43 were grouped during mapping.
(3) DNR complex is mapped as “Beaver Wetland Complex.” While Barr mapped these communities as “Marsh Complex”.
(4) Numbers may not total due to rounding.

Using information in DNR’s NHIS, PolyMet determined that one wetland community within the boundaries of the NorthMet project area—FPn62, Northern Rich Spruce Swamp (Basin)—has received a conservation status rank (S3) warranting its consideration as a possible rare natural community. A technical memorandum was compiled of the forested wetland native plant communities mapped by DNR in the Northern Superior Uplands Section, Laurentian Uplands Subsection, and Mine Site (Attachment C). The Technical Guidance explains that if the NHIS data layers identify such qualifying native plant communities, those communities “should be evaluated further” under the Technical Guidance. During this further evaluation, “the concept of rarity is explored separately, as part of the landscape context factor, in determining whether a plant community is a rare natural community."

Applying the instructions in the Technical Guidance, PolyMet evaluated further whether FPn62 qualifies as a "rare natural community" in light of the Landscape Context at the Mine Site, the Northern Superior Uplands section, and the Laurentian Uplands subsection. In making its assessment, PolyMet followed the Technical Guidance by considering: (1) the effect of "surrounding land uses"; (2) "[t]he presence and abundance of the same native plant community type within or near the project site"; (3) the plant community's rarity "at local, regional and statewide scales"; and (4) "[t]he currency and completeness of data about the affected native plant community, including known and potential occurrences in areas that have not yet been surveyed."

12.3.1.1 Surrounding Land Uses

The surrounding land uses at the Mine Site are well known. They include an active taconite mine, the inactive LTV processing facility, active railroad lines, and an active mine road. The influence of surrounding land uses on the continued viability of native plant communities varies widely depending on the proximity and nature of the feature and the type of native plant community. The FPn62 communities at the site are located far enough away from mine features and transportation corridors that those land uses do not have any effect on the health of the communities. This factor accordingly does not weigh in favor of a rare natural community designation.

12.3.1.2 Presence and Abundance

DNR data document the "presence and abundance" of FPn62 at the Mine Site. DNR has mapped approximately 225 acres of FPn62 at the Mine Site, which accounts for 32% of the just over 700 acres of wetland forest native plant community classes that have been mapped at the Mine Site. In other words, FPn62 is both present and abundant at the Mine Site. This landscape context factor therefore weighs against a finding that the FPn62 community at the Mine Site qualifies as a rare natural community.

12.3.1.3 Rarity at Local, Regional, and Statewide Scales

On a larger scale, FPn62 again fails to meet rarity criteria. As of 2016, DNR had identified 71 relevés of FPn62 in northeastern Minnesota. DNR has mapped a total of 16,223 acres of FPn62 in the Laurentian Uplands Subsection, which amounts to 31% of the total acreage of wetland forest native plant community classes mapped in that subsection. The 225 acres of FPn62 on the Mine Site is just 1.4% of the FPn62 acreage in the subsection. In the far larger Northern Superior Uplands Section, DNR has identified 23,602 FPn62 acres, 16.9% of the total acreage of wetland forest native plant community classes mapped. Those numbers make FPn62 the most commonly mapped wetland forest native plant community class in the Laurentian Uplands Subsection and the second-most commonly mapped wetland forest native plant community class in the Northern Superior Uplands Section.

Even recognizing that, as the Technical Guidance explains, DNR has focused its mapping work on “potential candidates for designation” as rare natural communities, the prevalence of FPn62 at the Mine Site, in the Laurentian Uplands Subsection, and in the Northern Superior Uplands Section strongly suggests that it is not a rare natural community in the context of the Project.

12.3.1.4 Currency and Completeness of Data

To address the final listed landscape context factor—“known and potential occurrences in areas that have not yet been surveyed”—PolyMet’s consultants conducted field work. Recognizing that only about 23% of the Laurentian Uplands Subsection has been mapped (and just 8% of the Northern Superior Uplands Section), PolyMet’s consultants worked to identify unmapped locations where FPn62 might occur. Based on a review of aerial photographs, the consultants visited a few relatively accessible public lands. This field work led to identification of 5 unmapped FPn62 communities in a 6-mile stretch of public land adjacent to Stony River Forest Road in the Laurentian Uplands Subsection (Attachment C). Separately, the consultants found one unmapped FPn62 community near the NorthMet plant site and two unmapped FPn62 communities west of Biwabik, all within the Nashwauk Uplands Subsection. These readily accessible communities underscore that FPn62 communities are not “rare” in the common sense meaning of the term.

12.3.1.5 Conclusion

NHIS data layers show that the Mine Site is home to one native wetland plant community—FPn62—that meets the screening criteria for further evaluation as a rare natural community. However, consideration of landscape context factors strongly weighs against such a finding. FPn62 is not especially rare at the Mine Site, or on a larger scale. Further investigation also indicates that FPn62 exists in multiple places not yet mapped in NHIS data layers. For these reasons, FPn62 is not a rare natural community in the context of the Mine Site.

12.3.2. Permanent Adverse Effects on Rare Natural Communities

In addition to providing instructions on identification of rare natural communities, the 2017 DNR-BWSR Technical Guidance also addresses “general factors . . . to consider in determining when a proposed project will permanently adversely affect a rare natural community.” The Technical Guidance explains that whether a project “permanently adversely affects” a rare natural community “is a site-specific determination that involves the analysis of a number of factors . . . .” In that context, and in the larger context of Minnesota Rule 8420.0515, PolyMet understands the phrase “permanently adversely affect” to mean an irreversible harm to the natural community’s existence in Minnesota.

For reasons discussed above, PolyMet has concluded that there are no rare natural communities at the Mine Site. PolyMet's project therefore will not permanently adversely affect any rare natural communities. In the event that DNR concludes FPn62 is a rare natural community, PolyMet's project will not permanently adversely affect it.

As already mentioned, DNR has mapped 23,602 acres of FPn62 in Northern Superior Uplands section, including 16,223 acres in the Laurentian Uplands subsection. The approximately 225 acres of FPn62 at the Mine Site accordingly make up less than 1% of the mapped FPn62 acreage in the Northern Superior Uplands section. Even after the NorthMet Mine is fully constructed, there will still be 23,377 unaffected acres—over 36.5 square miles—of FPn62 in the Northern Superior Uplands Section. Therefore, the Project does not threaten to destroy FPn62 communities as a whole within the Northern Superior Uplands section, much less the entire state of Minnesota.

The factors listed in the Technical Guidance—permanence of the impact, scope of the impact, ongoing and future impacts—reinforce the common-sense conclusion that a project affecting under 1% of the FPn62 communities in the Northern Superior Uplands section will not "permanently adversely affect" those communities.

To the extent that DNR concludes FPn62 may qualify as a rare natural community, PolyMet has extensive compensatory mitigation, which is described in Section 14. To the extent DNR determines that additional, more specific mitigation is necessary, it could include PolyMet providing funding for additional rare natural communities mapping in northern Minnesota.

12.4 Special Fish and Wildlife Resources

Special fish and wildlife resources in the vicinity of the Project include a documented record of a colonial waterbird nesting area, approximately 2,600 feet south-southeast of the northeast corner of the Tailings Basin, which was documented in the DNR NHIS database and wildlife travel corridors. The colonial waterbird nesting area, which was last observed in 1991, was primarily composed of blue heron (*Ardea herodias*). There is no recent evidence that the nest site (rookery) is still present and in use 25 years after the initial observation in 1991. The NHIS database information does not list any subsequent observations of a heron rookery at the documented location. Barr biologists have conducted numerous vegetation and other natural resource surveys in the near vicinity of the documented location, and have not observed an active heron rookery, or evidence of heron nests. According to geospatial data sources available through the Minnesota Geospatial Commons (Reference (51)), no other special fish and wildlife resources have been identified in the Project area (Mine Site, Plant Site, or Transportation and Utility Corridors). As such, the Project is not anticipated to have significant adverse impacts on special fish and wildlife resources.

Studies conducted in 2006 by Emmons & Olivier Resources (Reference (52)) and in 2009 by Barr (Reference (53)) identified wildlife habitat and travel corridors along the Mesabi Iron Range, and assessed the cumulative effects from past, present, and reasonably foreseeable projects on those corridors. The Emmons & Olivier report identified 13 wildlife corridors, and the Barr report identified 18 corridors. In both reports, a "wildlife corridor" was identified as a vegetated area that allows passage back and forth across the Iron Range, avoiding the various mining features (e.g., pits, stockpiles, tailings basins) that are impediments to wildlife movement along the Iron Range.

There are three wildlife corridors in the vicinity of the Project. All three are well outside of proposed Project activities, and none of them will be reduced, restricted, or otherwise altered from their current conditions. Therefore, no existing wildlife corridors will be affected by the Project.

12.5 Groundwater Sensitivity

Groundwater models used to predict the potential effects on water quality from the Project (Mine Site, Plant Site, and Transportation and Utility Corridors) indicate that with the proposed engineering controls, the Project would not cause any significant adverse effects on groundwater quality (Executive Summary and Section 5.2.2 of Reference (2)). For additional details, see Sections 5.2.2.3.2 and 5.2.2.3.3 of Reference (2).

12.6 Sensitive Surface Waters

No outstanding resource value waters listed under Minnesota Rules, part 7050.0355 are present in the Project area (Mine Site, Plant Site, or Transportation and Utility Corridors). Wyman Creek, which intersects the Transportation and Utility Corridors, is a Minnesota-listed trout stream. As discussed in Sections 4.2.2 and 4.2.6 of Reference (2), Wyman Creek would not be in the direct drainage of the Project. As such, it is anticipated that the Project will not adversely affect Wyman Creek or other sensitive surface waters.

12.7 Education or Research Use

Wetlands known to be used for educational or research purposes are not present in the Project area; as such, the Project will not impact these resources.

12.8 Waste Disposal Sites

As discussed in Section 4.2.1.3 and 4.2.1.4 of Reference (2), for the Mine Site and Transportation and Utility Corridors, there are no waste disposal sites or activities that involve the use of hazardous materials. The Plant Site and existing LTVSMC Tailings Basin are located in a brownfield area dominated by the existing facilities and infrastructure of the former LTVSMC taconite processing plant. In 2002, Cliffs Erie conducted a Phase I Environmental Site Assessment (Phase I ESA) of the former LTVSMC taconite processing plant and identified 62 potential Areas of Concern (AOCs). The legacy contamination discussion in Section 4.2.1.4.2 of Reference (2) provides the status of these AOCs.

All Project-related activities involving known or potential hazardous wastes or contaminants would be conducted according to applicable federal and state standards, as discussed in Chapter 3 of Reference (2).

12.9 Consistency with Other Plans

Table 12-2 identifies the existing local land use plans, zoning, and comprehensive plans within the Project area (Mine Site, Plant Site, or Transportation and Utility Corridors). As summarized in Section 5.2.1 of Reference (2), the Project activities are consistent with the formally adopted local land use plans, zoning, and comprehensive plans. No local water management plans or watershed management plans have been identified within the vicinity of the Project area.

Table 12-2 Existing Land Use Plans and Zoning

Plan	Mine Site	Plant Site	Transportation and Utility Corridor
City of Hoyt Lakes Zoning Ordinance		X	X
City of Babbitt Zoning Ordinance	X		X
City of Babbitt Comprehensive Land Use Plan	X		X
St. Louis County Comprehensive Land Use Plan	X	X	X
Land and Resource Management Plan for Superior National Forest	X		X
1854 Treaty Authority	X	X	X

13.0 Shoreline Impact Zones

There are no wetland impacts within 1,000 feet of a lakeshore for the Project. There are three wetlands within the Dunka Road and Utility Corridor located near streams that will be directly impacted. Two alder thicket (Type 6) wetlands are located within 300 feet of Longnose Creek and will have 0.14 acres (Wetland ID 392) and 0.34 acres (Wetland ID 862) of fill. One alder thicket (Type 6) wetland is located within 300 feet of Wyman Creek and will have 0.07 acres (Wetland ID 1124) of fill.

14.0 Wetland Mitigation

Wetlands that are directly impacted and impacted by fragmentation will be replaced and mitigated by credit purchase from an off-site wetland bank. PolyMet will purchase wetland bank credits in BSA #1, in the St. Louis River watershed, prior to construction of the Project.

Wetland mitigation will be accomplished by purchasing compensatory mitigation credits from an off-site wetland bank (Table 14-1). Preference for the bank selection follows the preferential sequencing for mitigation banking per the USACE St. Paul District Policy for Compensatory Mitigation in Minnesota (Reference (18)). Under that policy, the preference is that wetland mitigation banks under consideration be located in the Bank Service Area (BSA) #1, which is the BSA where the Project wetland impacts would occur.

Wetlands that are directly impacted and impacted by fragmentation will be replaced and mitigated by credits purchased from an off-site wetland bank (Table 14-1). PolyMet will purchase wetland bank credits in BSA #1, in the St. Louis River watershed, prior to construction of the Project.

The wetland bank that was approved by the USACE is summarized in Table 14-1. PolyMet would purchase wetland bank credits from this bank prior to construction. The bank document is provided in Attachment D.

Table 14-1 Wetland Bank Information

Wetland Bank Account Number	Minor Watersheds	Major Watershed	County	Bank Service Area Number	Number of Credits (ac)	Number of Credits (sq ft)
1609	Stone Creek (3089) Paleface River (3070) Whiteface River (3071) Whiteface River (3072)	St. Louis River (4)	St. Louis	1	1,800	78,408,000

14.1 State WCA Wetland Mitigation Overview

Based on the WCA wetland mitigation standards (Minnesota Rules, part 8420.0522, subpart 4), the mitigation credits are proposed at a ratio of one mitigation credit to one acre of wetland impact (1:1). The rationale for this proposal is that the mitigation credits will be purchased from a wetland bank (Table 14-1) within the same BSA as the project wetland impacts, all of which are in a greater than 80% area. See Large Table 5 for wetland replacement in accordance with the WCA using established wetland bank credits.

14.2 Federal CWA Wetland Mitigation Overview

PolyMet is working with the USACE St. Paul District to ascertain how many wetland bank credits will satisfy federal requirements. Based on the St. Paul District policy for wetland mitigation, the base ratio for compensation of wetland impacts is 1.5:1. Utilizing wetland bank credits located within the Project BSA allows for a 0.25:1 reduction from the base compensation ratio. Providing wetland bank credits of the same wetland type as the impacted wetlands (using the modified Eggers and Reed plant community classification system) allows for a 0.25:1 reduction from the base compensation ratio. Finally, compensatory wetland mitigation that is established in advance of the impacts, which is typically the case for wetland bank credits, also allows for a 0.25:1 reduction from the base compensation ratio, but no less than a ratio of 1:1. A draft guidance document from the St. Paul District USACE for the Project states that an increase in the base ratio to 2:1 may be required for certain wetland types, but no details are provided for established wetland bank credits containing mature plant communities of the same type as the impacts (Reference (54)). The proposed credits for wetland mitigation using the USACE mitigation policy ratios for the Project are summarized in Large Table 6. A final decision on this compensation ratio has not yet been made. Any credits obtained are available for additional wetland impacts occurred under WCA.

15.0 Wetland Monitoring

15.1 Pre-Project Wetland Hydrology Monitoring Sites

Pre-Project hydrology monitoring of wetlands and groundwater within and surrounding the proposed mine has been conducted since 2005 at well locations approved by the USACE and DNR. Hydrology data collected from 2005-2009 are presented in reports submitted to the USACE and the DNR (Reference (55), Reference (56), Reference (57)). During 2008 through 2011, there were 21 locations monitored for hydrology (Large Figure 15 and Large Figure 16; Reference (55)). During 2012-2016, there were 61 locations monitored for hydrology (Large Figure 15, Large Figure 16, and Large Figure 17). Baseline vegetation pre-project monitoring was completed in 2015 in the wetlands that are currently monitored for hydrology. The hydrology monitoring and vegetation monitoring protocols are described in Attachment E.

The primary objectives of the Pre-Project wetland hydrology monitoring study since 2005 have been to:

- gain a better understanding of the wetland hydrology at the Project site, i.e., defining whether specific wetlands are recharging the surficial deposits aquifer or are discharging to surface waters

- collect baseline hydrology data that could be used to assess the effect of the Project on wetland hydrology

- review the data collected in the hydrogeologic study along with the wetland hydrology data to determine whether specific wetlands have perched water tables or are in direct hydrologic connection with the surficial deposits aquifer

- determine the potential for indirect wetland impacts resulting from the Project

The Pre-Project monitoring locations will be utilized for future monitoring during mining activities. At the Mine Site, four existing monitoring wells were removed (Wells 3, 17, 18, and 19; Large Figure 15) because they were located within areas of direct project impacts.

The pre-project wetland hydrology monitoring study from 2005-2016 has followed the protocols described in the June 24, 2005 *Wetland Hydrology Study Plan* (Reference (58)), the May 13, 2008 *Addendum to Wetland Hydrology Monitoring Plan* (Reference (59)), and the April 12, 2010 *Addendum to Wetland Hydrology Monitoring Plan* (Reference (60)), and Attachment E). Monitoring of the wells started in 2005 and will continue throughout the Project in accordance with the plans (Reference (58), Reference (59), and Reference (60)), and Attachment E).

Monitoring wells include either a recording well with an automatic water level data recorder or a manual well for manual data collection, which were often paired with recording wells. The manual well data were used to validate the general trends of the recording well data. Manual well data were collected twice per month in 2007 and once per month in 2008, 2009, and 2010. Electronic well data were collected every 2 to 4 hours from 2007 through 2010. Starting in 2008, all monitoring locations were instrumented with recording wells so water levels could be recorded every 2 to 4 hours during the growing season. The monitoring wells were typically installed to a depth of 2 to 5 feet below the ground surface; additional details on installation are provided in the monitoring plans (Reference (58), Reference (59), and Reference (60)) and in the monitoring reports (Reference (55), Reference (56), and Reference (57)).

15.2 Wetland Hydrology Monitoring Sites Installed in 2014

In 2014, hydrology monitoring wells were installed at 33 additional monitoring locations that were identified as having the potential for indirect wetland impacts using the potential wetland impact factor rating (from 0-6) in the potential indirect wetland impact analysis discussed in Section 11.5 and Section 5.2.3 of Reference (2).

At the Mine Site, hydrology monitoring wells were installed in 2014 at 25 monitoring locations (Wells 25 through 48; Large Figure 9 and Large Figure 15). Twenty-four wells are located within wetlands that have impact factor ratings of 1, (9 wells), 2 (7 wells), 3 (6 wells), and 4 (2 wells) at the Mine Site. The 25th well is located within a reference wetland (Well Ref3).

Within the FTB area, hydrology monitoring wells were installed in 2014 at six monitoring locations (Wells TB9 through TB14; Large Figure 10 and Large Figure 16). The monitoring wells were installed within wetlands with impact factor ratings of 1 (1 well), 2 (2 wells), and 3 (2 wells). The monitoring locations include a variety of wetland community types and occur throughout all areas of potential indirect impacts (Large Figure 10 and Large Figure 16).

Within the Transportation and Utility Corridors, hydrology monitoring wells were installed in 2014 at three monitoring locations (Wells 41 through 43; Large Figure 11 and Large Figure 17) within wetlands that have impact factor ratings of 1.

Shallow water table monitoring wells were installed in 2014 at each of the wetland monitoring locations depicted in Large Figure 16, and Large Figure 17. Each monitoring location has one recording well; if any wells are damaged, those will be replaced as soon as practical to maintain data continuity.

Hydrologic monitoring will continue at the monitoring locations and at reference wetland locations every year throughout the growing season for the life of the mine operation, and may continue through closure of the Project. If it is determined that certain wells are not providing useful information, the monitoring may be modified with the concurrence of the USACE and DNR. Monitoring wells will be installed following well installation methods described in the Technical Standard for Water-Table Monitoring of Potential Wetland Sites (Reference (61)).

15.3 Reference Wetland Hydrology Monitoring Sites

Pre-project monitoring locations include five reference wetlands approved by the USACE and DNR to document the natural hydrologic fluctuations in wetlands that will not be affected by the Project. The reference wetland data will be used to facilitate interpretation of the Project hydrologic data. Within the Mine Site, hydrology monitoring wells were installed in 2008 and 2014 in reference wetlands (Large Figure 15, Large Figure 17). Within the FTB area, hydrology monitoring wells were installed in 2010 and 2014 in reference wetlands (Large Figure 16).

15.4 Wetland Vegetation Monitoring

In February 2016, a comprehensive monitoring plan for the Project was developed (Attachment E) that describes the monitoring plan for potential indirect wetland impacts, and incorporated the vegetation and hydrology monitoring plans. Pre-project baseline vegetation monitoring was conducted in June 2015 adjacent to each of the 61 hydrology monitoring wells at the Mine Site, Tailings Basin, and reference wetlands. The vegetation monitoring plots are 10-meters by 10-meters in non-forested communities and 20-meters by 20-meters in forested and shrub-dominated communities. Vegetation monitoring plots were located with a hand held GPS unit with sub-foot horizontal accuracy. The plots were located at all monitoring locations, including reference wetlands.

Vegetation monitoring will be conducted every five years by a qualified ecologist or botanist. A vegetation inventory will be conducted within each permanent vegetation monitoring plot during June or July, when most plant species will be identifiable. At least 90% of the plant taxa will be inventoried and the percent cover estimated within each plot. All vascular plants occurring within the plots will be identified at least to genus level and preferably to species.

Baseline vegetation data will be used to document potential shifts in vegetation that are inconsistent with changes documented in the reference wetlands.

15.5 Wetland Boundary Monitoring

Information on the wetland delineation is discussed in Section 11.2. As described in Reference (62) and Attachment E, portions of the monitored wetlands will be reviewed every five years concurrent with the vegetation monitoring to evaluate potential changes in wetland boundaries. Wetland boundaries will be field-delineated and located using a GPS with sub-foot horizontal accuracy. The field-based delineation will map at least 10% of the wetland boundary at each of the wetlands with monitoring locations (Large Figure 15, Large Figure 16, and Large Figure 17). The boundaries will be mapped on a rotating basis to include 10% of the wetland boundary every 5 years. A transect composed of at least two wetland delineation sample points will be completed along a section of the boundary reviewed in each of the monitored wetlands.

The delineation data will be compiled to map the boundary of each of the wetlands with monitoring locations. Based on the portion of the wetland that is delineated, the whole wetland boundary will be mapped using desktop review of current aerial photography, topography (LIDAR or site-specific data), and hydrology monitoring data. The results will be reported to the USACE and DNR at the end of each year of monitoring.

15.6 Potential Indirect Wetland Impacts

The hydrology, vegetation, and wetland boundary monitoring data collected as part of this monitoring program will be evaluated to determine if an adverse, potential indirect wetland impact has occurred as a result of the Project' construction and operation. Triggers that may indicate the need for additional monitoring or adaptive management are outlined in Attachment E and are based on the following threshold levels:

- A 50% reduction of the baseline wetland hydrology hydroperiod. Antecedent precipitation and reference wetland hydrology will be considered in the evaluation of wetland hydrology hydroperiod. The hydroperiod of a wetland is equal to the length of time and portion of the year the wetland holds ponded water or saturation within 12 inches of the soil surface. This period of time generally varies from year-to-year based on climatic conditions. Therefore, the judgment of surpassing this threshold will be evaluated considering the baseline pre-project monitoring data for each wetland conducted from 2005-2016.

- A change in vegetation species and/or cover, inconsistent with vegetation changes in the reference wetlands, such as: a 25% change in species richness; a 25% change in living tree cover; appearance of non-native invasive species where none were previously recorded, or a 25% increase in non-native invasive cover or number of species where non-native invasive species were previously recorded; or a 25% reduction of native hydrophytes. Other factors may contribute to changes in vegetation (disturbances or species introductions) that may be unrelated to changes in wetland hydrology or the nearby Project; such factors would be considered, if appropriate.

- Loss of wetland area (as defined by the wetland boundary determination) that is inconsistent with wetland area loss at reference wetlands.

These threshold levels will be evaluated with consideration of the Project activities and likelihood that such Project activities are responsible for the changes. Should adverse, indirect wetland impacts be identified during the monitoring program, an estimation of such impacts will be included in the monitoring report in the year that they are first detected. The data for hydrology, vegetation, and wetland boundary monitoring will be compiled in a report, including methods, results, and evaluation of potential adverse indirect wetland impacts, which will be submitted to the USACE and DNR by the end of each monitoring year.

15.7 Wetland Monitoring Plan for Potential Indirect Wetland Impacts

There has been pre-Project wetland monitoring and there will be monitoring throughout the construction and operation phases to determine whether wetlands are indirectly impacted by Project activities. Wetland monitoring is being conducted for the Project to provide baseline data to use in identifying potential indirect impacts to wetlands that may be caused by Project activities. Monitoring is currently being conducted within wetlands identified as having a potential indirect wetland impact factor rating of 3, 4, and 5 and a sampling of those wetlands with factor ratings of 1 and 2 (Attachment A). Hydrology, vegetation, and wetland boundaries will continue to be monitored, documented, and compared with baseline monitoring and reference wetlands to determine if indirect impacts occur during the construction and operations phases. A total of 56 wetland monitoring wells and five reference wells (61 total locations) have been installed to collect baseline hydrology data and to document potential indirect wetland impacts. The monitoring protocol is provided in the Monitoring Plan for Potential Indirect Wetland Impact (Attachment E). This monitoring will continue for the period necessary to evaluate potential indirect impacts, though portions of the monitoring design may be altered to improve the design or to eliminate unnecessary data collection.

15.8 Indirect Wetland Impact Mitigation

If indirect wetland impacts, based on the criteria of Section 15.6, occur and adaptive management has not been successful to avoid and minimize them, PolyMet will work with the USACE and DNR to respond, which may include the option to provide compensatory mitigation from a wetland bank for any unavoidable documented indirect impacts. This may require the revision of or development of another complete wetland replacement plan.

Compensatory mitigation would be based on the St. Paul District USACE Policy for wetland mitigation (Reference (18)) and as described in Section 14.0 for the USACE and the DNR. Compensatory loss of wetland area may be mitigated in accordance with the mitigation ratios of direct wetland impacts described in Section 14.1. Partial drainage or other changes to the wetlands, that do not result in the wetland loss but are above the threshold levels established in Section 15.6, may be mitigated at a lower ratio depending on the extent and degree of the changes to wetland function.

15.9 Adaptive Plan

An adaptive approach will be used to evaluate the most effective monitoring strategy for potential indirect effects. The monitoring plan will be updated annually based on results from the previous year. The monitoring plan criteria will be included in the Wetland Management Plan, which will contain all criteria and permit conditions. If indirect impacts are observed, additional monitoring may be developed to focus in those areas and/or to focus on a specific impact factor. Additional monitoring may include new monitoring locations in other wetlands and more detailed delineation and vegetation data collection.

The adaptive monitoring plan will be incorporated in two phases. Phase I of the adaptive monitoring plan will be broad-based monitoring to identify changes to wetlands or changes that may affect wetlands or surface waters. Phase II monitoring may be implemented to provide a more detailed assessment in a given area to analyze a potential impact factor. If necessary, the Phase II monitoring will be designed and implemented as needed to address the changes identified in Phase I monitoring. Phase II will be used to determine the need for additional mitigation or to develop a plan to control the changes identified in Phase I and minimize future impacts to wetlands.

15.10 Reporting

Wetland hydrology monitoring will continue at the monitoring locations and at reference wetland locations every year throughout the growing season for the life of the mine. If it is determined that certain wells are not providing useful information, the monitoring may be modified with the approval of the USACE and DNR.

Wetland monitoring data will be submitted to the USACE and DNR annually for the life of the mine. Wetland hydrology data will be presented every year to show monitoring locations, hydrographs, and analysis of wetland hydrologic conditions in the context of precipitation conditions. Vegetation and wetland boundary data will be presented every five years and will be used to determine the acreage of impacts and potential indirect impacts that are not evident based on hydrologic data. Indirect impacts will be assessed in the annual reports to the extent possible. Acreage of indirect impacts will be determined, if any, and will be used to determine the requirements for wetland mitigation credits, if such credits are needed. If compensatory mitigation is necessary, credits will be proposed in the annual report.

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Large Table 1 Summary of Wetlands

Project Area[1,2]	Aquatic Resource Type	Aquatic Resource ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Fragmentation Impact (acres)	Remaining Wetland Area (acres)	Dominant Existing Plant Community Type(s) in Impact Area[3]	Wetland Quality	Type of Direct Impact[4]	Duration of Impact[5]	County, Major Watershed #, and Bank Service Area # of Impact Area[6]
Mine Site	Wetland	1	3	0.42	0	0	0.42	Shallow marsh	Moderate			
Mine Site	Wetland	3	3	0.35	0	0	0.35	Shallow marsh	Moderate			
Mine Site	Wetland	5	2	0.61	0.61	0	0	Wet meadow	High	F	P	SLC, 3,1
Mine Site	Wetland	6	3	0.62	0	0	0.62	Shallow marsh	Moderate			
Mine Site	Wetland	7	2	0.07	0	0	0.07	Wet meadow	Moderate			
Mine Site	Wetland	8	2	6.80	6.80	0	0	Sedge meadow	Moderate	F,E	P	SLC, 3,1
Mine Site	Wetland	9	3	1.80	0.07	0	1.73	Shallow marsh	High	F	P	SLC, 3,1
Mine Site	Wetland	10	2	1.17	0	0	1.17	Sedge meadow	High			
Mine Site	Wetland	11	8	8.88	0	0	8.88	Coniferous bog	High			
Mine Site	Wetland	12	6	0.13	0	0	0.13	Alder thicket	High			
Mine Site	Wetland	13	4	5.03	0.09	0	4.94	Deep marsh	High	F	P	SLC, 3,1
Mine Site	Wetland	14	2	0.33	0.33	0	0	Wet meadow	High	F	P	SLC, 3,1
Mine Site	Wetland	16	3	0.31	0	0	0.31	Shallow marsh	High			
Mine Site	Wetland	18	3	18.9	18.90	0	0	Shallow marsh	High	E	P	SLC, 3,1
Mine Site	Wetland	19	3	1.68	0.05	0	1.63	Shallow marsh	High	E	P	SLC, 3,1
Mine Site	Wetland	20	2	17.06	16.96	0.1	0	Sedge meadow	High	E, Fr	P	SLC, 3,1
Mine Site	Wetland	22	3	1.43	0	0	1.43	Shallow marsh	High			
Mine Site	Wetland	22A	7	0.89	0	0	0.89	Coniferous swamp	High			
Mine Site	Wetland	24	6	0.80	0.39	0	0.41	Alder thicket	High	E	P	SLC, 3,1
Mine Site	Wetland	25	8	1.95	0	0	1.95	Coniferous bog	High			
Mine Site	Wetland	27	8	1.07	1.07	0	0	Coniferous swamp	Moderate	E	P	SLC, 3,1
Mine Site	Wetland	29	3	12.02	0	0	12.02	Shallow marsh	High			
Mine Site	Wetland	32	8	73.36	70.99	2.37	0	Coniferous bog	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	33A	6	18.46	5.77	0	12.69	Alder thicket	High	E	P	SLC, 3,1
Mine Site	Wetland	33B	7	4.56	0	0	4.56	Coniferous swamp	High		P	SLC, 3,1
Mine Site	Wetland	37	6	2.39	2.39	0	0	Shrub-carr	High	F	P	SLC, 3,1
Mine Site	Wetland	43	6	8.29	7.26	0	1.03	Alder thicket	High	F	P	SLC, 3,1
Mine Site	Wetland	44	6	3.27	1.99	0	1.28	Alder thicket	High	E	P	SLC, 3,1
Mine Site	Wetland	45	6	37.55	28.83	3.58	5.14	Alder thicket	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	47	8	0.54	0.40	0.14	0	Open bog	High	F, Fr	P	SLC, 3,1
Mine Site	Wetland	48	8	89.16	27.8	1.86	59.50	Coniferous bog	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	48A	7	2.65	2.19	0.02	0.43	Coniferous swamp	High	F, Fr	P	SLC, 3,1
Mine Site	Wetland	51	6	7.47	7.45	0.02	0	Alder thicket	High	F, Fr	P	SLC, 3,1
Mine Site	Wetland	52	6	3.88	3.88	<0.01	0	Alder thicket	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	53	6	18.59	0	0	18.59	Alder thicket	High			
Mine Site	Wetland	53A	7	2.35	0	0	2.35	Coniferous swamp	High			
Mine Site	Wetland	53B	7	0.43	0	0	0.43	Coniferous swamp	High			
Mine Site	Wetland	53C	7	2.88	0	0	2.88	Coniferous swamp	High			
Mine Site	Wetland	54	7	4.11	0	0	4.11	Coniferous swamp	High			
Mine Site	Wetland	54C	6	0.74	0	0	0.74	Alder thicket	High			

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Mine Site	Wetland	55	6	3.91	3.85	0.06	0	Alder thicket	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	56	8	2.79	2.79	0	0	Open bog	High	E	P	SLC, 3,1
Mine Site	Wetland	57	7	78.06	50.49	1.41	26.16	Coniferous swamp	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	58	6	34.58	0	0	34.58	Alder thicket	High			
Mine Site	Wetland	60	6	6.71	6.71	0	0	Alder thicket	High	F	P	SLC, 3,1
Mine Site	Wetland	61	7	0.45	0	0	0.45	Coniferous swamp	High			
Mine Site	Wetland	62	8	12.13	0	0	12.13	Coniferous bog	High			
Mine Site	Wetland	64	7	0.31	0	0	0.31	Hardwood swamp	High			
Mine Site	Wetland	68	7	23.81	10.89	0.09	12.83	Coniferous swamp	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	72	7	1.39	0	0	1.39	Coniferous swamp	High			
Mine Site	Wetland	74	7	6.12	6.12	0	0	Hardwood swamp	High	E	P	SLC, 3,1
Mine Site	Wetland	76	8	3.92	2.21	0	1.71	Coniferous bog	High	E	P	SLC, 3,1
Mine Site	Wetland	77	8	13.01	0.92	<0.01	12.09	Coniferous bog	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	78	8	1.75	1.75	0	0	Coniferous bog	High	F	P	SLC, 3,1
Mine Site	Wetland	79	8	2.39	0	0	2.39	Coniferous bog	High			
Mine Site	Wetland	80	8	0.29	0	0	0.29	Coniferous bog	High			
Mine Site	Wetland	81	7	1.68	1.44	0.24	0	Coniferous swamp	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	82	8	62.4	60.77	1.63	0	Coniferous bog	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	83	8	3.99	0	0	3.99	Open bog	High			
Mine Site	Wetland	84	8	1.33	0	0	1.33	Coniferous bog	High			
Mine Site	Wetland	85	8	1.41	1.41	0	0	Coniferous bog	High	E	P	SLC, 3,1
Mine Site	Wetland	86	8	2.47	0	0	2.47	Coniferous bog	High			
Mine Site	Wetland	88	8	5.58	2.84	0	2.74	Coniferous bog	High	F	P	SLC, 3,1
Mine Site	Wetland	90	8	176.08	34.22	0	141.86	Coniferous bog	High	F,E	P	SLC, 3,1
Mine Site	Wetland	90A	8	7.91	1.20	0	6.71	Open bog	High	F	P	SLC, 3,1
Mine Site	Wetland	95	8	2.54	2.54	0	0	Coniferous swamp	High	E	P	SLC, 3,1
Mine Site	Wetland	96	8	17.30	13.14	0	4.16	Coniferous bog	High	F,E	P	SLC, 3,1
Mine Site	Wetland	97	8	4.46	2.57	1.89	0	Coniferous bog	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	98	8	15.50	15.07	0.42	0	Coniferous bog	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	99	8	1.40	0.49	0	0.91	Coniferous bog	High	F,E	P	SLC, 3,1
Mine Site	Wetland	100	8	176.19	102.96	3.44	69.79	Coniferous bog	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	100A	6	1.66	1.66	0	0	Alder thicket	High	F	P	SLC, 3,1
Mine Site	Wetland	101	8	14.21	11.73	0.08	2.40	Coniferous bog	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	103	8	118.84	109.97	8.86	0	Coniferous bog	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	104	8	3.57	1.82	0.10	1.65	Coniferous bog	High	F, Fr	P	SLC, 3,1
Mine Site	Wetland	105	8	15.48	0	0	15.48	Coniferous bog	High			
Mine Site	Wetland	107	8	40.92	31.63	0.10	9.19	Coniferous bog	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	107A	7	1.74	1.69	0.05	0	Coniferous swamp	High	F,E, Fr	P	SLC, 3,1
Mine Site	Wetland	107B	3	4.51	2.89	0	1.62	Shallow marsh	High	F,E	P	SLC, 3,1
Mine Site	Wetland	107C	6	27.6	27.60	0	0	Alder thicket	High	E	P	SLC, 3,1
Mine Site	Wetland	114	8	0.73	0.73	0	0	Coniferous bog	High	F	P	SLC, 3,1

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Mine Site	Wetland	120	3	0.58	0.12	0	0.46	Shallow marsh	Moderate	E	P	SLC, 3,1
Mine Site	Wetland	200	7	6.36	6.36	0	0	Hardwood swamp	High	F	P	SLC, 3,1
Mine Site	Wetland	201	2	13.49	13.49	0	0	Wet meadow	High	F	P	SLC, 3,1
Mine Site	Wetland	202	8	3.11	3.11	0	0	Open bog	High	F	P	SLC, 3,1
Mine Site	Wetland	552	8	8.72	8.72	0	0	Coniferous bog	High	F	P	SLC, 3,1
Mine Site	Wetland	567	3	1.40	1.40	0	0	Shallow marsh	High	F	P	SLC, 3,1
MINE SITE SUBTOTAL		**87**		**1297.78**	**751.52**	**26.46**	**519.77**		**80/87 High 7/87 Moderate**			
Railroad Connection Corridor	Wetland	1038	7	0.07	0.07	0	0	Coniferous swamp	High	F	P	SLC, 3,1
Railroad Connection Corridor	Wetland	R-3	6	0.10	0.10	0	0	Shrub-carr	High	F	P	SLC, 3,1
Railroad Connection Corridor	Wetland	R-4	6	0.20	0.20	0	0	Alder thicket	High	F	P	SLC, 3,1
Railroad Connection Corridor	Wetland	R-5	3	0.07	0.07	0	0	Shallow marsh	High	F	P	SLC, 3,1
RAILROAD CONNECTION CORRIDOR SUBTOTAL		**4**		**0.44**	**0.44**	**0**	**0**		**4/4 High**			
Dunka Road and Utility Corridor	Wetland	22B	3	0.34	0.34	0	0	Shallow marsh	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	22C	6	0.38	0.38	0	0	Alder thicket	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	54A	7	0.60	0.60	0	0	Coniferous swamp	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	54B	6	0.13	0.13	0	0	Alder thicket	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	54D	7	0.09	0.09	0	0	Coniferous swamp	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	390	6	0.41	0.41	0	0	Alder thicket	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	392	6	0.14	0.14	0	0	Alder thicket	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	394	7	0.64	0.64	0	0	Coniferous swamp	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	395	7	0.01	0.01	0	0	Coniferous swamp	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	396	6	0.65	0.65	0	0	Alder thicket	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	400	8	0.14	0.14	0	0	Coniferous bog	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	553	7	0.09	0.09	0	0	Coniferous swamp	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	554	7	0.11	0.11	0	0	Coniferous swamp	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	569	6	0.68	0.68	0	0	Alder thicket	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	716	6	0.02	0.02	0	0	Alder thicket	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	814	8	0.75	0.75	0	0	Coniferous bog	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	862	6	0.78	0.78	0	0	Alder thicket	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	1034	6	0.02	0.02	0	0	Alder thicket	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	1035	6	0.16	0.16	0	0	Alder thicket	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	1124	6	0.44	0.44	0	0	Alder thicket	High	F	P	SLC, 3,1
Dunka Road and Utility Corridor	Wetland	R-7	3	0.18	0.18	0	0	Shallow marsh	High	F	P	SLC, 3,1
DUNKA ROAD AND UTILITY CORRIDOR SUBTOTAL		**21**		**6.76**	**6.76**	**0**	**0**		**21/21 High**			
FTB	Wetland	251	6	1.43	1.43	0	0	Alder thicket	Moderate	C	P	SLC, 3,1
FTB	Wetland	272	4	1.11	1.10	0.01	0	Deep marsh	Low	C, Fr	P	SLC, 3,1
FTB	Wetland	278	6	1.04	0.23	0	0.81	Alder thicket	Low	C	P	SLC, 3,1
FTB	Wetland	279	6	4.84	3.33	<0.01	1.51	Alder thicket	Low	C, Fr	P	SLC, 3,1

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FTB	Wetland	282	3	14.25	7.42	0	6.83	Shallow marsh	Moderate	C	P	SLC, 3,1
FTB	Wetland	284	6	2.92	2.51	0	0.41	Alder thicket	Low	C	P	SLC, 3,1
FTB	Wetland	290	7	0.48	0.37	0.02	0.10	Coniferous swamp	Moderate	F,E, Fr	P	SLC, 3,1
FTB	Wetland	292	4	1.71	1.71	0	0	Deep marsh	Low	C	P	SLC, 3,1
FTB	Wetland	307	3	0.78	0.78	0	0	Shallow marsh	Low	C	P	SLC, 3,1
FTB	Wetland	308	4	7.17	2.91	0	4.26	Deep marsh	Low	C	P	SLC, 3,1
FTB	Wetland	309	2	0.02	0.02	0	0	Wet meadow	Low	C	P	SLC, 3,1
FTB	Wetland	312	6	1.98	1.33	0	0.65	Shrub-carr	Low	C	P	SLC, 3,1
FTB	Wetland	314	3	24.87	6.01	0	18.86	Shallow marsh	Low	C	P	SLC, 3,1
FTB	Wetland	572	4	7.33	0.02	0	7.31	Deep marsh	Moderate	C	P	SLC, 3,1
FTB	Wetland	573	3	0.12	0	0	0.12	Shallow marsh	Low			
FTB	Wetland	582	4	27.49	8.11	0	19.38	Deep marsh	Low	C	P	SLC, 3,1
FTB	Wetland	585	6	1.58	0	0	1.58	Alder thicket	Low			
FTB	Wetland	586	4	1.89	1.53	0	0.36	Deep marsh	Low	C	P	SLC, 3,1
FTB	Wetland	587	3	0.97	0.17	0	0.80	Shallow marsh	Low	C	P	SLC, 3,1
FTB	Wetland	590	3	5.43	5.38	0	0.05	Shallow marsh	Low	C	P	SLC, 3,1
FTB	Wetland	591	4	2.71	0.7	0	2.01	Deep marsh	Low	C	P	SLC, 3,1
FTB	Wetland	593	4	9.80	8.47	0.15	1.18	Deep marsh	Low	C, Fr	P	SLC, 3,1
FTB	Wetland	594	4	0.06	0	0	0.06	Deep marsh	Low			
FTB	Wetland	595	4	2.14	1.09	0.01	1.04	Deep marsh	Low	F, Fr	P	SLC, 3,1
FTB	Wetland	811	7	0.20	0.20	0	0	Coniferous swamp	Low	C	P	SLC, 3,1
FTB	Wetland	968	7	13.76	11.37	0	2.40	Coniferous swamp	Low	C	P	SLC, 3,1
FTB	Wetland	1027	6	0.20	0	0	0.20	Alder thicket	Moderate			
FTB	Wetland	1125	2	0.07	0.07	0	0	Sedge meadow	Low	C	P	SLC, 3,1
FTB	Wetland	1126	7	0.69	0.69	0	0	Hardwood swamp	Low	C	P	SLC, 3,1
FTB	Wetland	1134	3	14.45	8.73	0.02	5.70	Shallow marsh	Low	C, Fr	P	SLC, 3,1
FTB	Wetland	1135	4	0.51	0	0	0.51	Deep marsh	Low			
FTB	Wetland	1139	3	20.25	2.54	0	17.71	Shallow marsh	Low	C	P	SLC, 3,1
FTB	Wetland	1155	3	0.55	0.41	0.15	0	Shallow marsh	Low	C, Fr	P	SLC, 3,1
FTB	Wetland	1156	3	14.49	11.08	0.06	3.35	Shallow marsh	Low	C, Fr	P	SLC, 3,1
FTB	Wetland	1159	3	0.05	0	0.05	0	Shallow marsh	Low	Fr	P	SLC, 3,1
FTB	Wetland	1160	5	0.85	0	0	0.85	Deep water	Low			
FTB	Wetland	1176	7	0.34	0	0	0.34	Hardwood Swamp	Moderate			
FTB	Wetland	P10	6	0.34	0	0	0.34	Alder thicket	Low			
FTB	Wetland	T1	4	1.93	0.11	0	1.82	Deep marsh	Low	F	P	SLC, 3,1
FTB	Wetland	T2	4	0.90	0.90	0	0	Deep marsh	Low	F	P	SLC, 3,1
FTB	Wetland	T3	2	0.09	0.09	0	0	Wet meadow	Low	F	P	SLC, 3,1
FTB	Wetland	T4	2	1.02	1.02	0	0	Wet meadow	Low	F	P	SLC, 3,1
FTB	Wetland	T5	2	0.24	0.24	0	0	Wet meadow	Low	F	P	SLC, 3,1
FTB	Wetland	T6	6	0.07	0.07	0	0	Shrub-carr	Low	F	P	SLC, 3,1
FTB	Wetland	T7	3	0.92	0.92	0	0	Shallow marsh	Low	F	P	SLC, 3,1

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FTB	Wetland	T10	4	1.48	1.48	0	0	Deep marsh	Low	F	P	SLC, 3,1
FTB	Wetland	T11	4	0.95	0.95	0	0	Deep marsh	Low	F	P	SLC, 3,1
FTB	Wetland	T12	3	0.39	0.39	0	0	Shallow marsh	Low	F	P	SLC, 3,1
FTB	Wetland	T13	4	1.05	0.97	0	0.08	Deep marsh	Low	F	P	SLC, 3,1
FTB	Wetland	T13A	4	12.72	0.16	0	12.56	Deep marsh	Low	F	P	SLC, 3,1
FTB	Wetland	T14	4	45.20	45.20	0	0	Deep marsh	Low	E	P	SLC, 3,1
FTB	Wetland	T15	3	1.70	1.70	0	0	Shallow marsh	Low	F	P	SLC, 3,1
FTB SUBTOTAL		**52**		**257.53**	**143.91**	**0.47**	**113.18**		**6/52 Moderate** **46/52 Low**			
HRF	Wetland	1159	3	0.62	0.62	0	0	Shallow marsh	Low	F	P	SLC, 3,1
HRF SUBTOTAL		**1**		**0.62**	**0.62**	**0**	**0**		**1/1 Low**			
Colby Lake Water Pipeline Corridor	Wetland	P1	4	0.23	0	0	0.23	Deep marsh	Low			
Colby Lake Water Pipeline Corridor	Wetland	P2	6	0.03	0	0	0.03	Shrub-carr	Low			
Colby Lake Water Pipeline Corridor	Wetland	P3	3	0.25	0	0	0.25	Shallow marsh	Low			
Colby Lake Water Pipeline Corridor	Wetland	P4	6	1.28	0	0	1.28	Shrub-carr	Low			
Colby Lake Water Pipeline Corridor	Wetland	P5-1	4	0.77	0	0	0.77	Deep marsh	Low			
Colby Lake Water Pipeline Corridor	Wetland	P5-2	3	0.14	0	0	0.14	Shallow marsh	Low			
Colby Lake Water Pipeline Corridor	Wetland	P6	3	0.18	0	0	0.18	Shallow marsh	Low			
Colby Lake Water Pipeline Corridor	Wetland	P7-1	3	0.11	0	0	0.11	Shallow marsh	Low			
Colby Lake Water Pipeline Corridor	Wetland	P7-2	3	1.90	0	0	1.90	Shallow marsh	Low			
Colby Lake Water Pipeline Corridor	Wetland	P8	2	0.07	0	0	0.07	Wet meadow	Low			
Colby Lake Water Pipeline Corridor	Wetland	P9	2	1.28	0	0	1.28	Wet meadow	Low			
Colby Lake Water Pipeline Corridor	Wetland	P10	6	0.41	0	0	0.41	Alder thicket	Low			
Colby Lake Water Pipeline Corridor	Wetland	P11	6	0.03	0	0	0.03	Shrub-carr	Low			
Colby Lake Water Pipeline Corridor	Wetland	P12	6	0.31	0	0	0.31	Shrub-carr	Moderate			
COLBY LAKE WATER PIPELINE CORRIDOR SUBTOTAL		**14**		**6.99**	**0**	**0**	**6.99**		**1/14 Moderate 13/14 Low**			
Second Creek	Wetland	1031	4	2.06	0	0	2.06	Deep marsh	Low			
Second Creek	Wetland	1161	4	9.41	0	0	9.41	Deep marsh	Low			
Second Creek	Wetland	1162	3	40.84	0	0	40.84	Shallow marsh	Low			

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Second Creek	Wetland	1163	7	14.8	0	0	14.80	Hardwood swamp	Low			
Second Creek	Wetland	1164	6	8.23	0	0	8.23	Alder thicket	Low			
Second Creek	Wetland	1165	7	6.25	0	0	6.25	Hardwood swamp	Low			
Second Creek	Wetland	1166	3	28.04	0	0	28.04	Shallow marsh	Low			
Second Creek	Wetland	1167	3	2.88	0	0	2.88	Shallow marsh	Low			
Second Creek	Wetland	1168	5	0.36	0	0	0.36	Shallow, open water	Low			
Second Creek	Wetland	1169	3	4.92	0	0	4.92	Shallow marsh	Low			
Second Creek	Wetland	1170	4	3.32	0	0	3.32	Deep marsh	Low			
Second Creek	Wetland	1171	6	3.87	0	0	3.87	Shrub-carr	Low			
Second Creek	Wetland	1172	3	1.96	0	0	1.96	Shallow marsh	Low			
Second Creek	Wetland	1173	5	0.93	0	0	0.93	Shallow, open water	Low			
Second Creek	Wetland	1174	6	118.75	0	0	118.75	Alder thicket	Low			
Second Creek	Wetland	1175	7	16.82	0	0	16.82	Coniferous swamp	Low			
Second Creek	Wetland	P1A	4	0.61	0	0	0.61	Deep marsh	Low			
Second Creek	Wetland	P2A	6	0.43	0	0	0.43	Shrub-carr	Low			
Second Creek	Wetland	P3A	3	24.24	0	0	24.24	Shallow marsh	Low			
Second Creek	Wetland	P4A	6	0.29	0	0	0.29	Shrub-carr	Low			
Second Creek	Wetland	P5-1A	4	0.03	0	0	0.03	Deep marsh	Low			
Second Creek	Wetland	P5-2A	3	2.75	0	0	2.75	Shallow marsh	Low			
SECOND CREEK SUBTOTAL		**22**		**291.79**	**0**	**0**	**291.79**		**22/22 Low**			
PROJECT TOTAL		**201**		**1,861.91**	**903.25**	**26.93**	**931.73**		**105/201 High** **14/201 Moderate** **82/201 Low**			

(1) The Project areas include the Mine Site, Railroad Connection Corridor, Dunka Road and Utility Corridor, Flotation Tailings Basin (FTB), Hydrometallurgical Residue Facility (HRF), Colby Lake Water Pipeline Corridor, and Second Creek.

(2) All wetlands are located in St. Louis County, Major Watershed #3 – St. Louis County, and Bank Service Area (BSA) #1.

(3) Information is from the *Wetland Plants and Plant Community Types of Minnesota and Wisconsin* 3rd Ed. as modified in MN Rules 8420.0405 Subp. 2.

(4) The types of wetland impacts include excavation (E), fill (F), fragmentation (Fr), and containment system (C).

(5) The duration of the impacts include permanent (P) or temporary (T).

(6) The impacts are located in St. Louis County (SLC), Major watershed #3, Bansk Servie Area #1.

Large Table 2 Summary of Wetland Impacts[1]

Project Area	Circular 39 Wetland Classification	1	2	2	3	4	5	6	6	7	7	8	8		
	Eggers and Reed Wetland Community	Seasonally Flooded	Fresh (Wet) Meadow	Sedge Meadow	Shallow Marsh	Deep Marsh	Shallow, Open Water	Shrub-Carr	Alder Thicket	Hardwood Swamp	Coniferous Swamp	Open Bog	Coniferous Bog	Deepwater	Wetland Total
Mine Site	Direct Impact (acres)	0	14.43	23.76	23.43	0.09	0	2.39	95.39	12.48	70.31	7.50	501.74	0	751.52
	Fragmentation Impacts (acres)	0	0	0.10	0	0	0	0	3.66	0	1.81	0.14	20.75	0	26.46
	# of impacted wetlands	0	3	2	6	1	0	1	11	2	7	4	20	0	57
Railroad Connection Corridor	Direct Impact (acres)	0	0	0	0.07	0	0	0.10	0.20	0	0.07	0	0	0	0.44
	Fragmentation Impacts (acres)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	# of impacted wetlands	0	0	0	1	0	0	1	1	0	1	0	0	0	4
Dunka Road and Utility Corridor	Direct Impact (acres)	0	0	0	0.52	0	0	0	3.81	0	1.54	0	0.89	0	6.76
	Fragmentation Impacts (acres)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	# of impacted wetlands	0	0	0	2	0	0	0	11	0	6	0	2	0	21
FTB Area	Direct Impact (acres)	0	1.37	0.07	45.53	75.41	0	1.40	7.50	0.69	11.94	0	0	0	143.91
	Fragmentation Impacts (acres)	0	0	0	0.28	0.17	0	0	0	0	0.02	0	0	0	0.47
	# of impacted wetlands	0	4	1	13	16	0	2	4	1	3	0	0	0	44
HRF	Direct Impact (acres)	0	0	0	0.62	0	0	0	0	0	0	0	0	0	0.62
	Fragmentation Impacts (acres)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	# of impacted wetlands	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Colby Lake Water Pipeline Corridor	Direct Impact (acres)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fragmentation Impacts (acres)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	# of impacted wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Second Creek	Direct Impact (acres)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fragmentation Impacts (acres)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	# of impacted wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	(acres)	0	15.80	23.93	70.45	75.67	0	3.89	110.56	13.17	85.69	7.64	523.38	0	930.18

(1) Wetland impacts include direct wetland impacts (903.25 acres) and indirectly fragmented wetlands (26.93 acres).

Large Table 3 Summary of Reduced Aquatic Ecosystem Impacts Based on Draft Alternative Development

Refinement made from Alternatives Evaluation	Project Aspects Changed	Environmental Impact Reduced
Mine Site Alternative in Draft EIS adopted as part of Project and refined based on additional drilling and engineering with Category 1 Stockpile Groundwater Containment System	Only Category 1 Waste Rock Stockpile is permanent – all other stockpiles relocated to the East Pit	Three permanent stockpiles and all associated long-term impacts were eliminated. Also, the highest sulfur rock will be backfilled into the East Pit and stored subaqueously.
	Move Temporary Category 4 Waste Rock Stockpile to be above Central Pit and Central Pit rescheduled so that floor of pit above East Pit backfill during operations	Reduce wetland impacts
	Eliminate a stockpile by combining the Category 2 and Category 3 waste rock into one stockpile, having a Category 4 Waste Rock Stockpile, and processing the lean ore as ore	Reduce wetland impacts
	Revise haul roads to reduce wetland fragmentation	Reduce wetland impacts
	Category 1 waste rock in East Pit or Category 1 Waste Rock Stockpile	Category 1 Waste Rock Stockpile can be closed, and cover system construction can begin in Mine Year 14 - less water flow through the pile once the cover is constructed.
	Replace Category 1 liner with Groundwater Containment System and pump collected water to WWTS	Capture and treat virtually all water from stockpile
	Maximize use of Category 1 rock and overburden for construction in above liner or below the water table applications	Any water that contacts these materials will be captured and treated, or used in an application where the redox conditions will not change
	Minor changes in pit and stockpile footprints due to updated drilling	Reduce wetland impacts
Category 1 Stockpile Cover System	ET cover system replaced with membrane cover system	Minimize long-term water flow through the stockpile

Waste Water Treatment System (WWTS)	Plan for sulfate treatment during operations and upgrade to Reverse Osmosis (RO) for long term	Project discharge meets current wild rice standard
New Concentrate Shipping Building near the Additive Plant with dewatering by filter instead of dryer	New dewatering equipment and required concentrate storage will not fit in existing building; alternate location evaluated	New building on previously disturbed ground = no wetland impacts
Relocate Hydrometallurgical Residue Facility	Move Hydrometallurgical Residue Facility from south end of Cell 2W to the Emergency Basin	Eliminate concerns about liner failure on location that is still settling and provide a virtually zero leakage liner system
FTB Seepage Containment System	Vertical wells on north side of FTB replaced by trench/barrier system on north and west sides	Capture and treat virtually all groundwater and surface seepage from FTB
Enhanced FTB Pond Cover (liner)	Additional bentonite amendment to further reduce seepage - results in routine overflow in closure	Further reduce seepage
Waste Water Treatment System (WWTS)	Pumping of excess water to Partridge River replaced by RO treatment of excess water also cleans up FTB pond to allow overflow in closure	Project discharge meets current wild rice standard
Adaptive Water Management Plan (AWMP)	Formal plan to adaptively manage water in operations, reclamation, and long-term closure via financially assured fixed and adaptive engineering controls that relies on mechanical treatment but has the ultimate objective of non-mechanical treatment in the long term	Provides a high degree of certainty in achieving water quality objectives based on proactive management; lessens impacts in the long term with low maintenance non-mechanical treatment

Abbreviations:
AWMP = Adaptive Water Management Plan
FTB = Flotation Tailings Basin
RO = reverse osmosis
WWTS = Waste Water Treatment System

Large Table 4 Adjoining Landowners

Owner Name	Mailing Address
Allete Inc.	30 West Superior Street Duluth, MN 55802
Blandin Paper Company	115 Southwest 1st Street Grand Rapids, MN 55744
Cliffs Erie LLC	c/o Cliffs Natural Resources, Inc. 200 Public Square, Suite 3100 Cleveland, OH 44114-2315
Cliffs Mining Services Company	4870 Waisanen Road PO Box 115 Embarrass, MN 55732
Cole, Bill C.	Marjorie A. Contos 129 West Anoka Street Duluth, MN 55803 or Marjorie Alison Contos Living Trust c/o US Bank Duluth-Trust 130 West Superior Street Duluth, MN 55802
Contos, M Alison et al.	NorthShore Mining Company James R. Korpi, CEO 10 Outer Drive Silver Bay, MN 55614
Cyprus Northshore Mining Corporation	115 Southwest 1st Street Grand Rapids, MN 55744
DuNord Land Company, LLC	William Blundin, Manager 138 East 65th Street New York, NY 10065
Erickson, William	1328 East 41st Street Hibbing, MN 55746
Glacier Park Company	1011 Western Avenue Seattle, WA 98104
Hilden, Teri	6309 Coyote Trail Lino Lakes, MN 55014
JER Minerals, Inc.	605 West 37th Street Hibbing, MN 55746
Johnson Minerals, Inc.	Peter J. Johnson, CEO 2214 Birch Point Road Tower, MN 55790

Owner Name	Mailing Address
Joki, Floyd E.	7607 North Skarp Road Embarrass, MN 55732
Kainz, Bruce R.	1202 Winton Road Ely, MN 55731
Lawless, John A. et.al.	7333 Mesaba Road Embarrass, MN 55732
McLean, C. Russell Jr.	2132 Woodland Avenue Duluth, MN
Mesabi Mining LLC	6714 Pointe Inverness Way Fort Wayne, IN 46804
Mesabi Nugget Delaware LLC	Jeff Hansen, Manager PO Box 235 Hoyt Lakes, MN 55750
Minnesota Power & Light	30 West Superior Street Duluth, MN 55802
Northshore Mining	James R. Korpi, CEO 10 Outer Drive Silver Bay, MN 55614
R & R Timber LLP.	Paul Scherer 4734 Byke Road Embarrass, MN 55732
Robinson Land Trust	c/o Paul Martin 729 Old Stable Place Walnut Creek, CA 94596
RGGS Land & Minerals Ltd LP	100 Waugh Drive, Suite 400 Houston, TX 77007
Salo, Robert A. et al.	4510 Kenaitze Court Kenai, Alaska 99611
Skluzacek, Paul D.	PO Box 157 Afton, MN 55001
State of Minnesota	DNR Central Office 500 Lafayette Road St. Paul, MN 55155-4040
Underland, Aaron M.	5326 Road 50 Aurora, MN 55705
United States Of America	USA, Forest Service Superior National Forest 8901 Grand Avenue Place Duluth, MN 55808

Owner Name	Mailing Address
Weinert, Christopher	403 8th Street North Sauk Rapids, MN 56739
Williams, Dorothy	4604 Heights Drive Columbia Heights, MN 55421
William J. Todd Jr. Living Trust	1075 Ortman Road Marquette, MI 49855
Williams, Richard and Beverly	16 Victoria Drive Webster, MA 01570
Youngman, David G.	25 Basswood Circle Babbitt, MN 55706

Large Table 5

Wetland Replacement Requirements Proposed for WCA

Utilizing Wetland Bank Credits from BSA #1

Poly Met Mining, Inc.

Wetland or Credit Type	NorthMet Project Proposed Direct Wetland Impacts (acres)(1,2)	Bank Credits Required for Replacement[3]	Total Mitigation Ratio
Type 2 Fresh (Wet) Meadow	15.80	15.80	1:1
Type 2 Sedge Meadow	23.93	23.93	1:1
Type 3 Shallow Marsh	70.45	70.45	1:1
Type 4 Deep Marsh	75.67	75.67	1:1
Type 5 Shallow, Open Water	0	0	1:1
Type 6 Shrub-Carr	3.89	3.89	1:1
Type 6 Alder Thicket	110.56	110.56	1:1
Type 7 Hardwood Swamp	13.17	13.17	1:1
Type 7 Coniferous Swamp	85.69	85.69	1:1
Type 8 Open Bog	7.64	7.64	1:1
Type 8 Coniferous Bog	523.38	523.38	1:1
Total	**930.18**	**930.18**	**---**

(1) Totals may not add exactly due to rounding.

(2) The total includes fragmentation of wetlands (26.9 acres).

(3) Per M.R. 8420.0522, Subp. 4.A.(1), the replacement ratio for withdrawal of existing wetland bank credits from within the Project bank service area (#1), is 1:1.

Large Table 6

Wetland Mitigation Utilizing USACE-Approved Wetland Bank Credits from BSA #1

Poly Met Mining, Inc.

	NorthMet Project Proposed Direct Wetland Impacts in Acres(1,2)							
	Non-forested, Non-bog, and Low or Medium Quality (Base Ratio 1.5:1) (3)	Non-forested, Non-bog, High Quality Wetlands (Base Ratio 1.75:1)(4)	Bogs and Forested, and Low or Medium Quality Wetlands (Base Ratio 1.75:1)(5)	Bogs, Forested, and High Quality (Base Ratio 2:1) (6)	Total Impacts	Total Credits Required for Mitigation at Base Ratio(3-6)	Total Credits Required After Applying Incentives(7)	Applied Mitigation Ratio
Type 2 Fresh (Wet) Meadow	1.37	14.43	0.0	0.0	**15.80**	27.31	19.41	1.23:1
Type 2 Sedge Meadow	6.87	17.06	0.0	0.0	**23.93**	40.16	28.20	1.18:1
Type 3 Shallow Marsh	46.55	23.90	0.0	0.0	**70.45**	111.65	76.43	1.08:1
Type 4 Deep Marsh	75.58	0.09	0.0	0.0	**75.67**	113.53	75.69	1:1
Type 6 Shrub-Carr	1.40	2.49	0.0	0.0	**3.89**	6.46	4.51	1.16:1
Type 6 Alder Thicket	7.50	103.06	0.0	0.0	**110.56**	191.61	136.33	1.23:1
Type 7 Hardwood Swamp	0.0	0.0	0.69	12.48	**13.17**	26.17	19.58	1.49:1
Type 7 Coniferous Swamp	0	0	13.03	72.66	**85.69**	168.12	125.28	1.46:1
Type 8 Open Bog	0	0	0	7.64	**7.64**	15.28	11.46	1.5:1
Type 8 Coniferous Bog	0	0	0	523.38	**523.38**	1046.76	785.07	1.5:1
Total	**139.27**	**161.03**	**13.72**	**616.16**	**930.18**	**1,747.04**	**1,281.95**	**1.38:1**

(1) Totals may not add exactly due to rounding.

(2)The total includes fragmentation of wetlands (26.9 acres).

(3) Base ratio 1.5:1 per USACE St. Paul District Policy for wetlands that are not considered high quality or difficult-to-replace.

(4) Base ratio 1.75:1 per USACE May 29, 2013 Draft Memorandum for wetlands that are high quality.

(5) Base ratio 1.75:1 per USACE May 29, 2013 Draft Memorandum for wetlands that are difficult-to-replace, which includes forested swamp and bog communities.

(6) Base ratio 2:1 per USACE May 29, 2013 Draft Memorandum for wetlands that are high quality AND difficult-to-replace, which includes forested wetland and bog communities.

(7) Per USACE St. Paul District Policy, includes 0.25 reduction for "in-place" (within the project BSA) and 0.25 reduction for "in-advance" (Corps-approved mitigation bank credits) from the base ratio.

Large Table 7 Summary of Soils in the Mine Site

Mapping Entity	Soil ELT/ Map Unit	Soil Name	Soil ELTP (for USFS Soils only)	Area (acres)	Percent of Project Area	Drainage/ Hydric Status
USFS	16	Upland Shallow Loamy Dry	18A[a]	912.1	30.3%	Well drained
USFS		Upland Shallow Loamy Dry	18B[a]	745.9	24.7%	Well drained
USFS	6	Lowland Organic Acid to Neutral	24[b]	887.2	29.4%	Poorly drained
USFS		Lowland Organic Acid to Neutral	32[c]	10.3	<1%	Poorly drained
USFS	2	Lowland Loamy Wet	47[d]	267.6	8.9%	Poorly drained
USFS	1	Lowland Loamy Moist	7[d]	7.3	<1%	Somewhat poorly drained
NRCS	F35D	Eveleth-Conic,, bouldery-Aquepts, rubbly complex	N/A	86.4	2.8%	Partially hydric
NRCS	F166A	Aquepts, rubbly-Tacoosh-Rifle complex	N/A	46.6	1.5%	Hydric
NRCS	F6B	Soudan-Eaglesnest-Babbit	N/A	34.7	1.2%	Not hydric
NRCS	F12B	Eaglesnest-Babbit complex	N/A	12.6	<1%	Partially hydric
NRCS	F129A	Tacoosh mucky peat	N/A	5.9	<1%	Hydric
NRCS	Unknown/ not mapped	Unknown/not mapped	N/A	18.2	<1%	Unknown

[a]This ELTP is comparable to the Whalsten and Conic NRCS St. Louis County map units
[b]This ELTP is comparable to the Rifle NRCS St. Louis County map unit
[c]This ELTP is comparable to the Cathro NRCS St. Louis County map unit
[d]This ELTP is comparable to the Babbitt NRCS St. Louis County map unit

Large Table 8 Summary of Soils in the Plant Site

Soil Map Unit	Soil Name	Area (acres)	Percent of Project Area	Hydric Status
1050	Tailings basin	3040.0	68.8%	Unknown
1003B	Udorthents, loamy (cut and fill land)	463.1	10.5%	Unknown
F3D	Eveleth-Eaglesnest-Conic complex	157.6	3.6%	Unknown
F4E	Eveleth-Conic, bouldery-Rock outcrop complex	152.3	3.4%	Unknown
F12B	Eaglesnest-Babbitt complex	118	2.7%	Partially hydric
F34A	Cathro muck	89.7	2.0%	Hydric
F30G	Conic, very bouldery-Insula, very bouldery-Rock outcrop complex	72.4	1.6%	Unknown
F13A	Babbitt, bouldery-Aquepts, rubbly, complex	67.1	1.5%	Partially hydric
F22F	Eveleth-Conic complex	58.3	1.3%	Unknown
F35D	Eveleth, bouldery-Conic, bouldery-Aquepts, rubbly, complex	57.3	1.3%	Partially hydric
F1C	Eaglesnest stony loam	42.5	1.0%	Not hydric
1021A	Rifle soils	37.1	<1%	Hydric
F177C	Eveleth-Eaglesnest complex	19.9	<1%	Partially hydric
1048	Dumps, iron mine	16.9	<1%	Unknown
W	Water	8.9	<1%	Hydric
F26E	Shagawa-Beargrease complex	7.4	<1%	Not hydric
F14D	Eveleth stony loam	4.8	<1%	Not hydric
F11B	Eaglesnest stony loam	3.3	<1%	Partially hydric
1049	Pits, iron mine	0.1	<1%	Unknown
F9B	Cloquet loam	0.1	<1%	Not hydric

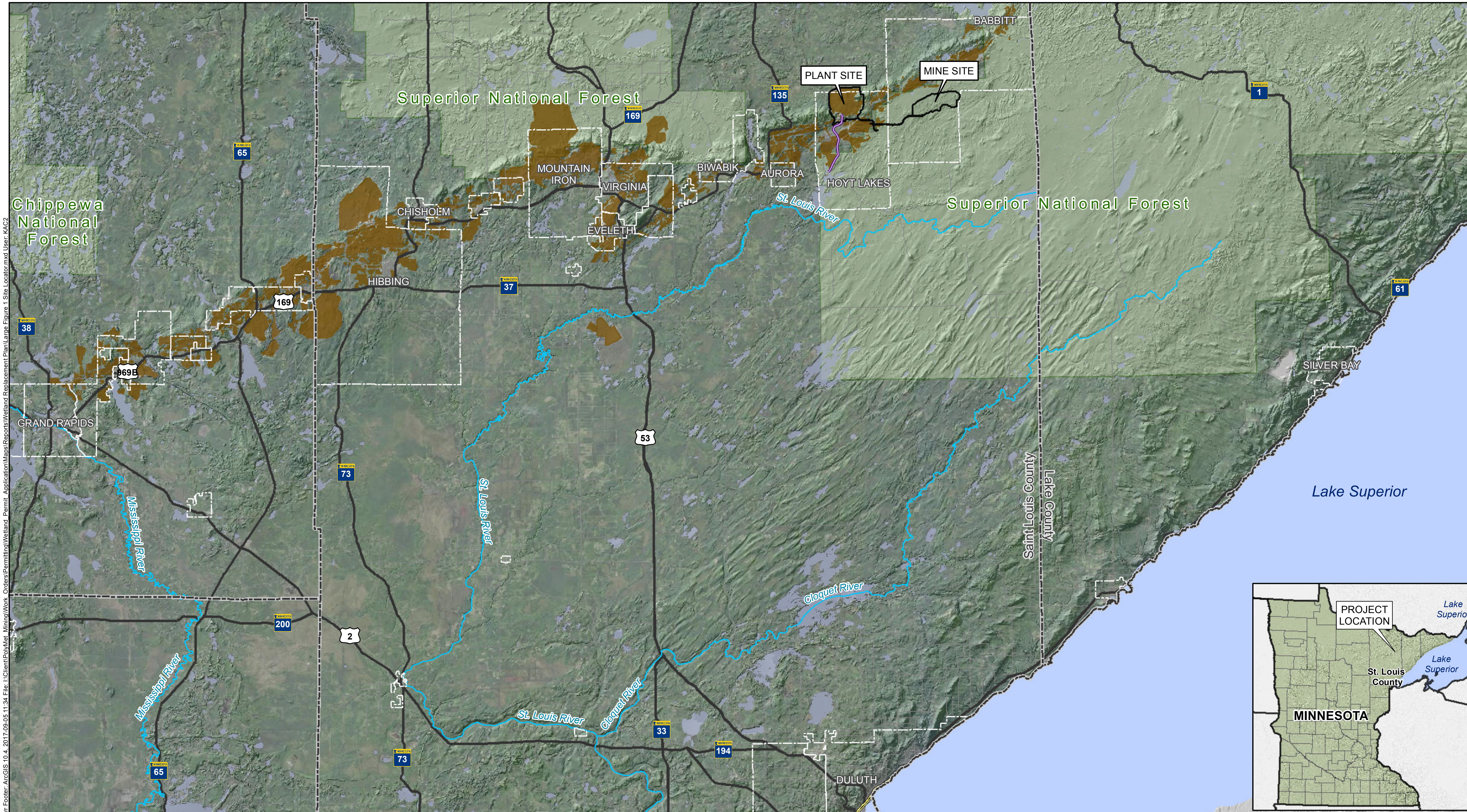
Large Table 9 Summary of Soils in the Dunka Road and Utility Corridor

Soil Map Unit	Soil Name	Area (acres)	Percent of Project Area	Hydric Status
F12B	Eaglesnest-Babbitt complex, 1 to 8 percent slopes, bouldery	19.02	17.6	Partially hydric
1049	Pits, iron mine	18.59	17.2	Unknown
F2B	Eaglesnest-Wahlsten complex 2 to 8 percent slopes bouldery	16.57	15.4	Unknown
1048	Dumps iron mine (mostly rock fragments)	13.46	12.5	Unknown
1003B	Udorthents loamy cut and fill (mine iron spoil other disturbed areas)	9.85	9.1	Unknown
F13A	Babbitt bouldery-Aquepts rubbly complex 0 to 3 percent slopes	6.88	6.4	Partially hydric
F14D	Eveleth stony loam 8 to 18 percent slopes bouldery	5.93	5.5	Not hydric
F166A	Aquepts rubbly-Tacoosh-Rifle complex 0 to 2 percent slopes	5.5	5.1	Hydric
F11B	Eaglesnest stony loam 2 to 8 percent slopes bouldery	5.28	4.9	Partially hydric
B147A	Tacoosh mucky peat Upham basin 0 to 1 percent slopes	3.9	3.6	Hydric
B147A	Rifle soils Upham basin 0 to 1 percent slopes	1.7	1.6	Hydric
1020A	Bowstring and Fluvaquents loamy frequently flooded	0.86	<1%	Hydric
1021A	Rifle soils, 0 to 1 percent slopes	0.19	<1%	Hydric
B119A	Tacoosh mucky peat, 0 to 1 percent slopes	0.05	<1%	Hydric

Large Table 10 Summary of Soils in the Colby Lake Water Pipeline Corridor

Soil Map Unit	Soil Name	Area (acres)	Percent of Project Area	Hydric Status
F12B	Eaglesnest-Babbitt complex	14.9	29.5%	Partially hydric
1003B	Udorthents, loamy	12.8	25.3%	Unknown
1050	Tailings Basin	11.3	22.3%	Unknown
F14D	Eveleth stony loam	2.8	5.6%	Not hydric
F9B	Cloquet loam	1.8	3.5%	Not hydric
F35D	Eveleth, bouldery-Conic, boulder-Aquepts, rubbly, complex	1.4	2.8%	Partially hydric
F34A	Cathro muck	1.3	2.6%	Hydric
F3D	Eveleth-Eaglesnest-Conic complex	1.3	2.6%	Unknown
1021A	Rifle soils	1.0	2.0%	Hydric
F32A	Merwin peat	0.9	1.8%	Hydric
F13A	Babbitt, bouldery-Aquepts, rubbly, complex	0.8	1.5%	Partially hydric
1048	Dumps, iron mine	0.2	<1%	Unknown

Large Figures



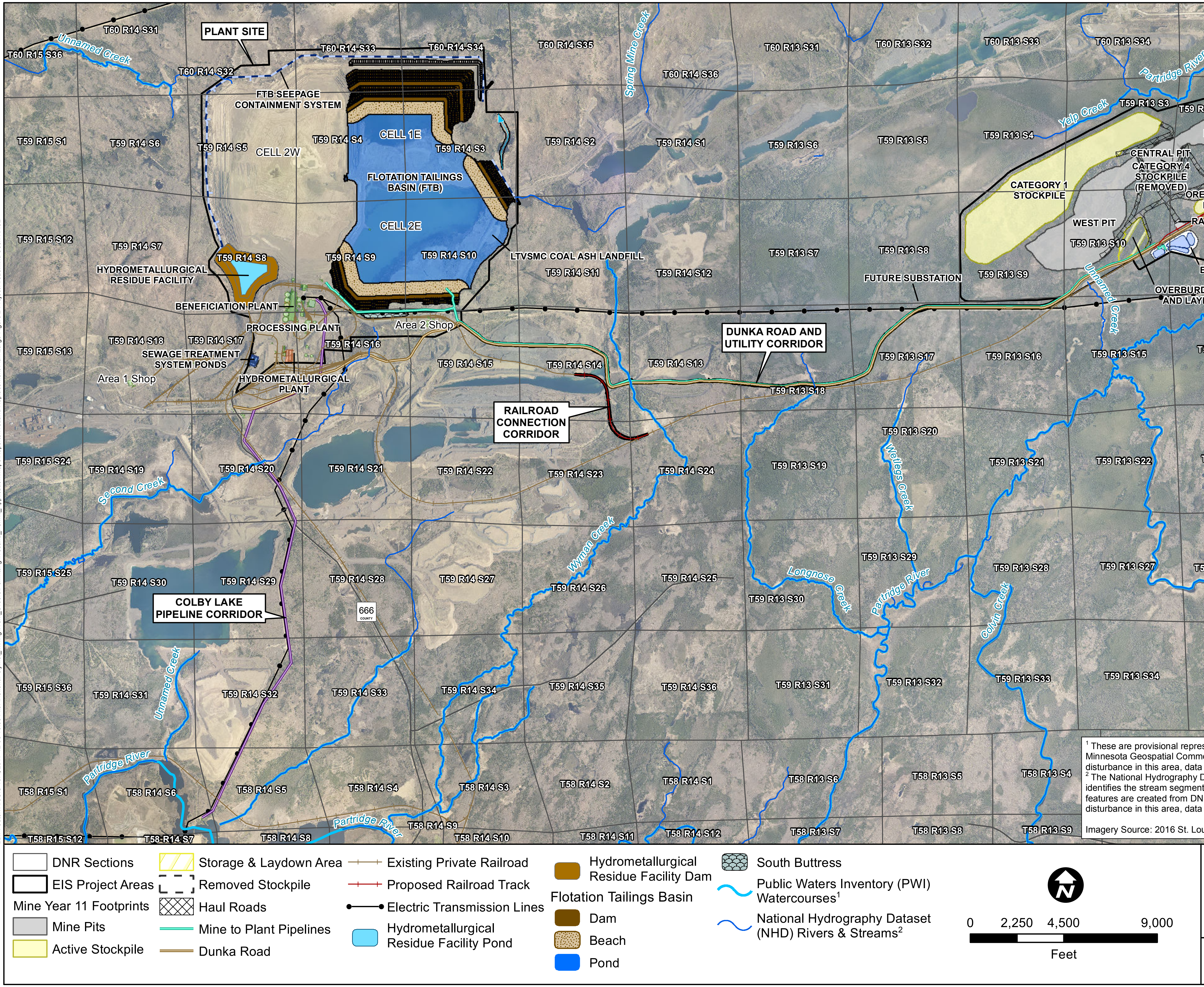
EIS Project Areas
Mesabi Iron Range
National Forest Boundary
County Boundaries
City Boundaries
Major River
Lakes

0 3.5 7 14
Miles

SITE LOCATOR MAP
NorthMet Project
Poly Met Mining, Inc.

Large Figure 1
Wetland Replacement Plan

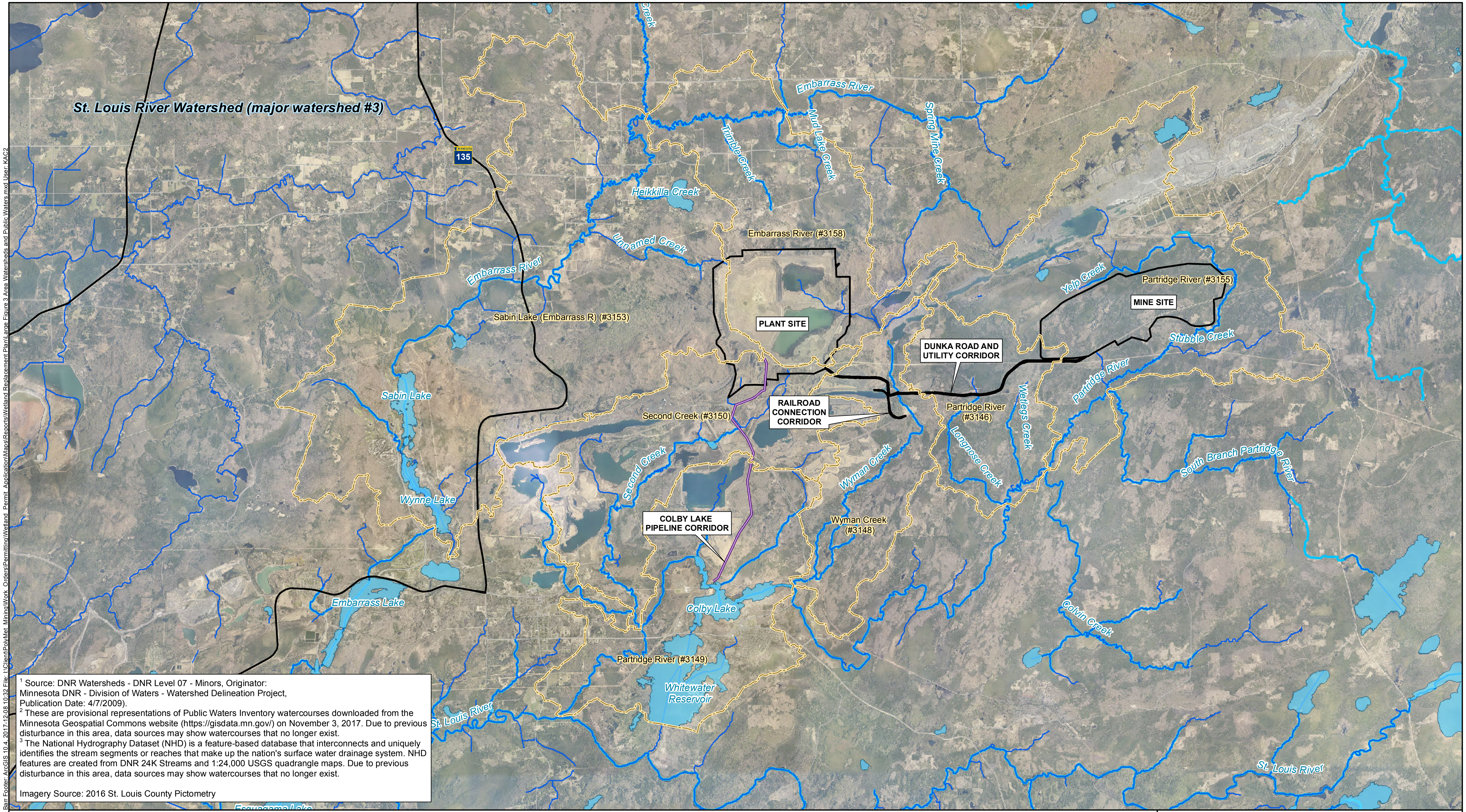
Barr Footer: ArcGIS 10.4, 2017-09-05 11:34 File: I:\Client\PolyMet_Mining\Work_Orders\Permitting\Wetland_Permit_Application\Maps\Reports\Wetland Replacement Plan\Large Figure 1 Site Locator.mxd User: KAC2



PROJECT AREAS
NorthMet Project
Poly Met Mining, Inc.

Large Figure 2
Wetland Replacement Plan

Barr Footer: ArcGIS 10.4, 2017-12-08 10:30 File: I:\Client\PolyMet_Mining\Work_Orders\Permitting\Wetland_Permit_Application\Maps\Reports\Wetland Replacement Plan\Large Figure 2 Project Areas.mxd User: KAC2



[1] Source: DNR Watersheds - DNR Level 07 - Minors, Originator: Minnesota DNR - Division of Waters - Watershed Delineation Project, Publication Date: 4/7/2009).

[2] These are provisional representations of Public Waters Inventory watercourses downloaded from the Minnesota Geospatial Commons website (https://gisdata.mn.gov/) on November 3, 2017. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.

[3] The National Hydrography Dataset (NHD) is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from DNR 24K Streams and 1:24,000 USGS quadrangle maps. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.

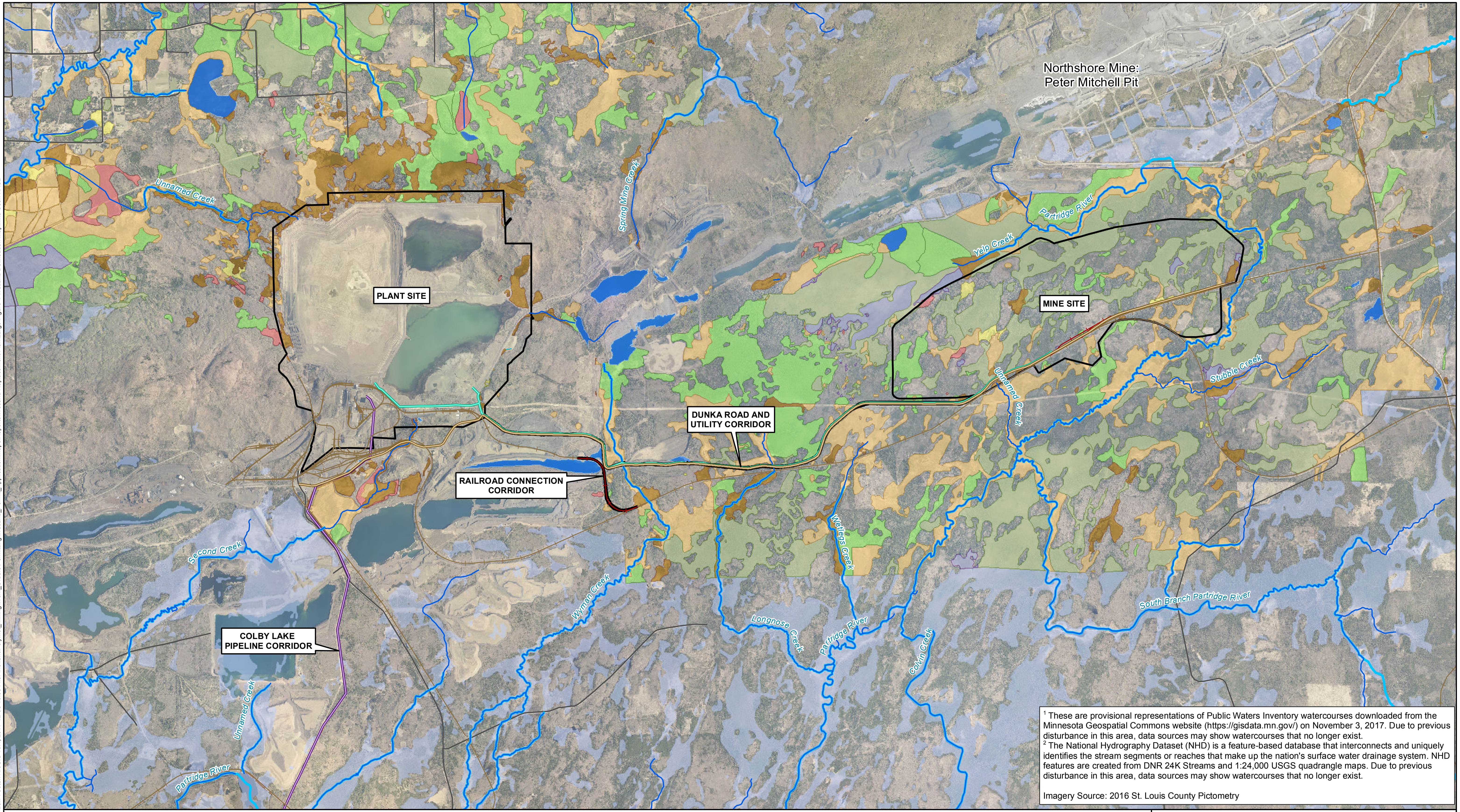
Imagery Source: 2016 St. Louis County Pictometry

- EIS Project Areas
- Minor Watershed Name (Minor Watershed Number)[1]
- Public Waters Inventory Basins[1]
- Public Waters Inventory (PWI) Watercourses[2]
- National Hydrography Dataset (NHD) Rivers & Streams[3]

0 5,000 10,000 20,000
Feet

PROJECT AREA WATERSHEDS AND PUBLIC WATERS
NorthMet Project
Poly Met Mining, Inc.

Large Figure 3
Wetland Replacement Plan



[1] These are provisional representations of Public Waters Inventory watercourses downloaded from the Minnesota Geospatial Commons website (https://gisdata.mn.gov/) on November 3, 2017. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.

[2] The National Hydrography Dataset (NHD) is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from DNR 24K Streams and 1:24,000 USGS quadrangle maps. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.

Imagery Source: 2016 St. Louis County Pictometry

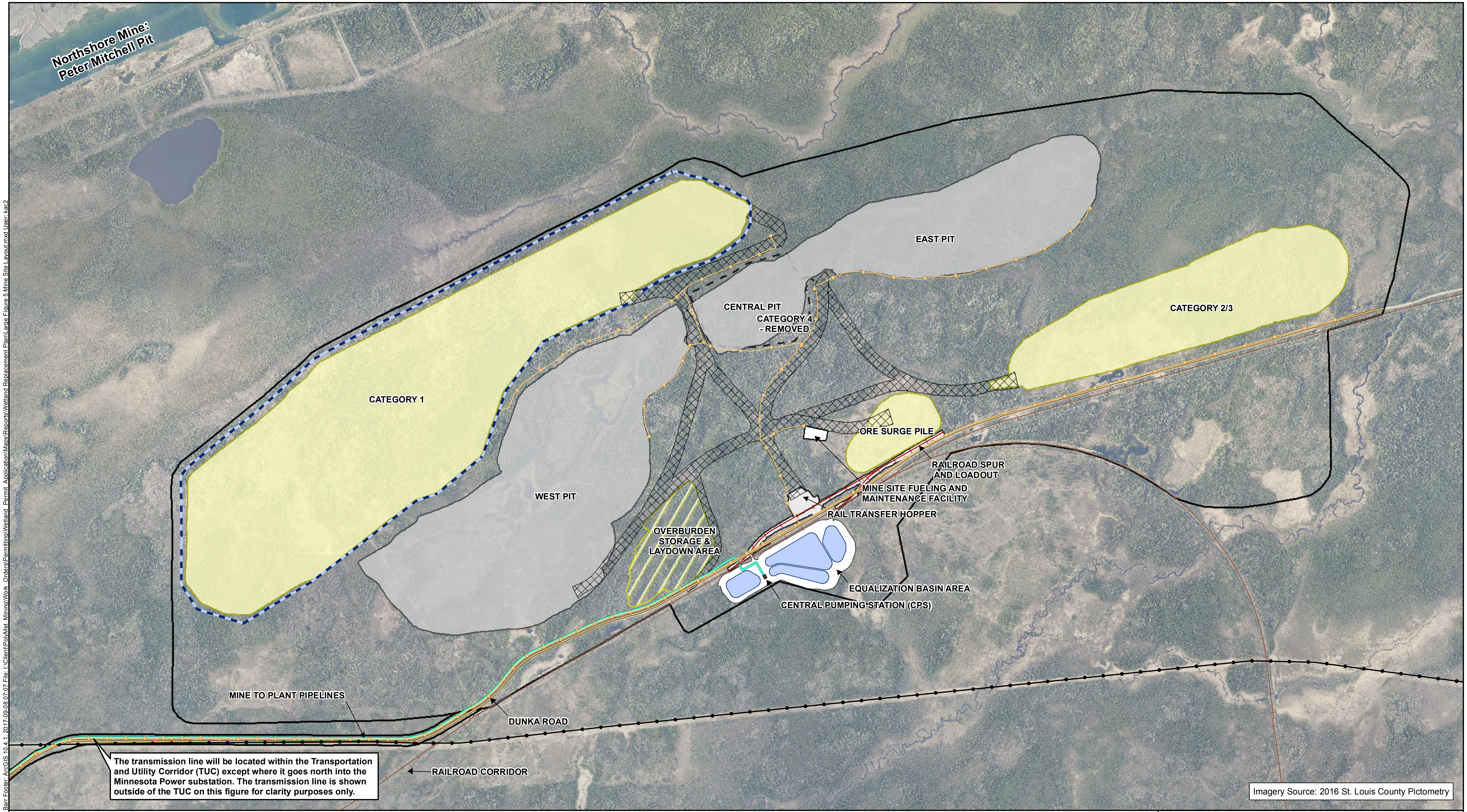
- EIS Project Areas
- Mine to Plant Pipelines
- Dunka Road
- Existing Private Railroad
- Proposed Railroad Track
- Public Waters Inventory (PWI) Watercourses[1]
- National Hydrography Dataset (NHD) Rivers & Streams[2]
- National Wetlands Inventory

Eggers & Reed Wetland Types
- Shrub Swamps (Alder thickets & Shrub-carrs)
- Coniferous bog
- Coniferous swamp
- Deep marsh; Shallow marsh
- Hardwood swamp
- Open water (Shallow, open water & lakes)
- Open bog
- Sedge meadow; Wet meadow
- Incidental

0 0.5 1 2
Miles

WETLAND DELINEATION
NorthMet Project
Poly Met Mining, Inc.

Large Figure 4
Wetland Replacement Plan

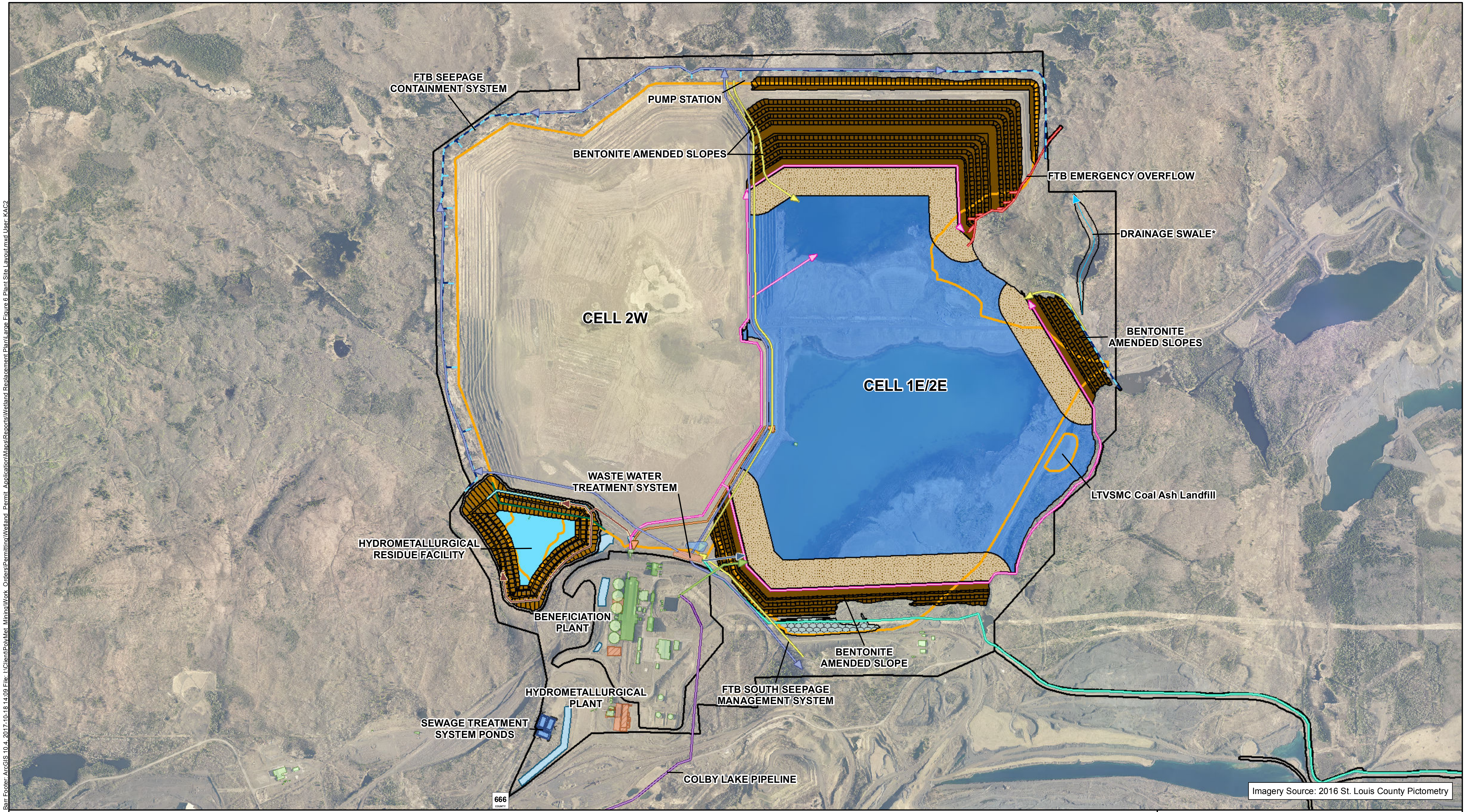


EIS Project Areas
Mine Year 11 Footprints
Mine Pits
Active Stockpile
Storage & Laydown Area
Removed Stockpile
Haul Roads
PolyMet Power Distribution Lines - Proposed
Minnesota Power Transmission Line
Groundwater Containment System
Mine to Plant Pipelines
Dunka Road
Existing Private Railroad
Proposed Railroad Track

0 750 1,500 3,000
Feet

MINE SITE LAYOUT
NorthMet Project
Poly Met Mining, Inc.

Large Figure 5
Wetland Replacement Plan

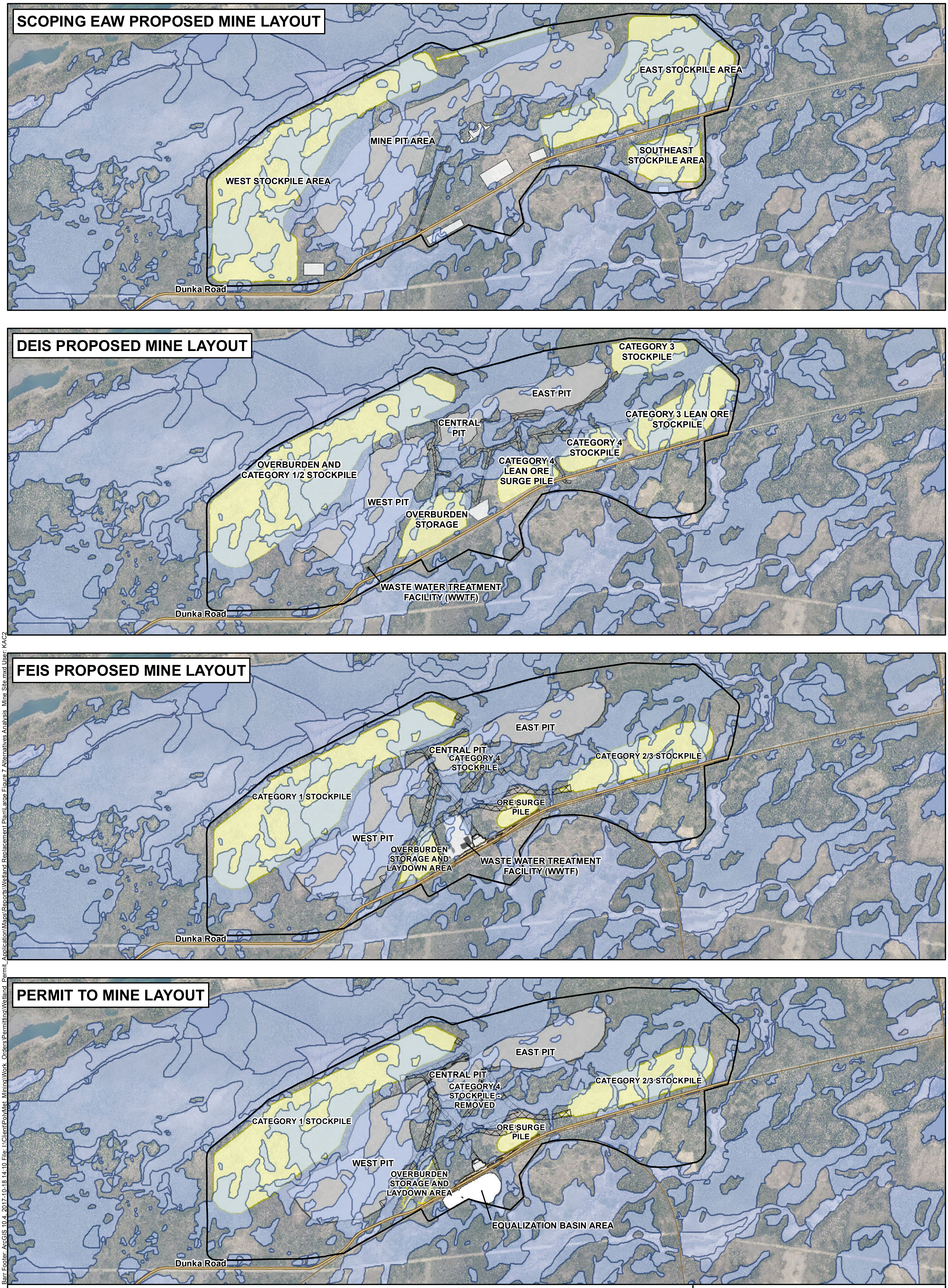


EIS Project Areas
Existing Beneficiation Plant Building
Existing Other Plant Building
Proposed Beneficiation Plant Building
Proposed Hydrometallurgical Plant Building
Cliffs Erie, LLC Permit to Mine Ultimate Tailings Basin Limit
FTB Water Return Pipe
FTB Tailings Discharge Pipe
Tailings Basin Seepage Water Pipe
Plant Reservoir Overflow
Treated Water Pipe
Treated Mine Water Pipe
FTB Seepage Collection Drain (under HRF)
Return Water Pipe
Residue Discharge Pipe
Mine to Plant Pipelines
FTB Seepage Containment System
Ponds
Hydrometallurgical Residue Facility Pond
Hydrometallurgical Residue Facility Dam
Flotation Tailings Basin
Dam
Beach
Pond
South Buttress
Drainage Flow Direction
*The drainage swale drains stormwater away from the toe of the dam.

0 2,000 4,000
Feet

PLANT SITE LAYOUT
NorthMet Project
Poly Met Mining, Inc.

Large Figure 6
Wetland Replacement Plan



- EIS Project Areas
- Mine Pits
- Stockpiles
- Haul Roads
- Dunka Road
- Wetlands

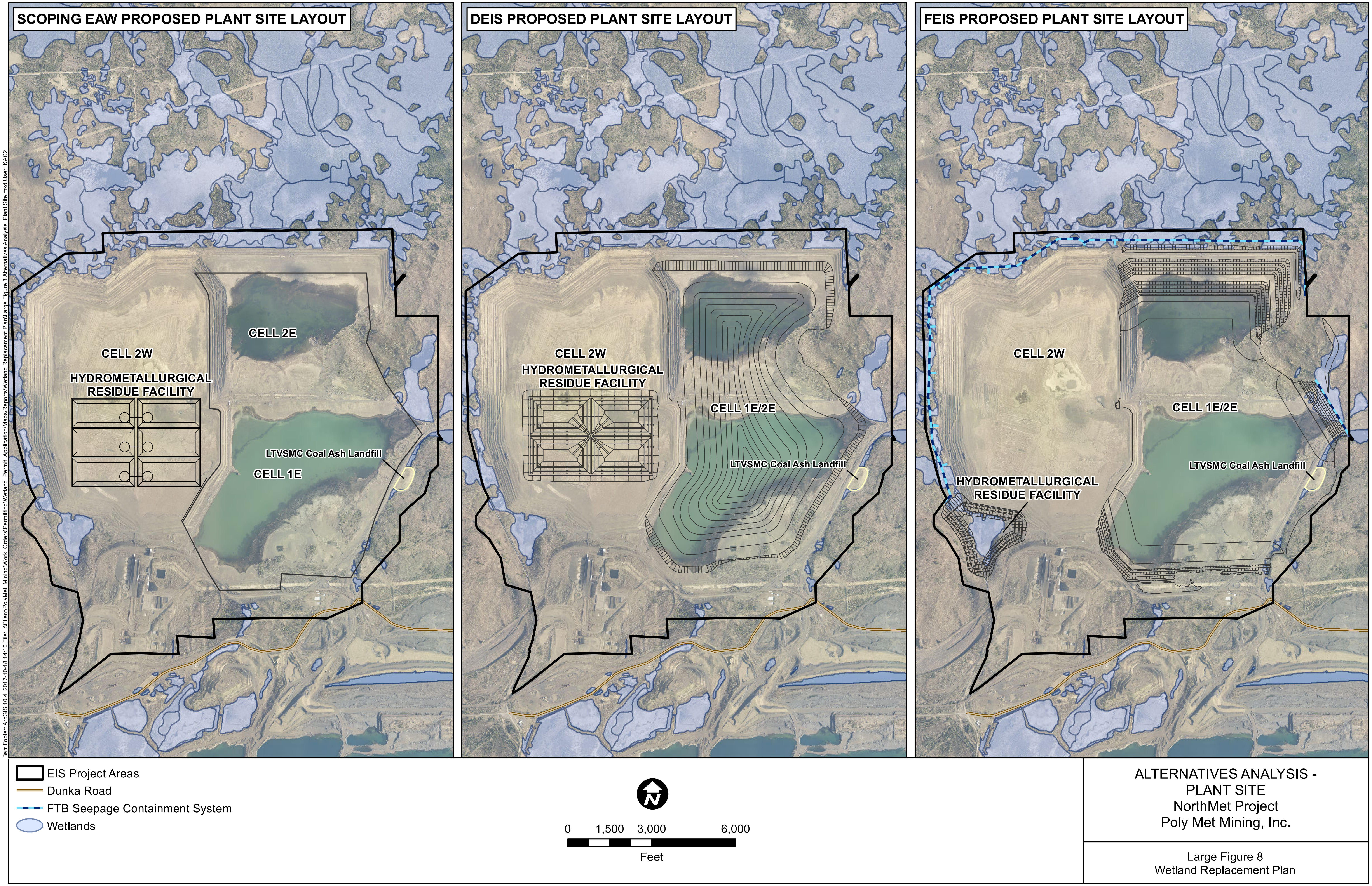
N

0 1,750 3,500 7,000

Feet

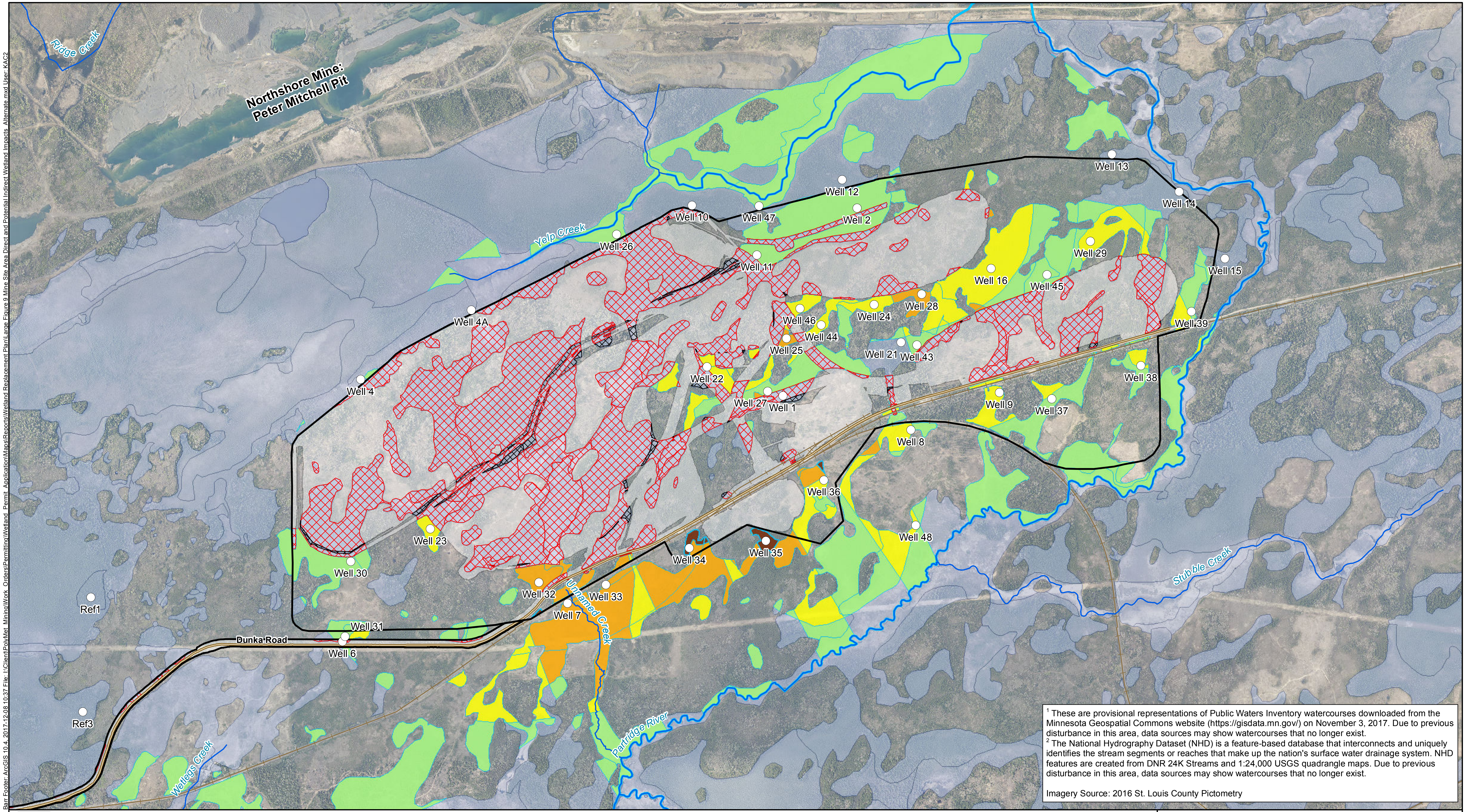
ALTERNATIVES ANALYSIS -
MINE SITE
NorthMet Project
Poly Met Mining, Inc.

