U.S. STEEL KEETAC TACONITE MINE EXPANSION PROJECT

Final Environmental Impact Statement

Prepared by

Minnesota Department of Natural Resources

in cooperation with

U.S. Army Corps of Engineers

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COVER SHEET

Final Environmental Impact Statement
United States Steel Corporation
Keetac Mine Expansion Project

The Minnesota Department of Natural Resources and the U.S. Army Corps of Engineers have jointly prepared this Final Environmental Impact Statement to evaluate the Proposed Project in accordance with the Minnesota Environmental Policy Act, Minnesota Statutes § 116D, and the National Environmental Policy Act 42 U.S. C. §§ 4321-4347.

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Abstract: This final Environmental Impact Statement documents the analysis of potential impacts associated with the United States Steel Corporation's Keetac Mine Expansion Project. The Proposed Project would restart an idle indurating line and upgrade plant components as well as expand the mine pit and stockpile areas. The height of the existing tailings basin would increase. The footprint of the tailings basin would increase slightly. New haul trucks and other in-pit mining equipment would be put to use. Additional mine dewatering activities would take place as the boundaries of the mine area expand. These changes would increase taconite pellet production from approximately 6 million tons a year to 9.6 million tons a year.

Approved for Issuance for Public Comment:

11/5/2010 — [signature]
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Nov 5, 2010 — [signature]
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LIST OF APPENDICES

Acronyms

(^{o}F) Degrees Fahrenheit
(AAQB) Ambient Air Quality Boundary
(Advisory Council) Advisory Council on Historic Preservation
(AERA) Air Emissions Risk Analysis
(AMSL) Above Mean Sea Level
(AN) Ammonium Nitrate
(ANC) Acid-Neutralizing Capacity
(ANFO) Ammonium Nitrate Fuel Oil
(APE) Area of Potential Effects
(AQRV) Air Quality Related Values
(ARRA) American Recovery and Reinvestment Act
(AST) Aboveground Storage Tank
(BACT) Best Available Control Technology
(BART) Best Available Retrofit Technology
(BAT) Best Available Technology Economically Achievable
(BCAP) Biomass Crop Assistance Program
(bcy) Bank Cubic Yards
(BIF) Biwabik Iron Formation
(BMPs) Best Management Practices
(BNSF) Burlington Northern Santa Fe
(BPT) Best Practicable Control Technologies
(BWCAW) Boundary Waters Canoe Area Wilderness
(BWSR) Board of Water and Soil Resources
(CAA) Clean Air Act
(CAIR) Clean Air Interstate Rule
(CALPUFF) California Puff Model
(CBOD) Carbonaceous Biological Oxygen Demand
(CDC) Center for Disease Control
(CE) Cumulative Effects
(CEMs) Continuous Emissions Monitors
(CEQ) Council on Environmental Quality
(CERCLA) Comprehensive Environmental Response, Compensation, and Liability Act
(CFR) Code of Federal Regulation
(cfs) Cubic Feet per Second
(CH_4) Methane
(CI) Cumulative Impacts
(Club) Hibbing Chisholm Path Blazers Club
(cm) Centimeters
(CO) Carbon Monoxide
(CO_2) Carbon Dioxide
(CO_2-e) Carbon Dioxide Equivalents
(COIs) Chemicals of Interest
(COP15) United Nations Climate Change Conference in Copenhagen
(COPIs) Chemicals of Potential Interest
(CPMS) Continuous Parameter Monitoring Systems
(CPTu) Cone Penetration Test
(CUP) Conditional Use Permit
(CWA) Clean Water Act
(CWI) County Well Index
(CY) Cubic Yard
(DATs) Deposition Analysis Thresholds
(dB(A)) decibels (A-weighted)
(DEED) Department of Employment and Economic Development
(DEIS) Draft Environmental Impact Statement
(DEM) Digital Elevation Model
(dpm) Diesel Particulate Matter
(DO) Dissolved Oxygen
(DoD) Department of Defense
(DOE) Department of Energy
(DRI) Direct Reduced Iron
(DSDD) Draft Scoping Decision Document
(EAF) Electric Arc Furnace
(EAW) Environmental Assessment Worksheet
(ECS) Ecological Classification System
(EDA) Electronic Data Access
(EEC) Estimated Environmental Concentrations
(EIS) Environmental Impact Statement
(EQB) Environmental Quality Board
(ESA) Effective Stress Analysis
(ESP) Electrostatic Precipitator
(ESQ) Ecological Screening Quotient
(FEIS) Final Environmental Impact Statement
(FLAG) Federal Land Managers' Air Quality-Related Values Workgroup
(FLMs) Federal Land Managers
(FO) Fuel Oil
(FPPA) Farmland Protection Policy Act
(FR) Federal Register
(FS) Factor of Safety
(FSC) Forest Stewardship Council
(FSDD) Final Scoping Decision Document
(ft) Foot
(GAP) Gap Analysis Program
(GEIS) Generic Environmental Impact Statement
(GHG) Greenhouse Gas
(GIA) Grants-in-Aid Program
(GIS) Geographic Information System
(GPD) Gallons per Day
(GSA) Gas Suspension Absorber
(Gt) Giga ton (a.k.a., one billion metric tons, TNT energy equivalent [defined not measured value])
(GWP) Global Warming Potential
(HAP) Hazardous Air Pollutant
(HFCs) Hydrofluorocarbons
(Hg) Mercury
(HHSRA) Human Health Screening-Level Risk Assessment
(HI) Hazard Index
(HQ) Hazard Quotient
(IBI) Index of Biotic Integrity
(IEUBK) Integrated Exposure Uptake Biokinetic
(IMPROVE) Interagency Monitoring of Protected Visual Environments
(IPCC) Intergovernmental Panel on Climate Change
(IRAP) Industrial Risk Assessment Program
(ISTS) Individual Sewage Treatment System
(kg ha^{-1}) Kilogram Per Hectare
(km) Kilometer
(kt) Kilo ton (a.k.a., one thousand metric tons, TNT energy equivalent [defined not measured value])
(LAER) Lowest Achievable Emission Rate
(LEDPA) Least Environmentally Damaging Practicable Alternative
(LF) Lineal Foot
(LGU) Local Government Unit
(LLBO) Leech Lake Band of Ojibwe

Acronyms (Cont.)

(MAAQS) Minnesota Ambient Air Quality Standards
(MACT) Maximum Achievable Control Technology
(Mbcy) Million Bank Cubic Yards
(MCBS) Minnesota County Biological Survey
(MCTE) Modified Central Tendency Exposure
(MDH) Minnesota Department of Health
(MDOC) Minnesota Department of Commerce
(MEI) Maximally Exposed Individual
(MEPA) Minnesota Environmental Policy Act
(MERP) Metropolitan Emission Reduction Project
(MFRC) Minnesota Forest Resources Council
(mg/L) Milligram per Liter
(MHS) Minnesota Historical Society
(MISO) Midwest Independent System Operation
(MLEP) Minnesota Logger Education Program
(MLTY) Million Long tons per Year
(MMLC) Minnesota Master Logger Certification
(MMREM) MPCA Mercury Risk Estimation Method
(MNDNR) Minnesota Department of Natural Resources
(MNDOT) Minnesota Department of Transportation
(MNRAM) Minnesota Routine Assessment Method for Evaluating Wetland Function
(MOA) Memorandum of Agreement)
(MOU) Memorandum of Understanding
(MPCA) Minnesota Pollution Control Agency
(MSL) Mean Sea Level
(MSTY) Million Short Tons per Year
(MSW) Mixed Solid Waste
(Mt) Mega ton (a.k.a., one million metric tons, TNT energy equivalent [defined not measured value])
(MTPA) Minnesota Timber Producers Association
(MW) Megawatts
(N_2O) Nitrous Oxide
(NO_2) Nitrogen Dioxide
(NAAQS) National Ambient Air Quality Standards
(NAPAP) National Acid Precipitation Assessment Program
(NEPA) National Environmental Policy Act
(NESHAPs) National Emissions Standards for Hazardous Air Pollutants
(NFRAP) No Further Remedial Action Planned
(NGVD) National Geodetic Vertical Datum
(NH_3) Ammonia
(NHIS) Natural Heritage Information System
(NHL) National Historic Landmark
(NHPA) National Historic Preservation Act
(NIPF) Non-Industrial Private Forest
(NO_3 -) Nitrate
(NOI) Notice of Intent
(NOx) Nitrogen Oxides
(NPDES) National Pollutant Discharge Elimination System
(NPS) National Park Service
(NRHP) National Register of Historic Places
(NSR) New Source Review
(NWI) National Wetlands Inventory
(O_3) Ozone
(ODT) Oven dried tons
(OHW) Ordinary High Water Level
(PAHs) Poly Aromatic Hydrocarbons
(Pb) Lead
(pcf) Per cubic foot
(PEFC) Program for the Endorsement of Forest Certification
(PFCs) Perfluorocarbons
(PM) Particulate Matter
(PM_{10}) Particulate Matter (less than 10µm)
($PM_{2.5}$) Particulate Matter (less than 2.5 µm)
(PMP) Probable Maximum Precipitation
(PO_4) Phosphate
(POTW) Publicly Owned Treatment Works
(ppm) Parts Per Million
(PPV) Peak Particle Velocity
(PSD) Prevention of Significant Deterioration
(psf) Per square foot
(PTE) Potential-To-Emit
(PUDs) Planned Unit Developments
(PWI) Public Waters Inventory
(RACT) Reasonably Available Control Technology
(RADM) Regional Acid Deposition Model
(RBLC) RACT/BACT/LAER Clearinghouse
(REAP) Rural Energy for America Program
(RGGI) Regional Greenhouse Gas Initiative
(RGU) Responsible Governmental Unit
(ROD) Record of Decision
(RPM) Revolutions per Minutes
(SDS) State Disposal System
(SEAW) Scoping Environmental Assessment Worksheet
(SF_6) Sulfur Hexafluoride
(SFI) Sustainable Forestry Initiative
(SFRA) Sustainable Forest Resource Act
(Sherco) Xcel Energy's Sherburne County Generating Station
(SHPO) State Historic Preservation Office
(SILs) Significant Impact Levels
(SIP) State Implementation Plan
(SLERA) Screening-Level Ecological Risk Assessment
(SO_2) Sulfur Dioxide
(SO_4) Sulfate
(SO_x) Sulfur Oxides
(SPCC) Spill Prevention Control and Countermeasure
(SRES) Special Report on Emissions Scenarios
(SWPPP) Storm Water Pollution Prevention Plan
(TH) Trunk Highway
(TMDL) Total Maximum Daily Load
(TPY) tons per year
(TRVs) Toxicity Reference Values
(TSA) Total Stress Analysis
(TSS) Total Suspended Solids
(U. S. Steel) United States Steel Corporation
(U.S.) United States
(UCL) Upper Confidence Level
(ug/dl) Micrograms per deciliter
(ug/m^3) Micrograms per cubic meter
(µm) Microns
(UMD) University of Minnesota – Duluth
(UNEP) United Nations Environment Program
(UNFCCC) United Nations Framework Convention on Climate Change
(USACE) U.S. Army Corps of Engineers

Acronyms (Cont.)

(USBM) U.S. Bureau of Mines
(USC) U.S. Code
(USDA) United States Department of Agriculture
(USGRCP) U. S. Global Climate Change Research Program
(USEPA) U.S. Environmental Protection Agency
(USFS) U.S. Forest Service
(USFWS) U.S. Fish and Wildlife Service
(USGS) U.S. Geological Survey
(VOC) Volatile Organic Compound
(VSQG) Very Small Quantity Generator
(W/m^2) watts per square meter
(WCA) Wetland Conservation Act
(WCI) Western Climate Initiative
(WMO) World Meteorological Organization
(WWTP) Wastewater Treatment Plant

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Definitions

Adverse effect: A harmful or undesired effect from the Proposed Project on the environment.

AERMOD air dispersion model: A steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain.

Air Quality Related Values (AQRVs): Features or properties of Class I areas that could be adversely affected by air pollution.

Ambient Air Quality Boundary: Ambient air means that portion of the atmosphere, external to buildings, to which the general public has access. The ambient air quality boundary is set as part of the ambient air quality modeling analysis completed for the Proposed Project and provides the boundary for which ambient air quality concentrations are predicted and compared to air quality standards established for Class I and II areas. Class I areas include state and national parks and wilderness areas and Class II areas are generally all areas that are not Class I areas.

Ambient Air Quality Standards: An ambient air quality standard sets legal limits on the level of an air pollutant in the outdoor (ambient) air necessary to protect public health. The U.S. Environmental Protection Agency (USEPA) is authorized to set ambient air quality standards. The state of Minnesota has also established ambient air quality standards.

Amphibole: A group of dark, rock-forming, ferromagnesian silicate minerals closely related in crystal form and composition. Amphiboles are characterized by a cross-linked double chain of tetrahedral with a silicon:oxygen ratio of 4:11, by columnar or fibrous prismatic crystals, and by good prismatic cleavage in two directions parallel to the crystal faces and intersecting at angles of about 56 degrees and 124 degrees; colors vary from white to black. Most amphiboles crystallize in the monoclinic system, some in the orthorhombic or triclinic systems; they constitute an abundant and widely distributed constituent in igneous and metamorphic rocks (some are wholly metamorphic or secondary), and they are analogous in chemical composition to pyroxenes.

Anthropogenic: Relating to or resulting from the influence of human beings on nature.

Average Discharge (Q_{Avg}): The annual average discharge in the stream and is representative of both high and low flows.

BACT (Best Available Control Technology): An emission limitation (including a visible emission standard) based on the maximum degree of reduction for each pollutant subject to regulation under the Act which would be emitted from any proposed major stationary source or major modification, taking into account energy, environmental, and economic impacts and other costs.

Baghouse Dust: the captured waste material produced from baghouse air emission controls.

Bankfull: The elevation of the floodplain adjacent to the active channel.

Bankfull flow: The discharge at channel capacity or the flow at which water just fills the channel without over-topping the banks.

Base flow (Q_{Base}): The component of streamflow not directly attributed to stormwater runoff. Base flow defines low flow conditions for maintaining viable habitat for stream organisms. While base flow does not transport large amounts of sediment it can be important in maintaining a low-flow channel needed by stream organisms when water levels drop in the summer and fall.

Bioaccumulation: Refers to accumulation of chemicals in an organism.

Biogenic: Produced by living organisms.

Biogenic emissions: Emissions resulting from the combustion of biomass.

Biomass: Plant material, vegetation, or agricultural waste used as a fuel or energy source.

Biotic Community: All the interacting organisms living together in a specific habitat of varying sizes, and larger ones may contain smaller ones.

Best Management Practices (BMPs): The schedule of activities, prohibition of practices, maintenance procedures, and other management practices to avoid or minimize pollution or habitat destruction to the environment. BMPs can also include treatment requirements, operating procedures and practices to control runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Blowdown water from wet scrubber: The scrubber water rich in solids that is wasted or blown down and replaced with low solids water.

Breach: An opening in the dam/dike embankment to allow drainage.

CALPUFF Model: A non-steady-state puff air dispersion model that simulates the effects of time- and space-varying meteorological conditions on pollution transport, transformation, and removal. CALPUFF can be applied for long range transport and for complex terrain.

Cubic Feet per Second (cfs): the rate of flow representing a volume of 1 cubic foot passing a given point in 1 second.

Definitions (Cont.)

Chemicals of Potential Interest (COPI): For human health and ecological risk analysis, COPI from mining sources are primarily metals and other constituents of the ore. COPI from processing sources include metals from the ore, emissions from fuel combustion, emissions related to processing agents (additives), and process products and byproducts.

Class I Area: Federal or State designated national parks and wilderness areas.

Class II Area: All areas that are not Class I areas.

Climate Change: A change in the state of the climate that can be identified using statistical tests by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer (IPCC).

Concentrate: Crushed ore is conveyed to a concentrator where the magnetic iron oxide minerals (concentrate) are separated from the nonmagnetic waste.

Criteria Pollutant: Seven Common Pollutants for which USEPA has set primary and/or secondary national air quality standards. These pollutants are: particulate matter less than or equal to 10 microns in size; particulate matter less than or equal to 2.5 microns in size; sulfur dioxide; nitrogen dioxide; carbon monoxide; ozone; and lead. These pollutants can harm health and the environment, and cause property damage. Of these pollutants, particle pollution and ground level ozone are the most widespread health threats. EPA calls these pollutants "criteria" air pollutants because it regulates them by developing human health-based and/or environmentally-based criteria (science-based guidelines) for setting permissible levels. The set of limits based on human health is called primary standards. Another set of limits intended to prevent environmental and property damage is called secondary standards.

Crude ore: Ore that has not been processed or refined in any way.

Cumulative Potential Effects: Means the effect on the environment that results from incremental effects of the project in addition to other projects in the environmentally relevant area that might be reasonably expected to affect the same environmental resources including future projects actually planned or for which a basis of expectation has been laid, regardless of what person undertakes the other projects or what jurisdictions have authority over the projects.

Decibels (dB(A)): A unit of sound pressure level, weighted for the purpose of determining the human response to sound, abbreviated as dB(A).

Deep Water Habitat: A body of water greater than two meters deep that is not a wetland or lake.

Dewatering: Removing water from one water body or area by pumping excess water to another area in preparation for mining, ore processing, and/or flow augmentation.

Ecological Classification System (ECS): Developed by the MNDNR and U.S. Forest Service, ecological land classifications are used to identify, describe, and map progressively smaller areas of land with increasingly uniform ecological features, including climate, geology, topography, soils, hydrology, and vegetation.

Electronic Data Access (EDA): The MPCA's database system that allows users to view and download environmental data that is collected and stored by the agency and its partner organizations.

Electrostatic Precipitator (ESP): A particulate matter control device that removes particles by passing the flue gas stream between electrically charged plates.

Environmental Assessment Worksheet (EAW): Provides information about a project that may have the potential for significant environmental effects. The EAW is prepared by the Responsible Governmental Unit or its agents to determine whether an Environmental Impact Statement should be prepared.

Evapotranspiration: The sum of evaporation and plant transpiration. Evaporation accounts for the movement of water to the air from sources such as the soil, canopy interception, and water bodies. Transpiration accounts for the movement of water within a plant and the subsequent loss of water as vapor through stomata in its leaves.

Final Scoping Decision Document (FSDD): Is a companion to the Scoping EAW prepared for the project. The purpose of a Scoping Decision Document is to identify those project alternatives and environmental impact issues that will be addressed in the EIS. A Scoping Decision Document also presents a tentative schedule of the environmental review process.

Free face: A rock surface exposed to air or water that provides room for expansion upon fragmentation; sometimes called an open face.

Fugitive Sources: For the FEIS, fugitive air emissions are all releases to air that are not released through a confined air stream.

Gas Suspension Absorber (GSA): A dry scrubber that utilizes a circulating fluidized bed (CFB) reactor with reagent injection for pollutant absorption. This type of scrubber provides for a well-mixed pollutant/reagent interaction by passing untreated exhaust gases through a bed of powdered reagent inside an enclosed reactor. A high volume of exhaust gas relative to the reactor size allows for the reagent to become suspended, or ‘fluidized’, and thus promotes efficient contact of pollutants and reagent. This type of scrubber is normally followed by an efficient particle capture device (e.g., ESP or fabric filter) to capture the resulting particulate entrained in the exhaust gas before release to the atmosphere.

General Development (GD) lakes: GD lakes are large, deep lakes, or lakes of varying sizes and depths with high levels and mixes of existing development. These lakes are extensively used for recreation, and except for the very large lakes, are heavily developed around the shore. Second and third tiers of development are common (source: Itasca County Zoning Ordinance).

Geomorphology: The study of the evolution and configuration of landforms.

Grate kiln indurating furnace: Grate kiln indurating furnace means a furnace system that hardens oxidizable green taconite ore pellets and consists of a traveling grate, a rotary kiln, and an annular cooler. The grate kiln indurating furnace begins at the point where the grate feed conveyor discharges the green balls onto the furnace traveling grate and ends where the hardened pellets exit the cooler. The atmospheric pellet cooler vent stack is not included as part of the grate kiln indurating furnace.

Greenhouse gases: Gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, atmosphere, and clouds (IPCC).

Hazardous Air Pollutant (HAP) emissions: Hazardous air pollutant listed in or pursuant to section 112(b) of the Clean Air Act.

Horizon (soil horizon): A layer of soil that can be distinguished from the surrounding soil chemical composition, color, and texture.

Hydrology: The science dealing with the origin, distribution, and circulation of waters of the earth such as rainfall, streamflow, infiltration, evaporation, and groundwater storage.

Index of Biotic Integrity (IBI): The stream IBI integrates information from individual, population, community, and ecosystem levels into a single ecologically based index of water resource quality (Karr, 1981).

Indurating: Indurating means the process whereby unfired taconite pellets, called green balls, are hardened at high temperature in an indurating furnace. Types of indurating furnaces include straight grate indurating furnaces and grate kiln indurating furnaces.

Industrial Risk Assessment Program (IRAP): A computer based multipathway risk assessment program that was developed to assess the potential human health risks from estimated facility emissions and potential related exposures.

Integrated Exposure Uptake Biokinetic (IEUBK) model: Developed by USEPA, it evaluates potential risks based on predicted blood lead levels associated with exposure to lead. It calculates an incremental increase in blood lead concentration due to exposure to lead.

Inundation: To flood, cover, or overspread with water.

Iron Oxide (Taconite) Pellets: Produced from taconite iron ore by a separation and concentration process (fine grinding and magnetic or flotation treatment) of iron ore from taconite to produce pellets.

Jurisdictional: The identification and location of jurisdictional Waters of the United States, which includes wetlands, is as a Jurisdiction Determination (JD). The USACE determines jurisdiction by documenting: connections of waters and wetlands to downstream navigable waters; interstate commerce connections; and adjacency of wetlands to other waters. The USACE also delineates the boundaries of wetlands.

Karst topography: A landscape created by groundwater dissolving sedimentary rock such as limestone. This creates land forms such as shafts, tunnels, caves, and sinkholes, resulting in a fragile landscape susceptible to erosion and pollution.

L_{10}: The sound level exceeded 10 percent of the time, which is typically the most intrusive, represents short term peaks in noise levels.

L_{50}: The sound level exceeded 50 percent of the time, which typically represents the median noise level.

Lean Ore: Rock with less than 15 percent magnetic iron content that may be economically viable in certain conditions.

Less than significant effect: An effect that is predicted to be below an identified threshold and/or an effect that was determined by the lead agencies to not have a magnitude that id great based on the context and intensity of that effect.

Littoral zone: The portion of a lake that is less than 15 feet in depth (MNDNR/MPCA); extends from the shoreline of a lake and continues to depth where sufficient light for plant growth reaches the sediments and lake bottom (U of M Extension).

Ln: Percent Noise Levels is the measurement of background noise.

Long Ton: A unit of mass measurement which is also called a metric ton is equivalent to 2,240 pounds or 1.12 short ton.

LoTOx™: A trademark multi-pollutant control technology involving Low Temperature Oxidation of the flue gas streams from wet scrubbers.

Macroinvertebrate: An animal without a backbone living in one stage of its life cycle, usually the nymph or larval stage that can be seen with the naked eye.

MACT (Maximum Achievable Control Technology): Technology-based air emission standards established under Title III of the 1990 Clean Air Act Amendments (also referred to as National Emission Standards for Hazardous Air Pollutants). The USEPA has developed standards for major HAP sources in certain industry categories. Standards are set on a case-by-case basis for a facility to be permitted if standards have not yet been set by USEPA for that facility's source category. Compliance with the MACT standards is designed to reduce HAP emissions.

Mesotrophic: Refers to a body of water having a moderate amount of dissolved nutrients.

Methylmercury: Is a neurotoxin and the form of mercury that is most easily bioaccumulated in organisms. Methylmercury consists of a methyl group bonded to a single mercury atom, and is formed in the environment primarily by a process called biomethylation. Mercury biomethylation is the transformation of divalent inorganic mercury (Hg(II)) to CH_3Hg^+, and is primarily carried out by sulfate-reducing bacteria that live in anoxic (low dissolved oxygen) environments, such as estuarine and lake bottom sediments. Methylmercury can also be degraded in the environment, either by photodegradation reactions that take place without the help of bacteria or other organisms, or by bacteria through a variety of pathways.

Mineland reclamation: To reclaim, restore, enhance, or develop areas that have been affected by mining.

Mycorrhizae: A group of soil organisms living in and around plant roots with which most plants establish a symbiotic relationship. Mycorrhizae extract mineral elements and water from soil for their host plant, and live off the plant's sugars. Trees and plants with thriving mycorrhizal roots systems are better able to survive and thrive in a variety of environments.

National Emission Standards for Hazardous Air Pollutants (NESHAPs): A group of emission standards promulgated by USEPA for sources of HAPs.

Natural Environment (NE) lakes: NE lakes are small, often shallow lakes with limited capacities for assimilating the impacts of development and recreational use. They often have adjacent lands with substantial constraints for development such as high water tables, exposed bedrock and soils unsuitable for septic systems. These lakes usually do not have much existing development or recreational use (source: Itasca County Zoning Ordinance).

No Action Alternative: The No Action Alternative includes ongoing actions (mining, taconite processing, and transport) at Keetac that would occur under the existing Permit to Mine, currently permitted wetlands, and actions occurring under permits that undergo procedural renewal at specified intervals, and permit amendments for actions that do not create an increased discharge or emission. The No Action Alternative includes areas within the current Permit to Mine boundary that have been or will be developed without the need for new permits. Mining at Keetac is anticipated to continue for approximately 12 years (until 2021) without the Proposed Project or new (amended) permits.

Nondegradation standards: Minnesota water quality standards (Minnesota Rules Chapter 7050) include four general components: beneficial uses; numeric standards; narrative standards; and nondegradation. The nondegradation standards provide extra protection for high quality or unique waters and outstanding resource value waters (ORVW) to keep them from being degraded.

NPDES Permit: National Pollutant Discharge Elimination System permit means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of Clean Water Act.

NPDES/SDS Permit: An NPDES/SDS Permit is a document that establishes the terms and conditions that must be met when a facility discharges wastewater to surface or groundwaters of the state. The permit is jointly issued under two programs. The National Pollutant Discharge Elimination System (NPDES) is a federal program established under the Clean Water Act, aimed at protecting the nation's waterways from point and nonpoint sources. In Minnesota, it is administered by the MPCA under a delegation from the USEPA. The State Disposal System (SDS) is a state program established under Minn. Stat. § 115. In Minnesota, when both permits are required they are combined into one NPDES/SDS Permit administered by the state. The permits are issued to permittees discharging to a surface water of the state.

Ore, taconite: Rock with greater than 15 percent magnetic iron content.

Orifice: an opening in a wall or dam through which flow occurs. Orifices may be used to measure or control rates of flow.

Outfall: The discharge point of a waste stream into a body of water; alternatively it may be the outlet of a river, drain or a sewer where it discharges into a lake or other body of water.

Overburden: Unconsolidated material above bedrock, such as soil and other material.

Phase I Survey: An archaeological survey conducted to locate and identify all archaeological sites within a survey area, estimate size and boundaries of identified sites, evaluate potential site significance and recommend treatment of identified sites.

Definitions (Cont.)

Phase II Survey: Further investigates a specific site identified in the Phase I survey, including site-specific archival research, intensive surface survey, site mapping and possibly excavation of a test unit.

Phase III Survey: Typically involves data recovery of a NRHP eligible site or other archaeologically important site that would be adversely impacted by a project.

PM_{10}: Particulate matter less than or equal 10 microns in aerodynamic diameter.

$PM_{2.5}$: Particulate matter less than or equal to 2.5 microns in aerodynamic diameter.

Preferred Alternative: The agencies' desired project that meets the purpose and need, is feasible, and gives consideration of the effects to the environment.

Proposed Project Boundary: The area which U.S. Steel will own, lease or have access to in relation to the Proposed Project.

Proposed Project Impact Area: The area within the Proposed Project Boundary where physical ground disturbances are proposed to occur. These types of disturbances would include areas associated with the mining pits, stockpile areas, plant layout/construction areas, and tailings basin.

Proposed Project: Expansion of an open pit taconite mine, adjacent stockpile areas, and the upgrade and construction of new equipment within the existing facility, and construction and reinforcement of tailings basin dams at the U.S. Steel Keetac Facility near Keewatin, Minnesota.

Recreational Development (RD) lakes: RD lakes are medium-sized lakes of varying depths and shapes with a variety of landform, soil and groundwater situations on the lands around them. Moderate levels of recreational use and existing development often characterize them (source: Itasca County Zoning Ordinance).

Residual biomass: Woody material that can not be harvested as roundwood including fine woody debris (tops and limbs), and brush. Residual biomass is also called slash or logging residue.

Short Ton: A unit of mass measurement equivalent to 2,000 pounds.

Significant effect: An effect that is predicted to be above an identified threshold and/or an effect that was determined by the lead agencies to have a magnitude that is great based on the context and intensity of that effect.

Slab caster: The semi-finished shapes (slabs) that the molten steel from the steelmaking operation or ladle metallurgy step is cast directly into.

Slurry: A liquid mixture of water and an insoluble material such as finely ground rock.

Species of Special Concern: Although the species is not endangered or threatened, it is extremely uncommon in Minnesota, or has unique or highly specific habitat requirements and deserves careful monitoring of its status. May include species that were once threatened or endangered but now have increasing or protected, stable populations.

Stemming: Inert material, such as crushed or ground rock, placed in a borehole (drill hole) after explosives. It is used to confine explosive materials.

Susceptible population: Populations of people who, due to intrinsic factors (such as developmental stage, strength of immune system, etc.) or external factors (such as behavior patterns that may increase exposure), are more likely to be affected by environmental pollutants than the general population.

Taconite: A variety of chert containing magnetite and hematite; mined as a low-grade iron ore.

Taconite Pellet: Wet taconite powder is rolled with clay inside large rotating cylinders resulting in marble-sized balls. The balls are then dried and heated until they are white hot. The balls harden as they cool. The finished product is taconite pellets.

Tailings: Coarse and/or finely ground, nonmagnetic waste rock from the concentrating process, which is pumped by pipeline as a slurry to the tailings basin.

Threatened and Endangered Species: A species is considered threatened if the species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range within Minnesota. A species is considered endangered if the species is threatened with extinction throughout all or a significant portion of its range within Minnesota.

Upper Confidence Level 95% (UCL 95%): A statistical tool for acknowledging uncertainties and variability within an environmental data set that defines a value that equals or exceeds the true mean of the data set 95 percent of the time.

Visibility Impairment: The most noticeable effect of fine particles present in the atmosphere as particle. This type of pollution degrades the visual appearance and perceived color of distant objects and reduces the range at which they can be distinguished from the background.

Waste Rock: Rock with less than 15 percent magnetic iron content and all other rock materials outside of the Lower Cherty unit of the Iron Formation.

Waters of the State: Water bodies, including wetlands, identified through a jurisdictional determination and regulated by the USACE under Section 404 of the Clean Water Act. Waters of the State for Minnesota regulatory agencies are defined in statute 115.01, subd. 22 as *all streams, lakes, ponds, marshes, watercourses, …and all* *other bodies or accumulations of water…which are within…the state or any portion thereof.*

Watershed: A geographic area from which water is drained by a river and its tributaries to a common outlet. A ridge or drainage divide separates a watershed from adjacent watersheds.

Weir: A weir is a small overflow dam commonly used to raise the level of a small river or stream. Weirs have traditionally been used to create mill ponds. Water flows over the top of a weir, although some weirs have sluice gates which release water at a level below the top of the weir. The crest of an overflow spillway on a large dam is often called a weir.

Wet scrubber: A particulate matter control device that removes particles from waste gas by capturing the particles in small liquid droplets (usually water) and separating the droplets from the gas stream using a cyclonic separator or mist eliminator.

Wetlands: Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.

Woody biomass: Biomass that may be comprised of roundwood, logging residue, mill residues, urban wood waste, and wood chips.

EIS Related Studies

A number of studies and reports were generated that were used in preparation of the EIS. These documents are listed in the table below in alphabetical order according to reference. Each of the documents was given an abbreviated title, which is used consistently throughout the FEIS text. The table also includes a short description of what each study is about and/or how the information was used for analysis. A full bibliography is included in Chapter 8.0, which lists all documents, websites, correspondence, and other information used for research and analysis in this FEIS. Please contact Erik Carlson at erik.carlson@state.mn.us if you would like to receive any reference document used in preparation of this FEIS.

Reference	Referred To in EIS Text As	Study Title
AECOM, 2009A	**Lynx Study**	*Keetac Iron Ore Expansion Project Canada Lynx Assessment Report*
Field studies were completed during the winter of 2009 for Canada lynx in the Proposed Project area. The findings of the field studies were provided in the Lynx Study.		
AECOM, 2009B	**Tailings Basin Evaluation**	*Technical Memorandum, Keetac Tailings Basin Evaluation*
Detailed descriptions of the soils and their geotechnical properties and behavior are provided in the Tailings Basin Evaluation, along with a detailed description of the porewater modeling.		
Barr, 2008A	**Botanical Survey**	*Botanical Survey Report Prepared for U.S. Steel*
The Botanical Survey was conducted in the summer of 2008. Survey methodology and results, including a summary of state-listed species found and their locations are documented in the Botanical Survey.		
Barr, 2008B	**Wetland Delineation Report**	*Wetland Delineation and Wetland Functional Assessment Report – Mine Expansion Project*
The Wetland Delineation Report provides detailed information on wetlands in the Proposed Project area, which was collected and field delineated in August 2005, and between June and September 2008. Review and approval of the Wetland Delineation Report, and subsequent wetland boundaries, was completed by the MNDNR and USACE in 2008.		
Barr, 2009A	**Wetland CE Study**	*Cumulative Wetland Effect Analysis Mine Expansion Project*
A cumulative effects analysis of wetland losses was performed as a special study for the FEIS. The results of the analysis are presented in the Wetland CE Study.		
Barr, 2009C	**BACT Report**	*Revised Best Available Technology Review (BACT) Report*
The BACT Report documents the process used to assess air pollution control technologies for the Proposed Project. Based on the findings of this analysis, proposed air pollution control technologies are selected.		
Barr, 2009C	**Fugitive Dust Plan**	*Fugitive Dust Emissions Control Plan*
The Fugitive Dust Plan lists activities that generate fugitive dust and describes methods that the Project Proposer undertakes to control fugitive emissions. It also lists the primary controls, contingent controls, operating practices and record keeping requirements for each of the activities that generate fugitive dust. This plan was submitted by the Project Proposer as Appendix E of their BACT Report.		

EIS Related Studies (Cont.)

Reference	Referred To in EIS Text As	Study Title
Barr, 2010B	**Class I Air Modeling Study**	*Class I Air Modeling Report*
Four Class I areas were assessed for potential impacts from the Proposed Project emissions using the CALPUFF modeling system: 1) Boundary Waters Canoe Area Wilderness (BWCAW), 2) Isle Royale National Park, 3) Rainbow Lake Wilderness Area, and 4) Voyageurs National Park. The analysis assessing the Class I air quality impacts and the results of the analysis are described in the Class I Air Modeling Study.		
Barr, 2009E	**Class II Report**	*Class II Air Dispersion Modeling Report*
The Class II modeling analysis is intended to address non-Class I areas that would be impacted by the Proposed Project. The highest impacts on Class II areas are local; modeled concentrations are highest near the facility. The results of the criteria pollutants analysis were described in the Class II Report.		
Barr, 2009F	**Climate Change Report**	*Climate Change Evaluation Report*
The Climate Change Report accounts for GHG emissions from the Proposed Project, including alternatives and potential effects.		
Barr, 2009G	**Air Emission Inventory**	*Air Emission Inventory Files and Summaries*
A summary of the current facility air emissions along with the Proposed Project air emissions are presented in the Air Emission Inventory. Additionally, a total facility air emissions table is presented to represent the facilities total air emissions after the Proposed Project.		
Barr, 2009H	**Plant CE Study**	*Cumulative Effects Analysis Sensitive Plant Species-Prepared for U.S. Steel*
The Plant CE Study identifies threats to the survival and persistence of each species within the study area as a result of foreseeable future mining projects. The analysis of cumulative effects assessed three time periods: past, present, and the reasonably foreseeable future.		
Barr, 2009I	**Acidification CI Study**	*Cumulative Impacts Analysis Minnesota Iron Range Industrial Development Projects – Assessment of Potential Ecosystem Acidification Cumulative Impacts in Northeast Minnesota*
The Acidification CI Study evaluated whether the cumulative acid precursor emissions (SO_2 and NOx) from the Proposed Project would cause or significantly contribute to ecosystem acidification in northeast Minnesota.		
Barr, 2009J	**Mercury Emission Factor Memo**	*Effect of Mercury Emission Factor Increase on Keetac Expansion Reports Technical Memorandum*
A summary of the updated Proposed Project mercury emission rates and how impacts vary with the new emission estimates for various analyses completed for the EIS and air permit.		

EIS Related Studies (Cont.)

<table>
<tr><th>Reference</th><th>Referred To in EIS Text As</th><th>Study Title</th></tr>
<tr><td>Barr, 2009K</td><td>Mercury Control Alternatives Evaluation</td><td>Mercury Control Alternatives Evaluation</td></tr>
<tr><td colspan="3">The Mercury Control Alternatives Evaluation reviewed emerging and non-commercially available mercury control technologies and identified activated carbon as potentially feasible technology for controlling mercury from the Proposed Project, in addition to mercury that would be controlled with the air pollution controls proposed for the furnace.</td></tr>
<tr><td>Barr, 2009L</td><td>HHSRA Addendum</td><td>Addendum to the February Human Health Screening-Level Risk Assessment</td></tr>
<tr><td>Barr, 2009M</td><td>HHSRA</td><td>Human Health Screening-Level Risk Assessment</td></tr>
<tr><td colspan="3">A HHSRA examines two types of potential effects on human health: acute (short-time period, one hour) and chronic (longer time period, months through years).</td></tr>
<tr><td>Barr, 2009N</td><td>Reconciliation Memo</td><td>Keetac Expansion Project Reconciliation of Recent Changes</td></tr>
<tr><td colspan="3">The Reconciliation Memo provided updated air-related data to various air-related reports and studies for the Proposed Project.</td></tr>
<tr><td>Barr, 2009O</td><td>Mercury TMDL Memo</td><td>Keetac Expansion Project: Summary of Steps Taken to Adhere to MPCA Mercury TMDL Guidance for New and Expanding Sources</td></tr>
<tr><td colspan="3">The Mercury Total Maximum Daily Load (TMDL) Memo provides a summary of the measures that the Project Proposer would use to adhere to the Mercury TMDL Guidance for New and Expanding Sources.</td></tr>
<tr><td>Barr, 2009P</td><td>O’Brien Creek Report</td><td>O’Brien Creek Stream Morphology Report</td></tr>
<tr><td colspan="3">The O’Brien Creek Report provides analysis associated with Perry Pit dewatering impacts on O’Brien Creek upstream of the Mesabi Chief Outfall.</td></tr>
<tr><td>Barr, 2009Q</td><td>Mineral Fibers Study</td><td>Fibers Related Data for the West End of the Mesabi Iron Range and the U.S. Steel Keetac Mine Expansion Report</td></tr>
<tr><td colspan="3">The Mineral Fibers Study discusses Iron Range mineralogy, intrusive rock formation, and taconite and intrusive rock tailings sampling results taken to determine the presence of amphibole materials.</td></tr>
<tr><td>Barr, 2009R</td><td>Mercury CI Study</td><td>Cumulative Impacts Analysis – Local Mercury Deposition and Bioaccumulation in Fish</td></tr>
<tr><td colspan="3">The Mercury CI Study evaluated the potential cumulative effects from mercury deposition and bioaccumulation in fish, as a result of reasonably foreseeable future actions that might affect the amount of mercury emitted in the immediate area around the Proposed Project.</td></tr>
</table>

EIS Related Studies (Cont.)

Reference	Referred To in EIS Text As	Study Title
Barr, 2009S	**Visibility CI Study**	*Assessment of Potential Visibility and Particulate Air Concentration on Cumulative Impacts in Federal Class I Areas in Minnesota*
The Visibility CI Study assesses the impacts from the Proposed Project, the Mesabi Nugget Phase II project and all other past and reasonably foreseeable proposed projects on Class I areas.		
Barr, 2009T	**Socioeconomic Study**	*Socioeconomic Impact Study*
The Socioeconomic Study evaluated potential socioeconomic impacts from the Proposed Project, both project specific impacts and cumulative effects, including housing, tax revenue, employment, low income and minority, populations, economic, and public services.		
Barr, 2009T (Appendix)	**UMD Economic Study**	*The Economic Impact of U.S. Steel's Keetac Mine Expansion on the State of Minnesota and the Arrowhead Region*
The UMD Economic Study analyzed the potential economic impact from constructing and operating the Proposed Project, which was used for the Socioeconomic Study.		
Barr, 2009U	**BACT SO_2 Limit Proposal**	*BACT SO_2 Limit Proposal Technical Memorandum*
The BACT SO_2 Limit Proposal provided an updated evaluation of SO_2 for the BACT Report.		
Barr, 2009V	**Noise Analysis Memo**	*Additional Keetac Expansion Noise Analysis Technical Memorandum*
The Noise Analysis Memo was completed to evaluate noise impacts from the proposed plant expansion, including the proposed biomass wood chipper (shredder) operation.		
Barr, 2009W	**Wild Rice and Sulfate Data Submittal**	*Wild Rice and Sulfate Water Quality Data Submittal*
The Wild Rice and Sulfate Data Submittal provided information on monitoring and sulfate sampling completed in Swan Lake and Hay Lake.		
Barr, 2009X	**SLERA**	*Screening-Level Ecological Risk Assessment*
The SLERA provides information on the potential upper bound of ecological risks related to air emissions and tailings basin discharge and seepage from the Proposed Project. In addition, the SLERA evaluated cumulative contributions to Swan Lake from the proposed Essar Steel project and the Post-Project Total Facility (existing Keetac facility and the Proposed Project).		
Barr, 2009Y	**Wildlife CE Study**	*Cumulative Effects Analysis of Wildlife Habitat and Threatened and Endangered Species*
The Wildlife CE Study used a land cover and plant communities assessment and the relationship between habitat types and wildlife species to assess cumulative effects to wildlife from the Proposed Project.		

EIS Related Studies (Cont.)

Reference	Referred To in EIS Text As	Study Title
Barr, 2009Z	**Inter-basin Transfer Memo**	*Inter-basin Transfer of Water memorandum*
The Inter-basin Transfer Memo evaluated the potential for water transfer between the Mississippi River watershed and the Great Lakes watershed and identified pit water runout elevations near the Perry/ Mesabi Chief pits and the Pillsbury/ Leonard/ Burt/ Monroe/ Dunwoody pits.		
Barr, 2009AA	**Noise Study**	*Proposed Stockpile Noise Assessment: Keetac Expansion Project*
The Noise Study modeled mining activity of the proposed stockpile areas on receptors nearby west of Kelly Lake and south of the proposed east stockpile to determine if noise levels during operation would exceed state standards.		
Barr, 2009BB	**Supplemental Noise Study**	*Proposed Stockpile Noise Assessment: Keetac Expansion Project – Supplement*
The Supplemental Noise Study evaluated several mitigation methods to achieve compliance with Minnesota night time noise standards at the nearest residences.		
Barr, 2009CC	**Indirect Wetland Impact Study**	*Indirect Wetland Impact Study: Keetac Mine Expansion Project*
The Indirect Wetlands Study evaluated the potential for indirect wetland impacts resulting from the Proposed Project and quantified potential indirect wetland impacts.		
Barr, 2009DD	**Water Discharge and Treatment Alternatives Memo**	*Technical Memorandum: Water Discharge and Treatment Alternatives*
The purpose of this memo is to provide information about water discharge alternatives that were considered part of the proposed design for the Keetac Expansion Project.		
Barr, 2009EE	**Hay Lake/Swan Lake Sulfate Concentration Memo**	*Technical Memorandum: Average sulfate concentrations and confidence intervals for Hay Lake and Swan Lake*
This memo provides the average sulfate concentrations and confidence intervals for Hay Lake and Swan Lake.		
Barr, 2009FF	**Wetland Mitigation Plan**	*Wetland Mitigation Plan – Keetac Expansion Project*
A wetland mitigation plan to provide compensatory wetland mitigation to replace unavoidable wetland impacts associated with the Proposed Project.		
Barr, 2009GG	**Wetland Mitigation Establishment Plan**	*Final Tailings Basin Wetland Mitigation Establishment Plan*
The plan was developed as the primary onsite effort to comply with state and federal wetland mitigation requirements for the Proposed Project.		
Crotteau, 2009A	**Wild Rice in Swan River Study**	*Wild Rice (Zizania sp.) Occurrence and Density in the Swan River*
The Wild Rice in Swan River Study summarized data collected during field reconnaissance for the presence of wild rice in Swan River.		

EIS Related Studies (Cont.)

<table>
<tr><th>Reference</th><th>Referred To in EIS Text As</th><th>Study Title</th></tr>
<tr><td>Crotteau, 2009B</td><td>Wild Rice in Hay Lake/Hay Creek Study</td><td>Hay Lake/Hay Creek Wild Rice and Stream Conditions Survey</td></tr>
<tr><td colspan="3">The Wild Rice in Hay Lake/Hay Creek Study summarized data collected during field reconnaissance for the presence of wild rice in Hay Lake and Hay Creek.</td></tr>
<tr><td>Gronhovd, et al., 2009</td><td>Phase I and Phase II Survey Report</td><td>Phase I and Phase II Cultural Resources Investigations for the Proposed Keetac Project near Keewatin, St. Louis and Itasca Counties, Minnesota</td></tr>
<tr><td colspan="3">The Phase I and Phase II Survey Report was completed for the Proposed Project, to identify if there are any archaeological sites, historic buildings, or structures that are potentially eligible for listing on the National Register of Historic Places that may potentially be impacted by the Proposed Project.</td></tr>
<tr><td>Kilgore et al., 2009</td><td>Biomass CI Study</td><td>Keetac Expansion Project Biomass Fuel Use and Cumulative Environmental Impacts Analysis</td></tr>
<tr><td colspan="3">The Biomass CI Study addresses the potential cumulative effects of biomass fuel used by the Proposed Project, including an in-state maximum use evaluation of potential impacts that would occur related to biomass harvest within Minnesota, details of biomass supply, and demand estimates associated with the Proposed Project.</td></tr>
<tr><td>Liesch, 2009A</td><td>No Action Alternative Memo</td><td>No Action Alternative Analysis for the Keetac Expansion EIS</td></tr>
<tr><td colspan="3">The No Action Alternative Analysis Memo describes the changes in discharge rates and water quality associated with the No Action Alternative for the Keetac Facility.</td></tr>
<tr><td>Liesch, 2009B</td><td>Turbidity Treatment Study</td><td>Turbidity Treatment and Technical Evaluation and Implementation</td></tr>
<tr><td colspan="3">The Turbidity Treatment Study evaluated methods for treating turbidity issues in Welcome Creek.</td></tr>
<tr><td>Liesch, 2009C</td><td>Water Quantity and Quality Report</td><td>Predicted Water Quantity and Quality Cumulative Impacts Evaluation</td></tr>
<tr><td colspan="3">The Water Quantity and Quality Report provides a cumulative analysis of the Proposed Project compared to the Essar Steel project. The study determines potential impacts from the proposed changes to inflows, which could impact water levels in Swan Lake. It also discusses increased flows to O'Brien Creek and Hay Creek as a result of the Proposed Project.</td></tr>
<tr><td>Liesch, 2009D</td><td>Water Balance/Mine Yield Study</td><td>Final Water Balance/Mine Yield Study Report</td></tr>
<tr><td colspan="3">The Water Balance/Mine Yield Study was undertaken to predict the changes that would be expected to occur from the plant expansion and to provide information on the effect of those changes on downstream resources.</td></tr>
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EIS Related Studies (Cont.)

<table>
<tr><th>Reference</th><th>Referred To in EIS Text As</th><th>Study Title</th></tr>
<tr><td>Liesch, 2009E</td><td>Hay Lake Sulfate Report</td><td>Hay Lake Sulfate Concentrations/Water Levels for the Keetac Expansion EIS</td></tr>
<tr><td colspan="3">The Hay Lake Sulfate Report examined potential impacts from the Proposed Project on sulfate concentrations in Hay Lake, which was identified as having the presence of wild rice.</td></tr>
<tr><td>Liesch, 2009F</td><td>Reservoir 4/Hay Lake Report</td><td>Reservoir 4/Hay Lake Water Elevations for the Keetac Expansion EIS</td></tr>
<tr><td colspan="3">The Reservoir 4/Hay Lake Report evaluated the potential impacts from the Proposed Project to water elevations in Reservoir 4 and Hay Lake.</td></tr>
<tr><td>Wenck, 2009</td><td>Traffic Analysis</td><td>Traffic Impact Analysis</td></tr>
<tr><td colspan="3">The Traffic Analysis for the Proposed Project included the development of peak hour and daily traffic forecasts, the operational analysis of critical intersections, and the development of recommended solutions.</td></tr>
<tr><td>Wenck, 2010 (see Appendix E of FEIS)</td><td>Stockpile Analysis</td><td>Analysis of Stockpile Location Concepts Report</td></tr>
<tr><td colspan="3">The Stockpile Analysis evaluated the two proposed stockpile locations, several alternative stockpile location concepts, and in-pit stockpile opportunities.</td></tr>
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Executive Summary

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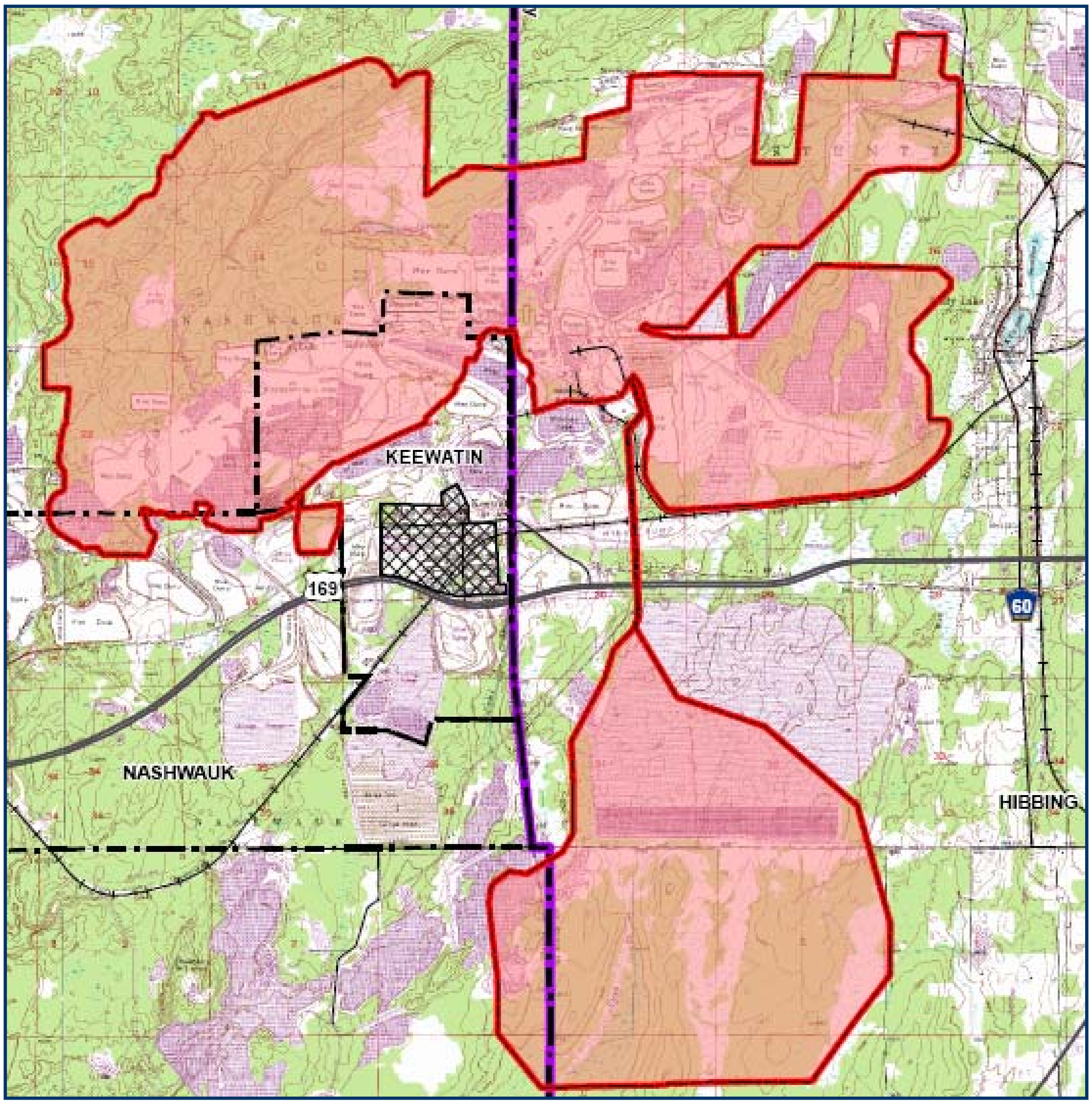
Introduction

United States Steel Corporation (Project Proposer) proposes to restart an idled production line and expand contiguous sections of its open pit iron ore mine (Proposed Project) at its existing Keetac mine and processing facility near Keewatin, Minnesota (ES Figure 1). The estimated cost of the Proposed Project is over $300 million. Mine planning and detailed design were prepared for a 25-year horizon. Due to the magnitude of the Proposed Project, an Environmental Impact Statement (EIS) is required under the National Environmental Policy Act (NEPA).

This Executive Summary (ES) describes the process of developing the Final Environmental Impact Statement (FEIS), including the alternatives to the Proposed Project that were considered based on evaluation criteria and environmental analysis. It provides an overview of the Proposed Project, its alternatives, potential effects on the environment, and mitigation measures.



ES Figure 1: Project Location Map

Keetac EIS Process

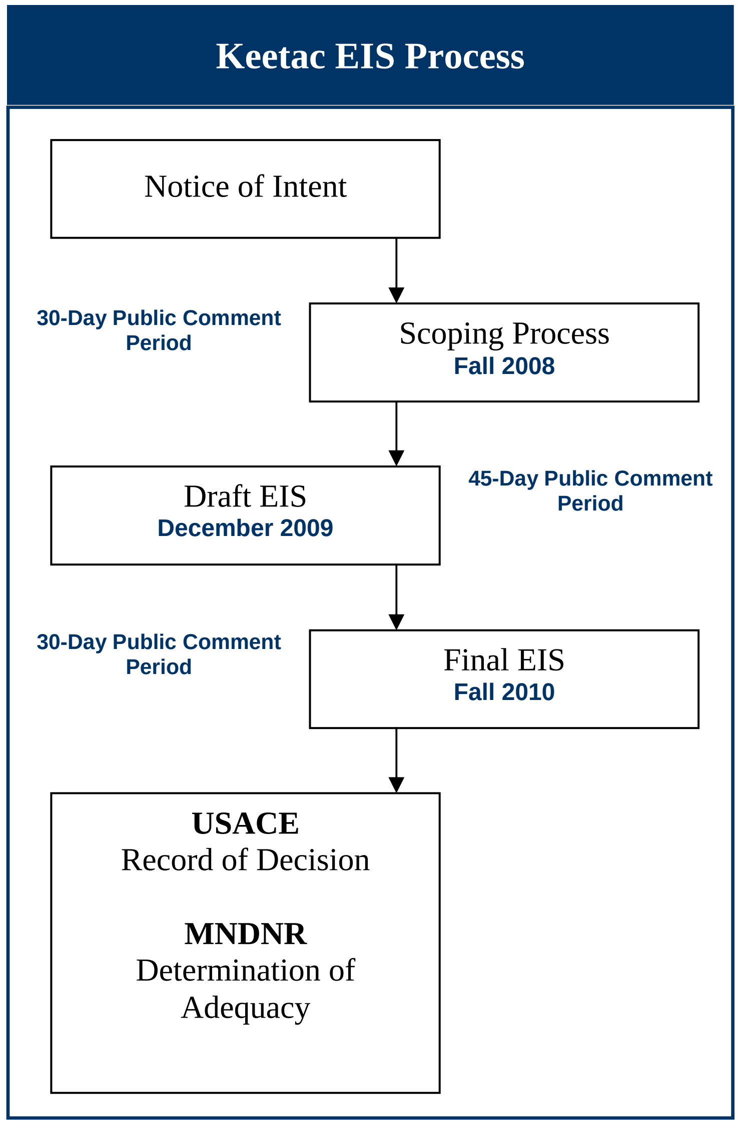
What is the need for this EIS?

There are a number of reasons, both discretionary and regulatory, that an EIS is being completed for this project. It typically depends on the type of project being proposed, its magnitude, and what state and federal regulations are required for environmental review and permitting specific to the proposed project.

The purpose of an EIS is to:

- Evaluate a proposed project's potentially significant environmental and socioeconomic effects;
- Consider reasonable alternatives;
- Explore mitigation measures for reducing or avoiding adverse effects; and
- Provide information to the public and to project decision-makers.

The Proposed Project requires an EIS under NEPA due to the magnitude of wetland impacts. These wetland impacts are considered a federal action for which the United States Army Corps of Engineers (USACE) has jurisdiction through the Clean Water Act (CWA) Section 404 permitting process. The Project Proposer has also agreed to complete a discretionary EIS under the Minnesota Environmental Policy Act (MEPA). The Minnesota Department of Natural Resources (MNDNR) and USACE have jointly prepared this EIS to evaluate the Proposed Project in accordance with MEPA, Minnesota Statute §116D, and NEPA, 42 USC §§ 4321-4347.



Although not mandatory under MEPA, the Project Proposer and the MNDNR agreed that a discretionary EIS would be prepared for the Proposed Project in accordance with Minnesota Rules, part 4410.2000, subp. 3B. The EIS is required to meet the applicable requirements of Minnesota Rules, parts 4410.0200 to 4410.7800 that govern the Minnesota Environmental Review Program.

The FEIS is intended to provide information to units of government on the environmental, economic and social impacts of a project before approvals or necessary permits are issued and to identify measures necessary to avoid, reduce, or mitigate adverse environmental effects. An EIS is not a means to approve or deny a proposed project.

What process was used to develop this FEIS?

In September 2008, as required by NEPA and MEPA, the MNDNR in partnership with the USACE prepared a Scoping Environmental Assessment Worksheet (SEAW) and a Draft Scoping Decision Document (DSDD) to provide information about the project, identify potentially significant environmental effects, and determine what issues and alternatives would be addressed in the EIS. Public notification and opportunities to receive information and public comment on the project began during the project scoping process.

A public meeting was held on October 1, 2008, at the Nashwauk-Keewatin High School in the City of Nashwauk to provide additional information on the project and allow for comments (verbal and written) and questions. The comments received during the scoping period were considered as part of the scoping process, prior to the agencies issuing the Final Scoping Decision Document (FSDD) on November 5, 2008. On November 17, 2008, the USACE published a Notice of Intent (NOI) to prepare an EIS in the Federal Register.

What is the Final Scoping Decision Document?

The FSDD satisfies the scoping requirements of MEPA and NEPA and serves as the blueprint for preparing the EIS for the project. Both the SEAW and FSDD are included in the FEIS as Appendix A and B, respectively. Responses to public comments received during the scoping process are included in Appendix C.

The MNDNR and USACE reviewed and considered the environmental issues identified and described in the SEAW, and then placed these issues into four categories in the FSDD according to significance and level of analysis required in the EIS. These categories are briefly described below along with a list of topics that are included in each category.

Not Addressed in EIS
These topics were considered not relevant or were so minor that they would not be addressed in this EIS:

- Water surface use
- Vehicle-related air emissions
- Compatibility with plans and land use management regulations

No Significant Impacts Expected
The MNDNR and USACE determined that the following topics are not expected to present potentially significant impacts, but would be addressed in the EIS using limited information beyond that provided in the SEAW, commensurate with the anticipated impacts. These topics include:

- Land Use
- Cover Types
- Water-Related Land Use Management Districts
- Erosion and Sedimentation
- Surface Water Runoff/Water Quality
- Geologic Hazards and Soil Conditions
- Solid Wastes, Hazardous Wastes, and Storage Tanks
- Traffic Impacts
- Odors, Noise, and Dust
- Amphibole Mineral Fibers
- Mineland Reclamation
- Socioeconomics
- Infrastructure and Public Service
- Visual Impacts
- Recreational Trails
- Federal Trust Responsibilities to Indian Tribes
- Historic Properties

Potentially Significant Impacts
The MNDNR and USACE identified the following topics in the FSDD that may result in potentially significant impacts and would include a substantial amount of additional information in the EIS beyond that included in the SEAW.

- Wetlands and Water Resources
- Fisheries and Aquatic Resources
- Wildlife Resources
- Threatened and Endangered Species
- Wild Rice Resources (added after scoping)
- Water Appropriations
- Wastewater/Water Quality
- Stationary Source Air Emissions
- Human Health

A detailed analysis of Wild Rice Resources was included in this FEIS.

Potential Cumulative Effects
Potential cumulative effects were also outlined in the FSDD for inclusion in the EIS. Potential cumulative effects associated with combined environmental effects of the Proposed Project and of past, present and reasonably foreseeable future actions include:

- Loss of Wetlands
- Biomass
- Climate Change
- Aquatic Habitat and Fisheries
- Wild Rice Resources (added after scoping)
- Mercury Emissions, Deposition, and Bioaccumulation
- Wildlife Habitat Loss/Fragmentation and Travel Corridor Obstruction
- Threatened and Endangered Species and Species of Concern
- Stream Flow and Lake Level Changes
- Inter-basin Transfer of Water
- Wastewater/Water Quality
- Class I Areas – Potential Impact to Air Quality
- Ecosystem Acidification Resulting from Deposition of Air Pollutants
- Human Health
- Ecological Health

What is each agency's role in this EIS process?

The MNDNR serves as the lead state agency in preparing this joint state/federal EIS and has coordinated with other state agencies (i.e., Minnesota Pollution Control Agency [MPCA] and the Minnesota Department of Health [MDH]) and participated with the USACE at two public meetings The MNDNR is responsible for determining EIS adequacy pursuant to MEPA.

The USACE is the lead federal agency in preparing this joint state/federal EIS. The USACE has determined that its action on the CWA Section 404 permit would be a major federal action that has the potential to significantly affect the quality of the human environment, requiring the preparation of a federal EIS pursuant to NEPA and its implementing regulations (40 CFR 1500-1508).

Keetac EIS Process (cont.)

> ***The MNDNR serves as the lead State agency, the USACE serves as the lead Federal agency, and the Bois Forte Band is a cooperating agency, in preparing the Keetac FEIS.***

The USACE has coordinated with other federal agencies including the U.S. Environmental Protection Agency (USEPA), U.S. Forest Service (USFS), and the U.S. Fish and Wildlife Service (USFWS). The USACE offered the seven federally-recognized Native American bands in northern Minnesota an opportunity to consult with the USACE regarding the project. Bois Forte Band requested to become a cooperating agency for the preparation of the EIS. The USACE will determine whether the EIS satisfies NEPA and the environmental review requirements of Section 404 of the CWA, and will prepare the federal Record of Decision (ROD).

What is the public's role in this EIS process?

In addition to the public meeting and comment period for the DSDD, the Draft Environmental Impact Statement (DEIS) was published and circulated in accordance with the rules and requirements of Minnesota Rules (EQB Rules) 4410, MEPA, and NEPA requirements. Citizens, organizations, tribal entities, and government entities were given a 45-day comment period in which to submit written comments on the Keetac DEIS. Additionally, a public meeting was held on Monday, January 11, 2010 in Hibbing, Minnesota to present information on the DEIS, answer questions, and provide a forum for oral and written public comments. Comments received were taken into account in assessing potential project impacts and potential mitigation for the FEIS. Responses to comments received were prepared and included in the FEIS. The USACE and MNDNR will receive comments on the adequacy of the FEIS during a 30-day public comment period, after which, the MNDNR will make a determination of adequacy, and the USACE will issue a ROD.

Description of the Proposed Project

What is the purpose of the Proposed Project?

The purpose of the Proposed Project is to increase the rate and total quantity of taconite pellet production at the Keetac facility in order to satisfy global demand for steel. This would be achieved through the expansion of an existing mine pit and re-starting an existing idle indurating line.

The purpose of the Proposed Project is to increase the rate and total quantity of taconite pellet production at the Keetac facility using existing infrastructure. The need of the Proposed Project is to satisfy global demand for steel. The Project Proposer would achieve the project purpose by expanding an existing mine at Keetac and refurbishing and operating the currently idle Phase I taconite processing line to increase taconite pellet production by 3.6 MSTY to a total output of 9.6 MSTY. The Proposed Project need would be accomplished by shipping taconite pellets to steel mills, which would be used to produce steel to meet the domestic and worldwide demands.

It was determined early that an alternative mine site would not be practicable for meeting the purpose of the Proposed Project. While an alternative iron ore mine pit could facilitate the mining of taconite, it would not take advantage of the existing infrastructure at the Keetac site. As a result, new infrastructure such as the processing plant, roads, power lines, tailing basin dam, etc., would need to be put in place at an alternative location. The construction of new infrastructure could greatly decrease the profitability of the mine. Furthermore, constructing a mine at an alternative site would likely not be less environmentally damaging than the Proposed Project.

Who is the Project Proposer?

United States Steel Corporation headquartered in Pittsburgh, Pennsylvania, is an integrated steel producer, with a raw steelmaking capability of 31.7 MSTY. Producing steel for over 100 years, United States Steel has production operations in the United States, Canada, and Central Europe. The company manufactures a wide range of steel sheet and tubular products for the automotive, appliance, container, industrial machinery, construction, and oil and gas industries. United States Steel is also involved in transportation services (railroad and barge operations) and real estate.

U.S. Steel operates two iron ore mines in Minnesota.

The company operates two iron mines through its Minnesota Ore Operations on the Mesabi Iron Range. They are Minntac in Mt. Iron and Keetac in Keewatin. Minntac and Keetac both mine taconite and concentrate it into taconite pellets. More information about United States Steel is available on their website: www.ussteel.com.

What is the Proposed Project?

Keetac is located on the Mesabi Iron Range, near Keewatin, Minnesota. The Mesabi Iron Range is a major, well-known geologic feature oriented roughly northeast to southwest across more than 120 miles of northeastern Minnesota from near Babbitt to near Grand Rapids. The Iron Range has been the largest source of iron ore produced in Minnesota since the 19th century, making Minnesota a predominant source of iron ore in the United States.

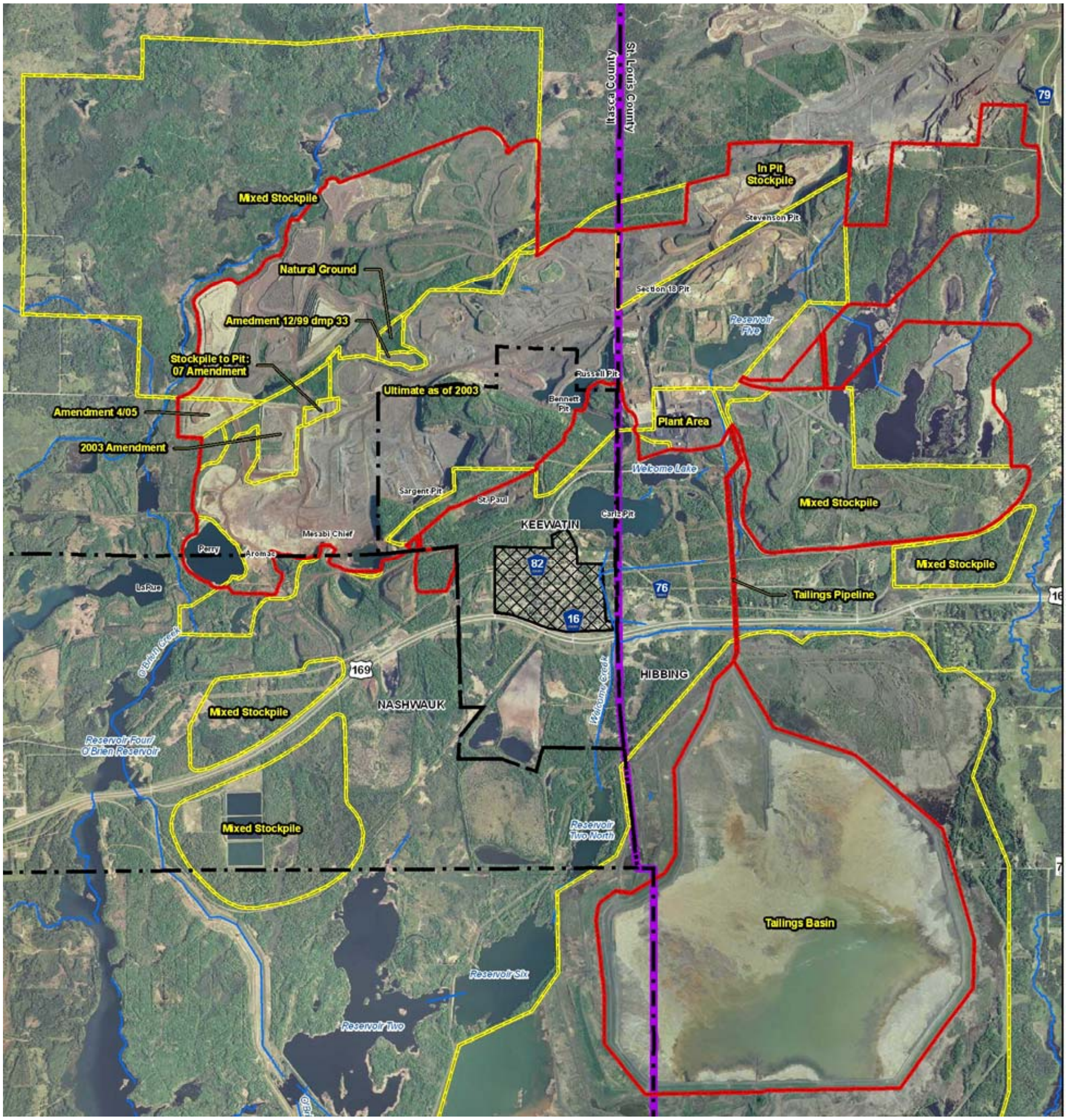
Taconite mining and taconite pellet production have been ongoing at Keetac site since 1967. Keetac began production using rotary hearth technology; this technology was soon abandoned for grate kiln technology. The original Phase I grate kiln pellet line began operation in 1969. In 1977, the Phase II expansion added a second grate kiln pellet line. The Phase I facility was idled in December 1980. Currently, there is one operating pellet producing line (Phase II) with an annual production rate of approximately 6.0 MSTY.

Taconite pellet production has been ongoing at Keetac since 1967. Currently the annual production rate of taconite pellets is 6.0 MSTY.

The Proposed Project would increase the taconite pellet production capacity by expanding the mine pit, adding stockpile areas, upgrading the concentrating and agglomerating processes, and restarting the Phase I line. The Proposed Project would increase Keetac's taconite pellet production output by 3.6 MSTY to a total annual output of 9.6 MSTY until about the year 2036.

Keetac’s current footprint and the facility limit, established in the MNDNR Permit to mine, are shown on ES Figure 2, and include mining pit limits, waste rock and surface stockpiles, and tailings basin. The Keetac facility is an active mine that can continue taconite pellet production at 6.0 MSTY until about the year 2021 under existing permits.

Description of the Proposed Project (cont.)



ES Figure 2: Comparison of Current and Proposed Keetac Footprint and Current MNDNR Permit to Mine Facilities Limit

With an estimated cost in excess of $300 million, the Proposed Project includes installation of energy-efficient technologies and new emission controls at the plant, expansion of mining and stockpiling, upgraded concentrating and agglomerating processes, a vertical expansion of the tailings basin, and construction of a biomass processing facility. The Proposed Project would increase the mine, waste rock and surface stockpiles, and tailings basin by approximately 2,075 acres. Existing rock crushing facilities and existing infrastructure (public roads, railroads) and utilities (water, electric, gas and sewer) are adequate to accommodate both existing operations and the Proposed Project. A spatial overview of the current and proposed Keetac footprint, including Proposed Project plans for the mine expansion, stockpile expansions, and tailings basin are shown on ES Figure 3.

Description of the Proposed Project (cont.)

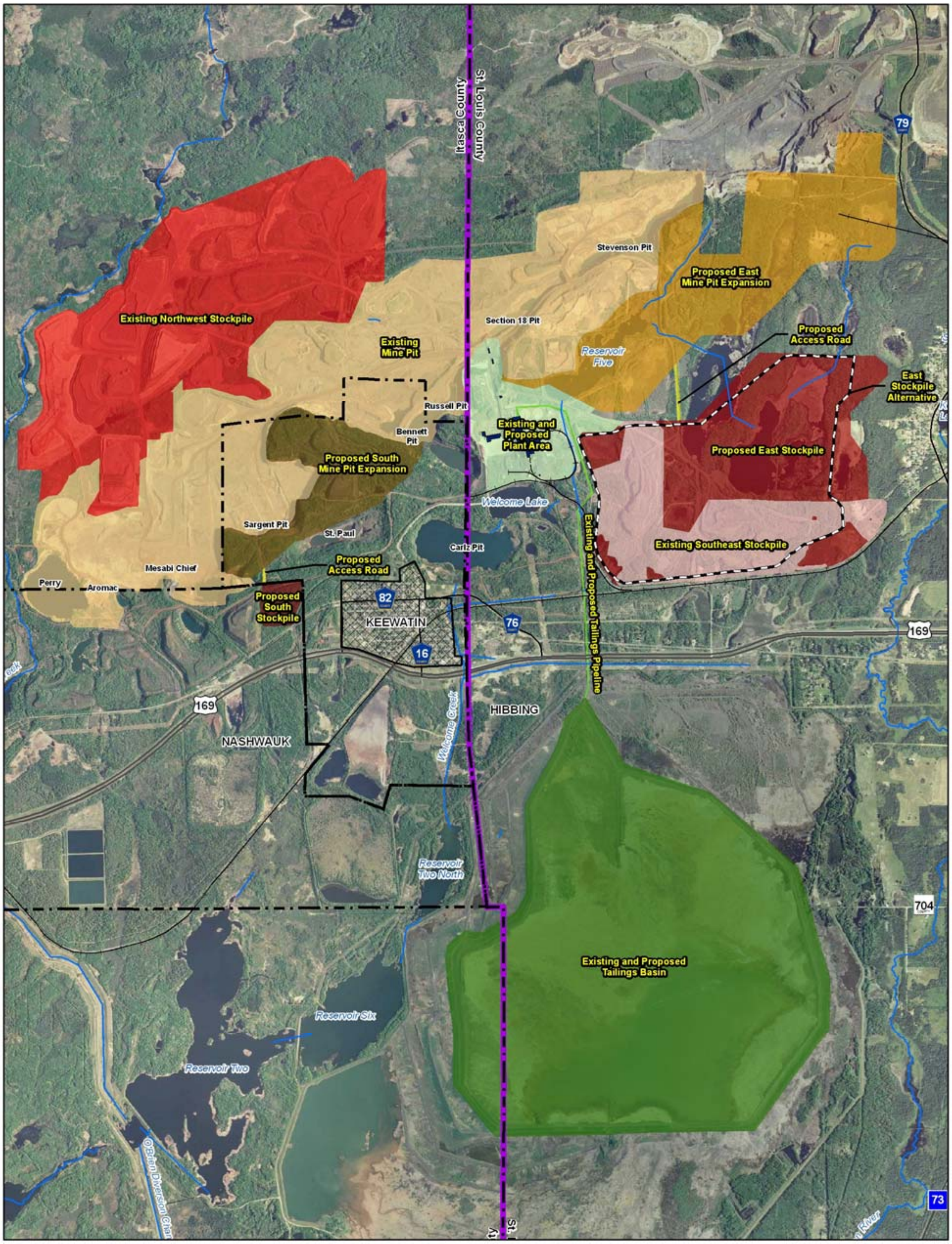
The indurating furnace equipment from the idled Phase I line would be refurbished and fueled by natural gas and biomass with coal and fuel oil used as backup fuels. Upgrades to the concentrating, and agglomerating processes would be required to supply additional material to the refurbished and restarted indurating furnace equipment. Additional process water would be required to increase production of the facility. The height of the current tailings basin would increase by approximately 80 feet to accommodate the additional tailings with a potential slight change in the horizontal footprint.

The potential environmental and socioeconomic effects of the Proposed Project are those that would occur if the mine expands beyond the No Action Alternative. This would increase taconite pellet production by 3.6 MSTY for a total annual output of approximately 9.6 MSTY.

The Project Proposer proposes to restart an idled production line and expand contiguous sections of the open pit taconite mine at its existing Keetac mine and processing facility. The Proposed Project would change the operation of the Keetac facility under new permits, or amendments to existing permits that would increase water discharges or air emissions and/or disturb additional land outside the Permit to Mine facility limit. The potential environmental and socioeconomic effects of the Proposed Project are those that would occur if the mine expands operations beyond the No Action Alternative (described below).

The proposed Keetac footprint illustrates the extent of the Proposed Project area, where potential environmental impacts would occur. A different sequence of mine development would occur under the No Action Alternative, compared to the Proposed Project. The Proposed Project would not start after the completion of the No Action Alternative, rather the proposed mine pit expansion would occur simultaneously in areas identified in both the No Action and Proposed Action Alternatives. Mine pit expansion would occur in these areas in order to meet the purpose and need of the Proposed Project (i.e., increased production to 9.6 MSTY).

Taconite pellet production would be increased by 3.6 MSTY.



ES Figure 3: Current and Proposed Keetac Footprint Areas

Description of the Proposed Project (cont.)

A 25-year mine plan for the Proposed Project is evaluated in this EIS. Actions beyond 25 years or outside the Proposed Project boundary may require additional environmental review. Likewise, mine permits are being requested for a 25-year mining program. Air and water-related permits are issued for shorter timeframes, typically with renewal at specified intervals (i.e., Title V air permit renews every five years) and permit amendments for actions that do not create an increased discharge or emission.

Open pit methods (as currently used at Keetac) would be used for the Proposed Project mining activities. Two main areas of the existing mine pit would be expanded. The first of these two expansion areas (proposed south mine pit expansion) is located west of the plant, expanding the existing Bennett/Russell Pit south. The second area of pit expansion (proposed east mine pit expansion) would include dewatering Reservoir Five to expand the Section 18 Pit east. In addition, the largest portion of the expansion would occur east of the Stevenson Pit continuing north, adjacent to and abutting the Hibbing Taconite (Hibtac) mine. The proposed south mine pit expansion and proposed east mine pit expansion are shown on ES Figure 3.

Expansion of the mine pit requires a Permit to Mine Amendment Application to the MNDNR. The Project Proposer submitted a preliminary draft Permit to Mine Application in July 2009. The Project Proposer currently plans to begin stripping and mining activities in both the proposed south and east mine pit expansions during the initial 5-year period of the new mine plan (2012 to 2017).

The Proposed Project is defined as the incremental change beyond what is allowed under the No Action Alternative and existing permits. Key features of the Proposed Project include:

- *Starting the new indurating line and upgrading concentrating and agglomeration processes*
- *Refurbishing the Phase I grate kiln furnace and changing the mixture of fuels used at Keetac to include biomass*
- *Expanding mine pit and stockpile boundaries*

Description of the No Action Alternative

Keetac is an operating taconite mine and taconite pellet processing facility. The No Action Alternative is defined as the continued operation of the mine and processing facility which would produce approximately 6.0 MSTY of taconite pellets. The No Action Alternative describes potential environmental and socioeconomic effects that would occur if the Proposed Project is not developed and the mine continues to operate. Mining at Keetac is anticipated to continue for approximately 12 years (until 2021) without the Proposed Project or new (amended) permits.

The No Action Alternative is to continue operating the facility under its current capacity and permits.

Mining at Keetac is anticipated to continue for approximately 12 years (until 2021) without the Proposed Project or new permits.

The No Action Alternative includes ongoing actions (i.e., mining, taconite processing, and transport) at Keetac that would occur under the existing Permit to Mine, existing wetland permits, actions occurring under permits that undergo renewal at specified intervals, and permit amendments for actions that do not create an increased discharge or emission (i.e., water appropriations permit amendment to maintain same pumping rate from a new source within current Permit to Mine facility limit).

The geographic boundary of the No Action Alternative encompasses areas within the current facility limit of the Permit to Mine that have been or would be developed without the need for new or amended permits**.**

Alternatives Considered and Evaluated in the EIS

Was an alternative site evaluated?

Minnesota Rules Chapter 4410 requires an evaluation of site location alternatives. Minnesota Rules Chapter 4410 allows the RGU to exclude alternative sites if other sites do not have significant environmental benefit compared to the project as proposed, or if other sites do not meet the underlying need and purpose of the Proposed Project.

Taconite mine pits refill with groundwater at mine closure.

The FSDD states that, "the MNDNR and USACE do not propose to evaluate alternative mine pit sites for the Proposed Project. An alternative mine site would not meet the underlying need or purpose of the Proposed Project. The mineralization of desired elements [presence of iron ore] within a geologic deposit dictates the location of the mine pit."

Geologic deposits in the Iron Range have the desired characteristics for the Project Proposer to operate a mine site. Outward expansion of the mine is determined by the location and formation of the ore body. The Proposed Project would utilize the ore body for mining and taconite production by expanding the existing mine pit further into the ore body.

While an alternative iron ore mine pit could facilitate the mining of taconite, it would not take advantage of the existing infrastructure at the Keetac site. As a result, new infrastructure which may include the processing plant, roads, power lines, tailing basin dam, etc., would need to be put in place at an alternative location. The increased impacts of constructing this infrastructure would not provide an environmental benefit when compared to the Proposed Project. The complement of existing usable infrastructure and available iron ore makes the Proposed Project practicable.

What alternative technologies were analyzed?

Best Available Control Technology (BACT)

The FSDD states that the EIS will evaluate air pollution control methods and/or technologies on sources of air pollutants, and Best Available Control Technology (BACT) where applicable. Emission units associated with the Proposed Project require a BACT analysis for SO_2, PM, PM_{10}, and $PM_{2.5}$.
BACT analysis includes the following steps, which are consistent with the process utilized to identify, evaluate, and select alternatives during the environmental review process:

Step 1 – Identify all control technologies
Step 2 – Eliminate technically infeasible options
Step 3 – Rank remaining control technologies by control effectiveness
Step 4 – Evaluate the most effective control technologies and document results
Step 5 – Select BACT

Alternatives Considered and Evaluated in the EIS (cont.)

The BACT analysis documents the process utilized to assess air pollution control technologies for the Proposed Project. Based on the findings of this analysis, proposed air pollution control technologies are selected.

Mercury Emissions

Based on the review of the available mercury control technologies, the Project Proposer has chosen to install activated carbon injection to control mercury emissions for the new line.

The FSDD stated that the EIS will identify all sources of mercury emissions, review mercury control technology for the Proposed Project, and summarize other potential mercury control technologies.

As part of this EIS analysis, mercury emissions and controls were evaluated. These evaluations reviewed the technical feasibility of possible mercury emission controls for the Proposed Project. The Project Proposer used a BACT-like analysis to evaluate the prospective mercury emissions controls.

The majority of research and published information of mercury control technologies focuses on coal-fired utility boilers. Research for mercury control technologies at taconite processing plants is ongoing. The mercury control technologies are classified into three categories of availability: commercially available, emerging technology, and in the research and development stages. These technologies were evaluated on their technical feasibility to the Proposed Project, their control effectiveness, and other impacts that may occur.

Based on the review of the available mercury control technologies, the Project Proposer has chosen to install activated carbon injection to control mercury emissions for the new line.

Greenhouse Gas Emissions

The FSDD states that the EIS will compare greenhouse gas (GHG) emissions from project alternatives and discuss the conclusions from the analysis. New and evolving environmental guidance and regulations on the state and federal levels recognize the potential consequences of GHG emissions on climate change. To address that issue, a methodology to analyze the cumulative effects of climate change was tailored for the Proposed Project by the MNDNR Briefing Sheet (MNDNR, 2008C).

To address the cumulative effects of climate change, Project Alternatives analyzed by the Project Proposer are summarized as follows:

- *Develop a carbon footprint for the Proposed Project with and without proposed GHG reduction activities.*
- *Develop fuel mix alternatives.*

What modified designs or layouts were evaluated?

Minnesota Rules, part 4410.2300 requires an evaluation of modified designs or layouts of the facility. The FSDD states that the following major components of the Keetac facility will be evaluated in the EIS:

- Plant and Pit Location on Site
- Tailings Thickener and Tailings Basin Locations
- Stockpile Location and Design, including Haul Roads
- Recreational Trails

The Proposed Project is an expansion of an existing facility with the major components, as listed above, included as part of current operations. A modified design or layout evaluating the inter-relationship of these components would require the relocation of two or more of the components listed above. This would be a major undertaking and require construction of new facilities, which would likely not have significant environmental benefit compared to the Proposed Project.

Plant Site

The FSDD states that, "the MNDNR and USACE do not propose to evaluate alternative mine plant sites for this Proposed Project. An alternative processing plant site would not have significant environmental benefit over the Proposed Project. The new processing line would be located on the existing Phase I plant footprint. A new plant location would alter land cover types and terrestrial habitats. Moreover, it would not meet the underlying need and purpose of the Proposed Project which includes reusing existing plant infrastructure" already in place for use by the Proposed Project.

> *The MNDNR and USACE determined that an alternative plant site, pit location, tailings thickener site, and tailings basin site would not have a significant environmental benefit over the Proposed Project, and therefore did not further evaluate these alternatives in the EIS.*

Pit Location

As stated in the FSDD, "the MNDNR and USACE do not propose to evaluate alternative mine pit sites for the Proposed Project. An alternative mine site would not meet the underlying need or purpose of the Proposed Project."

Geologic deposits in the Iron Range have the desired characteristics for the Project Proposer to operate a mine site. Outward expansion of the mine is determined by the location and formation of the ore body. The Proposed Project would utilize the ore body for mining and taconite production by expanding the existing mine pit further into the ore body.

While an alternative iron ore mine pit could facilitate the mining of taconite, it would not take advantage of the existing infrastructure at the Keetac site. As a result, new infrastructure which may include the processing plant, roads, power lines, tailing basin dam, etc., would need to be put in place at an alternative location. The increased impacts of constructing this infrastructure would not provide an environmental benefit when compared to the Proposed Project. The complement of existing usable infrastructure and available iron ore makes the Proposed Project practicable.

Tailing Thickener

The FSDD also states, "the MNDNR and USACE do not propose to evaluate tailing thickener sites for the Proposed Project. An alternative tailing thickener location would not have significant environmental

Alternatives Considered and Evaluated in the EIS (cont.)

benefits over the proposed location because the proposed tailings thickener locations are adjacent to the existing plant on previously disturbed ground. No other locations have significant environmental benefits over the proposed location."

Tailings Basin

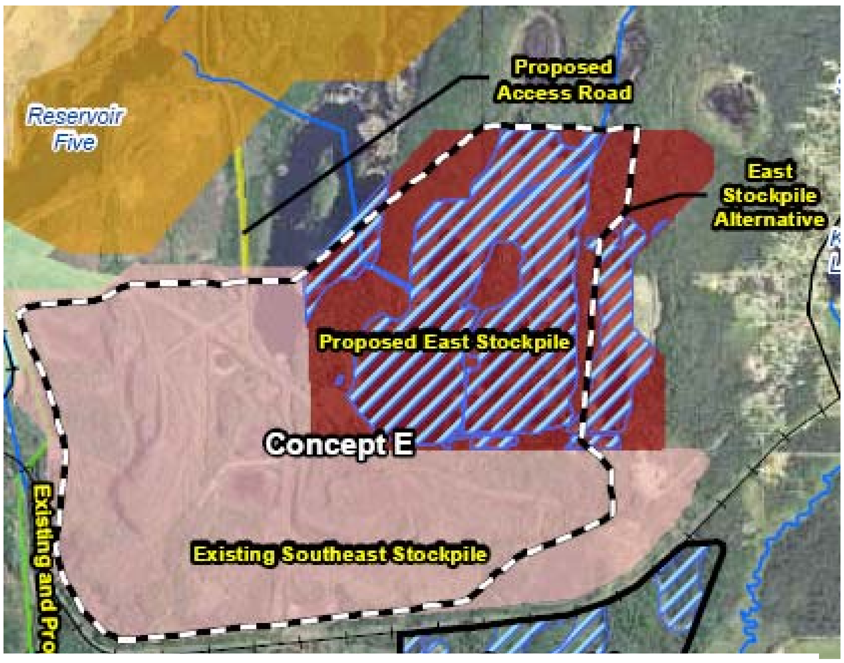
The FSDD stated that the MNDNR and USACE do not propose to evaluate alternative tailings basin sites for the Proposed Project. The Proposed Project intends to maintain the existing area of the tailings basin and build the basin vertically as tailings are produced, which would slightly expand the footprint of the active tailings basin. Without mitigation, a taller tailings basin may generate more fugitive dust, because of greater wind erosion across the surface of the basin. However, these possible adverse effects are offset by the land disturbance a new tailings basin would create, and can feasibly be mitigated. A new tailings basin location would therefore have no environmental benefits compared to the existing tailings basin.

Stockpile Design

The MNDNR and USACE do not propose to evaluate an alternative stockpile design. The proposed design would adhere to the relevant rules (Minnesota Rules Chapter 6130) for the construction of a stockpile for mining activities that are prescriptive in nature, defining maximum slope/bench configurations and vegetation requirements.

Stockpiles

The location and positioning of stockpiles for the Proposed Project is important because of impacts to wetlands. The FSDD states:



An alternative east stockpile configuration was identified.

Positioning of stockpiles is crucial to minimizing impacts to wetlands and potentially other natural resources. The EIS will evaluate the potential environmental effects of the proposed stockpile locations as well as alternative stockpile locations. In addition, the EIS will evaluate in-pit stockpile opportunities; in-pit stockpiles can help create future shallow-water habitat when pits are abandoned and reclaimed. This stockpile location analysis will consider not only potential wetland impacts, but also air emissions from haul truck and wind erosion, haul road location, lease fee-holder requirements, in-pit stockpile opportunities and other operational and environmental issues.

Alternatives Considered and Evaluated in the EIS (cont.)

A detailed stockpile location analysis was completed for this FEIS, which evaluated the two proposed stockpile locations (south and east), five alternative stockpile location concepts, and in-pit stockpile opportunities. This analysis along with supporting documentation is presented in Appendix E of the FEIS, and is summarized below.

The stockpile location analysis used a number of criteria to evaluate potential alternative stockpile locations. These criteria included the following:

- Wetland Acreage and Condition
- Upland Acreage
- Natural Habitat
- Threatened and Endangered Species
- Air Quality
- Location Relative to Iron Formation
- Surface Ownership, Control, and Mineral Rights Ownership
- Quantity and Duration of Stockpile Activity
- Haul Route Configurations and Haul Truck Operation
- Community Factors
- Feasibility and Economic Factors
- Safety Factors

View of proposed east stockpile area. These wetlands would be impacted.

The Project Proposer estimated and MNDNR mining engineers confirmed that with maximization of in-pit stockpiles and existing out of pit stockpile options, an additional 118 million bank cubic yards (Mbcy) of overburden from the proposed mine pit expansion would need to be stockpiled. Overburden would need to be removed over 21.5 years to continue uninterrupted mining of taconite. Using the stockpile capacity needs as a baseline to determine stockpile area size, several stockpile concepts were evaluated using the criteria listed above. The results of the analysis concluded that there is not a practicable alternative location to the proposed south stockpile. However, a practicable alternative to the proposed east stockpile does exist and was included as an alternative within the FEIS.

Was scale or magnitude evaluated as an alternative?

The FSDD states, “the MNDNR and USACE do not propose to evaluate proposed project scale or magnitude alternatives. The infrastructure requirements to mine and process ore are such that alternative scale or magnitude changes would not meet the underlying need for or purpose of the Proposed Project.”

Potential Environmental Effects and Mitigation Measures

The purpose of the environmental review process is to determine what potential environmental effects a proposed project could have on natural resources and the human environment. The MNDNR and USACE evaluated these potential environmental effects for the Proposed Project and its alternatives. The agencies' preferred alternative and the environmentally preferred alternative were identified. Criteria used for the EIS evaluation resulted in the identification of several different levels of potential environmental effects: no effect; less than significant effect; and significant effect. Where appropriate, these effects were also characterized as adverse or beneficial.

Evaluation and analysis completed for the FEIS resulted in a number of resources identified as having no potential effect from the Proposed Project or its alternatives. The effects were either associated specifically with the Proposed Project or were evaluated in the FEIS for potential cumulative effects (CE). These included:

- Water levels
- Fisheries and aquatic resources in Swan Lake, Welcome Lake, Hay Lake, West Swan River, and Reservoirs 2, 2N, 4, and 6
- Threatened and endangered animal species: Bald eagle and Canada lynx
- Odors
- Recreational Trails: Lawron Trail and Mesabi Trail
- Infrastructure and public services
- Dam safety
- Groundwater resources
- Inter-basin transfer of water
- Visual Impacts
- Solid waste, hazardous waste, and storage tanks
- Amphibole mineral fibers
- Human Health
- Traffic
- CE Biomass
- CE Climate change
- CE Water levels
- CE Fisheries and aquatic resources
- CE Threatened and endangered animals: Bald eagle and Canada lynx
- CE Class I Area impacts to air quality
- CE Ecosystem acidification

ES Table 1 summarizes potential environmental effects with associated mitigation and monitoring measures for the Proposed Project. The table indicates if the mitigation or monitoring measure has been adopted as part of the Proposed Project or has been identified as a measure that could be implemented. In some instances, possible mitigating measures are identified which could be implemented should monitoring indicate that an effect is occurring. Additional information related to mitigation for the Proposed Project is provided in the corresponding chapters of this FEIS for each topic area.

During analysis for the FEIS, the east stockpile alternative was developed. In most cases, the east stockpile alternative did not change the potential environmental effects compared to the Proposed Project. However, in some instances, the east stockpile alternative changed the magnitude of the potential environmental effects. Wetlands are the resource most affected by the east stockpile alternative by preventing the impact to approximately 100 acres of wetlands.