Large Figure 7
Wetland Replacement Plan



ALTERNATIVES ANALYSIS - PLANT SITE
NorthMet Project
Poly Met Mining, Inc.

Large Figure 8
Wetland Replacement Plan



EIS Project Areas
Wetland Hydrology Monitoring Locations
Dunka Road
Public Waters Inventory (PWI) Watercourses[1]
National Hydrography Dataset (NHD) Rivers & Streams[2]
Areas Disturbed by Proposed Project Features

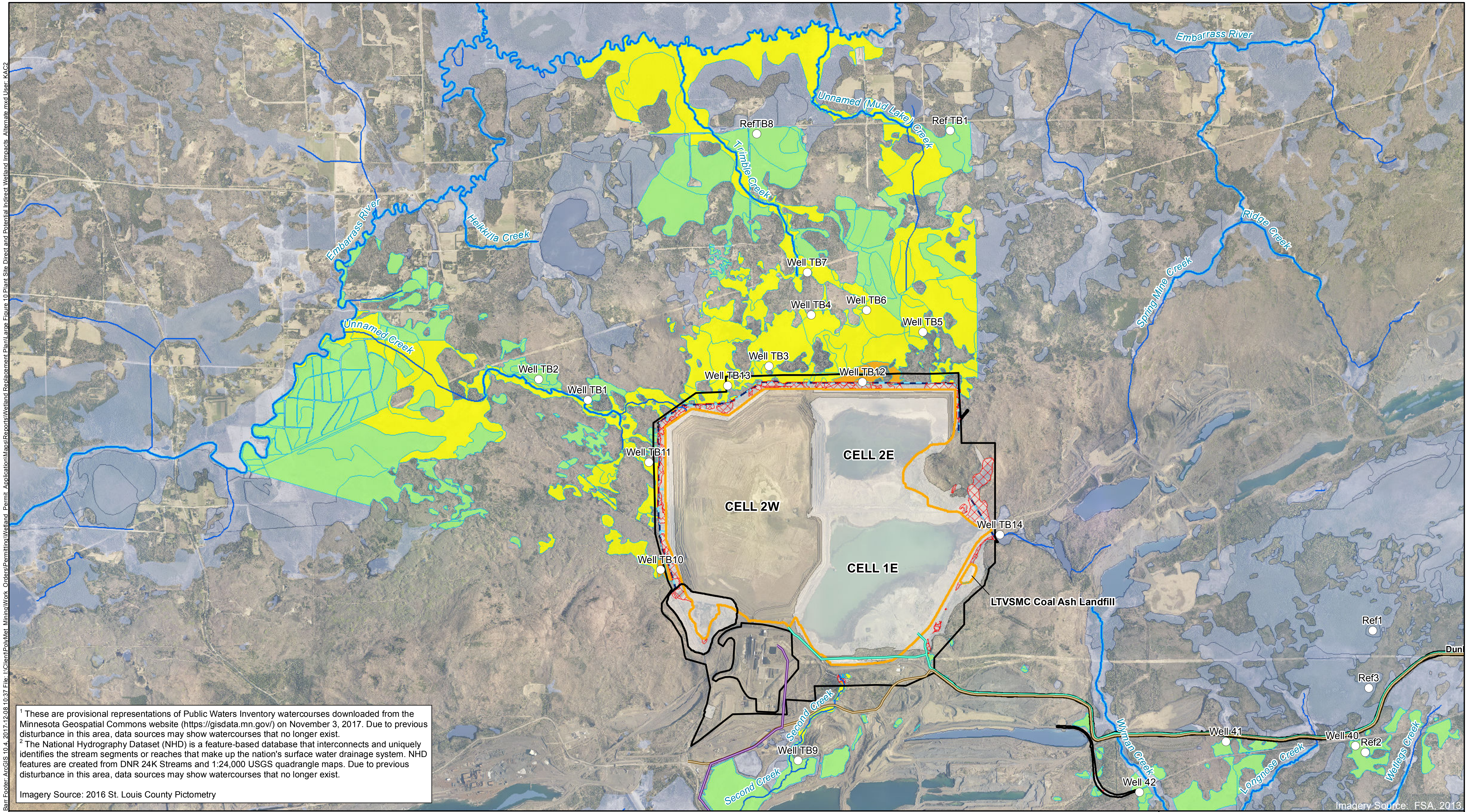
Direct Wetland Impacts
Fragmented Wetlands

Potential Indirect Wetland Impact Factor Rating
5 2
4 1
3 No Impact

0 1,000 2,000 4,000
Feet

MINE SITE DIRECT AND POTENTIAL INDIRECT WETLAND IMPACTS
NorthMet Project
Poly Met Mining, Inc.

Large Figure 9
Wetland Replacement Plan



[1] These are provisional representations of Public Waters Inventory watercourses downloaded from the Minnesota Geospatial Commons website (https://gisdata.mn.gov/) on November 3, 2017. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.
[2] The National Hydrography Dataset (NHD) is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from DNR 24K Streams and 1:24,000 USGS quadrangle maps. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.

Imagery Source: 2016 St. Louis County Pictometry

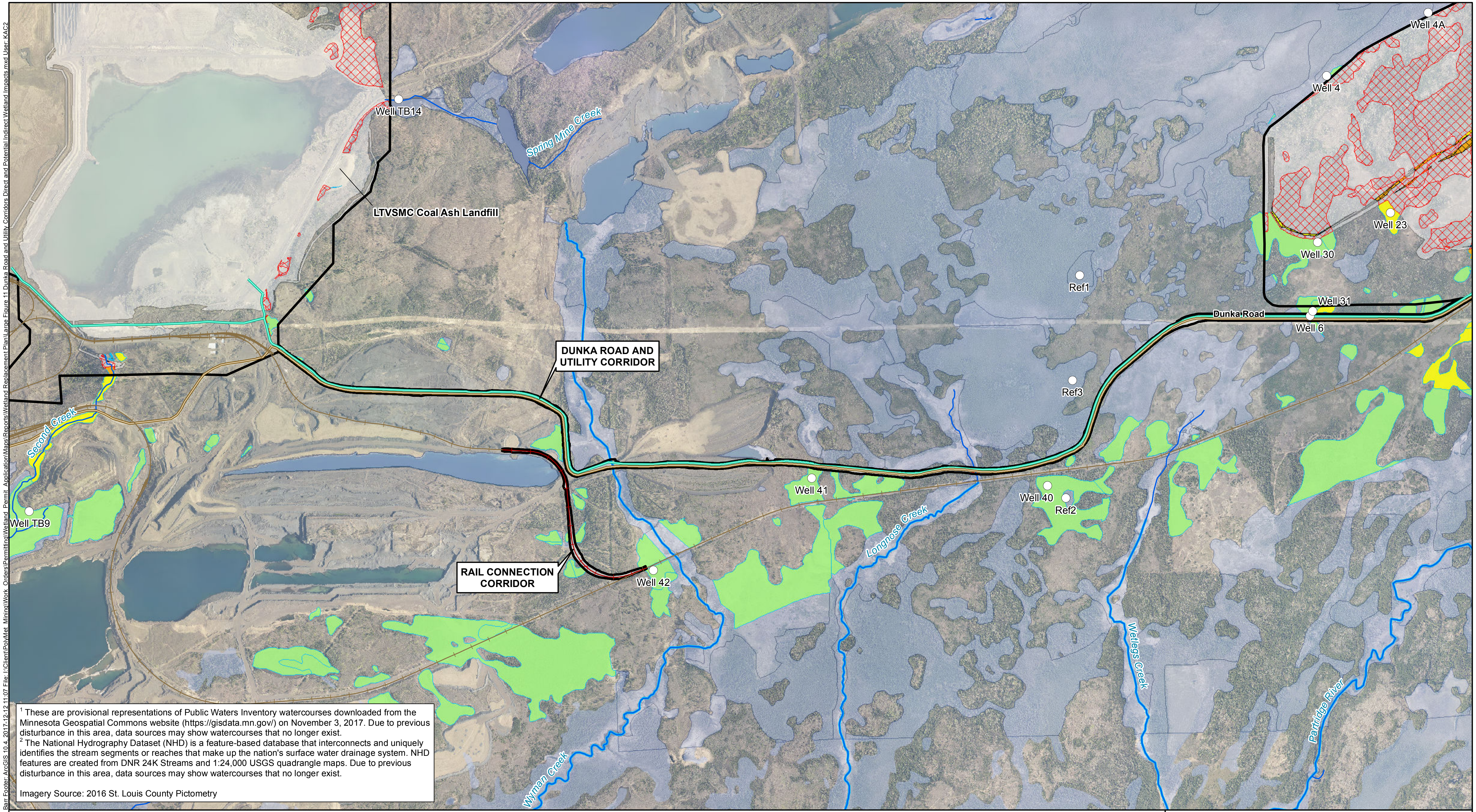
- EIS Project Areas
- Wetland Hydrology Monitoring Locations
- Cliffs Erie, LLC Permit to Mine Ultimate Tailings Basin Limit
- Dunka Road
- Mine to Plant Pipelines
- FTB Seepage Containment System
- Public Waters Inventory (PWI) Watercourses[1]
- National Hydrography Dataset (NHD) Rivers & Streams[2]
- Areas Disturbed by Proposed Project Features
- Direct Wetland Impacts
- Fragmented Wetlands

Potential Indirect Wetland Impact Factor Rating
- 5
- 4
- 3
- 2
- 1
- Incidental
- No Impact

0 2,000 4,000 8,000
Feet

PLANT SITE DIRECT AND POTENTIAL INDIRECT WETLAND IMPACTS
NorthMet Project
Poly Met Mining, Inc.

Large Figure 10
Wetland Replacement Plan



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Imagery Source: 2016 St. Louis County Pictometry

- EIS Project Areas
- Dunka Road
- Mine to Plant Pipelines
- Existing Private Railroad
- Proposed Railroad Track
- Public Waters Inventory (PWI) Watercourses[1]
- National Hydrography Dataset (NHD) Rivers & Streams[2]
- Areas Disturbed by Proposed Project Features
- Direct Wetland Impacts
- Fragmented Wetlands
- Incidental

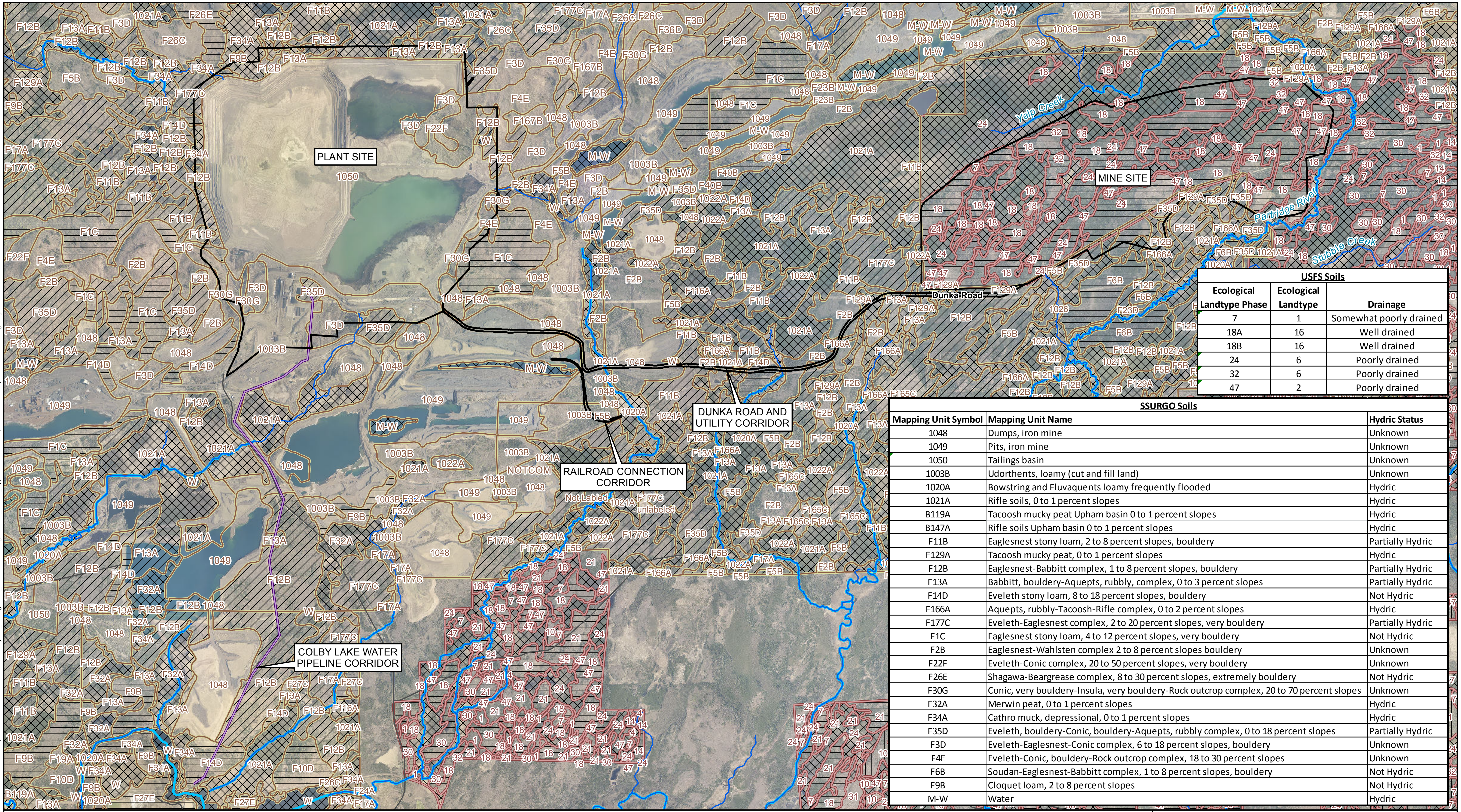
Potential Indirect Wetland Impact Factor Rating

5, 4, 3, 2, 1, No Impact

0 1,100 2,200 4,400
Feet

DUNKA ROAD AND UTILITY CORRIDORS
DIRECT AND POTENTIAL INDIRECT
WETLAND IMPACTS
NorthMet Project
Poly Met Mining, Inc.

Large Figure 11
Wetland Replacement Plan



USFS Soils

Ecological Landtype Phase	Ecological Landtype	Drainage
7	1	Somewhat poorly drained
18A	16	Well drained
18B	16	Well drained
24	6	Poorly drained
32	6	Poorly drained
47	2	Poorly drained

SSURGO Soils

Mapping Unit Symbol	Mapping Unit Name	Hydric Status
1048	Dumps, iron mine	Unknown
1049	Pits, iron mine	Unknown
1050	Tailings basin	Unknown
1003B	Udorthents, loamy (cut and fill land)	Unknown
1020A	Bowstring and Fluvaquents loamy frequently flooded	Hydric
1021A	Rifle soils, 0 to 1 percent slopes	Hydric
B119A	Tacoosh mucky peat Upham basin 0 to 1 percent slopes	Hydric
B147A	Rifle soils Upham basin 0 to 1 percent slopes	Hydric
F11B	Eaglesnest stony loam, 2 to 8 percent slopes, bouldery	Partially Hydric
F129A	Tacoosh mucky peat, 0 to 1 percent slopes	Hydric
F12B	Eaglesnest-Babbitt complex, 1 to 8 percent slopes, bouldery	Partially Hydric
F13A	Babbitt, bouldery-Aquepts, rubbly, complex, 0 to 3 percent slopes	Partially Hydric
F14D	Eveleth stony loam, 8 to 18 percent slopes, bouldery	Not Hydric
F166A	Aquepts, rubbly-Tacoosh-Rifle complex, 0 to 2 percent slopes	Hydric
F177C	Eveleth-Eaglesnest complex, 2 to 20 percent slopes, very bouldery	Partially Hydric
F1C	Eaglesnest stony loam, 4 to 12 percent slopes, very bouldery	Not Hydric
F2B	Eaglesnest-Wahlsten complex 2 to 8 percent slopes bouldery	Unknown
F22F	Eveleth-Conic complex, 20 to 50 percent slopes, very bouldery	Unknown
F26E	Shagawa-Beargrease complex, 8 to 30 percent slopes, extremely bouldery	Not Hydric
F30G	Conic, very bouldery-Insula, very bouldery-Rock outcrop complex, 20 to 70 percent slopes	Unknown
F32A	Merwin peat, 0 to 1 percent slopes	Hydric
F34A	Cathro muck, depressional, 0 to 1 percent slopes	Hydric
F35D	Eveleth, bouldery-Conic, bouldery-Aquepts, rubbly complex, 0 to 18 percent slopes	Partially Hydric
F3D	Eveleth-Eaglesnest-Conic complex, 6 to 18 percent slopes, bouldery	Unknown
F4E	Eveleth-Conic, bouldery-Rock outcrop complex, 18 to 30 percent slopes	Unknown
F6B	Soudan-Eaglesnest-Babbitt complex, 1 to 8 percent slopes, bouldery	Not Hydric
F9B	Cloquet loam, 2 to 8 percent slopes	Not Hydric
M-W	Water	Hydric

SSURGO Soils - Embarrass Subset (Mapping Unit Symbol)
Ecological Landtype Phase - USFS
Hydric Rating/Drainage Class
All Hydric/Poorly drained
Partially Hydric/Somewhat poorly drained
Not Hydric/Well drained
Unknown Hydric

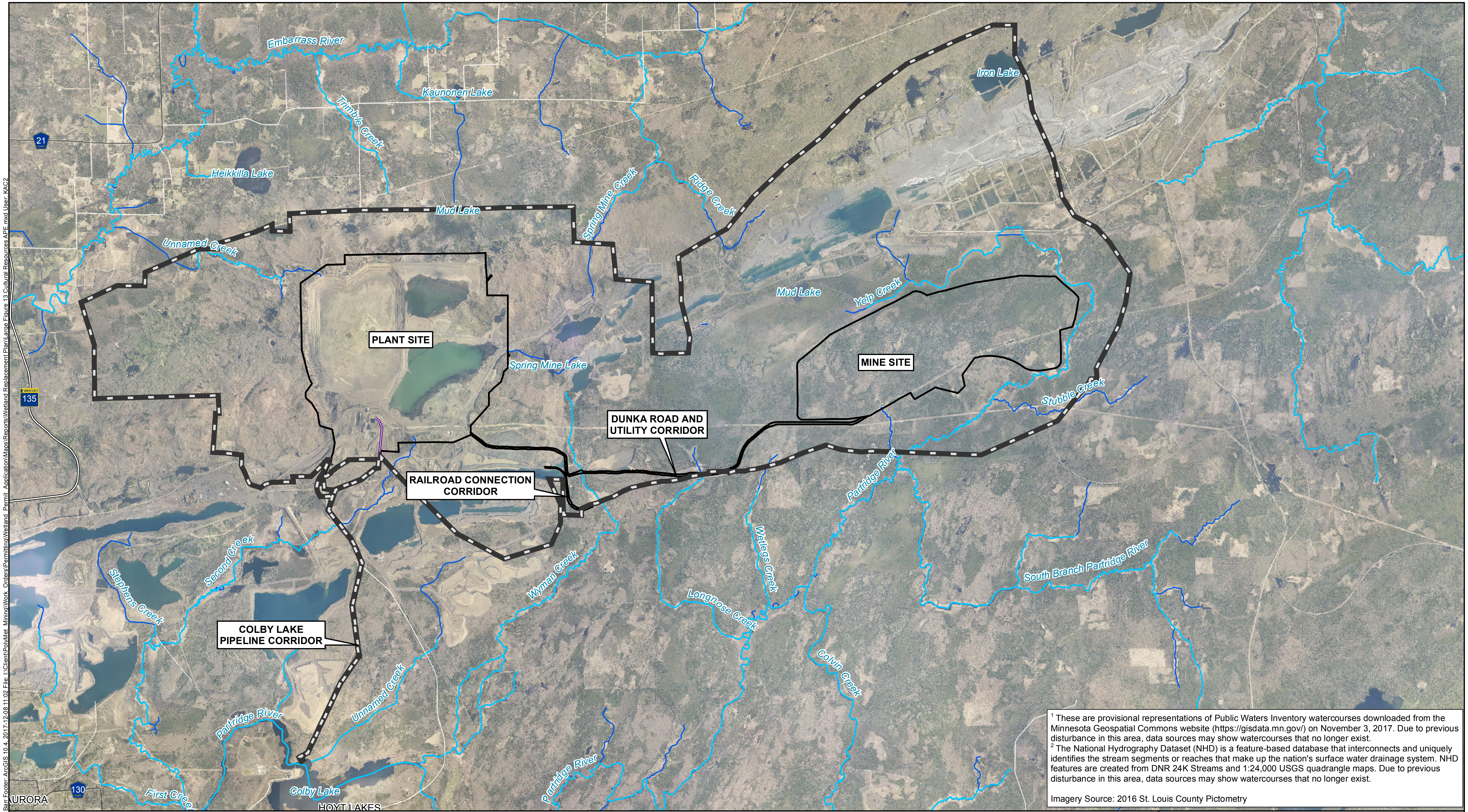
EIS Project Areas
Public Waters Inventory (PWI) Watercourses[1]
National Hydrography Dataset (NHD) Rivers & Streams[2]

[1] These are provisional representations of Public Waters Inventory watercourses downloaded from the Minnesota Geospatial Commons website (https://gisdata.mn.gov/) on November 3, 2017. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.
[2] The National Hydrography Dataset (NHD) is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from DNR 24K Streams and 1:24,000 USGS quadrangle maps. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.
Imagery Source: 2016 St. Louis County Pictometry

0 2,250 4,500 9,000
Feet

SOILS
NorthMet Project
Poly Met Mining, Inc.

Large Figure 12
Wetland Replacement Plan



[1] These are provisional representations of Public Waters Inventory watercourses downloaded from the Minnesota Geospatial Commons website (https://gisdata.mn.gov/) on November 3, 2017. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.

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Imagery Source: 2016 St. Louis County Pictometry

EIS Project Areas

Cultural Resources Area of Potential Effect (APE)

Public Waters Inventory (PWI) Watercourses[1]

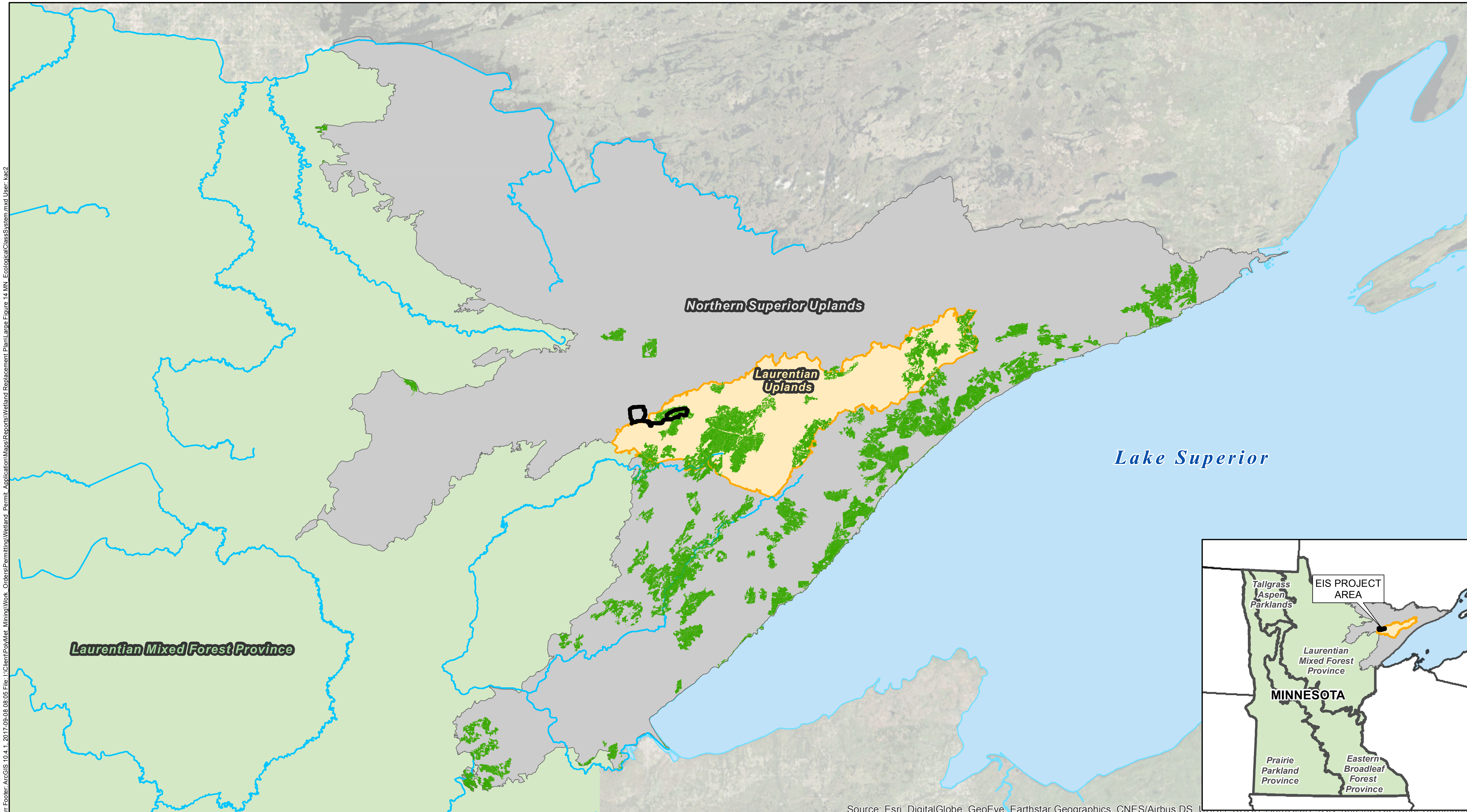
National Hydrography Dataset (NHD) Rivers & Streams[2]

0 0.625 1.25 2.5

Miles

AREA OF POTENTIAL EFFECT
NorthMet Project
Poly Met Mining, Inc.

Large Figure 13
Wetland Replacement Plan



EIS Project Areas

MnDNR-MBS Native Plant Communities in Northern Superior Uplands Section

Laurentian Uplands Subsection

Northern Superior Uplands Section

Ecological Provinces

Major River

Lakes

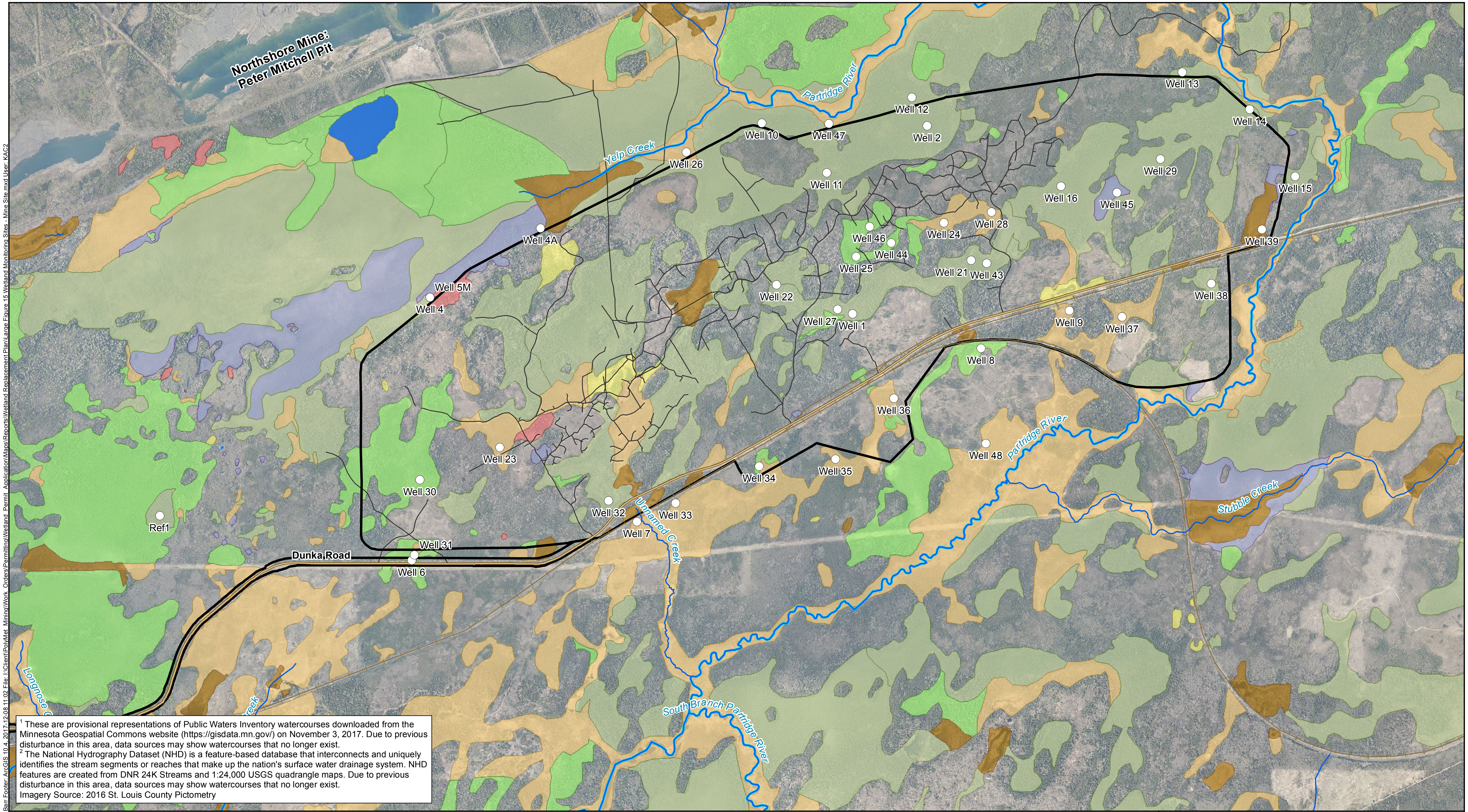
0 7.5 15 30

Miles

NATURAL COMMUNITIES
NorthMet Project
Poly Met Mining, Inc.

Large Figure 14
Wetland Replacement Plan

Barr Footer: ArcGIS 10.4.1, 2017-09-08 08:05 File: I:\Client\PolyMet_Mining\Work_Orders\Permitting\Wetland_Permit_Application\Maps\Reports\Wetland Replacement Plan\Large Figure 14 MN_EcologicalClassSystem.mxd User: kac2



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Imagery Source: 2016 St. Louis County Pictometry

Barr Footer: ArcGIS 10.4, 2017-12-08 11:02 File: I:\Client\PolyMet_Mining\Work_Orders\Permitting\Wetland_Permit_Application\Maps\Reports\Wetland Replacement Plan\Large Figure 15 Wetland Monitoring Sites - Mine Site.mxd User: KAC2

EIS Project Areas
Wetland Hydrology Monitoring Locations
Dunka Road
Railroads
USFS Trails
Public Waters Inventory (PWI) Watercourses[1]

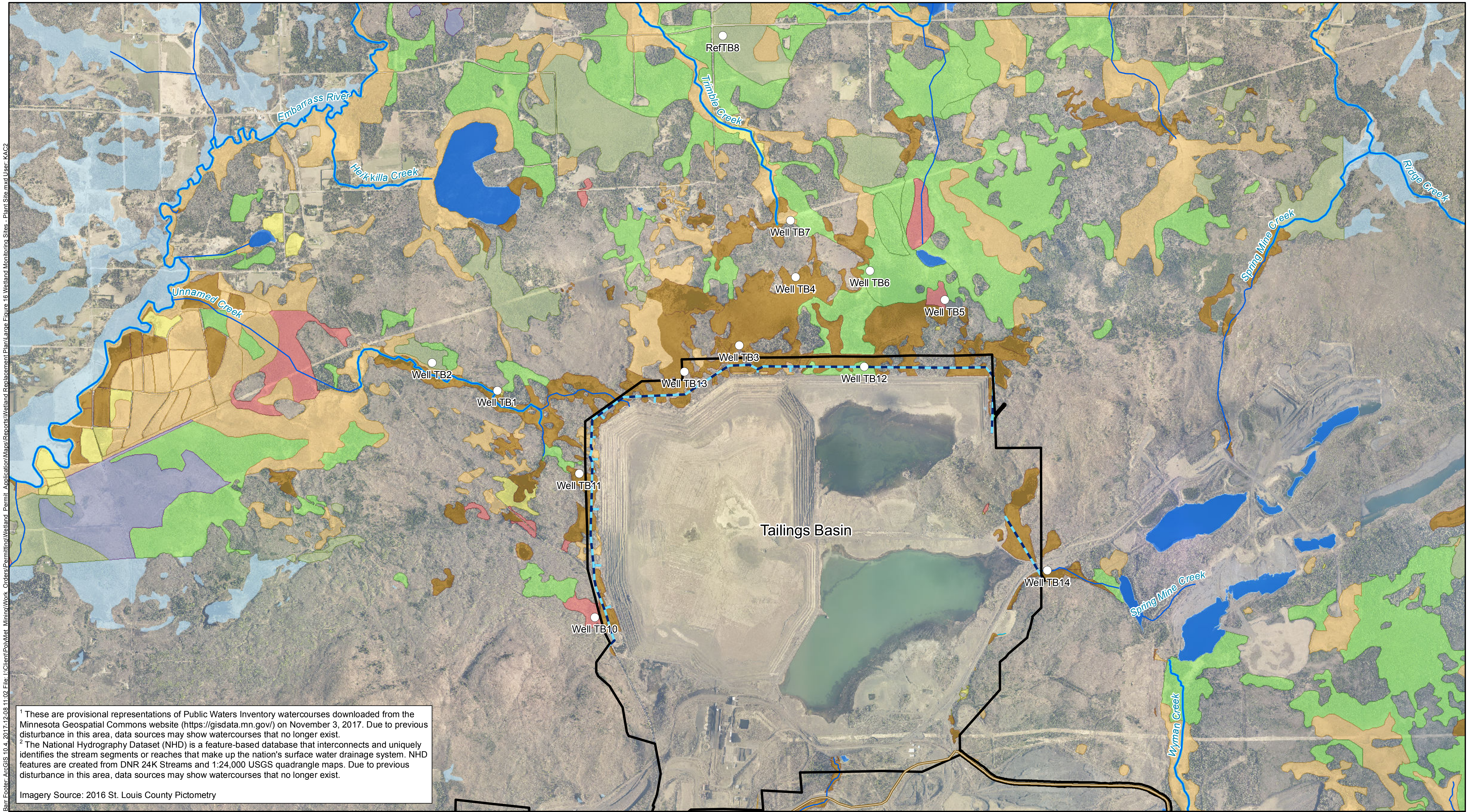
National Hydrography Dataset (NHD) Rivers & Streams[2]
Eggers & Reed Wetland Types
Shrub Swamps (Alder thickets & Shrub-carrs)
Coniferous bog
Coniferous swamp
Deep marsh; Shallow marsh
Hardwood swamp
Open water (Shallow, open water & lakes)
Open bog
Sedge meadow; Wet meadow

N

0 1,000 2,000 4,000
Feet

WETLAND MONITORING SITES - MINE SITE
NorthMet Project
Poly Met Mining, Inc.

Large Figure 15
Wetland Replacement Plan



[1] These are provisional representations of Public Waters Inventory watercourses downloaded from the Minnesota Geospatial Commons website (https://gisdata.mn.gov/) on November 3, 2017. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.
[2] The National Hydrography Dataset (NHD) is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from DNR 24K Streams and 1:24,000 USGS quadrangle maps. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.

Imagery Source: 2016 St. Louis County Pictometry

- EIS Project Areas
- Wetland Hydrology Monitoring Locations
- Dunka Road
- FTB Seepage Containment System
- Public Waters Inventory (PWI) Watercourses[1]
- National Hydrography Dataset (NHD) Rivers & Streams[2]
- National Wetlands Inventory

Eggers & Reed Wetland Types
- Shrub Swamps (Alder thickets & Shrub-carrs)
- Coniferous bog
- Coniferous swamp
- Deep marsh; Shallow marsh
- Hardwood swamp
- Open water (Shallow, open water & lakes)
- Open bog
- Sedge meadow; Wet meadow
- Incidental

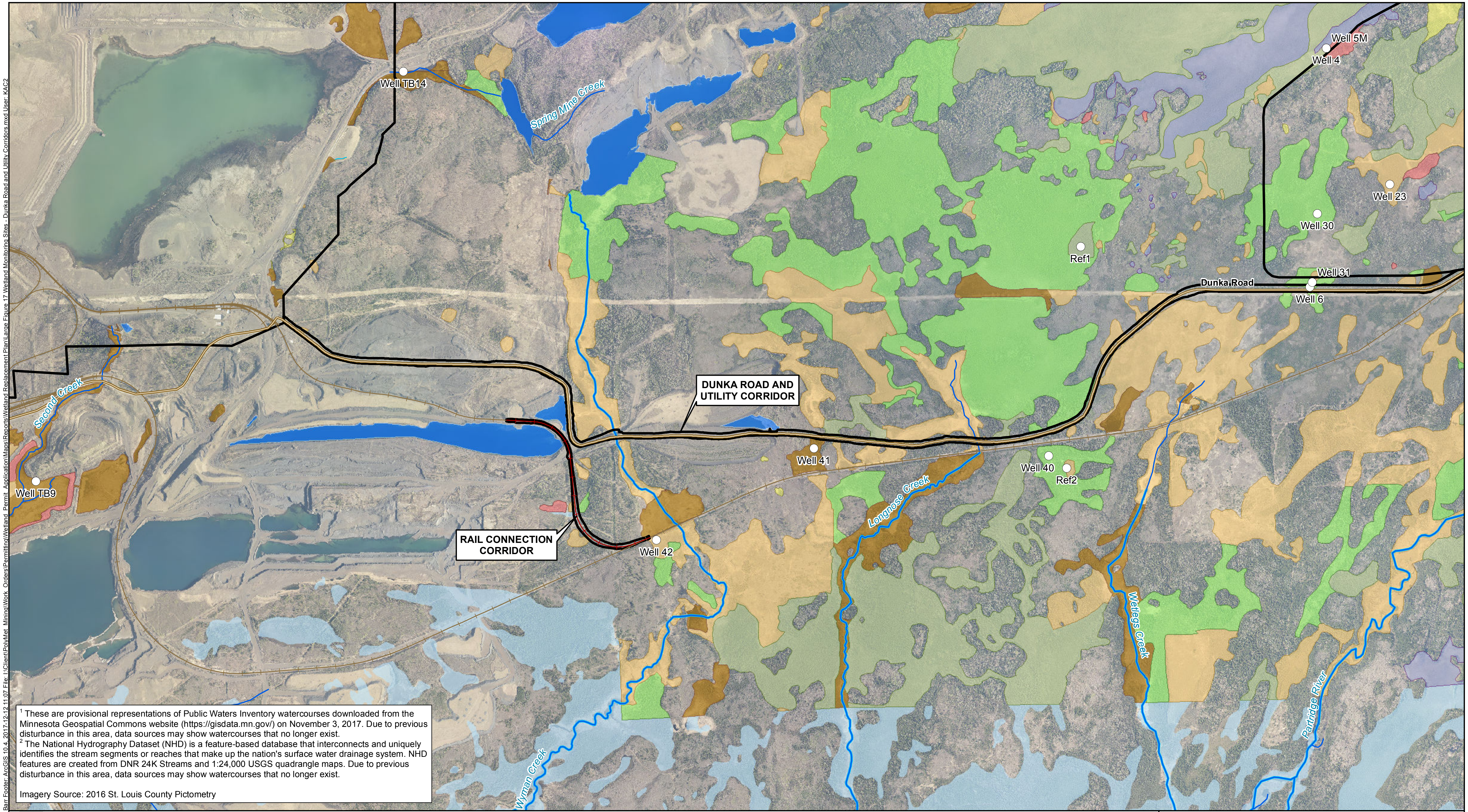
N

0 1,500 3,000 6,000
Feet

WETLAND MONITORING SITES - PLANT SITE
NorthMet Project
Poly Met Mining, Inc.

Large Figure 16
Wetland Replacement Plan

Barr Footer: ArcGIS 10.4, 2017-12-08 11:02



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[2] The National Hydrography Dataset (NHD) is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from DNR 24K Streams and 1:24,000 USGS quadrangle maps. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.

Imagery Source: 2016 St. Louis County Pictometry

- EIS Project Areas
- Wetland Hydrology Monitoring Locations
- Dunka Road
- Existing Private Railroad
- Proposed Railroad Track
- Public Waters Inventory (PWI) Watercourses[1]
- National Hydrography Dataset (NHD) Rivers & Streams[2]
- National Wetlands Inventory

Eggers & Reed Wetland Types

- Shrub Swamps (Alder thickets & Shrub-carrs)
- Coniferous bog
- Coniferous swamp
- Deep marsh; Shallow marsh
- Hardwood swamp
- Open water (Shallow, open water & lakes)
- Open bog
- Sedge meadow; Wet meadow
- Incidental

0 1,100 2,200 4,400
Feet

WETLAND MONITORING SITES - DUNKA ROAD AND UTILITY CORRIDORS
NorthMet Project
Poly Met Mining, Inc.

Large Figure 17
Wetland Replacement Plan

Barr Footer: ArcGIS 10.4, 2017-12-12 11:07 File: I:\Client\PolyMet_Mining\Work_Orders\Permitting\Wetland_Permit_Application\Maps\Reports\Wetland Replacement Plan\Large Figure 17 Wetland Monitoring Sites - Dunka Road and Utility Corridors.mxd User: KAC2

Attachments

Attachment A

NorthMet Project Wetland Data Package v11

POLYMET
MINING

NorthMet Project

Wetland Data Package

Version 11

Issue Date: April 8, 2015

This document was prepared for Poly Met Mining Inc. by Barr Engineering Co.

Table of Contents

Acronyms, Abbreviations and Units

Acronym / Abbreviation	Stands For
CWA	Clean Water Act
DA	Department of the Army
FTB	Flotation Tailings Basin
IAP	Impact Assessment Planning
HRF	Hydrometallurgical Residue Facility
LTVSMC	LTV Steel Mining Company
MDNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
NADP	National Atmospheric Deposition Program
NEPA	National Environmental Policy Act
NHIS	Natural Heritage Information System
NWI	National Wetland Inventory
OSLA	Overburden Storage and Laydown Area
OSP	Ore Surge Pile
RFSS	Regional Forester Sensitive Species
RTH	Rail Transfer Hopper
SGCN	Species of Greatest Conservation Need
TWP	Treated Water Pipeline
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
WCA	Wetland Conservation Act
WWTF	Waste Water Treatment Facility
WWTP	Waste Water Treatment Plant

Unit	Description
ac-ft/yr	acre-feet per year
dBA	Decibel
gpm	gallons per minute
g/cm^3	grams per cubic centimeter
$g/m^2/yr$	grams per square meter per year
kg/ha	Kilograms per hectare
mg/L	milligrams per Liter
mi^2	Square miles
µg/L	microgram per Liter
$µg/m^2/yr$	microgram per square meter per year

1.0 Introduction

This document presents the wetlands data used by the Wetland Management Plan for the NorthMet Project (Project). In cases where a supporting document is referenced, a general description of the supporting document is provided. Information may change during wetland permitting. Permitting decisions cannot be made until the permitting process.

Note that this document uses slightly different terminology to describe areas near the processing plant and Tailings Basin than is used in other documents. Whereas the Supplemental Draft Environmental Impact Statement (SDEIS, Reference (1)) and other Project documents use the term *Plant Site* to refer to the entire Project area where the processing plant and Tailings Basin are located, this document subdivides that area, with separate analyses of the Plant Site area (where processing facilities are located), the Hydrometallurgical Residue Facility (HRF) area, and the Flotation Tailings Basin (FTB) area. Furthermore, this document uses the term *FTB* to refer to the entire area within the boundaries of what is termed the Plant Site in the SDEIS, the minus the areas referred to in this document as the Plant Site and the HRF. This usage is an artifact of the specific way that the term FTB was used when the original wetland delineations and air modeling was done. It is maintained in this document to maintain continuity between the wetland data package and supporting analyses. Large Figure 1 shows the areas of the FTB, Plant Site, and HRF as used in this document.

1.1 Outline

The outline of this document is:

Section 2.0 Discussion of regulatory basis for wetland management

Section 3.0 Data on wetlands in the vicinity of the Project

Section 4.0 Discussion of the approach to evaluating direct, potential indirect, and cumulative wetlands impacts due to the Project

Section 5.0 Evaluation of direct, potential indirect, and cumulative wetlands impacts due to the Project

This document is intended to evolve through the environmental review, permitting, operating, reclamation, and long-term closure phases of the Project. A Revision History is included at the end of the document.

2.0 Regulatory Basis

Wetlands are defined by the *U.S. Army Corps of Engineers Wetland Delineation Manual* (Reference (2)) for administration of Section 404 of the Clean Water Act (CWA) and the Minnesota Wetland Conservation Act (WCA) of 1991 (Minnesota Rules, chapter 8420)

2.1 Section 404 of the Clean Water Act

The U.S. Army Corps of Engineers (USACE) has the authority to issue permits for the discharge of dredged or fill material into waters of the United States under Section 404 of the CWA. Because the Project will result in more than minimal adverse impact, the Project will be reviewed under the Department of the Army (DA) individual permit process. The DA Section 404 permits must be consistent with state water quality standards. This is determined through the Section 401 certification process administered by the Minnesota Pollution Control Agency (MPCA).

The U.S. Environmental Protection Agency (USEPA) reviews and comments on Federal Environmental Impact Statements pursuant to their authorities and responsibilities under the National Environmental Policy Act, Section 309 of the Clean Air Act, and Section 404 of the Clean Water Act. The USEPA has additional authorities under Section 404 of the CWA. Under Section 404(c) of the CWA, the USEPA has the authority to prohibit, restrict, or deny the discharge of dredged or fill material at defined sites in waters of the United States (including wetlands) whenever it determines, after notice and opportunity for public hearing, that use of such sites for disposal would have an unacceptable adverse impact on one or more resources, including fisheries, wildlife, municipal water supplies, or recreational areas. The 404(q) Memorandum of Agreement between the USACE and USEPA provides a procedure considering both agencies' views on projects including procedures for elevating unresolved issues to regional and national levels. The 404(q) process is most frequently used by USEPA when they wish to initiate consultation regarding concerns they may have about the impacts of a proposed project.

2.2 Section 401 Water Quality Certification

The MPCA has been delegated the authority by the USEPA to issue Section 401 Water Quality Certifications to ensure a project will comply with state water quality standards. Individual certification will be necessary because an individual Section 404 permit is required for the Project. The MPCA also has administrative authority under Minnesota Rules, part 7050.0186, regarding wetland mitigation.

2.3 Minnesota Wetland Conservation Act

The filling, excavation, and draining of wetlands is also regulated by the WCA, which is administered by a local governmental unit. For mining projects, the designated approving authority is the Minnesota Department of Natural Resources (MDNR) Division of Lands and Minerals. The WCA requires wetland mitigation for Project impacts.

2.4 Permitting Process

Project proponents that propose to discharge dredge or fill into waters of the United States, including jurisdictional wetlands, must complete a sequencing analysis that demonstrates that they have avoided and minimized impacts to waters of the United States, including flooding, draining or excavating waters, and provided adequate compensation for unavoidable impacts. The following are examples of actions to avoid and minimize impacts to waters of the United States:

- limiting the degree or magnitude of wetland activity
- rectifying temporary impacts by repairing, rehabilitating, or restoring the affected wetland
- reducing or eliminating impacts to wetlands over time by preserving the wetlands through proper maintenance, management, and operation of the Project to avoid further draining or flooding of wetlands

As a final step in the sequencing analysis, the Project proponent must mitigate unavoidable wetland impacts by replacing with wetland areas of equal or greater public value.

Poly Met Mining Inc. (PolyMet) initially submitted a wetland permit application to the USACE and a wetland permit pre-application to the MDNR in July 2004 (Reference (3)). Based on the revised Project plans, PolyMet submitted a revised combined wetland application in 2013, to fulfill the requirements of Sections 404 and 401 of the CWA and the WCA for the Project (Reference (4)). The wetland permit application describes the proposed mining activities that may impact wetlands and identify areas with potential impacts to wildlife, state or federally listed endangered and threatened species, and cultural resources. This revised combined application was sent to the USACE and the MDNR in August 2013. The USACE will send the form to the MPCA as deemed necessary. A permit or certification must be received from each agency before Project work can begin in wetlands.

2.5 Cumulative Wetland Impact Analysis

The cumulative wetland impact study is intended to help satisfy the requirements of Section 3.3.3.2 of the Scoping Decision Document (Reference (5)) to meet National Environmental Policy Act (NEPA) requirements (42 U.S.C. 4321 et seq.). The Council on Environmental Quality (CEQ), 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).*

While Section 404 of the CWA and the WCA provide programs for evaluating project-specific wetland impacts, the NEPA establishes national goals and a process to analyze cumulative effects on protected wetland resources (Section 404 permit authorization). The consideration of resources available in the past compared to those present currently, and the effects of reasonably foreseeable future actions, provides a context for assessing the cumulative impacts on wetland, lake, and deepwater resources.

3.0 Wetland Data

This section summarizes the wetland resources within the Project. Section 3.1 describes the various assessments of wetland resources that have been conducted for the Project. The wetlands within the Project footprint (Large Figure 1) and within select non-Project areas are presented in Section 3.2.

3.1 Wetland Delineation

Delineation and functional assessment of wetlands that may be impacted by the Project have been conducted as the Project has evolved. This section contains summaries of and references to the reports that have been submitted. Large Table 1 provides details for all wetlands located within the Project areas. For each area, the table provides the total acreage of the wetland, wetland type, total wetland area within the Project area (acres), direct wetland impacts (acres), remaining wetland area (acres), quality rating, and type of direct impact disturbance factor.

3.1.1 Initial Report (RS14 Draft-02)

Reference (3) was submitted in November 2006 and describes wetland delineation activities conducted at the Project site between August 2004 and July 2006 including the methods, findings, and a summary of wetland resources within the Project site. The Project areas have changed since the July 2004 permit application and the wetland resources within the Project areas have been refined based on additional field delineations (Sections 3.1.2 through 3.1.5).

Reference (3) presents the results of an evaluation of wetlands delineated within the following Project areas: mine pits, stockpiles, Tailings Basin, railroad access routes to the Plant Site, the Plant Site, and tailings dam drain system and water pipeline. The Tailings Basin is an actively permitted waste storage facility, and is therefore, not subject to state and federal wetland regulations.

3.1.2 Wetland Impacts – Dunka Road Improvements and Treated Water Pipeline (Technical Memorandum)

Reference (6) was submitted on April 26, 2007 and provides information pertaining to wetlands impacted by the Dunka Road improvements and the Treated Water Pipeline. The pipeline will be constructed adjacent to and north of Dunka Road. A field review was conducted in March 2007 to determine the wetland boundaries and verify wetland types in an area 100 feet south and 100 feet north of the road edge starting at the proposed location of the Minnesota Power Substation and ending just north of the junction of Dunka Road and the road to Area 5.

3.1.3 Wetland Impacts – Tailings Basin Mitigation Alternative (Technical Memorandum)

Reference (7) was submitted on June 2, 2008 and describes potential wetland impacts resulting from the construction of the tailings dam in the FTB area. A wetland delineation and functional assessment was conducted in March 2007, November 2007, and May 2008 to identify wetlands not included in prior delineations.

3.1.4 Memo: TB-12 Pipeline Route Threatened and Endangered Species Survey and Wetland Delineation Results for Tailings Basin Alternative

Reference (8) was submitted on December 7, 2009 and describes potential wetland impacts from the construction of the TB-12 pipeline. The construction corridor was 8.4 miles long and 50 feet wide, for a total of 50.6 acres, starting at the Plant Site and ending at the Partridge River. The field delineation was conducted on September 8-9, 2009. The TB-12 Pipeline is also referred to as the Colby Lake Water Pipeline. The Colby Lake Pipeline is not identified as a Project area because no construction will occur in this area.

3.1.5 Project Baseline Wetland Type Evaluation

Reference (9) was submitted in April 2011 and provides baseline data regarding the classification and acreages of wetlands surrounding the Mine Site (Area One) and Tailings Basin (Area Two) (Large Figure 2). Wetlands were evaluated within two areas using data collected from 2004-2010: a 23,927-acre area surrounding the Mine Site (referred to as Area One) and a 19,397-acre area located north and northwest of the Tailings Basin (referred to as Area Two). There were 11,195 acres of wetland identified within Area One (Large Figure 3) and 8,606 acres of wetland identified within Area Two (Large Figure 4). Area One and Area Two include all of the wetland delineations described in Sections 3.1.1 through 3.1.3. The wetlands identified within the TB-12 pipeline (Section 3.1.4) are not found within either Area One or Area Two.

Based on Reference (9), the most common wetland types in Area One include coniferous bog (42%), shrub swamp (30%), and coniferous swamp (18%). In Area Two, the most common wetland types include shrub swamp (34%), coniferous swamp (26%), and coniferous bog (15%). Wetlands across the two areas consist of large wetland complexes that are forested wetland communities dominated by black spruce and tamarack trees.

3.1.6 Updates to Previous Wetland Delineations

Updates to previous wetland delineations were made between April 2011 when Reference (9) was submitted and fall of 2012. Following additional site visits and aerial photograph review, wetland boundaries and types were further refined. Based on these updates, there are approximately 11,201 acres of wetland identified in Area One and 8,622 acres of wetlands identified in Area Two (Table 3-1).

Table 3-1 Wetland Types within Area One and Area Two

Eggers and Reed Wetland Community	Area One (acres)	Area Two (acres)
Coniferous bog	4,581	1,018
Coniferous swamp	2,072	2,537
Deep marsh	220	514
Hardwood swamp	27	161
Open bog	283	354
Open water (includes shallow, open water and lakes)	245	285
Sedge/wet meadow	46	137
Shallow marsh	359	654
Shrub swamp (includes alder thicket and shrub-carr)	3,368	2,962
Total acres of wetland	11,201	8,622

The wetland types in Area One include coniferous bog (41%), shrub swamp (30%), coniferous swamp (18%), shallow marsh (3%), open bog (3%), open water (2%), deep marsh (2%), sedge/wet meadow (less than 1%), and hardwood swamp (less than 1%). In Area Two, the wetland types include shrub swamp (34%), coniferous swamp (29%), coniferous bog (12%), shallow marsh (8%), deep marsh (6%), open bog (4%), open water (3%), hardwood swamp (2%), and sedge/wet meadow (2%).

3.1.7 Additional Non-Project Areas

Additional non-project areas were evaluated, which included the Colby Lake Water Pipeline and Second Creek (Reference (10)). The purpose of evaluating the Second Creek area was to provide data regarding potential indirect wetland impacts associated with stream flow augmentation activities for Second Creek, which are described in Reference (11). No Project construction is planned in the Second Creek area.

The area of analysis for Second Creek began at its origin, at the south end of Tailings Basin Cell 1E, and ended at the east edge of County Highway 666 (Large Figure 1). The majority of this area of analysis is located outside of the Project Areas (Large Figure 1). The Second Creek area included some areas adjacent to Second Creek that were also assessed within the FTB survey or the Colby Lake Pipeline survey.

3.2 Wetland Summary for the Project Areas

The Project footprint that will be used for this analysis has been defined and detailed in the Project Description (Reference (12)). Wetlands are summarized within the Project footprint, and in select non-Project areas. Project areas for the wetland analysis include the Mine Site, Railroad Connection Corridor, Dunka Road and Utility Corridor, Plant Site, FTB, and Hydrometallurgical Residue Facility (HRF). Non-Project areas for the wetland analysis include the Colby Lake Water Pipeline and Second Creek (Large Figure 1).

The Project areas include 166 wetlands covering approximately 1,579 acres (Large Table 1). The percentage (based on acreage) of Eggers and Reed (Reference (13)) wetland types identified in the Project areas include: coniferous bog (55%); alder thicket (12%); shallow marsh (11%); coniferous swamp (9%); deep marsh (7%); sedge meadow (2%); open bog (1%); wet meadow (1%); hardwood swamp (1%); shallow, open water (less than 1%); and shrub-carr (less than 1%).

The overall quality of the wetlands was evaluated using the Minnesota Rapid Assessment Method (MnRAM 3.0). Within the Project areas, 105 of the 166 wetlands (63%) in the Project area are rated as high quality, 11 wetlands (7%) are rated as moderate quality, and 50 wetlands (30%) are rated as low quality (Large Table 1). Low quality wetlands are located at the FTB and HRF. Wetlands at the Mine Site, Dunka Road and Utility Corridor, and Railroad Connection Corridor are ranked as high or moderate quality.

3.2.1 Mine Site

Wetlands were delineated on the 3,014 acre Mine Site (Large Figure 5). Construction of the following systems will occur in the Mine Site: mine pits, stockpiles, haul roads, Rail Transfer Hopper (RTH), Waste Water Treatment Facility (WWTF) and Central Pumping Station (CPS), stormwater ditches and ponds, process water pipes and ponds, culverts, perimeter dike, Category 1 Waste Rock Stockpile Groundwater Containment System, Treated Water Pipeline (TWP), and Dunka Road upgrades (Reference (12)).

A summary of the wetlands, classified by Reference (13) wetland community type, is provided in Table 3-2.

Table 3-2 Wetland Types within the Mine Site

Eggers and Reed Wetland Community	Mine Site (acres)
Coniferous bog	873.43
Coniferous swamp	128.61
Deep marsh	5.03
Hardwood swamp	12.79
Open bog	18.34
Open water (includes shallow, open water and lakes)	0
Sedge/wet meadow	39.53
Shallow marsh	44.02
Shrub swamp (includes alder thicket and shrub-carr)	176.03
Total acres of wetland	1,297.78

A total of 87 wetlands covering approximately 1,298 acres have been identified within the Mine Site (Large Table 1). A total of 7 wetlands, each over 50 acres in size within the Project area, comprise approximately 774 acres of wetlands within the Mine Site. There are an additional 5 wetlands, each over 20 acres in size within the Mine Site. Together, these 12 wetlands comprise 72% of the wetland area within the Mine Site.

A total of 79% of the wetlands in the Mine Site are coniferous swamp/bog and open bog communities. Shrub swamp wetland communities comprise 13%, shallow marshes comprise about 3%, sedge/wet meadow communities make up 3%, and hardwood swamp communities comprise 1% of the wetlands in the Mine Site. Deep marshes comprise less than 1% of the wetland area in the Mine Site.

Approximately 92% of the wetlands in the Mine Site are of high quality and 8% of wetlands are of moderate quality. High quality wetlands have low disturbance levels and high vegetative diversity and integrity. Moderate quality wetlands have impounded open water because of beaver dams and downstream culverts under Dunka Road or the railroad, are adjacent to U.S. Forest Service (USFS) roads, the Dunka Road corridor, or the Railroad Connection Corridor.

3.2.2 Railroad Connection Corridor

An approximately 1.1 mile length of railroad is proposed to connect two existing rail lines between the Mine Site and the Plant Site (Large Figure 6). A summary of the wetlands, classified by Reference (13) wetland community type, is provided in Table 3-3.

Table 3-3 Wetland Types within the Railroad Connection Corridor

Eggers and Reed Wetland Community	Railroad Connection Corridor (acres)
Coniferous bog	0
Coniferous swamp	0.07
Deep marsh	0
Hardwood swamp	0
Open bog	0
Open water (includes shallow, open water and lakes)	0
Sedge/wet meadow	0
Shallow marsh	0.07
Shrub swamp (includes alder thicket and shrub-carr)	0.30
Total acres of wetland	0.44

A total of 4 wetlands covering 0.44 acres have been identified within the Railroad Connection Corridor (Large Table 1). A total of 68% of the wetlands are shrub swamp, 16% are coniferous swamp, and 16% are shallow marsh.

All of the wetlands in the Railroad Connection Corridor are high quality. While these wetlands are moderately impacted by either a haul road or an existing railroad, they have high vegetative diversity/integrity.

3.2.3 Dunka Road and Utility Corridor

This Project area will include improvements to Dunka Road and construction of the Treated Water Pipeline (TWP) that will be located adjacent to and north of Dunka Road (Large Figure 7, Reference (6)). Dunka Road is an unpaved gravel road that was used as an active mine road in the former LTV Steel Mining Company (LTVSMC) operations. Dunka Road will be utilized to transport mine equipment between the Mine Site and the Area 1 Shop, as well as mine personnel between the Mine Site and the Area 2 Shop (Large Figure 1). The TWP will carry water from the CPS to the FTB. A summary of the wetlands, classified by Reference (13) wetland community type, is provided in Table 3-4.

Table 3-4 Wetland Types within the Dunka Road and Utility Corridor

Eggers and Reed Wetland Community	Dunka Road Corridor (acres)
Coniferous bog	0.89
Coniferous swamp	1.54
Deep marsh	0
Hardwood swamp	0
Open bog	0
Open water (includes shallow, open water and lakes)	0
Sedge/wet meadow	0
Shallow marsh	0.52
Shrub swamp (includes alder thicket and shrub-carr)	3.81
Total acres of wetland	6.76

A total of 21 wetlands, encompassing 6.76 acres, have been identified within the Dunka Road and Utility Corridor (Large Table 1). The wetlands in the corridor include shrub swamp (56%), coniferous swamp (23%), coniferous bog (13%), and shallow marsh (8%).

These wetlands are currently located adjacent to Dunka Road and some of the wetlands have been previously logged. Wetlands in the western half of the corridor are located within areas previously disturbed by mining activities in the former LTVSMC operations. All of the wetlands are of high quality.

3.2.4 Plant Site

The Plant Site is the location of the former LTVSMC facilities (Large Figure 8). The existing facilities will be upgraded and construction of the following systems will occur: Flotation Building, Concentrate Dewatering/Storage Building, Hydrometallurgical Plant, Oxygen Plant, and supporting infrastructure (e.g., road, etc.; Reference (12)).

Nearly the entire Plant Site is disturbed by past mining activities. No wetlands are present within the Plant Site, although there is a Plant Reservoir located east of the concentrator that is not regulated as a wetland (Reference (9)).

3.2.5 Flotation Tailings Basin (FTB)

The FTB includes the Tailings Basin cells identified as Cell 1E, Cell 2E, and Cell 2W (Large Figure 9). Construction of the following systems will occur in the FTB area: The FTB, an FTB Containment System to manage FTB seepage along the western, northern, and portions of the eastern sides of the Tailings Basin; a buttress for stability along the northern and eastern sides of Cell 2E; a drainage swale located northeast of Cell 2E; and an overflow channel located northeast of Cell 2E.

A summary of the wetlands located within the Project area, classified by Reference (13) wetland community type, is provided in Table 3-5.

Table 3-5 Wetland Types within the FTB

Eggers and Reed Wetland Community	FTB (acres)
Coniferous bog	0
Coniferous swamp	14.44
Deep marsh	106.27
Hardwood swamp	1.03
Open bog	0
Open water (includes deep water, shallow, open water and lakes)	0.85
Sedge/wet meadow	1.48(1)
Shallow marsh	99.79
Shrub swamp (includes alder thicket and shrub-carr)	14.39
Total acres of wetland	238.25(1)

(1) A 0.03 acre area of sedge/wetland meadow is classified as exempt.

A total of 52 wetlands covering approximately 238 acres were identified within the FTB (Large Table 1). There is a 0.03 acre portion of the sedge/wet meadow wetland identified as exempt because the wetlands are located within the Cliffs Erie LLC (formerly LTVSMC) Permit To Mine Ultimate Tailings Basin Limit boundary and are not regulated by state and federal wetland regulations (Section 5.1). The wetlands in the FTB include deep marsh (45%), shallow marsh (42%), coniferous swamp (6%), shrub swamp (6%), sedge/wet meadow (less than 1%), open water (less than 1%), and hardwood swamp (less than 1%).

The wetlands in the FTB have been previously impacted by LTVSMC tailings deposition, roads, and impoundment. The majority (92%) of wetlands within the FTB are currently rated as low quality with low vegetative diversity/integrity. Eight percent of the wetlands are rated as moderate quality.

3.2.6 Hydrometallurgical Residue Facility (HRF)

The HRF will be located near the southwest corner of the Cell 2W, at the site of the Emergency Basin used in the former LTVSMC operations (Large Figure 10, Reference (12)).

A summary of the wetlands located within the Project area, classified by Reference (13) wetland community type, is provided in Table 3-6.

Table 3-6 Wetland Types within the HRF

Eggers and Reed Wetland Community	HRF (acres)
Coniferous bog	0
Coniferous swamp	0
Deep marsh	0
Hardwood swamp	0
Open bog	0
Open water (includes deepwater, shallow, open water and lakes)	0
Sedge/wet meadow	0
Shallow marsh	36.07(1)
Shrub swamp (includes alder thicket and shrub-carr)	0
Total acres of wetland	36.07(1)

(1) A 28.56 acre area of shallow marsh is classified as exempt.

A total of 2 shallow marsh wetlands, covering 36.07 acres, were identified within the HRF (Large Table 1). There is a 28.56 acre portion of the shallow marsh wetland identified as exempt because wetlands located within the Cliffs Erie LLC (formerly LTVSMC) Permit to Mine Ultimate Tailings Basin Limit boundary are not regulated by state and federal wetland regulations (Section 5.1).

An unpaved, gravel road is located along the north side of these wetlands along with small buildings and associated facilities used in the former LTVSMC operations.

3.2.7 Colby Lake Water Pipeline

The Colby Lake Water Pipeline area of analysis contains an existing pipeline that was used to provide makeup water in the former LTVSMC operations (Large Figure 11). There will be no construction within this area as the existing pipeline will be used to provide water for the Project. A summary of the delineated wetlands, classified by Reference (13) wetland community type, is provided in Table 3-7.

Table 3-7 Wetland Types within the Colby Lake Water Pipeline

Eggers and Reed Wetland Community	Colby Lake Water Pipeline Corridor (acres)
Coniferous bog	0
Coniferous swamp	0
Deep marsh	1.00
Hardwood swamp	0
Open bog	0
Open water (includes deep water, shallow, open water and lakes)	0
Sedge/wet meadow	1.35
Shallow marsh	2.58
Shrub swamp (includes alder thicket and shrub-carr)	2.06
Total acres of wetland	6.99

A total of 14 wetlands covering 6.99 acres were identified within the Colby Lake Water Pipeline area of analysis. The wetlands include shallow marsh (37%), shrub swamp (30%), wet meadow (19%), and deep marsh (14%).

The wetlands are located adjacent to an unpaved, gravel road and within a previously disturbed corridor. The majority of wetlands in this corridor are rated as low quality (93%), with the remaining wetland rated as moderate quality (7%).

3.2.8 Second Creek

The Second Creek area of analysis is located south of the FTB (Large Figure 8). There will be no Project construction in this area.

A summary of delineated wetlands within the Second Creek area of analysis, classified by Reference (13) wetland community type, is provided in Table 3-8.

Table 3-8 Wetlands within the Second Creek Area

Eggers and Reed Wetland Community	Second Creek Area (acres)
Coniferous swamp	16.82
Deep marsh	19.57
Hardwood swamp	21.05
Open water (includes deep water, shallow, open water and lakes)	1.29
Wet meadow	1.28
Shallow marsh	106.02
Shrub swamp (includes alder thicket and shrub-carr)	132.88
Total acres of wetland	298.91

A total of 30 wetlands covering 298.91 acres were identified within the Second Creek area of analysis (Reference (10)). The wetlands include alder thicket or shrub-carr (44%), shallow marsh (35%), hardwood swamp (7%), deep marsh (7%), coniferous swamp (6%), wet meadow (less than 1%), and shallow, open water (less than 1%). Of these 30 wetlands, only 22 are unique to the Second Creek analysis area. One of these wetlands is located in the FTB area, and 7 are located in the Colby Lake Pipeline area of analysis. To avoid double counting those areas, the analysis of direct and potential indirect impacts in the Second Creek area (Sections 5.1.8 and 5.2.4) excludes areas that fall within the FTB or Colby Pipeline areas.

4.0 Methods for Impact Evaluation

The Wetland Work Plan (Attachment A) was approved by the Co-lead Agencies on September 16, 2011 and describes the methods that will be used to identify direct wetland impacts and potential indirect wetland impacts for the Project. The Wetland Work Plan was developed as specified in the Wetland Resources Impact Assessment Planning (IAP) Final Summary Memo and Co-lead Agency Final Work Plan Preparation Guidance of July 1, 2011 (Guidance Document) and the Wetland IAP Work Plan Compiled Comments dated August 30, 2011. Wetland impacts for the Project were previously evaluated for the Draft Environmental Impact Statement (DEIS) (Reference (14)) and included direct, potential indirect, and cumulative impacts. The results of the wetland analysis are presented in Section 5.0.

5.0 Impact Analysis

5.1 Direct Impacts

For this impact analysis, direct impacts are defined as mining-related activities that result in filling or excavation within the boundaries of a wetland. The analysis performed for the DEIS is described in Section 4.2 of Reference (14). The analysis performed for the Supplemental DEIS duplicates that effort using the revised Project Footprint and using accepted tools and protocols as defined in Attachment A. Wetlands within the Project Footprint were classified using Reference (13) wetland community types. The wetland types and acreages were identified in Reference (9), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

The FTB and the HRF are located within the LTVSMC Permit to Mine Ultimate Tailings Basin Limit boundary. When LTVSMC ceased production in January 2001, the mining related assets were transferred to Cleveland Cliffs, Inc. which formed Cliffs Erie LLC. Wetlands located within the Cliffs Erie LLC (formerly LTVSMC) Permit to Mine Ultimate Tailings Basin Limit boundary, are not regulated by state and federal wetland regulations so are not included in this analysis.

The direct impacts associated with each wetland within the Project areas are shown in Large Table 1. The direct wetland impacts are summarized by wetland type using Reference (13) wetland community types as shown in Large Table 2. Of the 166 wetlands in the Project area, 128 wetlands will be directly impacted, totaling 913.84 acres of direct wetland impact. The Mine Site will contain the majority of direct wetland impacts (83%), followed by the FTB (15%), HRF (less than 1%), Dunka Road and Utility Corridor (less than 1%), and the Railroad Connection Corridor (less than 0.1%). No direct impacts are associated with the Plant Site, the Colby Lake Water Pipeline area, or Second Creek area.

The direct wetland impacts within the Project areas will occur in the following wetland types: coniferous bog (56%), shrub swamp (12%), coniferous swamp (9%), shallow marsh (9%), deep marsh (8%), sedge/wet meadow (4%), hardwood swamp (1%), and open bog (1%).

5.1.1 Mine Site

The Project features within the Mine Site were buffered up to 100 feet, then the feature and buffer areas were merged, resulting in the proposed area of disturbance as shown in Large Figure 5. Creating a maximum area of potential disturbance for the Project features will avoid underestimating the direct wetland impacts in the Project area.

There are 59 directly impacted wetlands located in the Mine Site covering approximately 758 acres (Large Figure 5 and Large Table 2). The total wetlands impacted by direct wetland impact include fill (39%), excavation (24%), or both fill and excavation (37%). Three wetland types comprise 89% of the proposed wetland impacts in the Mine Site and include

508 acres of coniferous bog (67%), 98 acres of shrub swamp (13%), and 70 acres of coniferous swamp (9%). In addition, 38 acres of sedge/wet meadow (5%), 24 acres of shallow marsh (3%), 12 acres of hardwood swamp (2%), 8 acres of open bog (1%), and deep marsh (less than 1%) will also be impacted.

Approximately 99% of the directly impacted wetlands are rated high quality (Large Table 1). One percent of the directly impacted wetlands are rated as moderate quality with the disturbances in these wetlands related to impoundment and proximity to roads.

5.1.2 Railroad Connection Corridor

The proposed area of disturbance for the Railroad Connection Corridor includes the entire area shown in Large Figure 6. The Project features within the Railroad Connection Corridor were buffered up to 10 feet, then the feature and buffer areas were merged, resulting in the proposed area of disturbance as shown Large Figure 6. Creating a maximum area of potential disturbance for the Project features will avoid underestimating the direct wetland impacts in the Project area.

There are 4 directly impacted wetlands located in the Railroad Connection Corridor covering 0.44 acres (Large Figure 6 and Large Table 2). The type of direct wetland impact is fill (100%). The wetland types that will be directly impacted include shrub swamp (68%), coniferous swamp (16%), and shallow marsh (16%).

All of the wetlands in this area are high quality and have high vegetative diversity/integrity (Large Table 1). These wetlands have been moderately impacted by either a haul road or an existing railroad.

5.1.3 Dunka Road and Utility Corridor

The Project features within the Dunka Road and Utility Corridor were buffered up to 10 feet, then the feature and buffer areas were merged, resulting in the proposed area of disturbance as shown in Large Figure 7. Creating a maximum area of potential disturbance for the Project features will avoid underestimating the direct wetland impacts in the Project area.

There are 21 directly impacted wetlands located in the Dunka Road and Utility Corridor covering 6.76 acres (Large Figure 7 and Large Table 2). The type of direct wetland impact is fill (100%). The wetland types that will be directly impacted include shrub swamp (56%), coniferous swamp (23%), coniferous bog (13%), and shallow marsh (8%).

Some of the wetlands have been previously logged and wetlands in the western half of the corridor are located within areas previously disturbed by mining activities in the former LTVSMC operations. All of the wetlands are of high quality (Large Table 1).

5.1.4 Plant Site

There are no direct wetland impacts in the Plant Site because no wetlands are present. The constructed Plant Reservoir located east of the Concentrator Building is not regulated as a wetland (Large Figure 8).

5.1.5 Flotation Tailings Basin (FTB)

Wetlands located outside of the Cliffs Erie LLC Permit to Mine Ultimate Tailings Basin boundary but within the FTB are included in the direct wetland impact analysis (Large Figure 9). The wetland in the FTB that is not subject to state and federal regulations includes 0.03 acres of Wetland ID T8.

The Project features within the FTB were buffered up to 25 feet, then the feature and buffer areas were merged, resulting in the proposed area of disturbance as shown in Large Figure 9. Creating a maximum area of potential disturbance for the Project features will avoid underestimating the direct wetland impacts in the Project area.

There will be 43 directly impacted wetlands located in the FTB covering 140.93 acres (Large Figure 9, Large Table 2). The total wetlands impacted by direct wetland impact include fill (29%), excavation (2 %), excavation and fill (2 %), and the FTB Containment System (46%). The wetland types that will be directly impacted include deep marshes (53%), shallow marshes (32%), coniferous swamps (8%), shrub swamps (6%), and fresh/wet meadows (1%).

Wetlands in this area have been disturbed by previous mining activities in the former LTVSMC operations or by impoundments caused by beaver activity throughout the area. All of the directly impacted wetlands are disturbed by impoundment, fill, or ditches, and are low or moderate quality wetlands (Large Table 1).

5.1.6 Hydrometallurgical Residue Facility (HRF)

Wetlands located outside of the Cliffs Erie LLC Permit to Mine Ultimate Tailings Basin boundary but within the HRF are included in the direct wetland impact analysis (Large Figure 10). The wetland in this Project area that is not subject to state and federal regulations includes 28.56 acres of Wetland ID 1155.

The Project features within the HRF were buffered up to 50 feet, then the feature and buffer areas were merged, resulting in the proposed area of disturbance as shown Large Figure 10. Creating a maximum area of potential disturbance for the Project features will avoid underestimating the direct wetland impacts in the Project area.

There are two directly impacted wetlands located in the HRF covering 7.51 acres (Large Figure 10, Large Table 2). The type of direct wetland impact includes fill (100%). The wetland type that will be directly impacted includes shallow marsh (100%) which is currently a low quality wetland (Large Table 1).

5.1.7 Colby Lake Water Pipeline

There are no direct impacts to wetlands along the Colby Lake Water Pipeline because there will be no construction within this area (Large Figure 11).

5.1.8 Second Creek Area

There are no direct impacts to wetlands within the Second Creek area because there will be no construction within this area (Large Figure 8).

5.2 Potential Indirect Impacts

The analysis of potential indirect wetland impacts was completed based on information in Attachment A. The purpose of this analysis is to provide an estimate of potential indirect wetland impacts. The results of these respective analyses and assessments identify areas to be monitored for potential wetland impacts as part of the monitoring plan that is expected to be implemented as part of the Section 404 permit conditions for the Project.

Potential indirect wetland impacts were assessed based on:

- Changes in wetland watershed areas (during operation and long-term closure);
- Groundwater drawdown resulting from open pit mine dewatering;
- Groundwater drawdown resulting from operation of the FTB including groundwater seepage containment;
- Changes in stream flow near the Mine Site and FTB and associated impacts to wetlands abutting the streams (during operation and long-term closure);
- Wetland fragmentation from Project elements such as open pits, stockpiles, haul roads, etc.; and
- Potential change in wetland water quality related to atmospheric deposition of dust and rail car spillage associated with Mine Site and FTB operations.

Each analysis in the above list was completed using the same set of wetlands that were not directly impacted (Section 5.1), therefore there are wetlands that may be potentially indirectly impacted by more than one type of assessed source (e.g., Wetland ID X may be impacted by fragmentation, change in watershed, and groundwater drawdown). Therefore, the potential indirect impacts for each wetland cannot be summed across the analysis as this may result in double-counting acres for a wetland.

The potential indirect wetland impact analysis was completed for the Mine Site Area, the FTB Area, the transportation corridors (railroad and Dunka Road), the Colby Lake Water Pipeline area, and the Second Creek area. Wetlands that were identified as directly impacted in Section 5.1 were excluded from this evaluation. No potential indirect impacts are identified within the Plant Site due to the lack of wetlands in this area, or in the HRF, because all wetlands in the HRF are directly impacted.

5.2.1 Mine Site Area

Wetlands were identified within 500-feet increments beginning at the edge of the mine pits and continuing out to a total of 10,000 feet (Large Figure 12). The area of evaluation only included wetlands within Area One (Large Figure 12) where wetland type information has been developed and it did not include wetlands identified as directly impacted (Section 5.1). In addition, wetlands in the Peter Mitchell open pit taconite mine and areas north of this mine were excluded from evaluation as described in Attachment A). Large Table 3 identifies each wetland within each of the 500-feet zones and Large Table 4 provides a summary of wetland types within each 500-feet increment.

5.2.1.1 Potential Indirect Impacts – Wetland Fragmentation

For remaining wetlands not directly impacted (Section 5.1), an estimate of potential indirect wetland impacts from wetland fragmentation by Project features (open pits, stockpiles, haul roads, etc.) was determined based on an analysis of the various factors that may contribute to potential fragmentation. Considerations for determining a wetland fragment impact included: wetland type, source of hydrology, size of remaining wetland, location in the current watershed, location in the future watershed, connectivity to other wetlands, and direction of flow in the area. Wetland fragments in the Mine Site are identified in Table 5-1.

Wetlands were determined to be fragmented and their associated remaining acreage included as a potential indirect wetland impact, for example, if they were small remnants of a directly impacted wetland located between Project features (e.g., in the area between the Category 1 Waste Rock Stockpile and the West Pit).

Approximately 26.4 acres of wetland fragments were identified in the Mine Site (Table 5-1). The majority of the wetland fragments in the Mine Site consist of coniferous bog (79%), followed by alder thicket (14%), coniferous swamp (7%), and sedge meadow (less than 1%).

Table 5-1 Fragmented Wetlands in the Mine Site

Wetland ID	Eggers and Reed Wetland Community	Total Wetland Size (acres)	Direct Impact (acres)	Potential Indirect Impact (acres)
20	Sedge meadow	17.06	16.96	0.10
32	Coniferous bog	73.36	70.99	2.37
45	Alder thicket	37.55	28.83	3.58
48	Coniferous bog	89.16	27.8	1.86
51	Alder thicket	7.47	7.45	0.02
52	Alder thicket	3.88	3.88	<0.01
55	Alder thicket	3.91	3.85	0.06
57	Coniferous swamp	78.06	50.49	1.41
68	Coniferous swamp	23.81	10.89	0.09
77	Coniferous bog	13.01	0.92	<0.01
80	Coniferous bog	0.29	0.22	0.08
81	Coniferous swamp	1.68	1.44	0.24
82	Coniferous bog	62.4	60.77	1.63
86	Coniferous bog	2.47	2.46	0.01
97	Coniferous bog	4.46	2.57	1.89
98	Coniferous bog	15.5	15.07	0.42
100	Coniferous bog	176.19	102.96	3.44
101	Coniferous bog	14.21	11.73	0.08
103	Coniferous bog	118.84	109.97	8.86
104	Coniferous bog	3.57	3.47	0.10
107	Coniferous bog	40.92	31.63	0.10
107A	Coniferous swamp	1.74	1.69	0.05
Total acres of wetland		789.54	566.04	26.39

5.2.1.2 Potential Indirect Impacts – Change in Hydrology

5.2.1.2.1 Potential Indirect Impacts – Change in Hydrology due to Change in Watershed Area

Potential for indirect impacts to wetland acreage not directly impacted (Section 5.1) due to change in watershed area were assessed by evaluating the change in watershed area per acre of wetland. Watersheds were defined for each wetland within the Mine Site boundary as well as wetlands outside the Mine Site with watershed area that may be impacted by Project features. Wetland and watershed areas were determined for the following conditions: existing conditions, during operations when the maximum amount of watershed has been removed (i.e., maximum Project extent), and at long-term closure. The analysis was completed using the following steps:

- The watershed area is defined as the sum of the upland area and the wetland area within each watershed. For each wetland in the Mine Site Area, GIS was used to determine the upland area (acres) and wetland area (acres) within each watershed area (acres). Using these acreages, the percentage of a wetland within its watershed was calculated.

- The tributary acres per wetland acre were determined as a proportion of the watershed area (acres) to the wetland area (acres).

- The equivalent watershed yield (acre-feet/year (ac-ft/yr)) was determined for the existing, maximum operational extent, and long-term closure conditions. The average net precipitation rate is 11.77 inches/year, as calculated using the Partridge River streamflow data (Reference (15)). This rate was applied to each watershed to convert the tributary ratio in Step 2 to an equivalent flow (expressed as ac-ft/yr per acre of wetland) and an equivalent yield (expressed as inches/year).

- The change in the equivalent yield (inches/year) estimated over the life of the Project was evaluated relative to existing conditions equivalent yield to calculate a maximum percent change in yield. The change was compared to the range in observed yield estimated from USGS flow data of the Partridge River watershed for the historical period 1978-1988 (USGS gage 04015475).

The existing conditions include the wetlands which represent the existing, relatively undisturbed conditions in the Mine Site Area. Large Table 5 identifies the acreage for each wetland and its associated watershed for the existing conditions. This analysis includes wetlands and associated watersheds that are partially or completely within the Mine Site boundary. There is a total of 3,325 acres of wetlands within 6,287 acres of watershed; this results in about 53% of the analysis area covered by wetlands.

During operations, some watershed areas may be directly impacted by the Project and will no longer be considered as a tributary area to the wetland. Additionally, wetland areas may be directly impacted by the Project. As a result, the amount of water potentially contributed by the watershed to support the hydrology of the remaining wetlands may also change. Large Table 5 identifies the acreage for each wetland and its associated watershed for the operational conditions.

There were 20 wetlands that show an increase or decrease of greater than 20% equivalent yield which were identified as potentially indirectly impacted[1]. Ombrotrophic coniferous bogs and open bogs, identified in Large Table 5 were not included in the total wetland acreage because their hydrology is supported by precipitation and not dependent on the size of the watershed. There are 11 wetlands (totaling approximately 35 acres) that have the potential to experience an increase in yield per wetland acre of greater than 20% and 9 wetlands (totaling approximately 15 acres) that may experience a decrease in yield per wetland acre in excess of 20% (Large Table 5; Large Figure 13).

The 49.39 acres of potentially indirectly impacted wetland types include alder thicket (52%), coniferous swamp (34%), minerotrophic coniferous bog (8%), shallow marsh (6%), and sedge meadow (less than 1%).

During reclamation, a portion of the wetlands and wetland watersheds within the Mine Site will be restored to the existing condition. Large Table 5 identifies the acreage for each wetland and its associated watershed for the long-term closure conditions.

5.2.1.2.2 Potential Indirect Impacts – Changes in Hydrology – due to Drawdown

Suggested guidelines for potential wetland indirect impact zones resulting from changes in hydrology associated with the proposed mine development were provided by John Adams, ERM on February 26, 2011 (Reference (16)). Those suggested guidelines were supported by a 2009 position paper by the MDNR (Reference (17)), which provided a scientific analysis and analog data from other sites along the Mesabi Iron Range. The suggested potential impact zones were modified slightly by the Wetland IAP Group and the modified potential impact zones are referenced in Attachment A. The use of the potential impact zones referenced in Attachment A, as supported by the analog information referenced above, is a reasonable approach to estimating potential indirect wetland impacts resulting from hydrologic effects but is likely to overestimate the potential wetland impacts.

[1] The +/-20% threshold was used to assess impacts to wetland hydrology based on the direction of the Co-Lead Agencies to use this threshold to assess hydrologic changes to surface water resources downstream of the project, including streamflow. The +/-20% threshold, as used for streams, is referenced in in the USEPA's proposed determination on the Pebble Mine in Alaska; that document states: "A compilation of research from around the world indicates that, regardless of geographic location, daily streamflow alterations of greater than 20% can cause major changes in the structure and function of streams (Reference (51))."

Analog Data

This section discusses the justification for the use of the analog data (Reference (16)) "based upon comparisons of the existing regional and site-specific geologic data (such as bedrock faults, bedrock joint systems, bedrock topography, glacial till hydraulic conductivities, etc.), site-specific engineering controls such as the Category 1 Waste Rock Stockpile Groundwater Seepage Containment System, and the geologic settings of the analog information sites and the Mine Site" per Attachment A.

The analog data was used in place of a numerical model such as MODFLOW, which cannot practically be used to estimate potential indirect wetland impacts at the Mine Site, due to the complex mix of fractured bedrock, glacial deposits, and wetland soils at the Mine Site (Reference (17)) and therefore cannot be used to accurately assess the potential indirect impacts of pit dewatering on wetlands. As stated in Reference (17), previous versions of the MODFLOW model assumed that homogenous vertical and horizontal hydraulic conductivities were present within each model unit (i.e., bedrock, glacial deposits, and wetland soils), which is not the case at the Mine Site. Since the Adams and Liljegren position paper (Reference (17)) was issued, the MODFLOW model calibration was updated and the surficial deposits are represented as heterogeneous in the horizontal direction (Attachment B of Reference (15)). Despite the addition of heterogeneity to the MODFLOW model, the purpose of the model is to provide estimates of groundwater inflow rates to the pits. The model is not intended to represent the complex, localized heterogeneity that will likely exert a significant influence on whether potential indirect wetland impacts will occur.

The hydraulic properties of the bedrock and surficial deposits have been estimated at the Mine Site by a variety of methods, including conducting aquifer tests and using grain-size distribution data from soil borings. The range of hydraulic conductivities are as follows:

- Based on aquifer tests, the hydraulic conductivity of the unconsolidated deposits range from 0.012 to 31 feet/day (Reference (15)). Analysis of grain-size distribution data yielded a range of hydraulic conductivity estimates from 2 to 167 feet/day (Attachment B of Reference (15)).

- The hydraulic conductivity of bedrock of the Duluth Complex ranges from 0.00026 to 0.041 feet/day as measured by single well tests conducted in boreholes (Reference (15)).

- The hydraulic conductivity of bedrock of the Virginia Formation ranges from 0.0024 to 1.0 feet/day as measured by conducting four pumping tests (Reference (15)).

- Undecomposed, surface peat soils have hydraulic conductivities of up to several feet per day (Reference (17)).

- Deep, more decomposed peat layers have hydraulic conductivities on the order of 0.0028 feet/day (Reference (17)).

Because there is such a wide range in hydraulic conductivity within the natural geologic formations at the Mine Site, each model layer would contain widely variable hydraulic conductivities. Therefore, it is not realistic to model the expected effects of mine dewatering on wetlands in a meaningful fashion.

The Canisteo Pit analog site provides a clear example of how MODFLOW modeling cannot be expected to accurately estimate conditions in areas with highly variable, complex geology. In the Canisteo Pit modeling effort, the difference between simulated and measured water levels ranged from +28 feet to -4 feet and clearly could not accurately estimate water level changes of a few feet or less as would be necessary for estimating wetland impacts resulting from hydrologic changes (Reference (17)).

The low hydraulic conductivities result in most water movement in peat wetlands occurring horizontally in the upper layers of peat. The deeper, more decomposed peat soils limit vertical seepage because of the low hydraulic conductivities (~0.0028 feet/day) (Reference (17)). Increased vertical seepage will not be induced by the lowering of groundwater below such a peat layer, the wetland hydrology is simply perched on the impermeable peat layer as in many perched wetlands with no underlying groundwater. Therefore, hydrologic impacts to peat wetlands have only been observed to occur within 1,000 feet from the edge of the mine pits.

Vertical seepage losses from wetlands without peat soils will only have the potential to occur in isolated areas of contiguous, high hydraulic conductivity bedrock faults and fracture zones located under isolated areas of high hydraulic conductivity glacial till and aligned with wetlands containing high hydraulic conductivity soils. The probability of these three features aligning on a broad scale is extremely low (Reference (17)).

The geologic and hydrogeologic settings of the Mine Site and the analog sites are relatively similar with a thin veneer of heterogeneous unconsolidated deposits underlain by fractured bedrock. The hydraulic conductivity of the unconsolidated deposits and bedrock are lower at the Mine Site than at the analog sites, so it is expected that the stated impact zones will likely overestimate the extent of potential wetland impacts (Attachment A). In addition, due to the thin, discontinuous nature of the surficial deposits at the Mine Site, drawdown effects are expected to be more localized at the Mine Site than at the analog sites. The numerous bedrock outcrops present at the Mine Site are also expected to act as barriers to flow in the unconsolidated aquifer, thereby limiting the area of influence of the pit. The analog sites have fewer or no bedrock outcrops compared to the Mine Site. Finally, the presence of the Partridge River approximately 4,000-6,000 feet south (downstream) of the mine pits, is likely to act as a natural barrier to the expansion of the cone of depression within the surficial aquifer in the zone from 3,500-10,000 feet from the pit.

Prior to conducting the analysis to identify potential indirect wetland impacts resulting from changes in hydrology, bog wetlands within and surrounding the Mine Site were reclassified as either ombrotrophic or minerotrophic consistent with the November 2011, USACE Memorandum (Reference (18)). For purposes of addressing potential indirect impacts for the

Project, the Wetlands Workgroup recommended that wetlands identified as open bog or coniferous bog, using the Eggers and Reed (Reference (13)) classification system, should be subcategorized as either ombrotrophic or somewhat minerotrophic. This is important because ombrotrophic bogs would likely not be impacted by groundwater drawdown associated with dewatering during the Project, whereas more minerotrophic bogs would have a higher likelihood of being impacted (Reference (18)). Using a conservative approach for the analysis (i.e., one that errs on the side of estimating greater wetland impacts), all bog communities within 0-1,000 feet from the edge of the mine pits were categorized as Low Likelihood of wetland hydrology impact.

Wetlands are identified within four analog impact zones located within 0-1,000 feet, >1,000-2,000 feet, >2,000-3,500 feet, and >3,500-10,000 feet from the edge of the mine pits within Area One (Large Figure 14). Based on Attachment A, wetlands that are located within multiple analog impact zones are included in the analog impact zone that is closest to the edge of the mine pits. The likelihood of wetland hydrology impact is categorized as High, Medium, Low, and No Impact within the analog impact zones. The acreage of each wetland type within these potential impact zones is summarized in Large Table 6 and locations are shown in Attachment B, Large Figures B-1 to B5. Using this analysis, there are 1,328 acres of wetlands in the 0-1,000 feet zone (Large Figure B-2), 619 acres in the >1,000-2,000 feet zone (Large Figure B-3), 1,162 acres of wetlands in the >2,000-3,500 feet zone (Large Figure B-4), and 2,718 acres of wetlands in the >3,500-10,000 feet zone (Large Figure B-5) beyond the edge of the pits.

Large Figure B-5 shows the 5,827 acres of wetlands within these zones, with the likelihood of wetland hydrology impact categorized as: No Impact - 3,679 acres of wetlands (63%); Low Likelihood - 750 acres of wetlands (13%); Moderate Likelihood - 531 acres of wetlands (9%); and High Likelihood - 867 acres of wetlands (15%) (Large Table 6). Within 0-10,000 feet from the edge of the mine pits, wetland types with a High Likelihood of wetland hydrology impact include alder thicket (848 acres), coniferous swamp (19 acres), and sedge/wet meadow (less than 1 acre); with a Moderate Likelihood include alder thicket or shrub-carr (327 acres), coniferous swamp (195 acres), deep marsh (5 acres), shallow marsh (3 acres), and hardwood swamp (less than 1 acre); and with a Low Likelihood include coniferous swamp (223 acres), coniferous bog (453 acres), alder thicket or shrub-carr (68 acres), shallow marsh (4 acres), sedge/wet meadow (2 acres), and hardwood swamp (less than 1 acre).

The wetlands categorized as High Likelihood are dominated by one alder thicket (824 acres; wetland ID 53D) that has approximately 4 acres (less than 1%) within the 0-1,000 feet analog impact zone. The remainder of this wetland (more than 99%) is located more than 1,000 feet away from the edge of the mine pits and extends out to the edge of Area One (Large Figure B-1). Based on the analog data, hydrologic impacts to peat wetlands are only observed to occur within 1,000 feet from the edge of the mine pits. Therefore, wetlands were categorized within the analog impact zones using an alternate method to determine the likelihood of wetland hydrology impact. For this method, wetlands that are located within multiple analog impact zones are split along zone edges and acreage is calculated by zone. As a result, the acreage for wetlands crossing zone edges is split among multiple zones, rather than included in the analog impact zone that is closest to the edge of the mine pits (Attachment B, Large Figures B-1 through B5). The acreage of each wetland type within these potential impact zones is summarized in Large Table 7 and locations are shown in Attachment B, Large Figures B-6 through B10. Using this analysis, there are 234 acres of wetlands in the 0-1,000 feet zone (Large Figure B-7), 311 acres in the >1,000-2,000 feet zone (Large Figure B-8), 718 acres of wetlands in the >2,000-3,500 feet zone (Large Figure B-9), and 4,564 acres of wetlands in the >3,500-10,000 feet zone (Large Figure B-10).

Large Figure B-10 shows the 5,827 acres of wetlands within these zones, with the likelihood of wetland hydrology impact categorized as: No Impact - 5,094 acres of wetlands (87%); Low Likelihood - 568 acres of wetlands (10%); Moderate Likelihood - 119 acres of wetlands (2%); and High Likelihood - 46 acres of wetlands (1%) (Large Table 7). Within 0-10,000 feet from the edge of the Mine Pits, wetland types with a High Likelihood of wetland hydrology impact include alder thicket (27 acres), coniferous swamp (19 acres), and sedge/wet meadows (less than 1 acre); with a Moderate Likelihood include alder thicket and shrub-carr (96 acres), coniferous swamp (14 acres), deep marsh (5 acres), shallow marsh (3 acres), and hardwood swamp (less than 1 acre); and Low Likelihood include alder thicket and shrub-carr (247 acres), coniferous swamp (135 acres), coniferous bog (179 acres), shallow marsh (4 acres), sedge/wet meadow (2 acres), and hardwood swamp (1 acre).

Qualitative Discussion

This section includes the general discussion regarding potential indirect wetland impacts that might occur based on hypothetical hydrologic drawdown levels using the hydrologic wetland sensitivity method as described in Attachment A. The potential indirect wetland impacts may include: conversion to other wetland community types, a change in vegetation without a change in community type, conversion to uplands, or other impacts.

Three categories of hydrologic wetland sensitivity, each with associated groundwater drawdown levels for each wetland community type, were defined as follows:

- **None-to-Slight**: Water level changes in which impact on the community will be slight to none with the potential for slight changes in abundance of various species but no change in species present. Monitoring or mitigation not anticipated.

- **Moderate**: Water level changes that may have a moderate impact on the wetland community with the potential for the loss and addition of some species. Monitoring recommended with mitigation based on monitoring results.

- **Severe**: Water level changes expected to result in severe impacts on the community with the potential for considerable loss of characteristic plant species and invasion by other species, conversion of wetland type or conversion to upland. Monitoring should be conducted and mitigation may be required. According to the hydrologic wetland sensitivity method, wetlands in which groundwater is not the principal source of water and in which mitigation of surface water is planned (e.g., streamflow augmentation) should be excluded from this category.

The wetland community sensitivity and estimating of changes to wetland communities as a result of groundwater drawdown for the hydrologic wetland sensitivity method were determined based on evaluating the vegetation characteristics of numerous Minnesota wetlands contained in the MDNR Natural Heritage Information System (NHIS) database (Attachment A). That data was used to develop an ordination, which groups wetlands within the various native plant community system groups (Reference (19)) reflecting differences in the degree of wetness of each community. However, the degree of wetness and the source of wetness information were not well-documented so it is unclear if the wetness parameter is related to persistence of wetness throughout the growing season, the typical maximum depth of water within the wetland, or some other wetness characteristic.

That ordination was then used to estimate how wetland communities will respond to decreasing water levels, with the main assumption that wetlands will move to the drier part of the ordination. The three categories of potential impact to the wetland communities were defined as None-to-Slight, Moderate, or Severe. The method states that the changes in the wetland communities associated with the Severe category are less valid for estimating vegetation changes than wetland communities included in the Moderate or None-to-Slight categories (Attachment A). Therefore, the hydrologic wetland sensitivity method simply estimated how wetland communities will respond to groundwater drawdown by assuming that they will change to drier native plant communities or variants of the original community. No data or research was utilized from actual wetlands responding to groundwater drawdown so this analysis and related data should only be used as an initial estimate of what changes might be expected should groundwater levels actually fall as a result of the proposed mining activities. Monitoring of hydrology and vegetation within potentially impacted wetlands represents the best method for documenting actual community changes resulting from hydrology changes, understanding complex hydrologic conditions, and identifying potential future indirect impacts related from mine features.

The preliminary information developed for the hydrologic wetland sensitivity method was utilized to estimate what type of wetland impacts might occur at the Mine Site assuming various, theoretical groundwater drawdown levels. Large Table 8 provides a summary of the estimated wetland community changes using the groundwater drawdown thresholds for each wetland type as indicated in the hydrologic wetland sensitivity method (Attachment A). The hydrologic wetland sensitivity method did not evaluate shallow marsh, deep marsh, or shallow open water communities, so the groundwater breaks and estimated community changes were developed based on past experience and professional judgment.

5.2.1.2.3 Quantification of Potential Indirect Impacts due to Change in Hydrology

Large Table 8 shows that for minor groundwater drawdown, ranging from 0.5 feet to 2 feet for the various wetland communities, no substantial wetland community changes are identified. In the moderate impact sensitivity category with water level changes ranging from 0.5 feet to 4 feet, some changes to vegetation are possible in all wetland communities with marshes, open water, and meadow communities potentially resulting in conversion of wetland type and increased shrub and tree growth in shrub and forested wetlands. In the severe impact sensitivity category, nearly all wetland community types are estimated to convert to other wetland types with a few wetlands estimated to convert to upland, including meadow wetlands and possibly hardwood swamps. Monitoring to document impacts to wetlands is recommended for all potential impacts in the moderate and severe impact categories.

Because groundwater modeling cannot reasonably estimate potential indirect wetland impacts, Attachment A concluded that analog impact zones can provide a reasonable estimate of the areal extent of potential indirect wetland impacts resulting from hydrologic effects. In addition, the evaluation of theoretical groundwater drawdown levels can help estimate what types of potential indirect wetland impacts might occur. However, wetland hydrology is a complex mix of precipitation, surface runoff, and in some cases, groundwater. The response of complex natural systems to human disturbances can only be estimated. Therefore, monitoring of wetland hydrology and vegetation communities is the best way to document the extent and magnitude of wetland responses (potential indirect impacts) to human disturbances.

5.2.1.3 Potential Indirect Impacts – Wetlands Abutting the Partridge River

Wetlands abutting the Partridge River within Area One (Large Figure 3) are identified by wetland ID, wetland type using the Eggers and Reed (Reference (13)) wetland community types, and acreage in Table 5-2. There are approximately 1,478 acres of wetlands which include alder thicket or shrub-carr (86% of total acres), coniferous bog (13% of total acres), and shallow marsh (1% of total acres).

Table 5-2 Wetlands Abutting the Partridge River

Wetland ID	Eggers and Reed Wetland Community	Wetland Size (acres)
53D	Alder thicket	885.97
315	Alder thicket or Shrub-carr	322.84
678	Alder thicket	58.42
691	Alder thicket	6.23
708	Shallow marsh	3.92

Wetland ID	Eggers and Reed Wetland Community	Wetland Size (acres)
709	Shallow marsh	8.14
888	Coniferous bog	192.96
Total acres of wetland		1,478.48

The XP-SWMM model identified that the changes in average annual flow (and therefore stage) of the Partridge River will be within the naturally occurring annual variation for the Partridge River (Reference (15)). Therefore, no potential indirect wetland impacts are identified for the wetlands abutting the Partridge River.

5.2.1.4 Potential Indirect Impacts – Water Quality Changes

5.2.1.4.1 Fugitive Dust / Metals and Sulfide Dust Emissions

As described in Attachment A, a screening analysis was conducted that estimated potential annual deposition of dust, metals, and sulfur to wetlands within and adjacent to the proposed Mine Site and the FTB, respectively, from fugitive dust emissions. Note that this section discusses only the Mine Site and the FTB, unlike other subsections of 5.2.1. Emission rates and particle size distributions were based on total particulate matter. The estimated deposition from fugitive dust emissions is then used to identify those wetlands that have the potential for water quality changes (e.g., potential for water chemistry changes related to sulfide dust deposition).

The potential additions of dust, metals, and sulfur to wetlands from fugitive dust emissions at the Mine Site and the FTB were estimated using air dispersion/deposition modeling. The estimated inputs of the dust, metals, and sulfur to wetlands were evaluated for significance to potential changes in water quality. Specific components of the analysis identified in Attachment A are summarized below.

Sources of Fugitive Dust and Estimated Air Emissions

Sources of dust to be modeled at the Mine Site and at the FTB are identified in Table 5-3 and include the sources specified in Attachment A. One model run was conducted for each area – the Mine Site and the FTB. Each respective model run provided an estimate of potential dust deposition from a number of general fugitive dust sources. The source grouping function within the AERMOD model was used to identify the different sources of metals and sulfur.

Table 5-3 Emission Sources Modeled in the Assessment of Potential Indirect Wetland Impacts Related to Deposition of Dust, Metals, and Sulfur

Fugitive Dust Source[1]	Mine Site Modeling for Dust	Mine Site Modeling for Metals and Sulfur	FTB Modeling for Dust	FTB Modeling for Metals and Sulfur
Overburden and other construction rock screening and/or crushing	Included	Excluded	n/a	n/a
Loading/unloading of tailings from the former LTVSMC operations and construction of dams	n/a	n/a	Included	Included
Dust generation from traffic on unpaved roads at the ground surface (not in mine pits)				
• Roads made of general construction material	Included	Excluded	Included	Excluded
• Roads made of LTVSMC Tailings	n/a	n/a	Included	n/a[4]
Handling activities associated with ore and waste rock outside of the pits, includes truck loading and unloading outside of the pits. Activities related to:	Included	Included	n/a	n/a
• Category 1 waste rock stockpile	Included	Excluded	n/a	n/a
• Category 2/3 waste rock stockpile	Included	Included	n/a	n/a
• Category 4 waste rock stockpile	Included	Included	n/a	n/a
Rail car loading (RTH (ore))	Included	Included	n/a	n/a
Rock handling and roads within the pits[2]	Excluded	Excluded	n/a	n/a
Wind erosion				
• From stockpiles(3)	Excluded	Excluded	n/a	n/a
• From beaches consisting of Flotation Tailings	n/a	n/a	Included	Included
• From dams constructed of LTVSMC tailings	n/a	n/a	Included	Included

n/a = not applicable

(1) sources as identified in Attachment A

(2) Fugitive dust sources excluded from the analysis per Attachment A include rock handling and roads within the pits as these emissions are expected to be trapped within the respective pits and have minimal contribution to estimated air concentrations.

(3) The potential for wind erosion from the stockpiles was evaluated as part of the air emissions inventory and it was determined that wind erosion will not occur through the use of USEPA approved wind erosion calculations procedures in Section 13.2.5 of Reference (20).

(4) General road construction material assumed to be laid over the top of the LTVSMC tailings.

Potential fugitive dust emissions from the specified sources were calculated based on the following information:

- Particulate matter as Total Particulate Matter (TPM); particles smaller than about 20 to 50 µm (microns) in aerodynamic diameter.
- Current Mine Site layout; Mine Year 8 and Mine Year 13.
- Expected operations at the FTB (e.g., dam construction, wind erosion)

At the Mine Site, the material handling emissions occurring on the stockpiles and at the RTH were modeled as surface-based volume sources. The stockpile volume source dimensions were based on a typical haul truck height of 30 feet and a dumping zone side length of 197 feet, similar to the particulate emissions modeling conducted for Class II areas (Reference (21)).