ES TABLE 1: SUMMARY OF PROPOSED PROJECT POTENTIAL IMPACTS, MITIGATION AND MONITORING MEASURES

Major Environmental Resource	Potential Environmental Impact	Incorporated Into Proposed Project	Additional Identified Measures[1]
Wildlife Resources	• Loss of wildlife habitat in Proposed Project area and corridor obstruction • Loss of 30 state-listed T&E plants • Likely to affect, but not adversely affect gray wolf • 41 acres of farmland soils • 761 acres of wetlands • 560 acres of forest	• Revegetation through Mineland Reclamation Minnesota Rules Chapter 6130 • On-site wetland creation in inactive tailings basin • Maximize in-pit stockpiling	• Transplantation of endangered plant species • Land acquisition and preservation of endangered plant species sites • Conservation research funding • Ensure that Corridor #4 which is outside of the Proposed Project footprint remains open • Additional in-pit stockpiling, if feasible • Consider monetary contributions from proposed projects that could be used by the MNDNR or the USFS to manage or create forest land
Water Levels, Fisheries and Aquatic Resources	Potential effect to Hay Creek due to bankfull flows, but no significant effect from the Proposed Project anticipated to fisheries and aquatic resources or other water bodies	• Water quality monitoring required through NPDES/SDS permit • Monitoring of dewatering pumping flow rates	• Monitoring of water levels in Swan Lake • If necessary, modification to outlet weir to control Swan Lake water levels and flow to Swan River • If dewatering rates differ from projected, additional stream and lake monitoring and/or biological monitoring of habitat could occur • Conversion of mine pits to public fishing resources after project completion
Wetlands	Approximately 761 acres of wetland impacts.	• On-site wetland creation within inactive tailings basin area • Off-site mitigation in Aitkin County • Monitor wetlands adjacent to mine features • Control erosion from stockpiles	
Water Quality	• 10 mg/L modeled increase from existing concentration in Swan Lake sulfate concentration level (cumulative effect) • 2.6 mg/L modeled increase from the No Action Alternative concentration in Swan Lake sulfate concentration level (cumulative effect)	• Installation of a sulfate removal treatment system on the existing wet scrubber • Permit limits in NPDES/SDS permit • Water quality monitoring required through NPDES/SDS permit • Storm Water Pollution Prevention Plan (SWPPP) Best Management Practices (BMPs) • Revegetation through Mineland Reclamation Minnesota Rules Chapter 6130 • Collection and re-use of stormwater • Spill Prevention Control and Countermeasure (SPCC) Plan	• Installation of additional sulfate removal technology • Water re-use • Alternative water discharge location

ES TABLE 1: SUMMARY OF PROPOSED PROJECT POTENTIAL IMPACTS, MITIGATION AND MONITORING MEASURES

Major Environmental Resource	Potential Environmental Impact	Incorporated Into Proposed Project	Additional Identified Measures[1]
Air	• Fugitive dust emissions • Major stationary sources of air emissions • Air quality impacts to Class I areas • Air quality impacts to Class II areas • Mercury bioaccumulation in fish	• Testing and monitoring to confirm proper operation and compliance with emission limits • Continued implementation of fugitive dust control plan • Installation of best available air pollution control technologies • Using a mix of biomass and natural gas fuel to minimize Class I impacts • MPCA Implementation of the Mercury Air Emission Reductions Schedule of Compliance • Installation of activated carbon injection system on new line • Technology testing, installation of controls, and emission reductions at Minntac • Installation of dry scrubber air pollution control for SO_2 removal • Installation of a sulfate removal treatment system on the existing wet scrubber • Permit limits in NPDES/SDS permit • Low NOx burner	• Install additional emission reduction/control equipment • Enforceable reductions in emissions from the Proposed Project or nearby sources • Secure and retire tradable emission allowances • On-site green energy generation • Implementation of Regional Haze State Implementation Plan
Wild Rice	Unknown, however the changes in water levels and sulfate concentrations resulting from Proposed Project appear to be within the observed range of variation for lakes containing wild rice	• Installation of dry scrubber air pollution control for SO_2 removal • Installation of a sulfate removal treatment system on the existing wet scrubber • Permit limits in NPDES/SDS permit • Water quality monitoring required through NPDES/SDS permit	• Conduct follow-up field surveys to monitor the extent of wild rice and track changes in density • Monitor water levels in affected water bodies during critical life cycle stages of wild rice • Monitor sulfate concentrations in affected water bodies • Installation of additional sulfate removal technologies • Alternate discharge location and/or water re-use
Noise and Dust	• Noise during stockpile operations • Potential for tailings basin and stockpile dust	• Setbacks and quieting dozer equipment • Fugitive Dust Control Plan	• Noise monitoring
Historic Properties	Destruction of Bennett No. 2 Shaft Mine	• Phase III data recovery	
Trails and Recreation	• Current alignment for Hibbing South Spur Trail eliminated • 440 acres of land taken out of public access	• Re-route trail segment	

[1] One or more measures that could be undertaken by the Project Proposer as a permit condition, or if an action of the Proposed Project identifies an impact. Monitoring could be used to determine if impacts are occurring and to identify if and/or a type of mitigation which could be further implemented.

Steps in the Proposed Project Process

What is the estimated project schedule?

The Project Proposer has been working with the MNDNR and USACE to move the Proposed Project forward. An estimated timeline until full operation was created based on the steps in the regulatory processes including environmental review and permitting, as well as an anticipated construction schedule.

The Proposed Project timeline is dependent on numerous factors including completion of the EIS process, acquiring all necessary permits (federal, state and local), and the construction of the Proposed Project. The following timeline is presented to provide a general understanding of the anticipated project schedule, which is subject to change.

ES TABLE 2: Estimated Project Schedule

Complete the EIS, obtain permits and acquire project financing	2010 – 2011
Start construction Year 1 – Year 2	2011 – 2013
Complete construction and begin water management plan for the Proposed Project including dewatering of mine pits	2013 – 2015
Begin full operation of Proposed Project	2013 – 2015

What permits and approvals would be required prior to construction and operation of the Project?

ES Table 3 provides a list of the possible permits and approvals that have been identified for the Proposed Project. Additional details are included in Chapter 2.0 of the FEIS.

ES TABLE 3: Permits and Approvals

Unit of Government	Type of Application	Status
U.S. Army Corps of Engineers	Clean Water Act Section 404 Wetlands Permit	To be applied for
	Section 7 Endangered Species Act Consultation with U.S. Fish & Wildlife Service	To be completed by USACE
	National Historic Preservation Act Section 106 Determination for Cultural Resources	To be completed by USACE
U.S. Fish and Wildlife Service	Federal Endangered Species Permits	To be applied for
Minnesota Department of Natural Resources	Permit to Mine	To be amended, substantial change
	Water Appropriation Permit	To be amended
	Dam Safety Permit	To be amended
	Public Waters Permit	To be amended
	Wetland Conservation Act	To be amended
	Burning Permit (land clearing)	To be applied for, if needed
	Takings Permit (for Endangered or Threatened Species)	To be applied for
Minnesota Pollution Control Agency	Air Emissions Permit (Part 70 Operating Permit and PSD Construction Permit) – Major Permit Modification	To be applied for
	Clean Water Act Section 401 Water Quality Certification	To be applied for in conjunction with USACE Section 404 Permit Application
	NPDES/SDS Permit for Industrial Wastewater Discharge and Storm Water Discharge for Industrial Activity (Permit No. MN0031879) – Plant and Mine	Amendment in progress
	NPDES/SDS Permit for Industrial Wastewater Discharge and Storm Water Discharge for Industrial Activity (Permit No. MN0055948) – Tailings Basin	Amendment in progress
	Waste Tire Storage Permit	To be amended, if needed
	Storage Tank Permits (fuel tanks)	To be amended, if needed
	Hazardous Waste Generator License	To be amended
Minnesota Department of Health	Radioactive Material Registration (low-level radioactive materials in measuring instruments)	To be amended
City of Hibbing	Building Permit	To be applied for, if needed
	Shoreland Alteration Permit for construction in a shoreland management district	To be applied for, if needed
	Zoning Variance or CUP	To be applied for, if needed
City of Nashwauk	Zoning (Land Use) Permit	To be applied for, if needed

Organization and Content of the Final EIS

This FEIS analyzes potential impacts from the Proposed Project for various topics as identified in the FSDD. Volume I of the FEIS is broken into the following components:

- **Chapter 1** – **Introduction** provides a project overview, describes the purpose and need for the EIS and Proposed Project, and lists pollutants of interest that were analyzed in the FEIS.
- **Chapter 2** – **Government Approvals** lists and describes the various permits and agencies that would review the project prior to construction and operation.
- **Chapter 3** – **Alternatives and Proposed Actions** provides detailed information on the Proposed Project and the alternatives evaluated in the FEIS. It also describes the No Action Alternative, east stockpile alternative and current conditions of the existing Keetac facility.
- **Chapter 4 – Affected Environment and Environmental Consequences** describes the potentially affected environment in which the No Action Alternative, Proposed Project, and East Stockpile Alternative would occur. Environmental consequences of the Proposed Project and alternatives are analyzed and a discussion of potential impacts is presented for each topic area, considering short-term, long-term, beneficial, and adverse effects, and the significance of those effects.
- **Chapter 5** – **Cumulative Effects** presents the results of the analysis that identified the potential for cumulative effects within a local, regional, and in one case global context.
- **Chapter 6** – **Consultation and Coordination** describes how the MNDNR and USACE developed the FEIS in coordination with other state and federal agencies, tribal entities, and the public. The agencies' preferred alternative and the environmentally preferred alternative is discussed and identified in this chapter. This chapter also includes a distribution list of the individuals and organizations that will receive the FEIS.
- **Chapter 7** – **List of Preparers** provides a list of preparers and document reviewers, their qualifications, and areas of responsibility.
- **Chapter 8 – References** provides a list of references that were used during the evaluation and analysis for the FEIS and are cited in the FEIS text.
- **Figures and Appendices** are also included in the FEIS as Volume II and Volume III, respectively, and the reader is directed to these sources of information as needed throughout the FEIS.

What changed between the DEIS and the FEIS?

The public comment period for the DEIS identified areas within the text that needed to be revised or clarified. There are changes that occurred to the DEIS that are reflected in the FEIS. These changes have added clarity to the document as well as provided additional analysis of a stockpile alternative. Wetland impacts, updated analysis of potential impacts for Class I and II areas, discussion of financial assurance, and an expanded discussion of wild rice resources are some of the modifications.

The organization of the DEIS was based on the FSDD and potential project-specific impacts. These were discussed in both Chapter 4.0 and Chapter 6.0. The MNDNR and USACE determined that reorganization of the DEIS would provide more clarity to the reader of the FEIS. Additionally, it was logical to group and describe all project-specific topics and potential impacts together in one chapter and group related topics into new subsections. The combined chapter in the FEIS is Chapter 4.0 – Affected Environment and Environmental Consequences. Chapter 5.0 remained focused on cumulative effects, although some of the original subsection numbering changed based on grouping of related topics into the same subsections.

What are the findings of the FEIS?

Based on analysis and review completed for the FEIS, the Proposed Project with the East Stockpile Alternative would be the environmentally preferable alternative, and the agencies' preferred alternative for this project. It is also likely that this alternative would be the LEDPA. However, the LEDPA cannot be identified until the Section 404(b)(1) analysis is complete. The LEDPA will be identified prior to and presented in the ROD that will be prepared by the USACE.

The main difference between the preferred alternative and the Proposed Project with regard to potential environmental effects is the reduction in the number of wetland acres impacted under the preferred alternative. Although the preferred alternative would still significantly affect wetlands, the overall footprint of the east stockpile area would be reduced. This would reduce the number of acres of impacted wetlands by avoiding wetlands that would otherwise be affected by the proposed east stockpile. Approximately 100 acres of wetlands would be avoided under the preferred alternative compared to the Proposed Project.

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1.0 Introduction

1.1 PROJECT OVERVIEW

> The EIS is intended to provide information to units of government on the environmental impacts of a project before approvals or necessary permits are issued and to identify measures necessary to avoid, reduce, or mitigate adverse environmental effects.

United States Steel Corporation (Project Proposer) proposes to restart an idled production line and expand contiguous sections of the open pit iron ore mine at its existing Keetac mine and processing facility near Keewatin, Minnesota (see Figure 1.1). The physical expansion and increased rate of production of the Keetac facility is called the Proposed Project or Proposed Action Alternative. The Proposed Project requires an Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA). The Project Proposer has also agreed to completion of a discretionary EIS under the Minnesota Environmental Policy Act (MEPA). The Minnesota Department of Natural Resources (MNDNR) and United States Army Corps of Engineers (USACE) have jointly prepared this Final Environmental Impact Statement (FEIS) to evaluate the Proposed Project in accordance with MEPA, Minnesota Statute §116D, and NEPA, 42 USC §§ 4321-4347.

Keetac is located on the Mesabi Iron Range, a major, well-known geologic feature oriented roughly northeast to southwest across more than 120 miles of northeastern Minnesota from near Babbitt to near Grand Rapids. The Iron Range has been the largest source of iron ore produced in Minnesota since the 19th century, and Minnesota has been and continues to be the predominant source of iron ore in the United States.

Taconite mining and taconite pellet production have been ongoing at the Keetac site since 1967. Keetac began production using rotary hearth technology; this technology was soon abandoned for grate kiln technology. The original Phase I grate kiln pellet line began operation in 1969. In 1977, the Phase II expansion added a second grate kiln pellet line. The Phase I facility, however, was idled in December 1980. In 2003, U.S. Steel purchased the site from National Steel Corporation. Currently, there is one operational pellet producing line (Phase II) with an annual production rate of approximately 6.0 million short tons per year (MSTY). The Proposed Project would increase the taconite pellet production capacity by expanding the mine pit, adding stockpile areas, upgrading the concentrating and agglomerating processes, and restarting the Phase I line after significant refurbishing. For the purpose of the FEIS, the Phase I line will be referred to as the new line. The Proposed Project would increase Keetac's taconite pellet production output by 3.6 MSTY to a total annual output of 9.6 MSTY.

Keetac's footprint and the Permit to Mine facilities limit established by the MNDNR are shown on Figure 1.2, and include mining pit limits, waste rock and surface stockpile areas, and tailings basin area. The Keetac facility is an active operating mine that can continue taconite pellet production at 6.0 MSTY until about the year 2021 under existing permits. The Proposed Project would allow taconite pellet production of 9.6 MSTY at Keetac until about the year 2036. Environmental review has been completed on previous wetland-related impacts for existing Keetac operations through the Clean Water Act (CWA) Section 404 permitting process. The magnitude of the wetland impacts from the Proposed Project contributed to the USACE decision that a NEPA EIS process was required because the Proposed Project is a major federal action that may significantly affect the quality of the human environment.

At an estimated cost in excess of $300 million, the Proposed Project includes installation of energy efficient technologies and new emission controls at the plant, expansion of mining and stockpiling, upgraded concentrating and agglomerating processes, a vertical expansion of the tailings basin, and construction of a biomass processing facility. The Proposed Project would increase the mine, waste rock and surface material stockpiles, and tailings basin areas by a total of approximately 2,075 acres. Existing ore crushing facilities are adequate to accommodate existing operations as well as the Proposed Project. Existing infrastructure (public roads, railroads) and utilities (water, electric, gas and sewer) is also adequate for both existing operations and the Proposed Project. A spatial overview of the current and proposed Keetac footprint, including Proposed Project plans for the mine expansion, stockpile expansions, and tailings basin are shown on Figure 1.3.

> The purpose of the Proposed Project is to mine taconite from an expanded open pit mine at Keetac and to refurbish and operate the idle Phase I taconite processing line to increase taconite pellet production by 3.6 MSTY to a total output of 9.6 MSTY.

The indurating furnace equipment from the new line would be refurbished and fueled by natural gas and biomass with coal and fuel oil used as backup fuels. Upgrades to the concentrating, and agglomerating processes would be required to supply additional material to the refurbished and restarted indurating furnace equipment. Additional process water would be required to operate increased production in the facility. The height of the tailings basin would increase approximately 80 feet greater than the current elevation.

Mine planning and detailed design were prepared for a 25-year horizon. The Proposed Project would require additional environmental review and permitting, should the project extend beyond this 25-year mine plan. Expansion of the Proposed Project beyond that described in this FEIS might require supplemental environmental review.

A complete description of the Proposed Project is provided in Chapter 3.0.

1.2 PURPOSE AND NEED

The purpose of the Proposed Project is to increase the rate and total quantity of taconite pellet production at the Keetac facility using existing infrastructure. The need of the Proposed Project is to satisfy global demand for steel. The Project Proposer would achieve the project purpose by expanding an existing mine at Keetac and refurbishing and operating the currently idle Phase I taconite processing line to increase taconite pellet production by 3.6 MSTY to a total output of 9.6 MSTY. The Proposed Project need would be accomplished by shipping taconite pellets to steel mills, which would be used to produce steel to meet the domestic and worldwide demands.

1.3 ABOUT THE PROPOSER

United States Steel Corporation (U. S. Steel), headquartered in Pittsburgh, Pennsylvania is an integrated steel producer, with a raw steelmaking capacity of 31.7 MSTY. Producing steel for over 100 years, U. S. Steel has production operations in the United States, Canada, and Central Europe. The company manufactures a wide range of steel sheet and tubular products for the automotive, appliance, container, industrial machinery, construction, and oil and gas industries. U. S. Steel is also involved in transportation services (railroad and barge operations) and real estate operations.

The company operates two iron mines through its Minnesota Ore Operations on the Mesabi Iron Range. They are Minntac in Mt. Iron and Keetac in Keewatin. Minntac and Keetac both mine taconite and concentrate it into taconite pellets. More information about U. S. Steel is available on their website: www.ussteel.com.

1.4 FEIS PURPOSE AND OVERVIEW

The purpose of a FEIS is to:

- Evaluate the Proposed Project's potentially significant environmental and socioeconomic effects,
- Consider reasonable alternatives,
- Explore mitigation measures for reducing or avoiding adverse effects, and
- Provide information to the public and to project decisionmakers.

The FEIS is intended to provide information to units of government and the general public on the potential environmental effects of a project before approvals or necessary permits are issued and to identify measures necessary to avoid, reduce, or mitigate adverse environmental effects. The FEIS is not a means to approve or deny the Proposed Project.

1.4.1 Final Scoping Decisions – Level of Analysis

In September 2008, the MNDNR in partnership with the USACE prepared a Scoping Environmental Assessment Worksheet (SEAW) (see Appendix A) and a Draft Scoping Decision Document (DSDD) to provide information about the Proposed Project, identify potentially significant environmental effects, determine what issues and alternatives would be addressed in the EIS and the level of analysis required. Public notification and opportunities to receive information and public comment on the project began during the project scoping process. A notice of availability for review of the SEAW and DSDD was published in the September 8, 2008, Environmental Quality Board (EQB) *Monitor*. Publication of the *Monitor* notice initiated a 30-day public comment period and the joint state-federal scoping process. The 30-day public comment period concluded on October 8, 2008.

A public meeting was held during the comment period on October 1, 2008, at the Nashwauk-Keewatin High School in the City of Nashwauk to provide additional information on the Proposed Project and allow for comments (oral and written) and questions. The comments received during the scoping period were considered part of the scoping process, prior to the agencies issuing the Final Scoping Decision Document (FSDD) on November 5, 2008 (see Appendix B). Responses to public comments received during the scoping process are included in Appendix C. On November 17, 2008, the USACE published a Notice of Intent (NOI) to prepare an EIS in the Federal Register. The FSDD satisfies the scoping requirements of MEPA and NEPA and serves as the blueprint for preparing the EIS for the Proposed Project.

The Minnesota EQB Rules require that an EIS include at least one alternative of each of the following types, or provide an explanation of why no alternative is included in the EIS (Minnesota Rules, part 4410.2300, subp. G): alternative sites, alternative technologies, modified designs or layouts, modified scale or magnitude, and alternatives incorporating reasonable mitigation measures identified through public comments. The alternative of no action is also required to be addressed in the EIS. Alternatives evaluated in this EIS are presented in Chapter 3.0.

Environmental issues identified and described in the SEAW were placed into three categories in the FSDD by potential impact significance and level of analysis required in the EIS. These categories are briefly described below along with a list of topics that are included in each category. The FSDD describes in greater detail the issues and analyses to be included in this FEIS for each topic.

1.4.2 Topics Adequately Analyzed in the Scoping EAW

The following topics were reviewed and considered by the MNDNR and the USACE in the SEAW. It was determined that these topics were not relevant or were so minor that they would not be addressed in this FEIS.

- Water surface use
- On-road vehicle-related air emissions
- Compatibility with plans and land use regulations

1.4.3 Topics Analyzed in the EIS for Potential Impacts

During the EIS scoping process, the MNDNR and USACE determined a number of topics are not expected to present significant impacts, but would be further analyzed in the EIS using limited information beyond that provided in the SEAW commensurate with the level of anticipated impacts. These topics are included in the following list.

- Land use
- Cover types
- Water-related land use management district
- Erosion and sedimentation
- Water quality: surface water runoff
- Geologic hazards and soil conditions
- Solid wastes, hazardous wastes, and storage tanks
- Traffic
- Odors, noise, and dust
- Nearby Resources (Historic Properties, Recreational Trails)
- Visual impacts
- Infrastructure and public services
- Mineral fibers
- Tribal rights (Federal Trust Responsibilities)
- Economic and social impacts
- Mineland reclamation

The MNDNR and USACE also identified topics during the scoping process that may result in potentially significant impacts. These topics would require a substantial amount of additional information in the EIS beyond that included in the SEAW. Topics identified as needing substantial analysis in the EIS are included in the following list.

- Fish and wildlife
- State-listed (threatened, endangered or special concern) species, rare plant communities, or other sensitive ecological resources
- Physical impacts on water resources
- Water use
- Water quality: wastewater
- Stationary source air emissions
- Risk Assessment
- Wild rice (added after publication of the Draft EIS)

As a result of DEIS analysis, clarification of potential impacts was gained, and not all resources identified by the FSDD as potentially having significant impacts are expected to be significantly impacted. Conversely, some resources identified in the FSDD as potentially not having significant impacts may be impacted. EIS analysis evaluated each resource for potential environmental effects.

Based on analysis and findings of the DEIS, the structure of the FEIS was modified to combine the original Chapters 4.0 and 6.0 of the DEIS into one comprehensive chapter for the FEIS. This chapter, Chapter 4.0, covers all topics identified as potentially having impacts from the Proposed Project regardless of expected significance. Cumulative effects remain in a separate chapter, Chapter 5.0.

1.4.4 Cumulative Effects Analysis

The FSDD determined that the EIS would address the potential cumulative effects associated with combined environmental effects of the Proposed Project and of past, present and reasonably foreseeable future actions. The cumulative effects analyses outlined by the FSDD and presented in Chapter 5.0 include the following topics.

- Biomass
- Climate change
- Aquatic habitat and fisheries
- Wild rice resources (added after scoping)
- Mercury deposition and evaluation of bioaccumulation in fish in Northeast Minnesota
- Wildlife habitat
- Threatened and endangered species and species of concern
- Stream flow and lake level changes
- Inter-basin transfer of water
- Loss of wetlands
- Wastewater/water quality
- Class I Areas – Potential impact to air quality
- Ecosystem acidification from deposition of air pollutants
- Human health risk
- Ecological health risk

1.4.5 FEIS Organization

This FEIS analyzes potential environmental and socioeconomic effects from the No Action Alternative, Proposed Action Alternative, and East Stockpile Alternative. This FEIS also provides background information so that analyses of potential impacts from various alternatives and mitigation measures can be better understood while satisfying MEPA and NEPA requirements for an adequate EIS. Based on Council on Environmental Quality (CEQ) regulation 40 CFR 1502.10, this FEIS consistently uses several headings in Chapters 4.0 and 5.0. These headings are: Affected Environment, Environmental Consequences, and Mitigation Opportunities.

According to CEQ regulation 40 CFR 1502.15, the affected environment section should "succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration." The environmental consequences section forms the scientific and analytic basis for the alternative analysis.

> *The discussion will include the environmental impacts of the alternatives including the proposed action, any adverse environmental effects which cannot be avoided should the proposal be implemented, the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented* (CEQ regulation 40 CFR 1502.15).

Additionally, these rules require that mitigation measures for adverse environmental impacts be provided, which are included in this FEIS under the heading Mitigation Opportunities for each section.

1.5 POLLUTANTS OF INTEREST

Throughout this FEIS, pollutants are identified and discussed as they relate to a given emission or discharge from the Proposed Project. While the source of the pollutant may originate within the Proposed Project, the pollutant itself (which may cause an environmental impact), may be found in and around the Proposed Project at various distances and concentrations.

Below is a list of the major pollutants that are referenced within this FEIS. Included is a brief definition of the pollutant and the reason why the pollutant is being evaluated. A number of additional pollutants were also analyzed; however, this list represents those that are of most significance to the FEIS. The definitions below **do not** describe potential impacts from the Proposed Project.

- **Carbon Monoxide (CO)**: Carbon monoxide is a gas primarily released during combustion. At low concentrations, CO can cause fatigue in healthy people and chest pain in people with heart disease. At higher concentrations, CO can cause impaired vision and coordination: headaches, dizziness, confusion, nausea (USEPA, 2009A).
- **Greenhouse Gases (GHG)**: Greenhouse gases refer to a group of gases in the atmosphere that absorb and emit radiation of a specific wavelength. GHG exist in the atmosphere due to both natural and anthropogenic mechanisms. Increased GHG increase the temperature of the Earth's climate.
- **Lead (Pb)**: Lead is a malleable metal found in ore. Lead is also a powerful neurotoxin that accumulates in tissue over long periods of time. Lead is readily absorbed into the bloodstream after inhalation.
- **Mercury (Hg)**: Mercury is an elemental metal and the only metal that is a liquid at room temperature. Mercury is released from ore during taconite processing. Mercury can accumulate in tissue and exposure at high levels can harm the brain, heart, kidneys, lungs, and immune system.
  - Methylmercury is a highly toxic form of mercury that builds up in fish and animals that eat fish (USEPA, 2009A).
- **Nitrogen Oxides (NOx)**: Nitrogen oxide is a gas produced during combustion, generally from fuels. Nitrogen oxide can form nitric acid and fall to the Earth's surface as acid rain, potentially changing soil properties and water pH.
- **Ozone (O_3)**: Ozone is a gas present in the upper atmosphere and is important in protecting the Earth from the sun's radiation; however, ground level ozone is a harmful pollutant. Formed from volatile organic compounds, ozone is harmful to the respiratory systems of animals and can cause damage to plants.
- **Particulate Matter (PM)**: Particulate matter is tiny particles of solid or liquid suspended in a gas or liquid. PM can be released by burning fuel or processing of solid materials. Small particles less than 10 micrometers (PM_{10}) in diameter pose the greatest problem, because they can get deep into lungs, and some may even enter the bloodstream. Fine particles less than 2.5 micrometers in diameter ($PM_{2.5}$) are the major cause of reduced visibility (haze) in parts of the United States (USEPA, 2009A).
- **Sulfate (SO_4)**: Treatment of sulfate contributes to increased water hardness and conductivity. Sulfate may sometimes also be a factor in the process of mercury methylation and thus can contribute in the bioavailability of methylmercury.
- **Sulfur Dioxide (SO_2)**: Sulfur dioxide is a gas emitted through burning of sulfur containing items, primarily fuels. Sulfur dioxide can be oxidized to form sulfuric acid that falls to the Earth as acid rain, potentially changing soil properties and water pH.
- **Toxic Air Pollutants:** Toxic air pollutants, also known as hazardous air pollutants (HAPs), are those pollutants that are known or suspected to cause cancer or other serious health effects or adverse environmental effects. People exposed to toxic air pollutants at sufficient concentrations and durations may have an increased chance of getting cancer or experience other health effects (USEPA, 2009).

Discussion of potential project-related environmental impacts from these pollutants occur in several Chapters/Sections of this FEIS. Table 1.1 provides a summary of the various locations within this FEIS that the reader can review to understand the potential impacts associated with these pollutants.

TABLE 1.1 POLLUTANT INDEX

Section Number	Section Title
	CARBON MONOXIDE (CO)
3.3.5	Air Emissions
4.9.1	Emissions Inventory and Calculation of Emissions
4.9.3	BACT Review
4.9.6	Class II Area Impacts Analysis
	GREENHOUSE GASES (GHG)
3.3.5	Greenhouse Gas Emissions
5.2	Climate Change
	LEAD
4.9	Stationary Source Air Emissions
5.13	Risk Assessment
	MERCURY (Hg)
3.3.5	Air Emissions
3.3.5	Mercury Emissions Control
4.1.2	Fisheries and Aquatic Resources
4.4.1	Wastewater/Water Quality
4.9.7	Mercury Emissions/Mercury Balance/TMDL Implementation Plan Compliance
5.5	Mercury Emissions, Deposition and Bioaccumulation
5.13	Risk Assessment
	NITROGEN OXIDES (NOx)
3.3.5	Air Emissions
4.9.3	BACT
4.9.5	Class I Area Impacts Analysis
4.9.6	Class II Area Impacts Analysis
5.11	Class I Areas – Potential Cumulative Effect to Air Quality
	OZONE (O_3)
3.3.5	Air Emissions
5.2	Climate Change
5.12	Ecosystem Acidification Resulting from Deposition of Air Pollutants
	PARTICULATE MATTER
3.3.5	Air Emissions
4.9.1	Emissions Inventory and Calculation of Emissions
4.9.2	Fugitive Dust Control
4.9.3	BACT Review
4.9.4	MACT Compliance
4.9.6	Class II Area Impacts Analysis
5.11	Class I Areas – Potential Cumulative Effect to Air Quality
	SULFATE (SO_4)
3.2.3	Water Management
4.1.2	Fisheries and Aquatic Resources
4.4.1	Wastewater/Water Quality
5.3.2	Aquatic Habitat and Fisheries

Section Number	Section Title
4.7 & 5.4	Wild Rice Resources
5.5	Mercury Emissions, Deposition and Bioaccumulation
5.10	Wastewater/Water Quality – Cumulative Effects
5.11	Class I Areas – Potential Cumulative Effect to Air Quality
5.12	Ecosystem Acidification Resulting from Deposition of Air Pollutants
5.13	Risk Assessment
SULFUR DIOXIDE (SO_2)	
4.4.1	Wastewater/Water Quality
4.9.2	Fugitive Dust Control
4.9.3	BACT Review
4.9.5	Class I Area Impacts Analysis
4.9.6	Class II Area Impacts Analysis
5.2	Climate Change
5.11	Class I Areas – Potential Cumulative Effects to Air Quality
5.12	Ecosystem Acidification Resulting from Deposition of Air Pollutants
TOXIC AIR POLLUTANTS	
3.3.5	Air Emissions
4.9.1	Emissions Inventory and Calculation of Emissions
4.9.4	MACT Compliance

2.0 Government Approvals

All known potential government permits and approvals for the Proposed Project are listed below in Table 2.1, and explained further in the following sections. Although the FEIS provides information for use in permit issuance or denial, it is not required to gather or present all necessary permit-related information. No permits may be issued for the Proposed Project until the EIS is determined to be adequate.

TABLE 2.1 GOVERNMENT PERMITS AND APPROVALS FOR PROPOSED PROJECT

Unit of Government	Type of Application	Status
U.S. Army Corps of Engineers	Clean Water Act Section 404 Wetlands Permit	To be applied for
	Section 7 Endangered Species Act Consultation with U.S. Fish & Wildlife Service	To be completed by USACE
	National Historic Preservation Act Section 106 Determination for Historic Properties	To be completed by USACE
U.S. Fish and Wildlife Service	Federal Endangered Species Permits	To be applied for
Minnesota Department of Natural Resources	Permit to Mine	To be amended, substantial change
	Water Appropriation Permit	To be amended
	Dam Safety Permit	To be amended
	Public Waters Permit	To be amended
	Wetland Conservation Act	To be amended
	Burning Permit (land clearing)	To be applied for, if needed
	Takings Permit (for Endangered or Threatened Species)	To be applied for
Minnesota Pollution Control Agency	Air Emissions Permit (Part 70 Operating Permit and PSD Construction Permit) – Major Permit Amendment	To be applied for
	Clean Water Act Section 401 Water Quality Certification	To be applied for in conjunction with USACE Section 404 Permit Application
	NPDES/SDS Permit for Industrial Wastewater Discharge and Storm Water Discharge for Industrial Activity (Permit No. MN0031879) – Plant and Mine	Amendment in progress
	NPDES/SDS Permit for Industrial Wastewater Discharge and Storm Water Discharge for Industrial Activity (Permit No. MN0055948) – Tailings Basin	Amendment in progress
	Waste Tire Storage Permit	To be amended, if needed
	Storage Tank Permits (fuel tanks)	To be amended, if needed
	Hazardous Waste Generator License	To be amended

Unit of Government	Type of Application	Status
Minnesota Department of Health	Radioactive Material Registration (low-level radioactive materials in measuring instruments)	To be amended
City of Hibbing	Building Permit	To be applied for, if needed
	Shoreland Alteration Permit for construction in a shoreland management district	To be applied for, if needed
	Zoning Variance or CUP	To be applied for, if needed
City of Nashwauk	Zoning (Land Use) Permit	To be applied for, if needed

The following sections provide a brief description of each of the permits or approvals for the Proposed Project listed in Table 2.1 above.

2.1 UNITED STATES ARMY CORPS OF ENGINEERS

The USACE regulatory programs include Section 404 of the CWA (33 USC § 1344). As part of the Section 404 permitting process, the USACE will perform a Section 404(b)(1) Guidelines analysis, and can only issue a permit for the Least Environmentally Damaging Practicable Alternative (LEDPA). Additional information about the LEDPA is provided in Section 6.2. The USACE St. Paul District's regulatory jurisdiction covers the states of Minnesota and Wisconsin. Additionally, the USACE determines whether the EIS for the Proposed Project satisfies the environmental review requirements of NEPA and will prepare the Federal Record of Decision (ROD), which is required for the permitting process to proceed.

2.1.1 Section 404 Clean Water Act

Under Section 404, the USACE has regulatory authority over waters of the U.S. which includes jurisdictional lakes, rivers, streams, and wetlands. A Section 404 permit would be required for the discharge of dredged or fill material into waters of the U.S., including jurisdictional wetlands, for the various proposed mining activities including construction of new facilities, haul roads, stockpile areas, and tailings basin. The Project Proposer has agreed to a preliminary determination in which all wetlands impacted by the Proposed Project are considered jurisdictional.

The USACE generally requires compensatory mitigation for adverse effects to aquatic resources. This regulation establishes standards and criteria for the general compensatory mitigation requirements of the Section 404 permit. Specifically 33 CFR 332.3(n)(1) addresses financial assurance stating, "The district engineer shall require sufficient financial assurances to ensure a high level of confidence that the compensatory mitigation project will be successfully completed, in accordance with applicable performance standards." If a Section 404 permit is issued, financial assurances for the Proposed Project would be required as a condition of that permit. Financial assurance requirements for aquatic resource impacts would be based on the size and complexity of the mitigation project, the likelihood of success, past performance of the Project Proposer, all costs related to mitigation project development, and the form of financial assurance (e.g. performance bond, letters of credit or escrow accounts).

2.1.2 Section 7 Endangered Species Act Consultation with U.S. Fish and Wildlife Service

Section 7 of the Endangered Species Act [16 USC 1531 *et seq.*] requires federal agencies to consult with the USFWS to ensure that actions they authorize, permit or carryout would not jeopardize the continued existence of any listed species or adversely modify designated critical habitats. Section 7(a)(2) defines the consultation process, which is further developed in regulations promulgated at 50 CFR § 402. The USACE coordinates with the USFWS to fulfill the requirements of Section 7 as part of the Section 404 permitting process.

2.1.3 Section 106 National Historic Preservation Act Determination for Historic Properties

A determination of the Proposed Project's effects on historic properties will be made by the USACE pursuant to Section 106 of the National Historic Preservation Act as implemented by the Advisory Council on Historic Preservation's regulations found at 36 CFR Part 800. Completion of the Section 106 process, or execution of a programmatic agreement pursuant to 36 CFR § 800.14(b), will be required prior to the issuance of a USACE permit under Section 404 or a ROD for the EIS. Consultation is ongoing among the USACE, the Minnesota State Historic Preservation Office (SHPO), Project Proposer, and Ojibwe bands to conclude the Section 106 process.

2.2 MINNESOTA DEPARTMENT OF NATURAL RESOURCES

The MNDNR regulates activities that affect the state's natural resources, including those related to wetlands, water, mineral resources, and threatened and endangered species. These regulatory programs often require certain permits depending on the activity and its proposed magnitude. Additionally, the MNDNR is responsible for determining EIS adequacy pursuant to MEPA, which is required for the permitting process to move forward.

2.2.1 Permit to Mine

A Permit to Mine is required for any metallic mineral mining operations, pursuant to Minnesota Rules, part 6130.4200 and is issued by the MNDNR. The Permit to Mine application includes siting requirements, organizational data, environmental setting maps, environmental setting analysis, mining and reclamation maps, mining and reclamation plan, and an operating plan.

Once a permit has been issued, the applicant is required to provide: operating plans for forthcoming years of operation, not to exceed five years; an annual report for each year of operation; a deactivation plan must be submitted at least two years prior to deactivating any portion of the mining area; and a request for release submitted upon completion of approved deactivation plans.

Additionally, Minnesota Rules 6130.6000 set forth the circumstances for requiring a performance bond, or other security acceptable to the commissioner, on a mining operation. A performance bond is a financial means to assure that a project proposer will comply with the conditions of their Permit to Mine. A performance bond can be required by the MNDNR at any time pending a permit application, during the mining operation, or following completion of mining if a project proposer fails to perform reclamation, meet the requirements of Minnesota Rules Chapter 6130 or fails to conduct necessary research. A bond may also be required if there is reasonable doubt that the operator will be financially able to comply with the Permit to Mine or the rules. A project proposer is required to stay in compliance with the conditions of their Permit to Mine, including reclamation and closure requirements, pursuant to Minnesota Rules, parts 6130.1000 to 6130.4700.

If it is determined that financial assurance is required, the company would provide a detailed listing of all outstanding obligations requiring reclamation and the costs associated with each. That submittal would be reviewed by the MNDNR to determine if the list of obligations is complete and if the dollar amount is adequate. The financial instrument proposed would also be evaluated to be sure it is acceptable to the commissioner of the MNDNR.

Additionally, Minnesota Statute 93.49 Financial Assurance of Operator states, "The commissioner shall require a bond or other security or other financial assurance satisfactory to the commissioner from an operator. The commissioner shall review annually the extent of each operator's financial assurance under this section."

U.S. Steel is the signatory on the Permit to Mine for the existing Keetac operation. Keetac is a wholly owned subsidiary of U.S. Steel, thus the parent company of Keetac has signed the current Permit to Mine.

It was signed on October 21, 2003. The financial assurance is the guarantee of the corporation by their signature on the Permit to Mine. After the environmental review is completed and the permit amendment application is completed and has been noticed to the public, an amendment can be signed. This amendment would then incorporate all changes to the Proposed Project based on the expansion and alternatives and/or mitigations selected. This financial assurance would include costs associated with compliance with Wetland Conservation Act (WCA).

During the life of the Permit to Mine, the company is required to submit both annual reports (i.e., descriptions of the activities conducted on site in the preceding year) and operating plans (i.e., descriptions of what is planned to occur on site in the upcoming year). Each of these plans is reviewed for compliance with the permit. This review, combined with various site visits during the year, would call attention to any components of the plan that are outside the parameters of the permit and allow for adjustment, correction, permit amendment, or establishment of financial assurance, as necessary.

2.2.2 Water Appropriation Permit

Pursuant to Minnesota Statutes § 103G and Minnesota Rules Chapter 6115, a water use (appropriation) permit from MNDNR is required for all users withdrawing more than 10,000 gallons of water per day or one million gallons per year. A water appropriation permit from the MNDNR for the current and proposed Keetac footprint would be amended for dewatering of existing and proposed mine pits to accommodate planned mining activities.

2.2.3 Dam Safety Permit

Minnesota Rules, parts 6115.0300 through 6115.0520 for Public Water Resources describe the requirements pertaining to dam safety permits for new construction, repair, alteration, removal, and transfer of property containing a dam. A dam safety permit would be needed from the MNDNR for construction and maintenance of proposed improvements to the dams in the tailings basin.

2.2.4 Wetland Conservation Act

The MNDNR has been designated as the Local Government Unit (LGU) for the implementation of the Minnesota Wetland Conservation Act (WCA) for the Proposed Project. An amendment to the Project Proposer’s WCA Wetland Permit Application and Replacement Plan would be prepared and submitted to the MNDNR for WCA approval for unavoidable wetland impacts associated with the Proposed Project. This approval would be administered under the Permit to Mine and would be coordinated with the USACE Section 404 permit.

Minnesota Rules 8420.0522 outlines the replacement standards for wetlands as regulated under WCA. Minnesota Rules 8420.0522, subp. 9(A) and (B) discuss financial assurance requirements for compensatory wetland mitigation stating, "(A) For wetland replacement that is not in advance, a financial assurance acceptable to the local government unit must be submitted to, and approved by, the local government unit to ensure successful replacement. The local government unit may waive this requirement if it determines the financial assurance is not necessary to ensure successful replacement. The local government unit may incorporate this requirement into any financial assurance required by the local government unit for other aspects of the project. (B) The financial assurance may be used to cover costs of actions necessary to bring the project into compliance with the approved replacement plan specifications and monitoring requirements." The financial assurance requirements would be part of the WCA permitting process for the Proposed Project.

As described in Section 2.2.1, U.S. Steel is the signatory on the Permit to Mine, which financial assurance that includes costs associated with compliance with WCA. Section 2.2.1 provides further detail about the obligations of financial assurance under the Permit to Mine.

2.2.5 Burning Permit

An open burning permit would be required from the MNDNR if trees, brush, and other vegetative materials are burned on-site as part of any land clearing activities conducted for the Proposed Project. Local coordination with the cities of Keewatin and Hibbing may also be required.

2.2.6 Endangered Species Permit (Takings Permit)

A Takings Permit from the MNDNR is required for unavoidable impacts to State-listed threatened and endangered species pursuant to Minnesota Statute § 84.09895 (Protection of Threatened and Endangered Species). Some species listed under Minnesota law are also listed under the Federal Endangered Species Act (see Section 2.1.2 above). The law and rules prohibit taking, purchasing, importing, possessing, transporting, or selling endangered or threatened plants or animals, including their parts or seeds, without a permit. For plants, taking includes picking, digging, or destroying. The law and rules specify conditions under which the Commissioner of the MNDNR may issue permits to allow taking and possession of endangered or threatened species.

Permitting decisions must be consistent with the intent of the law, which is to retain or restore healthy populations of native plants and animals. The Project Proposer would submit a Takings Permit Application to the MNDNR for threatened and endangered plants species that would be affected by the Proposed Project.

2.3 MINNESOTA POLLUTION CONTROL AGENCY

2.3.1 Air Emissions Facility Permit

The MPCA has delegated authority from USEPA for the implementation of the Prevention of Significant Deterioration (PSD) regulations under Minnesota Rules, part 7007.3000, which requires that

> *Any person who constructs, modifies, reconstructs, or operates an emissions unit, emission facility, or stationary source must meet the requirements of Code of Federal Regulations, title 40, part 52.21(b)-(f) and (h)-(w), as amended, entitled Prevention of Significant Deterioration of Air Quality, which is adopted and incorporated by reference.*

Based on the potential-to-emit (PTE) for all pollutants, the Proposed Project is subject to PSD review and the Part 70 operating permit program. Therefore, the Project Proposer is required to obtain an air emissions permit to construct and operate the Proposed Project.

2.3.2 Section 401 Water Quality Certification

The MPCA is responsible for Section 401 water quality certification required for Section 404 permits issued by the USACE. Section 401 of the CWA (33 USC § 1341) requires that activities that may result in discharges to navigable waters and require a federal license or permit to construct, modify, or operate (i.e., Section 404 permits), must be conducted in compliance with Sections 301, 302, 303, 306, and 307 of the CWA. These portions of the CWA are directives for the development of state water quality standards. In order to ensure these activities comply with the CWA and the state water quality standards, a determination is made by the state agency with primary water quality regulatory responsibilities under the CWA. Such a determination is known as a 401 Water Quality Certification.

In Minnesota, the MPCA is the delegated agency responsible under Minnesota Statute 115.03 Powers and Duties for making certification determinations on federal permits that affect waters of the state. MPCA would evaluate whether to issue Section 401 certification for any Section 404 permit.

2.3.3 National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) Discharge Permits

The NPDES permitting authority, delegated to the MPCA by the USEPA, regulates wastewater and stormwater discharges to lakes, streams, wetlands, and other surface waters in Minnesota. State Disposal System (Minnesota Statute § 115) permits regulate the construction and operation of wastewater disposal systems, including land treatment systems. Together, NPDES/SDS permits establish specific limits and requirements to protect Minnesota's surface and groundwater quality for a variety of uses, including drinking water, fishing, and recreation.

For Minnesota industrial facilities, the MPCA issues these permits as consolidated water quality management permits. An individual NPDES/SDS permit for an industrial facility may cover a number of different waste types and activities, including industrial process wastewater, cooling water and stormwater.

An SDS permit is required for operation of the tailings basin as a private disposal system because of seepage from the basin to groundwater. An NPDES discharge permit is also needed for surface water discharge from the tailings basin. An NPDES discharge permit is needed for the discharge of maintenance dewatering water from the mine pits and stormwater collected from active mining and processing areas. Finally, an NPDES construction stormwater permit would also be needed to regulate stormwater management during initial pit dewatering, pre-stripping, and construction. Further description of stormwater discharge permits required for industrial and construction activities are provided below.

2.3.3.1 NPDES/SDS Permit for Industrial Wastewater Discharge and Storm Water Discharge for Industrial Activity

This permit addresses two changes: 1) a modification of the industrial wastewater discharge permit for maintenance dewatering of the mine pits and changes in the plant discharges to the tailings basin, and 2) stormwater discharges from the developed areas of the project site. The Minnesota Storm Water Program for industrial activity is designed to reduce the amount of pollution that enters surface and groundwater from industrial facilities in the form of stormwater runoff. The primary requirement is the development and implementation of a stormwater pollution prevention plan (SWPPP). This plan identifies potential pollutant sources at the Proposed Project, outlines operation procedures for material handling activities, and describes controls and best management practices that would be implemented to minimize pollutants in stormwater runoff. The Project Proposer has a current SWPPP, which would be amended to include the Proposed Project.

The Project Proposer currently has two NPDES/SDS permits for operation of the Keetac facility. These are Permit No. MN0031879 for the plant and mine discharges and Permit No. MN0055948 for the tailings basin. Permit No. MN0031879 would require a modification amendment for the Proposed Project for increased dewatering from the Mesabi Chief, Perry, and Aromac Pits as part of mine pit expansion. The Proposed Project would also require a modification amendment to Permit No. MN0055948 due to changes at the plant discharges to the tailings basin.

2.3.3.2 NPDES/SDS General Storm Water Discharge Permit for Construction Activity

Construction projects in Minnesota that disturb one acre or more of land must obtain coverage under Minnesota's NPDES general stormwater discharge permit for construction activity. The permit application certifies that temporary and/or permanent erosion and sediment control plans have been prepared and implemented to prevent soil particles from being transported off-site both during and after construction. The permit requires the applicant to prepare a SWPPP that applies best management practices for controlling and managing stormwater runoff during and after construction.

2.3.4 Storage Tank Permits

Storage tank permits are required for aboveground storage tanks and underground storage tanks containing petroleum products or hazardous materials. These permits include operational limits and construction requirements that help prevent or minimize the potential for significant environmental effects. Requirements include tank registration with the MPCA, a secondary containment area, routine monitoring for leaks, corrosion protection for the floor of the tank, overfill prevention equipment, and areas where substances are transferred must be equipped with spill containment. No new storage tanks are proposed.

2.3.5 Hazardous Waste Generator License

An entity who generates hazardous waste must obtain a hazardous waste generator license for each individual generation site. The procedures for application and issuance of a hazardous waste generator license are described in Minnesota Rules Chapter 7045. A permit application for a new treatment, storage, or disposal facility or activity must be submitted to the MPCA for review and approval before the planned date of the commencement of facility construction of the activity.

2.4 MINNESOTA DEPARTMENT OF HEALTH

2.4.1 Radioactive Material Registration

Types and quantities of radioactive materials that may be possessed and used, as well as any specific restrictions on their use are licensed by MDH. Typically, licenses describe the location of use, the training and qualifications of workers, specific procedures for using the materials, and any special safety precautions required. The license holder must follow the specific license requirements as well as the more general MDH rules.

2.5 LOCAL APPROVALS

There are five local governments that potentially have jurisdiction over portions of the Keetac facility. These are Itasca County, St. Louis County, the City of Hibbing, the City of Keewatin, and the City of Nashwauk. Of the five local governments, the City of Hibbing and City of Nashwauk would regulate one or more aspects of the Proposed Project.

2.5.1 City of Hibbing

The City of Hibbing zoning permits are required for new construction, replacement, or additions onto a structure, new installation or alteration of Individual Sewage Treatment System (ISTS), grading/filling or excavation in a Shoreland District, alteration of wetlands and public waters, and other permits including variances, conditional uses, planned unit developments (PUDs) and rezoning.

2.5.1.1 Building Permit

The City of Hibbing has adopted the Minnesota State Building Code, which is enforced through staff review of building plans and permit applications, issuance of building permits, and requirement of a wide range of field inspections to ensure compliance with state and local building and zoning codes. The Proposed Project includes a new building to house upgraded processing equipment. Construction of the new building would require a local building permit.

2.5.1.2 Shoreland Alteration Permit

Minnesota Rules, part 6130.1300 indicates that shoreland management areas should be avoided for mining activity. A shoreland alteration permit is required from the City of Hibbing for any grading/filling or excavation within the Shoreland Overlay District established under the City zoning ordinance. The Shoreland Overlay District is defined as the area surrounding a designated water body, extending out 1,000 feet from the ordinary high water level (OHW) of lakes/wetlands and 300 feet from streams. The Welcome Lake Shoreland Overlay District is adjacent to the Keetac plant.

2.5.1.3 Zoning Variance, Conditional Use Permit

Variances are necessary when compliance with the setback or lot size requirements cannot be achieved. Conditional Use Permits (CUPs) are necessary for certain land uses or development generally that would not be appropriate or without restriction in a particular zoning district, but may be allowed with conditions. A rezoning or map amendment would involve changing the zoning district from one to another. These applications require a public hearing process and review by the City of Hibbing Planning Commission/Board of Adjustment.

2.5.2 City of Nashwauk

2.5.2.1 Zoning (Land Use) Permits

The proposed south stockpile is located within the City of Nashwauk. City plan approval and permits may be required prior to construction.

3.0 Proposed Action and Alternatives

This chapter provides information on evaluated alternatives and the proposed action. Minnesota Rules require EIS studies to include a discussion of the No Build, or No Action Alternative, in addition to discussing the impacts of the Proposed Project. The Keetac facility exists, therefore the term No Build is not applicable. Instead, for this FEIS this alternative is referred to as the No Action Alternative. A detailed description of the No Action Alternative is provided in Section 3.2. Section 3.3 presents the description of the Proposed Action Alternative also referred to interchangeably in this FEIS as the Proposed Project.

The Minnesota Rules require EIS studies to include at least one alternative of each of the following categories or provide a description of why no alternative is included in the EIS (Minnesota Rules, part 4410.2300, subp. G). Minnesota Rules, part 4410.2300, subp. G states that:

> *An alternative may be excluded from the EIS analysis when it does not meet the underlying need for or purpose of the project, it would likely not have any significant environmental benefit compared to the project as proposed, or another alternative, of any type, that will be analyzed in the EIS would likely have similar environmental benefits but substantially less adverse economic, employment, or sociological impacts.*

Keetac is currently the westernmost active taconite mine within the Iron Range in northeastern Minnesota. The taconite pellet processing plant and most of the tailings basin are located in St. Louis County, but a large part of the mine pit area is located in Itasca County.

NEPA requirements are described in 40 CFR 1500-1508. NEPA 40 CFR 1502.14 requires that an EIS "present the environmental impacts of the proposal and the alternatives in comparative form," including evaluation of all reasonable alternatives, eliminated alternatives, the no action alternative, and appropriate mitigation measures.

Alternatives are discussed further in Section 3.3.5 through Section 3.6.

- Alternative Sites (Section 3.4)
- Alternative Technologies (Section 3.3.5.1)
- Modified Designs or Layouts (Section 3.5)
- Modified Scale or Magnitude (Section 3.6)

3.1 EXISTING CONDITIONS

Keetac is currently the westernmost active taconite mine within the Iron Range in northeastern Minnesota. The processing plant is located approximately one mile northeast of Keewatin, in Sections 18 and 19 of Township 57 North, Range 21 West, St. Louis County. The Iron Range has been producing iron ore since the late 19th century and remains today the largest source of iron ore in the United States.

Keetac's open pit mine straddles the Itasca County/St. Louis County line. An aerial plan overview of Keetac, including the processing plant, mine pits, stockpiles, and tailings basin are shown in Figures 1.2 and 1.3. The current operations are composed of two main areas: 1) the mining and stockpile areas and the processing plant, and 2) the tailings basin area. A tailings pipeline connects the two areas over Trunk

Highway (TH) 169. The taconite pellet processing plant and most of the tailings basin are located in St. Louis County, but a large part of the mine pit area is located in Itasca County.

Taconite mining and pellet production have been ongoing at the Keetac mine site since 1967, when the original Phase I taconite processing plant began operation by the Hanna Mining Company, operating agent for the assets of National Steel Pellet Corporation. In 1977, the Phase II expansion added a second grate kiln pellet line. The Phase I facility was then idled in December 1980 and remains idle today. In approximately 1987, National Steel Pellet Corporation became the sole owner and operator of the Keetac facility. The Project Proposer purchased the National Steel Corporation's assets in 2003, including the Keetac facility. Currently, there is one operational taconite pellet producing line (Phase II) with annual production of approximately 6.0 MSTY.

3.1.1 Mineral Resources

Taconite mining at Keetac occurs in the subcrop of the Biwabik Iron Formation of the Mesabi Iron Range. The subcrop of the Biwabik Iron Formation trends in an east northeast orientation over 100 miles from about the City of Grand Rapids to about the City of Babbitt and varies in width from one to three miles, dipping southeast five to seven degrees.

> Keetac's taconite ore body is mined by open-pit methods. After overburden is removed, waste rock and taconite are drilled, blasted, and loaded into mine trucks by diesel-hydraulic shovels.

The iron formation is the uppermost bedrock at the Keetac mine. It is generally covered by a 10 to 150 foot thick layer of glacial drift that contains soil and rocks deposited during the recession of the last glaciers. The iron formation has a thickness ranging from 300 to 700 feet. The iron formation is divided into four layered members. From top to bottom, as shown in Figure 3.1.1., these are Upper Slaty, Upper Cherty, Lower Slaty, and Lower Cherty. The Pokegama formation lies below the iron formation.

The low-grade magnetic iron ores, known as taconite, are mined predominantly from the Lower Cherty member plus smaller amounts with portions of the taconite ore coming from both the Upper Cherty and Upper Slaty members where the iron content is high enough and the silica content is low. The Upper Cherty ore is highly transitional and has a thickness ranging from 0 to 90 feet, roughly equal to 0 to 15 percent of the total formation thickness. The Lower Cherty ores are typically 120 to 160 feet, roughly equal to 25 to 30 percent of the total iron formation. These members are subdivided into a number of primary and secondary units, based on texture, layering, and variable distribution of the iron-bearing mineral suite.

The minerals found within the Upper and Lower Cherty magnetic taconite ore horizons are essentially the same. As identified by x-ray powder diffraction and microscopic studies, the minerals are overall fine-grained, intimately intergrown, and consist of quartz, magnetite, hematite, sideritic and ankeritic iron carbonates, iron silicates, chlorite, minnesotaite and stilpnomelane. Trace amounts of greenalite, talc, apatite, chamosite, and pyrite-marcasite have been noted in some individual specimens. Hematite occurs both as a primary mineral and as a secondary oxidation product after magnetite. All major iron-bearing minerals are present in each horizon ore unit. They may occur in various combinations and are generally disseminated in quartz-rich layers and concentrated in thinner iron-rich layers.

Based on work by Hanna Mining Company, then National Steel Pellet Company, and now the Project Proposer, the taconite has the mineral percentages represented in Table 3.1.1.

TABLE 3.1.1 TACONITE ORE COMPOSITION

Mineral	Mean Composition	Variability[1]
Iron oxides	28%	18-38%
Quartz	42%	33-55%
Iron silicates	15%	3-24%
Iron carbonates	15%	<1-23%
TOTAL	100%	

[1] Extremes in variability are related to secondary oxidation and leaching of the uppermost ore units.

Keetac operates under a number of permits and a mine plan, which outline how taconite is mined, processed, and transported. Section 3.2 describes the current taconite mining and processing at the facility, which is the process that would be continued under the No Action Alternative.

3.1.2 Taconite Processing

Keetac's taconite ore body is mined by open pit methods. After overburden is removed, waste rock and taconite are drilled, blasted, and loaded into mine trucks by diesel-hydraulic shovels. The raw ore is trucked to the primary crusher. Waste rock is used to construct dikes and haul roads or placed in waste rock stockpiles. During and following each phase of mining, reclamation of the overburden and waste rock stockpile slopes is completed according to MNDNR mineland reclamation requirements (Minnesota Rules Chapter 6130).

Crude ore is trucked from the pits to the primary crusher for size reduction to approximately eight inches in diameter. Crushed ore is conveyed to the existing crude ore storage building. From the crude ore storage area, crushed ore is conveyed to the concentrator where the magnetic iron oxide minerals (concentrate) are separated from the nonmagnetic waste (tailings). In the concentrator, the ore passes through a series of wet mills that grinds the rock to a flour-like consistency. Magnetic separators separate the magnetic iron minerals (concentrate) from the waste rock. Concentrate is pumped to the pellet plant. Waste rock (tailings) from the concentrator are pumped to the tailings thickeners where excess water is removed by sedimentation. There are three thickeners in operation. After thickening, the tailings slurry is pumped to the tailings basin for disposal.

In the pellet plant, wet iron oxide concentrate is dewatered in vacuum filters, mixed with binder and limestone, and then converted to unfired pellets in balling drums. The water that is removed by the vacuum filters is reused in the process. The unfired pellets are moved to the existing indurating furnace in the Phase II line and fired into hardened taconite pellets. The fired pellets are cooled and conveyed to a stockpile and loaded into rail cars for shipping.

3.1.3 Tailings Management

The tailings basin is located south of the mine and plant site, approximately one mile southeast of the City of Keewatin (see Figure 1.2). Approximately 13 million long tons per year (MLTY) of taconite process tailings are generated from the production of 6.0 MSTY of taconite pellets. Two pipelines within the same corridor direct the tailings from a lift station at the plant site to the tailings basin. The pipelines are elevated over TH 169.

The facility limit of the Permit to Mine for the tailings basin extends further south than the actual footprint of the tailings basin. Initially a larger area was used for the tailings than the current configuration. Figure 3.1.2 depicts the location of the current tailings basin dam, as well as a previously constructed dam used until approximately the mid-1990s when the new dam was constructed. The area between the old and new dam has been used for the creation of wetlands as part of the Project Proposer's on-site wetland mitigation strategy.

3.1.4 Water Management

The Project Proposer is currently permitted to pump water from the mine area in order to conduct mining operations, facilitate the disposal of tailings, and maintain surface waters. Figure 3.1.3 illustrates the current water flow direction at Keetac (i.e., mine pit dewatering) and the flow direction of water in area streams. Table 3.1.2 details the current water appropriations and permitting volume.

The majority of the Keetac facility is located within the Upper Mississippi major watershed with a small portion of the existing southeast stockpile and tailings basin exterior dam located in the Lake Superior major watershed. The minor watersheds affected by the Proposed Project, as shown on Figure 4.1.1, include:

- O'Brien Creek Watershed
- Hay Creek Watershed
- Welcome Creek Watershed
- Upper reaches of East and West Swan River Watersheds (Lake Superior Watershed)

TABLE 3.1.2 WATER APPROPRIATIONS PERMIT NO. 65-0351 – PERMITTED VOLUMES

Appropriation Location/ Discharge Location	Permitted Volume (GPM) [1]	Volume (MGY) [2]
Section 18 Mine "N-3" to Reservoir 5	900	---
Bennett Mine "N-4" to Reservoir 5	3,000	---
Section 18 Mine "N-7" to Reservoir 5	2,500	---
Stevenson Mine to Reservoir 5	2,400	---
Mesabi Chief Mine to O'Brien Creek and Reservoir 4 (O'Brien Reservoir)	4,000	---
TOTAL	**12,800**	**6,728**

[1] Gallons Per Minute
[2] Million Gallons Per Year

3.1.4.1 Processing Plant Consumptive Uses

The Project Proposer recycles water as part of taconite processing operations. Figure 3.1.4 is a water process flow diagram of Keetac's current water management system. Reservoir Five is used to replace water that is consumed by taconite processing operations. Reservoir Six contains water that is comprised, in part, of water that is recovered from the tailings deposition process, facility stormwater, and process water. Water from Reservoir Six is pumped to the processing plant (Wolf Hill Head Tank) for process water use. The following paragraphs provide a discussion of water use at Keetac under existing conditions.

3.1.4.1.1 Crusher

Crushing operations use a relatively small quantity of water for existing dust control and dust collector equipment. Process wastewater is produced and collected in the bottom of two coarse crushers located in the Section 18 Pit. Crusher #1 and Crusher #2 process wastewater is pumped to Sump #1 and then to Reservoir 5. This water is discharged via a sump to Section 18 Pit. Minor losses of water occur in the crusher due to evaporation. Water used in the crusher is recycled following discharge to Section 18 Pit, which is pumped to Reservoir Five.

3.1.4.1.2 Concentrator

The concentrator uses water to transport tailings in a slurry form to the tailings basin for disposal. The concentrator obtains the majority of its water via recycled water from Reservoir Six through the Wolf Hill Head Tank, which consists largely of water that has been collected from Keetac's tailings basin.

3.1.4.1.3 Plant

In the pellet plant, water is consumed when moist pellets are dried (prior to induration) and fired (indurated) resulting in water loss to the atmosphere. The wet scrubber operating on the existing Phase II indurating line incurs additional evaporation losses. Treated blowdown water from the existing Phase II wet scrubber is discharged to the tailings basin.

3.1.4.1.4 Tailings Basin

Tailings slurry from the concentrator and wet scrubber blowdown from the pellet plant is pumped from the plant area and spigotted into the tailings basin. As tailings are deposited by settling, water is trapped in the pore spaces of the deposited tailings (voids loss) resulting in a loss of water. Additionally, there are evaporation losses from the open water surface of the tailings basin and some water seepage from the bottom of the tailings basin. Seepage can result in groundwater mounding under the tailings basin, which ultimately flows in the general direction of the surface water in the inactive area of the tailings basin.

3.1.4.1.5 Existing Wells and Public Water Supply

The Keetac facility has two water supply wells (Unique Well Nos. 249517 and 248614) that supply water for potable and sanitary use at the facility and emergency pellet process cooling.

3.1.4.1.6 Stormwater

The current water management strategy at Keetac is to collect surface water runoff from all developed areas of the facility, route it to on-site stormwater ponds/reservoirs, and use all captured runoff. Stormwater from all developed areas of the facility is routed to a series of ten settling basins and ultimately discharged to Welcome Creek. Stormwater runoff in the mining areas is co-mingled with mine dewatering and discharged with those volumes. The facility has an NPDES permit and a SWPPP in place, which regulate stormwater discharge.

3.1.5 Air Emissions

Existing operations produce air emissions from stationary and mobile sources as listed below. Further discussion on air emissions related to the Proposed Project is found in Section 4.9.

Air emission sources for the Proposed Project include:

- Fugitive emissions from mining
- Fugitive emissions from ore crushing
- Fugitive emissions from tailings basin
- Fugitive emissions from stockpiles
- Emissions from taconite pellet induration furnaces
- Emissions from materials handling
- Fugitive emissions from overburden stripping
- Fugitive emissions from drilling and blasting of waste rock and taconite ore
- Fugitive emissions from loading and unloading of raw materials
- Fugitive emissions from ore dumping to crusher

- Fugitive emissions from conveyors
- Fugitive and exhaust emissions from vehicle traffic in mine

3.2 NO ACTION ALTERNATIVE

3.2.1 Introduction

Keetac is an operating taconite mine and taconite pellet processing facility. The No Action Alternative is defined as the continued operation of the mine and processing facility which would produce approximately 6.0 MSTY of taconite pellets. The No Action Alternative describes potential environmental and socioeconomic effects that would occur if the Proposed Project is not developed and the facility continues to operate. Operations at Keetac are anticipated to continue for approximately 12 years (until 2021) without the Proposed Project.

> The No Action Alternative describes potential environmental and socioeconomic effects that would occur if the Proposed Project is not developed and the facility continues to operate. Mining at Keetac is anticipated to continue for approximately 12 years (until 2021) without the Proposed Project.

The No Action Alternative includes ongoing actions (mining, taconite processing, and transport) at Keetac that would occur under the existing Permit to Mine, existing wetland permits, actions occurring under permits that undergo procedural renewal at specified intervals (i.e., Title V air permit renews every five years), and permit amendments for actions that do not create an increased discharge or emission. The geographic boundary of the No Action Alternative encompasses areas within the current Permit to Mine boundary that have been or would be developed without the need for new permits. Figure 3.2.1 illustrates the geographic boundary of the No Action Alternative assuming the mine pit would continue to expand only within the existing Permit to Mine facility limit and where the existing permitted limits of stockpiles are of sufficient area to accept surface overburden and waste rock.

Within each topical section of the FEIS the potential environmental impact of the No Action Alternative is described. If mitigation measures are used at Keetac during existing operations, these measures are also described and the effectiveness of the mitigation discussed. This section describes the ongoing operations of the mine and processing facility at Keetac, which would continue under the No Action Alternative. The No Action Alternative means mining would not cease at Keetac until approximately 2021.

3.2.2 Mine Plan

Mine planning and detailed design were originally prepared for a 25-year horizon, and have been subsequently amended several times to maintain 25 years of permitted capacity for Keetac. Under the No Action Alternative and at current processing rates, the Keetac mine is expected to deplete recoverable taconite by the year 2021, if no additional new or amended permits are issued. With the No Action Alternative, mining would continue in the Aromac Pit, Mesabi Chief Pit, Section 18 Pit, and Stevenson Pit within the current Permit to Mine facility limit to produce a taconite pellet output of 6.0 MSTY for the next 12 years.

> The Project Proposer would stockpile overburden and waste rock in existing stockpiles and in-pit stockpiles to the extent possible limiting the mine life to 12 years under the No Action Alternative.

For the No Action Alternative, the overall stripping ratio is 0.5 tons of stripping to 1 ton of taconite. Taconite has to be uncovered prior to mining and since there are multiple benches of taconite, stripping must be completed several years prior to mining an area. Therefore, the stripping ratio would be approximately 0.75 tons of waste to 1.0 ton of taconite for the first eight years, then no stripping for the last four years of the 12-year No Action Alternative timeframe. With these stripping ratios, approximately 10 million tons of surface overburden/waste rock and 20 MSTY of crude ore would be mined per year until approximately 2021. Approximately 20 MSTY of crude ore is required to produce approximately 6 MSTY of taconite pellets.

Under the proposed mine plan Keetac has taconite ore reserves to continue mining for approximately 22 to 25 years; however, current permits do not allow the facility to extend operations beyond the current 12-year mining period without additional expansions of stockpile areas (part of Proposed Project).

3.2.2.1 Waste Rock and Overburden Stockpiles

Mining under the No Action Alternative is limited by the area available for stockpiles. The No Action Alternative boundary shown on Figure 3.2.1 encompasses an area that is less than the current and proposed Keetac footprint. Areas within the mine (south/west of Bennett Pit and south/east of Stevenson Pit) are within the existing Permit to Mine facility limit with available crude ore, however sufficient stockpile area is unavailable due to the volume of surface overburden/waste rock needed to be stockpiled. Furthermore, the ability to mine in the area south/east of the Stevenson Pit as well as stockpile within some areas of the existing southeast stockpile are limited due to the need for wetland permitting through Section 404 of the CWA. These wetland impacts would require NEPA environmental review prior to Section 404 permitting, and subsequent mining and stockpiling and therefore do not fall within the definition of the No Action Alternative as used in this FEIS.

The Project Proposer would stockpile waste rock in existing stockpiles and in-pit stockpiles to the extent possible. A major factor in determining the feasibility of in-pit stockpiling is the management of mineral rights. There are many general classes of waste rock such as magnetic lean ore, non-magnetic lean ore, non-iron bearing rock, glacial drift, and Cretaceous rocks. Different fee owners have different material classifications, and it may or may not be possible to mix stockpiles by rock type and fee owner, requiring the need for larger stockpile areas.

Figure 3.2.2 depicts the existing stockpile areas that would be used for the No Action Alternative, which are included in the existing limits allowed under the current Permit to Mine. Additional information about the maximization of in-pit stockpiles is found in Section 3.5.3.

3.2.2.2 Haul Roads, Access Roads and Rail Lines

The Project Proposer would use the existing haul roads to transport surface overburden to the stockpile areas and taconite from the mine to the crusher. An existing road on the south side of the plant provides access to the plant from TH 169. A rail siding on the south side of the plant provides access to the existing Burlington Northern Santa Fe (BNSF) tracks about one mile south of the plant and one mile east of the City of Keewatin. Existing access and haul roads are shown on Figure 3.2.3.

3.2.2.3 Taconite Processing

Under the No Action Alternative, processing of taconite pellets would continue at the plant using only the existing Phase II production line at a rate of 6 MSTY. This taconite production process is shown as a simplified flow diagram in Figure 3.2.4.

3.2.2.4 Tailings Basin

Vertical expansion of the tailings basin is ongoing under current operations using conventional upstream dike construction methods. It is estimated that the height of the tailings basin would increase by approximately 24 feet with the No Action Alternative compared to existing elevations, as shown on Figure 3.2.5. Horizontal expansion of the tailings basin would not occur under the No Action Alternative.

3.2.3 Water Management

3.2.3.1 Dewatering

Appropriations from the Perry Pit are not included on the Project Proposer's current water appropriations permit and NPDES/SDS permit. The Project Proposer has received approval from the MNDNR to conduct dewatering at this location based on their current mine plan. Dewatering of the Perry Pit is part of the No Action Alternative. Dewatering of the Perry Pit is needed for continued mining of the Aromac Pit and Mesabi Chief Pit. This area has been stripped of overburden in preparation for mining. In order to safely work and to reduce groundwater inflow into the adjacent active mining area of the Aromac Pit, U. S. Steel has proposed to draw the Perry Pit water level down twenty-five (25) feet from its current static level. To accomplish this drawdown, U. S. Steel proposes to pump the pit down in three phases.

- Phase I – 3,000 GPM for the first four months
- Phase II – 1500 GPM for the next two years
- Phase III – Maintenance pumping at 800 GPM

The receiving body of water for the Perry Pit dewatering is the O'Brien Creek which flows to the O'Brien Diversion Channel.

3.2.3.2 Processing Plant Consumptive Uses

The No Action Alternative would continue to use the current water management system. Existing water sources, which include mine pit dewatering, stormwater runoff, and wells, are sufficient to continue operations for the No Action Alternative. Additionally, stormwater runoff under the No Action Alternative would continue to be managed through the NPDES permit requirements and the Project Proposer's current water management strategy in compliance with the facility SWPPP and industrial stormwater rules.

3.2.4 Air Emissions

Operations under the No Action Alternative would produce air emissions. Since the continued operations are not expected to increase air emissions above current levels, the current MPCA air quality permit is applicable and could be reissued on its procedural 5-year permit intervals (based on current rules and standards). Mining would be managed to control avoidable dust pursuant to Minnesota Rules, parts 6130.3700 and 7011.0150.

3.2.5 Closure

Keetac must conform to Minnesota Rules Chapter 6130 for taconite and iron ore mineland reclamation. Mineland reclamation includes the mine area, stockpile areas, tailings basin, and other areas disturbed by mining related activities. Under the Permit to Mine requirements, the Project Proposer actively reclaims stockpiles, tailings basin, and other mining impact areas during operations.

According to the Permit to Mine, vegetation establishment is initiated within the first growing season after an area is no longer scheduled to be disturbed or used in a manner that would interfere with the establishment and maintenance of that vegetation. Reclamation techniques such as grading, disking, seeding or planting, fertilizing, and mulching are used in the establishment of vegetation.

Vegetation is established on surface overburden stockpiles, exposed soils along diversion channels and roads, borrow pits, benches and tops of rock and lean ore stockpiles, tailings basin dikes and dams, the surface overburden portion of pit walls, and areas exposed or disturbed during deactivation (i.e., building sites). A minimum of two feet of overburden (or approved alternative soil amendment) is placed on the required or approved vegetation areas of each bench and top of waste rock stockpiles. Lean ore, waste rock, and coarse tailings stockpile slopes within one-fourth mile of residential and designated public use areas are reclaimed to provide aesthetic and compatible areas.

3.2.5.1 Stockpiles

Keetac must conform to Minnesota Rules Chapter 6130 for taconite and iron ore mineland reclamation. Mineland reclamation includes the mine area, stockpile areas, tailings basin, and other areas disturbed by mining related activities.

In accordance with current reclamation requirements, under Minnesota Rules, parts 6130.2400 to 6130.2800 waste rock, lean ore, and coarse tailings stockpile exterior slope lifts are designed not to exceed 30 feet in height, or 40 feet in height if covered with overburden and vegetation. The width of the benches is equal to, or greater than, 30 feet wide, and the sloped area between the benches can be no steeper than the angle of repose.

Overburden stockpile lifts cannot exceed 40 feet in height or have a bench width of less than 30 feet wide. The overburden stockpile is sloped to control runoff and cannot be steeper than a 2.5 to 1 ratio. When mining activities reach the ultimate No Action Alternative pit limit, the surface overburden portion of the pit walls must follow standards listed in Minnesota Rules, part 6130.2900 for reclamation.

3.2.5.2 Tailings Basin

Reclamation activities in the tailings basin area are conducted on the basin and on the interior and exterior portion of the dikes and dams as they are completed according to Minnesota Rules, part 6130.3600 and in accordance with the Dam Safety Permit.

3.2.5.3 Vegetation Standards

After three growing seasons (five growing seasons if it is a south or west facing slope) the surface will be repaired or replaced if 90 percent ground cover, consisting of living vegetation and its litter, has not been established. The repair or replacement would take place during the next normal planting period after it is determined that 90 percent ground cover has not been established. Minnesota Rules, part 6130.3600, subp. 4B requires that within ten growing seasons after an area at the facility is no longer scheduled to be disturbed or used in a manner that would interfere with the establishment and maintenance of vegetation, the area would have a vegetative community with characteristics similar to those in an approved reference area and be self-sustaining, regenerating, or at a stage in a recognized vegetation succession which provides wildlife habitat or other uses such as pasture or timber land.

3.3 PROPOSED ACTION ALTERNATIVE

3.3.1 Introduction

The Proposed Action Alternative describes potential environmental and socioeconomic effects that would occur if the mine expands beyond the No Action Alternative. Also referred to as the Proposed Project, this alternative would increase taconite pellet production by 3.6 MSTY for a total annual output of approximately 9.6 MSTY.

The Proposed Action Alternative (Proposed Project) is the expansion of taconite pellet production capacity and mining. The Proposed Action Alternative requires new permits, or amendments to existing permits that increase discharges or emissions or allow for disturbing additional land. The Proposed Action Alternative describes potential environmental and socioeconomic effects that would occur if the mine expands beyond the No Action Alternative. Also referred to as the Proposed Project, this alternative would increase taconite pellet production by 3.6 MSTY for a total annual output of approximately 9.6 MSTY.

3.3.2 Proposed Project

The geographic boundary of the Proposed Project, shown on Figure 3.3.1, encompasses expansion areas of the mine that cannot be developed unless one or more permits are issued. A Section 404 permit under the federal CWA would be required due to wetland impacts that would occur as a result of the Proposed Project. The USACE has determined that the issuance of the 404 permit for the wetlands impacts requires the preparation of a federal EIS pursuant to NEPA (42 USC §§ 4321-4347) and its implementing regulations (40 CFR parts 1500-1508). These impacts would occur within the mine pit, existing stockpiles, and proposed stockpiles covered by the Proposed Project boundary. Wetland permits are not the only permits required for the Proposed Project; however, these impacts were used to define the geographic boundary. A detailed discussion of wetland impacts is included in Section 4.6.

The Proposed Action Alternative boundary illustrates the extent of the Proposed Project, where all sources of potential environmental effects would occur. A different sequence of mine development would occur under the No Action Alternative, as compared to the Proposed Project. The Proposed Project would not start after the completion of the No Action Alternative, rather the proposed mine pit expansion would occur simultaneously in areas identified in both the No Action and Proposed Action Alternatives. Mine pit expansion would occur in these areas in order to meet the purpose of the Proposed Project (i.e., increased pellet production to 9.6 MSTY). Table 3.3.1 provides the acreage of the No Action and Proposed Action Alternatives.

TABLE 3.3.1 NO ACTION ALTERNATIVE AND PROPOSED PROJECT ACRES

	TYPES OF USE (in acres)			
Alternative	**Stockpiles and Roads**	**Mine Pit**	**Tailings Basin and Tailings Pipeline**	**Plant Site**
No Action	2,006.2	2,214.0	2,635.8	274.0
Proposed Action	777.0[1]	1,196.6[1]	2,735.7[2]	284.8[2]

[1] Increase in acreage over No Action Alternative
[2] Total acreage including No Action Alternative

In addition to mine pit and stockpile expansion, the Proposed Project would increase the taconite pellet production capacity at Keetac by restarting the idle Phase I line. Because restarting the Phase I line requires substantial upgrading, it is referred to as the new indurating line in the remainder of this FEIS. The new indurating line would include upgrading the concentrating and agglomerating processes and a new taconite indurating grate section would be installed to the grate kiln furnace. As part of the new grate section upgrade, an additional drying section would be added to provide for additional heat recovery and energy efficiency.

Wet iron oxide concentrate would be dewatered in vacuum filters, mixed with binder and limestone, and then converted to unfired pellets in balling drums. The unfired pellets would be moved to the new indurating furnace and fired into hardened iron oxide pellets. The fired pellets would be cooled and conveyed to a stockpile and loaded into rail cars for shipping.

In addition, the Proposed Project would also include the construction of a biomass chipping, drying and storage facility, which would be located in the southwest corner of the plant site. The biomass facility would provide biomass fuel to the new indurating line.

3.3.2.1 Mineral Resources

The Proposed Project would continue to mine the Upper Slaty, Upper Cherty and Lower Cherty members of the Biwabik Iron Formation. The mineral resources are the same for the Proposed Project as were previously described in Section 3.1 and shown in Table 3.1.1, including the mineralogy and petrology of the ore. The known ore reserves at Keetac are estimated at about

745 million tons, or about 25 years of reserves, based on the proposed production capacity of 9.6 MSTY.

Mineral leases give the lessee or entity leasing the premises, the exclusive right to explore for taconite, mine the taconite iron ore, beneficiate the ore, and build any roads, railroads, ditches, excavations, drains, or buildings as are necessary for the mining and beneficiating of the taconite iron ore from the leased premises. Keetac has secured the mineral leases for all the areas within the proposed mine expansion areas. Mining premises are divided up between U. S. Steel owned lands, State lands, and private ownership. Approximately 5 percent of the taconite in the proposed mine expansion areas is owned by U. S. Steel, 10 percent owned by the state of Minnesota, and the remainder is privately owned.

3.3.3 Mine and Facility Plan

Expansion of the mine pit requires a Permit to Mine Amendment Application to the MNDNR. The Project Proposer submitted a Permit to Mine Application in July 2009.

A 25-year mine plan for the Proposed Project is being evaluated in this FEIS. Actions beyond 25 years or outside the Proposed Project boundary (Figure 3.3.1) may require additional environmental review at that time. Likewise, mine permits are only being requested for a 25-year mining program. Air and water-related permits are issued for shorter timeframes, typically undergoing procedural renewal at specified intervals (i.e., Title V air permit renews every five years). Permit amendments are developed for actions that do not create an increased discharge or emission (i.e., water appropriations permit amendment to maintain same pumping rate from a new source within current Permit to Mine boundary).

Open pit methods, as currently used at Keetac and previously described for the No Action Alternative, would continue to be used for the Proposed Project mining activities. Two main areas of the existing mine pit would be expanded. The first of these two expansion areas, the proposed south mine pit expansion, is located west of the plant, and involves expanding the existing Bennett/Russell Pit south. The second area of pit expansion, the proposed east mine pit expansion, would include dewatering Reservoir Five to expand the Section 18 Pit east. In addition, the largest portion of the expansion would occur east of the Stevenson Pit continuing north adjacent to and abutting the Hibtac mine. The proposed south mine pit expansion and proposed east mine pit expansion are shown on Figure 3.3.2.

Expansion of the mine pit requires a Permit to Mine Amendment Application to the MNDNR. The Project Proposer submitted a Permit to Mine Application in July 2009. The Project Proposer plans to begin stripping and mining activities in both the proposed south and east mine pit expansions during the initial 5-year period of the new mine plan (2012 to 2017). The stripping ratio would range between 0.7 to 1.5 tons. This equates to an overall stripping ratio of 1.1 tons of waste to 1.0 ton of taconite. The 1.5 ratio would occur first in order to uncover the taconite and the 0.7 ratio would occur after that, with no stripping needed in the last several years of mining. Detailed mining and reclamation plans are included in the MNDNR Permit to Mine Application.

3.3.3.1 Waste Rock and Overburden Stockpiles

The Project Proposer would stockpile surface overburden and waste rock in existing stockpiles, new stockpiles, and in-pit stockpiles. An analysis of alternative stockpile areas is discussed in Section 3.5.3. Two new stockpile areas are proposed to serve the two mine pit expansion areas for placement of surface overburden. These two areas are the proposed east stockpile and the proposed south stockpile as shown on Figure 3.3.3.

The proposed east stockpile, approximately 700 acres, is the larger of the two proposed stockpiles. It is northeast of and immediately adjacent to the existing southeast stockpile. Although the existing southeast stockpile is used primarily for waste rock, the proposed east stockpile would be used solely for surface overburden. The proposed east stockpile would use the entire footprint for stockpiling with a final vertical height approximately 300 feet above existing grades.

Portions of the existing southeast stockpile are included in the Proposed Action Alternative due to the presence of wetlands that would be impacted by the Proposed Project. Access to the proposed east stockpile would occur utilizing an existing haul road to a point where construction of a new haul road located along the western and southern boundary of the stockpile would give access to the proposed east mine pit expansion.

The proposed south stockpile is approximately 40 acres and would serve as the surface overburden stockpile for a portion of the proposed south mine pit expansion. Additional stockpiling for the proposed south mine pit expansion would occur with in-pit stockpiling and by utilizing existing capacity in the northwest stockpile area. An existing haul road connects the northwest corner of the proposed south stockpile to the south mine pit expansion and would provide access to this stockpile. The final vertical height would be approximately 100 feet above existing grades.

As pit development progresses, the Project Proposer would evaluate the feasibility of additional in-pit stockpiling. A major factor in determining the feasibility of in-pit stockpiling is the management of mineral rights, which is determined by classification of rock type and by the individual fee owner. It may or may not be possible to mix stockpiles by rock type and fee owner, making in-pit stockpiling more difficult to implement due to space limitations within the pit. Where practical and allowed under mineral rights ownership, the Project Proposer would use in-pit stockpiling as discussed in Section 3.5.3 and Appendix E of this FEIS.

3.3.3.2 Haul Roads, Plant Access and Rail

Surface overburden and taconite at Keetac are transported by haul roads, plant access roads and rail. An existing road on the south side of the plant provides access to the plant from TH 169. A rail siding on the south side of the plant provides access to the existing BNSF tracks located about one mile south of the plant and one mile east of the City of Keewatin. Some new haul roads would be needed for transport of surface overburden to the new stockpile areas and taconite from the mine to the crusher. The Proposed Project would use existing haul road alignments and existing disturbed areas as much as possible in order to minimize potential wetland impacts. Figure 3.2.3 shows the existing access (TH 169 and BNSF rail line), existing haul roads, and the existing/proposed plant site.

With increased taconite pellet production from the Proposed Project, the number of BNSF rail cars needed on a trip to haul finished product would increase. However, no modifications to the siding or the main rail line would be necessary to accommodate the Proposed Project as the number of rail trips would not increase.

3.3.3.3 Taconite Processing

Refurbished and new processing equipment would be located at the existing plant site alongside current operations. The plant and associated infrastructure, including proposed expansion structures/buildings and biomass facility, are shown in Figure 3.3.4.

3.3.3.3.1 Crushing Operations

> Refurbished and new processing equipment would be located at the existing plant site alongside current operations.

The first step in processing crude taconite consists of crushing and grinding. Crude taconite would be trucked from the mine pits to the primary crusher for size reduction to approximately eight inches in diameter. Crushed taconite would be stored in the taconite barn in advance of milling to twelve inch rock and 80 percent ¾-inch rock. The existing crushers currently in operation have adequate capacity to process the additional taconite associated with the Proposed Project. No new crushing equipment would be added. The crushed taconite would be conveyed to the existing taconite storage building. The existing taconite storage building would be expanded to accommodate the additional crushed taconite.

3.3.3.3.2 Concentrator Plant

The taconite concentration and agglomerating processes would be expanded, but would remain similar to existing equipment in the existing indurating line. From the taconite storage area, crushed taconite would be conveyed to the concentrator where the magnetic iron oxide minerals (concentrate) are separated from the nonmagnetic waste (tailings). In the concentrator, the taconite passes through a series of wet mills that would grind the rock to a flour-like consistency. Magnetic separators then separate the magnetic iron minerals (concentrate) from the nonmagnetic waste. This nonmagnetic material that remains is called tailings and is transferred to the tailings basin.

3.3.3.3.3 Pellet Plant

> The Project Proposer plans to use a target rate of 1:1 biomass (up to 50,000 oven dried tons per year) and natural gas. A simplified diagram of the grate kiln furnace is shown in Figure 3.3.5.

Pelletization is the third major step in taconite processing. The concentrate slurry from the concentrator would be dewatered by vacuum filters to produce a filter cake, which in turn is mixed with bentonite, about 1 percent by weight limestone, and converted to unfired pellets (green balls) by tumbling moistened concentrate in a balling drum. The target green ball (and eventual pellet) size is ½-inch with a range from about ¼-inch to ¾-inch in diameter. Pelletizing the concentrate improves material handling and provides a source of feed material that is transportable off-site for use by subsequent steel manufacturing.

The pellets are dried and preheated on a moving grate system. Pellet oxidation occurs primarily in the preheat section of the moving grate system and hardening occurs in a rotary kiln. The pellets are hardened by a high heat process called induration. The green balls are dried and heated in an oxidizing atmosphere at a temperature of 1290° to 1400°C (2350° to 2550°F). The application of heat during induration triggers the oxidation of magnetite mineral (Fe_3O_4) to the hematite form of iron mineral (Fe_2O_3). The oxidation reaction is exothermic and contributes significant heat back to the induration process, which serves to reduce fuel requirements.

The Project Proposer plans to use natural gas and biomass as fuel for the new indurating furnace with coal and fuel oil as the primary backup. The Project Proposer plans to use a target rate of 1:1 biomass (up to 50,000 oven dried tons per year) and natural gas.

Finished pellet cooling occurs on a moving grate system. The rotary kiln is designed with an integrated recuperative heat recovery system to minimize energy use. The Proposed Project would refurbish the existing rotary kiln and install new pre-heat and cooling grate systems.

The new furnace design has two down draft drying zones, a tempered pre-heat zone and a pre-heat zone, prior to pellets entering the rotary kiln, and four cooling zones following the kiln. A simplified diagram of the grate kiln furnace is shown in Figure 3.3.5. The furnace consists of the following major sections:

- Downdraft Drying 1 (DDD1)
- Downdraft Drying 2 (DDD2)

- Tempered Pre-Heat (TPH)
- Pre-Heat (PRE)
- Rotary Kiln
- Pellet Cooler (C1, C2, C3, and C4)

In Figure 3.3.5, the pellets enter into DDD1 on the left side of the diagram and flow through from left to right, and exit from the last cooler section. After preheating in the grate section which consists of DDD1, DDD2, TPH, and PRE, pellets proceed into the kiln section of the furnace. The kiln section includes the main burner of the indurating system. Pellets exit the kiln and enter the pellet cooler. The recuperative heat recovery system uses heat released from kiln and the cooling zone by directing it back to the grate, which serves to heat pellets in the preheat zone and to dry green pellets in the drying zone.

Fuel is burned in the main burner in the kiln. The exhaust gases from the kiln flow through the Pre-Heat section and then through an internal cyclone to remove large particulates, and then through DDD1.

Ambient air is blown through each section of the Cooler to cool the fired pellets. The hot exhaust air from C1 is used as the air feed to the kiln for combustion and oxidation of iron in the pellets. This minimizes the amount of fuel that is needed to raise the temperature of the air in the kiln from ambient to operating temperatures. The hot exhaust air from C2 flows through the TPH section where the heat that was removed from the hot fired pellets is transferred to the green balls. Similarly the hot exhaust air from C3 flows through DDD2 and serves to remove moisture from the green balls. Exhaust air from the fourth section of the Cooler (C4) would be released directly to the atmosphere after it passes through pollution control equipment. The pellets are relatively cool in this section of the Cooler compared to the pellets passing through section C1 – C3 and the temperature and heat that could be recovered from the C4 exhaust is minimal.

Upon cooling, pellet handling and transfer operations consist of pellet screening and size classification, stockpiling, and transfer of finished pellets for transport off-site. Pellet plant additive receiving and handling includes rail car or truck unloading of materials such as limestone and bentonite, transfer to the additive storage silos, and the transfer of additives from the silos to day bins. Typically, the unloading and transfer of additives would be pneumatic. Emissions from these types of sources are particulate and particulate related pollutants and these would be controlled with baghouses where high temperatures and fire potential are not a concern or with wet scrubbers on streams where the temperature is high enough to lead to a potential fire hazard for a baghouse.

The increase in pellet production would include the installation of three to four new grinding mills and associated material handling equipment. The Proposed Project would include new coal and biomass handling equipment, to route coal from existing coal handling systems to the new furnace, and new material handling equipment to move finished pellets from the new furnace to the existing finished pellet storage area.

3.3.3.4 Biomass Facility

> The Proposed Project would process approximately 200,000 tons of green biomass annually, which would result in the production of about 100,000 oven dried tons. Approximately half of the oven dried biomass (50,000 tons) would be utilized at the Keetac facility, and the additional supply would be trucked to the Project Proposer's Minntac facility near Mountain Iron, Minnesota.

The proposed biomass facility includes a wood chipper, biomass dryer, and storage. The proposed biomass dryer would use recovered heat off the existing Phase II indurating furnace to process green woody biomass into oven dried fuel. The Project Proposer would purchase biomass fuels, from local suppliers, including material from forest harvesting not used in pulpwood or saw timber markets. These include roundwood, logging residual from forest harvest, and wood chips. The Proposed Project would process approximately 200,000 tons of green biomass annually, which would result in the production of about 100,000 oven dried tons. Approximately half of the oven dried biomass (50,000 tons) would be used at the Keetac facility, and the additional supply would be trucked to the Project Proposer's Minntac facility near Mountain Iron, Minnesota. Section 5.1 discusses biomass in greater detail.

3.3.3.5 Tailings Basin

The tailings basin is located south of the mine area and plant site, approximately one mile southeast of the City of Keewatin (see Figure 1.3). About 13 MLTY of taconite process tailings are pumped to the existing tailings basin. An additional 9 MLTY of tailings would result from the Proposed Project concentrating process and would also be pumped as slurry to the existing tailings basin. The overall 2,621-acre footprint of the active tailings basin would increase approximately 100 acres to 2,721 acres, as shown on Figure 3.1.2. The Proposed Project would increase the overall height of the tailings in the basin by approximately 58 feet compared to the No Action Alternative, as shown on Figure 3.2.5. The tailings basin dikes would be reinforced, as necessary to support the additional tailings to be placed in the basin.

Because only about 33 percent of the crude taconite becomes concentrate for iron making, about 67 percent is tailings and must be transferred to the tailings basin. Tailings from the concentrator would be pumped to the tailings thickeners where excess water would be removed by sedimentation. There are three thickeners in operation. Two additional thickeners would be added as part of the Proposed Project. Tailings rejected by primary and secondary magnetic separation processes would be pumped as a 30 percent slurry to the tailings basin. When the slurry reaches and spreads out into the tailings basin, flow velocity decreases and the tailings settle out of the water to form a tailings stockpile. The water separated from the tailings flows to the Stage 2 Reservoir, from which it then flows through a series of reservoirs with a majority of the water eventually recycled back to the plant as process water. A third tailings pipeline similar in size to the existing two pipelines and a third return water line would be installed as part of the Proposed Project.

In 2006, a modification was made to tailings basin operation to reduce beach area. This modification in basin operations resulted in reduced air emissions (dust). The tailings basin would be operated to maintain maximum water coverage on the surface of the active tailings basin. Additionally, the Project Proposer has implemented changes to its mulching program to improve coverage of inaccessible areas of the basin, including the use of helicopters as necessary.

3.3.4 Water Management

A Water Balance/Mine Yield Study was completed for the Proposed Project. This study provides a prediction of the changes that would be expected to occur from the plant expansion. It also provides information on the effect of those changes on downstream resources. The study concluded there are three future primary changes in the volume of Keetac discharges from the Proposed Project.

- Increased mine yield from expanded mining operations
- Increased evaporation due to a larger area of the tailings basin covered with pooled water
- Increased water locked-up in fine tails that coincides with increased production of tailings

One of these changes would result in an increase in the volume of water being discharged (pit dewatering), whereas the other two changes (evaporation and tailings loss) would decrease the volume of water being discharged. The net change in water volume being discharged due to the Proposed Project would result in a slight decrease during the early phases of the Proposed Project and a moderate increase in the latter phases of the Proposed Project. Impacts to surface water levels are discussed in Section 4.1.1.

3.3.4.1 Dewatering

As described in the No Action Alternative, the Project Proposer is currently permitted to pump water from the mine area in order to conduct mining operations, facilitate disposal of tailings, and maintain surface waters. The Proposed Project would require reallocation of mine dewatering volumes in the current water appropriations permit as the boundaries of the mine area increase. However, the Project Proposer intends to stay within the water appropriation volume limits that are currently permitted by the MNDNR during the life of the Proposed Project (see Table 3.1.2 for currently permitted appropriation volumes).

As previously described, the Proposed Project would include the progression of mining in the south and east portions of the mine pit. Additional mine dewatering activities would be necessary as the boundaries of the mine area increase. Expanded mining activities would begin in the first quarter of 2012. Figures 3.3.6 through 3.3.9 depict the mine pit dewatering plans in five year increments.

The following presents a description of the major highlights of pit dewatering activities during the Proposed Project. Additionally, Table 3.3.2 provides a summary of the Proposed Project estimated annual pit dewatering pumping volumes.

Period I – 2012 to 2016 (Initiation of Proposed Project Mining Activities Figure 3.3.6):
- Section 18 Pit would be pumped to Reservoir Five Pit.
- Russell Pit would be pumped to Reservoir Five.
- Stevenson Pit would be pumped to Reservoir Five.
- Crusher process water would be discharged to Section 18 Pit and then pumped to Reservoir Five Pit.
- Reservoir Five would be completely drained. In lieu of Reservoir Five, water would be piped from the Russell Pit, Section 18 Pit, Stevenson Pit, and the crusher directly to the plant for makeup water use or overflow into the Plant Diversion Ditch in the event of a plant shutdown or emergency.
- Current dewatering discharges from Hibtac Pit to Keetac would be terminated to allow stockpile development and dewatering operations.
- A new water line would be constructed to pump additional water from Reservoir Six to the processing plant.
- Continue to pump water from the Mesabi Chief, Aromac, and Perry Pits to O’Brien Creek.
- Transfer water from the Aromac Pit into the Mesabi Chief Pit where the pit wall protrusion prevents the natural flow of water into the Mesabi Chief Pit.

Period II – 2017 to 2021 (Figure 3.3.7):
- The Russell Pit, Section 18 Pit, Stevenson Pit and the crusher would be pumped directly to the plant diversion ditch or overflow into the Plant Diversion Ditch in the event of a plant shutdown or emergency.
- Crusher process water would continue to be routed to the Section 18 Pit.
- Water would continue to be pumped from the Mesabi Chief, Aromac and Perry Pits to O’Brien Creek.
- The mine has progressed through the area occupied by Reservoir Five.
- Continue to transfer water from the Aromac Pit into the Mesabi Chief Pit where the pit wall protrusion prevents the natural flow of water into the Mesabi Chief Pit.

Period III – 2022 to 2026 (Figure 3.3.8):

- The mine has progressed through the area occupied by Reservoir Five.
- The Russell Pit, Section 18 Pit, and Stevenson Pit and the crusher would be pumped directly to the plant or overflow into the Plant Diversion Ditch in the event of a plant shutdown or emergency.
- Crusher process water would continue to be routed to the Section 18 Pit.
- Water would continue to be pumped from the Mesabi Chief, Aromac and Perry Pits to O'Brien Creek.
- Toward the end of the period, start pumping from the Carmi Pit to the plant.
- Transfer water from the Aromac Pit into the Mesabi Chief Pit where the pit wall protrusion prevents the natural flow of water into the Mesabi Chief Pit.

Period IV and V – 2027 to 2036 (Figure 3.3.9):

- The Russell Pit, Section 18 Pit, Stevenson Pit and the crusher would be pumped directly to the plant or overflow into the Plant Diversion Ditch in the event of a plant shutdown or emergency.
- Crusher process water would continue to be routed to the Section 18 Pit.
- The Carmi Pit would be pumped to the plant.
- Hibtac closure of the mine pit portion that was dewatering into the Keetac pit.