The RTH volume source parameters were also identical to the parameters used in the particulate modeling conducted for Class II areas (Reference (21)).

For the Class II modeling for the Mine Site (Reference (21)), the maximum emissions were identified to occur in Mine Year 8 and Mine Year 13. Emissions from both years were modeled for this assessment.

For the FTB, the emissions and modeling were based in part on the assumption that non-reactive road construction material will be used to construct a roadbed on top of the LTVSMC tailings and that haul trucks will not be travelling on roads made from LTVSMC tailings.

Modeling with AERMOD in Deposition Mode

Modeling was conducted with the AERMOD model (version 12060) in deposition mode with plume wet and dry depletion to estimate annual particle deposition. Surface meteorological data used in the modeling are for Hibbing, Minnesota (2006-2010) and upper air meteorology from International Falls, Minnesota. Meteorological data were processed using AERMET (version 11059). See Class II Modeling Protocol (Reference (21). Each year of meteorological data was modeled individually and the highest estimated dust deposition rate for each receptor node was brought forward into the mapping of deposition isopleths.

Deposition modeling with AERMOD requires inputs for particle size, particle density, and mass fraction within each particle size category. The modeling for this assessment used one particle size (30 microns) and a particle density of 2.7 grams per cubic centimeter (g/cm^3), which is consistent with inputs used for Class II air modeling.

Receptors

The receptors of interest for this analysis are the wetlands that are not identified as directly impacted (Section 5.1). The respective initial receptor grids for the Mine Site and FTB were set up with near-field and far-field spacing. For the Mine Site, the near-field receptor spacing was 250 meters (within the ambient air boundary and out to 1,000 meters beyond the ambient air boundary). The far-field receptor spacing was 1,000 meters (from 1 kilometer out to 5 kilometers from the ambient air boundary). For the FTB, the near-field receptor spacing was 250 meters within the ambient air boundary. The far-field receptor spacing was 1,000 meters from the ambient air boundary out to 5 kilometers.

At both the Mine Site and the FTB, the fine grid (i.e., near-field grid) receptor spacing of 250 meters generally had at least one receptor being located over the wetlands within the property boundary and out to 1 kilometer beyond the property boundary (Large Figure 15 and Large Figure 16). However, for the area encompassed by the fine grid, a visual check was made using GIS mapping tools to ensure that wetland areas encompassed by the fine grid had at least once receptor within their boundaries. Additional receptors were then included in the grid such that at least one receptor node was specifically located within the area of each wetland. For the coarse grid (i.e., far-field grid), the specific assignment of a receptor to a wetland area was not done for either the Mine Site or the FTB Area. A visual review (again using GIS mapping) identified that most wetland areas for the coarse grid had a receptor within their respective boundaries or relatively close to them. In other words, the coarse grid receptor spacing of 1,000 meters provided good coverage of the wetland areas. In addition, initial modeling of dust deposition identified that deposition rates changed very little beyond about 1 kilometer from the ambient air boundary. Based on these two pieces of information, it was determined that for those wetland areas covered by the coarse grid that did not have a receptor within their respective area, the modeled deposition at the nearest receptor would be used.

Dust Deposition and Speciation to Individual Metals and Sulfur

For the general dust emission sources identified in Table 5-3, total particulate emissions on an annual basis were modeled for the Mine Site and the FTB, respectively. Each year of meteorological data (5 years in total) were modeled individually. The estimated annual dust deposition rate (grams per square meter; $g/m^2/yr$) for each receptor node for each modeled year was then post-processed in a calculation spreadsheet to identify the highest estimated dust deposition rate for each receptor node.

For the dust emission sources identified for assessing potential metals and sulfur deposition at the Mine Site and the FTB, respectively, the highest estimated dust deposition rate for each receptor node was then speciated to the respective metal and sulfur deposition rates based on the contribution of the sources to a receptor node and the metal and sulfur composition identified for each contributing source (ore and waste rock at the Mine Site and tailings at the FTB). The estimated metal or sulfur deposition for each contributing dust source at a receptor node was then summed to provide a "total" deposition rate for each respective metal and for sulfur at that receptor location.

Dust deposition rates were speciated for the following metals: arsenic, cadmium, chromium, lead, manganese, nickel, and selenium (Attachment A). Copper and vanadium were added to the evaluation because background deposition estimates were provided in Reference (22). Attachment C provides the chemical composition of ore, waste rock and tailings used in the dust speciation. The maximum concentration for each metal and sulfur was used in the speciation calculations.

For both the Mine Site and the FTB, for each receptor node, the post-processing of the dust deposition rate by source contribution was then summed to provide a "total" metal deposition rate and a "total" sulfur deposition rate.

The speciation of the model-estimated dust deposition rate to the respective metal and sulfur deposition rates is slightly different from the approach identified in Attachment A; page 6 for the Mine Site; page 10 for the FTB) which identified that "... *the total particulate emission rates (grams per second) will be speciated and converted to metals and sulfur emission rates based on data on the chemical composition of each material generating dust*. ...". However, with regard to estimating a potential deposition rate for the individual metals and sulfur, there is no difference in the two approaches.

<u>Estimates of Rural Background Deposition</u>

Estimates of rural background deposition rates for dust, metals and sulfur are provided in Table 5-4. The background dust deposition rate is based on an effects-level for vegetation (Reference (23), Reference (24)). Background metal deposition rates are estimated from monitoring data collected at a site near the shore of Lake Superior near Eagle Harbor, Michigan (Reference (22)). The background sulfur deposition rate is from data collected at the Fernberg Road Monitoring Site (National Atmospheric Deposition Program, NADP) near Ely, Minnesota (Reference (25)).

For dust, an annual effects-level deposition rate of 365 grams per square meter ($g/m^2/yr$) is compared to modeled annual dust deposition rates. This deposition rate is a potential effects threshold for photosynthesis (i.e., potential for reduced photosynthesis due to "dusting" of the plant surface) (References (23), Reference (24)). However, for this analysis, the vegetative surface area of the wetlands is not calculated or included in the analysis. The modeled dust deposition rate is assumed to be applied to the land surface area which is a smaller area than the vegetative surface area. Vegetative surface area can be up to 13 times greater than the land surface area (Reference (26)). For example, the ratio of leaf area in a forest compared to the ground surface area ranges from 1.4 to 8.4 and for grasslands it can range from 2.5 to 6.3. By only assessing dust deposition to the land surface area instead of the vegetative surface area, it is likely the ratio of modeled deposition rate to the effects level is being overestimated. In other words, the modeled deposition rate is not being spread over the larger surface area of the vegetation which would reduce the effective deposition rate.

For example, for a minimally vegetated ground surface with a surface area of 1.4 m^2, the deposition of 365 g to the 1.4 m^2 of vegetation surface results in deposition rate of 261g/m^2. Because this application does not include the deposition of dust to the vegetative surface area, it is likely that the areas identified to exceed the effects threshold of 365 g/m^2/yr has been overestimated.

For metals, background deposition is based on the data from Reference (22). Sweet et al. (Reference (22)) indicated that precipitation was under-collected by 45% to 70% when sample volumes were compared to corresponding rain gage amounts. Because wet deposition was considered to be underestimated, the wet deposition component was adjusted upward by a factor of 1.6 (see Attachment D for calculations). Table 5-4 presents the adjusted total deposition estimates.

Table 5-4 Estimated Background Deposition of Metals and Sulfur

Parameter	Background Deposition Rate (wet + dry)	Units(1)	Comments
Arsenic(4)	216	µg/m^2/yr	Wet deposition adjusted by a factor of 1.6. Attachment D.
Cadmium(4)	505	µg/m^2/yr	Wet deposition adjusted by a factor of 1.6. Attachment D.
Chromium(4)	255	µg/m^2/yr	Wet deposition adjusted by a factor of 1.6. Attachment D.
Copper(4)	3,520	µg/m^2/yr	Wet deposition adjusted by a factor of 1.6. Attachment D.
Dust(2),(3)	365	g/m^2/yr	Dust from total particulate matter (TPM). A “no effects” deposition rate related to photosynthesis.
Lead(4)	1,800	µg/m^2/yr	Wet deposition adjusted by a factor of 1.6. Attachment D.
Manganese(4)	5,580	µg/m^2/yr	Wet deposition adjusted by a factor of 1.6. Attachment D.
Nickel(4)	938	µg/m^2/yr	Wet deposition adjusted by a factor of 1.6. Attachment D.
Selenium(4)	572	µg/m^2/yr	Selenium deposition as reported in Reference (24).

Parameter	Background Deposition Rate (wet + dry)	Units[1]	Comments
Sulfur[5],[6]	0.16	$g/m^2/yr$	Wet deposition estimated from 2007-2011 NADP data (Reference (25)); dry deposition estimated to be 22% of total deposition based on recent estimates from Voyageurs National Park and from Reference (26)).
Vanadium[4]	385	$\mu g/m^2/yr$	Wet deposition adjusted by a factor of 1.6. Attachment D.
Zinc[4]	10,900	$\mu g/m^2/yr$	Wet deposition adjusted by a factor of 1.6. Attachment D.

(1) Units are $\mu g/m^2/yr$ = microgram per square meter per year or $g/m^2/yr$ = grams per square meter per year
(2) Reference (23)
(3) Reference (24)
(4) Reference (22)
(5) Reference (25)
(6) Reference (26)

Total background sulfur deposition includes both wet and dry deposition. Background wet deposition rates of sulfate are available from the NADP. The NADP maintains a network of monitors throughout the United States to measure wet deposition and includes several monitors in northeastern Minnesota. The closest monitoring site to Hoyt Lakes is the "Fernberg" site (ID: MN18) near Ely, Minnesota. The average annual wet deposition rate of sulfate over the past five years (2007-2011) at the Fernberg site was estimated (3.75 kg/ha), then converted to sulfur (sulfur is 33% of the sulfate; 1.25 kg/ha), and used as the background estimate for the wet deposition rate.

The Clean Air Status and Trends Network (CASTNET) operates a similar monitoring network for dry deposition and coordinates some sites with the NADP, however, this network does not have a site near Ely. The closest CASTNET site to Hoyt Lakes is in Voyageurs National Park near Sullivan Bay. Dry deposition monitored at this site in Voyageurs National Park indicates that dry sulfur deposition is approximately 19% of total (wet+dry) deposition. A 1991-1993 study (Reference (26)) estimated the percentage of dry deposition to total (wet + dry) deposition for various monitoring sites in Minnesota, including the Fernberg site near Ely (22.2%). This percentage of dry sulfur deposition to total (wet + dry) sulfur deposition (22%; average of three years) was used to estimate a total (wet + dry) background deposition of sulfur in the Hoyt Lakes area.

The calculation for background deposition in $g/m^2/year$, the deposition units in AERMOD, is as follows:

- average wet deposition of sulfate at NADP monitoring station MN18 = 3.75 kg/ha/yr
- sulfur as a percent of sulfate (SO4) = molecular weight of 32 / molecular weight of 96 = 33%
- sulfur content of wet sulfate deposition = 3.75 kg/ha x 0.33 = 1.25 kg/ha/yr
- percentage of dry deposition to total (wet + dry) sulfur deposition at Ely = 22.2%
- total (wet + dry) deposition of sulfur = wet deposition/(100 - %dry)/100 = 1.6 kg/ha/yr
- total background deposition of sulfur = 0.16 g/m^2/yr

The estimated background deposition for metals and sulfur is from data collected at sites characterized as open areas in rural settings that are reasonably distant from industrial sources and population centers. Reference (27) identifies that for forested areas, dry deposition may be underestimated. Vegetation can effectively scavenge fine particles and aerosols from the atmosphere and this interception can result in dry deposition being 50% or more of the total deposition. As noted for the Fernberg Road monitoring site, dry deposition is assumed to be 22% of total deposition. It is possible that the background sulfur deposition estimated for this analysis may be low due to an underestimation of dry deposition. However, no adjustments were made to the background sulfur deposition estimated for this analysis.

Significance Levels for Estimating the Potential Effects

For dust, metals, and sulfur, the following breakpoints are used for assessing the significance of a modeled deposition rate at a receptor node:

< 100% of background: no potential for effects expected

> 100% of the background value: potential for effects, include in future wetland monitoring

These are general categories of potential for effects. As this is a screening analysis to identify wetlands for potential inclusion in a monitoring program, there is some flexibility in identifying a potential level of deposition that suggests a potential for effect. Another consideration for selecting a deposition rate that is a high percent of the background rates is the likely overestimation of modeled deposition and the underestimation of background deposition. For example, with regard to model-estimated metal deposition, this screening evaluation used a maximum concentration from a range of possible values (see Attachment C for metal and sulfur concentrations) to speciate a maximum estimated dust deposition for a receptor node. Using a maximum metal concentration to speciate a maximum modeled deposition rate for each receptor node likely overestimates individual metal deposition. The underestimation of background metal deposition (i.e., wet deposition due to under-collection of precipitation) was identified in (Reference (22)). In addition, wet sulfate deposition may be underestimated as well because the NADP data for the Fernberg Road monitoring site (site MN18 in Reference (25)) indicates rainfall in the last 3 years is about 22% below the annual average. If sulfate deposition from 2007 and 2008 is used (both years approximately normal for precipitation amount), a background sulfur deposition rate of 0.23 $g/m^2/yr$ is calculated, about 44% higher than the background deposition used in this screening analysis. Also, Reference (27) identifies that for forested areas, dry deposition may be systematically underestimated due to sample collection and analysis methodology. It is possible that the background sulfur deposition estimated for this analysis may be low due to an underestimate of dry deposition.

Given the potential for overestimation of modeled deposition and underestimation of background deposition, and balancing the conservatism when their respective results are combined in this analysis, it seems reasonable to select the wetlands estimated to receive greater than 100% of background deposition (a potential doubling of the background deposition) for consideration in potential future monitoring.

Results (Modeled Deposition Rates Compared to Background Values

Model results in the form of isopleths where model-estimated deposition exceeds background deposition (i.e., modeled deposition is greater than 100% of background deposition) are overlain on the wetlands. For this screening analysis, the maximum extent of potential for effects on the wetlands for dust are presented and then for metals and sulfur at the Mine Site and the FTB, respectively. The model results for the individual metals and sulfur are not presented here, only the maximum area having the potential for effects from one or more the dust constituents.

Dust Deposition

At the Mine Site, dust deposition is concentrated relatively close to the ore loading pocket near the southern portion of the ambient air boundary (Large Figure 17). All receptors have model-estimated dust deposition of 25% or less of the effects-level background of 365 $g/m^2/yr$.

At the FTB, dust deposition is highest in three locations: southwest corner, northwest of the Plant Site; southeast corner; and the northeast corner, towards Area 5. All receptors have model-estimated dust deposition of 50% or less of the effects-level background of 365 $g/m^2/yr$ (Large Figure 18).

Overall, model-estimated dust deposition is largely constrained to within the respective ambient air boundaries at the Mine Site and at the FTB and model-estimated deposition is 50% or less of the effects-level background dust deposition.

Metals and Sulfur Deposition

The highest model-estimated metal and sulfur deposition at the Mine Site are in two defined areas: 1) near the ore loading pocket; and 2) at the east end of the Category 2/3 Waste Rock Stockpile near the eastern portion of the ambient air boundary (Large Figure 19). All of the receptor nodes with the highest model-estimated deposition rates (deposition rates greater than 100% of background) are located within the ambient air boundary.

At the FTB, there are two locations showing model-estimated deposition rates greater than 100% of background deposition: 1) approximately the southern and western two-thirds of the basin; and 2) a small area on the northern and eastern portion of the ambient air boundary (Large Figure 20). Approximately 90% of the receptor nodes with the highest model-estimated deposition rates (rates greater than 100% of background deposition) are located within the ambient air boundary. The remaining 10% of the receptor nodes with the highest-modeled deposition are located to the south and east of the FTB outside of the ambient air boundary.

Summary and Conclusions

There are 19,914 acres of wetlands identified within the receptor grid at the Mine Site. The deposition modeling results indicates that 1.1% of the wetlands within the receptor grid area are identified for consideration in future monitoring. There are 234 acres of wetland potentially indirectly impacted (modeled metal deposition greater than 100% of background), with 228 acres (97%) of the wetlands located within the Mine Site ambient air boundary. Based on the modeling results, approximately 234 acres of wetlands in the Mine Site Area are identified for potential inclusion in future monitoring.

At the FTB, there are 25,846 acres of wetlands identified within the receptor grid. Wetland ID 1155 in the HRF Area, which is not subject to state and federal regulations (Section 5.1.6), and a deepwater pit area located south of the FTB were not included in the total wetland acreage. The deposition modeling results indicates that 0.7% of the wetlands within the receptor grid area are identified for consideration in future monitoring. There are 194 acres of wetland potentially indirectly impacted (modeled metal deposition greater than 100% of background), with 59 acres (31%) of the wetlands located within the FTB ambient air boundary. Based on the modeling results, approximately 194 acres of wetlands in the FTB Area are identified for potential inclusion in future monitoring.

The deposition modeling results for dust, metals and sulfur do not indicate or suggest a degree of impact or that adverse effects will be expected to occur. The modeling only indicates those areas that were estimated to have deposition rates greater than 100% of background deposition. These specific wetland areas are identified for consideration in any future monitoring to be conducted for the Project.

5.2.1.4.2 Ore Spillage

See Section 5.2.3.2.1 for a discussion of potential indirect wetland impacts as related to ore spillage along the transportation corridors.

5.2.1.4.3 Leakage from Stockpiles/Mine Features and Seepage from Mine Pits

The stockpiles, mine pits, and other mine features (e.g., WWTF) are located within the Partridge River watershed. Water containing constituents generated in the waste rock stockpiles and mine pits has the potential to enter the shallow groundwater system via potential leakage from the liners (stockpiles and WWTF equalization basins) or seepage from the pits (Reference (15)). The leakage or seepage that enters groundwater will then be transported toward the Partridge River along groundwater flow paths. The Groundwater IAP process identified five such groundwater flow paths connecting the mine features to the Partridge River. These flow paths are being considered in the assessment of potential groundwater quality impacts (Reference (15)). The five flow paths are described in (Reference (15)) and include: East Pit – Category 2/3 flow path, Ore Surge Pile (OSP) flow path, WWTF flow path, Overburden Storage and Laydown Area (OSLA) flow path, and West Pit flow path. Because the water quality within these flow paths has the potential to change as a result of the Project, these same flow paths are considered in the assessment of potential indirect wetland impacts associated with leakage or seepage from mine features.

Wetlands within the groundwater flow paths were identified by wetland type using the Eggers and Reed (Reference (13)) wetland community types and acreage in Large Table 9. There are approximately 516 acres of wetlands, which include alder thicket or shrub-carr (56% of total acres), coniferous bog (33% of total acres), coniferous swamp (6% of total acres), open bog (2% of total acres), shallow marsh (2% of total acres), deep marsh (1% of total acres), and sedge/wet meadow (less than 1% of total acres).

Bog wetlands within and surrounding the Mine Site were reclassified as either ombrotrophic or minerotrophic consistent with the November 2011, USACE Memorandum (Large Table 10; Reference (18)). Other wetlands were classified as dominated by groundwater, although all wetlands receive precipitation and, as stated in Section 5.2.1.2.2, virtually all water movement in peat wetlands occurs horizontally in the upper layers of peat. Approximately 66% of the wetlands within the flow paths are classified as dominantly groundwater-fed while 34% of the wetlands are supported only by precipitation (Large Table 9).

The Partridge River currently represents the primary discharge location for shallow groundwater at the Mine Site. During operations, reclamation and long-term closure, groundwater in areas south of the mine pits will continue to discharge to the Partridge River while groundwater in areas north of the mine pits will discharge to the pits. The amount of groundwater discharge to surface water and wetlands between the mine features and the Partridge River is expected to be minimal relative to the amount of groundwater discharge to the Partridge River itself. Significant quantities of groundwater are not expected to discharge to the wetlands because of the very low hydraulic conductivities of the underlying peat layers, as cited in Section 5.2.1.2.2. In the water quality model, it is assumed that the leakage/seepage from mine features discharges to the Partridge River; there is assumed to be no groundwater discharge to surface water or wetlands along intermediate portions of the flow paths (Reference (15)). Therefore, the water quality model cannot be used to quantify the amount of leakage/seepage from mine features that discharges directly to individual wetlands. However, the water quality model can be used to provide a conservative estimate of the potential indirect wetlands impacts caused by water quality changes due to leakage/seepage from mine features. This approach and the resulting estimates are described in the following paragraphs.

The water quality model includes groundwater quality evaluation locations within the surficial aquifer and located along the Dunka Road for each of the groundwater flow paths. These evaluation locations are within the PolyMet property boundary, typically within close proximity of the mine features and are located up gradient of most of the groundwater-fed wetlands at the Mine Site. Thus, results of the water quality modeling within these flow paths can be used to evaluate groundwater quality that could flow to down gradient groundwater fed wetlands.

Water quality modeling results indicate groundwater quality along each flow path is likely to change from existing conditions. For this indirect wetland impact analysis, it is conservatively assumed that these changes may cause potential indirect impacts to the character, function, and quality of groundwater fed wetlands. Therefore this analysis also assumes that all down gradient groundwater-fed wetlands located within the five Mine Site surficial aquifer flow paths may have potential indirect wetland impacts related to water quality changes as a result off leakage/seepage from mine features.

The leakage/seepage rates associated the mine features are summarized in Table 5-5. Large Table 9 summarizes the wetland types within the flow paths with potential indirect wetland impacts resulting from mine feature leakage/seepage changes to water quality. Large Table 11 identifies wetlands within the flow path. Consistent with other potential indirect wetland impacts identified in this Data Package, the wetlands identified in Large Table 11 can be used to inform the development of a monitoring plan for potential future indirect impacts related water quality changes resulting from leakage/seepage from mine features.

Table 5-5 Leakage/Seepage Rates Associated with Mine Features

Mine Feature	Type of Flow	Maximum Rate[1] (gpm)
East Pit – Category 2/3 Stockpile	Seepage from the Mine Pit	6.5
	Liner Leakage	0.13
OSP	Liner Leakage	0.0062
WWTF	Liner Leakage	0.030
OSLA	Infiltration	32
West Pit	Seepage from the Mine Pit	6.4

(1) Flows shown represent the maximum monthly rate at a 90% probability.

This analysis does not indicate or suggest that actual adverse effects will occur or that adverse effects are expected to occur. The analysis only indicates areas that can be conservatively assumed to have potential indirect impacts due to changes in groundwater quality. These specific wetland areas are identified for consideration in future monitoring to be conducted during facility operations.

5.2.1.5 Potential Indirect Impacts – Wildlife Utilization of Nearby Habitats from Project Noise

The following sections summarize the potential indirect impacts to wildlife utilization of nearby habitats from Project noise. As outlined in Attachment A, the following three steps were used in the potential indirect impact analysis: 1) potential sources and range of Project noise were identified; 2) potential wildlife species and habitat preferences within the area were identified; and 3) potential impacts to wildlife utilization of nearby habitats from Project noise were qualitatively assessed.

5.2.1.5.1 Potential Sources and Range of Project Noise

Existing ambient steady equivalent noise levels for most of the Mine Site are in the range of 35 to 45 decibels (dBA), which is a range comparable to secluded woods or a quiet bedroom (Reference (28)). The Peter Mitchell Mine, north of the Mine Site, and traffic along Dunka Road and the existing railway, along the south edge of the Mine Site, also contribute brief, episodic noise impacts.

The primary sources of Project noise from the Mine Site will be blasting, haul trucks, and train horns, with noise levels ranging from 89-115 dBA. Noise from equipment such as graders, bull dozers, and support trucks will be less dominant sources of noise, ranging from 75-95 dBA (Reference (29). Blasting at the Mine Site is expected to occur once every two to three days. Typically, rock blasting generates a single event noise level ranging from 111-115 dBA at 50 feet from the blasting site (Table 5.5-7 of Reference (30)). Within most of the Mine Site, the sound from the blast will be similar to a loud clap of thunder.

5.2.1.5.2 General Habitat Types

Vegetation within the Mine Site consists primarily of forested and shrub wetlands, older forested uplands dominated by black spruce and/or jack pine, young aspen stands, and recently logged areas dominated by aspen, ferns, and grasses. Upland areas are likely to be used more by wildlife than wetlands in the Mine Site as preferred habitat, likely because uplands offer more cover and browse during the winter than wetlands.

5.2.1.5.3 Wildlife Species Present

Common wildlife species utilizing the Mine Site include the following (Reference (31), Reference (32)):

- large mammals, including white-tailed deer (*Odocoileus virginianus*), black bear (*Ursus americanus*), moose (*Alces americanus*), gray wolf (*Canis lupus*), coyote (*Canis latrans*)
- intermediate mammals, including muskrat (*Ondatra zimbethicus*), beaver (*Castor canadensis*), red fox (*Vulpes vulpes*), grey fox (*Urocyon cinereoargenteus*) and woodchucks (*Marmota monax*)
- small mammals, including species of bats, squirrels, voles, and mice
- wetland birds, including ducks and other waterfowl, wading birds, and perching birds with specific wetland habitat preferences
- upland birds, including most perching birds, owls, turkey vultures (*Cathartes aura*), hawks, and other birds of prey
- reptiles and amphibians, including common turtles, frogs, snakes, and lizards
- a wide range of insect species in wetland, upland, and transitional habitats

The MDNR Comprehensive Wildlife Conservation Strategy lists 65 Species of Greatest Conservation Need (SGCN) in the combined Laurentian Uplands and Nashwauk Uplands Subsections, in which the Mine Site is located (Reference (33)). Large Table 12 lists the SGCN species, along with their specific preferred habitat types. Habitat preferences for the SGCN species were reviewed, and the species were sorted in Large Table 12 to separate those species which utilize only wetland habitat types, those species which utilize only upland habitat types, and those species which utilize both wetland and upland habitats.

Based on the preferred habitat utilization, there are ten SGCN species that utilize only wetland habitats and fourteen SGCN species that utilize only upland habitats. The remaining 42 SGCN species utilize both wetland and upland habitats. The wetland habitat types utilized by the most SGCN species are lowland coniferous forest (25 species) and lowland shrub (22 species).

According to the MDNR NHIS database, the following three state-listed species (Reference (34)) have documented occurrences within ten miles of the Mine Site:

- gray wolf (*Canis lupus*), special concern
- bald eagle (*Haliaeetus leucocephalus*), special concern
- wood turtle (*Clemmys insculpta*), threatened

The wood turtle was found approximately 0.8 mile south of the Mine Site in 2004. The bald eagle may also be in the vicinity of the Mine Site, although the MDNR NHIS database has no records for bald eagle nests within 5 miles of the Mine Site. The bald eagle is no longer listed under the Endangered Species Act, but is protected under the Bald and Golden Eagle Protection Act. The habitat preferences for these three species are summarized in Large Table 12.

There are three federally listed species in St. Louis County; they include the Canada lynx (*Lynx canadensis*), a threatened mammal species; the gray wolf (*Canis lupus*), a threatened mammal species; and the piping plover (*Charadrius melodus*), an endangered wading bird species. Canada lynx may occasionally utilize the Mine Site (Reference (32)); however, there is no suitable habitat for piping plover at the Mine Site.

In addition to species listed under State and Federal endangered species acts, some wildlife species are also protected as Regional Forester Sensitive Species (RFSS) by the USFS (Reference (35)). The habitat preferences for these species are summarized in Large Table 12.

5.2.1.5.4 Potential Indirect Impacts to Wildlife Utilization of Nearby Habitats

The impacts of noise on wildlife are largely unknown and the assessment of impacts remains subjective (Reference (36)). Wildlife are receptive to different sound frequency spectrums, many of which may be inaudible to humans. Local wildlife are likely to be accustomed to the sound from mine activities currently found in the area. Noise from sources such as mine construction, mine and plant operations, and ore transport are sources of noise that will be relatively low-toned and constant, consistent with industrial fans, so it should present less annoyance than higher-pitched or variable tones of changing loudness (Reference (36)).

Some animals can adapt to predictable human activities, so if the activity generally occurs at predictable time periods at the same places or along the same routes, animals may become habituated to the activity (Reference (36)). Response of the animal depends on the context within which a human/animal encounter takes place, the behavioral state of the animal, the type of human activity, and the time and location of the activity.

Potential noise-related impacts to wildlife vary between species. The more common wildlife species (deer, small mammals, common birds) are habitat generalists with a relatively high tolerance of disturbance and human presence, and the noise generated by human activities.

These species may temporarily abandon habitats immediately adjacent to the Mine Site at the onset of the Project, but would likely return to those habitats as they become habituated to the activity.

Wildlife species with more specific habitat needs, and/or those that are more sensitive to proximity to human activities may abandon habitats near the Mine Site and migrate to habitats further from the noise sources. The distances migrated from the Mine Site will vary depending on the sensitivity to noise of each species.

5.2.2 Flotation Tailings Basin (FTB) Area

Wetlands were identified within the 500-feet increments beginning at the FTB boundary and continuing out to a total of 30,000 feet (Large Figure 21). The area of evaluation included only wetlands within Area Two where wetland type information has been developed and it did not include wetlands identified as directly impacted (Section 5.1). Large Table 13 identifies each wetland within each of the 500-feet zones and Large Table 14 provides a summary of wetland types within each 500-feet increment.

5.2.2.1 Potential Indirect Impacts – Wetland Fragmentation

For remaining wetlands not directly impacted as discussed in Section 5.1, an estimate of potential indirect wetland impacts from wetland fragmentation by Project features (i.e., containment system) was determined based on an analysis of the various factors that may contribute to potential fragmentation. Wetland fragments in the FTB Area are identified in Table 5-6.

Approximately 0.5 acres of wetland fragments were identified in the FTB Area. The majority of wetland fragments consist of shallow marsh (61%), followed by deep marsh (35%), coniferous swamp (4%), and alder thicket (less than 0.01%).

Table 5-6 Fragmented Wetlands in the FTB Area

Wetland ID	Eggers and Reed Wetland Community	Total Wetland Size (acres)	Direct Impact (acres)	Potential Indirect Impact (acres)
272	Deep marsh	1.11	1.10	0.01
279	Alder thicket	4.84	3.33	<0.01
290	Coniferous swamp	0.48	0.22	0.02
307	Shallow marsh	0.78	0.77	<0.01
593	Deep marsh	9.80	8.47	0.15
595	Deep marsh	2.14	1.09	0.01
1134	Shallow marsh	14.45	8.71	0.04
1155	Shallow marsh	0.55	7.30(1)	0.15
1156	Shallow marsh	14.49	11.08	0.06
1159	Shallow marsh	0.05	0.62(2)	0.05
Total acres of wetland		48.69	35.18	0.49

(1) Wetland 1155 is directly impacted by the HRF and FTB.
(2) Wetland 1159 is directly impacted by the HRF.

5.2.2.2 Potential Indirect Impacts – Changes in Hydrology

5.2.2.2.1 Wetlands within the FTB Surficial Groundwater Flow Paths

The three surficial aquifer groundwater flow paths are shown in Large Figure 22 and include Unnamed Creek (west flow path), Trimble Creek (northwest flow path), and Mud Lake Creek (north flow path) (Reference (37). Large Figure 22 also includes several surface water model evaluation locations within these flow paths (e.g., PM-11) and the approximate locations of Project surface water discharges (e.g., SD006). Large Table 15 summarizes the wetland types within the flow paths with potential indirect wetland impacts resulting from changes in hydrology. Large Table 16 identifies wetlands within the flow paths and hydrology source. Consistent with other potential indirect wetland impacts identified in this Data Package, the wetlands identified in Large Table 16 can be used to inform the development of a monitoring plan for potential future indirect impacts related water quality changes resulting from leakage/seepage from mine features.

5.2.2.2.2 Seepage from the FTB

Seepage modeling from the FTB is described in detail in Reference (37). The following discussion is a summary of information regarding seepage that leaves the FTB via the west, northwest, and north flow paths. Seepage from the southern toe of the Tailings Basin, which forms the headwaters of Second Creek, is discussed in Section 5.2.4.

The FTB Containment System, located along the northern and western sides of the Tailings Basin (Reference (37)) will collect approximately 90% of the seepage from the FTB to groundwater and 100% of the seepage from the FTB to surface water. The FTB Containment System located along a portion of the eastern side of the Tailings Basin will collect 100% of the seepage from the FTB (both groundwater and surface water). The seepage water to the west that bypasses the FTB Containment System is described in Reference (37). The seepage to the west is assumed to travel all the way to the Embarrass River via the west flow path. The seepage water to the northwest that bypasses the FTB Containment System is estimated to be about 6 gpm. The seepage to the northwest discharges to Trimble Creek at PM-19 via the northwest flow path. The seepage water to the north that bypasses the FTB Containment System is estimated to be about 4 gpm. The seepage to the north discharges to Mud Lake Creek at MLC-2 via the north flow path. The total amount of groundwater that is estimated to discharge to surface water from the west, northwest, and north flow paths is on average approximately 170 gpm, 85 gpm, and 70 gpm respectively. The total flow discharging to surface water is higher than the seepage flow entering groundwater because of the addition of recharge to the flow paths along the length of each flow path.

The aquifer capacity at the north, northwest, and west toes (which feed the north, northwest, and west flow paths respectively) is estimated to be 44 gpm, 55 gpm, and 110 gpm respectively. Under existing conditions, seepage from the Tailings Basin is in excess of the aquifer capacity at the toes of the Tailings Basin. Therefore, excess seepage that cannot be contained within the aquifer upwells to surface flow near the toes of the Tailings Basin and contributes flow to the nearby tributaries via surface runoff.

Under Project conditions, the FTB Containment System will capture all of the surface flow that is currently upwelling near the northern, northwestern, western, and portions of the eastern toes of the Tailings Basin dams. To prevent significant hydrologic impacts to Trimble Creek and Unnamed Creek due to reduction in flow, the water collected by the FTB Containment System will be treated by the WWTP and discharged to the tributaries. To the west, the discharge(s) will be directed to a location near the existing surface discharge SD006. To the northwest and north, the discharge(s) will be spigotted at multiple locations along the downstream side of the FTB Containment System to add flow to the adjacent wetlands, similar to what is occurring under existing conditions. Flow to Mud Lake Creek will be augmented entirely with off-site runoff diverted toward Mud Lake Creek by a drainage swale constructed northeast of Cell 2E. Augmentation will not be necessary at the eastern segment of the FTB Containment System. This area is currently flowing into the Tailings Basin, thus the collection of seepage will not have hydrologic impacts to the watershed. Reference (37) shows the expected amount of water needed for stream augmentation on an average annual basis.

5.2.2.2.3 Potential Indirect Impacts – Changes in Hydrology due to Drawdown or Surcharge

The augmentation described in Section 5.2.2.2.2 is designed such that the average annual water yield at the toe of the Tailings Basin is within +/- 20% of the No Action condition.

Plus or minus 20% is within the range of annual variability in precipitation, as well as streamflow, in the Embarrass watershed (Reference (15) and Reference (37)). Therefore, anticipated changes to downstream hydrology, including wetlands, is expected to be within the range of that typically observed due to natural variability.

The potential for indirect impacts due to reduced or increased seepage at the toe of the Tailings Basin is greatest immediately downstream of the toe, where seepage and augmentation account for nearly all the water yield (i.e., there is no upstream watershed). Downstream of the toe, the potential for impact will be reduced as the watershed area tributary to that location increases, and the portion of total water yield derived from runoff increases. That is, the potential for hydrologic impact diminishes radially as distance from the FTB increases. Large Table 13 categorizes wetland areas downstream of the Tailings Basin according to distance from the Tailings Basin. Wetlands located further from the Tailings Basin are anticipated to have less potential for indirect impacts due to hydrologic changes.

Wetland hydrology is a complex mix of precipitation, surface runoff, and in some cases, groundwater. Despite the use of augmentation to mitigate impacts, the response of complex natural systems to human disturbances can only be estimated. Therefore, monitoring of wetland hydrology and vegetation communities is the most appropriate way to document the extent and magnitude of wetland responses (potential indirect impacts) to the Project.

5.2.2.2.4 Quantification of Potential Indirect Impacts due to Change in Hydrology

See Section 5.2.1.2.2 for a discussion of potential indirect wetland impacts due to change in hydrology.

5.2.2.3 Potential Indirect Impacts – Wetlands Abutting Unnamed Creek, Trimble Creek, and Mud Lake Creek

Wetlands abutting Unnamed Creek, Trimble Creek, and Mud Lake Creek within Area Two (Large Figure 4) are identified by wetland ID, wetland type using the Eggers and Reed (Reference (13)) wetland community types, and acreage in Table 5-7 through Table 5-9.

There are approximately 2,576 acres of wetlands which include alder thicket or shrub-carr (63% of total acres), coniferous swamp (24% of total acres), hardwood swamp (5% of total acres), shallow marsh (5% of total acres), deep marsh (2% of total acres), and wet meadow (1% of total acres).

Wetlands abutting Unnamed Creek within Area Two include approximately 527 acres of wetlands which include alder thicket and shrub-carr (52% of total acres), hardwood swamp (19% of total acres), shallow marsh (16% of total acres), deep marsh (10% of total acres), and coniferous swamp (3% of total acres) (Table 5-7).

Table 5-7 Wetlands Abutting Unnamed Creek

Wetland ID	Eggers and Reed Wetland Community	Wetland Size (acres)
270	Shallow marsh	85.84
593A	Deep marsh	25.73
625	Coniferous swamp	3.70
627	Alder thicket or Shrub-carr	187.09
788	Hardwood swamp	98.13
820	Deep marsh	26.92
845	Coniferous swamp	12.64
876	Alder thicket	39.13
1071	Alder thicket or Shrub-carr	29.18
1147	Alder thicket or Shrub-carr	13.46
996	Alder thicket or Shrub-carr	4.10
593	Deep marsh	1.18
	Total acres of wetland	527.10

Wetlands abutting Trimble Creek within Area Two include approximately 886 acres of wetlands which include alder thicket and shrub-carr (78% of total acres), coniferous swamp (15% of total acres), shallow marsh (4% of total acres), wet meadow (2% of total acres), and deep marsh (1% of total acres) (Table 5-8).

Table 5-8 Wetlands Abutting Trimble Creek

Wetland ID	Eggers and Reed Wetland Community	Wetland Size (acres)
253	Deep marsh	5.89
254	Shallow marsh	36.72
953	Alder thicket or Shrub-carr	614.34
955	Alder thicket or Shrub-carr	39.24
956	Wet meadow	17.40
989	Coniferous swamp	130.31

Wetland ID	Eggers and Reed Wetland Community	Wetland Size (acres)
990	Alder thicket or Shrub-carr	42.22
529	Wet meadow	0.30
	Total acres of wetland	886.42

Wetlands abutting Mud Lake Creek within Area Two include approximately 1,162 acres of wetlands which include alder thicket and shrub-carr (56% of total acres), coniferous swamp (41% of total acres), and hardwood swamp (3 of total acres) (Table 5-9).

Table 5-9 Wetlands Abutting Mud Lake Creek

Wetland ID	Eggers and Reed Wetland Community	Wetland Size (acres)
285	Coniferous swamp	364.87
953	Alder thicket or Shrub-carr	614.34
866	Hardwood swamp	31.04
652	Coniferous swamp	109.44
986	Alder thicket or Shrub-carr	22.21
988	Alder thicket or Shrub-carr	20.51
	Total acres of wetland	1,162.41

A detailed hydrologic model has not been developed for the streams downstream of the Tailings Basin. Water management at the Plant Site consists of flow augmentation immediately downstream of the FTB Containment System (Section 5.2.2.2.2 and Reference (37)) to minimize hydrologic impacts to downstream watercourses. The hydrologic analysis presented in Reference (37) estimates that the changes in average annual flow (and therefore stage) of Unnamed Creek, Trimble Creek, and Mud Lake Creek will be within the annual variability that naturally occurs in the Embarrass River watershed. Therefore, no potential indirect wetland impacts are identified for the wetlands abutting Unnamed Creek, Trimble Creek, and Mud Lake Creek.

5.2.2.4 Potential Indirect Impacts – Water Quality Changes

5.2.2.4.1 Fugitive Dust / Metals and Sulfide Dust Emissions

The discussion, tables, and figures for this section are found in Section 5.2.1.4.1 which discusses the Mine Site and FTB.

5.2.2.4.2 Potential Indirect Impacts – Water Quality Changes

The Project will impact water quality downstream of the Tailings Basin by altering the chemistry and volume of seepage and surface water discharges leaving the Tailings Basin. Impacts to surface water and groundwater quality are quantified in (Reference (37)). The collection of existing seepage by the containment system and augmentation with WWTP effluent water will generally improve downstream water quality relative to current conditions. Water quality impacts to receiving waters are described in (Reference (37)). Even if water quality is improved, there is potential for indirect impacts to wetlands due to changes in water quality.

Potential indirect wetland impacts due to water quality changes may occur due to:

- Changes in groundwater quality,
- Changes in surface water quality, or
- Changes in both groundwater and surface water quality.

Wetland areas potentially impacted by water quality changes are shown in Large Figure 22 and listed in Table 5-10. Note that within this section, the term groundwater and surface water refer to the path by which Project water leaves the Tailings Basin (e.g., potential impacts from Tailings Basin groundwater seepage that discharges to surface water at a downstream location are classified as a potential impact due to changes in *groundwater* quality).

Table 5-10 Wetland Area Potentially Indirectly Impacted by Changes in Water Quality

Wetland Area (acres) Potentially Impacted by Changes in Water Quality	Mud Lake Creek (North)	Trimble Creek (Northwest)	Unnamed Creek (West)	Downstream of Groundwater Flow Paths(3)	Total
Groundwater Quality[1]	296.50	514.03	1,162.15	--	1972.68
Surface Water and Groundwater Quality[2]	835.77	568.92	690.87	570.16	2665.72
Total	1,132.27	1,082.95	1,853.02	570.16	4638.40

(1) Groundwater refers to water leaving the FTB within the surficial aquifer. Impacts resulting from the discharge of that seepage to surface water are considered an impact due to groundwater in this analysis.
(2) All areas potentially impacted by changes in surface water quality are also potentially impacted by changes in groundwater quality
(3) Potentially impacted wetlands are located along Trimble Creek and Mud Lake Creek, but outside of groundwater flow paths (see also Footnote (1)).

Potential for indirect impacts from changes in groundwater quality may occur anywhere along the modeled groundwater flow paths (Section 5.2.2.2.1). Wetlands that may be impacted in this manner are identified in Large Figure 22 and include a total of 4,068 acres. Potential for impacts to groundwater quality are diminished as distance from the Tailings Basin increases, as the relative portion of total groundwater that originates from the Tailings Basin decreases (Reference (37)). It should be noted that the amount of Tailings Basin seepage remaining in the surficial aquifer is very small (Section 5.2.2.2.1). Thus, the potential for indirect impacts due to changes in groundwater quality is anticipated to be small.

Potential impacts from changes in groundwater quality may also occur in any wetlands abutting tributary streams into which impacted groundwater may discharge. This includes all reaches of Unnamed Creek, Trimble Creek, and Mud Lake Creek (Large Figure 22). Wetlands abutting these streams and outside of the modeled groundwater flow paths add an additional 570 acres of potential indirect impacts due to changes in groundwater quality.

Changes in surface water quality may also potentially indirectly impact wetlands. Potential indirect impacts from changes in surface water quality may occur in wetlands within the surface watersheds immediately downstream of the Tailings Basin (Large Figure 22). This includes watersheds upstream of modeling locations UC-1a, TC-1, and MLC-3. These areas include 1,158 acres of wetlands (all of which may also be potentially indirectly impacted by changes in groundwater quality). Downstream of these locations, potential indirect impacts due to changes in surface water quality are limited to wetlands abutting the tributary streams. These areas include an additional 1,505 acres of wetlands (all of which may also be potentially indirectly impacted by changes in groundwater quality).

As with impacts from changes in groundwater quality, potential impacts due to changes in surface water quality are expected to diminish as distance from the Tailings Basin increases and flows originating from the Project are diluted by natural runoff.

The wetland hydrology downstream of the Tailings Basin is too complex to be accurately incorporated into the Plant Site probabilistic model detailed in Reference (37). The response of such complex natural systems to water quality changes originating at the Tailings Basin can only be estimated. Therefore, monitoring of wetland hydrology and vegetation communities is the best way to document the extent and magnitude of wetland responses (potential indirect wetland impacts) to the Project.

5.2.2.5 Potential Indirect Impacts – Wildlife Utilization of Nearby Habitats from Project Noise

The following sections summarize the potential indirect impacts to wildlife utilization of nearby habitats from Project noise. As outlined in Attachment A, the following three steps were used in the potential indirect impact analysis: 1) potential sources and range of Project noise were identified; 2) potential wildlife species and habitat preferences within the area were identified; and 3) potential impacts to wildlife utilization of nearby habitats from Project noise were qualitatively assessed.

5.2.2.5.1 Potential Sources and Range of Project Noise

Noise at the FTB will be generated primarily by the placement of FTB Containment System, construction of FTB dams, and by operation of various types of pumping equipment used to transport the tailings slurry and recovered water from the FTB Containment System. Noise levels heard by individual wildlife species cannot be exactly determined, because wildlife species are mobile. As an individual moves, the noise level from a given source changes with the distance between the source and the receptor (the individual animal).

5.2.2.5.2 General Habitat Types

The FTB and surrounding area is currently dominated by grasslands, extensive wetland complexes, and open water areas. The existing Tailings Basin is dominated by upland grassland communities across its flat upper surface and down the tailings dams that descend to the wetlands to the north and west. A natural upland promontory occurs along the northeastern edge of the FTB. This promontory is dominated by young aspen along the lower two-thirds of the slope, and by mixed hardwood and coniferous forest on the upper slopes.

5.2.2.5.3 Wildlife Species Present

Wildlife species within and adjacent to the FTB are similar to those described in Section 5.2.1.5 for the Mine Site. Most of the same common SGCN and RFSS species present at the Mine Site are also present at the FTB.

5.2.2.5.4 Potential Impacts to Wildlife Utilization of Nearby Habitats

Noise-related potential indirect impacts to wildlife utilization of nearby habitats will be similar to those for the Mine Site, described in Section 5.2.1.5, with one notable exception - the FTB is at least 5.5 miles from the nearest potential blasting site. At this distance, the sound of the blast will be under 61 dBA, based on a sound pressure level of 115 dBA at 50 feet from the blast (Reference (28). As a result, the physiological and behavioral changes potentially induced by blast noise will be greatly diminished at the FTB as compared to the Mine Site. In addition, the level of activity, including use of heavy equipment and number of support vehicles in operation, is expected to be lower at the FTB than at the Mine Site. As a result, overall noise generation should be lower at the FTB, resulting in fewer impacts to wildlife.

5.2.3 Transportation Corridors

Wetlands abutting the railroad corridor from the Mine Site to the Plant Site, within Area One and Area Two, are identified by wetland ID, wetland type using the Eggers and Reed (Reference (13)) wetland community types, and acreage in Large Table 17. There are approximately 543 acres of wetlands which include alder thicket or shrub-carr (75% of total acres), coniferous swamp (15% of total acres), shallow marsh (7% of total acres), deep marsh (1% of total acres), shallow, open water (1% of total acres), and sedge/wet meadow (less than 1% of total acres). Wetlands abutting the Dunka Road and Utility Corridor are identified in Section 3.2.3 and shown in Large Figure 7.

5.2.3.1 Potential Indirect Impacts – Wetland Fragmentation

For remaining wetlands not directly impacted as discussed in Section 5.1, an estimate of potential indirect wetland impacts from wetland fragmentation by Project features (Dunka Road and Utility Corridor and Railroad Connection Corridor) was determined based on an analysis of the various factors that may contribute to potential fragmentation.

An approximately 0.01 acre alder thicket (Wetland ID 1034A), which is located just outside of the Dunka Road and Utility Corridor, was identified as a wetland fragment. Wetland ID 1034A is connected to Wetland ID 1034, which is directly impacted by the Dunka Road and Utility Corridor.

5.2.3.2 Potential Indirect Impacts – Water Quality Changes

5.2.3.2.1 Mine to Plant Railroad

The potential release of dust from railcars transporting ore from the Mine Site to the Plant Site was addressed in the May 6, 2011 Air Impact Assessment Planning Summary Memo: "The Air IAP group concluded that there will be minimal air impacts from any dust generated from ore hauled in the railcars due to the coarse nature of the ore." Based on this conclusion, air modeling of potential release of dust from railcars was not performed because the potential wetland impacts will not be significant.

The Air IAP group concluded that any dust generated from ore hauled in railcars will be coarse in nature (i.e., relatively large particles). These larger particles will tend to deposit on the soil surface near the railcar and not be dispersed to any great extent. An estimate of the spillage of ore fines along the rail corridor is shown in Section 8.4.3 of Reference (38). It was assumed that all spillage of the coarse material will occur in a 2-meter wide strip on both sides of the centerline of the railway (total width = 4 meters) over the entire haul distance after loading (~ 8 miles; ~13,000 meters), resulting in approximately 0.11 Kg/square meter of ore fines deposited annually or 2.14 Kg/square meter deposited for the 20-year Project. This equates to 0.002 inch of depth of ore fines deposited annually or 0.05 inches deposited for the 20-year Project.

Using the geochemical modeling methods described in Section 8.4.3 of Reference (38) for the spilled ore, the quality of water contacting this material was estimated on a per-unit area basis which is also a per unit length of the rail corridor (see Attachment E for details). The contact water was assumed to mix with the background surface runoff, using the runoff water quality and quantity determined in Sections 5.3.2 and 6.1.3.3.2 of Reference (15) for the Mine Site water quality model. For each meter of railway (2 meter spillage strip on one side), the area required to have a less than 10% likelihood of the mixed contact and natural runoff exceeding water quality standards (as defined in Section 2.2 of Reference (15)) was estimated by successive runs of a probabilistic water quality model.

For most chemical constituents, the contact water leaving the spillage strip is estimated to have a greater than 90% likelihood of complying with surface water standards at all times. Constituents that have the potential to exceed surface water standards at the edge of the 2-meter spillage strip include aluminum, cobalt, copper, and nickel. Aluminum concentrations are often above the surface water standard in the background runoff, and it is not possible to achieve a less than 10% likelihood of exceeding the standard in the mixed water (Section 4.4.4.1.1 of Reference (15)). For cobalt, copper, and nickel the estimated area (square meters per meter of railroad track on each side) necessary to provide sufficient dilution for 90% probability of compliance is shown in Table 5-11.[2]

Table 5-11 Estimated Runoff Area Required for Dilution of Spillage Contact Water

Constituent	Surface Water Standard (µg/L)	Natural runoff area (m^2 per m of track)
Cobalt	5.0	2.5
Copper	9.3(1)	675
Nickel	52(1)	30

(1) Standard is hardness-based, value shown for 100 mg/L hardness

The limiting area required to provide sufficient dilution water for all constituents is estimated at 675 square meters per meter of track (one-sided). Approximately 543 acres of wetlands along the railroad corridor that may have potential indirect impacts are identified in Large Table 17. Watersheds were delineated for each wetland that abutted the railroad corridor as well as wetlands with contributing watersheds abutting the railroad corridor.

Wetlands that have contributing watersheds that include no segments of the railway (e.g., many of the wetlands uphill to the north of the rail corridor) were identified as having no potential indirect impacts from rail spillage. Wetlands immediately abutting the railway and whose watersheds include the rail centerline were identified as potentially being impacted, although the impacts may not extend to the full area of the wetland. Wetlands that have contributing watersheds which include natural areas that are larger than 675 square meters per meter of track (one-sided) in the contributing watershed were identified as having no potential indirect impacts.

5.2.3.2.2 Dunka Road

Loaded mine haul trucks will not travel on the Dunka Road. Empty mine haul trucks will only travel on the Dunka Road when they are in need of maintenance at the Area 1 Shop. It is

[2] Based on the PolyMet rail car modification evaluation (Reference (50)), ore spillage may be reduced by up to 97%, which would proportionally reduce the dilution needed to meet surface water standards.

estimated that each truck will travel to Area 1 Shop twice per year. The total one-way trips per year are estimated at 44. Given the low traffic volumes (< 1 trip per week on average) and the consideration that the ore trucks will be empty, it was determined in Attachment A that a quantitative assessment of impacts from ore particle discharge from haul truck travelling down the Dunka Road is not warranted. Therefore, no potential indirect wetland impacts were identified for wetlands abutting the Dunka Road.

5.2.3.2.3 Product Shipping

Products produced in the hydrometallurgical plant (Gold and Platinum Group Metals concentrate, mixed hydroxide precipitate) will be loaded into super sacks (i.e., large industrial sacks used to transport solid material) and then loaded onto trucks or railcars. There is little or no potential for spillage with this method of shipping and Attachment A concluded that with respect to flotation concentrate, as stated in the Project Description (Reference (12)), "Each filtered concentrate will be conveyed to separate stockpiles within an enclosed 10,000 ton storage facility for loading into covered rail cars. The storage facility will store about 7 to 10 days of production capacity when flotation concentrate will be directed to Concentrate Dewatering/Storage. The storage facility will have a concrete floor and provisions to wash wheeled equipment leaving the facility to prevent concentrates from being tracked out of the facility." Best Management Practices adopted at other mining facilities, such as enclosed storage and loading, covered cars, top-loaded gondola-type cars, and vehicle wash facilities, are proposed for use at the Project. PolyMet will be paid on tons received by customers so it has a vested interest in not losing any concentrate. The covered rail cars will be inspected for holes and any holes repaired before concentrate loading. Attachment A determined that because the common carrier route (i.e., the rail line used to transport products) is not known (ultimate customer not known and could change), there is no way to assess impacts along the common carrier route. Therefore, no potential indirect wetland impacts were identified for wetlands along a common carrier route.

5.2.3.3 Potential Indirect Impacts – Wildlife Utilization of Nearby Habitats from Project Noise

The following sections summarize the potential indirect impacts to wildlife utilization of nearby habitats from Project noise. As outlined in Attachment A, the following three steps were used in the potential indirect impact analysis: 1) potential sources and range of Project noise were identified; 2) potential wildlife species and habitat preferences within the area were identified; and 3) potential impacts to wildlife utilization of nearby habitats from Project noise were qualitatively assessed.

5.2.3.3.1 Potential Sources and Range of Noise

Noise along the transportation corridors will be generated by trucks along Dunka Road and trains. Noise from trucks passing along Dunka Road is estimated to range from 67 dBA for light trucks to 90 dBA for larger dump trucks (Table 3.7-1 of Reference (39)). The decibel level of a passing freight train at approximately 50 feet is 80 dBA. A locomotive’s horn decibel level is 96 dBA at 100 feet ahead of the locomotive (Table 3.7-1 of Reference (39)).

5.2.3.3.2 General Habitat Types

Wildlife habitat along the transportation corridors is varied, and includes wetlands, forested uplands, and maintained grasslands adjacent to existing roads and railroads.

5.2.3.3.3 Wildlife Species Present

Wildlife species present in the transportation corridors are similar to those described in Section 5.2.1.5 for the Mine Site. Most of the same common SGCN and RFSS species present at the Mine Site are also present along the transportation corridors.

5.2.3.3.4 Potential Impacts to Wildlife Utilization of Habitats

Noise-related impacts to wildlife utilization of habitats nearby the transportation corridors will be similar to those for the Mine Site, described in Section 5.2.1.5.

Blasting noise along the transportation corridors will be somewhat reduced relative to the Mine Site. For portions of transportation corridors within one mile of the Mine Site, the noise generated from a blast will range from 71-75 dBA. Tree cover and atmospheric absorption will decrease these levels further.

Species currently utilizing the grassland rights-of-way along Dunka Road and the railroad will likely continue to use these areas. Currently there is low to moderate traffic along Dunka Road. During the Project, increased traffic along the transportation routes may cause some wildlife species to abandon the adjacent habitats. However, these are already moderately disturbed habitats, and are therefore most likely used by habitat generalists rather than SGCN and other more sensitive species. As a result, increases in traffic along Dunka Road and the railroad are not likely to result in significant abandonment of adjacent habitats.

5.2.4 Second Creek

A total of 30 wetlands covering 298.91 acres were identified within the Second Creek area of analysis (Table 3-8). The wetlands include alder thicket or shrub-carr (44%), shallow marsh (35%), hardwood swamp (7%), deep marsh (7%), coniferous swamp (6%), wet meadow (less than 1%), and shallow, open water (less than 1%). Wetlands within the Second Creek area are identified in Section 3.2.8 and shown in Large Figure 8.

The potential indirect wetland impacts were assessed based on changes to hydrology due to groundwater flow or seepage, drawdown or surface water quantity, or changes in surface water quality or metals deposition. There are no potential indirect wetland impacts due to wetland fragmentation, changes in watershed area, or dust deposition.

5.2.4.1 Potential Indirect Impacts – Change in Hydrology

5.2.4.1.1 Potential Indirect Impacts – Change in Hydrology due to Groundwater Flow or Seepage

Seepage from the south side of the FTB is generally restricted by bedrock outcrops and does not contribute to the groundwater flow south of the FTB. All seepage from the south side of the FTB is surface water, forming the headwaters of Second Creek (Sections 4.3.2.2.1 and 5.1.1.2 of Reference (37)). There are no potential indirect impacts to wetlands as a result of changes in groundwater flow in the area of analysis.

The current seepage capture system located at the southern toe of Tailing Basin Cell 1E, which was installed as part of the Cliffs Erie Consent Decree, has reduced seepage leaving the existing Tailings Basin. No further reductions in flow to Second Creek are anticipated as part of the Project, rather, the Project will augmented stream flow in Second Creek with treated water from the WWTP in order to return flows to conditions that existed before the current seepage capture system was constructed as part of the Cliffs Erie Consent Decree. There will be no construction in this area as a result of stream augmentation.

5.2.4.1.2 Potential Indirect Impacts – Change in Hydrology due to Drawdown or Surcharge

Wetlands abutting Second Creek are identified by wetland ID, wetland type using Reference (13) wetland community types, and acreage in Table 5-12 and Large Figure 8. There are 8 wetlands covering approximately 179 acres which include alder thicket or shrub-carr (66%), shallow marsh (26%), and deep marsh (8%).

Table 5-12 Wetlands Abutting Second Creek

Wetland ID	Dominant Eggers and Reed Wetland Community	Total Wetland Area (acres)
595(1)	Deep marsh	1.05
595A	Deep marsh	3.06
1161	Deep marsh	9.41
1162	Shallow marsh	40.84
1174	Alder thicket or Shrub-carr	118.75
1176	Shallow marsh	4.92
P5-1	Deep marsh	0.77
P5-1A	Deep marsh	0.03
Total acres of wetland		178.83

(1) Wetland 595 includes 3 separate areas.

Flow augmentation at the south toe of the Tailings Basin is designed such that the average annual discharge to that location is within +/- 20% of the pre-Consent Decree condition (Section 5.2.2.8.1 of Reference (37)). Plus or minus 20% is within the range of annual variability in precipitation, as well as streamflow, in the Partridge and Embarrass watersheds (Section 5.2.2.8.1 of Reference (37)). Therefore, anticipated changes to downstream hydrology, including adjacent wetlands, is expected to be within the range of that typically observed due to natural variability. Therefore, no potential indirect wetland impacts are identified for the wetlands abutting Second Creek.

5.2.4.2 Potential Indirect Impacts – Water Quality Changes

5.2.4.2.1 Potential Indirect Impacts – Change in Surface Water Quality

The Project will impact water quality in Second Creek by altering the chemistry of surface water discharges to the headwaters of Second Creek (Sections 5.2.2.8.1 and Section 6.6 of Reference (37)). The collection of seepage by the South Seepage Management System and augmentation with WWTP effluent water will generally improve downstream water quality relative to current conditions. Even if water quality is improved, there is potential for indirect impacts to wetlands due to changes in water quality.

Potential indirect wetland impacts due to changes in water quality will be limited to wetlands abutting Second Creek. Potential indirect impacts due to changes in surface water quality are expected to diminish as the distance from the Tailings Basin increases. Upstream of County Road 666, there are approximately 179 acres of wetlands abutting Second Creek (Table 5-13) that have the potential to be indirectly impacted by the change in water quality due to stream flow augmentation of Second Creek.

Table 5-13 Wetlands Abutting Second Creek

Wetland ID	Dominant Eggers and Reed Wetland Community	Total Wetland Area (acres)
595[(1)]	Deep marsh	1.05
595A	Deep marsh	3.06
1161	Deep marsh	9.41
1162	Shallow marsh	40.84
1174	Alder thicket or Shrub-carr	118.75
1176	Shallow marsh	4.92
P5-1	Deep marsh	0.77
P5-1A	Deep marsh	0.03
Total acres of wetland		178.83

(1) Wetland 595 includes 3 separate areas.

5.2.4.2.2 Potential Indirect Impacts – Metals Deposition

The deposition modeling results (Section 5.2.1.4.1) indicate there are 7 wetlands in the Second Creek area covering approximately 44 acres that are potentially indirectly impacted (modeled metal deposition greater than 100% of background); of these, 1.05 acres are located within the FTB ambient air boundary (Large Figure 16). The wetlands are identified by wetland ID, wetland type using Eggers and Reed (Reference (13)), and acreage in Table 5-14.

Table 5-14 Wetlands Potentially Indirectly Impacted by Metal Deposition

Wetland ID	Dominant Eggers and Reed Wetland Community	Revised Total Wetland Area (acres)(1)	Reference (40) Total Wetland Area (acres)
595(2)	Deep marsh	1.05	1.05
595A	Deep marsh	3.06	3.06
1161(3)	Deep marsh	9.41	6.34
1166(3)	Shallow marsh	28.04	15.03
1167(3)	Shallow marsh	2.88	2.40
Total acres of wetland		44.44	

(1) Acreage for wetland IDs 595 and 595A did not change.
(2) Wetland 595 includes 3 separate areas.
(3) Previously identified in Reference (40) using the NWI.

5.2.5 Summary of Potential Indirect Wetland Impacts

The analysis in Section 5.2 identified six factors that may result in potential indirect wetland impacts: wetland fragmentation, change in wetland hydrology from changes in watershed area, changes in wetland hydrology from groundwater drawdown, water quality changes related to deposition of dust, water quality changes related to ore spillage along the transportation corridor, and changes in water quality related to leakage from stockpiles/mine features and seepage from mine pits. A wetland may be potentially indirectly impacted by none of these factors or up to a maximum of six, with different combinations of factors possible. A rating was developed for the wetlands based on the number of factors that may potentially affect it – from No Impact (0 factors) to 6 (all six factors potentially indirectly impacting the wetland). Using this approach, no wetlands were rated as a 6 in this analysis.

Using the method identified in Attachment A to identify potential indirect wetland impacts from drawdown (Section 5.2.1.2.2), approximately 54% of wetlands received a rating of 1, with one factor potentially indirectly impacting the wetland; 42% of wetlands received a rating of 2, with two factors potentially indirectly impacting the wetland; 3% of wetlands received a rating of 3, with three factors potentially indirectly impacting the wetland; less than 0.2% of wetlands received a rating of 4, with four factors potentially indirectly impacting the wetland; and less than 0.1% of wetlands received a rating of 5, with five factors potentially indirectly impacting the wetland. Table 5-15 shows the wetland acreage for each rating for Attachment A method Ratings 1, 2, 3, 4, and 5. Large Figure 23 through Large Figure 25 show the ratings for wetlands in the Project analysis areas.

Table 5-15 Rating for Wetlands Potentially Indirectly Impacted in the Project Area

Rating	Attachment A Method		Alternate Method	
	Wetlands (acres)	Wetlands (% of total acres)	Wetlands (acres)	Wetlands (% of total acres)
1	4,305.94	54.4%	3,466.12	52.8%
2	3,126.77	42.1%	2,888.37	44.0%
3	245.31	3.3%	205.97	3.1%
4	15.89	0.2%	8.11	0.1%
5	0.25	<0.1%	0.25	<0.1%
Total acres of wetland	7,694.16		6,568.82	

Using the alternative method to identify potential indirect wetland impacts from drawdown (Section 5.2.1.2.2), approximately 53% of wetlands received a rating of 1, with one factor potentially indirectly impacting the wetland; 44% of wetlands received a rating of 2, with two factors potentially indirectly impacting the wetland; 3% of wetlands received a rating of 3, with three factors potentially indirectly impacting the wetland; less than 1% of wetlands received a rating of 4, with four factors potentially indirectly impacting the wetland; and less than 0.1% of wetlands received a rating of 5, with five factors potentially indirectly impacting the wetland. Table 5-15 shows the wetland acreage for alternate method Ratings 1, 2, 3, 4, and 5. Large Figure 26 through Large Figure 28 show the ratings for wetlands in the Project Area.

5.3 Cumulative Wetland Impacts

An analysis was conducted to determine the cumulative effects of direct impacts from all past, present, and reasonably foreseeable future projects to the wetlands, lakes, and deepwater resources located in the Partridge River and Embarrass River watersheds. The number and extent of wetland, lake, and deepwater resources were estimated for three time periods, including pre-settlement, existing, and the foreseeable future. Attachment A summarizes the methodology used for the cumulative wetland impact analysis.

5.3.1 Pre-settlement Wetland and Water Resources

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. An estimate of pre-settlement wetland, lake, and deepwater acreages within the Partridge River and Embarrass River watersheds was developed using the U.S. Fish and Wildlife Service

(USFWS) National Wetland Inventory (NWI) maps and the original survey maps developed using data from the original Government Land Surveys.

In order to develop a relationship between NWI mapping and pre-settlement mapping of wetland, lake, and deepwater resources, townships in each watershed with minimal disturbance were used to calculate ratios of NWI to original survey wetland, lake, and deepwater resources. These ratios were used as adjustment factors to conform the original survey data to the standards and scales of the NWI data for estimating the pre-settlement wetland, lake, and deepwater resources within the disturbed areas of each watershed. The methodology used to identify disturbed areas in each watershed is summarized in Attachment A.

5.3.1.1 Partridge River Watershed

Township 58, Range 12 is one of the least disturbed townships in the Partridge River Watershed (0.2% disturbance in the entire township and 0.4% disturbance for the portion contained within the watershed: Large Figure 29). Using the disturbance at the township level (0.2%), 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% more wetlands, lakes, and deepwater resources identified on the NWI maps than the original survey maps in the Partridge River Watershed.

Disturbance within the townships located in the Partridge River Watershed range between 0.4% and 52.4%, with approximately 15% of the entire Partridge River Watershed containing significant human disturbance since settlement of the area (Large Figure 29). The disturbance types (and percent of the disturbance area) include: mining features including stockpiles, pits, roads, and other infrastructure (82% of the disturbance area); primarily municipal/residential development (e.g., Cities of Aurora and Hoyt Lakes) with some barren land and cultivated crops (13% of the disturbance area); and roads and railroads (5% of the disturbance area). Approximately 85% of the Partridge River Watershed was judged to be relatively undisturbed, so NWI mapping was used in these areas to represent pre-settlement conditions for wetland, lake, and deepwater resources.

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 Partridge River Watershed, comprising 33% of the watershed (Large Table 18, Large Figure 29).

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 2.6% of the watershed (Large Table 19, Large Figure 29).

No deepwater habitat (i.e., mine pits; Large Table 20, Large Figure 29) was identified in the watershed for the pre-settlement conditions.

5.3.1.2 Embarrass River Watershed

Township 61, Range 14 is one of the least disturbed townships in the Embarrass River Watershed (0.6% disturbance in the entire township and 0.7% disturbance for the portion contained within the watershed: Large Figure 29). Using the disturbance at the township level (0.6%), 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% fewer wetlands, lakes, and deepwater resources identified on the NWI maps than the original survey maps in the Embarrass River Watershed.

Disturbance within the portions of townships located in the Embarrass River Watershed range between 0.7% and 63.3%, with approximately 12% of the entire Embarrass River Watershed containing significant human disturbance since settlement of the area (Large Figure 29). The disturbance types (and percent of the disturbance area) include: mining features including stockpiles, pits, roads, and other infrastructure (61% of the disturbance area); primarily municipal/residential development (e.g., Cities of Babbitt, Biwabik, Gilbert, and McKinley) with some barren land and cultivated crops (27% of the disturbance area); and roads and railroads (12% of the disturbance area). Approximately 88% of the Embarrass River watershed was judged to be relatively undisturbed, so NWI mapping was used in these areas to represent pre-settlement conditions for wetland, lake, and deepwater resources.

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% of the watershed (Large Table 18, Large Figure 29).

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% of the watershed (Large Table 19, Large Figure 29).

No deepwater habitat (i.e., mine pits; Large Table 20, Large Figure 29) was identified in the watershed for the pre-settlement conditions.

5.3.2 Existing Wetland and Water Resources

The existing conditions time period represents wetlands, lakes, and deepwater resources as they exist today, prior to the development of the Project (Large Figure 30). Existing wetlands, lakes, and deepwater resources were estimated using the following sources of data: wetland delineations completed in the area (described in Section 3.0), NWI maps, USGS National Hydrograph Dataset to estimate lake or lacustrine water bodies, and MDNR Mesabi Mining Features (2009) in combination with 2010 LiDAR data and aerial photographs from 2003, 2008, 2009, and 2010 to estimate deepwater or mine pit water bodies.

5.3.2.1 Partridge River Watershed

A total of 31,318 acres of existing wetlands were identified in the 101,812 acre watershed, comprising 31% of the land area (Large Table 18, Large Figure 30). There has been a decrease of approximately 2,283 acres of wetland; this represents a 7% decrease in wetland area compared to pre-settlement conditions (Large Table 21).

A total of 3,194 acres of lakes were identified in the 101,812 acre watershed, comprising 3% of the land area (Large Table 19, Large Figure 30). There has been an increase of approximately 506 acres of lakes; this represents a 19% increase in lake area compared to pre-settlement conditions (Large Table 22).

A total of 3,146 acres of deepwater resources (i.e., mine pits) were identified in the 101,812 acre watershed, comprising 3% of the land area (Large Table 20, Large Figure 30). There has been an increase of 3,146 acres of deepwater resources in the watershed compared to no deepwater resources present under pre-settlement conditions (Large Table 23).

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.

5.3.2.2 Embarrass River Watershed

A total of 34,249 acres of existing wetlands were identified in the 116,797 acre watershed, comprising 29% of the land area (Large Table 18, Large Figure 30). There has been a decrease of approximately 402 acres of wetland; this represents a 1% decrease in wetland area compared to pre-settlement conditions (Large Table 21).

A total of 2,904 acres of lakes were identified in the 116,797 acre watershed, comprising 3% of the land area (Large Table 19, Large Figure 30). There was a decrease of approximately 217 acres of lakes in the watershed; this represents a 7% decrease in lake area compared to pre-settlement conditions (Large Table 22).

A total of 977 acres of deepwater resources (i.e., mine pits) were identified in the 116,797 acre watershed, comprising 1% of the land area (Large Table 20, Large Figure 30). There has been an increase of 977 acres of deepwater resources in the watershed compared to no deepwater resources present under pre-settlement conditions (Large Table 23).

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.

5.3.3 Projected Future Wetland and Water Resources

The future conditions time period represents wetlands, lakes, and deepwater resources expected to be present following the conclusion and long-term closure of the Project. It is assumed that the future conditions represents the time period after the conclusion of the future projects when the mine pits will have flooded with water.

Relevant agencies were contacted to identify foreseeable future actions within the Partridge River and Embarrass River watersheds. Agency officials were asked to identify actual or potential development projects that may occur during the life of the Project. The Project Description (Reference (12) describes a 20-year mine life followed by reclamation and long-term closure. Public officials from city, county, state, and federal agencies were contacted as shown in Attachment F. Based on Reference (41), foreseeable future actions did not include projects that have only been proposed because it is too speculative to include in this analysis.

Future projects were identified in the Partridge and Embarrass River watersheds that may impact wetland, lake, and deepwater resources. The locations of these projects are shown on Large Figure 31 and their potential effects on future conditions for wetland and deepwater habitat resources are summarized on Large Table 24. The following projects are included in assessment of cumulative wetland impacts:

- The Project, located in the Embarrass and Partridge River watersheds, has identified the potential for 914 acres of direct wetland impact over the next 20 years. Approximately 321 acres of deepwater habitat is planned at the Mine Site at the conclusion of the Project.

- The proposed Mesabi Nugget Phase II project, located in the Partridge River watershed, has identified the potential for approximately 267 acres of direct wetland impact (Reference (42)) over the life of the project (Large Table 24, Large Figure 31). Approximately 1,601 acres of deepwater habitat is planned at the conclusion of the project (Reference (43), resulting in an increase of 49 acres from existing 1,552 acres of deepwater habitat (Large Table 24).

- The ArcelorMittal East Reserve project, located in the Embarrass River watershed, has identified the potential for approximately 116 acres of direct wetland impact (Reference (44)) over the life of the project. Through 2014, there have been 67.14 acres of direct wetland impact (Reference (45)). Approximately 275 acres of deepwater habitat is planned at the conclusion of the project (Reference (46)), resulting in an increase of 275 acres from the existing 0 acres of deepwater habitat.

- The ArcelorMittal Pushback project, located in the Embarrass River watershed, has identified the potential for approximately 23 acres of direct wetland impact (Reference (47)) over the life of the project. Approximately 107 acres of deepwater habitat may develop at the conclusion of the project (Reference (47)), resulting in an increase of 107 acres from the existing 0 acres of deepwater habitat.

- The Mining Resources Austin Powder (Biwabik) project, located in the Embarrass River watershed, has identified the potential for approximately 4 acres of direct wetland impact (Reference (48)) over the life of the project. No deepwater habitat is planned at the conclusion of the project.

- The Mining Resources McKinley project, located in the Embarrass River watershed, has identified the potential for approximately 50 acres of direct wetland impact (Reference (48), Reference (49)) over the life of the project. No deepwater habitat is planned at the conclusion of the project.

- The Laskin Energy Park is located in the Partridge River watershed and south of the Minnesota Power Laskin Energy Center. It is located adjacent to Colby and Whitewater Lakes, near the City of Hoyt Lakes. If every lot in the 220-acre industrial park was fully developed, the potential direct wetland impacts could range from zero to seven acres. The amount of wetland mitigation that may be conducted in the Partridge River watershed is unknown at this time.

- St. Louis County Public Works will be conducting 8 bridge replacements in the Partridge and Embarrass River watersheds over the next 10 years. Bridge replacements generally directly impact 10,000 square feet of wetlands or less, so the maximum direct wetland impact from the bridge projects will be 1.8 acres. Information was not provided regarding potential indirect wetland impacts for this project.

To estimate the future projected wetland, lake, and deepwater resources impacts from the Project, the Mesabi Nugget Phase II project, the Laskin Energy Park project, and the St. Louis County bridge replacement, the maximum impact acreages were used to calculate total acreages in Large Table 24. For the projected future conditions, the acreage of wetland, lake, and deepwater resources was estimated by subtracting the future projected wetland impacts and adding the future projected development of wetland, lake, and deepwater resources to the existing resource totals (Large Table 24).

5.3.3.1 Partridge River Watershed

In addition to the Project, development of other projects (and associated impacts to and mitigation of wetland, lake and deepwater resources in the Partridge River Watershed) will occur under the foreseeable future conditions. Large Table 21 through Large Table 23 summarize future conditions for wetland, lake, and deepwater resources.

Approximately 30,276 acres of wetlands are projected to be present in the watershed in the foreseeable future comprising 30% of the land area (Large Table 18, Large Figure 31). The change in wetlands, as a proportion of all wetlands within the study area, will be a 10% reduction from pre-settlement conditions and a 3% reduction compared to existing conditions (Large Table 21).

Approximately 3,194 acres of lakes are projected to be present in the watershed in the foreseeable future, comprising 3% of the land area (Large Table 19, Large Figure 31). The change in lakes, as a proportion of the total study area, will be a 19% increase from pre-settlement conditions and there will be no changes compared to existing conditions (Large Table 22).

Approximately 3,516 acres of deepwater resources are projected to be present in the watershed in the foreseeable future, comprising 4% of the land area (Large Table 20, Large Figure 31). The change in deepwater, as a proportion of the total study area, will be a 100% increase from pre-settlement conditions and a 12% increase compared to existing conditions (Large Table 23).

5.3.3.2 Embarrass River Watershed

In addition to the Project, development of other projects (and associated impacts to and mitigation of wetland, lake, and deepwater resources in the Embarrass River Watershed) will occur under the foreseeable future conditions. Large Table 21 through Large Table 23 summarize future conditions for wetland, lake, and deepwater resources.

Approximately 33,947 acres of wetlands are projected to be present in the watershed in the foreseeable future comprising 29% of the land area (Large Table 18, Large Figure 31). The change in wetlands, as a proportion of all wetlands within the study area, will be a 2% reduction from pre-settlement conditions and a 1% reduction compared to existing conditions (Large Table 21).

Approximately 2,904 acres of lakes are projected to be present in the watershed in the foreseeable future, comprising 3% of the land area (Large Table 19, Large Figure 31). The change in lakes, as a proportion of the total study area, will be a 7% increase from pre-settlement conditions and there will be no changes compared to existing conditions (Large Table 22).

Approximately 1,359 acres of deepwater resources are projected to be present in the watershed in the foreseeable future, comprising 1% of the land area (Large Table 20, Large Figure 31). The change in deepwater, as a proportion of the total study area, will be a 100% increase from pre-settlement conditions and a 39% increase compared to the existing conditions (Large Table 23).

5.3.4 Qualitative Analysis of Cumulative Wetland Impacts 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 will be within the naturally occurring annual variation for the Partridge River (Section 5.2.1.3). Therefore, no potential indirect wetland impacts are identified for the wetlands abutting the Partridge River.

The St. Louis River is located downstream of the Partridge River. Thus, impacts to flows (and by extension water surface elevations) generated by the Project 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 wetland impacts 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.

5.3.5 Quantitative Analysis of Cumulative Wetland Impacts

The quantitative analysis of cumulative wetland impacts for the Partridge and Embarrass River watersheds is discussed in Section 5.3.3.

5.3.6 Climate Change

The qualitative assessment of the potential impacts of climate change on wetlands was included in the Climate Change Evaluation Report developed by the Air IAP. No additional assessment was conducted for this data package.

Revision History

Date	Version	Description
10/14/2011	1	Initial release
12/16/2011	2	Revisions based on comments received for Version 1 and additional information regarding Mine Site features.
1/20/2012	3	Revisions based on reviewing the status of wetlands within the currently permitted (Cliffs Erie LLC) waste facility boundary.
2/16/2012	4	Revisions based on comments received for Version 3
12/12/2012	5	Revisions based on additional information regarding Project features and wetland information.
12/28/2012	6	Revisions based on analysis of potential indirect wetland impacts.
3/1/2013	7	Revisions based on analysis of potential indirect wetland impacts.
11/17/2014	8	Revisions based on Project changes.
1/6/2015	9	Revisions based on agency comments provided for v8.
2/10/2015	10	Revisions based on agency comments provided for v9.
4/8/2015	11	Revisions based on agency comments provided for v10.

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Large Table 1 Summary of Wetlands in Project Areas

Project Area	Wetland ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Remaining Wetland Area (acres)	Dominant Eggers and Reed[1] Wetland Community	Wetland Quality	Type of Direct Impact[2]
Mine Site	1	3	0.42	0.00	0.42	Shallow marsh	Moderate	
Mine Site	3	3	0.35	0.00	0.35	Shallow marsh	Moderate	
Mine Site	5	2	0.61	0.61	0.00	Wet meadow	High	F
Mine Site	6	3	0.62	0.00	0.62	Shallow marsh	Moderate	
Mine Site	7	2	0.07	0.00	0.07	Wet meadow	Moderate	
Mine Site	8	2	6.80	6.80	0.00	Sedge meadow	Moderate	F,E
Mine Site	9	3	1.80	0.07	1.73	Shallow marsh	High	F
Mine Site	10	2	1.17	0.00	1.17	Sedge meadow	High	
Mine Site	11	8	8.88	0.00	8.88	Coniferous bog	High	
Mine Site	12	6	0.13	0.00	0.13	Alder thicket	High	
Mine Site	13	4	5.03	0.09	4.94	Deep marsh	High	F
Mine Site	14	2	0.33	0.33	0.00	Wet meadow	High	F
Mine Site	16	3	0.31	0.00	0.31	Shallow marsh	High	
Mine Site	18	3	18.90	18.90	0.00	Shallow marsh	High	E
Mine Site	19	3	1.68	0.05	1.63	Shallow marsh	High	E
Mine Site	20	2	17.06	16.96	0.10	Sedge meadow	High	E
Mine Site	22	3	1.43	0.00	1.43	Shallow marsh	High	
Mine Site	22A	7	0.89	0.00	0.89	Coniferous swamp	High	
Mine Site	24	6	0.80	0.39	0.41	Alder thicket	High	E
Mine Site	25	8	1.95	0.00	1.95	Coniferous bog	High	
Mine Site	27	8	1.07	1.07	0.00	Coniferous swamp	Moderate	E
Mine Site	29	3	12.02	0.00	12.02	Shallow marsh	High	
Mine Site	32	8	73.36	70.99	2.37	Coniferous bog	High	F,E
Mine Site	33A	6	18.46	5.77	12.69	Alder thicket	High	E
Mine Site	33B	7	4.56	0.00	4.56	Coniferous swamp	High	
Mine Site	37	6	2.39	2.39	0.00	Shrub-carr	High	F
Mine Site	43	6	8.29	7.26	1.03	Alder thicket	High	F
Mine Site	44	6	3.27	1.99	1.28	Alder thicket	High	E
Mine Site	45	6	37.55	28.83	8.72	Alder thicket	High	F,E
Mine Site	47	8	0.54	0.54	0.00	Open bog	High	F
Mine Site	48	8	89.16	27.80	61.36	Coniferous bog	High	F,E
Mine Site	48A	7	2.65	2.21	0.44	Coniferous swamp	High	F

Project Area	Wetland ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Remaining Wetland Area (acres)	Dominant Eggers and Reed[1] Wetland Community	Wetland Quality	Type of Direct Impact[2]
Mine Site	51	6	7.47	7.45	0.02	Alder thicket	High	F
Mine Site	52	6	3.88	3.88	0.00	Alder thicket	High	F,E
Mine Site	53	6	18.59	0.00	18.59	Alder thicket	High	
Mine Site	53A	7	2.35	0.00	2.35	Coniferous swamp	High	
Mine Site	53B	7	0.43	0.00	0.43	Coniferous swamp	High	
Mine Site	53C	7	2.88	0.00	2.88	Coniferous swamp	High	
Mine Site	54	7	4.11	0.00	4.11	Coniferous swamp	High	
Mine Site	54C	6	0.74	0.00	0.74	Alder thicket	High	
Mine Site	55	6	3.91	3.85	0.06	Alder thicket	High	F,E
Mine Site	56	8	2.79	2.79	0.00	Open bog	High	E
Mine Site	57	7	78.06	50.49	27.57	Coniferous swamp	High	F,E
Mine Site	58	6	34.58	0.00	34.58	Alder thicket	High	
Mine Site	60	6	6.71	6.71	0.00	Alder thicket	High	F
Mine Site	61	7	0.45	0.00	0.45	Coniferous swamp	High	
Mine Site	62	8	12.13	0.00	12.13	Coniferous bog	High	
Mine Site	64	7	0.31	0.00	0.31	Hardwood swamp	High	
Mine Site	68	7	23.81	10.89	12.92	Coniferous swamp	High	F,E
Mine Site	72	7	1.39	0.00	1.39	Coniferous swamp	High	
Mine Site	74	7	6.12	6.12	0.00	Hardwood swamp	High	E
Mine Site	76	8	3.92	2.21	1.71	Coniferous bog	High	E
Mine Site	77	8	13.01	0.92	12.09	Coniferous bog	High	F,E
Mine Site	78	8	1.75	1.75	0.00	Coniferous bog	High	F
Mine Site	79	8	2.39	0.00	2.39	Coniferous bog	High	
Mine Site	80	8	0.29	0.22	0.07	Coniferous bog	High	F
Mine Site	81	7	1.68	1.44	0.24	Coniferous swamp	High	F,E
Mine Site	82	8	62.40	60.77	1.63	Coniferous bog	High	F,E
Mine Site	83	8	3.99	0.00	3.99	Open bog	High	
Mine Site	84	8	1.33	0.00	1.33	Coniferous bog	High	
Mine Site	85	8	1.41	1.41	0.00	Coniferous bog	High	E
Mine Site	86	8	2.47	2.46	0.01	Coniferous bog	High	F
Mine Site	88	8	5.58	5.02	0.56	Coniferous bog	High	F
Mine Site	90	8	176.08	34.22	141.86	Coniferous bog	High	F,E
Mine Site	90A	8	7.91	1.20	6.71	Open bog	High	F

Project Area	Wetland ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Remaining Wetland Area (acres)	Dominant Eggers and Reed[1] Wetland Community	Wetland Quality	Type of Direct Impact[2]
Mine Site	95	8	2.54	2.54	0.00	Coniferous swamp	High	E
Mine Site	96	8	17.30	13.14	4.16	Coniferous bog	High	F,E
Mine Site	97	8	4.46	2.57	1.89	Coniferous bog	High	F,E
Mine Site	98	8	15.50	15.07	0.43	Coniferous bog	High	F,E
Mine Site	99	8	1.40	0.49	0.91	Coniferous bog	High	F,E
Mine Site	100	8	176.19	102.96	73.23	Coniferous bog	High	F,E
Mine Site	100A	6	1.66	1.66	0.00	Alder thicket	High	F
Mine Site	101	8	14.21	11.73	2.48	Coniferous bog	High	F,E
Mine Site	103	8	118.84	109.97	8.87	Coniferous bog	High	F,E
Mine Site	104	8	3.57	3.47	0.10	Coniferous bog	High	F
Mine Site	105	8	15.48	0.00	15.48	Coniferous bog	High	
Mine Site	107	8	40.92	31.63	9.29	Coniferous bog	High	F,E
Mine Site	107A	7	1.74	1.69	0.05	Coniferous swamp	High	F,E
Mine Site	107B	3	4.51	2.89	1.62	Shallow marsh	High	F,E
Mine Site	107C	6	27.60	27.60	0.00	Alder thicket	High	E
Mine Site	114	8	0.73	0.73	0.00	Coniferous bog	High	F
Mine Site	120	3	0.58	0.12	0.46	Shallow marsh	Moderate	E
Mine Site	200	7	6.36	6.36	0.00	Hardwood swamp	High	F
Mine Site	201	2	13.49	13.49	0.00	Wet meadow	High	F
Mine Site	202	8	3.11	3.11	0.00	Open bog	High	F
Mine Site	552	8	8.72	8.72	0.00	Coniferous bog	High	F
Mine Site	567	3	1.40	1.40	0.00	Shallow marsh	High	F
MINE SITE SUBTOTAL	**87**		**1297.78**	**758.19**	**539.59**		**80/87 High 7/87 Moderate**	
Railroad Connection Corridor	1038	7	0.07	0.07	0.00	Coniferous swamp	High	F
Railroad Connection Corridor	R-3	6	0.10	0.10	0.00	Shrub-carr	High	F
Railroad Connection Corridor	R-4	6	0.20	0.20	0.00	Alder thicket	High	F
Railroad Connection Corridor	R-5	3	0.07	0.07	0.00	Shallow marsh	High	F
RAILROAD CONNECTION CORRIDOR SUBTOTAL	**4**		**0.44**	**0.44**	**0.00**		**4/4 High**	
Dunka Road and Utility Corridor	22B	3	0.34	0.34	0.00	Shallow marsh	High	F
Dunka Road and Utility Corridor	22C	6	0.38	0.38	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	54A	7	0.60	0.60	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	54B	6	0.13	0.13	0.00	Alder thicket	High	F

Project Area	Wetland ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Remaining Wetland Area (acres)	Dominant Eggers and Reed[(1)] Wetland Community	Wetland Quality	Type of Direct Impact[(2)]
Dunka Road and Utility Corridor	54D	7	0.09	0.09	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	390	6	0.41	0.41	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	392	6	0.14	0.14	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	394	7	0.64	0.64	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	395	7	0.01	0.01	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	396	6	0.65	0.65	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	400	8	0.14	0.14	0.00	Coniferous bog	High	F
Dunka Road and Utility Corridor	553	7	0.09	0.09	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	554	7	0.11	0.11	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	569	6	0.68	0.68	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	716	6	0.02	0.02	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	814	8	0.75	0.75	0.00	Coniferous bog	High	F
Dunka Road and Utility Corridor	862	6	0.78	0.78	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	1034	6	0.02	0.02	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	1035	6	0.16	0.16	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	1124	6	0.44	0.44	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	R-7	3	0.18	0.18	0.00	Shallow marsh	High	F
DUNKA ROAD AND UTILITY CORRIDOR SUBTOTAL	**21**		**6.76**	**6.76**	**0.00**		**21/21 High**	
FTB	251	6	1.43	1.43	0.00	Alder thicket	Moderate	C
FTB	272	4	1.11	1.10	0.01	Deep marsh	Low	C
FTB	278	6	1.04	0.23	0.81	Alder thicket	Low	C
FTB	279	6	4.84	3.33	1.51	Alder thicket	Low	C
FTB	282	3	14.25	7.42	6.83	Shallow marsh	Moderate	C
FTB	284	6	2.92	2.51	0.41	Alder thicket	Low	C
FTB	290	7	0.48	0.22	0.26	Coniferous swamp	Moderate	F,E
FTB	292	4	1.71	1.29	0.42	Deep marsh	Low	C
FTB	307	3	0.78	0.77	0.01	Shallow marsh	Low	C
FTB	308	4	7.17	1.95	5.22	Deep marsh	Low	C
FTB	309	2	0.02	0.02	0.00	Wet meadow	Low	C
FTB	312	6	1.98	1.33	0.65	Shrub-carr	Low	C
FTB	314	3	24.87	5.70	19.17	Shallow marsh	Low	C
FTB	573	3	0.12	0.00	0.12	Shallow marsh	Low	
FTB	582	4	27.49	8.11	19.38	Deep marsh	Low	C

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FTB	585	6	1.58	0.00	1.58	Alder thicket	Low	
FTB	586	4	1.89	1.53	0.36	Deep marsh	Low	C
FTB	587	3	0.97	0.17	0.80	Shallow marsh	Low	C
FTB	590	3	5.43	5.38	0.05	Shallow marsh	Low	C
FTB	591	4	2.71	0.70	2.01	Deep marsh	Low	C
FTB	593	4	9.80	8.47	1.33	Deep marsh	Low	C
FTB	594	4	0.06	0.00	0.06	Deep marsh	Low	
FTB	595	4	2.14	1.09	1.05	Deep marsh	Low	F
FTB	811	7	0.20	0.20	0.00	Coniferous swamp	Low	C
FTB	968	7	13.76	10.27	3.49	Coniferous swamp	Low	C
FTB	1027	6	0.20	0.00	0.20	Alder thicket	Moderate	
FTB	1125	2	0.07	0.07	0.00	Sedge meadow	Low	F
FTB	1126	7	0.69	0.69	0.00	Hardwood swamp	Low	F
FTB	1134	3	14.45	8.71	5.74	Shallow marsh	Low	C
FTB	1135	4	0.51	0.00	0.51	Deep marsh	Low	
FTB	1139	3	20.25	2.54	17.71	Shallow marsh	Low	C
FTB	1155	3	0.55	0.41	0.14	Shallow marsh	Low	C
FTB	1156	3	15.07	11.08	3.99	Shallow marsh	Low	C
FTB	1159	3	0.05	0.00	0.05	Shallow marsh	Low	
FTB	1160	5	0.85	0.00	0.85	Deep water	Low	
FTB	1176	7	0.34	0.00	0.34	Hardwood swamp	Moderate	
FTB	P10	6	0.34	0.00	0.34	Alder thicket	Low	
FTB	T1	4	1.93	0.11	1.82	Deep marsh	Low	F
FTB	T2	4	0.90	0.90	0.00	Deep marsh	Low	F
FTB	T3	2	0.09	0.09	0.00	Wet meadow	Low	F
FTB	T4	2	1.02	1.02	0.00	Wet meadow	Low	F
FTB	T5	2	0.24	0.24	0.00	Wet meadow	Low	F
FTB	T6	6	0.07	0.07	0.00	Shrub-carr	Low	F
FTB	T7	3	0.92	0.92	0.00	Shallow marsh	Low	F
FTB	T8	2	0.03	0.01	0.02	Wet meadow	Low	F
FTB	T10	4	1.48	1.48	0.00	Deep marsh	Low	F
FTB	T11	4	0.95	0.95	0.00	Deep marsh	Low	F
FTB	T12	3	0.39	0.39	0.00	Shallow marsh	Low	F

Project Area	Wetland ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Remaining Wetland Area (acres)	Dominant Eggers and Reed[1] Wetland Community	Wetland Quality	Type of Direct Impact[2]
FTB	T13	4	1.05	0.97	0.08	Deep marsh	Low	F
FTB	T13A	4	0.16	0.16	0.00	Deep marsh	Low	F
FTB	T14	4	45.20	45.20	0.00	Deep marsh	Low	E
FTB	T15	3	1.70	1.70	0.00	Shallow marsh	Low	F
FTB SUBTOTAL	**52**		**238.25**	**140.93**	**97.32**		**5/52 Moderate 47/52 Low**	
HRF	1155	3	35.45	6.89	28.56	Shallow marsh	Low	F
HRF	1159	3	0.62	0.62	0.00	Shallow marsh	Low	F
HRF SUBTOTAL	**2**		**36.07**	**7.51**	**28.56**		**2/2 Low**	
PROJECT TOTAL	**166**		**1,579.24**	**913.83**	**665.41**		**105/166 High 12/166 Moderate 49/166 Low**	

(1) Reference (13)
(2) The types of direct wetland impact disturbance factors include excavation €, fill (F), and containment system (C).