TABLE 3.3.2 ESTIMATED ANNUAL PIT DEWATERING VOLUMES (MGY)

Period	Area	Location	Total Location Volume (MGY)	Total Area Volume (MGY)
2007	West	Mesabi Chief Sargent	937 254	1,191
	East	Russell S. 18 Stevenson	750 216 592	1,558
Period I 2012-2016	West	Mesabi Chief Aromac Perry	714 334 330	1,377
	Res. 2	Sargent	474	474
	East	Russell S. 18 Stevenson	715 240 749	1,705
Period II 2017-2021	West	Mesabi Chief Aromac Perry	780 442 331	1,554
	Res. 2	Sargent	755	755
	East	Russell S. 18 Stevenson	367 282 861	1,511
Period III 2022-2026	West	Mesabi Chief Aromac Perry	872 515 384	1,771
	Res. 2	Sargent	615	615
	East	Russell S. 18 Stevenson Carmi	265 119 1,218 130	1,732
Period IV 2027-2031	West	Mesabi Chief Aromac Perry	786 557 360	1,704
	Res. 2	Sargent	624	624
	East	Russell Stevenson Carmi	375 1,573 638	2,582
Period V 2032-2036	West	Mesabi Chief Aromac Perry	896 564 341	1,801
	Res. 2	Sargent	908	908
	East	Russell Stevenson Carmi	417 1,505 470	2,392

3.3.4.2 Processing Plant Consumptive Uses

As with the No Action Alternative, the Project Proposer would continue to recycle water for taconite processing operations for the Proposed Project. Figure 3.1.4 is a water flow diagram of the water management system for existing operations and the Proposed Project. As mining activities progress to the east, Reservoir Five would be dewatered and eliminated. After Reservoir Five is eliminated, water would be pumped directly from the Russell Pit, Section 18 Pit, Stevenson Pit, and the crusher to the plant for use as plant makeup water, with unused water being pumped to the ten settling basins. Water from the pits and crusher would be pumped to the ten settling basins during plant shut-downs. Water from Reservoir Six would continue to be pumped to the processing plant for process water use. The Proposed Project includes construction of a new water line to pump additional water from Reservoir Six to the processing plant. The following paragraphs provide a discussion of the change in water use at Keetac as part of the Proposed Project and how water uses would be affected by the Proposed Project.

3.3.4.2.1 Crusher

Water used for crushing operations would be discharged to Bennett Pit for the life of the Proposed Project. Dry controls would be used to control dust emissions on new material handling equipment so the Proposed Project would not result in substantial increases in water use at the crusher.

3.3.4.2.2 Concentrator

The Proposed Project would require additional water for transport of additional fine tailings that are generated due to the increase in ore processing. However, because most of the water is recycled water from Reservoir Six, the Proposed Project would not require a large increase in makeup water demand from the concentrator.

3.3.4.2.3 Pellet Plant

The Proposed Project would result in increased water losses due to the processing of additional pellets. The Project Proposer is proposing dry controls on several of the emission sources.

3.3.4.2.4 Tailings Basin

As previously described for the No Action Alternative, tailings from the concentrator and wet scrubber blowdown from the pellet plant are pumped into the tailings basin via pipeline from the plant area. Voids loss occurs by trapping water in pore spaces as tailings settle, resulting in water loss. Further discussion on voids loss is provided in Section 4.8. Additionally, there are evaporation losses from the open water surface of the tailings basin. The Proposed Project would involve the processing of additional taconite, which would use additional process water and result in more tailings slurry. This causes additional water losses in the tailings basin due to voids loss (Liesch, 2009D).

Additionally, some minor water loss would occur from tailings basin seepage. Minor seepage is anticipated to discharge to groundwater through the bottom of the tailings basin, resulting in groundwater mounding under the basin. This water would flow radially from the tailings basin perimeter, ultimately flowing in the general direction of surface groundwater in the area.

3.3.4.2.5 Project Surface Water and Groundwater Appropriations

Surface and groundwater appropriations are related to mine pit dewatering. In order to conduct mining operations, the Proposed Project would increase annual volumes of dewatering compared to current rates. Based on estimates for the Proposed Project, however, these volumes are less than what is currently allowed by existing appropriations permits.

The current appropriation permit for the facility is for 6,728 MGY. Keetac has requested an increased appropriation to 7,516 MGY. The permitted amounts greatly exceed the projected dewatering rates. If the Project Proposer needs to increase dewatering above the permitted rates, an amendment to the appropriation permit must be obtained.

Table 3.3.2 provides a summary of past (actual) and Proposed Project (estimated) annual pit dewatering pumping volumes. Section 3.3.4.1 provides additional information on pit dewatering as it relates to surface and groundwater appropriation.

3.3.4.2.6 Existing Wells and Public Water Supply

Keetac has two existing water supply wells for potable and sanitary uses, as well as emergency pellet process cooling. The Project Proposer does not anticipate that the Proposed Project would require the installation of additional water supply wells or require additional potable water at Keetac.

> Impacts to public water supply are not anticipated from the Proposed Project. However, contingency plans were negotiated between the Project Proposer and the cities of Keewatin and Nashwauk, which include a well monitoring plan, mitigation response plan, and funding mechanism if the Proposed Project activities impact city wells.

Impacts to public water supply are not anticipated from the Proposed Project. However, contingency plans were negotiated between the Project Proposer and the Cities of Keewatin and Nashwauk. Provisions of the plan include a well monitoring plan, mitigation response plan, and a funding mechanism if the Proposed Project activities impact city wells (see Appendix F).

3.3.4.2.7 Stormwater

The Proposed Project is not expected to affect the current stormwater management practices (as described under the No Action Alternative) or water quality related to stormwater runoff from the plant site. The Project Proposer would continue to manage stormwater runoff in compliance with the facility SWPPP and industrial stormwater rules. The SWPPP outlines the process and implementation of managing stormwater and avoiding and minimizing impacts from runoff by implementing BMPs. These BMPs include erosion prevention practices to minimize production of sediment, such as seeding and mulching practices and special measures for steep slopes and highly erodible soils (e.g., terracing, silt fence, erosion control fabric, and ditch checks). The SWPPP would be updated as needed to reflect the Proposed Project and current regulations at the time of Proposed Project implementation.

3.3.5 Air Emissions

The Proposed Project would increase air emissions above current levels. It would require a major modification under the federal PSD regulations for several air pollutants, including particulate matter (PM), particulate matter less than 10 and 2.5 micrometers in diameter (PM_{10} and $PM_{2.5}$) and sulfur dioxide (SO_2). Air emission permits for major sources require an air quality analysis to demonstrate that national ambient air quality standards would not be exceeded and that the project would not significantly deteriorate air quality.

> The Proposed Project would increase air emissions above current levels and would require a major modification under the federal PSD regulations for several air pollutants, including particulate matter (PM), particulate matter less than 10 and 2.5 micrometers in diameter (PM_{10} and $PM_{2.5}$) and sulfur dioxide (SO_2).

Both Itasca and St. Louis counties as well as the rest of the state of Minnesota are in attainment with the National Ambient Air Quality Standards (NAAQS) for all of the criteria pollutants (carbon monoxide (CO), particulate matter 10 microns or less (PM_{10}), particulate matter 2.5 microns or less ($PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NOx), lead (Pb), and ozone (O_3)). The closest non-attainment areas are the Eastern Wisconsin counties that exceed the 8-hour ozone standard; these areas are well beyond the impact area of the Proposed Project.

The mining operations are sources of fugitive particulate matter emissions. Point source emissions from mining operations include the crushers and the taconite conveyor. Fugitive sources include taconite loading, truck traffic, stockpiling of overburden and waste rock, and wind erosion of stockpiles and tailings basin.

Emission sources associated with the concentrator plant operations include fugitive emissions from the storage piles and from conveyor loading/unloading. The concentrator plant has relatively few air emission sources because the processes involved are wet under normal operations and there are no significant combustion emissions. Air emission point sources at the concentrator plant that do occur are all related to taconite conveying. Fugitive air emission sources are related to coarse taconite storage and reclaim, cobber (lean taconite) rejects stockpiling and handling, and tailings basin wind erosion.

The Project Proposer has committed to the installation of low NOx combustion on the main burner of the new indurating line for NOx mitigation. The low NOx main burner would be capable of fueling natural gas, biomass, coal and fuel oil, while reducing the generation of NOx compared to conventional main burners currently used at most taconite indurating furnaces. Low NOx main burners provide an effective means of reducing the formation of NOx without additional energy consumption and cross media impacts that plague end of pipe (i.e. after the pollutant has been formed) control technologies.

Air emission point sources associated with pellet induration include combustion and pellet oxidation products. By using the hot exhaust air from the kiln and the four cooler sections the amount of fuel that must be burned to dry and fire the pellets is minimized. Minimizing fuel combustion also reduces the amount of combustion related pollutants that are generated from fuel combustion in the kiln such as NOx, SO_2, CO, and greenhouse gases such as CO_2. In addition, the combustion gases from the kiln only flow through DDD1. Therefore, DDD2 and the Cooler exhaust are expected to contain mainly particulate related emissions. The temperature in DDD2 is not high enough for sulfur and mercury to be liberated. However, the temperature reached in the TPH zone and associated cooler zone 2 (C2) has the potential to volatilize sulfur and mercury from the pellets (liberated from the ore rather than from the fuel combustion) as shown on Figure 3.3.5 of the grate kiln furnace diagram.

Although mercury and SO_2 are generated from fuel combustion, the primary source of these pollutants is the taconite. The taconite contains naturally occurring elements containing mercury and sulfur that are released from the taconite at the high temperatures in the furnace. Most of the mercury and most of the sulfur would be released at the temperatures reached in the kiln. Because some sulfur and mercury may be released at a lower temperature than that achieved in the kiln, a small amount of sulfur and mercury would also be released in the TPH section of the furnace. When sulfur is released from the taconite and exposed to heat and oxygen it is converted to SO_2 (see Section 4.9.7 for estimated mercury emissions).

> The Class II air quality analysis demonstrates that PM_{10}, $PM_{2.5}$, SO_2, carbon monoxide (CO), nitrogen oxides (NO_x) and lead emissions meet the National Ambient Air Quality Standards (NAAQS), Minnesota Ambient Air Quality Standards (MAAQS) and PSD Class II Increment for the area within 50 kilometers (31 miles) of the Keetac facility.

The exhaust stream through DDD1 would contain combustion gases as well as pollutants volatilized or abraded from the pellets including: SO_2 from fuel combustion and volatilization off the pellets, NOx from fuel combustion and thermal generation, particulate emissions from fuel combustion and abrasion of the pellets, and mercury from fuel combustion and volatilization off the pellets. The emissions in the DDD1 exhaust stream would be controlled through the use of a gas suspension absorber (GSA) dry scrubber for removal of SO_2, injection of activated carbon for removal of mercury, and a dry electrostatic precipitator (ESP) for removal of particulate related emissions.

The exhaust stream through DDD2 would only contain particulate matter that comes off of the pellets as the air passes through the pellets. The emissions in the DDD2 exhaust stream would be controlled through the use of a dry ESP for removal of particulate related emissions. From a multimedia approach, minimizing and reducing the generation of NOx is more efficient than generating NOx and then attempting to control the emissions.

The exhaust stream through TPH would contain a small amount of SO_2 from the taconite, particulates off of the pellets, and potentially a small amount of mercury. The emissions in the TPH exhaust stream would be controlled through the use of a GSA dry scrubber for removal of SO_2, injection of activated carbon for removal of mercury, and a dry ESP for removal of particulate related emissions.

The exhaust stream through C4 would only contain particulate matter that comes off of the pellets as the air passes through the pellets. The emissions in the C4 exhaust stream would be controlled through the use of a dry ESP for removal of particulate related emissions.

Air emission point sources associated with the material handling operations include the transfer of binder and limestone to the grate feed, and the various pellet screening and transfer conveyors leading to the pellet storage bins or stockpiling. Point source emissions for the additive receiving and handling operations are the result of venting additive silos and day bins during pneumatic transfer. Day bins vent back to the storage silos, whose vents are controlled with fabric filters.

Fugitive air emission sources of particulates associated with the pellet plant include wind erosion of concentrate stockpiles, pellet handling, and pellet stockpiling. Fugitive air emissions are controlled by following a fugitive dust control plan that includes the use of water, dust suppressants, and other measures to minimize dust emissions. Fugitive air emission sources of particulates from wind erosion are also associated with the tailings basin. Tailings basin fugitive air emissions are controlled by following a fugitive dust control plan that includes revegetating beach areas to prevent erosion.

For air quality purposes, areas are divided into two classes based on local land use. These are referred to as Class I and Class II areas. Wilderness and national park areas are designated as Class I areas. All other areas are designated as Class II areas. Class I modeling has been conducted for the Proposed Project and submitted to the MPCA, National Park Service (NPS), and the USFS. Class II modeling has also been completed and submitted to the MPCA. This modeling information has also been used to evaluate the potential for environmental impacts associated with the Proposed Project.

In addition to PSD requirements, the Proposed Project is subject to Maximum Achievable Control Technology (MACT) requirements for those sources that are part of a HAP source category or that are major HAP sources individually. Taconite ore processing is an assigned a MACT category.

Mercury is present at trace levels in the taconite ore and volatilizes when subjected to the temperatures of taconite pellet induration. A mercury balance has been prepared for the Proposed Project. The Project Proposer proposes to control mercury emissions from the new indurating furnace using carbon injection. This type of control equipment is similar to that used by power plants to control mercury emissions.

The Proposed Project mining activities would be managed to control avoidable dust pursuant to Minnesota Rules, parts 6130.3700 and 7011.0150, which require reasonable measures to prevent particulate matter from becoming airborne. These measures could include water spray, chemical binders, anchored mulches, vegetation, enclosure, and containment.

Additional information on air emissions is provided in Sections 4.9.1 through 4.9.8.

3.3.5.1 Technology Alternatives

3.3.5.1.1 Air Pollution Control Technologies

Best Available Control Technology (BACT)

The FSDD states that the EIS will evaluate air pollution control methods and/or technologies on sources of air pollutants, and BACT where applicable. Emission units associated with the Proposed Project require a BACT analysis for SO_2, PM, PM_{10} and $PM_{2.5}$. Table 4.9.5 in Section 4.9.3.2 provides a summary of the BACT analysis performed for the Proposed Project. A BACT analysis is not required for units emitting NOx because the Project Proposer intends to limit NOx emissions to levels below PSD major modification thresholds.

BACT is an element of PSD and applies to emission units that are part of a major modification for one or more pollutants regulated under the Clean Air Act (CAA). It is defined as an emission limitation based on the maximum degree of reduction for a specific pollutant. The MPCA, on a case-by-case basis, takes into account energy, environmental, and economic impacts and other costs to determine what is achievable for such sources or modifications.

BACT analysis includes the following steps, which are consistent with the process used to identify, evaluate, and select alternatives during the environmental review process.
Step 1 – Identify all control technologies
Step 2 – Eliminate technically infeasible options
Step 3 – Rank remaining control technologies by control effectiveness
Step 4 – Evaluate the most effective control technologies and document results
Step 5 – Select BACT

The BACT analysis documents the process used to assess air pollution control technologies for the Proposed Project. Based on the findings of this analysis, proposed air pollution control technologies are selected. Section 4.9.3 provides additional details on the specific control technologies selected for the Proposed Project.

Review and approval of the BACT analysis and decision-making process will be performed by the MPCA as part of the air permit review process. Some changes in the air pollution control technologies that would be used by the Proposed Project may result from the MPCA permitting process. It is assumed that the air quality analysis included in this FEIS represents the maximum emissions and impacts that would result from the Proposed Project. If, as a result of the permit review process, higher emissions are proposed, the FEIS and air permit application analyses would need to be revised to reflect the additional impacts from the new, higher emission levels. The conclusions from the technology alternatives evaluated in the analysis have been incorporated into the Proposed Project prior to the impact evaluation or as necessary mitigation for potential environmental effects.

Mercury Emissions Control

The FSDD states that the EIS will identify all sources of mercury emissions, review mercury control technology for the Proposed Project, and summarize other potential mercury control technologies.

No operating taconite indurating furnace has a control technology installed for specifically controlling mercury. As part of this FEIS analysis, mercury emissions and controls were evaluated. These evaluations reviewed the technical feasibility of possible mercury emission controls for the Proposed Project. The Project Proposer used a BACT-like analysis to evaluate the prospective mercury emissions controls for the five basic steps in a BACT analysis, which were followed for the mercury analysis. The majority of research and published information of mercury control technologies focuses on coal-fired utility boilers. Research for mercury control technologies at taconite processing plants is ongoing.

The mercury control technologies are classified into three categories of availability: commercially available, emerging technology, and in the research and development stages. These technologies were evaluated on their technical feasibility to the Proposed Project, their control effectiveness, and other impacts that may occur.

Based on the review of the available mercury control technologies, the Project Proposer has chosen to install activated carbon injection (ACI) to control mercury emissions for the new line. The installation of ACI provides another level of control in addition to the mercury that would be controlled with the particulate air pollution controls proposed for the new furnace. Section 4.9.7 provides additional details on this mercury control technology selected for the Proposed Project. Table 4.9.23 lists the mercury emissions from the Proposed Project.

3.3.5.1.2 Greenhouse Gas Emissions

The FSDD states that the EIS will compare greenhouse gas (GHG) emissions from project alternatives and discuss the conclusions from the analysis. New and evolving environmental guidance and regulations on the state and federal levels recognize the potential consequences of GHG emissions on climate change (MPCA, 2008C). To address that issue, a methodology to analyze climate change was tailored for the Proposed Project by the MNDNR Briefing Sheet (MNDNR, 2008C).

The Project Alternatives related to GHG emissions are presented in the Climate Change Report. This report provides the calculations and methodology for the GHG emissions.

Also presented at the end of this section is a comparison of GHG emissions for the existing pellet production facility to the Proposed Project (see Comparison of GHG Emissions). A detailed description of GHG emissions and their relation to climate change is provided in Section 5.2 of the FEIS.

Proposed Project Carbon Footprint

GHG emissions are calculated using the methodology defined in The Climate Registry (TCR) General Reporting Protocol (GRP). Following TCR GRP, emissions include direct emissions (Scope 1), indirect emissions (Scope 2), and supply chain emissions (Scope 3). Per TCR GRP, Scope 1 and 2 emissions are required; however, inclusion of Scope 3 emissions is voluntary. Emissions were also calculated for land use changes and included as Direct (Scope 1) emissions per MPCA guidance.

The following direct, indirect, and supply chain sources from the Proposed Project are evaluated.

- Direct emissions (Scope 1)
    - Stationary combustion of fossil fuels: This includes the induration furnace and duct burners.
    - Fixed (non-combustion) physical or chemical processes: This includes the pellet production process.
    - Mobile source combustion: This includes small truck traffic, large mobile diesels, and small mobile diesels. These mobile sources include shipping of raw materials onsite (ore mined onsite and delivered to the process units).
    - Land use changes: This includes wetland and forest carbon cycle impacts.

- Indirect emissions (Scope 2)
  - Electricity purchases.
- Supply chain emissions (Scope 3)
  - Fuel shipping.
  - Product shipping.

Direct biogenic emissions from the combustion of biomass to produce energy are also evaluated, but are reported separately from the direct emissions per TCR GRP. Biogenic means the source of carbon was recently contained in living organic matter. Direct biogenic emissions can be calculated from stationary and/or mobile combustion sources. For the Proposed Project, only direct biogenic emissions from stationary combustion of biomass are applicable (there are no mobile combustion sources of biomass).

Biogenic emissions result from the combustion of biomass. In most cases, biomass carbon is carbon that was recently withdrawn from the atmosphere through photosynthesis and incorporated in plant matter. Combustion acts to return carbon in the form of CO_2 to the atmosphere, leaving the total amount of atmospheric CO_2 unchanged over the entire cycle that comprises plant photosynthesis, plant biomass accumulation and biomass combustion. For this reason, so long as emissions of CO_2 from biomass combustion are offset by an equal amount of carbon withdrawal into the biosphere through photosynthesis, those emissions are said to be carbon neutral. The combustion of very slowly accumulating peat constitutes one obvious exception to this rule. The carbon contained in peat can be many hundreds of years old, with the result that many centuries may need to pass for CO_2 emissions from peat combustion to be offset by new accumulations of carbon in existing peatlands.

Emissions are calculated using TCR GRP default emission factors. Where appropriate, site-specific stack test results and lab data, and utility-specific emission factors, are used in place of TCR GRP default emission factors. When the TCR GRP does not provide needed guidance, information from the Intergovernmental Panel on Climate Change (IPCC) is used. MPCA guidance specific to the Proposed Project was followed to estimate direct GHG emissions from land-use changes.

GHG emissions are converted to carbon dioxide equivalents (CO_2-e) to account for global warming potential, based on the MCPA document General Guidance for Carbon Footprint Development in Environmental Review (MPCA, 2008E) as shown in Table 3.3.3.

TABLE 3.3.3 GHG CO_2-EQUIVALENCE VALUES

Greenhouse Gas (Chemical Formula)	CO_2-Equivalence or Global Warming Potential
Carbon Dioxide (CO_2)	1
Methane (CH_4)	25
Nitrous Oxide (N_2O)	298

The carbon footprint of the Proposed Project is based on a proposed fuel mix alternative of 50 percent biomass – 50 percent natural gas. This fuel mix was selected by the Project Proposer as the recommended fuel mix alternative for the Proposed Project, and therefore, was used in determining the carbon footprint. Other fuel mix alternatives evaluated, along with a discussion of the selected fuel mix alternative are presented in below.

The two alternatives evaluated for the Proposed Project carbon footprint include: 1) GHG emissions without GHG reductions, and 2) GHG emissions with GHG reductions. The results of these two alternatives, in short tons per year (TPY) of CO_2-e, are summarized in Table 3.3.4.

Detailed information about the estimated land-use changes (wetlands and forests) is provided immediately following Table 3.3.4. The estimated GHG reductions are also provided in Table 3.3.4. The detailed information about the estimated GHG reductions is provided following Table 3.3.5 and the land use changes information. The GHG emission estimates for Scope 1, 2, and 3 emissions do not include direct biogenic emissions from the combustion of biomass to produce energy. These are presented separately at the bottom of Table 3.3.4.

TABLE 3.3.4 PROPOSED PROJECT GHG EMISSION SUMMARY (50% BIOMASS - 50% NATURAL GAS)

Source	Proposed Project Estimated GHG Emissions With Estimated GHG Emission Reductions from Optimal Design (TPY CO_2-e) [1]	Proposed Project Estimated GHG Emissions Without Estimated GHG Emission Reductions from Optimal Design (TPY CO_2-e) [2]	Estimated GHG Emission Reductions from Proposed Project from Optimal Design (TPY CO_2-e) [3]
Direct (Scope 1)			
Stationary Combustion	33,000	103,000	70,000
Fixed Physical or Chemical Processes	71,000	71,000	0
Mobile Sources	51,000	51,000	0
Fugitive Sources	0	0	0
Land Use Changes [4]	33,500	39,000	5,500
Direct (Scope 1) Total	**188,500**	**264,700**	**75,500**
Indirect (Scope 2)			
Electricity Purchases	570,000	577,000	7,000
Indirect (Scope 2) Total	**570,000**	**577,000**	**7,000**
Subtotal Direct and Indirect	**758,500**	**841,000**	**82,500**
Supply Chain (Scope 3)			
Fuel shipping	9,000	7,000	(2,000)[5]
Product shipping	412,000	506,000	94,000
Supply Chain (Scope 3) Total	**421,000**	**513,000**	**92,000**
Total Direct, Indirect and Supply Chain	**1,179,500**	**1,354,000**	**174,500**
Biogenic Direct			
Stationary Biomass Combustion	57,000	101,000	44,000
Total Direct (Scope 1) with Biogenic	245,500	365,000	119,500
Total Direct and Indirect (Scopes 1 and 2) with Biogenic	815,500	942,000	126,500

[1] This is Alternative 2 from the Briefing Sheet.
[2] This is Alternative 1 from the Briefing Sheet.
[3] See Table 3.3.6 for additional information about GHG Reductions.
[4] See Table 3.3.5 for additional information about land use changes.
[5] This number represents an increase associated with biomass shipping as compared to coal shipping.

Land Use Changes (Wetlands and Forests)

Wetland resources would be affected by the Proposed Project. Wetland resources at the project site are described in detail in Section 4.6. It is estimated that without mitigation at the proposed site, wetland carbon cycle impacts would range from possible decreases in wetland carbon sequestration, or partial to total loss of accumulated wetland carbon. Total loss of accumulated wetland carbon was estimated as a "worst-case" scenario. Emissions associated with this worst-case scenario would be the assumed impact without mitigation (as presented below); however, mitigation would occur as part of the Proposed Project (see Section 4.6).

It is also estimated that without mitigation at the proposed site, undisturbed forest areas would also be impacted by the Proposed Project. Specifically, a partial or total loss of aboveground forest carbon and some loss of carbon stored in forest soils may result.

Table 3.3.5 summarizes the estimated wetland and forest carbon cycle impacts (land use changes) from the Proposed Project without mitigation efforts. In estimating the GHG emissions associated with the Proposed Project, it was assumed as a worst-case scenario that all wetland impacts result in the total loss of stored wetland carbon and that all forest impacts result in the total loss of stored biomass carbon. These estimates represent worst-case scenarios.

TABLE 3.3.5 SUMMARY OF WETLAND AND FOREST CARBON CYCLE IMPACTS

Source	Estimated Emissions over Project Life (tons CO_2-e)	Estimated Annual Emissions (TPY CO_2-e)[1]
Wetlands		
Potential Wetland Carbon Stock Lost Due To Direct and Indirect Impacts	198,601	7,900
Potential Annual Wetland Sequestration Loss for Lag Time Between Wetland Impact and Mitigation		600
Total – Wetlands		8,500
Forests		
Potential Forest Carbon Stock Lost Due to Project Impacts	467,820	18,700
Potential Annual Forest Sequestration Loss		11,800
Total – Forests		30,500
Total – Wetlands and Forests		**39,000**

[1] Estimated emissions were converted to annual emissions based on a 25-year project life.

GHG Reductions

An evaluation of the potential of the Project Proposer to reduce GHG emissions through design changes and changes in operation was developed based on guidance provided by the MPCA (Completion of a Greenhouse Gas Emissions Evaluation) dated July 16, 2008 (MPCA, 2008B). This memorandum requires all new projects requiring an Air Emissions Risk Analysis (AERA) or Part 70 permit to evaluate choices made for the project that impact GHG emissions and quantify those choices. The GHG reduction options that were evaluated are summarized below. Following this summary, Table 3.3.6 summarizes the GHG emission reductions associated with the evaluations.

Direct (Scope 1):

- **Stationary Combustion: Induration Furnace Fuel Mix**
  Fuel mix scenarios for the indurating furnace were evaluated. The highest ranking fuel mix scenario is the 50 percent biomass – 50 percent natural gas scenario. It corresponds to the lowest GHG emissions possible from the furnace when taking into account the biogenic nature of biomass.

- **Stationary Combustion: Induration Furnace Improvements/Efficiencies**
  Gas stream heat recovery is planned for the new induration furnace. It is also proposed to modify the process to eliminate feed of partially oxidized sinter material. Both would reduce the heat needed in the kiln, which would reduce the amount of the selected fuel mix that is combusted. (Note – this also then reduces the biogenic GHG emissions associated with combustion of biomass. Biogenic emissions are accounted for separately from Direct – Scope 1 emissions.)

- **Stationary Combustion: Biomass Dryer Fuel Selection**
  The biomass dryer would be heated using waste heat from the pellet production process, rather than using natural gas.

- **Fixed Physical or Chemical Processes: Process Alternatives**
  The Proposed Project involves re-starting an existing line for the taconite pellet production. This existing line is a grate kiln-cooler system. One other main type of system exists, which is a traveling grate system. However, the traveling grate system is not considered further as a feasible option because the Proposed Project involves re-starting existing equipment rather than purchasing new equipment.

- **Mobile Sources: Haul Truck Options**
  Haul trucks within the facility that operate on biodiesel, compressed natural gas, and diesel were evaluated. The biodiesel type trucks are not feasible due to limited fuel availability and operational issues at low temperatures. Compressed natural gas type trucks are not feasible due to their limited availability and added cost. Diesel haul trucks, as currently used, are the option selected.

- **Fugitive Sources**
  No reduction projects were evaluated in this category as GHG emissions are not expected to occur from fugitive sources.

- **Land Use Changes (Wetlands and Forests)**
  The Project Proposer would take measures to compensate for enhanced wetland carbon releases sequestration through mitigation and stockpile design. Management of the wetlands would be used for wetland mitigation and enhancement. Additions of organic matter to mitigation and enhancement areas would encourage plant growth, which would lead to increased carbon sequestration in these areas. In addition, the plants themselves would accumulate carbon, especially if the vegetation is predominantly forest.

Indirect (Scope 2):

- **Electricity Purchases: Electrical Efficiency**
  The installation of synchronous motors for the new grinding mills and ball mills is proposed. These motors are 2 to 3 percent more efficient than existing induction motors.

- **Electricity Purchases: Electrical Provider**
  The Proposed Project is expected to require an additional 60 megawatts of power, which would be supplied by Minnesota Power. According to the MPCA document General Guidance for Carbon Footprint Development in Environmental Review (MPCA, 2008E), Minnesota Power has the second highest CO_2 emissions per megawatt-hour among Minnesota electrical providers. In 2007, new legislation set a renewable energy requirement in Minnesota of 25 percent by the year 2025, as well as the Next Generation Energy Act, which also addresses global warming and energy efficiency. Additional renewable energy production would begin to supplement Minnesota Power's existing hydro and wind renewable resources in 2008, to bring overall renewable energy supplied to Minnesota Power customers to 25 percent by 2025. Minnesota Power expects a decrease of roughly 20 percent of CO_2 emitted per megawatt generated by 2015. The Project Proposer is not recommending obtaining electrical load from another provider as they are within the service territory of a municipality, and as such they are precluded from obtaining an exemption from the Public Utilities Commission per Minnesota Statute 216B.20.

Supply Chain (Scope 3):

- **Fuel Shipping: Shipping of Combustion Fuels to Facility**
  A comparison of current shipping methods for existing fuels to the facility, to future shipping methods for the Proposed Project fuel mix alternative (50 percent biomass – 50 percent natural gas) was made. The Proposed Project results in an increase in GHG emissions from fuel shipping. However, this increase is offset by the decrease in direct GHG emissions from the furnace by the use of the natural gas and the biogenic characteristics of the biomass.

- **Product Shipping: Shipping of Product from Facility**
  Final pellet product would be shipped via a combination of rail and ore carrier to primarily internal customers including the former U.S. Steel – Hamilton Works, Ontario that was recently purchased by the Project Proposer. The pellets shipped to the former U.S. Steel – Hamilton Works would likely replace pellets shipped via train from Labrador to Hamilton, Ontario. This change in logistics would result in reductions of GHG emissions.

TABLE 3.3.6 GHG EMISSION REDUCTION EVALUATION (50% BIOMASS - 50% NATURAL GAS)

Source	**Project**	**Estimated GHG Emission Reductions (TPY CO_2-e)**
Direct (Scope 1)		
Stationary Combustion	Indurating Furnace Fuel Mix Selection	*(see Direct (Scope 1))*
	Indurating Furnace Gas Stream Heat Recovery *(natural gas reduction)*	61,200
	Indurating Furnace Process Improvement *(natural gas reduction)*	4,300
	Biomass Dryer Fuel Options – Selected Waste Heat *(natural gas reduction)*	4,200
	Total – Stationary Combustion	69,700 *(round to 70,000)*
Fixed Physical or Chemical Processes	Process Alternatives	*(not quantified)*
Mobile Sources	Haul Trucks – Diesel *(no change proposed)*	*(not quantified)*
Fugitive Sources	*(Not applicable to GHG emissions)*	*(not applicable)*
Direct (Scope 1)		
Land Use Changes	Potential Wetland Carbon Stock Less Reduction Due To Burial Under Stockpile Material	4,800
	Potential Annual Wetland Sequestration After Mitigation	700
	Total – Land Use Changes	5,500
Total Direct (Scope 1)	**75,500**	
Indirect (Scope 2)		
Electricity Purchases	Electrical Efficiency of Motors *(electrical consumption reduction)*	7,000
	Electrical Provider *(no change proposed)*	*(not quantified)*
Total Indirect (Scope 2)	**7,000**	
Supply Chain (Scope 3)		
Fuel Shipping	Shipping of Combustion Fuels to Facility	(2,000)[1]
Product Shipping	Shipping of Product from Facility	94,000
Total Supply Chain (Scope 3)	**92,000**	
Total, Scopes 1, 2 and 3	**174,500**	
Biogenic Direct		
Stationary Combustion	Indurating Furnace Process Improvement *(biomass reduction)*	44,000
Total, Direct (Scope 1) with Biogenic	119,500	
Total, Direct and Indirect (Scopes 1 and 2) with Biogenic	**126,500**	

[1] This number represents an increase rather than a reduction associated with biomass shipping as compared to coal shipping.

Proposed Project Fuel Mix Alternatives

As previously discussed, the Carbon Footprint for the Proposed Project was based on a selected fuel mix alternative of 50 percent natural gas and 50 percent biomass for stationary combustion at the indurating furnace. A discussion of how that alternative was selected is presented here.

An evaluation of fuel mix alternatives was required for the Proposed Project per the Briefing Sheet. The Project Proposer therefore evaluated the following fuel mix alternatives for the indurating furnace combustion.

- 100 percent Coal
- 100 percent Fuel Oil
- 100 percent Natural Gas
- 50 percent Biomass and 50 percent Natural Gas
- 60 percent Coal and 40 percent Natural Gas

An alternative not evaluated is the 100 percent biomass alternative. This is because the use of biomass requires the use of natural gas typically around a 50 percent mix in order for effective combustion of the biomass to occur in the indurating furnace.

Table 3.3.7 summarizes the GHG emissions estimated for each of the fuel mix alternatives. The GHG emission estimates for Scope 1, 2, and 3 emissions do not include direct biogenic emissions from biomass combusted to produce energy. Biogenic emissions are presented separately at the bottom of Table 3.3.7. As previously stated, biogenic means the source of carbon was recently contained in living organic matter.

TABLE 3.3.7 GHG EMISSIONS FOR THE FUEL MIX ALTERNATIVES

	100% Coal (TPY CO_2-e)	**60% Coal – 40% Nat. Gas (TPY CO_2-e)**	**100% Nat. Gas (TPY CO_2-e)**	**100% Fuel Oil (TPY CO_2-e)**	**50% Biomass – 50% Nat. Gas (TPY CO_2-e)**
Direct (Scope 1)					
Stationary Combustion	118,000	96,000	63,000	98,000	33,000
Fixed Physical or Chemical Processes	71,000	71,000	71,000	71,000	71,000
Mobile Sources	51,000	51,000	51,000	51,000	51,000
Fugitive Sources	0	0	0	0	0
Land Use Changes	33,500	33,500	33,500	33,500	33,500
Direct (Scope 1) Total	273,500	251,500	218,500	253,500	188,500
Indirect (Scope 2)					
Electricity Purchases	570,000	570,000	570,000	570,000	570,000
Subtotal Direct & Indirect	**843,500**	**821,500**	**788,500**	**823,500**	**758,500**
Supply Chain (Scope 3					
Fuel Shipping	6,000	7,000	9,000	1,000	9,000
Product Shipping	412,000	412,000	412,000	412,000	412,000
Total Scope 3	418,000	419,000	421,000	413,000	421,000
Total Direct, Indirect & Supply Chain	**1,261,500**	**1,240,500**	**1,209,500**	**1,236,500**	**1,179,500**
Biogenic Direct					
Stationary Biomass Combustion	0	0	0	0	57,000
Total Direct with Biogenic	273,500	251,500	218,500	253,500	245,500
Total Direct and Indirect with Biogenic	843,500	821,500	788,500	823,500	815,000

Based on the data presented in Table 3.3.7, a ranking of the fuel mix alternatives was determined based on two methods: 1) total Scope 1 and 2 GHG emissions, and 2) total Scope 1 and 2 GHG emissions and direct biogenic GHG emissions. Direct biogenic emissions are included in the second method to reflect the total estimated emissions from the direct and indirect sources at the facility. Table 3.3.8 summarizes the ranking of the fuel mix alternatives.

TABLE 3.3.8 RANKING OF THE FUEL MIX ALTERNATIVES

	100% Coal	**60% Coal –40% Nat. Gas**	**100% Nat. Gas**	**100% Fuel Oil**	**50% Biomass – 50% Nat. Gas**
Method 1 Ranking: Total Direct & Indirect (Scope 1 and 2) GHG Emissions					
GHG Emissions (TPY CO_2-e)	843,500	821,500	788,500	823,500	758,500
Ranking[1]	**5**	**3**	**2**	**4**	**1**
Method 2 Ranking: Total Direct & Indirect (Scope 1 and 2) and Direct Biogenic GHG Emissions					
GHG Emissions (TPY CO_2-e)	843,500	821,500	788,500	823,500	815,500
Ranking[1]	**5**	**3**	**1**	**4**	**2**

[1] Ranking: lowest emissions ranked as 1 and highest emissions ranked as 5.

The highest ranked fuel mix alternative when also including biogenic emissions is the 100 percent natural gas scenario. This alternative represents the lowest overall GHG emissions associated with the Proposed Project. However, this scenario results in the highest NOx emissions of the fuel alternatives. Modeling of changes in visibility impacts for the Proposed Project show that the use of 100 percent natural gas on a full time basis would have impacts on visibility in the Class I areas due to NOx (see Sections 4.9.5 and 5.11). With respect to GHG emissions, NOx is the only pollutant that limits the use of natural gas. The air permit for the Proposed Project would establish limits on NOx to address this issue. Therefore, to balance the impacts of visibility and GHG emissions, this fuel mix alternative was not considered further by the Project Proposer.

The second highest fuel mix alternative, when also including biogenic emissions, is the 50 percent biomass and 50 percent natural gas scenario. In addition, when subtracting out biogenic emissions (57,000 TPY CO_2-e), this scenario provides the lowest GHG emissions of the fuel mix alternatives. This alternative represents the lowest overall GHG emissions associated with the Proposed Project that is feasible at the facility.

The remaining fuel mix alternatives, including 100 percent coal, 100 percent fuel oil, and 60 percent coal and 40 percent natural gas, all ranked lower in the evaluation, with higher GHG emissions.

Therefore, the Project Proposer selected the 50 percent biomass and 50 percent natural gas fuel mix alternative for the Proposed Project. This alternative is represented in the carbon footprint GHG emission calculations presented. This fuel mix alternative would be represented in the air permit application for the Proposed Project.

Pellet Production Location Alternatives

Taconite pellets are produced throughout the world, and all production facilities emit greenhouse gases at varying levels depending on the plant design, combustion fuel used, and the energy efficiency of the indurating process being used. Each location is governed differently by air emission regulations that could be weaker, stronger or the same as those in the United States. These factors may result in differing rates of GHG emissions per unit of pellet production. Further discussion on air emission regulations can be found in Section 5.2.1.4.

The Keetac facility may produce pellets for use by the Project Proposer as a raw material in steel production at other locations, or alternately may be sold to other steel producers in the global steel market. However, depending on price, the additional production resulting from the Proposed Project would occur somewhere regardless of whether the Proposed Project is completed. Market demand would probably lead to an increase in production in one or more of the world's iron ore producing economies.

CO_2 is considered a global atmospheric constituent, since it stays in the atmosphere for long periods of time. The level of GHG emissions from taconite production, regardless of the location of where the GHG emissions occur in the world, would determine the impact on atmospheric concentrations of CO_2. The selection of the existing Keetac pellet production facility for the Proposed Project is based on the location of the iron ore deposits in Minnesota and the feasibility to complete the Proposed Project at the existing location.

Comparison of GHG Emissions for Existing Facility and Proposed Project

Greenhouse gas emissions from the existing Keetac production line as well as to those of the Proposed Project were evaluated for the purpose of comparing the existing line and the new line. The GHG emissions were normalized to a production level (referred to as intensity), and reported in tons CO_2-e per tons of pellets produced. The analysis of the existing production line is based on the current fuel mix of coal and natural gas. The evaluation of the Proposed Project is based on the selected fuel mix alternative of 50 percent biomass and 50 percent natural gas. A comparison of GHG intensities of the existing production line (a combination of coal and natural gas) and the Proposed Project is shown in Table 3.3.9.

TABLE 3.3.9 GHG EMISSIONS AND INTENSITY COMPARISON

Source	**Existing Production Line Emissions (Coal / Nat. Gas) (TPY CO_2-e)**	**Existing Production Line Intensity (ton CO_2-e / ton pellets produced)**	**Proposed Project Emissions (50% Biomass – 50% Nat. Gas) (TPY CO_2-e)**	**Proposed Project Intensity (ton CO_2-e / ton pellets produced)**	**GHG Intensity Improvement (ton CO_2-e / ton pellets produced)**
Direct (Scope 1) Total	508,000	0.085	188,500	0.052	0.033
Indirect (Scope 2) Total	962,000	0.160	570,000	0.158	0.002
Subtotal Direct & Indirect	1,470,000	0.245	758,500	0.211	0.034
Supply Chain (Scope 3) Total	860,000	0.143	421,000	0.117	0.026
Total Direct, Indirect & Supply Chain	**2,330,000**	**0.388**	**1,179,500**	**0.328**	**0.060** [1]
Biogenic Direct	0	0	57,000	0.016	

[1] Intensity improvement of Proposed Project to Existing Line = 0.060 / 0.388 = 15.6 percent.

This analysis suggests that the Proposed Project would result in GHG emissions that are 15.6 percent lower than the existing production line of Keetac. As indicated above, this is based on a reduction of GHG intensity in term of production level (tons per year of CO_2-e emissions per ton of pellets produced annually).

3.3.6 Proposed Project Summary

In summary, the Proposed Project is defined as the incremental change beyond what is allowed under the No Action Alternative and existing permits. Key features of the Proposed Project include.

- Starting the new indurating line and upgrading concentrating and agglomeration processes
- Refurbishing the Phase I grate kiln furnace and changing the mixture of fuels used at Keetac to include biomass
- Expanding mine pit and stockpile boundaries

3.3.7 Closure and Mineland Reclamation

The facility operates under a MNDNR issued Permit to Mine, which includes mine plan approval, approved mining pit limits, waste rock and surface stockpile areas, and tailings basin area. It also outlines mineland reclamation requirements, which are part of ongoing mining operations at the existing facility. Mineland reclamation activities would occur both during ongoing operations at the facility and during deactivation activities for final closure of the mine. The U.S. Steel Permit to Mine Application, dated July

2009, describes the proposed reclamation plan for mined areas of the Proposed Project. This reclamation plan must conform to Minnesota Rules Chapter 6130 for taconite and iron ore mineland reclamation. In summary, mineland reclamation would include the mine area, stockpile areas, tailings basin, and other areas disturbed by mining related activities. When mining activities reach the ultimate pit limit, the surface overburden portions of the pit walls would follow the standards listed in Minnesota Rules, part 6130.2900. The tailings basin would be designed and constructed according to Minnesota Rules, part 6130.3000 and in accordance with the Dam Safety Permit. The facility is complying with its Permit to Mine and reclamation requirements as governed by Minnesota Rules Chapter 6130.

Potential project impacts, described in Chapter 4.0 that can be mitigated through the implementation of mine reclamation practices include erosion and sedimentation, wetland impacts, changes in vegetation cover types, wildlife habitat, changes in surface water quality and quantity, watershed modifications, air quality (dust), solid waste, and visual impacts. Implementation of mine reclamation practices would be used to mitigate mining-related project impacts. Table 3.3.10 describes the potential impact along with the reclamation mitigation measure for that impact.

TABLE 3.3.10 MINE RECLAMATION AS MITIGATION FOR MINING IMPACTS

Mining Impact	Description	Reclamation Mitigation Practice
Erosion/sedimentation	Bare soil and sloped ground at stockpiles, tailings basins, or haul roads increase erosion and sedimentation potential.	• Temporary vegetation of inactive areas • Regrading • Revegetation • Mulching
Wetland impacts	Direct wetland losses resulting from the project.	• Potential for creation of wetlands at stockpiles, tailings basin, following mining. • Strategic in-pit disposal to create wetlands • Minimize watershed modifications
Changes in vegetation cover types	Removal of existing vegetation during mining	• Revegetation • Vegetation/land use approval
Wildlife	Loss of wildlife habitat resulting from changes in cover types. Potential barriers to travel in steep-sloped areas created by mining.	• Revegetation • Re-grading • In-pit disposal to reduce stockpile area
Changes in surface water quality and quantity	Increase in runoff (and potential increase in pollutant transport in runoff) due to exposed, compacted soils and steep slopes at stockpiles.	• Regrading • Revegetation • Mulching
Air quality (dust)	Bare soil increases wind transport of soil particles	• Watering or dust suppressant treatment of exposed soil to minimize dust in active mining areas, stockpiles and at the tailings basin. • Temporary vegetation in inactive areas. • Revegetation of exposed soil

Mining Impact	Description	Reclamation Mitigation Practice
Solid waste	Creation of additional waste rock and overburden stockpiles near mine pits and tailings storage at tailings basin.	• Regrading • Cover tops and benches of rock stockpiles with overburden prior to revegetation. • Revegetation • Mulching
Visual impacts	Stockpiles and the tailings basin are large and barren. Large industrial structures are visible in the landscape from relatively long distances.	• Regrading • Revegetation • Razing structures after final closure of operations. • Water-filled mine pits can be a visual amenity • Constructed buffers and barriers

As stated in Minnesota Rules, part 6130.2200, altered watersheds will be returned to pre-mining conditions when possible. Vegetation establishment will be initiated within the first growing season after an area, according to the permit to mine, is no longer scheduled to be disturbed or used in a manner that would interfere with the establishment and maintenance of vegetation. Reclamation techniques such as grading, disking, seeding or planting, fertilizing and mulching would be used in the establishment of vegetation.

Vegetation would be established on surface overburden stockpiles, exposed soils along diversion channels and roads, borrow pits, benches and tops of waste rock stockpiles, tailings basin, dikes and dams and surface overburden portions of pit walls. A minimum of two feet of overburden would be placed on the required or approved vegetation areas of each bench and top of waste rock stockpiles.

Waste rock and coarse tailings stockpiles' exterior slope lifts would be designed not to exceed 30 feet in height, or 40 feet in height if covered with overburden and vegetation. The width of the benches would be equal to, or greater than, 30 feet wide and the sloped area between the benches would be no steeper that the angle of repose. Materials of varying grades and types would be segregated within the same stockpile or placed in separate stockpiles.

Overburden stockpile lifts would not exceed 40 feet in height or have a bench width of less than 30 feet wide. The overburden stockpile would be sloped to control runoff and would not be steeper than 2.5:1. When mining activities reach the ultimate pit limit, the surface overburden portions of the pit walls would follow the standards listed in Minnesota Rules, part 6130.2900.

Progressive reclamation activities in the tailings basin area would be conducted on the interior of the basin and on the exterior portion of the dikes and dams (meaning these areas would be reclaimed as soon after initiation of the operations as practical and as continuously as practical throughout the life of the operation). The tailings basin would be designed and constructed according to Minnesota Rules, part 6130.3000 and in accordance with the Dam Safety Permit. The dust generation on the tailings basin would be minimized by maximizing the water pond area, vegetating exposed surfaces (either permanently or temporarily), through non-vegetative methods described in Minnesota Rules, part 6130.3700, and by modifying tailings basin operations. This operational modification would allow for more water retention and would move the beach area from the middle of the basin, where it was inaccessible, to the outside edges of the basin, where it would be accessible for the establishment of vegetation. These changes would reduce fugitive dust emissions from the tailings basin. Additional information on fugitive dust emissions and the Fugitive Dust Control Plan is provided in Section 4.9.2.

Fertilizing, seeding and mulching should be accomplished to expedite revegetation and to minimize erosion. Herbaceous plants should be seeded using a hydro-seeder or other methods. Seed mixes should be designed to achieve early stabilization and long-term cover. When necessary to control dust, temporary seeding may be used. In areas where erosion is a concern, mulch should be used to hasten stabilization. Removal of equipment, facilities and structures should be accomplished and provisions made for subsequent use and continued maintenance where necessary. Areas exposed during such removal (i.e., the building sites) would be vegetated.

After three growing seasons (five growing seasons if it is a south or west facing slope) the surface would be repaired or replaced if 90 percent ground cover, consisting of living vegetation and its litter, has not been established. The repair or replacement would take place during the next normal planting period after it is determined that 90 percent ground cover has not been established. Within ten growing seasons, established vegetation to provide subsequent land use is required before a mining deactivation release can be granted (Minnesota Rules, part 6130.3600, subp. 4B).

As described in Section 4.6 – Wetlands and in the wetland mitigation plan, the reclamation process would include creation of wetlands where feasible, to replace some of the wetland functions and values lost through mining activities.

Post-mining land uses would be presented to the commissioner of the MNDNR for approval two years prior to the deactivation of the mining area. The proposed land uses would be selected pursuant to Minnesota Rules, part 6130.4100, subp. 2. The deactivation activities for final closure of the mine would be fulfilled as prescribed in Minnesota Rules, part 6130.4100, subp. 2.

3.3.8 Project Schedule

The overall Proposed Project timeline is dependent on numerous factors including completion of the EIS process, acquiring all necessary permits (federal, state and local), and the construction of the Proposed Project. The following timeline is presented to provide a general understanding of the anticipated project schedule, which is subject to change.

Complete the EIS, obtain permits and acquire project financing	2010 – 2011
Start construction Year 1 – Year 2	2011 – 2013
Complete construction and begin water management plan for the Proposed Project including dewatering of mine pits	2013 – 2015
Begin full operation of Proposed Project	2013 – 2015

3.3.9 Connected Actions

The Project Proposer expects to purchase biomass, natural gas, coal, and fuel oil from suppliers. Similarly, electricity would be obtained from local utilities from existing sources through existing transmission lines. The current access to TH 169 is adequate for the Proposed Project and no improvements are expected to be necessary. Existing rail access is also adequate for the Proposed Project.

The Project Proposer would periodically deliver dried biomass from Keetac to the Minntac facility. The Minntac wood storage system would not change and has capacity to accept the biomass volume generated by Keetac. The current biomass limit at Minntac (220,000 TPY) is on a dry ton basis and this amount would not be exceeded by using biomass from the Proposed Project. There are no physical changes required at Minntac to be able to accept biomass from the Keetac facility and then subsequently use it at the Minntac facility as a fuel source.

Based on a review of Minntac's air permit, biomass combustion is allowed by the permit for Agglomerator Lines 3-7, and there are emission limits for the associated process stacks (Stack/Vents [SV] 103, 118, 127,144 and 151). The Hill Wood Products System (SV 195) (i.e., the Minntac wood storage system) has a process throughput limit of less than or equal to 220,000 TPY using a 12-month rolling sum of wood waste. Based on the Minntac capacity information, the proposed Keetac biomass facility is not considered a connected action.

3.4 SITE ALTERNATIVES

Minnesota Rules Chapter 4410 requires an evaluation of Site Location Alternatives. Minnesota Rules Chapter 4410 allows the RGU to exclude alternative sites if other sites do not have significant environmental benefit compared to the project as proposed, or if other sites do not meet the underlying need and purpose of the Proposed Project.

> The purpose of the project is to increase the rate and total quantity of taconite pellet production at the Keetac facility using existing infrastructure. The applicant's preferred alternative would achieve the project purpose through the expansion of an existing mine pit, and the re-starting of an existing idle indurating line.

3.4.1 Alternative Mine Pit

The FSDD states that, "the MNDNR and USACE do not propose to evaluate alternative mine pit sites for the Proposed Project. An alternative mine site would not meet the underlying need or purpose of the Proposed Project. The mineralization of desired elements [presence of iron ore] within a geologic deposit dictates the location of the mine pit."

Geologic deposits in the Iron Range have the desired characteristics for the Project Proposer to operate a mine site. Outward expansion of the mine is determined by the location and formation of the ore body. The Proposed Project would use the ore body for mining and taconite production by expanding the existing mine pit further into the ore body.

While an alternative iron ore mine pit could facilitate the mining of taconite, it would not take advantage of the existing infrastructure at the Keetac site. As a result, new infrastructure which may include the processing plant, roads, power lines, tailing basin dam, etc., would need to be put in place at an alternative location. The increased impacts of constructing this infrastructure would not provide an environmental benefit when compared to the Proposed Project. The complement of existing usable infrastructure and available iron ore makes the Proposed Project practicable.

3.5 MODIFIED DESIGNS OR LAYOUTS

The Minnesota Rules, part 4410.2300 requires an evaluation of modified designs or layouts of the facility. The FSDD states that the following major components of the Keetac facility will be evaluated in this FEIS.

- Plant and Pit Location on Site
- Tailings Thickener and Tailings Basin Locations
- Stockpile Location and Design, including Haul Roads
- Recreational Trails

The Proposed Project is an expansion of an existing facility with the major components, as listed above, included as part of current operations. A modified design or layout evaluating the inter-relationship of these components would require the relocation of two or more of the components listed above. This would be a major undertaking and require construction of new facilities, which would likely not have significant environmental benefit compared to the Proposed Project. Therefore, based on Minnesota

Rules, part 4410.2300, an overall evaluation of a modified design or layout of the inter-relationship of these components is not evaluated as part of this FEIS.

3.5.1 Plant and Pit Location on Site

The FSDD states that, "the MNDNR and USACE do not propose to evaluate alternative mine plant sites for this Proposed Project. An alternative processing plant site would not have significant environmental benefit over the Proposed Project. The new processing line would be located on the existing Phase I plant footprint. A new plant location would alter land cover types and terrestrial habitats. Moreover, it would not meet the underlying purpose of the Proposed Project which includes reusing existing plant infrastructure."

Additionally, as previously stated in Section 3.4.1, the FSDD states that, "the MNDNR and USACE do not propose to evaluate alternative mine pit sites for the Proposed Project. An alternative mine site would not meet the underlying need or purpose of the Proposed Project." The presence of taconite ore within a geologic deposit dictates the location of the mine pit. Outward expansion of the mine is determined by the location and formation of the ore body. The Proposed Project would use the ore body for mining and taconite production by expanding the existing mine pit further into the ore body.

3.5.2 Tailings Thickener and Tailings Basin Locations

3.5.2.1 Tailings Thickener Location

The FSDD states that, "the MNDNR and USACE do not propose to evaluate tailings thickener sites for the Proposed Project. An alternative tailings thickener location would not have significant environmental benefits over the proposed location because the proposed tailings thickener locations are adjacent to the existing plant on previously disturbed ground. No other locations have significant environmental benefits over the proposed location."

3.5.2.2 Tailings Basin Location

The FSDD stated that the MNDNR and USACE do not propose to evaluate alternative tailings basin sites for the Proposed Project. The Proposed Project intends to maintain the existing area of the tailings basin and build the basin vertically as tailings are produced, which would slightly expand the footprint of the active tailings basin, as shown on Figure 3.1.2. Without mitigation, a taller tailings basin may generate more fugitive dust, because of greater wind erosion across the surface of the basin. However, these possible adverse effects are offset by the land disturbance a new tailings basin would create, and can feasibly be mitigated. A new tailings basin location would therefore have no environmental benefits compared to the existing tailings basin.

3.5.3 Stockpile Design and Location

3.5.3.1 Design

The MNDNR and USACE do not propose to evaluate alternative stockpile design parameters that would not adhere to the relevant rules (Minnesota Rules Chapter 6130) for the construction of a stockpile for mining activities that are prescriptive in nature, defining maximum slope/bench configurations and vegetation requirements. A provision within Minnesota Rules Chapter 6130 allows acceptable research to determine if alternative stockpile configurations would have benefit. The provision also allows for a variance from the prescriptive nature of the rules if the research shows beneficial alternatives. Keetac may explore acceptable research as allowed by Minnesota Rules Chapter 6130 to meet both the economy of stockpile space and the reclamation goals, while better blending mining landforms with the surrounding landscape.

The Project Proposer is not considering any stockpile design parameters that are not already approved in Minnesota Rules Chapter 6130. However, the FEIS has examined other stockpile concepts and configurations. A detailed discussion of the stockpile concepts evaluated in the FEIS is provided in 3.5.3.3.1.

3.5.3.2 In-Pit Stockpiling Location

The Project Proposer intends to use in-pit stockpiles to the greatest extent possible. This would be done for several reasons. First, Minnesota Rules, part 6130.1400 encourages maximization of in-pit stockpiling. Minnesota Rules, part 6130.1400, subp. 1 states:

Mining shall be conducted to maximize use of past, present, and future mining areas so as to minimize the amount of land disturbed by mining and reduce the loss of nonmineral resources.

Second, it would result in the disturbance of less acreage, including wetlands, needed for out of pit stockpiles. Third, it is the most economical for the Project Proposer, as in-pit stockpiling would result in shorter hauling distance and wetland mitigation costs. Lastly, there would be air quality benefits, as reduced hauling would result in less particulate matter (PM), NOx and GHG emissions, which are related to hauling distances, and haul truck fuel consumption.

The Proposed Project would maximize the capacity of existing in-pit stockpiles. Expanding the footprint of existing in-pit stockpiles or constructing new in-pit stockpiles not identified on the proposed mine sequencing plan, would be evaluated near mid-life of the Proposed Project. Planning in-pit stockpiles is a complex evaluation limited by land ownership, stockpile ownership, type of waste rock in a stockpile, mineral rights, and mine sequencing[1]. For example, due to economics, technology, and pit depth, the Proposed Project cannot mine the entire known depth of the ore deposit. Future technological advances to ore benefication processes may allow for mining of the remaining deposit. For this reason, impediments, such as in-pit stockpiles, to future access of this potential ore are discouraged by mineral rights owners. The Project Proposer is only one of four to six owners of mineral rights.

Each mineral rights owner has a different setback from the mine pit walls based on the type of material exposed in the adjacent pit wall. The purpose for the setback is to enable future mining of the pit wall. The setback is wider for higher grade taconite. Typical mineral rights agreements state that the toe of an in-pit stockpile must be 200 feet from the edge of a pit wall that has exposed taconite ore. Additionally, residual products of greater potential future value (e.g., waste rock and unexcavated ore) must be placed on top of residual products of lesser value (e.g., surface overburden). This allows greater access to the more valuable material, and this material more economical to recover.

Mine sequencing impacts the development of in-pit stockpiles. Before in-pit stockpiles can be established, the surface overburden has to be removed, followed by the waste rock, and finally the crude ore to an agreed upon bottom of pit mining limit. The fee owner of the property has to agree that all the crude ore has been removed before they allow in-pit stockpiling. Therefore, the pit has to be mined out to the bottom limits in an area large enough to place waste material, before the surface overburden and waste rock can be stockpiled in the pit. Due to economics of mining low grade ore, it is not feasible to temporarily stockpile waste material out of pit and then move the waste material a second time (i.e., double handling) into the newly mined out portion of the pit.

[1] Mine sequencing is the order of mining and is as follows: 1) removal of surface soils, 2) removal of waste rock, and 3) removal of taconite ore.

If the economics would allow waste material to be double handled, the material still has to be temporarily stockpiled out of pit until there is enough space for in-pit stockpiling. This permanently disturbs the land area and wetlands where the temporary out of pit stockpile is placed. Waste rock and surface overburden are only allowed in an in-pit stockpile if 1) all the ore has been removed prior to stockpiling; 2) the ownership or origin of the material is the same as the ownership of the in-pit stockpile area; and 3) the waste material being in-pit stockpiled is of higher value than the material it is being stockpiled onto (i.e., waste rock on top of surface material).

The Project Proposer has a phased development plan for the in-pit stockpiling that correlates to the timing of the mining activities that is broken into four time periods through 2037. Appendix E contains calculations of mine sequencing and the volumes of waste rock and surface overburden that can be placed in-pit versus out of pit. The analysis in Appendix E shows that surface overburden is removed early during the mining period and must be removed from the pit to allow room for additional rock and taconite mining. The lack of available space where the pit has been mined to the final bottom limits and the need to leave space for future mining requires over 85 percent of the surface overburden to be stockpiled out of pit. Conversely, more of the waste rock (approximately 75 percent) that is removed after surface overburden can remain in-pit. In total of all the material that requires stockpiling, surface overburden and waste rock, approximately half remains in-pit and half is removed from the pit.

3.5.3.3 Out of Pit Stockpiling Location

The FSDD states, “Positioning of stockpiles is crucial to minimizing impacts to wetlands and potentially other natural resources. The EIS will evaluate the potential environmental effects of the proposed stockpile locations as well as alternative stockpile locations. In addition, the EIS will evaluate in-pit stockpile opportunities; in-pit stockpiles can help create future shallow-water habitat when pits are abandoned and reclaimed. This stockpile location analysis will consider not only potential wetland impacts, but also air emissions from haul truck and wind erosion, haul road location, lease fee-holder requirements, in-pit stockpile opportunities and other operational and environmental issues.” The Analysis of Stockpile Location Concepts Report was completed for the DEIS, which evaluated the two proposed stockpile locations, several alternative stockpile locations, and in-pit stockpile opportunities. The Stockpile Analysis was updated and expanded as a result of the comments, subsequent workshop, and additional analysis. The updated report is in Appendix E.

During the public comment period of the DEIS, several comments were received concerning the issue of wetland avoidance, minimization and mitigation. Also, additional information was requested about mine planning to reduce wetland impacts. In response to these comments the MNDNR, USACE, USEPA, MPCA, Bois Forte Band, and the Project Proposer convened for a two day workshop, held in April 2010, to ensure all possible sites were evaluated for out of pit stockpiling. The evaluation of all practicable sites for out of pit stockpiling, while maintaining the purpose of the project, assists the Project Proposer in demonstrating wetland avoidance and impact minimization.

The workshop participants evaluated all potential in-pit stockpiling and out of pit stockpiling areas within and surrounding the current mine site. From this effort an additional concept was developed, Concept E, that was not included in the DEIS. This concept was created as a reconfiguration of the proposed east stockpile. During this workshop, there was also considerable discussion of the proposed south stockpile and potential alternatives. Alternative locations for the proposed south stockpile were determined to be impracticable. The analysis, exclusion area mapping, mine sequencing evaluation, and supporting documentation for the decision to not include an alternative to the proposed south stockpile and include Concept E as an alternative to the proposed east stockpile in the FEIS is presented in Appendix E. Appendix E also contains the

Permit to Mine figures that depict the progression of the mine through the 25-year mine period. A summary of Appendix E is included below.

3.5.3.3.1 Stockpile Concepts Considered

The Stockpile Analysis used a number of criteria to evaluate potential alternative stockpile locations (see Appendix E). The analysis criteria included the following.

- Location Relative to Iron Formation
- Surface and Mineral Rights
- Quantity of Stockpile Material
- Haul Route Configurations and Haul Truck Operation
- Upland Habitat and Acres
- Wetland Acreage and Quality
- Threatened and Endangered Species
- Air Quality
- Noise and Visual Impacts
- Economic Factors
- Safety Factors

> The analysis, exclusion area mapping, mine sequencing evaluation, and supporting documentation for the decision to not include an alternative to the proposed south stockpile and include Concept E as an alternative to the proposed east stockpile in the FEIS is presented in Appendix E.

The Project Proposer estimates with maximization of in-pit stockpile and existing stockpile options, an additional 118 million bank cubic yards (Mbcy) of excess surface overburden from the Proposed Project would need to be stockpiled out of pit. Surface overburden would need to be removed over 21.5 years to continue uninterrupted mining of taconite.

Using the stockpile capacity needs as a baseline to determine stockpile area size, the following stockpile location concepts were evaluated using the criteria listed above. The proposed stockpile location, along with Concepts C, D and E, meet the underlying capacity needs of the Proposed Project. Concept B is within 10 percent of the capacity needs and could likely be configured, with some minor adjustments in the layout, to substantially serve the need. Concept A only fulfills approximately 11 percent of the needed stockpile capacity. All stockpile concepts use all or a majority of the existing southeast stockpile in their configurations. Greater detail is provided in the stockpile location analysis for each of the stockpile location concepts, along with the results of the analysis and figures showing the evaluated stockpile concepts. Below is a summary of that analysis and includes:

<u>Proposed Location</u>: Proposed stockpile locations include a 40-acre south stockpile, and a 539-acre east stockpile. In-pit stockpiling of excess waste rock and surface overburden in accordance with Minnesota Rules, part 6130.1400, and current mineral rights agreements would be included in the proposed locations.

<u>Existing Stockpiles:</u> The existing out of pit stockpile locations to the northwest and southeast of the pit would be used. The existing in-pit stockpiles would also be used.

Alternative Locations

Concept A: This is an area of approximately 160 acres located south of the railroad tracks and current southeast stockpile. This area is also bordered by TH 169 on the south. This concept does not contain adequate capacity alone to accommodate the Proposed Project stockpile needs, and therefore was eliminated from further analysis.

Concept B: This is an area of approximately 487 acres located north of the east end of the current northwest stockpile. Concept B is bound by the existing Permit to Mine area on the north and east and O'Brien Creek on the west. This concept has approximately equivalent area to the proposed east stockpile.

Concept C: This is an area equivalent to the proposed stockpile locations located northwest of the current northwest stockpile area. This concept was eliminated from further evaluation because it did not provide a significant environmental benefit over the Proposed Project.

Concept D: This is an area equivalent to the proposed stockpile locations located north and east of the current northwest stockpile area.

Alternative Reconfiguration

Concept E: This concept was created as a reconfiguration of the proposed east stockpile within the same footprint. It encompasses approximately 75 percent of the proposed east stockpile and 85 percent of the existing southeast stockpile. Although this concept has a smaller footprint than that of the proposed east stockpile, it could hold 100 percent of the volume of overburden required to be stockpiled for the east mine pit expansion.

3.5.3.3.2 Comparison of Concepts

Based on preliminary screening within the Stockpile Analysis, Concepts A and C were eliminated from further detailed evaluation. Concept A would not provide enough capacity and Concept C would not provide a significant environmental benefit when looking at the combined effects of all factors considered in the analysis.

The analysis determined that a more detailed comparison of the proposed east stockpile location to Concepts B, D, and E was warranted as summarized below. Air quality analysis comparisons were made based on emissions from truck exhaust and fugitive dust generated from haul truck traffic. This included GHG, NOx, and PM only.

Summary of Comparison of Concept B with Proposed East Stockpile Location

- Concept B would disturb approximately 115 additional acres of high quality wetland and 75 acres of upland forested habitat.
- Concept B would disturb approximately 108 fewer acres of wetland.
- Concept B, haul road Route 1 would result in a 30-70 percent increase in PM emissions and a 55 percent increase in NOx, and GHG emissions.
- Concept B, haul road Route 2 would result in a 14 percent increase in PM emissions and a 65-68 percent increase in NOx and GHG emissions.
- Concept B would not provide a change in noise levels on residential receptors compared to the No Action Alternative. Under the proposed east stockpile noise levels would increase, though they would meet noise standards with mitigation.
- Concept B would be less visible, as it is three to four times farther away from Kelly Lake than the proposed east stockpile, however the regional landscape is dotted with stockpiles from previous and currently active mining activities.

- Concept B could be configured to provide the anticipated necessary capacity.
- The land within Concept B is owned by the Project Proposer.
- Concept B, routes 1 and 2, would compromise worker safety. Route 1 would require haul trucks to pass through a congested and narrow area near the crusher. Route 2 would require haul trucks to navigate steep road grades.
- Concept B is estimated to cost the Project Proposer an additional $90-$106 million in comparison to the proposed east stockpile. This results in approximately an 87 percent increase to the economic impact of the stockpile and related hauling costs.

Summary of Comparison of Concept D with Proposed East Stockpile Location

- Concept D would disturb approximately 131 additional acres of high quality wetland and an additional 181 acres of upland forested habitat when compared to the proposed east stockpile.
- Concept D would disturb approximately 161 fewer acres of wetlands.
- Concept D, haul road Route 1 would result in a 56-66 percent increase in the PM, NOx, and GHG emissions. Concept D, haul road Route 2 would result in approximately equal PM emissions and approximately a 44 percent increase to the NOx and GHG emissions.
- Concept D would not offer a substantial improvement in noise, as the noise standards would be met during the day and met using mitigation at night with the proposed east stockpile.
- Concept D would be less visible, as it is approximately three times farther away from Kelly Lake than the proposed east stockpile; however, the regional landscape is dotted with stockpiles from previous and currently active mining activities.
- Concept D would provide enough stockpile capacity. However, the land within Concept D is not entirely owned or controlled by the Project Proposer. There are parcels of land in this area that would need to be acquired. It is unknown if this land could be acquired. Given this uncertainty, it is difficult for the Project Proposer to proceed with the assumption that this land would be available when needed.
- Concept D routes 1 and 2, would compromise worker safety. Route 1 would require haul trucks to pass through a congested and narrow area near the crusher. Route 2 would require haul trucks to navigate steep road grades.
- Concept D is estimated to cost the Project Proposer an additional $66 - $102 million in comparison to the proposed east stockpile. This results in a greater than 50 percent increase to the economic impact of the stockpile and related hauling costs.

Summary of Comparison of Concept E with Proposed East Stockpile Location

- Concept E is approximately 250 acres smaller than the proposed east stockpile and would disturb approximately 100 fewer acres of wetland including the avoidance of 39 acres of high quality wetland.
- The haul routes for overburden are similar and the PM emissions would be similar. Concept E would increase NOx, and GHG emissions by approximately 20-30 percent.
- Concept E and the proposed east stockpile both exceed state noise standards during nighttime operation of mining equipment; however mitigation can be implemented to eliminate this potential impact. During the day, noise standards are less restrictive, and therefore because Concept E is further away from residential receptors, impacts would be less.
- Concept E is in the same general location as the proposed east stockpile; however it would be 200 feet higher and potentially seen from further distances.
- Concept E would provide enough stockpile capacity, but requires a reconfiguration of waste rock stockpiles in the existing southeast stockpile and covering of an existing waste rock stockpile with surface overburden.
- The land within Concept E is owned or controlled by the Project Proposer.

- Concept E poses no additional hauling safety issues when compared to the proposed east stockpile.
- Since the location is the same as the proposed east stockpile, the economics are expected to be nearly the same. Concept E has a lower wetland mitigation cost requirement, but is offset by a higher capital expense due to hauling to increased heights. The costs with Concept E are estimated to be $13 - $33 million higher or an increase of 10-30 percent.

3.5.3.3.3 Conclusions of the Alternative Stockpile Location Analysis

The criteria used in the comparison of the proposed stockpile location to Concept B, D, and E were placed into the following two categories, Factors of Greater Importance and Factors of Lesser Importance. Some of the factors were dropped from the analysis due to their impacts either being equal (or nearly equal), or their impacts being negligible in comparison to the magnitude and potential impacts of other factors. Identified factors of relative greater importance were: total wetland disturbance, wetland quality disturbance, particulate emissions, ownership, safety, and economics. A decision making summary of the proposed east stockpile to Concepts B, D and E is provided below. Table 3.5.1 summarizes these findings.

Proposed East Stockpile vs. Concept B

Of the factors of greatest importance, the proposed east stockpile would have less affect over Concept B in the following areas: amount of high quality wetlands disturbed; PM emissions; safety; and economics. Concept B would have less affect over the proposed east stockpile in total wetlands disturbed. The proposed east stockpile and Concept B are equal under the factor of surface ownership since land related to these alternatives is under the control of the Project Proposer.

Proposed East Stockpile vs. Concept D

Of the factors of greatest importance, the proposed east stockpile would have less affect over Concept D in the following areas: amount of high quality wetlands disturbed; PM emissions; surface ownership; safety; and economics. Concept D would have less affect over the proposed east stockpile in total wetlands disturbed.

Proposed East Stockpile vs. Concept E

Of the factors of greatest importance, the proposed east stockpile would have fewer ownership issues and a lower cost when compared to Concept E. Concept E would have less affect on high quality wetlands.

TABLE 3.5.1 STOCKPILE CONCEPTS AND FACTORS OF GREATER IMPORTANCE

Concepts	**Total Wetlands Disturbed**	**High Quality Wetlands Disturbed**	**Particulate Emissions**	**Ownership**	**Safety**	**Economics**
Proposed east stockpile			Least emitted	No issues	Fewer concerns	Lowest cost
Concept B				No issues		
Concept D	Least disturbed					
Concept E		Least disturbed	Least emitted		Fewer concerns	

Concept B or D would not provide an environmental benefit over the proposed east stockpile. The USACE determined that Concept B and D are also not practicable because of the excessive cost to implement. Based on the results, the conclusion in Appendix E is that Concepts B and D are not a practicable alternative to the proposed east stockpile.

Based on the analysis described in Appendix E, the MNDNR and USACE concluded that Concept E has fewer adverse effects compared to the proposed east stockpile. For example, one hundred fewer acres of wetlands are affected (including 38.9 acres of high quality wetlands), and 148.8 fewer upland acres are impacted. Based on the results, the conclusion in Appendix E is that Concept E may provide an overall benefit compared to the proposed east stockpile and should be included in the FEIS as a viable stockpile alternative.

3.5.4 Recreational Trails

The FSDD states that, "the Proposed Project will likely affect snowmobile trails. If adverse impacts to trails are identified, new trail locations will be included and evaluated in the EIS." Impacts to recreational trails were considered for the Proposed Project Alternative and East Stockpile Alternative activities that prohibit or eliminate the use of a trail, such as land alterations due to mining. Finalized alternative trail alignments were not available at the time of this FEIS preparation. Section 4.19 provides more detail about potential recreational trail impacts from the Proposed Project and East Stockpile Alternative, and possible mitigation.

3.6 MODIFIED SCALE OR MAGNITUDE ALTERNATIVES

The FSDD states, "the MNDNR and USACE do not propose to evaluate proposed project scale or magnitude alternatives. The infrastructure requirements to mine and process ore are such that alternative scale or magnitude changes would not meet the underlying need for or purpose of the Proposed Project."

3.7 MITIGATION MEASURES IDENTIFIED THROUGH PUBLIC COMMENT

3.7.1 Scoping EAW

All comments about mitigation measures received during the SEAW comment period are listed in Table 3.7.1. This table lists the comment source, general topic area, a summary of the comment, how it is incorporated into this FEIS, and where it is addressed within this FEIS, if applicable.

TABLE 3.7.1 MITIGATION MEASURES IDENTIFIED THROUGH PUBLIC COMMENT ON THE SEAW

Comment Source	Topic	Comment Summary	Incorporation into DEIS	Location in DEIS
Fond du Lac Reservation	Air	The facility should create a contingency plan in case they cannot meet these limits as expected. For instance, if they exceed these limits such that the expansion is subject to PSD, there should be a definite timetable as to when a PSD permit application would be submitted to MPCA.	Air related impacts are discussed in the FEIS.	Section 4.9
MCEA	Biological	Mitigation for Canada lynx could include: protecting large blocks of habitat and re-vegetating large blocks of habitat. *Option 1:* Project Proposer obtain agreements from other landowners excluding from biomass harvest existing large habitat blocks in the areas that extend in a funnel away from Corridor #4 and other corridors. *Option 2:* Permit requirement that the Project Proposer pay for the improvement of insufficiently forested reclaimed mine sites at and around other identified corridors. Lynx biologists should be consulted for other immediate and ongoing mitigation options to include in the analysis.	Lynx survey indicated no lynx sightings or signs.	Section 4.3
Fond du Lac Reservation	Water	The agencies should require the company (Project Proposer) to use appropriate hydrologic modeling techniques to examine potential impacts from mine pit dewatering.	Hydrologic modeling was completed.	Section 4.1.1
Fond du Lac Reservation	Wetlands	The proposed wetland impacts include 15 acres of previous compensatory wetland mitigation sites from past impacts. These mitigation wetlands should be under either a conservation easement or covenant and therefore, should not be impacts for any reason. If the USACE allows compensatory mitigation wetlands to be impacted, a higher mitigation ratio should be imposed on this type of impact.	A discussion of wetland related impacts is discussed in the DEIS.	Section 4.6

3.7.2 Draft EIS

Comments were received from the USEPA during the DEIS comment period that related to new potential mitigation measures. No other comments were received during the DEIS comment period that identified additional mitigation measures for consideration in the FEIS. A summary of the USEPA's comments are provided in Table 3.7.2.

TABLE 3.7.2 MITIGATION MEASURES IDENTIFIED THROUGH PUBLIC COMMENT ON THE DEIS

Comment Source	Topic	Comment Summary	Incorporation into FEIS	Location in FEIS
USEPA	Wetlands	EPA commented that the Project Proposer did not demonstrate that impacts to wetlands were avoided or minimized to the extent practicable, and is therefore not in compliance with the 404(b)(1) Guidelines for the EIS analysis. EPA also commented that a LEDPA was not identified in the EIS, which further requires the applicant to evaluate practicable alternatives to avoid and minimize environmental impacts. The main wetland impacts would occur from the proposed east stockpile.	Additional analysis and evaluation of an East Stockpile Alternative was completed and discussion of this analysis was included in the FEIS. A preferred alternative has been identified in the FEIS and discussion of the LEDPA has been included.	Text revisions and additions are provided throughout the FEIS.

3.8 PAST AND REASONABLY FORESEEABLE ACTIONS IN THE PROJECT VICINITY

The Iron Range has a history of industrial type land uses, such as mining and forestry. These and other types of industries continue to operate in the Arrowhead Region of Minnesota. Based on past history, these industries will continue to operate at various levels under various regulations and technologies in the foreseeable future. The following is a list of past, present, and reasonably foreseeable actions that may have impacts on the resources the Proposed Project may impact.

3.8.1 Governmental Actions

- Logging of federal lands in accordance with the Superior National Forest Forest Management Plan;
- Logging of state and county lands in the Arrowhead Region;
- Implementation of Taconite MACT standards by facilities in the Arrowhead Region;
- Implementation of the Regional Haze Rules, including the regional haze State Implementation Plan, to reduce emissions of SO_2, NOx, and fine particles in Minnesota, adjoining states, and states found to significantly contribute to visibility impairment in the Class I areas in Minnesota;
- Implementation of the Best Available Retrofit Technology (BART) rule adopted in 2005 to reduce emissions of SO_2, NOx, and fine particles in Minnesota, adjoining states, and states found to contribute significantly to visibility impairment in the Class I areas in Minnesota; and
- Implementation of Minnesota Statewide Regional Mercury Total Maximum Daily Load (TMDL);
- Implementation of federal Acid Rain Program regulations to fulfill the requirements of Title IV of the Clean Air Act Amendments of 1990;
- Implementation of $PM_{2.5}$ regulations for permitting of stationary source air emissions;
- Federal mandates requiring various phase-in dates for use of Ultra-low Sulfur Diesel (ULSD) in on-road and non-road diesel engines;
- Possible future regulation of GHGs for stationary sources of air emissions;
- Possible future regulation of HAPs from electric generating units; and
- Possible future regulation to address interstate transport of air pollutants, through direct regulation of stationary sources and/or the state/federal implementation plan (SIP/FIP) process.

Future governmental actions are generally included in agency plans and budgets and can be predicted with some certainty.

3.8.2 Private Actions

- LTV Steel Mining Company (LTVSMC) closure and furnace shutdown in the Arrowhead Region airshed,
- Other taconite plant operations (with proposed modifications, if appropriate) located in other watersheds but in the Arrowhead Region airshed,
- LEA (Virginia and Hibbing) operations in the Arrowhead Region airshed,
- Minnesota Power Boswell Station (Cohasset) operations in the Arrowhead Region airshed,
- Minnesota Power Hibbard power station (Duluth) operations in the Arrowhead Region airshed,
- Minnesota Power Rapids Energy Center (Grand Rapids) operations in the Arrowhead Region airshed,
- Minnesota Power Laskin Energy Center (Hoyt Lakes) operations in the Arrowhead Region airshed, and
- Logging on private lands near the Proposed Project area.

Private actions are prevalent in the Proposed Project area. Past private actions include the various projects at the nearby Hibtac operation, the LEA biomass-fired energy project (Virginia and Hibbing), and Keetac's recently completed Fuel Diversification project. With regard to air emissions, major regional sources, including taconite processing plants and power plants, were considered for inclusion in the cumulative effects evaluation. Other past and present private actions were also considered for cumulative effects to other potentially affected resources.

3.8.3 Future Private Actions

Future private actions are less certain; projects may be studied for feasibility and then abandoned. A number of projects have been officially brought to the notice of the state of Minnesota and, in some cases, the federal government.

These potential future actions include:

- Excelsior Energy Inc. of Minnetonka, Minnesota, has been developing plans for the 600-megawatt Mesaba Energy Project in northern Minnesota under a Department of Energy grant. One possible site would be in the Taconite-Marble area, which is in the Mississippi River watershed. A federal EIS is being completed, but the power purchase agreement with Xcel Energy has not been approved by the Minnesota Public Utilities Commission.

- Essar Steel (formerly Minnesota Steel Industries, LLC) has received permits to reactivate the former Butler Taconite mine and tailings basin near Nashwauk, Minnesota. The project will also include construction of a new crusher, concentrator, pellet plant, direct reduction plant, and steel mill consisting of two electric arc furnaces, two ladle furnaces, two thin slab casters, and hot strip rolling mill to produce sheet steel. This project will be located in the Mississippi River watershed and Arrowhead Region airshed.

- Mesabi Nugget Delaware, LLC (Mesabi Nugget) purchased land and minerals rights on property located near Hoyt Lakes, Minnesota, formerly owned by Cleveland Cliffs. Mesabi Nugget plans to re-open the mine and crush and concentrate ore. The project is undergoing environmental review. This project would be located in the Lake Superior watershed and in the Arrowhead Region airshed.

- PolyMet Mining Co. proposes to construct and operate the NorthMet non-ferrous mine and processing facility near Hoyt Lakes, Minnesota. The project is undergoing environmental review. This project would be located in the Lake Superior watershed and in the Arrowhead Region airshed.

- United Taconite Company, owned by Cleveland-Cliffs Inc., completed a capital expansion in December 2004 at their processing facility near Eveleth, Minnesota. This expansion increased taconite pellet production by one million tons per year, bringing the mine's annual rated capacity to 5.2 million gross tons per annum. In 2008, United Taconite produced 5.1 million tons of taconite. This project is located in the Lake Superior watershed and in the Arrowhead Region airshed.

- Magnetation, Inc., located in Nashwauk, Minnesota, was incorporated in December 2006 and began shipping products commercially in February 2009. The Magnetation Process™ is designed to produce iron ore concentrate by recovering weakly magnetic iron oxide particles from natural iron ore and taconite tailings basins, already-mined iron formation stockpiles, and newly mined iron formation. This project is located in the Mississippi River watershed and in the Arrowhead Region airshed. Magnetation has amended its Permit to Mine for the Mesabi Chief Basin #3 to test product from a nearby site (Holman and Trout Lake basins). Magnetation also has a permit to mine on public notice through September 18, 2010 for a second operation (Holman and Trout Lake basins).

- Minnesota Power in partnership with Nashwauk Public Utilities Commission is proposing to construct four new 230 kV transmission lines and two new substations to provide power to the Essar Steel facility. The two substations would be located on Essar Steel property. One of the transmission lines would also be located on Essar Steel property. The other three transmission lines would include a combination of following existing right-of-ways, co-locating along existing lines, and constructing new transmission line corridors.

- Community growth and development would occur in the vicinity of the Proposed Project as the economy and housing market demand. This could have both potentially positive and negative implications for local infrastructure and public services that individuals and communities would need to plan for and address as needed.

- Forestry practices on public and private lands.

3.9 SUMMARY OF ALTERNATIVES ANALYZED IN THE EIS

Several project alternatives were analyzed for the FEIS. These included the No Action Alternative, Proposed Project Alternative, alternative stockpile locations, and air pollution control technology alternatives.

3.9.1 No Action Alternative

The No Action Alternative includes ongoing actions (mining, taconite processing, and transport) at Keetac that would occur under the existing Permit to Mine, currently permitted wetlands, actions occurring under permits that undergo procedural renewal at specified intervals, and permit amendments for actions that do not create an increased discharge or emission.

The No Action Alternative would continue to use the current Keetac water management system for consumptive use and stormwater runoff. Under the No Action Alternative (no new permits issued) and at current processing rates, the Keetac mine is expected to completely deplete the recoverable taconite within the current Permit to Mine boundary by the year 2021. Mining would continue in the Aromac Pit, Mesabi Chief Pit, Section 18 Pit, and Stevenson Pit within the current facility limit of the Permit to Mine. Dewatering of the Perry Pit would be required in order to continue mining in the Aromac and Mesabi Chief pits. The Project Proposer would stockpile overburden and waste rock in existing stockpiles and in-pit stockpiles to the extent possible.

The No Action Alternative would continue to produce a taconite pellet output of 6.0 MSTY for the next 12 years. Processing of taconite pellets would continue at the plant using only the Phase II production line. Tailings from production would continue to vertically expand the tailings basin by an estimated 24 feet under the No Action Alternative compared to existing elevations.

Keetac operations under the No Action Alternative are not expected to increase air emissions above current levels, and therefore, the current MPCA air quality permit is applicable and could be reissued on its procedural 5-year permit intervals. Additionally, Minnesota Rules Chapter 6130 and the Permit to Mine require the Project Proposer to implement mineland reclamation measures throughout the life of the mining operation, which would be ongoing under the No Action Alternative.

3.9.2 Proposed Action Alternative

The Proposed Action Alternative (Proposed Project) is the operation of the Keetac facility under new permits, or amendments to existing permits that increase discharges or emissions and expand the footprint. This alternative would increase taconite pellet production by 3.6 MSTY for a total annual output of approximately 9.6 MSTY. Increased taconite production would be accomplished through the expansion of mine areas and plant processing upgrades.

Two main areas of the existing mine pit would be expanded. The proposed south mine pit expansion (west of the plant) would expand the existing Bennett/Russell Pit and the Mesabi Chief Pit, and the proposed east mine pit expansion would expand the Section 18 Pit and the Stevenson Pit. The Project Proposer would stockpile overburden and waste rock in existing stockpiles, new stockpiles, and in-pit stockpiles.

In addition to mine pit and stockpile expansion, the Proposed Project would increase the taconite pellet production capacity at Keetac by restarting the idle Phase I line (new indurating line). The new indurating line would include upgrading the concentrating and agglomerating processes and a new taconite indurating grate kiln furnace. The Proposed Project would also include the construction of a biomass facility, which would provide biomass fuel to the new indurating line furnace. Refurbished and new processing equipment would be located at the existing plant site alongside current operations.

An additional 9.0 MLTY of tailings would result from the Proposed Project concentrating process and would also be pumped as slurry to the existing tailings basin. To accommodate increased water use and tailings production, two additional thickeners, a third tailings pipeline, and a third return water line would be added as part of the Proposed Project.

The Proposed Project would increase the overall height of the tailings in the basin by approximately 58 feet compared to the No Action Alternative. The tailings basin dikes would be reinforced, if necessary to support the additional tailings to be placed in the basin.

3.9.3 East Stockpile Alternative

The East Stockpile Alternative is described in Section 3.5.3.3.1 as Concept E, and encompasses approximately 75 percent of the proposed east stockpile and 85 percent of the existing southeast stockpile. The footprint would provide enough stockpile capacity by reconfiguring the existing southeast stockpile and raising the height 200 feet above the proposed east stockpile.

The East Stockpile Alternative would substitute for the proposed east stockpile and is referred to as Concept E in Appendix E. The Proposed Project with the East Stockpile Alternative would meet the purpose and need of the Keetac Mine Expansion Project as it would allow a 3.6 MSTY increase in taconite pellet production. This East Stockpile Alternative overlays part of the existing southeast stockpile and part the proposed east stockpile as shown in Figure 1.3. This stockpile could contain the same volume of overburden as the proposed east stockpile in a smaller footprint. However, it would be approximately 200 feet taller than the proposed east stockpile. The East Stockpile Alternative would not change the total amount of overburden needing to be stockpiled, air emissions from the processing plant, or water balance. The East Stockpile Alternative, however, would change mobile source air emissions, wetland impacts, land cover, visual impacts, project economics, snowmobile trail impacts, human health risk, noise, and wildlife corridor width compared to the Proposed Project. Potential effects to these resources and others are described in chapters 4.0 and 5.0. The feasibility of this alternative has been evaluated in the FEIS and has been shown to be practicable.

3.9.4 Air Pollution Control Technology Alternatives

3.9.4.1 Best Available Control Technology (BACT)

Emissions control technology alternatives were required to be evaluated for emission sources associated with the Proposed Project for PM, PM_{10}, $PM_{2.5}$ and SO_2 pollutants. The BACT evaluation identified applicable control technology options, eliminated technically infeasible options, ranked remaining alternatives by control effectiveness, evaluated the most effective controls, and selected BACT for each emission source/pollutant.

3.9.4.2 Mercury Emissions Control

Mercury emission control alternatives were evaluated for the Proposed Project for technical feasibility, control efficiency, and any other impacts they may present. Mercury control technologies are classified into three categories of availability: commercially available technology, emerging technology, and technology in the research and development state.

3.9.4.3 Greenhouse Gas Emissions

The Briefing Sheet for the Proposed Project (MNDNR, 2008C) defined alternatives to be evaluated for GHG emissions related to the Proposed Project.

4.0 Affected Environment and Environmental Consequences

Chapter 4.0 includes resources identified in the FSDD as having the potential to be significantly impacted by the Proposed Project. Because of this possibility, additional analysis beyond what was completed for the SEAW was done and is included in the FEIS. As a result of this analysis, further clarification of potential impacts was gained. Not all resources included in this chapter are expected to be significantly impacted.

Each topic in this chapter is presented as its own section organized into three main subsections: Affected Environment, Environmental Consequences, and Mitigation Opportunities. The Affected Environment subsection provides background information so that the analyses completed for the Environmental Consequences subsection, which analyzes the potential effects from the Proposed Project, can be better understood. Additionally, the potential environmental effects for the Proposed Project were determined based on the level of potential effect prior to mitigation for each of the resources. The federal Code of Regulations 40 CFR Section 1508.27 defines "significantly" by considering the context and intensity of an effect. The terms less than significant, significant, and adverse are used in Chapter 4.0 to describe the level or magnitude of the potential effect. These terms are further described in the Definitions section of this FEIS. The Mitigation Opportunities subsection identifies monitoring and/or mitigation measures that could be implemented to mitigate for potential impacts from the Proposed Project.

The specific topics addressed and the corresponding sections in Chapter 4.0 include:

Section 4.1 – Surface Water Resources
- 4.1.1 – Water Levels
- 4.1.2 – Fisheries and Aquatic Resources

Section 4.2 – Wildlife Resources
Section 4.3 – Threatened and Endangered Species
Section 4.4 – Water Quality
- 4.4.1 – Wastewater
- 4.4.2 – Surface Water Runoff
- 4.4.3 – Erosion and Sedimentation

Section 4.5 – Groundwater Resources
Section 4.6 – Wetlands
Section 4.7 – Wild Rice
Section 4.8 – Dam Safety
Section 4.9 – Stationary Source Air Emissions
- 4.9.1 – Emissions Inventory and Calculation of Emissions
- 4.9.2 – Fugitive Dust Control
- 4.9.3 – BACT Review
- 4.9.4 – MACT Compliance
- 4.9.5 – Class I Area Impacts Analysis
- 4.9.6 – Class II Area Impacts Analysis
- 4.9.7 – Mercury Emissions/Mercury Balance/TMDL Implementation Plan Compliance
- 4.9.8 – Human Health Risk Assessment

Section 4.10 – Land Use
Section 4.11 – Cover Types
Section 4.12 – Water-Related Land Use Management Districts
Section 4.13 – Geologic Hazards and Soil Conditions

Section 4.14 – Solid Wastes, Hazardous Wastes, and Storage Tanks
Section 4.15 – Traffic Impacts
Section 4.16 – Odors, Noise, and Dust
Section 4.17 – Historic Properties
Section 4.18 – Federal Trust Responsibilities to Indian Tribes
Section 4.19 – Recreational Trails
Section 4.20 – Visual Impacts
Section 4.21 – Infrastructure and Public Services
Section 4.22 – Socioeconomics
Section 4.23 – Amphibole Mineral Fibers

4.1 SURFACE WATER RESOURCES

The FSDD states that the EIS would "include a qualitative description of fisheries resources and angling activity in Swan Lake, Welcome Lake, Hay Lake, and four unnamed lakes (Reservoir Two, Reservoir Two North, Reservoir Four, and Reservoir Six) as well as Hay Creek and West Swan River." This section investigates the potential biological impacts to those lakes and streams including impacts to existing fish and invertebrate populations and habitat as well as potential changes to angling activity.

4.1.1 Water Levels

The FSDD states that, "the Proposed Project has the potential to significantly affect surface and groundwater resources in the project area both during and after mining. A detailed project water balance and watershed yield will be conducted to help quantify impacts on stream flow and lake water levels during mining operations and after mine closure."

> The state mineland reclamation rules (Minnesota Rules Chapter 6130) require that slopes are designed (and ultimately constructed) to reduce erosion and facilitate stabilization and revegetation.

Past mining activities have altered many of the watersheds, stream morphologies, and water levels. The results of these alterations have not reached equilibrium and will take many years to achieve a steady state. The analysis of this section of the FEIS in regard to non-wetland impacts incorporates this understanding.

The analysis in this section identifies the difference in impact between the No Action Alternative and the Proposed Project. Due to permit limitations associated with the No Action Alternative, projected impacts could not be predicted beyond 2021. Therefore, projected year 2021 impacts for the No Action Alternative will be compared with projected year 2036 impacts for the Proposed Project. These two time periods represent the time when dewatering rates would be the highest for each alternative and when the potential for high water levels and stream flows are the greatest. This, along with the documentation of the effects of previous mining activities, is the basis for the analysis of impacts.

The documents provided by the Project Proposer are listed below, which were submitted in support of quantifying and qualifying the potential impacts to non-wetland resources.

- Water Balance/Mine Yield Study
- Water Quantity and Quality Report
- No Action Alternative Memo
- O'Brien Creek Report
- Hay Lake Sulfate Report
- Reservoir Four/Hay Lake Report

4.1.1.1 Affected Environment

4.1.1.1.1 Lakes

There are ten lakes listed in the FSDD with potential to be impacted by the Proposed Project including: Reservoir Five, Welcome Lake, Reservoir Two North, Reservoir Six, Reservoir Two, Reservoir Four, Hay Lake, Swan Lake, Kelly Lake, and Snowshoe Lake. The location of these lakes in relation to Keetac is presented in Figure 4.1.1. Additional background information on lakes is provided in Section 4.1.2.1.

Table 4.1.1 provides background information on physical characteristics of each of the lakes evaluated for the Proposed Project. Specific information pertaining to each of the basins is provided in the following paragraphs. A water flow diagram of the facility is provided in Figure 3.1.3.

TABLE 4.1.1 PHYSICAL CHARACTERISTICS OF LAKES

Lake	Public Waters Inventory Status/ID	Watershed or Sub Watershed Size (mi^2)	Lake Area (ac)	Major Inflow	Outlet
Reservoir Five	Not a Public Water	1.02	86	Dewatering flows from East Mine Pits	Plant Make-up and Overflow to Welcome Creek
Welcome Lake	69-902W	0.12[1]	29	Surface Water	Ditch to Carlz Pit
Reservoir Two North	31-1228P	0.40	58	Welcome Creek	Drainage Ditch to Reservoir Two
Reservoir Six	31-1229P	0.42 [2]	174	Outer Tailings Basin Second Stage Pond	Plant Make-up and Drainage Ditch between Reservoir Two North and Reservoir Two
Reservoir Two	31-1039P	4.9	465	Drainage Ditch from Reservoir Two North	O'Brien Diversion Channel
Reservoir Four	31-1225P	8.5	102	O'Brien Creek	O'Brien Diversion Channel
Hay Lake	31-37W	44.7	25	Hay Creek	Hay Creek
Swan Lake	31-67P	104	2,472	Hay Creek	Upper Swan River
Snowshoe Lake	69-900W	0.74[1]	15	West Swan River	West Swan River to Kelly Lake
Kelly Lake	69-901P	1.14[1]	17	West Swan River from Snowshoe Lake	West Swan River

[1] USGS Topographic Data – 1988 NGVD
[2] Includes tailings basin inflow

Unnamed Lake – Reservoir Five

Reservoir Five receives dewatering flows from the east mine pits (Russell Pit, Stevenson, Section 18). The Russell Pit receives overflow water from the Bennett Pit which receives surface water runoff from the plant along with plant discharge water. Reservoir Five provides plant make-up water used for processing. Reservoir Five is not considered a "water of the state." Therefore, the MPCA does not regulate the discharges to this reservoir.