Large Table 2 Summary of Direct Wetland Impacts

Project Area	Circular 39 Wetland Classification	1	2	2	3	4	5	6	6	7	7	8	8		Wetland Total
	Eggers and Reed Wetland Community[1]	Seasonally Flooded	Fresh (Wet) Meadow	Sedge Meadow	Shallow Marsh	Deep Marsh	Shallow, Open Water	Shrub-Carr	Alder Thicket	Hardwood Swamp	Coniferous Swamp	Open Bog	Coniferous Bog	Deepwater	
Mine Site	Direct Impact (acres)	0.00	14.43	23.76	23.43	0.09	0.00	2.39	95.39	12.48	70.33	7.64	508.26	0.00	758.20
	# of directly impacted wetlands	0	3	2	6	1	0	1	11	2	7	4	22	0	59
Railroad Connection Corridor	Direct Impact (acres)	0.00	0.00	0.00	0.07	0.00	0.00	0.10	0.20	0.00	0.07	0.00	0.00	0.00	0.44
	# of directly impacted wetlands	0	0	0	1	0	0	1	1	0	1	0	0	0	4
Dunka Road and Utility Corridor	Direct Impact (acres)	0.00	0.00	0.00	0.52	0.00	0.00	0.00	3.81	0.00	1.54	0.00	0.89	0.00	6.76
	# of directly impacted wetlands	0	0	0	2	0	0	0	11	0	6	0	2	0	21
FTB	Direct Impact (acres)	0.00	1.38	0.07	45.19	74.01	0.00	1.40	7.50	0.69	10.69	0.00	0.00	0.00	140.93
	# of directly impacted wetlands	0	5	1	12	15	0	2	4	1	3	0	0	0	43
HRF	Direct Impact (acres)	0.00	0.00	0.00	7.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.51
	# of directly impacted wetlands	0	0	0	2	0	0	0	0	0	0	0	0	0	2
Total	(acres)	0.00	15.81	23.83	76.72	74.10	0.00	3.89	106.90	13.17	82.63	7.64	509.15	0.00	913.84

(1) Reference (13)

Large Table 3 Wetlands within 500-feet increments – Mine Site

Wetland ID	Eggers and Reed Wetland Community(1)	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
1	Shallow marsh	0	0	0	0	0	0	0	0.10	0.33	0	0	0	0	0	0	0	0	0	0	0
3	Shallow marsh	0	0	0	0	0	0	0	0	0	0.35	0	0	0	0	0	0	0	0	0	0
4	Wet meadow	0	0	0	0	0	0	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Shallow marsh	0	0	0	0	0	0	0	0.62	0	0	0	0	0	0	0	0	0	0	0	0
7	Wet meadow	0	0	0	0	0	0	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Shallow marsh	0	1.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	Sedge meadow	0	0	0	0	0.12	1.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	Coniferous bog	0	0	0	0	0	0	0	0.44	4.98	3.46	0	0	0	0	0	0	0	0	0	0
12	Alder thicket	0	0	0	0	0	0	0	0	0	0	0.13	0	0	0	0	0	0	0	0	0
13	Deep marsh	0.01	4.93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Shallow marsh	0	0	0.31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	Shallow marsh	0	0	0	0	0	0	0	0.12	1.00	0	0	0	0	0	0	0	0	0	0	0
19	Shallow marsh	0	0	0	0	0	1.62	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	Sedge meadow	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	Shallow marsh	0	0	1.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22A	Coniferous swamp	0	0	0.39	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22D	Shallow marsh	0	0	0.62	1.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22E	Alder thicket or Shrub-carr	0	0	0	2.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	Alder thicket	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	Coniferous bog	1.62	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	Shallow marsh	0	0	0	0	0	0	0	0	0.02	11.75	0.24	0	0	0	0	0	0	0	0	0
32	Coniferous bog	2.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33A	Alder thicket	11.77	0.92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33B	Coniferous swamp	1.96	2.47	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	Alder thicket	0	0.70	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
44	Alder thicket	1.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	Alder thicket	8.17	0.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	Shrub-carr	0	0	0	0	0.52	3.43	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	Coniferous bog	1.54	14.29	37.40	7.77	0.30	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48A	Coniferous swamp		0	0.43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	Alder thicket	0	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	Alder thicket	0	0	0	1.48	0.44	0	4.51	10.24	1.91	0	0	0	0	0	0	0	0	0	0	0
53A	Coniferous swamp	0	0	0	0	0	0	0	1.36	0.99	0	0	0	0	0	0	0	0	0	0	0
53B	Coniferous swamp	0	0	0	0	0	0	0.43	0	0	0	0	0	0	0	0	0	0	0	0	0
53C	Coniferous swamp	0	0	0	2.67	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53D	Alder thicket	0	3.67	30.49	44.04	31.61	14.74	19.96	27.72	42.97	48.42	73.99	129.85	107.42	52.72	39.85	33.10	38.85	35.91	31.97	16.02
53E	Coniferous swamp	0	0	0	0	0	0	0.05	1.83	0.04	0	0	0	0	0	0	0	0	0	0	0
54	Coniferous swamp	0	0	0	0	0	1.86	2.23	0.01	0	0	0	0	0	0	0	0	0	0	0	0
54C	Alder thicket	0	0	0	0	0	0.06	0.69	0	0	0	0	0	0	0	0	0	0	0	0	0
54E	Coniferous swamp	0	0	0	0	0	0	1.43	1.17	0	0	0	0	0	0	0	0	0	0	0	0
54F	Alder thicket	0	0	0	0	0	0	0.43	0	0	0	0	0	0	0	0	0	0	0	0	0
54G	Coniferous swamp	0	0	0	0	0	0.77	0.77	0	0	0	0	0	0	0	0	0	0	0	0	0
55	Alder thicket	0	0	0	0	0	0	0	0	0.06	0	0	0	0	0	0	0	0	0	0	0
57	Coniferous swamp	0	0	0	2.66	5.98	11.25	5.70	1.95	0	0	0	0	0	0	0	0	0	0	0	0
58	Alder thicket	0	0	0	0	0	3.36	9.33	18.26	2.98	0.64	0	0	0	0	0	0	0	0	0	0
61	Coniferous swamp	0	0	0	0.35	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	Coniferous bog	0	0.17	2.58	7.52	1.86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
64	Hardwood swamp	0	0	0	0.31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	Coniferous swamp	0.83	0.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	Coniferous bog	1.71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	Coniferous bog	2.20	8.79	1.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	Coniferous bog	0	2.39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	Coniferous bog	0	0	0.05	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	Coniferous swamp	0	0	0	0	0	0.24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	Coniferous bog	1.63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	Open bog	0	0	0	0	0	0	0	0	0	2.45	1.54	0	0	0	0	0	0	0	0	0
84	Coniferous bog	0	0	0	0	0	0.82	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0
84A	Coniferous bog	0	0	0	0	0	1.04	3.33	3.04	0.80	0	0	0	0	0	0	0	0	0	0	0
86	Coniferous bog	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	Coniferous bog	0	0	0	0.56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	Coniferous bog	17.53	28.70	19.37	14.09	15.60	13.04	13.05	15.21	5.19	0.00	0	0	0	0	0	0	0	0	0	0
90A	Open bog	0	0	3.97	2.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	Coniferous bog	4.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	Coniferous bog	1.89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
98	Coniferous bog	0	0	0	0	0	0	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0
99	Coniferous bog	0.91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	Coniferous bog	29.61	37.10	6.43	0.04	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
101	Coniferous bog	2.26	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103	Coniferous bog	8.86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	Coniferous bog	0	0	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	Coniferous bog	0	0	0	0	0	0	0	0	0	5.78	8.38	1.31	0	0	0	0	0	0	0	0
105A	Coniferous bog	0	0	0	0	0	0	0	0	0	0.04	0.09	0	0	0	0	0	0	0	0	0
106	Coniferous swamp	0	0	0	0	0	1.60	10.47	4.55	8.97	28.37	26.58	3.00	0	0	0	0	0	0	0	0
106B	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0.16	16.44	4.72	0	0	0	0	0
106C	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	5.70	10.75	3.48	0	0	0	0	0
106D	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.79	16.01	1.00	0	0	0
107	Coniferous bog	7.94	1.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
107A	Coniferous swamp	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
107B	Shallow marsh	1.61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	Shallow marsh	0	0	0	0	0	0.46	0	0	0	0	0	0	0	0	0	0	0	0	0	0
315	Alder thicket or Shrub-carr	0	0	6.31	10.90	34.96	60.64	57.68	46.65	44.89	25.08	16.34	6.77	12.04	0.42	0	0	0	0	0	0
394A	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.48	6.95	21.58	37.21
396A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.80	1.88	0	0	0
397	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0.54	11.99	23.56	29.74	39.05	37.66	34.16	34.53
404	Coniferous swamp	0	0	0	0	0	0	0	1.09	8.72	2.97	0	0	0	0	0	0	0	0	0	0
406	Coniferous bog	0	0	0	0	2.26	0.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
407	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	2.27	6.93	5.38	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
409	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.16	11.30	11.10	15.53	19.45
410	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0.07	1.96	0	0	0	0	0
457	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.90	16.40	31.66
458	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33
459	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.29	7.47	5.00	5.87	8.89	4.50
460	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	1.82	4.82	0.09	0	0	0	0	0
461	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.85	2.80
465	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.53	5.58	11.36	3.29	0
466	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	6.35	6.25	6.88	4.28	1.10	0	0
467	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	2.20	10.27	7.10	8.72	1.29	0	0
468	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.46	6.45	8.81	3.95	0	0
470	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.20
473	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.64	3.52	0.50
474	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.15	10.08	8.18	0.02	0	0
477	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.69
478	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.21	1.79	0
479	Coniferous bog	0	0	0	0	0	0	0	0	0.94	13.70	9.82	9.28	2.74	0.40	0	0	0	0	0	0
480	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	4.44	2.84	1.59	0	0	0	0	0	0	0	0
487	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.13	4.14	7.32

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
489	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	9.04	47.95	45.51	34.46	33.56	7.82	0.39	0
491	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.42	1.05
492	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	7.30	0.11
493	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.62	12.10	12.29	10.88	10.69	0
494	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.59
510	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02
512	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.54	12.01	3.79	0	0
513	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.52	5.86	2.99	0
514	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.96	5.09	0.26	0
515	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.30
516	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.40
519	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.09
530	Coniferous bog	0	0	0	0	0	0	0	0	0	0.31	14.88	11.79	29.83	34.75	28.28	24.43	27.89	17.32	4.79	9.41
531	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	6.34	17.16	7.18	5.22	10.40	11.52	10.15	2.48
532	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.79	5.10	8.32	1.03	0
533	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.76	5.44	1.60	0
534	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.86	10.19	7.15
535	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
538	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.29

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
539	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.01	8.34
540	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.45
546	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	5.93	20.25	24.83	39.97	47.95	30.85	19.89	33.37
547	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.58	9.57	1.18	0	0	0
548	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.25	10.11	1.21
553A	Coniferous swamp	0	0	0	0	0	0	0.73	1.73	0	0	0	0	0	0	0	0	0	0	0	0
554A	Coniferous swamp	0	0	0	0	0	0	0	0.83	1.22	0	0	0	0	0	0	0	0	0	0	0
555	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	2.45	3.28	9.06	20.65	25.15	25.81	16.25	11.96	11.14	4.04	1.44	0.40
556	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	1.84	0	0	0	0	0	0	0	0	0
557	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	2.72	0.20	0	0	0	0	0	0	0	0	0	0
558	Coniferous bog	0	0	0	0	0	0	0	0		4.65	7.57	3.85	0	0	0	0	0	0	0	0
559	Coniferous bog	0	0	0	0	0	0	0.09	2.61	7.89	10.74	8.29	4.49	0.01	0	0	0	0	0	0	0
561	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.87	11.82	3.84
562	Coniferous bog	0	0	0	0	0	3.60	1.67	0	0	0	0	0	0	0	0	0	0	0	0	0
564	Coniferous bog	0	0	0	0	0	0	0.44	3.14	0	0	0	0	0	0	0	0	0	0	0	0
565	Alder thicket or Shrub-carr	0	0	0	0	0.06	1.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0
566	Alder thicket or Shrub-carr	0	0	0	0	0	0	2.54	3.00	0.32	0	0	0	0	0	0	0	0	0	0	0
568	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.32	0.10	0	0	0	0
569A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	1.17	3.89	3.25	0	0	0	0	0
570	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.69	10.02	5.27	8.71	12.38	4.88

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
571	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.29	2.85
678	Alder thicket	0	0	0	0	0	0	0	0	0	0.15	14.50	15.18	18.90	9.66	0	0	0	0	0	0
679	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0	0	0	0	0	0	0
68	Coniferous swamp	7.97	4.94	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
681	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0.88	1.21	0	0	0	0	0	0	0
682	Open bog	0	0	0	0	0	0	0	0	0	0	0	2.14	0.02	0	0	0	0	0	0	0
688	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	1.28	0.74	0	0	0	0	0	0
689	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	4.20	0.42	0	0	0	0	0	0
691	Alder thicket	0	0	0	0	0	0	0	0	0	0	0.35	3.62	2.27	0	0	0	0	0	0	0
693	Coniferous bog	0	0	0	0	0	0	0	0	0	0	3.46	8.87	0	0	0	0	0	0	0	0
695	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	3.30	0	0	0	0	0	0	0	0
697	Coniferous bog	0	0	0	0	0	0	0	0	2.52	2.02	0	0	0	0	0	0	0	0	0	0
699	Coniferous bog	0	0	0	0	0	0	0	0.76	1.44	0	0	0	0	0	0	0	0	0	0	0
700	Open bog	0	0	0	0	0	0	0	0	0	0	0.63	0	0	0	0	0	0	0	0	0
701	Coniferous swamp	0	0	0	0.37	12.42	28.46	32.50	56.82	22.12	0.24	0	0	0	0	0	0	0	0	0	0
708	Shallow marsh	0	0	0	0	0	0	0	0	1.31	2.61	0	0	0	0	0	0	0	0	0	0
709	Shallow marsh	0	0	0	0	0	0	0	0	0	1.70	6.43	0	0	0	0	0	0	0	0	0
713	Coniferous bog	0	0	0	0	0	0	0	0	1.13	6.33	0.44	0	0	0	0	0	0	0	0	0
714	Coniferous bog	0	0	0	0	0	19.80	44.26	45.74	28.37	18.99	19.10	13.19	5.08	0.12	0	0	0	0	0	0
716A	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.08
725	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.62	5.21	2.17
726	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0.92	5.18	0.72	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
727	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0.26	0	0	0	0	0	0
728	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0
729	Sedge meadow	0	0	0	0	0	0	0	0	0	0	0	0	0.57	0.20	0	0	0	0	0	0
730	Open bog	0	0	0	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0
731	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0
732	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0.10	0	0	0	0	0	0	0
733	Open bog	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0
734	Open bog	0	0	0	0	0	0	0	0	0	0	0	0.26	0	0	0	0	0	0	0	0
735	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0.91	0	0	0	0	0	0
736	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0.16	0.42	0	0	0	0	0	0	0
737	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0.17	0.25	0	0	0	0	0	0	0
738	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0.59	0	0	0	0	0	0	0
739	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0.26	0	0	0	0	0	0	0
740	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0
741	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0.20	0.38	0	0	0	0	0	0	0
742	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0.01	2.56	0.91	0	0	0	0	0	0	0
743	Alder thicket	0	0	0	0	0	0	0	0	0	0.44	0.20	0	0	0	0	0	0	0	0	0
744	Alder thicket	0	0	0	0	0	0	0	0	0	0.96	0	0	0	0	0	0	0	0	0	0
745	Coniferous swamp	0	0	0	0	0	0	5.66	6.23	1.43	0	0	0	0	0	0	0	0	0	0	0
746	Alder thicket	0	0	0	0	0	0	0	0	0.33	0	0	0	0	0	0	0	0	0	0	0
747	Alder thicket	0	0	0	0	0	0	0	0.23	0.70	0	0	0	0	0	0	0	0	0	0	0
748	Alder thicket	0	0	0	0	0	0	0	0	0.47	0	0	0	0	0	0	0	0	0	0	0
749	Alder thicket	0	0	0	0	0	0	0	0	0.69	8.52	0.23		0	0	0	0	0	0	0	0
752	Alder thicket	0	0	0	0	0	0	0.16	3.43	0	0	0	0	0	0	0	0	0	0	0	0
753	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.27	0.25	0	0
754	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.18	0.80	0	0	0	0
755	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0.29	0.36	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
756	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.54	0	0	0	0	0
757	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0.30	0	0	0	0	0	0	0
759	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	5.79	4.29	0	0	0
760	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0.57	0	0	0	0	0	0	0
764	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.65	3.28	4.12	3.41	13.77	24.20
765	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.15	0
766	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.88	0	0
768	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.29
773	Coniferous bog	0	0	0	4.96	3.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
774	Coniferous bog	0	0	0	0	0	5.29	2.93	0	0	0	0	0	0	0	0	0	0	0	0	0
775	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.78	2.28	0
776	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.61	2.89	0.39	0	0
777	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0	0	0	0	0
778	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0.02	0.46	0	0	0	0	0	0	0	0
779	Alder thicket	0	0	0	0	0	0	0	0	0	0	0.96	0.07	0	0	0.55	0	0	0	0	0
780	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0.45	1.00	0	0	0	0	0	0	0	0
781	Coniferous bog	0	0	0	0	0	0	0	0	0.62	0.00	0	0	0	0	0	0	0	0	0	0
782	Coniferous bog	0	0	0	0	0	0	0	0		0.99	1.11	0	0	0	0	0	0	0	0	0
783	Coniferous bog	0	0	0	0	0	0	0	0	0.83	1.09	0	0	0	0	0	0	0	0	0	0
784	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	1.41	0.24	0	0	0	0	0	0	0
785	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	1.33	0	0	0	0	0	0	0
790	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.59	2.81	2.09
791	Lake	0	0	0	0	0	0	0	0	0	0	0	0	1.01	16.84	11.83	0.91	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
792	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	1.36	5.59	0.15	0	0	0	0
802	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	3.55	6.23	8.90	9.00	5.19	2.69	4.51
805	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
807	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.07	3.61
808	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	1.69	8.31	6.90	3.41	0	0	0	0	0
856	Coniferous swamp	0	0	0.00	6.90	2.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
864	Coniferous swamp	0	0	0	0	0	0.02	9.54	25.19	30.52	28.01	13.68	5.38	0.14	0	0	0	0	0	0	0
885	Open bog	0	0	0	0	0	0	0	12.96	37.36	37.85	23.34	9.32	10.84	5.11	2.46	0	0	0	0	0
887	Coniferous bog	0	0	0	0	0	0.65	20.75	43.72	33.07	27.97	44.84	54.45	47.30	44.90	50.38	51.06	43.00	29.33	20.15	14.11
888	Coniferous bog	0	1.18	36.50	50.85	55.24	25.94	14.79	8.37	0	0	0	0	0	0	0	0	0	0	0	0
889	Shallow marsh	0	0	0	0	12.22	17.96	6.48	0.31	0	0	0	0	0	0	0	0	0	0	0	0
890	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	3.34	11.24	19.69	3.00	0	0	0	0	0	0	0	0
891	Coniferous swamp	0	0	0	0	0	0	0	0	0.58	6.36	7.82	0.02	0	0	0	0	0	0	0	0
899	Open bog	0	0	0	0	0.68	10.96	16.35	2.15	0	0	0	0	0	0	0	0	0	0	0	0
900	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.23	7.97	1.37	0	0	0
901	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0.02	0.46	0	0	0	0	0	0	0
903	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.89	3.64	4.17	0
904	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	2.33	0	0	0	0	0	0
906	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.87	3.38	0	0
924	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.58	0.03	0
925	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.93	2.46	0
930	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0.05	2.18	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
931	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	1.54	2.78	0	0	0	0	0	0
949	Coniferous bog	0	0	0	0	0	0	0	0	0.30	1.50	0	0	0	0	0	0	0	0	0	0
972	Hardwood swamp	0	0	0	0	0	0	0.90	0	0	0	0	0	0	0	0	0	0	0	0	0
973	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.47	4.59	3.93	0	0	0
984	Coniferous bog	0	0	0	0	14.64	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0
997	Shallow marsh	0	0	0	0	0	0	0	0	0	0	1.15	0.36	0	0	0	0	0	0	0	0
999	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0.01	0.70	0	0	0	0	0	0	0	0
1004	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0.94	0	0	0	0	0	0	0
1005	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.91	0.50	0
1131	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0.36	4.19	0	0	0	0	0	0	0
1132	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.16	0	0	0	0	0
1136	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.12	11.88	24.49	3.01	0
1137	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.76	4.35	6.73	0.25	0	0
1138	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.59	0.64		0	0	0
1144	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.08	9.41	14.78	19.60	7.49	0.44
1145	Coniferous swamp	0	0	0	0	0	0	0	0	0	2.80	16.78	23.58	28.22	8.51	0.66	0	0	0	0	0
1146	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.39	2.77	0	0	0	0
1149	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.80	0	0	0	0	0
1153	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.39	9.39	4.14	0	0	0
1154	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	4.06	11.06	1.99	0	0	0	0	0
Total acres of wetland		118.36	114.99	147.94	162.94	195.14	231.13	291.33	351.58	306.52	326.40	357.56	345.18	355.05	381.79	343.77	405.60	422.32	348.93	318.66	298.94

(1) Reference (13)

Large Table 4 Summary of Wetlands within 500-feet Increments – Mine Site Area

Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
	0 - 500 Feet	500 - 1,000 Feet	1,000 - 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
Alder thicket	21.62	5.85	30.82	45.52	32.05	18.16	35.08	59.88	50.11	59.13	90.36	149.08	130.72	62.67	40.76	33.10	41.12	38.04	33.12	16.10
Alder thicket or Shrub-carr	0	0	6.31	13.35	35.02	62.49	60.22	49.65	53.72	44.24	49.77	32.01	38.36	33.82	44.36	50.24	50.64	34.92	46.90	54.54
Coniferous bog	84.21	94.51	103.53	85.82	93.07	70.80	102.23	123.03	88.08	97.57	118.94	116.91	122.29	203.43	187.58	221.64	216.50	144.79	120.87	101.11
Coniferous swamp	10.81	7.96	0.96	13.45	21.46	44.20	69.51	102.76	74.59	68.75	64.88	34.13	47.67	57.03	49.68	75.88	78.83	80.02	75.97	86.37
Deep marsh	0.01	4.93	0	0	0	0	0	0	0	0	0	0	0	0	1.91	1.86	12.64	29.93	5.62	8.34
Hardwood swamp	0	0	0	0.31	0	0	0.90	0	0	0	0	0	0.57	0	0.18	0.80	0	0.78	2.28	4.29
Lake	0	0	0	0	0	0	0	0	0	0	0	0	1.01	16.84	11.83	0.91	0	0	0	0
Open bog	0	0	3.97	2.74	0.68	10.96	16.35	15.11	37.36	40.30	25.78	11.97	12.31	7.80	6.12	17.89	16.58	12.81	13.15	0
Sedge meadow	0.10	0	0	0	0.12	1.05	0	0	0	0	0	0	0.57	0.20	0	0	0	0	0	0
Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.70
Shallow marsh	1.61	1.74	2.35	1.75	12.22	20.04	6.48	1.15	2.66	16.41	7.83	1.06	0.94	0	0.16	0	1.89	4.23	6.98	3.29
Shallow, open water	0	0	0	0	0	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0
Shrub-carr	0	0	0	0	0.52	3.43	0	0	0	0	0	0.02	0.46	0	1.19	3.28	4.12	3.41	13.77	24.20
Wet meadow	0	0	0	0	0	0	0.56	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Total acres of wetland	118.36	114.99	147.94	162.94	195.14	231.13	291.33	351.58	306.52	326.40	357.56	345.18	355.05	381.79	343.77	405.60	422.32	348.93	318.66	298.94

(1) Reference (13)

Large Table 5
Wetland and Watershed Acreages During Existing Operations Conditions, and Reclamation Conditions – Mine Site

			Pre-Mining (Existing) Conditions						Operations Conditions [1]						Reclamation Conditions					
Wetland ID[2]	Eggers and Reed Wetland Type	**Change in Equivalent Yield[3] (%)**	Watershed Total Area (acres)	Upland Area (acres)	Wetland Area (acres)	Wetland Area (%)	Tributary Acres per Wetland Acre	Contributing Net Precipitation (ac-ft/yr)	Watershed Total Area (acres)	Upland Area (acres)	Wetland Area (acres)	Wetland Area (%)	Tributary Acres per Wetland Acre	Contributing Net Precipitation (ac-ft/yr)	Watershed Total Area (acres)	Upland Area (acres)	Wetland Area (acres)	Wetland Area (%)	Tributary Acres per Wetland Acre	Contributing Net Precipitation (ac-ft/yr)
1	shallow marsh	0%	2.63	2.21	0.42	16.0%	6.26	6.14	2.63	2.21	0.42	16.0%	6.26	6.14	2.64	2.21	0.42	16.1%	6.22	5.86
3	shallow marsh	0%	1.95	1.60	0.35	17.9%	5.57	5.46	1.95	1.60	0.35	17.9%	5.57	5.46	1.95	1.60	0.35	18.1%	5.51	5.19
5	wet meadow	R	5.99	5.38	0.61	10.2%	9.82	9.63												
6	shallow marsh	50%	3.22	2.60	0.62	19.3%	5.19	5.09	1.61	0.99	0.62	38.5%	2.60	2.55	3.22	2.60	0.62	19.2%	5.21	4.91
7	wet meadow	0%	0.72	0.65	0.07	9.7%	10.29	10.09	0.72	0.65	0.07	9.7%	10.29	10.09	0.72	0.65	0.07	9.2%	10.88	10.25
8	sedge meadow	R	33.23	26.43	6.80	20.5%	4.89	4.79	2.94	2.94	0.00				33.24	26.43	6.80	20.5%	4.89	4.60
9	shallow marsh	18%	8.04	6.24	1.80	22.4%	4.47	4.38	6.36	4.63	1.73	27.2%	3.68	3.61	8.04	6.31	1.73	21.5%	4.65	4.38
10	sedge meadow	0%	9.64	8.47	1.17	12.1%	8.24	8.08	9.64	8.47	1.17	12.1%	8.24	8.08	9.63	8.47	1.17	12.1%	8.25	7.77
11	coniferous bog	NA	23.99	15.11	8.88	37.0%	2.70	2.65	23.99	15.11	8.88	37.0%	2.70	2.65	23.99	15.11	8.88	37.0%	2.70	2.54
12	alder thicket	0%	0.13	0.00	0.13	100.0%	1.00	0.98	0.13	0.00	0.13	100.0%	1.00	0.98	0.13	0.00	0.13	100.0%	1.00	0.94
13	deep marsh	11%	11.60	6.57	5.03	43.4%	2.31	2.26	10.13	5.19	4.94	48.8%	2.05	2.01	11.60	6.66	4.94	42.6%	2.35	2.21
14	wet meadow	R	4.44	4.11	0.33	7.4%	13.45	13.20							4.25	3.92	0.33	7.8%	12.86	12.11
16	shallow marsh	86%	15.07	14.76	0.31	2.1%	48.61	47.68	2.08	1.77	0.31	14.9%	6.71	6.58	15.06	14.76	0.31	2.0%	48.88	46.03
18	shallow marsh	R	38.67	19.77	18.90	48.9%	2.05	2.01												
19	shallow marsh	-2%	8.46	6.78	1.68	19.9%	5.04	4.94	8.38	6.75	1.63	19.5%	5.14	5.04	8.46	6.83	1.63	19.2%	5.20	4.90
20	sedge meadow	30%	24.44	7.38	17.06	69.8%	1.43	1.41	0.10		0.10	100.0%	1.00	0.98	0.10		0.10	100.0%	1.00	0.94
22	shallow marsh	0%	3.47	2.04	1.43	41.2%	2.43	2.38	3.47	2.04	1.43	41.2%	2.43	2.38	3.47	2.04	1.43	41.1%	2.43	2.29
22A	coniferous swamp	0%	12.49	11.60	0.89	7.1%	14.03	13.76	12.49	11.60	0.89	7.1%	14.03	13.76	12.49	11.60	0.89	7.1%	14.06	13.24
22E	coniferous swamp	0%	8.06	5.61	2.45	30.4%	3.29	3.23	8.06	5.61	2.45	30.4%	3.29	3.23	8.06	5.61	2.45	30.4%	3.29	3.10
24	alder thicket	57%	12.68	11.88	0.80	6.3%	15.85	15.55	2.78	2.37	0.41	14.7%	6.78	6.65	2.79	2.37	0.41	14.8%	6.73	6.34
25	coniferous bog	NA	5.59	3.64	1.95	34.9%	2.87	2.81	5.59	3.64	1.95	34.9%	2.87	2.81	5.59	3.64	1.95	34.8%	2.87	2.70
27	coniferous swamp	R	13.33	12.26	1.07	8.0%	12.46	12.22												
29	shallow marsh	7%	22.17	10.15	12.02	54.2%	1.84	1.81	20.64	8.62	12.02	58.2%	1.72	1.68	22.16	10.15	12.02	54.2%	1.84	1.74
32	coniferous bog	-159%	131.46	58.10	73.36	55.8%	1.79	1.76	10.98	8.61	2.37	21.6%	4.63	4.54	45.79	0.90	44.89	98.0%	1.02	0.96
33A	alder thicket	30%	43.79	25.33	18.46	42.2%	2.37	2.33	21.11	8.42	12.69	60.1%	1.66	1.63	21.12	8.42	12.69	60.1%	1.66	1.57
33B	coniferous swamp	0%	9.16	4.60	4.56	49.8%	2.01	1.97	9.16	4.60	4.56	49.8%	2.01	1.97	9.16	4.60	4.56	49.8%	2.01	1.89
37	shrub-carr	R	11.22	8.83	2.39	21.3%	4.69	4.60												
43	alder thicket	56%	25.17	16.88	8.29	32.9%	3.04	2.98	1.39	0.36	1.03	74.1%	1.35	1.32	25.17	16.88	8.29	32.9%	3.04	2.86
44	alder thicket	-65%	20.79	17.52	3.27	15.7%	6.36	6.24	13.42	12.14	1.28	9.5%	10.48	10.28	13.42	12.14	1.28	9.5%	10.52	9.91
45	alder thicket	-63%	70.31	32.76	37.55	53.4%	1.87	1.84	26.67	17.95	8.72	32.7%	3.06	3.00	29.15	20.43	8.72	29.9%	3.34	3.15
47	open bog	R	28.60	28.06	0.54	1.9%	52.96	51.95												
48	coniferous bog	20%	199.33	110.17	89.16	44.7%	2.24	2.19	109.87	48.51	61.36	55.8%	1.79	1.76	188.28	120.80	67.47	35.8%	2.79	2.63
48A	coniferous swamp	60%	6.68	4.03	2.65	39.7%	2.52	2.47	0.44	0.00	0.44	100.0%	1.00	0.98	4.87	4.43	0.44	9.0%	11.06	10.42
51	alder thicket	-3635%	18.60	11.13	7.47	40.2%	2.49	2.44	1.86	1.84	0.02	1.1%	93.00	91.22	18.29	14.93	3.36	18.4%	5.44	5.12
52	alder thicket	R	23.44	19.56	3.88	16.6%	6.04	5.93	1.88	1.88	0.00				23.44	20.80	2.64	11.3%	8.89	8.37
53	alder thicket	0%	53.71	35.12	18.59	34.6%	2.89	2.83	53.71	35.12	18.59	34.6%	2.89	2.83	53.70	35.12	18.59	34.6%	2.89	2.72
53A	coniferous swamp	0%	3.77	1.42	2.35	62.3%	1.60	1.57	3.77	1.42	2.35	62.3%	1.60	1.57	3.77	1.42	2.35	62.3%	1.60	1.51
53B	coniferous swamp	20%	6.14	5.71	0.43	7.0%	14.28	14.01	4.92	4.49	0.43	8.7%	11.44	11.22	6.14	5.71	0.43	7.0%	14.29	13.45
53C	coniferous swamp	36%	24.02	21.14	2.88	12.0%	8.34	8.18	15.41	12.53	2.88	18.7%	5.35	5.25	24.15	21.27	2.88	11.9%	8.38	7.89
53D	coniferous swamp	0%	1320.57	651.40	669.17	50.7%	1.97	1.94	1319.65	650.48	669.17	50.7%	1.97	1.93	1321.47	652.30	669.17	50.6%	1.97	1.86
54	coniferous swamp	0%	36.06	31.95	4.11	11.4%	8.77	8.61	36.06	31.95	4.11	11.4%	8.77	8.61	36.06	31.95	4.11	11.4%	8.78	8.27
54C	alder thicket	0%	0.74	0.00	0.74	100.0%	1.00	0.98	0.74	0.00	0.74	100.0%	1.00	0.98	0.74	0.00	0.74	100.0%	1.00	0.94
54E	alder thicket	-7%	5.82	3.22	2.60	44.7%	2.24	2.20	6.21	3.61	2.60	41.9%	2.39	2.34	6.21	3.61	2.60	41.9%	2.39	2.25
54F	alder thicket	0%	0.43	0.00	0.43	100.0%	1.00	0.98	0.43	0.00	0.43	100.0%	1.00	0.98	0.43	0.00	0.43	100.0%	1.00	0.94
54G	alder thicket	33%	6.48	4.94	1.54	23.8%	4.21	4.13	4.36	2.82	1.54	35.3%	2.83	2.78	6.47	4.94	1.54	23.8%	4.21	3.96
55	alder thicket	-364%	17.70	13.79	3.91	22.1%	4.53	4.44	1.26	1.20	0.06	4.8%	21.00	20.60	17.70	13.79	3.91	22.1%	4.52	4.26
56	open bog	R	13.21	10.42	2.79	21.1%	4.73	4.64	2.48	2.48										
57	coniferous swamp	-12%	137.06	59.00	78.06	57.0%	1.76	1.72	54.12	26.55	27.57	50.9%	1.96	1.93	54.12	26.55	27.56	50.9%	1.96	1.85
58	alder thicket	0%	107.19	72.61	34.58	32.3%	3.10	3.04	107.19	72.61	34.58	32.3%	3.10	3.04	107.20	72.61	34.58	32.3%	3.10	2.92
60	alder thicket	R	28.48	21.77	6.71	23.6%	4.24	4.16							0.00					
61	coniferous swamp	0%	2.70	2.25	0.45	16.7%	6.00	5.89	2.70	2.25	0.45	16.7%	6.00	5.89	2.70	2.25	0.45	16.7%	5.98	5.63
62	coniferous bog	NA	24.35	12.22	12.13	49.8%	2.01	1.97	24.35	12.22	12.13	49.8%	2.01	1.97	24.35	12.22	12.13	49.8%	2.01	1.89
64	hardwood swamp	0%	4.80	4.49	0.31	6.5%	15.48	15.19	4.80	4.49	0.31	6.5%	15.48	15.19	4.79	4.49	0.31	6.4%	15.68	14.77
68	coniferous swamp	23%	59.24	35.43	23.81	40.2%	2.49	2.44	24.73	11.81	12.92	52.2%	1.91	1.88	39.78	26.51	13.27	33.4%	3.00	2.82
72	coniferous swamp	0%	5.67	4.28	1.39	24.5%	4.08	4.00	5.67	4.28	1.39	24.5%	4.08	4.00	5.66	4.28	1.39	24.5%	4.09	3.85
74	hardwood swamp	R	10.64	4.52	6.12	57.5%	1.74	1.71												
76	coniferous bog	NA	13.10	9.18	3.92	29.9%	3.34	3.28	6.49	4.78	1.71	26.3%	3.80	3.72	6.49	4.78	1.71	26.3%	3.80	3.58
77	coniferous bog	NA	25.28	12.27	13.01	51.5%	1.94	1.91	15.20	3.11	12.09	79.5%	1.26	1.23	17.18	4.18	13.01	75.7%	1.32	1.24
78	coniferous bog	R	5.73	3.98	1.75	30.5%	3.27	3.21												
79	coniferous bog	NA	10.62	8.23	2.39	22.5%	4.44	4.36	10.62	8.23	2.39	22.5%	4.44	4.36	10.62	8.23	2.39	22.5%	4.45	4.19
80	coniferous bog	-17%	5.68	5.39	0.29	5.1%	19.59	19.21	1.61	1.54	0.07	4.3%	23.00	22.56	1.61	1.54	0.07	4.4%	22.93	21.59
81	coniferous swamp	-41%	51.06	49.38	1.68	3.3%	30.39	29.81	10.32	10.08	0.24	2.3%	43.00	42.18	51.57	50.59	0.98	1.9%	52.65	49.58
82	coniferous bog	32%	113.19	50.79	62.40	55.1%	1.81	1.78	2.00	0.37	1.63	81.5%	1.23	1.20	1.99	0.36	1.63	81.8%	1.22	1.15
83	open bog	NA	18.64	14.65	3.99	21.4%	4.67	4.58	18.64	14.65	3.99	21.4%	4.67	4.58	18.64	14.65	3.99	21.4%	4.67	4.40
84	coniferous bog	NA	5.67	4.34	1.33	23.5%	4.26	4.18	5.67	4.34	1.33	23.5%	4.26	4.18	5.67	4.34	1.33	23.4%	4.28	4.03
84A	coniferous bog	NA	11.50	3.28	8.22	71.5%	1.40	1.37	11.50	3.28	8.22	71.5%	1.40	1.37	11.50	3.28	8.22	71.4%	1.40	1.32
85	coniferous bog	R	5.07	3.66	1.41	27.8%	3.60	3.53												
86	coniferous bog	NA	8.25	5.78	2.47	29.9%	3.34	3.28	1.16	1.15	0.01	0.9%	116.00	113.78	1.16	1.15	0.01	0.8%	121.57	114.47
88	coniferous bog	NA	9.86	4.28	5.58	56.6%	1.77	1.73	3.09	2.53	0.56	18.1%	5.52	5.41	1.56	1.00	0.56	35.8%	2.79	2.63
90	coniferous bog	NA	328.07	151.99	176.08	53.7%	1.86	1.83	234.60	92.74	141.86	60.5%	1.65	1.62	305.32	129.70	175.62	57.5%	1.74	1.64
90A	open bog	NA	8.25	0.34	7.91	95.9%	1.04	1.02	7.05	0.34	6.71	95.2%	1.05	1.03	8.25	0.34	7.91	95.8%	1.04	0.98
95	coniferous swamp	R	17.43	14.89	2.54	14.6%	6.86	6.73												
96	coniferous bog	NA	39.02	21.72	17.30	44.3%	2.26	2.21	10.63	6.47	4.16	39.1%	2.56	2.51	10.82	6.66	4.16	38.4%	2.60	2.45

Large Table 5

Wetland and Watershed Acreages During Existing Operations Conditions, and Reclamation Conditions – Mine Site

			Pre-Mining (Existing) Conditions						Operations Conditions [1]						Reclamation Conditions					
Wetland ID[2]	Eggers and Reed Wetland Type	**Change in Equivalent Yield[3] (%)**	Watershed Total Area (acres)	Upland Area (acres)	Wetland Area (acres)	Wetland Area (%)	Tributary Acres per Wetland Acre	Contributing Net Precipitation (ac-ft/yr)	Watershed Total Area (acres)	Upland Area (acres)	Wetland Area (acres)	Wetland Area (%)	Tributary Acres per Wetland Acre	Contributing Net Precipitation (ac-ft/yr)	Watershed Total Area (acres)	Upland Area (acres)	Wetland Area (acres)	Wetland Area (%)	Tributary Acres per Wetland Acre	Contributing Net Precipitation (ac-ft/yr)
97	coniferous bog	NA	11.03	6.57	4.46	40.4%	2.47	2.43	3.61	1.72	1.89	52.4%	1.91	1.87	3.60	1.71	1.89	52.4%	1.91	1.80
98	coniferous bog	NA	49.43	33.93	15.50	31.4%	3.19	3.13	2.36	1.93	0.43	18.2%	5.49	5.38	49.42	33.93	15.50	31.4%	3.19	3.00
99	coniferous bog	NA	5.38	3.98	1.40	26.0%	3.84	3.77	1.47	0.56	0.91	61.9%	1.62	1.58	3.83	2.56	1.27	33.2%	3.01	2.83
100	coniferous bog	NA	295.25	119.06	176.19	59.7%	1.68	1.64	93.20	19.97	73.23	78.6%	1.27	1.25	101.43	25.32	76.11	75.0%	1.33	1.25
100A	alder thicket	R	1.66		1.66	100.0%	1.00	0.98												
101	coniferous bog	NA	34.92	20.71	14.21	40.7%	2.46	2.41	4.01	1.53	2.48	61.8%	1.62	1.59	10.14	3.58	6.56	64.7%	1.54	1.45
103	coniferous bog	11%	157.93	39.09	118.84	75.2%	1.33	1.30	10.52	1.65	8.87	84.3%	1.19	1.16	10.52	1.65	8.87	84.3%	1.19	1.12
104	coniferous bog	NA	8.30	4.73	3.57	43.0%	2.32	2.28	0.87	0.77	0.10	11.5%	8.70	8.53	0.87	0.77	0.10	11.3%	8.88	8.36
105	coniferous bog	NA	59.43	43.95	15.48	26.0%	3.84	3.77	59.43	43.95	15.48	26.0%	3.84	3.77	59.44	43.95	15.48	26.0%	3.84	3.62
105A	coniferous bog	NA	0.62	0.50	0.12	19.4%	5.17	5.07	0.62	0.50	0.12	19.4%	5.17	5.07	0.63	0.50	0.12	19.7%	5.08	4.78
106	coniferous bog	0%	168.57	84.99	83.58	49.6%	2.02	1.98	168.57	84.99	83.58	49.6%	2.02	1.98	168.58	84.99	83.58	49.6%	2.02	1.90
107	coniferous bog	NA	90.50	49.58	40.92	45.2%	2.21	2.17	42.80	33.51	9.29	21.7%	4.61	4.52	40.97	29.93	11.04	26.9%	3.71	3.49
107A	coniferous swamp	-1118%	4.40	2.66	1.74	39.5%	2.53	2.48	1.54	1.49	0.05	3.2%	30.80	30.21	1.92	1.68	0.24	12.6%	7.96	7.49
107B	shallow marsh	-67%	7.41	2.90	4.51	60.9%	1.64	1.61	4.44	2.82	1.62	36.5%	2.74	2.69	3.03	1.41	1.62	53.3%	1.88	1.77
107C	alder thicket	R	28.29	0.69	27.60	97.6%	1.03	1.01												
114	coniferous bog	R	8.00	7.27	0.73	9.1%	10.96	10.75												
120	shallow marsh	-23%	8.93	8.35	0.58	6.5%	15.40	15.10	8.73	8.27	0.46	5.3%	18.98	18.61	8.93	8.47	0.46	5.1%	19.57	18.43
200	hardwood swamp	R	13.51	7.15	6.36	47.1%	2.12	2.08												
201	wet meadow	R	24.54	11.05	13.49	55.0%	1.82	1.78												
202	open bog	R	6.52	3.41	3.11	47.7%	2.10	2.06												
315	alder thicket/shrub-car	0%	533.68	210.84	322.84	60.5%	1.65	1.62	533.68	210.84	322.84	60.5%	1.65	1.62	533.68	210.84	322.84	60.5%	1.65	1.56
552	coniferous bog	R	24.35	15.63	8.72	35.8%	2.79	2.74												
566	alder thicket/shrub-car	11%	32.49	26.62	5.87	18.1%	5.53	5.43	29.05	23.18	5.87	20.2%	4.95	4.85	32.49	26.62	5.87	18.1%	5.53	5.21
567	shallow marsh	R	3.72	2.32	1.40	37.6%	2.66	2.61												
678	alder thicket	0%	148.21	89.79	58.42	39.4%	2.54	2.49	148.21	89.79	58.42	39.4%	2.54	2.49	148.22	89.79	58.42	39.4%	2.54	2.39
679	coniferous bog	NA	0.50		0.50	100.0%	1.00	0.98	0.50	0.00	0.50	100.0%	1.00	0.98	0.50	0.00	0.50	100.0%	1.00	0.94
682	open bog	NA	4.85	2.69	2.16	44.5%	2.25	2.20	4.85	2.69	2.16	44.5%	2.25	2.20	4.85	2.69	2.16	44.6%	2.24	2.11
691	alder thicket	0%	32.11	25.88	6.23	19.4%	5.15	5.06	32.11	25.88	6.23	19.4%	5.15	5.06	32.12	25.88	6.23	19.4%	5.15	4.85
693	coniferous bog	NA	26.40	14.07	12.33	46.7%	2.14	2.10	26.40	14.07	12.33	46.7%	2.14	2.10	26.40	14.07	12.33	46.7%	2.14	2.02
699	coniferous bog	NA	2.21		2.21	100.0%	1.00	0.98	2.21	0.00	2.21	100.0%	1.00	0.98	2.21	0.00	2.21	100.0%	1.00	0.94
745	coniferous bog	NA	24.65	11.32	13.33	54.1%	1.85	1.81	24.65	11.32	13.33	54.1%	1.85	1.81	24.65	11.32	13.33	54.1%	1.85	1.74
782	coniferous bog	NA	6.54	4.44	2.10	32.1%	3.11	3.05	6.54	4.44	2.10	32.1%	3.11	3.05	6.54	4.44	2.10	32.1%	3.11	2.93
783	coniferous bog	NA	4.85	2.94	1.91	39.4%	2.54	2.49	4.85	2.94	1.91	39.4%	2.54	2.49	4.86	2.94	1.91	39.4%	2.54	2.39
887	coniferous bog	4%	701.48	146.12	555.36	79.2%	1.26	1.24	670.31	114.95	555.36	82.9%	1.21	1.18	670.31	114.95	555.36	82.9%	1.21	1.14
888	coniferous bog	NA	260.25	67.29	192.96	74.1%	1.35	1.32	260.25	67.29	192.96	74.1%	1.35	1.32	260.25	67.29	192.96	74.1%	1.35	1.27
889	shallow marsh	11%	75.69	8.55	67.14	88.7%	1.13	1.11	67.35	0.21	67.14	99.7%	1.00	0.98	67.35	0.21	67.14	99.7%	1.00	0.94
972	hardwood swamp	0%	0.90		0.90	100.0%	1.00	0.98	0.90	0.00	0.90	100.0%	1.00	0.98	0.90	0.00	0.90	100.0%	1.00	0.94
984	coniferous bog	NA	16.04	0.98	15.06	93.9%	1.07	1.04	15.32	0.26	15.06	98.3%	1.02	1.00	15.32	0.26	15.06	98.3%	1.02	0.96

(1) Wetland areas include fragments identified in Section 5.2.1.1

(2) Wetlands in bold are identified as ombrotrophic.

(3) Change in the equivalent yield from existing conditions to operational conditions is identified as increasing (+), decreasing (-), no change (0), watershed is removed (R), or not applicable (NA) for ombrotrophic coniferous and open bogs.

Large Table 6 Summary of Wetlands Crossing Analog Impact Zones Resulting from Changes in Hydrology – Mine Site

Likelihood of wetland hydrology impact based on wetland type for each analogue distance	Wetland Area (acres) within each Analogue Increment (feet)				Eggers and Reed Wetland Community[1]
	0-1,000 feet	1,000-2,000 feet	2,000-3,500 feet	3,500-10,000 feet	
0 – 1,000 feet					
High Likelihood	866.85	---	---	---	coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, and alder thicket
Moderate Likelihood	8.30	---	---	---	deep marsh, shallow marsh, and shallow, open water
Low Likelihood	452.81	---	---	---	Minerotrophic and ombrotrophic coniferous bog
No Impact	0	---	---	---	open bog
1,000 – 2,000 feet					
Moderate Likelihood	---	522.40	---	---	coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, and alder thicket
Low Likelihood	---	4.11	---	---	deep marsh, shallow marsh, and shallow, open water
No Impact	---	92.05	---	---	minerotrophic and ombrotrophic coniferous bog and open bog
2,000 – 3,500 feet					
Low Likelihood	---	---	293.12	---	coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, and alder thicket
No Impact	---	---	868.89	---	deep marsh, shallow marsh, and shallow, open water, minerotrophic and ombrotrophic coniferous bog and open bog
3,500 – 10,000 feet					
No Impact	---	---	---	2,718.30	all wetland types
Total acres of wetland	1,327.96	618.56	1,162.01	2,718.30	

(1) Reference (13)

Large Table 7 Summary of Wetlands within Analog Impact Zones Resulting from Changes in Hydrology – Mine Site

Likelihood of wetland hydrology impact based on wetland type for each analogue distance	Wetland Area (acres) within each Analogue Increment (feet)				Eggers and Reed Wetland Community[1]
	0-1,000 feet	1,000-2,000 feet	2,000-3,500 feet	3,500-10,000 feet	
0 – 1,000 feet					
High Likelihood	46.37	---	---	---	coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, and alder thicket
Moderate Likelihood	8.3	---	---	---	deep marsh, shallow marsh, and shallow, open water
Low Likelihood	178.80	---	---	---	minerotrophic and ombrotrophic coniferous bog
No Impact	0	---	---	---	open bog
1,000 – 2,000 feet					
Moderate Likelihood	---	110.77	---	---	coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, and alder thicket
Low Likelihood	---	4.11	---	---	deep marsh, shallow marsh, and shallow, open water
No Impact	---	196.14	---	---	minerotrophic and ombrotrophic coniferous bog and open bog
2,000 – 3,500 feet					
Low Likelihood	---	---	384.99	---	coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, and alder thicket
No Impact	---	---	332.99	---	deep marsh, shallow marsh, and shallow, open water, minerotrophic and ombrotrophic coniferous bog and open bog
3,500 – 10,000 feet					
No Impact	---	---	---	4,564.38	all wetland types
Total acres of wetland	233.47	311.02	717.98	4,564.38	

(1) Reference (13)

Large Table 8 Summary of Potential Wetland Community Changes Due to Drawdown

Impact Sensitivity Category[1]	None		Moderate		Severe	
Community Type	**Water Level Drawdown (feet)**	**Potential Impact**	**Water Level Drawdown (feet)**	**Potential Impact**	**Water Level Drawdown (feet)**	**Potential Impact**
Ombrotrophic Coniferous and Open bog	<0.75	None	0.75-2	Minor vegetation changes; Increased tree growth	>2	Possible conversion of wetland type
Minerotrophic Coniferous and Open bog	<0.5	None	0.5-2	Change in vegetation; Increased tree growth	>2	Possible conversion of wetland type
Shallow marsh[2]	<1	None	1-3	Conversion of type	>3	Conversion of wetland type
Deep marsh[2]	<2	None	2-4	Conversion of type	>4	Conversion of wetland type
Shallow, open water[2]	<2	None	2-4	Conversion of type	>4	Conversion of wetland type
Conifer swamp	<1	None	1-2	Minor changes in vegetation; Increased tree growth	>2	Change in vegetation
Hardwood swamp	<2	None	2-4	Change in vegetation; Increased tree growth	>4	Conversion of wetland type; possible conversion to upland
Alder thicket	<1	None	1-4	Change in vegetation; Increased shrub growth	>4	Conversion of wetland type; increased shrub growth
Shrub-carr	<0.5	None	0.5-3	Change in vegetation; Increased shrub growth	>3	Conversion of wetland type
Wet/Sedge meadow	<0.5	None	0.5-3	Change in vegetation; Conversion of type	>3	Conversion to upland

(1) Interpreted from information provided in the hydrologic wetland sensitivity method as described in the Wetland Work Plan (Attachment A).
(2) Shallow marsh, deep marsh, and shallow open water communities were not evaluated in the hydrologic wetland sensitivity method as described in the Wetland Work Plan (Attachment A), but are estimated in this table based on best professional judgment.

Large Table 9 Summary of Wetlands within the Mine Site Groundwater Flow Paths

Eggers and Reed Wetland Community[1]	Hydrology	Wetlands within the Mine Site Groundwater Flow Paths (acres)				
		West Pit	Overburden Storage and Laydown Area (OSLA)	Wastewater Treatment Facility (WWTF)	Ore Surge Pile (OSP)	Category 2/3 Stockpile
Alder thicket	Groundwater	90.53	40.87	18.79	27.59	103.06
Alder thicket or Shrub-carr	Groundwater	0	2.87	0	0	0
Minerotrophic coniferous bog	Precipitation/ Groundwater	0.04	0	0	0	6.27
Ombrotrophic coniferous bog	Precipitation	16.48	0	0	0	148.18
Coniferous swamp	Groundwater	0	2.88	20.06	10.16	0.04
Deep marsh	Groundwater	4.94	0	0	0	0
Open bog	Precipitation	0	0	0	0	8.87
Sedge meadow	Groundwater	0	0	0	0	1.17
Shallow marsh	Groundwater	3.35	0.11	0	0	5.48
Shrub-carr	Groundwater	0	3.95	0	0	0
Wet meadow	Groundwater	0	0	0	0	0.07
Total acres of wetland		115.34	50.68	38.85	37.75	273.14

(1) Reference (13)

Large Table 10 Summary of Coniferous and Open Bogs in Area One

Wetland ID	Eggers and Reed Community[1]	Status
11	Coniferous bog	Ombrotrophic
25	Coniferous bog	Ombrotrophic
32	Coniferous bog	Minerotrophic
48	Coniferous bog	Minerotrophic
62	Coniferous bog	Ombrotrophic
76	Coniferous bog	Ombrotrophic
77	Coniferous bog	Ombrotrophic
79	Coniferous bog	Ombrotrophic
80	Coniferous bog	Ombrotrophic
82	Coniferous bog	Minerotrophic
83	Open bog	Ombrotrophic
84	Coniferous bog	Ombrotrophic
84A	Coniferous bog	Ombrotrophic
86	Coniferous bog	Ombrotrophic
88	Coniferous bog	Ombrotrophic
90	Coniferous bog	Ombrotrophic
90A	Open bog	Ombrotrophic
96	Coniferous bog	Ombrotrophic
97	Coniferous bog	Ombrotrophic
98	Coniferous bog	Ombrotrophic
99	Coniferous bog	Ombrotrophic
100	Coniferous bog	Ombrotrophic
101	Coniferous bog	Ombrotrophic
103	Coniferous bog	Ombrotrophic
104	Coniferous bog	Ombrotrophic
105	Coniferous bog	Ombrotrophic
105A	Coniferous bog	Ombrotrophic
106B	Coniferous bog	Ombrotrophic
106C	Coniferous bog	Ombrotrophic
106D	Coniferous bog	Ombrotrophic
107	Coniferous bog	Ombrotrophic
400A	Coniferous bog	Ombrotrophic
406	Coniferous bog	Ombrotrophic

Wetland ID	Eggers and Reed Community[1]	Status
409	Coniferous bog	Ombrotrophic
415	Coniferous bog	Ombrotrophic
418	Coniferous bog	Ombrotrophic
419	Coniferous bog	Ombrotrophic
422	Coniferous bog	Ombrotrophic
423	Coniferous bog	Ombrotrophic
425	Coniferous bog	Ombrotrophic
435	Coniferous bog	Ombrotrophic
437	Coniferous bog	Ombrotrophic
438	Coniferous bog	Ombrotrophic
439	Coniferous bog	Ombrotrophic
441	Coniferous bog	Ombrotrophic
442	Coniferous bog	Ombrotrophic
451	Coniferous bog	Ombrotrophic
456	Coniferous bog	Ombrotrophic
459	Coniferous bog	Ombrotrophic
460	Coniferous bog	Ombrotrophic
465	Coniferous bog	Ombrotrophic
467	Coniferous bog	Ombrotrophic
469	Coniferous bog	Ombrotrophic
473	Coniferous bog	Ombrotrophic
474	Coniferous bog	Ombrotrophic
477	Coniferous bog	Ombrotrophic
478	Coniferous bog	Ombrotrophic
479	Coniferous bog	Ombrotrophic
489	Coniferous bog	Ombrotrophic
490	Coniferous bog	Ombrotrophic
492	Coniferous bog	Ombrotrophic
493	Open bog	Ombrotrophic
494	Coniferous bog	Ombrotrophic
496	Coniferous bog	Ombrotrophic
498	Coniferous bog	Ombrotrophic
499	Coniferous bog	Ombrotrophic
502	Coniferous bog	Ombrotrophic

Wetland ID	Eggers and Reed Community[(1)]	Status
503	Coniferous bog	Ombrotrophic
507	Coniferous bog	Ombrotrophic
508	Coniferous bog	Ombrotrophic
510	Coniferous bog	Ombrotrophic
513	Coniferous bog	Ombrotrophic
514	Coniferous bog	Ombrotrophic
519	Coniferous bog	Ombrotrophic
520	Coniferous bog	Ombrotrophic
526	Coniferous bog	Ombrotrophic
528	Coniferous bog	Ombrotrophic
530	Coniferous bog	Ombrotrophic
531	Coniferous bog	Ombrotrophic
535	Coniferous bog	Ombrotrophic
538	Coniferous bog	Ombrotrophic
540	Coniferous bog	Ombrotrophic
541	Coniferous bog	Ombrotrophic
546	Coniferous bog	Ombrotrophic
547	Coniferous bog	Ombrotrophic
548	Coniferous bog	Ombrotrophic
550	Open bog	Ombrotrophic
558	Coniferous bog	Ombrotrophic
559	Coniferous bog	Ombrotrophic
560	Coniferous bog	Ombrotrophic
561	Coniferous bog	Ombrotrophic
562	Coniferous bog	Ombrotrophic
564	Coniferous bog	Ombrotrophic
679	Coniferous bog	Ombrotrophic
681	Coniferous bog	Ombrotrophic
682	Open bog	Ombrotrophic
693	Coniferous bog	Ombrotrophic
695	Coniferous bog	Ombrotrophic
697	Coniferous bog	Ombrotrophic
699	Coniferous bog	Ombrotrophic
700	Open bog	Ombrotrophic

Wetland ID	Eggers and Reed Community[1]	Status
713	Coniferous bog	Ombrotrophic
714	Coniferous bog	Ombrotrophic
727	Open bog	Ombrotrophic
728	Open bog	Ombrotrophic
730	Open bog	Ombrotrophic
732	Open bog	Ombrotrophic
733	Open bog	Ombrotrophic
734	Open bog	Ombrotrophic
735	Coniferous bog	Ombrotrophic
737	Coniferous bog	Ombrotrophic
738	Open bog	Ombrotrophic
739	Open bog	Ombrotrophic
740	Open bog	Ombrotrophic
742	Coniferous bog	Ombrotrophic
757	Open bog	Ombrotrophic
759	Open bog	Ombrotrophic
773	Coniferous bog	Ombrotrophic
774	Coniferous bog	Ombrotrophic
776	Coniferous bog	Ombrotrophic
777	Open bog	Ombrotrophic
780	Coniferous bog	Ombrotrophic
781	Coniferous bog	Ombrotrophic
782	Coniferous bog	Ombrotrophic
783	Coniferous bog	Ombrotrophic
784	Coniferous bog	Ombrotrophic
795	Coniferous bog	Ombrotrophic
799	Coniferous bog	Ombrotrophic
814A	Coniferous bog	Ombrotrophic
885	Open bog	Ombrotrophic
887	Coniferous bog	Minerotrophic
888	Coniferous bog	Ombrotrophic
899	Open bog	Ombrotrophic
900	Coniferous bog	Minerotrophic
925	Open bog	Ombrotrophic

Wetland ID	Eggers and Reed Community[1]	Status
930	Open bog	Ombrotrophic
931	Coniferous bog	Ombrotrophic
949	Coniferous bog	Ombrotrophic
984	Coniferous bog	Ombrotrophic
1044	Coniferous bog	Ombrotrophic
1131	Coniferous bog	Ombrotrophic
1149	Coniferous bog	Ombrotrophic

(1) Reference (13)

Large Table 11 Wetlands within the Mine Site Groundwater Flow Paths

Wetland ID	Eggers and Reed Wetland Community[1]	Dominant Source of Hydrology	Wetland Size (acres)
East Pit – Category 2/3 Stockpile			
1	Shallow marsh	Groundwater	0.42
3	Shallow marsh	Groundwater	0.35
6	Shallow marsh	Groundwater	0.62
7	Wet meadow	Groundwater	0.07
10	Sedge meadow	Groundwater	1.17
11	Coniferous bog	Precipitation	8.88
12	Alder thicket	Groundwater	0.13
24	Alder thicket	Groundwater	0.41
29	Shallow marsh	Groundwater	4.09
33A	Alder thicket	Groundwater	6.31
43	Alder thicket	Groundwater	1.03
48	Coniferous bog	Groundwater	6.27
53D	Alder thicket	Groundwater	29.79
55	Alder thicket	Groundwater	0.06
58	Alder thicket	Groundwater	34.57
77	Coniferous bog	Precipitation	12.08
90	Coniferous bog	Precipitation	108.62
90A	Open bog	Precipitation	6.71
98	Coniferous bog	Precipitation	0.42
105	Coniferous bog	Precipitation	15.47
105A	Coniferous bog	Precipitation	0.12
106	Coniferous swamp	Groundwater	0.04
678	Alder thicket	Groundwater	30.76
679	Coniferous bog	Precipitation	0.50
681	Coniferous bog	Precipitation	2.09
682	Open bog	Precipitation	2.16
Waste Water Treatment Facility (WWTF)			
53	Alder thicket	Groundwater	0.38
53D	Alder thicket	Groundwater	18.41
106	Coniferous swamp	Groundwater	20.06

Wetland ID	Eggers and Reed Wetland Community[1]	Dominant Source of Hydrology	Wetland Size (acres)
Ore Surge Pile (OSP)			
53	Alder thicket	Groundwater	0.52
53D	Alder thicket	Groundwater	27.07
106	Coniferous swamp	Groundwater	10.16
Overburden Storage and Laydown Area (OSLA)			
4	Wet meadow	Groundwater	0.00
9	Shallow marsh	Groundwater	0.11
46	Shrub-carr	Groundwater	3.95
52	Alder thicket	Groundwater	0.00
53	Alder thicket	Groundwater	1.92
53C	Coniferous swamp	Groundwater	2.88
53D	Alder thicket	Groundwater	38.95
557	Alder thicket or Shrub-carr	Groundwater	2.87
West Pit			
9	Shallow marsh	Groundwater	1.43
13	Deep marsh	Groundwater	4.94
16	Shallow marsh	Groundwater	0.31
32	Coniferous bog	Groundwater	0.04
53D	Alder thicket	Groundwater	90.53
79	Coniferous bog	Precipitation	0.07
107	Coniferous bog	Precipitation	9.29
107B	Shallow marsh	Groundwater	1.61
558	Coniferous bog	Precipitation	3.08
559	Coniferous bog	Precipitation	1.24
562	Coniferous bog	Precipitation	2.80
Total acres of wetland			515.76

(1) Reference (13)

Large Table 12 Summary of Wildlife Species and Associated Habitat Types

Taxa[1]	Scientific Name	Common Name	State ETSC	Federal ESA or BGEPA (eagle)	SGCN	USFS RFSS	Number of habitats	Wetland Habitats								Upland Habitats									Wetland and Upland Habitats
								Forest- Lowland Coniferous	Forest- Lowland Deciduous	Lake- Deep	Lake- Shallow	River- Headwater to large	River- Very Large	Shrub- Lowland	Wetland- Non-forest	Cropland	Developed	Forest- Upland Coniferous	Forest- Upland Deciduous (Aspen)	Forest- Upland Deciduous	Grassland	Prairie	Shoreline-dunes-cliff/talus	Shrub/woodland- Upland	
BI	*Gavia immer*	Common Loon	NL	NL	x		1			x															W
BI	*Limnodromus griseus*	Short-billed Dowitcher	NL	NL	x		1								x										W
BI	*Melospiza georgiana*	Swamp Sparrow	NL	NL	x		3	x						x	x										W
BI	*Rallus limicola*	Virginia Rail	NL	NL	x		3				x			x	x										W
FI	*Ichthyomyzon fossor*	Northern Brook Lamprey	SPC	NL	x	x	1					x													W
IN	*Erebia mancinus*	Taiga Alpine	SPC	NL	x	x	1	x																	W
IN	*Erebia discoidalis*	Red-diked alpine	NL	NL			2	x						x											W
IN	*Lycaena epixanthe michiganensis*	Bog Copper	NL	NL	x		2	x						x											W
IN	*Oeneis jutta ascerta*	Jutta Arctic	NL	NL			2	x						x											W
IN	*Somatochlora brevicincta*	Quebec emerald	NL	NL		x	1								x										W
MO	*Lasmigona compressa*	Creek Heelsplitter	SPC	NL	x	x	1					x													W
MO	*Ligumia recta*	Black Sandshell	SPC	NL	x	x	2					x	x												W
RE	*Chelydra serpentina*	Common Snapping Turtle	SPC	NL	x		5			x	x	x	x		x										W
RE	*Glyptemys insculpta*	Wood turtle	T	NL		x	5	x	x			x		x	x										W
BI	*Aegolius funereus*	Boreal Owl	NL	NL	x	x	4	x						x				x	x						B
BI	*Ammodramus leconteii*	Le Conte's Sparrow	NL	NL	x		4							x	x						x	x			B
BI	*Anas rubripes*	American Black Duck	NL	NL	x		9	x	x		x				x			x	x	x	x			x	B
BI	*Botaurus lentiginosus*	American Bittern	NL	NL	x		5	x						x	x						x	x			B
BI	*Calidris alpina*	Dunlin	NL	NL	x		2								x								x		B
BI	*Calidris pusilla*	Semipalmated Sandpiper	NL	NL	x		2								x								x		B
BI	*Catharus fuscescens*	Veery	NL	NL	x		5	x	x									x	x	x					B
BI	*Circus cyaneus*	Northern Harrier	NL	NL	x		6	x						x	x						x	x		x	B
BI	*Cistothorus platensis*	Sedge Wren	NL	NL	x		5	x						x	x						x	x			B
BI	*Coccyzus erythropthalmus*	Black-billed Cuckoo	NL	NL	x		6		x					x				x	x	x				x	B
BI	*Contopus cooperi*	Olive-sided Flycatcher	NL	NL	x	x	4	x						x				x						x	B

								Wetland Habitats								Upland Habitats									
Taxa[1]	Scientific Name	Common Name	State ETSC	Federal ESA or BGEPA (eagle)	SGCN	USFS RFSS	Number of habitats	Forest- Lowland Coniferous	Forest- Lowland Deciduous	Lake- Deep	Lake- Shallow	River- Headwater to large	River- Very Large	Shrub- Lowland	Wetland- Non-forest	Cropland	Developed	Forest- Upland Coniferous	Forest- Upland Deciduous (Aspen)	Forest- Upland Deciduous	Grassland	Prairie	Shoreline-dunes-cliff/talus	Shrub/woodland- Upland	Wetland and Upland Habitats
BI	*Contopus virens*	Eastern Wood-pewee	NL	NL	x		5		x									x	x	x		x			B
BI	*Setophaga castanea*	Bay-breasted Warbler	NL	NL	x	x	2	x										x							B
BI	*Calidris alpina*	Dunlin	NL	NL	x		2								x								x		B
BI	*Dolichonyx oryzivorus*	Bobolink	NL	NL	x		6							x	x	x					x	x		x	B
BI	*Empidonax minimus*	Least Flycatcher	NL	NL	x		4		x									x	x	x					B
BI	*Falcipennis canadensis*	Spruce Grouse	NL	NL	x		4	x						x				x						x	B
BI	*Falco peregrinus*	Peregrine Falcon	THR	NL	x		10	x			x		x	x	x		x				x	x	x	x	B
BI	*Haliaeetus leucocephalus*	Bald Eagle	SPC	THR	x	x	7		x	x		x						x	x	x				x	B
BI	*Melanerpes erythrocephalus*	Red-headed Woodpecker	NL	NL	x		8		x							x	x		x	x	x	x		x	B
BI	*Oporornis agilis*	Connecticut Warbler	NL	NL	x	x	2	x										x							B
BI	*Pheucticus ludovicianus*	Rose-breasted Grosbeak	NL	NL	x		5		x									x	x	x		x			B
BI	*Picoides arcticus*	Black-backed Woodpecker	NL	NL	x		3	x										x						x	B
BI	*Pluvialis dominica*	American Golden-plover	NL	NL	x		2								x								x		B
BI	*Podiceps grisegena*	Red-necked Grebe	NL	NL	x		2				x				x										B
BI	*Poecile hudsonica*	Boreal Chickadee	NL	NL	x		2	x										x							B
BI	*Scolopax minor*	American Woodcock	NL	NL	x		4							x					x		x			x	B
BI	*Seiurus aurocapilla*	Ovenbird	NL	NL	x		4		x									x	x	x					B
BI	*Setophaga castanea*	Bay-breasted Warbler	NL	NL	x	x	2	x										x							B
BI	*Sphyrapicus varius*	Yellow-bellied Sapsucker	NL	NL	x		4		x									x	x	x					B
BI	*Stelgidopteryx serripennis*	Northern Rough-winged Swallow	NL	NL	x		3					x									x		x		B
BI	*Strix nebulosa*	Great grey owl	NL	NL		x		x										x							B
BI	*Tringa melanoleuca*	Greater Yellowlegs	NL	NL	x		2								x								x		B
BI	*Troglodytes*	Winter Wren	NL	NL	x		3	x	x									x							B
BI	*Tympanuchus phasianellus*	Sharp-tailed Grouse	NL	NL	x		6							x	x	x					x	x		x	B
BI	*Vermivora chrysoptera*	Golden-winged Warbler	NL	NL	x		3	x						x					x						B
BI	*Wilsonia canadensis*	Canada Warbler	NL	NL	x		4	x										x	x	x					B

Taxa[1]	Scientific Name	Common Name	State ETSC	Federal ESA or BGEPA (eagle)	SGCN	USFS RFSS	Number of habitats	Wetland Habitats								Upland Habitats									Wetland and Upland Habitats
								Forest- Lowland Coniferous	Forest- Lowland Deciduous	Lake- Deep	Lake- Shallow	River- Headwater to large	River- Very Large	Shrub- Lowland	Wetland- Non-forest	Cropland	Developed	Forest- Upland Coniferous	Forest- Upland Deciduous (Aspen)	Forest- Upland Deciduous	Grassland	Prairie	Shoreline-dunes-cliff/talus	Shrub/woodland- Upland	
BI	*Zonotrichia albicollis*	White-throated Sparrow	NL	NL	x		7	x	x					x				x	x	x				x	B
MA	*Canis lupus*	Gray Wolf	SPC	THR	x	x	11	x						x	x	x		x	x	x	x	x	x	x	B
MA	*Lynx canadensis*	Canada lynx	NL	THR	x		7	x	x					x				x	x	x				x	B
MA	*Microtus chrotorrhinus*	Rock Vole	NL	NL	x		6		x					x				x	x				x	x	B
MA	*Sorex fumeus*	Smoky Shrew	SPC	NL	x		3	x										x					x		B
MA	*Spermophilus franklinii*	Franklin's Ground Squirrel	NL	NL	x		5							x	x						x	x		x	B
AM	*Plethodon cinereus*	Eastern Red-backed Salamander	NL	NL	x		3											x	x	x					U
BI	*Accipiter gentilis*	Northern Goshawk	NL	NL	x	x	3											x	x	x					U
BI	*Caprimulgus vociferus*	Whip-poor-will	NL	NL	x		2											x		x					U
BI	*Chordeiles minor*	Common Nighthawk	NL	NL	x		2										x						x		U
BI	*Dendroica caerulescens*	Black-throated Blue Warbler	NL	NL	x		3											x	x	x					U
BI	*Hylocichla mustelina*	Wood Thrush	NL	NL	x		3											x	x	x					U
BI	*Picoides dorsalis*	Three-toed woodpecker	NL	NL		x	1											x							U
BI	*Sturnella magna*	Eastern Meadowlark	NL	NL	x		2														x	x			U
BI	*Toxostoma rufum*	Brown Thrasher	NL	NL	x		2										x							x	U
BI	*Tryngites subruficollis*	Buff-breasted Sandpiper	NL	NL	x		4									x	x				x	x			U
IN	*Plebejus idas nabokovi*	Nabokov's Blue	SPC	NL	x	x	2											x						x	U
IN	*Oeneis macounii*	Macoun's Arctic	NL	NL	x		1											x							U
IN	*Phyciodes batesii*	Tawny Crescent	NL	NL	x		2											x						x	U
IN	*Pyrgus centaureae freija*	Grizzled Skipper	SPC	NL	x	x	1																	x	U
MA	*Taxidea taxus*	American Badger	NL	NL	x		7									x	x	x		x	x	x		x	U

(1) Taxa include amphibians (AM), birds (BI), fish (FI), insects (IN), mammals (MA), mollusks (MO), reptiles (RE), and spiders (SP).

Large Table 13 Wetlands within 500-feet increments – Flotation Tailings Basin Area

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
1000	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1001	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1002	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1003	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1006	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1008	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1009	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1010	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1011	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1012	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1013	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.78	7.80
1014	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1015	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1016	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1017	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1018	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1019	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1020	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1021	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1022	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.73	5.83
1023	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.35

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
1024	Coniferous swamp	0	0	0	1.41	5.42	3.92	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0
1025	Hardwood swamp	0	0	1.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1026	Shallow open water	0	0	0	0	0	3.76	6.06	2.93	0.00	0	0	0	0	0	0	0	0	0	0	0
1027	Alder thicket	0	0.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1027A	Alder thicket or Shrub-carr	0	0.28	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1056	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.04	0	0	0	0	0
1057	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.83	2.04	0	0	0
1058	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.66	1.19	0
1059	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.72	3.74
1060	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.49
1065	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1066	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1067	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1069	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1070	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1071	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1072	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1073	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1074	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1076	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
1077	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
1078	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.44	7.54	17.86
1079	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1080	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.55
1081	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	2.15	7.55	17.16	14.94	10.31	11.98	13.90	16.61	11.15
1082	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0.29	4.78	4.57	13.17	12.91	6.75	0.92
1083	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	4.96	9.32	0.16	0	0	0	0	0	0
1084	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.37
1085	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.09	1.23	0	0	0
1086	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.64	1.30	0
1091	Shallow marsh	0	0.05	1.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1092	Alder thicket or Shrub-carr	0	0	0	0	4.62	6.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1093	Shallow marsh	0.64	4.29	1.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1094	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	Coniferous swamp	0	0	0	0	0	0	0	1.11	3.53	0.14	0	0	0	0	0	0	0	0	0	0
1096	Shallow open water	0	0	0	0	0	0	0	2.55	10.55	12.16	13.08	12.22	11.48	8.33	2.66	0	0	0	0	0
1105	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1106	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1107	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1108	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
1109	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1110	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1111	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1112	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1113	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1114	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1115	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1116	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.06	5.76	0.19	0	0
1117	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.38	7.64	2.29	2.71	0	0
1125	Sedge meadow	0	0.07		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1126	Hardwood swamp	0	0.45	0.24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1129	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1130	Coniferous swamp	0	0	0	0	0	0	0	0	6.53	8.95	9.19	6.86	0.75	0	0	0	0	0	0	0
1133	Coniferous swamp	0	10.36	12.10	13.66	24.26	10.00	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0
1134	Shallow marsh	2.65	3.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1134A	Shallow marsh	0	1.82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1135	Deep marsh	0	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1135A	Deep marsh	0	2.06	4.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139	Shallow marsh	2.39	12.42	2.87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139A	Shallow marsh	0	4.39	0.92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139B	Shallow marsh	0	1.05	8.64	9.48	15.32	9.87	0.23	0	0	0	0	0	0	0	0	0	0	0	0	0
1140	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1141	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1142	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1143	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
1147	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1148	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1150	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1151	Coniferous swamp	0	0	0	0	2.23	25.56	32.98	26.57	9.69	3.85	1.26	3.60	10.35	1.18	0	0	0	0	0	0
1156	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1157	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.59	0.34	0	0	0	0
1158	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.13	0	0	0	0
252	Coniferous swamp	0	0	0	0	0	0	0	0	0.15	7.65	9.99	8.64	10.43	5.51	3.34	0	0	0	0	0
253	Deep marsh	0	0	0	0	0	0	0	0	1.15	4.12	0.62	0	0	0	0	0	0	0	0	0
254	Shallow marsh	0	0	0	0	0	0	0	1.41	7.93	11.19	10.52	5.65	0	0	0	0	0	0	0	0
255	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0.11	2.88	2.54	0.60	0	0	0
256	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	1.68	7.89	8.80	5.03	0.02	0	0	0	0	0	0	0
257	Coniferous bog	0	0	0	0	0	0	0	0.79	15.47	20.86	13.04	10.94	8.40	11.78	3.27	0.18		0	0	0
259	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0.30	0.05	0	0	0	0	0	0	0	0	0
260	Shallow marsh	0	1.09	18.63	30.93	32.42	34.56	25.79	4.17	1.57	0.37	0	0	0	0	0	0	0	0	0	0
261	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0.84	0	0	0	0	0	0	0	0	0	0	0
262	Shallow marsh	0	0	0	0	0	0	0	1.85	0.02	0	0	0	0	0	0	0	0	0	0	0
263	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0.74	0	0	0	0	0	0	0	0	0	0	0	0
264	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.14	5.79	1.92	0	0	0
265	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	1.15	1.89	1.45	0.30	0	0	0	0	0	0	0	0	0
267	Alder thicket or Shrub-carr	0	0	0	0	0	1.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
268	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0		0.24	2.77	1.75	1.18	1.27	5.99	2.22	0	0	0	0
270	Shallow marsh	0	1.34	5.65	17.76	13.22	6.24	3.64	5.28	2.35	2.46	4.85	5.01	4.85	5.12	4.47	3.56	0	0	0	0
271	Coniferous swamp	0	0	0	0	1.23	3.69	7.70	5.11	0.35	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
272	Deep marsh	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
275	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.38	5.22	12.77	7.23	3.97	0
276	Coniferous swamp	0	0.86	4.42	3.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
277	Alder thicket or Shrub-carr	0	0	0	0	0	0	2.39	7.93	3.87	0.26	0	0	0	0	0	0	0	0	0	0
278	Alder thicket	0.75	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
278A	Alder thicket or Shrub-carr	0	1.84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279	Alder thicket	1.39	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279A	Alder thicket or Shrub-carr	0	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279B	Alder thicket or Shrub-carr	0	1.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
280	Sedge meadow	0	0	0	0	3.36	5.28	8.08	0.40	0	0	0	0	0	0	0	0	0	0	0	0
281	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0.24	1.22	0	0	0	0	0	0	0	0	0	0
282	Shallow marsh	6.69	0.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282A	Shallow marsh	0	5.99	0.64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282B	Shallow marsh	0.20	10.14	2.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
283	Deep marsh	0	0	0	0	0	0	0	0	0.04	6.46	2.39	0	0	0	0	0	0	0	0	0
284	Alder thicket	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
284A	Alder thicket or Shrub-carr	0.03	2.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
285	Coniferous swamp	0	0	0	2.51	11.37	15.49	20.26	23.81	21.64	13.77	34.18	43.36	49.32	44.66	35.27	20.51	16.01	12.44	0.10	0
286	Shallow open water	0	0	0	0	0	0		5.13	2.31	0	0	0	0	0	0	0	0	0	0	0
287	Alder thicket or Shrub-carr	0	0	0	0	0	0	1.66	4.27	0	0	0	0	0	0	0	0	0	0	0	0
288	Deep marsh	0	0	0.46	1.94	2.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
289	Alder thicket or Shrub-carr	0	0	0	1.54	1.39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
290	Coniferous swamp	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community(1)	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
292	Deep marsh	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292A	Deep marsh	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
293	Deep marsh	0	0	0	0	1.47	4.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0
307	Shallow marsh	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
308	Deep marsh	3.53	1.69	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
308A	Deep marsh	0	5.72	20.29	25.10	24.08	0.34	0	0	0	0	0	0	0	0	0	0	0	0	0	0
312	Shrub-carr	0.65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
314	Shallow marsh	10.94	8.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
314A	Shallow marsh	0	8.46	4.80	6.07	1.58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
475	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.66	4.95	9.09	2.02	0	0
476	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.77	0.05	0	0
529	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.30	0	0
549	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
572	Deep marsh	3.28	4.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
573	Shallow marsh	0	0.12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
573A	Shallow marsh	0	5.44	8.19	0.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
574	Deep marsh	0	0	5.77	6.29	0.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
575	Alder thicket or Shrub-carr	0	0	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
576	Sedge meadow or Wet meadow	0	0	0	0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
577	Alder thicket or Shrub-carr	0	0	0	0.05	3.93	8.43	1.05	0	0	0	0	0	0	0	0	0	0	0	0	0
578	Deep marsh	0	0	0	0	0	0	0	0.38	7.99	7.93	1.18	0	0	0	0	0	0	0	0	0
579	Deep marsh	0	0	0	0	0	0	0	0	0	0.91	1.23	0	0	0	0	0	0	0	0	0
580	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0.28	1.44	0	0	0	0	0	0	0	0
581	Coniferous swamp	0	0	0	0	0	1.59	8.53	9.32	1.17	0	0	0	0	0	0	0	0	0	0	0
582	Deep marsh	6.69	12.69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
582A	Deep marsh	0	16.88	3.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
584	Alder thicket or Shrub-carr	0	0.03	7.00	13.64	10.10	10.80	10.92	0.49	0	0	0	0	0	0	0	0	0	0	0	0
585	Alder thicket	0	0.86	0.72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
585A	Alder thicket or Shrub-carr	0	0.04	2.73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
586	Deep marsh	0.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
587	Shallow marsh	0.51	0.29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
588	Alder thicket or Shrub-carr	0	0	0	0	0	0	0.07	8.36	8.63	1.14	0	0	0	0	0	0	0	0	0	0
589	Deep marsh	0	0	0	0	2.81	13.77	14.84	8.60	0	0	0	0	0	0	0	0	0	0	0	0
590	Shallow marsh	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
591	Deep marsh	1.70	0.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
591A	Deep marsh	0.18	2.56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
592	Alder thicket or Shrub-carr	0	0	0	0	0	0	1.64	0.14	0	0	0	0	0	0	0	0	0	0	0	0
593	Deep marsh	1.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
593A	Deep marsh	1.04	8.27	9.52	5.98	0.90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
594	Deep marsh	0.03	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
594A	Deep marsh	0	0.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
596	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0.24	0	0	0	0	0	0	0	0	0	0	0	0
597	Hardwood swamp	0	0	0	0	0	0	0	1.76	2.45	0.23	0	0	0	0	0	0	0	0	0	0
598	Alder thicket or Shrub-carr	0	0	0	0	0.55	3.99	1.77	0	0	0	0	0	0	0	0	0	0	0	0	0
599	Alder thicket or Shrub-carr	0	0	0	0	0	2.79		0	0	0	0	0	0	0	0	0	0	0	0	0
600	Shallow marsh	0	0	0	0	0	3.50	4.97	0.31	0	0	0	0	0	0	0	0	0	0	0	0
601	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0.21	1.13	0	0	0	0	0	0	0	0
602	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0.59	0.01	0	0	0	0	0	0	0	0	0
603	Shallow marsh	0	0	0	0	0	0	0	0	0.07	0.03	0	0	0	0	0	0	0	0	0	0
604	Shallow marsh	0	0	0	0	0	0	0	0	0.12	0	0	0	0	0	0	0	0	0	0	0
605	Shallow marsh	0	0	0	0	0	0	0	0	0.13	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
606	Shallow marsh	0	0	0	0	0	0	0	0	0.12	0.07	0	0	0	0	0	0	0	0	0	0
607	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0.09	0	0	0	0	0	0	0	0	0	0	0
608	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0.44	0	0	0	0	0	0	0
609	Coniferous swamp	0	0	0	0	0	0	0	0.86	1.99	6.79	8.77	12.32	7.07	0.98	0	0	0	0	0	0
610	Shallow marsh	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0	0	0	0	0
611	Coniferous bog	0	0	0	0	0	0	0	0	0.58	0	0	0	0	0	0	0	0	0	0	0
612	Coniferous bog	0	0	0	0	0	0	0.21	1.98	0	0	0	0	0	0	0	0	0	0	0	0
613	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	1.45	0.14	0	0	0	0	0	0	0	0	0
614	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	1.23	0	0	0	0	0	0	0
615	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0.44	0	0	0	0	0	0	0	0
616	Deep marsh	0	0	0	0	0	0	0	0	0	0	5.45	0.53	0	0	0	0	0	0	0	0
617	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	1.48	0.60	0	0	0	0	0	0	0
618	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0.08	1.38	0	0	0	0	0	0
619	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0.17	0.71	0	0	0	0	0	0	0
620	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0.28	0	0	0	0	0	0	0
621	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0.52	0	0	0	0	0	0	0
622	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0.29	0.08	0	0	0	0	0	0
623	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0.88	0	0	0	0	0	0
624	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.05	1.79	0	0	0	0
625	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.18	2.52	0
626	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.22
627	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.42	6.80	23.55	26.28	26.35	25.01
628	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
629	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.19	6.17	0.30
630	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.15	2.77	3.08	1.92	0.13
631	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.21	5.92
632	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
633	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
634	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.51
635	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
636	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.24	0.01	0
637	Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.87	14.79	18.98	17.15	18.68	25.45
638	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.07	7.31	0	0	0
639	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.04	0	0	0	0	0
640	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.58	6.19
641	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
642	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
643	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0.99	0.61	0	0	0	0	0	0
644	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
645	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
646	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
647	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
648	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
649	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
650	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
651	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
652	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11.30	21.91	35.19
653	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
654	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
655	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
656	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.89	1.05
657	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0.01	2.34	3.42	3.64	9.70	18.01	8.76	15.09
659	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
660	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0.82	2.08	0	0	0	0	0
662	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
663	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
664	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
665	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
667	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
669	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.38	4.19	7.26	6.56	0	0
670	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	2.37
672	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.78	4.27	0	0	0
673	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.40	22.11
674	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
675	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
676	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
677	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
786	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
787	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
788	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.80	4.67	11.51
810	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.62	10.37	0.74	0	0
816	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
817	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
818	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
819	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
820	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
821	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
822	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
823	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
824	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
825	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
826	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
827	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
828	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
829	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
830	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
831	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
832	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
833	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
834	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
835	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
836	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
837	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
838	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
840	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
841	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
842	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
843	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
844	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
845	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
846	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
847	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
848	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
849	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
850	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
851	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
852	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
854	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
866	Hardwood swamp	0	0	0	0	0	0	0	0	1.95	9.04	9.05	5.87	4.50	0.61	0	0	0	0	0	0
867	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	6.92	19.74	22.04	11.64	9.18	4.66	5.26	0	0	0	0	0	0
868	Hardwood swamp	0	0	0	0	1.90	7.01	0.95	0	0	0	0	0	0	0	0	0	0	0	0	0
869	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
870	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	4.49	19.86	20.61	21.30	0.45	0	0	0
871	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
872	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
873	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
874	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
875	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
876	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
877	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
878	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
908	Shallow marsh	0	0	0	0	0	1.59	3.75	2.64	0.73	0	0	0	0	0	0	0	0	0	0	0
915	Alder thicket	0	0	0	0	0	0	0	0	0	0	5.18	0.29	0	0	0	0	0	0	0	0
917	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0.01	5.23	6.38	5.83	2.42	0	0	0	0	0
918	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	3.19	3.62	2.36	0.28	0	0	0	0	0	0
921	Alder thicket or Shrub-carr	0	0	0	0	0	0	0.13	0.25	0	0	0	0	0	0	0	0	0	0	0	0
923	Wet meadow	0	0	0	0	0	0	0.17	0.52	0	0	0	0	0	0	0	0	0	0	0	0
942	Deep marsh	0	0	0	0	0	1.40	1.56	0	0	0	0	0	0	0	0	0	0	0	0	0
943	Deep marsh	0	0	0	0.87	5.51	7.42	0.23	0	0	0	0	0	0	0	0	0	0	0	0	0
944	Hardwood swamp	0	0	0	0	1.43	0.99	0.20	0	0	0	0	0	0	0	0	0	0	0	0	0
945	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0.32	2.00	0	0	0	0	0	0	0	0	0	0	0
946	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.44	0.51	0	0
947	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	2.09	5.57	6.15	5.75	0.81	0	0	0	0	0	0
950	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
951	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.88	18.88	33.02	32.26	26.22
952	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
953	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
954	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
955	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	2.44	7.40	6.81	2.70	12.59	6.91	0.37	0	0
956	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09	2.70	3.83	7.27	3.51	0	0
957	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	1.41	1.81	3.65	0	0	0	0
958	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	1.38	2.19	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
963	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.35	7.40
964	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2.70
965	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.44	5.78	0.01
966	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.19	4.22	1.90	1.84	0	0
968	Coniferous swamp	3.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
974	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.23
975	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0.44	5.79	6.68	8.71	4.70	0	0
976	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.20	7.69	9.11
977	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
978	Hardwood swamp	0	0	0	0	1.33	1.42	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0
979	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	2.15	3.37	0.22	0	0	0	0
980	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	1.25	1.57	0	0	0	0	0	0	0	0	0	0
981	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0.38	0	0	0	0	0	0
982	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
983	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.85	0.84	0	0	0	0
985	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
986	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
987	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
988	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
989	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
990	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.40	8.25	6.17
991	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.30	20.05	21.40
992	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
993	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
994	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
995	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
996	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.73	2.37	0	0	0
T1	Deep marsh	1.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T13	Deep marsh	0.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T13A	Deep marsh	2.96	4.17	2.97	1.46	1.05	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T8	Wet meadow	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
Total acres of wetland		55.05	147.62	133.17	142.59	174.34	195.34	159.99	138.45	140.81	157.22	162.95	160.46	161.41	146.60	149.87	173.90	214.77	209.31	219.15	285.35

(1) Reference (13)

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
1000	Coniferous swamp	0	0	0.43	7.90	4.60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1001	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.16	21.99
1002	Coniferous swamp	0	0	0	0	1.03	3.26	1.52	0	0	0	0	0	0	0	0	0	0	0	0	0
1003	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1006	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1008	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1009	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.06
1010	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1011	Alder thicket or Shrub-carr	0	0	0	0.49	1.59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1012	Coniferous swamp	0	2.08	0.71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1013	Coniferous bog	1.18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1014	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0.18	0	0	0	0	0	0	0	0	0	0	0	0
1015	Coniferous bog	0	1.21	12.56	17.14	18.08	21.96	14.91	10.89	2.56	0	0	0	0	0	0	0	0	0	0	0
1016	Sedge meadow or Wet meadow	0	0	0.21	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1017	Alder thicket or Shrub-carr	0	0	0	1.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1018	Coniferous bog	0	0	0	0.11	5.00	3.86	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0
1019	Coniferous bog	0	0	0		2.70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1020	Sedge meadow or Wet meadow	0	0	0.25	1.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1021	Coniferous bog	0	0	0	0	0	0	0	2.75	2.35	0	0	0	0	0	0	0	0	0	0	0
1022	Deep marsh	4.98	6.58	1.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1023	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1024	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
1025	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1026	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1027	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1027A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1056	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1057	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1058	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1059	Shallow open water	0.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1060	Shallow open water	3.52	4.61	4.62	3.19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1065	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	2.31	8.45	23.25	67.41	57.03	3.96	0	0	0
1066	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0.92	2.29	17.46	28.73	24.55	19.79	13.46	1.14	0	0	0	0	0
1067	Alder thicket or Shrub-carr	0	0	0	0	0.73	15.22	13.06	17.41	9.51	1.14	0	0	0	0	0	0	0	0	0	0
1069	Shallow marsh	0	0	0	0	0	0	3.22	4.82	10.33	1.55	0	0	0	0	0	0	0	0	0	0
1070	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	2.44	1.36	0	0	0	0	0	0	0	0
1071	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0.03	2.00	11.77	4.36	3.42	2.85	4.71	0.03	0	0	0	0	0
1072	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	2.77	4.18	1.67	0	0	0
1073	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.44	3.34	0	0
1074	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1076	Coniferous swamp	0	2.73	7.74	21.47	17.17	1.59	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1077	Alder thicket or Shrub-carr	4.39	15.47	24.09	7.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
1078	Shallow marsh	3.37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1079	Coniferous swamp	0	0.37	2.10	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1080	Coniferous swamp	4.57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1081	Alder thicket or Shrub-carr	11.32	5.26	3.44	8.13	8.29	2.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1082	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1083	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1084	Deep marsh	8.80	3.69	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1085	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1086	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1091	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1092	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1093	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1094	Sedge meadow or Wet meadow	0	1.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1096	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1105	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09	5.33	0	0	0	0
1106	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.34	15.97	14.87	4.43	0	0
1107	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0.43	0.41	0	0	0	0	0	0	0
1108	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0		0.80	1.71	0	0	0	0	0	0
1109	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0.62	0.14	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
1110	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0.28	0	0	0	0	0	0	0	0
1111	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0.00	0.63	0	0	0	0	0	0	0
1112	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	1.92	0.35	0	0	0	0	0
1113	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1114	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.59
1115	Shallow marsh	0	0	0	0	0	0.43	0.66	0	0	0	0	0	0	0	0	0	0	0	0	0
1116	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1117	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1125	Sedge meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1126	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1129	Coniferous swamp	0	0	0.01	4.91	4.86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1130	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1133	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1134	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1134A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1135	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1135A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139B	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1140	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0.01	2.60	6.19	13.39	15.05	19.32	21.57	0.86
1141	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0.21	7.60	1.60	0	0	0	0	0	0	0
1142	Alder thicket or Shrub-carr	0	0	0	0	2.39	9.09	8.30	0.57	0	0	0	0	0	0	0	0	0	0	0	0
1143	Coniferous swamp	0	0	0	0	0.63	3.69	3.33	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
1147	Alder thicket or Shrub-carr	0	0	0	0	3.69	9.56	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0
1148	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1150	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.69
1151	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1156	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1157	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1158	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
252	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
253	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
254	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
255	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
256	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
257	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
259	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
260	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
261	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
262	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
263	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
264	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
265	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
267	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
268	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
270	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
271	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
272	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
275	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
276	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
277	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
278	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
278A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279B	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
280	Sedge meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
281	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282B	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
283	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
284	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
284A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
285	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
286	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
287	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
288	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
289	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
290	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
293	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
307	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
308	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
308A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
312	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
314	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
314A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
475	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
476	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
529	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
549	Alder thicket or Shrub-carr	0	0	0.28	1.93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
572	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
573	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
573A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
574	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
575	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
576	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
577	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
578	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
579	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
580	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community(1)	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
581	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
582	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
582A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
584	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
585	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
585A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
586	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
587	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
588	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
589	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
590	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
591	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
591A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
592	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
593	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
593A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
594	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
594A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
596	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
597	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
598	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
599	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
600	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
601	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
602	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
603	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
604	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
605	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
606	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
607	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
608	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
609	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
610	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
611	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
612	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
613	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
614	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
615	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
616	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
617	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
618	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
619	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
620	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
621	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
622	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
623	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
624	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
625	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
626	Coniferous swamp	6.13	8.81	9.97	16.88	32.70	31.67	32.28	36.12	36.53	22.97	15.52	6.69	1.31	0	0	0	0	0	0	0
627	Alder thicket or Shrub-carr	13.82	11.86	11.05	11.52	12.17	9.85	4.02	0.30	0	0	0	0	0	0	0	0	0	0	0	0
628	Deep marsh	4.45	5.54	0.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
629	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
630	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
631	Coniferous swamp	1.92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
632	Alder thicket or Shrub-carr	0.99	2.39	6.43	1.32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
633	Alder thicket or Shrub-carr	0.73	0.34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
634	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
635	Alder thicket or Shrub-carr	1.54	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
636	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
637	Lake	25.17	10.92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
638	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
639	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
640	Coniferous bog	9.27	5.50	4.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
641	Coniferous swamp	0	0	0	0	2.77	6.00	3.25	2.22	1.50	0.40	0	0	0	0	0	0	0	0	0	0
642	Shallow open water	0	0	0	0	0.02	4.67	3.65	0	0	0	0	0	0	0	0	0	0	0	0	0
643	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
644	Coniferous swamp	0	0	0	0	0	0	0	6.51	7.82	0	0	0	0	0	0	0	0	0	0	0
645	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0.78	0.26	0	0	0	0	0	0	0
646	Alder thicket or Shrub-carr	0	0	0	0	0	0.45	1.30	1.43	1.48	1.49	1.43	1.39	1.40	0.67	2.28	3.29	0.14	1.31	5.02	0.34
647	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	3.37	3.17	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
648	Alder thicket	0	0	0	0	0	0.26	2.98	2.14	3.95	1.96	14.82	18.53	1.32	0	0	0	0	0	0	0
649	Sedge meadow or Wet meadow	0	0	0	0	1.28	7.39	1.95	0	0	0	0	0	0	0	0	0	0	0	0	0
650	Sedge meadow or Wet meadow	0	0	0	5.37	2.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
651	Alder thicket	0	0	0	0	0	0	0	0	1.03	1.06	0	0	0	0	0	0	0	0	0	0
652	Coniferous swamp	28.35	12.35	0.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
653	Coniferous bog	0	0	0	0	0.12	5.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
654	Shrub-carr	0	0	0	0	0	0	0	1.41	6.59	1.85	1.97	3.03	0.32	0	0	0	0	0	0	0
655	Alder thicket or Shrub-carr	3.55	1.95	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
656	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
657	Alder thicket or Shrub-carr	12.43	17.82	8.69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
659	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.20	1.88	2.99	0	0	0
660	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
662	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	6.66	7.61	6.64	5.45	0	0	0	0	0
663	Coniferous swamp	0	0	0	0	0	0	1.88	4.34	6.86	0.04	0	0	0	0	0	0	0	0	0	0
664	Coniferous swamp	0	0	0	0	4.74	8.52	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0
665	Shallow open water	0	0	0	0	5.69	9.83	3.75	1.44	0	0	0	0	0	0	0	0	0	0	0	0
667	Coniferous swamp	0	0	0	0	4.42	6.06	6.75	0.11	0	0	0	0	0	0	0	0	0	0	0	0
669	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
670	Coniferous swamp	4.18	6.69	11.60	5.23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
672	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
673	Coniferous swamp	33.66	30.42	20.90	10.76	3.39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
674	Open bog	0	0	0	0	0	0	0	0	0	1.13	1.22	0	0	0	0	0	0	0	0	0
675	Open bog	0	0	0	0	0	0	0	3.39	6.12	0.16	0	0	0	0	0	0	0	0	0	0
676	Deep marsh	0	0	0	0	0	0	0	0	0	5.77	3.71	0	0	0	0	0	0	0	0	0
677	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	9.27	24.90	23.93	12.82	30.73	30.94	24.51	8.55	0
786	Open bog	0	0	0		0.20	5.05	11.72	14.91	12.41	22.95	28.97	35.42	38.55	35.06	29.30	16.59	10.32	5.39	0	0
787	Alder thicket or Shrub-carr	0	0	0	2.64	5.79	3.02	2.93	1.85	0	0	0	0	0	0	0	0	0	0	0	0
788	Hardwood swamp	19.91	28.49	24.01	4.99	3.69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
810	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
816	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	1.29	11.32	2.85	0	0	0	0	0	0
817	Deep marsh	0	0	0	0	0	0	0	0	0	2.62	6.89	0.52	0	0	0	0	0	0	0	0
818	Deep marsh	0	0	0	0	0	0	0	0	0	0	0.00	7.10	0.02	0	0	0	0	0	0	0
819	Deep marsh	0	0	0	0	0	0	0	0	0	0	0.12	0.85	0	0	0	0	0	0	0	0
820	Deep marsh	0	0	0	0	0	0	1.35	11.73	11.71	2.12		0	0	0	0	0	0	0	0	0
821	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.57	4.80	2.81	0	0	0
822	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0.07	4.39	0	0	0	0	0
823	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0.27	5.39	0.55	0	0	0	0
824	Shallow marsh	0	0	0	0	0	4.40	1.34	0	0	0	0	0	0	0	0	0	0	0	0	0
825	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09	1.70	0	0
826	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.02	4.91	0	0
827	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	2.42	0.09	0	0
828	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.39	3.06	0.80	0	0
829	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.99	3.82	0	0	0
830	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.13	1.75	0	0	0	0
831	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	5.63	8.03	0	0	0	0	0
832	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	2.92	6.45	0	0	0	0	0	0
833	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	2.59	12.54	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
834	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	2.30	5.95	0	0	0	0	0	0	0
835	Wet meadow	0	0	0	0	0	0	0	0	0.10	5.19	6.12	1.25	0	0	0	0	0	0	0	0
836	Shrub-carr	0	0	0	0	0	0	0	0	3.11	6.46	1.93	0	0	0	0	0	0	0	0	0
837	Shrub-carr	0	0	0	0	0	0	0	3.48	8.80	1.21	0	0	0	0	0	0	0	0	0	0
838	Shrub-carr	0	0	0	0	0	0.57	10.59	7.82	0	0	0	0	0	0	0	0	0	0	0	0
839	Shrub-carr	0	0	0	0	0	0	0	1.44	10.63	0.99	0	0	0	0	0	0	0	0	0	0
840	Shrub-carr	0	0	0	0	10.93	19.41	0.95	0	0	0	0	0	0	0	0	0	0	0	0	0
841	Shrub-carr	0	0	0	0	0	0	0	0	0	0.52	8.72	0	0	0	0	0	0	0	0	0
842	Shrub-carr	0	0	0	0	0	0	0	0	0	0	2.60	5.70	0	0	0	0	0	0	0	0
843	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	6.14	6.42	0	0	0	0	0	0	0
844	Shrub-carr	0	0	0	0	0	0	0.27	9.54	14.75	3.96	0	0	0	0	0	0	0	0	0	0
845	Coniferous swamp	0	0	0	0	0	1.11	7.43	4.10	0	0	0	0	0	0	0	0	0	0	0	0
846	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	1.47	6.15	0.01	0	0	0	0	0	0
847	Shallow marsh	0	0	0	0	0	4.32	12.89	0.65	0	0	0	0	0	0	0	0	0	0	0	0
848	Shrub-carr	0	0	0	0	0	0	0	0	0.90	13.73	1.39	0	0	0	0	0	0	0	0	0
849	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	5.68	5.19	0	0	0	0	0	0	0
850	Shrub-carr	0	0	0	0	0	0	0	0	0.08	5.49	14.84	9.32	0	0	0	0	0	0	0	0
851	Shrub-carr	0	0	0	0	0	0	4.76	11.87	3.10	0	0	0	0	0	0	0	0	0	0	0
852	Shrub-carr	0	0	0	0	0	0	3.68	0	0	0	0	0	0	0	0	0	0	0	0	0
854	Coniferous swamp	0	0	0	4.77	9.22	0.57	0	0	0	0	0	0	0	0	0	0	0	0	0	0
866	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
867	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
868	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
869	Alder thicket or Shrub-carr	0	8.71	7.13	0.66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
870	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
871	Alder thicket or Shrub-carr	0	0	0	4.48	13.40	14.67	7.74	0.82	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
872	Coniferous swamp	0	0	0	0	0	2.80	7.05	8.28	9.27	9.12	5.76	0	0	0	0	0	0	0	0	0
873	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	1.04	4.96	4.00	0	0	0	0	0	0	0
874	Coniferous swamp	0	0	0	0	0	1.80	3.53	0.48	0	0	0	0	0	0	0	0	0	0	0	0
875	Alder thicket or Shrub-carr	0	0	0	0.12	9.26	17.59	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0
876	Alder thicket	0	0	11.28	18.38	9.46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
877	Alder thicket or Shrub-carr	2.04	7.62	2.98	0.00		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
878	Alder thicket or Shrub-carr	0	9.36	14.46	8.09	3.63	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
908	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
915	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
917	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
918	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
921	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
923	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
942	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
943	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
944	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
945	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
946	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
947	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
950	Alder thicket or Shrub-carr	0	0	0	0	0	0	3.10	0.03	0	0	0	0	0	0	0	0	0	0	0	0
951	Coniferous bog	19.26	13.61	10.97	8.69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
952	Alder thicket or Shrub-carr	0	0	0	0	4.94	23.47	42.90	27.02	9.36	0.79	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
953	Alder thicket or Shrub-carr	0	0	0	4.73	24.50	17.23	18.39	23.70	33.71	84.51	117.24	113.24	62.20	32.44	30.16	35.05	16.92	0	0	0
954	Coniferous swamp	0	0	0	14.52	17.18	17.76	28.98	32.92	44.34	19.73	0.09	0	0	0	0	0	0	0	0	0
955	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
956	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
957	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
958	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
963	Alder thicket or Shrub-carr	4.63	13.45	13.39	11.31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
964	Coniferous swamp	12.02	9.76	13.44	4.94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
965	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
966	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
968	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
974	Coniferous bog	20.70	15.80	18.13	9.32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
975	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
976	Coniferous swamp	4.41	7.17	22.41	27.66	12.23	1.68	0	0	0	0	0	0	0	0	0	0	0	0	0	0
977	Coniferous swamp	0	0	0	0	0	0	0.61	12.15	11.04	2.47	2.54	16.46	8.41	0	0	0	0	0	0	0
978	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
979	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
980	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
981	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
982	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0.73	10.83	16.56	39.66	21.81	9.15	4.48	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
983	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0.25	6.97	6.22	7.73	13.03	19.24	1.81	0	0	0	0	0	0
986	Alder thicket or Shrub-carr	0	0.69	11.37	10.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
987	Shallow open water	0	0	0	0	1.47	0.32	0	0	0	0	0	0	0	0	0	0	0	0	0	0
988	Alder thicket or Shrub-carr	0	0	0	3.27	14.24	3.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
989	Coniferous swamp	0	0	0	0.00	9.96	5.41	3.33	15.36	30.62	29.93	24.04	11.59	0	0	0	0	0	0	0	0
990	Alder thicket or Shrub-carr	3.49	5.40	8.39	7.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
991	Coniferous swamp	8.27	2.65	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
992	Alder thicket or Shrub-carr	0	0	0	7.77	7.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
993	Alder thicket or Shrub-carr	0.14	3.04	3.83	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
994	Coniferous bog	0	0	0	5.81	12.99	7.24	0.73	0	0	0	0	0	0	0	0	0	0	0	0	0
995	Coniferous swamp	0.01	3.69	8.54	6.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
996	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T1	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T13	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T13A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T8	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total acres of wetland		283.28	287.31	302.15	292.22	310.86	312.02	281.38	285.38	311.82	286.76	304.43	326.61	248.66	186.85	198.60	233.91	135.33	74.95	44.78	27.53

(1) Reference (13)

Wetland ID	Eggers and Reed Wetland Community(1)	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
1000	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1001	Coniferous bog	11.90	11.97	19.50	6.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1002	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1003	Alder thicket or Shrub-carr	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1006	Alder thicket or Shrub-carr	4.99	0.56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1008	Alder thicket or Shrub-carr	0	0	0	0.08	1.41	2.91	3.54	1.85	2.53	1.60	2.82	3.07	5.34	3.73	0	0	0	0	0	0
1009	Alder thicket or Shrub-carr	3.67	1.96	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1010	Coniferous bog	0	0	0	2.56	12.32	13.93	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0
1011	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1012	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1013	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1014	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1015	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1016	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1017	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1018	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1019	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1020	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1021	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1022	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1023	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1024	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
1025	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1026	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1027	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1027A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1056	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1057	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1058	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1059	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1060	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1065	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1066	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1067	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1069	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1070	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1071	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1072	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1073	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1074	Coniferous bog	0	0	0	0	0	7.69	21.21	22.67	19.66	14.63	15.24	21.34	11.21	9.79	2.79	0	0	0	0	0
1076	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1077	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
1078	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1079	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1080	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1081	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1082	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1083	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1084	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1085	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1086	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1091	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1092	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1093	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1094	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1096	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1105	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1106	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1107	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1108	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1109	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
1110	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1111	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1112	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1113	Coniferous bog	0	0	0	0	0	0	0	0	0	0.44	1.99	8.13	18.67	7.24	12.35	12.94	10.54	5.31	3.27	0.95
1114	Hardwood swamp	2.90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1115	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1116	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1117	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1125	Sedge meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1126	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1129	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1130	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1133	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1134	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1134A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1135	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1135A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139B	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1140	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1141	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1142	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1143	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
1147	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1148	Open bog	0	0	0	0	0	0	0.18	9.89	19.57	24.98	19.66	0.24	0	0	0	0	0	0	0	0
1150	Shallow marsh	2.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1151	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1156	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1157	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1158	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
252	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
253	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
254	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
255	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
256	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
257	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
259	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
260	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
261	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
262	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
263	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
264	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
265	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
267	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
268	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
270	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
271	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
272	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
275	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
276	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
277	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
278	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
278A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279B	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
280	Sedge meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
281	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282B	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
283	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
284	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
284A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
285	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
286	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
287	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
288	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
289	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
290	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
293	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
307	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
308	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
308A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
312	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
314	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
314A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
475	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
476	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
529	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
549	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
572	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
573	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
573A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
574	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
575	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
576	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
577	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
578	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
579	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
580	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
581	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
582	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
582A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
584	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
585	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
585A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
586	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
587	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
588	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
589	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
590	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
591	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
591A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
592	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
593	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
593A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
594	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
594A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
596	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
597	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
598	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
599	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
600	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
601	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
602	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
603	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
604	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
605	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
606	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
607	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
608	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
609	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
610	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
611	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
612	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
613	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
614	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
615	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
616	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
617	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
618	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
619	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
620	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
621	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
622	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
623	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
624	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
625	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
626	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
627	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
628	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
629	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
630	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
631	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
632	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
633	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
634	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
635	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
636	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
637	Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
638	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
639	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
640	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
641	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
642	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
643	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
644	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
645	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
646	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
647	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
648	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
649	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
650	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
651	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
652	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
653	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
654	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
655	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
656	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
657	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
659	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
660	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
662	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
663	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
664	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
665	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
667	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
669	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
670	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
672	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
673	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
674	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
675	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
676	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
677	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
786	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
787	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
788	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
810	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
816	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
817	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
818	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
819	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
820	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
821	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
822	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
823	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
824	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
825	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
826	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
827	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
828	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
829	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
830	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
831	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
832	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
833	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
834	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
835	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
836	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
837	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
838	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
840	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
841	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
842	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
843	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
844	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
845	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
846	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
847	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
848	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
849	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
850	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
851	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
852	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
854	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
866	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
867	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
868	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
869	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
870	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
871	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
872	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
873	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
874	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
875	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
876	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
877	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
878	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
908	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
915	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
917	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
918	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
921	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
923	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
942	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
943	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
944	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
945	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
946	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
947	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
950	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
951	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
952	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
953	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
954	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
955	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
956	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
957	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
958	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
963	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
964	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
965	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
966	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
968	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
974	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
975	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
976	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
977	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
978	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
979	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
980	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
981	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
982	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
983	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
986	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
987	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
988	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
989	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
990	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
991	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
992	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
993	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
994	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
995	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
996	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T1	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T13	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T13A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T8	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total acres of wetland		26.18	14.49	19.51	9.47	13.73	24.53	24.99	34.41	41.76	41.65	39.71	32.78	35.22	20.76	15.14	12.94	10.54	5.31	3.27	0.95

(1) Reference (13)

Large Table 14 Summary of Wetlands within 500-Feet Increments – Flotation Tailings Basin Area

Eggers and Reed Wetland Community[(1)]	Wetlands (acres) within 500-Feet Increments From the Edge of the Floatation Tailings Basin																			
	0 - 500 Feet	500 - 1,000 Feet	1,000 - 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
Alder thicket	2.55	1.25	0.72	0	0	0	0	0	0	0	5.18	0.29	0.08	1.76	0	0	0	0	0	0
Alder thicket or Shrub-carr	0.03	6.60	10.73	15.23	20.59	33.58	19.63	30.81	40.23	40.24	29.77	29.44	29.08	37.38	41.50	46.33	73.99	69.93	68.68	69.03
Coniferous bog	0	0	0	0	0	0	0.21	2.77	16.05	20.86	13.05	16.17	19.27	37.47	26.30	24.51	22.10	38.34	36.55	45.57
Coniferous swamp	3.76	11.22	16.52	20.98	44.51	60.25	69.63	66.78	45.05	41.15	66.58	83.36	89.60	54.91	56.17	56.15	65.94	67.72	79.39	104.50
Deep marsh	23.96	59.69	47.71	41.64	38.68	27.29	16.63	8.98	9.18	19.42	10.87	0.53	0	0	1.97	9.17	8.05	2.90	1.73	7.20
Hardwood swamp	0	0.45	1.79	0	4.66	9.42	1.20	1.76	4.40	9.27	9.05	5.87	4.50	1.43	2.93	0.84	0	0.80	4.67	11.51
Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.87	14.79	18.98	17.15	18.68	25.45
Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sedge meadow	0	0.07	0	0	3.36	5.28	8.08	0.40	0	0	0	0	0	0	0	0	0	0	0	0
Sedge meadow or Wet meadow	0	0	0	0.35	0	0	0	0	0	0	0	0	0	0	0	3.09	1.23	0	0	0
Shallow marsh	24.07	68.34	55.70	64.39	62.54	55.76	38.38	15.82	13.04	14.12	15.37	12.58	6.96	5.23	14.77	12.36	15.17	7.00	7.54	17.86
Shallow, open water	0	0	0	0	0	3.76	6.06	10.61	12.86	12.16	13.08	12.22	11.92	8.33	2.66	2.83	2.04	1.66	1.91	4.23
Shrub-carr	0.65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wet meadow	0.03	0	0	0	0	0	0.17	0.52	0	0	0	0	0	0.09	2.70	3.83	7.27	3.81	0	0
Total acres of wetland	55.05	147.62	133.17	142.59	174.34	195.34	159.99	138.45	140.81	157.22	162.95	160.46	161.41	146.60	149.87	173.90	214.77	209.31	219.15	285.35

Eggers and Reed Wetland Community(1)	Wetlands (acres) within 500-Feet Increments From the Edge of the Floatation Tailings Basin																			
	10,000 - 10,500 Feet	10,500 - 11,000 Feet	11,000 - 11,500 Feet	11,500 - 12,000 Feet	12,000 - 12,500 Feet	12,500 - 13,000 Feet	13,000 - 13,500 Feet	13,500 - 14,000 Feet	14,000 - 14,500 Feet	14,500 - 15,000 Feet	15,000 - 15,500 Feet	15,500 - 16,000 Feet	16,000 - 16,500 Feet	16,500 - 17,000 Feet	17,000 - 17,500 Feet	17,500 - 18,000 Feet	18,000 - 18,500 Feet	18,500 - 19,000 Feet	19,000 - 19,500 Feet	19,500 - 20,000 Feet
Alder thicket	0	0	11.28	18.38	9.46	0.26	2.98	2.14	4.98	3.02	14.82	18.53	1.32	0	0	0	0	0	0	0
Alder thicket or Shrub-carr	59.07	103.58	115.75	92.44	111.84	125.28	101.99	74.51	65.32	123.38	162.14	178.28	137.86	89.56	65.76	112.91	71.92	38.31	18.05	0.40
Coniferous bog	50.41	36.12	46.10	41.07	38.89	38.17	15.67	13.64	4.91	0	0	0	0.01	2.60	6.19	13.39	15.05	19.32	26.73	22.85
Coniferous swamp	103.52	86.72	98.16	125.25	124.90	91.92	99.96	122.59	147.98	84.66	48.99	48.67	29.78	31.81	74.75	74.88	21.82	4.43	0	0
Deep marsh	18.23	15.81	1.77	0	0	0	1.35	11.73	11.71	10.51	10.72	9.76	11.34	2.85	0	0	0	0	0	0
Hardwood swamp	19.91	28.49	24.01	4.99	3.69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.59
Lake	25.17	10.92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Open bog	0	0	0	0	0.20	5.05	11.72	18.30	18.53	24.24	30.19	35.42	38.55	35.06	29.30	16.59	10.32	5.39	0	0
Sedge meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sedge meadow or Wet meadow	0	1.06	0.46	6.90	3.77	7.39	1.95	0	0	0	0	0.28	0	0	0.09	5.33	0	0	0	0
Shallow marsh	3.37	0	0	0	0	9.15	18.11	5.47	10.33	1.55	0	0.78	2.85	12.88	14.48	7.10	2.81	0	0	1.69
Shallow, open water	3.60	4.61	4.62	3.19	7.18	14.82	7.40	1.44	0	0	0	0	0	0	0	0	0	0	0	0
Shrub-carr	0	0	0	0	10.93	19.98	20.25	35.56	47.96	34.21	31.45	31.34	18.08	0.01	0	0	0	0	0	0
Wet meadow	0	0	0	0	0	0	0	0	0.10	5.19	6.12	3.55	8.87	12.08	8.03	3.71	13.41	7.50	0	0
Total acres of wetland	283.28	287.31	302.15	292.22	310.86	312.02	281.38	285.38	311.82	286.76	304.43	326.61	248.66	186.85	198.60	233.91	135.33	74.95	44.78	27.53

Eggers and Reed Wetland Community[1]	Wetlands (acres) within 500-Feet Increments From the Edge of the Floatation Tailings Basin																			
	20,000 - 20,500 Feet	20,500 - 21,000 Feet	21,000 - 21,500 Feet	21,500 - 22,000 Feet	22,000 - 22,500 Feet	22,500 - 23,000 Feet	23,000 - 23,500 Feet	23,500 - 24,000 Feet	24,000 - 24,500 Feet	24,500 - 25,000 Feet	25,000 - 25,500 Feet	25,500 - 26,000 Feet	26,000 - 26,500 Feet	26,500 - 27,000 Feet	27,000 - 27,500 Feet	27,500 - 28,000 Feet	28,000 - 28,500 Feet	28,500 - 29,000 Feet	29,000 - 29,500 Feet	29,500 - 30,000 Feet
Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alder thicket or Shrub-carr	9.16	2.52	0.01	0.08	1.41	2.91	3.54	1.85	2.53	1.60	2.82	3.07	5.34	3.73	0	0	0	0	0	0
Coniferous bog	11.90	11.97	19.50	9.39	12.32	21.62	21.27	22.67	19.66	15.07	17.23	29.47	29.88	17.03	15.14	12.94	10.54	5.31	3.27	0.95
Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hardwood swamp	2.90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Open bog	0	0	0	0	0	0	0.18	9.89	19.57	24.98	19.66	0.24	0	0	0	0	0	0	0	0
Sedge meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shallow marsh	2.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shallow, open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total acres of wetland	26.18	14.49	19.51	9.47	13.73	24.53	24.99	34.41	41.76	41.65	39.71	32.78	35.22	20.76	15.14	12.94	10.54	5.31	3.27	0.95

(1) Reference (13)

Large Table 15 Summary of Wetlands within the FTB Groundwater Flow Paths

Eggers and Reed Wetland Community[1]	Hydrology	Wetlands within the FTB Groundwater Flow Paths (acres)		
		Unnamed Creek	Trimble Creek	Mud Lake Creek
Alder thicket	Groundwater	53.36	8.90	0
Alder thicket or Shrub-carr	Groundwater	433.41	227.34	144.85
Ombrotrophic coniferous bog	Precipitation	37.56	196.63	58.14
Coniferous swamp	Groundwater	375.48	308.35	630.61
Deep marsh	Groundwater	130.89	97.59	125.83
Hardwood swamp	Groundwater	126.05	0	40.91
Open bog	Precipitation	157.48	0	0
Sedge meadow	Groundwater	17.13	0	0
Sedge or Wet meadow	Groundwater	17.88	0	0.35
Shallow marsh	Groundwater	196.48	225.79	124.14
Shallow, open water	Groundwater	8.34	0	7.44
Shrub-carr	Groundwater	234.72	0.65	0
Wet meadow	Groundwater	64.24	17.70	0
Total acres of wetland		1853.02	1082.95	1132.27

(1) Reference (13)

Large Table 16 Wetlands within the FTB Groundwater Flow Paths

Wetland ID	Eggers and Reed Wetland Community[(1)]	Dominant Source of Hydrology	Area (acres)
Unnamed Creek			
264	Coniferous swamp	Groundwater	10.86
265	Alder thicket or Shrub-carr	Groundwater	0.42
268	Alder thicket or Shrub-carr	Groundwater	15.44
270	Shallow marsh	Groundwater	85.84
271	Coniferous swamp	Groundwater	18.08
275	Coniferous swamp	Groundwater	30.59
276	Coniferous swamp	Groundwater	8.68
277	Alder thicket or Shrub-carr	Groundwater	14.46
278	Alder thicket	Groundwater	0.81
278A	Alder thicket or Shrub-carr	Groundwater	1.84
279	Alder thicket	Groundwater	1.50
279A	Alder thicket or Shrub-carr	Groundwater	0.33
279B	Alder thicket or Shrub-carr	Groundwater	1.13
280	Sedge meadow	Groundwater	17.13
281	Alder thicket or Shrub-carr	Groundwater	1.46
282	Shallow marsh	Groundwater	6.83
282A	Shallow marsh	Groundwater	6.63
282B	Shallow marsh	Groundwater	12.41
283	Deep marsh	Groundwater	8.89
284	Alder thicket	Groundwater	0.41
284A	Alder thicket or Shrub-carr	Groundwater	2.99
287	Alder thicket or Shrub-carr	Groundwater	5.93
293	Deep marsh	Groundwater	5.74
591	Deep marsh	Groundwater	0.36
591A	Deep marsh	Groundwater	0.15
593	Deep marsh	Groundwater	1.18
593A	Deep marsh	Groundwater	25.73
594	Deep marsh	Groundwater	0.06
594A	Deep marsh	Groundwater	0.75
596	Alder thicket or Shrub-carr	Groundwater	0.24
597	Hardwood swamp	Groundwater	4.45
598	Alder thicket or Shrub-carr	Groundwater	6.31