If levels in Reservoir Five become too high, water overflows through a weir and through a series of ten settling basins to its final outlet point at the Welcome Creek weir (SD 002 of Permit No. MN0031879).

Welcome Lake

Welcome Lake is connected to Carlz Pit but is not connected to Welcome Creek or other water bodies in the surrounding area.

Unnamed Lake - Reservoir Two North

Reservoir Two North receives inflows from the City of Keewatin stormwater flows, WWTP, and discharges to Welcome Creek.

Unnamed Lake - Reservoir Six

Reservoir Six is located downstream of Reservoir Two North and upstream of Reservoir Two, and serves as the main source of water for the Keetac plant, comprising up to 75 percent of the total inflow (Water Balance/Mine Yield Study). Reservoir Six is connected to a drainage ditch between Reservoir Two and Reservoir Two North (SD 005 of Permit No. MN0055948). Depending on the level of Reservoir Two, water can flow in to or out of Reservoir Six via the drainage ditch.

If water levels become too low in Reservoir Six, water can be pumped from Reservoir Two into Reservoir Six to provide make-up water for the plant. Additionally, if water levels become too high in Reservoir Six there is an emergency overflow from Reservoir Six to Reservoir Two. Reservoir Six is part of the tailings basin and is not considered a "water of the state." Therefore, the MPCA does not regulate the discharges to the reservoir.

Unnamed Lake - Reservoir Two

Reservoir Two currently receives water from Reservoir Two North and Reservoir Six via a drainage ditch. Welcome Creek can also contribute to the water in Reservoir Two via Reservoir Two North. Reservoir Two also receives wastewater flows from the City of Nashwauk WWTP and serves as the emergency overflow route for Reservoir Six.

Unnamed Lake - Reservoir Four

Reservoir Four, also referred to as O'Brien Reservoir, is a widening of O'Brien Creek. Reservoir Four was constructed in 1977 by the Hanna Mining Company to use as a water supply reservoir for the taconite pellet and processing plant. Currently Reservoir Four receives dewatering inflows from the Mesabi Chief Outfall (SD 003 of Permit No. MN0031879). The Mesabi Chief Outfall provides an outlet for dewatering from the Mesabi Chief and Sargent Pits.

Hay Lake

Hay Lake is located along Hay Creek downstream of the confluence of Hay Creek and the O'Brien Diversion Channel, and 3.5 miles upstream of Swan Lake. Inflow and outflow are via Hay Creek.

Swan Lake

Swan Lake is an important recreational resource in the region, and due to the potential for changes to contributing upstream water bodies, it is included in the EIS. Tributaries to Swan Lake have undergone varying changes to their pre-mining hydrology. The combined effect of these changes is relatively small since the watershed size has not changed appreciably.

Swan Lake receives inflow from six sources: Oxhide Creek, Pickerel Creek, O'Brien Creek downstream of TH 169, Hay Creek, Hart Creek, and Lebron Creek. Hay Creek is the only inlet to Swan Lake that has a potential to be impacted by the Proposed Project. The portion of O'Brien Creek which directly drains into Swan Lake is not impacted by the Proposed Project. The portion of O'Brien Creek upstream of O'Brien Lake (north of TH 169) is diverted into the O'Brien Diversion Channel and routed into Hay Creek, which then flows into Swan Lake. The diversion of O'Brien Creek was due to past mining activities and is considered a pre-existing condition. However, the upper portion of O'Brien Creek is impacted by the Proposed Project and is discussed later in this section.

Kelly Lake

Kelly Lake would not receive any dewatering flows but was included in the FSDD due to the potential for changes in surface water flows.

Snowshoe Lake

Snowshoe Lake would not receive any dewatering flows but was included in the FSDD due to the potential for changes in surface water flows.

There are four streams listed in the FSDD that would potentially be impacted by the Proposed Project: O'Brien Creek, Swan River, Welcome Creek, and Hay Creek.

4.1.1.1.2 Streams

There are four streams listed in the FSDD that would potentially be impacted by the Proposed Project: O'Brien Creek, Swan River, Welcome Creek, and Hay Creek. The locations of these streams in relation to the Proposed Project are presented in Figure 4.1.1. The main source of information describing these streams is the Water Balance/Mine Yield Study. Potential impacts to the streams as a result of the Proposed Project would be based on changes to the existing conditions described below.

Table 4.1.2 provides background information on physical characteristics of each of stream evaluated for the Proposed Project, and is discussed below. Additional background information is provided in Section 4.1.2.1.

TABLE 4.1.2 PHYSICAL CHARACTERISTICS OF STREAMS

Stream	Public Waters Inventory Status/ID	Watershed Size (mi^2)	Keetac Inflows
Welcome Creek	Public Water Stream	1.4	Welcome Creek Weir (SD002 of Permit No. MN 0031879)
O'Brien Creek	Public Water Stream	6.4	Mesabi Chief Outfall (SD 003 of Permit No. MN0031879)
Hay Creek	Public Water Stream	16.7	O'Brien Diversion Channel (Receives inflows from Reservoir Four and Two)
Swan River	Public Water Stream	114 [1]	Hay Creek

[1] USGS Interactive Watershed Map – http://gisdmnspl.cr.usgs.gov. Includes drainage areas outside Keetac Project.

Welcome Creek

Welcome Creek is 1-½ miles long, with its headwaters beginning at the Welcome Creek weir (SD002 of Permit No. MN 0031879). Welcome Creek starts approximately one mile south of the Keetac plant and flows in a southerly direction to its outlet into Reservoir Two North (see Figure 3.1.3). Between its headwaters and discharge into Reservoir Two North, additional flows from the City of Keewatin storm sewer system and WWTP occur. Over time, Welcome Creek has been straightened and has experienced changes in watershed boundaries due to previous mining activities.

O'Brien Creek

O'Brien Creek is a perennial stream that outlets into Reservoir Four (O'Brien Reservoir). O'Brien Creek, its watershed, and channel alignment have been dramatically altered due to past activities. Changes in the watershed size and channel alignment over time reduced its watershed from its original size of 8.4 square miles to 6.4 square miles (O'Brien Creek Report) and resulted in a significant amount of the channel being straightened. O'Brien Creek is currently receiving water from the Mesabi Chief Outfall and will be receiving water from the dewatering of the Perry Pit in the near future.

Hay Creek

The headwaters for Hay Creek is located immediately south of the outer berm of the existing tailings basin (see Figure 4.1.1). Hay Creek flows southwest from its origin for approximately 3.5 miles where the O'Brien Diversion Channel flows into Hay Creek. The creek then continues south for 1.5 miles where it enters Hay Lake. The creek exits Hay Lake and then flows southwest for an additional 3.5 miles into the southeast corner of Swan Lake. There is limited data available describing the physical conditions of Hay Creek. Based on information collected by the MPCA during a biological survey in 1999, the channel of Hay Creek is 0.8 meters deep and 7 meters wide within 0.5 miles of the entrance to Swan Lake. The channel is likely smaller farther upstream from Swan Lake.

Swan River

Swan River flows into the southeast corner of Swan Lake and exits in the southwest corner of the lake. The Swan River flows south and eventually discharges into the Mississippi River. Changes in lake levels in Swan Lake have the potential to change flows in Swan River, which is why it is included in the FEIS.

4.1.1.1.3 No Action Alternative

Under the No Action Alternative, the Project Proposer would continue dewatering activities as part of its current operations. The volumes of dewatering would continue to increase as mining depths increase, resulting in greater groundwater inflows. The Project Proposer holds a water appropriations permit for mine pit dewatering from two areas, specifically the east mine pits (Russell, Section 18, and Stevenson) and the west mine pits (Mesabi Chief and Sargent), and has amended the permit to allow for dewatering of the Perry Pit. Dewatering flows from the east mine pits serve as plant make-up water and then discharge to either the tailings basin or to Welcome Creek. Dewatering flows from the west mine pits are discharged to O'Brien Creek via the Mesabi Chief Outfall.

The Project Proposer has submitted NPDES and Appropriation permit applications that would allow for increases in dewatering flows and changes to the flow direction of the dewatering flows. For the west mine pits, a new discharge has been approved for dewatering of the Perry Pit. The Perry Pit dewatering flows will be discharged to O'Brien Creek via a new outfall that would be located upstream of the Mesabi Chief Outfall.

These proposed changes to dewatering are not part of the Proposed Project and would occur under the current Permit to Mine. The increased dewatering would result in higher flows to O'Brien Creek (from the Aromac, Perry, and Sargent pits; the Mesabi Chief rate would be lower).

The Water Quantity and Quality Report discusses increased flows to O'Brien Creek and Hay Creek as a result of the Proposed Project. A portion of the increased flows would occur under the No Action Alternative actions described above.

<u>Lakes</u>

Table 4.1.3 provides a description of each of the potentially impacted lakes under the No Action. Specific information pertaining to each of the basins is discussed below.

TABLE 4.1.3 NO ACTION ALTERNATIVE LAKE INFORMATION

Lake	Discharge out of Lake (cfs)[1]	Comment on Inflows
Reservoir Five	4.02	Has been modeled as remaining in place for No Action Alternative
Welcome Lake	Not Evaluated	No significant impact
Reservoir Two North	2.05 [1]	Welcome Creek Outfall
Reservoir Six	4.15	Outer Tailings Basin
Reservoir Two	8.9	Sargent Pit, Welcome Creek Outfall, Reservoir Six
Reservoir Four	15.2	Mesabi Chief Outfall, Perry Pit
Hay Lake	36.3	All Plant Outfalls
Swan Lake	60.1 [2]	All Plant Outfalls
Snowshoe Lake	Not Evaluated	No significant impacts
Kelly Lake	Not Evaluated	No significant impacts

[1] Values represent Welcome Creek Weir discharge rates, which include runoff and groundwater infiltration prior to the weir. These values do not include runoff and other sources into Welcome Creek downstream of the weir and prior to Reservoir Two North (No Action Alternative memo)

[2] O'Brien Creek and O'Brien Reservoir Mean Annual Flow plus West Mines (Water Balance/Mine Yield Study)

Unnamed Lake – Reservoir Five

Reservoir Five would continue to serve as a water source for the plant. The overflow for Reservoir Five would continue to be the Welcome Creek Outfall. Reservoir Five would also continue to serve as a storage facility. Its water levels would change based on the needs of the facility.

Welcome Lake

Welcome Lake would have no significant impact on surface water flows or additional dewatering flows (Water Balance/Mine Yield Study).

Unnamed Lake - Reservoir Two North

There is no change in Reservoir Two North flows, which would continue to receive discharge from the Welcome Creek Outfall (SD002 of Permit No. MN 0031879) at a rate of 2.05 cfs under the No Action Alternative.

Unnamed Lake - Reservoir Six

Reservoir Six would serve as the main source of water consumed at the Keetac plant. Reservoir Six would discharge 4.15 cfs (No Action Alternative Memo) on an annual basis. Reservoir Six is used as a storage facility where water levels fluctuate based on the needs of the facility, and are not managed to a specific elevation.

Unnamed Lake - Reservoir Two

The No Action Alternative results in an average annual discharge of 8.9 cfs from Reservoir Two to the O'Brien Diversion Channel. Because Reservoir Two is used to augment the water supply in Reservoir 6 and is not used as a storage facility on a day to day basis by the Project Proposer. This results in some fluctuation of water levels based on the needs of the Keetac facility. The reservoir is not managed to a specific elevation. The property around Reservoir Two is entirely owned by the Project Proposer which enables its use as a storage facility.

Unnamed Lake - Reservoir Four

The Project Proposer has amended an existing water appropriation permit (#65-0351) to allow continued dewatering out of the Mesabi Chief Pit and additional further dewatering of the Perry Pit. The Aromac will be dewatered via the existing Mesabi Chief Outfall, which would enable additional mining within the current Permit to Mine. The Perry Pit discharge will occur upstream of the Mesabi Chief Outfall and flow to Reservoir Four.

As part of the Proposed Project, the Sargent Pit dewatering water is proposed to be primarily redirected from the Mesabi Chief Outfall to Reservoir Two in 2012, but with the option to also discharge through the Mesabi Chief Outfall. For the No Action Alternative, the Sargent Pit dewatering will continue to be discharged via the Mesabi Chief Outfall. The dewatering rate from the Mesabi Chief and Perry Pit outfalls combined would be 8.5 cfs for the No Action Alternative.

Hay Lake

Hay Lake would receive an additional 2.5 cfs (36.3 cfs total) of flow from Keetac for the No Action Alternative compared to current conditions.

Swan Lake

The No Action Alternative would result in Swan Lake receiving an additional 2.5 cfs (36.3 cfs total) from the Keetac facility via Hay Creek, compared to current conditions.

Kelly Lake

Kelly Lake would continue to receive stormwater runoff from the eastern edge of the Proposed Project footprint similar to current conditions under the No Action Alternative.

Snowshoe Lake

Snowshoe Lake would continue to receive stormwater runoff from the eastern edge of the Proposed Project footprint similar to current conditions under the No Action Alternative.

<u>Streams</u>

Table 4.1.4 provides a description of each of the potentially impacted streams under the No Action Alternative. Specific information pertaining to each of the basins is provided below.

TABLE 4.1.4 NO ACTION ALTERNATIVE STREAM CHARACTERISTICS

Stream	Mean Annual Flow (cfs)	Keetac Influenced Inflows
Welcome Creek	2.05 [1]	Welcome Creek Weir (SD002 of Permit No. MN 0031879)
O'Brien Creek	15.2 [2]	Mesabi Chief Outfall (SD 003 of Permit No. MN0031879) Perry Pit Outfall (SD 00X)
Hay Creek	36.3	O'Brien Diversion Channel (Receives inflows from Reservoir Four and Two)
Swan River	60.1 [3]	Hay Creek

[1] Values represent Welcome Creek Weir discharge rates, which include runoff and groundwater infiltration prior to the weir. These values do not include runoff and other sources into Welcome Creek downstream of the weir and prior to Reservoir Two North (No Action Alternative Memo)

[2] O'Brien Creek and O'Brien Reservoir Mean Annual Flow plus West Mines (Water Balance/Mine Yield Study)

[3] Based on a 6.46 decrease in average annual flow due to Essar Steel and a 2.54 cfs increase in Hay Creek (assume starting baseline flow rate of 64.1 cfs)

Welcome Creek

Welcome Creek would receive discharges from the facility through Welcome Creek Outfall (SD002 of Permit No. MN 0031879) at a rate of 2.05 cfs.

O'Brien Creek

O'Brien Creek for the No Action Alternative would receive flows from both the Mesabi Chief Outfall and the Perry Pit.

The effects of the Perry Pit discharge as part of the No Action Alternative were evaluated in the O'Brien Creek Report; the report indicates that O'Brien Creek would be able to handle the minor increase in flows without significant or detrimental changes.

Hay Creek

Hay Creek would continue to receive discharges associated with mine dewatering and plant discharge flows, which would increase by 2.5 cfs (36.3 cfs total).

Swan River

Swan River would continue to receive discharges associated with mine dewatering and plant discharge flows via Swan Lake. These flows would increase by 2.5 cfs (36.3 cfs total).

4.1.1.2 Environmental Consequences

Environmental consequences associated with the Proposed Project were evaluated in the referenced documents in Section 4.1.1. The compilation of these documents provides an overview of how the Proposed Project would alter dewatering flow rates, plant discharges, and drainage areas.

Analysis of the potential impacts was completed through several complex water resource and mine yield models which were developed for the Proposed Project. A detailed narrative on the procedures used in the modeling is provided in the Water Balance/Mine Yield Study. The results of this modeling served as the basis for the evaluation of Proposed Project impacts along with analysis of cumulative effects which are discussed in Section 5.3.1.

4.1.1.2.1 Proposed Action Alternative

Lakes identified in the SEAW that have potential for significant impacts are described and quantified below. Impacts to lakes are based on changes to water levels over the period of the Proposed Project. The changes in lake levels and inflows summarized in Tables 4.1.5 and 4.1.6 are detailed in the documents listed in Section 4.1.1.

TABLE 4.1.5 PROPOSED PROJECT LAKE LEVEL IMPACTS

Lake	Mean Elevation (ft)		Change
	No Action Alternative	Proposed Project	Elevation (ft)
Reservoir Four	1401.99	1401.97	-0.02
Hay Lake	1358.03	1358.07	+0.04
Swan Lake	1335.66	1335.69	+0.03

Reservoir Two, Two North, and Six water elevations were not evaluated because the land around them is owned by the Proposer and the water within them is managed for their needs. Welcome Lake, Snowshoe Lake and Kelly Lake were also not evaluated because initial data indicated that their water elevations would continue to stay within their normal ranges over the life of the Proposed Project.

TABLE 4.1.6 PROPOSED PROJECT FLOW IMPACTS ON LAKES

Lake	Out Flow Discharge (cfs)		Change	
	No Action Alternative	Proposed Project	Flow (cfs)	(%)
Reservoir Five[4]	4.02	4.02	0.0	0.0
Welcome Lake	No significant impact			
Reservoir Two North	2.05 [1]	1.65 [1]	0.42	-20
Reservoir Six	4.15	5.68	1.53	37
Reservoir Two	8.9	13.9	5.0	56
Reservoir Four	15.2 [2]	14.3 [2]	-0.9	-6
Hay Lake	36.3	40.3	4.0	11
Swan Lake	60.1 [3]	64.1	4.0	6.7
Snowshoe Lake	No significant impact			
Kelly Lake	No significant impact			

[1] Values represent Welcome Creek Weir discharge rates, which include runoff and groundwater infiltration prior to the weir. These values do not include runoff and other sources into Welcome Creek downstream of the weir and prior to Reservoir Two North (No Action Alternative Memo).

[2] O'Brien Creek and O'Brien Reservoir Mean Annual Flow plus West Mines (Water Balance/Mine Yield Study)

[3] Based on a 6.46 decrease in average annual flow due to Essar Steel and a 2.5 cfs increase in Hay Creek (assume starting baseline flow volume 64.1 cfs).

[4] Reservoir 5 to be eliminated after 5 years of operation

Unnamed Lake – Reservoir Five

Reservoir Five would be removed within the first 5 years for the Proposed Project to allow for additional mining to occur. A sump area would still exist where Reservoir Five exists. A sump would be used to collect dewatering flows from the Russell, Section 18, Stevenson and new Carmi Pit.

Reservoir Five has been determined to be a jurisdictional wetland under WCA and CWA Section 404. The impact to Reservoir Five would require replacement mitigation under these regulations and is documented in Section 4.6.

Unnamed Lake - Reservoir Four

Reservoir Four would receive additional mine dewatering flows from the Proposed Project. These flows would increase as a result of additional depth and width of mining associated with the Proposed Project. As mentioned, the major inflow to Reservoir Four is the Mesabi Chief Outfall (SD 003 of Permit No. MN0031879) along with the Perry Pit Discharge.

The increase in flow would not result in significant changes to water levels in Reservoir Four because the basin is a flow-through system. The increased flow into the reservoir would result in increased discharge from Reservoir Four into the O'Brien Diversion Channel, which has the capacity to accommodate the increased inflow.

Hay Lake

Hay Lake would receive additional flows routed through Hay Creek. The predicted increase in elevation of 0.02 ft (less than 0.01 percent) is a minimal impact and would not significantly impact the lake.

Swan Lake

Swan Lake would not experience any direct discharges. Instead it would receive higher volumes of water as a result of the Proposed Project. These higher flows would be a result of project discharges into O'Brien Creek, O'Brien Diversion Channel, and ultimately to Hay Creek and into Swan Lake. This increase in flow modeled under worst-case, high-flow conditions would result in a 0.03-foot increase in the average Swan Lake elevation.

Other Lakes

Review of the proposed plan indicates there would be no significant impacts to the following lakes:

- Welcome Lake
- Unnamed Lake - Reservoir Two North
- Unnamed Lake - Reservoir Six
- Unnamed Lake - Reservoir Two
- Kelly Lake
- Snowshoe Lake

Table 4.1.7 provides a summary of the projected change in stream flow volumes for Welcome Creek, O'Brien Creek, Hay Creek and Swan River.

TABLE 4.1.7 PROPOSED PROJECT IMPACTS ON STREAMS

Stream	**No Action Alternative Average Annual Discharge (cfs)**	**Proposed Project Average Annual Discharge (cfs)**	**Change**	**Keetac Inflows**
			(cfs)	(%)
Welcome Creek	2.05 [1]	1.63 [1]	-0.42	-20
O'Brien Creek	15.2 [2]	14.3 [2]	-0.9	-6
Hay Creek	36.3	40.3	4.0	11
Swan River	60.1 [3]	64.1	4.0	6.7

[1] Values represent Welcome Creek Weir discharge rates, which include runoff and groundwater infiltration prior to the weir. These values do not include runoff and other sources into Welcome Creek downstream of the weir and prior to Reservoir Two North (No Action Alternative Memo).

[2] O'Brien Creek and O'Brien Reservoir Mean Annual Flow plus West Mines (Liesch, 200D)

[3] Based on a 4 cfs increase in Hay Creek and 0.64 cfs increase overall to Swan Lake discharge (assume starting flow volume 61.1 cfs)

Welcome Creek

Welcome Creek inflow would decrease by 20 percent due to rerouting of mine dewatering.

O'Brien Creek

O'Brien Creek inflow would decrease by approximately 6 percent

Hay Creek

Hay Creek would experience the greatest increase in average annual flow (11 percent) when including runoff. This increase in flow

> Although no substantial impacts have been identified for the Proposed Project, dewatering flow rates should be monitored to assure that there would be no appreciable deviation from the existing permitted flow rates.

results in less than a 0.1 foot increase in stream levels, based on channel dimensions reported in the biological survey for Hay Creek. The change in flow in Hay Creek is not anticipated to have a significant impact given the relatively small increase in discharge.

Swan River

The general flow pathways to the Swan River would not be altered, and would result in minimal increase in flow. The increase of 6.7 percent is considered minimal and would not cause a significant impact on the Swan River.

4.1.1.2.2 East Stockpile Alternative

The potential environmental effects to surface water resources from the East Stockpile Alternative are the same as those identified for the Proposed Project.

4.1.1.3 Monitoring and Mitigation

There would be relatively small impacts to lake levels or stream flows from the Proposed Project. Although no substantial impacts have been identified for the Proposed Project, dewatering flow rates should be monitored to assure that there would be no appreciable deviation from the existing, permitted flow rates. MNDNR water appropriations permitted values would serve as the basis for monitoring and mitigation for the Proposed Project. If permit flows differ significantly from those estimated in the above-mentioned studies, a proposed monitoring and mitigation plan is provided below.

4.1.1.3.1 Monitoring

Field monitoring of conditions could be performed at the following times:

- Existing conditions (baseline)
- At 5-year intervals during normal operations
- Post-mining, once pits are filled and discharging

Monitoring could be performed at previously designated monitoring locations noted in the Water Balance/Mine Yield Study. The following data could be compiled at each scheduled monitoring time and at each monitoring location, to document the baseline (existing) and progressive physical condition of the creek inputs over time:

- Discharge Rates
- Pumping Rates – if applicable
- Lake Levels
- Velocities

In addition, the rates of dewatering could be monitored and recorded. Biological monitoring of aquatic habitat is further proposed in Section 4.1.2 – Fisheries and Aquatic Resources.

4.1.1.3.2 Mitigation

Since there are no anticipated impacts the potential mitigation measures are general. If surface water levels increase or decrease more than expected the following measures could be taken:

- Redistribute flow among the reservoirs
- Alter timing of discharges seasonally or at appropriate times
- Install flow control structures at key points in the system

4.1.2 Fisheries and Aquatic Resources

4.1.2.1 Affected Environment

4.1.2.1.1 Lakes

There are seven lakes listed in the FSDD as having the potential to be impacted by the Proposed Project: Swan Lake, Welcome Lake, Hay Lake, Reservoir Two, Reservoir Two North, Reservoir Four, and Reservoir Six. The location of these lakes is presented in Figure 4.1.1. The main source for information describing the existing condition of these lakes is the MNDNR. The MNDNR prepares Lake Management Plans for lakes that are actively managed for fishing and recreational activity. Each plan provides a summary of the fish population assessments conducted on the lake, fisheries management information such as stocking reports, historical background, and future management plans.

Due to the vast number of water bodies managed across the state the MNDNR focuses its efforts on conducting fish population surveys, lake assessments, and management activities on lakes with public access points; this is because these lakes are the highest priority to the general public. For the lakes that are actively managed, the MNDNR prepares a lake management plan that summarizes past survey and management efforts while directing future actions.

Of the seven lakes evaluated in the FEIS, a lake management plan was available for only two; Swan Lake and Reservoir Four. In the absence of a lake management plan, information about the fisheries resources, aquatic habitat, and recreation use for the other five lakes is limited. As a result, the discussion of potential impacts to these lakes is general. However, based on similarities between some of the lakes and on other sources of information available, reasonable inferences can be made on fish resources and aquatic habitat.

Swan Lake

> Swan Lake is the largest recreational resource near the Proposed Project and receives 12.4 hours of fishing per acre in the summer.

Swan Lake is the largest recreational resource near the Proposed Project. It is located approximately eight miles southwest of the Keetac plant and is an important recreational resource in the region. Because the potential for changes to contributing upstream water bodies, it is included in this FEIS. The 2,472-acre lake has an average depth of 40 feet, a maximum depth of 65 feet, and a littoral area (which is defined as the area of the lake that is 15 feet or less) of 507 acres or 20 percent of the lake. Swan Lake receives water from the following seven sources: Oxhide Creek, Snowball Creek, Pickerel Creek, O'Brien Creek, Hay Creek, Hart Creek, and Lebron Creek (see Figure 4.1.1). The lake outlet is located in the southwest corner of the lake where it drains into the Swan River. Swan Lake has hard, clear water and is classified as mesotrophic, meaning it has moderate nutrient levels and supports aquatic vegetation.

Based on angler usage estimates from the MNDNR surveys, Swan Lake is an important regional fishery. Recreational users can access Swan Lake by means of three public boat accesses. One is a paved access maintained by the MNDNR and the other two are earthen ramps maintained by Lone Pine Township. Swan Lake receives angling activity during both the open water and ice fishing seasons. In 2001, angling activity was estimated at 12.4 hours per acre for the summer, open water season and 3.9 hours per acre during the winter, ice fishing season (angler hour estimates are total hours fished during a season divided by total lake surface area). Compared to similar type lakes in the Grand Rapids MNDNR Area Fisheries Office survey area, these estimates indicate Swan Lake is one of the highest used lakes in the Grand Rapids area.

Lakes are surveyed on a rotational basis by the MNDNR. The sampling frequency varies from approximately once every two years to once every ten years or more depending on the recreational importance of the lake. Review of the MNDNR lake management plan (2006) for Swan Lake indicates that the lake is surveyed approximately once every five years. The last fish survey was conducted in 2005. The plan states that the next survey will take place during the summer of 2009. As a result, information presented is similar to the information that was included in the Minnesota Steel FEIS.

The primary management species for the lake are walleye and northern pike, with black crappie as a secondary species. Northern pike have exhibited above average growth rates in Swan Lake while walleye and black crappie have exhibited average growth. The Swan Lake fishery has been managed through habitat protection, restricted harvest regulations, and stocking. Walleye have been stocked at varying intensities since the 1940s. In 2001, the plan was to stock fry two consecutive years followed by two years of no stocking. In 2006, the plan was revised to include stocking on an annual basis. Recently, 17 to 26 inch walleye have been protected by the fishing regulations for Swan Lake to help increase the abundance of spawning size fish and enhancing natural reproduction.

Fish population assessments conducted on Swan Lake have indicated that natural reproduction of walleyes is occurring within the lake as evidenced by non-stocked year size classes present. However, because the stocked fry are not marked, it has not been possible to compare their contribution to the population of the naturally produced fry. Historical information for Swan Lake indicates that walleye spawning runs previously occurred in O'Brien and Hay Creeks (MNDNR Lake Management Plan, 2006).

The O'Brien Creek watershed was altered by the creation of O'Brien Lake in 1978 when Butler Taconite constructed a large earthen dam that flooded two former basins including O'Brien Lake and Little O'Brien Lake. This increased water levels by 25 to 30 feet in O'Brien Lake. In 1986 an outlet from O'Brien Lake to O'Brien Creek was constructed when Butler Taconite vacated the area. Due to the creation of O'Brien Lake, flows from O'Brien Creek to Swan Lake have decreased, but it is not known to what extent.

The Hay Creek watershed was altered by the creation of the O'Brien Diversion Channel (approximately 1978/1979 by Hanna Mining Company) and the existing Keetac tailings basin (approximately 1968 after pellet production began at the facility).

The alteration of flows within Hay and O'Brien Creeks has likely affected the spawning success of walleyes in Swan Lake to an unknown extent. In 1999, a spawning assessment was completed by the Grand Rapids Area Fisheries Office on these streams and it was documented that natural walleye reproduction continues to occur. The MNDNR Lake Management Plan (2006) indicates that recent walleye stocking efforts have not always led to strong walleye year classes and that environmental factors (e.g., timing of spring runoff, stream flow, available spawning habitat, availability of forage) are likely more important in determining year class success.

Welcome Lake

> Welcome Lake is entirely surrounded by private property owned by the Project Proposer. The MNDNR Area Fisheries Manager believes it is unlikely that walleyes constitute a significant component of the fish community in Welcome Lake.

Welcome Lake is a small 28.6-acre basin (see Figure 4.1.1) and is listed as a public water body (PWI# 69-0902W). Welcome Lake is connected to Carlz Pit but is not connected to Welcome Creek or other water bodies in the surrounding area. The lake is entirely surrounded by private property owned by the Project Proposer. Public access to the lake is not allowed due to liability and safety concerns. Therefore, no fishing or recreational activity takes place. Due to the lack of a public access, a lake management plan has not been prepared by the

MNDNR. The MNDNR has not conducted fish population surveys or assessments for Welcome Lake. The MNDNR files for the lake include a hand drawn map of the basin stating that the maximum depth is 33 feet. A search of the MPCA Electronic Data Access (EDA) website revealed that water quality surveys have not been conducted. The MNDNR LakeFinder website includes a limited amount of information on Welcome Lake, which includes the University of Minnesota estimates of water clarity based on satellite imagery. This data reveals that Welcome Lake has moderately clear water with water clarity values ranging from 6 to 12 feet, indicating that it is likely a mesotrophic lake.

The MNDNR files include records of walleye caught in 1950; however, the MNDNR Area Fisheries Manager believes it is unlikely that walleyes constitute a significant component of the fish community in Welcome Lake. Emergent vegetation (e.g., cattail) is present around the edges of Welcome Lake indicating the lake has a shallow, littoral zone. Based on the species found in other systems near the Proposed Project, such as Reservoir Four, it is likely that Welcome Lake also contains sport fish such as bluegills, black crappie, northern pike, and largemouth bass.

Hay Lake

> Review of aerial photography of Hay Lake shows fringe wetlands where Hay Lake enters and exits the lake. Due to the presence of these wetland areas, MNDNR biologists indicated that Hay Lake is likely a shallow basin and would have fish and wildlife communities typical of a shallow lake.

Hay Lake (PWI# 31-0037) is a small 25.2-acre basin (see Figure 4.1.1). Hay Lake is located downstream of the confluence of Hay Creek and the O'Brien Diversion Channel, and upstream of Swan Lake. Hay Creek flows through Hay Lake. A designated public access point has not been established on Hay Lake and as such, a lake management plan has not been prepared by the MNDNR. Review of aerial photographs and USGS topographic maps revealed that no developed roads exist to Hay Lake. Access may be possible by all terrain vehicle (ATV) trails or former logging roads. Hay Lake may also be accessible by small boat or canoe via Hay Creek from Swan Lake.

MNDNR fish population surveys or assessments have not been conducted by the MNDNR for Hay Lake. A search of the MPCA EDA revealed that water quality surveys have not been conducted on Hay Lake. The MNDNR LakeFinder website has a limited amount of information on Hay Lake that includes the University of Minnesota estimates of water clarity based on satellite imagery. Based on this data Hay Lake has moderately clear water ranging from 6 to 12 feet, indicating that it is likely a mesotrophic lake. A lake map is not available for Hay Lake and as a result the lake depths and bottom contours are not known.

While there is no fish community data available for Hay Lake, it is located only 3.5 miles upstream of Swan Lake and is connected by Hay Creek. Reports from the Swan Lake management plan indicate that Hay Creek was historically an important system for walleye spawning runs each spring. It is reasonable to assume that due to the connectivity of Hay Lake to Hay Creek and ultimately Swan Lake, that fish are able to migrate between the basins and that the fish community of Hay Lake resembles the community present in Hay Creek and Swan Lake. MNDNR conducted a survey of Hay Creek in 1999 to determine the presence of walleye habitat. During that survey, MNDNR biologists did not travel all the way from Swan Lake to Hay Lake but determined it is possible to access Hay Lake via Hay Creek. Discussions with MNDNR Fisheries staff indicated there is beaver activity on Hay Creek, which may impact fish migration from Swan Lake and Hay Creek into Hay Lake.

Aerial photography of Hay Lake shows fringe wetlands where Hay Lake enters and exits the lake. Due to the presence of these wetland areas, MNDNR biologists stated that Hay Lake is likely a shallow basin and would have fish and wildlife communities typical of a shallow lake. The MPCA conducted a fish population assessment of Hay Creek in 1999, approximately three miles downstream of Hay Lake. There were nine species collected during the survey. Of these, black crappie, pumpkinseed, rock bass and yellow perch are likely to be present in Hay Lake. The other species collected are stream species (e.g., creek chub, tadpole madtom, Iowa darter) that are less likely to be found in Hay Lake. In addition to the panfish species listed above, it is likely that Hay Lake contains northern pike and largemouth bass. Walleyes may be present in Hay Lake but due to its small size, it is unlikely that Hay Lake contains the proper spawning habitat (i.e., shallow, oxygenated, clean gravel substrates) to sustain a large walleye population.

Unnamed Lake - Reservoir Two

Reservoir Two is a 465-acre basin located south of TH 169. The basin is located between the southwest corner of the tailings basin and the O'Brien Diversion Channel (see Figure 4.1.1). Reservoir Two is located downstream of Reservoir Two North and Reservoir Six. Reservoir Two is a public water (PWI# 31-1039), but all of the land surrounding the reservoir is owned by the Project Proposer. Public access to the lake is not allowed due to liability and safety concerns. Therefore, no fishing or recreational activity takes place on the reservoir. There is no lake information available for Reservoir Two on the MNDNR LakeFinder website. There is no lake map available for Reservoir Two, and as a result, the lake depths and bottom contours are not known. An MNDNR lake management plan has not been prepared for the lake and there are no records of past fish population surveys or management activities conducted by the MNDNR in the basin. A search of the MPCA EDA website returned no records of past water quality monitoring conducted in Reservoir Two.

The Water Balance/Mine Yield Study for the Proposed Project indicates that Reservoir Two discharges to the O'Brien Diversion Channel via a dam structure. However, due to the change in elevation between Reservoir Two and the O'Brien Diversion Channel, it would be difficult for fish to migrate. Reservoir Two is connected to Reservoir Six and Reservoir Two North via Welcome Creek. It is likely that Reservoir Two contains a fish community similar to that found in Welcome Creek, as well as Reservoirs Six and Two North. The MNDNR surveyed the fish population of Welcome Creek in 1986, collecting 13 total species. Five of these species are also likely found in Reservoir Two including northern pike, white sucker, brown bullhead, rock bass, and yellow perch. Based on the species found in other systems near the Proposed Project, it is likely that Reservoir Two also contains bluegill, black crappie, and possibly largemouth bass.

Unnamed Lake - Reservoir Two North

Reservoir Two North is a 58-acre basin located south of TH 169 and is located adjacent to the northwest corner of the tailings basin (see Figure 4.1.1). Welcome Creek flows into the north side of Reservoir Two North. Reservoir Two North then flows into Reservoir Six.

Reservoir Two North is a public water (PWI# 31-1228), but all of the land surrounding the reservoir is owned by the Project Proposer. Public access to the lake is not allowed due to liability and safety concerns. Therefore, no fishing or recreational activity takes place on the reservoir. There is no lake information or lake map available for Reservoir Two North on the MNDNR LakeFinder website; as a result, the lake depths and bottom contours are not known. A lake management plan has not been prepared for the lake, and there are no records of past fish population surveys or management activities conducted by the MNDNR. A search of the MPCA EDA website returned no records of past water quality monitoring conducted in Reservoir Two North. It is likely that species present in Reservoir Two are also present in Reservoir Two North.

Unnamed Lake - Reservoir Four

Reservoir Four, also referred to as O'Brien Reservoir (PWI# 31-1229p), is a widening of O'Brien Creek located southwest of the Keetac plant and north of TH 169 (see Figure 4.1.1). Reservoir Four is a 102-acre basin with a maximum depth of 41.5 feet. The littoral area of the lake covers approximately ten acres or 10 percent of the basin. Information relating to the physical characteristics and fish community of Reservoir Four was obtained from the MNDNR LakeFinder website and from the 2004 MNDNR lake management plan.

According to the lake management plan, Reservoir Four was constructed in 1977 by the Hanna Mining Company to use as a water supply reservoir for the taconite pellet and processing plant. There is no lake map available for Reservoir Four so the lake bottom contours are not known. There is one public access within a park, located on the southeast shore of the lake that is owned by the City of Nashwauk. The remaining shoreline around Reservoir Four is undeveloped. A past total phosphorus sample had a concentration of 0.030 mg/L, suggesting the lake would likely be classified as mesotrophic. Based on records from MNDNR Fisheries, water clarity has been improving in Reservoir Four, with Secchi depth readings (a measure of visible depth) of 4.0 ft (1983), 7.0 ft (1993) and 16.3 ft (2003).

The lake management plan indicates that Reservoir Four has received discharge water from the LaRue Pit in the past (the lake management plan for the LaRue Pit indicates that the pit stopped discharging in 2007 due to mining activities to the east of the pit). Reservoir Four also receives Mesabi Chief Outfall discharge. Mine pit discharges are typically clear, clean, and low in nutrient concentrations and so the mine pit discharges to Reservoir Four may help to improve the water quality in the lake.

The most recent fish survey on Reservoir Four was conducted by the MNDNR in 2003. The lake management plan indicates that the primary management species for the lake are black crappie and northern pike, with bluegill, largemouth bass, and walleye listed as secondary management species. MNDNR fish surveys indicated that walleye, largemouth bass, and northern pike are all reproducing in the lake and are exhibiting average growth rates typical of similar class lakes across Minnesota. The surveys also indicate that black crappie and bluegill abundance has increased in Reservoir Four over time. This is likely due to the creation of the low flow, lake type habitats in the reservoir as opposed to the flowing habitats that would have been present in O'Brien Creek prior to the reservoir's creation. The MNDNR management goals for Reservoir Four are to maintain the current black crappie population, maintain or increase the size structure of northern pike, and stock walleyes approximately once every four years to create an additional fishing opportunity for anglers outside of the primary management goals for the lake.

Unnamed Lake - Reservoir Six

Reservoir Six is a 174-acre basin located south of the Keetac plant and TH 169. The basin is located west of the tailings basin (see Figure 4.1.1). Reservoir Six is located downstream of Reservoir Two North and upstream of Reservoir Two. However, depending on water elevations in Reservoir Six, flow from Reservoir Two North usually flows directly to Reservoir Two. Reservoir Six serves as the main source of water consumed at the plant.

Reservoir Six is a public water (PWI# 31-1229), but all of the land surrounding the reservoir is owned by the Project Proposer. Public access to the lake is not allowed due to liability and safety concerns. Therefore, no fishing or recreational activity takes place on the reservoir. There is no lake information or lake map available for Reservoir Six on the MNDNR LakeFinder website, and as a result the lake depths and bottom contours are not known. A lake management plan has not been prepared by the MNDNR for the lake, and there are no records of past fish population surveys or management activities conducted by the MNDNR.

A search of the MPCA EDA website returned no records of past water quality monitoring conducted in Reservoir Six. It is likely that species present in Reservoir Two are also present in Reservoir Six.

4.1.2.1.2 Streams

The FSDD found that Hay Creek and West Swan River could potentially be impacted by the Proposed Project. Welcome Creek and Obrien Creek would not be affected by the Proposed Project. The Perry Pit discharge is part of the No Action Alternative and the Mesabi Pit discharge is not increasing. Thus, there is no change in flow in these creeks and they are not included in the analysis.

The main source of information describing the existing ecological community of each stream was from fish and invertebrate community surveys conducted by the MPCA. Potential impacts to the streams as a result of the Proposed Project would be based on changes to the existing conditions described below.

Hay Creek

> There is high quality habitat available to the aquatic community in Hay Creek and existing communities of both fish and macroinvertebrates are thriving in the system.

Hay Creek is an 8.5-mile long stream with its headwaters located immediately south of the outer berm of the tailings basin (see Figure 4.1.1). Hay Creek flows southwest for approximately 3.5 miles where it meets the O'Brien Diversion Channel. The creek then continues south for 1.5 miles where it enters Hay Lake. The creek is also the outlet to Hay Lake and then flows southwest for an additional 3.5 miles into the southeast corner of Swan Lake.

There is limited data available describing the physical conditions of Hay Creek. Based on information collected by the MPCA during a biological survey in 1999, the channel of Hay Creek is 0.8 meters deep and 7 meters wide within 0.5 miles of the entrance to Swan Lake. The channel is likely smaller farther upstream from Swan Lake. Water quality data collected by the MPCA indicates that Hay Creek had low turbidity (5.4 NTU) and low nutrient concentrations (total phosphorus of 0.028 ug/L). Dissolved oxygen concentrations were 6.0 mg/L and temperature was 19.2 C at the time of the survey.

The MPCA conducted both fish and macroinvertebrate surveys in Hay Creek during the summer of 1999. There were nine total fish species collected by the MPCA, including the sport fish species black crappie, pumpkinseed, rock bass, and yellow perch. Due to the connectivity to Swan Lake, northern pike and walleye are also likely present in Hay Creek. The MPCA calculated an Index of Biotic Integrity (IBI) score for both the fish community and macroinvertebrate community surveys. The fish community IBI returned a score of 70 out of 100 which is considered good. The macroinvertebrate community IBI returned a score of 94 out of 100 which is considered excellent. This indicates that there is high quality habitat available to the aquatic community in Hay Creek and that the existing communities of both fish and macroinvertebrates are thriving in the system.

There are no designated public access points to Hay Creek, but the creek is accessible from Swan Lake. It is likely that the majority of recreation users and anglers using Hay Creek enter via Swan Lake. In the spring of 1999, the MNDNR investigated Hay Creek for the presence of walleye spawning activity from Swan Lake to one mile upstream, or one half the distance to Moose Lake. During the survey, suitable walleye spawning habitat was found and eggs deposited during spawning runs were found at the majority of areas investigated. The MNDNR concluded that Hay Creek is significantly contributing to spring walleye spawning runs from Swan Lake. It is likely that anglers target Hay Creek to fish for walleyes during spring runs. The MNDNR indicated that beaver activity on Hay Creek may be limiting the migration of walleyes to upstream lakes such as Moose Lake and Hay Lake.

West Swan River

West Swan River is a 41-mile long river that with headwaters at Kelly Lake; this is approximately 2.5 miles east of the Keetac plant (see Figure 4.1.1). The river then flows south for approximately 20 miles before turning east and flowing another 20 miles where it ends at its confluence with the East Swan River. The West Swan River is connected to Sand Lake (PWI# 69-0895) and Coon Lake (PWI# 69-885) via Coon Creek. Based on review of the MNDNR public access points GIS data, there are no designated public access points on the West Swan River. However, the river can be accessed via the East Swan River, Coon Lake or at public road crossings.

Limited water quality information is available on the MPCA EDA website for West Swan River (data was collected by the fish survey crew). At the time of the biological survey in July 1998, the river channel had a measured depth of 0.75 meters, a width of 8 meters and had a moderate flow of 34 cubic feet per second (cfs). Dissolved oxygen concentrations were 5.8 mg/L and the temperature was 22.3 C at the time of the survey. The river was moderately nutrient-rich with total phosphorus concentrations of 0.063 ug/L.

The MPCA conducted a fish survey of the West Swan River in 1998. During the survey, 11 species of fish were collected, including the sport fish species largemouth bass, northern pike, and rock bass, however there were only four total individuals collected from these three species. The northern pike collected was of a catchable size but would still be considered small by anglers (less than 18 inches in length). The rock bass and largemouth bass collected were small individuals not of catchable size (less than five inches).

While the game fish collected from the West Swan River during the MPCA surveys were small, it is likely that larger, catchable size populations of fish exist in the river. The West Swan River is connected to the East Swan River and discussions with MNDNR Fisheries revealed that the East Swan River contains catchable size fish including both warm water species and trout in certain designated sections. It is unlikely that West Swan River contains the proper cold water habitat to support a trout fishery but it is likely that warm water game fish species migrate into the West Swan River from the East Swan River. Overall, due to the limited access points, the West Swan River likely receives a low amount of angling and recreational activity.

4.1.2.1.3 No Action Alternative

The No Action Alternative has the potential to create environmental impacts to fisheries and aquatic habitat. The No Action Alternative would increase the flows in O'Brien and Hay Creeks. The increase in dewatering flows is not anticipated to significantly alter bankfull flows (defined as high flows that significantly affect stream erosion and deposition and, therefore, morphology) in O'Brien and Hay Creeks. Changes could result in small scale alteration of the available aquatic habitat for fish and macroinvertebrates or lead to minor stream bank erosion. Plant discharges would increase and result in increased sulfate loadings to Swan Lake. Increases in sulfate may lead to increases in methylmercury in lake sediments. However, sulfate interaction with mercury is a complex process in lakes. It is not known how the increased sulfate loading would affect the fish community of Swan Lake. Additional information on mercury can be found in Section 4.9.7 and 5.5.

Dewatering

The Project Proposer holds or has applied for permits allowing mine pit dewatering from two areas: the east mine pits (Russell, Section 18, and Stevenson pits) and the west mine pits (Mesabi Chief, Sargent, and Perry pits). Dewatering flows from the east mine pits serve as plant make-up water and then discharge to either the tailings basin or to Welcome Creek. Dewatering flows from the west mine pits are discharged to O'Brien Creek via the Mesabi Chief outfall. The Project Proposer has been approved for permits that will allow for increases in dewatering flows and changes to the flow direction of the dewatering flows. For the west mine pits a permit application for a new discharge has been approved for dewatering of the Perry Pit. The Perry Pit dewatering flows will be discharged to O'Brien Creek via a new outfall that would be located upstream of the Mesabi Chief outfall.

This change in Perry Pit dewatering is not part of the Proposed Project and will take place as part of increased mining operations under the current Permit to Mine. The increased dewatering will result in increased flows to O'Brien Creek and to Hay Creek.

The Water Quantity and Quality Report discusses increased flows to O'Brien Creek and Hay Creek as a result of the Proposed Project. A portion of the described increased flows would occur without the Proposed Project, due to the actions described above. The No Action Alternative Memo describes the predicted discharges, flow rates, constituent loadings and downstream impacts for the No Action Alternative.

Plant Discharge

Operations at the Keetac facility include a discharge of plant treated process water in accordance with the tailings basin NPDES permit. A new wet scrubber for control of air emissions was installed in 2006 and has resulted in an increase in sulfate load in the plant wastewater. The increased sulfate load from the tailings basin discharge results in an increased sulfate load to Swan Lake. Sulfate concentrations were monitored in Swan Lake in 2006 as part of the Minnesota Steel EIS. The results indicate that the in-lake sulfate concentration averaged 19.3 mg/L. Based on estimates of the sulfate load from the Keetac plant wastewater discharge, the predicted current sulfate concentration is estimated to be 23.4 mg/L, which is in reasonable agreement to 2009 sampling results. Continued mining operations at the Keetac facility would result in an increase in sulfate concentrations. The No Action Alternative Memo estimates that 75 percent of the increased sulfate load compared to the Proposed Project would occur as part of the No Action Alternative, which is further discussed in Section 4.4.1.1.

4.1.2.2 Environmental Consequences

Physical changes to the watersheds, lake levels and stream flows of the water resources located in the vicinity of the Proposed Project are described in Section 4.1.1. The physical impacts to these water bodies were used to determine the potential for impacts to the fisheries resource, aquatic habitat and recreational angling activity of each water body. The key habitat requirements for the primary management fish species in each water body are presented in Table 4.1.8.

4.1.2.2.1 Lakes

> There are no direct impacts to Swan Lake in the form of direct discharges to or water appropriations from the lake as a result of the Proposed Project; however, Swan Lake is the downstream receiving water of O'Brien Creek and Hay Creek that would receive flows from the Proposed Project.

Changes to water levels, water flows or water quality of a water body that would cause the loss of a critical habitat element or a significant change to an essential water quality parameter (i.e., dissolved oxygen, temperature, etc.) would be considered to be an impact to the fisheries resources of that water body. The Water Balance/Mine Yield Study, the No Action Alternative Memo, and the Water Quantity and Quality Report provided details on water level, water flow, and water quality changes to identified water bodies as a result of the Proposed Project.

Potential impacts to the fish community or aquatic habitat for each water body are described below. The identification of potential impacts was then used to assess the potential for impacts on angling activity or angler satisfaction for a specific water body. The MNDNR target management species for each fishery for which a lake management plan has been prepared are provided along with their required critical habitat elements. A description of existing and future conditions, along with recommended monitoring and mitigation options are also provided (see Table 4.1.8).

Swan Lake

> The calculated worst-case cumulative increase of the Swan Lake sulfate concentration has been estimated to be from 34.9 mg/L to 40.1 mg/L over the life of the Proposed Project.

Direct discharges to, or water appropriations from, Swan Lake would not occur. However, Swan Lake is the downstream receiving water of O'Brien Creek and Hay Creek, which would receive flows from the Proposed Project. The Proposed Project would result in increased inflows to Swan Lake, via Hay Creek (Water Balance/Mine Yield Report). The additional inflows from Hay Creek into Swan Lake would include both dewatering flows from the west mine pits (Mesabi Chief outfall and the proposed Perry outfall, which flows into O'Brien Creek, then into the O'Brien Diversion Channel and ultimately into Hay Creek) and process water from the facility (plant water discharged to the tailings basin, which flows into Reservoir Six, then into Reservoir Two and then into the O'Brien Diversion Channel). A minor volume of plant discharge flows indirectly to Welcome Creek and is discharged through Reservoir Two. The total increase of inflows from Hay Creek would range from 0.0 to 6.5 cfs across the five different proposed mining periods (see Table 4.1.9). The proposed increase in inflows would result in an increase in Swan Lake water levels of less than an inch for all phases compared with current lake elevations (Water Quantity and Quality report).

The proposed dewatering increase from the west mine pits would not change the water quality of the inflow water to Swan Lake. This is because the Proposed Project would not change the dewatering process, only the rates of dewatering flows. The mine pits contain cold, clear water that is naturally low in nutrient concentrations. The increased volume of dewatering flows from the mine pits would not result in significant changes to the majority of typical water quality parameters of concern (i.e., nitrogen, phosphorus, chloride, mercury and other trace metals). However, the Proposed Project would result in an increased total sulfate load, which would result in an increase of the sulfate concentration of Swan Lake.

> It is unlikely that water quality parameters would change outside of the optimal ranges required by the target management fish species of Swan Lake as a result of the Proposed Project.

The modeling conducted was a worst-case estimate using a simple mixing model, and therefore did not account for sulfate conversion that may occur in the sediment of the lake. The calculated worst-case increase of the Swan Lake sulfate concentration has been estimated to be from 34.9 mg/L to 40.1 mg/L over the life of the Proposed Project including contributions from the Proposed Project as well as those from the Essar Steel project (Water Quantity and Quality Report). There is not an established state standard for sulfate for the protection of aquatic life. For reference, the USEPA drinking water standard for sulfate is 250 mg/L.

The target management fish species of Swan Lake are walleye, northern pike, and black crappie. The required critical habitat elements for each of these target species of Swan Lake are listed in Table 4.1.8. The projected lake level increases in Swan Lake as a result of the Proposed Project are estimated to be very small, less than one-inch under all conditions. These small projected increases would not reduce or eliminate the amount of available habitat for the target management species or other components of the existing fish community. The small increased water levels would not lead to shoreline instability or erosion during open water or ice conditions. The increases would not reduce near shore spawning and cover habitat. The increases in water levels would not impact angler access to Swan Lake. The water quality of the increased dewatering flows is similar to the existing inflows to Swan Lake from the Keetac facility. It is unlikely that water quality parameters would change outside of the optimal ranges required by the target management fish species of Swan Lake as a result of the Proposed Project (Water Balance/Mine Yield Study, Liesch, 2009D).

TABLE 4.1.8 SUMMARY OF FISHERIES IMPACTS

Water Body	Fish Species	MNDNR Management Status	Key Habitat Elements[1]	Existing Water Body Conditions	Future Conditions
Swan Lake	Walleye	Primary	• Feed on small forage fish, invertebrates, crustaceans and leeches. • The optimal temperatures are from 20-24C and optimal DO from 3-5 mg/L. • The key habitat feature is well oxygenated shallow gravel substrates near current or wave action for spawning.	• Walleyes are stocked by MNDNR annually but some natural reproduction of walleyes occurs. • Past alteration of Hay Creek and O'Brien Creek flows have affected walleye spawning success. • Northern Pike were stocked historically but current population is based on natural reproduction. • Black crappie have not been managed through stocking. • Swan Lake receives high amounts of regional angling activity during both open water and ice fishing seasons. • Some increases in nutrient loads have occurred that have contributed to increases in aquatic vegetation growth.	• Increased flows from the Proposed Project would increase water levels by less than 0.1 feet at all times. • Losses of shallow areas with aquatic vegetation are not anticipated. • Water quality not expected to change outside of preferred ranges of management species. • Population impacts are not anticipated for any of the target management species. • Adverse impacts to overall angler access, lake usage or success are not likely.
	Northern Pike	Primary	• Ambush predator that feeds primarily on fish. • The optimal temperatures are from 10-24C; optimal DO from 3-7 mg/L. • The key habitat factor is access to shallow spawning habitat with submerged vegetation.		
	Black Crappie	Secondary	• Feed on small forage fish. The key population limiting factor is the availability of forage fish. • Intolerant of high turbidity. • The optimal temperatures from 23-32C and optimal DO above 5.0 mg/L. Spawning habitat is shallow areas with submerged vegetation.		

[1] Key habitat elements for each species were taken from the Habitat Suitability Index Reports published by the U.S. Fish and Wildlife Service. The individual reports are listed in the references.

TABLE 4.1.8 SUMMARY OF FISHERIES IMPACTS

Water Body	Fish Species	MNDNR Management Status	Key Habitat Elements[1]	Existing Water Body Conditions	Future Conditions
Reservoir Four	Black Crappie	Primary	• Feed on small forage fish. The key population limiting factor is the availability of forage fish. • Intolerant of high turbidity. • The optimal temperatures from 23-32C and optimal DO above 5.0 mg/L. • Spawning habitat is shallow areas with submerged vegetation.	• There is no current stocking of target management species in the reservoir. • Largemouth bass and northern pike are all reproducing in the lake and are exhibiting average growth rates typical of similar class lakes across Minnesota. • Black crappie and bluegill abundance has increased since the creation of the reservoir. • The MNDNR management goals for Reservoir Four are to maintain the current black crappie population, maintain or increase the size structure of northern pike and potentially stock walleyes approximately once every four years to create a bonus fishery.	• Reservoir Four would receive increased inflows from the Proposed Project as a result of increased dewatering. However, additional inflows would not impact water levels as discharges from Reservoir Four would also increase. • Losses of shallow areas with aquatic vegetation are not anticipated. • Water quality not expected to change outside of preferred ranges of management species. • Population impacts are not anticipated for any of the target management species. • Adverse impacts to overall angler access, lake usage or success are not likely.
	Northern Pike	Primary	• Ambush predator that feeds primarily on fish. • The optimal temperatures are from 10-24C; optimal DO from 3-7 mg/L. • The key habitat factor is access to shallow spawning habitat with submerged vegetation.		

[1] Key habitat elements for each species were taken from the Habitat Suitability Index Reports published by the U.S. Fish and Wildlife Service. The individual reports are listed in the references.

TABLE 4.1.8 SUMMARY OF FISHERIES IMPACTS

Water Body	Fish Species	MNDNR Management Status	Key Habitat Elements[1]	Existing Water Body Conditions	Future Conditions
Reservoir Four	Bluegill	Secondary	• Feed on a variety of zooplankton and aquatic invertebrates. • The optimal temperatures from 10-30C and optimal DO above 5 mg/L. • Moderately intolerant of turbidity. • Require adequate submergent vegetative for feeding, spawning and escaping predation.	• There is no current stocking of target management species in the reservoir. • Largemouth bass and northern pike are all reproducing in the lake and are exhibiting average growth rates typical of similar class lakes across Minnesota. • Black crappie and bluegill abundance has increased since the creation of the reservoir. • The MNDNR management goals for Reservoir Four are to maintain the current black crappie population, maintain or increase the size structure of northern pike and potentially stock walleyes approximately once every four years to create a bonus fishery.	• Reservoir Four would receive increased inflows from the Proposed Project as a result of increased dewatering. However, additional inflows would not impact water levels as discharges from Reservoir Four would also increase. • Losses of shallow areas with aquatic vegetation are not anticipated. • Water quality not expected to change outside of preferred ranges of management species. • Population impacts are not anticipated for any of the target management species. • Adverse impacts to overall angler access, lake usage or success are not likely.
	Large-mouth Bass	Secondary	• Feed primarily on fish but also crustaceans and invertebrates. • The optimal temperature from 24-30C and optimal DO above 8.0 mg/L. • Intolerant of high turbidity. • Create spawning beds in aquatic vegetation over gravel or sand.		
Hay Creek	N/A	N/A			

[1] Key habitat elements for each species were taken from the Habitat Suitability Index Reports published by the U.S. Fish and Wildlife Service. The individual reports are listed in the references.

The one water quality parameter that would increase in Swan Lake as a result of the Proposed Project is sulfate. The increase in sulfate concentration would not result in significant changes to other parameters such as pH or conductivity that could potentially impact the existing fish community. However, there has been research conducted on the influence on mercury methylation from the addition of sulfate to lakes and wetlands sediments. Methylmercury is the form of mercury considered to be the most biologically available for uptake by fish, and eating mercury contaminated fish is the primary route of exposure for most people and wildlife. Sulfate reducing bacteria (SRB) have been shown to be responsible for most of the transformation of deposited mercury into methylmercury (MPCA, 2007A) especially in sulfate poor systems such as wetlands.

A study conducted on wetland sediments in northern Minnesota revealed that sulfate loading to a sulfate poor wetland led to increased methylmercury concentration in sediment porewater, as well as in wetland outflows (Swain et al., 2003). However, during the same study laboratory experiments on Spring Lake (Itasca County) sediments showed that added sulfate decreased the production of methylmercury (Swain et al., 2003).

The study determined that the decrease in methylmercury production from sulfate additions was likely due to a combination of factors including binding of sulfides, reduction in pH and/or increased formation of mercury-chloride species. A transect of the lake sediments found that methylmercury concentrations were negatively correlated with inorganic sulfides and lake depth. This study indicates that the methylation of mercury in lakes is a complex process, influenced by a variety of factors. There is a MNDNR fish consumption advisory related to mercury for Swan Lake. A full discussion of the ecological risk of mercury absorbed by fish from the Proposed Project is provided in Section 5.13.2.

There would not be an effect to fish and aquatic resources in Swan Lake from the Proposed Project. The predicted magnitude of change to lake levels is extremely small and less than the natural variation of the lake. The predicted increase in mercury in fish from potential increases in sulfate concentrations is not expected to change the health of fish. Change in water quantity and quality are not enough to change critical fish habitat elements.

Welcome Lake

The Proposed Project would not have appropriations from or discharges to Welcome Lake. Changes to lake levels, lake water quality or aquatic habitat are not anticipated as a result of the Proposed Project. It is expected that the Welcome Lake fish community would not change from what exists in the basin. Fish and aquatic resources in Welcome Lake would not be affected by the Proposed Project. The predicted magnitude of change to lake levels or to water quality parameters is zero. There is no change expected to critical fish habitat elements. Due to the absence of a public access on Welcome Lake and the lack of recreational activity, the Proposed Project would not alter local public fishing patterns on Welcome Lake.

Hay Lake

Hay Lake receives Keetac plant discharge from three sources via the O'Brien Diversion Channel, which flows into Hay Creek that in turn serves as the inflow to Hay Lake. The Proposed Project would increase the flows to Hay Creek and ultimately Hay Lake under each of the proposed five-year mining periods with the increase ranging from 0.0 to 6.5 cfs (see Table 4.1.9).

TABLE 4.1.9 CALCULATED CHANGES IN FLOWS FOR HAY CREEK

Mining Period	Mean Annual Flow (cfs)	Mean Annual Flow (percent)	Bankfull Flow (cfs) [1]	Bankfull Flow (percent)
Existing (2009)	33.8	na	218.2	na
Proposed 2012-2016	33.8	0.2	211.9	-2.9
Proposed 2017-2021	34.9	3.1	213.0	-2.4
Proposed 2022-2026	36.1	6.8	214.3	-1.8
Proposed 2027-2031	39.5	16.8	217.6	0.3
Proposed 2032-2036	40.3	19.1	218.4	0.1

Source: No Action Alternative Memo
[1] Based on 1.5 year return

The proposed increase of flows in Hay Creek, ranging from 0 to 19 percent, would not significantly change the water levels in Hay Lake. This is because Hay Creek is both the inlet and outlet to the basin. The increased inflows to Hay Lake would result in increased outflows from the lake, and as a result the water levels would remain similar to existing conditions. Additionally, there is a wetland/bog area surrounding the lake that would serve as a buffer to the increased flows (i.e., additional storage volume) that would further reduce the impacts of the increased flows on lake water levels. The proposed increase in flows would not reduce the potential for fish to migrate into Hay Lake from either Hay Creek or Swan Lake but would possibly increase the migration opportunities under some higher flow scenarios.

The Proposed Project would result in increased inflows to Hay Lake via Hay Creek, but the increased flows are not likely to result in significant changes to the existing lake levels or lake water quality. Therefore it is unlikely that the fish community of Hay Lake would be altered from existing conditions as a result of the Proposed Project. The proposed increases in flow would not alter existing lake access or angling activity on Hay Lake as a result of the Proposed Project. There would not be an effect to fish and aquatic resources in Hay Lake from the Proposed Project. The predicted magnitude of change to lake levels is extremely small and less than the natural variation of the lake. There is no change expected to critical fish habitat elements.

Unnamed Lake - Reservoir Two

The average discharge from Reservoir Two to the O'Brien Diversion Channel is approximately 9.6 cfs (Water Balance/Mine Yield Study). Compared to current conditions, the Reservoir Two average discharges are predicted to increase under each of the proposed five-year mining periods. Reservoir discharges would generally be 0.9 to 1.4 times the average current conditions, ranging from 9.10 cfs to 13.9 cfs. Increased inflows that would lead to these proposed increased discharges are not anticipated to significantly alter the current water levels of Reservoir Two.

In addition to the five proposed mining scenarios, the Water Balance/Mine Yield Study identifies two different worst-case scenarios: one for low flow conditions and one for high flow conditions. The low flow condition assumes drought (lowest precipitation in 25 years) precipitation with maximum plant water consumption. The high flow condition assumes wet year (highest precipitation in 25 years) precipitation under maximum mine pumping conditions. Under the worst-case low flow scenario (2012) there would be no discharge from the reservoir. However, this would result in less than 0.5 ft decrease in the Reservoir Two water levels. Under the worst-case high flow scenario (2027 or 2036), discharges from Reservoir Two would increase to approximately 24 cfs, which is 2.5 times the current average conditions but similar to current wet year conditions. The increased inflows would result in the increased discharges to the O'Brien Diversion Channel and would not significantly increase water levels in the reservoir.

Due to the low potential for changes to the water levels or water quality of Reservoir Two, changes to the existing fish community of Reservoir Two are not anticipated as a result of the Proposed Project. Due to the lack of public access to Reservoir Two, impacts to local angling activity would not occur as a result of the Proposed Project. Fish and aquatic resources in Reservoir Two would not be affected by the Proposed Project. The magnitude of change of environmental parameters that could affect fish is small.

Unnamed Lake - Reservoir Two North

The general flow of water to and from Reservoir Two North would not be altered as a result of the Proposed Project. Under existing conditions, Reservoir Two North receives inflow from the Keetac facility through the Welcome Creek weir and the reservoir discharges to a channel that flows to Reservoir Two. The typical Keetac portion of inflow from the Welcome Creek weir to Reservoir Two North is 2.1 cfs under existing conditions. The outflow from Reservoir Two North is not monitored and as a result is not known.

The Proposed Project would decrease the amount of inflow and discharges from Reservoir Two North under most mining scenarios. These changes would not result in significant changes to the reservoir water levels. Water quality of inflows to and discharges from Reservoir Two North are expected to remain similar to existing conditions because the mining process would not change from existing conditions under the Proposed Project.

Due to the lack of potential changes to the water levels or water quality of Reservoir Two North, changes to the existing fish community of Reservoir Two North are not anticipated as a result of the Proposed Project. Due to the lack of public access to Reservoir Two North, impacts to local angling activity would not occur as a result of the Proposed Project. Fish and aquatic resources in Reservoir Two North would not be affected by the Proposed Project. The magnitude of change of environmental parameters that could affect fish is small.

Unnamed Lake - Reservoir Four

The Proposed Project would not change the source of flows to Reservoir Four, however the volume of flow would change. Reservoir Four receives dewatering flows from the existing facility via the Mesabi Chief Outfall that discharges into O'Brien Creek that flows into Reservoir Four. The Proposed Project would increase the flows from the combination of Mesabi Chief and Aromac-Perry Pit dewatering to O'Brien Creek. The proposed increased dewatering rates would result in 0.4 to 2.2 cfs of additional inflow into Reservoir Four (Water Quantity and Quality Report). The increase in flow as a result of the Proposed Project would not result in significant changes to water levels in Reservoir Four because the basin is a flow through system. The increased flow into the reservoir would result in increased discharge from Reservoir Four into the O'Brien Diversion Channel, which has the capacity to accommodate the proposed increase inflow. The proposed increase in flows to the reservoir would be from pit dewatering activities. Mine pits typically have low nutrient concentrations and as a result the water quality of Reservoir Four would not be impacted due to the increase of dewatering flows as a result of the Proposed Project.

The additional dewatering flows that Reservoir Four would receive as a result of the Proposed Project would not result in changes to critical habitat or water quality parameters required by target management species (see Table 4.1.8). The Proposed Project increase in dewatering flows would not result in water level changes that would limit angler access to Reservoir Four.

Due to the absence of anticipated impacts to the existing target management species or other components of the existing fish community, the Proposed Project would not impact angler success or local/regional fishing patterns in Reservoir Four. Fish and aquatic resources in

Reservoir Four would not be affected by the Proposed Project. The magnitude of change of environmental parameters that could affect fish is small.

Unnamed Lake - Reservoir Six

Reservoir Six supplies approximately 75 percent of the total inflow to the existing facility. The predicted discharge from Reservoir Six averages 3.2 cfs under current conditions. Under the Proposed Project, Reservoir Six would continue to serve as the main inflow source to the facility. The flow pathways would not be changed as a result of the Proposed Project, but the flow volumes would increase. The discharges from Reservoir Six would increase by 1.6 to 6.3 cfs under the different five-year mining scenarios from the Proposed Project assuming Sargent Mine Yield is included in the Reservoir Six discharge. This represents an increase of one to two times over existing average conditions. The majority of the increased inflows to Reservoir Six would result from increased discharge from the outer tailings basins second stage pond. The increased Reservoir Six discharges contribute to the increased Reservoir Two discharges to the O'Brien Diversion Channel. Water levels in Reservoir Six are not expected to change significantly because inflow and outflow from the reservoir balance with little change in storage.

Water quality parameters in Reservoir Six are in a state of flux due to fine tuning of the process at the existing facility. The addition of a wet-scrubber to control air emissions from the existing line has led to an increase in sulfate loading in the discharge. In an attempt to reduce the sulfate loading in the discharge, the Project Proposer is planning to upgrade the existing wastewater treatment system on the existing line. Monitoring of the existing Reservoir Six sulfate concentrations show that the concentrations are increasing. However, due to the proposed upgrade of the wastewater treatment system to remove sulfate from the existing wet scrubber, sulfate concentrations are expected to ultimately decrease from current conditions. Calculated sulfate concentrations in Reservoir Six are expected to decrease from the existing 2008 concentrations of 124 mg/L to 83 mg/L over the life of the Proposed Project (Liesch, 2009C). For reference, under both existing and proposed conditions the sulfate concentration in Reservoir Six is below the USEPA drinking water standard of 250 mg/L. Other water quality parameters (i.e., phosphorus, nitrogen, chloride, mercury or other trace metals) are not expected to change significantly as a result of the Proposed Project.

Due to the lack of potential changes to the water levels or water quality of Reservoir Six, changes to the existing fish community of Reservoir Six are not anticipated as a result of the Proposed Project. Due to the lack of public access to Reservoir Six, impacts to local angling activity would not occur as a result of the Proposed Project. Fish and aquatic resources in Reservoir Six would not be affected by the Proposed Project. The magnitude of change of environmental parameters that could affect fish is small.

4.1.2.2.2 Streams

Physical changes to the watersheds, lake levels, and stream flows of the water bodies located in the vicinity of the Proposed Project are described in Section 4.1.1. The physical impacts to these water bodies were used to determine the potential for impacts to the biotic communities of each stream. Changes to water flows that would cause a loss in the availability, diversity, or quality of in-stream habitat were considered to be a potential impact on the biotic community of the stream. Potential impacts to the biotic communities for each stream in the vicinity of the Proposed Project are described below.

Hay Creek

The headwaters of Hay Creek are located immediately south of the tailings basin. Hay Creek receives inflow from the O'Brien Diversion Channel from the Keetac facility in the form of dewatering flows from the west mine pits, Reservoir Four and the plant process water that is discharged ultimately through Reservoir Two. The plant process water discharged through Reservoir Two is conveyed through the tailings basin system and out Reservoir Six and through Welcome Creek. The Proposed Project would not alter the flow pathways to Hay Creek from the facility but would result in increased flows to Hay Creek. The Proposed Project would result in an increase of flow in Hay Creek under each of the five-year mining scenarios, ranging from 0.0 to 6.5 cfs (see Table 4.1.9). This equates to a 0 to 19 percent increase in average daily flow over the life of the Proposed Project. However, the modeled bankfull flows in Hay Creek as a result of the Proposed Project would range from a 6.3 cfs decrease to a 0.2 cfs increase (see Table 4.1.9). This equates to a range of a 3 percent decrease to a 0.1 percent increase in bankfull flows, which is the critical factor for stream channel integrity. The water quality associated with the flows to Hay Creek from the Proposed Project would not change significantly from existing conditions because the mining process would not change under the Proposed Project, only the volume of water discharged to Hay Creek. This is because the Proposed Project would not change the existing mining process but instead would only change the volume of water discharged to Hay Creek.

The headwaters of Hay Creek are located immediately south of the tailings basin. Hay Creek receives inflow from the O'Brien Diversion Channel from the Keetac facility in the form of dewatering flows from the west mine pits, Reservoir Four and the plant process water that is discharged ultimately through Reservoir Two in the form of dewatering flows from the West Mine pits.

The Hay Creek watershed has been altered as a result of past mining activities, including the creation of the O'Brien Diversion Channel and the tailings basin. These changes have led to an alteration of flows in Hay Creek. In spite of these past watershed alterations, the existing biotic community of Hay Creek ranges from good to excellent. This may be due to the time that has elapsed since the time of watershed alterations (i.e., approximately 30 years since the reconstruction of the O'Brien Diversion Channel by Hanna Mining Company) allowing the biotic community time to recover. The increases in flow in Hay Creek as a result of the Proposed Project would be similar in nature to past changes experienced by Hay Creek from mining activities (i.e., current or past permitted dewatering of mine pits). The bankfull flows, which are defined as the channel forming flow, of Hay Creek are predicted to be altered slightly, with up to a 1-tenth of a percent increase. This small increase is not expected to significantly alter the geomorphology of Hay Creek. However, the average daily flows are expected to increase from 0 to 19 percent over the life of the Proposed Project. This increase in daily flows is not likely to result in large-scale stream process alterations since the bankfull flows vary by a maximum of only 3 percent. The increased stream velocities that are likely associated with the increased flows could lead to alteration of aquatic habitat or some stream bank erosion on a small scale.

There would be a potential adverse effect to Hay Creek due to a predicted change to bankfull flows from the Proposed Project. However, the small magnitude of change to bankfull flows is not expected to significantly change the geomorphology of the creek. As a result, significant effects to the fish or macroinvertebrate populations are not anticipated. A monitoring plan would be necessary, and mitigation would be used if needed.

West Swan River

Water is not appropriated from or directly discharged to the West Swan River. Due to the lack to either water appropriations or discharges on the West Swan River, effects on water levels or water quality of the river are not expected to occur as a result of the Proposed Project. It is possible that there would be some groundwater interaction between the West Swan River and the tailings basin. However, the groundwater interaction is not anticipated to change significantly from the existing conditions and the small possible increase in groundwater provided to the river as seepage from the tailings basin would not have a significant impact on flow in the river. Changes to the existing fish community or availability of aquatic habitat in the West Swan River are not anticipated as a result of the Proposed Project. The West Swan River does not have a designated public access point and as a result likely receives a low to moderate amount of local recreational and angling activity. The Proposed Project would not impact the existing amount of angling or recreational activity on the West Swan River.

4.1.2.2.3 East Stockpile Alternative

The potential effects of the East Stockpile Alternative on fisheries and aquatic resources are the same as associated with the Proposed Project.

4.1.2.3 Monitoring and Mitigation

4.1.2.3.1 Monitoring

> Impacts to fisheries and aquatic habitat for lakes and streams near the Proposed Project are anticipated to be minor. Mitigation for project related impacts could be limited to biological monitoring in streams and lake level monitoring and adjustments, to allow for continued public access.

The Proposed Project would increase stream flows to Hay Creek in a similar manner as past mining projects in the area (i.e., Hay Creek would be the ultimate downstream receiving water for mine pit dewatering flows). However, it is not known what potential impacts the additional increased flows in Hay Creek may have on the existing high-quality biotic community. Due to the quality of the current biotic community, monitoring of the fish and macroinvertebrate communities could be conducted as mitigation for the Proposed Project to attempt to determine if the proposed increase in flows alter the health or structure of the existing biological community. Establishment of baseline conditions through monitoring prior to project startup would provide a means to determine if an appreciable deviation from the existing conditions occurs in Hay Creek as a result of the Proposed Project. After the EIS process is complete, the MNDNR will consider amending an existing water appropriations permit for Keetac to include monitoring of fish and macroinvertebrate communities and water chemistry because of a modeled increase in mean annual flows to Hay Creek. The MNDNR would consider using accepted physical habitat assessment and/or biological community assessment methodologies. Monitoring of Hay Creek during project operations could be used to either confirm that the biotic community of Hay Creek is not impacted by the Proposed Project or serve as an early detection of alterations to the biotic community.

Both fish and macroinvertebrate surveys could be conducted regularly on Hay Creek to monitor the health of fish and macroinvertebrate communities. The MPCA has developed survey protocols for both fish and macroinvertebrate surveys to collect data required to calculate community IBI scores. The surveys can be completed in a relatively short amount of field time (approximately one to two days combined). It has been ten years since the MPCA survey, so an initial survey prior to project startup could be conducted to establish the baseline of the existing fish and invertebrate communities. After the baseline sampling, future IBI samplings could be conducted on Hay Creek to determine if biotic community health is being influenced by the Proposed Project. A possible stream fish and macroinvertebrate IBI monitoring program for Hay Creek could include the following sampling schedule:

- Prior to project startup
- Subsequently during each of the five-year mining periods

Impacts to fisheries and aquatic habitat for lakes near the Proposed Project are anticipated to be minor. Lake level monitoring could be conducted similar to stream monitoring, and as required through permitting. The agencies could make physical habitat or biological community monitoring a requirement of the permitting process. If monitoring indicates an impact, future adverse effects would be subject to permitting requirements depending on the change indicated and/or the impact. Reporting requirements are also part of the permitting process. The permits that relate to fisheries and aquatic resources potentially impacted by the Proposed Project, include the NPDES/SDS permit and the Water Appropriations permit. Both of which require monitoring.

4.1.2.3.2 Mitigation

Since Proposed Project impacts to fisheries and aquatic resources in lakes are anticipated to be minor, mitigation could include conversion of mine pits to public fishing resources after project completion, which allows for public access. This mitigation would fit with current MNDNR recommendations for in-pit stockpiling practices.

The MNDNR recommends in-pit stockpiling where feasible to assist in the conversion of completed mine pits to fisheries resources. In the past, the MNDNR has stocked mine pit lakes with species such as rainbow trout, brook trout or lake trout. The MNDNR manages the LaRue Pit as a cold water trout fishery. Recent surveys of the LaRue Pit show that multiple year classes of stocked rainbow trout are present in the pit, suggesting long term survival. Additional species found in the LaRue Pit include bluegill, largemouth bass, northern pike, and brook trout which have been found in the pit even though there are no past records of them being stocked. Based on conversations with the MNDNR Fisheries Biologists, the key factor in successful use of the mine pits as fisheries resources is the amount of shallow, littoral habitat.

A study of reclaimed mine pit lakes conducted by the MNDNR revealed that both benthic invertebrate and zooplankton densities were low in mine pit lakes compared to oligotrophic natural lakes (Pierce and Tomcko, 1989). A main concern in undertaking a mine pit reclamation project through the stocking of trout species is the lack of available forage food to sustain adequate growth and survival of stocked trout. The implementation of in-pit stockpiling, if it is determined to be feasible, could help to improve the productivity of mine pit lakes by creating shallow areas near the shores. These shallow areas would provide a simulated littoral habitat in the deep mine pits. These littoral areas could provide a starting place for primary production (i.e., plant and algal growth) that would add to the productivity of the mine pits.

Changes in the biotic community of Hay Creek are not anticipated, however if monitoring reveals impacts due to mining-related activities, habitat improvement or other mitigation strategies could be developed to limit or eliminate further impacts or declines in the biotic community of Hay Creek. If surface water levels increase or decrease more than expected the following measures could be taken.

- Redistribute flow among the reservoirs
- Alter timing of discharges seasonally or at appropriate times
- Install flow control structures at key points in the system
- Stream bank stabilization or other similar control measure

4.2 WILDLIFE RESOURCES

The Proposed Project contains habitat for a variety of wildlife species. The FSDD states that, "The EIS will include a qualitative description of wildlife species present in the project area and describe potential project impacts."

> The current and proposed Keetac footprint lies within the Nashwauk Uplands subsection of the Northern Superior Uplands section of the Laurentian Mixed Forest Province.

The Wildlife CE Study for the Proposed Project was based upon assessment of land cover and plant communities (i.e., habitats) on the site and the relationship between habitat and wildlife species. Proposed impacts to plant habitats and the resulting impacts to wildlife were assessed to determine the effects of the Proposed Project may have on wildlife. This section provides a general discussion on wildlife habitat and wildlife, and potential impacts to wildlife from the Proposed Project. Section 4.3 provides additional discussion of threatened and endangered wildlife species present in the vicinity of the Proposed Project.

Table 4.2.1 presents a summary of the common and Latin names for the species discussed the subsequent Section. The discussion uses the common names.

TABLE 4.2.1 COMMON AND SCIENTIFIC NAMES FOR SPECIES

Common Name (Animals)	**Scientific Name**
Beaver	*Castor canadensis*
Black Bear	*Ursus americanus*
Bobcat	*Lynx rufus*
Canada Lynx	*Lynx Canadensis*
Coyote	*Canis latrans*
Fisher	*Martes pennant,*
Gray Wolf	*Canis lupus*
Mink	*Mustela vison*
Moose	*Alces alces*
Pine Marten	*Martes Americana*
Red Fox	*Vulpes vulpes*
Red Squirrel	*Tamiasciurus hudsonicus*
Snowshoe Hare	*Lepus americanus*
White-Tailed Deer	*Odocoileus virginianus*
Common Name (Birds)	**Scientific Name**
Bald Eagle	*Haliaeetus leucocephalus*
Belted Kingfisher	*Megaceryle alcyon*
Common Snipe	*Gallinago gallinago*
Great Blue Heron	*Ardea Herodias*
Killdeer	*Charadrius vociferous*
Peregrine Falcon	*Falco peregrinus*
Ruffed Grouse	*Bonasa umbellus*
Sharp-Tailed Grouse	*Tympanuchus phasianellus*
Swamp Sparrow	*Melospiza gerogiana*

Common Name (Plants)	Scientific Name
Blunt-Lobed Grape Fern	*Botrychium oneidense*
Least Moonwort	*Botrychium simplex*
Mingan Moonwort	*Botrychium. minganense*
Pale Moonwort	*Botrychium. pallidum*
Prairie Moonwort	*Botrychium campestre*
Clustered Bur Reed	*Sparganium glomeratum*
Ternate or St. Lawrence Grapefern	*Botrychium rugulosum*
Torrey's Manna-Grass	*Torreyochloa pallida*
Triangle Moonwort	*Botrychium lanceolatum*
Trianglelobe or Upswept Moonwort	*Botrychium ascendens*
Tubercled Rein-Orchid	*Platanthera flava var. herbiola*
Common Name (Wetland Plants)	**Scientific Name**
American white water lily	*Nymphaea odorata*
Aspen	*Populus sp.*
Black ash	*Fraxinus nigra*
Canada bluejoint grass	*Calamagrostis Canadensis*
Cattails	*Typha sp.*
Lake sedge	*Carex lacustrus*
Leather leaf	*Chamaedaphne calyculata*
Reed canary grass	*Phalaris arundinacea*
Sedges	*Carex sp.*
Sensitive fern	*Onoclea sensibilis*
Speckled alder	*Alnus rugosa*
Sphagnum moss	*Sphagnum sp.*
Tussock sedge	*Carex stricta*
Willows	*Salix sp.*

4.2.1 Affected Environment

4.2.1.1 Existing Conditions

The current and Proposed Project footprint lies within the Nashwauk Uplands subsection of the Northern Superior Uplands section of the Laurentian Mixed Forest Province, according to the Field Guide to the Native Plant Communities of Minnesota (MNDNR, 2003). This subsection and the Northern Superior Uplands Section lie within the Canadian Shield in Minnesota and are characterized by partially exposed Precambrian bedrock, intermittent lakes, and significant topographic relief (MNDNR, 2003). Land cover and plant community types that occur within the Nashwauk Uplands subsection may include upland mixed forest, upland conifers, lowland conifers, lowland hardwoods, woodland, brushland, grasslands, emergent wetlands, bogs, rivers, open water habitats, temporary openings, and open ground. Land use includes various human dwellings and development.

Information contained in the cumulative effects report was used to document land cover and to assess plant communities and associated wildlife species likely to occur in the Proposed Project area and potential impacts from the Proposed Project. The report is summarized in more detail in Section 5.6 – Wildlife Habitat Loss/Fragmentation and Wildlife Corridor Obstruction. A list of terrestrial vertebrate wildlife species that may be found in and around the Keetac mine is in Appendix K.

4.2.1.2 Existing Land Cover and Plant Communities

Plant communities providing wildlife habitat that are present within the current and proposed Keetac footprint range include upland mixed hardwood-conifer forest, mesic hardwood forest and marshes.

> Previous mining activity has disturbed much of the land within the Keetac footprint, and much of the area has been converted to land with mine pits and stockpiles that has very little value as wildlife habitat. The Project Proposer has designated 10,000 acres to the SFIA.

Previous mining activity has disturbed much of the land within the Keetac footprint, and much of the area has been converted to land with mine pits and stockpiles that has very little value as wildlife habitat. Some areas within the Keetac site where previous mining activity has occurred have revegetated naturally (i.e., historic stockpiles created by natural ore miners) or through human efforts (i.e., created wetland mitigation areas) and provide some wildlife habitat. While the revegetated areas do not completely replace the functional value of the original habitat, they provide some value as wildlife habitat within the Proposed Project area. In addition, the Project Proposer has designated and registered in excess of 10,000 acres in the Sustainable Forest Incentive Act (SFIA). This provides wildlife habitat and public access to the property.

4.2.1.3 Existing Wildlife

The MNDNR Gap Analysis Program (GAP) analysis identified a total of 203 amphibian, bird, mammal, or reptile species that could occur in the native plant communities or habitats common to the Nashwauk Uplands subsection. However, since the Keetac site makes up a very small portion of the entire Nashwauk Uplands subsection and does not contain all of the plant communities and habitat types found throughout the subsection, it is likely that only a fraction of the species actually exist within the property controlled by the Project Proposer.

The species likely to be present in the Project footprint are based on the habitat types found on the site. Areas that contain a combination of upland and wetland plant communities likely provide habitat for mammals such as white-tailed deer, black bear, coyote, gray wolf, bobcat, beaver, pine marten, fisher, mink, red squirrel, red fox, bats, snowshoe hare, Canada lynx, other small mammals, and possibly moose. Birds that use these habitats could include bald eagles, cormorants, swans, osprey, several species of, hawks and numerous passerine (i.e., perching) species.

Wetlands on the site provide habitat for amphibians, turtles, waterfowl, great blue heron, common snipe, killdeer, belted kingfisher, and swamp sparrow. Forests and/or open areas provide habitat for hawks, owls, woodpeckers, and numerous passerine bird species. Ruffed grouse are also likely present in areas with disturbed and second growth forest. On the west side of the reclaimed tailings basin, sharp-tailed grouse have established a stable population.

4.2.1.4 No Action Alternative

The No Action Alternative land cover is described in Section 4.11 and includes five general cover type categories: forest, mining, open water, past mine feature: revegetated, and wetland. These five categories were compared to the specific plant community types for wildlife habitat (i.e., undisturbed habitat). Table 4.2.2 summarizes the land cover found on the Keetac current and proposed footprint including acres for each plant type community. The most prevalent plant community types include aspen/white birch forest, upland and lowland shrubs, aquatic habitats, and marsh.

TABLE 4.2.2 UNDISTURBED HABITATS UNDER THE NO ACTION ALTERNATIVE

Undisturbed Habitats under the No Action Alternative	Acres
Aspen/White Birch	502.40
Pine	2.05
Upland Conifer Forest	2.12
Lowland Conifer Forest	2.95
Upland Deciduous Forest	24.22
Lowland Deciduous Forest	0.00
Other Forest	31.25
Upland Shrub	185.42
Lowland Shrub	173.89
Grassland	13.14
Marsh	169.22
Aquatic	187.00
TOTAL Undisturbed Habitats	**1,293.67**

Source: MNDNR 2007 Mining Features data, USGS National Land Cover Database 2001, GAP datasets, MNDOT Railroads dataset (Barr, 2009), Keetac Wetland Delineations (Barr, 2007), 2008 aerial photography, Wenck Associates

Under the No Action Alternative, estimated land cover would consist of approximately 1,294 acres of undisturbed wildlife habitat (i.e., the general categories of forest, wetland, or open water habitats). The remaining 7,920 acres of the total 9,214-acre current and proposed Keetac footprint would already be impacted in some way by past or current (2021) mining activities (i.e., mining or past mine feature: revegetated). An additional 57 acres of wetlands may be impacted by the Proposed Project outside of the current and proposed Keetac footprint, which is further discussed in Section 4.6. Analysis of pre-settlement and estimated land cover under the No Action Alternative indicates that approximately 86 percent of the Keetac footprint would be converted from the original pre-settlement land cover to an anthropogenic land cover.

Based on the cover types analysis completed for the No Action Alternative, approximately 13 percent or 1,240 acres of the current and proposed Keetac footprint is revegetated past mine features, such as stockpiles that have naturally revegetated over time or through human efforts. The revegetated areas include various cover types (e.g., aspen/white birch, grasslands, etc.). Of the 1,240 acres of past mine features: revegetated cover type, 1.3 percent (16.7 acres) may provide some habitat value. These areas primarily include aspen/white birch, upland and lowland shrubs and aquatic habitats.

4.2.2 Environmental Consequences

4.2.2.1 Proposed Action Alternative

The mining activities from the Proposed Project are not expected to significantly change the type or abundance of wildlife habitat available in the region. Although the Proposed Project would involve the loss of some wildlife habitat, much of the site impact would occur in or adjacent to previously disturbed sites or previously mined areas.

In order to assess potential impacts to wildlife from the Proposed Project, the existing land cover conditions were compared to the proposed impacts. A detailed description of the datasets that were combined to demonstrate land cover conditions are described in the Wildlife CE Study.

For the purposes of assessing potential impacts to wildlife from the Proposed Project, impacts to natural habitat land cover types were assessed. The disturbances were designated as "High Impact" or "Moderate Impact." High Impacts are defined as those areas that have been altered such that they provide no habitat, food or shelter to wildlife species. High Impact disturbances may include physical barriers to wildlife travel. High Impacts include mining pits or the mine plant buildings and facilities.

Moderate Impacts include changes in topography, community structure, diversity, or function from the original habitat, but do not create physically impenetrable barriers for many wildlife species and may still provide habitat in the future. Examples of Moderate Impacts include stockpiles, tailings basins, borrow areas, settling ponds, and haul roads. While some of the Moderate Impact areas could eventually provide lower quality wildlife habitat, they cause at least a short-term loss of wildlife habitat. For the purposes of assessing worst-case potential impacts to natural habitat land cover, Moderate and High Impacts were combined for the assessment.

The Proposed Project would result in Moderate to High Impacts to 100 percent of the 1,294 acres of undisturbed vegetated wildlife habitat in the current and proposed Keetac footprint.

The majority of the proposed impacts to vegetated wildlife habitat from the Proposed Project would be to early successional habitats that are abundant near Keetac, including aspen/white birch forest, and lowland and upland shrub. Since these early successional habitats are abundant in the vicinity of Keetac and would potentially become more abundant as previously mined areas are revegetated, the loss of these habitats on the mine site is not likely to create population level impacts, but may result in impacts to individual animals. It is likely that wildlife would relocate to a nearby similar habitat outside of the areas that are being actively mined.

A small percentage of the proposed impacts to wildlife habitat are to mature forest communities such as conifer and upland deciduous forests. The impact footprint to these native forest habitat types is small because these habitats make up a small portion of the current conditions. The remaining future impacts from the Proposed Project would occur on previously developed or disturbed land that would not result in the loss of significant wildlife habitat.

> Although the Proposed Project would involve the loss of some wildlife habitat, much of the site impact would occur in or adjacent to previously disturbed sites or previously mined areas.

The project site contains habitat that is suitable for a variety of wildlife species. However, because the site is within an existing operating mine, the site likely favors habitation by species that are more tolerant of human disturbance. Species such as white-tailed deer are well-adapted to anthropogenic disturbances and are regularly seen on or near mine sites. Other large species such as black bear and moose are also tolerant of some anthropogenic disturbances and are common near mine sites.

Small scale (local level) impacts to wildlife populations may occur to small, less mobile species (i.e., small rodents, amphibians, and reptiles) that have difficulty relocating.

In general, wildlife would be adversely affected by the Proposed Project as there would be loss of habitat. The magnitude of wildlife habitat loss is large. However, this loss is only expected to affect less mobile individuals, such as small rodents and reptiles, but not whole populations of animals. Furthermore, much of the wildlife habitat that would be destroyed is prevalent nearby, and therefore individuals can relocate. Effects to wildlife are expected to be less than significant, and no monitoring or mitigation is proposed.

4.2.2.2 East Stockpile Alternative

The potential environmental effects to wildlife resources from the East Stockpile Alternative are the same as those associated with the Proposed Project.

4.2.3 Mitigation Opportunities

No specific habitat monitoring is recommended since the impacts are well understood.

4.2.3.1 Mitigation

Wildlife habitat would be lost due to the Proposed Project. This would likely result in wildlife being displaced to suitable habitat adjacent to the project site during active mining operations. It is likely that some wildlife would return to areas that are revegetated in the years and decades following completion of mining activities. Mineland reclamation (Minnesota Rules Chapter 6130) practices would be followed in order to facilitate the re-establishment of vegetated wildlife habitat upon completion of disturbance of an area. This would decrease the overall loss of wildlife habitat due to the Proposed Project. Mineland reclamation is described in Section 3.3.7.

4.3 THREATENED AND ENDANGERED SPECIES

The FSDD states that, "the EIS analysis would include an evaluation of the potential impacts to state and federally threatened and endangered species and state species of special concern." Analysis in this section focuses primarily on those issues related to listed plant and animal species that may be found at the Proposed Project. An analysis of the potential cumulative effects to threatened and endangered species and state species of special concern from projects across the Iron Range is provided in Section 5.7.

4.3.1 Affected Environment

4.3.1.1 Regulatory Framework

The Federal Endangered Species Act of 1973, as amended (16 USC §§ 1531 – 1544) defines the regulations pertaining to plant and animal species that have been federally-designated as threatened or endangered.

Minnesota's Endangered Species Statute (Minnesota Statutes Section 84.0895) requires the MNDNR to adopt rules designating species meeting the statutory definitions of endangered, threatened, or species of special concern. The resulting list of Endangered, Threatened, and Special Concern Species is codified as Minnesota Rules Chapter 6134. The Endangered Species Statute also authorizes the MNDNR to adopt rules that regulate treatment of species designated as endangered and threatened. These regulations are codified as Minnesota Rules, parts 6212.1800 to 6212.2300.

Minnesota's Endangered Species Statute and the associated rules impose a variety of restrictions, a permit program, and several exemptions pertaining to species designated as endangered or threatened. Species of special concern are not protected by Minnesota's Endangered Species Statute or the associated rules.

The rules prohibit taking an endangered or threatened species without a permit. Rules specify that a Takings Permit may be issued only for scientific study, for educational programs, to enhance propagation or survival of the species, to prevent injury to people or property, or when the social and economic benefit of the taking outweigh the harm caused by it.

Based on these regulatory considerations, the discussion in this section focuses on state and federally-listed threatened and endangered species and species of special concern for both plants and animals. Species listed as "special concern" by the MNDNR are also discussed, but these species are not offered the same level of protection or regulation under state rules. Table 4.3.1 provides a summary of the state and federally-listed threatened and endangered species, and species of concern in the vicinity of the Proposed Project.

TABLE 4.3.1 SUMMARY OF STATE AND FEDERALLY-LISTED SPECIES WITHIN THE PROPOSED PROJECT VICINITY

Species	Species Type	Common Name	Minnesota State Status	Federal Status
Haliaeetus leucocephalus	Animal	bald eagle	Special concern	Protected[1]
Lynx canadensis	Animal	Canada lynx	No status	Threatened
Falco peregrinus	Animal	peregrine falcon	Threatened	No status
Charadrius melodus	Animal	piping plover	Endangered	Threatened
Canus lupis	Animal	gray wolf	Special concern	Threatened
Botrychium pallidum	Plant	pale moonwort	Endangered	No status
Botrychium rugulosum	Plant	ternate grapefern	Threatened	No status
Botrychium ascendens	Plant	triangle moonwort	Proposed Endangered	No status
Sparganium glomeratum	Plant	clustered bur reed	Special concern	No status
Platanthera flava var. herbiola	Plant	tubercled rein-orchid	Endangered	No status
Botrychium simplex	Plant	least moonwort	Special concern	No status
Botrychium campestre	Plant	prairie moonwort	Special concern	No status
Botrychium oneidense	Plant	blunt-lobed grapefern	Endangered	No status
Botrichium minganese	Plant	mingan moonwort	Special concern	No status
Torreyochloa pallida	Plant	Torrey's manna grass	Special concern	No status

[1] The bald eagle does not have a threatened and endangered status, but is protected under the Bald and Golden Eagle Protection Act of 1940.