Wetland ID	Eggers and Reed Wetland Community[(1)]	Dominant Source of Hydrology	Area (acres)
599	Alder thicket or Shrub-carr	Groundwater	2.79
600	Shallow marsh	Groundwater	8.79
601	Alder thicket or Shrub-carr	Groundwater	1.34
602	Alder thicket or Shrub-carr	Groundwater	0.60
624	Alder thicket or Shrub-carr	Groundwater	4.84
625	Coniferous swamp	Groundwater	3.70
626	Coniferous swamp	Groundwater	200.75
627	Alder thicket or Shrub-carr	Groundwater	187.10
628	Deep marsh	Groundwater	10.53
629	Alder thicket or Shrub-carr	Groundwater	10.66
630	Coniferous bog	Precipitation	8.05
631	Coniferous swamp	Groundwater	10.05
632	Alder thicket or Shrub-carr	Groundwater	11.13
633	Alder thicket or Shrub-carr	Groundwater	1.07
634	Alder thicket or Shrub-carr	Groundwater	0.51
635	Alder thicket or Shrub-carr	Groundwater	1.76
636	Coniferous bog	Precipitation	2.26
641	Coniferous swamp	Groundwater	16.16
642	Shallow, open water	Groundwater	8.34
644	Coniferous swamp	Groundwater	11.73
645	Shallow marsh	Groundwater	1.04
646	Alder thicket or Shrub-carr	Groundwater	16.76
647	Alder thicket or Shrub-carr	Groundwater	6.55
648	Alder thicket	Groundwater	11.51
649	Sedge meadow or Wet meadow	Groundwater	10.01
650	Sedge meadow or Wet meadow	Groundwater	7.87
656	Alder thicket or Shrub-carr	Groundwater	1.94
786	Open bog	Precipitation	157.48
787	Alder thicket or Shrub-carr	Groundwater	16.23
788	Hardwood swamp	Groundwater	98.13
816	Deep marsh	Groundwater	15.46
817	Deep marsh	Groundwater	10.03
818	Deep marsh	Groundwater	7.13
819	Deep marsh	Groundwater	0.97
820	Deep marsh	Groundwater	26.92

Wetland ID	Eggers and Reed Wetland Community[(1)]	Dominant Source of Hydrology	Area (acres)
821	Shallow marsh	Groundwater	9.19
822	Shallow marsh	Groundwater	4.46
823	Shallow marsh	Groundwater	6.22
824	Shallow marsh	Groundwater	5.74
825	Wet meadow	Groundwater	0.07
826	Wet meadow	Groundwater	8.93
827	Wet meadow	Groundwater	2.84
828	Wet meadow	Groundwater	4.25
829	Wet meadow	Groundwater	3.50
830	Shallow marsh	Groundwater	4.88
831	Wet meadow	Groundwater	13.66
832	Wet meadow	Groundwater	9.38
833	Shallow marsh	Groundwater	15.14
834	Wet meadow	Groundwater	8.26
835	Wet meadow	Groundwater	12.66
836	Shrub-carr	Groundwater	11.50
837	Shrub-carr	Groundwater	13.50
838	Shrub-carr	Groundwater	19.00
839	Shrub-carr	Groundwater	13.07
840	Shrub-carr	Groundwater	31.30
841	Shrub-carr	Groundwater	9.24
842	Shrub-carr	Groundwater	8.30
843	Shrub-carr	Groundwater	12.56
844	Shrub-carr	Groundwater	28.54
845	Coniferous swamp	Groundwater	12.64
846	Shrub-carr	Groundwater	7.63
847	Shallow marsh	Groundwater	17.87
848	Shrub-carr	Groundwater	16.03
849	Shrub-carr	Groundwater	10.88
850	Shrub-carr	Groundwater	29.75
851	Shrub-carr	Groundwater	19.74
852	Shrub-carr	Groundwater	3.68
876	Alder thicket	Groundwater	39.13
877	Alder thicket or Shrub-carr	Groundwater	12.65
878	Alder thicket or Shrub-carr	Groundwater	35.55

Wetland ID	Eggers and Reed Wetland Community[(1)]	Dominant Source of Hydrology	Area (acres)
917	Coniferous bog	Precipitation	19.88
918	Coniferous swamp	Groundwater	9.44
921	Alder thicket or Shrub-carr	Groundwater	0.38
923	Wet meadow	Groundwater	0.69
942	Deep marsh	Groundwater	2.96
943	Deep marsh	Groundwater	14.03
944	Hardwood swamp	Groundwater	2.61
945	Alder thicket or Shrub-carr	Groundwater	2.32
950	Alder thicket or Shrub-carr	Groundwater	3.13
978	Hardwood swamp	Groundwater	2.80
980	Alder thicket or Shrub-carr	Groundwater	2.82
996	Alder thicket or Shrub-carr	Groundwater	4.10
1025	Hardwood swamp	Groundwater	1.55
1070	Alder thicket or Shrub-carr	Groundwater	3.80
1071	Alder thicket or Shrub-carr	Groundwater	29.18
1072	Alder thicket or Shrub-carr	Groundwater	8.62
1073	Alder thicket or Shrub-carr	Groundwater	3.57
1129	Coniferous swamp	Groundwater	9.79
1147	Alder thicket or Shrub-carr	Groundwater	13.46
1156	Shallow marsh	Groundwater	4.08
NA	Hardwood swamp	Groundwater	16.51
NA	Coniferous swamp	Groundwater	30.02
NA	Shallow marsh	Groundwater	7.36
NA	Coniferous swamp	Groundwater	2.99
NA	Coniferous bog	Precipitation	6.23
NA	Coniferous bog	Precipitation	1.14
Trimble Creek			
252	Coniferous swamp	Groundwater	45.74
253	Deep marsh	Groundwater	5.89
254	Shallow marsh	Groundwater	36.71
256	Alder thicket or Shrub-carr	Groundwater	21.23
259	Alder thicket or Shrub-carr	Groundwater	0.34
260	Shallow marsh	Groundwater	114.62
261	Alder thicket or Shrub-carr	Groundwater	0.84
262	Shallow marsh	Groundwater	1.86

Wetland ID	Eggers and Reed Wetland Community[(1)]	Dominant Source of Hydrology	Area (acres)
267	Alder thicket or Shrub-carr	Groundwater	1.09
312	Shrub-carr	Groundwater	0.65
476	Alder thicket or Shrub-carr	Groundwater	0.82
529	Wet meadow	Groundwater	0.30
549	Alder thicket or Shrub-carr	Groundwater	1.89
578	Deep marsh	Groundwater	0.69
579	Deep marsh	Groundwater	2.14
580	Alder thicket or Shrub-carr	Groundwater	1.72
581	Coniferous swamp	Groundwater	20.62
582	Deep marsh	Groundwater	18.39
582A	Deep marsh	Groundwater	19.84
584	Alder thicket or Shrub-carr	Groundwater	53.00
585	Alder thicket	Groundwater	1.58
585A	Alder thicket or Shrub-carr	Groundwater	2.78
586	Deep marsh	Groundwater	0.36
587	Shallow marsh	Groundwater	0.81
588	Alder thicket or Shrub-carr	Groundwater	18.22
589	Deep marsh	Groundwater	40.05
590	Shallow marsh	Groundwater	0.05
591	Deep marsh	Groundwater	1.65
591A	Deep marsh	Groundwater	2.60
609	Coniferous swamp	Groundwater	0.33
610	Shallow marsh	Groundwater	0.09
611	Coniferous bog	Precipitation	0.23
612	Coniferous bog	Precipitation	2.19
613	Alder thicket or Shrub-carr	Groundwater	1.59
614	Shallow marsh	Groundwater	1.23
615	Shallow marsh	Groundwater	0.44
616	Deep marsh	Groundwater	5.98
617	Shallow marsh	Groundwater	2.08
618	Alder thicket	Groundwater	1.46
619	Alder thicket or Shrub-carr	Groundwater	0.88
620	Shallow marsh	Groundwater	0.28
621	Alder thicket or Shrub-carr	Groundwater	0.52
622	Alder thicket or Shrub-carr	Groundwater	0.37

Wetland ID	Eggers and Reed Wetland Community[(1)]	Dominant Source of Hydrology	Area (acres)
623	Alder thicket or Shrub-carr	Groundwater	0.89
643	Alder thicket or Shrub-carr	Groundwater	1.59
670	Coniferous swamp	Groundwater	29.76
672	Coniferous swamp	Groundwater	9.05
673	Coniferous swamp	Groundwater	110.07
810	Alder thicket or Shrub-carr	Groundwater	11.40
869	Alder thicket or Shrub-carr	Groundwater	16.50
870	Coniferous bog	Precipitation	8.60
915	Alder thicket	Groundwater	5.48
946	Alder thicket or Shrub-carr	Groundwater	0.12
947	Alder thicket or Shrub-carr	Groundwater	0.76
951	Coniferous bog	Precipitation	116.45
954	Coniferous swamp	Groundwater	39.29
956	Wet meadow	Groundwater	17.40
957	Coniferous swamp	Groundwater	6.88
958	Alder thicket or Shrub-carr	Groundwater	3.58
974	Coniferous bog	Precipitation	69.16
975	Coniferous swamp	Groundwater	26.33
979	Alder thicket or Shrub-carr	Groundwater	5.75
981	Alder thicket	Groundwater	0.38
990	Alder thicket or Shrub-carr	Groundwater	42.22
991	Coniferous swamp	Groundwater	55.70
995	Coniferous swamp	Groundwater	3.82
1139	Shallow marsh	Groundwater	17.70
1139A	Shallow marsh	Groundwater	5.31
1139B	Shallow marsh	Groundwater	44.61
Mud Lake Creek			
260	Shallow marsh	Groundwater	34.98
285	Coniferous swamp	Groundwater	243.19
286	Shallow, open water	Groundwater	7.44
288	Deep marsh	Groundwater	4.51
290	Coniferous swamp	Groundwater	0.25
292	Deep marsh	Groundwater	0.41
292A	Deep marsh	Groundwater	0.07
308	Deep marsh	Groundwater	5.22

Wetland ID	Eggers and Reed Wetland Community[(1)]	Dominant Source of Hydrology	Area (acres)
308A	Deep marsh	Groundwater	75.57
314	Shallow marsh	Groundwater	19.17
314A	Shallow marsh	Groundwater	20.92
572	Deep marsh	Groundwater	7.34
573	Shallow marsh	Groundwater	0.12
573A	Shallow marsh	Groundwater	11.33
574	Deep marsh	Groundwater	6.59
575	Alder thicket or Shrub-carr	Groundwater	0.49
576	Sedge meadow or Wet meadow	Groundwater	0.35
577	Alder thicket or Shrub-carr	Groundwater	2.26
578	Deep marsh	Groundwater	16.81
582	Deep marsh	Groundwater	0.99
582A	Deep marsh	Groundwater	0.90
652	Coniferous swamp	Groundwater	109.44
669	Shallow marsh	Groundwater	21.39
810	Alder thicket or Shrub-carr	Groundwater	0.35
866	Hardwood swamp	Groundwater	31.04
867	Alder thicket or Shrub-carr	Groundwater	64.89
868	Hardwood swamp	Groundwater	9.87
870	Coniferous bog	Precipitation	58.14
908	Shallow marsh	Groundwater	8.70
947	Alder thicket or Shrub-carr	Groundwater	19.62
963	Alder thicket or Shrub-carr	Groundwater	26.88
964	Coniferous swamp	Groundwater	42.88
965	Coniferous swamp	Groundwater	11.22
966	Alder thicket or Shrub-carr	Groundwater	8.15
968	Coniferous swamp	Groundwater	3.49
986	Alder thicket or Shrub-carr	Groundwater	22.21
1130	Coniferous swamp	Groundwater	32.29
1133	Coniferous swamp	Groundwater	70.54
1134	Shallow marsh	Groundwater	5.71
1134A	Shallow marsh	Groundwater	1.82
1135	Deep marsh	Groundwater	0.51
1135A	Deep marsh	Groundwater	6.91
1151	Coniferous swamp	Groundwater	117.31

(1) Reference (13)

Large Table 17 Summary of Wetlands Abutting the Railroad Corridor - Mine Site to Plant Site

Wetland ID	Eggers and Reed Wetland Community[1]	Wetland Size (acres)
9	Shallow marsh	1.80
13	Deep marsh	5.03
16	Shallow marsh	0.31
53	Alder thicket	18.59
53B	Coniferous swamp	0.43
53C	Coniferous swamp	2.88
53D	Alder thicket	241.16
81	Coniferous swamp	1.68
390A	Alder thicket or Shrub-carr	13.54
391	Coniferous swamp	22.32
556	Alder thicket or Shrub-carr	1.84
565	Alder thicket or Shrub-carr	1.92
568	Deep marsh	0.42
570	Alder thicket or Shrub-carr	31.69
571	Coniferous swamp	44.05
583	Alder thicket or Shrub-carr	0.13
595	Deep marsh	1.06
716A	Alder thicket	1.04
903	Shallow marsh	9.71
1037	Shallow, open water	6.59
1038A	Coniferous swamp	1.68
1041	Alder thicket or Shrub-carr	81.52
1042	Sedge meadow or Wet meadow	0.69
1119	Coniferous swamp	7.93
1137	Alder thicket or Shrub-carr	8.92
1160	Shallow, open water	0.85
R-1	Alder thicket or Shrub-carr	1.05
R-2	Alder thicket or Shrub-carr	1.65
R-3A	Alder thicket or Shrub-carr	0.53
R-4A	Alder thicket	3.31
R-5A	Shallow marsh	16.30
R-7A	Shallow marsh	12.05
Total acres of wetland		542.67

(1) Reference (13)

Large Table 18 Total Wetland Area (Acres) for Pre-Settlement, Existing, and Future Conditions

		Pre-Settlement Conditions		Existing Conditions		Foreseeable Future Conditions with the Project		Foreseeable Future Conditions with the No Action Alternative	
Watershed	Total Land Area (acres)	Area (acres)	% of Watershed	Area (acres)	% of Watershed	Area (acres)	% of Watershed	Area (acres)	% of Watershed
Partridge River	101,812	33,601	33.0%	31,318	30.8%	30,276	29.7%	31,044	30.5%
Embarrass River	116,797	34,650	29.7%	34,249	29.3%	33,947	29.1%	34,122	29.2%

Large Table 19 Total Lake Area (Acres) for Pre-Settlement, Existing, and Future Conditions

		Pre-Settlement Conditions		Existing Conditions		Foreseeable Future Conditions with the Project		Foreseeable Future Conditions with the No Action Alternative	
Watershed	Total Land Area (acres)	Area (acres)	% of Watershed	Area (acres)	% of Watershed	Area (acres)	% of Watershed	Area (acres)	% of Watershed
Partridge River	101,812	2,688	2.6%	3,194	3.1%	3,194	3.1%	3,194	3.1%
Embarrass River	116,797	3,121	2.7%	2,904	2.5%	2,904	2.5%	2,904	2.5%

Large Table 20 Total Deepwater Habitat Area (Acres) for Pre-Settlement, Existing, and Future Conditions

		Pre-Settlement Conditions		Existing Conditions		Foreseeable Future Conditions with the Project		Foreseeable Future Conditions with the No Action Alternative	
Watershed	Total Land Area (acres)	Area (acres)	% of Watershed	Area (acres)	% of Watershed	Area (acres)	% of Watershed	Area (acres)	% of Watershed
Partridge River	101,812	0	0.0%	3,146	3.1%	3,516	3.5%	3,195	3.1%
Embarrass River	116,797	0	0.0%	977	0.8%	1,359	1.2%	1359	1.2%

Large Table 21 Summary of Future Known Changes in Wetland Resources for the Study Area(1)

Watershed	Total Land Area (acres)	Pre-Settlement Conditions (acres)	Existing Conditions (acres)	% Change from Pre-Settlement to Existing Conditions	Foreseeable Future Conditions with the Project (acres)	% Change from Pre-Settlement to Future Conditions with the Project	% Change from Existing to Future Conditions with the Project	Foreseeable Future Conditions with the No Action Alternative (acres)	% Change from Pre-Settlement to Future Conditions with the No Action Alternative	% Change from Existing to Future Conditions with the No Action Alternative
Partridge River	101,812	33,601	31,318	-6.8%	30,276	-9.9%	-3.3%	31,044	-7.6%	-0.9%
Embarrass River	116,797	34,650	34,249	-1.2%	33,947	-2.0%	-0.9%	34,122	-1.5%	-0.4%

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

Large Table 22 Summary of Future Known Changes in Lake Resources for the Study Area(1)

Watershed	Total Land Area (acres)	Pre-Settlement Conditions (acres)	Existing Conditions (acres)	% Change from Pre-Settlement to Existing Conditions	Foreseeable Future Conditions with the Project (acres)	% Change from Pre-Settlement to Future Conditions with the Project	% Change from Existing to Future Conditions with the Project	Foreseeable Future Conditions with the No Action Alternative (acres)	% Change from Pre-Settlement to Future Conditions with the No Action Alternative	% Change from Existing to Future Conditions with the No Action Alternative
Partridge River	101,812	2,688	3,194	18.8%	3,194	18.8%	0%	3,194	18.8%	0%
Embarrass River	116,797	3,121	2,904	-7.0%	2,904	-7.0%	0%	2,904	-7.0%	0%

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

Large Table 23 Summary of Future Known Changes in Deepwater Habitat Resources for the Study Area

Watershed	Total Land Area (acres)	Pre-Settlement Conditions (acres)	Existing Conditions (acres)	% Change from Pre-Settlement to Existing Conditions	Foreseeable Future Conditions with the Project (acres)	% Change from Pre-Settlement to Future Conditions with the Project	% Change from Existing to Future Conditions with the Project	Foreseeable Future Conditions with the No Action Alternative (acres)	% Change from Pre-Settlement to Future Conditions with the No Action Alternative	% Change from Existing to Future Conditions with the No Action Alternative
Partridge River	101,812	0	3,146	100%	3,516	100%	11.8%	3,195	100%	1.6%
Embarrass River	116,797	0	977	100%	1,359	100%	39%	1,359	100%	39%

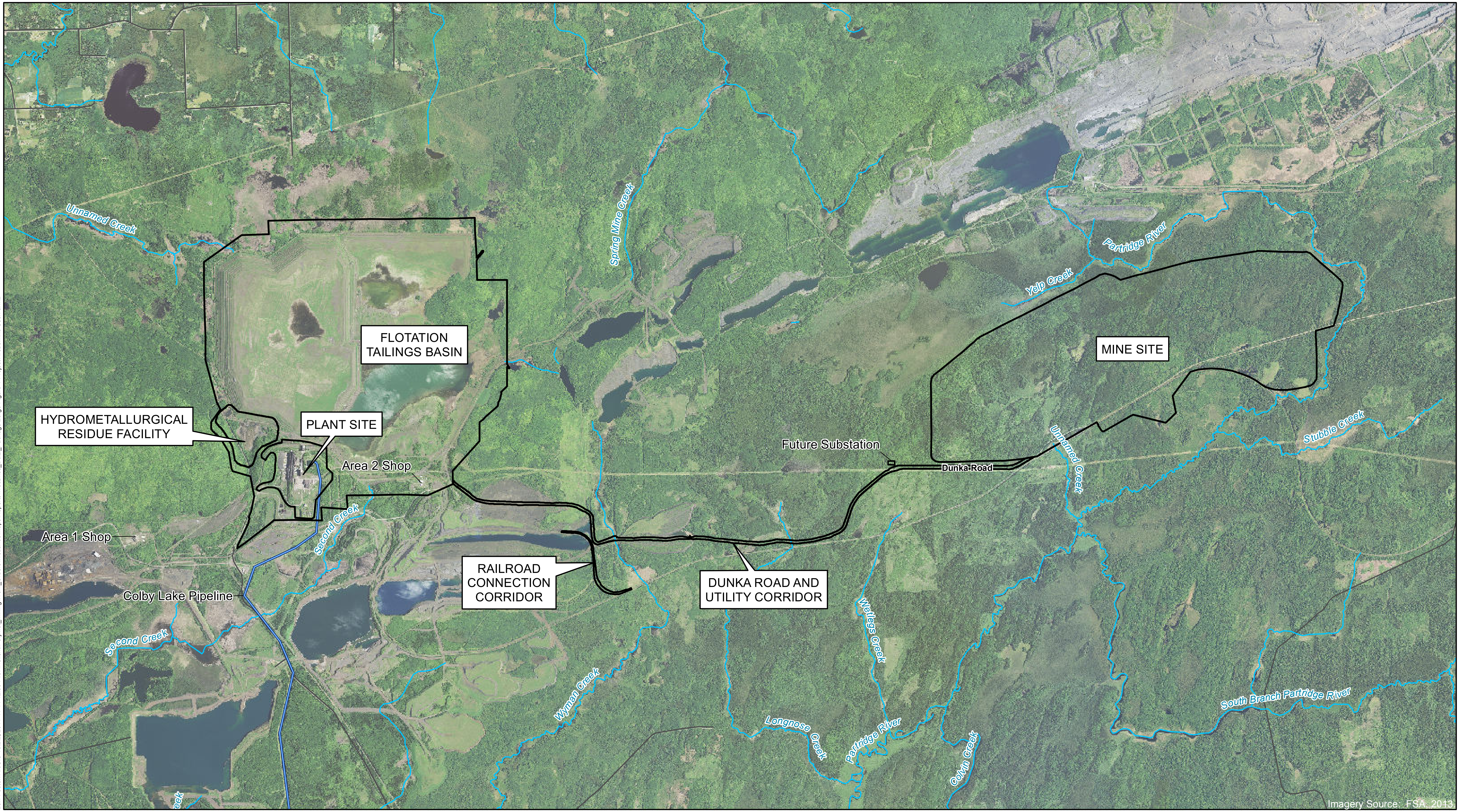
(1) The (-) represents a loss of deepwater acres and the (+) represents a gain of deepwater acres.

Large Table 24 Comparison of Future Conditions for Wetland and Deepwater Habitat Resources[1]

Project Name	Watershed	Wetland Impact (acres)	Proposed Wetland Mitigation (acres)	Net Change in Wetlands (acres)	Existing Deepwater Habitat (acres)	Future Deepwater Habitat (acres)	Net Change in Deepwater (acres)
PolyMet Mining Company	Partridge River	-767.6	0	-767.6	0	321.0	321.0
Mesabi Nugget Phase II	Partridge River	-266.8	0	-266.8	1,552.0	1,601.0	49.0
Laskin Energy Park - worst case scenario	Partridge River	-6.8	0	-6.8	0	0	0
St. Louis County Public Works Bridge Replacement	Partridge River	-0.9	0	-0.9	0	0	0
Total - Partridge River Watershed with Project		**-1042.1**	**0**	**-1,042.1**	**1,552.0**	**1,922.0**	**370.0**
Total - Partridge River Watershed without Project		**-275.4**	**0**	**-274.5**	**1,552.0**	**1,601.0**	**49.0**
PolyMet Mining Company	Embarrass River	-146.2	0	-146.2	0	0	0
PolyMet Mining Company[2]	Embarrass River	-28.6	0	-28.6	0	0	0
St. Louis County Public Works Bridge Replacement	Embarrass River	-0.9	0	-0.9	0	0	0
ArcelorMittal East Reserve	Embarrass River	-49.1	0	-49.1	0	275	275
ArcelorMittal Pushback	Embarrass River	-23.5	0	-23.5	0	107	107
Mining Resources - Powder Basin (Biwabik)	Embarrass River	-3.4	0	-3.4	0	0	0
Mining Resources - McKinley	Embarrass River	-50.1	0	-50.1	0	0	0
Total - Embarrass River Watershed with Project		**-301.8**	**0**	**-301.8**	**0**	**382**	**382**
Total - Embarrass River Watershed without Project		**-127.0**	**0**	**-127.0**	**0**	**382**	**382**

(1) The (-) represents a loss of water resources acres and the (+) represents a gain of water resources acres.
(2) These wetlands as exempt because the wetlands are located within the Cliffs Erie LLC (formerly LTVSMC) Permit To Mine Ultimate Tailings Basin Limit boundary and are not regulated by state and federal wetland regulations (Section 5.1).

Large Figures

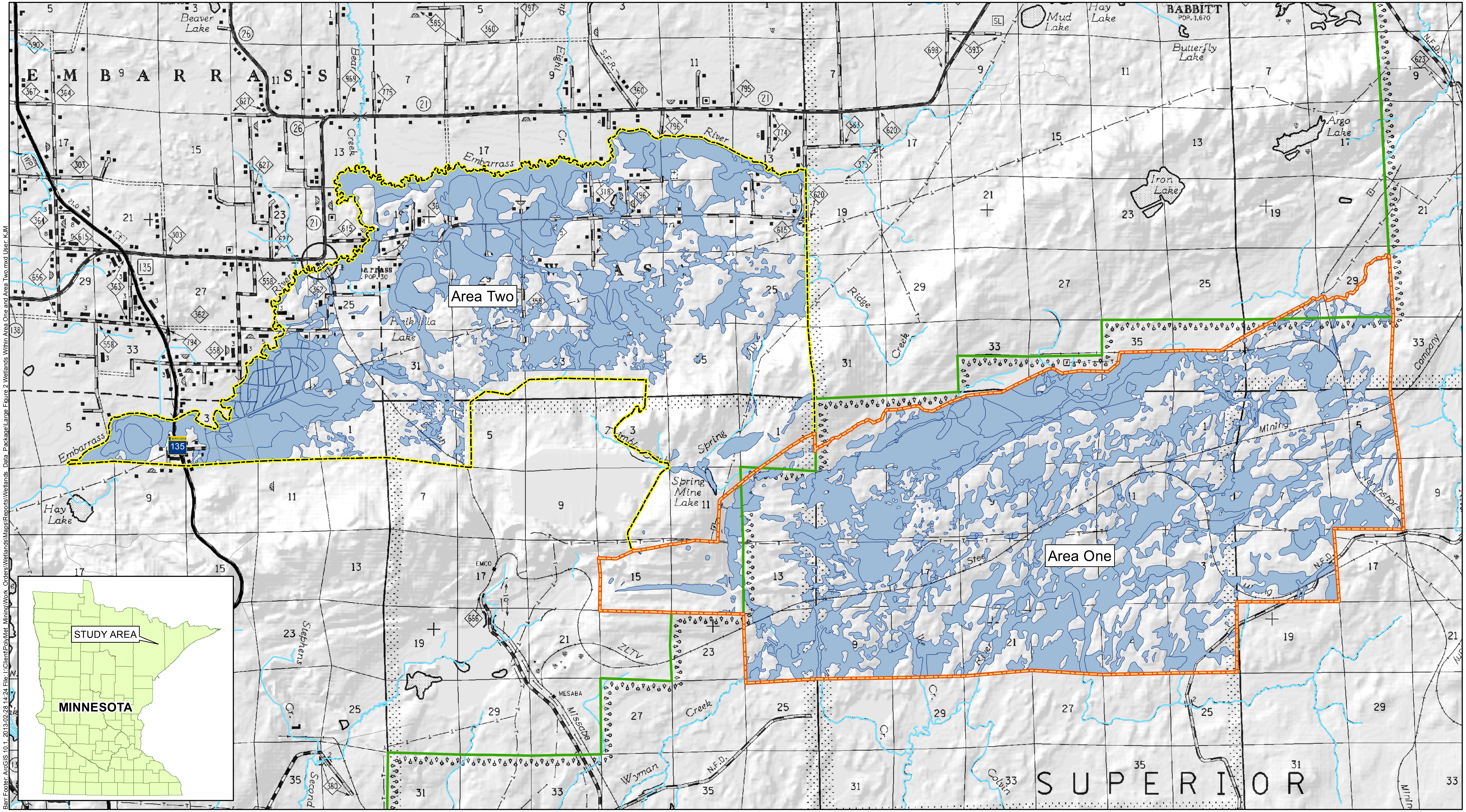


Project Areas
Rivers & Streams

N

0 2,250 4,500 9,000
Feet

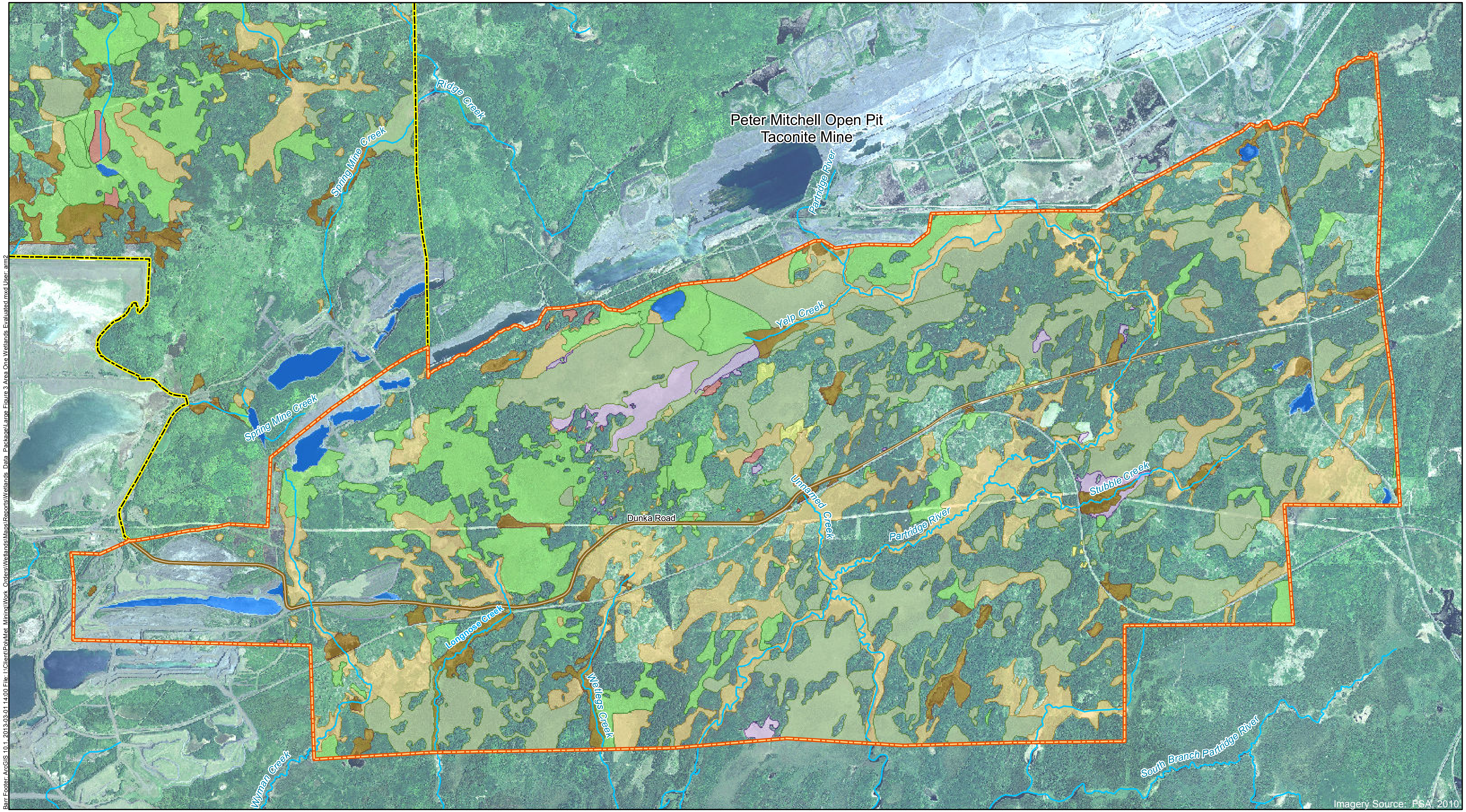
Large Figure 1
PROJECT AREAS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Area One
Area Two
National Forest Boundary
Wetlands
Streams

0 0.625 1.25 2.5
Miles

Large Figure 2
WETLANDS WITHIN
AREA ONE AND AREA TWO
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

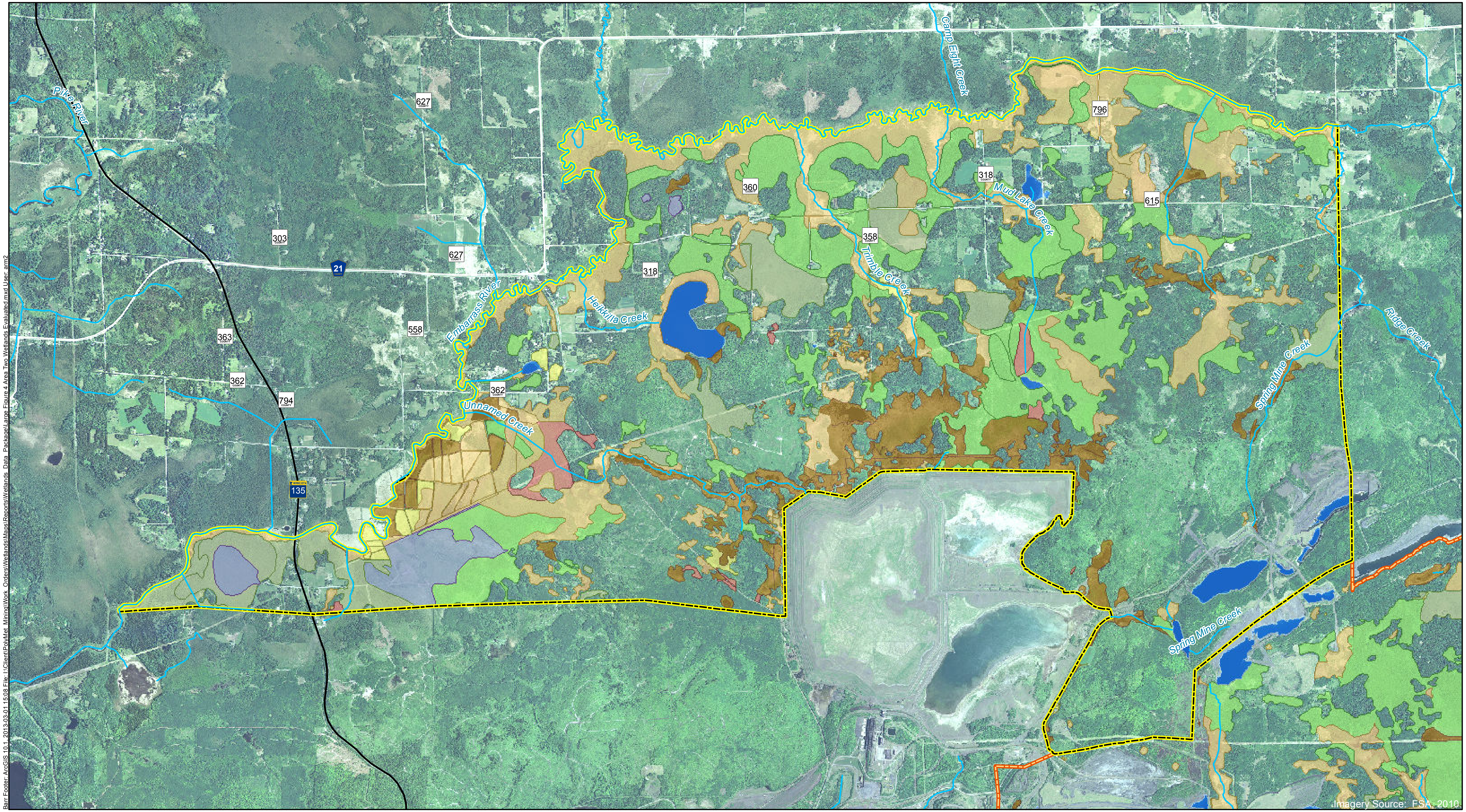


Area One
Area Two
Eggers & Reed Wetland Types
Shrub Swamps (Alder thickets & Shrub-carrs)
Coniferous bog
Coniferous swamp
Deep marsh; Shallow marsh
Hardwood swamp
Open water (Shallow, open water & lakes)
Open bog
Sedge meadow; Wet meadow
Dunka Road
Rivers & Streams

N

0 2,000 4,000 8,000
Feet

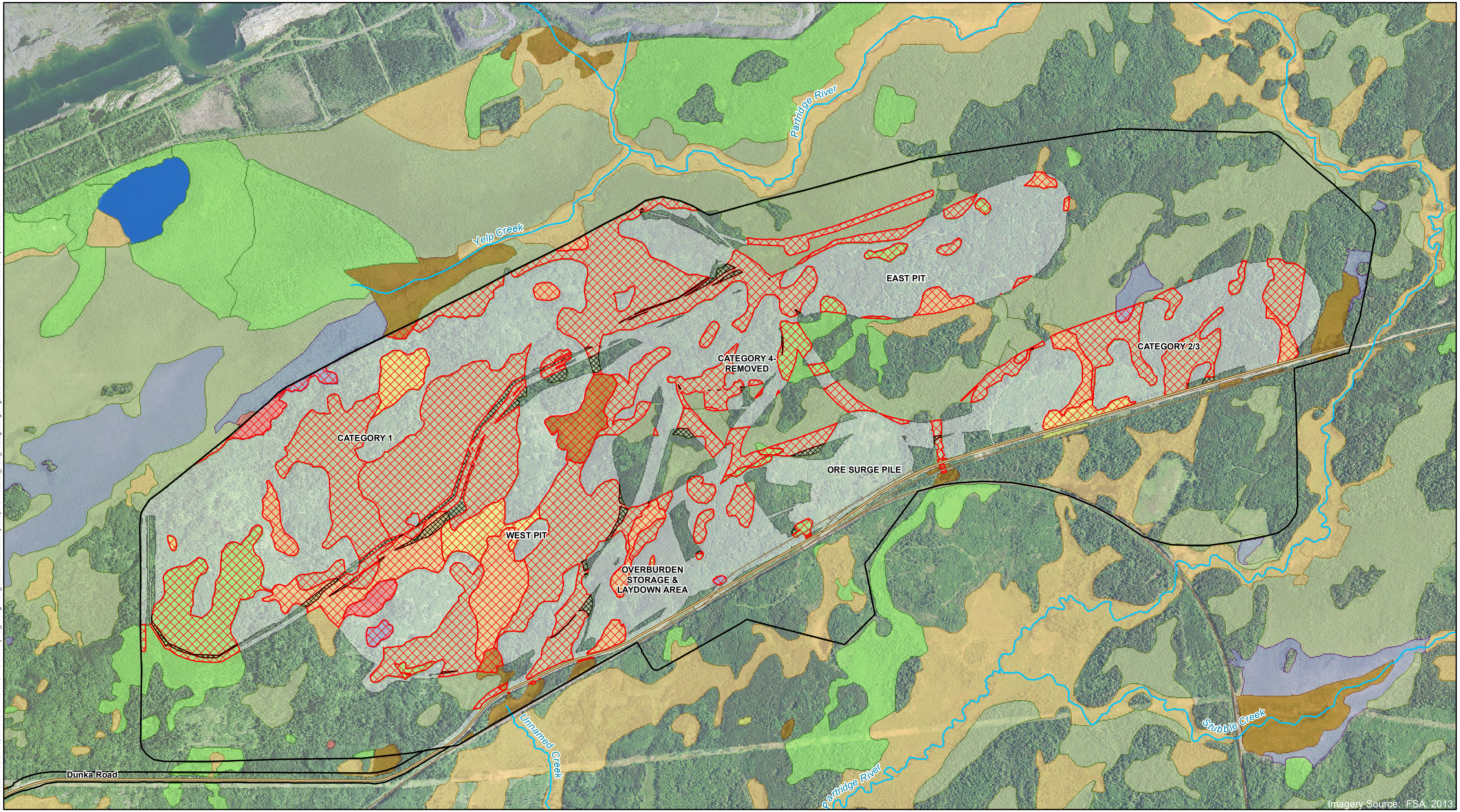
Large Figure 3
AREA ONE -
WETLANDS EVALUATED
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Area Two
Area One
Rivers & Streams
Eggers & Reed Wetland Types
Shrub Swamps (Alder thickets & Shrub-carrs)
Coniferous bog
Coniferous swamp
Deep marsh; Shallow marsh
Hardwood swamp
Open water (Shallow, open water & lakes)
Open bog
Sedge meadow; Wet meadow

0 2,000 4,000 8,000
Feet

Large Figure 4
AREA TWO -
WETLANDS EVALUATED
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Mine Site
Areas Disturbed by Proposed Project Features
Direct Wetland Impacts
Fragmented Wetlands

Eggers & Reed Wetland Types
Shrub Swamps (Alder thickets & Shrub-carrs)
Coniferous bog
Coniferous swamp
Deep marsh; Shallow marsh
Hardwood swamp
Open water (Shallow, open water & lakes)
Open bog
Sedge meadow; Wet meadow

N

0 750 1,500 3,000
Feet

Large Figure 5
MINE SITE AREA WETLANDS AND DIRECT WETLAND IMPACTS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

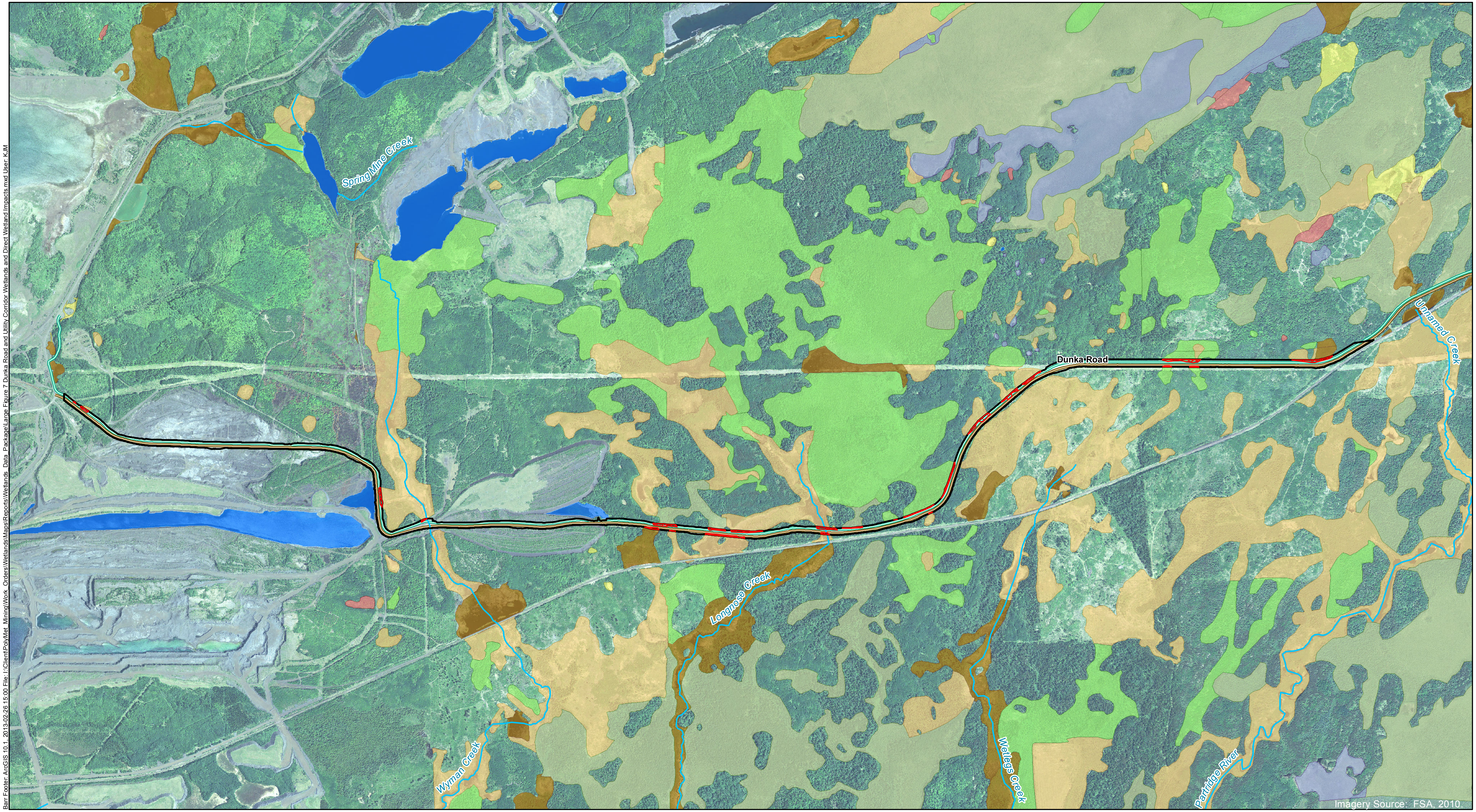
Railroad Connection Corridor
Proposed Track
Existing Railroad
Dunka Road
Areas Disturbed by Proposed Project Features
Direct Wetland Impacts

Eggers & Reed Wetland Types
Shrub Swamps (Alder thickets & Shrub-carrs)
Coniferous bog
Coniferous swamp
Deep marsh; Shallow marsh
Hardwood swamp
Open water (Shallow, open water & lakes)
Open bog
Sedge meadow; Wet meadow

N

0 250 500 1,000
Feet

Large Figure 6
RAILROAD CONNECTION CORRIDOR WETLANDS AND DIRECT WETLAND IMPACTS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



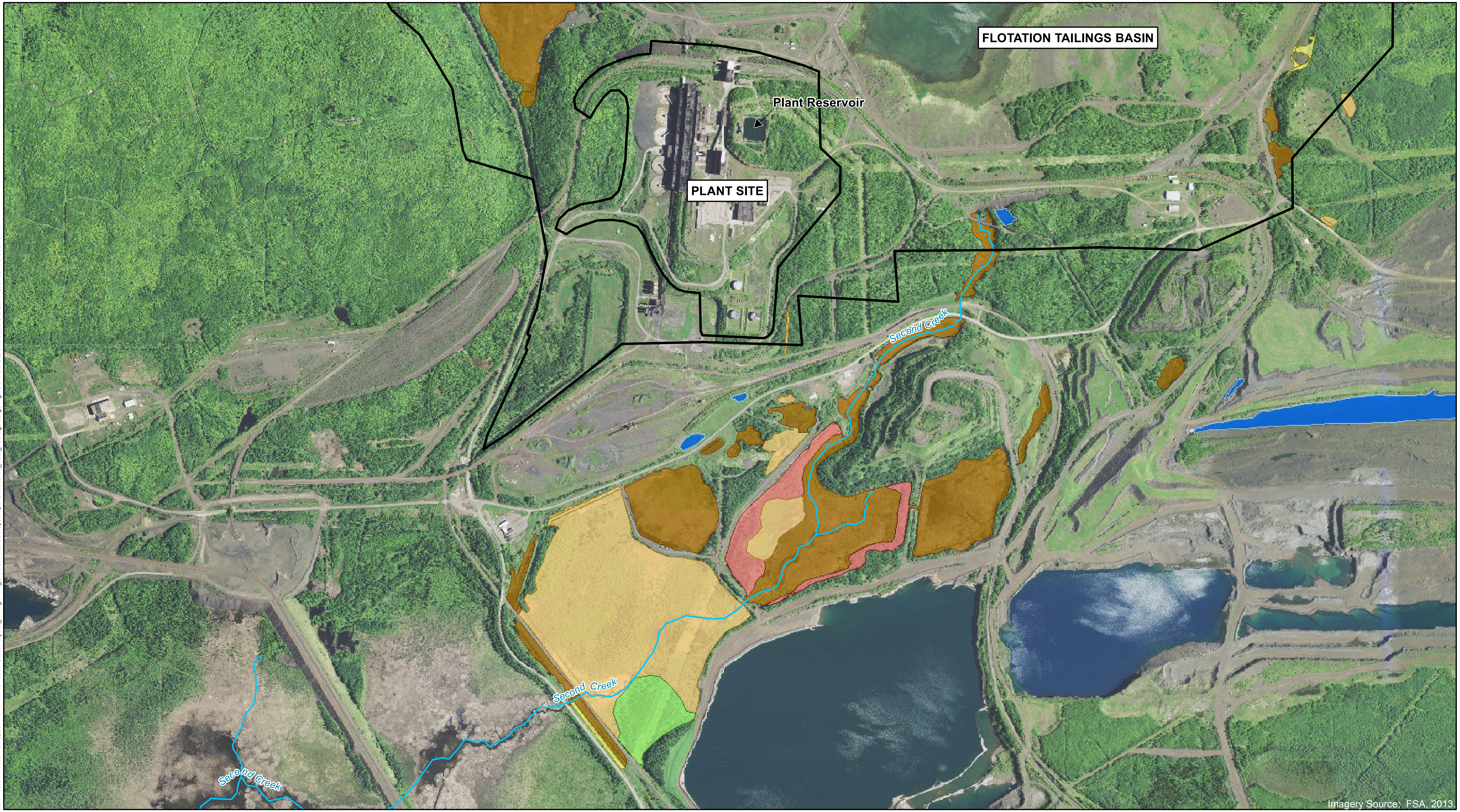
Dunka Road and Utility Corridor
Dunka Road
Treated Water Pipeline
Areas Disturbed by Proposed Project Features
Direct Wetland Impacts

Eggers & Reed Wetland Types
Shrub Swamps (Alder thickets & Shrub-carrs)
Coniferous bog
Coniferous swamp
Deep marsh; Shallow marsh
Hardwood swamp
Open water (Shallow, open water & lakes)
Open bog
Sedge meadow; Wet meadow

0 1,000 2,000 4,000
Feet

Large Figure 7
DUNKA ROAD AND UTILITY CORRIDOR WETLANDS AND DIRECT WETLAND IMPACTS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

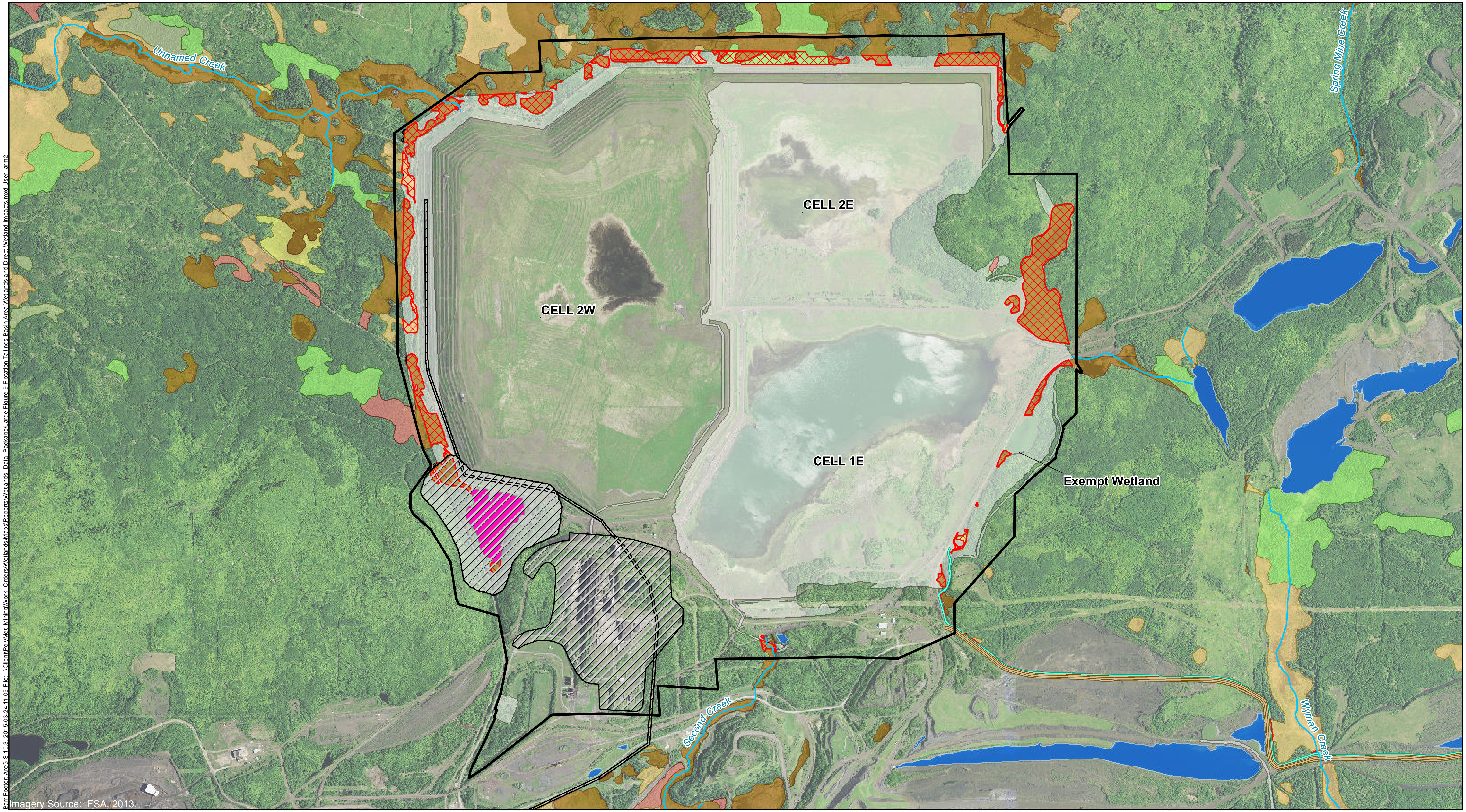
Barr Footer: ArcGIS 10.1, 2013-02-26 15:00 File: I:\Client\PolyMet_Mining\Work_Orders\Wetlands\Maps\Reports\Wetlands_Data_Package\Large Figure 7 Dunka Road and Utility Corridor Wetlands and Direct Wetland Impacts.mxd User: KJM



Project Area
Rivers & Streams
Eggers & Reed Wetland Types
Shrub Swamps (Alder thickets & Shrub-carrs)
Coniferous bog
Coniferous swamp
Deep marsh; Shallow marsh
Hardwood swamp
Open water (Shallow, open water & lakes)
Open bog
Sedge meadow; Wet meadow

0 600 1,200 2,400
Feet

Large Figure 8
PLANT SITE AND
SECOND CREEK WETLANDS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



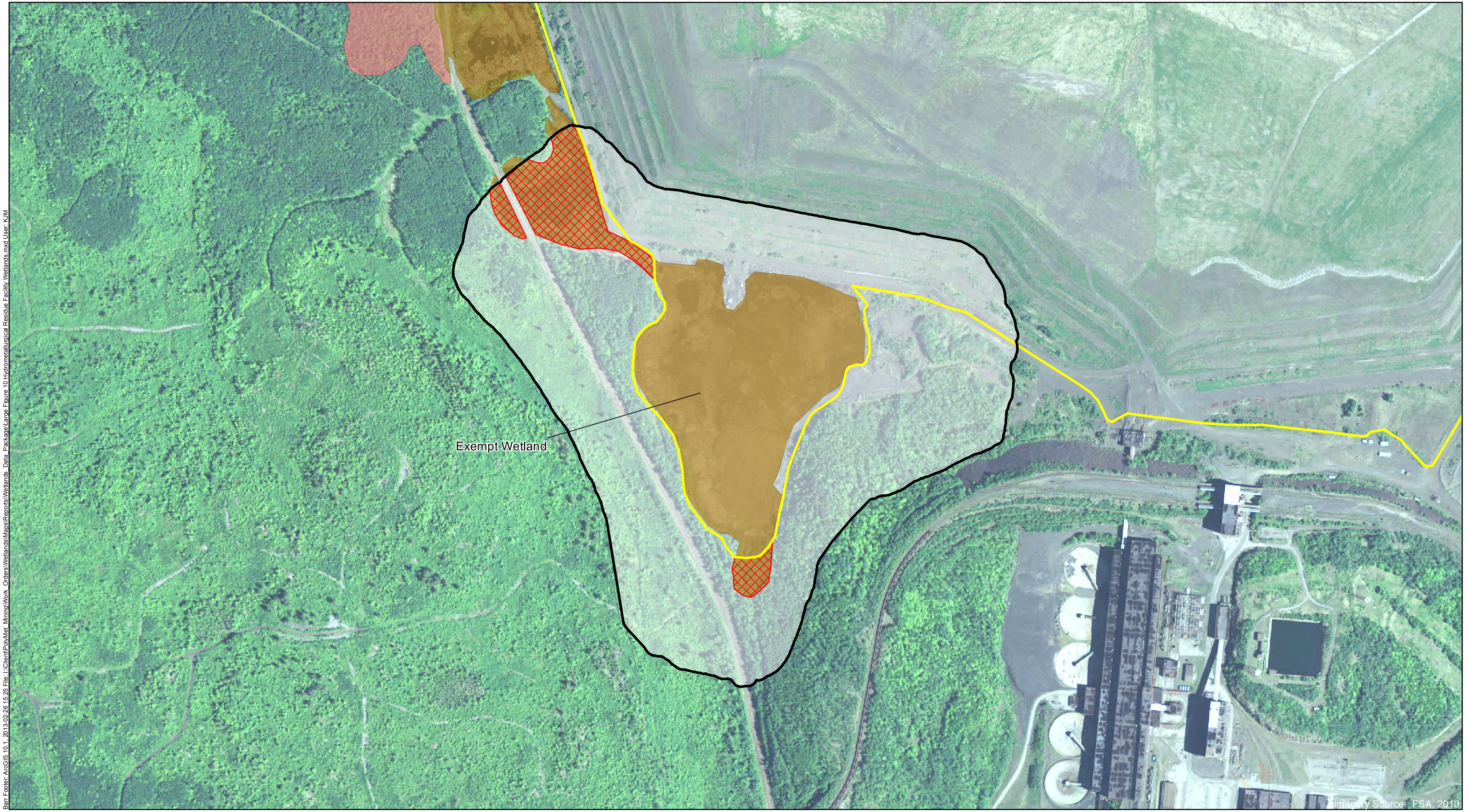
- Tailings Basin
- Areas Excluded from Tailings Basin Boundary
- Dunka Road
- Treated Water Pipeline
- Areas Disturbed by Proposed Project Features
- Direct Wetland Impacts
- Fragmented Wetlands
- Exempt Wetlands

Eggers & Reed Wetland Types

- Shrub Swamps (Alder thickets & Shrub-carrs)
- Coniferous bog
- Coniferous swamp
- Deep marsh; Shallow marsh
- Hardwood swamp
- Open water (Shallow, open water & lakes)
- Open bog
- Sedge meadow; Wet meadow

0 1,000 2,000 4,000
Feet

Large Figure 9
FLOTATION TAILINGS BASIN AREA WETLANDS
AND DIRECT WETLAND IMPACTS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



- Hydrometallurgical Residue Facility
- Cliffs Erie, LLC Permit to Mine Ultimate Tailings Basin Limit
- Areas Disturbed by Proposed Project Features
- Direct Wetland Impacts

Eggers & Reed Wetland Types

- Shrub Swamps (Alder thickets & Shrub-carrs)
- Coniferous bog
- Coniferous swamp
- Deep marsh; Shallow marsh
- Hardwood swamp
- Open water (Shallow, open water & lakes)
- Open bog
- Sedge meadow; Wet meadow

N

0 250 500 1,000

Feet

Large Figure 10
HYDROMETALLURGICAL RESIDUE FACILITY
WETLANDS AND DIRECT WETLAND IMPACTS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

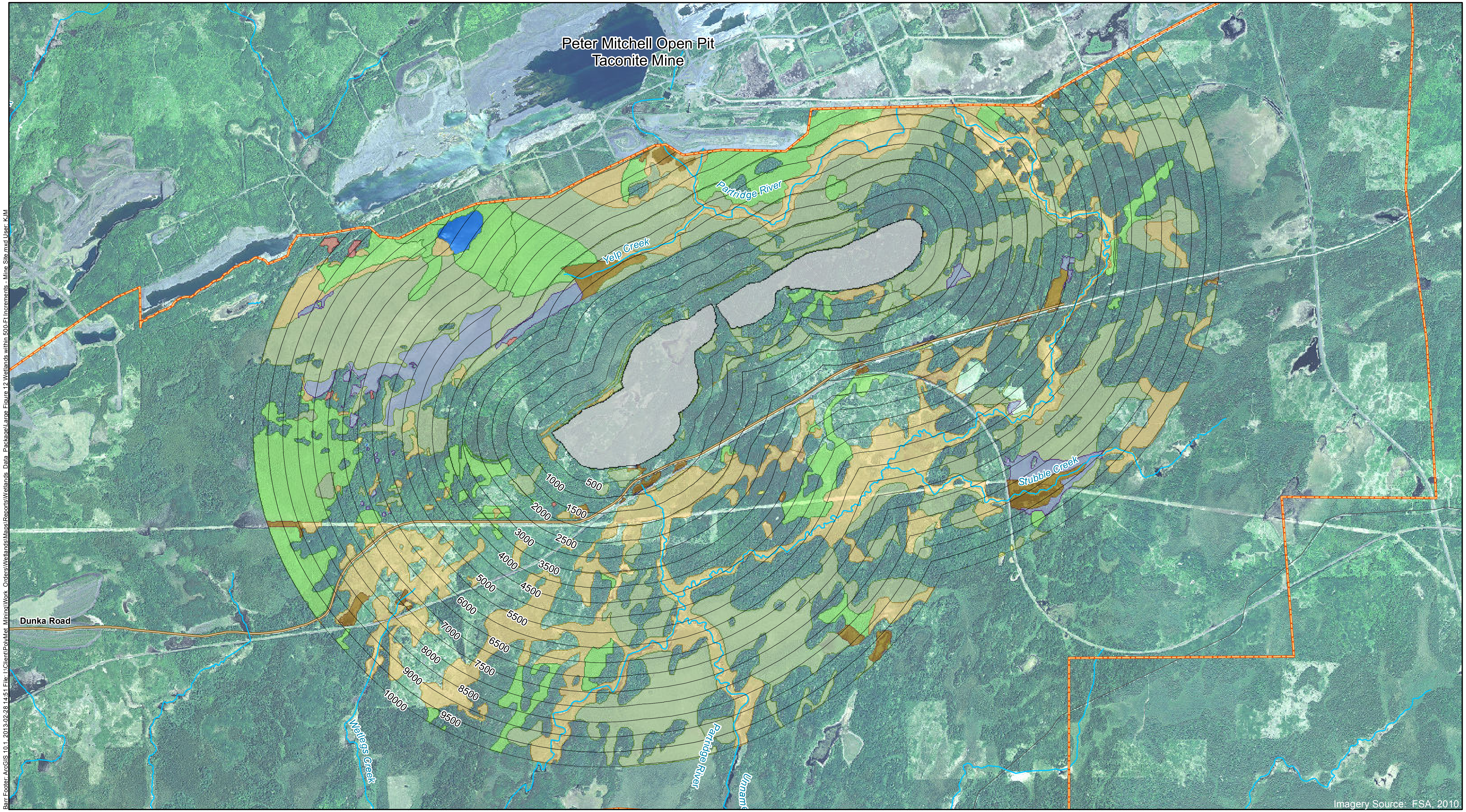
Colby Lake Water Pipeline Evaluation Area

Eggers & Reed Wetland Types

- Shrub Swamps (Alder thickets & Shrub-carrs)
- Coniferous bog
- Coniferous swamp
- Deep marsh; Shallow marsh
- Hardwood swamp
- Open water (Shallow, open water & lakes)
- Open bog
- Sedge meadow; Wet meadow

0 750 1,500 3,000
Feet

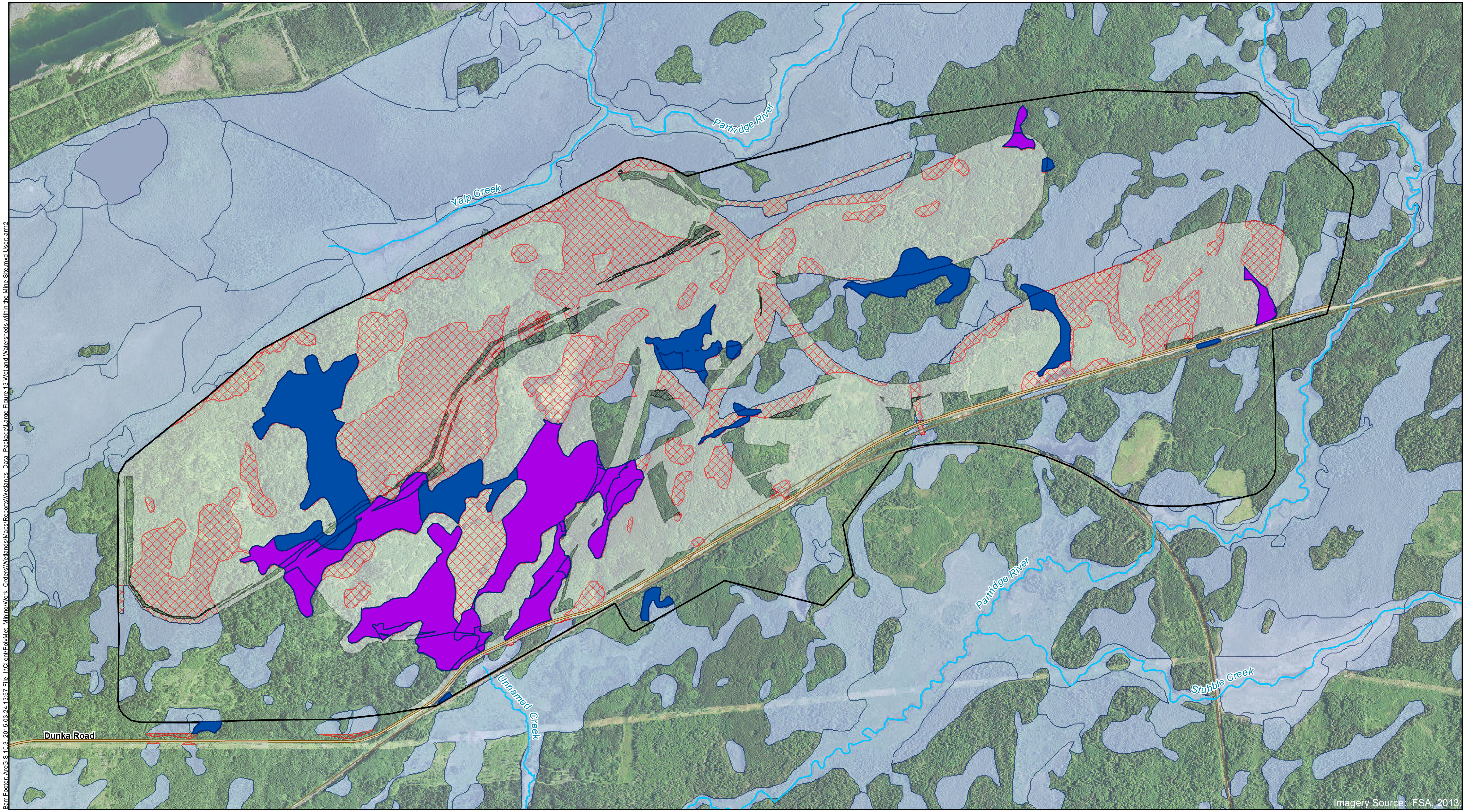
Large Figure 11
COLBY LAKE WATER PIPELINE WETLANDS
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, MInnesota



500-Ft Increments
Baseline Type Evaluation Study Areas
Area One
Eggers & Reed Wetland Types
Shrub Swamps (Alder thickets & Shrub-carrs)
Coniferous bog
Coniferous swamp
Deep marsh; Shallow marsh
Hardwood swamp
Open water (Shallow, open water & lakes)
Open bog
Sedge meadow; Wet meadow
Dunka Road
Rivers & Streams

0 1,500 3,000 6,000
Feet

Large Figure 12
WETLANDS WITHIN 500-FT
INCREMENTS - MINE SITE AREA
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

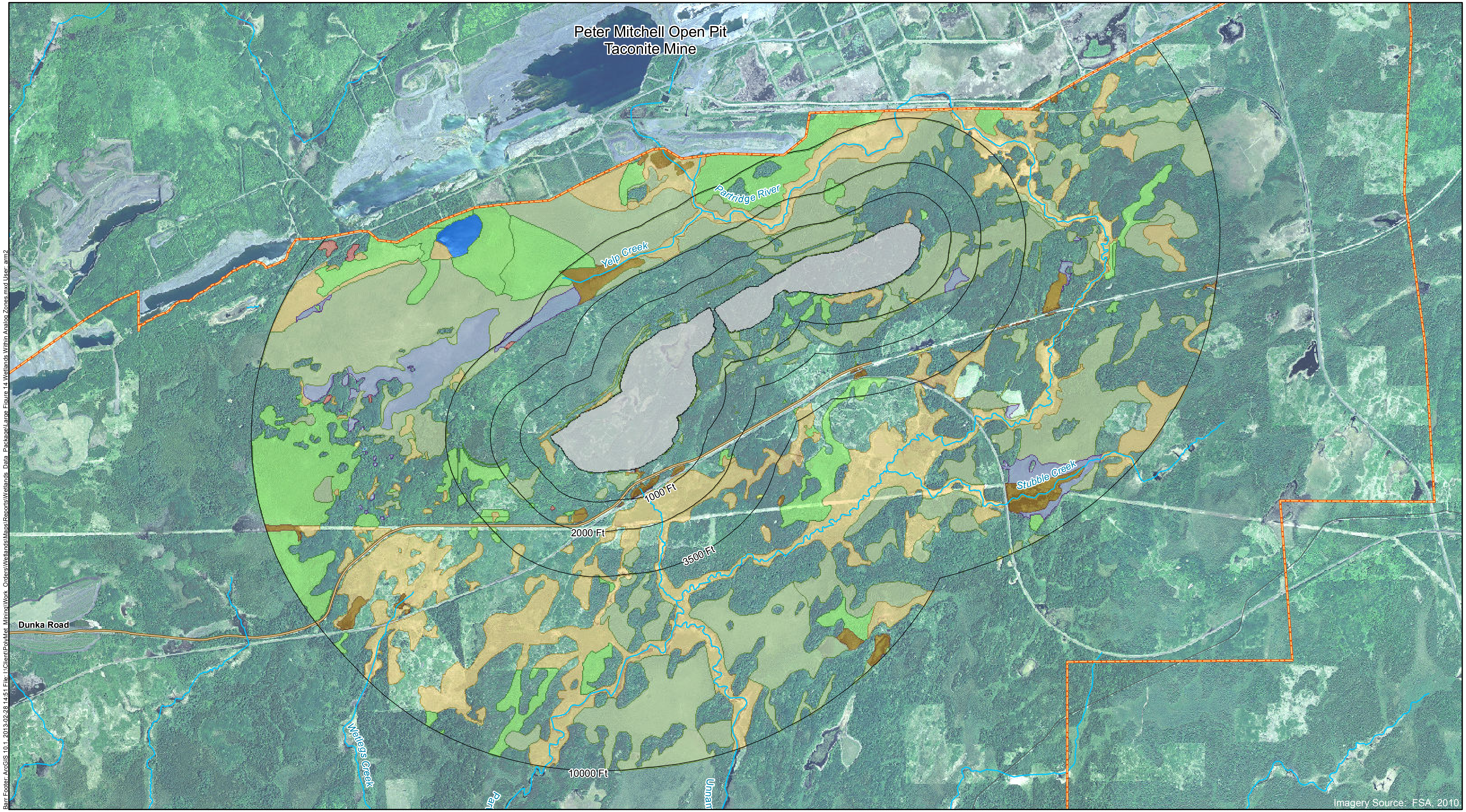


Mine Site
Areas Disturbed by Proposed Project Features
Dunka Road
Direct Wetland Impact
Fragmented Wetland
Wetland

Potential Indirect Wetland Impacts
Decrease in Yield per Wetland Acre of Greater Than 20%
Increase in Yield per Wetland Acre of Greater Than 20%

0 750 1,500 3,000
Feet

Large Figure 13
WETLANDS POTENTIALLY INDIRECTLY IMPACTED BY CHANGE IN WATERSHED AREA
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

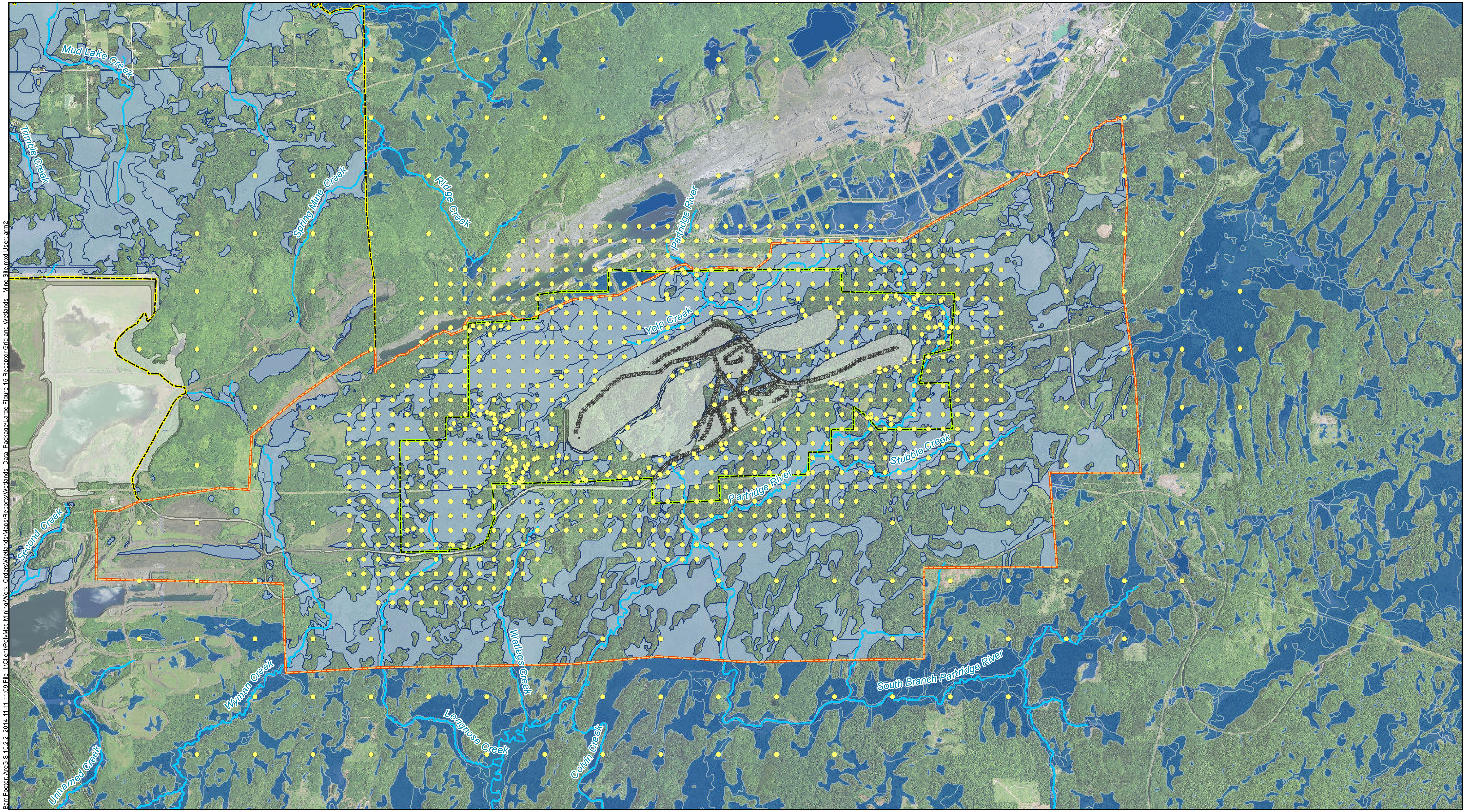


- Analog Impact Zones (Feet)
- 20 Year Mine Pit
- Baseline Type Evaluation Study Area One

Eggers & Reed Wetland Types
- Shrub Swamps (Alder thickets & Shrub-carrs)
- Coniferous bog
- Coniferous swamp
- Deep marsh; Shallow marsh
- Hardwood swamp
- Open water (Shallow, open water & lakes)
- Open bog
- Sedge meadow; Wet meadow
- Dunka Road
- Rivers & Streams

0 1,500 3,000 6,000
Feet

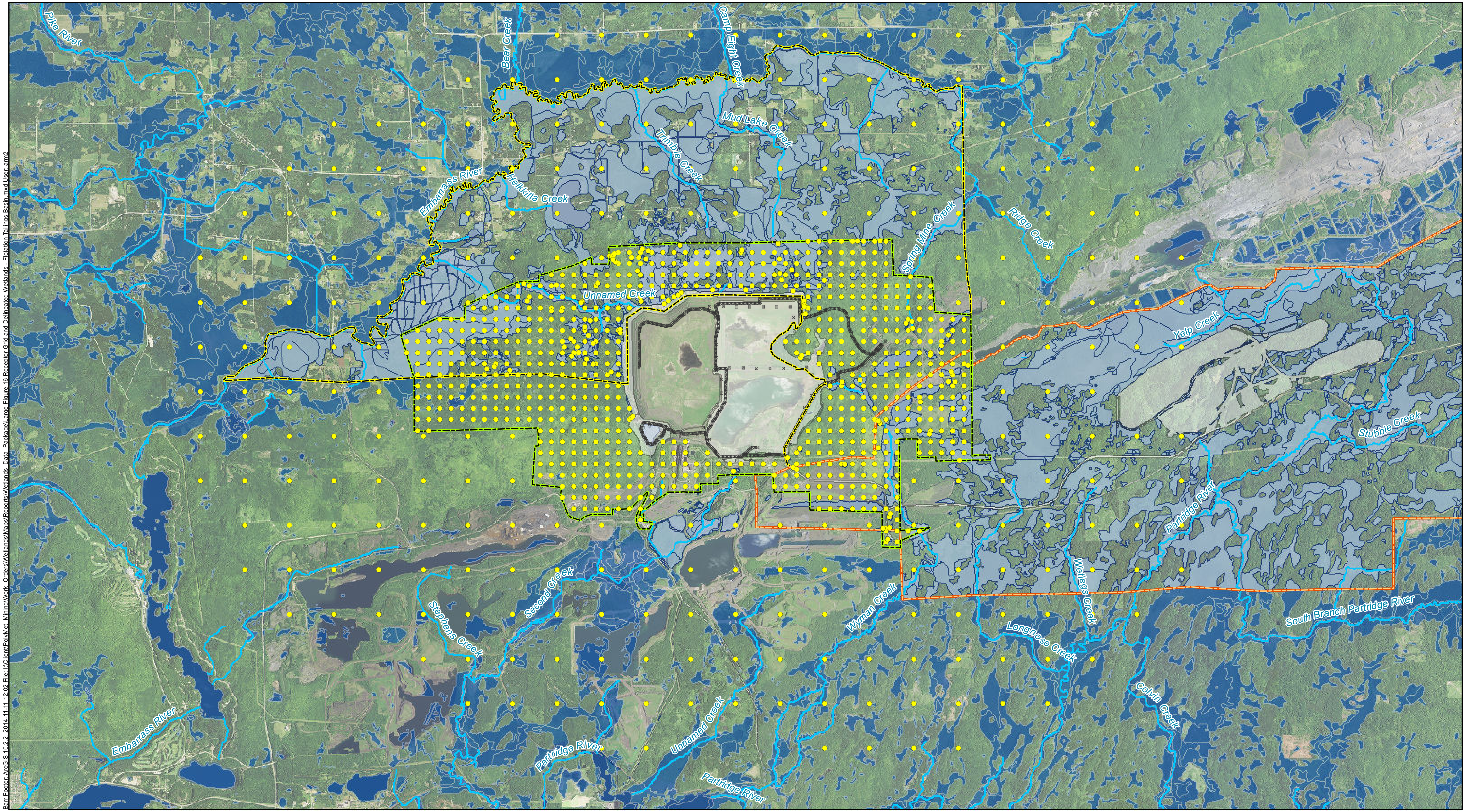
Large Figure 14
WETLANDS WITHIN ANALOG ZONES
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Receptor Grid
Volume Sources (Roads)
Areas Disturbed by Proposed Project Features
Ambient Air Boundary
Baseline Type Evaluation Study Areas
Area One
Area Two
Wetlands
National Wetland Inventory (NWI)
Rivers and Streams

0 2,500 5,000 10,000
Feet

Large Figure 15
RECEPTOR GRID AND
WETLANDS - MINE SITE
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



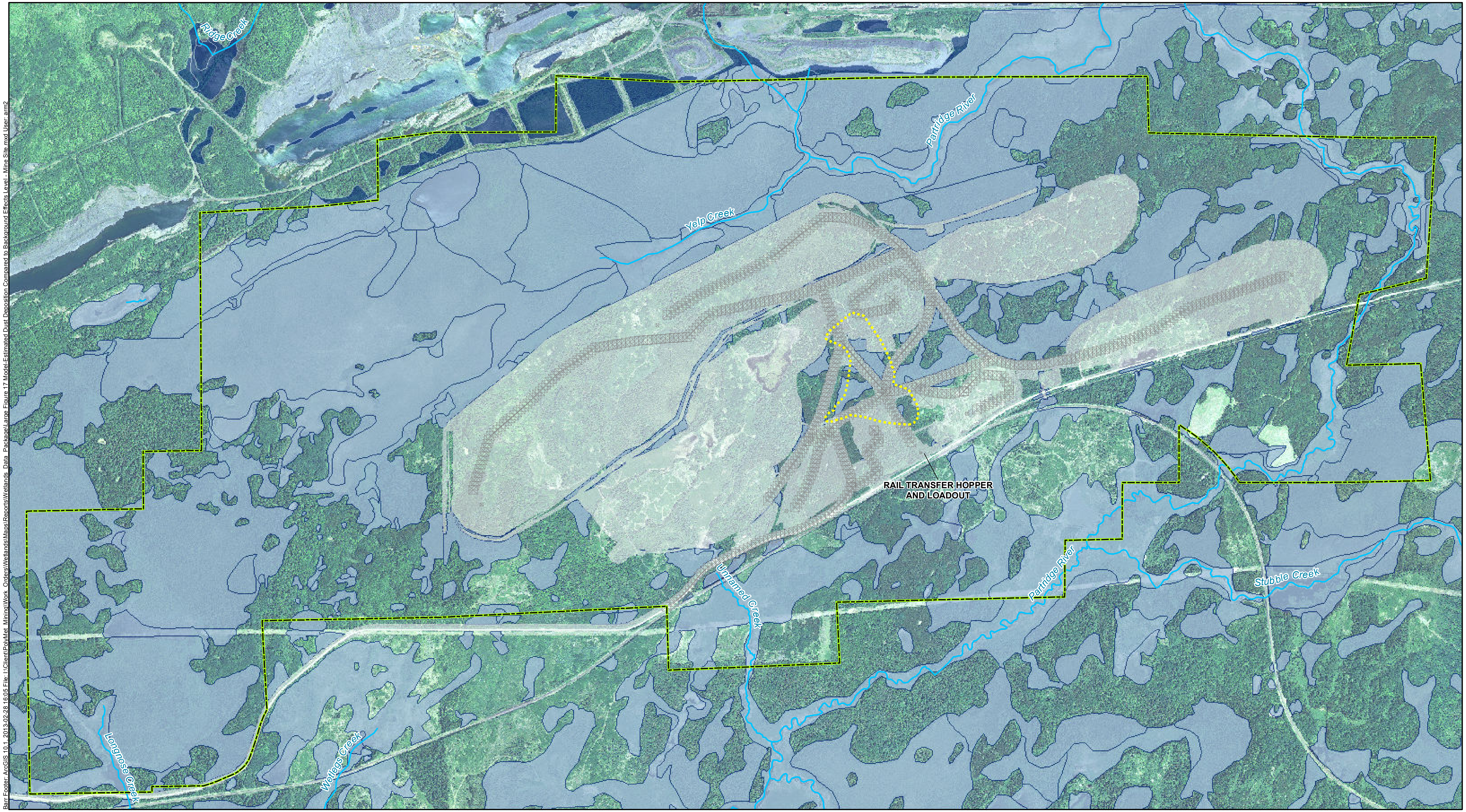
- Receptor Grid
- Volume Sources (Roads)
- Areas Disturbed by Proposed Project Features
- Ambient Air Boundary

Baseline Type Evaluation Study Areas

- Area One
- Area Two
- Wetlands
- National Wetland Inventory (NWI)
- Rivers and Streams

0 0.625 1.25 2.5
Miles

Large Figure 16
RECEPTOR GRID AND WETLANDS - FLOTATION TAILINGS BASIN
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Extent of Highest Estimated Deposition Receptors with Deposition of 25% of Background

Volume Sources (Roads)

Areas Disturbed by Proposed Project Features

Ambient Air Boundary

Wetlands

National Wetland Inventory (NWI)

Rivers and Streams

0 1,000 2,000 4,000

Feet

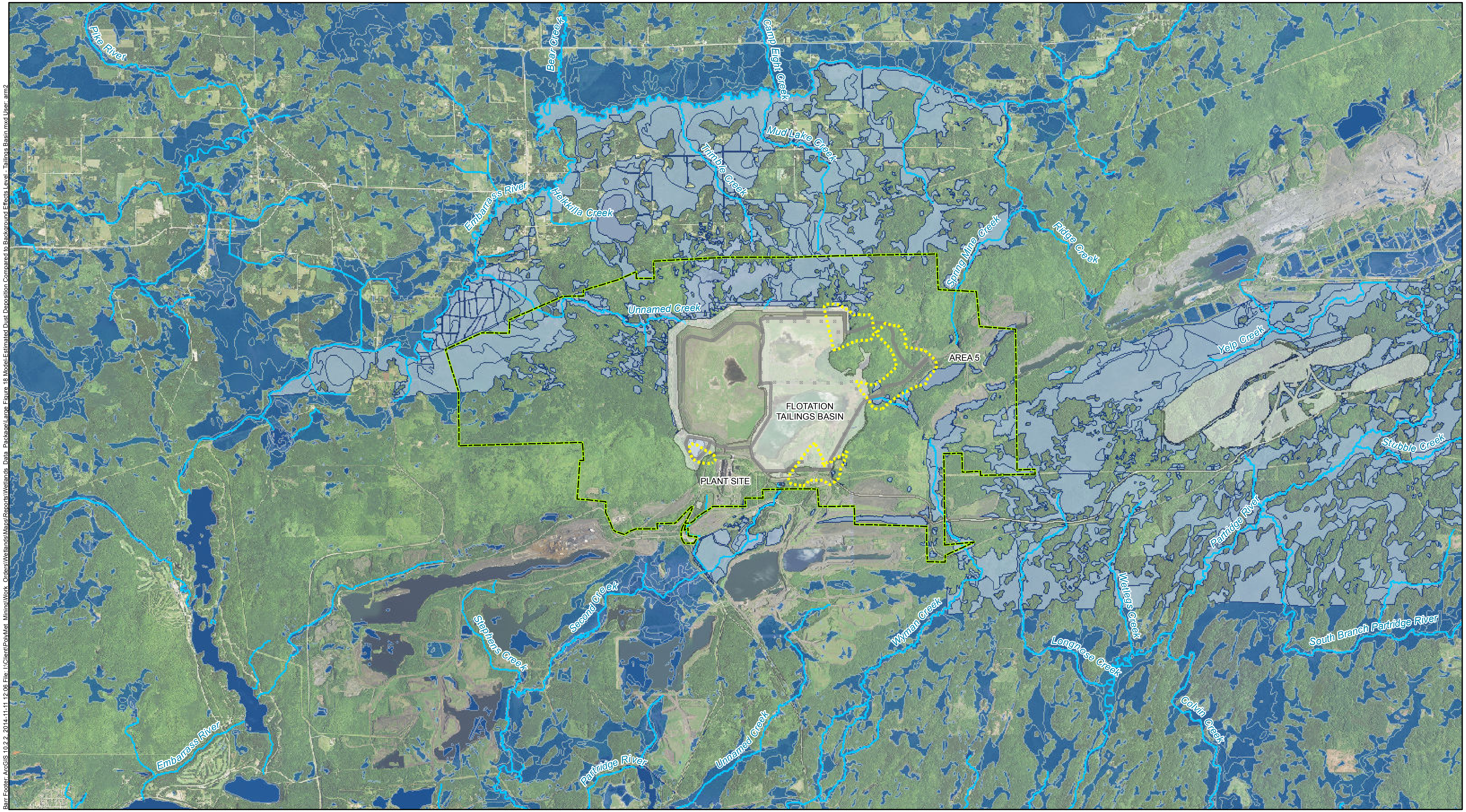
Large Figure 17

MODEL-ESTIMATED DUST DEPOSITION COMPARED TO BACKGROUND EFFECTS LEVEL - MINE SITE

NorthMet Project

Poly Met Mining Inc.

Hoyt Lakes, Minnesota



Extent of Highest Estimated Deposition Receptors with Deposition of 50% of Background

Rivers and Streams

Volume Sources (Roads)

Areas Disturbed by Proposed Project Features

Ambient Air Boundary

Wetlands

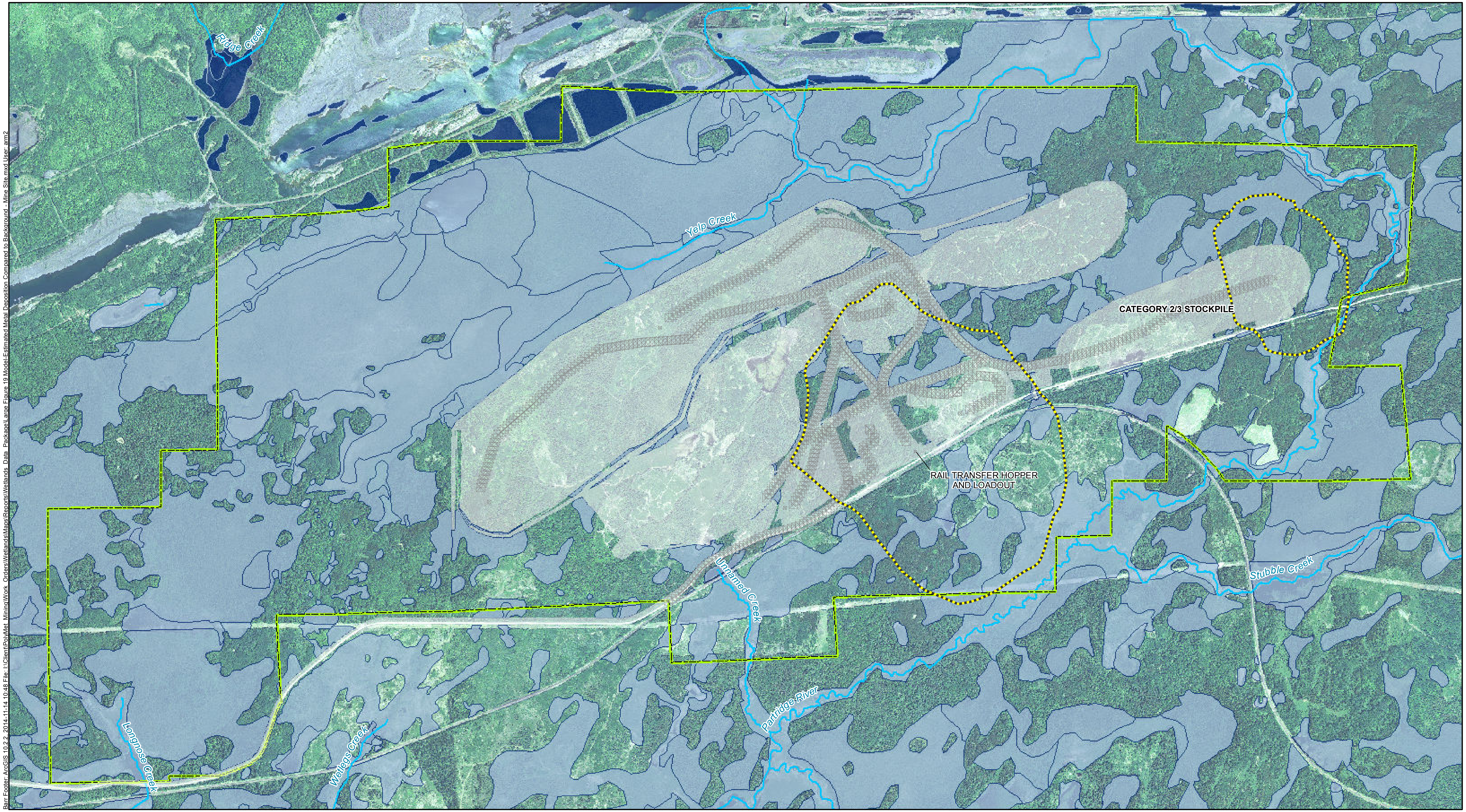
National Wetland Inventory (NWI)

N

0 0.625 1.25 2.5

Miles

Large Figure 18
MODEL-ESTIMATED DUST DEPOSITION
COMPARED TO BACKGROUND
EFFECTS LEVEL - FLOTATION TAILINGS BASIN
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Extent of Highest Estimated Deposition Receptors with Deposition of 100% of Background

Volume Sources (Roads)

Ambient Air Boundary

Areas Disturbed by Proposed Project Features

National Wetland Inventory (NWI)

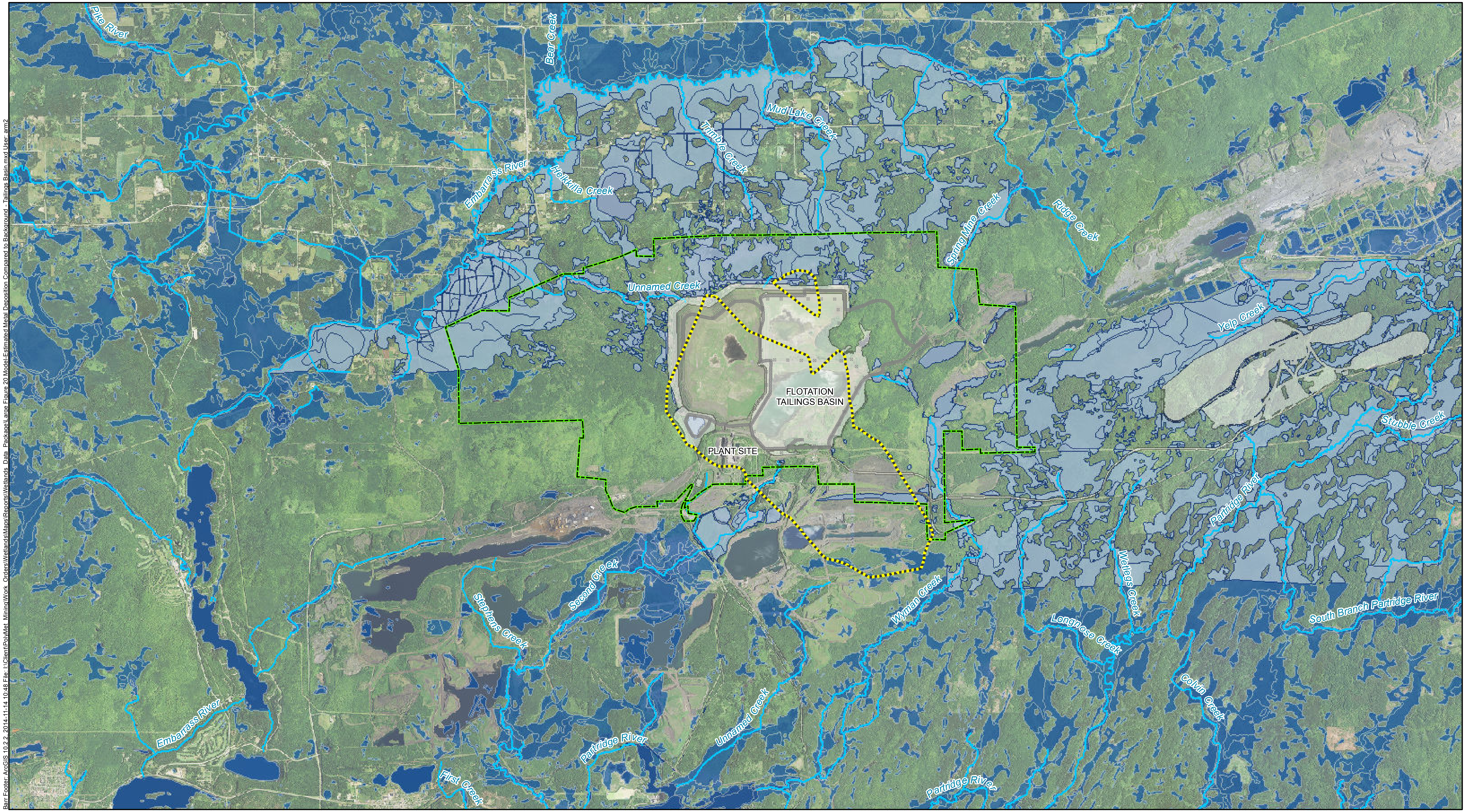
Wetlands

Rivers and Streams

0 1,000 2,000 4,000

Feet

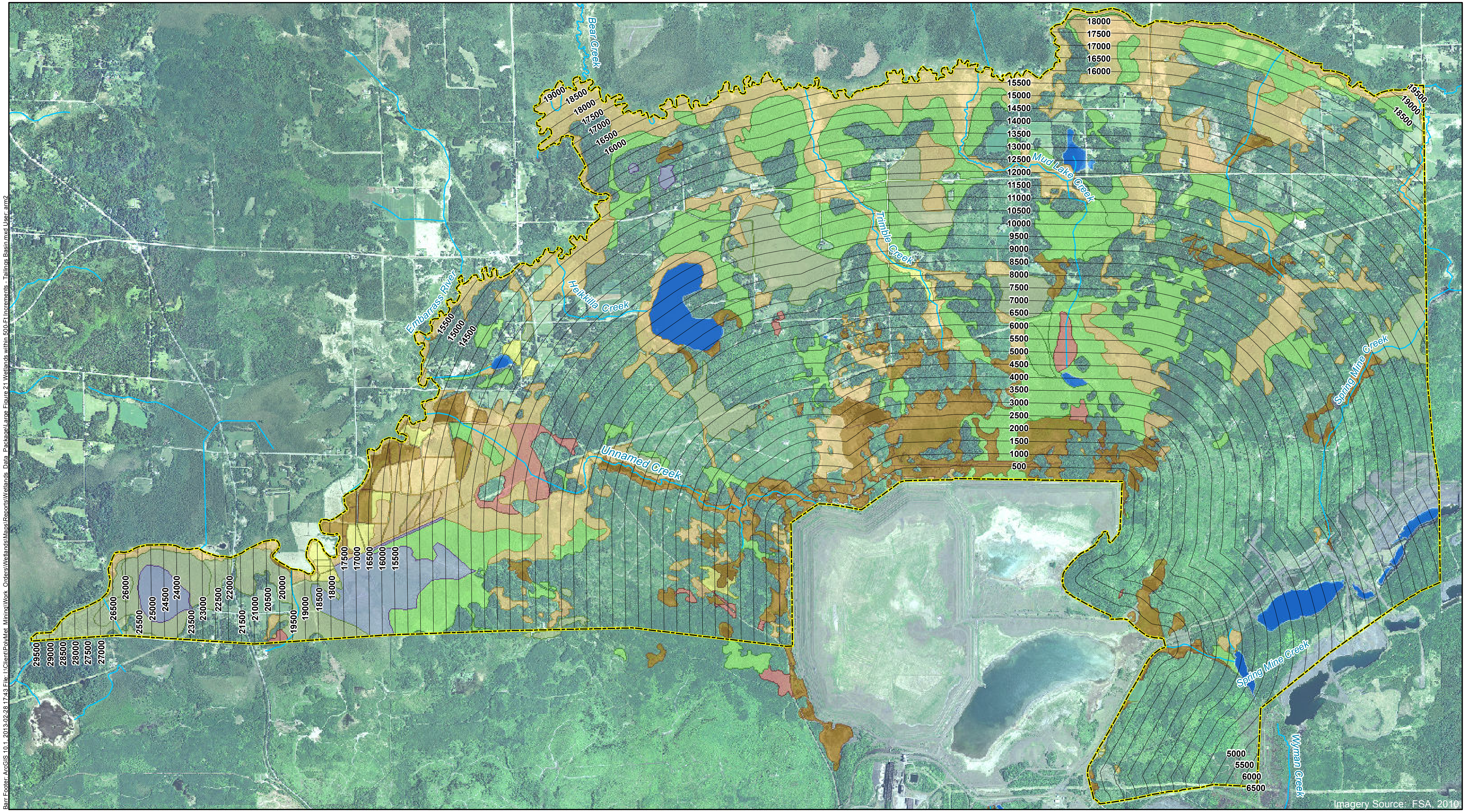
Large Figure 19
MODEL - ESTIMATED METAL DEPOSITION
COMPARED TO BACKGROUND
EFFECTS LEVEL - MINE SITE
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



- Extent of Highest Estimated Deposition Receptors with Deposition of 100% of Background
- Rivers and Streams
- Volume Sources (Roads)
- Ambient Air Boundary
- Areas Disturbed by Proposed Project Features
- Wetlands
- National Wetland Inventory (NWI)

0 0.625 1.25 2.5
Miles

Large Figure 20
MODEL - ESTIMATED METAL DEPOSITION COMPAREDTO BACKGROUND EFFECTS LEVEL - FLOTATION TAILINGS BASIN
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



500-Ft Increments

Baseline Type Evaluation Study Area Two

Area Two

Eggers & Reed Wetland Types

Shrub Swamps (Alder thickets & Shrub-carrs)

Coniferous bog

Coniferous swamp

Deep marsh; Shallow marsh

Hardwood swamp

Open water (Shallow, open water & lakes)

Open bog

Sedge meadow; Wet meadow

Rivers & Streams

0 1,750 3,500 7,000

Feet

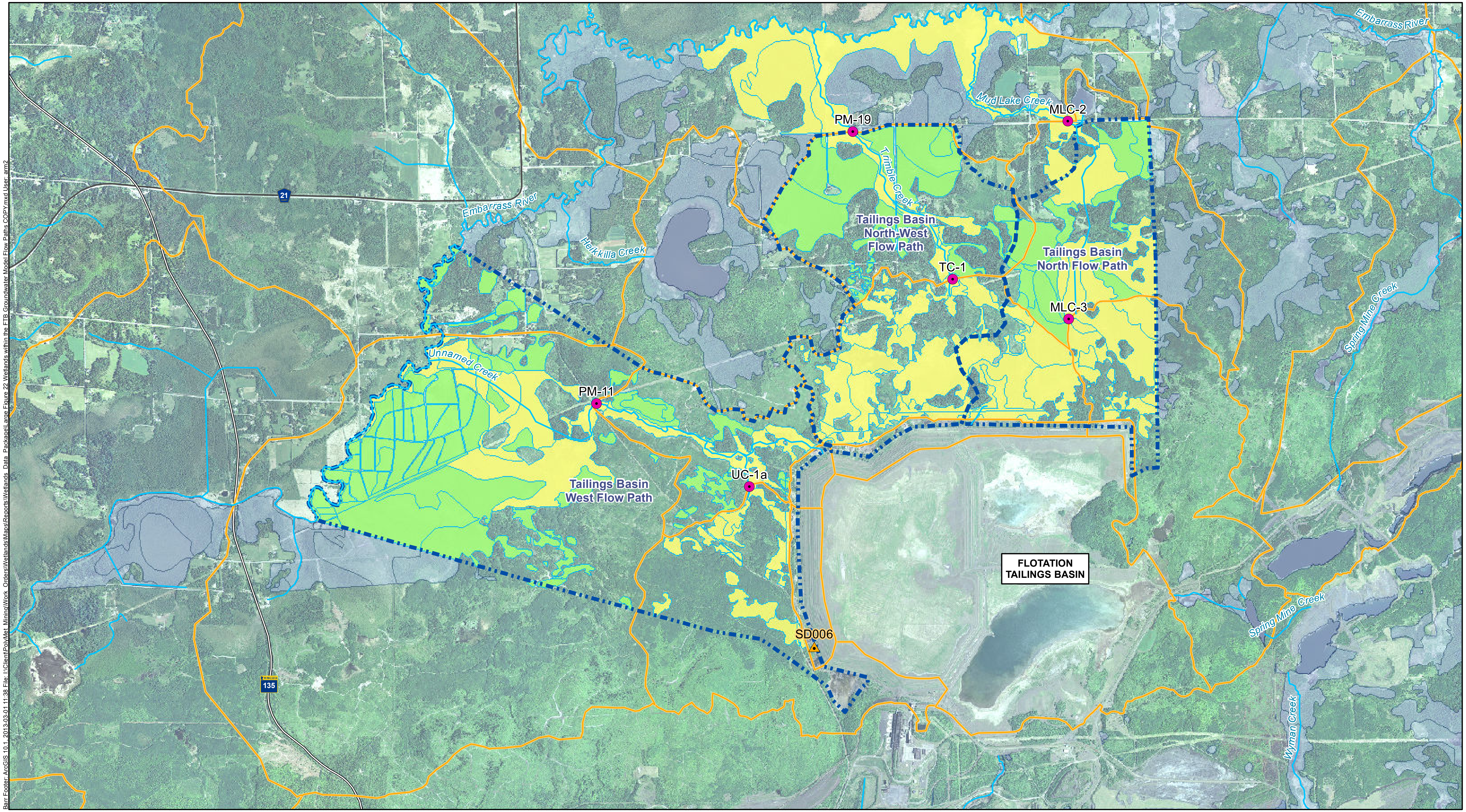
Large Figure 21

WETLANDS WITHIN 500-FT INCREMENTS - FLOTATION TAILINGS BASIN AREA

NorthMet Project

Poly Met Mining Inc.