4.3.1.2 Existing Conditions

The SEAW described the initial database searches that provided information available during scoping. The initial search of the MNDNR Natural Heritage Information System (NHIS) database was conducted to support the SEAW in March 2008. The search results from the NHIS database are valid for one year from the date of the search for use in the environmental review process. More than one year would have past from the time of the initial query of the NHIS database prior to the FEIS being available for public comment. As a result, an additional query of the NHIS database was conducted for the Proposed Project. The updated query was conducted in February 2009 and again in November 2010 to support the FEIS.

The updated NHIS database search returned no records of federally-listed threatened or endangered plant or animal species within the Proposed Project Impact Area. The updated NHIS database search from November 2010 identified ten populations of state-listed threatened and endangered plant species, and one state-listed threatened and endangered animal species within a one-mile radius of the Proposed Project. The database search provides a guideline for the presence of a species, but does not completely exclude the potential for a species to be present within the Proposed Project Impact Area. There were an additional ten populations of plant species of special concern identified in this search area and one species of special concern animal.

The general locations of the records from the NHIS database of listed plant and animal species near Keetac are displayed in Figure 4.3.1.

4.3.1.2.1 Plants

The NHIS database search from November 2010 identified ten populations of state-listed threatened and endangered plant species within a one mile radius of the Proposed Project: two populations of blunt-lobed grape fern, three of pale moonwort, two of tubercled rein-orchid, two of ternate or St. Lawrence grapefern, and one of triangle moonwort. In addition, populations of species listed as special concern were included in the database search results: seven populations of least moonwort, one population of mingan moonwort, one population of Torrey's manna grass, and one population of prairie moonwort.

The database listings were used, along with other information sources, in the preparation of a list of target species to be searched for during botanical field survey work performed in the Proposed Project areas in 2008. The survey methodology and results were described in the Botanical Survey. The survey was conducted between July and September 2008. A summary of state-listed species found during the Botanical Survey is found in Table 4.3.2. The locations of state-listed species are shown on Figure 4.3.2 and 4.3.3.

TABLE 4.3.2 STATE-LISTED SPECIES – 2008 BOTANICAL SURVEY

Species	***Botrychium pallidum***	***Botrychium rugulosum***	***Botrychium ascendens***	***Sparganium glomeratum***
Common Name	Pale moonwort	Ternate grapefern	Triangle moonwort	Clustered bur-reed
State Status	Endangered	Threatened	Proposed Endangered	Special Concern
Populations	3	2	7	4
Individuals	23	7	37	~600

Although pale moonwort is listed as state-endangered, the MNDNR proposes reclassifying it as a special concern species, noting in the *Draft Amendments to Minnesota's List of Endangered, Threatened, and Special Concern Species* that the distribution of the species has recently been well-documented in central and northeast Minnesota. The MNDNR notes that although there are very few plants at most documented sites, additional surveys are likely to find more locations of the species (MNDNR, 2007).

The MNDNR has also proposed reclassifying ternate grapefern as a special concern species, noting its recent, well documented distribution in coniferous and deciduous forests of central and northeast Minnesota (MNDNR, 2007).

Triangle moonwort is not listed as state threatened or endangered because it was only discovered recently in the state. The MNDNR proposes to list it as an endangered species, noting that it is disjunct from an existing western population and threatened by the loss of early successional habitat (MNDNR, 2007).

Species in the genus Botrychium share many of the same biology and life history characteristics. The differences between the species arise mainly in the microhabitats and disturbance regimes that each species prefers. A summary of the important characteristics in each species' life history are provided in Table 4.3.3. A detailed discussion of the distribution, preferred habitat, and life histories of the state-listed plant species is found in the Plant CE Study.

TABLE 4.3.3 BOTRYCHIUM SPECIES LIFE HISTORY CHARACTERISTICS

Scientific Name	***Botrychium pallidum***	***Botrychium rugulosum***	***Botrychium ascendens***
Common Name	Pale moonwort	Ternate grapefern	Trianglelobe moonwort
State Status	Endangered [1]	Threatened [1]	Proposed Endangered
Range	Northern Species	St. Lawrence Seaway	Western Species
Preferred Habitat	Early successional forest edges (aspen, poplar, paper birch)	Early successional forest edges (hardwood, mixed, pine); forest openings; low, moist habitats	Early successional forest edges (aspen, poplar, paper birch)
Disturbance Regime Preference	Continual disturbance along forest openings, roadways, and tailings basins	Continual disturbance along forest openings, roadways, and tailings basins	Continual disturbance along forest openings, roadways, tailings basins, and riparian areas
Limiting Factors	Mycorrhizal health Soil moisture Partial shade Spore source	Mycorrhizal health Soil moisture Partial shade Spore source	Mycorrhizal health Soil moisture Partial shade Spore source
Threats	Logging Altered forest habitat Altered hydrology Lakeshore homes Forest succession	Logging Altered forest habitat Altered hydrology Lakeshore homes Forest succession	Logging Altered forest habitat Altered hydrology Forest succession

[1] Proposed to be reclassified as special concern species.

4.3.1.2.2 Animals

Three records of state-listed animal species were returned from the updated NHIS database search in February 2009. These were a bald eagle's nest and two peregrine falcon nests. An updated NHIS query was completed in November 2010. The results of this query did not include records state or federally-listed animal species within the vicinity of the Proposed Project. However, the results of the NHIS database are used as a guideline for determining approximate locations and presence of species. The NHIS query results do not exclude the potential for occurrences of a given species in a certain area, especially if that species is known to migrate through the area.

A discussion of the distribution, preferred habitat, and life histories of the state-listed species from the NHIS search is found in the Wildlife CE Study. Information relating to the life history and habitat requirements of the Canada lynx was provided in the Lynx Study. A general description of the habitat and life histories of the state-listed species identified in the NHIS search and the Canada lynx and gray wolf is provided here based on information from the Wildlife CE Study, Lynx Study, and information available on the MNDNR Rare Species Guide website (www.dnr.state.mn.us/rsg/index.html), and USFWS website (www.fws.gov).

Bald Eagle

> A bald eagle pair currently occupies a nest in the tailings basin.

One record was of a bald eagle's nest on an island within O'Brien Lake, located approximately 2 miles west of the outer berm of the existing Keetac tailings basin. The bald eagle is listed as a species of special concern in Minnesota. In addition to the bald eagle's nest in O'Brien Lake, there is another known nest that has not been previously documented by NHIS surveyors. This active nest is located near the southeastern edge of the tailings basin. The bald eagle pair now occupies their second nest in the area. Their first nest was just outside the outer berm of the tailings basin but the snag fell in 2007, and the nest was destroyed. The pair returned to the area the following year and built a new second nest within the same area.

The bald eagle (*Haliaeetus leucocephalus*) is listed as a species of special concern in Minnesota. The bald eagle was removed from the federal endangered species list in 2007, due to population increases across the U.S. that are the result of a decrease in dichlorodiphenyltrichloroethane (DDT) in the environment. The bald eagle is still protected today by the Bald and Golden Eagle Protection Act of 1940.

Bald eagles typically nest in large trees near bodies of water or large rivers, including the Mississippi and St. Croix Rivers, mainly in the northern forested portion of the state. During pre-settlement times, bald eagles nested across Minnesota, including the southern portions of the state along prairie streams and marshes. Recent population increases of the bald eagle throughout the Midwest have seen the bald eagle extend into portions of its pre-settlement range. Current estimates indicate that Minnesota has the third most bald eagle nests in the United States, behind only Alaska and Florida. Bald eagle pairs are monogamous and may mate for life. Nest sites are built in large, sturdy trees often in open cover that provides a view of the area. Nest sites are often reused in subsequent years. The bald eagle diet consists mainly of fish, especially for individuals that live along large water bodies, but bald eagles also use carrion (http://www.baldeagleinfo.com/eagle/eagle3.html). The historical threat to bald eagles was the chemical pesticide DDT. While DDT is no longer in widespread use and does not pose the same threat to bald eagles, the main threat to bald eagles is still human activity from habitat loss (cutting of large, mature nest trees) and chemicals (such as heavy metals) released into the environment.

Peregrine Falcon

The 2010 NHIS database search included two peregrine falcon nests located approximately 3.5 miles northeast of the existing mine and 2.5 miles from the Proposed Project. The peregrine falcon (*Falco peregrinus*) is listed as threatened in Minnesota. Like the bald eagle, the decline of the peregrine falcon was largely due to the presence of DDT in the environment. Following the decrease of DDT use across the U.S., the populations of peregrine falcons have increased. In 1996, the peregrine falcon was upgraded from endangered to threatened on Minnesota's endangered species list and in 1999 it was removed from the federal endangered species list. According to the MNDNR, the peregrine falcon currently can be found in 21 counties in Minnesota.

The artificial cliffs created by large open mine pits have also created some habitat for nesting peregrine falcons as these areas mimic natural cliffs.

Historically, peregrine falcons nested along cliff edges near lakes or rivers in Minnesota. The peregrine falcon continues to use these habitats, but now can also be found nesting on buildings or bridges. It is estimated that approximately 70 percent of breeding peregrine falcons inhabit urban or semi-urban areas across the U.S. (Tordoff et al., 2005). The artificial cliffs created by large open mine pits have also created some habitat for nesting peregrine falcons as these areas mimic natural cliffs. The diet of the peregrine falcon mainly consists of birds, which it captures in the air. However, it may also consume lizards, fish, or small mammals. Because the peregrine falcon specializes in aerial predation of birds, it prefers open habitat areas for hunting.

Canada Lynx

The Canada lynx (*Lynx canadensis*) was added to the federal endangered species list in 2000 as threatened for several states in the Northeast and Great Lakes Region, including Minnesota. Currently, the lynx is offered no special status under the Minnesota Endangered Species Statute. Critical habitat has been designated by the USFWS on two occasions for areas in Minnesota. The first was in 2006 when a 317 square mile area located in Voyageurs National Park was designated critical habitat and the second was in 2009 when an additional 8,226 square mile area in portions of Cook, Koochiching, Lake and St. Louis Counties was designated critical habitat. The nearest critical habitat is about 23 miles east of the Proposed Project.

The FSDD stated that the Project Proposer would conduct field studies to determine the presence of Canada lynx (*Lynx canadensis*) in the Proposed Project area. Field studies were completed during the winter of 2009 for lynx in the Proposed Project area. The findings of the field studies were provided in the Lynx Study. The findings of the Lynx Study in the Proposed Project area and the potential for project related impacts are provided in Section 4.3.2.

Populations of lynx in North America are associated with boreal forests, with the southern extent of the boreal forests extending into northern portions of the U.S. In addition to the habitat provided by the boreal forests, lynx populations also require the proper snow conditions. This is due to the lynx' strong association with their preferred prey, the snowshoe hare, and the specialized traits lynx have developed for hunting it. Lynx and snowshoe hare exhibit the classic predator prey relationship, with the population of one species having a direct impact on the prevalence of the other species. Lynx are predators that specialize in hunting the snowshoe hare in deep snow conditions. Its wide paws with thick cushions of hair on the soles of its feet act as snowshoes allowing lynx a distinct competitive advantage over other carnivores.

The habitat requirements of lynx coincide with the habitat requirements of the snowshoe hare, which includes spruce forests with dense understories. Understory habitat is typically denser in new growth forests as compared to mature forest areas. The dense understory provides forage and cover from predators for the snowshoe hare but also provides denning habitat for lynx. It typically has large home ranges of over 40 square miles in size. The size of the home range is generally larger in the southern extent of the lynx range due to patchy forest habitat, low densities of snowshoe hare, and lighter snow conditions, allowing predators such as coyotes to compete with lynx. It is highly mobile and known to exhibit migratory behavior for various reasons including hunting, dispersal and searching for mates. Lynx can make long distance movements greater than 60 miles and have the ability to cross non-forested habitats in search of suitable forested habitat conditions and/or snowshoe hare populations.

Gray Wolf

The Proposed Project is located between 30 and 40 miles south/southwest of the designated critical habitat areas for the gray wolf.

The gray wolf (*Canus lupis*) is listed as a species of special concern in Minnesota and is federally-listed as threatened. Prior to human settlement the gray wolf (also called the timber wolf) was common across Minnesota and throughout North America to approximately 20^{o} latitude (the approximate southerly latitude of Mexico City). Gray wolves are habitat generalists and can thrive in any type of habitat in North America including forests, prairies, swamps, mountains, deserts and barren lands.

The gray wolf was federally-listed as an endangered species in 1974. However, the status of the gray wolf has changed multiple times over the last three years based on the identification of distinct populations in different regions of the United States; health of those populations; and a lawsuit filed against the USFWS for removal of identified populations of the gray wolf from the federal endangered species list. The Western Great Lakes Population of gray wolves was removed from the federal endangered species list in February 2007 and then added back to the list in September 2008 based on a U.S. District Court ruling. In April 2009, the Western Great Lakes Population of gray wolves was again removed from the federal list but a ruling on July 1, 2009, withdrew the delisting to allow for adequate public comment on the USFWS plan to delist the gray wolf. As a result, the Western Great Lakes Population of gray wolves is currently listed as a federally threatened species.

Within Minnesota, there have been three areas designated as critical habitat: a 4,488 square mile area in Cook, Lake and St. Louis Counties, a 1,856 square mile area in Lake and St. Louis Counties, and a 3,501 square mile area in Koochiching, Beltrami and Lake of the Woods Counties. The Proposed Project is located between 30 and 40 miles south/southwest of the designated critical habitat areas for the gray wolf.

The FSDD stated that the EIS would assess potential effects from the Proposed Project on the gray wolf due to the species being relisted as a federally-listed threatened species. The status of the gray wolf has changed multiple times over the last three years based on the identification of distinct populations in different regions of the United States; health of those populations; and a lawsuit filed against the USFWS for removal of identified populations of the gray wolf from the federal endangered species list. The USFWS identified a distinct population segment of the gray wolf termed the Western Great Lakes Population, which includes all of Minnesota, Wisconsin and Michigan and portions of Iowa, North Dakota, South Dakota, Illinois, and Ohio. The Western Great Lakes Population of gray wolves was removed from the federal endangered species list in February 2007 and then added back to the list in September 2008 based on a U.S. District Court ruling.

In April 2009, the Western Great Lakes Population of gray wolves was again removed from the federal list, but a ruling on July 1, 2009, withdrew the delisting to allow for adequate public comment on the USFWS plan to delist the gray wolf. As a result, the Western Great Lakes Population of gray wolves is listed as a federally threatened species. The potential project related impacts to the gray wolf are provided in Section 4.3.2.

Gray wolves are fairly large mammals, ranging from 50 – 85 lbs for females and 70 – 110 lbs for males and are much larger than coyotes which average 25 – 35 lbs in size. Gray wolves reside in packs that typically average four to eight wolves in Minnesota. The territory size of wolves is highly variable, ranging from 25 to 150 square miles in Minnesota, but known to be in the range of 300 to 1,000 square miles in other areas. Territories of neighboring wolf packs rarely overlap. The prey of wolves typically includes large, hoofed mammals, such as white-tailed deer and moose. When populations of deer or other large mammals are sparse, wolves also prey on medium sized mammals such as beaver and snowshoe hare. Wolves have no natural predators but causes of wolf mortality include wounds sustained from hunting prey, competition with other wolf packs, and human-related mortality including vehicle collisions, authorized management killings, and poaching. The greatest long-term threat to the gray wolf is habitat loss.

Piping Plover

The piping plover (*Charadrius melodus*) is a federally-listed threatened species by the USFWS. However, the Great Lakes Population of the piping plover is listed as endangered by USFWS. In Minnesota, the species is listed as endangered by the MNDNR.

The piping plover is a small, sand colored shorebird, approximately 16 to 18 cm (6 to 7 inches) in height. The NHIS database query did not identify known occurrences of the piping plover within or adjacent to the Proposed Project Impact Area. The Proposed Project is located on the boarder of Itasca and St. Louis Counties. The FWS and MNDNR list St. Louis County as potentially having habitat required by the piping plover, and therefore a description of the species is included in this FEIS.

There are three distinct populations of the piping plover within the United States, identified as the Atlantic Coast, the Great Lakes, and the northern Great Plains populations. Both the Great Lakes and northern Great Plains populations of piping plover have occurred historically within Minnesota. However, only the Great Lakes Population is near the Proposed Project. Piping plovers are known to nest in Minnesota, and spend time from mid-April to early September on the breeding grounds, depending on annual migration conditions. The preferred nesting habitat of the piping plover includes sandy, shoreland areas intermixed with gravel or pebble substrates with scattered tufts of grasses or no vegetation. The diet of the piping plover mainly consists of insects, both terrestrial and aquatic. The past and current factors that have lead to the species decline include the loss of sandy shoreline habitat through development; predation; fluctuating water levels; and competition with gulls for nesting areas.

The most recent known occurrences of the piping plover near the Proposed Project were within the Duluth Harbor area on Lake Superior. This population has been extirpated from the area. Although there have been small numbers of piping plover sporadically observed near the Duluth Harbor, there have been no successful nesting attempts in this area for over 25 years. The only known population of piping plover that still exists within Minnesota is a small breeding population on Pine and Curry Islands in Lake of the Woods County. This population is very small with only zero to two breeding pairs per season.

4.3.1.3 No Action Alternative

4.3.1.3.1 Plants

There are no known occurrences of state or federally-listed threatened, endangered or special concern species in the No Action Alternative boundary. No takings permits have been issued for the No Action Alternative. Direct impacts to state or federal threatened, endangered or special concern species are not anticipated.

4.3.1.3.2 Animal

A pair of bald eagles has a nest located near the southeastern edge of the tailings basin. This is the only known occurrences of state or federally-listed threatened, endangered or special concern species in the No Action Alternative boundary. Direct impacts to state or federally-listed threatened, endangered or special concern species are not anticipated.

4.3.2 Environmental Consequences

Potential effects on threatened and endangered plant and animal species were evaluated for the Proposed Project as described in Sections 4.3.2.1 and 4.3.2.2. Additionally, potential effects were also evaluated for the East Stockpile Alternative as described in Section 4.3.2.3. A draft Biological Assessment of the potential project effects on federally-listed threatened and endangered species has been prepared by USACE and can be found in Appendix O.

4.3.2.1 Plants

The Proposed Project would cause the loss of state-listed threatened/endangered species in three locations. The Proposed Project effects on state threatened, endangered, and proposed endangered plant species are expected to be adverse and significant as individual plants would be destroyed. The designation as threatened or endangered connotes that the populations of the plants are low, and further effects may harm the survival of the species in the state. Mitigation options are identified and can be considered at the issuance of the Takings Permit. The potential effects are summarized in Table 4.3.4, and the locations of the affected populations are shown on Figure 4.3.1.

TABLE 4.3.4 STATE-LISTED SPECIES-POTENTIAL IMPACTS

Species	***Botrychium pallidum***	***Botrychium ascendens***	***Sparganium glomeratum***	***Botrychium rugulosum***
Common Name	Pale moonwort	Trianglelobe moonwort	Clustered burweed	Ternate grapefern
State Status	Endangered	Proposed Endangered	Special Concern	Threatened
# of potentially disturbed locations	1	2	0[1]	2
# of potentially disturbed individuals	1	22	0[1]	7

[1] Alterations to hydrology of adjacent areas may have indirect impacts on some populations.

The individual *B. pallidum* that would be lost by the Proposed Project is located in the proposed east mine pit expansion area in a large disturbed area vegetated with young aspen and poplar. This is an adverse effect that would be significant due to its state endangered species status. A MNDNR Takings Permit would be required if destruction of this plant species cannot be avoided.

The Proposed Project would cause the loss of state-listed threatened/endangered plant species in three locations.

The 22 individuals of the proposed endangered *B. ascendens* are located in the proposed east mine pit expansion area. One population is located in a young aspen and poplar stand in sandy soils with thin, patchy leaf litter. The other population is found in a large disturbed area vegetated with young aspen and poplar. This is an adverse effect that would be significant due to its state proposed endangered species status. A MNDNR Takings Permit would be required if destruction of this plant species cannot be avoided.

The two locations of *B. rugulosum* are located in the existing southeast stockpile area. Many species of *Botrychium* can persist underground for several years without being visible above ground. For the purpose of assessing potential impacts for this FEIS, it is assumed that the individuals identified in the Botanical Survey are still present at this location. Based on this assumed impact, the Proposed Project would take a total of approximately 30 threatened and endangered plants. This is an adverse effect that would be significant due to its state threatened species status. A MNDNR Takings Permit would be required if destruction of this plant species cannot be avoided.

The Proposed Project would not remove any individuals of *Sparganium glomeratum* found on the site. However, assessment of monitored wetland impacts indicates that adjacent mining activities would potentially alter the hydrology of the wetland margins where these populations are found adjacent to the proposed east mine pit expansion area. The Proposed Project effects on *Sparganium glomeratum* are potentially adverse as there may be an indirect effect to populations of this plant due to changes in hydrology that may alter nearby wetlands where the plant has been known to grow. The significance of the potential indirect effect is unknown.

Additional sites with listed species were found in the area between the proposed east stockpile and proposed east mine pit expansion areas. Although these additional sites would not be directly impacted by the Proposed Project, indirect impacts could potentially occur. Upon final design, the actual number of listed species locations to be removed would be determined prior to an application for a Takings Permit.

4.3.2.2 Animals

4.3.2.2.1 Bald Eagle

There is one known occurrence of an active bald eagle nest within the Proposed Project area. The nest is located in a tree within the tailings basin and is actually the second nest constructed in the area by this pair of bald eagles. Their first nest was just outside the outer berm of the tailings basin, but the snag fell in 2007 and the nest was destroyed. The fact that the pair returned to the same area the following year to construct a new nest indicates that they are accustomed to a certain amount of mining and human activity in the area.

The Proposed Project would not encroach on the nest site in a manner that would alter or impact the individuals occupying the nests. The Proposed Project would add new tailings to the basin, but would not be disturbing the perimeter berm in the vicinity of the nest. As a result, no impacts from the on the bald eagle nest would be expected as a result of the Proposed Project.

4.3.2.2.2 Peregrine Falcon

The 2009 NHIS database search included two peregrine falcon nests located approximately 3.5 miles northeast of the existing mine and 2.5 miles from the Proposed Project. All other known occurrences of state or federal threatened, endangered or special concern species are located outside of the Proposed Project impact area. Direct impacts to state or federal threatened, endangered or special concern species as a result of the Proposed Project are not anticipated. The existing peregrine falcon nest located to the west of the Proposed Project would not be directly impacted. This nest site is currently adjacent to existing operational taconite mines as well as other human altered areas such as the City of Keewatin and TH 169. It is therefore reasonable to assume that individuals utilizing this nest site is accustomed to a certain amount of human activity and disturbance. The Proposed Project would not encroach on the nest site in a manner that would alter or impact the individuals occupying the nests.

4.3.2.2.3 Canada Lynx

> Impacts to lynx or lynx populations are not anticipated as a result of the Proposed Project.

During 2009, the Project Proposer conducted field studies to determine the presence of Canada lynx in the Proposed Project area. The study area was defined as a six mile buffer around Keetac. A total of 185 miles of transects were surveyed and an additional 19 miles of transects adjacent to the study area were also surveyed. There were no lynx sightings, and there were no lynx signs observed in the study area during the 2009 survey. The findings of the field studies were provided in the 2009 Keetac Iron Ore Expansion Project Canada Lynx Assessment Report.

The area near the Proposed Project was also surveyed in 2007 as part of a survey for the Essar Steel mining project. The 2007 survey also produced no lynx sightings or lynx signs in the study area. The 2009 survey determined that there is some lynx habitat available in the study area but that it occurs in small patches that are not likely suitable to support a lynx. The

2009 survey determined that lynx do not reside in the study area but that it is possible that lynx occasionally travel through the area.

Rail traffic is not expected to increase during the Proposed Project (only the length of individual trains). Thus, there is no concern for increased lynx fatalities from train traffic. There will be an increase in truck traffic, which will occur on the three new haul roads between the mine pit and the new/expanded stockpile areas. Because there has been no evidence of the presence of a lynx in the Project Area in recent times, it seems unlikely that increased truck traffic as a result of the Proposed Project would result in disturbance to lynx or a lynx fatality.

Based on the conclusion that the lynx do not reside in the Proposed Project site, the patchy nature of suitable lynx habitat in the study area, the prevalence of similar habitat in adjacent areas, the mobility of lynx, and their large home ranges; impacts to lynx or lynx populations would not be anticipated as a result of the Proposed Project.

4.3.2.2.4 Gray Wolf

The Western Great Lakes Population of gray wolves, which includes all of Minnesota, has been steadily increasing and has exceeded management goals (USFWS, April 2009 – Federal Register, vol. 74, no. 62). The Proposed Project site provides some habitat for wolves, including areas that have not been mined, revegetated stockpiles, and fringe areas of the tailings basin.

Based on information provided in the Wildlife Cumulative Effects Study, gray wolves were observed on the Keetac site in 2000. Calling surveys located wolves south of the Keetac site in 2004. Wolves have also been observed at other mine sites on the Iron Range. Based on this information, gray wolves near the Proposed Project and along the Iron Range are tolerating a certain amount of human disturbance and mining activity within their established territories. Since wolves are habitat generalists with large home ranges, the mining has little impact to available wolf habitat and populations.

The Proposed Project would be located outside of the area designated as critical habitat for the gray wolf in Minnesota. The expansion of the overall mine footprint is relatively small compared to the typical home range of wolf packs in Minnesota, which can reach 150 square miles. The home range of a wolf pack that potentially includes the Proposed Project site would not be significantly altered through the expansion of mining activities resulting from the Proposed Project.

The Proposed Project would lead to an increase in human disturbance to wolves in the Project Area. The effect of increased disturbance would be minor because any wolves in the area are likely accustomed to such disturbance and the increase in human activity would be relatively minor within the setting of an existing active mine. The construction and use of new haul roads and the resulting truck traffic as described above would lead to a potential increase in risk for wolf-truck collisions. However, the new haul roads would be located close to active areas of the mine and do not cross major wildlife corridors. Furthermore, two experienced U.S. Steel employees working at the Keetac site for 20 years reported no know wolf collisions at the site during their time. While the potential for collisions would increase with the Proposed Project, it seems unlikely that a wolf would be killed by a truck because of their infrequent occurrence on the site, the continued disturbance on the site and lack of collisions on site in the past. It is likely that the Proposed Project would have a minor effect on wolves through increased disturbance that would result in wolves avoiding the Project Area. This effect is expected to be minor because the Project Area is an existing mine that is experiencing a level of disturbance (Appendix O – Draft Biological Assessment).

4.3.2.2.5 Piping Plover

Critical habitat has been designated for this species near Duluth. The species can be seen in Duluth Harbor on occasion, but no successful nesting has been known to occur there in the last 25 years (MDNR, http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ABNNB03070#). There are no known occurrences of the species in the Project Area, though it is possible that it could be present at times, likely during migration.

Because of the rarity of the species in Minnesota and the lack of any records of its existence in the Project Area, it is unlikely that it will be present on the project site. Furthermore, if a piping plover does pass through the site, it is unlikely that the Proposed Project would have an effect on the individual because habitats directly affected by the proposed project are not suitable for this species.

4.3.2.3 East Stockpile Alternative

The East Stockpile Alternative would not change the Proposed Project's potential effects on threatened and endangered species. However, the footprint of the proposed east stockpile would be reduced under the East Stockpile Alternative. This would not reduce the effects to known location of threatened and endangered plant species, but it would reduce suitable habitat where threatened and endangered species could be found or become established. The potential environmental effects on threatened and endangered species and species of concern from the East Stockpile Alternative are the same as the potential effects identified for the Proposed Project.

4.3.3 Mitigation

No specific habitat or species monitoring is recommended since the potential impacts are understood.

4.3.3.1 Plants

If there are no feasible alternatives to taking the state-listed *Botrychium* species, the Project Proposer would be required to provide compensatory mitigation to reduce the impact of the loss of the populations.

Mitigating for takings of *Botrychium* through transplantation is possible, but transplanting rare plants is often unsuccessful. The MNDNR policy is to consider transplantation after efforts to avoid takings have been exhausted. There have been two efforts to transplant impacted species of *Botrychium* in recent years. The preliminary results at the recent transplantation sites are positive, although there is no long term data demonstrating with certainty that either transplantation was successful.

Other options for mitigation may include land acquisition and preservation of additional existing populations, or funding research of conservation efforts to benefit the impacted species. The final details of the compensatory mitigation for the taking of threatened and endangered plant species would be defined in the Takings Permit application submitted to the MNDNR.

4.3.3.2 Animals

Specific mitigation for project-related impacts to threatened, endangered or special concern species of animals is not proposed. The Project Proposer should notify the MNDNR, USACE, and the USFWS in the event that threatened, endangered or special concern species of animals are encountered on, or adjacent to, the Proposed Project.

4.4 WATER QUALITY

4.4.1 Wastewater

> The compound of greatest concern in regard to down stream impacts is sulfate. Sulfate is of primary concern because it may adversely impact the growth of wild rice and may promote mercury methylation in some environments.

The Proposed Project has the potential to alter the quantity and quality of wastewater that is discharged into the surrounding environment and may affect several lakes and streams. The FSDD indicated that a project water balance and watershed yield would be conducted to quantify the potential effects of the Proposed Project on streams and lakes in its vicinity and that the EIS would discuss impaired waters that may be affected by the Proposed Project. In particular, the FSDD stated that the EIS shall address phosphorous and how the phosphorous levels, among other parameters, would be affected by the Proposed Project. As is discussed within this section, however, sulfate and mercury levels have emerged during the EIS process as a significant concern with regard to surface water. The FSDD also indicated that the EIS would discuss potential water quality changes due to potential changes in the use of chemicals in facility water treatment.

Studies prepared to address the topics presented in the FSDD regarding wastewater and water quality effects from the Proposed Project include the following.

- Water Balance/Mine Yield Study
- No Action Alternative Memo
- Turbidity Treatment Study
- Water Quantity and Quality Report
- Mercury TMDL Memo
- Hay Lake Sulfate Report
- Water Quality Sampling Plan

The water quality parameters of concern addressed in the Water Quality Sampling Plan (Liesch, 2008) were:

- Sulfate
- Phosphorus
- Nitrogen
- Chloride
- Mercury
- Trace metals
- Hardness
- Conductivity
- TSS

At the completion of the EIS related studies listed above, the MPCA and MNDNR reviewed water quality parameters to determine if any facility changes would result in changes to discharge concentrations. In addition to the EIS related studies, the agencies utilized years of past monitoring data and the analysis completed for the Minnesota Steel EIS (2007) to assist in their evaluation.

Keetac is an operating facility that has been permitted to discharge to receiving water bodies including Hay Creek, Welcome Creek, and O'Brien Creek in the Upper Mississippi River Basin for more than 20 years. The last NPDES/SDS permit issuance was on June 15, 2006. Hay Creek, Welcome Creek, and O'Brien Creek ultimately flow into Swan Lake. One other mining operation, Essar Steel, also would have water discharge to Swan Lake once their facility is constructed, estimated to be completed in 2012. The MPCA has received years of monitoring data from Keetac as part of their NPDES/SDS permit (Permit No. – MN0031879). They have continually adjusted limits for the facility based on water quality standards applicable for the receiving water bodies and would continue to do so as water quality standards are adopted or modified.

The agencies reviewed the maximum water discharge concentrations monitored during 2008 when the Keetac facility was producing taconite at near capacity. Monitoring data from 2008 shows the only water quality parameter exceeding the state standard was sulfate. Conductivity was the next closest to exceeding a water quality standard (Water Balance/Mine Yield Report).

The Water Balance/Mine Yield Study states:

> *The levels of other typical parameters of concern such as phosphorous, nitrogen, mercury, chloride, or trace metals are currently very low in the discharges from Keetac and are expected to remain in the same concentration ranges* [under the Proposed Project] *as are currently being discharged. This includes the water quality from mine dewatering, Welcome Creek, and Reservoir 6 monitoring points. This is primarily due to the fact that the expansion will continue to process taconite in the same manner as currently.*

The agencies' review of water quality parameters, past monitoring data, other EISs, and the Proposed Project resulted in the determination that water quality parameters, other than sulfate, hardness, and conductivity, would remain relatively unchanged. It was further determined that there would be no potential to exceed water quality standards in downstream receiving waters from other water quality parameters. The Water Quantity and Quality Report confirms this decision.

The Water Quantity and Quality Report states:

> *Historical discharge water quality monitoring indicates that levels of typical parameters of concern such as phosphorous, nitrogen, mercury, chloride, or trace metals are currently very low in the discharges from Keetac and are expected to remain in the same concentration ranges as are currently being discharged. The concentration of these and all compounds in the discharge waters are anticipated to be below applicable water quality standards for the receiving waters now and for the duration of the Keetac Expansion Project. However, under current operating conditions sulfate, hardness, and conductivity levels would increase to a new equilibrium due to the installation of a scrubber and lime precipitation wastewater treatment system in 2006.*

The Proposed Project has potential to release mercury into the environment through air emissions and water discharges. The MPCA has negotiated a Mercury Air Emissions Reductions Schedule of Compliance with the Project Proposer to adhere to the Implementation Plan for Minnesota's Statewide Mercury Total Maximum Daily Load (Mercury TMDL Implementation Plan), discussed further in Section 4.9.7. Minnesota is one of only a few states that have an aggressive statewide plan to reduce mercury emissions. The Mercury TMDL Implementation Plan calls for a 75 percent reduction in mercury emissions by 2025 for the Ferrous Mining and Processing Industry. The schedule utilizes Appendix 6 in the Mercury TMDL Implementation Plan which outlines guidelines for permitting new and modified air emissions sources. The schedule details the procedures to be followed by the Project Proposer to meet the 2025 reduction goal for the existing Keetac line, new line, and the Project Proposer's other Minnesota taconite facility, Minntac.

Mercury water discharges from the Proposed Project, which are covered under the existing NPDES/SDS permit, would continue to discharge to the Upper Mississippi River Basin. The Upper Mississippi River Basin has a mercury water quality standard of 6.9 ng/L. Based on previous monitoring required by the NPDES/SDS permit and additional monitoring associated with the EIS, mercury levels would continue to stay below that standard. Past monitoring data shows the highest mercury level detected at 2.8 ng/L with an average concentration of 1.4 ng/L (Water Balance/Mine Yield Report). Mercury in water discharges would be monitored as part of the NPDES/SDS permit.

It is understood that water bodies in the vicinity of the Proposed Project are impaired for mercury in fish tissue (Figure 4.9.7.1). Minnesota's Mercury TMDL Implementation Plan attempts to reduce these fish tissue levels. Mercury levels in fish tissue in downstream water bodies are accounted for in the issuance of the NPDES/SDS permit. As downstream water bodies are already impaired for mercury the standard established for mercury in water discharges is reflected in the NPDES/SDS permit for the facility. The NPDES/SDS permit from the facility would comply with the Mercury TMDL Implementation Plan. The relationship between sulfate and methylmercury in water and fish is discussed in the Ecological Risk Assessment of the EIS, which is Section 5.13.2. Section 4.9.7 discusses mercury air emissions and control technologies. Table 4.9.22 of the EIS also provides a summary of the proposed change in mercury in fish tissue.

Based on these analyses, the compound of greatest concern in regard to down stream impacts from water discharges is sulfate. Sulfate is of primary concern because it may adversely impact the growth of wild rice and may promote mercury methylation in some environments. Sulfate can also potentially lead to the release of phosphate (PO_4) in some environmental settings, but there are no indications this is the case based on past monitored phosphorus levels. Sections 4.7 and 5.4 include detailed discussions of the wild rice presence and the potential for impacts on wild rice stands that receive discharges from the Proposed Project. Hardness and conductivity are two additional parameters of concern discussed in this section. However, they are secondary to sulfate in potential environmental effects.

4.4.1.1 Affected Environment

Most of the effluent water from the Keetac facility is either associated with the tailings slurry that enters the tailings basin or mine pit dewatering. Treated process wastewater and stormwater runoff comprise the remaining portion of effluent water. All of these discharges ultimately flow into Hay Creek which flows through Hay Lake and into Swan Lake.

4.4.1.1.1 Regulatory Framework

To discharge effluent to the surface waters, a permit must be acquired. In Minnesota there are two water quality discharge permits. The first is the National Pollutant Discharge Elimination System (NPDES), and the second is the State Disposal System (SDS). The NPDES is a federal regulation system that was established under the CWA. The SDS was established under Minnesota Statute Section 115. Taconite mining facilities require both permits. When both permits are required, they are issued together as an NPDES/SDS permit by the MPCA. This type of permit regulates water treatment and disposal systems that dispose water as surface-water and/or groundwater discharge and may limit constituent concentrations and various characteristics of the water that is discharged. The Project Proposer possesses NPDES/SDS Permit No. MN0055948, and NPDES/SDS Permit No. MN0031879 for the Keetac facility.

The requirements of 40 CFR Part 440, subp. A apply to discharges from iron mining facilities. The standards represent the degree of effluent removal using best practicable control technologies (BPT) and Best Available Technology Economically Achievable (BAT). These requirements are incorporated into the NPDES permit monitoring and are shown on Table 4.4.1.

TABLE 4.4.1 NPDES MONITORING

Parameter	1-day maximum	30-day Average
Dissolved Fe	2 mg/L	1 mg/L
TSS	30 mg/L	20 mg/L
pH	Range 6.0 to 9.0	Range 6.0 to 9.0

The following is used by the MPCA to evaluate waters that contain wild rice.

> *The goal of the MPCA is to protect those surface waters used for the production of wild rice. The quality of these waters shall permit their use for irrigation without significant damage or adverse effects upon any vegetation usually grown in the waters. The current state water rule establishes pollutant standards to be used as a guide for determining the suitability of waters for such uses, including the production of wild rice. When evaluating any facility or project with potential wild rice impacts, the MPCA will consider all available information to determine which surface waters are used for the production of wild rice. If any surface water is determined to be a wild rice water, the MPCA will evaluate whether there is a reasonable potential for the discharge(s) to cause or contribute to a violation of the applicable water quality standard. If a reasonable potential exists, then the MPCA will establish an appropriate water quality based effluent limit in the facility permit to protect the applicable water quality standard and the designated uses of the water as a wild rice production water*.

In addition, Minnesota Rules, part 7050.0224 states,

> *The quality of these waters and the aquatic habitat necessary to support the propagation and maintenance of wild rice plant species must not be materially impaired or degraded. If the standards in this part are exceeded in waters of the state that have the Class 4 designation, it is considered indicative of a polluted condition which is actually or potentially deleterious, harmful, detrimental, or injurious with respect to the designated uses.*

Minnesota Rules, part 7050.0470, subp. 1 identifies water bodies as selected wild rice waters.

4.4.1.1.2 Sanitary Wastewater

The first source of sanitary wastewater produced at the facility is the main processing plant. The Project Proposer operates an activated sludge wastewater treatment plant (WWTP) for the treatment of sanitary wastewater produced at the main processing plant. The WWTP consists of a bar screen, comminutor, diffused aeration tank, sludge holding tank and chlorination contact tank. The WWTP's chlorinated effluent is discharged to Reservoir Five. The WWTP is designed to treat an average flow of 40,000 gallons per day (gpd). Biosolids from the WWTP are periodically transferred to the city of Keewatin's publicly owned treatment works (POTW).

The other source of sanitary wastewater production is the coarse crusher facility. A septic tank and drain field system is used to treat less than 10,000 gpd of sanitary wastewater generated at the coarse crusher's employee shower and change house facility. Thus, this discharge does not enter the wastewater stream of the main facility.

4.4.1.1.3 Process Wastewater and Water Treatment

The major source of process wastewater at the Keetac facility is the tailings slurry. Wastewater flow to the tailings basin consists of tailings slurry associated with ore beneficiation processing in the concentrator and treated blow down water (the water carrying the particulates) from the wet scrubber. The estimated average wastewater flow rate to the tailings basin is 20 million gallons per day (MGD).

The major source of process wastewater at the Keetac facility is the tailings slurry. The estimated average wastewater flow rate to the tailings basin is 20 million gallons per day (MGD).

A recirculating wet scrubber facilitates the treatment of waste gas from the existing indurating line. The wet scrubber system uses hydrated lime ($Ca(OH)_2$) for pH control and a polymer as a clarification and coagulation aid. The scrubber water is sprayed into the waste gas to remove sulfur dioxide (SO_2). Excess SO_2 dissolves as H_2SO_3, which oxidizes to H_2SO_4 in the wastewater treatment system. The lime is then added to precipitate out the SO_4 as $CaSO_4$. Sulfate removal is effective for the wet scrubber stream when calcium concentrations are in excess allowing sulfate to precipitate out. The high levels of calcium (from lime additive) present in the wastewater stream have led to elevated hardness and conductivity. Blow down from the wet scrubber is discharged to the tailings basin. Solids produced in the wet scrubber are dewatered by filter presses and disposed in a permitted off-site facility. Treated water and filtrate from the filter presses is discharged to the tailings basin (see Section 4.4.1.2.1 for additional wastewater treatment under Proposed Project).

Floor drain overflow from the pellet plant and concentrator is discharged to the Bennett Pit. This discharge may also include emergency overflow process wastewater from the concentrator during a power failure. All steam cleaning and floor drain wastewater from the truck shops and plant/machine/welding shops are treated by an oil/water separator and sedimentation tank that overflows to the Bennett Pit. Sludge from shop areas is disposed of off-site in permitted facilities as required by law. Oils collected in the oil/water separator are reclaimed for refining and reuse by a permitted off-site waste handler.

Process wastewater is also produced and collected in the bottom of two coarse crushers located in the Section 18 Pit. Crusher #1 and Crusher #2 process wastewater is pumped to Sump #1 and then to Reservoir Five. The maximum anticipated daily pumping rate from Sump #1 is 2.6 MGD, although typical pumping rates are approximately 200,000 gallons per day.

Additional sources of process wastewater are mine pit dewatering from the Bennett Pit, Russell Pit, Stevenson Pit, and the proposed Carmi Pit. Process wastewater from current mine pit dewatering operations is discharged to Reservoir Five at an average rate of 4 MGD. Other mine pit dewatering operations occur at the Sargent Pit and Mesabi Chief Pit. Process wastewater from these mine pit dewatering operations is discharged through the Mesabi Chief Outfall at an average rate of 5.85 MGD. The Project Proposer is permitted to dewater the Perry Pit at a rate of 0.90 MGD into O'Brien Creek at a separate discharge point (Liesch, 2009A). The Perry Pit is part of the No Action Alternative.

Water treatment also occurs at various stages in Keetac’s process. Make-up water for the recirculating non-contact cooling water system is softened and treated with a potassium hydroxide solution at a rate of 30 gpy. Additional chemicals, such as corrosion inhibitors or corrosion inhibitors/descalers, and microbiocides are also added.

Dewatering and wastewater flows are treated for sediment from mine sumps, the tailings basin, and the facility sedimentation basin system. Additionally, Keetac operates a water treatment plant, which is regulated under the Safe Drinking Water Act by the Minnesota Department of Health, to treat well water with potassium hydroxide and potassium permanganate for potable and sanitary uses. The water treatment plant backwash wastewater from the sand filters is periodically discharged through existing Outfall SD001 to Welcome Lake at a rate of less than 10,000 gpd. Filter backwash solids are land applied on a site within the inactive Bennett tailings basin.

4.4.1.1.4 No Action Alternative

This section addresses the impacts to water quality under the No Action Alternative as a result of wastewater, process water discharge, mine pit dewatering, and water treatment. The potential sulfate concentrations presented in Sections 4.4.1.1.4 and 4.4.1.2 represent effects without additional controls or project modifications that would be required to meet the 10 mg/L sulfate standard.

Mercury, hardness, and conductivity are not expected to change significantly under either the No Action or Proposed Project and currently meet water quality standards. Current mercury concentrations in the outfalls range from non-detect to 2.8 ug/L and are monitored under the NPDES permit. The maximum expected hardness in the discharges is 362 mg/L, with a standard of 500 mg/L. Specific conductance is estimated to be a maximum of 863 umhos in Reservoir 6. The Minnesota un-listed water quality standard is 1000 umhos. (Water Balance/Mine Yield Report).

As discussed above, the primary chemical of concern is sulfate. Table 4.4.2 compares the concentration of sulfate that would accumulate in Swan Lake and Hay Lake if the mine continued to operate under the No Action Alternative versus the sulfate concentrations present under current conditions.

TABLE 4.4.2 PREDICTED SULFATE IMPACTS TO SWAN LAKE AND HAY LAKE

	Sulfate Load (TPY)	Hay Lake Sulfate Concentration Range (mg/L) [1]	Predicted Swan Lake Concentration Range (mg/L) [1]
Current 2009	1039	46.8 - 58.2	24.9 - 30.1
No Action Alternative 2021	1285	49.8 - 61.2	29.0 - 34.2

[1] Range represents the 95% confidence interval of data collected between June 24, and September 16, 2009
Sources: Liesch, 2009A; Liesch, 2009E; Barr, 2009EE
TPY - Tons per year

Under the No Action Alternative, the mean sulfate concentration in Swan Lake would increase from the current level of 28.8 mg/L to 32.9 mg/L by 2021. This results in an increase in sulfate loading to Swan Lake of 246 TPY. Hay Lake sulfate concentration would also increase from a mean of 52.5 mg/L to 55.2 mg/L.

4.4.1.2 Environmental Consequences

This section addresses the impacts to water quality in surrounding waters under the Proposed Project as a result of wastewater, process water discharges, water discharge, and mine pit dewatering. Changes in water level and the water balance are discussed in Section 4.1.1. As discussed above, sulfate concentrations have been identified as the significant contaminant of concern. Current discharge water quality shows that other parameters (phosphorus, mercury, nitrogen, chloride, trace metals) are not likely to change significantly as a result of wastewater discharges since the overall process is not changing. Monitoring presented in the Water Balance/Mine Yield Report through 2008 showed very low concentrations of these parameters. Sampling was conducted in 2008 under the approval of the MPCA and MNDNR and it was concluded that no additional sampling was required. Sulfate, hardness and conductivity were retained as the only parameters expected to change under the No Action Alternative or Proposed Project.

It is assumed that Keetac would continue to discharge sulfate at similar concentrations of the No Action Alternative if the Proposed Project did not go forward. Based on this assumption, project area water bodies would be affected by the Proposed Project as follows.

> The predicted Swan Lake sulfate concentration increases by 2.6 mg/L from the Proposed Project. The small predicted change in sulfate concentrations in Swan Lake is primarily due to increased loading associated with larger processing and dewatering rates being offset by the installation of advanced treatment equipment on the existing wet scrubber wastewater treatment plant or other location to achieve similar sulfate load reductions.

Swan Lake, Swan River, Hay Lake, and Hay Creek all currently exceed the state water quality standard for sulfate concentration. Until the water quality standard of 10 mg/L is met, either during or at the end of the compliance schedule, the Proposed Project would have a significant, adverse effect on the water quality of these water bodies by continuing to discharge sulfate above the standard. Once the standard is met, however, the Proposed Project would not affect water quality in these water bodies. Change in nitrogen, mercury, chloride or trace metals is not expected and the facility meets applicable water quality standards for these constituents. Additionally, water quality in Welcome Creek would not be affected as a result of the Proposed Project as sulfate concentrations would not change compared to the No Action Alternative. All applicable water quality standards will be met during or before the end of the compliance schedule. The following provides a more detailed discussion of the potential environmental effects from the Proposed Project.

4.4.1.2.1 Proposed Project

Pit Dewatering

The Proposed Project would extend mining horizontally and vertically in the existing pits, which would increase the amount of water that is generated from dewatering. The west side mining area which includes Mesabi Chief Pit, Perry Pit (began in 2010), Aromac Pit, and potentially the Sargent Pit would discharge more water. Sargent Pit would either discharge overflow west into the Mesabi Chief or to the south into Reservoir Two.

Mine pit dewatering from the east pits (Section 18, Carmi, Russell, and Stevenson) would serve as plant make-up water, with process water being routed to the tailings basin and ultimately Reservoir Six.

It is anticipated that for the first few years of the Proposed Project that the discharge volume from Reservoir Six would decrease relative to current rates because of an increase in plant use, an increase in evaporation from an increased tailings basin clear pool, and an increase in void volume lock-up. Ultimately, Reservoir Six discharge would increase compared to the volumes currently discharged due to increased mine yield.

Wastewater Treatment

The Proposed Project may include additional use of flocculants, water softening agents, micro-biocides, corrosion inhibitors, and de-scalers, among others for process water treatment due to the increase in material processed and quantities of water used in Keetac's taconite processing operations. These treatment chemicals are regularly used in water treatment. Changes or increases to chemical additives are covered in the NPDES permits and must be addressed through a request to the MPCA.

Membrane filtration technology is an advanced technology that can be used to treat water containing dissolved solids. Nano-filtration is a specialized type of membrane filtration. The particles that can be removed using this technology are as small as an ion. Currently, there is a sulfate precipitation system but no membrane-filtration technology installed for treatment of the wet scrubber wastewater effluent.

The Project Proposer, based on work conducted for the U.S. Steel Minntac facility, selected membrane filtration as a feasible treatment technology for the Proposed Project (Water Discharge and Treatment Alternatives memo). Based on this selection, the Project Proposer is planning to install a nano-filtration system (or similar wastewater treatment process) to further treat the scrubber blow down or other location to achieve similar sulfate load reductions. Nano-filtration can also remove mercury that has bonded to particulate matter from the discharge water.

Presently, the wet scrubber blow down treatment system uses hydrated lime ($Ca(OH)_2$) to precipitate out calcium sulfate. Based on pilot scale testing at Minntac, it is predicted that the installation of nano-filtration technology would reduce sulfate concentrations in the wet scrubber treated effluent by an additional 50 percent. The membrane system is capable of removing greater than 90 percent of the sulfate ions from the wastewater. However, treatment of the membrane reject water must be accomplished using a lime precipitation system. The combined removal of the nano-filtration/lime precipitation system is estimated at 50 percent.

Water Quality

The primary parameter of concern is sulfate; other parameters that require discussion are mercury, water hardness, and conductivity.

Mercury

Mercury levels would have minimal change in waters surrounding the project due to wastewater discharges from the site, but could change as a result of mercury emissions deposition. Management of mercury emissions is discussed in Section 4.9.7.

Hardness and Conductivity

In order to remove sulfate from air emissions on the existing line, water containing dissolved lime is sprayed into the process flue gas. The lime binds to the sulfate and precipitates out of solution as calcium sulfate. This process is used in the wet scrubber system that was installed in 2006. The precipitation of sulfate is a primary concern to Keetac because it is a useful method of removing sulfate from air emissions. However, calcium and sulfate must be present in excess of equilibrium concentrations for the precipitation of calcium sulfate, leading to elevated calcium levels. Calcium levels are linked to water hardness and conductivity and are of secondary concern to the removal of sulfate.

The addition of a proposed cold lime softening processing in conjunction with membrane filtration (or similar technology) to the wet scrubber wastewater blowdown stream would reduce levels of calcium and sulfate being discharged to Reservoir Six. Calcium and sulfate account for a significant portion of the specific conductance measured at the facility. According to the Water Balance/Mine Yield Study, specific conductance is predicted to peak at 863 μmhos/cm in the Reservoir Six discharge before decreasing due to the addition of the proposed wet scrubber blowdown treatment system and increased discharge flow rates.

Sulfate

Sulfate is a primary concern for the Proposed Project based on sulfate levels in pit dewatering and discharge from the tailings basin. Sulfate levels from pit dewatering is associated with groundwater and surface water contacting sulfur-bearing minerals present in open mining areas. Sulfate from the tailings basin is associated with process water and wet scrubber blowdown water. For comparing the No Action Alternative with the Proposed Action Alternative, Table 4.4.3 shows the sources and loading rates of the various sulfate sources in the wastewaters.

TABLE 4.4.3 PREDICTED SULFATE DISCHARGE LOADINGS

Period	Welcome Creek Weir Discharge			West Mine Discharge			Reservoir Six Discharge[1]			Total	
	Sulfate Concentration (mg/L)[2]	Flow (MGY)	Sulfate Load (TPY)	Sulfate Concentration (mg/L)[2]	Flow (MGY)	Sulfate Load (TPY)	Sulfate Concentration (mg/L)[3]	Flow (MGY)	Sulfate Load (TPY)	Flow (MGY)	Sulfate Load (TPY)
No Action Alternative 2021	102	488	208	66	2,014	555	128	978	523	3,480	1,285
Period V 2032-2036	102	388	165	66	1,801	496	83	2,247	778	4,463	1,440

Sources: Barr, 2009EE, Liesch, 2009A

Notes:

MGY – Million gallons per year

TPY – Tons per year

[1] Reservoir Six discharge flow rates include Sargent Pit dewatering volumes (excluding No Action Alternative).

[2] Based on 2008 sampling data. Sulfate concentrations are not expected to change with expanded mining extents

[3] Based on modeling results which include flow changes due to expansion, Sargent Pit discharges, and a proposed treatment system to remove 50 percent of current sulfate loadings (excluding No Action Alternative)

The results of the analysis indicate an increase in flow volumes (983 MGY) and sulfate loading (155 TPY) to downstream waters as a result of the Proposed Project. Below is a discussion of the potential impacts to receiving waters from sulfate.

Swan Lake and Hay Lake

Currently, all discharges from the Keetac facility reach Swan Lake via Hay Creek. This would continue to be the case after implementation of the Proposed Project. Hay Lake is a relatively small 30-acre basin compared to the 2,472-acre Swan Lake. Hay Creek enters Hay Lake at its north edge, exits the lake from the west edge, and flows to Swan Lake.

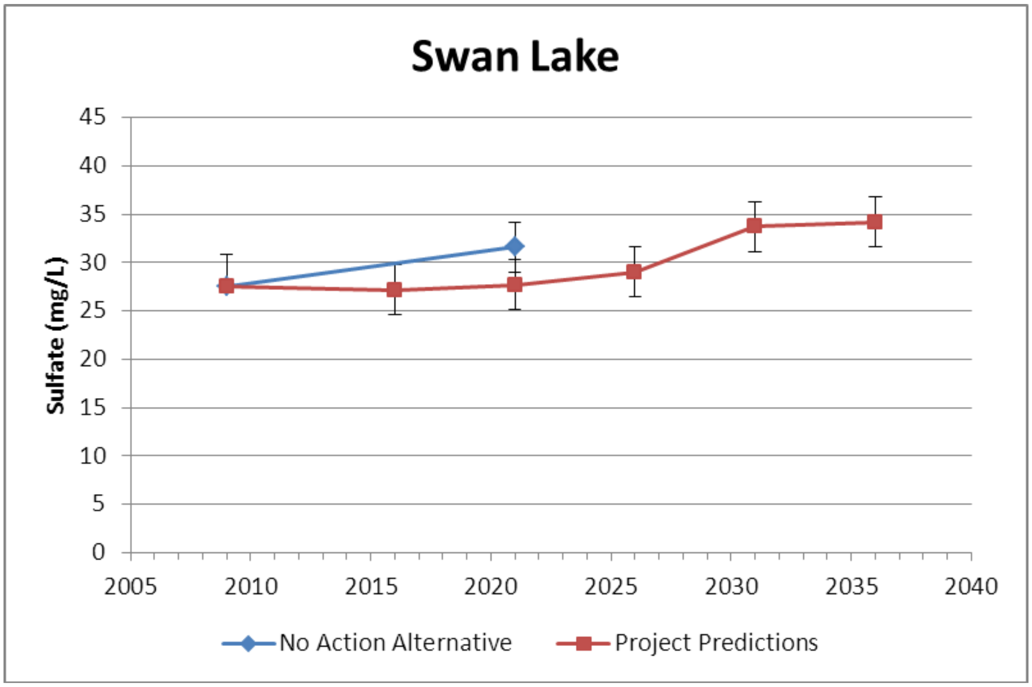
Table 4.4.4 summarizes the changes in sulfate loading in Swan Lake associated with the No Action Alternative and the Proposed Project (No Action Alternative Memo), and Illustration 4-1A presents this information in graphical form. The predicted Swan Lake sulfate concentration increases by 2.6 mg/L from the Proposed Project. Hay Lake sulfate concentration changes are predicted to decrease by 3.4 mg/L from the Proposed Project (Hay Lake Sulfate Report).

TABLE 4.4.4 PREDICTED SULFATE DISCHARGE LOADINGS TO SWAN LAKE EXCLUDING ESSAR STEEL

	Sulfate Load (TPY)	**Change in Sulfate Load compared to BASE (TPY)**	**Predicted Change in Sulfate Concentration Compared to BASE (mg/L)**	**Predicted Swan Lake Concentration Mean due to Keetac Proposed Project (mg/L)**	**Predicted Swan Lake Concentration Range due to Keetac Proposed Project (mg/L) [2]**
Current [1] 2009	1039	NA	NA	27.5	24.9 - 30.1
No Action Alternative (2021 BASE)	1285	0	0	31.6	29.0 - 34.2
Period I 2012-2016	1019	-266	-4.4	27.2	24.6 - 29.8
Period II 2017-2021	1049	-236	-3.9	27.7	25.1 - 30.3
Period III 2022-2026	1128	-157	-2.6	29.0	26.5 - 31.6
Period IV 2027-2031	1408	123	2.1	33.7	31.1 - 36.3
Period V 2032-2036	1440	155	2.6	34.2	31.6 - 36.8

Sources: Barr, 2009EE; Liesch, 2009A
[1] Values are measured values from samples collected June - December 2009
[2] Range represents the 95% confidence interval of data collected between June 24, 2009 and December 1, 2009
TPY - Tons per year

ILLUSTRATION 4-1A PREDICTED SWAN LAKE SULFATE CONCENTRATIONS*



Source: Barr, 2009EE
*Sulfate concentrations in Swan Lake taken as the predicted cumulative concentration in Swan Lake minus the change in concentration associated with Essar Steel.

The initial decreases in sulfate loading in Period 1 (2012-2016) are associated with the installation of a new wet scrubber blowdown treatment process. At the conclusion of the Proposed Project in 2036, the mean sulfate concentration is predicted to be 34.2 mg/L from contributions of the Proposed Project. The predicted change in sulfate concentrations in Swan Lake is primarily due to increased loading associated with larger processing and dewatering rates, which is then offset by the installation of advanced treatment equipment on the existing wet scrubber blowdown treatment plant. The sulfate concentration in the water discharged from the mining pits and tailings basin would likely remain stable, but the volume is expected to increase.

Table 4.4.5 summarizes the changes in sulfate loading in Hay Lake associated with the No Action Alternative and the Proposed Project (No Action Alternative Memo), as shown on Illustration 4-1B in graphical form.

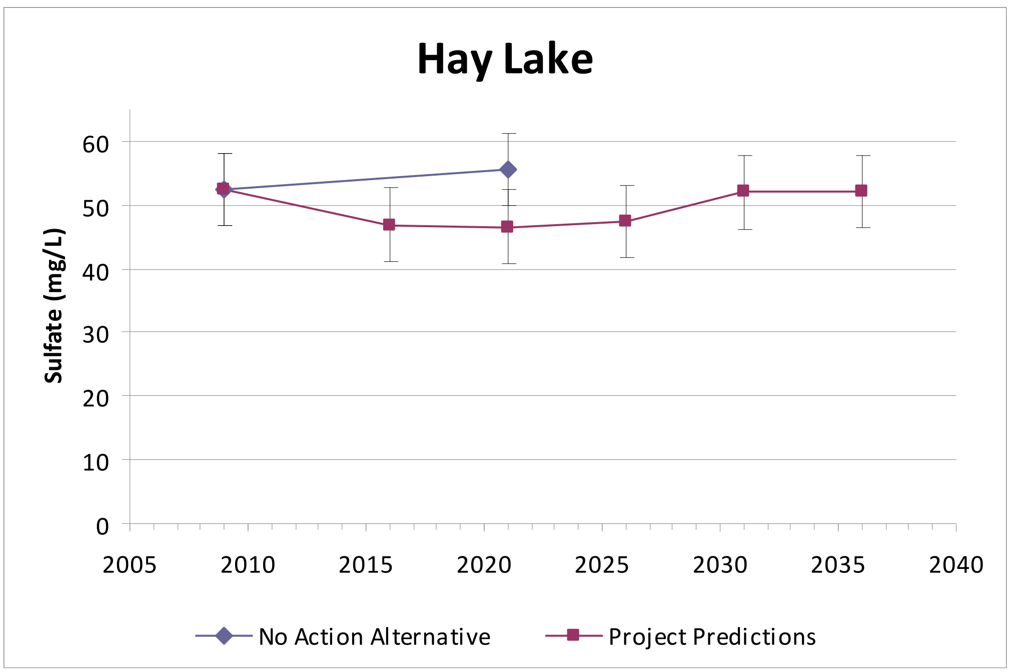
TABLE 4.4.5 PREDICTED SULFATE DISCHARGE LOADINGS TO HAY LAKE

	Sulfate Load (TPY)	Change in Sulfate Load (TPY)	Predicted Change in Sulfate Concentration Compared to BASE (mg/L)	Predicted Hay Lake Concentration Mean due to Keetac Proposed Project (mg/L)	Predicted Hay Lake Concentration Range due to Keetac Proposed Project (mg/L) [2]
Current [1] 2009	1039			52.5	46.8 - 58.2
No Action Alternative (2021 BASE)	1285	0		55.5	49.8 - 61.2
Period I 2012-2016	1019	-266	-8.6	46.9	41.2 - 52.6
Period II 2017-2021	1049	-236	-8.9	46.6	40.9 - 52.3
Period III 2022-2026	1128	-157	-8.1	47.4	41.7 - 53.1
Period IV 2027-2031	1408	123	-3.5	52.0	46.3 - 57.7
Period V	1440	155	-3.4	52.1	46.4 - 57.8

[1] Values are measured values from samples collected June - September 2009

[2] Range represents the 95% confidence interval of data collected between June 24, 2009 and September 16, 2009

ILLUSTRATION 4-1B PREDICTED HAY LAKE SULFATE CONCENTRATIONS



Source: Barr, 2009EE

The sulfate levels in Hay Lake are predicted to decrease as a result of the Proposed Project; however, the potential for impacts, in particular to wild rice, is unknown. The decrease in sulfate concentration is due to the installation of advanced wastewater treatment equipment on the existing scrubber, use of dry controls for the new scrubber, and the increased dewatering flow diluting sulfate concentrations. The MPCA would evaluate the necessary standard for sulfate to ensure the beneficial use is protected. A more detailed discussion on the potential for wild rice impacts is provided in Sections 4.7 and 5.4.

Other Parameters

Chloride, nitrogen, and phosphorous are at low levels and are not expected to change considerably in the waters surrounding the Proposed Project (Water Balance/Mine Yield Study). Additional discussion of other potentially impacted waters is given below.

Hay Creek

Decreases in base flow lower the flow rates and velocities of water within the creek. At times when flow rates are low, there is a decrease in dissolved oxygen. Increases in mine yield dewatering from the west mine pits is projected to increase by 2.2 cfs above the current rate over the next 25 years due to the changes brought about by the Proposed Project. Any future decreases in base flow would be countered by the flow increases from additional dewatering from the west pits.

Welcome Creek

Water quality in Welcome Creek is not expected to change significantly due to the Proposed Project. The current turbidity problems within Welcome Creek are due to high concentrations of dissolved iron in groundwater that enters Keetac's system of settling basins upstream of Welcome Creek. The turbidity problem is being addressed through a turbidity implementation schedule (Liesch, 2009B) and in accordance with the current NPDES/SDS permit, which would also require groundwater monitoring. These efforts are expected to decrease turbidity to levels below the discharge standard. A TSS standard would be included in the NPDES/SDS permit once a state TSS standard has been established by the MPCA.

4.4.1.2.2 East Stockpile Alternative

The potential environmental effects from changes to water quality and wastewater discharges from the East Stockpile Alternative are the same as the Proposed Project.

4.4.1.3 Monitoring and Mitigation

4.4.1.3.1 Monitoring

Wastewater Discharges

The Project Proposer possesses NPDES/SDS Permit No. MN0055948, and NPDES/SDS Permit No. MN0031879 for the Keetac facility, which would be modified based on conditions under the Proposed Project. These permits regulate the water treatment and disposal systems that dispose water as surface water discharge, and also limit concentration and various characteristics of the water that is discharged. Monitoring of numerous discharges and process stages within the facility and reporting is required under these permits. The monitoring parameters for flows discharged from the facility under the existing and modified permits would be:

- Flow
- Carbonaceous Biological Oxygen Demand (CBOD)
- Fecal Coliform
- Total Suspended Solids (TSS)

- Iron
- Calcium
- Fluoride
- Mercury
- pH
- Sulfate
- Total Nitrogen
- Ammonia Nitrogen
- Nitrate plus nitrite (as N)
- Phosphorus
- Oil and grease
- Specific Conductance
- Turbidity
- Evaporation
- Precipitation
- Temperature

This is only a summary of the monitoring requirements for all locations. The NDPES permits should be referenced for specific limits and locations for this monitoring. Under the NPDES/SDS permitting process any changes to (or new) chemicals used would be reviewed. Changes to the monitoring requirements would be made to the permit as warranted. If exceedances or a Notice of Violation occur, MPCA would work with the Project Proposer to bring discharges within permit guidelines.

Mercury air emissions would continue to be monitored due to the settling potential in the project vicinity. MPCA would ensure compliance with permitted limits in regard to the facility and state mercury Total Maximum Daily Load (TMDL). Mercury monitoring, TMDL requirements, and mitigation are discussed in more detail in Section 4.9.7 and 5.5.

4.4.1.3.2 Mitigation

Process improvements would be installed for the Proposed Project. A description of each of these measures is provided below.

Dry Scrubber

Part of the Proposed Project is the addition of a dry scrubber process (electrostatic precipitator discussed in Section 4.9) to the new indurating line. The dry scrubber system would provide similar efficiency in removing sulfate as the existing wet scrubber, but would also increase mercury control and prevent a wastewater discharge.

Wet Scrubber

The Proposed Project includes a new wet scrubber effluent treatment system on the existing indurating line. The upgrade would use nano-filtration or a similar technology to treat the effluent from the existing wet scrubber blow down treatment system. This upgrade is predicted to remove 50 percent of the sulfate in the effluent. Levels are expected to be below non-degradation standards and reduce the equilibrium sulfate concentrations below pre-project levels. Implementation of a scrubber effluent treatment system upgrade would also decrease water hardness and specific conductance in water discharged to the tailings basin (Reservoir Six).

The wet scrubber technique can successfully remove sulfur dioxide from the air; the sulfur is precipitated out as calcium sulfate. However, the use of water in the process results in a wastewater stream with high sulfate concentrations. The addition of membrane filtration would provide additional treatment to the existing wet scrubber blowdown treatment system. If at any time the current wastewater treatment techniques used to treat the effluent water at the mining facility became inadequate, other methods which are more effective are available including: alternative membrane treatments, chemical precipitation, ion exchange, and bacterial sulfate-reduction treatment (BSRT). These sulfate removal technologies could be evaluated for addition to the existing treatment system or used in place of the currently proposed system.

4.4.2 Surface Water Runoff

The FSDD for the Proposed Project states for surface water runoff, "Stormwater flow from the plant site is not expected to change as a result of the Proposed Project. Hydrologic studies to determine the volume of stormwater runoff from new waste rock stockpiles will be conducted prior to completion of the draft EIS." This section focuses on stormwater management within the project impact areas of the Proposed Project. Further discussion on water balance and physical impacts to water resources is provided in Section 4.1.1 and wetlands in Section 4.6.

4.4.2.1 Affected Environment

4.4.2.1.1 Existing Conditions

Keetac consists of large open mining pits, stockpiles, a tailings basin, water-filled mine pits and various areas not previously disturbed by mining activities. Surface waters at the site are composed of natural and reclaimed wetlands, lakes and flooded mine pits, natural streams, and constructed water channels.

The area is composed of two main areas: (1) the mining and stockpile areas as well as the processing plant site, and (2) the tailings basin area. The majority of the Keetac facility is located within the Upper Mississippi Watershed. A small portion of the proposed east stockpile and existing tailings basin exterior dam is located in the Lake Superior Watershed. Watershed boundaries for both major and minor watersheds are shown on Figure 4.1.1. Minor watersheds include O'Brien Creek, Welcome Creek, and Hay Creek watersheds. The majority of stormwater in operational areas at Keetac flows to the Upper Mississippi Watershed. Figure 3.1.2 shows the current direction of water flow at Keetac.

Mining operations have altered the natural routing of surface water runoff. Stockpiles of overburden and waste material have been placed within and over watershed boundaries, causing varying changes to surface water runoff. The tailings basin was created, which resulted in large flat areas bound by sloped dikes and dams. The tailings basin has discharge from seeps, which has altered the water flow to watersheds and water bodies around the site. Excavated mine pits intercepted surface water runoff and deep groundwater. Past mining in the area has left alterations in the landscape cover and surface water flow directions compared to pre-mining conditions.

4.4.2.1.2 Regulatory Framework

MPCA requires NPDES/SDS permits for industrial wastewater and stormwater discharges. Additionally, requirements for erosion control practices, during and after mining, are provided by the MNDNR Permit to Mine consistent with the *Taconite and Iron Ore Mineland Reclamation Rules* (Minnesota Rules Chapter 6130). Further discussion of mineland reclamation is provided in Section 3.3.7.

The MPCA has issued the NPDES/SDS Industrial Storm Water Multi-Sector General Permit MNR 050000 for discharges associated with industrial activity. This permit would replace NPDES/SDS General Permit for Industrial Storm Water Activity, MNG 610000, but is not specifically for the Proposed Project. This general permit is intended to regulate stormwater (rain, snow, and snowmelt) runoff which comes into contact with industrial activities and significant materials (materials which have the potential to cause contamination). Implementation of this general permit would likely result in applicable requirements to be incorporated into the NPDES/SDS permits associated with the Proposed Project.

The Project Proposer has two NPDES/SDS permits for operation of the Keetac facility. These permits regulate industrial wastewater and stormwater discharges. Permit No. MN0031879 is for the plant and mine (Mesabi Chief Pit, Welcome Creek weir, and backwash from well water treatment for potable water use at the plant), and Permit No. MN0055948 is for the tailings basin, primarily for discharge to Reservoir Two.

The Project Proposer has received a modification amendment to existing NPDES/SDS Permit No. MN0031879 for dewatering of the Perry Pit. The permit modification allows dewatering of the Perry Pit is not part of the Proposed Project.

> The Project Proposer's water management strategy provides mitigation for potentially contaminated surface water runoff by the collection and re-use of this water or treatment under the NPDES/SDS permit.

The NPDES/SDS permits reflect two major elements of the Proposed Project that relate to surface water runoff management. First, essentially all runoff from the site is captured for use in processing (see Section 4.5 – Groundwater Resources) with the exception of the discharges from the Mesabi Chief (annual average 6.19 cfs) and Perry (annual average 1.63 cfs) pits, the ten settling basins system, and discharges to Reservoir Two (combination of surface water runoff and plant facility discharge maximum for duration of the project is 13.85 cfs). Second there would be treated discharge of surface water runoff from developed areas of the site – all stormwater collected would be either treated in the ten settling basins prior to discharge to Welcome Creek (annual average 2.07 cfs) or in the mine pit dewatering sumps prior to discharge to O'Brien Creek.

4.4.2.1.3 No Action Alternative

Under its existing permits, the Keetac facility would continue to mine taconite to the extent of the pit limit as described in Section 3.2. Current surface water flow would not change significantly without construction of the Proposed Project.

4.4.2.2 Environmental Consequences

The current water management strategy at the Keetac facility is to collect surface water runoff from all developed areas in the vicinity of the processing plant, route it to on-site stormwater ponds/reservoirs, and treat it in settling ponds prior to discharge. The Project Proposer would use the same strategy for areas affected by the Proposed Project. Through the NPDES/SDS permit requirements and the Project Proposer's current water management strategy, there would be minimal discharge from the project site of sediment or pollutants associated with surface water runoff. The Proposed Project is not anticipated to impact the current water management practices or water quality related to surface water runoff from the plant site. More surface water runoff is anticipated due to the Proposed Project, which would result in an adverse effect without a water management strategy. Monitoring and mitigation are required as part of the NPDES/SDS permit, which is anticipated to minimize potential effects to less than significant as described in Section 4.4.2.3. Further detail is given in the Project Proposer's NPDES/SDS Permits and summarized by operational area below. The sources, management, and disposal of process water are discussed in Section 4.4.1. Figures 3.3.6 – 3.3.9 show the direction of water flow at various phases of the Proposed Project.

4.4.2.2.1 Plant Site

The plant site includes numerous taconite processing components, including specific materials exposed to stormwater: concentrate piles, pellet piles, and broken pellet chip piles. Stormwater from the plant site flows to the Bennett Pit, Welcome Lake or to the plant site diversion ditch system located east of the plant. The diversion ditch system manages both process water and stormwater from the plant site, and then discharges into Welcome Creek, which flows into Reservoir Two North. Wastewater/Water Quality is discussed in Section 4.4.1.

The Proposed Project would result in the construction of new buildings or building additions. The majority of the stormwater at the plant site is routed through the ten settling basins for treatment and is covered by the existing NPDES permit that contains TSS limits. Therefore, a construction stormwater permit would not be required for that area. However, stormwater from the new biomass facility would be discharged to Welcome Lake, and therefore would require a General Construction Storm Water Permit. The stormwater permit requires a program of inspection and recordkeeping procedures to verify that inspections and maintenance are being completed. The stormwater permit also requires the development of a project-specific pollution prevention plan to address erosion and sediment control measures, and BMPs.

4.4.2.2.2 Mine Pit/Stockpiles

Mine pit expansion would require additional dewatering. After mining is complete, the mine pit would be allowed to fill with water. This would create a stormwater detention area. Waste rock stockpiles would be constructed east of Reservoir Five. The proposed east stockpile consists primarily of previously undisturbed land. It is anticipated that the Proposed Project would impact several hundred acres of wetlands, which would alter the current flow of surface water. Section 4.6 provides greater detail on potential wetland impacts.

4.4.2.2.3 Pit Dewatering

The Project Proposer is permitted (NPDES/SDS Permit No. MN0031879) to dewater the Mesabi Chief and Perry pits and discharge water to O'Brien Creek, which flows to O'Brien Reservoir (Reservoir Four). O'Brien Reservoir flows to the O'Brien Diversion Channel that flows into Hay Creek, eventually flowing into Swan Lake.

With the exception of mine pit dewatering at the Mesabi Chief and Perry pits, water is collected in sumps as part of pit dewatering activities at the mine site and is pumped into Reservoir Five. Reservoir Five is used for plant makeup water. At a maximum elevation, Reservoir Five overflows to the plant diversion ditch system, which consists of a series of ten sedimentation basins and a conveyance channel. This system provides for additional water treatment of stormwater runoff water from the plant area, nearby inactive and active waste rock stockpile areas, and overflow from Reservoir Five. The Proposed Project would eventually mine the Reservoir Five area, which would eliminate the collection of surface water runoff in that reservoir.

The Proposed Project would include the progression of mining in the south and east portions of the mine pit. Additional mine dewatering activities would be necessary as the boundaries of the mine area increase. Expanded mining activities are anticipated to begin in 2012. Based on preliminary estimates, no additional water beyond that which the Project Proposer is permitted to appropriate would be needed for the Proposed Project. Further discussion on pit dewatering and water appropriations can be found in Section 4.5.

4.4.2.2.4 Tailings Basin

As part of the Proposed Project, the tailings basin dam would be altered to strengthen the dam walls and increase its height. The footprint would be minimally expanded as required if ongoing monitoring indicates a need for expansion. There would be no alterations to the exterior tailings basin dike. These improvements are not likely to impact the current flow of surface water. Surface drainage from the exterior of the tailings basin dikes flows to West Swan River, Reservoir Two, Reservoir Two North, Welcome Creek, unnamed wetlands, and into Hay Creek. Surface water quality could potentially be impacted by erosion and sedimentation as discussed in Section 4.4.3.

Tailings slurry from the concentrator and treated wet scrubber blowdown from the pellet plant is pumped from the plant area via pipeline into the tailings basin, where tailings are deposited by sedimentation and water is clarified. Following tailings deposition, clarified water enters a secondary exterior pond for additional clarification. An overflow structure allows water to drain from the secondary exterior pond into Reservoir Six. Water is pumped from Reservoir Six back to the Wolf Hill Head Tank located near processing plants for use as process water. Water is also occasionally discharged from Reservoir Six to Reservoir Two, which flows to the O'Brien Diversion Channel that flows into Hay Creek.

4.4.2.2.5 East Stockpile Alternative

The potential environmental effects from changes to surface water runoff and associated water quality from the East Stockpile Alternative are the same as those identified for the Proposed Project.

4.4.2.3 Mitigation Opportunities

The Project Proposer's water management strategy provides mitigation for potentially contaminated surface water runoff by the collection and reuse of this water or treatment under the NPDES/SDS permit. The Project Proposer operates the Keetac facility in accordance with NPDES/SDS Permit No. MN0055948 and NPDES/SDS Permit No. MN0031879. These permits require measures to ensure that discharges of runoff to major lakes and high quality wetlands are avoided or minimized.

Additionally, the Project Proposer has a SWPPP in place for the existing Keetac facility as part of the requirements for the NPDES/SDS permit. The SWPPP outlines the process and implementation of managing stormwater and avoiding and minimizing impacts from runoff by implementing BMPs, and conducting routine inspections. These BMPs may include erosion prevention practices to minimize production of sediment, such as seeding and mulching practices and special measures for steep slopes and highly erodible soils (i.e., terracing, silt fence, erosion control fabric, ditch checks, and proper application of chemical dust suppressants).

The Proposed Project would require a separate modification amendment to NPDES/SDS Permit No. MN0031879 for increased dewatering from the Mesabi Chief and Aromac Pits as part of mine pit expansion. The Proposed Project would also require a modification amendment to NPDES/SDS Permit No. MN0055948 due to changes in plant discharges to the tailings basin.

A NPDES General Storm Water Construction Permit would be required for the new biomass facility area and would also contain measures and procedures for minimizing stormwater erosion and sedimentation.

4.4.3 Erosion and Sedimentation

The FSDD for the Proposed Project states, "U.S. Steel will prepare a detailed facility water balance that will be used to evaluate Keetac's potential need to discharge additional water from the facility. If necessary, the EIS may address runoff in downstream sensitive areas as part of the larger issue of surface water runoff and overall water quality impacts of the project. Mitigation measures for adverse impacts will be described." Water related erosion at the project site is discussed in this section.

Surface water runoff and overall water quality is discussed in Section 4.4.2. Wind erosion at exposed soil surfaces in disturbed areas of the project is addressed in Section 3.3.7 – Closure and Mineland Reclamation and Section 4.9 – Stationary Source Air Emissions.

> Stockpiles, mine pit side slopes, tailings basin dike slopes, and areas disturbed by mining facility activities, such as haul roads, exist and can contribute to erosion and sedimentation.

4.4.3.1 Affected Environment

4.4.3.1.1 Existing Conditions

The area includes stream channels, wetlands, lakes and flooded mine pits that are susceptible to impacts associated with erosion and sediment transport. There is also potential erosion from surface water runoff, which could add to sediment transport loading. Stockpiles, mine pit side slopes, tailings basin dike slopes, and areas disturbed by mining facility activities, such as haul roads, exist and can contribute to erosion and sedimentation.

4.4.3.1.2 Regulatory Framework

Permitting for the project would include a Storm Water Pollution Prevention Plan (SWPPP) as part of the NPDES permit required by MPCA for the proposed on-site management of surface runoff. Erosion control related to reclamation would be addressed by the MNDNR Permit to Mine based on the requirements of the *Taconite and Iron Ore Mineland Reclamation Rules* (Minnesota Rules Chapter 6130). Section 4.4.2 provides a discussion on the Proposed Project permitting and surface runoff management.

The MPCA has issued the NPDES/SDS Industrial Storm Water Multi-Sector General Permit MNR 050000 for discharges associated with industrial activity. This permit would replace NPDES/SDS General Permit for Industrial Storm Water Activity, MNG 610000, but is not specifically for the Proposed Project. This general permit is intended to regulate stormwater runoff (rain, snow, and snowmelt) that comes into contact with industrial activities and significant materials (materials which have the potential to cause contamination). The Draft Industrial Storm Water Multi-Sector General Permit was open for public review and comment during July 2009. Implementation of this draft general permit would likely result in applicable requirements to be incorporated into the NPDES/SDS permits associated with the Proposed Project.

4.4.3.1.3 No Action Alternative

Keetac's NPDES permit requires a SWPPP, and the Permit to Mine requires post-mining reclamation, both of which outline measures to minimize erosion from existing operations. Under the No Action Alternative, Keetac would continue to operate under its existing permits and renew these permits as necessary for the life of the mine.

4.4.3.2 Environmental Consequences

> The clearing of existing vegetation and the stockpiling of new materials would create new barren surfaces susceptible to stormwater erosion and sediment transport.

The Project Proposer, as indicated above, operates under two NPDES/SDS permits. To comply with discharge permits, the Proposed Project would not discharge surface water runoff containing sediments or pollutants off site without treatment. Therefore, sedimentation impacts to downstream water bodies resulting from the Proposed Project are unlikely. Further discussion was previously provided in Section 4.4.2 – Surface Water Runoff. However, erosion-prone areas would be created on disturbed areas of the site as discussed below. More erosion and sedimentation is anticipated due to larger stockpiles and tailings basin, which would result in an adverse effect. Monitoring and mitigation, as described in Section 4.4.3.3, are required as part of the NPDES/SDS permit, which is anticipated to minimize potential effects to less than significant. Erosion and sedimentation at these areas would be mitigated through the implementation of BMPs.

4.4.3.2.1 Mine Pit

The Proposed Project includes expanding the existing mine pit limit into areas not previously disturbed by mining activity or revegetated after previous mining activities. If the pit expansion proceeds, vegetated areas would be logged to use timber resources and enhance pit operating safety.

The proposed east mine pit expansion is adjacent to a mine pit actively used by Hibtac. Hibtac conveys excess water into a wetland on the north side of the proposed east mine pit expansion. If the Proposed Project is implemented, the Project Proposer would cease its agreement with Hibtac for water conveyance to this wetland. Section 4.6 provides further discussion on wetlands and potential wetland impacts.

4.4.3.2.2 Stockpiles

The proposed east stockpile is previously undisturbed land, including forest and wetlands. The proposed south stockpile is also previously undisturbed forest land. In preparation for stockpiling overburden, waste rock, and other process materials, the area would be logged to remove the timber resources and enhance pit operating safety. A discussion on potential wetland impacts is provided in Section 4.6.

4.4.3.2.3 Tailings Basin

The Proposed Project would increase the tailings basin inner dam height by an additional 80 feet from current design. Tailings basins are designed for sediment containment and expand inward and upward, so disturbances should be contained within the basin. Construction activities associated with increasing the inner dam height are not likely to cause erosion and sedimentation transport outside the basin. The exterior dam slopes were revegetated in the past. No disturbance to the established vegetation on the exterior dam is expected to occur due to the Proposed Project. The Project Proposer is working on erosion control measures at the tailings basin, including seeding, mulching, and revegetation as needed. These measures would continue during construction and operation of the tailings basin and are governed by Minnesota Rules Chapter 6130, which are further discussed in Section 3.3.7 – Closure and Mineland Reclamation.

4.4.3.2.4 East Stockpile Alternative

The potential environmental effects from erosion and sedimentation on water quality from the East Stockpile Alternative are the same as those associated with the Proposed Project.

4.4.3.3 Mitigation Opportunities

BMPs identified in the NPDES/SDS permits for the Proposed Project would serve two primary purposes: erosion control and stormwater retention. The Proposed Project would use the same capture and conveyance approach that the current Keetac facility uses for collecting, storing, routing, and utilizing stormwater (described in greater detail in Section 4.4.2).

The NPDES permit requires the identification of BMPs and a SWPPP to assist in controlling erosion that occurs during construction and operation of the facility and mining areas. The MNDNR Permit to Mine requires stockpiles and pit slopes to withstand a 100-year storm event without failure, and to minimize erosion. Vegetation is required for surface overburden stockpiles, benches, tops of rock and ore stockpiles, pit overburden slopes, dikes and dams, cuts, pits, trenches, and other disturbed areas.

The state Mineland Reclamation Rules (Minnesota Rules Chapter 6130) require that slopes are designed (and ultimately constructed) to reduce erosion and facilitate stabilization and revegetation. Once final grades on a disturbed surface have been reached, the surface is required to be vegetated, in order to meet vegetative cover standards to help control erosion, in the first normal planting period following the time when the area is no longer scheduled to be disturbed.

Surface overburden stockpiles are required to have 30-foot wide benches at 40-foot maximum lift height, slopes of 2.5 to 1 or shallower, and drainage control systems capable of handling surface runoff. Overburden portions of the mines pits are also required to be sloped and vegetated. Other mine disturbances, such as drainage ditch slopes, also require vegetation.

4.5 GROUNDWATER RESOURCES

The water use issue identified in the FSDD has the potential for adverse effects on the municipal water supplies for the City of Keewatin and the City of Nashwauk due to increased dewatering of mine pits.

The FSDD stated that it is not anticipated that groundwater modeling will be necessary or effective to evaluate the potential hydraulic impacts of the proposed mining operations on the municipal water supply wells of the City of Keewatin and the City of Nashwauk. The FSDD stated that the EIS analysis will discuss contingency planning and monitoring programs for the two municipal water supplies. The FSDD also stated that the EIS will discuss a monitoring program to track water levels in the LaRue Pit Complex and Perry Pit.

Analysis in this section focuses primarily on the issues related to the potential for mine dewatering activity to reduce the water levels in the Biwabik Iron Formation to levels that would interfere with the normal operation of the municipal wells. A secondary risk is the potential for changes in water quality from altered groundwater flow patterns due to dewatering activities.

4.5.1 Affected Environment

4.5.1.1 Existing Conditions

The City of Keewatin operates two municipal wells (Well Nos. 1 and 3 - Unique Well Numbers 192359 and 751520). A previously used well (No. 2 - unique number 228828) was shut down and is being retained for water level monitoring. These wells are constructed in the BIF. The City of Keewatin uses approximately 65 million gallons per year. The bottom elevations of the active wells are 867 and 857 feet AMSL, respectively. Water levels are between 1276 and 1289 feet, based on 2007 measurements.

The City of Nashwauk operates two municipal wells (Well Nos. 3 and 4 – Unique Well Numbers 241017 and 228819) constructed in the BIF. Nashwauk uses between 45 and 65 million gallons per year. The bottom elevations of the wells 1075 and 899 feet AMSL, respectively. Water levels are between 1361 feet and 1364 feet based on 2006 measurements.

Both Cities have basic treatment, disinfection, and distribution facilities.

The degree of hydraulic connection between the proposed dewatering activities and the municipal supplies cannot be predicted with current information. The bedrock is fractured and the specific fractures create specific zones of groundwater flow. Since the alignment and interconnection of individual fractures is not known, attempting to create a detailed computer model of the groundwater flow patterns with the available data would be largely speculative.

4.5.1.2 No Action Alternative

Under the No Action Alternative the existing dewatering would continue through at least 2021. Table 4.5.1 presents the projected dewatering elevations and projected portion of dewatering from groundwater flow rates for the six mining pits as presented in the No Action Alternative Memo. The current appropriation permit for the facility is for 6728 MGY. Keetac has requested an increased appropriation to 7516 MGY, which is well above the expected actual dewatering rates. If the permitted amounts need to be exceeded, a permit amendment is necessary.

TABLE 4.5.1 NO ACTION ALTERNATIVE 2021 (MAX) DEWATERING RATES AND ELEVATIONS

Pit	Pumping Level (Ft. NGVD)	Dewatering Rate (MGY)
Mesabi Chief	1090	703
Aromac	1100	563
Perry	1100	333
Sargent	1135	415
Russell	1220	563
Section 18	1145	426
Stevenson	1195	696
Total		3699

Source: Liesch, 2009A

The no action dewatering elevations are below the current water levels in the municipal wells. In general it can be expected that the effects of dewatering on the water supply aquifer will decrease with distance from the center of mining. However, due to the unknown nature of fractures, local porosity, and general hydraulic interconnectedness of the Biwabik Iron Formation, predictions are difficult. Thus, there is the possibility that dewatering under the No Action Alternative could create a large enough cone of depression to lower water levels and have some effect on the Keewatin or Nashwauk wells. A specific fracture zone could allow unexpected drawdown. The Nashwauk wells are farther from the center of mining operations, and the effects, if any, are expected to be less.

Reportedly, (oral communication with Jim Walsh, MDH) the water levels in the Keewatin wells have lowered by approximately 100 feet since dewatering started in the Mesabi Chief pit in the mid 1990s. If the observed water level declines are consistent with the above expectations, there remains over 300 feet of available head in these wells; suggesting the past declines do not pose a problem for the City of Keewatin.

4.5.2 Environmental Consequences

4.5.2.1 Proposed Action Alternative

Proposed Project pumping rate estimates increase approximately 56 percent over the No Action Alternative.

Under the Proposed Action Alternative mining would continue until 2036 within the expanded mine limits. The Project Proposer completed a water balance study, which is discussed in Section 4.1.1. Table 4.5.2 presents the dewatering elevations and flow rates projected in the water balance study.

TABLE 4.5.2 PROPOSED PROJECT 2036 DEWATERING RATES AND ELEVATIONS

Pit	Pumping Level (Ft. NGVD)	Dewatering Rate (MGY)
Mesabi Chief	1100	896
Aromac	1100	564
Perry	1100	341
Sargent	1100	908
Russell	1350	417
Stevenson	1195	1505
Carmi	1060	470
Total		5101

Source: Liesch, 2009C

The dewatering elevations are similar to the No Action Alternative. Proposed Project pumping rate estimates increase approximately 56 percent over the No Action Alternative. The increase is primarily due to the larger area of mining under the Proposed Project. Increasing the pumping rate while maintaining similar pumping elevations suggests that the cone of depression from the pumping would be broader in extent than under the No Action Alternative. This would tend to lower the water levels in the municipal well fields more than under the No Action Alternative.

This suggests that the risk to the municipal supplies is somewhat higher with the Proposed Action Alternative. Lower water levels may reduce the capacity of some municipal wells. Shifting groundwater flow directions may cause change in groundwater chemistry as the wells begin to draw from different areas of the aquifer.

Since the degree of interconnectivity between the mine pits and the water supplies cannot be accurately determined and the fractured nature of the bedrock is inherently difficult to predict, this comparison is only qualitative. Furthermore, the mining plan would be implemented over time so the final impacts would occur gradually. As determined in the FSDD, the appropriate response is to develop a long term contingency and monitoring plan to address the potential risk to the water supplies.

There is potential for an adverse effect to groundwater due to mine pit dewatering. The significance of the potential effect is uncertain as fractured bedrock conditions around the mine make modeling inaccurate. Monitoring of the Proposed Project and mitigation would be used to minimize potential effects.

4.5.2.2 East Stockpile Alternative

The potential environmental effects on groundwater from the East Stockpile Alternative are the same as those identified for the Proposed Project.

4.5.3 Monitoring and Mitigation

In spring 2009, the Project Proposer entered into water supply contingency agreements with the City of Keewatin and the City of Nashwauk (see Appendix F).

4.5.3.1 Monitoring

The predicted mine dewatering yield elevations and pumping rates would likely proceed incrementally with each 5-year phase of the Proposed Project. The potential impacts to the aquifer system and the municipal water systems would therefore occur slowly over time, several years or more. The contingency plan and annual reporting agreements would identify potential problems as they evolve during each phase of the Proposed Project.

The number and location of monitoring wells, and monitoring frequency would be identified in the water appropriation permit based on several factors including the ability to determine if the impact is attributable to the Project Proposer.

> Mitigation actions could include additional treatment for water quality impacts or development of additional water supplies for impacts to well capacity.

The agreements include the following major tasks:

1. Installing a monitoring well between the Nashwauk well field and the mine pits (final location to be determined in the field),
2. Monitoring surface water elevations at the Mesabi Chief Pit, St. Paul Pit, Carlz Pit, and LaRue Pit Complex,
3. Monitoring groundwater levels at the new Nashwauk observation well and the unused Keewatin municipal well,
4. Conducting baseline groundwater sampling for general water quality and dissolved mineral constituents, and
5. Providing an annual report to each city by February 15 of each year beginning in 2011.

4.5.3.2 Mitigation

If adverse impacts to the capacity or quality of either water system are identified, the agreements require the Project Proposer to immediately notify the City, the MNDNR and the MDH. The agreements cite Minnesota Rules, part 6115.0730, which govern well interference problems involving water appropriation. The Project Proposer and these parties would determine the appropriate response actions to mitigate the identified impacts. Mitigation actions could include additional treatment for water quality impacts or development of additional water supplies for impacts to well capacity.

4.6 WETLANDS

For the Proposed Project

- The USACE St. Paul District is the permitting authority for federal CWA Section 404 permits.
- The MNDNR Division of Lands and Minerals administers the WCA approval process as part of the Permit to Mine.
- The MPCA has authority to issue a CWA Section 401 water quality certification on the CWA Section 404 permit.

The FSDD states that the EIS would include a discussion on impacts to water resources, including wetlands, and that wetland delineations, mitigation sites, and the feasibility of wetland mitigation would be evaluated. The FSDD also stated that potential future wetland impacts due to actions of the project would be evaluated.

4.6.1 Affected Environment

4.6.1.1 Existing Conditions

Existing wetland resources within the Proposed Project area were assessed as part of this FEIS. This assessment included delineation of current wetland boundaries, review of hydrologic monitoring data, and an analysis of mining impacts on wetlands. Most wetland boundaries were field delineated, while other wetland boundaries were estimated utilizing existing maps, aerial photography, soil surveys and other available information. Figure 4.6.5 shows the wetland resources found within the current and proposed Keetac footprint that would be impacted by the Proposed Project.

Detailed information collected for wetlands is contained in the Wetland Delineation Report (see EIS Related Studies section of the FEIS). Wetlands were field delineated in August 2005, and between June and September 2008. The wetland delineations were performed according to the Routine On-Site Determination Method specified in the U.S. Army Corps of Engineers Wetlands

Delineation Manual, 1987 Edition. Review and approval of the Wetland Delineation Report, and subsequent wetland boundaries, was completed by the MNDNR and USACE in 2008.

The majority of the Proposed Project is located within the Mississippi River (Grand Rapids) major watershed and Wetland Bank Service Area 5. The eastern edge of the Proposed Project is located in the St. Louis River major watershed and Wetland Bank Service Area 1. All proposed wetland impacts would occur in the Mississippi River major watershed and Wetland Bank Service Area 5.

4.6.1.2 Regulatory Framework

Wetlands are protected under state and federal laws, including the WCA (Minnesota Rules Chapter 8420), Minnesota Rules, part 7050.0186, and the CWA Sections 401 and 404. In addition, some wetlands are also designated as Minnesota Public Waters and subject to the Public Waters Work Permit Rules (Minnesota Rules Chapter 6115).

Both the state and federal wetland regulations require that a permit, approval, and/or certification be issued by the regulatory agency for wetland impacts as defined by the respective regulations (hereafter referred to as "permitted"). For the Proposed Project, the USACE St. Paul District is the permitting authority for federal CWA Section 404 permits; the MNDNR Division of Lands and Minerals administers the WCA approval process as part of the Permit to Mine (Minnesota Rules, part 8420.0200, subp. 1D), and the MPCA has authority to issue a CWA Section 401 water quality certification on the CWA Section 404 permit. The CWA Section 404 permit and the Permit to Mine both have financial assurance mechanisms to ensure successful completion of the Proposed Project. Financial assurance can be a condition of a permit under the CWA Section 404, and the MNDNR has authority to require a performance bond for compliance with the conditions of the Permit to Mine. Additional information about financial assurance is included in Sections 2.1 and 2.2.

The Public Waters Inventory (PWI) described in Minnesota Statute 103G.005 identifies waters and wetlands under the jurisdiction of the MNDNR Division of Waters. While there are several Public Waters adjacent to the current and proposed Keetac footprint, there are no designated Public Waters that would be directly affected by the Proposed Project.