Hoyt Lakes, Minnesota

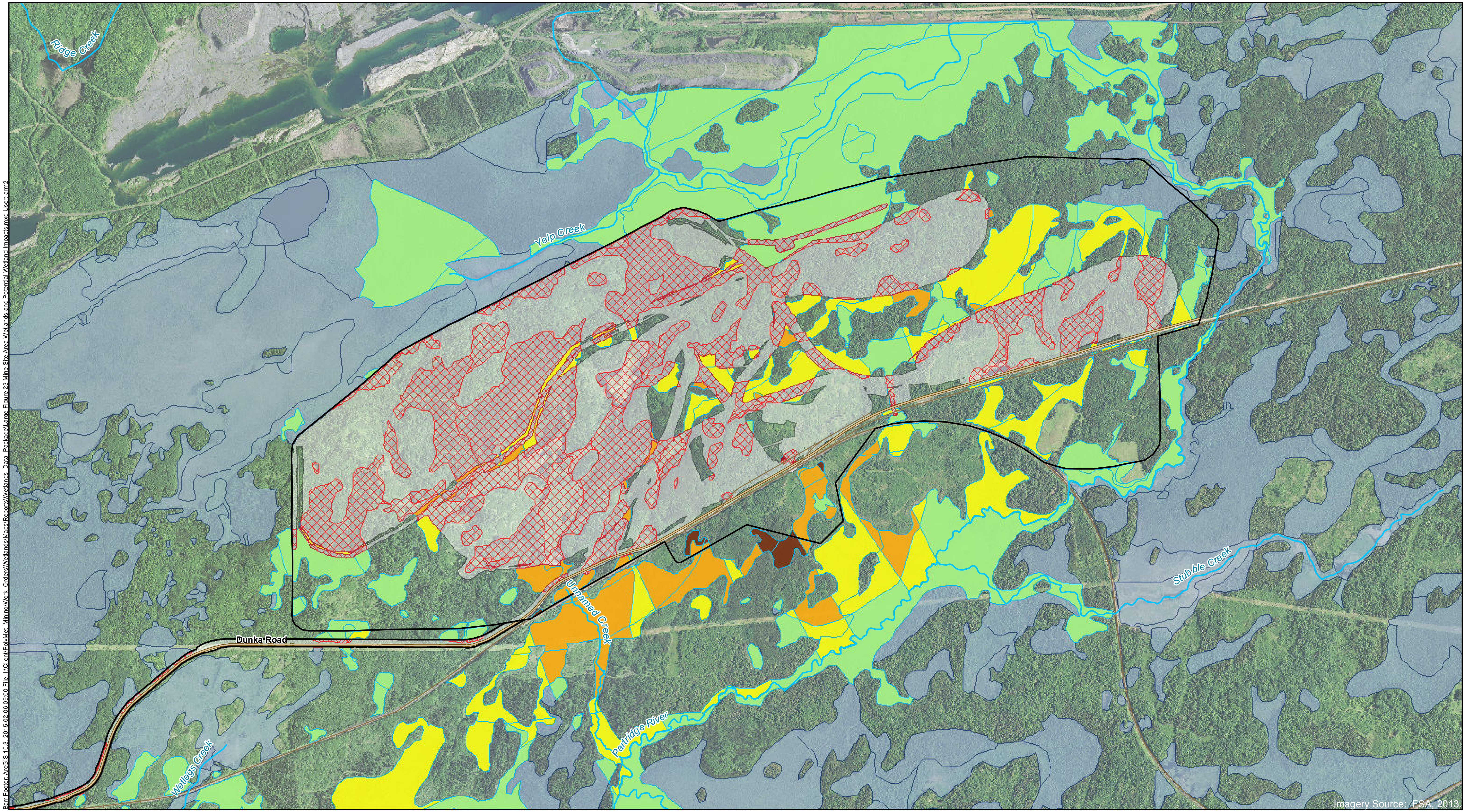


- Surface Water Model Evaluation Location
- Approximate Location of Project Surface Water Discharge
- Rivers and Streams
- Subwatersheds with Project
- Groundwater Flow Path
- Wetlands

Wetlands with Potential for Indirect Impacts
- Surface Water and Groundwater
- Groundwater Only

0 1,500 3,000 6,000
Feet

Large Figure 22
WETLANDS WITHIN THE FTB
GROUNDWATER MODEL FLOW PATHS
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, MN



- Mine Site
- Areas Disturbed by Proposed Project Features
- Dunka Road
- Direct Wetland Impacts

Potential Wetland Indirect Impact Factor Rating

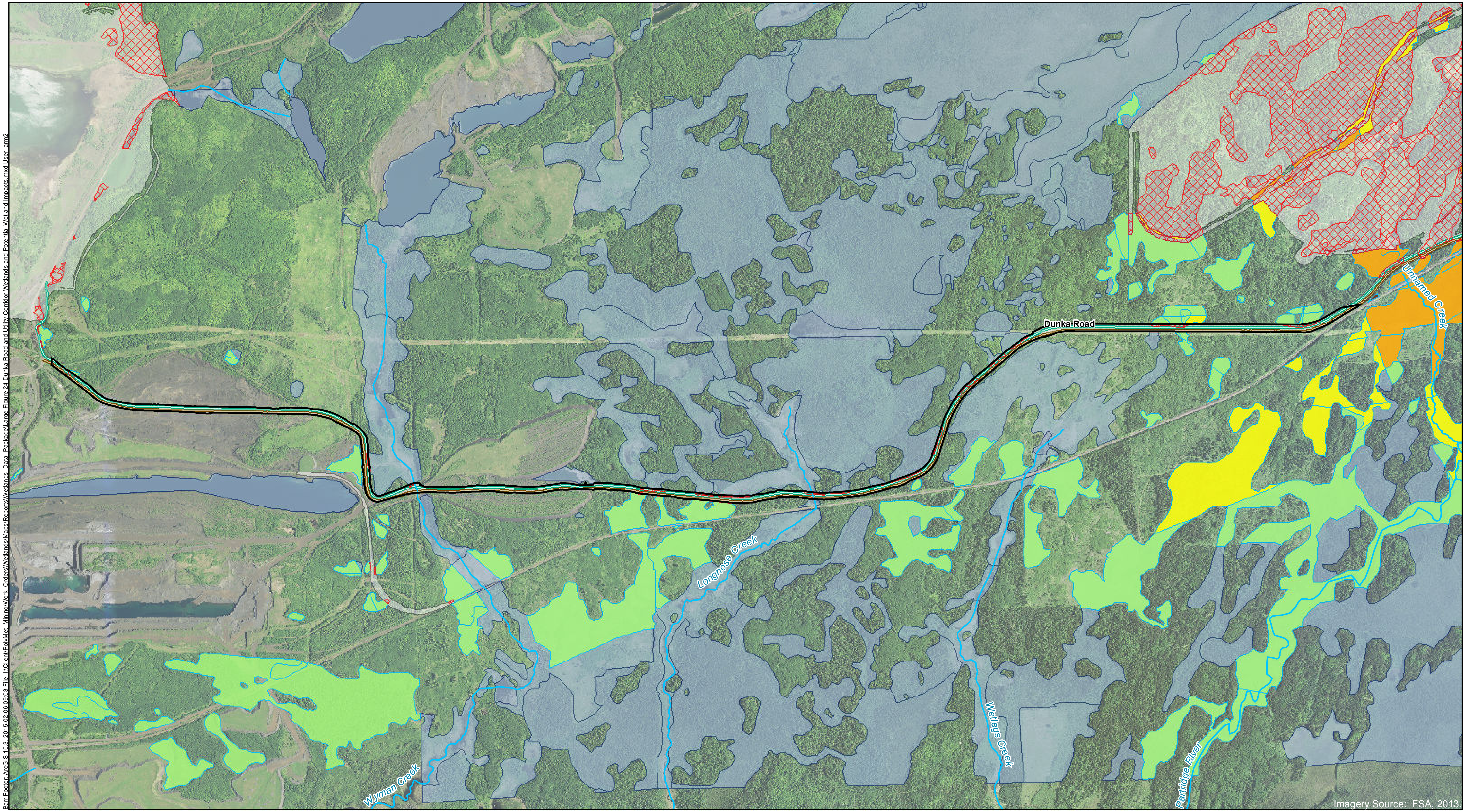
- 5
- 4
- 3
- 2
- 1
- No Impact

N

0 1,000 2,000 4,000

Feet

Large Figure 23
MINE SITE AREA WETLANDS AND POTENTIAL WETLAND IMPACTS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Barr Footer: ArcGIS 10.3, 2015-02-06 09:03 File: I:\Client\PolyMet_Mining\Work_Orders\Wetlands\Maps\Reports\Wetlands_Data_Package\Large Figure 24 Dunka Road and Utility Corridor Wetlands and Potential Wetland Impacts.mxd User: arm2

- Dunka Road and Utility Corridor
- Dunka Road
- Treated Water Pipeline
- Areas Disturbed by Proposed Project Features
- Direct Wetland Impacts

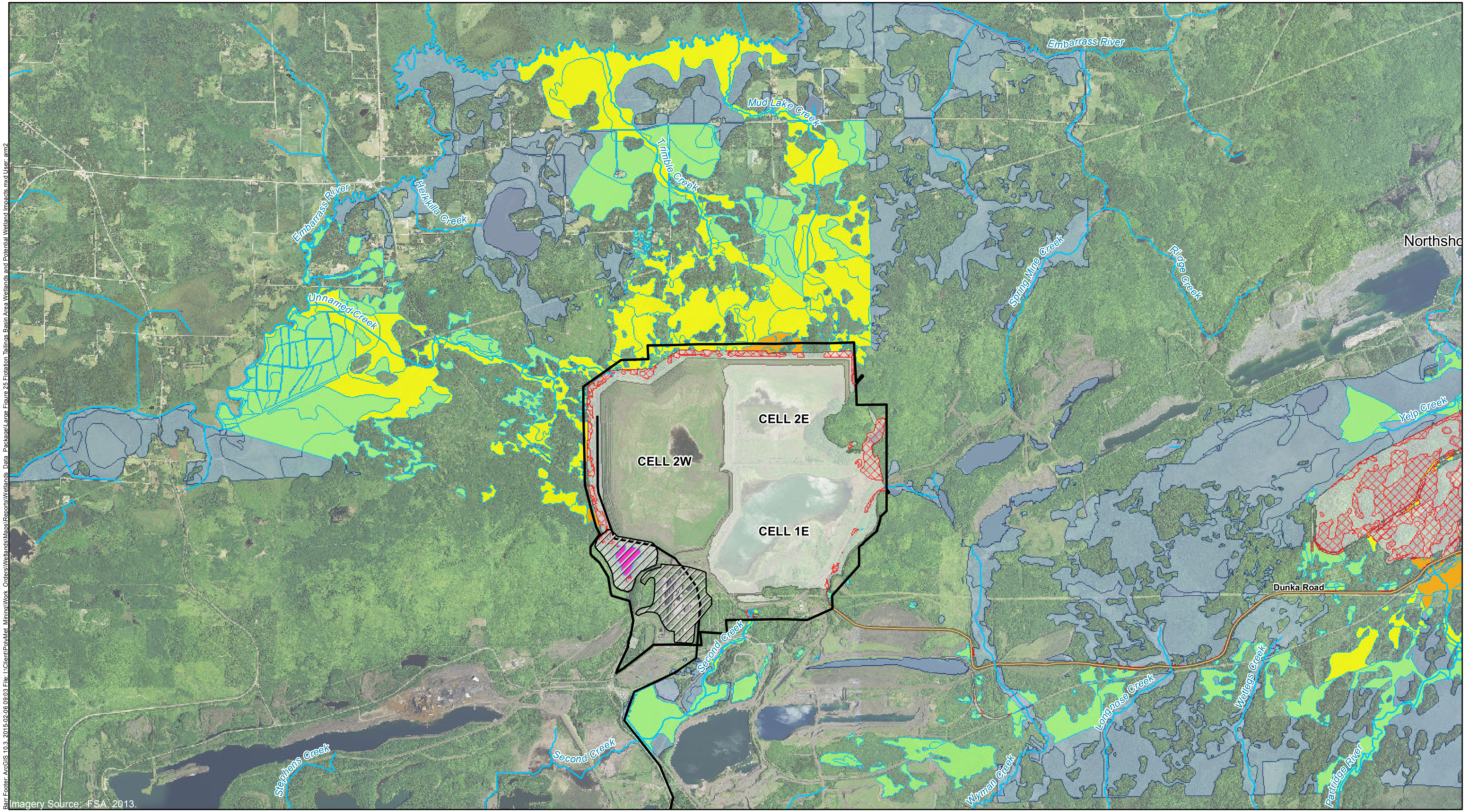
Potential Wetland Indirect Impact Factor Rating

- 4
- 3
- 2
- 1
- No Impact

N

0 1,000 2,000 4,000
Feet

Large Figure 24
DUNKA ROAD AND UTILITY CORRIDOR WETLANDS AND POTENTIAL WETLAND IMPACTS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



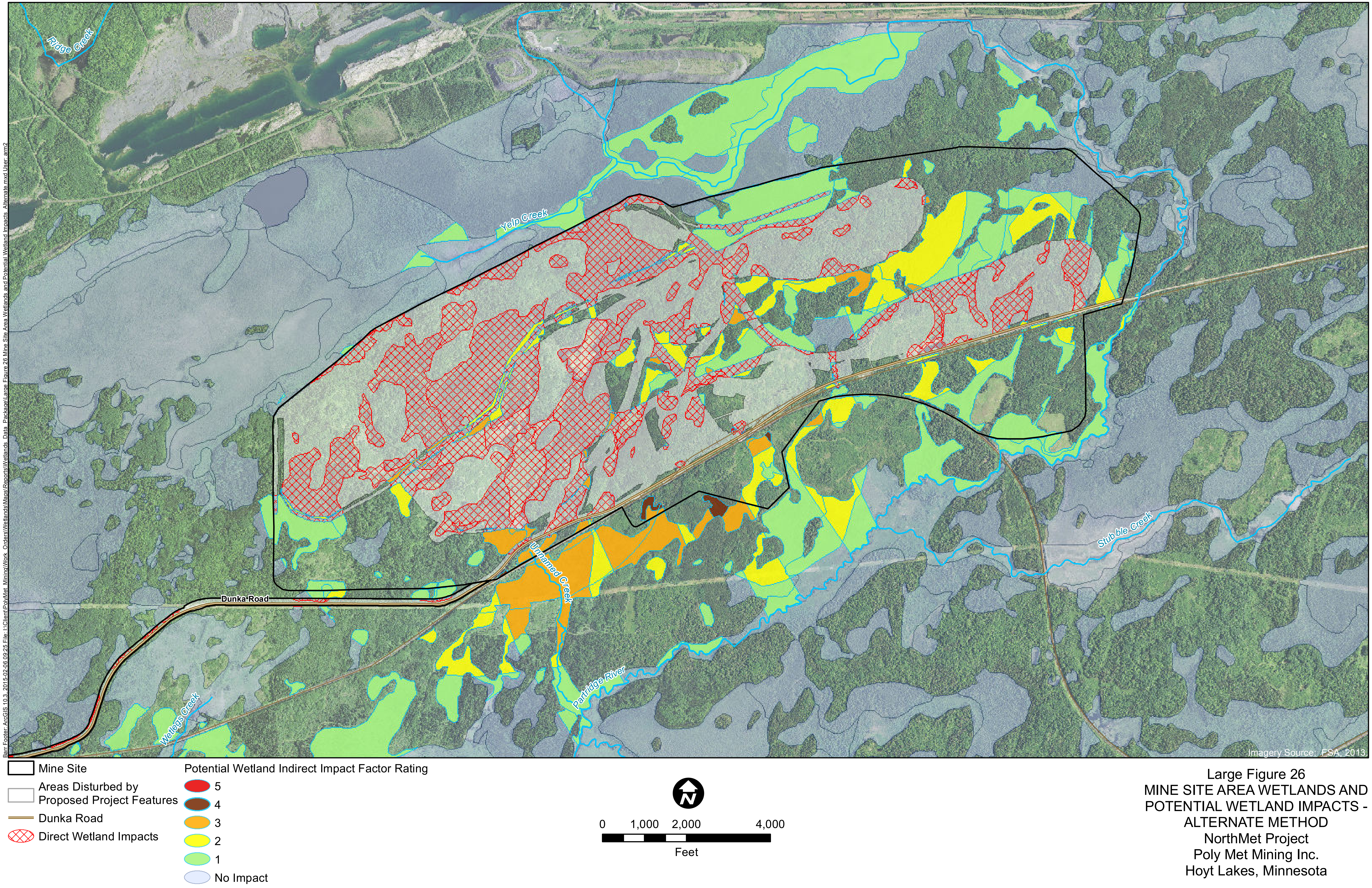
Tailings Basin
Areas Excluded from Tailings Basin Boundary
Areas Disturbed by Proposed Project Features
Dunka Road
Direct Wetland Impacts

Potential Wetland Indirect Impact Factor Rating
5
4
3
2
1
Exempt

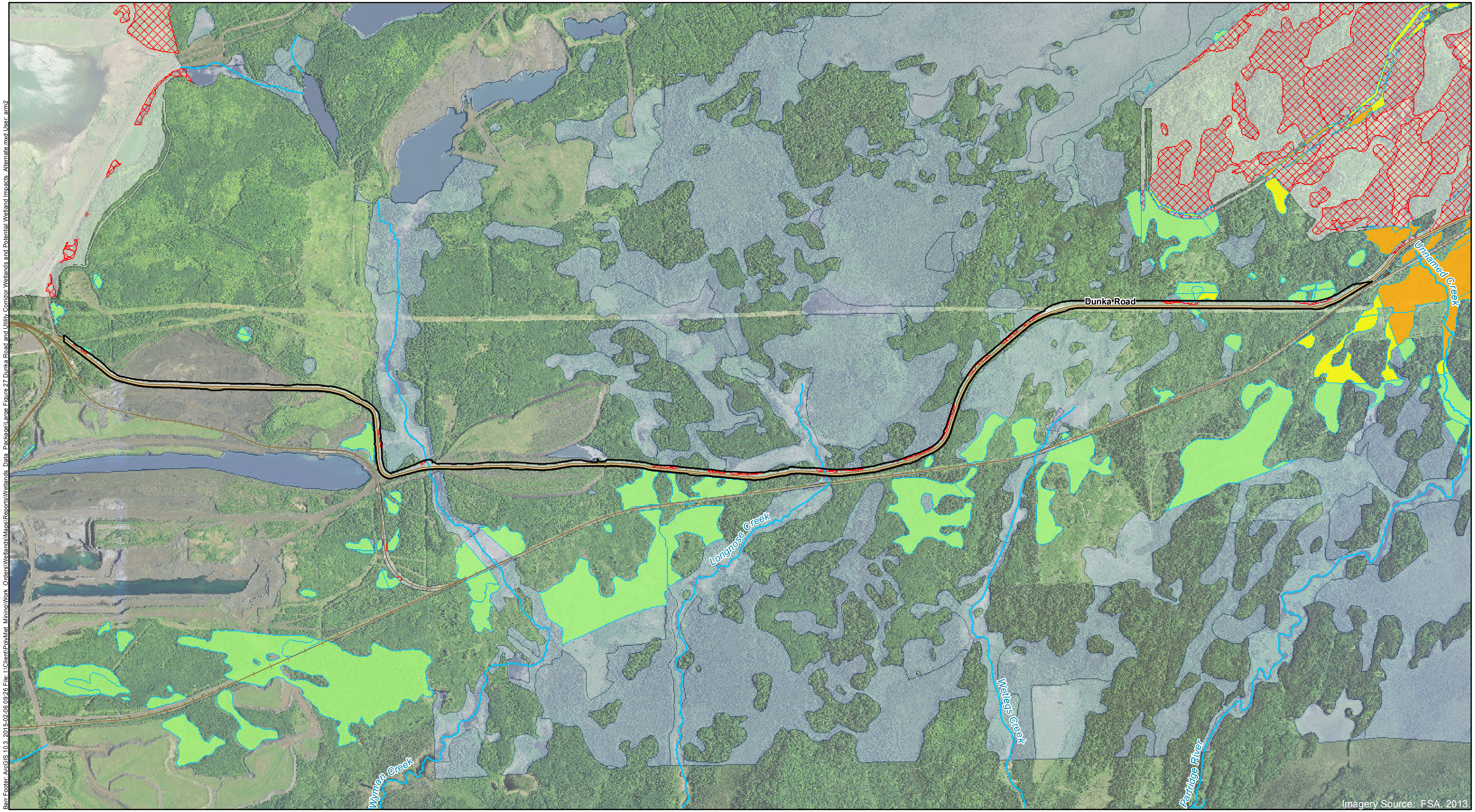
N

0 2,250 4,500 9,000
Feet

Large Figure 25
FLOTATION TAILINGS BASIN AREA WETLANDS AND POTENTIAL WETLAND IMPACTS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Large Figure 26
MINE SITE AREA WETLANDS AND POTENTIAL WETLAND IMPACTS - ALTERNATE METHOD
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Dunka Road and Utility Corridor

Areas Disturbed by Proposed Project Features

Dunka Road

Direct Wetland Impacts

Potential Wetland Indirect Impact Factor Rating

4

3

2

1

No Impact

N

0 1,000 2,000 4,000

Feet

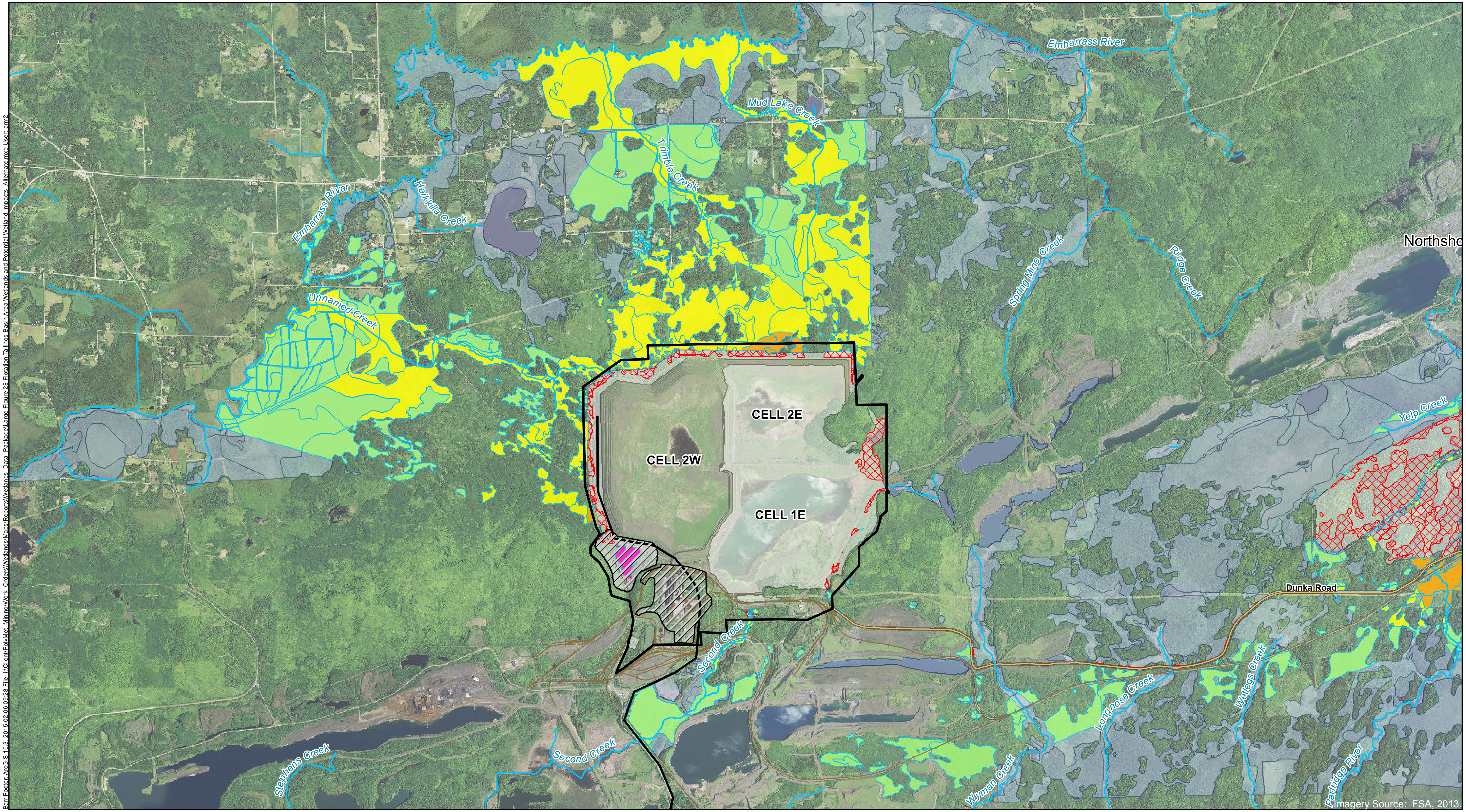
Large Figure 27

DUNKA ROAD AND UTILITY CORRIDOR WETLANDS AND POTENTIAL WETLAND IMPACTS - ALTERNATE METHOD

NorthMet Project

Poly Met Mining Inc.

Hoyt Lakes, Minnesota

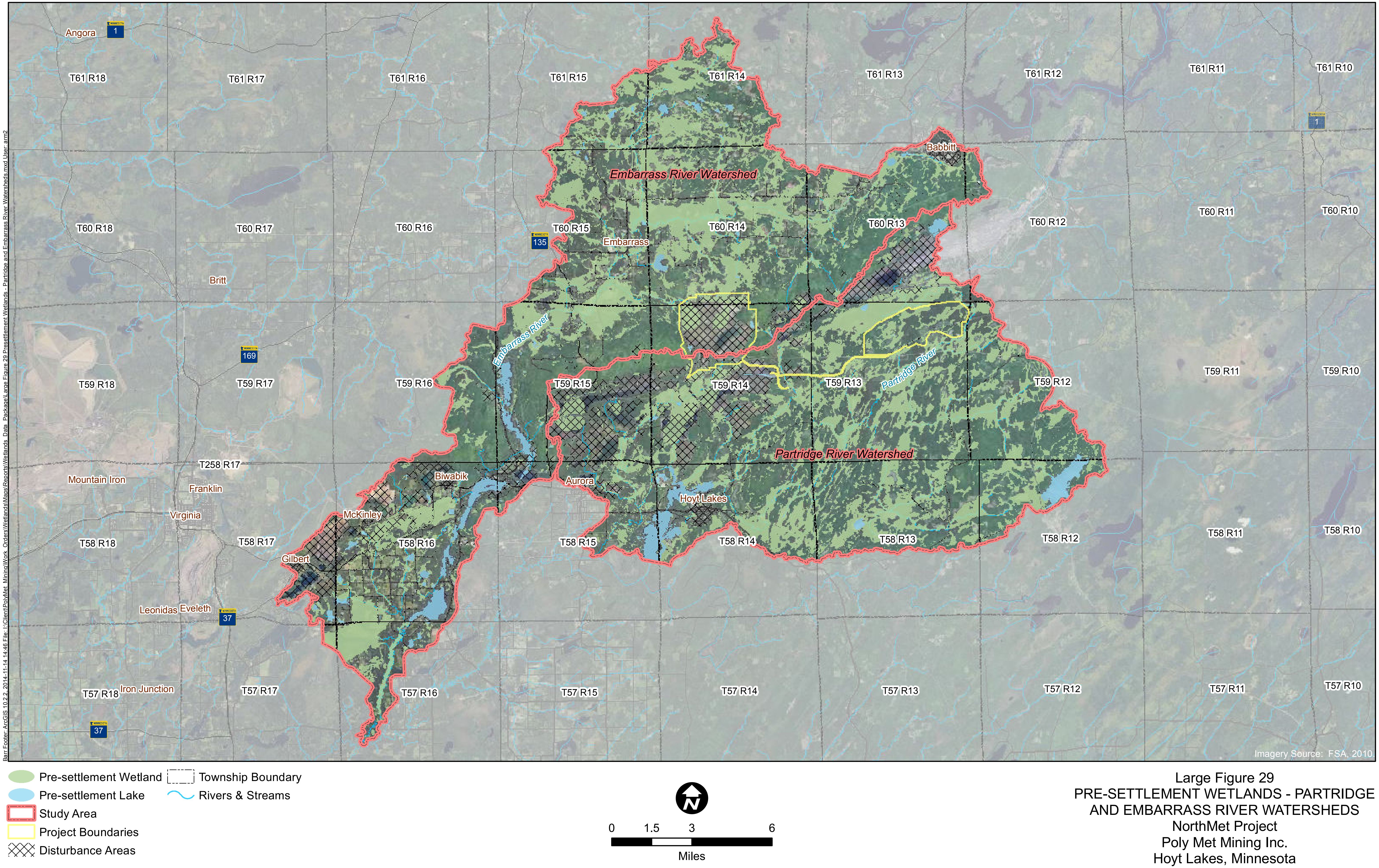


Tailings Basin
Areas Excluded from Tailings Basin Boundary
Dunka Road
Direct Wetland Impacts
No Impact

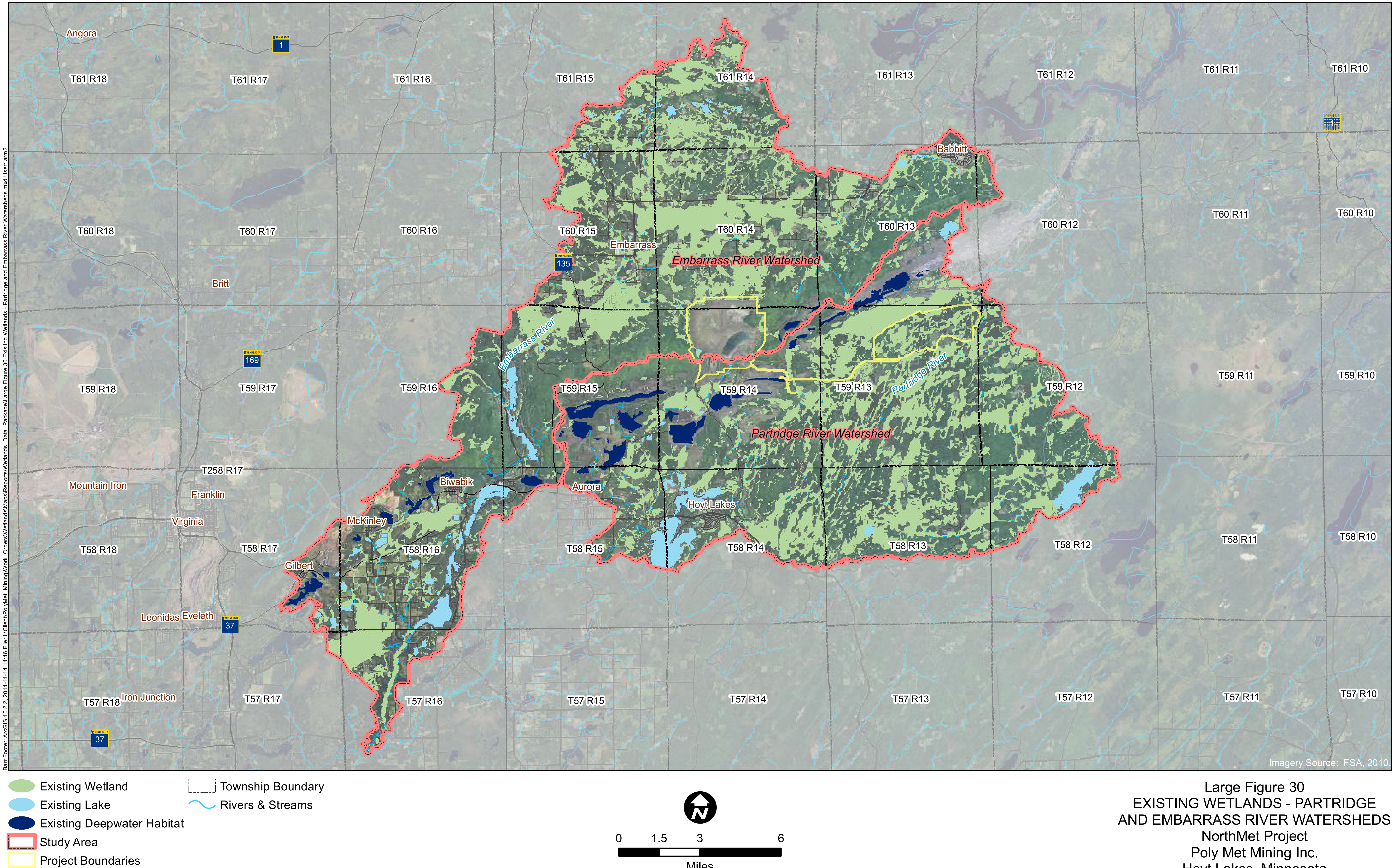
Potential Wetland Indirect Impact Factor Rating
5
4
3
2
1
Exempt

0 2,250 4,500 9,000
Feet

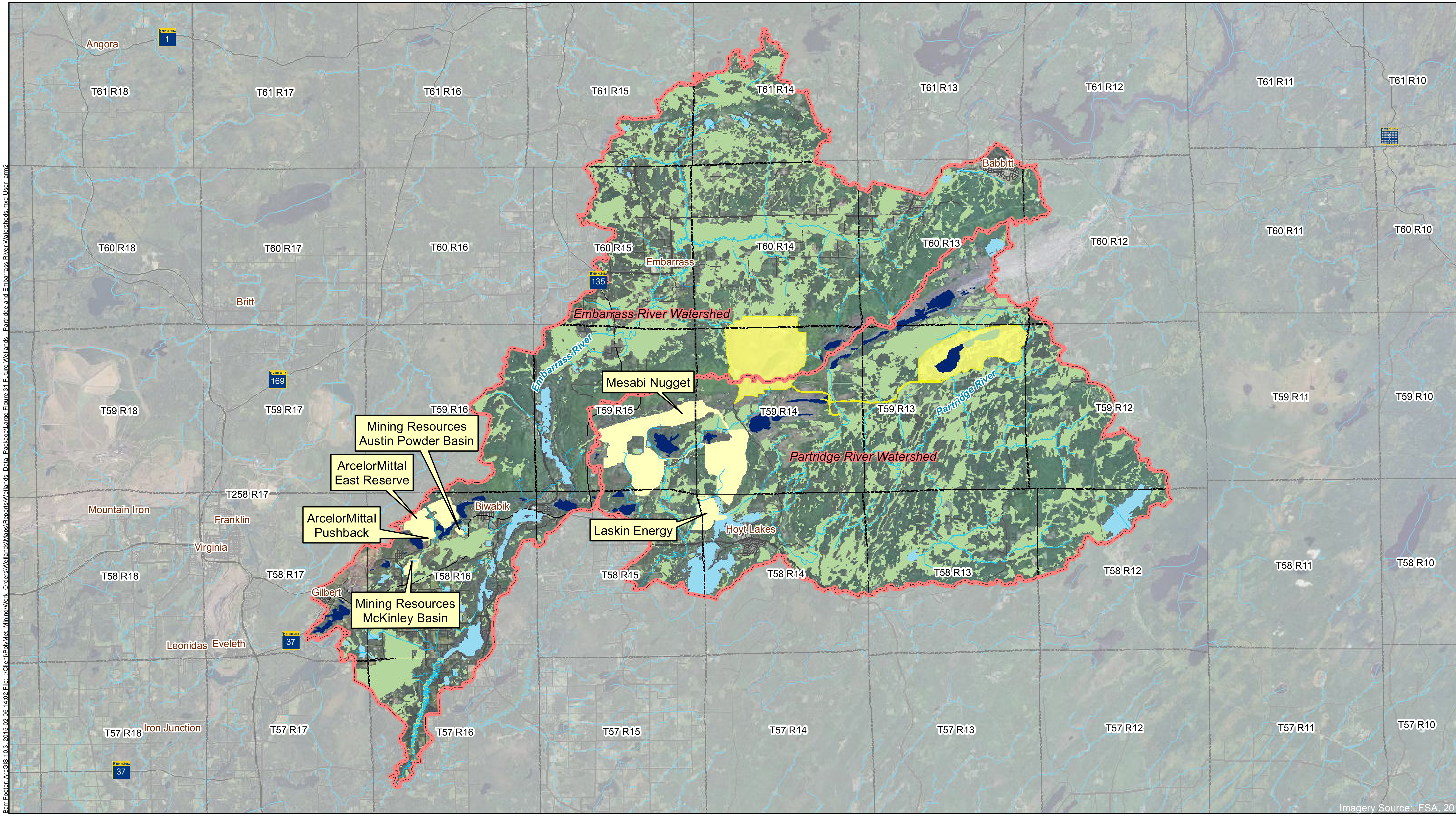
Large Figure 28
FLOTATION TAILINGS BASIN AREA WETLANDS AND POTENTIAL WETLAND IMPACTS - ALTERNATE METHOD
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Large Figure 29
PRE-SETTLEMENT WETLANDS - PARTRIDGE AND EMBARRASS RIVER WATERSHEDS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Large Figure 30
EXISTING WETLANDS - PARTRIDGE
AND EMBARRASS RIVER WATERSHEDS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Future Wetland
Future Lake
Future Deepwater Habitat
Study Area
Project Boundaries
Other Project Areas
Township Boundary
Rivers & Streams

0 1.5 3 6
Miles

Large Figure 31
FUTURE WETLANDS - PARTRIDGE
AND EMBARRASS RIVER WATERSHEDS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

Attachments

Attachment A

NorthMet Wetland Analysis Work Plan v3

POLYMET MINING

NorthMet Project

Wetland Analysis Work Plan

Version 3

October 13, 2011

NorthMet Project
Wetland Analysis Work Plan
Version 3

Table of Contents

1. Project

This document is the Work Plan for wetland analysis for the NorthMet Project (Project) as specified in Wetland Resources IAP Final Summary Memo and Co-lead Agency Final Work Plan Preparation Guidance of July 1, 2011 (Guidance Document) and the Wetland IAP Work Plan Compiled Comments dated August 30, 2011.

The project that will be modeled is the project described in the Co-lead Agency Draft Alternative Summary as amended in September, 2011. The Project Footprint that will be used for this analysis has been defined and detailed in the NorthMet Project Project Description (Reference 1).

2. Background

Wetland impacts for the Project were previously evaluated for the DEIS and included direct, potential indirect, and cumulative impacts. Using the wetland types and acreages identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), direct, potential indirect, and cumulative impacts will be evaluated as described in the following sections. The results of the wetland analysis in this Work Plan will be presented in the Wetland Data Package.

3. Direct Wetland Impacts

Direct wetland impacts will result from filling and excavation. The analysis performed for the SDEIS will duplicate the analysis performed for the DEIS (Section 4.2 of Reference 2) using the current Project Footprint described in Reference 1.

Wetlands within the Project Footprint will be identified using the Eggers and Reed (1997) community classification system. The wetland types and acreages for each wetland were identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

The analysis output for the direct wetland impact will include:

1. A summary table will provide information for each wetland within the Project Footprint and include:
    a. The wetland type, wetland acreage, and direct impact will be calculated using GIS.
    b. The type of direct impact (fill, excavation, etc.) will be identified.
    c. The quality of each wetland will be identified.
2. For each Eggers and Reed (1997) wetland type, a summary table will provide the total acreage and total acres of direct impact for the following Project Areas - Mine Site, railroad corridor, Dunka Road and utility corridor, Plant Site, Flotation Tailings Basin, Hydrometallurgical Residue Facility, and the Colby Lake water pipeline corridor.
    a. Figures for each of the Project Areas will be created that show the areas with direct wetland impacts.
3. The total direct wetland impact acreage for the Project Footprint will be provided.

4. Potential Indirect Wetland Impacts

The analysis of potential indirect wetland impacts will be completed using the Guidance Document. The purpose of this analysis is to provide an estimate of potential indirect wetland impacts.

Potential indirect wetland impacts will be assessed based on: changes in wetland watershed areas (during operation and post-closure); groundwater drawdown resulting from open pit mine dewatering; groundwater mounding/drawdown resulting from operation of the Flotation Tailings Basin including groundwater seepage interception wells; changes in stream flow near the Mine Site and Flotation Tailings

Basin and associated impacts to wetlands abutting the streams (during operation and post-closure); wetland fragmentation from Project elements such as open pits, stockpiles, haul roads, etc.; and changes in wetland water quality. If/when the Project is permitted, an indirect wetland impact monitoring plan will be implemented as part of the Section 404 permit conditions.

The analysis will be completed for the Mine Site, the Flotation Tailings Basin, and the transportation corridors (railroad and Dunka Road).

4.1 Mine Site

4.1.1 Wetland Identification

Wetlands within the Mine Site will be identified using the Eggers and Reed (1997) community classification system. The wetland types and acreages for Area One (which includes the Mine Site) were identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

Wetland acreage by wetland type will be calculated using GIS within 500-foot radius increments beginning at the mine pits and continuing out to a total radius of 10,000 feet (for a total of 20 increments). The area of evaluation will only include wetlands within Area One where wetland type information has been developed and it will not include wetlands identified as directly impacted in Section 3.0. In addition, wetlands in the Peter Mitchell open pit taconite mine and areas north of this mine will be excluded from evaluation as described in the Guidance Document.

1. A detailed table will be provided for each increment identifying the wetland type and acreage for each wetland.
2. A summary table will be provided for each increment identifying the total acreage and total acres of direct impact for each Eggers and Reed (1997) wetland type.
3. For each wetland that will be directly impacted, the acreage for the portion of the remaining wetland will be calculated and included in a table.
4. A figure will be provided showing the increments and identifying the Eggers and Reed (1997) wetland types within each increment.

4.1.2 Potential Indirect Wetland Impacts Resulting from a Change in Watershed Area

For each wetland that will not be directly impacted by fill or excavation, but will have Project elements impacting its watershed, an estimate of the change in watershed area (acreage and percent gain or loss) will be calculated.

The change (acreage and percent gain or loss) in watershed areas and the wetland area found within each watershed will be identified for the following conditions: pre-Project, during operation when the maximum amount of watershed has been removed, and at closure.

An estimate of potential indirect wetland impacts (wetland acres by wetland type and type of indirect impact) will be calculated for non-directly impacted wetlands that will have changed watershed areas (during operation and post-closure) for each watershed that was identified as changed in the previous paragraph, using the following steps:

1. Determine the tributary acres per wetland acre for the pre-Project, during operation, and after closure conditions.
2. Determine the equivalent watershed yield (ac-ft/yr) for the pre-Project, during operation, and after closure conditions. The existing watershed yield will be calculated based on available gage data from Section 4.4.1 of Reference 3. This rate would be applied to each watershed to

convert the tributary ratio in Step 1 to an equivalent yield (or equivalent average contributing net precipitation), expressed as acre-feet/year (ac-ft/yr) per acre of wetland.

3. The range in the equivalent yield (inches/year) estimated over the life of the Project will be evaluated relative to pre-Project yield to calculate a maximum percent change in yield. The estimated relative change in yield will be evaluated on a case-by-case basis, taking into account factors such as wetland type, to determine the potential for indirect impacts (e.g., groundwater fed wetlands may be less susceptible to changes in surface watershed).

4.1.3 Potential Indirect Wetland Impacts Resulting from Wetland Fragmentation

For remaining wetlands not directly impacted or indirectly impacted by watershed area changes, an estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) from wetland fragmentation by Project features (open pits, stockpiles, haul roads, etc) will be determined, using the following steps:.

1. For each portion of a remaining wetland, excluding indirect impacts from watershed changes, the potential area of indirect impacts will be determined based on an analysis of the various factors that may contribute to potential fragmentation. Based on this analysis, the identifying factor(s) contributing to potential fragmentation (change in size of wetland, surrounded by Project features, change in function and values of wetland e.g. wildlife habitat, etc.) will be identified. [Note: noise and dust do not cause fragmentation impacts according to the U.S. Army Corps of Engineers, May 16, 2011 conference call.]

4.1.4 Potential Indirect Wetland Impacts Resulting from Changes in Hydrology

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of indirect impact) due to groundwater drawdown from open pit mine dewatering, based on the Co-lead Agency guidance for estimating potential indirect wetland impacts from groundwater drawdown near open pit mines as provided on July 1, 2011 will be determined, using the following steps.

1. Use the information provided by the Groundwater IAP Group and other available and relevant hydrogeologic data to justify whether to use or modify the provided analogue information which is based upon comparisons of the existing regional and site specific geologic data (such as bedrock faults, bedrock joint systems, bedrock topography, glacial till hydraulic conductivities, etc.), site specific engineering controls such as the Category 1 Waste Rock Stockpile seepage containment system, and the geologic settings of the analogue information sites and the Mine Site.
2. Use the guidelines provided by the Corps Memorandum (CEMVP-OP-R) Distinguishing Between Bogs That Are Entirely Precipitation Driven Versus Those with Some Degree of Mineral Inputs from Groundwater and/or Surface Water Runoff to identify minerotrophic and ombrotrophic coniferous and open bogs.

The potential indirect wetland impact from glacial aquifer drawdown will be based on the analogue impact zone with the greater potential drawdown (zone closer to the open pit mine) for wetlands that lie on both sides of the analogue distance boundary. The analogue distances are described below in steps 1, 2, 3 and 4.

1. For all wetlands, provide a table and figure identifying type and acreage of wetlands located within 0 feet to 1,000 feet from the pit edge. The table will also identify the type of indirect wetland impact for each indirectly impacted wetland. Identify the likelihood of wetland hydrology impact based on wetland type.
    a. High Likelihood – includes coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, and alder thicket

b. Moderate Likelihood – deep marsh, shallow marsh, and shallow open water
c. Low Likelihood – minerotrophic coniferous bog and open bog
d. No Impact anticipated as identified in Guidance Document – ombrotrophic coniferous bog and open bog

2. For all wetlands, provide a table and figure identifying type and acreage of wetlands located within >1,000 feet to 2,000 feet from the pit edge. The table will also identify the type of indirect wetland impact for each indirectly impacted wetland. Identify the likelihood of wetland hydrology impact based on wetland type.
   a. Moderate Likelihood – coniferous swamps, hardwood swamps, sedge/wet meadow, shrub-carr, and alder thicket
   b. Low Likelihood – deep marsh; shallow marsh, and shallow open water
   c. No Impact anticipated as identified in Guidance Document – minerotrophic and ombrotrophic coniferous bog and open bog
3. For all wetlands, provide a table and figure identifying type and acreage of wetlands located within >2,000 feet to 3,500 feet from the pit edge. The table will also identify the type of indirect wetland impact for each indirectly impacted wetland. Identify the likelihood of wetland hydrology impact based on wetland type.
   a. Low Likelihood – coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, alder thicket
   b. No Impact anticipated as identified in Guidance Document – deep marsh, shallow marsh, shallow open water, coniferous bog, open bog
4. For all wetlands, provide a table and figure identifying type and acreage of wetlands located within >3,500 feet to 10,000 feet from the pit edge (within the wetland evaluation area). The table will also identify the type of indirect wetland impact for each indirectly impacted wetland.
   a. No Impact anticipated as identified in Guidance Document – all wetland types

A general discussion will be provided regarding the potential indirect wetland hydrology drawdown impacts to each wetland type based on the wetland sensitivity class tables for falling groundwater tables found in the Crandon mine project document titled *Wetland Impact Assessment Technical Memorandum – Appendix B* (Peterson Environmental Consulting, Inc. 2002).

1. A qualitative discussion of the types of potential indirect wetland impacts that might occur will be provided based on hypothetical hydrologic drawdown levels. Potential indirect wetland impacts might include: conversion to other wetland community types, a change in vegetation without a change in community type, conversion to uplands, or other impacts, which will be categorized using the Eggers and Reed (1997) wetland classification system.

4.1.5 Potential Indirect Wetland Impacts for Wetlands Abutting the Partridge River

Estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) for wetlands abutting the Partridge River as a result of changes in river flow resulting from the Project (during operation and post-closure), using the following steps.

1. Identify in GIS the wetlands abutting the Partridge River within Area One. A table will identify the wetland ID, type and acreage for each wetland (only within the area previously characterized for wetlands).

2. Provide the change in flow and water levels in the Partridge River using the model developed in Section 5.6 of Reference 3.
3. Identify whether the changes in flow (and therefore stage) resulting from the Project are within the observed natural variation for the Partridge River (Section 4.4.1 of Reference 3).
4. If the changes in flow and water levels are not within the observed natural variation for the Partridge River, identify the potential indirect impacts for the wetlands abutting the Partridge River.

4.1.6 Potential Indirect Wetland Impacts Resulting from Water Quality Changes

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) for remaining wetlands not directly impacted or indirectly impacted by previously evaluated causes in Sections 4.1.2 through 4.1.5 that would be impacted by water quality changes (such as from sulfide-bearing dust deposition, ore spillage, seepage from stockpiles, etc.) will be completed using the following steps:

1. Fugitive Dust Emissions
    a. The air emissions from all surface fugitive dust sources at the Mine Site will be modeled using an EPA approved air dispersion model with a deposition algorithm (AERMOD version 11103). This is the same model that has been proposed to be used for assessing air impacts in Class II areas in the draft NorthMet Air Modeling Work Plan (version 1, May 9, 2011) which was developed in response to the Air Impacts Assessment Planning Summary Memo dated May 6, 2011. Comments have been received on this draft Work Plan, with no objections to the proposed model, so this model is expected to be specified in the final Work Plan. Emission rates and particle size distributions will be based on total particulate matter. Receptors will be placed on all delineated wetlands within the Project ambient air boundaries that have not been identified as directly impacted. The receptor grid will also initially extend 5 kilometers beyond the ambient air boundaries with a grid spacing of 500 meters. The receptor grid may be adjusted based on preliminary modeling results. Other modeling details would generally follow those specified in the Class II modeling protocols for the Mine Site as defined by the Air IAP and/or generally excepted modeling practice.
    b. The modeled dust sources at the Mine Site will include ore and waste rock truck loading and unloading outside of the pits, railcar loading, dust generation from traffic on unpaved roads on the surface (i.e. not in the pits), and overburden and other construction rock screening and/or crushing as defined by the Air IAP.
    c. Rock handling and roads within the pits will not be included in the analysis because: a) "pit-trapping" would greatly reduce the potential for dust to impact areas outside of the pits and b) Barr's past experience which indicates that the AERMOD "open pit" algorithm is incompatible with the AERMOD deposition algorithm.
    d. The output of the model will be deposition rate (grams per square meter) on an annual basis. The model results will be compared to background values such that contours where the modeled deposition is small relative to the background value can be developed. This can be considered a conservative assessment of how far away potential impacts to wetlands from dust may occur from fugitive dust sources. This should be considered a screening level analysis such that it would identify an upper bound for the potential range of distances at which impacts might occur, but the results will not identify actual impacts. This range of distances could be used to

estimate the extent of potential indirect impacts to guide development of monitoring plans to document actual indirect impacts. Based on the results of the screening analysis, PolyMet may propose a more refined approach to assess the distance at which potential impacts may occur.

2. Metals and Sulfide Dust Emissions

    a. The potential for sulfur deposition was evaluated for the DEIS Mine Plan in Screening Analysis of the Potential for Fugitive Dust Emissions Associated with Sulfide Rock Handling at the NorthMet Project Mine Site to Increase Sulfur Deposition to Nearby Wetlands (Barr, January 28, 2010). This analysis included dust emissions from the handling of Category 2, 3, and 4 waste rock and ore. Lean ore handling emissions were also modeled, but lean ore has been eliminated as a rock classification in the updated Mine Plan.

    b. The handling activities associated with Category 2, 3 and 4 waste rock and ore located outside of the pits will be included in the metals and sulfur analysis for the Mine Site. This includes truck loading and unloading with waste rock and ore and railcar loading with ore. Note: the potential for wind erosion from the stockpiles has been evaluated, and it has been determined that wind erosion would not occur through the use of EPA approved wind erosion calculations procedures in Section 13.2.5 of Reference 4. The calculations are described in the Mine Site Emission Inventory Spreadsheet (Version 2 Submitted August 1, 2011). This spreadsheet references the detailed calculations based on five years of meteorological data provided to MPCA via FTP site on May 9, 2011.

    c. Modeling will be conducted for the included sources in the same manner as described for dust modeling. The dust modeling and metals and sulfide modeling may be conducted in separate model runs or in the same run utilizing the model's source grouping capabilities.

    d. For air dispersion/deposition modeling, the total particulate emission rates (grams per second) will be speciated and converted to metals and sulfur emission rates based on data on the chemical composition of each material generating dust. Metals for evaluation, associated with rock and soils, would be: arsenic, cadmium, chromium, lead, manganese, nickel and selenium.

    e. Mercury will not be evaluated at the Mine Site for dust deposition because the concentration of mercury in the rock to be mined is very low (Sections 5.0 and 5.8 of Reference 3) and not considered to be environmentally significant in this medium.

    f. The model-estimated sulfur and metals deposition rates (grams per square meter) will be compared to background values to determine distance contours beyond which the deposition rate is insignificant compared to background. As with the dust analysis, this would be a screening level evaluation that could be used to identify a range of distances from a source beyond which impacts would be unlikely to occur. This range of distances could be used to estimate the extent of potential indirect wetland impacts to guide development of monitoring plans to document actual indirect impacts. PolyMet may choose to propose a more refined approach depending on the results of the screening level analysis. A more refined approach could take into account such factors as the potential for metals and/or sulfur to be liberated from the rock particles depending on the rock chemistry, environmental chemistry and general conditions in the ecosystem where the deposition is predicted to occur.

3. Ore spillage – see the Section 4.3.2.

4. Leakage from stockpile will be evaluated using the following steps:
    a. Quantify the amount of stockpile leakage water that discharges to surface water and wetlands, down gradient of the stockpiles based on the results of the water quality modeling.
    b. Identify the wetlands (type, acreage) within the surficial aquifer groundwater flowpaths from mine features using boundaries used in the water quality modeling (as shown in the Groundwater IAP Summary document).
    c. Categorize the wetlands within the flowpaths in Step ii into groundwater-fed and precipitation-fed wetlands using guidance from the Corps “Bog Memo” and evaluate the potential for indirect impacts based on potential water quality changes from the mine features.

4.1.7 Potential Indirect Wetland Impacts to Wildlife Utilization of Nearby Habitats From Project Noise

Provide a general discussion regarding the potential indirect wetland impact to wildlife utilization of nearby habitats from project noise using the following steps:

1. Identify the potential sources of project noise and the range of emitted noise levels.
2. Identify wildlife species that are found within the area, as well as their preferred habitats using wildlife surveys previously conducted for the NorthMet Project (Section 4.4 of Reference 2).
3. Qualitatively discuss the potential impacts and possible short- and long-term reactions of wildlife species to the potential project noise levels.

4.2 Flotation Tailings Basin

4.2.1 Wetland Identification

Wetlands around the Flotation Tailings Basin will be identified using the Eggers and Reed (1997) community classification system. The wetland types and acreages for Area Two (which includes the Flotation Tailings Basin) were identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

Wetland acreage by wetland type will be calculated using GIS within 500-foot radius increments beginning at the Flotation Tailings Basin and continuing out to the Embarrass River. The area of evaluation will only include wetlands within Area Two where wetland type information has been developed and it will not include wetlands identified as directly impacted in Section 3.0.

1. A detailed table will be provided for each increment identifying the wetland type and acreage for each wetland.
2. A summary table will be provided for each increment identifying the total acreage and total acres of direct impact for each Eggers and Reed (1997) wetland type.
3. For each wetland that will be directly impacted, the acreage for the portion of the remaining wetland will be calculated and included in a table.
4. A figure will be provided showing the increments and identifying the Eggers and Reed (1997) wetland types within each increment.

4.2.2 Potential Indirect Wetland Impacts Resulting from Changes in Hydrology

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) from hydrologic changes (groundwater upwelling and resulting surface water flow in wetlands and/or groundwater drawdown near the groundwater seepage interception wells) resulting from groundwater seepage and/or interception well pumping will be determined.

1. Quantify the amount of Flotation Tailings Basin groundwater seepage water that discharges to surface water features, including wetlands, down gradient of the Flotation Tailings Basin. A MODFLOW model developed for the Flotation Tailings Basin will be used in conjunction with a GoldSim probabilistic model to estimate the quantity of seepage that discharges to surface water features.
2. Identify all the wetlands (type, acreage) within the surficial aquifer groundwater flowpaths downgradient of the Flotation Tailings Basin using boundaries used in the water quality modeling (as shown in the Groundwater IAP Summary document).
3. Using the wetlands identified in step 2, categorize the wetlands into groundwater-fed and precipitation-fed wetlands using guidance in the Corps Memorandum (CEMVP-OP-R) *Distinguishing Between Bogs That Are Entirely Precipitation Driven Versus Those with Some Degree of Mineral Inputs from Groundwater and/or Surface Water Runoff* and evaluate the potential for indirect impacts resulting from groundwater seepage and/or interception well pumping.

Provide a general discussion regarding the potential indirect wetland hydrology impacts to each wetland type based on the wetland sensitivity class tables for rising groundwater tables found in the Crandon mine project document titled *Wetland Impact Assessment Technical Memorandum – Appendix B* (Peterson Environmental Consulting, Inc. 2002).

1. A qualitative discussion of the types of potential indirect wetland impacts that might occur will be provided based on hypothetical hydrologic drawdown or surchage levels. Potential indirect wetland impacts might include: conversion to other wetland community types, a change in vegetation without a change in community type, conversion to uplands, or other impacts, which will be categorized using the Eggers and Reed (1997) wetland classification system.

4.2.3 Potential Indirect Wetland Impacts for Wetlands Abutting Trimble Creek and the Two Unnamed Creeks

An estimate of potential indirect wetland impacts (wetland acres by wetland type) in wetlands abutting the three streams north and west of the Flotation Tailings Basin (Trimble Creek and the two unnamed creeks as shown in Figure 3 of the Water Resources IAP – Surface Water Summary Memo) as a result of changes in stream flow resulting from operation of the Flotation Tailings Basin will be determined using the following steps:

1. Identify in GIS the wetlands abutting the west Unnamed Creek (Mud Lake Creek), Trimble Creek, and the east Unnamed Creek within Area Two. A table will identify the wetland ID, type and acreage for each wetland (only within the area previously characterized for wetlands).
2. Provide the change in flow in the three streams using the GoldSim probabilistic model developed in Reference 6 and the method described in Section 4.4 of Reference 2. Estimate a corresponding change in stage based on available rating curves or simple hydraulic equations (e.g. Manning's equation).

3. Identify whether the changes in flow (and by extension, stage) are within the estimated natural variation for the three streams based on observed data or unit-area relationships extrapolated from gage data (Section 4.4.1 of Reference 5 and Page 3 of Reference 6).
4. If the changes in flow and water levels are not within the observed natural variation for the three streams, identify the potential indirect impacts for the wetlands abutting the three streams.

4.2.4 Potential Indirect Wetland Impacts Resulting from Water Quality Changes

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) for wetlands that would be impacted by water quality changes (such as from sulfide-bearing dust deposition from the Flotation Tailings Basin, Flotation Tailings Basin groundwater seepage, etc.) will be completed using the following steps:

1. Fugitive Dust Emissions
    a. The air emissions from all surface fugitive dust sources at the Flotation Tailings Basin site will be modeled using an EPA approved air dispersion model with a deposition algorithm (AERMOD version 11103). This is the same model that has been proposed to be used for assessing air impacts in Class II areas in the draft NorthMet Air Modeling Work Plan (version 1, May 9, 2011) which was developed in response to the Air Impacts Assessment Planning Summary Memo dated May 6, 2011. Comments have been received on this draft Work Plan, with no objections to the proposed model, so this model is expected to be specified in the final Work Plan. Emission rates and particle size distributions will be based on total particulate matter. Receptors will be placed on all delineated wetlands within the Project ambient air boundaries that have not been identified as directly impacted. The receptor grid will also initially extend 5 kilometers beyond the ambient air boundaries with a grid spacing of 500 meters. The receptor grid may be adjusted based on preliminary modeling results. Other modeling details would generally follow those specified in the Class II modeling protocols for the Plant Site as defined by the Air IAP and/or generally excepted modeling practice.
    b. The modeled dust sources at the Flotation Tailings Basin will include LTV Steel Mining Company (LTVSMC) tailings loading and unloading, unpaved road traffic, and wind erosion from dams constructed of LTVSMC tailings and beaches composed of NorthMet tailings.
    c. The output of the model will be deposition rate (grams per square meter) on an annual basis. The model results will be compared to background values such that contours where the modeled deposition is small relative to the background value can be developed. This can be considered a conservative assessment of how far away potential impacts to wetlands from dust may occur from fugitive dust sources. This should be considered a screening level analysis such that it would identify an upper bound for the potential range of distances at which impacts might occur, but the results will not identify actual impacts. This range of distances could be used to estimate the extent of potential indirect impacts to guide development of monitoring plans to document actual indirect impacts. Based on the results of the screening analysis, if model-estimated particle deposition is equal to current background deposition (i.e., 100 percent of current background; i.e., a potential doubling of deposition), PolyMet may propose a more refined approach to assess the distance at which potential impacts may occur.
2. Metals and Sulfide Dust Emission

a. At the Flotation Tailings Basin wind erosion from the embankment and beaches as well as truck traffic on roads composed of LTVSMC tailings will be included in the analysis.

b. Modeling will be conducted for the included sources in the same manner as described for dust modeling. The dust modeling and metals and sulfide modeling may be conducted in separate model runs or in the same run utilizing the model's source grouping capabilities.

c. For air dispersion/deposition modeling, the total particulate emission rates (grams per second) will be speciated and converted to metals and sulfur emission rates based on data on the chemical composition of each material generating dust. Proposed metals for evaluation, associated with rock and soils, will include: arsenic, cadmium, chromium, lead, manganese, nickel, and selenium.

d. Because the NorthMet ore is low in mercury, the tailings, which includes roughly 98 percent of the ore, will also be low in mercury, and in fact pilot study data shows that the mercury preferentially goes to the flotation concentrate. The mercury in the tailings is also expected to be strongly bound within the mineral matrix. This is also true of the LTVSMC tailings that will be used to construct the Flotation Tailings Basin dams and that may be present on some road surfaces. Therefore, any mercury present in dust from the Flotation Tailings Basin would not be biologically available and we are not proposing to consider mercury in the deposition analysis at the Flotation Tailings Basin. When metal ores are concentrated and heated, such as in taconite mining or in smelting processes, then mercury becomes a metal of interest for air emissions and deposition. For the Project, potential mercury air emissions from ore processing (i.e., potential emissions from the autoclave) are being evaluated for potential local deposition impacts.

e. The model-estimated sulfur and metals deposition rates (grams per square meter) will be compared to background values to determine distance contours beyond which the deposition rate is insignificant compared to background. As with the dust analysis, this will be a screening level evaluation that could be used to identify a range of distances from a source beyond which impacts would be unlikely to occur. This range of distances could be used to estimate the extent of potential indirect wetland impacts to guide development of monitoring plans to document actual indirect impacts. If model-estimated sulfur or individual metal deposition is equal to current background deposition (i.e., 100% of current background; i.e., a potential doubling of deposition), PolyMet may propose a more refined approach depending on the results of the screening level analysis. A more refined approach could take into account such factors as the potential for metals and/or sulfur to be liberated from the rock particles depending on the rock chemistry, environmental chemistry and general conditions in the ecosystem where the deposition is predicted to occur.

3. Flotation Tailings Basin Groundwater Seepage

a. Identify the chemistry from the Flotation Tailings Basin groundwater seepage based on the results of the water quality modeling (Reference 6).

b. Identify the wetlands (type, acreage) within the down gradient zone using boundaries used in the water quality modeling (as shown in the Groundwater IAP Summary document).

c. Categorize the wetlands within the flowpaths in Step ii into groundwater-fed and precipitation-fed wetlands using guidance from the Corps Memorandum (CEMVP-

OP-R) *Distinguishing Between Bogs That Are Entirely Precipitation Driven Versus Those with Some Degree of Mineral Inputs from Groundwater and/or Surface Water Runoff* and evaluate the potential for indirect impacts based on potential water quality changes from the Flotation Tailings Basin.

4.2.5 Potential Indirect Wetland Impacts to Wildlife Utilization of Nearby Habitats From Project Noise

Provide a general discussion regarding the potential indirect wetland impact to wildlife utilization of nearby habitats from project noise using the following steps:

1. Identify the potential sources of project noise and the range of emitted noise levels.
2. Identify wildlife species that are found within the area, as well as their preferred habitats using wildlife surveys previously conducted for the NorthMet Project (Section 4.4 of Reference 2).
3. Qualitatively discuss the potential impacts and possible short- and long-term reactions of wildlife species to the potential project noise levels.

4.3 Transportation Corridors

4.3.1 Wetland Identification

Wetlands around the Flotation Tailings Basin will be identified using the Eggers and Reed (1997) community classification system. The wetland types and acreages for Area Two (which includes the Flotation Tailings Basin) were identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

The wetlands abutting the Dunka Road and the railroad corridor within Area One and Area Two will be identified using GIS. The wetland ID, type and acreage for each wetland (only within the area previously characterized for wetlands) will be identified in a table.

4.3.2 Potential Indirect Wetland Impacts Resulting from Water Quality Changes

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) for wetlands that will be impacted by water quality changes (such as from sulfide-bearing dust deposition, ore spillage, etc.) will be completed using the following steps:

<u>Mine to Plant Rail</u>

The potential release of dust from railcars transporting ore from the Mine Site to the Plant Site was addressed in the May 6, 2011 Air Impact Assessment Planning Summary Memo, "The air IAP group concluded that there would be minimal air impacts from any dust generated from ore hauled in the railcars due to the coarse nature of the ore. " Based on this conclusion, air modeling of potential release of dust from railcars will not be performed because the potential wetland impacts will not be significant.

The air IAP group concluded that any dust generated from ore hauled in railcars would be coarse in nature (i.e., relatively large particles). These larger particles would tend to deposit near the railcar and not be dispersed to any great extent. An estimate of the spillage of ore fines along the rail corridor is shown in Section 8.5.3 of Reference 7. Assuming that all spillage of the coarse material would occur in a 2 meter wide strip on both sides of the centerline of the railway (total width = 4 meters) over the entire haul distance after loading (~ 8 miles; ~13,000 meters), results in approximately 0.11 Kg/square meter of ore fines annually or 2.14 Kg/square meter for the 20 year Project. This equates to 0.002 inch of depth annually or 0.05 inches for the 20 year Project.

Using the geochemical modeling methods described in Reference 7 for the Ore Surge Pile, the quality of water infiltrating through this material will be estimated on a per-unit area basis which will also be on a per unit length of the rail corridor. If the water quality is found to have a greater than 10 percent likelihood of exceeding water quality standards as defined in Table 1-3 of Reference 8, the unit area required to provide sufficient precipitation to dilute the water to meet standards will be calculated and converted to a distance to be added to the 2 meters from the centerline of the rail corridor that will be a potential dust impact corridor. Any wetlands identified in the above paragraph of this section that are within the potential dust impact corridor will be considered to be potentially indirectly impacted.

Dunka Road

Loaded mine haul trucks will not travel on the Dunka Road. Empty mine haul trucks will only travel on the Dunka Road when they are in need of maintenance at the Area 1 Shop. It is estimated that each truck will travel to Area 1 twice per year. The total one-way trips per year are estimated at 44. Given the low traffic volumes (< 1 trip per week on average) a quantitative assessment of impacts from ore particle discharge from haul trucks travelling down the Dunka Road is not warranted.

Product Shipping

Products produced in the hydrometallurgical plant (AU/PGM concentrate, mixed hydroxide precipitate) will be loaded into super sacks (i.e. large industrial sacks used to transport solid material) and then loaded onto trucks or railcars. There is little or no potential for spillage with this method of shipping. With respect to flotation concentrate, as stated in the project description (Reference 1) "Each filtered concentrate would be conveyed to separate stockpiles within an enclosed 10,000 ton storage facility for loading into covered rail cars. The storage facility would store about 7 to 10 days of production capacity when flotation concentrate would be directed to Concentrate Dewatering/Storage. The storage facility would have a concrete floor and provisions to wash wheeled equipment leaving the facility to prevent concentrates from being tracked out of the facility." The flotation concentrate is similar material to that which caused issues at the Red Dog Mine in Alaska (zinc concentrate transported in truck trailers), which has been cited as an example of potential consequences of product transport at mining operations. Some issues at Red Dog were driven by road dust and port activities which do not apply to the Project. Best Management Practices adopted at Red Dog - enclosed storage and loading, covered cars, and vehicle wash facilities - are proposed for use at the NorthMet project. Because the common carrier route (i.e. the rail line used to transport products) is not known (ultimate customer not known and could change), there is no way to assess impacts along the common carrier route. PolyMet will be paid on tons received by customers so it has a vested interest in not losing any concentrate. The covered rail cars will be inspected for holes and any holes repaired before concentrate loading.

4.3.3 Potential Indirect Wetland Impacts Resulting from Wetland Fragmentation

For remaining wetlands not directly impacted or identified in 4.3.2, an estimate of potential indirect wetlands (wetland acres by wetland type, and type of indirect impact) from wetland fragmentation by Project features will be completed using the following steps:

1. For each portion of a remaining wetland, excluding indirect impacts identified in 4.2.3, the potential area of indirect impacts would be determined based on an analysis of the various factors that may contribute to potential fragmentation. Based on the analysis, the identifying factor(s) contributing to potential fragmentation (change in size of wetland, surrounded by Project features, change in function and values of wetland e.g. wildlife habitat, etc.) would be identified. [Note: noise and dust do not cause fragmentation impacts according to the U.S. Army Corps of Engineers, May 16, 2011 conference call.]

4.3.4 Potential Indirect Wetland Impacts to Wildlife Utilization of Nearby Habitats From Project Noise

Provide a general discussion regarding the potential indirect wetland impact to wildlife utilization of nearby habitats from project noise using the following steps:

1. Identify the potential sources of project noise and the range of emitted noise levels.
2. Identify wildlife species that are found within the area, as well as their preferred habitats using wildlife surveys previously conducted for the NorthMet Project (Section 4.4 of Reference 2).
3. Qualitatively discuss the potential impacts and possible short- and long-term reactions of wildlife species to the potential project noise levels.

5. Cumulative Wetland Impacts

Analysis of cumulative wetland impacts will be done using accepted tools and protocols. The analysis performed for the DEIS is described and summarized in Section 4.3 of Reference 1. The analysis performed for the SDEIS will generally duplicate that effort using the revised direct and potential indirect wetland impact acreage, along with updated watershed information. The assessment will be conducted for both the Partridge River watershed and the Embarrass River watershed. The following steps will provide acreage for wetland and water resources for the pre-settlement, existing and foreseeable future conditions. Tables and figures will be developed to present the information.

5.1 Presettlement Wetland and Water Resources

The pre-settlement conditions time period represents wetlands, lakes, and deepwater resources as they existed prior to mining and urban development in the late 1800s to early 1900s. An estimate of pre-settlement wetland, lakes, and deepwater acreage within the Partridge River and Embarrass River watersheds will be developed in GIS using the following steps:

1. The acreage of wetland and water resources estimated for the pre-settlement period will be developed using the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) and the original survey maps developed using data from the original Government Land Surveys along with other historical surveys and sources, generally from the late 1800s.
2. The NWI mapping efforts were generated from interpretations of black-and-white aerial photographs completed in the late 1970s to early 1980s. The NWI is a more accurate depiction of historic wetland resources where human disturbance has been limited. Therefore, the NWI will be used as a base wetland map and available delineation data will be substituted to improve the accuracy of the wetland mapping.
3. The original survey maps will be obtained from the MDNR GIS Data Deli maps at http://deli.dnr.state.mn.us/. The original survey maps identify water resources as marshes, bottoms, swamps, lakes, ponds, and rivers, as documented in early land surveys. The original survey maps are a more accurate depiction of historic wetland resources where human disturbance is present. The water resources within the areas of human disturbance in each watershed will be digitized and presented on a figure.
4. The wetland and water resources mapped on the original survey maps will be digitized for one township, with minimal disturbance (roads, railroads, mining areas, etc.) located within and adjacent to the Partridge River watershed and for one township located within the Embarrass River watershed. It is assumed that if there is a minimal amount of disturbance in a township, the NWI mapping would be representative of pre-settlement wetland and water resources conditions. Therefore the data from each township will be used to develop a relationship between the NWI and original survey data.

5. The total wetland and water resources acreage for the two data sets will be compiled and the ratio of NWI to original survey map wetland and water resources will be calculated for each township. This ratio will indicate the percent of wetland and water resources identified on the NWI maps compared the original survey maps. This ratio will be used as an adjustment factor to conform the original survey data to the standards and scales of the NWI data for estimating the pre-settlement wetland resources within the disturbed areas of the watershed. The selected townships and data used to determine the adjustment factor will be presented in a table.
6. For the human disturbance areas, the NWI wetlands and water resources located within the human disturbance polygon boundaries will be removed using a GIS clipping tool. The NWI within these disturbance areas do not accurately reflect pre-settlement conditions because the NWI either included wetlands that have since been eliminated because of disturbance activities or did not include wetlands that had already been eliminated when the NWI was completed (e.g., reservoir development permanently flooded the wetlands). Because the NWI does not accurately map these types of areas, it does not accurately represent pre-settlement conditions; therefore the NWI wetlands in the disturbed areas will be replaced with wetlands mapped on the original survey maps. The total area of wetland and water resources within those polygons will be corrected using the adjustment factor. The total acreage of pre-settlement wetlands and water resources will be estimated for the two watersheds.

5.2 Existing Wetland and Water Resources

The existing conditions time period represents wetland, lake, and deepwater resources as they exist today, prior to the development of the Project. An estimate of existing wetland, lake, and deepwater acreage within the Partridge River and Embarrass River watersheds will be developed in GIS using the following steps:

1. Existing wetland, lake, and deepwater resources will be estimated using: wetland delineations completed in the area (as available); lake or lacustrine water body acreages will be estimated using the USGS National Hydrograph Dataset and the NWI datasets; deepwater or mine pit water body acreages will be estimated using a combination of the MDNR Mesabi Mining Features (2008) and interpretation of 2003, 2008, 2009, and 2010 FSA aerial photographs; and NWI mapping.
2. A "composite" wetland and water resources layer will be developed by deleting all of the NWI polygons from areas in which more detailed mapping had been completed and replacing them with the delineated wetland, lake, and deepwater resources.

5.3 Projected Future Wetland and Water Resources

An estimate of future wetland acreage within the Partridge River and Embarrass River watersheds will be completed considering reasonably foreseeable future project wetland impacts, both direct and potential indirect. Reasonably foreseeable future projects are defined as those that have been permitted and those that have had permit applications submitted and/or are undergoing environmental review by regulatory agencies.

The future conditions time period represents wetland, lake, and deepwater resources expected to be present following conclusion and reclamation of the Project. It is assumed that the future conditions follows some time after conclusion of the future projects such that the mine pit will have filled with water.

Relevant public officials from city, county, state and federal agencies will be contacted to identify reasonably foreseeable future actions within the study area. Agency officials will be asked to identify reasonably foreseeable future projects that may occur during the life of the Project. Contacts will include the City of Babbitt, St. Louis County, MDNR, Minnesota Board of Water and Soil Resources, the U.S. Forest Service, and the Iron Range Resources and Rehabilitation Board (IRRRB).

Future projects will be identified in the Partridge River watershed and the Embarrass River watershed that may impact wetland, lake, and deepwater resources. For the projected future conditions, the acreage of wetland, lake, and deepwater resources will be estimated by subtracting the future projected wetland impacts and adding the future projected development of wetland, lake, and deepwater resources to the existing resource totals. This information will be provided as a table.

5.4 Qualitative Analysis of Cumulative Wetland Impacts for the St. Louis River below the Ordinary High Water Mark From Its Confluence with the Embarrass River to Lake Superior

A qualitative analysis of cumulative wetland impacts for the St. Louis River below the ordinary high water mark from its confluence with the Embarrass River to Lake Superior will be developed based on a qualitative estimate of flow changes in the river.

A qualitative estimate of flow changes in the St. Louis River will be developed from the results of the Partridge River hydrologic modeling described in Section 7.1.1 of Reference 3. The estimated flow changes in the St. Louis River will be evaluated relative to gage data to determine if the changes are expected to be within the natural variation of flow within the St. Louis River will be developed using the following steps:

1. If the evaluation of the estimated flow changes in the St. Louis River is within the natural variation of average annual flow in within the St. Louis River observed at USGS gage 04016500 (St. Louis River near Aurora), no further analysis will be conducted. This location is the most upstream location of the St. Louis River affected by the NorthMet Project, and will therefore show the greatest impact.
2. If the evaluation of the estimated flow changes in the St. Louis River is not within the natural variation of flow in within the St. Louis River, the following analysis will be conducted.
    a. An estimate of existing wetland acreage and wetland types below the ordinary high water mark of the St. Louis River from its confluence with the Embarrass River to Lake Superior will be made using the National Wetland Inventory.
    b. An estimate of future wetland acreage and wetland types below the ordinary high water mark of the St. Louis River will be made from its confluence with the Embarrass River to Lake Superior.

5.5 Quantitative Analysis of Cumulative Wetland Impacts

5.5.1 Partridge River and Embarrass River Watersheds

A quantitative analysis of cumulative impacts for the Partridge River and Embarrass River watersheds will be developed using the following steps:

1. The acreage of wetland, lake, and deepwater resources for the pre-settlement, existing and reasonably foreseeable future conditions will be provided as a table. The foreseeable future conditions will include evaluation of a No Action Alternative and the Proposed Action.
    a. The acreage of wetland, lake, and deepwater resources will be compared and discussed for the pre-settlement, existing and reasonably foreseeable future conditions.
    b. The project's effect on the wetland, lake, and deepwater resources will be discussed and compared for the study area. This includes a discussion of changes in acreage,

water quality, unique habitat, adjacency to stream resources, and cumulative effects of projects within each watershed.

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

A quantitative analysis of cumulative impacts for wetlands located below the ordinary high water mark of the of the St. Louis River from its confluence with the Embarrass River to Lake Superior will be developed using the following steps:

1. If the evaluation of the estimated flow changes in the St. Louis River is within the natural variation of flow in within the St. Louis River, no further analysis will be conducted.
2. If the evaluation of the estimated flow changes in the St. Louis River is not within the natural variation of flow in within the St. Louis River, determine the change in wetland acreage from existing to future conditions based on a qualitative estimate of flow changes in the St. Louis River.

5.6 Climate Change

A qualitative analysis of estimated climate change impacts (to be coordinated with the climate change evaluation being conducted for the air impacts chapter of the SDEIS) on cumulative wetland impacts in the Partridge River Watershed, the Embarrass River Watershed, and below the ordinary high water mark of the of the St. Louis River from its confluence with the Embarrass River to Lake Superior.

The qualitative assessment of the potential impacts of climate change on wetlands will be included in the Climate Change Evaluation Report developed by the Air IAP. No additional assessment will be conducted.

6. References

Reference 1 NorthMet Project Project Description, Version 3, September 13, 2011

Reference 2 NorthMet Project Draft Environmental Impact Statement. U.S. Army Corps of Engineers and Minnesota Department of Natural Resources. October 2009.

Reference 3 NorthMet Project Water Modeling Data Package – Volume 1 (Mine Site) Version 5

Reference 4 Compilation of Air Pollutant Emission Factors, AP-42 5th edit. Volume I Stationary Point and Area Sources, Section 13.2.5. Updated November 2006. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.

Reference 5 NorthMet Project Water Modeling Data Package – Volume 2 (Plant Site) Version 2

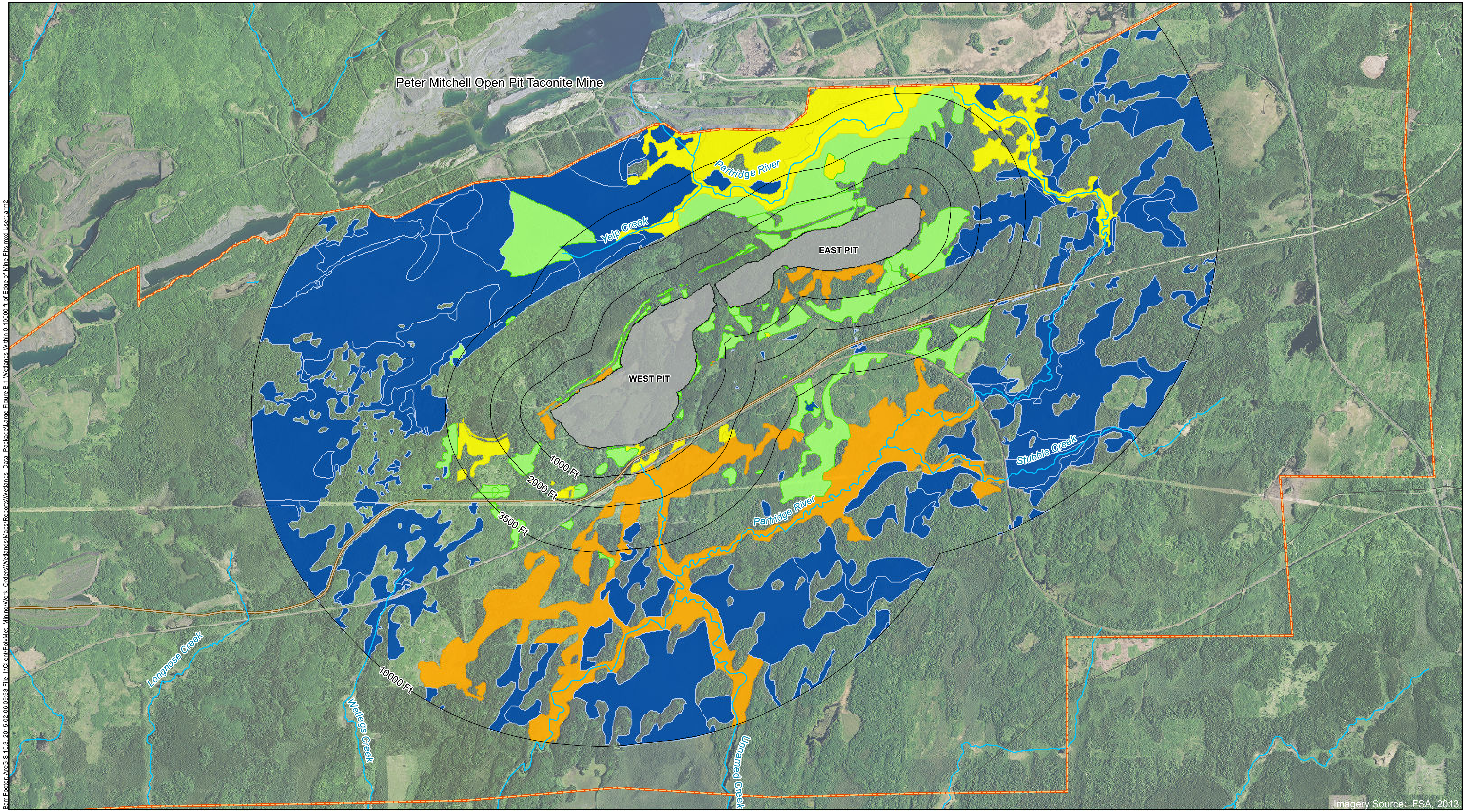
Reference 6 Surface Water IAP Group Summary Document, Date: May 20, 2011.

Reference 7 NorthMet Project Waste Characterization Data Package Version 5

Reference 8 NorthMet Mine Site Water Modeling Work Plan Version 2

Attachment B

Wetlands within Analog Zones – Mine Site

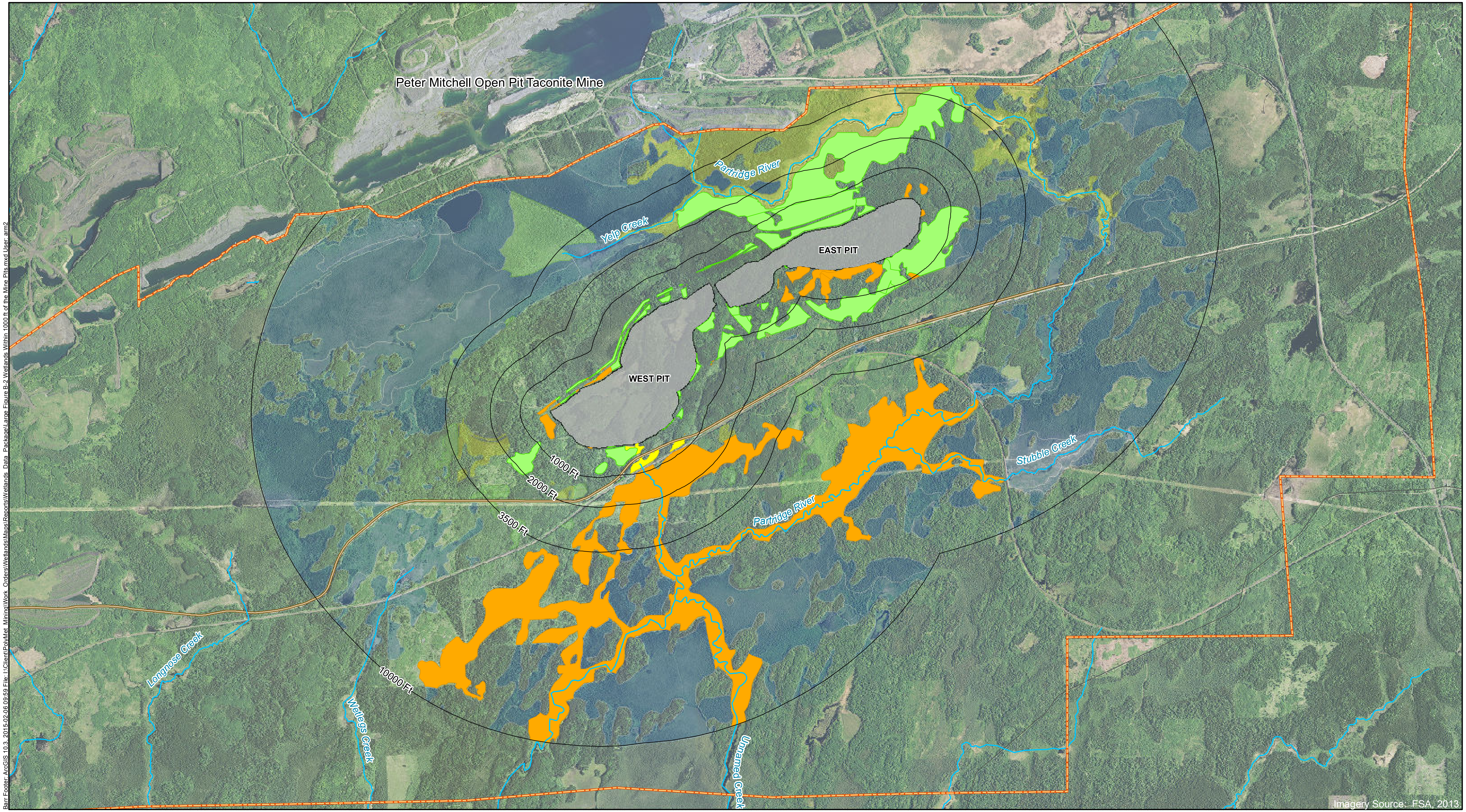


Pits - Mine Year 20
Baseline Type Evaluation Study Area One
Analogue Impact Zones (Feet)
Dunka Road
Rivers & Streams

Likelihood of Wetland Hydrology Impact
High Likelihood
Moderate Likelihood
Low Likelihood
No Impact

0 1,500 3,000 6,000
Feet

Large Figure B-1
WETLANDS WITHIN 0 - 10,000 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



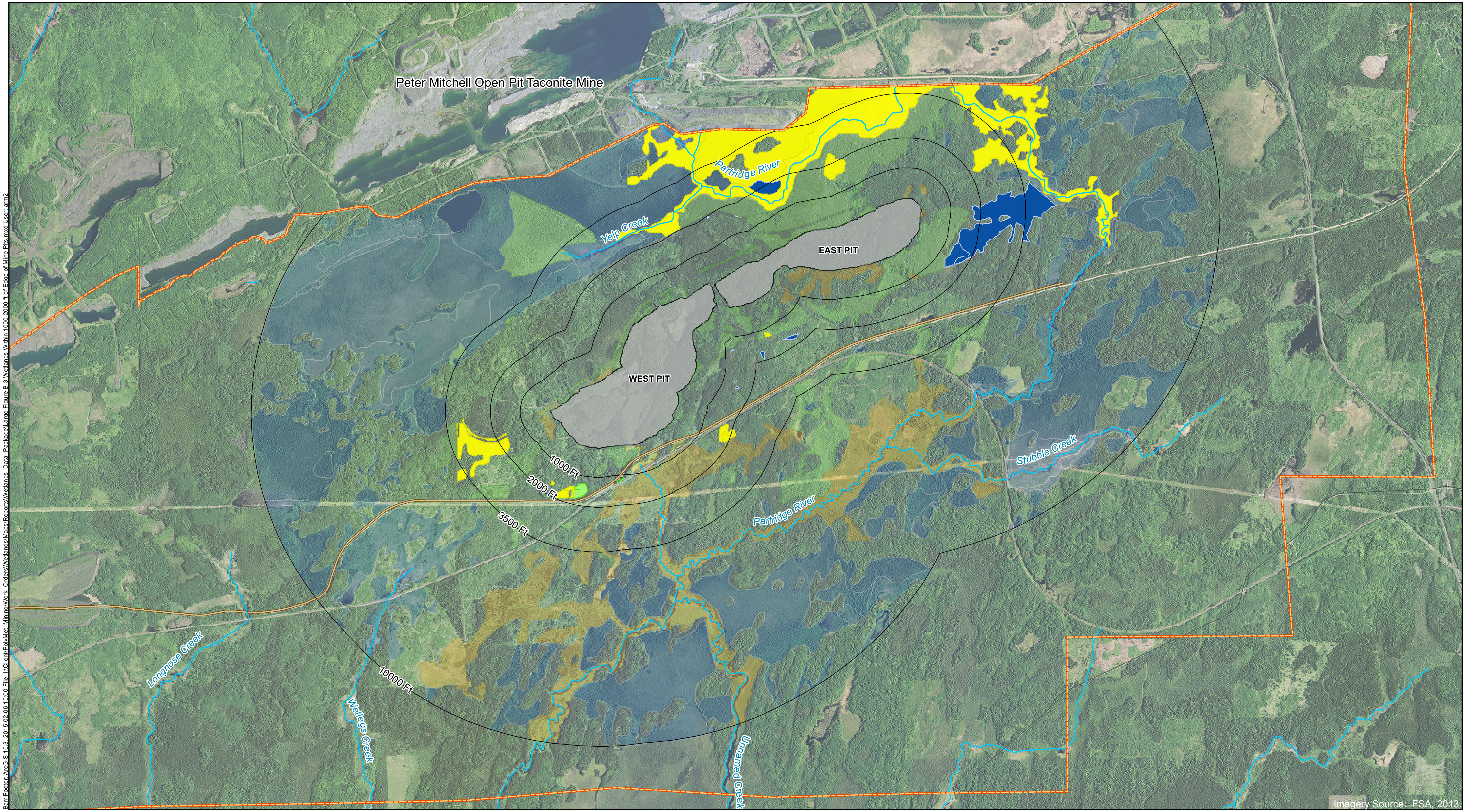
Pits - Mine Year 20
Baseline Type Evaluation Study Area One
Analogue Impact Zones (Feet)
Dunka Road
Rivers & Streams

Likelihood of Wetland Hydrology Impact
High Likelihood
Moderate Likelihood
Low Likelihood
No Impact

N

0 1,500 3,000 6,000
Feet

Large Figure B-2
WETLANDS WITHIN 0 - 1,000 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

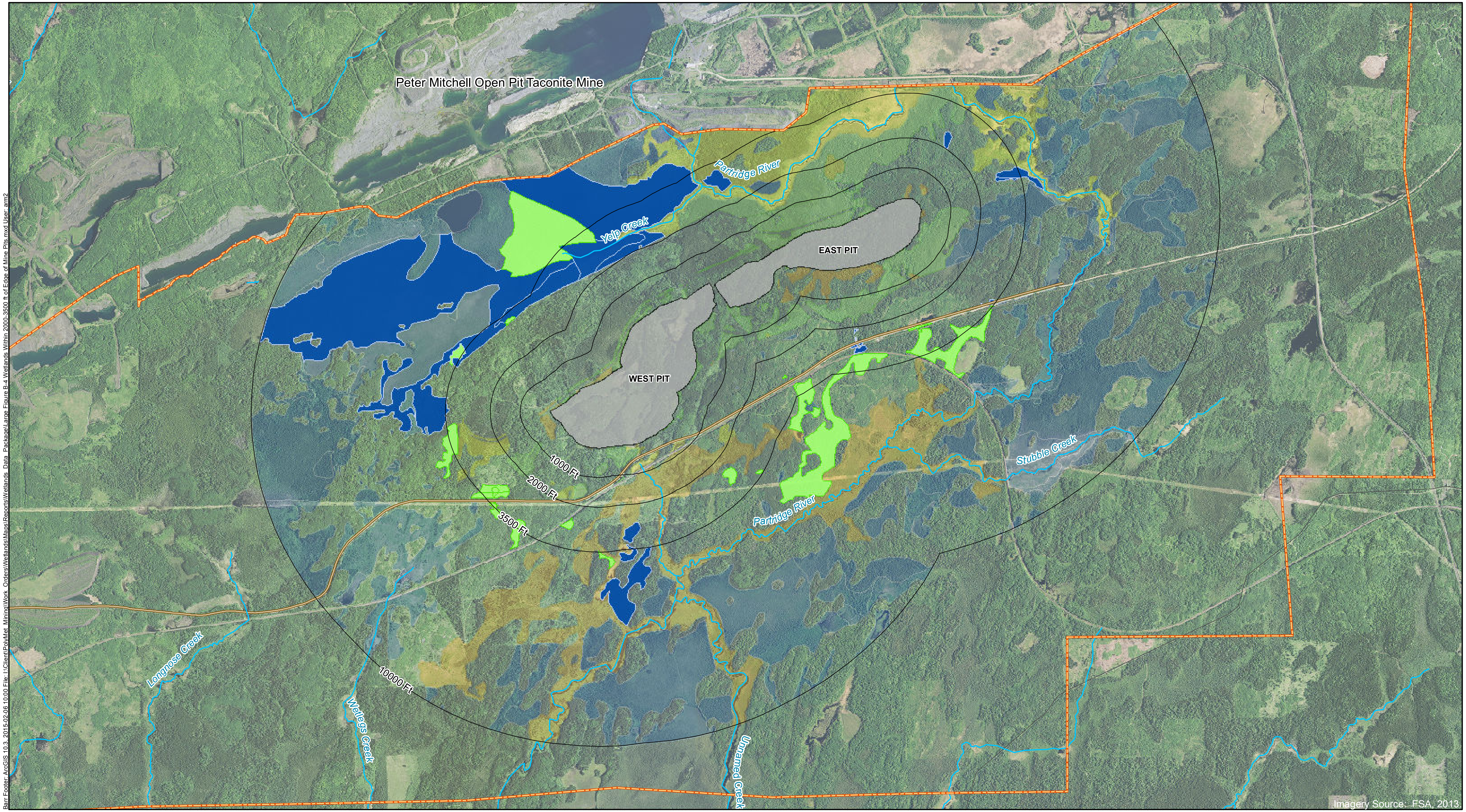


Pits - Mine Year 20
Baseline Type Evaluation Study Area One
Analogue Impact Zones (Feet)
Dunka Road
Rivers & Streams

Likelihood of Wetland Hydrology Impact
Moderate Likelihood
Low Likelihood
No Impact

0 1,500 3,000 6,000
Feet

Large Figure B-3
WETLANDS WITHIN >1,000 - 2,000 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



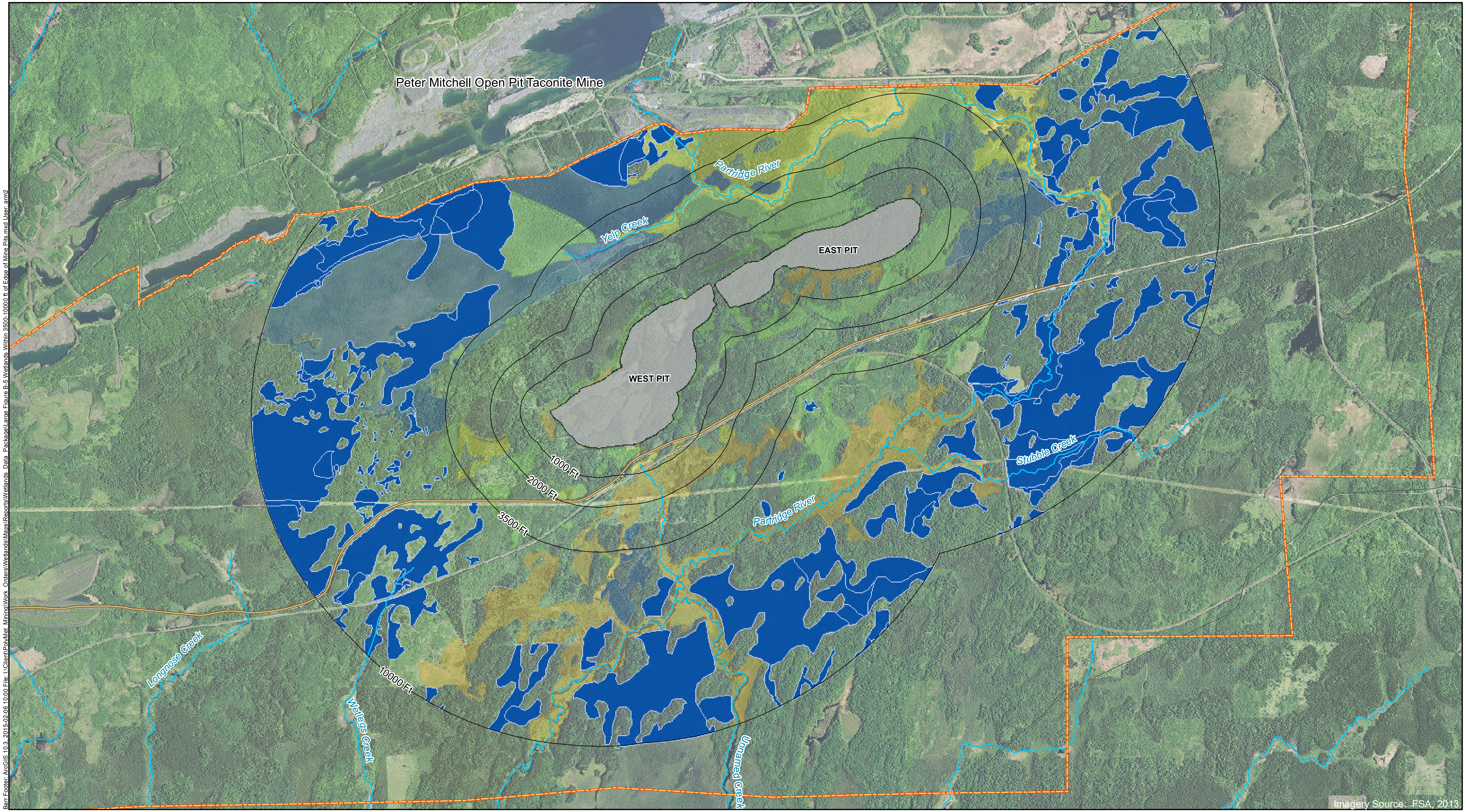
Barr Footer: ArcGIS 10.3, 2015-02-06 10:00 File: I:\Client\PolyMet_Mining\Work_Orders\Wetlands\Maps\Reports\Wetlands_Data_Package\Large Figure B-4 Wetlands Within 2000-3500 ft of Edge of Mine Pits.mxd User: arm2

Pits - Mine Year 20
Baseline Type Evaluation Study Area One
Analogue Impact Zones (Feet)
Dunka Road
Rivers & Streams

Likelihood of Wetland Hydrology Impact
Low Likelihood
No Impact

0 1,500 3,000 6,000
Feet

Large Figure B-4
WETLANDS WITHIN >2,000 - 3,500 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

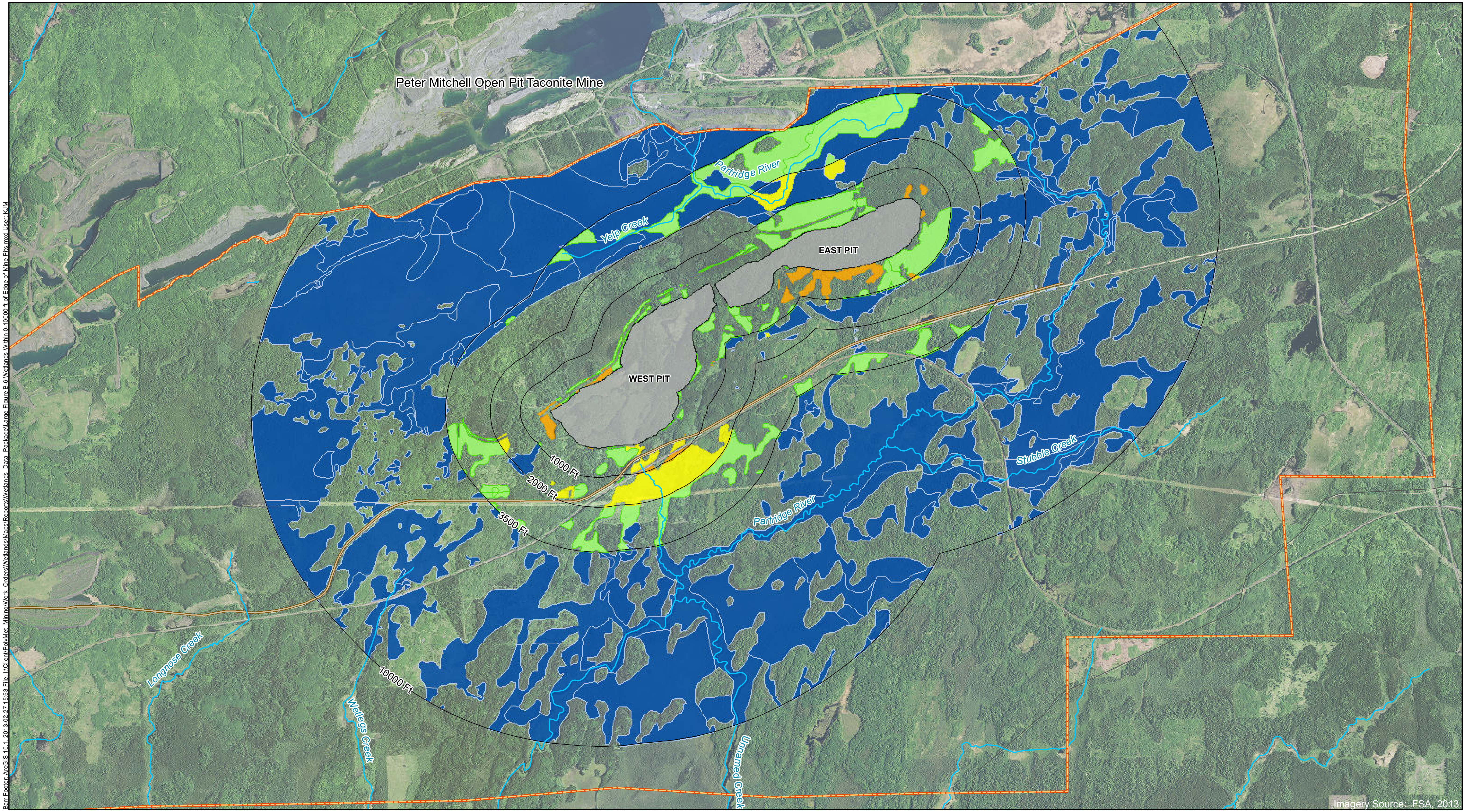


Pits - Mine Year 20
Baseline Type Evaluation Study Area One
Analogue Impact Zones (Feet)
Dunka Road
Rivers & Streams

Likelihood of Wetland Hydrology Impact
No Impact

0 1,500 3,000 6,000
Feet

Large Figure B-5
WETLANDS WITHIN >3,500 - 10,000 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



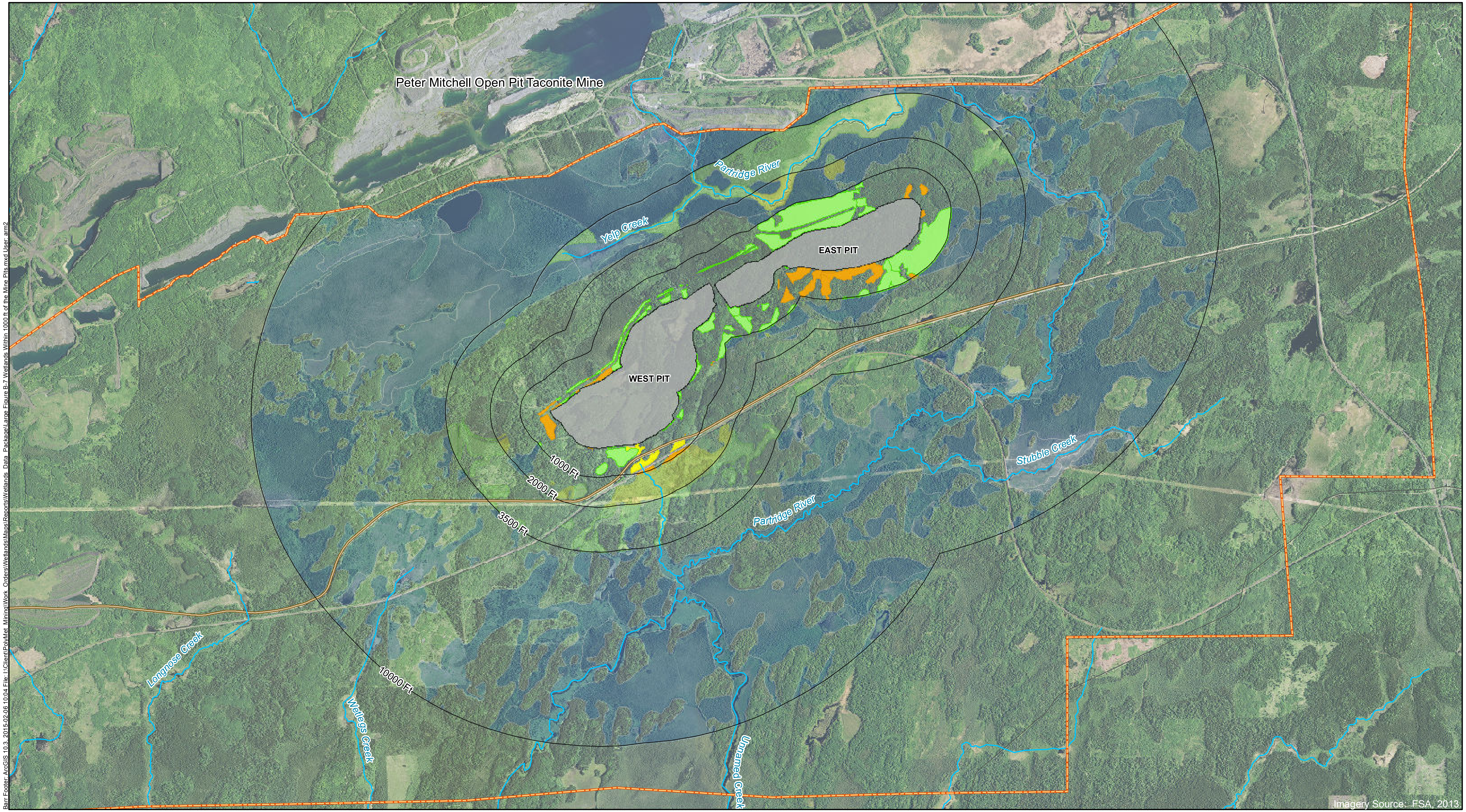
- Pits - Mine Year 20
- Baseline Type Evaluation Study Area One
- Analogue Impact Zones (Feet)
- Dunka Road
- Rivers & Streams

Likelihood of Wetland Hydrology Impact

- High Likelihood
- Moderate Likelihood
- Low Likelihood
- No Impact

0 1,500 3,000 6,000
Feet

Large Figure B-6
WETLANDS WITHIN 0 - 10,000 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



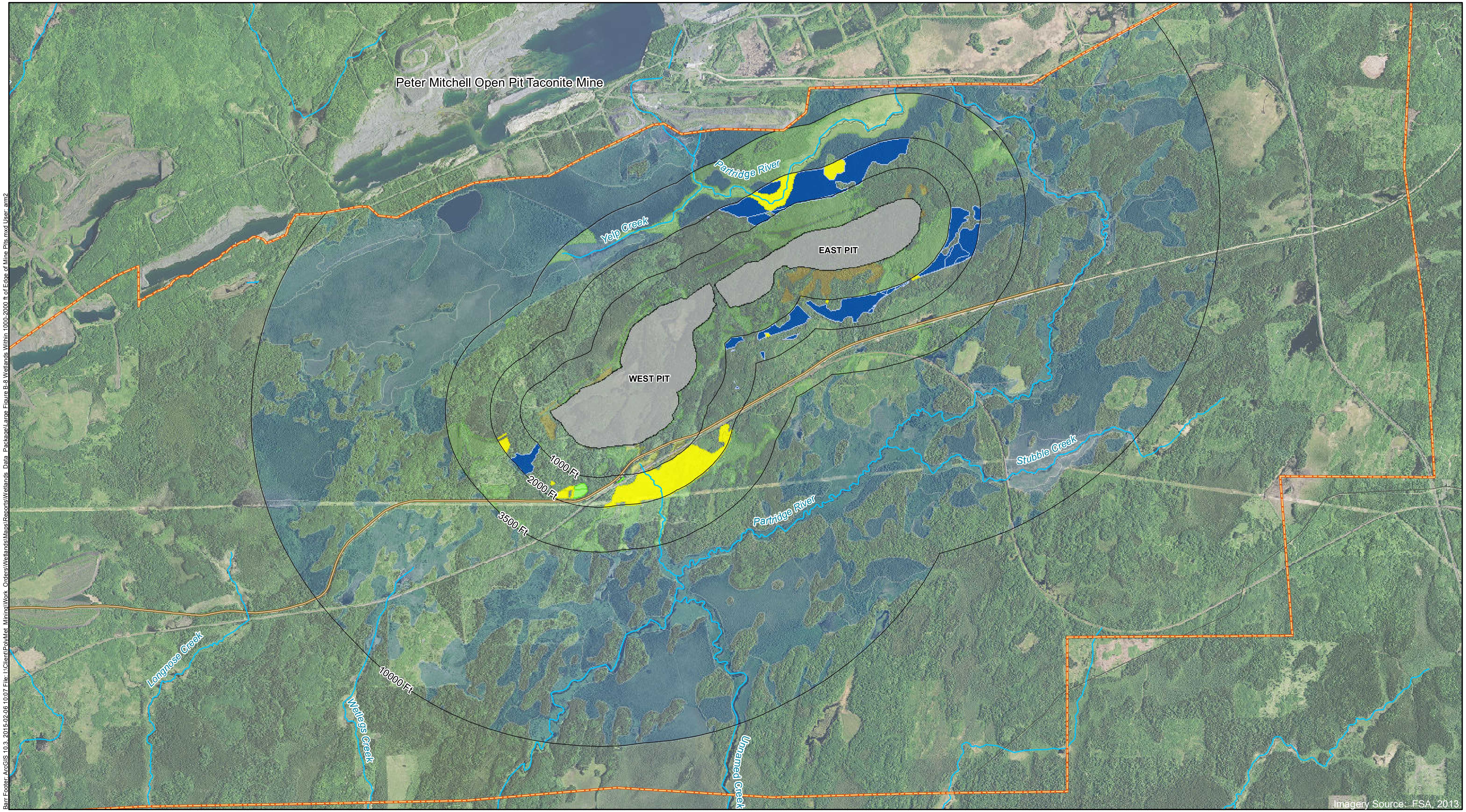
Pits - Mine Year 20
Baseline Type Evaluation Study Area One
Analogue Impact Zones (Feet)
Dunka Road
Rivers & Streams

Likelihood of Wetland Hydrology Impact
High Likelihood
Moderate Likelihood
Low Likelihood
No Impact

0 1,500 3,000 6,000
Feet

Large Figure B-7
WETLANDS WITHIN 0 - 1,000 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

Barr Footer: ArcGIS 10.3, 2015-02-06 10:04 File: I:\Client\PolyMet Mining\Work Orders\Wetlands\Maps\Reports\Wetlands Data Package\Large Figure B-7 Wetlands Within 1000 ft of the Mine Pits.mxd User: arm2

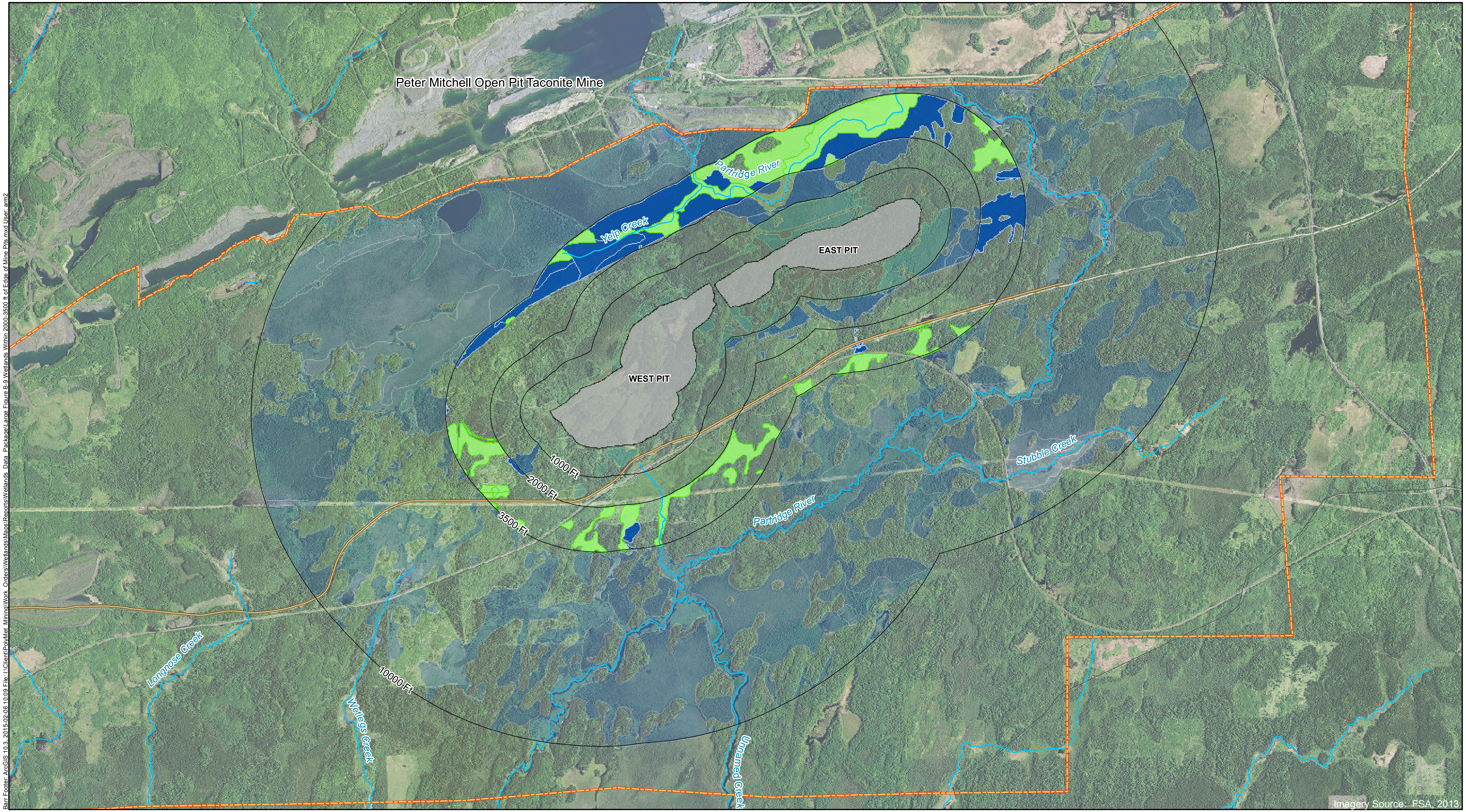


Pits - Mine Year 20
Baseline Type Evaluation Study Area One
Analogue Impact Zones (Feet)
Dunka Road
Rivers & Streams

Likelihood of Wetland Hydrology Impact
Moderate Likelihood
Low Likelihood
No Impact

0 1,500 3,000 6,000
Feet

Large Figure B-8
WETLANDS WITHIN >1,000 - 2,000 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

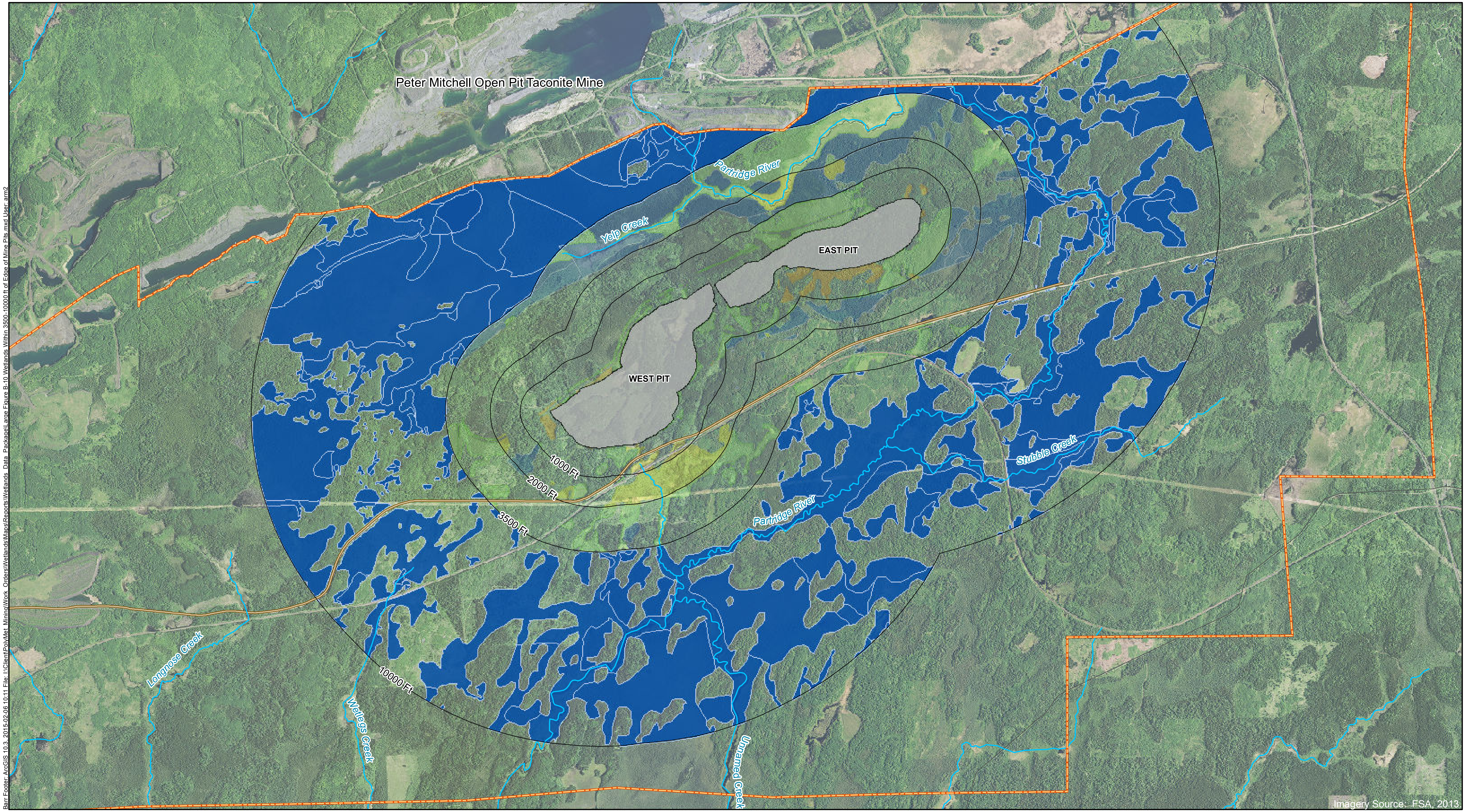


Pits - Mine Year 20
Baseline Type Evaluation Study Area One
Analogue Impact Zones (Feet)
Dunka Road
Rivers & Streams

Likelihood of Wetland Hydrology Impact
Low Likelihood
No Impact

0 1,500 3,000 6,000
Feet

Large Figure B-9
WETLANDS WITHIN >2,000 - 3,500 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Barr Footer: ArcGIS 10.3, 2015-02-06 10:11 File: I:\Client\PolyMet_Mining\Work_Orders\Wetlands\Maps\Reports\Wetlands_Data_Package\Large Figure B-10 Wetlands Within 3500-10000 ft of Edge of Mine Pits.mxd User: arm2

Pits - Mine Year 20
Baseline Type Evaluation Study Area One
Analogue Impact Zones (Feet)
Dunka Road
Rivers & Streams

Likelihood of Wetland Hydrology Impact
No Impact

N

0 1,500 3,000 6,000
Feet

Large Figure B-10
WETLANDS WITHIN >3,500 - 10,000 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

Attachment C

Chemistry of NorthMet Ore, NorthMet Tailings, and LTVSMC Tailings

Table C1-1 Ore and Waste Rock Chemistry Data Used Speciate Dust Depostion

	Ore[1]					Category 1 Waste Rock				
	Center	East	West	Max		Center	East	West	Max	
Constituent	**95% UCL**	**95% UCL**	**95% UCL**	**95% UCL**	**99th Percentile**	**95% UCL**	**95% UCL**	**95% UCL**	**95% UCL**	**99th Percentile**
AS_PPM	18.8	7.84	9.51	18.83	28.1	6.18	5.82	8.48	8.48	13.2
CD_PPM	0.838	0.923	0.814	0.92	2.50	0.513	0.609	0.576	0.61	1.30
CR_PPM	119	124	208	208.46	559	160	178	182	181.85	286
Cu_D	0.286	0.363	0.312	0.36	0.594	0.032	0.0394	0.046	0.0460	0.082
MN_PPM	970	956	911	970.41	1279	846	989	1004	1004.10	1363
Ni_D	0.106	0.0976	0.082	0.11	0.153	0.032	0.0305	0.0343	0.0343	0.056
PB_PPM	9.11	10.6	7.81	10.58	16.8	3.74	5.65	5.33	5.65	12.1
SE_PPM				5.5					8.4	
Sulfur_PPM				9,588.6					n/a	
V_PPM	106	126	96.5	126.29	259	63.8	117	98.2	117.00	168
ZN_PPM	100	104	92.3	104.12	138	80.4	110	86.4	110.17	116
	Category 2/3 Waste Rock					**Category 4 Waste Rock[2]**				
	Center	**East**	**West**	**Max**						
Constituent	**95% UCL**	**95% UCL**	**95% UCL**	**95% UCL**	**99th Percentile**	**95% UCL**	**99th Percentile**	**Max**		
AS_PPM	7.15	7.10	9.32	9.32	20.8	33.8	86.7			
CD_PPM	0.555	0.708	0.721	0.72	1.60	1.80	3.40			
CR_PPM	130	225	219	224.69	474	159	325			
Cu_D	0.068	0.072	0.100	0.10	0.130	0.0369	0.1290			
MN_PPM	713	1026	964	1025.74	1300	529	1758			
Ni_D	0.033	0.035	0.0362	0.04	0.051	0.0191	0.0470			
PB_PPM	3.25	6.77	6.81	6.81	13.7	12.4	25.1			
SE_PPM				8.38				8.38		
Sulfur_PPM				3,476.5				34,540.0		
V_PPM	49.9	119	124	123.94	280	143	256			
ZN_PPM	73.2	110	83.7	110.08	147	273	555			

PPM = part per million concentration

General Notes:

Values listed are the 95% upper confidence limit (UCL) for the mean for the maximum year in the 20-year projected life of the mine.