Regulatory processes require similar documentation of existing wetland boundaries, proposed wetland impacts (including functional assessment analyses), and documentation of project sequencing. Project sequencing includes wetland impact avoidance and minimization efforts, as well as proposed mitigation for unavoidable impacts. These regulatory processes do however differ with respect to the definition of wetlands/waters that are regulated in each process.

CWA applies to Waters of the U.S., which include jurisdictional wetlands and lakes (i.e., water bodies greater than 2 meters deep, which are not defined as wetlands, such as deep water mine pits or other manmade wetlands). However, wetlands and other water bodies that are isolated, such as those that do not have a surface water connection to a tributary system to a navigable water of the U.S. or a sufficient connection to interstate commerce other than their use by migratory birds, are not regulated under Section 404 of the CWA (SWANCC decision of 2001).

In contrast, WCA regulates isolated wetlands, but does not regulate wetlands created for a purpose other than to create the wetland (Minnesota Rules, part 8420.0105, subp. 2D). Thus, most, if not all, of the wetlands and other water bodies within the current and proposed Keetac footprint would be regulated through either CWA or WCA. Regardless, all wetlands are regulated by MPCA under Minnesota Rules, part 7050.0185.

4.6.1.3 Wetland Classification System Descriptors

As part of the Wetland Delineation Report, wetlands were classified using the Circular 39 system (Shaw and Fredine, 1971), the USFWS Cowardin Classification System (Cowardin, et al., 1979), and the Eggers and Reed Plant Community Classification System (Eggers and Reed, 1997). Previously, the Circular 39 classification system was the primary system used to classify wetland type. WCA rules still use Circular 39 but recently incorporated the Eggers and Reed classification system. CWA permitting generally follows the Eggers and Reed classification system. A summary of the Circular 39 and comparable Eggers and Reed descriptors are provided in Table 4.6.1.

TABLE 4.6.1 WETLAND CLASSIFICATION SYSTEM DESCRIPTORS

Wetland Plant Community Type (Eggers and Reed, 1997)	**U.S. Fish and Wildlife Service Circular 39 (Shaw and Fredine, 1971)**
Floodplain Forest	Type 1: Seasonally flooded basin or flat
Seasonally Flooded Basin	Type 1: Seasonally flooded basin or flat
Wet to Wet-Mesic Prairie	Type 1: Seasonally flooded basin or flat; Type 2: Inland fresh meadow
Fresh (Wet) Meadow	Type 1: Seasonally flooded basin or flat; Type 2: Inland fresh meadow
Sedge Meadow	Type 2: Inland fresh meadow
Calcareous Fen	Type 2: Inland fresh meadow
Shallow Marsh	Type 3: Inland shallow fresh marsh
Deep Marsh	Type 4: Inland deep fresh marsh
Shallow, Open Water	Type 5: Inland open fresh water
Shrub-Carr	Type 6: Shrub swamp
Alder Thicket	Type 6: Shrub swamp
Hardwood Swamp	Type 7: Wooded swamp
Coniferous Swamp	Type 7: Wooded swamp
Open Bog	Type 8: Bog
Coniferous Bog	Type 8: Bog

The origin of wetlands was also determined during the Wetland Delineation Report. Wetlands were classified as being incidental or natural. Wetlands determined to be formed by natural processes on a naturally formed landscape where the soils, vegetation, and hydrology have formed due to natural geologic and biologic processes were classified as natural. Wetlands formed on a landscape that did not exist historically in the landscape or by non-natural means were classified as incidental. Incidental wetlands include those having soils, vegetation, and hydrology on human-established substrate such as disposed mine tailings, mine stockpiles or formed due to human-induced changes such as diked impoundments.

The Wetland Delineation Report further classified wetlands as permitted or unpermitted. Wetlands classified as permitted have already been permitted to be physically altered under CWA Section 404 and approved in a WCA Wetland Replacement Plan. Wetlands classified as unpermitted have not been permitted for impact under CWA Section 404 and do not have an approved WCA Wetland Replacement Plan.

4.6.1.4 Wetland Functional Assessment Methodology

Wetlands provide a variety of functions such as flood water storage, nutrient and sediment removal, fish and wildlife habitat, and recreational opportunities. The Minnesota Routine Assessment Method for Evaluating Wetland Functions (MNRAM) was created by BWSR to quantify wetland functions. The USACE also recognizes the MNRAM methodology to assess existing wetland functions (USACE, 2009).

The Wetland Delineation Report provides data related to the functions and values of each wetland classified as unpermitted. The functional rating categories used include: low, moderate, high, and exceptional. The functional rating is based primarily on the diversity and/or the integrity of vegetation within the wetland in comparison to an undisturbed condition for that wetland type. An exceptional rating results from one or more of the following conditions: 1) highly diverse wetlands with virtually no non-native species, 2) moderately intact, rare or regionally imperiled wetland communities in the watershed, or 3) the presence or previous siting of rare, threatened, or endangered plant species. A high rating indicates the presence of diverse, native wetland species and minimal non-native or invasive species. Wetlands rated moderate have some non-native and/or invasive species present, but the wetland is not dominated by them. Wetlands that rate low are primarily dominated by non-native and/or invasive species.

While the vegetative diversity/integrity of the wetland serves as one indicator of wetland functional quality, many other factors contribute to the overall functioning of the wetland in the larger landscape. To provide a more comprehensive assessment of wetland functional quality, other applicable wetland functions evaluated in MNRAM were also considered in rating overall wetland quality. The wetland functions that were typically most applicable include: maintenance of characteristic hydrologic regime, flood attenuation, maintenance of wetland water quality, wildlife habitat, and downstream water quality. The cutoff between high, medium, and low quality generally followed the guidelines established within MNRAM.

Wetlands rated high for overall quality include those in which the natural ecological and hydrological functions within the wetland are intact and performing at a high level. There is less emphasis on the value of the wetland to humans (e.g., aesthetics, flood attenuation, and protecting downstream water quality). Generally, these wetlands include those in which the natural hydrologic conditions have not been significantly altered and the water quality is intact. The vegetative diversity/integrity is typically rated high. There is little evidence of long-lasting disturbance to the basic processes and hydrologic regime in the wetland such as altered surrounding upland habitats, altered watershed extent, altered land uses within the watershed, altered outlet, etc. These wetlands also include those wetlands in which the characteristic wildlife, amphibian, or fish habitat structure is rated high quality.

Moderate quality wetlands are those in which the ecological and hydrological functions have been impaired and are not performing as they did historically. Some of the influences affecting the wetland include: changes to land uses in the watershed, changes in watershed area, changes to the outlet from the wetland, and the introduction of invasive species.

Low quality wetlands include those in which the natural ecological and hydrological functions have been severely impaired and the critical, natural processes supporting the wetland are no longer in place. This category typically includes wetlands that have recently formed on artificial substrates or those that have developed due to impoundments, diking, or blocked drainage. Low quality wetlands are frequently dominated by few vegetation species that are typically invasive or non-native or have large areas of open soil due to erosion or other factors. The landscape surrounding these wetlands may be artificial (e.g., stockpiles, disposed tailings, dikes, roads, railroads, etc.) with steep slopes, minimal vegetation, or other characteristics that limit the value of the wetland for wildlife and result in erosion or other processes that degrade the wetland.

To ensure the integrity of the functional assessments, the assessment procedures were established to rate wetlands at a higher level of functioning if there was any question as to which rating applied. By using the higher ratings there is less chance of underestimating impacts. Several landscape characteristics are important for evaluating these wetland functions. Some of the key landscape and wetland characteristics that are considered in the MNRAM ranking of wetland functional quality are provided in Table 4.6.2.

TABLE 4.6.2 LANDSCAPE FACTORS INFLUENCING WETLAND FUNCTIONAL QUALITY

MNRAM Category	Role in Wetland Function and Quality
Wetland or Lake Outlet Characteristics	Outlets influence flood attenuation, downstream water quality, and other hydrologic processes
Watershed and Adjacent Land Uses and Condition	Adjacent land uses influence wetland hydrology, sediment and nutrient loading to wetlands, connectivity for wildlife habitat, and other factors
Soil Condition	Soil condition influences plant community type, vegetative diversity, overall wetland quality, and productivity (trophic state)
Erosion and Sedimentation	Influences downstream water quality, trophic state of wetlands, vegetative diversity, and overall wetland quality
Wetland Vegetative Cover and Vegetation Types	Influences vegetative diversity, wildlife habitat as well as hydrologic characteristics (e.g., evapotranspiration or resistance to flow in floodplain wetlands)
Wetland Community Diversity and Interspersion	Influences the vegetative diversity and overall wetland quality as well as value for wildlife habitat
Human Disturbances (both past and present)	Mining, logging, road building, stream channelization and other alterations to the landscape

The broader landscape factors in Table 4.6.2 were typically evaluated on a scale larger than one specific wetland, because of similarities within the different areas of the Proposed Project. For example, the soil and vegetation conditions in the watershed contributing to the wetland quality were similar for the wetlands located in the proposed east mine pit expansion and proposed east stockpile. Human disturbance levels were typically similar across broad areas, especially in areas where mining has altered the landscape, such as in the proposed east stockpile. Other, more local factors were evaluated for each wetland or small groups of wetlands. Vegetative diversity/integrity and the overall functional quality rating for delineated unpermitted wetlands for which a functional assessment was performed, is summarized in Section 4.6.1.5.

4.6.1.5 Summary of Wetland Functional Ratings

Wetland functional assessment summaries located within the five Proposed Project areas, plant area, proposed east mine pit expansion, proposed east stockpile, proposed south mine pit expansion, and proposed south stockpile, are described in the following sections. Table summaries are included depicting the number of wetlands to be impacted within each project area with a corresponding vegetative diversity/integrity and overall wetland quality rating. Section 4.6.2 provides additional discussion of each wetland classification, acreage, and proposed impact.

Plant Area

Portions of two wetland basins exist within the plant area. Table 4.6.3 summarizes the functional ratings of the basins. Both of the basins are rated as low quality for both vegetative diversity/integrity and overall wetland quality.

TABLE 4.6.3 PLANT AREA RATING SUMMARY

Total # of Wetlands	Impact Area (acres)	Vegetative Diversity/ Integrity	Overall Wetland Quality
2	9.47	Exceptional **0**	Exceptional **0**
		High **0**	High **0**
		Moderate **0**	Moderate **0**
		Low **2**	Low **2**
		No Assessment **0**	No Assessment **0**

Proposed East Mine Pit Expansion Area

Identified within this area are 17 wetland basins totaling 257.95 acres. Many of the wetlands found in this area are small, isolated basins that have formed on disturbed soils in areas of natural drainage impediment, or borrow areas along roadways. In this area is Wetland 7, also known as Reservoir Five, which was historically a wetland of smaller size based on review of historical aerial photographs. Wetland 7 was impounded and used as a water source for the mining operation, which resulted in it becoming larger and deeper. Table 4.6.4 summarizes the functional ratings for each basin. Functional assessments were performed on selected basins within the proposed east mine pit expansion area. Two wetlands of 0.14 and 0.17 acres were not assessed in the proposed east mine pit expansion area for functional status. These wetlands were not assessed due to their small size.

TABLE 4.6.4 PROPOSED EAST MINE PIT EXPANSION AREA RATING SUMMARY

Total # of Wetlands	Impact Area (acres)	Vegetative Diversity/ Integrity	Overall Wetland Quality
17	257.95	Exceptional **0**	Exceptional **0**
		High **2**	High **0**
		Moderate **6**	Moderate **7**
		Low **5**	Low **6**
		No Assessment **4**	No Assessment **4**

Proposed East Stockpile

The 732-acre proposed east stockpile area includes the proposed east stockpile road. The area contains 23 wetlands totaling 446.71 acres. Table 4.6.5 summarizes the functional ratings for each basin. Historically the wetlands within this area were smaller as viewed on aerial photographs from the 1940s. Previous stockpiling activities in the existing southeast stockpile have caused a water impoundment within some of these wetlands. The result of this impoundment is larger open water wetland basins with relatively low functional ratings compared to a native undisturbed community.

Two wetlands encompassing 9 percent (39 acres) of the wetlands that would be impacted within the proposed east stockpile area are rated high quality. A total of 77 percent (346 acres) are rated moderate quality, and 14 percent (61 acres) are rated low quality. Previous disturbances related to impoundment, excavation, hydrologic alterations, and proximity to roads and mine dumps have contributed to the moderate and low quality of the majority of the wetlands.

TABLE 4.6.5 PROPOSED EAST STOCKPILE AREA RATING SUMMARY

Total # of Wetlands	Impact Area (acres)	Vegetative Diversity/ Integrity	Overall Wetland Quality
23	446.71	Exceptional **0**	Exceptional **0**
		High **0**	High **2**
		Moderate **11**	Moderate **8**
		Low **12**	Low **13**
		No Assessment **0**	No Assessment **0**

Proposed South Mine Pit Expansion

The proposed south mine pit expansion area evaluated for wetlands encompasses 328.2 acres and contains seven wetland basins totaling 34.47 acres. Table 4.6.6 summarizes the functional ratings for each basin. Functional assessments were not performed on the two deep water habitat areas, which make up 72 percent of the impacts. The functional assessments were not performed on these deep water habitats because the wetland methodology does not apply.

In the proposed south mine pit expansion area, 27 percent of the wetland impact acreage would be to wetlands with a moderate rating. The remaining 1 percent of wetland impact acreage would be to wetlands with a low rating.

TABLE 4.6.6 PROPOSED SOUTH MINE PIT EXPANSION AREA RATING SUMMARY

Total # of Wetlands/Deep Water Habitat	Impact Area (acres)	Vegetative Diversity/ Integrity	Overall Wetland and Deep Water Quality
7	34.47	Exceptional **0**	Exceptional **0**
		High **0**	High **0**
		Moderate **1**	Moderate **2**
		Low **4**	Low **3**
		No Assessment **2**	No Assessment **2**

Proposed South Stockpile Area

The proposed south stockpile area encompasses approximately 40 acres and contains three wetland basins totaling 10.91 acres. Table 4.6.7 summarizes the functional ratings for each basin. The majority of the proposed wetland impacts (9.23 acres) in this area would be to a hardwood swamp dominated by black ash that was rated high for overall wetland quality.

TABLE 4.6.7 PROPOSED SOUTH STOCKPILE AREA RATING SUMMARY

Total # of Wetlands/Deep Water Habitat	Impact Area (acres)	Vegetative Diversity/ Integrity	Overall Wetland and Deep Water Quality
3	10.91	Exceptional **0**	Exceptional **0**
		High **1**	High **1**
		Moderate **2**	Moderate **0**
		Low **0**	Low **2**
		No Assessment **0**	No Assessment **0**

4.6.1.6 No Action Alternative

The No Action Alternative would avoid 761.31 acres of wetland impacts from the Proposed Project.

The No Action Alternative would avoid 761.31 acres of wetland impacts and deep water habitat impacts from the Proposed Project. Wetland impacts that have not been previously permitted totaling 5.42 acres would occur within the No Action Alternative boundary. Three of the wetland basins are located in the existing mine pit, while six basins are proposed to be impacted in the existing northwest stockpile. Table 4.6.8 identifies these previously unpermitted impacts, and Figure 4.6.1 shows the locations of the basins. With the exception of Wetland 7, the basins were not classified and functional assessments were not required on the wetlands within the No Action Alternative boundary. Functional assessments would be completed at the time of permitting.

TABLE 4.6.8 NO ACTION ALTERNATIVE WETLANDS

Impact Area	Wetland ID	Dominant Circular 39 Type	Wetland Community Type (Eggers & Reed)	Wetland Area (acres)	Overall Wetland Quality	Vegetative Diversity/ Integrity
Existing Mine Pit	2000_Z	-	-	0.01	N/A	N/A
Existing Mine Pit	2008_2	-	Deep Water	1.01	N/A	N/A
Existing Mine Pit	7	5	Shallow Open Water	0.10	Low	Low
Existing Northwest Stockpile	-	-	-	2.34	N/A	N/A
Existing Northwest Stockpile	-	-	-	0.09	N/A	N/A
Existing Northwest Stockpile	-	-	-	0.29	N/A	N/A
Existing Northwest Stockpile	-	-	-	1.22	N/A	N/A
Existing Northwest Stockpile	-	-	-	0.32	N/A	N/A
Existing Northwest Stockpile	-	-	-	0.04	N/A	N/A

- No data available.

4.6.2 Environmental Consequences

This section describes estimated wetland impacts and deep water habitat impacts from the Proposed Project. Since the location of taconite deposits determines where mining (and associated out of pit stockpiling) is feasible, relocation options to avoid wetland impacts are not practicable at the scale necessary to meet the purpose of the Proposed Project. Several constraints are imposed on the Project Proposer when attempting to locate out of pit stockpiles including: ambient air quality boundary setbacks, transportation infrastructure, mineral rights ownership, safety, economics, and property ownership issues.

For these reasons, no complete wetland avoidance alternatives are practicable for the Proposed Project. Appendix E of this FEIS evaluates several out of pit stockpiling alternatives, maximizing in-pit stockpiling, and how mine plan sequencing requires out of pit stockpiling.

The need for out of pit stockpiles creates wetland impacts. The Proposed Project results in an estimated 761.31 acres of wetland impacts.

The analysis in Appendix E confirms that out of pit stockpiling is required to meet stockpiling needs after maximizing in-pit stockpiling. The analysis in Appendix E evaluates locations of alternative stockpiles in comparison to the proposed stockpiles in an effort to determine if there is a location that would have greater environmental benefit. The analysis considers the ability to minimize wetland acreage and functional quality impacts. The need for out of pit stockpiles creates the potential for wetland impacts. To minimize out of pit stockpiling needs and associated wetland impacts, the Project Proposer intends to maximize in-pit stockpiling wherever feasible as discussed in Section 3.5.3.2. Mineral owner rights and mine plan sequencing limit available space and prohibit the complete use of in-pit stockpiling. The analysis in Appendix E concludes that one alternative stockpile location (identified in the FEIS as the East Stockpile Alternative) would provide environmental benefit over the proposed east stockpile location primarily due to fewer wetland impacts.

Table 4.6.15, at the end of this sub-section, compares and summarizes the total wetland impacts by Eggers and Reed Classification and wetland type (Circular 39) for the Proposed Project. The estimated area of wetland impacts in this table (and in the tables for each sub-area) assume that all wetlands within the boundary defining each impact sub-area would be impacted. Wetlands adjacent to mine features that have the potential for future impacts and/or degradation are discussed in Section 4.6.2.2.2.

Based on the assumption that all wetlands in each impact area would be completely impacted, the Proposed Project results in an estimated 761.31 acres of wetland impacts. An additional 174.6 acres of wetland would be monitored to determine if future impacts are caused by the Proposed Project. Wetland impacts from the Proposed Project are depicted on Figure 4.6.2. The potential effects to wetlands would be adverse and significant. The magnitude of the effects would be great, and the potential effects surpass state and federal regulatory thresholds for permits. Monitoring and mitigation would be required.

The sections that follow describe the anticipated project impacts for individual impact areas, potential indirect wetland impacts (Section 4.6.2.2.2), and proposed mitigation for unavoidable wetland impacts (Section 4.6.3).

4.6.2.1 Proposed Action Alternative

4.6.2.1.1 Potential Direct Impacts

The Proposed Project includes wetland impacts at the plant area, proposed east mine pit expansion, proposed east stockpile, proposed south mine pit expansion, and proposed south stockpile, described individually below. The wetland impacts estimate assumes that all of the wetland areas within the designated Proposed Project areas would be impacted by filling or other activities that would result in loss of wetlands and/or wetland functions. Within the Proposed Project area there are 761.31 acres of impacts that would occur to 53 wetlands. The wetland impacts for each impact area are listed by wetland type and by Eggers & Reed Classification in Table 4.6.15. In order to determine if actions of the Proposed Project cause future wetland impacts, 174.6 acres of wetlands adjacent to mine features would be monitored as required by the 401 certification, CWA Section 404 permit, and WCA approval.

Plant Area

Wetland impacts to two wetland basins totaling 9.47 acres would occur from the Proposed Project within the 285-acre plant area as shown on Figure 4.6.3. Table 4.6.9 summarizes the size and classification for each basin in the plant area. Wetland impacts would occur to shallow open water (Type 5) and shallow marsh (Type 3) basins that are all rated low quality.

TABLE 4.6.9 WETLAND RESOURCES: PLANT AREA

Wetland ID	Dominant Circular 39 Type	Wetland Community Type (Eggers & Reed)	Wetland Area (acres)	Overall Wetland Quality	Vegetative Diversity/ Integrity
7	5	Shallow Open Water	6.09	Low	Low
2008_25	3	Shallow Marsh	3.38	Low	Low

Proposed East Mine Pit Expansion

A total of 17 wetlands covering 257.95 acres located within the proposed east mine pit expansion area would be impacted from the Proposed Project; see Table 4.6.10 and Figure 4.6.4. Shallow open water (Type 5) and shallow marsh (Type 3) wetlands make up approximately 32 percent and 24 percent, respectively, of the wetland impacts in this expansion area. One shallow open water wetland (Wetland 7/Reservoir Five) makes up all of the area of that type and generally contains little vegetation. The shallow marsh wetlands are dominated by cattails (*Typha sp.*) and are found in wetland complexes including components of other wetland types.

Disturbances from previous mining activities such as impoundment, excavation, hydrologic alterations, and proximity to roads and other mine features contribute to the moderate and low quality ratings of these wetlands.

Shrub-carrs (Type 6) and deep marshes (Type 4) make up approximately 21 and 20 percent of the impacted wetland areas, respectively. The shrub-carr wetlands are dominated by speckled alder (*Alnus rugosa*), willows (*Salix* sp.), black ash (*Fraxinus nigra*), Canada bluejoint grass (*Calamagrostis Canadensis*), and sedges *(Carex sp.)*.

Seasonally flooded basins (Type 1) and fresh (wet) meadows (Type 2) each represent less than 2 percent of the wetland impacts. The seasonally flooded basins are dominated by aspen (*Populus* sp.) and black ash. Fresh (wet) meadows are dominated by Canada bluejoint grass.

Seven of the 17 wetlands that are proposed to be impacted in the proposed east mine pit expansion area are of moderate quality, with six rated as low quality, and zero rated as high quality. Four of the wetlands were not assessed, but could be at the time of permitting. Disturbances from previous mining activities such as impoundment, excavation, hydrologic alterations, and proximity to roads and other mine features contribute to the moderate and low quality ratings of these wetlands.

TABLE 4.6.10 WETLAND RESOURCES: PROPOSED EAST MINE PIT EXPANSION AREA

Wetland ID	Dominant Circular 39 Type	Wetland Community Type (Eggers & Reed)	Wetland Area (acres)	Overall Wetland Quality	Vegetative Diversity/ Integrity
5	2	Fresh (Wet) Meadow	1.14	Moderate	High
7	5	Shallow Open Water	80.61	Low	Low
16	1	Seasonally Flooded Basin	0.25	Low	N/A
32	3	Shallow Marsh	1.65	N/A	Moderate
33	2	Fresh (Wet) Meadow	0.49	N/A	Low
2008_31	3	Shallow Marsh	38.62	Moderate	Moderate
2008_47	3	Shallow Marsh	1.62	Low	N/A
2008_52	6	Shrub-Carr	48.31	Moderate	Moderate
2008_53	4	Deep Marsh	51.64	Moderate	High
2008_54	1	Seasonally Flooded Basin	5.57	Low	Low
2008_55	2	Fresh (Wet) Meadow	0.73	Low	Low
2008_56	2	Fresh (Wet) Meadow	0.98	Low	Low
2008_57	3	Shallow Marsh	21.52	Moderate	Moderate
2008_58	6	Shrub-Carr	3.75	Moderate	Moderate
2008_62	6	Shrub-Carr	0.17	N/A	N/A
2008_63	2	Fresh (Wet) Meadow	0.76	Moderate	Moderate
2008_60	6	Shrub-Carr	0.14	N/A	N/A

Proposed East Stockpile

To construct the proposed east stockpile the Project Proposer must first drain the wetlands within the footprint of the stockpile. This would be completed by first removing a beaver dam that is holding water back in the proposed east stockpile. Water would naturally drain from the wetlands to Reservoir Five. Additional water would need to be pumped to Reservoir Five to completely remove the water in the wetlands. It is estimated the draining/pumping of the wetlands would require approximately two months. The draining of the wetlands would also drain wetlands connected to those within the footprint of the proposed east stockpile, specifically to the northwest, north, and east.

Upon draining the water from the wetlands, a base is constructed for the stockpile using surface overburden from the mine pit. In areas adjacent to the remaining wetlands within the stockpile a gentle slope (approximately 5 to 1) is used to create a buffer around the wetlands. The slope is seeded with native vegetation and maintained for approximately 50 feet from the wetland prior to beginning the stockpile. Upon completion of the upland buffer the wetlands would be allowed to naturally refill. Should the construction be completed during a dry period, the Project Proposer would pump water back into the wetlands from Reservoir Five or the Stevenson Pit to restore wetland hydrology. Monitoring of the wetlands before and after this construction would determine if a change has occurred to the remaining wetlands requiring additional wetland compensation.

A total of 23 wetlands encompassing 446.71 acres would be impacted from the Proposed Project in the proposed east stockpile area; see Table 4.6.11 and Figure 4.6.5. Wetland impacts would occur to these wetlands from the placement of surface overburden stripped from the mine.

The predominant wetland community in the proposed east stockpile area is shallow open water/deep marsh (Type 4/5), making up 68 percent of the wetland impacts. Four shallow open water wetlands exist and contain little vegetation overall, with some American white water lily (*Nymphaea odorata*) present along the edge of the wetlands.

Shallow marsh communities (Type 3) make up 21 percent of the wetland impacts and are dominated by cattails, reed canary grass (*Phalaris arundinacea*), and lake sedge (*Carex lacustrus*). Shrub-carr and alder thicket wetlands (Type 6) make up approximately 10 percent of the wetland impacts in the proposed east stockpile. Dominant vegetation species in these community types are willow, speckled alder (*Alnus rugosa*), leather leaf (*Chamaedaphne calyculata*), tussock sedge (*Carex stricta*), sensitive fern (*Onoclea sensibilis*), and sphagnum moss. Three fresh (wet) meadows represent 1 percent of the wetland impacts in the proposed east stockpile. These communities are dominated by tussock sedge, reed canary grass, and cattail.

TABLE 4.6.11 WETLAND RESOURCES: PROPOSED EAST STOCKPILE AREA

Wetland ID	Dominant Circular 39 Type	Wetland Community Type (Eggers & Reed)	Wetland Area (acres)	Overall Wetland Quality	Vegetative Diversity/ Integrity
18	2	Fresh (Wet) Meadow	3.52	Moderate	Moderate
2008_13	6	Alder Thicket	17.83	High	Moderate
2008_22	6	Shrub-Carr	5.21	Moderate	Moderate
2008_23	3	Shallow Marsh	6.56	Moderate	Low
2008_24	3	Shallow Marsh	2.32	Moderate	Low
2008_25	3	Shallow Marsh	24.0	Low	Low
2008_26	2	Fresh (Wet) Meadow	3.15	Low	Low
2008_27	3	Shallow Marsh	5.01	Low	Low
2008_28	5	Deep Marsh	5.86	Low	Low
2008_29	5	Deep Marsh	12.77	Low	Low
2008_30	3	Shallow Marsh	1.68	Low	Low
2008_31	3	Shallow Marsh	51.97	Moderate	Moderate
2008_32	6	Shrub-Carr	0.13	Low	Low
2008_33	6	Shrub-Carr	21.06	High	Moderate
2008_34	2	Fresh (Wet) Meadow	0.04	Low	Low
2008_37	5	Deep Marsh	4.75	Low	Moderate
2008_38	5	Deep Marsh	3.45	Low	Moderate
2008_39	5	Shallow Open Water	98.62	Moderate	Moderate
2008_40	5	Shallow Open Water	135.46	Moderate	Moderate
2008_41	5	Shallow Open Water	42.64	Moderate	Moderate
2008_42	6	Shrub-Carr	0.17	Low	Low
2008_43	3	Shallow Marsh	0.14	Low	Low
2008_21	5	Shallow Open Water	0.37	Low	Moderate

Proposed South Mine Pit Expansion

The proposed south mine pit expansion area includes seven impacted wetlands encompassing 34.47 acres; see Table 4.6.12 and Figure 4.6.6. Impacts to these wetlands would occur during the removal of surface overburden to access the taconite ore body. Impacts would also occur to two deep water habitats adjacent to this area.

Most of the proposed wetland impacts (72 percent) from the proposed south mine pit expansion would be to deep water habitats. The remaining impacts would be to shallow marsh (Type 3) and shrub-carr (Type 6) wetlands.

TABLE 4.6.12 WETLAND RESOURCES: PROPOSED SOUTH MINE PIT EXPANSION AREA

Wetland ID	Dominant Circular 39 Type	Wetland Community Type (Eggers & Reed)	Wetland Area (acres)	Overall Wetland Quality	Vegetative Diversity/ Integrity
2008_16	6	Shrub-Carr	1.38	Moderate	Moderate
2008_17	3	Shallow Marsh	7.94	Moderate	Low
2008_18	6	Shrub-Carr	0.08	Low	Low
2008_19	6	Shrub-Carr	0.04	Low	Low
2008_20	3	Shallow Marsh	0.05	Low	Low
2008_66	DW	Deep Water	17.19	N/A	N/A
2008_69	DW	Deep Water	7.79	N/A	N/A

Proposed South Stockpile

Three wetlands totaling 10.91 acres in the proposed south stockpile area would be impacted from the Proposed Project; see Table 4.6.13 and Figure 4.6.7. Impacts to these wetlands would occur from the placement of surface overburden stripped from the mine.

The majority (87 percent) of the proposed wetland impacts would occur to one high quality hardwood swamp (Type 7) wetland that is dominated by black ash, willows, reed canary grass, and sphagnum moss. The remaining proposed impacts would occur to two shallow marsh (Type 3) wetlands that are dominated by cattail and sedges. The shallow marsh basins are disturbed, as one is in an excavated ditch and the other is partially excavated.

TABLE 4.6.13 WETLAND RESOURCES: PROPOSED SOUTH STOCKPILE AREA

Wetland ID	Dominant Circular 39 Type	Wetland Community Type (Eggers & Reed)	Wetland Area (acres)	Overall Wetland Quality	Vegetative Diversity/ Integrity
2008_14	3	Shallow Marsh	0.45	Low	Moderate
2008_15	3	Shallow Marsh	0.93	Low	High
2008_44	7	Hardwood Swamp	9.53	High	Moderate

Tailings Basin

The area adjacent to the tailings basin contains five wetland basins totaling 136.3 acres that have been used as mitigation for previous wetland impacts. These wetlands were first identified and created in 2000 on the old tailings surface. One wetland from these newly created wetlands would be impacted from the Proposed Project; this area totals 1.80 acres and would require mitigation. Table 4.6.14 summarizes the wetlands located within this area and Figure 4.6.8 shows the location of the proposed wetland impact.

The area adjacent to the tailings basin contains five wetland basins totaling 136.3 acres that have been used as mitigation for previous wetland impacts. One wetland would be impacted, from these newly created wetlands, for a total of 1.80 acres from the Proposed Project that would require mitigation.

TABLE 4.6.14 WETLAND RESOURCES: TAILINGS BASIN AREA

Wetland ID	Dominant Circular 39 Type	Wetland Community Type (Eggers & Reed)	Total Wetland Area (acres)	Wetland Impact
Tailings Basin 1	4	Deep Marsh	43.2	1.8
Tailings Basin 2	3	Shallow Marsh	53	0
Tailings Basin 3	4	Deep Marsh	22.8	0
Tailings Basin 4	4	Deep Marsh	15.4	0
Tailings Basin 5	3	Shallow Marsh	1.9	0

TABLE 4.6.15 SUMMARY OF WETLAND IMPACTS (PROPOSED PROJECT)

Project Area	Circular 39	1	2	2	3	4	5	6	6	7			
	Eggers and Reed Wetland Classification	Seasonally Flooded Basin	Fresh (Wet) Meadow	Sedge Meadow	Shallow Marsh	Deep Marsh	Shallow Open Water	Shrub-Carr	Alder Thicket	Hardwood Swamp	Wetland Total	Deep water Habitat	Total
Plant Area	Area (acres)	0	0	0	3.38	0	6.09	0	0	0	9.47	0	9.47
	% of impact area	0.0%	0.0%	0.0%	35.5%	0.0%	64.5%	0.0%	0.0%	0.0%	100%	0%	100%
	# of wetlands	0	0	0	1	0	1	0	0	0	3	0	3
Proposed East Mine Pit Expansion	Area (acres)	5.82	4.1	0	63.41	51.64	80.61	52.37	0	0	257.95	0	257.95
	% of impact area	2.3%	1.6%	0.0%	23.7%	20.3%	31.6%	20.6%	0.0%	0.0%	100%	0%	100%
	# of wetlands	2	5	0	4	1	1	4	0	0	17	0	17
Proposed East Stockpile	Area (acres)	0	6.71	0	91.68	26.83	277.09	26.57	17.83	0	446.71	0	446.71
	% of impact area	0.0%	1.5%	0.0%	20.5%	6.0%	62.1%	5.9%	4.0%	0.0%	100%	0%	100%
	# of wetlands	0	3	0	7	4	4	4	1	0	23	0	23
Proposed South Mine Pit Expansion	Area (acres)	0	0	0	7.99	0	0	1.50	0	0	9.49	24.98	34.47
	% of impact area	0.0%	0.0%	0.0%	23.2%	0.0%	0.0%	4.4%	0.0%	0.0%	27.5%	72.5%	100%
	# of wetlands	0	0	0	2	0	0	3	0	0	5	2	7
Proposed South Stockpile	Area (acres)	0	0	0	1.38	0	0	0	0	9.53	10.91	0	10.91
	% of impact area	0.0%	0.0%	0.0%	12.6%	0.0%	0.0%	0.0%	0.0%	87.4%	100%	0%	100%
	# of wetlands	0	0	0	2	0	0	0	0	1	3	0	3
Tailings Basin	Area (acres)	0	0	0	0	1.8	0	0	0	0	1.80	0	1.8
	% of impact area	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100%	0%	100%
	# of wetlands	0	0	0	0	1	0	0	0	0	1	0	1
Total	Area (acres)	5.82	10.81	0	167.84	82.31	363.93	80.44	17.83	9.53	736.33	24.98	761.31
	% of impact area	0.8%	1.4%	0.0%	22.0%	10.5%	47.8%	10.6%	2.3%	1.3%	96.7%	3.3%	100%
	# of wetlands	2	8	0	16	6	6	11	1	1	51	2	53

4.6.2.1.2 Potential Indirect Impacts

To address the potential for additional future wetland impacts to wetlands other than the direct effects described above (i.e., indirect impacts), the Project Proposer was directed to complete an assessment of these potential impacts. Results of the assessment are found in the Indirect Wetland Impact Study (see EIS Related Studies section of the FEIS).

The results of the Indirect Wetland Impact Study concluded that potential indirect wetland impacts exist from alterations to groundwater and surface water surrounding the Proposed Project boundaries. However, the study was inconclusive to quantify the impacts, and therefore wetland monitoring would be conducted as part of the Proposed Project. Additional information on proposed monitoring and mitigation of potential indirect impacts is provided in Section 4.6.3.2.

Figure 4.6.9 and Table 4.6.16 depict a total of 174.6 acres of wetlands that have been monitored since 2008. These wetlands would continue to be monitored according to requirements established in the Section 404 permit. To assist with monitoring for future impacts, monitoring wells have been installed as shown on Figure 4.6.9.

TABLE 4.6.16 PROPOSED PROJECT MONITORED WETLANDS

Wetland ID	Dominant Circular 39 Type	Wetland Community Type (Eggers & Reed)	Wetland Area (acres)	Overall Wetland Quality	Vegetative Diversity/ Integrity
7	3	Shallow Marsh	2.49	Low	N/A
16	5	Deep Marsh	9.62	Moderate	Moderate
18	3	Shallow Marsh	3.88	Moderate	Moderate
17	3	Shallow Marsh	83.81	Moderate	Moderate
32	5	Shallow Open Water	13.96	Moderate	Moderate
33	6	Shrub-Carr	35.08	Moderate	Moderate
2008_66	DW	Deep Water	25.79	Moderate	High

4.6.2.2 East Stockpile Alternative

4.6.2.2.1 Potential Direct Impacts

The East Stockpile Alternative would alter the size of the proposed east stockpile area by creating a smaller overall stockpile footprint disturbing less total area and wetlands as shown on Figure 4.6.10. The East Stockpile Alternative would not change the size of disturbed areas or amount of impacts to wetlands for the other areas of the Proposed Project including: the plant, east mine pit expansion, south mine pit expansion, south stockpile, or tailings basin. The East Stockpile Alternative would disturb twenty wetland basins totaling 346.1 acres. Table 4.6.17 summarizes the functional ratings of each impacted wetland for the East Stockpile Alternative.

TABLE 4.6.17 EAST STOCKPILE ALTERNATIVE RATING SUMMARY

Total # of Wetlands	Impact Area (acres)	Vegetative Diversity/ Integrity	Overall Wetland Quality
20	346.1	Exceptional **0**	Exceptional **0**
		High **0**	High 0
		Moderate **8**	Moderate **7**
		Low **11**	Low **12**
		No Assessment **1**	No Assessment **1**

Table 4.6.18 and Figure 4.6.10 identifies the wetlands that would be impacted with the East Stockpile Alternative.

TABLE 4.6.18 WETLAND RESOURCES: EAST STOCKPILE ALTERNATIVE

Wetland ID	Dominant Circular 39 Type	Wetland Community Type (Eggers & Reed)	Wetland Area (acres)	Overall Wetland Quality	Vegetative Diversity/ Integrity
18	2	Fresh (Wet) Meadow	3.52	Moderate	Moderate
2008_21	5	Shallow Open Water	0.37	Low	Moderate
2008_22	6	Shrub-Carr	5.21	Moderate	Moderate
2008_23	3	Shallow Marsh	6.56	Moderate	Low
2008_24	3	Shallow Marsh	2.32	Moderate	Low
2008_25	3	Shallow Marsh	24.0	Low	Low
2008_26	2	Fresh (Wet) Meadow	3.15	Low	Low
2008_27	3	Shallow Marsh	5.01	Low	Low
2008_28	5	Deep Marsh	5.86	Low	Low
2008_29	5	Deep Marsh	12.77	Low	Low
2008_30	3	Shallow Marsh	1.68	Low	Low
2008_31	3	Shallow Marsh	34.28	Moderate	Moderate
2008_32	6	Shrub-Carr	0.13	Low	Low
2008_37	5	Deep Marsh	1.58	Low	Moderate
2008_38	5	Deep Marsh	3.45	Low	Moderate
2008_39	5	Shallow Open Water	98.62	Moderate	Moderate
2008_40	5	Shallow Open Water	135.44	Moderate	Moderate
2008_41	5	Shallow Open Water	1.84	Moderate	Moderate
2008_42	6	Shrub-Carr	0.17	Low	Low
2008_43	3	Shallow Marsh	0.14	Low	Low

A total of 100.6 acres of wetland impacts would be avoided with the East Stockpile Alternative, including 38.89 acres of high quality wetland impacts when compared to the proposed east stockpile. Table 4.6.19 identifies the wetlands that would be impacted by the Proposed Project, but would not be impacted with the East Stockpile Alternative. The potential effects from the East Stockpile Alternative would be adverse and significant with effects similar to those of the Proposed Project. Monitoring and mitigation would be required.

TABLE 4.6.19 WETLANDS NOT IMPACTED UNDER EAST STOCKPILE ALTERNATIVE

Wetland ID	Dominant Circular 39 Type	Wetland Community Type (Eggers & Reed)	Wetland Area (acres)	Overall Wetland Quality	Vegetative Diversity/ Integrity
2008_13	6	Alder Thicket	17.83	High	Moderate
2008_31	3	Shallow Marsh	17.69	Moderate	Moderate
2008_33	6	Shrub-Carr	21.06	High	Moderate
2008_34	2	Fresh (Wet) Meadow	0.039	Low	Low
2008_37	5	Deep Marsh	3.17	Low	Moderate
2008_41	5	Shallow Open Water	40.8	Moderate	Moderate

4.6.2.2.2 Potential Indirect Impacts

In addition to identifying direct wetland impacts, Figure 4.6.10 highlights 275 acres of wetland adjacent to the East Stockpile Alternative that would be monitored to quantify any future wetland impacts or degradation from indirect impacts, similar to the discussion in Section 4.6.2.1.2. As shown in Table 4.6.20 and on Figure 4.6.10, the East Stockpile Alternative requires an additional 100 acres of wetland that would need monitoring.

TABLE 4.6.20 EAST STOCKPILE ALTERNATIVE MONITORED WETLANDS

Wetland ID	Dominant Circular 39 Type	Wetland Community Type (Eggers & Reed)	Wetland Area (acres)	Overall Wetland Quality	Vegetative Diversity/ Integrity
17	3	Shallow Marsh	2.49	Low	N/A
2008_34	2	Fresh (Wet) Meadow	0.039	Low	Low
2008_41	5	Shallow Open Water	54.77	Moderate	Moderate
2008_45	5	Deep Marsh	9.62	Moderate	Moderate
2008_46	3	Shallow Marsh	3.88	Low	Low
2008_37	5	Deep Marsh	3.17	Low	Moderate
2008_31	3	Shallow Marsh	101.29	Moderate	Moderate
2008_33	6	Shrub-Carr	21.06	High	Moderate
2008_13	6	Alder Thicket	17.83	High	Moderate
2008_53	4	Deep Marsh	25.79	Moderate	High
2008_52	6	Shrub-Carr	35.08	Moderate	Moderate

4.6.3 Monitoring and Mitigation

As discussed in Section 4.6.1.2, three government agencies have jurisdiction over wetland impacts for the Proposed Project. The MNDNR, USACE, and MPCA would need to review and approve the Project Proposer's wetland mitigation plan to satisfy replacement requirements of the unavoidable wetland impacts.

As the WCA jurisdictional agency, the MNDNR uses a technical evaluation panel (TEP) process to provide technical expertise and comments in evaluating wetland impact projects. The TEP is typically comprised of a wetland specialist from the county Soil and Water Conservation District (or similar department within the county government where the project occurs), a BWSR wetland specialist, and a MNDNR Regional Environmental Assessment Ecologist. In some cases there are several other agencies involved in assessing the projects as part of the TEP including: highway departments, public works departments, planning and zoning departments, the MPCA, and the USACE.

> Unavoidable wetland and deep water impacts from the Proposed Project totaling 761.31 acres (Table 4.6.15) must be mitigated. This amount could be reduced by 100.6 acres using the East Stockpile Alternative. The mitigation ratio (the amount of wetland compensation to replace impacted wetlands) is determined in the permitting/approval process to ensure that equivalent amounts and type of wetland functions are replaced.

During environmental review, comments from TEP members are made directly to the lead staff of the MNDNR. After environmental review comments are submitted, but before a permit to mine or permit amendment is issued, the wetland mitigation plan is distributed to the TEP for additional review and comment. Comments from the TEP on the wetland mitigation plan including any objections to the amount of credit and how credit was determined are sent to the MNDNR Lands and Minerals (LAM). In general, replacement credit under WCA follows part 8420.0522, subp. 4 Replacement Ratios and part 8420.0526 Actions Eligible for Credit. Comments are discussed and issues worked out prior to making a final decision. MNDNR LAM considers comments from the TEP, USACE, MPCA, other MNDNR divisions, other agencies, and the public prior to making a decision on the wetland mitigation plan.

The wetland mitigation plan is used during the federal and state permitting/approval processes to assess wetland impacts and determine appropriate mitigation. USACE compensatory wetland mitigation is regulated by 33 CFR 332.3(n), which describes the use of financial assurances. In the state permitting process for WCA, Minnesota Rules, part 8420.0552 sets forth replacement standards and requires financial assurances to ensure successful wetland replacement. Additionally, the MNDNR has the authority through the Permit to Mine process to require a performance bond as means to ensure compliance with Minnesota Rules Chapter 6130, which includes successful completion of reclamation and closure activities.

4.6.3.1 Mitigation of Direct Wetland Impacts

As evaluated in this section wetland impacts and deep water habitat impacts totaling 761.31 acres have been identified for the Proposed Project. An additional 174.6 acres of wetlands and deep water habitat located adjacent to the Proposed Project would be monitored for future impacts from activities of the Proposed Project. These could require additional compensation if determined necessary based on monitoring results.

Unavoidable wetland and deep water habitat impacts from the Proposed Project must be mitigated as required by state and federal regulatory requirements. The mitigation ratio (the amount of wetland and deep water habitat that must be created, restored, enhanced, or preserved to replace impacted wetlands and deep water habitats) is determined in the permitting/approval processes. The processes also ensure that equivalent wetland types are created. For example, shallow marsh wetland would be replaced with shallow marsh wetland.

The mitigation ratio is also influenced by a number of other considerations, including:
- whether mitigation is completed concurrently or prior (in-advance) to wetland impacts,
- location of the mitigation wetlands relative to the impact wetlands (in-place),
- the type of mitigation wetlands relative to the impact wetlands (in-kind) and,
- The type of mitigation proposed – creation, restoration, or preservation.

The overall goal of the regulations is to replace wetland impacts with wetlands that are of the same type, provide similar functions, and are of comparable or better quality compared to the impacted wetlands. Onsite wetland mitigation would be accomplished primarily by developing wetlands within the inactive areas of the tailings basin. As noted above, the MNDNR and USACE have been working with the Project Proposer since 2000 on establishing wetlands in the inactive area of the tailings basin, which is shown on Figure 4.6.8.

In the mid 1990s, the current tailings basin dam was constructed leaving a large inactive area of tailings around the west, south, and east sides of the dam. After a few years of inactivity the Project Proposer observed wet areas on the old tailings and recognized the opportunity to create wetlands in this inactive area. Around 2000, the MNDNR and USACE accepted a proposal from the Project Proposer to create wetlands in the inactive area of the tailings basin to compensate for future impacts. Since the area was still within the current facility limit of the Permit to Mine, the USACE and MNDNR determined that any wet areas that developed since the mid 1990s were not jurisdictional wetlands and could be managed to create mitigation wetlands.

> The amount of on-site wetland mitigation credit approved by the MNDNR, USACE, and the MPCA would be determined in the next 5-10 years based on the success of the Project Proposer's Wetland Mitigation Establishment Plan.

Using this same concept, the Project Proposer indentified similar wet areas throughout the inactive area of the tailings basin in 2005 and 2008, as shown on Figure 4.6.8. As in 2000, the MNDNR and USACE determined that these wet areas did not meet the definition of a wetland (i.e., lacked wetland soils and wetland vegetation). The 2005 and 2008 wetlands undergo annual monitoring to track the progression of wetland hydrology and functional status.

Based on the monitoring conducted to date, and a proposal submitted by the Project Proposer to enhance these wetlands, it is estimated that the 2005 and 2008 wetlands would be fully functional and approved by the MNDNR, USACE, and the MPCA with 5-10 years as mitigation wetlands for a portion of the Proposed Project impacts. The proposal submitted by the Project Proposer is the Wetland Mitigation Establishment Plan and is found in Appendix I of the FEIS. This plan identifies the establishment efforts and ongoing maintenance that would occur to meet the mitigation goals.

A macro scale analysis (Barr, 2010D and Liesch, 2010) across the entire tailings basin representing post-closure conditions (i.e., at closure of the mine, pumping of water into the tailings basin would cease) was completed to determine the percent contribution the inner tailings basin has to the hydrology of the outer tailings basin wetlands following closure of the mine. The analysis indicates that approximately 50-60 percent of the water added to the outer tailings basin is from the inner tailings basin. While this appears to be a large contribution, it is unknown what impact the loss of water input during mining has on hydrology to an individual wetland basin. A micro scale analysis of each wetland creation in the outer tailings basin would need to be completed and submitted to the USACE, MNDNR, and MPCA prior to issuance of the ROD, WCA approval, and Section 401 Certification. This micro scale analysis would evaluate the hydrology inputs, output mechanisms, depth of water, and topography of each wetland basin to demonstrate that wetland hydrology and vegetation would be unaffected after mine closure. If this micro scale analysis determines that the loss of hydrology after mine closure is significant, additional off site wetland compensation would be required. Prior to the approval of wetland credits in the outer tailings basin, a final wetland determination and evaluation, such as MNRAM would be completed.

Based on the success of the Wetland Mitigation Establishment Plan (listed in the EIS Related Studies section of the FEIS), the amount of onsite wetland compensation credit approved by the MNDNR, USACE, and the MPCA would be determined in the next 5-10 years. If all of the wetland creation in the tailings basin is successful, which would be determined over the next 5-10 years, wetland compensation credit would total approximately 437 acres in that location, a credit amount equal to 75 percent of the wetland area created. The 75 percent credit amount was determined through concurrence with WCA rules and USACE St. Paul District policy.

An additional 324 acres of wetland compensation credit off-site is necessary to meet compensatory wetland mitigation requirements. A lower compensation credit, or likely minimum, would be administered by the regulatory agencies if not all of the performance standards for the created wetlands are met. It has been determined that this minimum would be approximately 20 percent compensation credit indicating that the Project Proposer would likely receive between 20-75 percent compensation credit for the on site wetland creation based on success. The Project Proposer would have to provide off-site compensation if and when it is determined the performance standards would not be met in any or all created wetlands.

Several off-site mitigation options were evaluated by the Project Proposer that were all within the same Wetland Bank Service Area as the proposed wetland impacts. The Wetland Mitigation Plan (Barr, 2009FF) found in Appendix J of the FEIS, identifies the properties evaluated for off site wetland mitigation. Off-site wetland mitigation would be accomplished through a combination of wetland creation and wetland restoration at a site in Aitkin County identified as the Palisade Site in the Wetland Mitigation Plan.

Table 4.6.21 summarizes the Project Proposer's wetland mitigation proposal applying a 1:1 mitigation ratio to all wetland impacts and the maximum allowable compensation credit of 75 percent for created wetlands. Deep water habitat impacts totaling 25 acres would be mitigated for upon closure of the mine pits at which time they would fill with water creating deep water habitat.

TABLE 4.6.21 WETLAND MITIGATION PLAN

Wetland Communities	Proposed Project and No Action Alternative Wetland Impact (ac)	Proposed On-Site Mitigation	75% Compensation Credit	Minimum Proposed Off-Site Mitigation
Seasonally Flooded (Type 1)	5.8	5.1	3.83	0.7
Wet Meadow (Type 2)	10	99.0	74.25	118.43
Shallow Marsh (Type 3)	172.1	84.6	63.45	108.65
Deep Marsh (Type 4)	76.7	27.0	20.25	56.45
Shallow, Open Water (Type 5)	363.43	0.0	0	20.7
Shrub Carr (Type 6)	86.4	296.1	222.08	0.0
Alder Thicket (Type 6)	17.8	20.6	15.45	0.0
Hardwood Swamp (Type 7)	9.5	26.7	20.02	0.0
Coniferous Swamp (Type 7)	0.0	23.3	17.48	0.0
Total	**741.73**	**582.4**	**436.8**	**304.93**

4.6.3.2 Monitoring and Mitigation for Indirect Impacts

In some areas adjacent to the Proposed Project boundaries, groundwater drawdown and surface water flooding could occur that would indirectly impact adjacent wetlands. To monitor these potential future indirect impacts, monitoring wells would be installed and monitored to document the effect on adjacent wetlands as shown in Figure 4.6.9.

Hydraulic monitoring began in 2008 by the Project Proposer in wetlands adjacent to the Proposed Project boundaries to document and compare water elevations pre and post project. Monitoring wells were installed in wetland basins in 2008 and water level measurements are recorded approximately every four hours from May to October at each wetland. Additional monitoring would occur regularly, as determined during permitting, to ensure additional sedimentation, fill impacts, and/or increased hydrology from the Proposed Project have not occurred.

If water level monitoring data indicates additional wetland drainage due to groundwater drawdown, mitigation measures such as a cut-off wall constructed near the edge of the pit adjacent to the wetlands could be considered to minimize subsurface drainage. If additional drainage due to groundwater drawdown occurs, additional wetland mitigation would be required.

In areas where surface water drainage patterns may be altered as a result of the Proposed Project, additional impacts to wetlands could be avoided or mitigated by implementing practices that would not impact wetland hydrology. The construction of outlets may be necessary to maintain wetland hydrology in wetlands that are likely to become wetter due to the Proposed Project. Also, to minimize potential for surface drainage of wetlands located directly adjacent to mine pits, low-permeability berms could be constructed along the edge of the remaining wetlands.

Any Section 401, Section 404 or WCA permits or approvals that may be issued to the Project Proposer would require ongoing wetland monitoring for potential indirect impacts. Monitored wetlands for the Proposed Project are shown in Table 4.6.16 and Table 4.6.20 for the East Stockpile Alternative. Multiple CWA and WCA permitting/approval processes would occur during the 5-year mining periods of the Proposed Project. Should additional impacts be recognized during one of the mining periods, additional monitoring wells may be needed and a revision to the monitoring plan completed.

4.6.3.3 Monitoring and Mitigation for Temporary Impacts

Wetlands in the area northwest, north, and east of the proposed east stockpile would experience a temporary impact from the removal of water. WCA allows for temporary impacts for up to six months without requiring mitigation. The USACE St. Paul District Office has required compensation for temporary impacts to wetlands (6 months or less) in the past for other projects. The replacement ratios used range from 0.1:1 to 0.5:1. Monitoring of temporary impacts would occur to quantify the extent and duration of the impacts.

4.7 WILD RICE

4.7.1 Introduction

Wild rice has cultural, ecological, and economic importance to Ojibwe and non-Ojibwe people in Minnesota. Culturally, the Ojibwe people have a strong spiritual tie to wild rice. Ecologically, wild rice provides food and habitat for many fish and wildlife species. Economically, wild rice harvesting and sale benefits Minnesota's economy. Wild rice is present throughout Minnesota, with a greater amount of waters containing wild rice located in central and northeastern portions of the state (MNDNR, 2008A).

> Wild rice is spiritually and culturally significant to Ojibwe in Minnesota, throughout the U.S. Midwest, and parts of Canada. It is a central theme in their cultural and spiritual identity.

Four water bodies that receive discharges from Keetac have been identified as containing wild rice: Swan Lake, Swan River, Hay Creek, and Hay Lake. The presence of wild rice in these water bodies was identified after the completion of the SEAW and FSDD. Wild rice is a resource that has a potential to be impacted by the Proposed Project, therefore the MNDNR and USACE determined that an evaluation of potential impacts should be included in the FEIS.

Potential impacts on wild rice were evaluated through review of the following project-related studies.

- Water Balance/Mine Yield Study (Liesch, 2009D)
- No Action Alternative Memo (Liesch, 2009A)
- Water Quantity and Quality Report (Liesch, 2009C)
- Wild Rice and Sulfate Data Submittal (Barr, 2009W)
- Hay Lake Sulfate Report (Liesch, 2009E)
- Hay Lake/Swan Lake Sulfate Concentration Memo (Barr, 2009EE)
- Wild Rice in Swan Lake Study (Crotteau, 2009A)
- Wild Rice in Hay Lake and Hay Creek Study (Crotteau, 2009B)

Other wild rice-related studies were also reviewed to assess Proposed Project impacts, including Natural Wild Rice In Minnesota (MNDNR, 2008A); and Wild Rice Harvester Survey (MNDNR, 2006A). Additionally, as part of a literature review that occurred after the publication of the DEIS, over 40 wild rice related studies and reports were reviewed, and then summarized for consideration during analysis of the potential impacts from the Proposed Project. A complete list of project-related studies and additional literature used to evaluate potential impacts on wild rice can be found in Chapter 8 – References, and the wild rice literature summaries are included in Appendix M of the FEIS.

Potential cumulative effects to Swan Lake and Swan River are expected from both the Proposed Project and Essar Steel Project. A discussion of the cumulative effects on wild rice is provided in Section 5.4.

4.7.2 Wild Rice as a Resource

In Minnesota, wild rice is recognized as an important resource by many groups. Values placed on wild rice by these different groups are discussed in the following paragraphs.

4.7.2.1 Ojibwe Cultural Value

Wild rice is spiritually and culturally significant to the Ojibwe in Minnesota, and throughout the U.S. Midwest, as well as parts of Canada. It is a central theme in their cultural and spiritual identity. The Ojibwe migratory story tells how Ojibwe came from "the East" to the place of "the food that grows on water" (Benton-Banni, 1988). Wild Rice is "manoomin" in Ojibwe and is considered a special gift from the Creator (Ackley, 2000; Schlender, 2000).

A Trygg map indicates there was one Native American village along the Swan River at the outlet of Swan Lake (Barr, 2009W). A "Chippewa Indian House" is also identified at this location. It is likely the camp was used as a "Ricing Camp", which is a site traditionally used by bands to stay during the ricing season, as well as a location for other hunting/gathering activities during other parts of the year (Vennum, 1988, follow up discussion with biologists from Leech Lake Band, Bois Forte and 1854 Authority, September 2009). Trygg maps typically under-represent the presence of villages as more may have been in the area. Hay Lake could have also served as a wild rice harvesting area although no villages were identified in the Trygg maps and access to the lake has been limited resulting in little documented use.

Ojibwe Band members make up greater than 60 percent of all wild rice harvesters in Minnesota. Their presence in the harvesting population is a demonstration of the importance of wild rice to their community. A more detailed explanation of historic properties is provided in sections 4.17 and 4.18.

4.7.2.2 Economic Value

> There were over 1,600 non-tribal annual license holders in 2006, which harvested, on average, 450 pounds of wild rice per license.

Wild rice has economic value to those who harvest it. Wild rice's economic value in Minnesota is elevated due to its nutritional value and its resistance to spoiling. The value of wild rice as a food source for traditional rituals and daily consumption is high, but it is also valued as a revenue source. Wild rice harvested by hand is sold by tribal communities and by licensed wild rice harvesters throughout the state. There were over 1,600 non-tribal annual license holders in 2006, which harvested on average of 450 pounds of wild rice per license (MNDNR, 2006A). As a commodity, wild rice over the past five years has had a value between $1.00 to $1.50 per pound (MNDNR, 2008A).

Based on a survey of wild rice harvesters completed by the MNDNR in 2006, 11 license holders harvested wild rice on Swan Lake. No license holders were reported on Hay Lake. Contacting the 11 respondents about the value of their harvests was not possible since the survey remained anonymous. While the economic value of the Swan Lake stand has not been calculated, it should be noted that Itasca County accounts for a large portion of the wild rice stands and harvesting within the state. Based on lake surveys and harvester surveys completed by the MNDNR, the counties of Aitkin, Cass, Crow Wing, Itasca, and St. Louis contain over 60 percent of the inventoried waters that contain wild rice in the state. These counties also make up 70 percent of the harvesting trips (MNDNR, 2008A). Although these lakes were inventoried and found to have wild rice, the water bodies are not necessarily designated as wild rice waters in state rules. A listing of designated wild rice waters can be found in Minnesota Rules, part 7050.0470. None of the water bodies affected by the Proposed Project are listed as wild rice waters in Minnesota Rules.

4.7.2.3 Environmental Value

The presence of wild rice stands can improve the habitat and water quality of a water body. Wild rice is a key component to the ecology of a water body due to its ability to provide shelter for organisms in the water, be a major food source, and serve as a natural windbreak.

Wild rice has been noted as a top-ten food source for migrating waterfowl based on its nutritional value for a variety of species (MNDNR, 2008A). Several species rely heavily on wild rice stands to provide the nutrients needed during long migration seasons. As a result of these benefits, waterfowl target these water bodies. Wild rice is sought out by waterfowl groups, such as Ducks Unlimited and Minnesota Waterfowl Association, due to its ability to attract migrating waterfowl. This has lead to companies now providing native wild rice to area wildlife managers (i.e., MNDNR Wildlife Area Manager, USFWS Refuge Managers) to initiate the establishment of wild rice stands in water bodies. In addition to waterfowl, wild rice stands provide habitat for aquatic organisms and protection for fish against predators.

Along with its habitat benefits, dense wild rice stands, like many types of emergent vegetation, serve as a natural windbreak for shorelines. Its ability to serve as a natural windbreak limits turbulence in the water column, and reduces erosion along shorelines (MNDNR, 2008A).

4.7.2.4 Preferred Habitat and Life Cycle

The presence of wild rice stands can improve the habitat and water quality of a water body. Wild rice is a key component to the ecology of a water body due to its ability to provide shelter for organisms in the water, be a major food source, and serve as a natural windbreak. Wild rice has been noted as a top ten food source for migrating waterfowl based on its nutritional value for a variety of species.

Wild rice requires specific habitat conditions for optimum growth. A description of wild rice habitat and life cycle is summarized here based on information developed by the MNDNR report in 2008.

Wild rice may be found growing on a wide variety of water body bottom types, but it grows best over several inches of soft organic muck. Clear to moderately stained water is preferred, as darkly stained water can limit sunlight penetration and impact early plant development. Wild rice typically requires the presence of some moving water and grows best in depths of 0.5 to 3.0 feet of water, with early summer water depths being especially critical (Moyle, 1944a).

Water levels that are relatively stable or decline slowly throughout the growing season are preferred, as abrupt water level increases during the early part of the growing season can uproot young plants. Rivers, flowages, and lakes with an inlet and outlet provide the most optimal habitats for wild rice growth.

Wild rice is an annual plant that develops in the spring from a seed that dropped off the plant the previous fall. The seed requires a dormancy period of three to four months in 35 degrees Fahrenheit or colder water before germinating in the spring when water temperatures reach 40 degrees Fahrenheit.

The plant goes through several distinct growth phases during its life cycle. During the submerged leaf stage in late May to early June, a cluster of underwater leaves forms. The floating leaf stage typically begins in mid-June as floating leaves develop and lay flat on the water surface. This is when wild rice is most susceptible to being uprooted by rapidly rising water levels or high winds.

Aerial shoots typically begin to develop by the end of June and grow to a height of two to eight feet above the water surface by August. Wild rice begins to flower by late July and the seeds develop in August and September. The wild rice seeds on the same plant mature across a staggered time period, ensuring that some seeds survive changing environmental conditions to perpetuate the stand. Some seeds may remain dormant in the bottom sediment for many years to several decades if conditions are not suitable for germination, thus allowing wild rice populations to survive through time periods with less than optimal conditions and reduced seed productivity. The time period from germination to dropping of mature seeds ranges from about 110 to 130 days, depending upon environmental conditions. Even under ideal growing conditions, wild rice stands undergo approximately three to five year cycles in which seed productivity varies. A typical cycle includes a high production year followed by a low production year, which is followed by a gradual increase in productivity.

Two potential outcomes of the Proposed Project are thought to have the potential to influence the health of wild rice: 1) increased water levels and 2) increased sulfate concentrations. Other changes, such as loss of genetic diversity between stands, introduction of invasive species, and climate change (MNDNR, 2008A) may also influence the health of wild rice but have not been identified as being directly related to the Proposed Project.

Due to the buoyancy of young plants, wild rice is susceptible to fluctuations of water levels during early summer when it is in a floating leaf stage. Rapid water fluctuations of over 0.5 feet can result in uprooting of the plant and limit its potential to produce the kernels harvested for wild rice (MNDNR, 2008A).

Although wild rice can grow at depths greater than three feet, plants growing in deeper water typically have poor seed production and populations of the plant have lower stem density (MNDNR, 2008A). While rapid water level increases are detrimental to wild rice, so are long-term stable water levels. Long-term stable water levels create conditions that favor other aquatic vegetation that may out compete wild rice. There is a significant amount of variability in the established impact on wild rice density based on lake level fluctuations, but it is noted that lake levels do have an impact on wild rice (Moyle, 1944a; Peden, 1982).

A second condition that can impact wild rice stands is a change in water chemistry specifically discharges that release sulfate in concentrations that could impact waters that contain wild rice.

> Swan Lake, Swan River, Hay Creek and Hay Lake were the only identified water bodies that contain wild rice which receive water from the Keetac facility.

A given sulfate concentration however is only part of the picture because sulfate reacts with the existing water chemistry of a given water body. Sulfate has a strong interrelationship with water hardness (calcium and magnesium) and chloride, all considered total dissolved solids (TDS). The interrelationship between the TDS in a water body determines its sulfate toxicity level. Essentially, higher chloride and hardness concentrations in a water body lower the potential for sulfate toxicity.

Initial water quality sampling was completed by the Project Proposer to determine the concentrations of various water quality parameters that would potentially be discharged by the Proposed Project. This initial sampling measured the discharge concentrations from the existing

Keetac facility and evaluated those against water quality standards and loading criteria. Based on the initial sampling, the FSDD determined that sulfate, conductivity, and water hardness would be evaluated in the EIS.

As further described in section 4.4 – Water Quality, numerous water quality parameters were reviewed. In examining the No Action Alternative compared to the Proposed Project, sulfate was determined to be the only water quality parameter that would change with the Proposed Project. Therefore it was evaluated in the EIS.

Several studies (referenced at end of paragraph) have found wild rice in water with sulfate concentrations between 50 mg/L to 282 mg/L. Recent sampling showed sulfate level ranges in Swan and Hay Lake were between 5.8 to 51 and 46 to 78 mg/L, respectively (Barr, 2009W). A thorough literature review revealed that, the effects of sulfate on wild rice growth and production at concentrations similar to those sampled for the Proposed Project are unclear; no long-term studies over the natural cycle of wild rice have been carried out examining this question (Bavin and Berndt, 2008B; Moyle, 1944a; Peden, 1982; Minnesota Power)[2].

As mentioned, two water quality parameters: hardness and chloride, influence the toxicity of sulfate at various concentration levels. Water quality samples taken from the Keetac facility demonstrate chloride and hardness concentrations would continue to be above a concentration of 5 mg/L chloride and 100 mg/L hardness (Liesch, 2009C), thus limiting the potential for sulfate toxicity from increased sulfate discharges. The proposed wet scrubber effluent treatment system would also increase hardness in the tailings slurry water by raising the calcium concentration by 24 mg/L (Liesch, 2009D). This additional calcium would create a higher calcium to magnesium ratio, thus creating a more favorable cation (calcium) for sulfate to bond with in order to form calcium sulfate (CaSO4) (i.e., gypsum). Magnesium sulfate ($MgSO_4$) (i.e., Epsom salt) is a more toxic compound to aquatic plants than calcium sulfate (IDNR, 2009). Without the addition of calcium from the wastewater treatment system, sulfate would be more likely to bond with magnesium, which would create a greater potential for increased sulfate toxicity levels in the water body.

4.7.3 Regulatory Framework

Statewide water quality standards were first adopted in Minnesota in 1967. In 1972, the Clean Water Act (CWA) required the MPCA to amend some of its original water quality standards. Every three years the federal CWA requires states to obtain public comment on, and revise as needed, their water quality standards. This is considered a triennial review.

The MPCA adopted a sulfate standard in 1973 of 10 mg/L (Office of Administrative Hearings, 1997). Minnesota Rules, part 7050.0224, subp. 1 addresses water quality applicable to wild rice:

> *In recognition of the ecological importance of this resource, and in conjunction with Minnesota Indian tribes, selected wild rice waters have been specifically identified [WR] and listed in part 7050.0470, subpart 1. The quality of these waters and the aquatic habitat necessary to support the propagation and maintenance of wild rice plant species must not be materially impaired or degraded.*

[2] Many documents concerning wild rice and sulfate were provided by the Project Proposer to the MNDNR and are available upon request. These documents, including several additional studies were reviewed and summarized. This summary is included in Appendix M.

Minnesota Rules, part 7050.0224, subp. 2 further states:

> *The quality of Class 4A waters of the state shall be such as to permit their use for irrigation without significant damage or adverse effects upon any crops or vegetation usually grown in the waters or area, including truck garden crops. The following standards shall be used as a guide in determining the susceptibility of the waters for such uses….*
>
> *Sulfates (SO_4) – 10 mg/L, applicable to water used for production of wild rice during periods when the rice may be susceptible to damage by high sulfate levels.*

In 1997, a formal rulemaking process to amend Minnesota Rules Chapter 7050 was completed. The Statement of Need and Reasonableness (SONAR) for that process indicated that the numeric sulfate standard was not modified, but that wild rice waters were designated in the Lake Superior Basin in Part 7050.0470 and a narrative describing the importance of wild rice was added to Part 7050.0224. Minnesota Rules Chapter 7052 was also adopted during the 1997 rulemaking process. These rules were adopted as part of the Great Lakes Water Quality Initiative to implement nondegradation standards for pollutants to the Lake Superior Basin.

An NPDES permit from the MPCA would be required for the Proposed Project. The NPDES permit would regulate facility discharge to meet water quality standards. MPCA staff has reviewed and considered the available information for the Proposed Project, including site specific wild rice data and water quality data. Based on the information and data received to date, MPCA staff has determined that it cannot at this time support a sulfate value other than 10 mg/L as the applicable ambient standard for waters used for the production of wild rice that may be impacted by the Proposed Project. The USACE requires a CWA 401 Water Quality Certification before issuance of a CWA Section 404 permit.

Current rules and regulations require the MPCA to develop effluent limitations based on Minnesota state water quality standards for protection of the receiving water for its use classification. In addition, the MPCA may develop standards that are specific to a particular discharge. These standards may be based on toxicity studies, best professional judgment analysis, and in some instances standards developed by other U.S. states or regulatory agencies. Minnesota Rules and the U.S. Code of Federal Regulations (CFR) require that the MPCA categorize industrial dischargers consistent with the U.S. Environmental Protection Agency federal categorical standards, and state standards if appropriate.

4.7.4 Affected Environment

Swan Lake, Swan River, Hay Creek, and Hay Lake were the only identified water bodies that contain wild rice that receive water from the Keetac facility. Thus, they will be the only water bodies analyzed for potential impacts. However, as part of the EIS the Project Proposer completed a wild rice survey and water quality sampling on Swan Lake, Moose Lake, and Hay Lake. Moose Lake, as shown in Figure 4.7.1, contains wild rice stands and does not receive any discharge from industrial projects, and therefore serves as a reference water body for the area. A summary of the survey and sampling data is provided in Table 4.7.1 (Barr, 2009W). Figures 4.7.1 through 4.7.4 provide aerial overviews of the wild rice stands and monitoring locations.

TABLE 4.7.1 WILD RICE MONITORING RESULTS

Water Body	Swan Lake	Swan River [1]	Hay Lake	Hay Creek [2]
Wild Rice Stand (ac)	50	~ 1.0 [3]	10	< 1.0 [3]
Density (stems/m^2)	33-80	~10-40 [3]	61-184	~10-40 [3]
Sulfate Levels (mg/L) 95% Confidence Intervals	25-30 (Main Lake) 3.9-26.1 (Southwest Bay)	25-30 [4]	48-55 [5]	
Annual Range of Water Level (ft) [6]	1.5	1.5	1.25 [7]	1.25 [7]

[1] Data from approximately 2.0 mile segment of river from Swan Lake outlet to dam controlling Swan Lake
[2] Data from 1.4 mile segment of Hay Creek from Hay Lake outlet toward Swan Lake
[3] Estimated based on field observation by Mike Crotteau 9-11-09 and 9-15-09 and interpretation of stem counts from Wild Rice and Sulfate Data Submittal Study.
[4] Sulfate range the same as the Main Lake of Swan Lake as sulfate levels in river would be representative of sulfate levels monitored in lake.
[5] The two columns were combined because the sulfate levels in Hay Lake also reflect the sulfate levels in Hay Creek due to short residence time in the lake.
[6] Change in water level due is average annual change
[7] Considerable beaver activity occurs on Hay Creek which can impact water levels in excess of 2 feet on Hay Lake and Hay Creek.

4.7.4.1 Hay Lake and Hay Creek

Hay Lake is a 25.2-acre basin located approximately nine miles south of the Keetac facility. Hay Creek serves as the inflow and outlet to Hay Lake, with the lake located downstream of the confluence of Hay Creek and the O'Brien Diversion Channel, and upstream of Swan Lake. Figures 4.7.2 and 4.7.4 depict the wild rice present in Hay Lake and Hay Creek (Barr, 2009W; Crotteau, 2009B).

Wild rice stands surveyed in Hay Lake were between 60-180 stems/m^2 in July 2009 (Barr, 2009W). Wild rice covers approximately a third of the lake and has the greatest density at the outlet of the lake compared to the perimeter. Wild rice stands in Hay Creek were observed to be moderate to sparse and had an aerial coverage of less than one acre (Crotteau, 2009B).

Sulfate levels in Hay Lake surface water were only sampled from June to December 2009 (Barr, 2009W) and ranged between 46-78 mg/L. Hay Lake experienced a spike in sulfate concentrations during the first two weeks of July. The increase in sulfate levels during the two weeks in July has not been associated with a specific reason, but would be considered in a monitoring plan. Sulfate levels in Hay Creek upstream of Hay Lake were similar to Hay Lake while the sulfate levels in Hay Creek downstream of Hay Lake, prior to Swan Lake, were typically lower (5-10 mg/L). This is probably due to the dilution from lower sulfate inflows from Moose Lake and adjacent runoff flows.

Based on surveys completed in 2009 (Crotteau, 2009B) the flow control for Hay Lake was determined to be a series of beaver dams. The dams act as weirs resulting in an average annual water level fluctuation of 1.25 feet (spring high flow – mean annual flow) (Liesch, 2009E). The presence of wild rice indicates water levels fluctuate at a gradual enough rate to allow wild rice growth.

4.7.4.2 Swan Lake and Swan River

The MNDNR report (MNDNR, 2008A), a recent survey (Barr, 2009W), and a MNDNR Survey (Crotteau, 2009A) identified Swan Lake as containing an estimated 50 acres of wild rice. Beginning at State Highway 65, Crotteau surveyed the mouth of Swan River to the dam downstream. The majority of the wild rice in Swan Lake is located in the southwest bay of the lake. The southwest bay is relatively shallow compared to the rest of the lake; this may be a primary reason for greater wild rice presence. Figures 4.7.2 and 4.7.3 depict the extent of wild rice in the southwest bay of Swan Lake and Swan River (Crotteau, 2009A). Based on the MNDNR Harvester Survey (MNDNR, 2006A), 11 respondents reported harvesting on Swan Lake, indicating the wild rice stand was still used as a harvesting resource in 2006.

Water bodies upstream of Swan Lake and Swan River receive discharge from the WWTPs in the cities of Keewatin and Nashwauk. Two mining facilities, Essar Steel Minnesota, LLC and Keetac also discharge to water bodies upstream of Swan Lake and Swan River. Each of these industrial discharges contributes to the water quantity and water quality in Swan Lake and Swan River.

Sulfate levels monitored in Swan Lake demonstrate great variability throughout the year and also variability throughout the lake. Results of samples in the main body of the lake varied from results in the southwest bay, where the majority of the wild rice is present. During 2009, sulfate levels in the southwest bay of Swan Lake were between 7-11 mg/L, except for a spike of 48 mg/L, which occurred during a two-week period in July. The main portion of the lake exhibited sulfate levels between 23-38 mg/L during the same time period, except for a similar spike in July of 51 mg/L. The southwest bay is an isolated bay that has no major inlets, limiting potential mixing with the rest of the lake, and likely why the sulfate concentrations are lower. The reasoning for the variation in sulfate concentrations throughout the year is presently unknown.

The annual seasonal water level fluctuation in Swan Lake is 1.5 feet (Liesch, 2009A), indicating the fluctuations occur at a gradual enough rate to allow wild rice to grow.

The Swan River contains small stands of wild rice from the outlet to the beaver dam controlling the Swan Lake elevation (Crotteau, 2009A). There is a denser stand (~1.0 acre) of wild rice immediately upstream of the dam. The density of the wild rice stands (10-30 stems/m^2) in the Swan River were not measured but were visually estimated based on actual densities measured in Swan Lake and from an interpretation of qualification statements (Crotteau, 2009A).

Sulfate concentrations were measured at the outlet (i.e., Swan River) for Swan Lake. Since there are no tributaries to Swan Lake, sulfate concentrations were not measured in Swan River. Based on sulfate levels measured in Swan Lake (23-51 mg/L), it is reasonable to assume similar values would be detected in Swan River. Along with sulfate levels, it can be assumed that water level fluctuations in the Swan River up to the dam are also similar to Swan Lake and are gradual enough to enable wild rice to grow.

4.7.4.3 No Action Alternative

The current conditions under the No Action Alternative include discharges that impact downstream water bodies with known wild rice resources. These water bodies include Hay Lake, Hay Creek, Swan Lake and Swan River. Discharges from Keewatin and Nashwauk wastewater treatment plants, existing Keetac discharges, and recently permitted discharges from Perry Pit dewatering activities all impact water bodies identified as containing wild rice.

Under the No Action Alternative, the Project Proposer would continue dewatering activities as part of its current operations in the east mine pits (Russell, Section 18, and Stevenson) and west mine pits (Mesabi Chief, Aromac, and Sargent). The west mine pits discharge into O'Brien Creek, which eventually flows to Hay Creek. Under the existing Permit to Mine, the Project Proposer has been approved for a modification to the NPDES and Appropriation permit for dewatering of the Perry Pit (SD012), which is part of the west mine pits. The Perry Pit dewatering flows will be discharged to O'Brien Creek via a new outfall. Additional information on physical impacts to water resources, including a discussion on the dewatering activities at Keetac is found in section 4.1.1.

Current sulfate concentrations in the discharge water from the west mine pits have a monthly average of approximately 66 mg/L. Based on Minnesota Rules, part 7050.0224, subp. 2 in combination with available information, the permit amendment for the Perry Pit discharge has established water quality effluent limits for sulfate at 14 mg/L for the monthly average maximum and 24 mg/L for the daily maximum. The permit amendments for Mesabi Chief dewatering (SD003) and facility discharges to Welcome Creek (SD002) are set at the same limits as the Perry Pit discharge. The Keetac facility will have a nine-year compliance schedule to meet the sulfate concentration effluent limits required by the new permit. It is anticipated that the effluent limits of 14 mg/L monthly average sulfate concentration levels will be met and could potentially lower the sulfate concentrations in receiving water bodies (i.e., Hay Creek, Hay Lake, Swan Lake and Swan River). Potential effects on wild rice from adherence to the sulfate water quality standard may be beneficial. The magnitude of the potential effect to wild rice before or after the standard is met is unknown.

Hay Lake and Hay Creek

Hay Lake and Hay Creek would continue to receive discharges associated with mine dewatering and plant discharge flows, which would increase by 2.5 cfs (36.3 cfs total) compared to current conditions. These increases in flow would cause slight increases in water levels and increases in sulfate concentrations as shown in Table 4.7.2, below. The potential effects on wild rice in Hay Lake and Hay Creek from the No Action Alternative are uncertain. Future permit renewal application processes would evaluate sulfate concentrations in these water bodies and assign appropriate effluent discharge limits that the Keetac facility would be required to comply with. Part of the permit requirements would likely be monitoring of wild rice resources relative to sulfate concentration levels in these water bodies.

Swan Lake and Swan River

The No Action Alternative would result in Swan Lake and Swan River receiving an additional 2.5 cfs (36.3 cfs total) from the Keetac facility via Hay Creek, compared to current conditions. These increases in flow would cause slight increases (i.e., nearly undetectable) in water levels and increases in sulfate concentrations as shown in Table 4.7.2, below. The potential effects on wild rice in Swan Lake and Swan River from the No Action Alternative are uncertain. Future permit renewal application processes would evaluate sulfate concentrations in these water bodies and assign appropriate effluent discharge limits that the Keetac facility would be required to comply with. Part of the permit requirements would likely be monitoring of wild rice resources relative to sulfate concentration levels in these water bodies.

4.7.5 Environmental Consequences

4.7.5.1 Hay Lake and Hay Creek

> There are no conclusive studies which demonstrate what the impacts to wild rice stands are based on increases in sulfate concentration; however, naturally occurring wild rice stands have been found growing in waters with sulfate concentrations between 50 and 282 mg/L.

Hay Lake receives discharges from the Keetac facility and from the WWTPs in the cities of Keewatin and Nashwauk. Water level fluctuations in Hay Lake have been estimated and are provided in Table 4.7.2. Although not listed in Table 4.7.2, Hay Creek is anticipated to experience similar water level and sulfate concentration changes as Hay Lake.

Sulfate levels were sampled in Hay Lake during the summer of 2009 (Barr, 2009W) to establish a current sulfate concentration in Hay Lake. The Project Proposer modeled the projected increase in sulfate concentrations in Hay Lake as a result of the Proposed Project, and concentrations in Hay Creek are anticipated to be similar. The current concentration range is based on the 95 percent confidence interval of the 2009 sampling. The projected sulfate concentrations are based on the current range plus the modeled increase (Liesch, 2009C). Existing sulfate concentration levels in Hay Lake exceed the state standard of 10 mg/L.

TABLE 4.7.2 CHANGES IN LAKE LEVEL AND SULFATE CONCENTRATIONS – HAY LAKE

	Current (2009)	No Action Alternative (2021)	Proposed Project (2036)
Lake Level (ft)[1, 2]	1358.00	1358.03	1358.07
Sulfate Concentration (mg/L)[2]	48-55	51-58	47-55 [3]

[1] Water Quantity and Quality Report
[2] Hay Lake/Swan Lake Sulfate Concentration Memo (95% Confidence Interval)
[3] This dataset range includes current conditions, No Action Alternative, and Proposed Project with the use of dry air pollution control devices on the new line and a membrane filtration technology.

See Illustration 4-1B for detailed projection of sulfate concentrations.

The average annual elevation changes in Hay Lake determined by the Project Proposer would be 0.07 ft. These changes are based on a free-flowing outlet and do not incorporate the variability which can occur with additional changes to beaver dams. Since the lake naturally varies by approximately 1.25 feet annually, a projected 0.07 ft. change in lake level would be a minimal impact. The changes in water levels in Hay Lake would be representative of the changes anticipated in Hay Creek and is not considered a change that could significantly impact wild rice.

Beaver dams could change water levels enough to impact wild rice stands if it occurred at a time when wild rice is susceptible to water level changes, but beaver activity cannot be predicted and furthermore has no connection to the Proposed Project. Typically, beavers flood areas for protection from predators and to ensure an underwater entrance to their den. Beaver dams are typically constructed of available materials in an area, such as wood, plant parts, and mud, and tend to increase the size of their dams as the water level in a pond increases. A dam is maintained to keep the water deep enough from freezing solid in the winter so that the beaver can reach its food supply at the bottom of the pond. A family of beavers may have more than one dam in an area (Link, 2004).

Sulfate levels in Hay Lake and Hay Creek were modeled to decrease by eight percent as a result of the Proposed Project, but would still be above the state standard of 10 mg/L. The impact to wild rice stands as a result of a decrease in sulfate concentrations is uncertain and should be incorporated into a monitoring plan.

Hay Creek downstream of Hay Lake would experience similar decreases in sulfate concentrations. This is because Hay Lake is a flow-through lake and concentrations in Hay Lake would be representative of concentrations in Hay Creek.

There are no conclusive studies that demonstrate what the impacts to wild rice stands are relative to increases in sulfate concentrations. However, research has found that wild rice may tolerate a wide range of sulfate concentration (Bavin and Berndt, 2008B; Moyle, 1944a; Peden, 1982) because naturally occurring wild rice stands have been found growing in waters with sulfate concentrations between 50 and 282 mg/L. Therefore, it is difficult to predict what effect changes in sulfate concentrations would have on wild rice's geographic extent, stem density or seed productivity in Hay Lake.

Hay Lake and Hay Creek exceed the state water quality standard for sulfate. It is anticipated that the Proposed Project would continue to exceed the state water quality standard for sulfate at the onset. The effect of this exceedance on wild rice is adverse however the magnitude is unknown. A compliance schedule would be implemented by the Project Proposer to meet the state water quality standard as directed by the permit within a period estimated at nine years. Water quality monitoring would be required, and actions to reduce the sulfate concentrations to meet the sulfate water quality standard would be required. The MPCA has determined that a nine year compliance schedule is a reasonable amount of time to take the steps necessary to write, review, revise, and implement a Water Management Study Plan, Sulfate Reduction Strategy Study Plan, and a Sulfate Reduction Plan, and potentially conduct a study to gather data and information that would support a total sulfate limit, other than the final limitations included in the permit.

The water quality standard for sulfate is now exceeded. When the sulfate water quality standard is met, either during or at the end of the compliance schedule, sulfate concentrations would decrease. Potential effects on wild rice from adherence to the sulfate water quality standard may be beneficial. The magnitude of the potential effect to wild rice before or after the standard is met is unknown.

4.7.5.2 Swan Lake and Swan River

A summary of the predicted changes to lake level elevation and range of sulfate concentrations in Swan Lake are provided in Table 4.7.3. The current concentration range is based on the 95 percent confidence interval of the 2009 sampling. The projected sulfate concentrations are based on the current range plus the modeled increase (Liesch, 2009C). It was assumed that changes in sulfate concentrations in the main body of the lake would be representative of changes experienced in the southwest bay, where wild rice is present. The current sulfate concentration levels in Swan Lake exceed the state standard of 10 mg/L.

TABLE 4.7.3 CHANGES IN LAKE LEVEL AND SULFATE CONCENTRATIONS – SWAN LAKE

	Current (2010)	No Action Alternative (2021)	Proposed Project (2036)
Lake Level (ft)[1, 2]	1335.64	1335.67	1335.71
Sulfate Concentration (mg/L)[2]	25-30	29-34	32-37 [3]

[1] Increase based on Water Quantity and Quality Report

[2] Hay Lake/Swan Lake Sulfate Concentration Memo (95% Confidence Interval)

[3] This dataset range assumes the use of dry air pollution control devices on the new line and a membrane filtration technology.

See Illustration 5-10 for detailed projection of sulfate concentrations.

The Proposed Project would not significantly impact the average water level in Swan Lake, compared with the 1.5 foot natural annual range of water level change in the lake. The potential for impacts to wild rice in Swan Lake from increased discharge and water level fluctuation attributed to the Proposed Project would be minimal. Based on model results, Swan River, as the outlet for Swan Lake, would also likely experience a similar fluctuation in water level. The Proposed Project is not anticipated to have a significant adverse impact on water levels in Swan Lake, Swan River, Hay Lake or Hay Creek.

The change in sulfate concentrations in the main portion of the lake would also be representative of levels detected in Swan River. Wild rice is present in the Swan River which has average sulfate concentrations greater than 28 mg/L, indicating stands would continue to exist at the higher sulfate concentration. However, the impact to the geographic extent, stem densities, and seed productivity is unknown and should be incorporated into a monitoring plan.

Modeling completed for the Proposed Project assumes the southwest bay would experience a similar sulfate concentration increase resulting in a range between 11-33 mg/L. The data used for the modeling was based on one year of monitoring data. During the one year of monitoring, the southwest bay experienced two months where sulfate concentrations increased dramatically and then decreased back to average levels. The occurrence of this phenomenon is not completely understood, and the spike in concentrations created a wider range in the modeling results. It is anticipated that as monitoring continues to occur and more data are collected, the range in sulfate concentrations would become less variable, and trends can begin to be recognized. Regardless of the range in sulfate concentrations, wild rice exists in Swan Lake and Swan River at sulfate concentrations greater than the concentrations in the southwest bay, indicating stands could continue to exist, but the impact to the geographic extent and stem densities is uncertain and should be incorporated into a monitoring plan.

The sulfate concentration in Swan Lake and Swan River exceeds the water quality standard of 10 mg/L for sulfate, and the Proposed Project would increase sulfate concentrations by 6.7 mg/L in Swan Lake and Swan River by the year 2036 for a total projected sulfate concentration level of approximately 32 to 37 mg/L. This is a potentially adverse impact on water quality with a significance that is uncertain for wild rice.

In the short term, it is anticipated that the Proposed Project would exceed the state water quality standard for sulfate at the onset in Swan Lake and Swan River. The effect of this exceedance on wild rice is adverse, however the significance is unknown. A compliance schedule would be implemented by the Project Proposer to meet the state water quality standard as directed by the permit within a period estimated at nine years. Monitoring would be required, and mitigation identified as needed.

In the long term, adherence to the sulfate water quality standard may beneficially affect wild rice in Swan Lake and Swan River due to decreasing sulfate concentrations. The magnitude of the potential benefit to wild rice from a decrease in sulfate concentrations is unknown. The effects of lower sulfate concentrations on the health of wild rice should be monitored.

4.7.5.3 East Stockpile Alternative

The potential environmental effects from changes to water quality and potential effects on wild rice from the East Stockpile Alternative are the same as those associated with the Proposed Project.

4.7.6 Monitoring and Mitigation

The potential impacts to the health of wild rice are uncertain and would likely become apparent over time as positive, negative, or no effect. This requires monitoring and potentially mitigation. Potential water quality impacts are more certain, as the current ambient levels of sulfate in the affected water bodies exceed the state standard of 10 mg/L. The Proposed Project would discharge additional sulfate into the water bodies, potentially causing an increase in existing sulfate concentration levels. However, a compliance schedule would be implemented by the Project Proposer to meet the state water quality standard for sulfate over a set number years as directed by the permit. This would result in a long term reduction in the current sulfate concentrations of affected water bodies.

4.7.6.1 Mitigation

> If mitigation is determined to be required, preliminary mitigation alternatives have been identified based on the present understanding of the Proposed Project. These include, but are not limited to sulfate removal technologies, alternate water discharge location, and/or water reuse.

Section 4.7.5 indicated that water level changes in Swan Lake, Swan River, Hay Creek, and Hay Lake are not expected to change significantly. The impact of sulfate concentration changes to wild rice is uncertain, and may require further investigation and/or mitigation if monitoring determines there are impacts to wild rice.

Additionally, Moose Lake was also surveyed and sampled by the Project Proposer, and determined to have wild rice. Moose Lake does not receive any point source discharge and can serve as a reference lake to determine the significance of impacts to wild rice stands in Swan Lake, Swan River, Hay Lake, and Hay Creek. If mitigation is determined to be required, preliminary mitigation alternatives have been identified based on the present understanding of the Proposed Project. These include, but are not limited to sulfate removal technologies, alternate water discharge location, and/or water reuse. These alternatives would need to consider feasibility and compare water quality and quantity changes as well as wetland, fisheries, wild rice and recreation impacts. A description of each of these alternatives is described below.

4.7.6.1.1 Sulfate Removal Technologies

The Proposed Project includes the use of dry-air pollution control devices on the new line. In addition, the Project Proposer has proposed construction of a membrane-filtration technology, specifically suited to remove sulfate, to treat blow down water from the existing wet scrubber (see Section 4.4 – Water Quality). These mitigative measures would reduce the amount of sulfate in the discharges as part of the Proposed Project. A similar treatment system technology could be evaluated for use on other water discharges, but feasibility is yet to be determined. The reduction of sulfate levels discharged from the facility would reduce loading to Swan Lake and Hay Lake thereby lowering sulfate concentrations in these water bodies.

4.7.6.1.2 Alternate Water Discharge Location

If sulfate concentrations in water discharges from the Keetac facility cannot be reduced to acceptable levels for discharge into Swan Lake, Swan River, Hay Creek, and Hay Lake, alternative discharge locations could be considered. For example, discharging water directly to Swan River would avoid wild rice stands. A review of the MNDNR report indicates that there are no water bodies which contain wild rice between Swan Lake and the Swan River confluence with the Mississippi River (MNDNR, 2008A).

An alternative discharge location may also avoid some water bodies with wild rice, but not all. For example, some or all of the water from the O'Brien Diversion Channel and Reservoir Two may be able to be directed down the remnant stretch of Welcome Creek to O'Brien Lake and ultimately to Swan Lake. The Welcome Creek remnant is located between O'Brien Lake and the O'Brien Diversion Channel. It is connected to O'Brien Lake but it is not connected to the Diversion Channel or to Reservoir Two. This discharge location would avoid Hay Creek and Hay Lake wild rice stands. An analysis of any alternative discharge location would need to consider feasibility and compare water quality and quantity changes as well as wetland, fisheries, wild rice, and recreation impacts.

4.7.6.1.3 Water Re-use

Water discharges from the Keetac facility could be routed to Essar Steel to ensure they have adequate water available for production. If additional water is needed at Essar Steel, the Keetac facility could route water to the Essar Steel facility. This would reduce the flows to Swan Lake and Hay Lake thereby lowering the concentrations of sulfate in these water bodies.

4.7.6.1.4 Eliminate Tailings Basin Seepage

Containing tailings basin discharge within a closed system would eliminate the potential for increased sulfate discharge to nearby water bodies.

4.7.6.2 Monitoring

Monitoring efforts would be conducted to document changes to wild rice in Swan Lake, the southwest bay of Swan Lake, Swan River, Hay Creek, and Hay Lake. Monitoring efforts could potentially include:

1. Conducting follow-up field surveys to monitor the extent of wild rice and track changes in density and distribution of wild rice,
2. Monitoring water levels in Hay Lake, Hay Creek, Swan Lake, and Swan River during critical life cycle stages of wild rice to determine if brief and long-term changes in mining activity have an effect on wild rice health, and/or
3. Monitoring sulfate concentrations in Swan Lake, Swan River, Hay Creek, and Hay Lake to determine if brief and long-term changes in mining activity have an impact on sulfate concentrations.

4.8 DAM SAFETY

The FSDD stated that the EIS will include a significant discussion on dam safety. This section focuses on the dam safety of the tailings basin only.

4.8.1 Affected Environment

This section was written based on information in the Tailings Basin Evaluation.

4.8.1.1 Existing Basin Configuration

> The Project Proposer is working with the MNDNR to obtain any necessary permit amendments for the tailings basin dam.

The original tailings basin was constructed as two basins (Stage 1 and Stage 2) with footprint areas of approximately 1,560 acres and 4,300 acres, respectively (Figure 3.1.2). A third basin was constructed within the combined footprint of both original basins and is referred to as the Stage 2 Interior Tailings Basin. The tailings basin footprint is 2,500 acres. It was constructed with a 15-foot high starter dike that has a top elevation of 1,495 feet. This starter dike was constructed over previously placed fine tailings in the original two basins that had an elevation of approximately 1,480 feet. The thickness of the previously placed fine tailings varies and is a maximum of 40 feet. For the purpose of the FEIS, the Stage 2 Interior Tailings Basin will be referred here to as the tailings basin.

Conventional upstream dike construction methods involve incrementally raising the dike surrounding the basin. The raisings were constructed by discharging the coarser tailings onto the existing dike and periodically grading them out to consolidate them and form a uniform surface. Each raise in the dike elevation is constructed over the previous dike raise, matching the outside slope and extending the dike upward and inward, such that portions of the fill are placed on previously placed tailings. Each construction lift is approximately 5 feet thick, and at the current tailings generation rate of 13 MLTY, the average annual increase in height is 2.7 feet.

The coarse tailings are similar to coarse sand in that it is suitable fill material for the dike due to its strength and seepage characteristics. Approximately 3 percent of the total tailings, 234,000 CY, are used for dike construction each year at the current tailings generation rate. The placed unit weight of the coarse tailings is 140 lb/cubic foot (pcf).

The current dike elevation is approximately 1,530 feet, meaning the current tailings basin dike height, above the original tailings surface, is approximately 50 feet. The length of the tailings basin dike is 42,000 feet along the perimeter, and there is an additional 3,000 foot long finger dike extending into the basin from the north end of the basin (see Figure 3.1.2).

The tailings basin dike geometry consists of an approximate outer slope of 6H:1V (1 foot of vertical rise for each 6 feet horizontally, or an approximate slope of 16 percent) with benches every 25 vertical feet that are 30 feet wide. A cross section of the basin is included as Figure 3.2.5, and depicts the following:

- Original topography
- Stage 2 Interior Basin topography as of a May, 24, 1996 aerial photo
- Topography and pond water level as of December, 2006

- Probable topography at various stages of the basin in the future, specifically:
  - Year 2012 based on current production rates
  - Year 2021 based on current production rates
  - Ultimate buildout (year 2036) based on production rates expected as a result of the expansion

The tailings basin beach is at an approximate elevation of 1,527 feet. The approximate basin water surface elevation is 1,523 feet, providing approximately seven feet of freeboard.

4.8.1.2 Hydrology and Hydraulics

The tailings basin footprint creates its own watershed, because the perimeter dikes prevent run-on as well as runoff. This footprint is 2,500 acres. Current storage capacities are 2,400 acre-feet at the normal pool elevation of 1,522 feet and 6,000 acre-feet at the dam crest elevation of 1,530 feet.

The current decant structure is an 8-foot-diameter precast concrete manhole riser with a 38-inch-diameter barrel. The spillway is normally raised in 1.4-foot sections as the basin elevation is increased by tailings placement. Preliminary estimates of spillway hydraulics indicates the existing decant structure can pass approximately 300 cfs at a maximum head of 5 feet, thus allowing an additional 2 feet of freeboard for wave action. Normal operations maintain approximately 7 feet of freeboard.

Under normal operations, the basin has the ability to store the runoff from both a six-hour Probable Maximum Precipitation (PMP) event of 22 inches and a 500-year, 24-hour precipitation event of 7 inches with no outflow from the decant structure.

The method of determining the PMP event is not discussed within the Tailings Basin Evaluation; however, it is reasonably consistent with an internal MNDNR analysis on June 29, June 30, and July 2, 2009. The magnitude of the 500-year, 24-hour precipitation event was estimated by plotting storm frequency totals from Bulletin 71, by Huff and Angel (1992) and projecting a 500-year storm frequency.

4.8.1.3 Regulatory Framework

The tailings basin is regulated under the Minnesota Rules, parts 6115.0300 through 6115.0520. These rules outline the various reporting and inspection requirements based on the hazard classification of the subject dam. The three general hazard classifications are Low Hazard, Significant Hazard, and High Hazard, and are defined below:

- Low Hazard Dam:
  Dams assigned the low hazard classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner’s property.

- Significant Hazard Dam:
  Dams assigned the significant hazard classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or other concerns. Significant hazard classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

- High Hazard Potential:
  Dams assigned the high hazard classification are those where failure or misoperation will probably cause loss of human life.

The older, original Stage 1 dam (MN00800) is classified as a low hazard dam and the original Stage 2 dam (MN0080) is classified as a significant hazard dam.

The tailings basin dam has not yet had a hazard classification assigned. The Project Proposer is working with the MNDNR to obtain the proper permit and hazard classification for the tailings basin dam. The MNDNR recently performed a site inspection of the tailings basin and found it to be in good shape and well maintained (June 3, 2009 MNDNR memo by Jason Boyle and Dana Dostert).

4.8.1.4 Analysis of Existing Dam

> The key component of a dam safety analysis is the slope stability evaluation…the results indicate that the stability of the embankment in both its current and ultimately permitted configurations meets the selected minimum Factor of Safety chosen for the analysis.

The key component of a dam safety analysis is the slope stability evaluation. Stability analyses performed of the tailings basin followed the methodology developed at other iron tailings basins (Walton et al., 2002). This analysis procedure is applicable when saturated tailings' shear strengths are reduced to steady-state shear strengths due to some future form of rapid undrained loading (e.g., rapid fill, earthquake, flooding). The stability analyses were performed for the existing condition case at elevation 1,530 feet, and the current permitted final elevation case at 1,585 feet (AECOM, 2009B).

Stability Analysis

The computer program Slope/W (Geo-Slope International, Ltd., Version 6.22) was used to model the stability of the location shown on Figure 3.1.2. The Project Proposer and their consultant chose the section shown on the figure for analysis due to reports of weaker foundation soils in that area.

The Slope/W model used the Morgenstern-Price force and moment limit-equilibrium method of slices to compute the Factor of Safety (FS) versus sliding. Based on the depositional history of the tailings, the slopes are subject to block sliding failures along the horizontal bedding planes of soft or loose layers within the tailings. For this evaluation, both Effective Stress Analysis (ESA) and Total Stress Analysis (TSA) conditions were evaluated.

Subsurface Conditions

Detailed subsurface investigation programs indicate the presence of three distinct tailings zones and three types of natural soils within the tailings basin dam. A general description of the soils is outlined below. Detailed descriptions of the soils and their geotechnical properties and behavior are provided in the Tailings Basin Evaluation.

- The upper zone of tailings consisted of fine to coarse sand-size particles that represent the coarse faction separated during the deposition of the tailings within the basin. These upper tailings were defined as coarse tailings. The relative density ranged from very loose to dense. These tailings were mechanically placed to construct the exterior dikes of the basin.
- Below the coarse tailings zone, layers of coarse grained tailings and fine grained tailings (slimes) were encountered. The thickness of the slimes varies as a result of the tailings

deposition process. Therefore, this zone was defined as layered tailings. Due to the layering of coarse and fine-grained tailings, this material has anisotropic undrained shear strengths for horizontal and inclined (vertical) shear planes.

- Underlying the layered tailings was a zone of very fine-grained tailings which have been denoted as slimes. This differs from the above layer in that it is not interbedded with coarse tailings. This layer of tailings was deposited during operation of the original tailings basin (Stage 1). The slimes zone thickness ranged from 5 to 10 feet at the base of the Stage 2 Interior tailings basin. Both sub-zones contained desiccated and saturated layers resulting in anisotropic undrained shear strengths. It is expected that the material properties of this soil layer will improve over time as consolidation due to the weight of subsequently placed tailings occurs.
- Beneath the slimes, natural soils exist with a 1- to 2-foot thick layer of peat, which is the original ground surface prior to the construction of the tailings basin. The elevation of the tailings/natural soils vary across the site. The transition from tailings to natural soils occurs at an approximate elevation of 1,470 feet.
- Underlying the peat strata, silty clays and granular till soils were encountered. The silty clays have a stiff to very stiff consistency based upon estimates of undrained shear strength, while the granular till density is medium dense to dense.

Porewater Pressure Conditions

Excess porewater pressure is an important factor in the stability analysis; if not relieved it can lead to soil instability (behaving like a liquid or *liquefaction*).

Another important concept within the analysis of the tailings basin is the pressure within the tailings and embankment. Porewater is the water within the void space of the soil. Porewater pressure reflects the level of the water surface (phreatic surface) within the tailings and embankment, and/or hydrostatic pressure within the tailings mass due to the weight of overlying soils and tailings drainage capabilities. Excess porewater pressure is important in the stability analysis; if not relieved it can lead to soil instability (behaving like a liquid or *liquefaction*).

The porewater pressures input for the stability model were developed from the Seep/W model for the existing condition analysis. The seepage model was calibrated using data obtained from instrumentation installed in the area.

For the analyses of the permitted and proposed final basin heights, an assumed phreatic surface was input into the models. The investigative work indicates the presence of excess porewater pressures within low and very low strength tailings at the time of the 2007 exploration. Dike construction was occurring at this location at the time of the porewater pressure measurements. The excess porewater pressure is attributed to the increase in effective overburden pressure from tailings deposition and perimeter dike construction. The excess porewater pressure dissipates over time as the tailings consolidate (i.e., compress or settle into a more dense and stronger state). A detailed description of the porewater modeling is included in the Tailings Basin Evaluation.

Stability Analysis Results

A minimum TSA Factor of Safety (FS) against a sliding value of 1.2 for this basin has been selected for a rapid undrained loading failure case, assuming the tailings are assigned lower bound, undrained steady-state shear strength values as discussed previously.

A minimum FS of 1.2 is justified based upon the conservative nature of the parameter selection, analysis approach, the amount of high quality field and laboratory testing of the tailings and performance monitoring program using instrumentation at select transects along the basin perimeter.

The analyses are performed using steady-state undrained shear strength parameters to evaluate the risk against static or seismic liquefaction of the embankment or its foundation. The undrained stability analyses approach, which adopts a lower acceptable FS, is rational since the analyses force failure surfaces along weaker horizontal tailings beds or laminate zones and uses select lower bound steady-state undrained shear strengths for the saturated tailings materials. Failure surfaces that use wedge block shapes were used to model the layered deposition of the tailings within the basin. Circular failure surface cases were also analyzed.

The analysis results show that a wedge failure block mode is the controlling mode which would be expected due to the anisotropic nature of the hydraulically deposited tailings. All of this assumes that the structure would be performance monitored in the future in order to confirm assumed strength gain, piezometric response and no movement along zones of weaker materials.

For the ESA model, a minimum FS of 1.5 was chosen. For this analysis both circular and wedge block failures were evaluated. In all cases the wedge block failure was the controlling analysis, as it had lower FS than the circular failures.

The results of the stability analyses are summarized below:

- Current Configuration (Dike elevation 1530)
  - TSA Analysis – FS = 1.3
  - ESA Analysis – FS = 3.9
- Permitted Configuration (Dike Elevation 1585)
  - TSA Analysis – FS = 1.2
  - ESA Analysis – FS = 3.4

The results indicate that the stability of the embankment in both its current and ultimately permitted configurations meets the selected minimum FS chosen for the analysis.

The selected minimum acceptable FS of 1.2 is slightly less protective than the traditional value of 1.3 for the TSA analysis; however, this is considered acceptable due to the conservative assumptions made with respect to soil strength, quality and quantity of data gathered, and the observational approach planned to monitor the embankment.

4.8.1.5 No Action Alternative

The currently permitted tailings basin is estimated to provide 13 MLTY of tailings storage by incrementally raising the dike to its permitted elevation of 1,587 feet, using the upstream dike construction methods described above.

4.8.2 Environmental Consequences

4.8.2.1 Proposed Action Alternative Basin Configuration

The Proposed Project would increase the tailings production to 21 MLTY, and to accommodate the additional tailings the final crest elevation of the tailings basin dam embankment would be approximately 1,612 feet as shown on Figure 3.2.5. The methods used to raise the tailings basin dam would be the same upstream dike construction methods described earlier in this section.

The Proposed Project plans to maximize the open water area of the water pond to limit fugitive dust liftoff (blowing) at the tailings basin beach. This would occur while maintaining an approximate 250-foot-wide tailings basin beach from dike heel to water pond to limit basin seepage and maintain adequate stability of the perimeter dikes.

> The Proposed Project would increase the tailings production to 21 MLTY, and to accommodate the additional tailings the final crest elevation of the tailings basin dam embankment would be approximately 1,612 feet.

4.8.2.2 Hydrology and Hydraulics

The proposed increased mine production rate would accelerate the vertical expansion of the basin, which would require planning and development of a new system to control the basin pond level capabilities as currently exists. The MNDNR would require the Project Proposer to demonstrate the control structure is capable of handling a 6-hour PMP event. This would be addressed in the permitting stage of the Proposed Project.

4.8.2.3 Analysis of Proposed Dam

Observed potential consequences of a dam breach or misoperation are as follows:

- A breach of the interior dam is expected to be contained within the exterior dam, with the exception of the east side. There is no constructed embankment on the east and the basin grades into the natural landscape. As the dam height increases, there is a minor concern about potential impacts to the dwellings that are approximately one mile away on the east side of the dam.
- There is a road and a few dwellings on the northwest side of the basin, with the nearest dwelling at 1,700 feet from the tailings basin dam. The elevation difference at this point is such that the danger of impact to these dwellings in the event of a breach is minor.

The tailings basin distances to potentially impacted dwellings and relative elevations from the tailings basin dam are shown on Figure 3.1.2.

The slope stability evaluation for the proposed dam has followed the same methodology described in Section 4.8.1.4 and has the following results.

- Final Configuration (Dike Elevation 1,612 feet)
  - TSA Analysis – FS = 1.2
  - ESA Analysis – FS = 3.8

The results indicate that the stability of the embankment in its proposed final configuration meets the selected minimum FS chosen for the analysis.

The selected minimum acceptable FS of 1.2 is slightly less protective than the traditional value of 1.3 for the TSA analysis; however, this is considered acceptable due to the conservative assumptions made with respect to soil strength, quality and quantity of data gathered, and the observational approach planned to monitor the embankment.

Under the assumption that the tailings basin embankments would remain in an undrained condition, the Proposed Project would have no change to dam safety. The Proposed Project would have a slightly beneficial effect on dam safety assuming a drained condition of the embankments.

However, as with all tailings basin dams, there is a potential for failure, and therefore an adverse effect to the environment. The permitted and proposed dam configurations under the undrained condition were modeled to be slightly less safe than what is considered to be a minimally acceptable level. It is unknown what the magnitude of the potential adverse effects would be if the dam were to experience a failure. Monitoring of the dam embankments would be necessary, and mitigation would be identified if needed.

4.8.2.4 East Stockpile Alternative

The environmental effects on dam safety from the East Stockpile Alternative are the same as those identified for the Proposed Project.

4.8.3 Monitoring and Mitigation

4.8.3.1 Monitoring

> The Proposed Project plans to maximize the open water area of the water pond to limit fugitive dust lift off at tailings basin beach.

Since the computed FS values are above 1.2 but below 1.5, the observational method as proposed by Dr. Ralph Peck, P.E., S.E. (Peck, 1969) would be used to monitor the basin stability using instrumentation and visual observations to confirm performance. Instrumentation would be used to detect movements and monitor porewater pressures in the embankment. In addition, cone penetration test (CPTu) soundings and SPT borings would be performed routinely to measure gains in undrained shear strength within the low strength tailings. Borings would be needed to periodically collect undisturbed samples of the tailings for laboratory strength testing.

The Project Proposer is in the process of installing performance monitoring instrumentation within the basin. Since completion of one dike lift requires three or more years depending on production rates, the installation of instrumentation is staged to occur with the dike construction. At this time, instrumentation has been installed along the east and southeast sections of the perimeter dike. Instrumentation would be installed along south, southwest, and west sections of the perimeter dike as the operation of the tailings basin proceeds in these areas.

The instrumentation to be installed would include:

- Inclinometers to measure horizontal movements of the perimeter dike,
- Borros Anchors and/or settlement plates installed to measure vertical settlement of the perimeter dike,
- Piezometers to measure the porewater pressure within the perimeter dike, and
- Observation wells to monitor the phreatic surface.

4.8.3.2 Mitigation

After each rise in dike height, the Project Proposer would re-compute the dam stability and offer updated conclusions and recommendations about basin stability improvements that can be made to improve dam safety while considering operational costs. At that time, details of the performance monitoring program can also be made and design modifications identified, as necessary, to maintain adequate FS for stability. The Project Proposer would submit this information to the MNDNR with the required annual Dam Status Report.

4.9 STATIONARY SOURCE AIR EMISSIONS

4.9.1 Emissions Inventory and Calculation of Emissions

The FSDD indicates that an air emission inventory would be completed for all air pollutants and air emissions described in the EIS. A summary of the current facility air emissions along with the Proposed Project air emissions are presented in this section. Additionally, a total facility air emissions table is presented to represent the facility's total air emissions after the Proposed Project.

4.9.1.1 Affected Environment

4.9.1.1.1 Existing Conditions

The Keetac facility is considered a major stationary source for air emissions under the New Source Review (NSR) Prevention of Significant Deterioration (PSD) permit program, and is also considered an affected source of Hazardous Air Pollutants (HAPs) under the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations.

Air emissions from the facility result from mining and crushing, material handling, pelletizing, induration, pellet storage and loadout, additive receiving and handling, concentrate storage, waste rock storage, tailings storage, diesel fuel usage, and support activities.

Total facility controlled potential emissions for the existing facility are presented in Table 4.9.1. Criteria pollutants and HAPs are shown. Criteria pollutants include particulate matter (PM), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), carbon monoxide (CO), nitrogen oxides (NOx), sulfur dioxide (SO_2), volatile organic compounds (VOCs) and lead.

TABLE 4.9.1 EXISTING FACILITY CONTROLLED POTENTIAL EMISSIONS[1]

Existing Facility	Crushing/ Handling	Induration	Biomass	Diesels	Mining Fugitives	Totals
CO	0	93	0	363	0	456
NOx	0	3,500[3]	0	1,394	0	4,894
PM	342	178	0	49	5,618	6,188
PM_{10}	169	332	0	32	1,590	2,124
$PM_{2.5}$	90	112	0	32	167	401
SO_2	0	845	0	21	0	866
VOC	0	10	0	44	0	53
Lead	0.00	0.22	0.00	0.01	0.00	0.23
Single HAP[2]	0	43	0	0	0	43
Total HAP	<1	51	0	1	1	54

Sources: Barr, 2009N; Barr, 2009G
[1] Shown in Tons Per Year (TPY)
[2] The maximum single HAP is provided. For the existing facility, this is hydrochloric acid (HCl).
[3] Based on the NOx limit taken on the existing line; see additional information describing the NOx limit following Table 4.9.3.

4.9.1.1.2 No Action Alternative

The No Action Alternative for the Proposed Project would allow the facility to continue to operate under its current air emissions permit. The emissions sources and potential emissions (as represented in Table 4.9.1) would remain the same and the existing requirements under the current permit would remain in effect. The facility would be subject to future rules or regulations as they develop (e.g., regional haze, climate change), which may require revisions to the air emissions permit at that time.

4.9.1.2 Environmental Consequences

4.9.1.2.1 Proposed Action Alternative

Air emissions from the Proposed Project result from taconite mining, crushing, material handling, pelletizing, induration, pellet storage and loadout, additive receiving and handling, waste rock storage, tailings storage, biomass drying, diesel fuel usage, and support activities. Criteria pollutant and HAP emissions, both controlled and uncontrolled, have been calculated for the Proposed Project.

Emissions calculations were completed using USEPA's AP-42 emission factors, vendor information, engineering estimates, stack test data, and regulatory emission limits.

Controlled potential emissions for the Proposed Project are presented in Table 4.9.2. The total facility controlled potential emissions for the facility after the Proposed Project are presented in Table 4.9.3.

TABLE 4.9.2 PROPOSED PROJECT CONTROLLED POTENTIAL EMISSIONS[1]

Proposed Project	Crushing/ Handling	Induration	Biomass	Diesels	Mining Fugitives	Totals
CO	0	89	0	266	0	355
NOx	0	2,340[3]	0	243	0	2,583
PM	104	102	7	7	3,299	3,520
PM_{10}	178	204	7	6	919	1,314
$PM_{2.5}$	178	204	7	6	95	489
SO_2	0	81	0	0.5	0	81
VOC	0	19	8	29	0	56
Lead	0.00	0.10	0.00	0.00	0.00	0.10
Single HAP[2]	0	22	0	0	0	22
Total HAP	1	26	0	1	0.5	29

Sources: Barr, 2009N; Barr, 2009G
[1] Shown in Tons Per Year (TPY)
[2] The maximum single HAP is provided. For the Proposed Project, this is hydrochloric acid (HCl).
[3] Based on the NOx limit taken on the expansion line; see additional information describing the NOx limit following Table 4.9.3.

TABLE 4.9.3 TOTAL FACILITY AFTER PROPOSED PROJECT CONTROLLED POTENTIAL EMISSIONS[1]

Total Facility (existing plus proposed)	Crushing/ Handling	Induration	Biomass	Diesels	Mining Fugitives	Totals
CO	0	182	0	629	0	811
NOx	0	5,840[3]	0	1,637	0	7,477
PM	447	280	7	56	8,918	9,708
PM_{10}	347	536	7	38	2,509	3,438
$PM_{2.5}$	268	316	7	37	262	890
SO_2	0	925	0	22	0	947
VOC	0	29	8	72	0	109
Lead	0.00	0.32	0.00	0.01	0.00	0.33
Single HAP[2]	0	65	0	0	0	65
Total HAP	2	78	0	2	2	83

Sources: Barr, 2009N; Barr, 2009G

1 Shown in Tons Per Year (TPY)

2 The maximum single HAP is provided. For the total facility (existing facility plus Proposed Project) this is Hydrochloric Acid (HCl).

3 Individual NOx limits have been proposed for both the new and existing indurating lines that would equate to an overall NOx emission rate of 5,840 TPY. See additional information describing the NOx limit following this table.

The annual NOx limit was established based on a PSD netting analysis. In the netting analysis, the Project Proposer used a two-year baseline actual emissions period ending on November 1, 2001. During that period, NOx emissions from the existing indurating furnace averaged 5,805 TPY. The permit for the Proposed Project would limit NOx emissions from the existing furnace to 3,500 TPY. This limit would create a reduction of 2,305 TPY of NOx that would be creditable against an emissions increase. PSD also allows an increase in emissions below the PSD significance level, which for NOx is 40 TPY. The Proposed Project would increase NOx emissions by 2,340 TPY (2,305 plus 35) for the installation and operation of the second indurating furnace (the “new line”). Since the new line itself has no creditable decreases, NOx emissions from the new line would be limited to 2,340 tons per year. Individual NOx limits have been proposed for both the new and existing indurating lines that would equate to an overall NOx emission rate of 5,840 TPY NOx emissions from both the existing furnace and the new line will have a total annual limit of 5,840 TPY (3,500 TPY existing furnace plus 2,340 TPY from the new line). Continuous emissions monitors (CEMs) will be used to directly measure the emissions of NOx from both the existing furnace and the new line to determine compliance with the NOx emission limits.

4.9.1.3 Mitigation Opportunities

Several of the new emission sources would be subject to BACT and/or NESHAP requirements. BACT requires the Permittee to operate the equipment in the most efficient manner and with stringent emission limits. For the Proposed Project, BACT analysis is required for particulate matter and SO_2 pollutants to evaluate the latest technology advancements and emission limits. The NESHAP standards (also referred to as MACT – Maximum Achievable Control Technology) are also technology-based standards that require a facility to meet emission rate limits for the applicable source category. For specific emission limitations for the Proposed Project see Section 4.9.3 for BACT limits and see Section 4.9.4 for MACT (NESHAP) limits.

4.9.2 Fugitive Dust Control

The FSDD indicates that a fugitive dust control plan would be developed to address mitigation efforts of fugitive emission sources. This section addresses the Project Proposer's existing fugitive dust control plan and how it may be affected by the Proposed Project.

> The Project Proposer relies on the use of natural moisture and water spraying to control fugitive dust from most of the fugitive emission sources. Mulch is applied at the tailings basin to control dust from exposed beach areas.

4.9.2.1 Affected Environment

4.9.2.1.1 Fugitive Dust Emissions Control Plan

The Project Proposer's Fugitive Dust Plan was updated in 2007. The plan was updated to reflect enhanced dust control methods that the Project Proposer is employing at the tailings basin to better control dust emissions during the winter months in the event that there is a lack of snow cover. The Project Proposer operates emission sources that generate fugitive dust at the existing facility according to the Fugitive Dust Plan. This plan was submitted by the Project Proposer as Appendix E of their BACT Report (Barr, 2009C).

The Fugitive Dust Plan lists activities that generate fugitive dust and describes methods that the Project Proposer undertakes to control fugitive emissions from the property. The types of activities include:

- Blasting,
- Haul road traffic,
- Loading/unloading areas,
- Stockpiles,
- Tailings basin,
- Material transfer points,
- Coal handling activities, and
- Other Sources.

The Fugitive Dust Plan lists the primary controls, contingent controls, operating practices and record keeping requirements for each of the activities that generate fugitive dust.

On average, blasting activities occur weekly for crude ore, and five to ten times per year for waste rock. The Project Proposer uses Best Mining Practices blasting techniques to satisfy the requirements of the Mineland Reclamation Rules (Minnesota Rules, parts 6130.3800 and 6130.3900). These techniques include:

- Engineered blast hole pattern to minimize the amount of blasting agent used and maximize fragmentation,
- Blast hole stemming to direct energy horizontally,
- Blast hole delays to provide planned consecutive detonation rather than simultaneous detonation to reduce shock and moves the rock outward instead of upward into the air,
- Monitoring meteorological conditions to prevent blasting when temperature inversion and wind conditions would create air shock (overpressure) beyond state and federal limits.

The Project Proposer relies on the use of natural moisture and water spraying to control fugitive dust from most of the fugitive emission sources. Haul road sources may also require dust suppressant, regular road maintenance, and application of snow when available during freezing conditions to control fugitive dust emissions. Loading areas, unloading areas, and stockpiles rely on the use of natural moisture content and water spraying to control fugitive dust. Control of fugitive dust emissions at the tailings basin relies on minimizing the beach areas, applying mulch, re-vegetating, and application of dust suppressant. To control dust at material transfer points the Project Proposer relies on minimal drop distances from conveyor to pile, bin or conveyor in addition to natural moisture content and water sprays. Coal handling activities rely on the use of natural moisture content, water spraying, and dust suppressant application to control fugitive dust.

Other sources of fugitive dust include portable crushing operations in the mine and small truck traffic. Fugitive dust emissions generated by the portable crushing operations is managed by the crushing contractor. Fugitive dust emissions from small truck traffic can be controlled by dust suppressants.

4.9.2.1.2 Tailings Basin Fugitive Dust Observed Impacts

The tailings basin is designed to operate as a submerged interior basin. This type of basin design requires a dike system encompassing a large pond of water with beach areas at the edge of the water. Residual materials in the crude ore (tailings) that are not recovered as iron at the pellet processing plant are pumped in as a slurry to the tailings basin. The tailings slurry is pumped to one of the beach areas. Here the tailings are spigotted into the basin until the tailings reach a specific height in the pond. Medium and coarse textured tailings settle out from the slurry and onto the beach areas. The medium and coarse textured tailings are periodically pushed up on the dikes to raise the height of the dams. Fines are transported further out into the pond to settle out and are submerged beneath the pond waters. The source of fugitive dust emissions at the tailings basin is wind erosion of the exposed tailings on the beaches (Barr, 2009C).

The tailings basin was originally constructed as two adjacent basins that partially overlap one another each with a footprint of 1,560 acres and 4,300 acres, respectively. More recently, a third basin has been constructed within the footprint of the first two basins. The footprint of the third basin covers 2,500 acres (AECOM, 2009B). Figure 3.1.2 depicts the tailings basin.

The average natural elevation of the base of the tailings basin is approximately 1,480 feet above sea level. The permitted height of the tailings basin is 1,585 feet above sea level. The approximate current height of the tailings basin is 1,530 feet above sea level. This means that the approximate height above ground of the tailings basin (50 feet) is at roughly half of the permitted height of 105 feet above ground (AECOM, 2009B). The proposed permitted height of the tailings basin following the Proposed Project is 1,612 feet above sea level, or 132 feet above ground. Figure 3.2.5 depicts a cross-section of the tailings basin.

In years past, fugitive dust emissions from the tailings basin were not a severe problem. However, as the basin elevation rose with time and as natural terrain and islands of trees became covered with tailings, beach areas became susceptible to dust generation.

In the recent past, the Project Proposer and the MPCA have entered into a Stipulation Agreement concerning fugitive dust emissions from the tailings basin (MPCA, 2007). Windy conditions were observed during several days in October and November 2006. The water level in the basin was relatively low due to low sections of the dike. In addition, there was a lack of snow cover which also provides for control of fugitive dust emissions. The low water level and lack of snow cover allowed more beach areas in the tailings basin to be exposed. These portions of the tailings basin beaches were neither mulched nor treated with chemical dust suppressant to prevent fugitive dust emissions because they could not be reached with typical mulching equipment due to soft surface conditions in the basin. These conditions allowed tailings particulates to become entrained into the wind and were deposited onto roads and residences to the north and east of the tailings basin.

The Project Proposer mulched 400 acres of the tailings basin which were being eroded by the wind following the October and November 2006 incidents after the ground froze and access could be achieved. In early 2007, the Project Proposer made attempts at snow making on the basin but this was unsuccessful. Later in 2007, the Project Proposer began using a helicopter to apply mulch to areas that could not be reached by conventional methods before freezing. Since 2006, the Project Proposer has sprayed, mulched or seeded 3,329 acres with traditional tractor equipment, mulched or seeded 618 acres with helicopters, applied bio-solids to 398 acres and planted 55,200 trees. In addition, the Project Proposer installed a booster pump in the spring of 2007 to raise the southern dike of the tailings basin. A higher dike would allow an increased water level in the basin to submerge more of the uncovered tailings. Beach areas would be reduced to approximately 250 feet in maximum width.

In 2007, the Project Proposer and the MPCA agreed to a Stipulation Agreement to resolve the reported violations by specifying actions the Project Proposer agreed to undertake. The actions included:

1. A civil penalty,
2. A Supplemental Environmental Project to the City of Keewatin that the City applied to the purchase of a street washer/sweeper,
3. A corrective action plan and schedule to prevent fugitive dust emissions release in the future, and
4. An ambient air quality monitoring plan consisting of continuous monitoring for PM_{10} to determine compliance with PM_{10} ambient standards. The plan requires three monitors to be located near the tailings basin as well as a meteorological station.

The MPCA Duluth office reported that the Project Proposer started the PM_{10} monitors on March 31, 2008. Each monitor recorded one 24-hour period with concentrations greater than the PM_{10} standard in 2008, which is allowable at each monitor, each year. Therefore, no violations occurred during 2008. The MPCA reported on February 11, 2010 that through the end of 2009, no violations have occurred in seven quarters of ambient air monitoring at the three sites near the Keetac tailings basin. Additionally, no violations of ambient PM_{10} standards or fugitive dust rules were reported in 2010 as of May 20, 2010.

The Project Proposer has fulfilled MPCA requirements for continuous ambient monitoring of PM_{10} for the past two years without violation of the PM_{10} standard. On October 8, 2010 the MPCA reported that the stipulation agreement was terminated after more than three years without a dust complaint and along with the two years of ambient monitoring without a violation. No related conditions other than the submittal of a fugitive dust control plan for the facility operation will be included in the Project Proposer’s air permit.

4.9.2.1.3 No Action Alternative

The Project Proposer would continue to operate according to the Fugitive Dust Plan under the No Action Alternative, as described in Section 4.9.2.1.1. All control measures, operating practices, and recordkeeping that are required by the plan would still be required for the No Action Alternative.

The Project Proposer may continue without additional permits other than standard reissuance of the Title V operating permit under the No Action Alternative. Based on current production rates, the tailings basin would increase to the permitted elevation of 1,585 feet above sea level, and in 2021 the tailings basin would be approximately 105 feet above ground (AECOM, 2009B).

An ambient air quality analysis was performed to demonstrate compliance with the Minnesota and National Ambient Air Quality Standards (MAAQS and NAAQS) for PM_{10}, $PM_{2.5}$, NOx, SO_2, CO, and lead (Barr, 2009E). Additional information about the analysis can be found in Section 4.9.6.

Fugitive dust emissions generated by wind erosion from the tailings basin was included as part of the modeling analysis. Pollutants affected by wind erosion are PM_{10} and $PM_{2.5}$. The modeling was completed with the assumption that the entire perimeter of the tailings basin is exposed and vulnerable to wind erosion. The Project Proposer would revegetate the beach areas over time to prevent erosion, so only portions of the beach area are typically prone to wind erosion on a given day (Barr, 2009C).

The PM_{10} modeling results for the No Action Alternative modeling scenario show compliance with the applicable standards. The No Action Alternative modeling is based on the assumption that all existing permits would be renewed and the existing facility would continue to operate in its current capacity. The maximum 24-hour PM_{10} predicted impacts at the tailings basin boundary range between 46-65 micrograms per cubic meter (µg/m^3). These impacts included a background concentration of 26 µg/m^3 and occurred at the north and east boundary of the tailings basin. The 24-hour PM_{10} predicted impacts around the remainder of the tailings basin are in the range of 30-45 µg/m^3 including background concentrations. The National and Minnesota Ambient Air Quality Standards (NAAQS/MAAQS) for 24-hour PM_{10} is 150 µg/m^3 (Barr, 2009E).

The $PM_{2.5}$ modeling results for the No Action Alternative modeling scenario show compliance with the applicable standards. The No Action Alternative modeling is based on the assumption that all existing permits would be renewed and the existing facility would continue to operate in its current capacity. The maximum 24-hour $PM_{2.5}$ predicted impacts at the tailings basin boundary range between 21-22 µg/m^3. These impacts included a background concentration of 17 µg/m^3 and occurred at the north and east boundary of the tailings basin. The 24-hour $PM_{2.5}$ predicted impacts around the remainder of the tailings basin are in the range of 19-20 µg/m^3 including background concentrations. The National and Minnesota Ambient Air Quality Standards (NAAQS/MAAQS) for 24-hour $PM_{2.5}$ is 35 µg/m^3 (Barr, 2009E).

4.9.2.2 Environmental Consequences

4.9.2.2.1 Proposed Action Alternative

> Modeling results for the Proposed Project scenario show compliance with applicable standards.

The Fugitive Dust Plan was submitted by the Project Proposer in compliance with the requirement to perform a BACT analysis as part of the Proposed Project. The BACT Report cites industry best practices for controlling fugitive dust emissions. The Project Proposer was requested by MPCA to update the Fugitive Dust Plan to account for the changes noted during MPCA's review of the BACT Report. The Project Proposer has made these updates and submitted the revisions to the MPCA including adding operating practices and control measures for the proposed sources biomass receiving/storage and pellet storage pile/conveyor. The Project Proposer's revisions also include modifying notification requirements for future plan changes and expanding the discussion of the plan purpose. The modified Fugitive Dust Plan incorporating these changes would be included in the final air permit application. Other types of fugitive dust emission sources that are proposed as part of the project already exist at the current facility. The types of emission sources that generate fugitive dust are accounted for in the modified Fugitive Dust Plan.

4.9.2.2.2 Tailings Basin Fugitive Dust Predicted Impacts

As a result of the increased tailings production from the Proposed Project, the tailings basin storage capacity would increase the permitted height to 1,612 feet above sea level. Total approximate height above ground of the tailings basin would be roughly 132 feet. This height would be achieved in approximately 2037 when the mine ore in the proposed amendment to the permit to mine pit limit would be exhausted (AECOM, 2009B). Current tailings basin mitigation measures used at the Keetac facility are described in Section 4.9.2.1.2.

An ambient air quality analysis was performed to demonstrate compliance with the MAAQS, NAAQS, and Prevention of Significant Deterioration (PSD) Class II Increment Standards for PM_{10}, $PM_{2.5}$, NOx, SO_2, CO, and lead (Barr, 2009E). Additional information about the analysis can be found in Section 4.9.6.

Fugitive dust emissions generated by wind erosion from the tailings basin was included as part of the modeling analysis. Pollutants affected by wind erosion are PM_{10} and $PM_{2.5}$. The modeling was completed with the assumption that the entire perimeter of the tailings basin is exposed and vulnerable to wind erosion. The Project Proposer revegetates the beach areas over time to prevent erosion, so only portions of the beach area are typically prone to wind erosion on a given day (Barr, 2009C).

The PM_{10} modeling results for the Proposed Project modeling scenario show compliance with the applicable standards. The Proposed Project modeling is based on the operation of the existing emission sources as well as the emission sources associated with the Proposed Project. The maximum 24-hour PM_{10} predicted impacts at the tailings basin boundary range between 66-75 $\mu g/m^3$. These impacts included a background concentration of 30 $\mu g/m^3$ and occurred at the north boundary of the tailings basin. The 24-hour PM_{10} predicted impacts around the remainder of the tailings basin are in the range of 30-65 $\mu g/m^3$ including background concentrations. The NAAQS/MAAQS for 24-hour PM_{10} is 150 $\mu g/m^3$ (Barr, 2010I).

The $PM_{2.5}$ modeling results for the Proposed Project modeling scenario show compliance with the applicable standards. The Proposed Project modeling is based on the operation of the existing emission sources as well as the emission sources associated with the Proposed Project. The maximum 24-hour $PM_{2.5}$ predicted impacts at the tailings basin boundary range between 27-29 $\mu g/m^3$. These impacts included a background concentration of 17 $\mu g/m^3$ and occurred at the north boundary of the tailings basin. The 24-hour $PM_{2.5}$ predicted impacts around the remainder of the tailings basin are in the range of 19-23 $\mu g/m^3$ including background concentrations. The NAAQS/MAAQS for 24-hour $PM_{2.5}$ is 35 $\mu g/m^3$ (Barr, 2010I).

The $PM_{2.5}$ modeling for the Proposed Project point sources is based on modeling $PM_{2.5}$ emissions at PM_{10} emission rates. This is a conservative approach that is built into the modeling in order to address the limited information about $PM_{2.5}$ emissions at taconite facilities.

The Proposed Project has a potential to increase fugitive dust emissions and for those emissions to have an adverse effect on the environment. The magnitude of the effect is likely to be highly variable, localized and dependent upon the success of dust mitigation efforts and weather conditions. The magnitude of the effect would be less than significant.

4.9.2.2.3 East Stockpile Alternative

The potential environmental effects from changes to fugitive dust from the East Stockpile Alternative are the same as those identified for the Proposed Project.

4.9.2.3 Mitigation Opportunities

The Fugitive Dust Plan lists activities that generate fugitive dust and describes methods that the Project Proposer implements to control fugitive emissions from the property. The purpose of the plan is to ensure operational activities emitting fugitive dust are managed and controlled. The Fugitive Dust Plan lists the primary controls, contingent controls, operating practices and record keeping requirements for each of the activities that generate fugitive dust. The plan contains mitigation opportunities for the Project Proposer to comply with the requirements of the Project Proposer's air permit and BACT Report about fugitive dust emission sources. This plan would be modified and included in the air permit for the Proposed Project.

4.9.3 BACT Review

As summarized in Section 3.3.5.1.1 – Best Available Control Technologies, the FSDD states that the FEIS would evaluate air pollution control methods and/or technologies for the Proposed Project on sources of air pollutants, and be limited to BACT where applicable.

> The facility will fulfill all regulatory requirements in the air permitting process.

BACT is defined in 40 CFR 52.21(j) as follows:

an emission limitation (including a visible emission standard) based on the maximum degree of reduction of each air pollutant subject to regulation under the Clean Air Act which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental and economic impacts, and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant…

4.9.3.1 Affected Environment

4.9.3.1.1 Existing Conditions

The existing facility operates as a major stationary source under PSD, emitting several criteria pollutants, including PM, PM_{10}, $PM_{2.5}$, NOx, SO_2, VOCs, CO and lead.

4.9.3.1.2 No Action Alternative

The No Action Alternative for the Proposed Project would allow the facility to continue to operate under its current air permit, Permit #13700063-003. The facility would continue to operate under the existing permit applying for renewals/amendments as dictated by the permit and applicable law. The facility would be subject to future rules or regulations as they develop (e.g., regional haze), which may require revisions to the air emissions permit at that time.

4.9.3.2 Environmental Consequences

4.9.3.2.1 Proposed Action Alternative

The Proposed Project requires the Project Proposer to apply for a major amendment application to their current permit. The major amendment application would include BACT requirements as a result of the permitting review for the Proposed Project.

Emission units constructed or modified as part of the Proposed Project are subject to PSD review. Because the emissions increase associated with PM, PM_{10}, $PM_{2.5}$ and SO_2 exceed their respective PSD significance thresholds, the Proposed Project is a major modification and requires a BACT analysis of these pollutants.

The Project Proposer would accept federally enforceable permit limits for NOx on the existing and proposed induration furnaces. These limits would restrict facility-wide emissions below levels that would trigger a major modification for NOx. In addition, the Proposed Project is not a major modification for lead, CO, VOCs, fluorides, and sulfuric acid mist. Therefore, BACT analysis is not required for these PSD pollutants.

Regulations require the Project Proposer to conduct a case-by-case BACT analysis for each emission source associated with the Proposed Project for PM, PM_{10}, $PM_{2.5}$ and SO_2. This section summarizes information presented in the BACT Report, the Reconciliation Memo, and the BACT SO_2 Limit Proposal. Table 4.9.4 shows a summary of the emission sources and the PSD pollutants emitted.

TABLE 4.9.4 CATEGORIZATION OF EMISSION SOURCES SUBJECT TO BACT REVIEW

Source	PSD Pollutants Emitted
Additive Storage Bins and Mixing Equipment (Includes Bentonite Bin, Limestone Bin, Lime Bin, and Activated Carbon Bin)	PM, PM_{10} and $PM_{2.5}$
Coal Bin 2 New Line (Solid Fuels Handling)	PM, PM_{10} and $PM_{2.5}$
Biomass Handling and Drying (Includes Biomass Unloading, Biomass Dryer Handling, Biomass Hammermill #1 and #2, and Biomass Dryer)	PM, PM_{10} and $PM_{2.5}$
Biomass Fuel Silos (Includes Biomass Intermediate Dry Fuel Silo and Biomass Prepared Fuel Silo)	PM, PM_{10} and $PM_{2.5}$
Mill Feeder 1 and 2 (Crushed Ore Handling in Storage Shed)	PM, PM_{10} and $PM_{2.5}$
Grate Feed New Line (Green Ball Feed to the New Induration Furnace)	PM, PM_{10} and $PM_{2.5}$
Grate Kiln – Down Draft Drying Zone 1 Exhaust	PM, PM_{10}, $PM_{2.5}$ and SO_2
Grate Kiln – Down Draft Drying Zone 2 Exhaust	PM, PM_{10}, and $PM_{2.5}$
Grate Kiln – Tempered Pre-Heat Zone Exhaust	PM, PM_{10}, $PM_{2.5}$ and SO_2
Grate Discharge New Line (Pellet Discharge from the Traveling Grate)	PM, PM_{10} and $PM_{2.5}$
Pellet Cooler – Cooler Zone C4 Exhaust	PM, PM_{10} and $PM_{2.5}$

Source	PSD Pollutants Emitted
Finished Pellet Discharge / Pellet Screening (Includes Cooler Vibrating Feeder New Line, Pellet Product Conveyor and Reject Discharge, Stacker, and Pellet Screening System and Sampler)	PM, PM_{10} and $PM_{2.5}$
Finished Transfer Conveyors and Loadout Conveyor	PM, PM_{10} and $PM_{2.5}$
Reclaim Conveyor	PM, PM_{10} and $PM_{2.5}$
Fugitives	PM, PM_{10} and $PM_{2.5}$

The Proposed Project's BACT analysis used USEPA's top-down approach. Following the top-down approach, the control technology with the highest level of control that is economically feasible is determined the BACT technology. This analysis is based on environmental, energy, and economic impacts. The steps involved include:

- Identify applicable options,
- Eliminate technically infeasible options,
- Rank remaining alternatives by control effectiveness,
- Evaluate most effective controls, and
- Select BACT.

In determining BACT for the emission units included in the Proposed Project, information from the following sources was evaluated in the BACT review:

- Online USEPA RACT/BACT/LAER Clearinghouse (RBLC) System,
- USEPA's NSR Bulletin Board,
- USEPA/State Air Quality Permits,
- Air Pollution Control Technology Vendors, and
- Manufacturer's Recommendations.

The control technologies proposed as BACT for the Proposed Project include:

- Wet Scrubbers for control of PM, PM_{10} and $PM_{2.5}$ emissions from the Grate Feed New Line, Grate Discharge New Line, and Finished Pellet Discharge/Pellet Screening material handling systems.
- Enclosures with Fabric Filters (baghouses) for control of PM, PM_{10} and $PM_{2.5}$ emissions from all other material handling systems.
- Dry Electrostatic Precipitators (ESP's) for PM, PM_{10} and $PM_{2.5}$ control on the new grate kiln induration furnace.
- Fugitive dust control plan for controlling fugitive PM, PM_{10} and $PM_{2.5}$ emissions. Fugitive dust sources (e.g., haul roads, stockpiles, loading/unloading areas) are described in Section 4.9.2.
- Gas Suspension Absorber (GSA) dry scrubbers for control of SO_2 emissions from the new grate kiln induration furnace.

These proposed control technologies and associated emission sources are summarized in Table 4.9.5.

TABLE 4.9.5 BACT ANALYSIS SUMMARY

Source	$PM/PM_{10}/PM_{2.5}$	SO_2	Opacity
Additive Storage Bins and Mixing Equipment	Baghouse	NA	Baghouse
Coal Bin 2 New Line	Baghouse	NA	Baghouse
Biomass Handling and Drying	Baghouse	NA	Baghouse
Biomass Fuel Silos	Baghouse	NA	Baghouse
Mill Feeder 1 and 2	Baghouse	NA	Baghouse
Grate Feed New Line	Wet Scrubber	NA	Wet Scrubber
Grate Kiln – Down Draft Drying Zone 1 Exhaust	Dry ESP	GSA	Dry ESP
Grate Kiln – Down Draft Drying Zone 2 Exhaust	Dry ESP	NA	Dry ESP
Grate Kiln – Tempered Pre-Heat Zone Exhaust	Dry ESP	GSA	Dry ESP
Grate Discharge New Line	Wet Scrubber	NA	Wet Scrubber
Pellet Cooler – Cooler Zone C4 Exhaust	Dry ESP	NA	Dry ESP
Finished Pellet Discharge / Pellet Screening	Wet Scrubber	NA	Wet Scrubber
Finished Transfer Conveyors and Loadout Conveyor	Baghouse	NA	Baghouse
Reclaim Conveyor	Baghouse	NA	Baghouse
Fugitives	Work Practices	NA	Work Practices

NA = not applicable; BACT is not triggered
ESP = Electrostatic Precipitator
GSA = Gas Suspension Absorber

As required by PSD regulations, BACT emission limits and performance standards were proposed by the Project Proposer for inclusion in the air emissions permit. A summary of the proposed BACT performance standards and emission limits are presented in Tables 4.9.6 and 4.9.7 below.

Very little information is available about $PM_{2.5}$ emissions at taconite facilities. The Project Proposer and MPCA have negotiated a test and set procedure that would be used to determine $PM_{2.5}$ emission limits. Initially, PM_{10} would be assumed to be equal to $PM_{2.5}$ emissions. The results from the initial performance tests would be used to set the $PM_{2.5}$ limits. This applies to both the performance standard limits and the mass emission limits.

TABLE 4.9.6 PROPOSED BACT PERFORMANCE STANDARD SUMMARY

Source	PM	PM_{10}	$PM_{2.5}$	SO_2	Opacity
Additive Storage Bins and Mixing Equipment	0.0020 gr/dscf*	0.0020 gr/dscf*	0.0020 gr/dscf*	NA	<5%
Coal Bin 2 New Line	0.0020 gr/dscf*	0.0020 gr/dscf*	0.0020 gr/dscf*	NA	<5%
Biomass Handling and Drying	0.0020 gr/dscf*	0.0020 gr/dscf*	0.0020 gr/dscf*	NA	<5%
Biomass Fuel Silos and Biomass Storage Building[1]	0.0020 gr/dscf*	0.0020 gr/dscf*	0.0020 gr/dscf*	NA	<5%
Mill Feeder 1 and 2	0.0020 gr/dscf*	0.0020 gr/dscf*	0.0020 gr/dscf*	NA	<5%
Grate Feed New Line	0.0050 gr/dscf*	0.0075 gr/dscf*	0.0075 gr/dscf*	NA	<10%
Grate Kiln – Down Draft Drying Zone 1 Exhaust	0.0060 gr/dscf*	0.012 gr/dscf*	0.012 gr/dscf*	5 ppm[2]	<5%
Grate Kiln – Down Draft Drying Zone 2 Exhaust	0.0060 gr/dscf*	0.012 gr/dscf*	0.012 gr/dscf*	NA	<5%
Grate Kiln – Tempered Pre-Heat Zone Exhaust	0.0060 gr/dscf*	0.012 gr/dscf*	0.012 gr/dscf*	5 ppm[2]	<5%
Grate Discharge New Line	0.0050 gr/dscf*	0.0075 gr/dscf*	0.0075 gr/dscf*	NA	<10%
Pellet Cooler – Cooler Zone C4 Exhaust	0.0060 gr/dscf*	0.012 gr/dscf*	0.012 gr/dscf*	NA	<5%
Finished Pellet Discharge / Pellet Screening:					
Cooler Vibrating Feeder New Line and Pellet Product Conveyor and Reject Discharge New Line	0.0050 gr/dscf*	0.0096 gr/dscf*	0.0096 gr/dscf*	NA	<10%
Stacker and Pellet System and Sampler	0.0050 gr/dscf*	0.0063 gr/dscf*	0.0063 gr/dscf*	NA	<10%
Finished Transfer Conveyors and Loadout Conveyor	0.0020 gr/dscf*	0.0020 gr/dscf*	0.0020 gr/dscf*	NA	<5%
Reclaim Conveyor	0.0020 gr/dscf*	0.0020 gr/dscf*	0.0020 gr/dscf*	NA	<5%
Fugitives	FDCP	FDCP	FDCP	NA	<10%

* PM as measured by USEPA Method 5. PM_{10} and $PM_{2.5}$ as measured by Methods 201/201A or OTM 27 for filterables or Method 5 for filterables from wet scrubbers, and Methods 202 or OTM 28 for condensables.

[1] Calculated emissions are negligible from the Biomass Storage Building.

2 5ppm would be the final SO_2 performance standard. However, Keetac would have an initial limit of 8ppm during the first 455 days after initial startup of the new indurating line. The optimization of the control equipment would occur during this period to ensure that the final limit would be met.

NA = not applicable; for this pollutant at this source, BACT is not triggered

FDCP = Fugitive Dust Control Plan

gr/dscf = grains per dry standard cubic feet

TABLE 4.9.7 PROPOSED BACT MASS EMISSION LIMIT SUMMARY

Source	PM	PM_{10}	$PM_{2.5}$	SO_2	Opacity
Additive Storage Bins and Mixing Equipment:					
Bentonite Bin & Limestone Bin (each)	0.21 lb/hr	0.21 lb/hr	0.21 lb/hr	NA	NA
Lime Bin and Activated Carbon Bin (each)	0.02 lb/hr	0.02 lb/hr	0.02 lb/hr	NA	NA
Coal Bin 2 New Line	0.41 lb/hr	0.41 lb/hr	0.41 lb/hr	NA	NA
Biomass Handling and Drying:					
Biomass Unloading	0.26 lb/hr	0.26 lb/hr	0.26 lb/hr	NA	NA
Biomass Dryer Handling	0.08 lb/hr	0.08 lb/hr	0.08 lb/hr	NA	NA
Biomass Hammermill #1 and #2	0.41 lb/hr	0.41 lb/hr	0.41 lb/hr	NA	NA
Biomass Dryer	0.31 lb/hr	0.31 lb/hr	0.31 lb/hr	NA	NA
Biomass Fuel Silos:					
Biomass Intermediate Dry Fuel Silo	0.11 lb/hr	0.11 lb/hr	0.11 lb/hr	NA	NA
Biomass Prepared Fuel Silo	0.07 lb/hr	0.07 lb/hr	0.07 lb/hr	NA	NA
Biomass Storage Building	0.003 lb/hr	0.002 lb/hr	0.002 lb/hr	NA	NA
Mill Feeder 1 and 2	0.51 lb/hr	0.51 lb/hr	0.51 lb/hr	NA	NA
Grate Feed New Line	1.29 lb/hr	1.93 lb/hr	1.93 lb/hr	NA	NA
Grate Kiln – Down Draft Drying Zone 1 Exhaust	10.49 lb/hr	20.98 lb/hr	20.98 lb/hr	23.32 lb/hr[1]	NA
Grate Kiln – Down Draft Drying Zone 2 Exhaust	7.12 lb/hr	14.25 lb/hr	14.25 lb/hr	NA	NA
Grate Kiln – Tempered Pre-Heat Zone Exhaust	5.67 lb/hr	11.34 lb/hr	11.34 lb/hr	6.28 lb/hr[1]	NA
Grate Discharge New Line	1.29 lb/hr	1.93 lb/hr	1.93 lb/hr	NA	NA
Pellet Cooler – Cooler Zone C4 Exhaust	9.85 lb/hr	19.71 lb/hr	19.71 lb/hr	NA	NA
Finished Pellet Discharge / Pellet Screening:					
Cooler Vibrating Feeder New Line	2.55 lb/hr	4.90 lb/hr	4.90 lb/hr	NA	NA
Pellet Product Conveyor and Reject Discharge New Line	2.61 lb/hr	5.02 lb/hr	5.02 lb/hr	NA	NA
Stacker	0.19 lb/hr	0.24 lb/hr	0.24 lb/hr	NA	NA
Pellet Screening System and Sampler	3.21 lb/hr	4.05 lb/hr	4.05 lb/hr	NA	NA
Emergency Truck Loadout	0.21 lb/hr	0.21 lb/hr	0.21 lb/hr	NA	NA
Finished Transfer Conveyors and Loadout Conveyor	0.21 lb/hr	0.21 lb/hr	0.21 lb/hr	NA	NA
Reclaim Conveyor	0.31 lb/hr	0.31 lb/hr	0.31 lb/hr	NA	NA
Fugitives	NA	NA	NA	NA	NA

[1] Levels used in modeling. Exact limits will be defined in the air permit.
Note – Averaging times for limits are defined in BACT Report.
lb/hr = pounds per hour

In the final air emissions permit, the MPCA would include control equipment requirements and BACT limits that are equal to or more stringent than those shown in Tables 4.9.5, 4.9.6, and 4.9.7. The air emissions permit would also specify BACT limits for periods of startup and shutdown.

Cross media impacts from the control equipment are further described in the EIS as follows:

- Water discharges from the wet scrubbers are described in Section 4.4.1 of the FEIS.
- Solid waste disposal from baghouses and ESP's are described in Section 4.14 of this FEIS.

There would be an increase in air pollutants reviewed under BACT for the Proposed Project. Increased air emissions would result in an adverse effect to the environment. The adverse effect would be less than significant as the Project Proposer would meet BACT requirements under PSD review.

4.9.3.2.2 East Stockpile Alternative

The potential environmental effects from changes to air emissions from the East Stockpile Alternative are the same as those associated with the Proposed Project. Both would meet BACT requirements under PSD review.

4.9.3.3 Mitigation Opportunities

The Proposed Project has several emissions units that are subject to BACT standards, therefore, maximum levels of control are being considered for installation to maximize control of pollutants and reduce impacts on the environment. The Class II area impacts analysis (Section 4.9.6) indicated that the Proposed Project demonstrated compliance with the Class II increment standards, Minnesota Ambient Air Quality Standards, and National Ambient Air Quality Standards. The facility would fulfill all regulatory requirements in the air permitting process.

4.9.4 MACT Compliance

The Clean Air Act Amendments of 1990 require the USEPA to regulate emissions of toxic air pollutants (Hazardous Air Pollutants – HAPs) using technology-based standards. These standards are known as the National Emissions Standards for Hazardous Air Pollutants (NESHAP) or the Maximum Achievable Control Technology (MACT) standards. USEPA identified and compiled a list of major sources of air toxics and established a timeframe in which MACT standards for each source category would be promulgated. When all of the 90+ MACT rules are finalized, around 170 source types would be affected.

4.9.4.1 Affected Environment

4.9.4.1.1 Existing Conditions

The Keetac facility operates under its existing air permit; Permit No. 13700063-003. The facility has several emission units subject to the Federal MACT Standard:

- 40 CFR Part 63, subp. RRRRR - Taconite Iron Ore Processing NESHAP, promulgated October 30, 2003.

The Taconite Iron Ore Processing NESHAP was developed in order to regulate: 1) existing taconite iron ore processing facilities; 2) modifications to existing facilities; and 3) new

taconite iron ore processing facilities. The standard requires control of metallic HAP, where particulate matter emissions serve as a surrogate measure of metallic HAP emissions.
For the existing facility, the air permit defines the following compliance requirements for the compliance with the Taconite Iron Ore Processing MACT:

- Install, operate, and maintain Continuous Parameter Monitoring Systems (CPMS) for air pollution control devices (wet scrubbers and centrifugal collectors) to monitor air stream pressure drop and, if appropriate, scrubber water flow rate.
- Comply with each emission limitation, work practice standard, and operation and maintenance requirement that applies to the source.
- Prepare and implement a fugitive dust emissions control plan for sources of fugitive dust.

The emission limits defined in the Taconite Iron Ore Processing NESHAP for the existing affected sources are as follows:

- Control ore crushing and ore handling air emissions to 0.008 grains per dry standard cubic foot (gr/dscf) for PM. The facility operates wet scrubbers and centrifugal collectors to meet this limit.
- Control indurating furnace air emissions to 0.01 gr/dscf PM. The facility operates wet scrubbers and centrifugal collectors to meet this limit.
- Control finished pellet handling air emissions to 0.008 gr/dscf PM. The facility operates wet scrubbers to meet this limit.

4.9.4.1.2 No Action Alternative

The No Action Alternative for the Proposed Project would allow the facility to continue to operate under its current air permit. The facility would continue to operate under the existing permit applying for renewals/amendments as dictated by the permit. The existing emission units that are subject to NESHAP Subpart RRRRR would continue to be subject to that regulation.

4.9.4.2 Environmental Consequences

4.9.4.2.1 Proposed Action Alternative

Taconite Iron Ore Processing NESHAP Requirements

The Proposed Project has air emission sources that are subject to the Federal MACT standard:

- 40 CFR Part 63, Subpart RRRRR, Taconite Iron Ore Processing NESHAP (promulgated October 30, 2003).

For the Proposed Project, the following compliance requirements (similar to the existing facility air permit requirements) would be applicable for compliance with the Taconite Iron Ore Processing MACT:

- Install, operate, and maintain CPMS for air pollution control devices. This includes CPMS on the wet scrubbers to monitor air stream pressure drop and, if appropriate, scrubber water flow rate, and CPMS on the ESP to monitor secondary voltage and secondary current.
- Install, operate, and maintain a bag leak detection system on each proposed baghouse (fabric filter) that is subject to the Taconite MACT.

- Comply with each emission limitation, work practice standard, and operation and maintenance requirement that applies to the source.
- Prepare and implement a fugitive dust emissions control plan for sources of fugitive dust.

The emission limits defined in the Taconite Iron Ore Processing NESHAP for the proposed new affected sources are as follows:

- Control ore crushing and ore handling air emissions to 0.005 gr/dscf for filterable PM as a flow-weighted average. The Project Proposer would install and operate fabric filters or wet scrubbers to meet this limit.
- Control indurating furnace air emissions to 0.006 gr/dscf filterable PM (new grate kiln indurating furnace processing magnetite). The Project Proposer would install and operate electrostatic precipitators to meet this limit.
- Control finished pellet handling air emissions to 0.005 gr/dscf filterable PM as a flow-weighted average. The Project Proposer would install and operate fabric filters or wet scrubbers to meet this limit.

There would be an increase in air pollutants regulated under the Taconite Iron Ore Processing NESHAP. These air emissions would result in an adverse effect to the environment. The adverse effect would be less than significant as the Project Proposer would comply with the Taconite Iron Ore Processing MACT.

Case-by-Case MACT Determinations

As part of the permitting review process for the Proposed Project, the Project Proposer completed a Case-by-Case MACT determination to determine which, if any, units would be subject to a Case-by-Case MACT review by MPCA. The Project Proposer had the following finding about Case-by-Case MACT:

> *The addition of the furnace is not occurring at a greenfield site; the site has previously been developed. The project is an addition to an existing site. For that reason, item (1) of the definition of construct a major source in §63.41(a) does not apply. In contrast to item (1), item (2) of the definition of construct a major source requires a look at individual processes or production units that are being added. As noted above, the furnace itself (and some associated equipment) triggers the Taconite MACT and will be required to follow the new source conditions. The activated carbon bin and the noncontact biomass dryer are the processes/production units to be examined. However, the emissions from these sources, when taken apart from the furnace, do not exceed the 10/25 thresholds. Thus, item (2) also does not apply. Since these are the only situations in which 112(g) applies, 112(g) does not apply to the Keetac project.*

MPCA reviewed this finding. Therefore, based on the above information, Case-by-Case MACT does not apply to the Proposed Project.

4.9.4.2.2 East Stockpile Alternative

The potential environmental effects from changes to air emissions from the East Stockpile Alternative are the same as those from the Proposed Project. Both would comply with Taconite Iron Ore Processing MACT.

4.9.4.3 Mitigation Opportunities

The Proposed Project has several emissions units that are subject to NESHAP standards, therefore, maximum levels of control are being considered for installation, to maximize the control of pollutants and reduce impacts on the environment.

4.9.5 Class I Area Impacts Analysis

> Four Class I areas were assessed for potential impacts from the Proposed Project: 1) Boundary Waters Canoe Area Wilderness (BWCAW), 2) Isle Royale National Park, 3) Rainbow Lake Wilderness Area, and 4) Voyageurs National Park.

As required by the FSDD, an ambient air quality modeling analysis was conducted relative to Class I PSD area classifications. Ambient air quality modeling was conducted to determine the level of impact from the Proposed Project on Class I areas. For air quality purposes, areas are divided into two classes based on local land use. These are referred to as Class I and Class II areas. Class I areas include international parks, national wilderness areas which exceed 5,000 acres in size, national memorial parks which exceed 5,000 acres in size, and national parks which exceed 6,000 acres in size; other areas are designated as Class II areas. This section addresses the Class I area impacts analysis. Section 4.9.6 addresses impacts associated with the Class II areas.

4.9.5.1 Affected Environment

Class I areas include international parks, national wilderness areas, national memorial parks, and national parks. Four Class I areas were assessed for potential impacts from the Proposed Project: the Boundary Waters Canoe Area Wilderness (BWCAW), Isle Royale National Park, Rainbow Lake Wilderness Area, and Voyageurs National Park.

Air Quality Related Values (AQRVs) are resources of Class I areas that may be adversely affected by changes in air pollution. The Clean Air Act requires that potential AQRV impacts be reviewed for all major sources near Class I areas. The AQRVs analyzed as part of this study included the following:

- Effects on flora and fauna: Lichen species are generally used as an indicator of potential air pollution damage in evaluating potential adverse effects to flora and fauna. Lichen are especially susceptible to air pollution and show adverse effects before other plant species and animal species.
- Effects on acid deposition: Acid deposition impacts analysis for the BWCAW and Rainbow Lake Wilderness Area considers the total concentration or deposition including background. For Voyageurs National Park and Isle Royale National Park, thresholds (DATS) were calculated for total sulfur and total nitrogen to evaluate the contribution of additional nitrogen or sulfur deposition within Class I areas. These thresholds are intended to distinguish where deposition increases may result in adverse ecosystem stresses, as well as where the deposition increases are likely to have a negligible impact on AQRVs and,
- Effects on visibility impairment: Three Class I areas were included in the visibility analysis for the Proposed Project: the BWCAW, Voyageurs National Park, and Isle Royale National Park. Visibility has not been established as an AQRV for the Rainbow Lakes Wilderness, so visibility impacts were not modeled for that area.

Background for Class I and Class II Analyses

An increase in ambient air concentration consumes air quality increment. The increment in an area limits the amount that the air quality can deteriorate. Class I and Class II differ in the amount of increased emissions that are allowed. Class I increment standards are designed to maintain pristine areas and have more restrictive thresholds than their Class II counterparts. When developing air permitting regulations, it was anticipated that increases in ambient air concentrations would be necessary for economic growth to occur. Ambient air concentrations are capped by the National Ambient Air Quality Standards (NAAQS), which are set to protect human health.

The air permitting regulations were also designed to keep ambient air concentrations relatively unchanged from the established baseline, except for small increases. In the area around the Proposed Project site, the major source baseline was established in 1975. The Proposed Project is located in both Itasca and St. Louis Counties. The earlier minor source baseline data was chosen for this project. The PM_{10} minor source baseline was established in 1979 for both Itasca and St. Louis Counties. The NOx minor source baseline date was established in 1989 in Itasca County and the SO_2 minor source baseline date was established in 1986 in St. Louis County.

Increment increases can also be accommodated through decreases in ambient air concentrations. These can result from reductions in air emissions from sources in an area since a baseline was established. In addition to impacts on ambient air concentrations, potential impacts to air quality related values such as visibility and flora/fauna are required to be assessed for Class I areas.

4.9.5.1.1 No Action Alternative

The No Action Alternative for this project would allow the facility to continue to operate under current permits. The emission sources would remain the same and existing requirements would remain in effect. The facility would be subject to future rules or regulations as they develop, which may require revisions to their existing permits at that time.

4.9.5.2 Environmental Consequences

4.9.5.2.1 Proposed Action Alternative

The analysis assessing the Class I air quality impacts were performed for the Proposed Project. The results of the analysis were described in the Class I Air Modeling Study.

Figure 4.9.5.1 shows the Class I areas that were evaluated. Four Class I areas were assessed for potential impacts from the Proposed Project emissions using the CALPUFF modeling system: 1) BWCAW, 2) Isle Royale National Park, 3) Rainbow Lake Wilderness Area, and 4) Voyageurs National Park.

As previously mentioned, AQRVs are resources of Class I areas that may be adversely affected by changes in air pollution. The Clean Air Act requires that potential AQRV impacts be reviewed for all major sources near Class I areas. The AQRVs analyzed as part of this study include:

- Effects on flora and fauna,
- Effects on acid deposition, and
- Effects on visibility impairment.

Modeling was also performed to determine if a full Class I increment analysis was necessary as part of this study. This modeling showed that the increases in concentrations were less than the Significant Impact Levels (SILs) as defined by USEPA except for the 24-hour SO_2 standard. Therefore, additional increment analysis was performed for SO_2.

The CALPUFF Modeling System is the USEPA preferred model for assessing long-range transport, or greater than 50 meters from the source of pollutants from individual sources. The main components of the CALPUFF system are CALMET, CALPUFF and CALPOST, along with a number of pre-processing programs. The Class I modeling was completed in accordance with the modeling protocol approved by the Federal Land Managers (FLMs). The FLMs are the entities assigned the responsibility for review of potential Class I impacts for each Class I area. The FLMs for the Class I areas applicable to the Proposed Project are:

- U.S. Department of Agriculture (USFS) for the Boundary Water Canoe Area Wilderness,
- U.S. Department of the Interior (NPS) for Isle Royale National Park,
- U.S. Department of Agriculture (USFS) for Rainbow Lake Wilderness Area, and
- U.S. Department of the Interior (NPS) for Voyageurs National Park.

4.9.5.2.2 Modeling Results for Air Quality Related Values

Flora and Fauna

Table 4.9.8 below compares the sum of background SO_2 concentrations plus modeled ambient air SO_2 concentrations from the Proposed Project emissions for the four Class I areas. Lichen species are generally used as an indicator of potential air pollution damage in evaluating potential adverse effects to flora and fauna. Lichen are especially susceptible to air pollution and show adverse effects before other plant species and animal species. If pollutant concentrations in a Class I area are at a level such that no damage occurs to native lichens, then it can be concluded that other flora and fauna species are protected. The most sensitive lichen species are only present when annual average SO_2 concentrations are less than 40 $\mu g/m^3$ (Adams, et al., 1991). As can be seen in Table 4.9.8, all estimated SO_2 ambient air concentrations are lower than 40 $\mu g/m^3$, and they are also below the "Green Line Concentration" of 5 $\mu g/m^3$, indicating that there should be no adverse impacts from the Proposed Project emissions on flora or fauna in the Class I areas. The "Green Line Concentration" is used as a screening level by the FLMs to determine if SO_2 ambient concentrations are at a level as to have no adverse effects from the Proposed Project (i.e., levels below the "Green Line Concentration" are not expected to have adverse effects).

TABLE 4.9.8 CLASS I ANALYSIS RESULTS FOR EFFECTS ON FLORA AND FAUNA

Location	Background Air Concentration[1] ($\mu g/m^3$)	Modeled Project Contribution[2] ($\mu g/m^3$)	Total Projected Air Concentration ($\mu g/m^3$)	Green Line Concentration[3] ($\mu g/m^3$)
BWCAW	1.2	0.007	1.2	5
Isle Royale National Park	2.0	0.001	2.0	5
Rainbow Lake Wilderness Area	1.6	0.002	1.6	5
Voyageurs National Park	0.7	0.006	0.7	5

[1] Mean annual SO_2 concentrations (ug/m^3)
[2] Modeled ambient air concentration in Class 1 area using the CALPUFF modeling system.
[3] Green line concentration from Adams et al.

Acid Deposition

The National Park Service and the US Forest Service evaluate effects on terrestrial and aquatic ecosystems differently. The acid deposition impact analysis for the BWCAW and Rainbow Lake Wilderness Area considers the total concentration or deposition including background. The acid deposition impact on terrestrial and aquatic ecosystems is judged to be acceptable by the US Forest Service if ambient air concentrations and/or deposition including background are below the respective "green line."

For Voyageurs National Park and Isle Royale National Park, DATs were calculated for total sulfur and total nitrogen. DATs have been developed by the National Park Service and US Fish and Wildlife Service (USFWS) to evaluate the contribution of additional nitrogen (N) or sulfur (S) to deposition within Class I areas (http:www.nature.nps.gov/air/Pubs/pdf/flag/nsDATGuidance.pdf). The DATs are intended to distinguish where deposition increases may result in adverse ecosystem stresses, as well as where the deposition increases are likely to have a negligible impact on AQRVs.

Project-related deposition was estimated using the CALPUFF modeling system and results for potential terrestrial and aquatic impacts are presented in Tables 4.9.9 and 4.9.10, respectively below. SO_2, S and N impacts from the Proposed Project are below the green line value or DATs for terrestrial and aquatic ecosystems in the Class I areas. Impacts from the Proposed Project on the terrestrial nitrogen deposition at Rainbow Lake Wilderness Area are insignificant.

TABLE 4.9.9 CLASS I ANALYSIS RESULTS FOR TERRESTRIAL IMPACTS

Location[2]	Pollutant	Background Data [1]	Model Air Concentration or Calculated Project-Related Deposition[3]	Total Concentration or Deposition	Green Line Value or Deposition Analysis Threshold [4 5]
BWCAW	Ann. Ave SO_2 ($\mu g/m^3$)	1.2	0.007	1.2	5 $\mu g/m^3$
	3-hour max SO_2 ($\mu g/m^3$)	10.8	0.649	11.4	100 $\mu g/m^3$
	Total Sulfur (kg/ha/yr)	2.85	0.005	2.86	5-7 kg/ha/yr S
	Total Nitrogen (kg/ha/yr)	4.75	0.004	4.75	5-8 kg/ha/yr N
Isle Royale National Park	Ann. Ave SO_2 ($\mu g/m^3$)	2.0	0.001	2.0	5 $\mu g/m^3$
	3-hour max SO_2 ($\mu g/m^3$)	18	0.079	18	100 $\mu g/m^3$
	Total Sulfur (kg/ha/yr)	2.15	0.001	2.15 [6]	0.01 kg/ha/yr S
	Total Nitrogen (kg/ha/yr)	3.85	0.000	3.85 [6]	0.01 kg/ha/yr N
Rainbow Lake Wilderness Area	Ann. Ave SO_2 ($\mu g/m^3$)	1.6	0.002	1.6	5 $\mu g/m^3$
	3-hour max SO_2 ($\mu g/m^3$)	14.4	0.195	14.6	100 $\mu g/m^3$
	Total Sulfur (kg/ha/yr)	2.98	0.002	2.98 [6]	5-7 kg/ha/yr S
	Total Nitrogen (kg/ha/yr)	5.88	0.001	5.88 [6]	5-8 kg/ha/yr N
Voyageurs National Park	Ann. Ave SO_2 ($\mu g/m^3$)	0.7	0.006	1.2	5 $\mu g/m^3$
	3-hour max SO_2 ($\mu g/m^3$)	6.3	0.329	11.1	100 $\mu g/m^3$
	Total Sulfur (kg/ha/yr)	1.84	0.005	1.84 [6]	0.01 kg/ha/yr S
	Total Nitrogen (kg/ha/yr)	3.87	0.003	3.87 [6]	0.01 kg/ha/yr N

1 Mean annual SO_2 concentrations (ug/m^3)
2 Modeled air concentration in each Class I area.
3 Model estimated ambient air concentrations using the CALPUFF modeling system.
4 Green line concentration from Adams et al, 1991. DAT is based on National Park Service Guidance for the Eastern U.S.
5 S = Sulfur, N = Nitrogen.
6 Majority of total concentration or deposition is due to background. The modeled air concentration contributes less than 1 percent to the total concentration. Total concentration value is not relevant for the NPS areas.

TABLE 4.9.10 SCREENING ANALYSIS RESULTS FOR POTENTIAL AQUATIC EFFECTS

Location	Pollutant [1]	Background Deposition [2](kg/ha/yr)	Estimated Project-Related Deposition (kg/ha/yr)	Total Deposition (Project + Background) (kg/ha/yr)[3]	Green Line Value or Deposition Analysis Threshold [4](kg/ha/yr)
BWCAW	Total Sulfur Total S + 20% of Total N	2.85 3.80	0.005 0.006	2.86 3.81	7.5-8.0 9-10
Isle Royale National Park	Total Sulfur Total S + 20% of Total N	2.15 2.85	0.001 0.000	2.15 [5] 3.85 [5]	0.01 0.01
Rainbow Lake Wilderness Area	Total Sulfur Total S + 20% of Total N	2.98 4.16	0.002 0.002	2.98 4.16	3.5-4.5 4.5-5.5
Voyageurs National Park	Total Sulfur Total S + 20% of Total N	1.84 3.87	0.005 0.003	1.85 [5] 3.87 [5]	0.01 0.01

[1] S = Sulfur, N = Nitrogen.
[2] Annual wet deposition data from NAPD database (http://nadp.sws.uiuc.edu)
[3] Highest modeled deposition used in the assessment.
[4] Green line concentration from Adams et al, 1991. Deposition Analysis Thresholds based on National Park Service guidance for the eastern U.S.
[5] Majority of total concentration or deposition is due to background. The modeled air concentration contributes less than 1 percent to the total concentration.

Visibility Impairment Modeling

Three Class I areas were included in the visibility analysis for the Proposed Project: the BWCAW (located 43 miles from Proposed Project's facility), Voyageurs National Park (64 miles), and Isle Royale National Park (177 miles). Because visibility has not been established as an AQRV for the Rainbow Lake Wilderness Area, visibility impacts were not modeled for that area.

Visibility impairment is defined as, "Any humanly perceptible change in visibility (visual range, contrast, coloration) from that which would have existed under natural conditions." (40 CFR 51.301(x)). As indicated above, thresholds to determine potential visibility impacts are established by FLM guidance. FLMs are concerned about a change in light extinction from new source growth of greater than 5 percent as compared against natural conditions. A change in light extinction from new source growth of greater than 10 percent as compared against natural conditions would require mitigation.

The potential for visibility impacts associated with the Proposed Project was evaluated based on accepted guidance from the FLMs in the Federal Land Managers' Air Quality Related Values Workgroup (FLAG), Phase 1 Report, December 2000 (FLM, 2000). The FLMs are charged with direct responsibility for management of Class I areas and have a responsibility to protect the air quality related values (including visibility) of those areas. Potential changes in the visibility are expressed in terms of changes in an extinction coefficient (b_{ext}). The visibility analysis was completed in three major steps:

1. The CALPUFF modeling system was used to calculate the atmospheric concentrations of visibility-impairing pollutants in the BWCAW, Voyageurs National Park and the Isle Royale National Park.

2. Extinction coefficients (Δb_{ext}) were calculated from the model-generated atmospheric concentrations of visibility-impairing pollutants.
3. The potential visibility impacts were expressed as changes in the overall extinction coefficient and the number of days resulting in a change greater than 5 percent and 10 percent. The visibility thresholds were established by the FLMs in the Federal Land Managers' Air Quality Related Values Workgroup (FLAG), Phase 1 Report, December 2000 (FLM, 2000).

The visibility modeling was based on the emission rates for the final modified facility minus the baseline facility. The emission rates for the final modified facility were based on a combined NOx emission rate from the existing indurating furnace and the new line. The results are presented in Table 4.9.11 for the Class I areas evaluated.

The listed *ranges* in days over 5 percent or 10 percent change in extinction coefficient in the table represent the range in values for the three years modeled (i.e., 2002, 2003 and 2004). Average monthly background chemical speciation concentrations for BWCAW, Voyageurs National Park and Isle Royale National Park were obtained from the Interagency Monitoring of Protected Visual Environments (IMPROVE) website for years 1992 through 2004.

The modeling scenario for the final modified facility was based on a combined NOx emission rate from the existing indurating furnace and the new line. The combined NOx emission rate reflects the fuel mixes as well as the limited NOx emission rate of 1,652 lb/hr (as a 24-hour block average). Sensitivity analysis was completed to determine how to distribute the emissions between the two lines to show maximum modeled results. The sensitivity analysis showed that the worst-case modeled impacts occurred by modeling the existing line at its maximum emission rate and attributing the remaining allowable NOx emissions to the new line. This is referred to as the "24-Hour Limited Scenario." As indicated below, the 24-hour visibility modeling analysis results show there are zero days with extinction coefficients (Δb_{ext}) greater than 10 percent at all Class I areas.

TABLE 4.9.11 CLASS I VISIBILITY MODELING RESULTS COMPARED TO NATURAL BACKGROUND

Location	Parameter	24-Hour Limited Modeled Scenario[1]
BWCAW	Maximum Δb_{ext} (%)	3.41 – 7.67
	Days with $\Delta b_{ext} \geq$ 5%	0 – 4
	Days with $\Delta b_{ext} \geq$ 10%	0
Isle Royale National Park	Maximum Δb_{ext} (%)	1.59 – 2.09
	Days with $\Delta b_{ext} \geq$ 5%	0
	Days with $\Delta b_{ext} \geq$ 10%	0
Voyageurs National Park	Maximum Δb_{ext} (%)	2.93 – 4.88
	Days with $\Delta b_{ext} \geq$ 5%	0
	Days with $\Delta b_{ext} \geq$ 10%	0

[1] Maximum changes in the daily extinction coefficients compared to natural background and the number of days per year for the three years modeled (i.e., 2002, 2003 and 2004) in which the increase in the daily extinction coefficient exceeds 5 and 10 percent due to the Proposed Project's emissions.

Class I Area Increment Analysis

Federal air emission permitting rules for major sources require that an air quality analysis be conducted to demonstrate that national ambient air quality standards would not be exceeded and that the Proposed Project would not significantly deteriorate air quality from baseline levels beyond what has been set aside for growth. The allowance for growth, in terms of air quality, is defined as the increment of the national ambient air quality standards that are set aside for increases in ambient air concentrations of certain criteria pollutants. Class I areas have the smallest amount of growth in terms of lowest increment that is allowed.

A cumulative increment analysis that includes all increment consuming and expanding sources is required of any major PSD source for which the modeled Class I area impacts of that facility's emissions alone are above the SILs. Modeling of the Proposed Project showed that its impacts are below the SILs for PM_{10}, and NOx. For SO_2, cumulative increment analysis was completed.

Table 4.9.12 shows the value of the maximum modeled pollutant concentrations of the Proposed Project emissions compared to the Class I increments and SILs at a single receptor for the model years of 2002, 2003 and 2004. The highest result from the three (3) years is provided in the table below. As indicated above, the modeling demonstrates that the predicted increases in ambient air concentrations are less than the SILs except for the 24-hour SO_2 averaging period. Therefore, additional analysis was not required for PM_{10} and NOx, but was required for the 24-hour SO_2 averaging period.

TABLE 4.9.12 MAXIMUM PM_{10}, NOx, AND SO_2 POLLUTANT CONCENTRATIONS

Pollutant	Averaging Period	PSD Class I Increment (μg/m³)	USEPA SIL (μg/m³)	Modeled Results: BWCAW (μg/m³)	Modeled Results: Voyageurs National Park (μg/m³)	Modeled Results: Isle Royale National Park (μg/m³)	Modeled Results: Rainbow Lake Wilderness Area (μg/m³)
SO_2	3-Hour	25	1	0.649	0.329	0.079	0.195
	24-Hour	5	0.2	0.219	0.113	0.021	0.048
	Annual	2	0.1	0.007	0.006	0.001	0.002
NO_x	Annual	2.5	0.1	0.010	0.007	0.001	0.003
PM_{10}	24-Hour	8	0.3	0.159	0.071	0.037	0.049
	Annual	4	0.2	0.003	0.003	0.002	0.002

For SO_2, additional increment consumption analysis was performed for one receptor located in a portion of the BWCAW above the SIL. As shown in Table 4.9.13 below, the cumulative SO_2 modeling demonstrated compliance with the increment standard.

TABLE 4.9.13 CUMULATIVE SO_2 24-HOUR CONCENTRATIONS COMPARED TO CLASS I INCREMENT

Pollutant	Averaging Period	PSD Class I Increment (μg/m³)	Modeled Results: BWCAW (μg/m³)
SO_2	24-Hour	5	1.6

Cumulative effects related to the Class I area impacts analysis are described in Section 5.11 of this FEIS.

There would not be an adverse effect to air quality from the Proposed Project in Class I areas using Green Line environmental thresholds for flora and fauna, and terrestrial and aquatic systems. However, there would be an adverse effect to visibility in Class I areas from the Proposed Project. Controls on emissions implemented through the air permit would further reduce the modeled impacts. An additional modeling analysis would be required to determine the exact reduction, but these effects are anticipated to be less than significant.

4.9.5.2.3 East Stockpile Alternative

The potential environmental effects from changes to air quality from the East Stockpile Alternative are the same as those from the Proposed Project. Both would implement controls on emissions as required in the air permit.

4.9.5.3 Mitigation Opportunities

Adverse impact on flora and fauna is not expected from the Proposed Project. In addition, no adverse impact on terrestrial aquatic ecosystems is expected. The Class I increment analysis demonstrates that air quality would not be deteriorated as a result of the Proposed Project. Therefore, no additional mitigation strategies are identified for the Proposed Project to address flora and fauna, terrestrial aquatic ecosystems and Class I increment.

Modeling conducted according to FLM guidance indicates that there could be impacts to visibility in Class I areas under the maximum operating scenario. Therefore, the air quality permit would be required to include mitigation measures to address the visibility impacts. The Project Proposer has committed to the installation of low NOx combustion on the main burner of the new indurating line for NOx mitigation. The low NOx main burner would be capable of fueling natural gas, biomass, coal and fuel oil, while reducing the generation of NOx compared to conventional main burners used at most taconite indurating furnaces. Low NOx main burners provide an effective means of reducing the formation of NOx without additional energy consumption and cross media impacts that plague end of pipe (i.e. after the pollutant has been formed) control technologies. From a multimedia approach, minimizing and reducing the generation of NOx is more efficient than generating NOx and then attempting to control the emissions. In addition, the air permit will include a 24-hour block average NOx limit of 1652 lb/hr for the combined NOx emissions from the existing and new indurating line. CEMs will be used to directly measure the NOx from both the existing and the expansion indurating furnaces to determine compliance with the NOx emission limits. However, as part of the Regional Haze SIP, some of the other technologies may be pilot tested at taconite furnaces in the future. Below is a discussion of other possible mitigation measures that have been identified, but are not being considered for the Proposed Project.

1. *Install emission reduction/control equipment* on proposed equipment or implement process optimization. Add on control options include: selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), and Mobotec System^{TM}. The Mobotec system was pilot tested at a taconite facility, but was not proved feasible. The other aforementioned control technologies have not yet been tested or implemented at taconite facilities. There are several technical differences between taconite furnaces and other types of emission sources where these technologies have been implemented. However, pilot testing of some of these other technologies is planned.

2. *Enforceable reductions in emissions from the Proposed Project facility or nearby sources and modeling the improvement to visibility.* If the emission rates of visibility impairing

pollutants from the Project Proposer's facility or other facilities could be reduced, these could be used to offset the impacts from a new line. A demonstration of the reduced impacts of the new emission rates on visibility would be necessary in submitting a permit amendment to the MPCA. Any proposal would be shared with the FLMs. After considering the comments of the FLMs, the MPCA may approve and would make any reduced emission rates an enforceable condition of the Air Emissions Permit.

3. *On-Site Green Energy Generation.* Another possible mitigation option is for the Project Proposer to build Green Energy generation on-site to offset potential impacts of actual emissions. The types of Green Energy generation include wind, and solar.

4.9.6 Class II Area Impacts Analysis

The CAA requires USEPA to set NAAQS for common pollutants generated by all sectors of industry that have the potential to affect public health. Two types of national air quality standards are named in the Clean Air Act. Primary standards are intended to protect public health. Secondary standards are designed to protect public welfare such as visibility degradation, animal, plant, and building deterioration. USEPA has set NAAQS for seven pollutants called criteria pollutants. The seven criteria pollutants are PM_{10}, $PM_{2.5}$, NOx, SO_2, CO, ozone, and lead. The FSDD requires that an ambient air quality analysis be performed to demonstrate compliance with NAAQS, the Minnesota Ambient Air Quality Standards (MAAQS), and the PSD Class II Increment Standards for the criteria pollutants.

On October 20, 2010, EPA promulgated increment standards for $PM_{2.5}$. $PM_{2.5}$ increment standards are for the 24-hour and annual averaging periods. The new increment standards for $PM_{2.5}$ will become effective on December 20, 2010. Following December 20, 2010, state regulating agencies will have a 1-year time period to implement the new increment standards. The Project Proposer will need to demonstrate compliance with these new $PM_{2.5}$ increment standards during this time period.

While the Class I modeling analysis described in Section 4.9.5 addresses the impacts of the Proposed Project on pristine areas such as National Parks and Wilderness areas, the Class II modeling analysis is intended to address non-Class I areas that would be impacted by the Proposed Project. The highest impacts on Class II areas are highest near the facility.

As shown in Table 4.9.14, both the existing facility and the Proposed Project are greater than the PSD Significant Emission Rates and could potentially emit more than 100 TPY of several criteria pollutants. This qualifies the existing facility as a major stationary source for PSD and the Proposed Project triggers PSD for several pollutants. All criteria pollutants were modeled to support the EIS. The results of the criteria pollutants analysis were described in the Class II Report, the Reconciliation Memo, and the Summary of Class II Modeling Changes Memo. The results of the modeling analysis are presented in this section from those sources.

TABLE 4.9.14 ANNUAL CRITERIA AIR POLLUTANT EMISSIONS

Pollutant	Existing Facility Controlled Potential-to-Emit (TPY[1])	Proposed Project Controlled Potential-to-Emit (TPY)	PSD Significant Emission Rate (TPY)
CO	93	89	100
NOx	3,500[2]	2,340[2]	40
PM	6,139	3,513	25
PM_{10}	2,092	1,308	15
$PM_{2.5}$	369	483	10
SO_2	845	81	40
VOC	10	27	40
Lead	0.22	0.1	0.6

[1] TPY = Ton per Year
[2] NOx removed from PSD evaluation using netting analysis. See Section 4.9.1.2 for additional information on the annual NOx limits.

Air dispersion modeling is used to demonstrate compliance with the MAAQS, NAAQS, and PSD Increment Standards to meet both EIS and air permitting requirements. The Project Proposer completed Class II air dispersion modeling as part of the EIS and the PSD permit application. The modeling results were compared against MAAQS, NAAQS, and the PSD Class II Increment Standards. The ambient air quality standards were developed by USEPA and Minnesota to protect human health and the environment. The PSD increment standards were developed and designed by USEPA to prevent rapid degradation of air quality by limiting the increase in ambient air concentrations above the present concentration

4.9.6.1 Class II Modeling Methodology

The Project Proposer used the AMS/USEPA Regulatory Model (AERMOD, version 09292), to predict concentrations of PM_{10}, $PM_{2.5}$, NOx, SO_2, CO, and lead. AERMOD is the preferred air dispersion model in the USEPA *Guideline on Air Quality Models*, 40 CFR 51, Appendix W.

The $PM_{2.5}$ modeling for the Proposed Project point sources is based on modeling $PM_{2.5}$ emissions at PM_{10} emission rates. This conservatism is built into the modeling to address the limited information about $PM_{2.5}$ emissions at taconite facilities.

The air dispersion modeling was completed using surface meteorological data from the Hibbing, Minnesota meteorological observation station (ID #94931) with concurrent upper air sounding data from the International Falls, Minnesota meteorological observation station (ID #14918) for the years 2001 through 2005. The modeling relied on data for the years 2001 through 2005.

The receptor grid used in the modeling analysis reflects the ambient air quality boundary around the Proposed Project's mine, plant, and tailings basin areas (see Figures 4.9.6.1 and 4.9.6.2). Receptors were placed along this boundary at intervals of 100 meters. Areas of the boundary where maximum predicted impacts were expected to occur were supplemented with additional receptors at intervals of 25 meters along the boundary. Receptors extended beyond the ambient air quality boundary at intervals of 100 or 250 meters depending on whether maximum predicted concentrations were expected in an area.

To preserve and enforce the ambient air quality boundary the Project Proposer plans to restrict public access to the site using a combination of natural physical barriers, signage, gates, fencing, and patrols. Public recreational trails inside the Project Proposer's ambient air quality boundary were evaluated in the modeling analysis as ambient air as part of the Proposed Project. Section 4.19 discusses other potential impacts to recreational trails from the Proposed Project.

4.9.6.1.1 Nearby Facility Emission Sources

The Project Proposer worked with MPCA modeling staff to determine which nearby facilities within 50 kilometers needed to be included in the modeling analysis. MPCA staff provided a screening process called "20D Analysis." The basis of this analysis is from a North Carolina Air Quality section memo, "Screening Threshold Method for PSD Modeling." The memo reasons that nearby facilities with a ratio of emissions (Q) to distance (D) less than 20 kilometers are not likely to have a significant impact on the contribution to air concentrations in the impact area that is being evaluated for the Proposed Project. The Project Proposer multiplied the emissions by an MPCA scalar to add conservatism to the screening process (http://www.pca.state.mn.us/air/modeling.html/FAR Data for Nearby Sources.pdf).

The nearby facilities identified as significant in the "20D Analysis" were first modeled using MPCA's First-Approximation Run (FAR) approach where emissions from entire facilities were modeled with a single volume source. The 20D method was used to identify NAAQS facilities not PSD facilities. No PSD sources were excluded using this method. A nearby facility was only included in the Project Proposer's refined modeling analysis if predicted concentrations from each source were greater than the PSD SIL for each pollutant and each averaging period. SO_2, NOx, and PM_{10} emission sources from the nearby facilities listed in Table 4.9.15 were included in the modeling analysis.

TABLE 4.9.15 CLASS II MODELING NEARBY FACILITIES

Facility [1]	SO_2 - NAAQS	SO_2 - INC	NOx - NAAQS	NOx - INC	PM_{10} - NAAQS	PM_{10} - INC
ArcelorMittal	X					
Blandin Paper Co.	X	X		X		X
Excelsior Energy	X	X	X	X	X	X
Hibbing Public Utilities	X			X		
Hibtac	X	X	X		X	
Mesabi Nugget 1		X		X		
Minnesota Power	X	X				
Essar Steel	X	X	X	X	X	X
Minntac	X			X	X	
Potlatch – Cook				X		
Potlatch – Grand Rapids				X		X
UTAC Fairlane Plant	X					
Virginia Public Utilities	X					

[1] The presence of "X" indicates the facility was included in the modeling analysis.
Note - INC stands for increment.

The nearby facilities that were modeled for PM_{10} NAAQS were also modeled for $PM_{2.5}$ NAAQS.

4.9.6.1.2 Background Concentrations

Background concentrations account for the impacts from natural background levels, other existing minor, major and area sources, and long-range transport. Class II modeling is considered near-field modeling and is considered within 50 kilometers of the facility. Emission from facility sources outside the 50 kilometer radius are captured in the background concentrations. The background concentrations are added to the model predicted concentrations and then compared with the NAAQS and MAAQS to demonstrate compliance with the applicable standards in accordance with MPCA and USEPA modeling guidance.

4.9.6.2 Affected Environment

4.9.6.2.1 Existing Conditions

An ambient air quality analysis was not performed for the facility's existing conditions. However, an air dispersion modeling analysis was performed for the No Action Alternative. The results of the No Action modeling analysis (see Section 4.9.6.2.2) are considered a conservative estimate of the facility's existing conditions due the difference in the mine pit boundaries. The size of the existing mine pit is less than the size of the mine pit used in the No Action modeling analysis.

4.9.6.2.2 No Action Alternative

An ambient air quality analysis was performed for the No Action Alternative to demonstrate compliance with the MAAQS and NAAQS for PM_{10}, $PM_{2.5}$, SO_2, CO, NOx and lead (Barr, 2009E). The No Action Alternative modeling analysis included all emission sources venting to a stack as well as existing fugitive emissions. The various types of emission units that vent to a stack include: crushers, conveyor transfer points, additive handling, grate kilns, pellet coolers, pellet screens, coal handling, and lime receiving. Stack emissions were modeled as point sources using specific discharge parameters for stack height, stack temperature, exhaust air flow rate, and stack diameter. Emission rates used in the modeling analysis relied on maximum potential hourly emissions. Emission rates used in the modeling accounted for current air permit limits and control efficiencies for emission sources equipped with air pollution control equipment. Emissions generated by the following insignificant activities were not included in the modeling analysis: space heaters, generators powered by diesel and natural gas fired engines, contractor crushing in the pit, biomass chipper, and maintenance area and shop boilers. The Project Proposer did not see any significant changes in results based solely on the insignificant sources because they are not a major contributor to the maximum concentrations.

The modeling analysis also included fugitive sources of dust generated by vehicle traffic traveling on paved and unpaved haul roads, material handling activities, and wind erosion from stockpiles and the tailings basin. Fugitive emission sources at the facility were modeled as individual volume sources, a series of volume sources, area sources, or open pit sources. The volume source representing the coal handling area included emissions from coal handling and road emissions generated by vehicles that travel in that area.

Vehicle traffic on haul roads leading to ore, waste rock, and surface overburden stockpiles outside of the mine were modeled as a line of volume sources following proposed haul routes. Emissions were based on the maximum throughput capacity for each type of material and the maximum distance from the mine to the stockpiles. Haul roads would be controlled through water application, dust suppressant application, regular road maintenance, and application of snow when available during freezing conditions to control fugitive dust emissions. Emissions were based on a control efficiency of 80 percent to account for the controls. The 80 percent haul road control efficiency was derived from the *Taconite Industry*

Haul Truck Unpaved Haul Road Fugitive Particulate Emission Control Factor and Control Efficiency document, dated November 1998.

Areas with storage piles, such as the coal pile, were modeled with two co-located volume sources. The first volume source corresponded to the material handling and/or vehicle traffic emissions and is represented by a constant hourly emission rate, while the second volume source represented wind erosion emissions from the pile. Wind erosion emissions from storage piles were based on a two-step approach of quantifying wind erosion emissions combined with commensurate wind-speed dependent scalars. This procedure is based on AP-42, Section 13.2.5 "Industrial Wind Erosion" and wind speed data from the Hibbing 2001-2005 meteorological data.

The existing mine pit was represented in the model as an OPENPIT source. OPENPIT sources require site-specific information about pit length, width, volume, and average release height. All emissions that are generated in the pit are modeled using a single OPENPIT source in the modeling analysis. All material handling and vehicle traffic emissions were consolidated to a single emission rate representing the entire pit. OPENPIT sources also require particle size ranges, mass fraction, and particle density for each particle size. Particle size information is based on particle size multipliers reported in AP-42, Section 13.2.2 "Unpaved Roads" because roughly 95 percent of all emissions in the pit are generated by vehicle traffic.

Fugitive dust emissions generated by wind erosion from the tailings basin was included as part of the modeling analysis as area sources. The modeling was completed with the assumption that the entire perimeter of the tailings basin is exposed and vulnerable to wind erosion. The Project Proposer revegetates the beach areas over time to prevent erosion, so only portions of the beach area are typically prone to wind erosion on a given day. Wind erosion emissions from the tailings basin also relied upon the two-step approach of quantifying wind erosion emissions combined with commensurate wind-speed dependent scalars. All No Action Alternative modeling sources can be seen in Figure 4.9.6.3.

The Project Proposer included particulate deposition for PM_{10} fugitive emission sources through the use of the exponential decay term. Only mechanically generated fugitive sources were modeled with exponential decay because these types of sources are near the surface and are most influenced by deposition. Particulate deposition was not used for $PM_{2.5}$ modeling because the main removal method is gravitational settling, which is small for $PM_{2.5}$.

Air dispersion modeling analyses using AERMOD typically rely on AERMOD's deposition algorithms to account for particulate deposition. The Project Proposer found that modeling the OPENPIT source with the deposition algorithms produced unexpected results. The Project Proposer found that AERMOD was predicting maximum impacts far from the site. Maximum concentrations generated by haul road traffic and wind erosion from storage piles are typically found at the facility fence line or property line. An alternative method to represent particulate deposition in the model was sought.

The alternative method to representing particulate deposition was based on AERMOD's exponential decay term. The decay term is based on pollutant half-life, which can be calculated using Stoke's Law for gravitational settling velocity. This method is based on the method used by Midwest Research Institute in the 1979 modeling analyses for MPCA's total suspended particulate state implementation plan. Portions of the Iron Range were designated non-attainment. Particulate deposition using this decay method was used to compare modeled impacts against monitoring data to determine actual attainment status of the area.