Columns labeled "Max Avg." contain the value used in the previous emission inventory submittals for comparison.

95% UCL Values are in PPM except for Cu and Ni which are expressed as percents. Maximum averages are all expresses as PPM (divide by 10,000 to convert PPM to %).

Footnotes:

[1]Ore data used in the previous emission inventory submittals was not separated into East and Central pit values.

[2]Because of the relatively small volume of Category 4 Waste Rock, the statistical analysis was conducted for all data independent of year and pit.

References:

Geerts, S.D., 1994, Petrography and geochemistry of a platinum group element-bearing mineralized horizon in the Dunka Road prospect (Keweenawan) Duluth Complex northeastern Minnesota: Unpublished M.S. Thesis. University of Minnesota Duluth. 155 p., 8 plates.

Severson, M.J., 1988. Geology and structure of a portion of the Partridge River intrusion: A progress report: Natural Resources Research Institute, University of Minnesota Duluth, Technical Report, NRRI/GMIN-TR-88-08. Duluth, Minnesota. 78 p., 5 plates.

Severson, M.J., and Hauck, S.A. 1990. Geology, geochemistry, and stratigraphy of a portion of the Partridge River intrusion: Natural Resources Research Institute, University of Minnesota Duluth, Technical Report, NRRI/GMIN-TR-89-11. 235 p. 4 plates, 1 diskette.

Table C1-2 Tailings Chemistry Data Used to Speciate Dust Deposition

Metal	Conc. (ppm)	Source	Comments
NorthMet Tailings			
Arsenic	81	2000 Pilot Study [2]	Emission factors calculated from trace metal analysis completed on tailings produced during the pilot study. The results from the -38um fraction was used because this would approximate TSP except when the -10um fraction appeared to produce higher quality data (e.g. lower detection limits). Data for the analysis of the entire tailings size range was also evaluated, but these values were lower, with the exception of boron, and the smaller particle sizes would represent those most likely to become airborne. The data for the entire tailings size range was used for boron, because the size specific data were below the detection limit. With the exception of vanadium, analysis for all of these elements was also performed during the 2005 pilot study. However, the results from 2000 were higher for all elements. 2000 data was used for all elements to be conservative.
Cadmium	0.08	2005/2006 Pilot Study [1]	Emission factor calculated from data obtained during 2005 and 2006 pilot studies. Average value for all parcels calculated. Values below the detection limit assumed to be at the detection limit.
Chromium	310	2000 Pilot Study [2]	Emission factors calculated from trace metal analysis completed on tailings produced during the pilot study. The results from the -38um fraction was used because this would approximate TSP except when the -10um fraction appeared to produce higher quality data (e.g. lower detection limits). Data for the analysis of the entire tailings size range was also evaluated, but these values were lower, with the exception of boron, and the smaller particle sizes would represent those most likely to become airborne. The data for the entire tailings size range was used for boron, because the size specific data were below the detection limit. With the exception of vanadium, analysis for all of these elements was also performed during the 2005 pilot study. However, the results from 2000 were higher for all elements. 2000 data was used for all elements to be conservative.
Copper	547		
Lead	383		
Manganese	1400		
Nickel	510	2000 Pilot Study [2]	Emission factors calculated from trace metal analysis completed on tailings produced during the pilot study. The results from the -38um fraction was used because this would approximate TSP except when the -10um fraction appeared to produce higher quality data (e.g. lower detection limits). Data for the analysis of the entire tailings size range was also evaluated, but these values were lower, with the exception of boron, and the smaller particle sizes would represent those most likely to become airborne. The data for the entire tailings size range was used for boron, because the size specific data were below the detection limit. With the exception of vanadium, analysis for all of these elements was also performed during the 2005 pilot study. However, the results from 2000 were higher for all elements. 2000 data was used for all elements to be conservative.
Selenium	1.2	2005/2006 Pilot Study [1]	Emission factor calculated from data obtained during 2005 and 2006 pilot studies. Average value for all parcels calculated. Values below the detection limit assumed to be at the detection limit.
Sulfur	1,210	Water Modeling Data Package; as of Sept. 04, 2012	1,210 mg S / kg tailings is ~ 0.12% sulfur content.
Zinc	548	2000 Pilot Study [2]	Emission factors calculated from trace metal analysis completed on tailings produced during the pilot study. The results from the -38um fraction was used because this would approximate TSP except when the -10um fraction appeared to produce higher quality data (e.g. lower detection limits). Data for the analysis of the entire tailings size range was also evaluated, but these values were lower, with the exception of boron, and the smaller particle sizes would represent those most likely to become airborne. The data for the entire tailings size range was used for boron, because the size specific data were below the detection limit. With the exception of vanadium, analysis for all of these elements was also performed during the 2005 pilot study. However, the results from 2000 were higher for all elements. 2000 data was used for all elements to be

Metal	Conc. (ppm)	Source	Comments
			conservative.
Vanadium	210	2000 Pilot Study [2]	Emission factors calculated from trace metal analysis completed on tailings produced during the pilot study. The results from the -38um fraction was used because this would approximate TSP except when the -10um fraction appeared to produce higher quality data (e.g. lower detection limits). Data for the analysis of the entire tailings size range was also evaluated, but these values were lower, with the exception of boron, and the smaller particle sizes would represent those most likely to become airborne. The data for the entire tailings size range was used for boron, because the size specific data were below the detection limit. With the exception of vanadium, analysis for all of these elements was also performed during the 2005 pilot study. However, the results from 2000 were higher for all elements. 2000 data was used for all elements to be conservative.
LTVSMC Tailings Chemistry			
Arsenic	24.6	Waste water modeling report [3]	
Cadmium	0.25	Waste water modeling report [3]	Result reports as < 0.5
Chromium	66.8	Waste water modeling report [3]	
Copper	12.6	Waste water modeling report [3]	
Lead	5.6	Waste water modeling report [3]	
Manganese	4880	Waste water modeling report [3]	
Nickel	4	Waste water modeling report [3]	
Selenium	1.2	NorthMet Data	Data not available for LTVSMC tailings.
Sulfur	1,210	Water Modeling Data Package; as of Sept. 04, 2012	1,210 mg S / kg tailings is ~ 0.12% sulfur content. Sulfur content of NorthMet tailings assumed to the sulfur content of the LTVSMC tailings.
Zinc	15.8	Waste water modeling report [3]	
Vanadium	10.4	LTVSMC tailings data (Aqua Regia tests)	Data submitted to the MDNR in June 2011 via email from P.Hinck (Barr) to M.Olson (MDNR).

[1] Barr Engineering Co. May 2006. Environmental Sampling and Analysis Flotation Process Liquids and Solids Sampling Results Pilot Test – NorthMet Deposit PolyMet Mining, Inc. Table 9 and Barr Engineering Co. July 2006. Draft - Environmental Sampling and Analysis Flotation Process Optimization Test. Table 5.

[2] SGS Lakefield Research Limited. Flotation Pilot Plant Products Environmental Investigation and Air Testing from NorthMet Samples. June 30, 2004. LR10054-003 Progress Report No. 6, Tables B-6 and B-1.

[3] Barr Engineering Co. July 20, 2007. Waste Water Modeling – Tailings; NorthMet Project. Table 5-1 and supporting data set.'

Attachment D

Adjustment of Background Metal Deposition

ATTACHMENT D

Adjustment of Background Metal Deposition

The authors estimated that precipitation was under-estimated by 45% to 70%. An initial review of data (comparison of dry deposition and wet deposition as a percent of total deposition) indicates wet deposition is less than 50% of total deposition for the metals, except selenium (Table C2-1). Wet deposition in rural areas should account for 50% or more of the total deposition. For the Eagle Harbor data, the deposition estimates are considered to be skewed toward dry deposition (except for selenium)

Table D2-1 Comparing Wet Deposition and Dry Deposition to Total Deposition for the Eagle Harbor, Michigan Monitoring Site (Data as reported from Sweet et al. (1998).

Metal	Dry Deposition	Wet Deposition	Total (wet+dry)	Dry Deposition as a % of Total	Wet Deposition as a % of Total	Comments
	µg/m2/yr	µg/m2/yr	µg/m2/yr			
Vanadium	260	78	338	77%	23%	Wet dep % is low
Chromium	130	78	208	63%	38%	Wet dep % is low
Manganese	1,900	2,300	4,200	45%	55%	
Nickel	570	230	800	71%	29%	Wet dep % is low
Copper	2,400	700	3,100	77%	23%	Wet dep % is low
Zinc	5,300	3,500	8,800	60%	40%	Wet dep % is low
Arsenic	91	78	169	54%	46%	Wet dep % is low
Selenium	52	520	572	9%	91%	
Cadmium	380	78	458	83%	17%	Wet dep % is low
Lead (Pb)	920	550	1,470	63%	37%	Wet dep % is low

µg/m2/yr = micrograms per square meter per year

Because Sweet et al. (1998) indicated that precipitation was under-collected by 45% to 70%, the wet deposition component of t heir data was adjusted. The mid-range of the under-collection (60%) was used to adjust estimated wet deposition. A factor of 1.6 was applied to the wet deposition reported by Sweet et al. (1998). The adjusted wet deposition was added to the estimated dry deposition reported by Sweet et al. (1998) to derive an “adjusted total deposition” (Table C2-2). The adjusted total deposition from Table C2-2 was used for comparison to the respective modeled metal deposition rates for the Mine Site and Flotation Tailings Basin.

However, no adjustment to the selenium wet deposition was made because wet deposition was already accounting for 91% of the total deposition.

Even with the adjustment in wet deposition by a factor of 1.6, the adjusted wet deposition for most metals is less than 50% of total deposition.

Table D2-2 Summary Table of Adjustments in Background Metal Deposition Due to the Under-Collection of Precipitation at the Eagle Harbor, Michigan Monitoring Site (reported data from Sweet et al. 1998.)

Metal	Reported Dry Deposition [1]	Reported Wet Deposition [1]	Adjusted Wet Deposition [2]	Adjusted Total (Dry + Adjusted Wet) [3]	Dry Deposition as a % of Adjusted Total	Adjusted Wet Deposition as a % of Adjusted Total
	µg/m2/yr	µg/m2/yr	µg/m2/yr	µg/m2/yr		
Vanadium	260	78	125	385	68%	32%
Chromium	130	78	125	255	51%	49%
Manganese	1,900	2,300	3,680	5,580	34%	66%
Nickel	570	230	368	938	61%	39%
Copper	2,400	700	1,120	3,520	68%	32%
Zinc	5,300	3,500	5,600	10,900	49%	51%
Arsenic	91	78	125	216	42%	58%
Selenium	52	520	520 [4]	572 [4]	91% [4]	9% [4]
Cadmium	380	78	125	505	75%	25%
Lead (Pb)	920	550	880	1,800	51%	49%

µg/m2/yr = micrograms per square meter per year

[1] Deposition as reported by Sweet et al. (1998).

[2] Adjusted Wet Deposition = Reported Deposition x 1.6

[3] Adjusted Total Deposition = Reported Dry Deposition + Adjusted Wet Deposition

[4] Selenium wet deposition and total deposition were not adjusted for under-collection of precipitation.

Adjustment in total deposition compared to the deposition reported by Sweet et al. (1998) is summarized in Table C2-3. Overall, the adjustment in wet deposition by a factor of 1.6 (60% increase) results in relatively small increases in total deposition. Because dry deposition is the major component of the total deposition, the adjustment in the wet deposition for under-collection of precipitation does not change the total deposition appreciably and for most of the metals wet deposition is still the smaller component of the total deposition (Table C2-2).

Table D2-3. Change in estimated total deposition from the values originally reported by Sweet et al (1998)

	Initial Data: From Sweet et al. (1998)					
Metal	**Reported Dry Deposition**	**Reported Wet Deposition**	**Reported Total Deposition (wet + dry)**	**Adjusted Wet Deposition**	**Adjusted Total Deposition (adjusted wet + dry)**	**% Change in Total Deposition (Adjusted Total - Reported Total)/Reported Total**
	µg/m2/yr	µg/m2/yr	µg/m2/yr	µg/m2/yr	µg/m2/yr	%
Vanadium	260	78	338	125	385	14%
Chromium	130	78	208	125	255	23%
Manganese	1,900	2,300	4,200	3,680	5,580	33%
Nickel	570	230	800	368	938	17%
Copper	2,400	700	3,100	1,120	3,520	14%
Zinc	5,300	3,500	8,800	5,600	10,900	24%
Arsenic	91	78	169	125	216	28%
Selenium	52	520	572			
Cadmium	380	78	458	125	505	10%
Lead (Pb)	920	550	1,470	880	1,800	22%

Memorandum

To: Project File
From: Peter Hinck
Subject: NorthMet Mine Site to Plant Site rail impacts modeling
Date: December 21, 2012
Project: 23690862.00

This memorandum documents the water quality modeling assumptions and methods used to estimate the potential indirect impacts to wetlands along the Mine Site to Plant Site rail corridor. The basis for this analysis is described in the Wetland Analysis Work Plan (Reference [1], Section 4.3.2).

Conceptual model

As discussed in Reference [1], the goal of this analysis is to estimate the quality of water contacting spilled ore material along the rail corridor. If the resulting water quality (at Point 1 in Figure 1 below) is found to have a greater than 10 percent likelihood of exceeding surface water quality standards, this analysis seeks to determine the unit area needed (dimension *X* in Figure 1) to provide sufficient precipitation to dilute the water to meet water quality standards (at Point 2 in Figure 1).

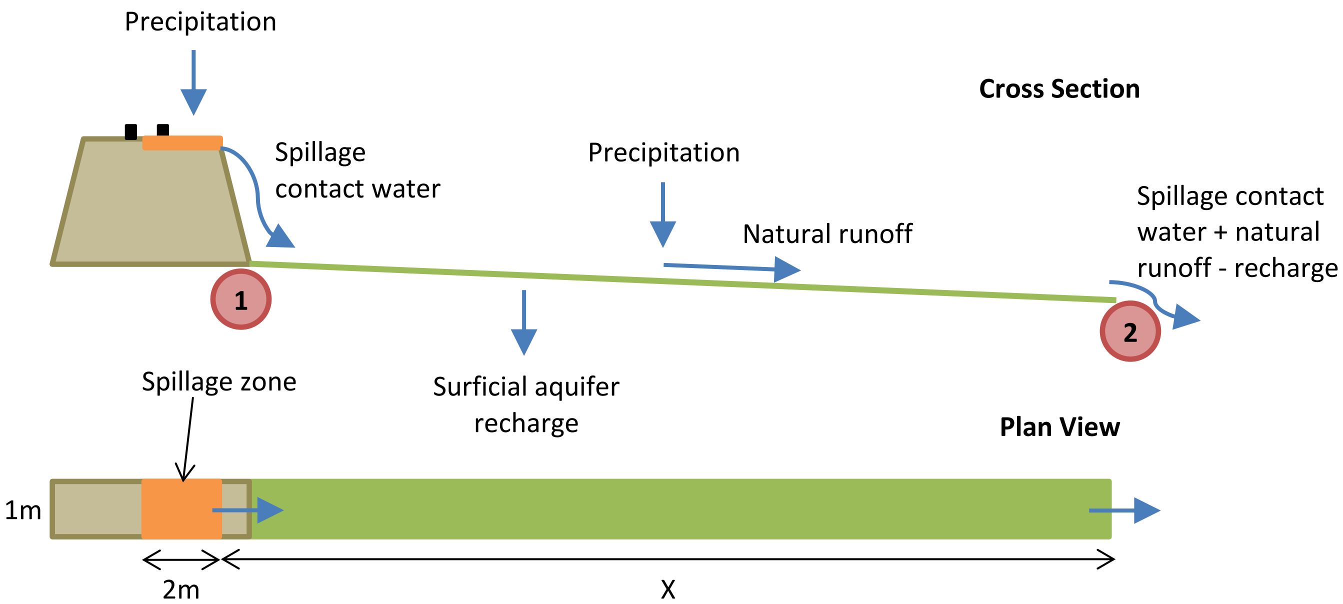


Figure 1 Rail spillage conceptual model schematic

This modeling was performed using a probabilistic simulation in the GoldSim software, similar to the water quality modeling for the Mine Site. The model was run at a monthly timestep for 100 years, with 500 realizations performed using the GoldSim Monte Carlo simulation package.

Model input parameters

The list below includes all of the input parameters used in this modeling and their references. Any adjustments from the referenced methods or values are documented here.

Geochemical Parameters

- Width of spillage zone: 2 meters on both sides of the centerline of the railway (total width = 4 meters) (Reference [1], Section 4.3.2)
- Mass of spilled ore: 2.14 kg/m^2 at the end of 20 years, assumed to accumulate linearly from zero mass at time zero (Reference [1], Section 4.3.2)
- Humidity cell release rates: As defined for "ore composites" (Reference [2], Section 8.1)
- Water contact factor: 1.0, assumed complete rinsing (Reference [2], Section 8.4.3)
- Particle size factor: 1.0, assumed particle size distribution identical to humidity cells (Reference [2], Section 8.4.3)
- Temperature factor: uncertainty in annual field temperature and activation energy (Reference [2], Section 8.2.4)
- Acidification: uncertainty in acidification factor and time to acidification, time to acidification assumed to be scaled by the temperature factor (Reference [2], Sections 8.2.5 and 9.4)
- Concentration caps: uncertainty in nonacidic and acidic concentration caps for Duluth Complex Category 2/3/4 waste rock and ore (Reference [2], Sections 8.3.1.6 and 8.3.3)
- Depletion: mass of constituents per unit ore (Reference [2], Sections 8.4.1)

Hydrology Parameters

- Annual and monthly precipitation: uncertainty in annual precipitation (Reference [3], Section 5.2)
- Contact water from spilled ore: uniform range from 40% to 60% of annual precipitation (Reference [3], Section 6.1.3.4.2)
- Runoff from natural areas: uncertainty in summer and winter runoff as a percent of precipitation (Reference [3], Section 6.1.3.3.2)
- Annual surficial aquifer recharge: uniform range from 0.36 to 1.8 inches per year (Reference [3], Section 5.4.1.2)

Water Quality Parameters

- Background runoff water quality: uncertainty in mean runoff concentrations, calibrated to the Partridge River watershed (Reference [3], Section 5.3.2)
- Surface water quality standards: standards applicable to the Partridge River, 100 mg/L hardness assumed for hardness-based standards (Reference [3], Section 2.2)

Additional modeling assumptions and methods

Constituent release from the spilled ore was modeled using release rates derived from ore composite humidity cells as well as from total metal content to total sulfur ratios from tests on core samples of ore rock (Reference [2], Section 8.1). Sulfate release was modeled using the linear regression to sulfur content developed from humidity cells at a range of sulfur contents (Reference [2], Section 8.1.1). The sulfur content used in this calculation was the currently-modeled sulfur content, with the result that sulfate release rates decrease as the remaining sulfur content decreases in the model. For metals with release rates based on metal to sulfur ratios, this method results in a corresponding decrease in metal release rates.

The water balance for the both the spillage zone and the natural runoff zone was modeled with consideration of the effects of snowmelt. Precipitation during the months of November through March is assumed to be stored on the landscape as snow. The accumulated snow is released as a one-month flow during the month of April. This method reduces the potential for unrealistically high concentrations due to low flows in the winter months, when in reality any water will be frozen in ice and snow.

The defined runoff or contact water from the spillage zone is assumed to be completely mixed with the runoff from natural areas. The only loss of water (and dissolved constituent mass) from this system prior to evaluation of standards compliance is due to recharge into the surficial aquifer. The recharge lost from the system is assumed to flow at the same rate both beneath the ore spillage zone (contact water concentration) and within the natural areas (mixed contact and natural runoff water concentration).

The modeled concentrations of all constituents were compared to surface water quality standards at each timestep during the 100-year simulation at both the edge of the spillage zone (Point 1 in Figure 1) and at the downstream edge of the mixing zone (Point 2 in Figure 1). For every timestep the fraction of the 500 realizations with recorded exceedances of the water quality standards was computed and compared to the stated goal of a less than 10% likelihood of exceeding a standard. For example, if at model time 20.5 years the concentration of copper was above the water quality standard in 75 of the 500 realizations, the simulation would have a 15% (75/500) likelihood of an exceedance and would fail the 10% goal. The model was run multiple times with varying lengths of the dilution zone (dimension *X* in Figure 1) until the 10% goal was met for all constituents in all timesteps.

Results

For the majority of the modeled constituents, concentrations are expected to be well below the applicable surface water quality standards at the edge of the spillage zone. No additional dilution from unimpacted surface runoff is necessary, and there is little or no potential for indirect impacts to adjacent wetlands.

Four constituents have modeled concentrations at the edge of the spillage zone that have a greater than 10% likelihood of exceeding surface water quality standards: aluminum, cobalt, copper and nickel. The modeled water quality in the spillage contact water is shown for each of these constituents in Figure 2 through Figure 5; sulfate concentrations are also included for reference in Figure 6.

Background surface runoff has an approximately 20% likelihood of exceeding the water quality standard for aluminum, so no amount of dilution is possible to meet the goal of less than 10% likelihood of exceeding the standard. Therefore aluminum was not carried forward for additional analysis.

For cobalt, the likelihood of exceeding the surface water quality standard at the edge of the seepage zone is a maximum of approximately 90%. Using successive runs of the water quality model it was estimated that 2.5 meters (perpendicular to the rail line) of additional natural background runoff is necessary to reduce the likelihood of exceeding the standard to below 10%. Figure 7 shows the modeled cobalt concentrations at the downstream edge of a 2.5-meter buffer. Figure 8 shows the likelihood of exceedance for cobalt through time for both the edge of the seepage zone (purple line) and at the edge of a 2.5-meter buffer (green line).

For nickel, exceedances of the surface water quality standard at the edge of the seepage zone occurred in all model realizations for a period of about 30 years. Compared to cobalt, a longer buffer of an unimpacted runoff zone is necessary in order to dilute nickel concentrations to below the standard; the required distance is estimated as 30 meters (perpendicular to the rail line) for nickel. Figure 9 shows the modeled nickel concentrations at the downstream edge of a 30-meter buffer. Figure 10 shows the likelihood of exceedance for nickel through time for both the edge of the seepage zone (purple line) and at the edge of a 30-meter buffer (green line).

For copper, the modeled water quality at the edge of the seepage zone is consistently above the surface water quality standard until copper depletion begins to occur after about 40 years. Copper requires the longest buffer of an unimpacted runoff zone in order to have a less than 10% likelihood of exceeding the standard; the required distance is estimated as 675 meters (perpendicular to the rail line). Figure 11 shows the modeled copper concentrations at the downstream edge of a 675-meter buffer. Figure 12 shows the likelihood of exceedance for copper through time for both the edge of the seepage zone (purple line) and at the edge of a 30-meter buffer (green line).

Recommendations

Based on this analysis, it is recommended that wetlands with watersheds that contain less than 675 m^2 of unimpacted areas per meter of rail (one-sided) within the watershed be identified as potentially indirectly impacted due to water quality changes. Wetlands that are physically near the rail corridor but are not hydraulically connected to the rail line (i.e. no rail spillage areas are within the wetland's watershed) should not be considered to be indirectly impacted due to rail spillage effects.

References

[1] NorthMet Project Wetland Analysis Work Plan. Version 3, October 2011.

[2] NorthMet Project Waste Characterization Data Package. Version 9, July 2012.

[3] NorthMet Project Water Modeling Data Package – Volume 1 (Mine Site). Version 10, July 2012.

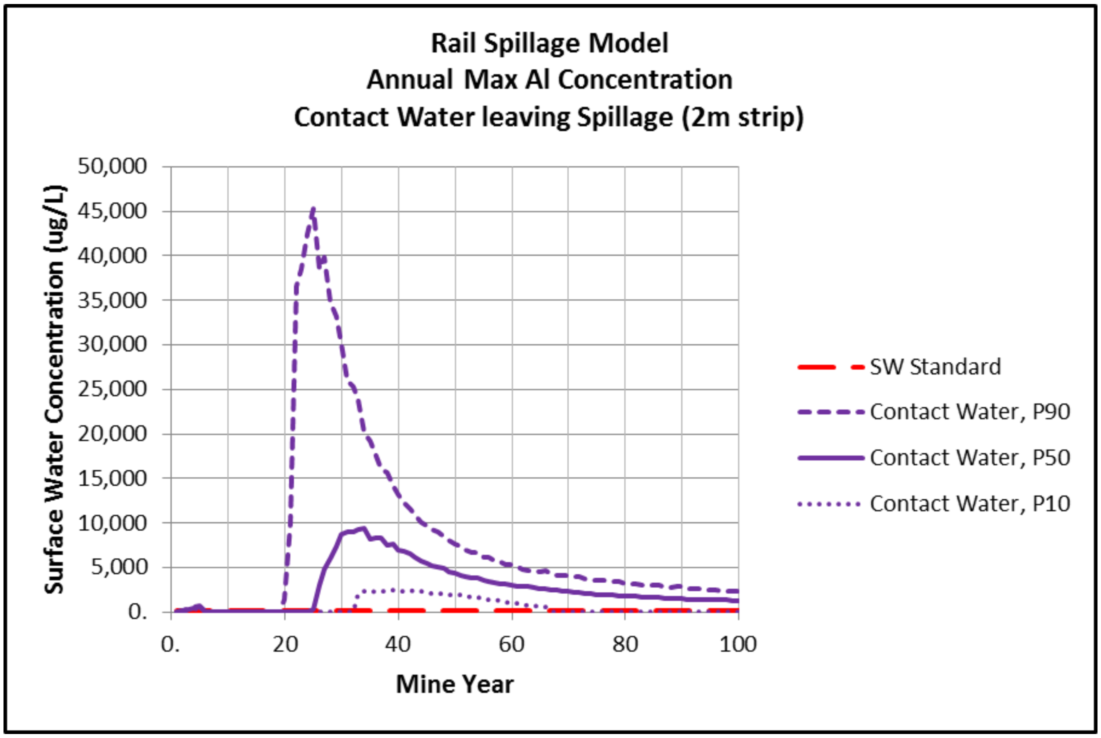


Figure 2 Aluminum concentrations at the edge of the spillage zone

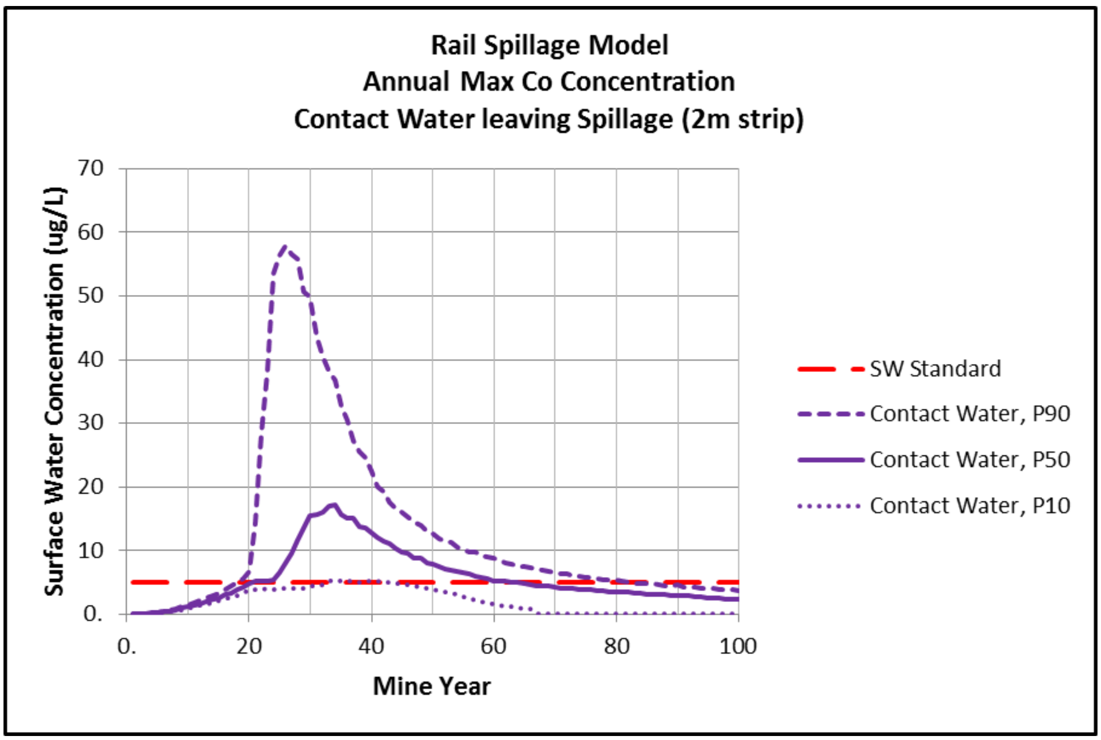


Figure 3 Cobalt concentrations at the edge of the spillage zone

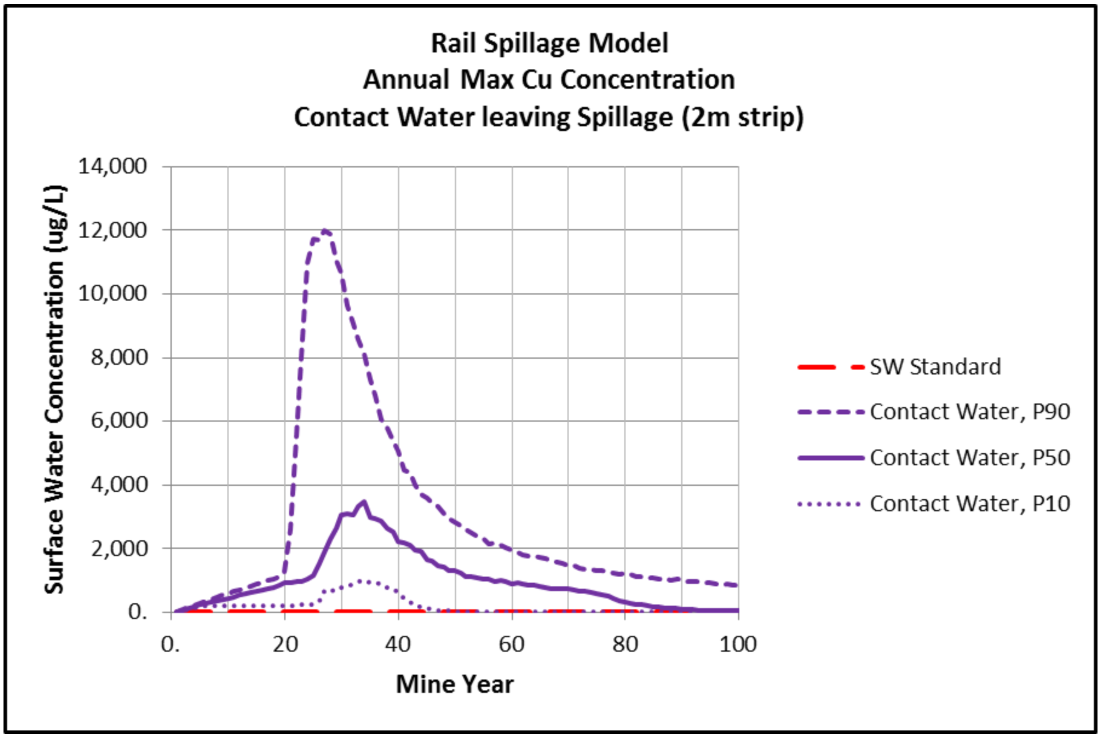


Figure 4 Copper concentrations at the edge of the spillage zone

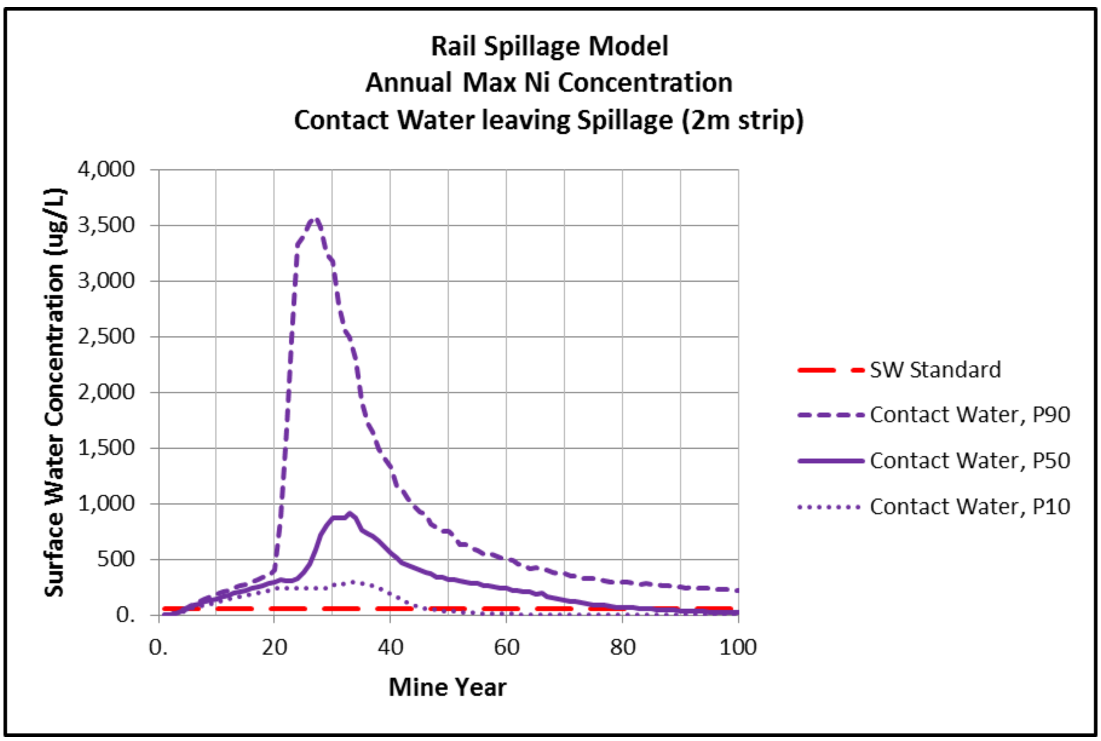


Figure 5 Nickel concentrations at the edge of the spillage zone

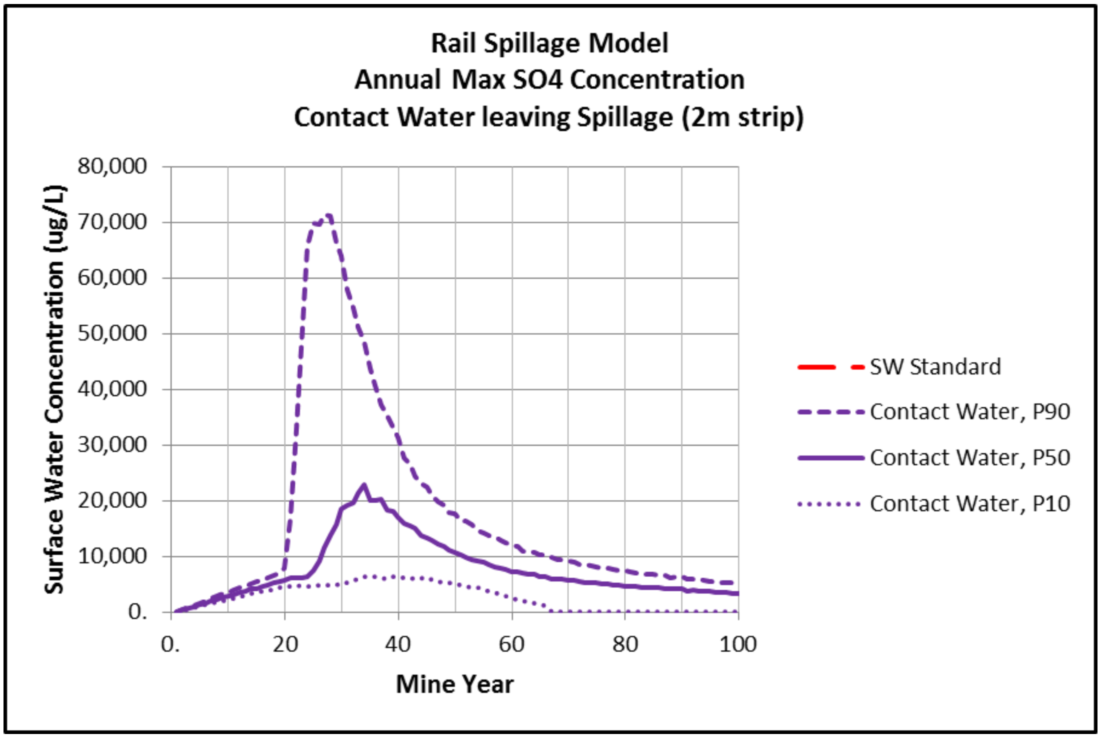


Figure 6 Sulfate concentrations at the edge of the spillage zone

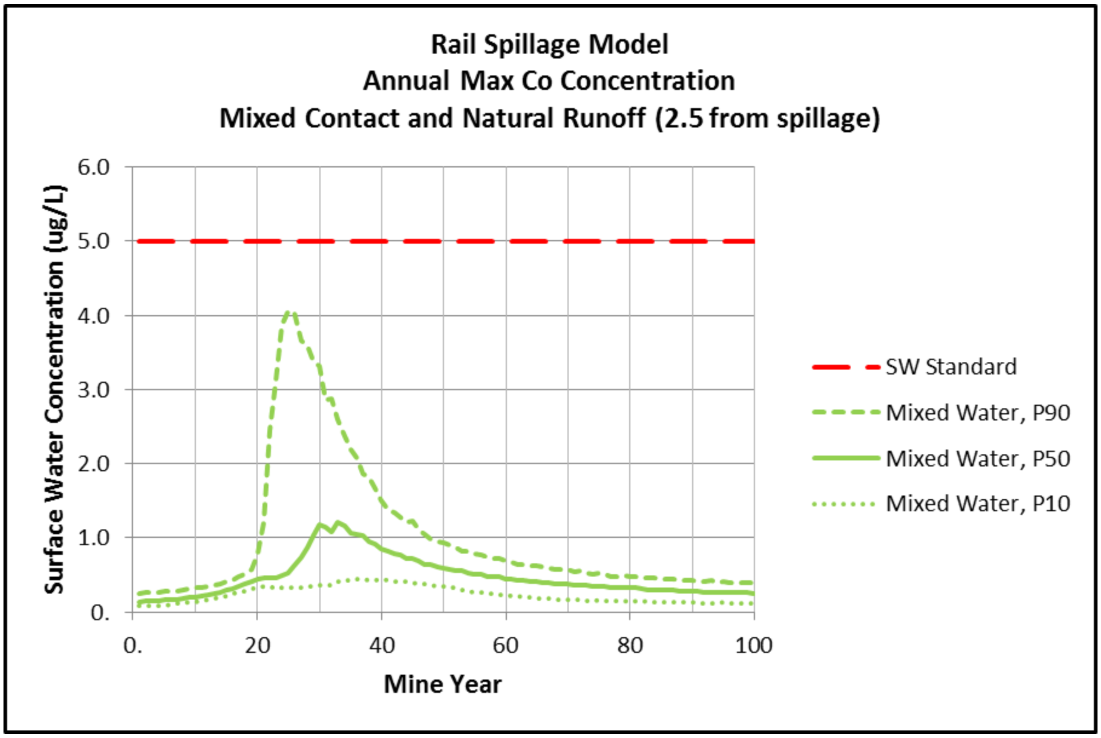


Figure 7 Cobalt concentrations at the edge of a 2.5-m buffer

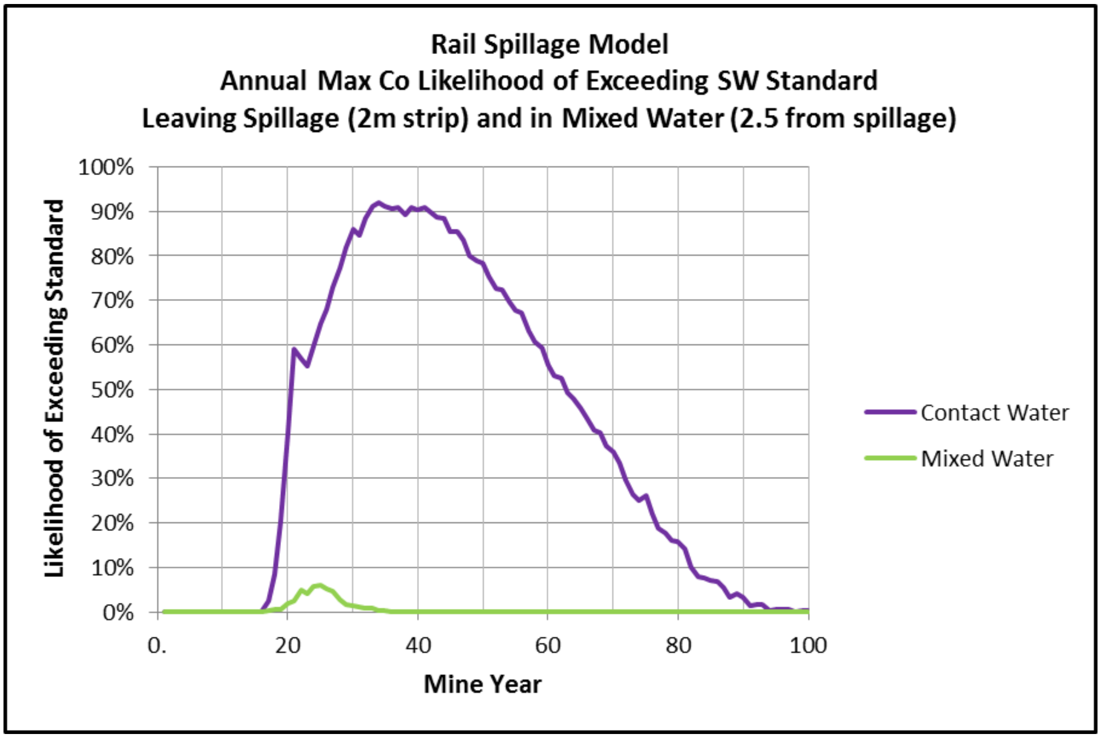


Figure 8 Cobalt likelihood of exceedance

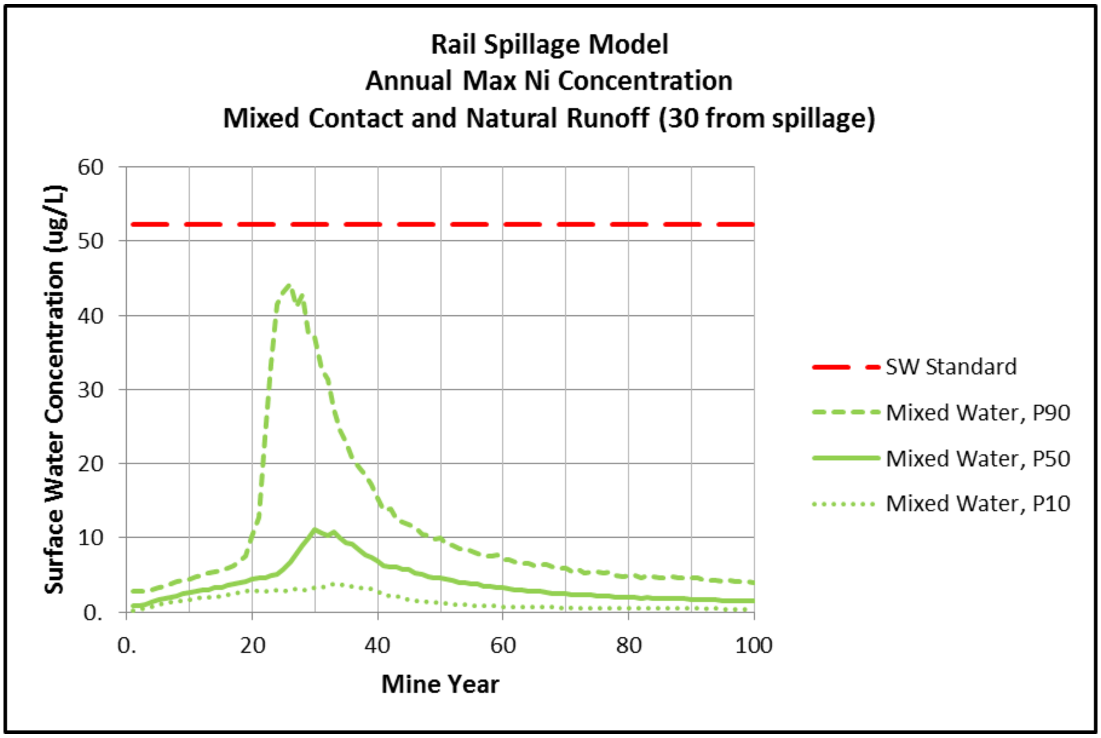


Figure 9 Nickel concentrations at the edge of a 30-m buffer

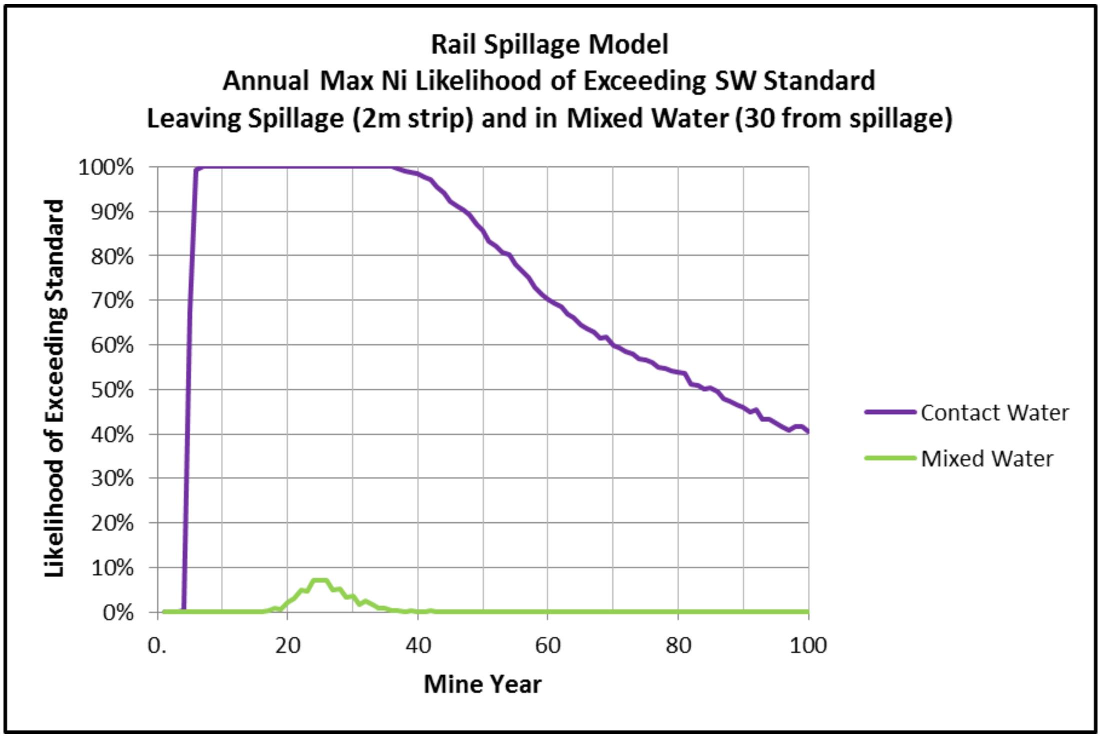


Figure 10 Nickel likelihood of exceedance

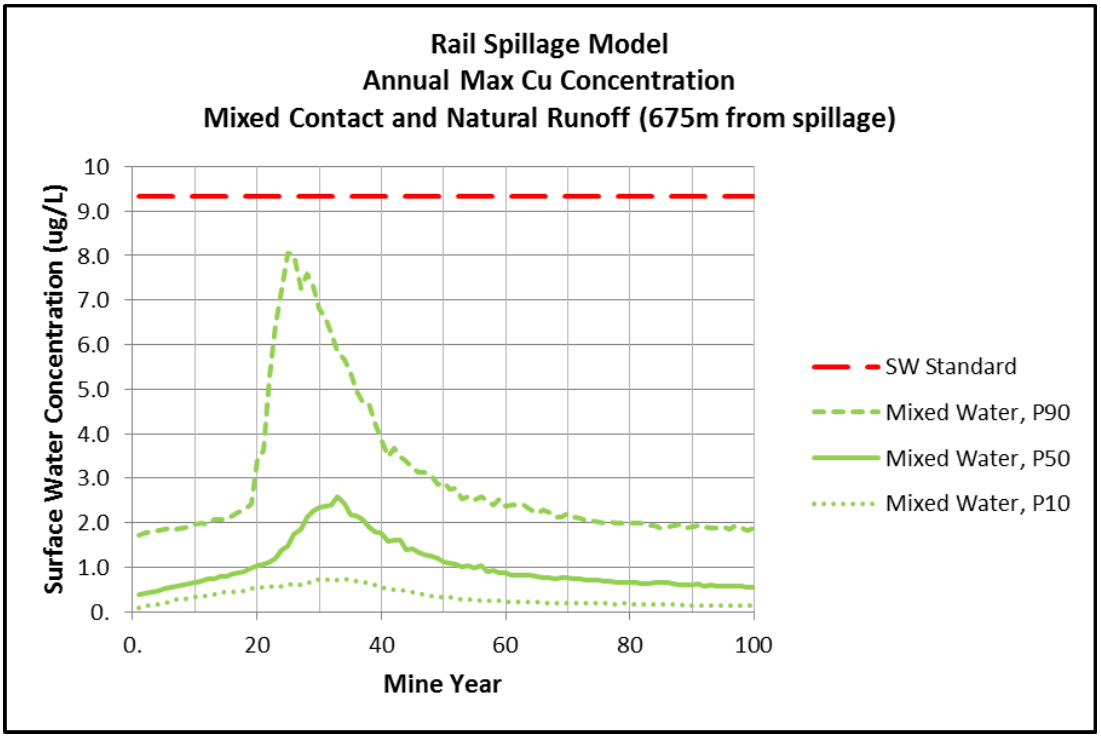


Figure 11 Copper concentrations at the edge of a 675-m buffer

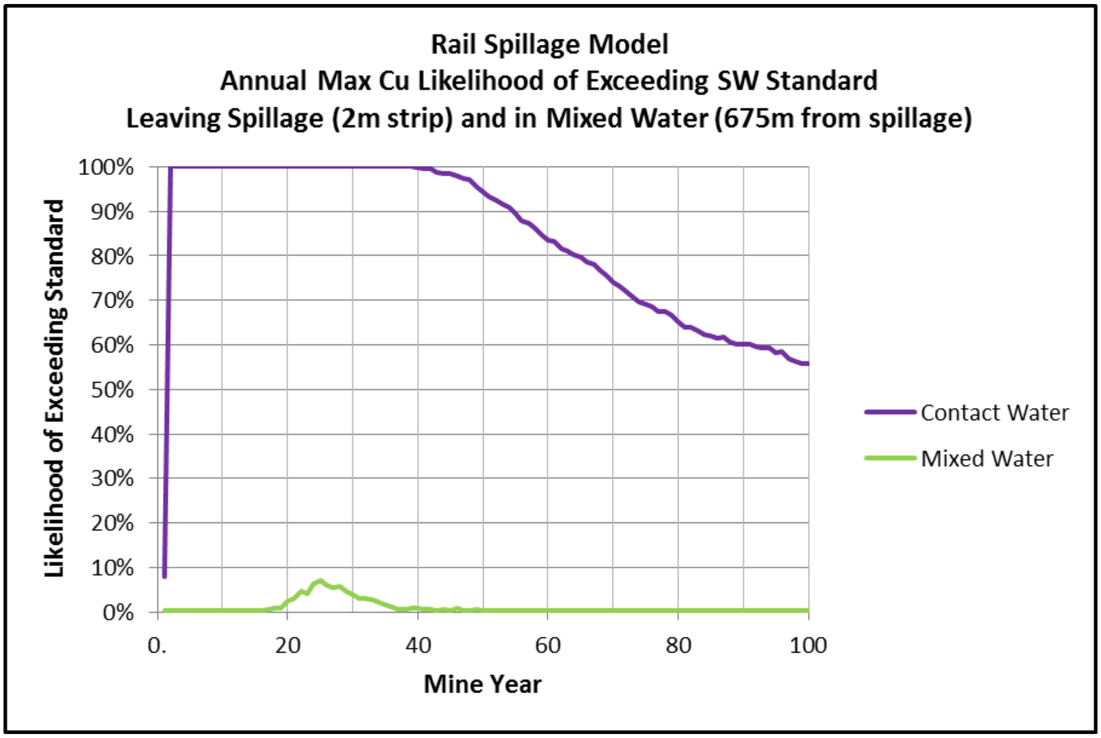


Figure 12 Copper likelihood of exceedance

Attachment F

Foreseeable Future Actions within the Partridge River and Embarrass River Watersheds

1. U.S. Forest Service
    a. Superior National Forest: Marty Rye
        i. The Eastern States BLM office has received 33 federal hardrock mineral prospecting permit applications and 21 operating plan proposals for mineral explorations in Superior National Forest. An EIS for the prospecting permits is currently under draft revision to determine where and under what circumstances the lands may be explored. The scope of the DEIS covers 1.7 million acres of land in Superior National Forest. Wetland impacts are unknown at this time but may occur if mineral prospecting permits are accepted.
2. Minnesota DNR
    a. Lands and Minerals: Anne Jagunich
        i. The Mesabi Nugget project at the old LTV site will impact wetlands and the Partridge River. No other projects were identified.
    b. Forestry: Mike Magnuson
        i. Future wetland impacts are not known at this time.
    c. Waters: Amy Loiselle
        i. She referred to St. Louis County planning, MN BWSR, MN DNR staff, USFS staff, the Duluth EPA, MPCA, and Iron Range Resources for information on specific projects in the future.
3. Minnesota DOT
    a. Website
        i. The website lists upcoming projects on Highways 135 and 37, which cross the Partridge River watershed. However, project locations are outside the watershed boundaries. No wetland impacts are expected.
    b. Duluth office: Howard Mackey
        i. Highway projects are planned no more than 3 years in advance, but long range road plans do not show any highway projects in the watersheds for the next 20 years. Routine culvert replacements will be conducted on highways 135 and 37, but any wetland impacts will be temporary.
4. Minnesota Board of Soil and Water Resources
    a. Joan Weyandt
        i. She referred to St. Louis County Landuse and Planning and had no information on projects impacting wetlands.
5. St. Louis County
    a. Landuse Planning and Zoning, Duluth office: Mark Lindhorst

    i. The Embarrass River watershed has little development, and no major projects are planned which will affect wetlands. The only foreseeable development in the watersheds includes homeowners adding decks, garages, or driveways to their properties. No wetland impacts are known at this time.

b. Land Department, Pike Lake office: Mark Pannkuk

    i. The Land department only manages tax forfeit lands, most of which is forestland. Foreseeable wetland impacts from the Land department may include logging bridges "under the silviculture exemption" over the next 5 years. He referred to Planning and Zoning department for specific permitting information and other projects in the county.

c. Public Works Department, Duluth office: Inga Foster

    i. The 10 year plan for St. Louis County road projects was provided: http://www.stlouiscountymn.gov/Portals/0/Library/Land-Property/Maps/Map%20Gallery/Transportation/Road-Construction-10YearPlan-2011-2020.pdf and is subject to change based on funding.

    ii. Projects in the study watersheds in the 10 year plan include: 8 bridge replacements and 1 complete road re-build (also mentioned by the City of Biwabik contact as a 3.5 mile road replacement project). Bridge replacements should impact no greater than 10,000 sq. feet per bridge – for a maximum wetland impact of 80,000 sq. ft. (1.8 acres). Wetland impacts associated with the road replacement are unknown at this time.

6. North St. Louis County Soil and Water Conservation District

    a. Virginia Office: Paul Ojanen

        i. He referred to Inga Foster for county public works roads projects. Cliffs-Eerie is expanding a road near Babbitt for a mining project that will result in wetland impacts. There may also be an unknown number of smaller-scale projects which may impact wetlands. He also referred to St. Louis County Land Department for forestry impacts and the MNDOT in Duluth for highway impacts.

7. City of Babbitt

    a. Public Works: Rich Posie

        i. The City of Babbitt is planning road building and storm sewer maintenance in the western portion of the municipality. Wetland impacts are unknown at this time.

8. City of Biwabik

    a. City Administrator: Jeff Jacobsen

        i. Two projects may impact wetlands in the Partridge River watershed. First, County Highway 4, just north of Biwabik, is being extended, and the project will create 3.5 miles of new roadway; this is the same project described by St. Louis County Public Works.

9. City of Embarrass
    a. Town Clerk: Diane Nelmark
        i. Future wetland impacts are not known at this time.
10. City of Gilbert
    a. Public Works: Ken Kuitunen
        i. Future wetland impacts are not known at this time.
11. City of Aurora
    a. Public Works
        i. Future wetland impacts are not known at this time.
12. City of Mckinley
    a. Public Works
        i. Future wetland impacts are not known at this time.
13. City of Hoyt Lakes
    a. Public Works
        i. Future wetland impacts are not known at this time.
14. Iron Range Resources and Rehabilitation Board (IRRRB)
    a. Mining and Mine land Reclamation: Dan Jordan
        i. A number of mining projects may impacts wetlands within the Partridge and Embarrass River watersheds. Pending approval, Mesabi Nugget, Twin Metals, Arcelor Mittal, Northshore Mining Company, Encampment Resources, and Teck Resources plan to pursue underground copper-nickel mining operations. All projects are currently in the exploratory and/or permitting phase.
        ii. Cardero Resource Corp. is currently in an "advanced" exploratory phase of an iron-titanium (Ilmenite) mining project just south of Hoyt Lakes at the Longnose property. The plant for this mining operation will likely be located within or adjacent to Hoyt Lakes. See the project summary dated April 12, 2011 at: http://www.cardero.com/s/minnesota_ferro.asp?ReportID=459547

Attachment B

NorthMet Project Wetland Analysis Work Plan v3

POLYMET
MINING

NorthMet Project

Wetland Analysis Work Plan

Version 3

October 13, 2011

NorthMet Project
Wetland Analysis Work Plan
Version 3

Table of Contents

1. Project

This document is the Work Plan for wetland analysis for the NorthMet Project (Project) as specified in Wetland Resources IAP Final Summary Memo and Co-lead Agency Final Work Plan Preparation Guidance of July 1, 2011 (Guidance Document) and the Wetland IAP Work Plan Compiled Comments dated August 30, 2011.

The project that will be modeled is the project described in the Co-lead Agency Draft Alternative Summary as amended in September, 2011. The Project Footprint that will be used for this analysis has been defined and detailed in the NorthMet Project Project Description (Reference 1).

2. Background

Wetland impacts for the Project were previously evaluated for the DEIS and included direct, potential indirect, and cumulative impacts. Using the wetland types and acreages identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), direct, potential indirect, and cumulative impacts will be evaluated as described in the following sections. The results of the wetland analysis in this Work Plan will be presented in the Wetland Data Package.

3. Direct Wetland Impacts

Direct wetland impacts will result from filling and excavation. The analysis performed for the SDEIS will duplicate the analysis performed for the DEIS (Section 4.2 of Reference 2) using the current Project Footprint described in Reference 1.

Wetlands within the Project Footprint will be identified using the Eggers and Reed (1997) community classification system. The wetland types and acreages for each wetland were identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

The analysis output for the direct wetland impact will include:

1. A summary table will provide information for each wetland within the Project Footprint and include:
    a. The wetland type, wetland acreage, and direct impact will be calculated using GIS.
    b. The type of direct impact (fill, excavation, etc.) will be identified.
    c. The quality of each wetland will be identified.
2. For each Eggers and Reed (1997) wetland type, a summary table will provide the total acreage and total acres of direct impact for the following Project Areas - Mine Site, railroad corridor, Dunka Road and utility corridor, Plant Site, Flotation Tailings Basin, Hydrometallurgical Residue Facility, and the Colby Lake water pipeline corridor.
    a. Figures for each of the Project Areas will be created that show the areas with direct wetland impacts.
3. The total direct wetland impact acreage for the Project Footprint will be provided.

4. Potential Indirect Wetland Impacts

The analysis of potential indirect wetland impacts will be completed using the Guidance Document. The purpose of this analysis is to provide an estimate of potential indirect wetland impacts.

Potential indirect wetland impacts will be assessed based on: changes in wetland watershed areas (during operation and post-closure); groundwater drawdown resulting from open pit mine dewatering; groundwater mounding/drawdown resulting from operation of the Flotation Tailings Basin including groundwater seepage interception wells; changes in stream flow near the Mine Site and Flotation Tailings

Basin and associated impacts to wetlands abutting the streams (during operation and post-closure); wetland fragmentation from Project elements such as open pits, stockpiles, haul roads, etc.; and changes in wetland water quality. If/when the Project is permitted, an indirect wetland impact monitoring plan will be implemented as part of the Section 404 permit conditions.

The analysis will be completed for the Mine Site, the Flotation Tailings Basin, and the transportation corridors (railroad and Dunka Road).

4.1 Mine Site

4.1.1 Wetland Identification

Wetlands within the Mine Site will be identified using the Eggers and Reed (1997) community classification system. The wetland types and acreages for Area One (which includes the Mine Site) were identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

Wetland acreage by wetland type will be calculated using GIS within 500-foot radius increments beginning at the mine pits and continuing out to a total radius of 10,000 feet (for a total of 20 increments). The area of evaluation will only include wetlands within Area One where wetland type information has been developed and it will not include wetlands identified as directly impacted in Section 3.0. In addition, wetlands in the Peter Mitchell open pit taconite mine and areas north of this mine will be excluded from evaluation as described in the Guidance Document.

1. A detailed table will be provided for each increment identifying the wetland type and acreage for each wetland.
2. A summary table will be provided for each increment identifying the total acreage and total acres of direct impact for each Eggers and Reed (1997) wetland type.
3. For each wetland that will be directly impacted, the acreage for the portion of the remaining wetland will be calculated and included in a table.
4. A figure will be provided showing the increments and identifying the Eggers and Reed (1997) wetland types within each increment.

4.1.2 Potential Indirect Wetland Impacts Resulting from a Change in Watershed Area

For each wetland that will not be directly impacted by fill or excavation, but will have Project elements impacting its watershed, an estimate of the change in watershed area (acreage and percent gain or loss) will be calculated.

The change (acreage and percent gain or loss) in watershed areas and the wetland area found within each watershed will be identified for the following conditions: pre-Project, during operation when the maximum amount of watershed has been removed, and at closure.

An estimate of potential indirect wetland impacts (wetland acres by wetland type and type of indirect impact) will be calculated for non-directly impacted wetlands that will have changed watershed areas (during operation and post-closure) for each watershed that was identified as changed in the previous paragraph, using the following steps:

1. Determine the tributary acres per wetland acre for the pre-Project, during operation, and after closure conditions.
2. Determine the equivalent watershed yield (ac-ft/yr) for the pre-Project, during operation, and after closure conditions. The existing watershed yield will be calculated based on available gage data from Section 4.4.1 of Reference 3. This rate would be applied to each watershed to

convert the tributary ratio in Step 1 to an equivalent yield (or equivalent average contributing net precipitation), expressed as acre-feet/year (ac-ft/yr) per acre of wetland.

3. The range in the equivalent yield (inches/year) estimated over the life of the Project will be evaluated relative to pre-Project yield to calculate a maximum percent change in yield. The estimated relative change in yield will be evaluated on a case-by-case basis, taking into account factors such as wetland type, to determine the potential for indirect impacts (e.g., groundwater fed wetlands may be less susceptible to changes in surface watershed).

4.1.3 Potential Indirect Wetland Impacts Resulting from Wetland Fragmentation

For remaining wetlands not directly impacted or indirectly impacted by watershed area changes, an estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) from wetland fragmentation by Project features (open pits, stockpiles, haul roads, etc) will be determined, using the following steps:.

1. For each portion of a remaining wetland, excluding indirect impacts from watershed changes, the potential area of indirect impacts will be determined based on an analysis of the various factors that may contribute to potential fragmentation. Based on this analysis, the identifying factor(s) contributing to potential fragmentation (change in size of wetland, surrounded by Project features, change in function and values of wetland e.g. wildlife habitat, etc.) will be identified. [Note: noise and dust do not cause fragmentation impacts according to the U.S. Army Corps of Engineers, May 16, 2011 conference call.]

4.1.4 Potential Indirect Wetland Impacts Resulting from Changes in Hydrology

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of indirect impact) due to groundwater drawdown from open pit mine dewatering, based on the Co-lead Agency guidance for estimating potential indirect wetland impacts from groundwater drawdown near open pit mines as provided on July 1, 2011 will be determined, using the following steps.

1. Use the information provided by the Groundwater IAP Group and other available and relevant hydrogeologic data to justify whether to use or modify the provided analogue information which is based upon comparisons of the existing regional and site specific geologic data (such as bedrock faults, bedrock joint systems, bedrock topography, glacial till hydraulic conductivities, etc.), site specific engineering controls such as the Category 1 Waste Rock Stockpile seepage containment system, and the geologic settings of the analogue information sites and the Mine Site.

2. Use the guidelines provided by the Corps Memorandum (CEMVP-OP-R) Distinguishing Between Bogs That Are Entirely Precipitation Driven Versus Those with Some Degree of Mineral Inputs from Groundwater and/or Surface Water Runoff to identify minerotrophic and ombrotrophic coniferous and open bogs.

The potential indirect wetland impact from glacial aquifer drawdown will be based on the analogue impact zone with the greater potential drawdown (zone closer to the open pit mine) for wetlands that lie on both sides of the analogue distance boundary. The analogue distances are described below in steps 1, 2, 3 and 4.

1. For all wetlands, provide a table and figure identifying type and acreage of wetlands located within 0 feet to 1,000 feet from the pit edge. The table will also identify the type of indirect wetland impact for each indirectly impacted wetland. Identify the likelihood of wetland hydrology impact based on wetland type.

    a. High Likelihood – includes coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, and alder thicket

b. Moderate Likelihood – deep marsh, shallow marsh, and shallow open water

c. Low Likelihood – minerotrophic coniferous bog and open bog

d. No Impact anticipated as identified in Guidance Document – ombrotrophic coniferous bog and open bog

2. For all wetlands, provide a table and figure identifying type and acreage of wetlands located within >1,000 feet to 2,000 feet from the pit edge. The table will also identify the type of indirect wetland impact for each indirectly impacted wetland. Identify the likelihood of wetland hydrology impact based on wetland type.

    a. Moderate Likelihood – coniferous swamps, hardwood swamps, sedge/wet meadow, shrub-carr, and alder thicket

    b. Low Likelihood – deep marsh; shallow marsh, and shallow open water

    c. No Impact anticipated as identified in Guidance Document – minerotrophic and ombrotrophic coniferous bog and open bog

3. For all wetlands, provide a table and figure identifying type and acreage of wetlands located within >2,000 feet to 3,500 feet from the pit edge. The table will also identify the type of indirect wetland impact for each indirectly impacted wetland. Identify the likelihood of wetland hydrology impact based on wetland type.

    a. Low Likelihood – coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, alder thicket

    b. No Impact anticipated as identified in Guidance Document – deep marsh, shallow marsh, shallow open water, coniferous bog, open bog

4. For all wetlands, provide a table and figure identifying type and acreage of wetlands located within >3,500 feet to 10,000 feet from the pit edge (within the wetland evaluation area). The table will also identify the type of indirect wetland impact for each indirectly impacted wetland.

    a. No Impact anticipated as identified in Guidance Document – all wetland types

A general discussion will be provided regarding the potential indirect wetland hydrology drawdown impacts to each wetland type based on the wetland sensitivity class tables for falling groundwater tables found in the Crandon mine project document titled *Wetland Impact Assessment Technical Memorandum – Appendix B* (Peterson Environmental Consulting, Inc. 2002).

1. A qualitative discussion of the types of potential indirect wetland impacts that might occur will be provided based on hypothetical hydrologic drawdown levels. Potential indirect wetland impacts might include: conversion to other wetland community types, a change in vegetation without a change in community type, conversion to uplands, or other impacts, which will be categorized using the Eggers and Reed (1997) wetland classification system.

4.1.5 Potential Indirect Wetland Impacts for Wetlands Abutting the Partridge River

Estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) for wetlands abutting the Partridge River as a result of changes in river flow resulting from the Project (during operation and post-closure), using the following steps.

1. Identify in GIS the wetlands abutting the Partridge River within Area One. A table will identify the wetland ID, type and acreage for each wetland (only within the area previously characterized for wetlands).

2. Provide the change in flow and water levels in the Partridge River using the model developed in Section 5.6 of Reference 3.
3. Identify whether the changes in flow (and therefore stage) resulting from the Project are within the observed natural variation for the Partridge River (Section 4.4.1 of Reference 3).
4. If the changes in flow and water levels are not within the observed natural variation for the Partridge River, identify the potential indirect impacts for the wetlands abutting the Partridge River.

4.1.6 Potential Indirect Wetland Impacts Resulting from Water Quality Changes

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) for remaining wetlands not directly impacted or indirectly impacted by previously evaluated causes in Sections 4.1.2 through 4.1.5 that would be impacted by water quality changes (such as from sulfide-bearing dust deposition, ore spillage, seepage from stockpiles, etc.) will be completed using the following steps:

1. Fugitive Dust Emissions
    a. The air emissions from all surface fugitive dust sources at the Mine Site will be modeled using an EPA approved air dispersion model with a deposition algorithm (AERMOD version 11103). This is the same model that has been proposed to be used for assessing air impacts in Class II areas in the draft NorthMet Air Modeling Work Plan (version 1, May 9, 2011) which was developed in response to the Air Impacts Assessment Planning Summary Memo dated May 6, 2011. Comments have been received on this draft Work Plan, with no objections to the proposed model, so this model is expected to be specified in the final Work Plan. Emission rates and particle size distributions will be based on total particulate matter. Receptors will be placed on all delineated wetlands within the Project ambient air boundaries that have not been identified as directly impacted. The receptor grid will also initially extend 5 kilometers beyond the ambient air boundaries with a grid spacing of 500 meters. The receptor grid may be adjusted based on preliminary modeling results. Other modeling details would generally follow those specified in the Class II modeling protocols for the Mine Site as defined by the Air IAP and/or generally excepted modeling practice.
    b. The modeled dust sources at the Mine Site will include ore and waste rock truck loading and unloading outside of the pits, railcar loading, dust generation from traffic on unpaved roads on the surface (i.e. not in the pits), and overburden and other construction rock screening and/or crushing as defined by the Air IAP.
    c. Rock handling and roads within the pits will not be included in the analysis because: a) "pit-trapping" would greatly reduce the potential for dust to impact areas outside of the pits and b) Barr's past experience which indicates that the AERMOD "open pit" algorithm is incompatible with the AERMOD deposition algorithm.
    d. The output of the model will be deposition rate (grams per square meter) on an annual basis. The model results will be compared to background values such that contours where the modeled deposition is small relative to the background value can be developed. This can be considered a conservative assessment of how far away potential impacts to wetlands from dust may occur from fugitive dust sources. This should be considered a screening level analysis such that it would identify an upper bound for the potential range of distances at which impacts might occur, but the results will not identify actual impacts. This range of distances could be used to

estimate the extent of potential indirect impacts to guide development of monitoring plans to document actual indirect impacts. Based on the results of the screening analysis, PolyMet may propose a more refined approach to assess the distance at which potential impacts may occur.

2. Metals and Sulfide Dust Emissions

   a. The potential for sulfur deposition was evaluated for the DEIS Mine Plan in Screening Analysis of the Potential for Fugitive Dust Emissions Associated with Sulfide Rock Handling at the NorthMet Project Mine Site to Increase Sulfur Deposition to Nearby Wetlands (Barr, January 28, 2010). This analysis included dust emissions from the handling of Category 2, 3, and 4 waste rock and ore. Lean ore handling emissions were also modeled, but lean ore has been eliminated as a rock classification in the updated Mine Plan.

   b. The handling activities associated with Category 2, 3 and 4 waste rock and ore located outside of the pits will be included in the metals and sulfur analysis for the Mine Site. This includes truck loading and unloading with waste rock and ore and railcar loading with ore. Note: the potential for wind erosion from the stockpiles has been evaluated, and it has been determined that wind erosion would not occur through the use of EPA approved wind erosion calculations procedures in Section 13.2.5 of Reference 4. The calculations are described in the Mine Site Emission Inventory Spreadsheet (Version 2 Submitted August 1, 2011). This spreadsheet references the detailed calculations based on five years of meteorological data provided to MPCA via FTP site on May 9, 2011.

   c. Modeling will be conducted for the included sources in the same manner as described for dust modeling. The dust modeling and metals and sulfide modeling may be conducted in separate model runs or in the same run utilizing the model's source grouping capabilities.

   d. For air dispersion/deposition modeling, the total particulate emission rates (grams per second) will be speciated and converted to metals and sulfur emission rates based on data on the chemical composition of each material generating dust. Metals for evaluation, associated with rock and soils, would be: arsenic, cadmium, chromium, lead, manganese, nickel and selenium.

   e. Mercury will not be evaluated at the Mine Site for dust deposition because the concentration of mercury in the rock to be mined is very low (Sections 5.0 and 5.8 of Reference 3) and not considered to be environmentally significant in this medium.

   f. The model-estimated sulfur and metals deposition rates (grams per square meter) will be compared to background values to determine distance contours beyond which the deposition rate is insignificant compared to background. As with the dust analysis, this would be a screening level evaluation that could be used to identify a range of distances from a source beyond which impacts would be unlikely to occur. This range of distances could be used to estimate the extent of potential indirect wetland impacts to guide development of monitoring plans to document actual indirect impacts. PolyMet may choose to propose a more refined approach depending on the results of the screening level analysis. A more refined approach could take into account such factors as the potential for metals and/or sulfur to be liberated from the rock particles depending on the rock chemistry, environmental chemistry and general conditions in the ecosystem where the deposition is predicted to occur.

3. Ore spillage – see the Section 4.3.2.

4. Leakage from stockpile will be evaluated using the following steps:
    a. Quantify the amount of stockpile leakage water that discharges to surface water and wetlands, down gradient of the stockpiles based on the results of the water quality modeling.
    b. Identify the wetlands (type, acreage) within the surficial aquifer groundwater flowpaths from mine features using boundaries used in the water quality modeling (as shown in the Groundwater IAP Summary document).
    c. Categorize the wetlands within the flowpaths in Step ii into groundwater-fed and precipitation-fed wetlands using guidance from the Corps "Bog Memo" and evaluate the potential for indirect impacts based on potential water quality changes from the mine features.

4.1.7 Potential Indirect Wetland Impacts to Wildlife Utilization of Nearby Habitats From Project Noise

Provide a general discussion regarding the potential indirect wetland impact to wildlife utilization of nearby habitats from project noise using the following steps:

1. Identify the potential sources of project noise and the range of emitted noise levels.
2. Identify wildlife species that are found within the area, as well as their preferred habitats using wildlife surveys previously conducted for the NorthMet Project (Section 4.4 of Reference 2).
3. Qualitatively discuss the potential impacts and possible short- and long-term reactions of wildlife species to the potential project noise levels.

4.2 Flotation Tailings Basin

4.2.1 Wetland Identification

Wetlands around the Flotation Tailings Basin will be identified using the Eggers and Reed (1997) community classification system. The wetland types and acreages for Area Two (which includes the Flotation Tailings Basin) were identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

Wetland acreage by wetland type will be calculated using GIS within 500-foot radius increments beginning at the Flotation Tailings Basin and continuing out to the Embarrass River. The area of evaluation will only include wetlands within Area Two where wetland type information has been developed and it will not include wetlands identified as directly impacted in Section 3.0.

1. A detailed table will be provided for each increment identifying the wetland type and acreage for each wetland.
2. A summary table will be provided for each increment identifying the total acreage and total acres of direct impact for each Eggers and Reed (1997) wetland type.
3. For each wetland that will be directly impacted, the acreage for the portion of the remaining wetland will be calculated and included in a table.
4. A figure will be provided showing the increments and identifying the Eggers and Reed (1997) wetland types within each increment.

4.2.2 Potential Indirect Wetland Impacts Resulting from Changes in Hydrology

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) from hydrologic changes (groundwater upwelling and resulting surface water flow in wetlands and/or groundwater drawdown near the groundwater seepage interception wells) resulting from groundwater seepage and/or interception well pumping will be determined.

1. Quantify the amount of Flotation Tailings Basin groundwater seepage water that discharges to surface water features, including wetlands, down gradient of the Flotation Tailings Basin. A MODFLOW model developed for the Flotation Tailings Basin will be used in conjunction with a GoldSim probabilistic model to estimate the quantity of seepage that discharges to surface water features.
2. Identify all the wetlands (type, acreage) within the surficial aquifer groundwater flowpaths downgradient of the Flotation Tailings Basin using boundaries used in the water quality modeling (as shown in the Groundwater IAP Summary document).
3. Using the wetlands identified in step 2, categorize the wetlands into groundwater-fed and precipitation-fed wetlands using guidance in the Corps Memorandum (CEMVP-OP-R) *Distinguishing Between Bogs That Are Entirely Precipitation Driven Versus Those with Some Degree of Mineral Inputs from Groundwater and/or Surface Water Runoff* and evaluate the potential for indirect impacts resulting from groundwater seepage and/or interception well pumping.

Provide a general discussion regarding the potential indirect wetland hydrology impacts to each wetland type based on the wetland sensitivity class tables for rising groundwater tables found in the Crandon mine project document titled *Wetland Impact Assessment Technical Memorandum – Appendix B* (Peterson Environmental Consulting, Inc. 2002).

1. A qualitative discussion of the types of potential indirect wetland impacts that might occur will be provided based on hypothetical hydrologic drawdown or surchage levels. Potential indirect wetland impacts might include: conversion to other wetland community types, a change in vegetation without a change in community type, conversion to uplands, or other impacts, which will be categorized using the Eggers and Reed (1997) wetland classification system.

4.2.3 Potential Indirect Wetland Impacts for Wetlands Abutting Trimble Creek and the Two Unnamed Creeks

An estimate of potential indirect wetland impacts (wetland acres by wetland type) in wetlands abutting the three streams north and west of the Flotation Tailings Basin (Trimble Creek and the two unnamed creeks as shown in Figure 3 of the Water Resources IAP – Surface Water Summary Memo) as a result of changes in stream flow resulting from operation of the Flotation Tailings Basin will be determined using the following steps:

1. Identify in GIS the wetlands abutting the west Unnamed Creek (Mud Lake Creek), Trimble Creek, and the east Unnamed Creek within Area Two. A table will identify the wetland ID, type and acreage for each wetland (only within the area previously characterized for wetlands).
2. Provide the change in flow in the three streams using the GoldSim probabilistic model developed in Reference 6 and the method described in Section 4.4 of Reference 2. Estimate a corresponding change in stage based on available rating curves or simple hydraulic equations (e.g. Manning's equation).

3. Identify whether the changes in flow (and by extension, stage) are within the estimated natural variation for the three streams based on observed data or unit-area relationships extrapolated from gage data (Section 4.4.1 of Reference 5 and Page 3 of Reference 6).
4. If the changes in flow and water levels are not within the observed natural variation for the three streams, identify the potential indirect impacts for the wetlands abutting the three streams.

4.2.4 Potential Indirect Wetland Impacts Resulting from Water Quality Changes

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) for wetlands that would be impacted by water quality changes (such as from sulfide-bearing dust deposition from the Flotation Tailings Basin, Flotation Tailings Basin groundwater seepage, etc.) will be completed using the following steps:

1. Fugitive Dust Emissions
    a. The air emissions from all surface fugitive dust sources at the Flotation Tailings Basin site will be modeled using an EPA approved air dispersion model with a deposition algorithm (AERMOD version 11103). This is the same model that has been proposed to be used for assessing air impacts in Class II areas in the draft NorthMet Air Modeling Work Plan (version 1, May 9, 2011) which was developed in response to the Air Impacts Assessment Planning Summary Memo dated May 6, 2011. Comments have been received on this draft Work Plan, with no objections to the proposed model, so this model is expected to be specified in the final Work Plan. Emission rates and particle size distributions will be based on total particulate matter. Receptors will be placed on all delineated wetlands within the Project ambient air boundaries that have not been identified as directly impacted. The receptor grid will also initially extend 5 kilometers beyond the ambient air boundaries with a grid spacing of 500 meters. The receptor grid may be adjusted based on preliminary modeling results. Other modeling details would generally follow those specified in the Class II modeling protocols for the Plant Site as defined by the Air IAP and/or generally excepted modeling practice.
    b. The modeled dust sources at the Flotation Tailings Basin will include LTV Steel Mining Company (LTVSMC) tailings loading and unloading, unpaved road traffic, and wind erosion from dams constructed of LTVSMC tailings and beaches composed of NorthMet tailings.
    c. The output of the model will be deposition rate (grams per square meter) on an annual basis. The model results will be compared to background values such that contours where the modeled deposition is small relative to the background value can be developed. This can be considered a conservative assessment of how far away potential impacts to wetlands from dust may occur from fugitive dust sources. This should be considered a screening level analysis such that it would identify an upper bound for the potential range of distances at which impacts might occur, but the results will not identify actual impacts. This range of distances could be used to estimate the extent of potential indirect impacts to guide development of monitoring plans to document actual indirect impacts. Based on the results of the screening analysis, if model-estimated particle deposition is equal to current background deposition (i.e., 100 percent of current background; i.e., a potential doubling of deposition), PolyMet may propose a more refined approach to assess the distance at which potential impacts may occur.
2. Metals and Sulfide Dust Emission

a. At the Flotation Tailings Basin wind erosion from the embankment and beaches as well as truck traffic on roads composed of LTVSMC tailings will be included in the analysis.

b. Modeling will be conducted for the included sources in the same manner as described for dust modeling. The dust modeling and metals and sulfide modeling may be conducted in separate model runs or in the same run utilizing the model's source grouping capabilities.

c. For air dispersion/deposition modeling, the total particulate emission rates (grams per second) will be speciated and converted to metals and sulfur emission rates based on data on the chemical composition of each material generating dust. Proposed metals for evaluation, associated with rock and soils, will include: arsenic, cadmium, chromium, lead, manganese, nickel, and selenium.

d. Because the NorthMet ore is low in mercury, the tailings, which includes roughly 98 percent of the ore, will also be low in mercury, and in fact pilot study data shows that the mercury preferentially goes to the flotation concentrate. The mercury in the tailings is also expected to be strongly bound within the mineral matrix. This is also true of the LTVSMC tailings that will be used to construct the Flotation Tailings Basin dams and that may be present on some road surfaces. Therefore, any mercury present in dust from the Flotation Tailings Basin would not be biologically available and we are not proposing to consider mercury in the deposition analysis at the Flotation Tailings Basin. When metal ores are concentrated and heated, such as in taconite mining or in smelting processes, then mercury becomes a metal of interest for air emissions and deposition. For the Project, potential mercury air emissions from ore processing (i.e., potential emissions from the autoclave) are being evaluated for potential local deposition impacts.

e. The model-estimated sulfur and metals deposition rates (grams per square meter) will be compared to background values to determine distance contours beyond which the deposition rate is insignificant compared to background. As with the dust analysis, this will be a screening level evaluation that could be used to identify a range of distances from a source beyond which impacts would be unlikely to occur. This range of distances could be used to estimate the extent of potential indirect wetland impacts to guide development of monitoring plans to document actual indirect impacts. If model-estimated sulfur or individual metal deposition is equal to current background deposition (i.e., 100% of current background; i.e., a potential doubling of deposition), PolyMet may propose a more refined approach depending on the results of the screening level analysis. A more refined approach could take into account such factors as the potential for metals and/or sulfur to be liberated from the rock particles depending on the rock chemistry, environmental chemistry and general conditions in the ecosystem where the deposition is predicted to occur.

3. Flotation Tailings Basin Groundwater Seepage

    a. Identify the chemistry from the Flotation Tailings Basin groundwater seepage based on the results of the water quality modeling (Reference 6).

    b. Identify the wetlands (type, acreage) within the down gradient zone using boundaries used in the water quality modeling (as shown in the Groundwater IAP Summary document).

    c. Categorize the wetlands within the flowpaths in Step ii into groundwater-fed and precipitation-fed wetlands using guidance from the Corps Memorandum (CEMVP-

OP-R) *Distinguishing Between Bogs That Are Entirely Precipitation Driven Versus Those with Some Degree of Mineral Inputs from Groundwater and/or Surface Water Runoff* and evaluate the potential for indirect impacts based on potential water quality changes from the Flotation Tailings Basin.

4.2.5 Potential Indirect Wetland Impacts to Wildlife Utilization of Nearby Habitats From Project Noise

Provide a general discussion regarding the potential indirect wetland impact to wildlife utilization of nearby habitats from project noise using the following steps:

1. Identify the potential sources of project noise and the range of emitted noise levels.
2. Identify wildlife species that are found within the area, as well as their preferred habitats using wildlife surveys previously conducted for the NorthMet Project (Section 4.4 of Reference 2).
3. Qualitatively discuss the potential impacts and possible short- and long-term reactions of wildlife species to the potential project noise levels.

4.3 Transportation Corridors

4.3.1 Wetland Identification

Wetlands around the Flotation Tailings Basin will be identified using the Eggers and Reed (1997) community classification system. The wetland types and acreages for Area Two (which includes the Flotation Tailings Basin) were identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

The wetlands abutting the Dunka Road and the railroad corridor within Area One and Area Two will be identified using GIS. The wetland ID, type and acreage for each wetland (only within the area previously characterized for wetlands) will be identified in a table.

4.3.2 Potential Indirect Wetland Impacts Resulting from Water Quality Changes

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) for wetlands that will be impacted by water quality changes (such as from sulfide-bearing dust deposition, ore spillage, etc.) will be completed using the following steps:

<u>Mine to Plant Rail</u>

The potential release of dust from railcars transporting ore from the Mine Site to the Plant Site was addressed in the May 6, 2011 Air Impact Assessment Planning Summary Memo, "The air IAP group concluded that there would be minimal air impacts from any dust generated from ore hauled in the railcars due to the coarse nature of the ore. " Based on this conclusion, air modeling of potential release of dust from railcars will not be performed because the potential wetland impacts will not be significant.

The air IAP group concluded that any dust generated from ore hauled in railcars would be coarse in nature (i.e., relatively large particles). These larger particles would tend to deposit near the railcar and not be dispersed to any great extent. An estimate of the spillage of ore fines along the rail corridor is shown in Section 8.5.3 of Reference 7. Assuming that all spillage of the coarse material would occur in a 2 meter wide strip on both sides of the centerline of the railway (total width = 4 meters) over the entire haul distance after loading (~ 8 miles; ~13,000 meters), results in approximately 0.11 Kg/square meter of ore fines annually or 2.14 Kg/square meter for the 20 year Project. This equates to 0.002 inch of depth annually or 0.05 inches for the 20 year Project.

Using the geochemical modeling methods described in Reference 7 for the Ore Surge Pile, the quality of water infiltrating through this material will be estimated on a per-unit area basis which will also be on a per unit length of the rail corridor. If the water quality is found to have a greater than 10 percent likelihood of exceeding water quality standards as defined in Table 1-3 of Reference 8, the unit area required to provide sufficient precipitation to dilute the water to meet standards will be calculated and converted to a distance to be added to the 2 meters from the centerline of the rail corridor that will be a potential dust impact corridor. Any wetlands identified in the above paragraph of this section that are within the potential dust impact corridor will be considered to be potentially indirectly impacted.

Dunka Road

Loaded mine haul trucks will not travel on the Dunka Road. Empty mine haul trucks will only travel on the Dunka Road when they are in need of maintenance at the Area 1 Shop. It is estimated that each truck will travel to Area 1 twice per year. The total one-way trips per year are estimated at 44. Given the low traffic volumes (< 1 trip per week on average) a quantitative assessment of impacts from ore particle discharge from haul trucks travelling down the Dunka Road is not warranted.

Product Shipping

Products produced in the hydrometallurgical plant (AU/PGM concentrate, mixed hydroxide precipitate) will be loaded into super sacks (i.e. large industrial sacks used to transport solid material) and then loaded onto trucks or railcars. There is little or no potential for spillage with this method of shipping. With respect to flotation concentrate, as stated in the project description (Reference 1) "Each filtered concentrate would be conveyed to separate stockpiles within an enclosed 10,000 ton storage facility for loading into covered rail cars. The storage facility would store about 7 to 10 days of production capacity when flotation concentrate would be directed to Concentrate Dewatering/Storage. The storage facility would have a concrete floor and provisions to wash wheeled equipment leaving the facility to prevent concentrates from being tracked out of the facility." The flotation concentrate is similar material to that which caused issues at the Red Dog Mine in Alaska (zinc concentrate transported in truck trailers), which has been cited as an example of potential consequences of product transport at mining operations. Some issues at Red Dog were driven by road dust and port activities which do not apply to the Project. Best Management Practices adopted at Red Dog - enclosed storage and loading, covered cars, and vehicle wash facilities - are proposed for use at the NorthMet project. Because the common carrier route (i.e. the rail line used to transport products) is not known (ultimate customer not known and could change), there is no way to assess impacts along the common carrier route. PolyMet will be paid on tons received by customers so it has a vested interest in not losing any concentrate. The covered rail cars will be inspected for holes and any holes repaired before concentrate loading.

4.3.3 Potential Indirect Wetland Impacts Resulting from Wetland Fragmentation

For remaining wetlands not directly impacted or identified in 4.3.2, an estimate of potential indirect wetlands (wetland acres by wetland type, and type of indirect impact) from wetland fragmentation by Project features will be completed using the following steps:

1. For each portion of a remaining wetland, excluding indirect impacts identified in 4.2.3, the potential area of indirect impacts would be determined based on an analysis of the various factors that may contribute to potential fragmentation. Based on the analysis, the identifying factor(s) contributing to potential fragmentation (change in size of wetland, surrounded by Project features, change in function and values of wetland e.g. wildlife habitat, etc.) would be identified. [Note: noise and dust do not cause fragmentation impacts according to the U.S. Army Corps of Engineers, May 16, 2011 conference call.]

4.3.4 Potential Indirect Wetland Impacts to Wildlife Utilization of Nearby Habitats From Project Noise

Provide a general discussion regarding the potential indirect wetland impact to wildlife utilization of nearby habitats from project noise using the following steps:

1. Identify the potential sources of project noise and the range of emitted noise levels.
2. Identify wildlife species that are found within the area, as well as their preferred habitats using wildlife surveys previously conducted for the NorthMet Project (Section 4.4 of Reference 2).
3. Qualitatively discuss the potential impacts and possible short- and long-term reactions of wildlife species to the potential project noise levels.

5. Cumulative Wetland Impacts

Analysis of cumulative wetland impacts will be done using accepted tools and protocols. The analysis performed for the DEIS is described and summarized in Section 4.3 of Reference 1. The analysis performed for the SDEIS will generally duplicate that effort using the revised direct and potential indirect wetland impact acreage, along with updated watershed information. The assessment will be conducted for both the Partridge River watershed and the Embarrass River watershed. The following steps will provide acreage for wetland and water resources for the pre-settlement, existing and foreseeable future conditions. Tables and figures will be developed to present the information.

5.1 Presettlement Wetland and Water Resources

The pre-settlement conditions time period represents wetlands, lakes, and deepwater resources as they existed prior to mining and urban development in the late 1800s to early 1900s. An estimate of pre-settlement wetland, lakes, and deepwater acreage within the Partridge River and Embarrass River watersheds will be developed in GIS using the following steps:

1. The acreage of wetland and water resources estimated for the pre-settlement period will be developed using the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) and the original survey maps developed using data from the original Government Land Surveys along with other historical surveys and sources, generally from the late 1800s.
2. The NWI mapping efforts were generated from interpretations of black-and-white aerial photographs completed in the late 1970s to early 1980s. The NWI is a more accurate depiction of historic wetland resources where human disturbance has been limited. Therefore, the NWI will be used as a base wetland map and available delineation data will be substituted to improve the accuracy of the wetland mapping.
3. The original survey maps will be obtained from the MDNR GIS Data Deli maps at http://deli.dnr.state.mn.us/. The original survey maps identify water resources as marshes, bottoms, swamps, lakes, ponds, and rivers, as documented in early land surveys. The original survey maps are a more accurate depiction of historic wetland resources where human disturbance is present. The water resources within the areas of human disturbance in each watershed will be digitized and presented on a figure.
4. The wetland and water resources mapped on the original survey maps will be digitized for one township, with minimal disturbance (roads, railroads, mining areas, etc.) located within and adjacent to the Partridge River watershed and for one township located within the Embarrass River watershed. It is assumed that if there is a minimal amount of disturbance in a township, the NWI mapping would be representative of pre-settlement wetland and water resources conditions. Therefore the data from each township will be used to develop a relationship between the NWI and original survey data.

5. The total wetland and water resources acreage for the two data sets will be compiled and the ratio of NWI to original survey map wetland and water resources will be calculated for each township. This ratio will indicate the percent of wetland and water resources identified on the NWI maps compared the original survey maps. This ratio will be used as an adjustment factor to conform the original survey data to the standards and scales of the NWI data for estimating the pre-settlement wetland resources within the disturbed areas of the watershed. The selected townships and data used to determine the adjustment factor will be presented in a table.
6. For the human disturbance areas, the NWI wetlands and water resources located within the human disturbance polygon boundaries will be removed using a GIS clipping tool. The NWI within these disturbance areas do not accurately reflect pre-settlement conditions because the NWI either included wetlands that have since been eliminated because of disturbance activities or did not include wetlands that had already been eliminated when the NWI was completed (e.g., reservoir development permanently flooded the wetlands). Because the NWI does not accurately map these types of areas, it does not accurately represent pre-settlement conditions; therefore the NWI wetlands in the disturbed areas will be replaced with wetlands mapped on the original survey maps. The total area of wetland and water resources within those polygons will be corrected using the adjustment factor. The total acreage of pre-settlement wetlands and water resources will be estimated for the two watersheds.

5.2 Existing Wetland and Water Resources

The existing conditions time period represents wetland, lake, and deepwater resources as they exist today, prior to the development of the Project. An estimate of existing wetland, lake, and deepwater acreage within the Partridge River and Embarrass River watersheds will be developed in GIS using the following steps:

1. Existing wetland, lake, and deepwater resources will be estimated using: wetland delineations completed in the area (as available); lake or lacustrine water body acreages will be estimated using the USGS National Hydrograph Dataset and the NWI datasets; deepwater or mine pit water body acreages will be estimated using a combination of the MDNR Mesabi Mining Features (2008) and interpretation of 2003, 2008, 2009, and 2010 FSA aerial photographs; and NWI mapping.
2. A “composite” wetland and water resources layer will be developed by deleting all of the NWI polygons from areas in which more detailed mapping had been completed and replacing them with the delineated wetland, lake, and deepwater resources.

5.3 Projected Future Wetland and Water Resources

An estimate of future wetland acreage within the Partridge River and Embarrass River watersheds will be completed considering reasonably foreseeable future project wetland impacts, both direct and potential indirect. Reasonably foreseeable future projects are defined as those that have been permitted and those that have had permit applications submitted and/or are undergoing environmental review by regulatory agencies.

The future conditions time period represents wetland, lake, and deepwater resources expected to be present following conclusion and reclamation of the Project. It is assumed that the future conditions follows some time after conclusion of the future projects such that the mine pit will have filled with water.

Relevant public officials from city, county, state and federal agencies will be contacted to identify reasonably foreseeable future actions within the study area. Agency officials will be asked to identify reasonably foreseeable future projects that may occur during the life of the Project. Contacts will include the City of Babbitt, St. Louis County, MDNR, Minnesota Board of Water and Soil Resources, the U.S. Forest Service, and the Iron Range Resources and Rehabilitation Board (IRRRB).

Future projects will be identified in the Partridge River watershed and the Embarrass River watershed that may impact wetland, lake, and deepwater resources. For the projected future conditions, the acreage of wetland, lake, and deepwater resources will be estimated by subtracting the future projected wetland impacts and adding the future projected development of wetland, lake, and deepwater resources to the existing resource totals. This information will be provided as a table.

5.4 Qualitative Analysis of Cumulative Wetland Impacts for the St. Louis River below the Ordinary High Water Mark From Its Confluence with the Embarrass River to Lake Superior

A qualitative analysis of cumulative wetland impacts for the St. Louis River below the ordinary high water mark from its confluence with the Embarrass River to Lake Superior will be developed based on a qualitative estimate of flow changes in the river.

A qualitative estimate of flow changes in the St. Louis River will be developed from the results of the Partridge River hydrologic modeling described in Section 7.1.1 of Reference 3. The estimated flow changes in the St. Louis River will be evaluated relative to gage data to determine if the changes are expected to be within the natural variation of flow within the St. Louis River will be developed using the following steps:

1. If the evaluation of the estimated flow changes in the St. Louis River is within the natural variation of average annual flow in within the St. Louis River observed at USGS gage 04016500 (St. Louis River near Aurora), no further analysis will be conducted. This location is the most upstream location of the St. Louis River affected by the NorthMet Project, and will therefore show the greatest impact.
2. If the evaluation of the estimated flow changes in the St. Louis River is not within the natural variation of flow in within the St. Louis River, the following analysis will be conducted.
    a. An estimate of existing wetland acreage and wetland types below the ordinary high water mark of the St. Louis River from its confluence with the Embarrass River to Lake Superior will be made using the National Wetland Inventory.
    b. An estimate of future wetland acreage and wetland types below the ordinary high water mark of the St. Louis River will be made from its confluence with the Embarrass River to Lake Superior.

5.5 Quantitative Analysis of Cumulative Wetland Impacts

5.5.1 Partridge River and Embarrass River Watersheds

A quantitative analysis of cumulative impacts for the Partridge River and Embarrass River watersheds will be developed using the following steps:

1. The acreage of wetland, lake, and deepwater resources for the pre-settlement, existing and reasonably foreseeable future conditions will be provided as a table. The foreseeable future conditions will include evaluation of a No Action Alternative and the Proposed Action.
    a. The acreage of wetland, lake, and deepwater resources will be compared and discussed for the pre-settlement, existing and reasonably foreseeable future conditions.
    b. The project's effect on the wetland, lake, and deepwater resources will be discussed and compared for the study area. This includes a discussion of changes in acreage,

water quality, unique habitat, adjacency to stream resources, and cumulative effects of projects within each watershed.

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

A quantitative analysis of cumulative impacts for wetlands located below the ordinary high water mark of the of the St. Louis River from its confluence with the Embarrass River to Lake Superior will be developed using the following steps:

1. If the evaluation of the estimated flow changes in the St. Louis River is within the natural variation of flow in within the St. Louis River, no further analysis will be conducted.
2. If the evaluation of the estimated flow changes in the St. Louis River is not within the natural variation of flow in within the St. Louis River, determine the change in wetland acreage from existing to future conditions based on a qualitative estimate of flow changes in the St. Louis River.

5.6 Climate Change

A qualitative analysis of estimated climate change impacts (to be coordinated with the climate change evaluation being conducted for the air impacts chapter of the SDEIS) on cumulative wetland impacts in the Partridge River Watershed, the Embarrass River Watershed, and below the ordinary high water mark of the of the St. Louis River from its confluence with the Embarrass River to Lake Superior.

The qualitative assessment of the potential impacts of climate change on wetlands will be included in the Climate Change Evaluation Report developed by the Air IAP. No additional assessment will be conducted.

6. References

Reference 1 NorthMet Project Project Description, Version 3, September 13, 2011

Reference 2 NorthMet Project Draft Environmental Impact Statement. U.S. Army Corps of Engineers and Minnesota Department of Natural Resources. October 2009.

Reference 3 NorthMet Project Water Modeling Data Package – Volume 1 (Mine Site) Version 5

Reference 4 Compilation of Air Pollutant Emission Factors, AP-42 5th edit. Volume I Stationary Point and Area Sources, Section 13.2.5. Updated November 2006. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.

Reference 5 NorthMet Project Water Modeling Data Package – Volume 2 (Plant Site) Version 2

Reference 6 Surface Water IAP Group Summary Document, Date: May 20, 2011.

Reference 7 NorthMet Project Waste Characterization Data Package Version 5

Reference 8 NorthMet Mine Site Water Modeling Work Plan Version 2

Attachment C

Mapping of wetland forest native plant communities in the Northern Superior Uplands Section and Laurentian Uplands Subsection by the Minnesota Department of Natural Resources – Minnesota Biological Survey (with additional mapping of FPn62 by Barr) Memorandum

Memorandum

To: Jennifer Saran, Kevin Pylka, and Brad Moore PolyMet
From: Barr Engineering Co.
Subject: Mapping of wetland forest native plant communities in the Northern Superior Uplands Section and Laurentian Uplands Subsection by the Minnesota Department of Natural Resources – Minnesota Biological Survey (with additional mapping of FPn62 by Barr)
Date: September 11, 2017
Project: Poly Met Mining Inc.

The purpose of this technical memorandum is to summarize the mapping of wetland forest native plant communities completed by the Minnesota Department of Natural Resources (MnDNR) - Minnesota Biological Survey (MBS) for a large geographic area around the Mine Site. The MnDNR maps and classifies native plant communities according to the MnDNR Ecological Classification System (ECS) (MnDNR 2003).

The MnDNR and U.S. Forest Service (USFS) developed the ECS for ecological mapping and landscape classification in Minnesota following the National Hierarchical Framework of Ecological Units (ECOMAP 1993). As described by the MnDNR, ecological land classifications are used to identify, describe, and map progressively smaller areas of land with increasingly uniform ecological features (MnDNR 2003). The system uses associations of biotic and environmental factors, including climate, geology, topography, soils, hydrology, and vegetation. The state of Minnesota is divided into four ecological provinces, each of which is further subdivided into ecological sections and subsections (Figure 1).

As shown on Figure 1, the Mine Site is situated within the Laurentian Uplands Subsection of the Northern Superior Uplands Section in the Laurentian Mixed Forest Province (MnDNR 2003). The Northern Superior Uplands Section is a 5,970,080 acre area in the eastern portion of the Laurentian Mixed Forest Province and the Laurentian Uplands Subsection is an approximately 567,293 acre area in the west-central portion of the Northern Superior Uplands Section. The Mine Site occupies approximately 3,015 acres in the northwest portion of the Laurentian Uplands Subsection.

Native Plant Community Background

The MnDNR has developed a field guide to native plant communities for each of the four ecological provinces in Minnesota (i.e. MnDNR 2003 for the Laurentian Mixed Forest Province). Minnesota's native plant community classification is driven by plant species composition and incorporates geography and environmental conditions (MnDNR 2003). The MnDNR native plant community classification system is divided into six classification levels, as summarized in Table 1.

Table 1. MnDNR native plant community classification hierarchy*

Classification Level	Dominant Factors	Example
System Group	Vegetation structure & hydrology	Wetland Forest Systems
Ecological System	Ecological processes	Acid Peatland (AP)
Floristic Region	Climate & paleohistory	Northern (n)
Native Plant Community Class	Local environmental conditions	Northern Poor Conifer Swamp (APn81)
Native Plant Community Type	Canopy dominants, substrate, or finer environmental conditions	Poor Tamarack-Black Spruce Swamp (APn81b)
Native Plant Community Subtype	Finer distinctions in canopy dominants, substrate, or environmental conditions	Black Spruce Subtype (APn81b1)

*Table developed from MnNDR 2003.

There are 13 ecological systems (e.g., Acid Peatland System) mapped within the Laurentian Mixed Forest Province, all of which are also present in the Northern Superior Uplands Section and Laurentian Uplands Subsection. The Northern Superior Uplands Section and Laurentian Uplands Subsection are located in the northern floristic region, which the "n" denotes in the native plant community name. In order to define the specific plant community class, two numbers follow the floristic region designation ("n" here). The first number indicates the soil moisture of the plant community, on a 0-9 scale, with 0 driest and 9 wettest. The second number indicates the nutrient levels of the plant community, with 0 poorest in nutrients and 9 richest. Thus, for example, native plant community APn81 is an acid peatland type in the north, with very wet conditions and very low nutrients. Each ecological system includes multiple ECS or native plant community classes, with a brief name assigned (e.g., APn81 Northern Poor Conifer Swamp). For purposes of this memo, native plant communities are discussed at the class level.

The MnDNR has assigned each native plant community a conservation status rank (S-rank) that reflects the risk of elimination of that native plant community from Minnesota (MnDNR 2009). The S-ranks are developed by the conservation organization NatureServe, and were assigned by MnDNR plant ecologists based on:

- Geographic range or extent
- Area of range occupied
- Number of occurrences
- Number of good occurrences (percent of occurrences that have good viability and ecological integrity)
- Environmental specificity

- Long-term trend
- Short-term trend
- Scope and severity of major threats
- Intrinsic vulnerability.

There are five S-ranks, including:

- S1 – critically imperiled
- S2 – imperiled
- S3 – vulnerable to extirpation
- S4 – apparently secure; uncommon but not rare
- S5 – secure, common, widespread, and abundant

MnDNR Native Plant Community Mapping at the ECS Section and Subsection Levels

The MnDNR has mapped native plant communities across certain portions of the Northern Superior Uplands ECS Section and the Laurentian Upland ECS Subsection, as summarized in Figure 1 and Table 2.

Table 2. Summary native plant communities mapped by MnDNR within the Northern Superior Uplands Section and Laurentian Uplands Subsection*

Ecological Classification System Section/Subsection within Laurentian Mixed Forest Province	Total Acres	Acres Mapped by MnDNR	Percent of Area Mapped
Northern Superior Uplands Section	5,970,080	506,771	8%
Laurentian Uplands Subsection	567,293	128,142	23%

*Data derived from MnDNR Native Plant Communities (MBS) shapefile (MnDNR 2015).

The MnDNR has mapped native plant communities across approximately 506,771 acres of the Northern Superior Uplands ECS Section; this represents approximately eight percent of the section area (Table 2, Figure 1). Approximately 28 percent (139,421 acres) of the mapped native plant communities in this section are mapped as classes within the Wetland Forest ecological system. Table 3 summarizes the wetland forest native plant community classes within the Northern Superior Uplands ECS Section.

Table 3. Wetland Forest System native plant community classes mapped by MnDNR within the Northern Superior Uplands ECS Section*

Native Plant Community Class	S-Rank	Acres Mapped in Northern Superior Uplands ECS Section	Percent of Wetland Forest Area Mapped in Northern Superior Uplands ECS Section
APn81 (Northern Poor Conifer Swamp)	S4 or S5**	31,628	22.7%
FPn62 (Northern Rich Spruce Swamp (Basin))	S3	23,602	16.9%
APn80 (Northern Spruce Bog)	S4	21,412	15.4%
WFn53 (Northern Wet Cedar Forest)	S3 or S4**	19,433	13.9%
FPn63 (Northern Cedar Swamp)	S4	19,393	13.9%
FPn82 (Northern Rich Tamarack Swamp (Western Basin))	S5	9,746	7.0%
WFn64 (Northern Very Wet Ash Swamp)	S4	8,176	5.9%
WFn55 (Northern Wet Ash Swamp)	S4	4,151	3.0%
FFn57 (Northern Terrace Forest)	S3	1,168	0.8%
FPn81 (Northern Rich Tamarack Swamp (Water Track))	S4	673	0.5%
FPn71 (Northern Rich Spruce Swamp – Water Track)	S3	39	<0.1%
Total area mapped as wetland forest native plant community class		**139,421**	**100%**

*Data derived from MnDNR Native Plant Communities (MBS) shapefile (MnDNR 2015).
**Two conservation ranks (S-Ranks) are provided because more than one type within these classes is present; in these situations, the different types have different S-Ranks.

As indicated in Table 3, wetland forest native plant community classes mapped by the MnDNR in the Northern Superior Uplands Section consist of 11 native plant community classes, with APn81 (Northern Poor Conifer Swamp) representing the most dominant native plant community, followed by FPn62 (Northern Rich Spruce Swamp). Each of these native plant community classes represents approximately one-fifth to one-sixth of the wetland forest area mapped by the MnDNR. However, only eight percent of the land area in the Northern Superior Uplands Section has been mapped by the MnDNR.

Within the Laurentian Uplands ECS Subsection, the MnDNR has mapped native plant communities across approximately 128,142 acres; this represents just less than one quarter of the subsection area (Table 2, Figure 1). Approximately 41 percent (52,484 acres) of the mapped native plant communities in this subsection are mapped as classes within the Wetland Forest ecological system. Table 4 summarizes the wetland forest native plant community classes within the Laurentian Uplands ECS Subsection.

Table 4. Wetland Forest System native plant community classes mapped by MnDNR within the Laurentian Uplands ECS Subsection*

Native Plant Community Class	S-Rank	Acres Mapped in Laurentian Uplands ECS Subsection	Percent of Wetland Forest Area Mapped in Laurentian Uplands ECS Subsection
FPn62 (Northern Rich Spruce Swamp (Basin))	S3	16,223	30.9%
APn81 (Northern Poor Conifer Swamp)	S4 or S5**	14,659	27.9%
APn80 (Northern Spruce Bog)	S4	7,387	14.1%
FPn63 (Northern Cedar Swamp)	S4	6,673	12.7%
FPn82 (Northern Rich Tamarack Swamp (Western Basin))	S5	4,442	8.5%
WFn53 (Northern Wet Cedar Forest)	S3 or S4**	1,307	2.5%
WFn64 (Northern Very Wet Ash Swamp)	S4	776	1.5%
FPn81 (Northern Rich Tamarack Swamp (Water Track))	S4	660	1.3%
WFn55 (Northern Wet Ash Swamp)	S4	340	0.6%
FFn57 (Northern Terrace Forest)	S3	16	<0.1%
Total area mapped as wetland forest native plant community class		**52,484**	**100%**

*Data derived from MnDNR Native Plant Communities (MBS) shapefile (MnDNR 2015).
**Two conservation ranks (S-Ranks) are provided because more than one type within these classes is present; in these situations, the different types have different S-Ranks.

As indicated in Table 4, the wetland forest native plant community classes mapped by the MnDNR within the Laurentian Uplands ECS Subsection consist of 10 native plant community classes, with FPn62 (Northern Rich Spruce Swamp) representing the most dominant native plant community class, followed by APn81 (Northern Poor Conifer Swamp). Both of these native plant communities each represent approximately 30 percent of the mapped wetland forest native plant community classes in the Laurentian Uplands Subsection.

Northern Rich Spruce Swamps (FPn62) are dominated by black spruce and occur on deep peat in small basins on scoured bedrock terrain or on till plains. The peat surface is influenced by mineral-rich groundwater or surface runoff (MnDNR 2013). Northern Poor Conifer Swamps (APn81) are conifer-dominated peatlands with sparse canopy of stunted trees. The understory of Northern Poor Conifer Swamps is depauperate and dominated by ericaceous shrubs, fine-leaved graminoids, and low hummocks of *Sphagnum* moss. Minerotrophic plant species are present in Northern Poor Conifer Swamps (MnDNR 2003).

The main differences between Northern Rich Spruce Swamps (FPn62) and Northern Poor Conifer Swamps (APn81) generally stem from a difference in richness, as their names imply. Northern Rich Spruce Swamps (FPn62) are generally richer in minerals and have higher pH, higher species diversity, and denser and taller canopies than Northern Poor Conifer Swamps (APn81) (MnDNR 2003).

Additional FPn62 Mapping Identified by Barr

In August of 2017, Barr Engineering Co. (Barr) identified additional locations where FPn62 (Northern Rich Spruce Swamp) is present in the Laurentian Uplands Subsection, but not currently mapped by the MnDNR. Barr reviewed aerial photographs to identify potential locations where FPn62 may be present, based on crown density and color in the aerial imagery, and focusing on relatively accessible areas (i.e., within close proximity to a road) that are on public land. Barr identified a 6-mile stretch along Stony River Forest Road, approximately 15 miles east of Babbitt, as an area likely to have additional FPn62 communities.

Barr conducted a field review to determine whether FPn62 communities were present in the locations identified adjacent to Stony River Forest Road. Barr documented five unmapped FPn62 communities within this stretch, all of which were within one-half mile from the road. The locations of the identified FPn62 communities in the Laurentian Uplands Subsection are summarized in Table 5. In each of these locations, Barr documented the vegetative characteristics of FPn62 communities as defined and outlined in the 2003 MnDNR ECS guide to native plant communities of the Laurentian Mixed Forest Province (MnDNR 2003). These include vegetation species composition and density in the canopy, understory, tall shrub, low shrub, forb, graminoid, and moss strata. For a given plant community to be designated as FPn62, Barr field staff verified that at least one of the specific plant indicators for FPn62 at each stratum was present in the appropriate density, and that, taken collectively, the seven strata comprised an FPn62 class as defined in the ECS guide. Moreover, Barr field staff further considered other native plant community class designations that might potentially apply to the site being evaluated, and verified that the site conditions did not support other class designations over the FPn62 class.

Table 5. Locations of Barr-identified FPn62 Communities in the Laurentian Uplands and Nashwauk Uplands Subsections

Ecological Subsection	Township	Range	Section
Laurentian Uplands Subsection	58	9	18
	58	9	19
	58	9	19
	59	9	28
	59	9	33
Nashwauk Uplands Subsection	59	16	21
	59	16	21
	60	14	22

In addition to documenting FPn62 communities in the Laurentian Uplands Subsection, Barr also documented three locations of unmapped FPn62 communities in the Nashwauk Uplands Subsection, where the 4,418-acre Plant Site is located (Figure 1). The Nashwauk Uplands Subsection contains approximately 810,000 acres and is located west of the Laurentian Uplands Subsection. Approximately 4,798 acres of native plant community have been mapped by the MnDNR in the Nashwauk Uplands Subsection, which represents approximately 0.6 % of the subsection.

Barr used the same methodology for the Nashwauk Uplands Subsection as described above for locating and identify unmapped FPn62 communities in the Laurentian Uplands Subsection. The locations of the identified FPn62 communities in the Nashwauk Uplands Subsection are summarized in Table 5.

References

ECOMAP. 1993. National hierarchical framework of ecological units. Unpublished administrative paper. U.S. Department of Agriculture, Forest Service. Washington, D.C., USA.

Minnesota Board of Water and Soils Resources and Minnesota Department of Natural Resources (MnDNR). 2017. Wetland Conservation Act – Technical Guidance on Rare Natural Communities.

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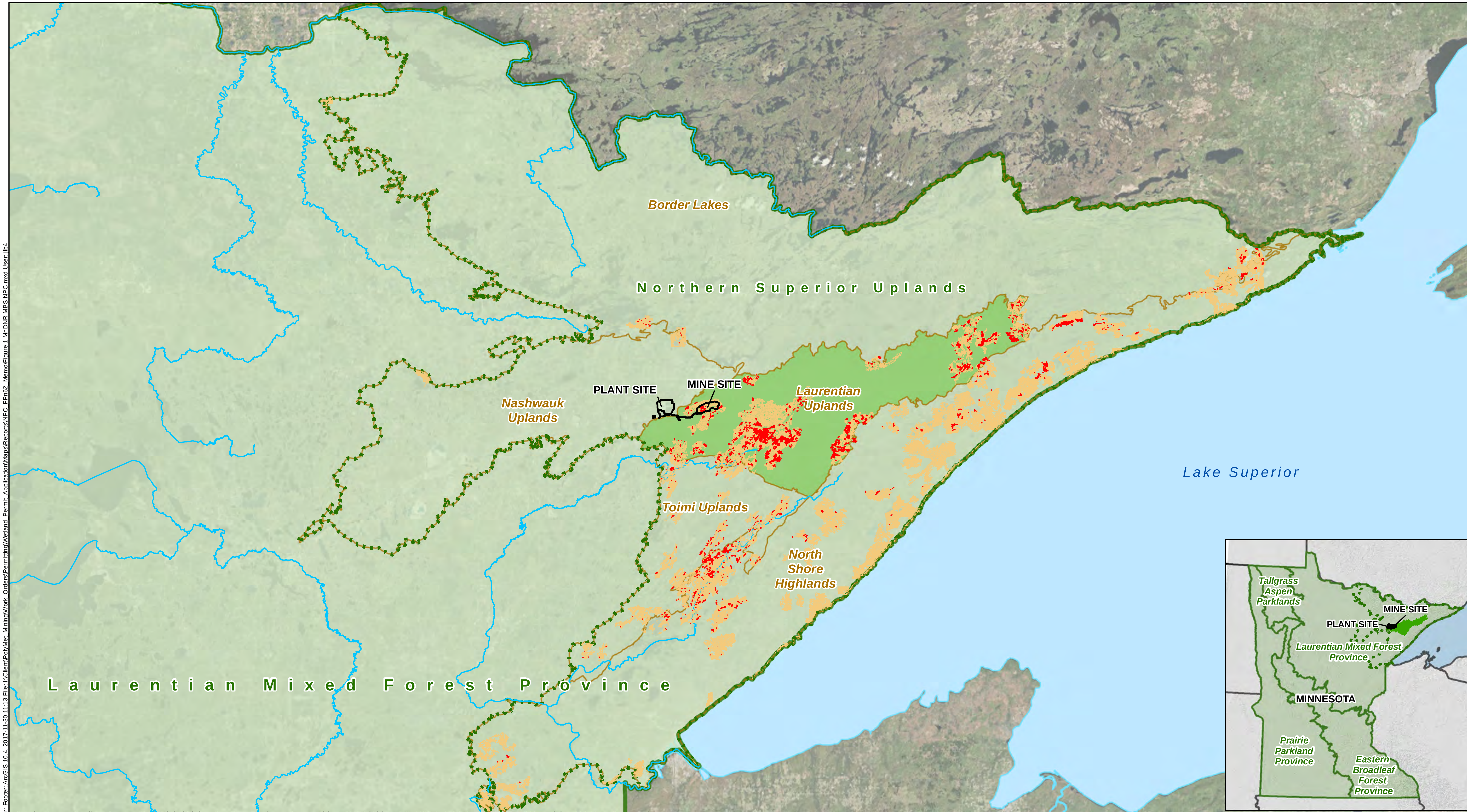
MnDNR. 2015. Native Plant Communities (MBS). GIS shapefile. Downloaded from the MnDNR Data Deli in June 2015.



EIS Project Areas

Ecological Classification System (ECS)

Ecological Province

ECS Section - Northern Superior Uplands

ECS Subsection - Laurentian Uplands

ECS Subsection

MnDNR-MBS Native Plant Communities in the Northern Superior Uplands ECS Section

Native Plant Communities

Northern Rich Spruce Swamps (FPn62)

0 15 30

Miles

Figure 1
MnDNR-MBS NATIVE PLANT COMMUNITIES IN THE NORTHERN SUPERIOR UPLANDS ECS SECTION
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, MN

Attachment D

Wetland Bank Option Agreement

Exhibit C

Notification Letter

PolyMet Mining, Inc. and EIP, by signature below, verify that they have reached an agreement under which EIP will provide credits from its Superior Mitigation Bank for PolyMet to use to meet the requirements that PolyMet expects to have for wetland mitigation in the Minnesota Permit to Mine for the NorthMet project and the US Army Corps of Engineers Section 404 permit for the NorthMet project. Under that agreement, up to 1,800 credits will be available to PolyMet Mining, Inc. for purchase.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed as of the day and year first above written.

BUYER:

POLYMET MINING, INC.

By ____________________
Name: ____________________
Title: ____________________

SELLER:

EIP CREDIT CO., LLC

By [signature]
Name: Nicholas Dilks
Title: Manager

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed as of the day and year first above written.

BUYER:

POLYMET MINING, INC.

By ______________________
Name: Jonathan Cherry
Title: President + CEO

SELLER:

EIP CREDIT CO., LLC

By ______________________
Name: ______________________
Title: ______________________

Attachment E

Monitoring Plan for Potential Indirect Wetland Impacts

BARR

Monitoring Plan for Potential Indirect Wetland Impacts

NorthMet Project

Prepared for
Poly Met Mining Inc.

December 2017

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Monitoring Plan for Potential Indirect Wetland Impacts

December 2017

Contents

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List of Exhibits

Acronyms

Acronym	Description
FTB	Flotation Tailings Basin
DNR	Minnesota Department of Natural Resources
NPC	Native Plant Community
USACE	U.S. Army Corps of Engineers
WCA	Wetland Conservation Act

1.0 Introduction

The purpose of this document is to present a proposed monitoring plan for potential indirect wetland impacts for the Poly Met Mining Inc. (PolyMet) NorthMet Project (Project). The purpose of the study is to determine whether or not indirect wetland impacts result from the permitted project and if so, the extent of those impacts. The Project is located in St. Louis County, northeast of Hoyt Lakes, Minnesota, as shown in Large Figure 1.

As described in Section 5.2 of Reference (1), an analysis was conducted to establish an estimate of potential indirect wetland impacts. This analysis was based on the following six factors:

- Changes in wetland watershed areas (during operation and long-term closure)
- Groundwater drawdown resulting from open pit mine dewatering
- Groundwater drawdown resulting from operation of the Flotation Tailings Basin (FTB) including groundwater seepage containment
- Changes in stream flow near the Mine Site and FTB and associated impacts to wetlands abutting the streams (during operation and long-term closure)
- Wetland fragmentation from Project elements such as open pits, stockpiles, haul roads, etc.
- Potential change in wetland water quality related to atmospheric deposition of dust and rail car spillage associated with Mine Site and FTB operations

Each wetland was assessed to determine whether it could potentially be affected by any of the six factors listed above. A wetland could potentially be indirectly impacted by none of the factors, or up to a maximum of six factors. A potential indirect impact rating was developed based on the number of factors that may potentially affect a wetland – from No Impact (0 factors) to 6 (all six factors potentially indirectly impacting the wetland).

This analysis was conducted to help identify wetlands that would be the focus of monitoring for potential indirect impacts. Based on this analysis, monitoring will occur within all wetlands having a potential indirect wetland impact factor rating of 5 and 4, within most wetlands having an impact factor rating of 3, and a sampling of those wetlands with factor ratings of 2 and 1. For more information on the analysis of potential indirect wetland impacts, see Section 5.2 of Reference (1)).

Hydrology, vegetation, and wetland boundaries will be monitored, documented, and compared with baseline monitoring and reference wetlands to determine if indirect impacts occur at the Site. A total of 61 monitoring wells, including five reference wells have been installed to document potential indirect wetland impacts (Large Figure 2 and Large Figure 3). The monitoring program will continue for the life of the Project and post-Project, as necessary.

The outline of this document is:

Section 2.0	Description of the hydrology monitoring that will be conducted as part of the monitoring program
Section 3.0	Description of the vegetation monitoring that will be conducted as part of the monitoring program
Section 4.0	Description of the wetland boundary evaluation
Section 5.0	Description of the potential indirect wetland impact assessment
Section 6.0	Description of the adaptive management strategy
Section 7.0	Description of proposed mitigation for potential indirect impacts

2.0 Hydrology Monitoring

The objective of wetland hydrology monitoring is to document pre-project hydrology conditions, and, during Project operations and closure, assess whether the wetlands have been impacted by the potential indirect impacts discussed above an in Section 5.2 of Reference (1), Section 11.5 of Reference (2), and Section 11.4 of Reference (3). Locations of wetland hydrology monitoring wells for assessment of potential indirect wetland impacts are shown on Large Figure 2 and Large Figure 3.

The pre-project wetland hydrology monitoring study has followed the protocols described in Reference (4), Reference (5), and Reference (6). The objectives of wetland hydrology monitoring are to:

- Gain a better understanding of the wetland hydrology at the Project site, i.e., defining whether specific wetlands are recharging the surficial deposits aquifer or are discharging to surface waters.
- Collect baseline hydrology data that could be used to assess the effect of the Project on wetland hydrology.
- Determine the potential for indirect wetland impacts resulting from the Project.

Wetland hydrology monitoring will be conducted during operation of the Mine Site and Plant Site to document potential indirect wetland impacts. The wetland hydrology monitoring plan has been developed as described in the Section 17 of Reference (2). The plan was developed with the purpose of meeting the Section 404, Wetland Conservation Act (WCA), and Section 401 permit conditions, which will describe the purpose, methods, and criteria to be implemented to document potential indirect wetland impacts.

2.1 Pre-Project Mine Site Area Wetland Monitoring

Large Figure 2 shows the locations of all current monitoring wells in the Mine Site and Transportation Corridor (Mine Site area). As described in Section 4.2.1 of Reference (7), pre-project hydrology monitoring at the Mine Site area began in 2005, and has continued yearly through 2017, and will continue in 2018. There are 46 wetland hydrology monitoring wells in the Mine Site area, including three monitoring wells located in reference wetlands (Large Figure 2).

Hydrology monitoring at the Mine Site has evolved over time, and wells were installed in 2005, 2008, 2010, and 2014. In 2005, there were 20 shallow manual wells and 4 recording wells initially installed at 19 locations in the Mine Site area (Section 2.1 of Reference (8) and Section 4.2.1 of Reference (7). In 2008, two wells were removed because they were located within future stockpile footprints, two new wells were added and one well was relocated out of the potential direct impact area (Reference (5)). Starting in 2008, all monitoring locations were instrumented with recording wells so water levels could be recorded every 2 to 4 hours. The monitoring wells were typically placed to a depth of 2 to 5 feet below the ground surface.

In 2010, two wells were relocated because they were determined to be in areas that will be directly impacted by the Project (Reference (6)). During 2008 through 2010, there were 21 locations monitored at the Mine Site (Section 2.1 of Reference (9), Section 2.1 of References (8), and Section 4.2.1 of Reference (7)). In 2014, wetland monitoring wells were installed at 25 additional locations at the Mine Site and Transportation and Utility Corridors. All wells were installed following the protocols described in Reference (4).

Two reference wetlands were selected in 2008, located west of the Mine Site (Reference (5)). In 2014, a third reference wetland was selected, located to the southwest of the Mine Site (Section 4.2.1 of Reference (7)). One shallow monitoring well was installed in each reference wetland. The purpose of monitoring the reference wetlands is to document the natural hydrology fluctuations in wetlands that will not be affected by the Project to facilitate interpretation of the Project data in relation to climatic fluctuations.

2.2 Pre-Project Plant Site Area Wetland Monitoring

Large Figure 3 shows the locations of all current monitoring wells in the Plant Site area. As described in Section 4.2.3 of Reference (7), pre-project hydrology monitoring began in 2010, and has continued yearly through 2017, and will continue in 2018.

There are 15 wetland hydrology monitoring wells in the Plant Site area. Wells were installed in 2010 and 2014, following the protocols described in Reference (4). Electronic water level data were collected every 4 hours during the six growing seasons. The monitoring wells were typically placed to a depth of 2 to 5 feet below the ground surface.

Shallow monitoring wells were initially installed at eight locations, including a reference wetland location, near the Plant Site in 2010, primarily north and west of the FTB (Reference (6)). In 2014, shallow monitoring wells were installed at seven additional locations in the Plant Site area, including a second reference wetland location.

One reference wetland was selected in 2010, located approximately 2.2 miles north of the Plant Site (Large Figure 3). In 2014, a second reference wetland was selected was installed approximately 2.2 miles northeast of the FTB (Large Figure 3). One shallow monitoring well was installed in each reference wetland. The purpose of monitoring the reference wetlands is to document the natural hydrology fluctuations in wetlands that will not be affected by the Project to facilitate interpretation of the Project data in relation to climatic fluctuations.

3.0 Vegetation Monitoring

Vegetation monitoring, as described in Reference (10), will occur in wetlands that may be potentially indirectly impacted by the Project. The objectives of vegetation monitoring are to:

- Establish baseline vegetation community data at all wetland hydrology monitoring well locations.
- Use the wetland hydrology and vegetation data to monitor whether changes occur over time in order to determine if indirect wetland impacts result from the Project.

Wetland vegetation monitoring will be conducted pre-Project (baseline conditions), during operation of the Mine Site and Plant Site, and during closure. The plan was developed with the purpose of meeting the Section 404 and WCA permit conditions, which will describe the purpose, methods, and criteria to be implemented to document potential indirect wetland impacts.

Pre-project baseline vegetation monitoring was conducted in June 2015 by establishing vegetation relevés at each of the 61 well locations (Large Figure 2 and Large Figure 3). After Project operations begin, vegetation monitoring will be conducted every other year until the pit limits have been reached and the hydrology data has shown stabilized conditions for at least two years. After that, vegetation monitoring will be conducted every five years, unless triggers for hydrology or vegetation indicate the need for more frequent vegetation monitoring (as described in Section 5.1). A decrease in monitoring may be requested from the USACE, DNR, and MPCA if the monitoring consistently shows no impacts.

3.1 Vegetation Monitoring Protocol

The protocol described in the following sections summarizes methodology for locating the vegetation relevés and monitoring potential indirect wetland impacts for the Project. The time periods for monitoring include pre-Project (baseline conditions), during the Project, and during closure.

The Potential Indirect Wetland Impact Vegetation Monitoring Plan Memorandum (Reference (10)), was provided for review to the U.S. Army Corps of Engineers (USACE) and Minnesota Department of Natural Resources (DNR) – Lands and Minerals. Based on comments from the USACE, bryophyte transects and collection of bryophytes was included in the survey for each relevé.

3.1.1 Establishing and Monumenting Relevés

The relevé center was be established near each associated shallow groundwater well; however, the shallow groundwater well is not located in the relevé. This is because repeated visits to the wells could result in changes in vegetation that are not related to changes in hydrology. The center of the relevé was recorded with a GPS unit. Where feasible, a distance and bearing from the relevé center to the associated well was recorded as a secondary means of re-establishing the relevé center on subsequent monitoring visits. Relevés were laid out, wherever feasible, with the centerline of the relevé on a north-south axis. If laying out the relevé on a north-south axis resulted in portions of the relevé lying outside of the vegetation community type associated with the well, then the centerline was rotated to get all or as much of the relevé within the same vegetation community type. Where relevés could not be laid out on a north-south axis, the orientation of the centerline through the relevé was recorded (e.g., 285º).

Photographs were taken, at a minimum, from the relevé center in all four cardinal directions, and from the relevé corners, facing inward to the center. Photographs were intermediate to wide-angle to maximize the view of all strata.

3.1.2 Vegetation Relevé Monitoring

Vegetation relevé monitoring was conducted to characterize baseline conditions in the wetlands and will continue in the future in order to evaluate whether potential indirect impacts result from the Project. The relevé monitoring will be replicated every two years for the first six years, and every five years after that to determine if the wetlands are potentially indirectly impacted by the Project. Vegetation will be monitored in 61 permanent relevés, which include five reference relevés. Each relevé is located near one of the existing 61 shallow groundwater monitoring wells (Large Figure 2 and Large Figure 3).

Each relevé measures 10-meters by 10-meters in non-forested communities. Relevés in forested communities are 20-meters by 20-meters for shrub and tree strata, with a 10-meter by 10-meter herbaceous and vine plot nested within the larger relevé. The size for the relevés was selected based on the DNR relevé method, which uses the same size for relevés (page 6-8 of Reference (11)). The four corners of each relevé were flagged and the points were located using GPS (with sub-meter accuracy) so that the relevé is easily located in subsequent years of monitoring.

Vegetation in the monitoring relevés will continue to be inventoried during June or July when most plant species will be readily identified by botanists/ecologists. Surveyors will continue to record the species name and cover class for all plant species present within the plot. All vascular plants observed within the plots will continue to be identified to the genus level and preferably to species. All plant species that cannot be identified in the field will also be recorded so their cover can be estimated; voucher specimens will be collected for later identification. The botanical team will continue to estimate the absolute cover of each plant species identified within the relevé.

The vegetation monitoring includes characterization of the vegetation community structure, including the relevé and wetland community in which each well is located. The documentation includes vegetation community type (see Section 3.1.4 below), type(s) of observed disturbance(s), disturbance level and extent, percent cover of forested canopy, percent sphagnum cover, percent non-sphagnum bryophyte cover, and percent cover by four stratum classes. The four stratum classes are defined as trees (woody plants 3 inches or more in diameter at breast height), sapling/shrub stratum (woody plants less than 3 inches in diameter at breast height and greater than one meter tall), herbaceous layer (consists of all herbaceous plants including herbaceous vines, regardless of size, and woody plants less than 1 meter tall), and woody vines (consists of all woody vines greater than 1 meter in height).

3.1.3 Vegetation Meander Survey

In addition to the relevé survey, timed vegetation meander surveys (meander survey) are also conducted in the vicinity of the relevé, within the wetland community where each monitoring well is located. The meander survey is only conducted within the wetland community type specified for the monitoring well (Attachment A of Reference (10)). The purpose of this meander survey is to document additional species within the wetland community that were not observed and identified during the relevé survey. The additional documentation of plant species along the meander survey augments the relevé inventory, and yields a more comprehensive measure of species richness at each plot.

At the beginning of the meander survey, the biologist meanders for at least 20 minutes, documenting every plant species observed while walking through the wetland community. During this 20 minutes, the biologist meanders for 15 minutes while recording every observed species; during the final 5 minutes, if more than 2 new species are observed and recorded, the biologist continues to meander for an additional 5 minutes (for a total time of 25 minutes). At the end of the meander survey, the estimated cover for each observed species is estimated by the biologist.

3.1.4 Vegetation Community Monitoring

Vegetation community characterization and mapping is conducted for each relevé, and for community types immediately adjacent to the vegetation community in which the relevé is located. Adjacent community types are determined according to the Eggers and Reed community types (Reference (12)) and the Native Plant Community (NPC) classification system based on DNR ecological land classifications (NPC), documented to the NPC Class Code level (e.g., APn80) (Reference (13)). Baseline data includes documentation of the adjacent community types in close proximity to the wells and their dominant vegetation. Photographs were and will continue to be taken within the adjacent vegetation communities.

4.0 Wetland Boundary Evaluation

The wetland boundaries within the wetland areas identified for hydrology monitoring have been delineated before mining activities are started to establish the pre-project, baseline wetland extents, as described in Section 11.3 of Reference (3). The delineation was discussed with the Wetland IAP Workgroup, and the delineation was approved by the co-lead agencies as part of the Wetland IAP Workgroup process on March 30, 2011.

During Project construction, portions of the monitored wetland boundaries will be reviewed every five years to evaluate potential changes in wetland boundaries. Wetland boundaries will be field-delineated and located using a GPS with sub-foot horizontal accuracy. The field-based delineation will map the same 10% of the wetland boundary at each of the wetlands with monitoring locations (Large Figure 2 and Large Figure 3). The 10% of the wetland boundary that would be monitoring would be located near potential impact area (e.g., mine pit or stockpile) and in the general area of the wetland hydrology monitoring well. Wetland delineation data will be compiled to map each boundary and the results will be reported with each annual monitoring report. A loss of wetland area from the baseline wetland extent will be considered an impact.

5.0 Potential Indirect Wetland Impact Assessment

As described in Reference (10), the hydrology, vegetation, and vegetation community monitoring data collected as part of this monitoring program will be evaluated to determine if adverse, indirect wetland impacts occur as a result of the Project. The evaluation of the cause of impacts should consider other sources of disturbance, including beaver activity, or introduction of invasive species and other factors, such as logging, that may be unrelated to Project activity. In addition, the evaluation will consider natural variability by comparison of the results to the reference wetland results.

5.1 Triggers for More Frequent Vegetation Monitoring

If any of the following hydrology and vegetation triggers is met, the vegetation monitoring interval may be decreased.

5.1.1 Hydrology Triggers

There are two hydrology triggers to consider, as described in the Wetland Data Package (Reference (1)):

1. A 25% reduction of the baseline wetland hydroperiod will be considered the hydrology trigger for evaluating whether the vegetation monitoring interval should be reduced.
2. Consider Large Table 8: Summary of Potential Wetland Community Changes Due to Drawdown (Section 5.2.1.2.3 of Reference (1)) as a guideline to indicate the potential of water level drawdown for each wetland community type. If water level drawdown, as documented in hydrology monitoring, continues to be within the "None" Impact Sensitivity Category, no hydrology impact triggers will be met. If water level drawdown reaches the lower range of the "Moderate" Impact Sensitivity Category, the hydrology trigger will be met.

5.1.2 Vegetation Triggers

The meander vegetation survey can indicate broad changes in vegetation. The vegetation plot surveys can provide more detailed documentation of the changes.

There are triggers that may indicate the potential development of adverse indirect impacts. The vegetation triggers that are indicative of potential indirect impacts:

- 12% change in species richness;
- 12% change in living tree cover;
- Appearance of non-native invasive species in a relevé where none were previously recorded, or a 12% increase in non-native invasive cover or number of species in relevés where non-native invasive species were previously recorded; or
- A 12% reduction of native hydrophytic species in the relevé.

5.2 Regulatory Impact Measures

The triggers identified in Section 5.1 are based on regulatory impact measures, but are more stringent in order to proactively avoid potential development of adverse indirect impacts. These triggers would be used to determine whether the monitoring frequency needs to be increased or whether other adaptive management measures or mitigation need to be implemented. Regulatory measures that may indicate an adverse, indirect wetland impact are as follows:

1. Exhibit A provides the details of the performance standard, which states: For each individual monitoring well location, inundation/depth to the water table during the growing season shall remain within the minimum/maximum brackets (e.g., Figures 1-4 in Exhibit A) documented by baseline monitoring well data1 when placed in context of hydrological conditions. Deviations from baseline monitoring well data meeting one or both of the following criteria will be evaluated by the District Engineer to determine whether adaptive management, increased monitoring, and/or additional compensatory mitigation are triggered: (1) frequency: >2 growing seasons; and (2) duration: >14 consecutive days.

2. Change in vegetation species composition and/or cover as described below, inconsistent with vegetation changes in the reference wetlands.

    - 25% change in species richness;
    - 25% change in living tree cover;
    - Appearance of non-native invasive species in a relevé where none were previously recorded, or a 25% increase in non-native invasive cover or number of species in relevés where non-native invasive species were previously recorded; or
    - A 25% reduction of native hydrophytic species in the relevé.

3. A change in wetland community type coincident with a reduction in wetland hydroperiod that is not consistent with wetland community type change documented within the reference wetland.

4. Changes in monitored wetland boundaries inconsistent with changes in boundaries of reference wetlands.

5.3 Reporting

The data for hydrology, vegetation, and wetland boundary monitoring will be compiled into annual reports to be submitted to the USACE, DNR, and Minnesota Pollution Control Agency as part of the Permit to Mine Annual Report on March 31 of each year (Attachment 13 of Reference (14)). Annual reports will include methods, results, and evaluation of potential adverse indirect wetland impacts. Vegetation and wetland boundary monitoring data will only be included in years in which that monitoring was conducted. PolyMet will discuss the results of monitoring on an annual basis with the agencies and will determine if there is a need to modify this monitoring plan.

6.0 Adaptive Management

As described in Section 17.8 of Reference (2)) and Section 15.9 of Reference (3), an adaptive approach will be used to evaluate the most effective monitoring strategy for potential indirect effects. The monitoring plan will be updated annually based on results from the previous year. If indirect impacts are observed, additional monitoring may be developed to focus in those areas and/or to focus on a specific impact factor. Additional monitoring may include new monitoring locations in other wetlands and more detailed delineation and vegetation data collection.

The adaptive monitoring plan will be incorporated in two phases. Phase I of the adaptive monitoring plan will be broad-based monitoring to identify changes to wetlands or changes that may affect wetlands or surface waters. Possible alternatives that could be implemented to reduce wetland impacts if potential conditions occur, i.e. sheet piling, cut off walls, berms, etc. that could be placed around the mine pits. Phase II monitoring may be implemented to provide a more detailed assessment in a given area to analyze a potential impact factor. If necessary, the Phase II monitoring will be designed and implemented as needed to address the changes identified in Phase I monitoring. Phase II will be used to determine the need for additional mitigation or to develop a plan to control the changes identified in Phase I and minimize future impacts to wetlands.

7.0 Impact Mitigation

As described in the Wetland Permit Application (Section 17.9 of Reference (2)), if indirect wetland impacts, occur, based on the criteria described Section 15.6 of Reference (2), PolyMet will work with the USACE, DNR, and MPCA to respond, which will include compensatory mitigation for any indirect impacts. Compensatory loss of wetland area may be mitigated in accordance with the mitigation ratios of direct wetland impacts as proposed for the USACE, DNR, and MPCA in Section 14.0 of Reference (2). Compensatory mitigation would be based on the St. Paul District USACE Policy for wetland mitigation (Reference (15)). Partial drainage or other changes to the wetlands, that do not result in the wetland loss but exceed the threshold levels established in Section 15.6 of Reference (2), may be mitigated at a lower ratio depending on the extent and degree of the changes to wetland function.

8.0 References

1. **Poly Met Mining Inc.** NorthMet Project Wetland Data Package (v11). April 2015.

2. —. NorthMet Project Wetland Permit Application (v2). August 19, 2013.

3. **Barr Engineering Co.** NorthMet Project Wetland Replacement Plan (v3) Prepared for Poly Met Mining, Inc. December 2017.

4. —. Wetland Hydrology Study Plan. June 24, 2005.

5. —. Addendum to Wetland Hydrology Monitoring Plan. May 13, 2008.

6. —. Addendum to Wetland Hydrology Study Plan. April 12, 2010.

7. —. Wetland Hydrology Monitoring Report Summary 2005-2016 - NorthMet Site. February 2017.

8. —. Wetland Hydrology Monitoring Report 2007-2009. March 2010.

9. —. Wetland Hydrology Study Report 2006 (RS44). [RS44 Draft-02]. November 20, 2006.

10. —. Potential Indirect Wetland Impact Vegetation Monitoring Plan Memorandum to Steve Eggers (USACE), Colleen Allen (MNDNR). Prepared for Poly Met Mining Inc. NorthMet Project. June 8, 2015.

11. **Minnesota Department of Natural Resources.** *A Handbook for Collecting Vegetation Plot Data in Minnesota: The Relevé Method.* 2nd. 2013.

12. **Eggers, S.D. and D.M. Reed.** Wetland Plants and Communities of Minnesota and Wisconsin: Third Edition. *US Army Corps of Engineers.* [Online] 2011. http://www.myp.usace.army.mil/docs/wetlands/Cover.pdf.

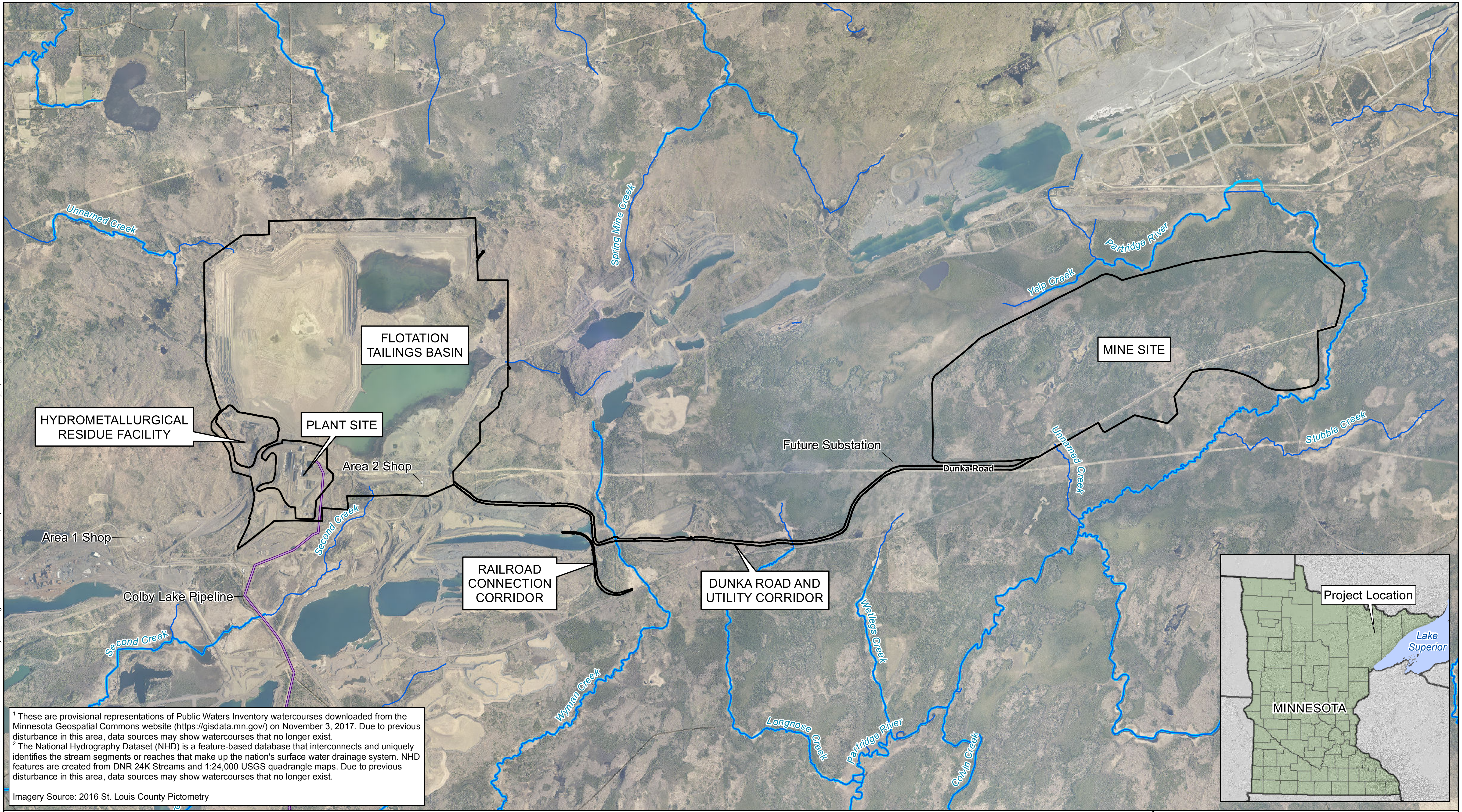
13. **Minnesota Department of Natural Resources.** *Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province.* s.l. : Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program, St. Paul, MN, 2003.

14. **Barr Engineering Co.** Permit to Mine Application (v3). Prepared for Poly Met Mining, Inc. NorthMet Project. December 2017.

15. **U.S. Army Corps of Engineers St. Paul District.** St. Paul District Policy for Wetland Compensatory Mitigation in Minnesota. January 2009.

16. **Poly Met Mining Inc.** NorthMet Project Wetland Management Plan (v7). January 2015.

Large Figures



[1] These are provisional representations of Public Waters Inventory watercourses downloaded from the Minnesota Geospatial Commons website (https://gisdata.mn.gov/) on November 3, 2017. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.
[2] The National Hydrography Dataset (NHD) is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from DNR 24K Streams and 1:24,000 USGS quadrangle maps. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.

Imagery Source: 2016 St. Louis County Pictometry

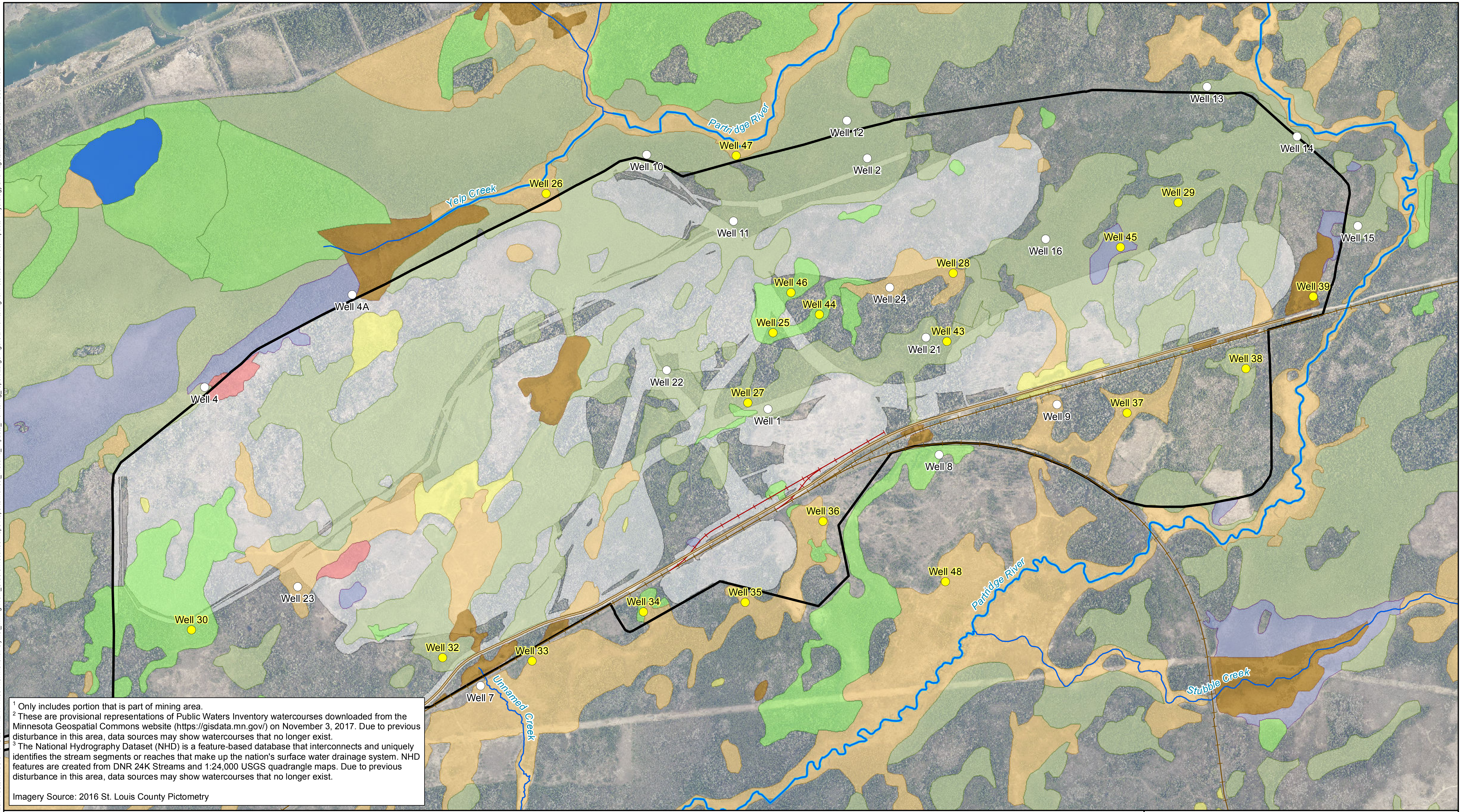
Project Areas
Colby Lake Pipeline
Public Waters Inventory (PWI) Watercourses[1]
National Hydrography Dataset (NHD) Rivers & Streams[2]

N

0 2,250 4,500 9,000
Feet

PROJECT LOCATION
NorthMet Project
Poly Met Mining, Inc.

Large Figure 1
Indirect Wetland Impacts Monitoring Report



[1] Only includes portion that is part of mining area.
[2] These are provisional representations of Public Waters Inventory watercourses downloaded from the Minnesota Geospatial Commons website (https://gisdata.mn.gov/) on November 3, 2017. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.
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Imagery Source: 2016 St. Louis County Pictometry

Wetland Hydrology Monitoring Locations
- Installed Prior to 2014
- Installed in 2014
- Dunka Road[1]
- Existing Private Railroad
- Proposed Railroad Track

- Public Waters Inventory (PWI) Watercourses[2]
- National Hydrography Dataset (NHD) Rivers & Streams[3]
- Project Areas
- Areas Disturbed by Proposed Project Features

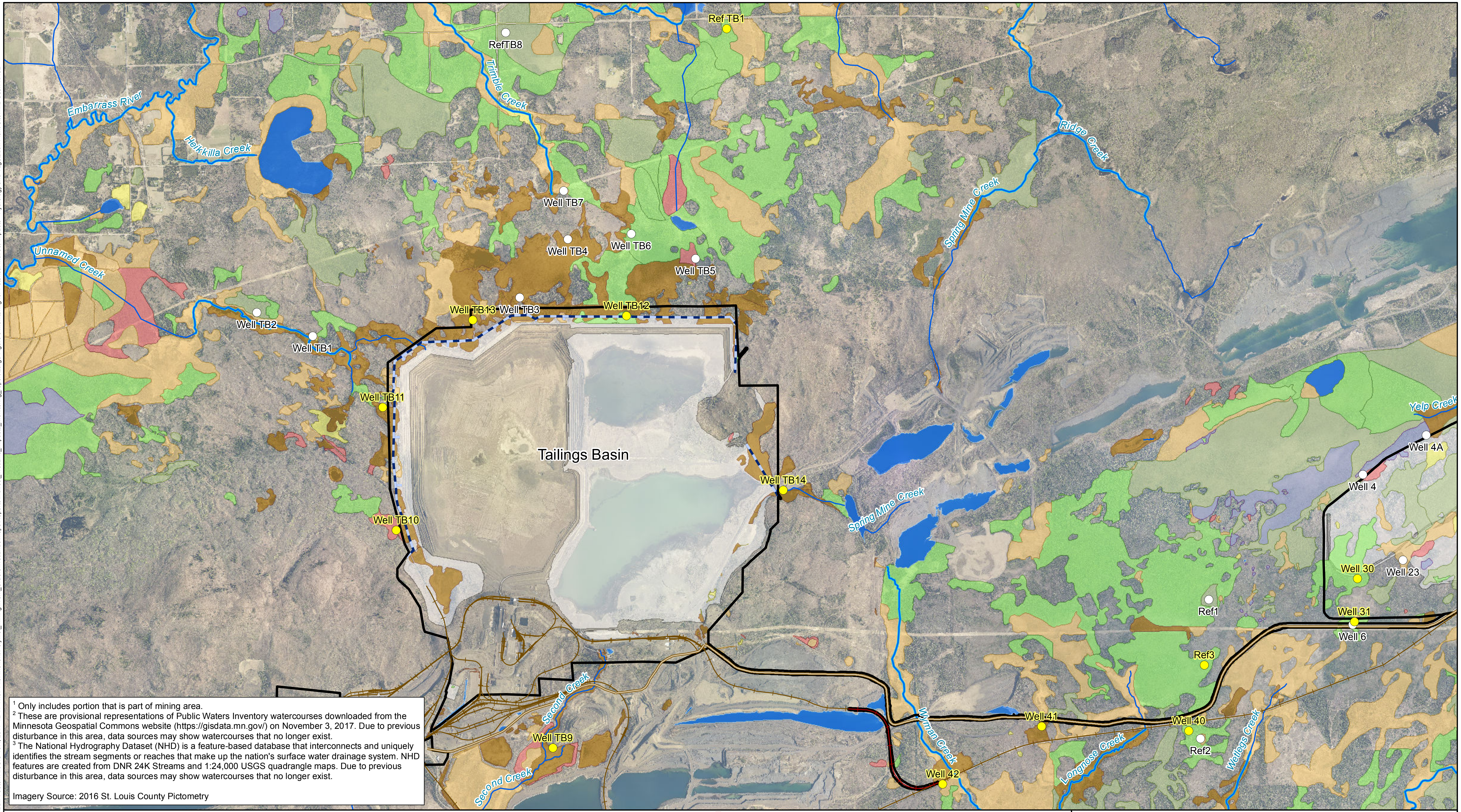
Eggers & Reed Wetland Types
- Shrub Swamps (Alder thickets & Shrub-carrs)
- Coniferous bog
- Coniferous swamp
- Deep marsh; Shallow marsh
- Hardwood swamp
- Open water (Shallow, open water & lakes)
- Open bog
- Sedge meadow; Wet meadow

N

0 750 1,500 3,000
Feet

MONITORING FOR POTENTIAL INDIRECT IMPACTS - HYDROLOGY AND VEGETATION MINE SITE
NorthMet Project
Poly Met Mining, Inc.

Large Figure 2
Indirect Wetland Impacts Monitoring Report



[1] Only includes portion that is part of mining area.
[2] These are provisional representations of Public Waters Inventory watercourses downloaded from the Minnesota Geospatial Commons website (https://gisdata.mn.gov/) on November 3, 2017. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.
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Imagery Source: 2016 St. Louis County Pictometry

Wetland Hydrology Monitoring Locations
- Installed Prior to 2014
- Installed in 2014
- Dunka Road[1]
- Existing Private Railroad
- Proposed Railroad Track
- Cutoff Wall FTB Containment System

- Public Waters Inventory (PWI) Watercourses[2]
- National Hydrography Dataset (NHD) Rivers & Streams[3]
- Project Areas
- Areas Disturbed by Proposed Project Features

Eggers & Reed Wetland Types
- Shrub Swamps (Alder thickets & Shrub-carrs)
- Coniferous bog
- Coniferous swamp
- Deep marsh; Shallow marsh
- Hardwood swamp
- Open water (Shallow, open water & lakes)
- Open bog
- Sedge meadow; Wet meadow

0 1,750 3,500 7,000
Feet

MONITORING FOR POTENTIAL INDIRECT IMPACTS - HYDROLOGY AND VEGETATION PLANT SITE AND TRANSPORTATION AND UTILITY CORRIDOR
NorthMet Project
Poly Met Mining, Inc.

Large Figure 3
Indirect Wetland Impacts Monitoring Report

Barr Footer: ArcGIS 10.4, 2017-12-11 11:07 File: I:\Client\PolyMet_Mining\Work_Orders\Wetlands\Maps\Reports\Indirect_Wetland_Impacts_Monitoring_report\Large Figure 3 Monitoring for Potential Indirect Impacts - Hydrology and Vegetation Plant Site.mxd User: KAC2

Exhibit A

Interpreting Monitoring Well Data for Determining Potential In-Direct Hydrological Impacts to Wetlands Memo

CEMVP-OP-R (1999-5528-JKA) 22 November 2017

Draft MEMORANDUM

SUBJECT: *Interpreting Monitoring Well Data for Determining Potential In-Direct Hydrological Impacts to Wetlands*

1. **Introduction**

Should the NorthMet project be permitted and constructed, a component of monitoring for potential in-direct impacts to wetlands includes comparison of post-construction monitoring well data to baseline data, collection of which began in 2005. This necessitates a performance standard addressing how that data would be analyzed. Specifically, frequency and duration of deviations from baseline monitoring well data would be evaluated by the District Engineer to determine whether adaptive management, increased monitoring, and/or additional compensatory mitigation are warranted. The following is my recommendation:

> *For each individual monitoring well location, inundation/depth to the water table during the growing season shall remain within the minimum/maximum brackets (e.g., Figures 1-4) documented by baseline monitoring well data*[1] *when placed in context of hydrological conditions.*[2,3] *Deviations from baseline monitoring well data meeting one or both of the following criteria will be evaluated by the District Engineer to determine whether adaptive management, increased monitoring, and/or additional compensatory mitigation are triggered: (1) frequency: ≥2 growing seasons; and (2) duration: ≥14 consecutive days.*

This would be in addition to the measures described in the *Monitoring Plan for Potential Indirect Wetland Impacts—NorthMet Project* (Barr Engineering, Inc. 2016) and any subsequent iterations.

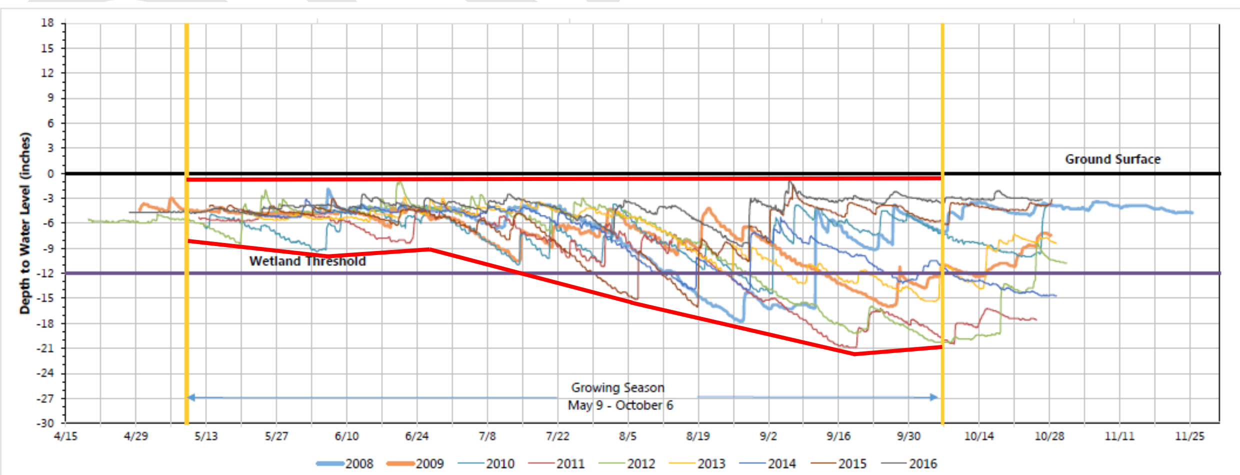

Figure 1—Red brackets define minimum/maximum range of water levels at Wetland Monitoring Well 10.

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[1] Barr Engineering, Inc. reports dated 2006, 2010 and 2017. See Literature Cited herein.

[2] Including 30-day rolling totals of precipitation, data from reference monitoring wells located outside of potential in-direct impacts, and the U.S. Drought Monitor (http://droughtmonitor.unl.edu).

[3] See discussion herein under 2.b.

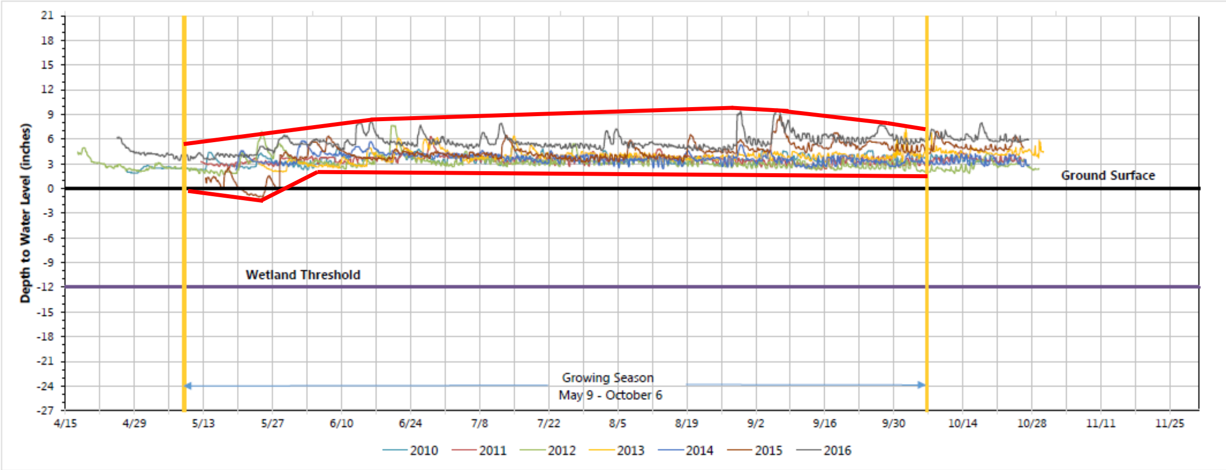

Figure 2—Red brackets define minimum/maximum range of water levels at Wetland Monitoring Well TB6.

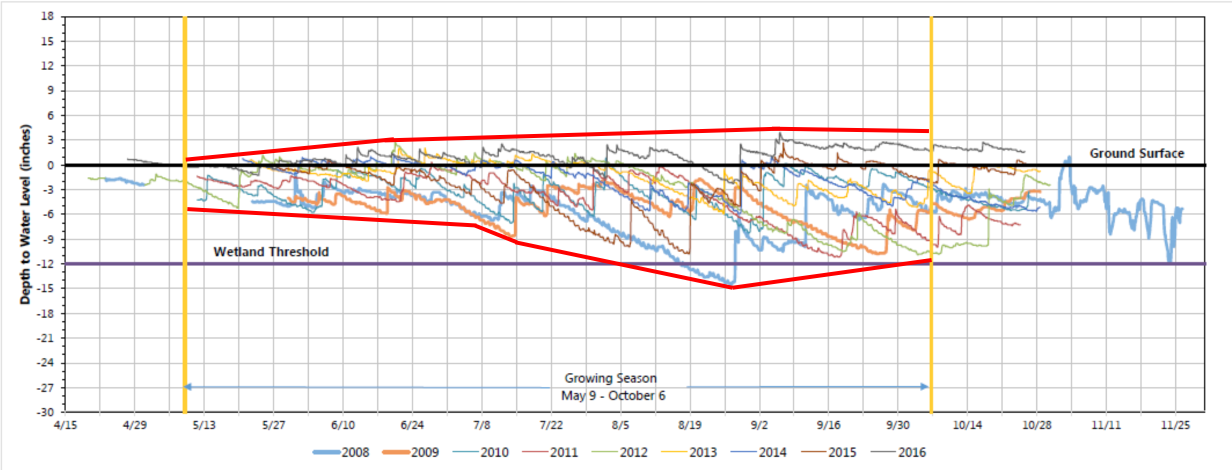

Figure 3—Red brackets define minimum/maximum range of water levels at Wetland Monitoring Well 21.

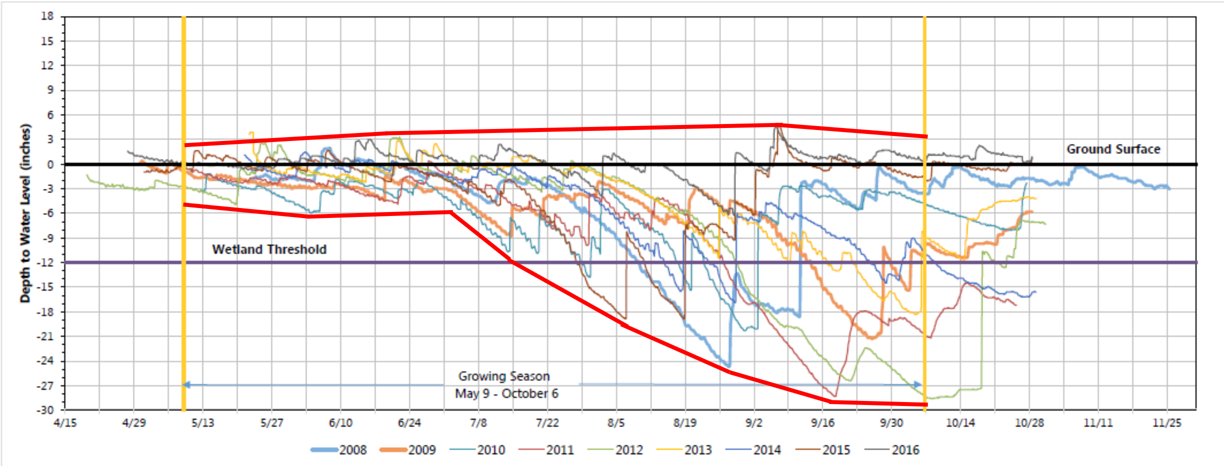

Figure 4—Red brackets define minimum/maximum range of water levels at Wetland Monitoring Well 22.

The intent is to identify any trends in changes to baseline wetland hydrographs. A deviation that occurs during one growing season is not a trend—thus, the specification for ≥2 growing seasons in the above performance standard. Similarly, a deviation lasting a few days does not establish a trend, while a deviation lasting ≥14 consecutive days is more indicative of a trend.

2. **Discussion**

a. Types of Baseline Hydrographs. Baseline monitoring well data illustrate two general hydrographs that characterize wetlands within the project site. One is inundation and/or a water table ≤12 inches below the soil surface throughout the growing season. Wetland Monitoring Wells 23 (Figure 5) and 4 (Figure 6) illustrate this category. The other is inundation and/or a water table ≤12 inches below the soil surface from the start of the growing season into July after which inundation/water table levels exhibit considerable variability and, at least in some years, drop more than 12 inches below the soil surface. Wetland Monitoring Wells 15 (Figure 7) and 6 (Figure 8) illustrate this category. In one case, the water table dropped 33 inches below the soil surface by late summer (Figure 8).

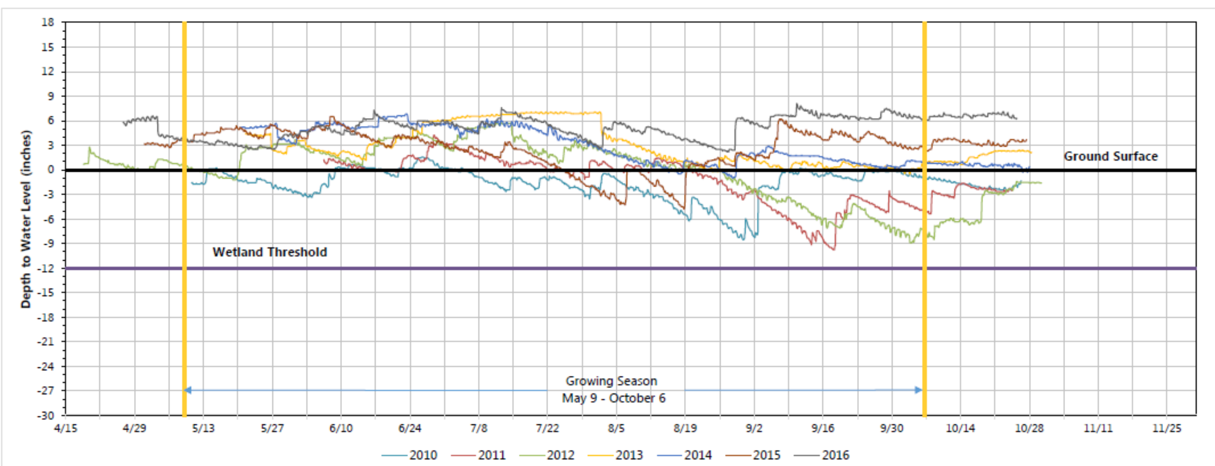

Figure 5—Wetland Monitoring Well 23.

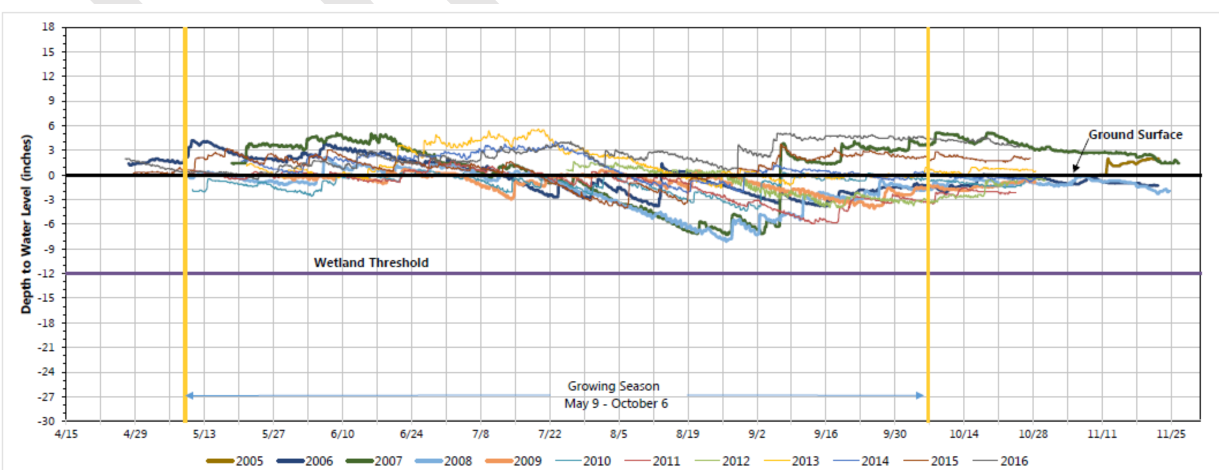

Figure 6—Wetland Monitoring Well 4.

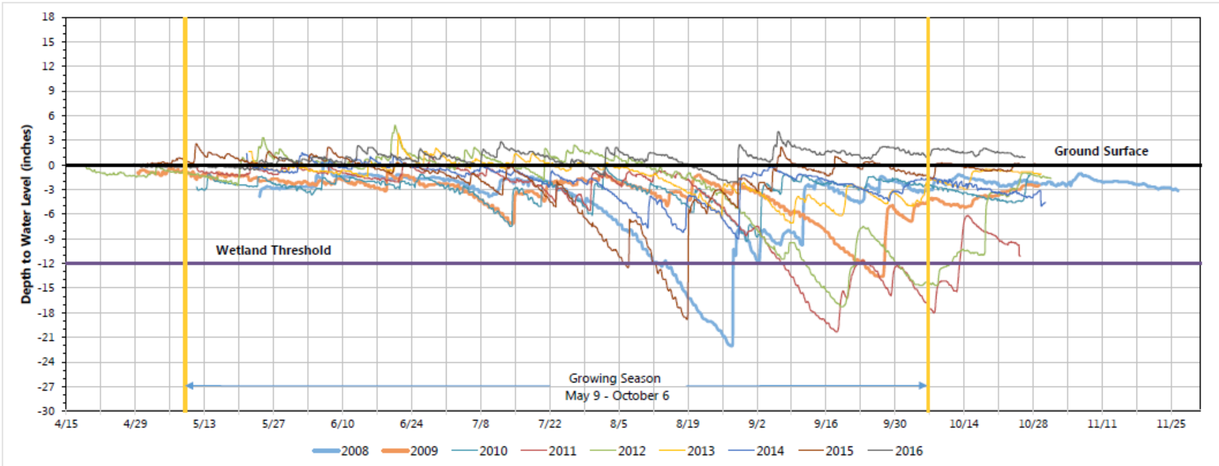

Figure 7—Wetland Monitoring Well 15.

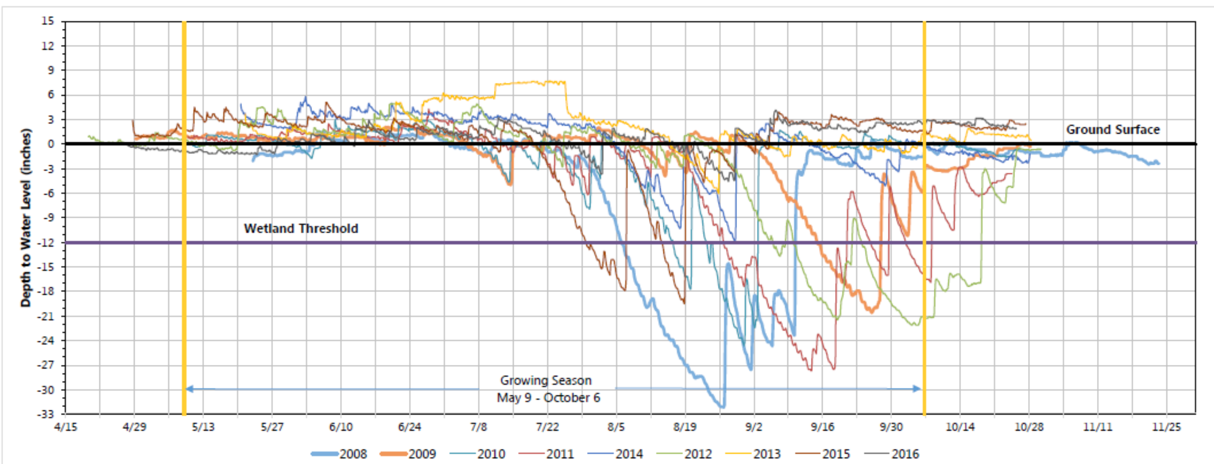

Figure 8—Wetland Monitoring Well 6.

b. In Context of Hydrological Conditions. An essential component of evaluating monitoring well data is placing those data in the context of hydrological conditions. Reports by Barr Engineering, Inc. (2006, 2010 and 2017) provide narratives, tables and figures describing hydrological conditions in terms of annual, monthly, and 30-day rolling totals of precipitation.

A key consideration is drought conditions. Analyses of post-project monitoring well data must be able to differentiate low water table levels that naturally occur due to drought conditions from low water levels that may be due to dewatering associated with mine operations. In Figures 6, 7 and 8 above, note the drop in water table depths during August and September of 2008, the lowest water table levels for any monitoring year at those particular monitoring well locations. Figure 9 illustrates 30-day rolling totals of precipitation in 2008 and the U.S. Drought Monitor for September 2, 2008 showing that the project area was within an area experiencing moderate drought conditions thereby providing an explanation for the low water table levels. If, during mine operations, similar low water table levels are recorded under similar drought conditions it would be considered within the normal range of variability for wetland hydrology at those monitoring well locations. If, however, similar low water levels are recorded during non-drought conditions, it would be considered an indicator of drawdown effects of mine operations unless a different explanation is identified and confirmed.

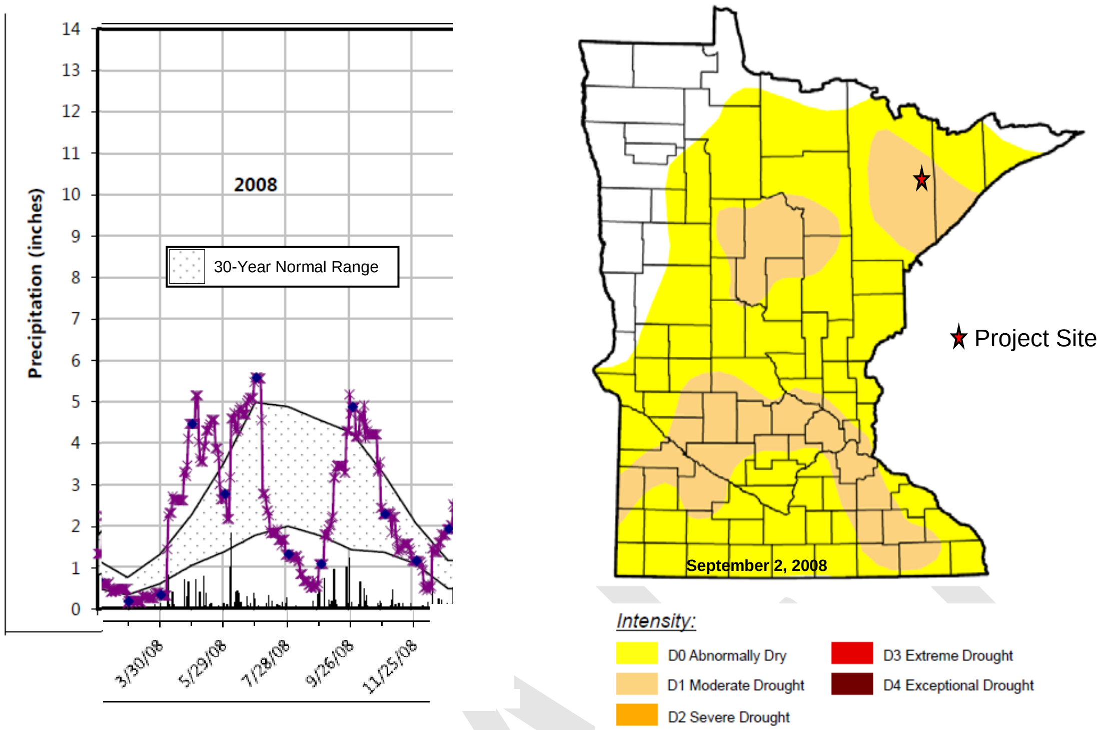

Figure 9

Alternatively, water levels during drought periods—as identified by the U.S. Drought Monitor—could be omitted, i.e., exclude the lowest water table readings from the minimum/maximum brackets. This approach is not recommended for two reasons. First, as stated above, drought periods are a natural occurrence—low water levels during drought periods are part of the natural variability in wetland hydrology. Disregarding valid data illustrating the full range of natural variability is not good science. Second, drought periods since 2005 were frequent, ranged from a few weeks to many weeks, and could come and go during the same growing season. Omitting water table levels recorded during drought periods would make for a more complex and potentially confusing performance standard to evaluate as a "trigger" for increased monitoring, adaptive management, and/or additional compensatory mitigation.

c. <u>Interpreting Shorter-Term Monitoring Well Data</u>. Thirty-two of the 61 wetland monitoring wells were installed in 2014 resulting in three growing seasons of data submitted to date with the 2017 growing season data to be submitted in the near future. These data provide a basis for determining the minimum/maximum brackets for performance standards, but are not as substantiated as data from well locations with seven or more growing seasons of monitoring. Precipitation during the 2014-2015-2016 growing seasons covered the gamut from wetter than normal to drought conditions (Figure 10). Early growing seasons in both 2014 and 2015 were wetter than normal followed by a steep drop to drier than normal then rebounding to normal (2014), or several drops into the low end of normal during mid-growing season resulting in drought conditions (Figure 11) followed by wetter than normal conditions in September to the close of the growing season (2015). In contrast, the 2016 growing season was wetter than normal for most of its duration except that the early growing was abnormally dry (Figure 11).

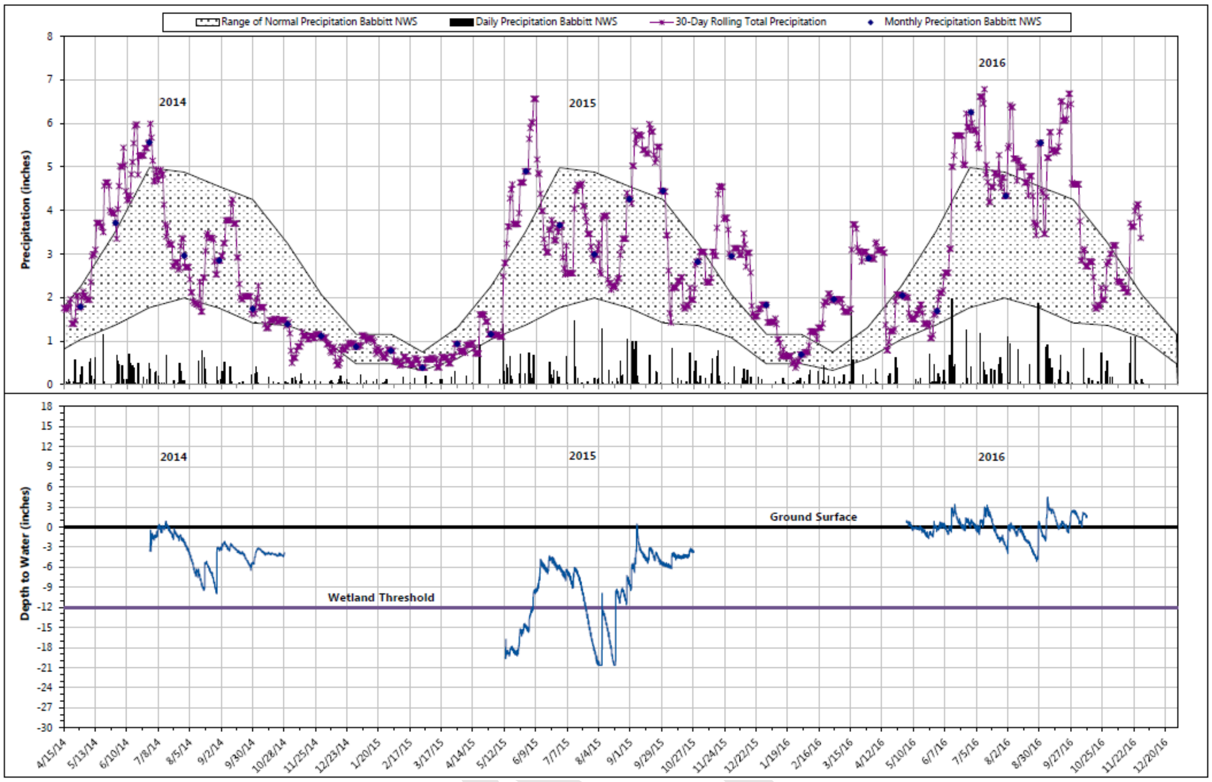

Figure 10—Thirty-day rolling totals of precipitation during 2014-2015-2016. Note in the lower graph how closely water levels in the wetland (blue lines) mirror peaks and valleys in the 30-day rolling totals (Wetland Monitoring Well 27).

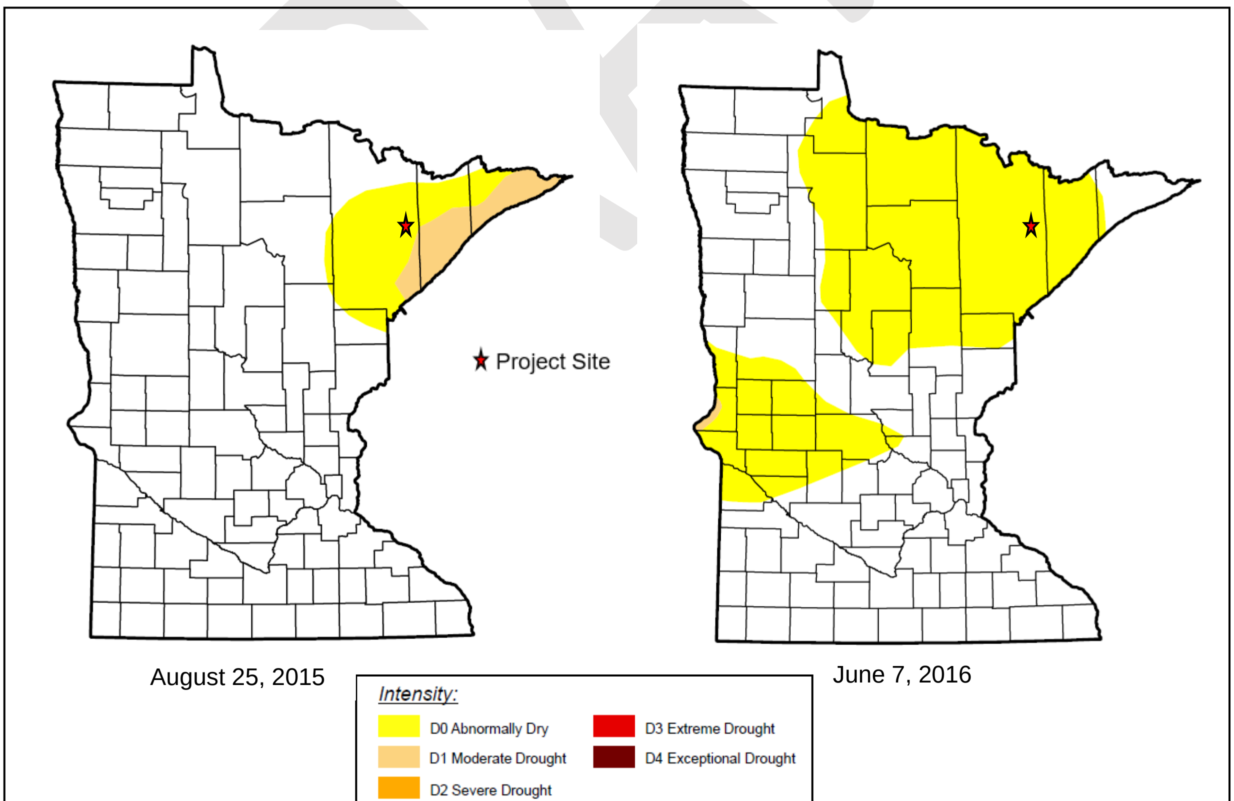

Figure 11

In the case of Wetland Monitoring Well 41 (Figure 12), water levels were relatively consistent in spite of the variable precipitation during 2014-2016—slightly above the soil surface to almost 9 inches below the soil surface throughout the growing season. Drops to the lowest water levels in August of both 2014 and 2015 correspond to mid-summer valleys in the 30-day rolling totals when precipitation ranged into the low end of normal or, for a brief duration, drier than normal (Figure 10). Minimum/maximum brackets for this monitoring well location are shown by Figure 13 with the caveat that water levels reaching 9 inches below the soil surface should be correlated with similar hydrological conditions, e.g., U.S. Drought Monitor (Figure 11).

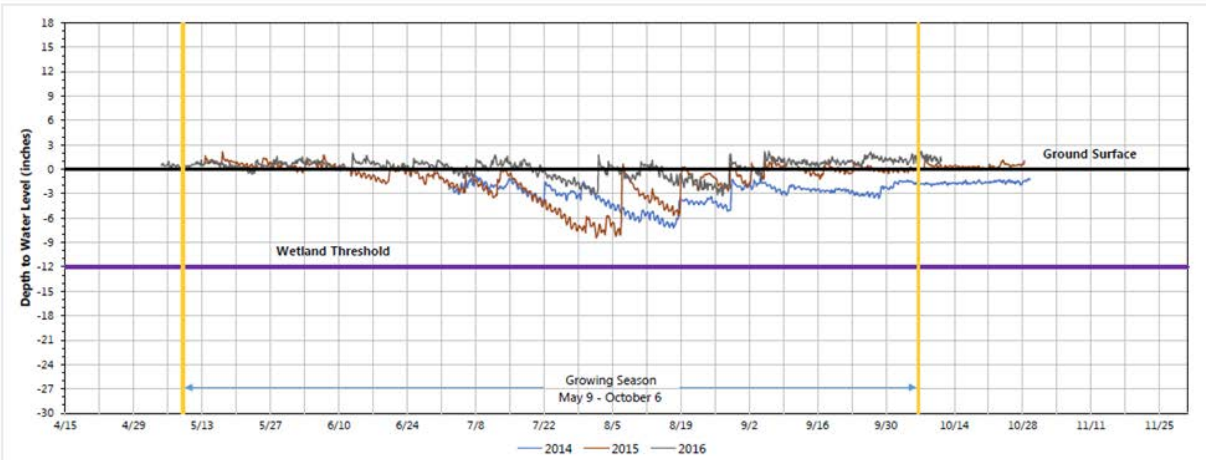

Figure 12—Wetland Monitoring Well 41.

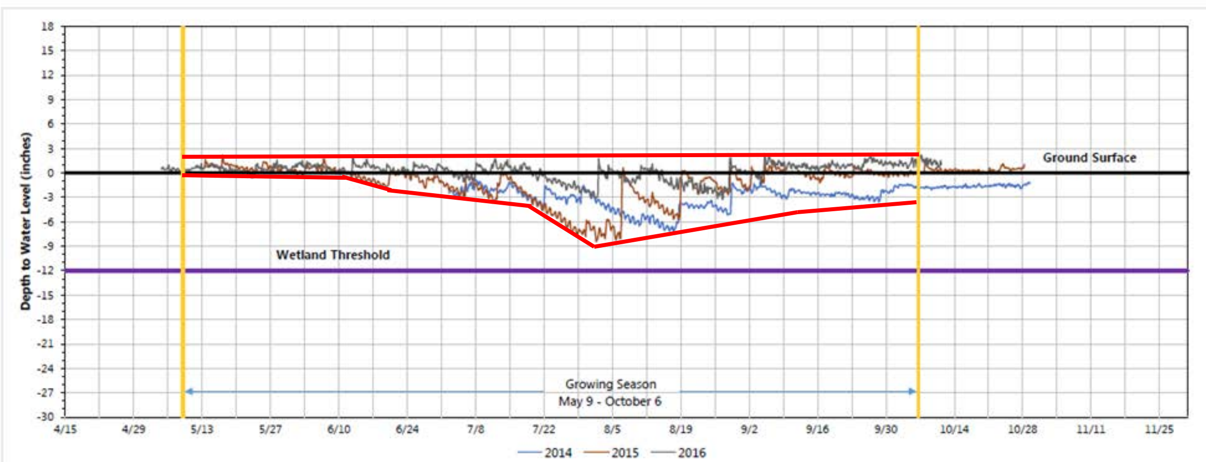

Figure 13—Minimum/maximum brackets (red lines) for Wetland Monitoring Well 41.

The hydrograph for Wetland Monitoring Well 28 (Figure 14) illustrates a much more varied response to hydrological conditions during 2014-2016. Reference wells and/or other monitoring well(s) of the same hydrograph type (see discussion in 2.a.) can be used to confirm an appropriate minimum/maximum range. In this case, Wetland Monitoring Well 24 is of the same hydrograph type (Figure 15), is in close proximity, is located within the same plant community type, and has been monitored for seven growing seasons thereby providing longer-term data on baseline conditions. Both monitoring well locations show similar responses, e.g., high water levels in 2016 and lowest water levels in August 2015.

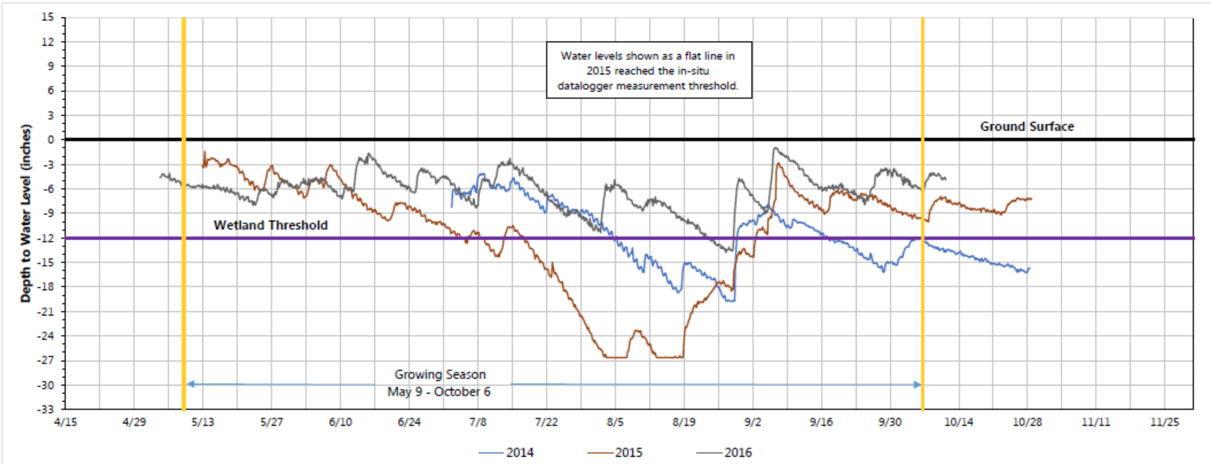

Figure 14—Wetland Monitoring Well 28.

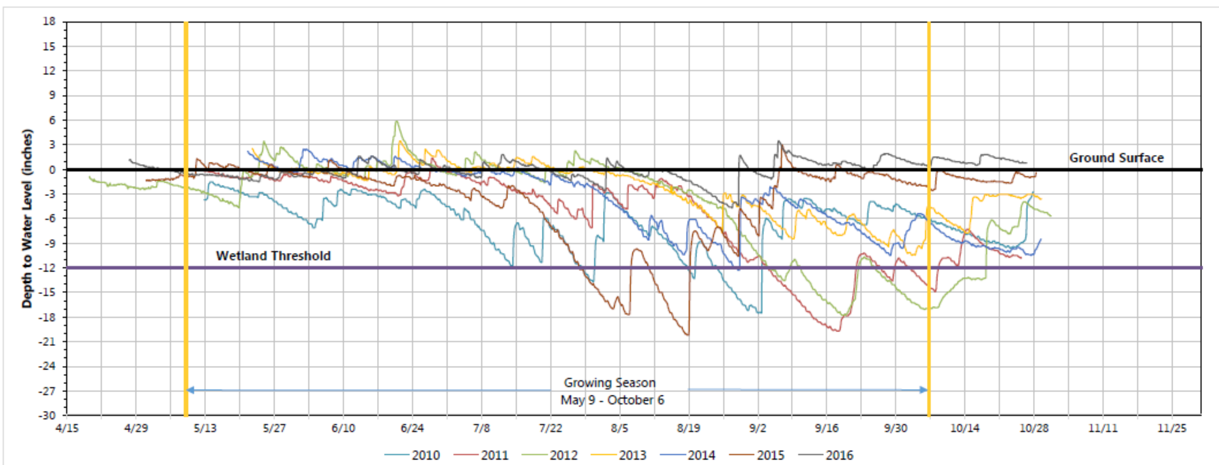

Figure 15—Wetland Monitoring Well 24.

Five reference monitoring wells have been established at locations outside of any potential in-direct effects. Water level responses to hydrological conditions recorded by these wells provides invaluable data for interpreting the timing and degree of rise or fall in water levels in monitoring wells located within areas that may experience in-direct effects due to mine operations. For example, in August-September of 2014 and 2015, water level responses in Reference Monitoring Well 3 (Figure 16) show drops in water table readings that correspond to those recorded at Wetland Monitoring Wells 24 (Figure 15) and 28 (Figure 14).

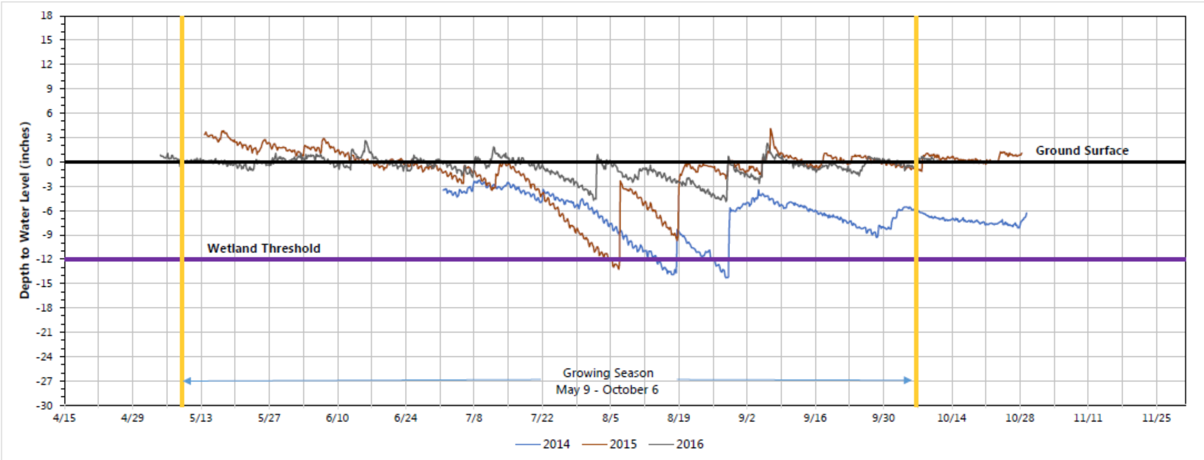

Figure 16—Reference Wetland Monitoring Well 3.

With the above knowledge, minimum/maximum brackets could be reasonably drawn as shown by Figure 17 with the caveat that low water table levels exhibited in August-September 2015 should be correlated—i.e., should only occur—under similar drought conditions. If, during mine operations, low water levels similar to August 2015 occur during a period of—for example—wetter than normal hydrological conditions, it would indicate that the low water levels were due to mine operations rather than natural variability in wetland hydrology unless a different explanation is identified and confirmed.

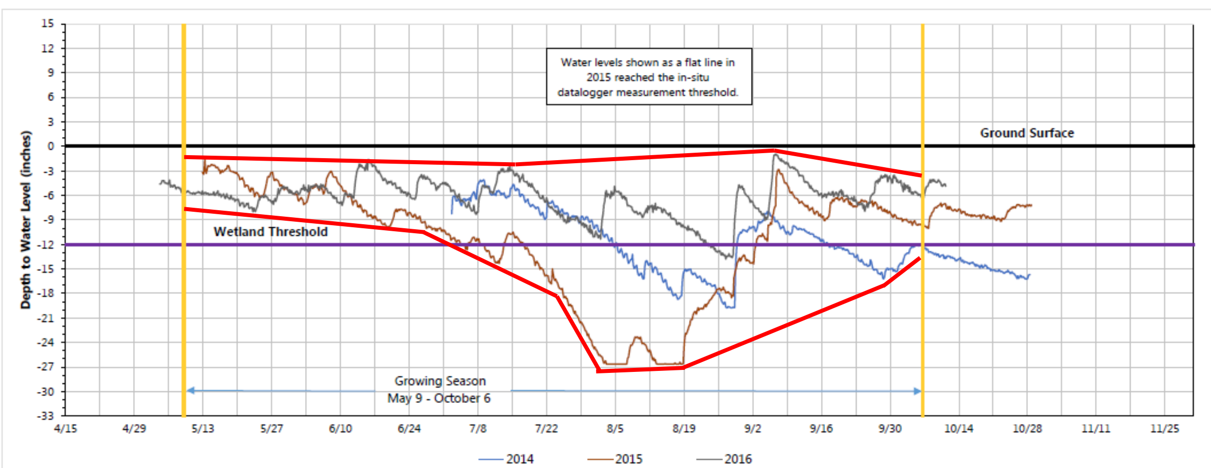

Figure 17—Red brackets define minimum/maximum range of water levels at Wetland Monitoring Well 28.

3. **Summary**

The performance standard proposed herein would provide a scientifically sound basis to evaluate whether in-direct wetland impacts occur by analyzing the following: (1) baseline (pre-project) monitoring well data including reference wetlands; (2) post-construction monitoring well data including reference wetlands; and (3) analyses of hydrological conditions (e.g., 30-day rolling totals of precipitation, U.S. Drought Monitor).

4. **Point of Contact.** Any questions on the above can be directed to me at 651-290-5371 or steve.d.eggers@usace.army.mil.

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Regulatory Branch

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