Particulate deposition was considered for fugitive PM_{10} emission sources only. All of the PM_{10} emission sources were modeled as single source model runs in AERMOD. The modeled impacts were saved to a POSTFILE for each source. Post-processing of these files was completed to determine the design concentrations for each standard. Single source model runs allowed the use of the exponential decay term to represent deposition for the fugitive sources, while the non-fugitive sources were modeled without the decay term.

The predicted concentrations from the No Action Alternative modeling analysis are presented in Table 4.9.16 along with background concentrations and the National and Minnesota Ambient Air Quality Standards.

TABLE 4.9.16 MAXIMUM PREDICTED AMBIENT AIR CONCENTRATIONS – NO ACTION ALTERNATIVE

Pollutant	Averaging Period	Modeled Impact[1] (µg/m^3)	Background Concentration (µg/m^3)	Predicted Ambient Air Concentration (µg/m^3)	Minnesota Ambient Air Quality Standard (µg/m^3)	National Ambient Air Quality Standard (µg/m^3)
$PM_{2.5}$	24-Hour	8	17	25	35	35
	Annual	2	6	8	15	15
PM_{10}	24-Hour	49	30	79	150	150
	Annual	5	11	16	50	---
SO_2	1-Hour	176	8	184	1,300	196
	3-Hour	156	10	166	915	1,300
	24-Hour	37	4	41	365	365
	Annual	4	2	6	60	80
NOx	Annual	16	7	23	100	100
CO	1-Hour	11	460	471	35,000	40,000
	8-Hour	6	276	282	10,000	10,000
Lead	Quarterly	0.00112	Not Available	0.00112	0.15	0.15

[1] All modeled impacts represent the maximum highest 1st-high concentration (H1H) from the AERMOD output files except 24-hour $PM_{2.5}$ and 24-hour PM_{10}. The 24-hour $PM_{2.5}$ modeled impact represents the five-year average of the highest 8th-high concentrations (H8H). The 24-hour PM_{10} modeled impact represents the highest 6th-high (H6H) concentration over the five consecutive years of meteorological data.
µg/m^3 = micrograms per cubic meter

The modeling results in Table 4.9.16 show compliance with the applicable standards. Modeling results for SO_2, NOx, CO, and lead are far below applicable standards. Predicted concentrations range from 0.1 to 29 percent of the applicable standards for these four pollutants. PM_{10} concentrations are 34 to 50 percent of the applicable standards. $PM_{2.5}$ concentrations are 60 to 83 percent of the applicable standards. These results demonstrate that the No Action Alternative, combined with nearby facilities, complies with all state and federal ambient air quality standards.

4.9.6.3 Environmental Consequences

4.9.6.3.1 Proposed Action Alternative

Proposed Project (NAAQS)

An ambient air quality analysis was performed for the Proposed Project to demonstrate compliance with the MAAQS and NAAQS for PM_{10}, $PM_{2.5}$, SO_2, CO, NOx, and lead. The modeling analysis also demonstrated compliance with the PSD Class II increment standards for PM_{10}, SO_2, and NOx.

The modeling analysis for the Proposed Project includes all existing emission units plus new emission sources. Some of the new emission units would be similar to the emission units that already operate at the site. These types of new emission units include pellet coolers, pellet screens, mineral bins (bentonite, limestone, and lime), and grate kilns. Other new emission units would be new to the site, which include biomass handling, mineral bins (bentonite, limestone, lime, activated carbon), hammermills, mill feeders, fuel silos, and a biomass dryer. Emissions from insignificant activities were included in the modeling analysis.

The Proposed Project modeling analysis accounted for new limits to existing equipment as well as new air pollution control technologies resulting in reduced emission rates. The control technologies proposed include wet scrubbers, fabric filters (baghouses), dry electrostatic precipitators, gas suspension absorber dry scrubbers and low-NOx combustion on the main burner of the new line. NOx emissions from the existing facility are reduced by the Proposed Project because the Project Proposer would take federally enforceable permit limits for NOx on the existing and proposed induration furnaces through the use of coal, natural gas, or biomass fuel mixes.

In addition to the new emission units associated with the Proposed Project, the modeling analysis for the Proposed Project includes modifications to some of the existing emission units affected by the project. The main pit was expanded in size to reflect the increase in the permitted mining area operations associated with the Proposed Project. There would be an increase in fugitive emissions due to additional haul roads, traffic and storage piles due to the Proposed Project. The modeling sources used in the Proposed Project modeling analysis can be seen in Figure 4.9.6.4.

The predicted concentrations from the Proposed Project modeling analysis are presented in Table 4.9.17 along with background concentrations and the NAAQS and MAAQS standards.

TABLE 4.9.17 MAXIMUM PREDICTED AMBIENT AIR CONCENTRATIONS – PROPOSED PROJECT

Pollutant	Averaging Period	Modeled Impact[1] (μg/m³)	Background Concentration (μg/m³)	Predicted Ambient Air Concentration (μg/m³)	Minnesota Ambient Air Quality Standard (μg/m³)	National Ambient Air Quality Standard (μg/m³)
$PM_{2.5}$	24-Hour	17	17	34	35	35
	Annual	4	6	10	15	15
PM_{10}	24-Hour	71	30	101	150	150
	Annual	18	11	29	50	---
SO_2	1-Hour	181	8	189	1,300	196
	3-Hour	169	10	179	915	1,300
	24-Hour	38	4	42	365	365
	Annual	5	2	7	60	80
NOx	1-Hour	139	48	187	---	188
	Annual	28	7	35	100	100
CO	1-Hour	195	460	655	35,000	40,000
	8-Hour	63	276	339	10,000	10,000
Lead	Quarterly	0.00189	Not Available	0.00189	0.15	0.15

[1] All modeled impacts represent the maximum highest 1st-high concentration (H1H) from the AERMOD output files except 24-hour $PM_{2.5}$, 24-hour PM_{10}, 1-hour SO_2, and 1-hour NO_2. The 24-hour $PM_{2.5}$ modeled impact represents the five-year average of the highest 8th-high concentrations (H8H). The 24-hour PM_{10} modeled impact represents the highest 6th-high (H6H) concentration over the five consecutive years of meteorological data. The 1-hour SO_2 modeled impact represents is the five-year average of the 99th percentile of the maximum daily 1-hour concentrations. The 1-hour NO_2 modeled impact represents is the five-year average of the 98th percentile of the maximum daily 1-hour concentrations.

μg/m³ = micrograms per cubic meter

The modeling results in Table 4.9.17 show compliance with the applicable standards. Modeling results for SO_2, CO, and lead as a percent of the standard are quite similar to modeling results as a percent of the standard for the No Action Alternative, indicating that the Proposed Project has minimal impacts with regard to SO_2, CO, and lead on Class II areas. NOx results as a percent of the standard appear similar to that of the No Action Alternative because the Proposed Project includes reductions to existing NOx emissions in addition to new NOx emission sources. The net effect results in a slight increase in predicted NOx concentrations.

PM_{10} and $PM_{2.5}$ concentrations in the Proposed Project modeling analysis are higher than the PM_{10} and $PM_{2.5}$ concentrations predicted in the No Action Alternative modeling analysis. This increase in PM_{10} and $PM_{2.5}$ impacts are due to the mine pit expansion and the associated haul road traffic and material handling.

The 24-hour $PM_{2.5}$ impacts inclusive of background are approximately 90 percent of NAAQS/MAAQS. Predicted impacts that are 90 percent of a standard means a low allowable increase level. In this case, MPCA Air Emissions Permits typically include a permit condition to re-model when a low allowable increase level exists.

These results demonstrate that the Proposed Project, combined with nearby facilities, complies with all state and federal ambient air quality standards.

Proposed Project (PSD)

The predicted increment consumption impacts are presented below in Table 4.9.18 along with the Class II increment standards.

TABLE 4.9.18 MAXIMUM PREDICTED INCREMENT CONSUMPTION NEAR THE PROPOSED PROJECT

Pollutant	Averaging Period	Modeled Impact[1] (µg/m^3)	PSD Class II Increment Standard (µg/m^3)
PM_{10}	24-Hour	19	30
	Annual	4	17
SO_2	3-Hour	43	512
	24-Hour	20	91
	Annual	1	20
NOx	Annual	10	25

[1] All modeled impacts represent the maximum highest 1st-high concentration (H1H) from the AERMOD output files except 24-hour PM_{10}. The 24-hour PM_{10} modeled impact represents the highest 2nd-high concentrations (H2H) of the five individual years of meteorological data.
µg/m^3 = micrograms per cubic meter

The modeling results in Table 4.9.18 show compliance with the applicable increment standards. Predicted increment consumption ranges from 5 to 60 percent of the applicable standards. These results demonstrate that the Proposed Project, combined with nearby increment consuming sources, complies with the federal increment limits. There would be an increase in emissions of criteria pollutants from the Proposed Project resulting in an adverse effect to air quality in Class II areas. However, modeling of ambient air concentrations predicts a less than significant effect to air quality after control equipment and fugitive dust mitigation actions are implemented to meet permit limits.

4.9.6.3.2 East Stockpile Alternative

An ambient air quality analysis was performed for the East Stockpile Alternative to demonstrate compliance with the MAAQS and NAAQS for PM_{10} and $PM_{2.5}$ (Barr, 2010J) at the ambient air quality boundary. The modeling analysis also demonstrated compliance with the PSD Class II increment standards for PM_{10}. The East Stockpile Alternative would only have an impact on PM_{10} and $PM_{2.5}$ because the emission sources that are affected by the alternative emit fugitive dust only. The specific emission sources that were changed in this analysis include the location for the east waste rock and overburden stockpiles as well as the changes in the haul roads to both stockpiles. All other model options, nearby source information, receptor placement and background concentrations assumed in the Proposed Project modeling analysis were also used in the East Stockpile Alternative modeling analysis. The modeling sources used in the East Stockpile Alternative modeling analysis are shown in Figure 4.9.6.5.

The predicted concentrations from the Proposed Project modeling analysis are presented in Table 4.9.19 along with background concentrations and the NAAQS and MAAQS standards.

TABLE 4.9.19 MAXIMUM PREDICTED AMBIENT AIR CONCENTRATIONS – EAST STOCKPILE ALTERNATIVE

Pollutant	Averaging Period	Modeled Impact[1] (µg/m^3)	Background Concentration (µg/m^3)	Predicted Ambient Air Concentration (µg/m^3)	Minnesota Ambient Air Quality Standard (µg/m^3)	National Ambient Air Quality Standard (µg/m^3)
$PM_{2.5}$	24-Hour	17	17	34	35	35
	Annual	4	6	10	15	15
PM_{10}	24-Hour	77	30	107	150	150
	Annual	18	11	29	50	---

[1] All modeled impacts represent the maximum highest 1st-high concentration (H1H) from the AERMOD output files except 24-hour $PM_{2.5}$ and 24-hour PM_{10}. The 24-hour $PM_{2.5}$ modeled impact represents the five-year average of the highest 8th-high concentrations (H8H). The 24-hour PM_{10} modeled impact represents the highest 6th-high (H6H) concentration over the five consecutive years of meteorological data.
µg/m^3 = micrograms per cubic meter

PM_{10} and $PM_{2.5}$ concentrations in the East Stockpile Alternative modeling analysis are the same as the PM_{10} and $PM_{2.5}$ concentrations predicted in the Proposed Project modeling analysis, except for 24-hour PM_{10}. This increase in the 24-hour concentration of PM_{10} predicted impacts is approximately six percent higher than the Proposed Project modeled results. These results demonstrate that the East Stockpile Alternative combined with nearby facilities complies with all state and federal ambient air quality standards.

The predicted increment consumption impacts are presented below in Table 4.9.20 along with the Class II increment standards.

TABLE 4.9.20 MAXIMUM PREDICTED INCREMENT CONSUMPTION NEAR THE PROPOSED PROJECT

Pollutant	Averaging Period	Modeled Impact[1] (µg/m^3)	PSD Class II Increment Standard (µg/m^3)
PM_{10}	24-Hour	19	30
	Annual	3	17

[1] The annual modeled impact represents the maximum highest 1st-high concentration (H1H) from the AERMOD output files. The 24-hour PM_{10} modeled impact represents the highest 2nd-high concentrations (H2H) of the five individual years of meteorological data.
µg/m^3 = micrograms per cubic meter

The modeling results in Table 4.9.20 show compliance with the applicable increment standards. PM_{10} increment consumption in the East Stockpile Alternative modeling analysis is the same as the PM_{10} increment consumption predicted in the Proposed Project modeling analysis. These results demonstrate that the East Stockpile Alternative, combined with nearby increment consuming sources, complies with the federal increment limits.

Snowmobile Trail East Stockpile Alternative (NAAQS)

An ambient air quality analysis was also performed for the Hibbing South Spur snowmobile trail. The snowmobile trail runs through the Project Proposer's property within the ambient air quality boundary. Figure 4.9.6.6 shows the location of the trail with respect to the ambient air quality boundary. The ambient air quality analysis of the East Stockpile Alternative was performed using receptor locations placed along the snowmobile trail. The ambient air quality analysis was performed for the East Stockpile Alternative for the snowmobile trail to demonstrate compliance with the MAAQS and NAAQS for PM_{10}, $PM_{2.5}$, SO_2, CO, NOx, and lead. The modeling analysis also demonstrated compliance with the PSD Class II increment standards for PM_{10}, SO_2, and NOx.

The predicted concentrations from the East Stockpile Alternative modeling analysis near the snowmobile trail are presented in Table 4.9.21 along with background concentrations and the NAAQS and MAAQS standards.

TABLE 4.9.21 MAXIMUM PREDICTED AMBIENT AIR CONCENTRATIONS – EAST STOCKPILE ALTERNATIVE NEAR THE SNOWMOBILE TRAIL

Pollutant	Averaging Period	Modeled Impact[1] ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Predicted Ambient Air Concentration ($\mu g/m^3$)	Minnesota Ambient Air Quality Standard ($\mu g/m^3$)	National Ambient Air Quality Standard ($\mu g/m^3$)
$PM_{2.5}$	24-Hour	7	17	24	35	35
	Annual	3	6	9	15	15
PM_{10}	24-Hour	47	30	77	150	150
	Annual	10	11	21	50	---
SO_2	1-Hour	89	8	97	1,300	196
	3-Hour	81	10	91	915	1,300
	24-Hour	22	4	26	365	365
	Annual	3	2	5	60	80
NOx	1-Hour	95	48	143	---	188
	Annual	8	7	15	100	100
CO	1-Hour	61	460	521	35,000	40,000
	8-Hour	25	276	301	10,000	10,000
Lead	Quarterly	0.0004	Not Available	0.0004	0.15	0.15

[1] All modeled impacts represent the maximum highest 1st-high concentration (H1H) from the AERMOD output files except 24-hour $PM_{2.5}$, 24-hour PM_{10}, 1-hour SO_2, and 1-hour NO_2. The 24-hour $PM_{2.5}$ modeled impact represents the five-year average of the highest 8th-high concentrations (H8H). The 24-hour PM_{10} modeled impact represents the highest 6th-high (H6H) concentration over the five consecutive years of meteorological data. The 1-hour SO_2 modeled impact represents is the five-year average of the 99th percentile of the maximum daily 1-hour concentrations. The 1-hour NO_2 modeled impact represents is the five-year average of the 98th percentile of the maximum daily 1-hour concentrations.

$\mu g/m^3$ = micrograms per cubic meter

The modeling results in Table 4.9.21 show compliance with the applicable standards. Modeling results for all pollutants at locations along the snowmobile trail are less than the modeling results for locations along the ambient air quality boundary. These results demonstrate that the East Stockpile Alternative near the snowmobile trail, combined with nearby facilities, comply with all state and federal ambient air quality standards.

Snowmobile Trail East Stockpile Alternative (PSD)

The predicted increment consumption impacts from the East Stockpile Alternative modeling analysis near the snowmobile trail are presented below in Table 4.9.22 along with the Class II increment standards.

TABLE 4.9.22 MAXIMUM PREDICTED INCREMENT CONSUMPTION – EAST STOCKPILE ALTERNATIVE NEAR THE SNOWMOBILE TRAIL

Pollutant	Averaging Period	Modeled Impact[1] ($\mu g/m^3$)	PSD Class II Increment Standard ($\mu g/m^3$)
PM_{10}	24-Hour	29.8	30
	Annual	5	17
SO_2	3-Hour	28	512
	24-Hour	14	91
	Annual	1	20
NOx	Annual	2	25

[1] All modeled impacts represent the maximum highest 1st-high concentration (H1H) from the AERMOD output files except 24-hour PM_{10}. The 24-hour PM_{10} modeled impact represents the highest 2nd-high concentrations (H2H) of the five individual years of meteorological data.

$\mu g/m^3$ = micrograms per cubic meter

The modeling results in Table 4.9.22 show compliance with the applicable increment standards. Predicted increment consumption ranges from 5 to 30 percent of the applicable standards, except 24-hour PM_{10}. The 24-hour PM_{10} predicted increment consumption is approximately 99 percent of the standard. Predicted increment consumption that is more than 90 percent of a standard means a low allowable increase level. In this case, MPCA Air Emissions Permits typically include a permit condition to re-model when a permit modification is requested and low allowable increase level exists.

These results demonstrate that the East Stockpile Alternative modeling analysis near the snowmobile trail, combined with nearby increment consuming sources, complies with the federal increment limits. There would be an increase in emissions of criteria pollutants from the East Stockpile Alternative modeling analysis near the snowmobile trail resulting in an adverse effect to air quality along the snowmobile trail. However, modeling of ambient air concentrations predicts a less than significant effect to air quality after control equipment and fugitive dust mitigation actions are implemented to meet permit limits.

4.9.6.4 Mitigation Opportunities

The Class II modeling analyses described in this section include all mitigation steps proposed in the form of air pollution control equipment efficiencies and proposed air permit limits. The air pollution control equipment efficiencies and proposed air permit limits are required as part of the Project Proposer's air permit application to meet state and federal requirements. The analyses also included the mitigation actions to control fugitive dust emissions generated by different types of emission sources. The fugitive dust mitigation actions are described by the Project Proposer's Fugitive Dust Plan (see Section 4.9.2) (Barr, 2009C).

4.9.7 Mercury Emissions/Mercury Balance/TMDL Implementation Plan Compliance

In the context of project specific impacts of mercury, the FSDD states that a mercury mass balance and local impact analysis would be completed. In addition, the EIS would show how the Project Proposer would comply with Minnesota's Mercury Total Maximum Daily Load (TMDL) (MPCA, 2007A) implementation plan. Further, the EIS would show a range of impacts reflecting the range of control efficiencies.

This section gives an overview of mercury in the environment, and addresses proposed mercury control technologies, potential mercury emissions from the Proposed Project, and the Project Proposer's plan to comply with the implementation plan for Minnesota's Mercury TMDL. Additional information on the cumulative effects of mercury deposition and bioaccumulation in fish, and associated human/ecological risks are addressed in Section 5.5 and Section 5.13, respectively.

In an effort to determine potential impacts of mercury emissions as it relates to the Proposed Project, mercury-related technical analyses were completed. Mercury information for the Proposed Project is contained in the following documents:

- Mercury Control Alternatives Evaluation
- Mercury Emission Factor Memo
- Mercury TMDL Memo
- Mercury CI Study

4.9.7.1 Background

Mercury is one of 188 Hazardous Air Pollutants (HAPs) required to be inventoried, and is of heightened concern in Minnesota due to widespread mercury contamination of fish in Minnesota lakes. Therefore, the potential impacts of mercury released from the Proposed Project were estimated, and the results analyzed in this FEIS.

The MPCA website states:

> *Mercury is an environmental problem around the world. Minnesota and other states with many lakes are especially aware of this because one of the most serious ways people are exposed to mercury is through eating contaminated fish. Some mercury is natural in the environment. Some comes from our intentional uses of mercury, and some is a polluting byproduct of burning coal and certain mining and manufacturing processes.*

Additional background information about mercury can be found on the MPCA website: http://www.pca.state.mn.us/air/mercury.html

4.9.7.1.1 Mercury Speciation and Transport

Mercury speciation plays a role in determining the transport and environmental fate of mercury after it is emitted from a facility. The behavior of mercury is determined by the species in which it is found both prior to and after pollution controls:

- **Elemental mercury (Hg^0)**: This form of mercury can be transported long distances, having an average residence time in the atmosphere of several months to a year or more. This form of mercury has an atmospheric deposition rate that is very slow, but is not zero.

- **Oxidized mercury (Hg^{2+})**: A water-soluble form of mercury that has a relatively high potential to be captured by air pollution control systems. If oxidized mercury is emitted from a facility, the propensity for the oxidized mercury to associate with water and particles tends to result in a significant proportion of the oxidized mercury to be deposited relatively close to an emission source, typically within 100 kilometers (62 miles) of the emission source.
- **Particle-bound mercury (Hg_p)**: This form of mercury also has a relatively high potential to be captured by air pollution control systems. If particle-bound mercury is emitted from a facility, there also is a tendency for coarse particles (greater than 2.5 microns) to be deposited locally within 100 kilometers of a facility and for fine particles (less than 2.5 microns) to be transported further.

4.9.7.1.2 Mercury Control Technologies

No currently operating taconite indurating furnace has a control technology installed for specifically controlling mercury. However, some mercury control has been demonstrated as a co-benefit of the use of wet scrubber particulate matter control devices and the management of scrubber solids. The Mercury Control Alternatives Evaluation (Barr, 2009K) reviewed emerging and non-commercially available mercury control technologies and identified activated carbon injection as a potentially feasible technology for controlling mercury from the Proposed Project, in addition to mercury that would be controlled with the particulate air pollution controls proposed for the new line.

Most of the research and technology development for controlling mercury emissions has been at coal-fired utility boilers. Technologies are identified in the Mercury Control Alternatives Evaluation. Some are still in research and/or pilot-scale testing, and have not been demonstrated as a commercially viable mercury control alternative for taconite furnaces.

Basic research on controlling mercury from existing taconite furnaces is underway. MNDNR has led a number of research projects to evaluate potential mercury emission control technologies. These technologies include: 1) injecting oxidizing agents into the furnace to change the mercury species to be captured in existing wet scrubbers; and 2) bench scale tests on fixed bed sorbent reactors show considerable mercury control. While the technologies show promise, none have been demonstrated on a full scale or long term basis.

Based on the BACT analysis of controls for the proposed furnace, the proposed pollution control system consists of a gas suspension absorber (GSA) scrubber for control of sulfur dioxide emissions followed by a dry electrostatic precipitator (ESP) for control of particulate emissions.

Based on the BACT analysis of controls for the proposed furnace, the proposed pollution control system consists of a gas suspension absorber (GSA) scrubber for control of sulfur dioxide emissions followed by a dry electrostatic precipitator (ESP) for control of particulate emissions. Dry methods were used instead of wet methods for control of SO_2. The rationale for this is explained in the BACT Report (Barr, 2009C).

Data from coal-fired power plants indicate that the semi-dry SO_2 control system spray dryer adsorber (SDA) in combination with an ESP shows 35 percent removal of mercury. Data from coal-fired power plants also indicate that a control system consisting of an SDA-ESP along with activated carbon injection (ACI) burning Powder River Basin coal can have a control efficiency of 50 to 80 percent. ACI technology has achieved commercial availability for utility coal fired boilers, and is viewed by the MPCA and Project Proposer as having the highest potential for controlling mercury emissions from the proposed furnace. Because ACI technology has not been demonstrated on taconite facilities and the efficiency is yet undetermined, impact analyses have been conducted by evaluating air pollution control without ACI and assumes that this proposed air pollution control system would provide 30 percent mercury control.

One air pollution control technology with potential to control mercury was recently permitted by the MPCA at Essar Steel, a taconite induration furnace in Nashwauk, Minnesota. The technology, which as known as LoTOx, has the potential to remove mercury when combined with a wet scrubber. LoTOx technology injects ozone into flue gases to convert nitrogen oxides to elemental nitrogen. The ozone potentially would also oxidize elemental mercury in the flue gases, making mercury more readily captured in the wet scrubber. The BACT analysis conducted for SO_2 controls for the Proposed Project has selected dry scrubbing over wet scrubbing, and therefore LoTOx is not a feasible technology.

4.9.7.1.3 No Action Alternative

The No Action Alternative would allow the facility to continue to operate under its current air emissions permit. The emissions sources would remain the same and the existing requirements under the current permit would generally remain in effect. However, the facility remains a source subject to the conditions and commitments for mercury emission reductions under Minnesota's reduction strategy to address the Minnesota TMDL requirements for reducing mercury by 2025. Future mercury emissions under the No Action Alternative may be lower than mercury emissions from the current conditions of the existing facility. Existing conditions as they relate to mercury currently in the environment are included in more detail in Section 5.5.

4.9.7.2 Mercury Emission Rates from the Proposed Project

Mercury is emitted from the Keetac facility because mercury is found in iron ore. Mercury is liberated from the ore during the high heat treatment in the taconite indurating furnace. Figure 3.3.4 shows the preliminary layout of the plant additions for the Proposed Project. Secondary emission sources of mercury to the furnace, comprising less than 1 percent of total mercury emissions, include other raw material additives, fuel combustion, and process water.

Mercury-containing particles associated with the ore (mining, hauling, crushing/grinding) remains within the mineral matrix and are not considered available for bioaccumulation, and therefore are not considered part of this impact assessment. Based on wet scrubber control of the material handling emission points and the mercury content of the ore, the Proposed Project mercury emissions from material handling are estimated to be less than 0.001 pounds per year (Barr 2009N).

The MPCA assesses the impacts of a facility on the basis of its potential to emit (PTE), that is, the maximum emissions level allowed under the facility's air quality emissions permit. The MPCA seeks emission estimates that do not underestimate reasonably expected emissions, especially when process inputs like iron ore have a known variability. Stack testing data of mercury emissions from the existing induration furnace at Keetac was relied on to estimate mercury emissions from the Proposed Project. When using stack test data to generate emission factors, MPCA policy is to use the upper limit of a confidence interval of the data set. The mercury emissions rate for the Proposed Project is calculated based on an emission factor. This factor is the sum of an ore-based term (the 95 percent upper confidence level [UCL] of test run data from available performance testing at the existing furnace) and a coal-based term (the 95 percent UCL of mercury content of Powder River Basin Coal in the USGS Coal Quality Database).

Mercury emissions testing on the existing indurating furnace at Keetac was conducted in 1999, 2004 and 2008. The average uncontrolled mercury emissions from the existing indurating furnace are 2.35E-5 pounds of mercury per ton of pellet (lb Hg/ton pellet). The calculated 95 percent UCL value of the stack testing data set is 3.0E-5 lb Hg/ton pellet (Barr, 2009X). Mercury emissions from the Proposed Project are calculated by multiplying the pellet mercury UCL value by the pellet throughput and then applying any control efficiency. The calculation method is described in the equation below.

<u>Mercury Emissions Equation</u>

$$3.00E-05\,\frac{lb\ Hg}{ton\ pellet}\times Throughput\,\frac{ton\ pellet}{yr}\times\left(1-Control\ Efficiency\right)\equiv Hg\,\frac{lb}{yr}$$

Table 4.9.23 provides a summary of the potential environmental releases of mercury from the Proposed Project. The emissions listed in the table represent mercury emissions from the induration furnace, including ore and fuels.

4.9.7.2.1 Mercury Emissions - Uncontrolled

Uncontrolled emissions from the Proposed Project are calculated by multiplying the 95 percent UCL emission factor by the pellet throughput. Based on the maximum pellet production of 450 tons per hour (tph) for 8,760 hour, the potential pellet throughput is 3,942,000 tons per year (TPY). Potential uncontrolled mercury emissions from the Proposed Project at the maximum potential pellet throughput are calculated to be 118 pounds per year (lb/yr).

However, the Project Proposer is accepting a permit condition that would limit the Proposed Project potential pellet throughput to 3,600,000 TPY through the new line. Therefore the uncontrolled annual mercury emissions from the Proposed Project are calculated to be 108 lb/yr.

In the EIS analysis, the potential mercury air emissions, before emission controls, are estimated to be 68 percent elemental mercury, 1 percent particle-bound mercury and 31 percent oxidized mercury species (Barr, 2009J). This speciation profile is based on data from the existing facility and is similar to the speciation (60 percent elemental, 14 percent particle-bound, and 26 percent oxidized) observed at coal-fired power plants using similar coal.

4.9.7.2.2 Mercury Emissions - Controlled

Controlled emissions from the Proposed Project are calculated by multiplying the 95 percent UCL emission factor by the pellet throughput and applying the control efficiency of the control equipment. As discussed above, the Proposed Project assumes 30 percent control efficiency through the use of a GSA/ESP. Based on the 95 percent UCL uncontrolled emission factor, potential pellet throughput of 450 tph or 3,942,000 TPY and 30 percent control efficiency; potential controlled mercury emissions are estimated to be 9.45E-03 lb/hr and 83 lb/yr respectively. The Mercury Control Alternatives Evaluation (Barr, 2009K) determined that with the additional installation of the ACI system, the control efficiency increases to a minimum of 50 percent and potential controlled mercury emissions are estimated to be 6.75E-03 lb/hr and 59 lb/yr respectively.

However, the Project Proposer is accepting a permit condition that would limit the Proposed Project potential pellet throughput to 3,600,000 TPY through the new furnace. Therefore the "limited potential" maximum annual mercury emissions from the Proposed Project are shown below.

Proposed Project Mercury Emissions

- after the proposed GSA/ESP system, are estimated to be 76 lb/yr, and
- after the proposed GSA-ACI/ESP system, are estimated to be 54 lb/yr.

In the EIS analysis, the potential mercury air emissions, after emission controls, are estimated to be 93 percent elemental mercury, 1 percent particle-bound mercury and 6 percent oxidized mercury species (Barr, 2009J). This speciation profile is based on data from coal-fired power plants using similar control systems as the Proposed Project.

For the local impacts assessed in this section and in Section 4.9.8 and the cumulative effects analysis in Section 5.5, for the proposed GSA/ESP system (without ACI), the following controlled mercury emission rates and speciation profile are used:

1. maximum hourly emissions – 9.45E-03 lb/hr
2. maximum annual emissions – 76 lb/yr
3. Mercury speciation - 93 percent elemental, 1 percent particle-bound, and 6 percent oxidized

TABLE 4.9.23 POTENTIAL MERCURY RELEASES TO THE ENVIRONMENT FROM THE PROPOSED PROJECT

(Barr 2009EF+)		Emissions calculated using 95 percent UCL emission factor of 3.00E-05 lb Hg / ton pellet [1]								
		Expansion Project Kiln [(2)] Only				**Existing Facility Kiln [2] Only**				**Total**
Emission Basis (Proposed Control)	[3] Control Efficiency	Pellet Throughput (ton/hr)	Pellet Throughput (TPY)	Mercury [4] (lb/hr)	Mercury [4] (lb/yr)	Pellet Throughput (ton/hr)	Pellet Throughput (TPY)	Mercury [5] (lb/hr)	Mercury [5] (lb/yr)	Mercury (lb/yr)
Proposed Project Emissions at Maximum (Potential) Pellet Throughput										
Uncontrolled	0%	450	3,942,000	1.35E-02	118.1	830	7,270,800	2.49E-02	218.2	336.3
Controlled (GSA/ESP)	30%	450	3,942,000	9.45E-03	82.7	830	7,270,800	1.74E-02	152.7	235.1
Proposed Project Emissions at Limited Pellet Throughput										
Uncontrolled	0%	---	3,600,000	---	108.0	---	6,000,000	---	180.0	288.0
Controlled (GSA/ESP)	30%	---	3,600,000	---	75.5	---	6,000,000	---	126.0	201.5
Controlled (GSA-ACI/ESP)	50%	---	3,600,000	---	54.0	---	---	---	126.0	180.0

[1] Emission Factor of 3.00 E-05 is based on 95 percent UCL of stack test data and includes pellet emissions as well as coal as fuel (MPCA 2/20/09; email from Hongming Jiang).

[2] Emissions are listed as "Kiln Only" because the above emission factor includes emissions from pellets and coal as fuel and represent nearly all of the mercury emissions. All other emission sources at the plant represent less than 1 percent of total mercury emissions (Barr 2009EF+).

[3] Controlled emissions assume 30 percent mercury control efficiency for both the existing furnace (wet scrubber) and the new furnace (GSA/ESP control). The addition of the proposed carbon injection system increases the control efficiency of the new furnace to 50 percent.

[4] Mercury emissions from the Proposed Project have an estimated speciation of:

Uncontrolled = 68 percent elemental mercury, 1 percent particle-bound mercury and 31 percent oxidized mercury based on data from the existing facility

Controlled = 93 percent elemental mercury, 1 percent particle-bound mercury and 6 percent oxidized mercury based on data from coal-fired power plants using similar dry emission controls.

[5] Controlled mercury emissions from the existing facility have an estimated speciation of:

Controlled = 93 percent elemental mercury, 2 percent particle-bound mercury and 5 percent oxidized mercury, based on stack test data from existing taconite furnaces employing wet emission controls.

ton/hr = ton per hour; TPY = ton per year; lb/hr = pound per hour; lb/yr = pound per year

4.9.7.3 Environmental Consequences

To assess the impacts of mercury, the Project Proposer was directed to use the MPCA mercury risk estimation method (MMREM), a method developed by the MPCA to determine human health risk from increases of mercury emissions from a project. The MMREM assesses the incremental mercury risk associated with eating fish from water bodies near permitted and potentially permitted sources. The MMREM can be used to estimate the noncancer oral hazard quotients associated with fish tissue consumption based on increases in mercury deposition due to a given project. MMREM is not a mechanistic model of mercury methylation and bioaccumulation, but rather combines empirical fish contamination data with the premise that mercury concentrations in fish would achieve a steady state in relation to atmospheric mercury deposition (MPCA, 2006). The methodology and assumptions used in the assessment are described in Sections 4.9.8 and 5.13.

MMREM was used to determine both local and cumulative effects from the Proposed Project for selected lakes. The selected lakes are all within the expected area of impact for the Proposed Project. Table 4.9.24 below identifies the lakes that were selected for assessment (column A), and the current concentration of mercury in fish in parts per million (column B). Using the MMREM, column F identifies the potential calculated increase in mercury concentration of fish in the identified lake. This table is shown again in Section 5.5, because the results of the cumulative effects analysis (columns C and D) were used to derive the increases in mercury loading and fish contamination for the Proposed Project.

TABLE 4.9.24 POTENTIAL INCREASE IN MERCURY LOADING AND FISH CONCENTRATIONS - CUMULATIVE EFFECTS OF MULTIPLE FACILITIES AND PROPOSED PROJECT ALONE

A	B	C	D	E	F	G
		Cumulative	**Cumulative**		**Keetac Alone**	**Keetac Alone**
Lake	Ambient Fish Mercury Concentration (ppm)[1]	Increase in mercury loading and fish contamination (%)	Increase in fish mercury (ppm)	Proportion of Cumulative Due to Keetac alone (%)[3]	Increase in mercury loading and fish contamination (%)	Increase in fish mercury (ppm)
	(Appendix D) [2]	(Calculated from Appendix D) [2]	(Calculated from columns B and C)	(Table 3) [2]	(Calculated from columns C and E)	(Calculated from columns B and F)
Big Sucker Lake	0.48	3.90%	0.019	5.10%	0.20%	0.001
Coons Lake	0.48	1.50%	0.007	33.80%	0.50%	0.002
Horsehead Lake	0.48	1.40%	0.007	58.70%	0.80%	0.004
Kelly Lake	0.48	2.80%	0.013	78.30%	2.20%	0.011
O'Brien Lake	0.59	2.50%	0.015	15.30%	0.38%	0.002
Swan Lake	0.42	5.50%	0.023	34.1%	1.88%	0.008

1 Upper 95 percent confidence interval of the mean fish concentration data. Background fish mercury concentration data for Big Sucker Lake, Coons Lake, Horsehead Lake and Kelly Lake are not available at this time. The background fish mercury concentration for these four lakes is estimated using data from other lakes in the Keewatin area.

2 Source: Barr, 2009R

3 Percents for O'Brien and Swan account for different mercury air concentrations over the lake as compared to over the watershed.

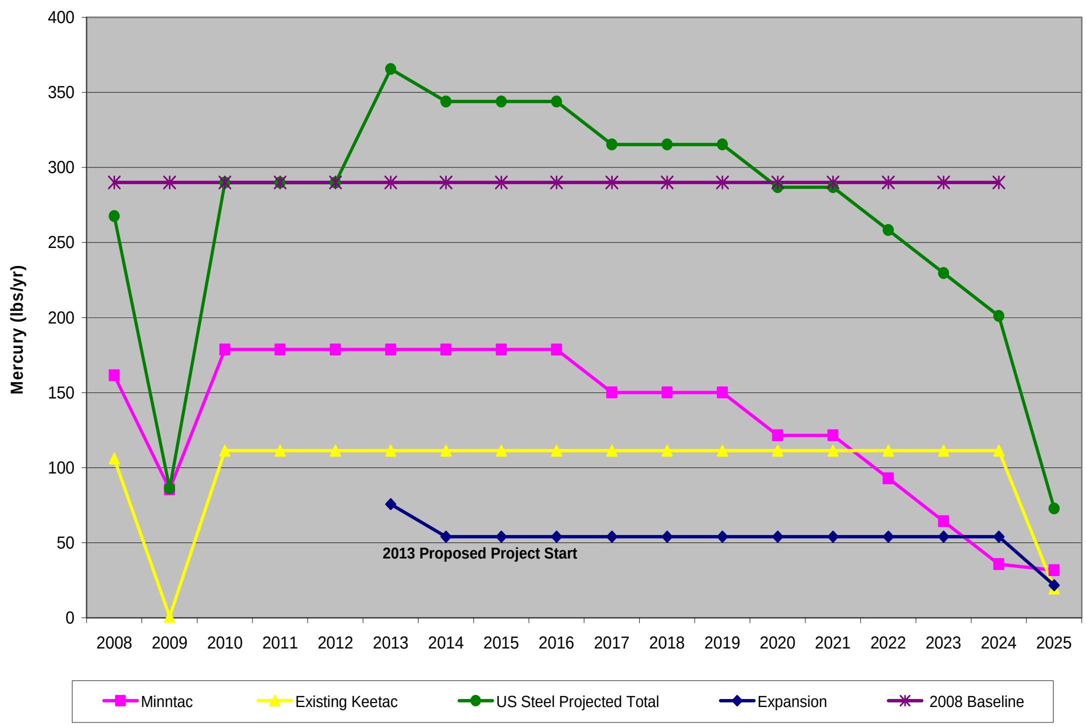
ppm = parts per million

The largest potential increase in fish mercury concentration is calculated for Kelly Lake. The increase in fish tissue mercury concentration is calculated to be 0.011 ppm, (column G), or about 2.2 percent of existing mercury concentration in fish (column F). This calculated potential change in fish tissue concentration is unlikely to result in a statistically detectable increase in fish tissue concentrations due to variability of mercury concentrations between fish in any given lake. The calculated increases of mercury in the other local lakes selected for assessment is less than 1 percent; this change is even less likely to cause a detectable change in fish tissue concentrations.

All of the lakes identified in this assessment have fish tissue concentrations greater than the MPCA water quality standard of 0.20 ppm, and are identified as "impaired." Mercury impaired waters in the vicinity of the Proposed Project are shown on Figure 4.9.7.1. Kelly Lake is subject to a site specific state fish consumption advisory, where the general population (not subsistence fishers or pregnant or nursing women) is advised to consume no more than one fish meal a week caught from Kelly Lake. The calculated change in mercury concentration does not change this advisory; the consumption advisory remains the same. The changes calculated for the other lakes in the assessment also mean that there is no change in the fish consumption advisory already provided for those lakes.

Annual mercury emissions, actual and projected, from 2008-2025 from the U.S. Steel Minnesota taconite facilities, including the Proposed Project, are shown on Illustration 4-2. The controlled emissions calculated assume an efficency below what is reasonably expected and a maximum production scenario. U.S. Steel proposes the installation of controls on the existing Keetac line, Minntac, and Proposed Project to adhere to their share of the Mercury TMDL Implementation Plan by 2025. The Mercury TMDL Implementation Plan and U.S. Steel's commitment to a mercury emission Schedule of Compliance is discussed in Section 4.9.7.4.

ILLUSTRATION 4-2 PROPOSED PROJECT MERCURY EMISSIONS



Until approximately 2019, there would be an adverse effect to the environment. Mercury emissions from the Proposed Project would increase total mercury emissions from U.S. Steel facilities over the 290 lbs/yr baseline established in 2008. Short-term effects would be significant because the lakes potentially affected by the Proposed Project are already impaired.

From 2020 to 2024, U.S. Steel would install controls to begin reducing mercury emissions for all of their Minnesota taconite facilities below the 2008 baseline to comply with the Mercury TMDL. The Mercury TMDL requires that after 2025 broad mercury emission reduction goals from the taconite industry in Minnesota would be met. Compliance with the Mercury TMDL would likely have a benefical effect to the environment.

As shown in Table 4.9.24 (columns B to D) both existing and new projects with the potential to release mercury are proposed in this area, and their impacts have also been estimated in a cumulative effects analysis. Section 5.5 provides a description of those projects and discusses their cumulative effects.

4.9.7.3.1 East Stockpile Alternative

The potential environmental effects from changes to mercury emissions from the East Stockpile Alternative are the same as those from the Proposed Project.

4.9.7.4 Mitigation Opportunities

The lakes identified for impact assessment already exceed the MPCA water quality threshold for mercury in fish tissue and are subject to fish consumption advisories. Because these lakes exceed the water quality threshold, they are “impaired” and are included in Minnesota’s TMDL Pollutant Reduction Plan. The TMDL for mercury allocates reduction requirements for sources contributing mercury to the impaired water bodies in Minnesota. The long-term goal of the mercury TMDL is for fish to meet water quality standards; the approach for Minnesota’s share is mass reductions from state mercury sources (MPCA, 2009I). As part of the implementation plan for the approved Statewide Mercury TMDL, a receiving water body’s mercury level would be incorporated into the NPDES/SDS permit for mercury limits in Keetac’s discharge water.

About 90 percent of the mercury deposition in the state originates from outside the state, so the first cut allocation of the TMDL reduction is a 90 percent federal share. USEPA in its approval of the TMDL has acknowledged the federal government’s responsibility for meeting its reduction goal. The remaining 10 percent reduction allocation is Minnesota’s, for which the MPCA has the responsibility for developing schedules and meeting reasonable assurance requirements of the Clean Water Act (CWA).

The USEPA approved Minnesota's Statewide Mercury TMDL Pollutant Reduction Plan in March 2007. Since then, the MPCA has worked with stakeholders representing a broad range of interests to identify strategies and timelines that would be included in an implementation plan. The stakeholders' recommendations, completed in June 2008, are contained in the *Strategy Framework for Implementing Minnesota's Statewide Mercury TMDL* (MPCA, 2009I). Progress for Minnesota’s Statewide Mercury TMDL Implementation Plan is reviewed on a regular basis by the Implementation Oversight Board. This group meets to review and evaluate progress toward achieving goals of the Statewide Mercury TMDL and to determine whether additional measures are needed to meet these goals.

The Mercury TMDL deals with existing sources separately from new or modified sources. How increases in mercury emissions for new and modified sources are addressed in the TMDL framework, as decided upon by the MPCA, USEPA, and regulated industries, can be found in the Mercury TMDL Implementation Plan. The plan states that after May 1, 2008, new and expanding air emission sources of mercury would be allowed provided the following measures are employed to ensure that the new and expanding sources do not result in an eventual exceedance of the TMDL goals:

1. The source is required to achieve best control.
2. The source must complete environmental review as applicable, including evaluation of local and cumulative effects.
3. The source must submit a plan to the MPCA to account for the proposed emission.

New sources are expected to offset new emissions by arranging a reduction equal to the new emissions from existing sources in the state beyond those otherwise required in the reduction strategy for the existing sources. If mercury reductions from an existing facility in Minnesota can not be identified a new or expanding facility may propose alternative mitigation strategies in lieu of in-state air emission reductions.

If an expanding source can demonstrate no net increase from their proposed project, then no additional offsets are required.

Regulatory control is important in potentially reducing mercury emissions. The 2006 Minnesota Mercury Reduction Act requires Minnesota's largest coal-fired power plants to cut mercury emissions by 90 percent by 2015. Coal-fired power plants account for approximately 55 percent of the state's mercury emissions. The taconite industry, which accounts for about 22 percent of statewide mercury emissions, has set a goal to reduce mercury emissions by 75 percent by the year 2025. Due to the absence of proven mercury control technologies for taconite furnaces, the industry is focused on research and development of new technologies to control mercury emissions to meet this goal.

4.9.7.4.1 Project Proposal for Keetac Under the New and Expanding Source Guidelines of the Mercury Reduction Strategy

It was assumed for purposes of this analysis that mercury emissions from the new indurating furnace are controlled by 30 percent. This is considered to be a reasonable assumption based on mercury control performance at power plants with air pollution control devices similar to that being proposed for this furnace (dry acid gas scrubbing and an electrostatic precipitator for particulate matter capture). The Project Proposer would also propose to install an ACI system on the furnace exhaust stacks. This action is designed to potentially improve mercury capture at this unit to 50 percent or greater, thereby minimizing the increase in mercury emissions that would require equivalent reductions elsewhere by the Project Proposer. Also, installing and optimizing ACI would help determine whether the technology can be retrofitted to existing taconite furnaces.

In addition, the Project Proposer has developed technology research and demonstration plans to conduct testing of control technologies on existing lines at its Minntac facility. Further, the Project Proposer has developed an agreement with the MPCA to install mercury controls on existing lines at Minntac and Keetac to the extent necessary to offset the increase in mercury emissions from the Proposed Project. In August 2010, U.S. Steel and the MPCA entered into the *Mercury Air Emissions Reductions Schedule of Compliance* (MPCA, 2010). The Schedule of Compliance details the procedures to be followed by U.S. Steel to meet the 2025 reduction goal for the existing Keetac line, Proposed Project line, and their other Minnesota taconite facility, Minntac.

Installation of the control technologies at existing furnaces would enable the Project Proposer to first achieve reductions such that emissions from this Proposed Project would not increase total mercury emissions from Project Proposer-owned facilities, as well as aid U. S. Steel in meeting the industry's commitment to mercury reductions by 2025 (Barr, 2009O).

Mercury reduction strategies have been developed by the MPCA and its stakeholder groups that allow for "early reductions" of mercury. By installing controls early, the total mercury emissions from the Project Proposer at Minntac and Keetac, including the Proposed Project, can be maintained at the same or lower total emissions than would otherwise occur without the Proposed Project.

The Proposed Project would not increase cumulative mercury emissions through the use of:

- Installation of SO_2 and PM control train that has an inherent control efficiency of mercury of at least 30 percent;
- Use of activated carbon injection to achieve 50 to 80 percent control;
- Retrofitting air pollution controls at Keetac and Minntac to lower mercury emissions.

Illustration 4-3 depicts how the increase associated with the Proposed Project and the early installation of controls at Minntac would affect annual mercury emissions from 2008 to 2025. The year 2008 represents the best year the MPCA is able to select as a baseline year to assess the impacts of U.S. Steel's proposal of evaluating total cumulative emissions between its operating facilities.

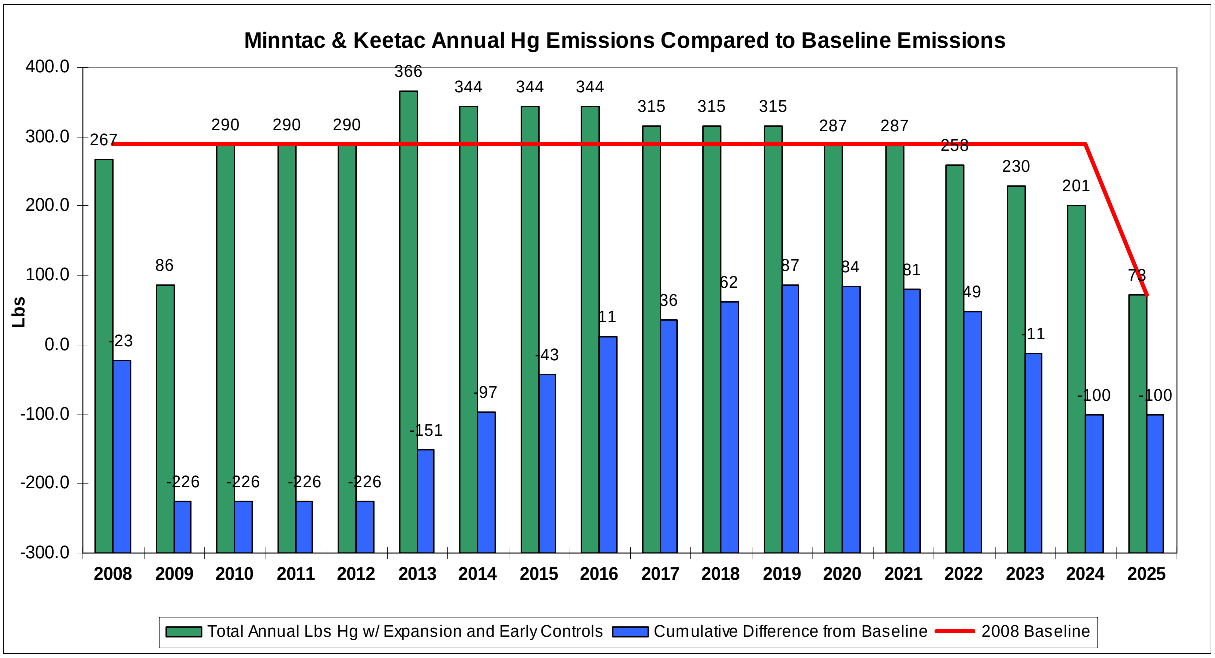
The MPCA adopted the Mercury TMDL report in March, 2007 that established a state-wide goal for mercury emission reductions. To reach the total reductions goal the MPCA developed in October 2009 the Mercury TMDL Implementation Plan. The Implementation Plan established a target reduction of 210 lb/yr by 2025 from all plants collectively in the ferrous mining and processing industry. This would result in a 75 percent reduction from peak production estimates. Facilities in the ferrous mining and processing industry are responsible for reaching the Mercury TMDL plan goal by 2025.

Also, according to the Implementation Plan, new or expanding emission sources are expected to arrange for a reduction from existing Minnesota sources equal to the new actual emissions. These are referred to as "equivalent reductions." Equivalent reductions can also be accomplished by reducing emissions ahead of the schedule established in the Implementation Plan.

In September, 2008, the Project Proposer presented a strategy for adhering to the Implementation Plan. U.S. Steel proposed to use the year 2005, and the rate of 332.2 lbs/yr, as described in the Mercury TMDL Memo (Appendix H), as the starting point to calculate equivalent reductions. However, the MPCA chose the emissions rate of 290 lbs/yr as the level above which the Project Proposer is expected arrange for reductions at Keetac, Minntac or both. This level was established by accounting for the pollution control equipment that was installed at Keetac and Minntac in 2006 and 2007 that decreased annual mercury emissions by 28 percent. This resulted in an annual emission rate from both facilities of 291.1 pounds in 2007.

Using this approach the cumulative emissions for 2008 to 2025 from all U.S. Steel sources would be the same or less, including the Proposed Project. This approach was presented to external stakeholders in early 2009 who agreed to the approach in concept. As part of this discussion, stakeholders generally agreed that reductions due to curtailed production could count as equivalent reductions since the environment benefits regardless of the cause of the reduction. Subsequently, the MPCA and U.S. Steel entered into a Mercury Air Emission Reductions Schedule of Compliance in August 2010 after a year of negotiation to document how U.S. Steel facilities would adhere to the Implementation Plan. The year 2008 was chosen as the baseline year since this was the most recent year that represented realistic sustained production, a common criterion for baseline selection and it coincided with the development of the Schedule of Compliance.

ILLUSTRATION 4-3 PROJECTED ANNUAL CUMULATIVE MERCURY EMISSIONS FROM US STEEL MINNESOTA TACONITE FACILITIES



Mercury emissions would be expected to increase with the start-up of the Proposed Project. Decreases occur at the time controls are installed on the existing lines at Minntac. All mercury emission reduction controls at Minntac will be in place by 2025. The Project Proposer estimates that through commitments to research and early implementation of mercury controls at existing units, by 2025 total mercury emissions at both Minntac and Keetac, including the Proposed Project, may achieve the same or lower emissions than would otherwise occur without the Proposed Project.

4.9.8 Human Health Risk Assessment

The FSDD requires that the EIS evaluate the potential risk to human health posed by the Proposed Project. In response to that requirement, a multi-pathway Human Health Screening-Level Risk Assessment (HHSRA) was conducted.

This section includes a general discussion on risk assessment and risk assessment methods, pollutants addressed, exposure scenarios and results. HHSRA results based on a study completed by the Project Proposer titled “Human Health Screening-Level Risk Assessment, U.S. Steel Keetac Expansion Project” (Barr, 2009M) and a supplemental document titled “Addendum to the February Human Health Screening-Level Risk Assessment” (Barr, 2009L) are presented in this section. Additional information related to the HHSRA can be found in Appendix G and includes the results for specific locations, quantitative results and ingestion rates. Table 4.9.25 lists the chemicals assessed in the analysis.

This section also presents results for mercury from fish consumption using existing fish tissue data from area lakes and incremental impacts for mercury emissions from the Proposed Project. Mercury is discussed in additional detail in Sections 4.9.7 and 5.5 of the FEIS. For a discussion regarding the cumulative effects on other species (non-human) the reader is directed to the Ecological Risk Assessment Section 5.13.2. For a discussion of amphibole mineral fibers, see Section 4.23.

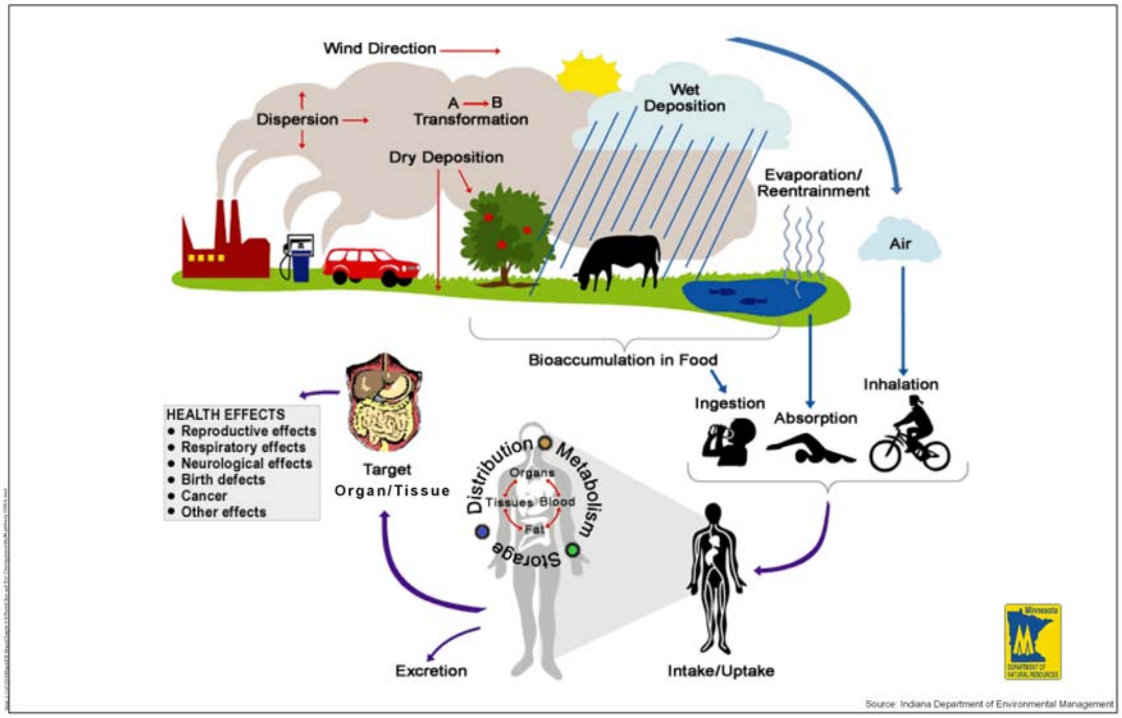
This multi-pathway HHSRA was conducted for each of the following three scenarios:

- The Proposed Project alone, results presented in this section of the FEIS
- The existing permitted facility, results presented in this section of the FEIS

- The Post-Project Total Facility (i.e., the total facility as it would be if the Proposed Project is implemented), results presented in Section 5.13.1. The inhalation risk results from the multi-pathway Post-Project Total Facility were also extracted and presented in the Cumulative Air Emissions Risk Analysis in Section 5.13.1.

In a multi-pathway risk analysis, multiple exposure routes (breathing, eating) and pathways (air emissions, water releases) are considered and evaluated together. Illustration 4-4 depicts some of the potential exposure pathways that may be assessed in multi-pathway risk assessments.

ILLUSTRATION 4-4 POTENTIAL EXPOSURE PATHWAYS FOR MULTI-PATHWAY RISK ASSESSMENTS



The discussion and results presented in this section are based on the HHSRA and the HHSRA Addendum. Updates to these documents are also cited in the Chapter 8.0 – References and include: Supplemental analysis to the February 2009 HHSRA: *Modeling of final permitted NOx emission rates and updated acute inhalation risks at the property boundary and for the alternative waste rock stockpile location and snowmobile trail, Updated* PM_{10} *and* $PM_{2.5}$ *results for Class II Report and Stockpiles Alternative Analysis* (Barr, 2010F), and *Response to Questions for* NO_2 *Review for the EIS Workshop*. Please refer to those documents for additional detail and analysis.

4.9.8.1 Methodology

Table 4.9.25 lists pollutants from air emissions that were assessed in the analysis. Emissions from mining, processing, and mobile sources were included in the assessment and generally consist of particulate, particulate-bound, semi-volatile and volatile (gaseous) emissions.

TABLE 4.9.25 CHEMICALS ASSESSED IN THE HHSRA

2-Chloroacetophenone	Carbon Disulfide	Fluorine, Fluorides	Phenanthrene
5-Methylchrysene	Chloride salts	Formaldehyde	Phenol
Acenaphthene	Chlorine, Chlorides (as chloride)	Hexane, N-	Phosphorous Compounds (as Phosphoric Acid)
Acenaphthylene	Chlorobenzene	Hydrogen Chloride	Polycyclic Organic Matter (POM)
Acetaldehyde	Chloroethane	Hydrogen Cyanide	Potassium Compounds
Acetophone	Chloroform (Trichloromethane)	Hydrogen Fluoride	Propane
Acrolein	Chromium, Trivalent (III)	Indeno(1,2,3-cd)pyrene	Propionaldehyde
Aluminum Compounds (as Aluminum)	Chromium, Hexavalent (VI)	Iron Compounds (as Iron)	Propylene
Anthracene	Chrysene	Isophorone	Pyrene
Antimony Compounds (as Antimony)	Cobalt Compounds (as Cobalt)	Lead Compounds (as Lead)	Selenium Compounds (as Selenium)
Arsenic Compounds (as Arsenic)	Copper Compounds (as Copper)	Magnesium Compounds (as Magnesium)	Silver Compounds (as Silver)
Barium Compounds (as Barium)	Crystalline Silica	Manganese Compounds (as Manganese)	Sodium Compounds (as Sodium)
Benzene	Cumene (Isopropylbenzene)	Mercury Compounds Methyl Mercury	Styrene
Benzo(a)anthracene	Cyanide	Methyl bromide (Bromomethane)	Strontium Compounds (as Strontium)
Benzo(a)pyrene	Dibenzo(a,h)anthracene	Methyl chloride (Chloromethane)	Sulfur Compounds
Benzo(b)fluoranthene	Dichlorobenzenes	Methyl Ethyl Ketone (2-Butanone)	Sulfuric Acid
Benzo[g,h,i]perylene	Dichloroethane, 1,2- (Ethylene Dichloride)	Methyl Hydrazine	Tetrachlorethylene (Perchloroethylene) (Perc)
Benzo(k)fluoranthene	Dimethyl Sulfide	Methyl Methacrylate	Thallium
Benzyl chloride	Dimethylbenz(a)anthracene, 7,12-	Methyl tertiary (tert) butyl ether	Tin Compounds (as Tin)
Beryllium (as Beryllium)	Dinitrotoluene, 2,4-	Methylcholanthrene, 3-	Titanium Compounds (as Titanium)
Biphenyl	Dioxin/Furan (as 2,3,7,8-tetraCDDD, equivalents)	Methylene chloride	Toluene
Boron Compounds (as Boron)	Ethane	Molybdenum Compounds (as Molybdenum)	Trichloroethane, 1,1,1-
Bromoform (Tribromomethane)	Ethylbenzene	Naphthalene	Vanadium Compounds (as Vanadium)
Butadiene, 1,3-	Ethylene Dibromide	Naphthalene, 2-methyl	Vinyl Acetate
Butane	Ethylhexyl phthalate,bis-2-	Nickel Compounds	Xylene
Cadmium Compounds (as Cadmium)	Fluoranthene	Nitrogen dioxide (1-hour only)	Zinc Compounds
Calcium Compounds	Fluorene	Pentane	

Source: Barr, 2009M

A HHSRA examines the following types of potential effects on human health:

- Acute (non-cancer). These types of effects would occur as a result of exposure over a short-time period (1-hr) with results expressed by a hazard index (HI)
- Chronic. These types of effects would occur as a result of exposure over a longer time period (years through a lifetime). Chronic effects are further categorized as:
  - Non-Cancer – results are also expressed by an HI
  - Cancer – Because the assumed relationship between dose and likelihood of cancer is distinct from that of non-cancer endpoints, the results are expressed as the potential additional risk of developing cancer over a lifetime (a number [1, 2, …] per 100,000). A result of 1 in 100,000 for example refers to an upper-bound probability that one individual in a population of one hundred thousand could develop cancer as a result of exposures over a lifetime.

An HI is the sum of the ratios of exposure concentration to toxicity values for individual chemicals. A simple, single pathway exposure version of a HI is illustrated below:

$$HI = \frac{C_1}{TV_1} + \frac{C_2}{TV_2} + \quad + \frac{C_n}{TV\ of\ C_n}$$

C_n = concentration of Chemical n in the exposure being analyzed (for example for the inhalation pathway), where n equals each chemical in the group up to the # “n”.
TV_n = toxicity value (concentration at or below which adverse health effects are not expected to occur) for chemical n.

In Minnesota, a non-cancer HI value of 1.0, and an additional lifetime cancer risk of 1 in 100,000 are used as guidelines for interpreting the results of a human health risk assessment. For example, if a project resulted in an HI of less than or equal to 1.0, and an additional lifetime cancer risk of less than or equal to 1 in 100,000, it would be considered to not have the potential for significant adverse health effects for susceptible populations. When risk estimates are above risk guidelines adverse impacts cannot be ruled out and therefore these screening level results require further investigation. The EPA National Air Toxics Assessment (NATA) glossary states that “A respiratory HI greater than 1.0 can be best described as indicating that a potential may exist for adverse irritation to the respiratory system”. These guidelines have been established to be protective of public health and are viewed only as guidelines, rather than a definitive value with distinct limits. Note that cancer risk estimates should not be considered valid beyond 1 significant digit – for example, a value of 1.2 in 100,000 is not significantly different from 1 in 100,000. Two significant digits are reported in some cases here in order to provide transparency in the presentation of results. The reader is reminded not to judge results based on additional significant digits.

A protocol using standard risk analysis methodology was developed by the Project Proposer’s consultant, and was reviewed by the MPCA, MDH and MNDNR (through their consultant, Wenck Associates). The HHSRA relies on:

- Emissions data (how much of what chemicals are emitted),
- Dispersion, deposition and environmental fate modeling and analysis (multi-pathway modeling with the Industrial Risk Assessment Program, IRAP) (estimations of how much of the chemical enters the surrounding environment, how and where it enters, and how it moves through the environment),
- Toxicity (how toxic is a particular chemical over what exposure timeframe, and, resulting in what endpoints) and,
- Exposure data (estimations of how people are exposed and how much/often are they exposed to the chemical).

The same emission rate data sets are used in this analysis as were used for other EIS studies and permitting analyses. Dispersion models that were used for this analysis are those that are approved by the USEPA for this type of purpose. For mercury, the Minnesota Mercury Risk Estimation Model (MMREM) was used to estimate potential health risks due to fish consumption.

Toxicity data was used according to an MDH/MPCA established hierarchy of data sources. Those toxicity data sources include MDH recommended values, Minnesota Rules, California EPA toxicity values data, and USEPA toxicity values.

Unless otherwise noted, potential effects from multiple chemical emissions were assumed to be additive within acute, chronic non-cancer, and chronic cancer groupings.

Different exposure scenarios for the HHSRA were assessed and include:

- Resident Scenario – this hypothetical individual resides at a location potentially affected by the project. The hypothetical individual in this location also inhales air, ingests surface water, consumes produce from a home garden and homegrown chickens and eggs - all potentially affected by emissions from the Proposed Project. This scenario also assumes that this hypothetical individual would consume some locally caught fish.
- Farmer Scenario – in addition to the resident scenario described above, this hypothetical individual consumes homegrown beef, pork and milk. This scenario assumes that homegrown feed is supplied to these animals as well. This scenario also assumes that this hypothetical individual would consume some locally caught fish.
    - Available information for the Keewatin area indicates that there are no farms in the area that match all of the assumptions in the 'farmer' exposure scenario. Therefore, assessment of 'farmer' exposure here is theoretical and is provided for screening purposes.
- Fisher Scenario – in addition to the resident scenario described above this individual also ingests higher levels of fish that are caught in local water bodies.

For each exposure scenario above, two levels of exposure were considered; one scenario that assumed a worst-case, maximum level exposure and one that assumed a lesser level of exposure. Details on exposure assumptions for the two scenarios are included in Appendix G. These two levels of exposure are referred to as the Maximally Exposed Individual (MEI) and the Modified Central Tendency Exposure (MCTE). Both adult and child levels of exposure were considered for each exposure scenario (MEI and MCTE).

The analysis estimated potential hazard indices and potential incremental cancer risks for each exposure scenario (e.g. resident, farmer, fisher) at varying locations. Those locations were identified based on areas of potentially high air pollutant concentrations and deposition as well as potentially sensitive locations around the project (e.g., schools, nursing homes, child care centers, etc.). Multiple locations are used because air concentrations generally decrease with distance from the point of discharge. Figure 4.9.8.1 identifies the locations assessed in this analysis. Appendix G lists locations and the associated exposure scenario. It should be recognized that the accuracy of the location of the results is limited – in other words the location is not exact.

Horsehead, Swan, Kelly, O'Brien, and Coons lakes and their watersheds were included in the analysis. Pollutants were assumed to deposit over the lakes and their watersheds and accumulate through the watershed in the analysis. Each fisher scenario was assessed for the lake/watershed most likely to be fished or at locations of highest potential deposition.

Two levels of fish consumption were assessed with the MMREM: 1) a recreational level or approximately 0.4 pounds per week (lbs/wk), and 2) a higher level or approximately 3 lbs/wk. This higher level comes from Table 10-28 of USEPA's Exposure Factors Handbook (USEPA,

1997) and equates to a 95th percentile consumption rate. Tribal representatives have suggested a higher level (a value of roughly 3.5 lbs/week). Such a change would affect results linearly for each lake assessed – increasing results by roughly 13 percent. As an example, a 13 percent increase in exposure would increase the potential result from 1.8 per 100,000 to 2.0 per 100,000.

Incorporation of a 13 percent increase in the rate of fish consumption (3.0 lbs per week to 3.5 lbs per week) would increase non-cancer hazard indices for the study lakes. These adjustments in consumption rate would only be applicable to the fisher scenario, and would not be appropriate adjustments for other exposure scenarios. Overall, these adjustments of fish consumption rates do not significantly affect reported estimates of risk.

4.9.8.2 Environmental Consequences

4.9.8.2.1 Acute Results

The following provides a summary of the acute (1-hour) results for the Proposed Project.

Existing Facility

The acute (1-hr) results for the existing permitted facility were separated by health endpoints, however within each endpoint the pollutant-specific results were assumed to be additive. The acute, respiratory endpoint HI, when using solely natural gas, reflected a possible HI as high as 2.6. In order to reach a potential HI of 2.6, the existing facility would need to combust 100 percent natural gas at full operating capacity in all combustion units simultaneously, in combination with worst-case meteorological conditions. The acute hazard quotient also assumes a high percent of the total NOx is emitted as NO_2 (the health indicator in NO_x). The EPA approved a refinement for the Class II modeling of hourly NO_2, that if used for this assessment would lower this reported value to between approximately 1.2 - 1.6. For other toxic endpoints, the HI was determined to be less than 1.0.

Proposed Project

Acute HI values for the Proposed Project are all less than 1.0, with a maximum HI result of 0.7[3]. In order for this maximum to be realized, the same conditions as described under the existing facility would need to occur (i.e., 100 percent natural gas, all units at full operating capacity). Similar to the existing facility description above, the acute hazard quotient for the proposed project also assumes a high percent of the total NOx is emitted as NO_2 (the health indicator in NO_x). The EPA approved refinement for the Class II modeling of hourly NO_2, would lower this value to approximately 0.4 - 0.6.

4.9.8.2.2 Chronic Non-Cancer Results

Existing Facility and Proposed Project

Chronic non-cancer results are less than a HI of 1.0 in all cases and exposure scenarios for both the Proposed Project and the existing facility (maximum of 0.5 for high level [approximately 3 lbs/week] fish consumer using Kelly Lake).

[3] *The maximal acute modeled hazard quotients reported in the Existing Facility and the Proposed Project sections do not occur at the same location when the proposed project is modeled separately from the existing facility. The hazard quotients reported above, are therefore not additive. When the Total Facility Post Project is modeled, highest modeled hazard quotient is 2.7, as reported and discussed in Chapter 5.*

4.9.8.2.3 Chronic Cancer Results

Existing Facility

Chronic cancer risk results for the existing permitted facility for the maximum exposure scenario are greater than 1 in 100,000. These results are discussed further below. The results represent an upper bound estimate, while actual risks are likely to be lower for the pollutants assessed.

Existing Facility - Farmer Scenario

For the hypothetical farmer, the maximum exposure scenario (MEI) has a maximum risk estimate of 2.6 in 100,000. This modeled result occurs in the Kelly Lake area. The maximum exposure scenario assumes an individual lives at the location of maximum impact for 70 years and inhales outdoor air every day, all day long and eats beef, pork, poultry, eggs, and milk from animals that live at that location and whose feed is grown at that location. This exposure scenario also assumes the individual eats produce grown at that location. Additional information on this exposure scenario is provided in Appendix G. Using a lesser exposure scenario (MCTE) the result drops to 0.07 in 100,000 at the same location.

Modeled risk estimates were close to or greater than 1 in 100,000 at two other locations. One is 1.5 in 100,000 at a farmer exposure scenario receptor location, east of the northern portion of the tailings basin. The second is 0.95 in 100,000 for a farmer exposure receptor location north of the processing facility.

As noted previously, farmer receptors were located based on potential future land use and do not currently represent farms that meet the exposure scenario assumptions.

The exposure pathways that contribute the most to these results are milk and beef consumption. The pollutants contributing the most to these results are dioxins and Poly-Aromatic Hydrocarbons (PAHs).

Existing Facility – Fisher Scenario

For the fisher scenario, the MEI with a high level of fish consumption (consuming approximately 3 lbs/week of fish from Kelly Lake) has a result of 1.8 in 100,000 (at 3.5 lbs/week, the result would be 2.0 per 100,000). Using a lesser exposure scenario (MCTE) the result drops to 0.03 in 100,000 at the same location. The exposure pathway that contributes most to this result is the consumption of fish and the pollutants contributing most to this result are dioxins, PAHs and arsenic.

Existing Facility – Resident Scenario

For residents, the MEI with a recreational level of fish consumption (0.4 lbs/week) has a result of 1.4 in 100,000, which occurs in the Welcome Lake area. Using a lesser exposure scenario (MCTE) this result drops to 0.06 in 100,000 at the same location. A second location (on the southeastern processing facility boundary) has a result of 1.0 in 100,000. Using a lesser exposure scenario (MCTE) this result drops to 0.04 in 100,000 at the same location. The exposure pathways most contributing to this result are produce-related consumption and inhalation. The pollutants most contributing to this result are arsenic and dioxins.

Proposed Project

Chronic cancer risk results for the Proposed Project alone have a maximum result of 0.4 in 100,000. The maximum potential result is for a farmer scenario at maximum exposure levels.

4.9.8.2.4 Mercury Results

The local mercury deposition analysis assesses the potential contributions from the Proposed Project to selected lakes within 10 kilometers. Background mercury deposition is included as an input value to the MMREM spreadsheet and it is assumed the existing facility contributes to the background deposition and to the background mercury fish tissue levels. The MMREM analysis used the most recent mercury emission data available for the existing facility and assumed that a 30 percent mercury control efficiency would be implemented as part of the Proposed Project. Further information on proposed mercury controls is provided in Section 4.9.7.

The analysis shows that the Proposed Project alone would likely not measurably affect fish tissue levels at recreational consumption levels (approximately 0.4 lbs/week). At higher consumption levels (approximately 3 lbs/week) MMREM calculated an incremental HI for fish consumption at 30 percent control of 0.08 to 0.5 depending on the specific lake assessed. (Reference Wachtler Memo 4/14/2009 (Barr, 2009J)). See Section 4.9.7 for further discussion of existing levels and 5.13.1 for potential cumulative results.

4.9.8.2.5 Summary of Results

- Results for the Proposed Project alone are less than general risk assessment guidelines in all cases.
- Results for the existing facility are higher than general risk assessment guidelines for the acute health impact estimates assuming worst-case operating conditions combined with worst-case meteorological conditions.
- Results for the existing facility for the farmer scenario are higher than general risk assessment guidelines for longer time frames (chronic) using maximum exposure assumptions. This is true for farmer cancer, but not for all other chronic, hypothetical exposure scenarios (farmer non-cancer chronic, etc.). Further analysis using MCTE exposure assumptions indicates that the risk estimates for the existing facility are below guidelines.
- Potential mercury emissions from the Proposed Project alone would not be sufficient to affect discernibly mercury fish tissue levels at recreational consumption levels (approximately 0.4 lbs/week). At higher consumption levels (approximately 3 lbs/week), the MMREM calculated an incremental HQ for fish consumption of 0.08 to 0.5, at 30 percent control, depending on the lake assessed.

The acute, chronic non-cancer and chronic cancer risk estimates increase with the Proposed Project, and therefore there is a potential for adverse impacts to health. However, the risks of the Proposed Project alone (excluding the existing facility) are below the guidelines, and therefore the incremental effects are not significant.

At recreational fish consumption levels, there would be no discernable change to human health risk estimates due to mercury emissions from the Proposed Project alone. At higher consumption levels, there would be an adverse effect to human health risk estimates. The significance of the effect on human health estimates is unknown.

This analysis was based on standard risk assessment methods and assumptions designed to be protective of public health. Actual risk estimates are likely to be lower than predicted.

The Proposed Project would have an adverse effect on acute, chronic non-cancer and cancer human health risk estimates, as the modeled estimated risks would increase. However, the risks of the Proposed Project (excluding the existing facility) are below the guidelines, and therefore the incremental effects are not significant. According to the criteria set out for effects determinations in the EIS, any modeled increase in an impact was determined to be an "adverse effect," and if the modeled increase was higher than a comparison value that determination was deemed significant.

There would be no discernable change to human health risks at recreational fish consumption levels due to mercury emissions from the Proposed Project alone. At higher consumption levels, there would be an adverse effect to human health risk estimates. The significance of the effect on human health estimates is unknown.

This analysis was based on standard risk assessment methods and assumptions designed to be protective of public health. Actual risk estimates are likely to be lower than predicted.

4.9.8.2.6 East Stockpile Alternative

A supplemental analysis to the February 2009 HHSRA was performed to determine the human health risk associated with the East Stockpile Alternative location and configuration. The supplemental analysis addressed specific emission sources and rates associated with stockpile construction including fugitive dust from the stockpile and haul road segments, and diesel fuel combustion emissions from haul trucks. These emissions were modeled for the East Stockpile Alternative location and compared to the proposed east stockpile location, referred to as the "base case", in the original Work Plan.

A comparison of the carcinogenic risk associated with the East Stockpile Alternative location (Figure 4.9.8.1) shows small differences (both increases and decreases) in estimated incremental cancer risk values for receptor locations 7, 8, 9, and 14 when compared to the base case location. These small differences, however, do not change the final results reported in Section 4.9.8.2 since those results were rounded to one significant figure in accordance with EPA guidance in reporting carcinogenic risk. A similar comparison of the non-cancer chronic risk showed small decreases in estimated potential risk for all four receptor locations; all HI values were below 1.0 for both stockpile locations; all HI values were below 1.0 for both stockpile locations. Likewise, the estimated HI values for the non-cancer acute inhalation risk were lower (2.0 compared to 2.4) for the East Stockpile Alternative location. Consequently, there is no significant difference in estimated human health risks between the two stockpile locations and configurations.

4.9.8.3 Risk Assessment Uncertainties

Risk assessments involve uncertainties at all levels of the analysis, including emission rates, emission parameters (i.e., location, height, velocity), toxicity, whether effects are additive or not, and exposure (i.e., inhalation and ingestion rates). Each of these uncertainties could result in an over or under-estimate of the results. In general risk assessment methods are established to be health protective. In risk assessment analysis, there are likely to be uncertainties that are unique to that analysis and may greatly influence results. Some of the uncertainties that might impact this risk assessment are listed below.

- There is uncertainty in the consumption rates of the population surrounding the Proposed Project and how long they may reside at locations of maximal air concentrations. The maximal exposure assumptions result in over estimations of risk (exposure to maximal air concentrations for 24 hours/day, 365 days per year and a 70 year lifetime, high home-grown food consumption rates, etc.)

- The assumption that metals were 100 percent bio-available. The HHSRA assumes that exposure to a particular metal occurs in such a way that 100 percent of the metal can be taken into body systems (metabolized). In this analysis, this assumption has the largest affect on the estimated risks for arsenic. Metals (such as arsenic) may or may not be in a chemical form that can be taken up by the human body. This assumption results in an overestimation of risk.

- There is uncertainty as to the toxicity data used for the dioxin/furan group of substances. The toxicity values used for dioxin/furan as part of this analysis were developed by MDH and are referred to as 'provisional'. MDH suggests that using the provisional values is appropriate. Use of the provisional values tends to increase results. Alternative values are available from California Environmental Protection Agency, Office of Environmental Health Hazard Assessment.

- There is uncertainty as to the toxicity data used for arsenic. There is a newer inhalation toxicity value available for arsenic that is based on more recent data and more studies overall, and would result in a lower estimate of risks but has not undergone state agency review and therefore was not used in this analysis.

- Dioxins and PAHs are semi-volatile gases that are likely to condense onto particles soon after being emitted into the air. Arsenic is a particle emission. Sources of these emissions are mobile sources (dioxins and PAHs) and the indurating furnaces (dioxins and arsenic). Dioxins/furans are semi-volatile, highly hydrophobic compounds. Shortly after formation during combustion, they are likely to adsorb onto existing particles or condense into particles along with other emissions. The distance they travel (their behavior in the air) is related to the particle size with which they are associated. Available models do not fully account for the physical/chemical behavior of these pollutants.

- There is uncertainty in the estimation of risk for diesel particulate matter (dpm) emissions stemming from emissions estimates and toxicity values. In this analysis, risks from dpm were estimated for the specific individual pollutants potentially on diesel particulates (e.g. PAHs, dioxins/furans, arsenic, etc.). Another manner of estimating risks for dpm is the estimation of risks based on emissions and toxicity values for dpm as a mixture. This uncertainty can result in an under or overestimation of risks.

- For the screening level acute hazard index modeling, 75 percent of the NOx was assumed to be NO_2. This assumption likely overestimates the ratio of NO_2/NOx by approximately 0.5.

Overall, the analysis was based on standard risk assessment methods and assumptions, designed to be protective of public health.

4.10 LAND USE

The FSDD stated that the FEIS analysis should include potential land use conflicts with nearby residences and water bodies with respect to physical alteration of water resources, noise blasting, new haul roads and automobile traffic. As noted in Section 4.10.2 below, these impacts are described in detail in other sections of this FEIS.

> Much of the Proposed Project area has been previously excavated or otherwise altered by past and present mining activities.

The FSDD indicated that the SEAW Item 27 – Compatibility with Plans and Land Use Regulations was adequately analyzed and would not be addressed in the FEIS. The SEAW provides detailed information about land use plans and regulations in the project vicinity.

4.10.1 Affected Environment

Current and historic economic uses of land within and adjacent to the Proposed Project are primarily mining. Much of the Proposed Project area has been previously excavated or otherwise altered by past and present mining activities.

Although previously undisturbed by mining, the proposed east stockpile area has been previously impacted by damming of water, created by the existing southeast stockpile, resulting in larger wetland areas. Consisting of primarily undisturbed land, the proposed east mine pit expansion includes a small area previously mined for aggregate. The proposed south stockpile and proposed south mine pit expansion are located directly adjacent to the existing pit.

Nearest residences are located in the City of Keewatin, south of the Proposed Project, and east of the facility boundary in Kelly Lake, which is part of the City of Hibbing. Water bodies nearest the project are Kelly Lake, Snowshoe Lake, Welcome Lake, Reservoir Two North, and Reservoir Six.

4.10.1.1 No Action Alternative

If the Proposed Project is not constructed, it is anticipated that the Project Proposer would continue to operate the mining facility under existing permits. These permits would allow the Project Proposer to continue to excavate iron ore in both altered and undisturbed areas outside of the active pit. Figure 3.2.1 illustrates the boundary and extent of mining activities that would occur under the No Action Alternative.

4.10.2 Environmental Consequences

The SEAW describes current land use in areas within and adjacent to the Proposed Project. This information was used to assess potential impacts to land use and served as the basis for FSDD identification of potential land use conflicts with the Proposed Project. Table 4.10.1 summarizes the potential impacts identified in the FSDD that could affect nearby residences and water bodies. The table also indicates the section of the FEIS that provides further discussion on each of the potential impacts for residences and water bodies.

TABLE 4.10.1 LAND USE-RELATED ISSUES DESCRIBED FOR THE PROPOSED PROJECT

Potential Impact	Residences	Water bodies
Wetlands	-	FEIS Section 4.6
Water Levels and Surface Water Runoff	-	FEIS Section 4.1.1 FEIS Section 4.4.2
Blasting Noise	FEIS Section 4.16	-
Dust	FEIS Sections 4.9.2 and 4.16	-
Traffic	FEIS Section 4.15	-
New Haul Roads	FEIS Section 3.3.3	-

4.10.2.1 Proposed Action Alternative

4.10.2.1.1 Mine and Stockpile Areas

As described in the SEAW, the proposed mine expansion and stockpile areas for the Proposed Project are located primarily north and east of the City of Keewatin (see Figure 1.3). The proposed east stockpile would be within one-half mile of the nearest Kelly Lake residence. This would increase both the size (footprint) of the existing stockpile and the amount of heavy equipment use near Kelly Lake, compared to the No Action Alternative. Potential visual and noise impacts from the proposed east stockpile would be brought approximately 200 to 1,000 feet closer to some Kelly Lake residents than with the No Action Alternative.

The proposed south stockpile and proposed south mine pit expansion would bring mining-related activity closer to the City of Keewatin residents. The proposed south stockpile would have visual impacts on Keewatin residents due to its height and proximity. The proposed south mine pit expansion and proposed south stockpile would also create noise impacts from increased use of heavy equipment in the area, along with blasting for the mine pit expansion. A noise study was completed for the Proposed Project that indicated that none of the six receptors modeled in the Kelly Lake area exceeded the daytime standard. One receptor west of Kelly Lake is predicted to exceed state L_{50} noise standards both during the day and at night. Three receptors in the Kelly Lake area are predicted to exceed the L_{10} night time standard when proposed east stockpile activity is closest. Receptors to the south between the proposed east stockpile area and TH 169 were also studied; one receptor was predicted to exceed L_{10} night time noise standards when stockpile activity is closest. No other receptors were predicted to exceed day or night time noise standards in this location. Additional discussion on potential impacts from noise is found in Section 4.16.

The potential impact of dust from the proposed east stockpile would be closer to residents in Kelly Lake, compared to the No Action Alternative and current zoning. However, significant dust impacts are not anticipated. Sections 4.9.2 and 4.16 provide further discussion on potential dust impacts.

4.10.2.1.2 Plant Site

The plant area is bordered by Welcome Lake to the south and the city of Keewatin, approximately one mile southwest. Increased plant production would increase the potential for noise impacts. Equipment upgrades would occur inside enclosed structures, with the exception of the wood chipper for the proposed biomass facility. A noise analysis completed for the proposed plant expansion, including the wood chipper, projected no significant noise impacts to nearby residents. Further discussion on potential noise impacts is provided in Section 4.16.

4.10.2.1.3 Tailings Basin

The existing tailings basin would be vertically expanded and the dams would be strengthened to accommodate additional production of tailings from the Proposed Project. Potential dust generation from the expansion of the tailings basin is not anticipated to increase. The nearest residences are less than one mile northeast of the tailings basin area. An area south of the active tailings basin is within the Permit to Mine facilities limit, but is not part of the Proposed Project. The Project Proposer operates under a Fugitive Dust Control Plan, which outlines mitigation measures to reduce or eliminate periodic dust impacts to nearby residences (see Sections 4.9.2 and 4.16 for more detail). The Project Proposer is working to minimize dust by using a variety of measures, including helicopter-based seeding and mulching of areas within the tailings basin.

Two reservoirs are located west of the exterior tailings basin dam. These water bodies are designated as MNDNR Public Waters. No physical alteration of these water bodies is anticipated from the Proposed Project. More information is provided in Sections 4.1.1, 4.6, and 4.12.

4.10.2.2 Environmental Hazards on or Near the Site

Based on MPCA data, the SEAW identified several contaminated sites within the Proposed Project vicinity. Proposed Project impact areas did not change from the SEAW. Environmental hazard sites, listed below and identified on Figure 4.10.2, are not expected to be impacted by the Proposed Project.

- Keewatin Dump Site. This dump is located south of the City of Keewatin and was listed on MPCA's 1980 Statewide Open Dump Inventory.
- Former Butler Taconite Plant. This site is on TH 169 west of U.S. Steel's control property. A voluntary cleanup of the site was conducted. The property was listed by the USEPA as a No Further Remedial Action Planned (NFRAP) site and was removed from the USEPA's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) system.
- Inland Steel Mining Co. St. Paul Mine was operated from 1956 to 1964. This site is included because of the possible use of solvents and greases on site, but it is a low priority site for MPCA inspection and has a low hazard potential. The property was listed by USEPA as a NFRAP site and was removed from the USEPA's CERCLA system.
- National Steel Pellet Co. Dump. This unpermitted dump was identified on MPCA's 1980 Statewide Open Dump Inventory.
- Kelly Lake Dumps I and II. These unpermitted dumps were identified on MPCA's 1980 Statewide Open Dump Inventory.

The Land Recycling Act of 1992 created the MPCA Voluntary Investigation and Cleanup (VIC) Program, which provides future liability protection for responsibility from contamination problems at a site if a property owner or potential buyer voluntarily undertake an investigation and, if necessary, cleanup action approved by the MPCA. EIS analysis identified the location of VIC sites near the Proposed Project. There are no sites within close proximity (1 mile) to the Proposed Project. Therefore the Proposed Project is not expected to impact known VIC sites in Itasca or St. Louis Counties.

Additionally, the Project Proposer is in the process of completing a Leak Site Investigation for the removal of a 415-gallon underground storage tank (UST) (MPCA Leaksite No. 16602). MPCA has agreed with the Project Proposer's recommendation for closure of the leak site upon completion of a Conceptual Corrective Action Design Worksheet and soil excavation of the contaminated area.

No other records of potential environmental hazards have been identified. Based on the historical use of portions of the project site for mining and processing activities, it is possible that smaller, unidentified environmental hazards (e.g., small spills) exist within the project boundaries. Environmental hazards discovered during facility development would be handled under appropriate regulatory programs.

4.10.2.3 East Stockpile Alternative

The East Stockpile Alternative would not change the Proposed Project's potential effects on land use regulations or environmental hazards on or near the site. Other potential effects related to land use topics listed in Table 4.10.1 are described in various sections of this FEIS.

4.10.3 Mitigation Opportunities

Impacts to nearby residents and water bodies are covered in a number of other sections of the FEIS. Measures to avoid and minimize noise and dust would be used during construction and operation. Mineland reclamation procedures would further control dust and reduce visual impacts. Details on mitigation measures for each of the topic areas are included in Sections 4.1.1 – Water Levels, 4.6 – Wetlands, 4.9 – Stationary Source Air Emissions, 4.16 – Odors, Noise, and Dust, 4.20 – Visual Impacts, and 3.3.7 – Mineland Reclamation.

Additionally, when local governments (City of Hibbing and City of Nashwauk) begin reviewing the project permit applications, an appropriate permitting process (e.g., plan approval, granting a Conditional Use Permit [CUP] or variance) would be determined. During this process, a local government may elect to specify mitigation or restrictions as conditions of permit approval.

4.11 COVER TYPES

> GIS analysis and aerial photo interpretation isolated five general cover types in the affected area: forest, mining, open water, past mine feature revegetated, and wetland.

The FSDD states that the SEAW cover type area estimates need to be updated in the EIS to reflect refined project plans made available for the EIS and that the EIS "will describe the conversion of existing land cover types that will result from project implementation and reclamation." The FSDD also states that the cumulative effects of land cover changes need to be analyzed as a result of biomass harvest and that there should be an analysis of potential prime and unique farmland impacts.

This chapter provides updated cover type information. It describes and analyzes the conversion of land cover types in 12 distinct project areas as shown in the first column of Table 4.11.2. Each project area is broken into five general cover types. Acres are reported for each cover type for three land cover conditions: conditions under the No Action Alternative, conditions under the Proposed Action Alternative, the East Stockpile Alternative, and land cover after reclamation activities. This chapter also includes a section on potential impacts to prime farmland, unique farmland, and farmland of statewide importance.

Not all land cover information and analysis is provided in this chapter. Though estimated reclamation (revegetation) acreage is provided in this section, information on specific reclamation measures is provided in Section 3.3.7 – Closure and Mineland Reclamation and potential impacts from wetlands are described in Section 4.6. The cumulative effects analysis for biomass harvest is provided in Section 5.1 – Biomass.

4.11.1 Affected Environment

GIS analysis and aerial photo interpretation isolated five general cover types in the affected area: forest, mining, open water, past mine feature, revegetated, and wetland. Forest cover type includes areas that have remained naturally covered by trees or have revegetated after presettlement. Based on MNDNR 2007 Mine Features mapping, the mining cover type classification was applied to all areas that have been mined or would be mined under the No Action Alternative, Proposed Project, and East Stockpile Alternative descriptions, and have not revegetated. The open water classification includes areas identified by the Project Proposer that would remain as water in the tailings basin for the No Action Alternative, and would become water during the Proposed Project and upon post reclamation (i.e., mine pits filling with water). Past mine feature: revegetated includes areas that were previously impacted by mining, such as stripping, grading, and stockpiling, and have re-established vegetation through natural succession and/or mineland reclamation measures. The wetland cover type classification was determined based on known wetland delineations completed for Keetac and wetland areas that have not been permitted for mining impacts.

The Code of Federal Regulation 7 CFR 657 defines the farmland classifications. Prime farmland is defined as land that has the best combination of physical and chemical characteristics for producing food and crops, and is also available to grow these uses. Unique farmland is defined as land other than prime farmland that is used for the production of specific high value food and fiber crops. Farmland of statewide importance is defined as land, in addition to prime and unique farmlands, that is of statewide importance for the production of food and crops based on criteria determined by state agencies.

Most of the soils identified by the Itasca County and St. Louis County Soil Surveys as prime or unique farmland soils have been permanently altered by past mining activity. No farmland soils in the project area are currently used for agricultural purposes. Although farmland soil type exists in the project area, agriculture is not a current land use. Figure 4.11.1 shows the farmland soil types in the Proposed Project that have not been impacted by past mining activity.

4.11.1.1 No Action Alternative

The cover types analysis for the No Action Alternative estimates the acres of the various cover types after mining has been completed, but prior to reclamation, as shown on Figure 4.11.2. This conservative estimate indicates a worse-case assessment of cover type changes, since no reclamation is taken into account and is summarized in Table 4.11.2.

Table 4.11.1 summarizes farmland soil types within the project boundary. Approximately 95 acres of farmland soils in forested areas would be impacted by the No Action Alternative. The impacts would occur in the existing mine pit as mining advanced into currently permitted areas and in the existing northwest stockpile as overburden and waste rock were placed in that area. Mining and past mine feature: revegetated areas have been altered by mining related activities; therefore, farmland soils identified by the soil survey no longer exist.

TABLE 4.11.1 NO ACTION ALTERNATIVE FARMLAND SOIL IMPACTS

Project Area	Land Cover Type	Farmland Classification	Acres
Existing Mine Pit	Forest	All areas prime farmland	18.96
		Prime farmland if drained	1.43
		Total	**20.39**
Existing Northwest Stockpile	Forest	All areas prime farmland	57.03
		Prime farmland if drained	19.32
		Total	**76.35**
		Total Prime Farmland in No Action Alternative Area	**96.74**

Source: USDA, National Agricultural Statistics Service, 2007 Minnesota Cropland Data Layer, Wenck Associates

4.11.2 Environmental Consequences

4.11.2.1 Cover Types

Based on the anticipated cover types present in 2021 as the starting point, potential impacts from the Proposed Project were analyzed using the expected mine closure date of 2036. Post-reclamation was analyzed and estimated based on ten years after closure and known reclamation measures of the Proposed Project as indicated by Minnesota Rules Chapter 6130. Table 4.11.2 summarizes the estimated cover type acreages for each of the project areas for 2036, as shown on Figure 4.11.3. Post-closure is shown on Figure 4.11.4 and includes the No Action Alternative cover types for comparison. Figure 4.11.4 and Table 4.11.2 depict the worst-case scenario for the No Action Alternative cover types by not showing all of the land that could potentially be revegetated. Some slopes and tops of in-pit stockpiles would be revegetated, which were not used in the FEIS cover types analysis. Additionally, the mine pit would fill with water to approximately 1,430 MSL elevation, which is below the maximum elevation of the pit, meaning most water would be contained within the pit and would not overflow, except by the Perry Pit.

TABLE 4.11.2 COVER TYPE ACREAGE FOR THE PROJECT BOUNDARY[1]

Project Area	Cover Type	No Action (2021)	Proposed Project at Mine Closure (2036)	Post Reclamation (approx. 2046)
Existing Northwest Stockpile	Forest	0.0	0.0	0.0
	Mining	1,495.1	0.0	0.0
	Open Water	0.0	0.0	0.0
	Past mine feature: Revegetated	0.0	1,495.1	1,495.1
	Wetland	0.0	0.0	0.0
Existing Southeast Stockpile	Forest	0.0	0.0	0.0
	Mining	511.1	0.0	0.0
	Open Water	0.0	0.0	0.0
	Past mine feature: Revegetated	0.0	511.1	511.1
	Wetland	0.0	0.0	0.0
Proposed South Stockpile	Forest	24.4	0.0	0.0
	Mining (Road)	1.1	1.1	1.1
	Open Water	0.0	0.0	0.0
	Past mine feature: Revegetated	4.6	39.6	39.6
	Wetland	10.4	0.0	0.0
Proposed East Stockpile	Forest	196.9	0.0	0.0
	Mining (Road)	4.2	4.2	4.2
	Open Water	0.0	0.0	0.0
	Past mine feature: Revegetated	97.1	732.1	732.1
	Wetland	438.0	0.0	0.0
Existing Mine Pit	Forest	0.0	0.0	0.0
	Mining	2,214.0	2,214.0	0.0
	Open Water	0.0	0.0	2,214.0
	Past mine feature: Revegetated	0.0	0.0	0.0
	Wetland	0.0	0.0	0.0
Proposed East Mine Pit Expansion	Forest	248.7	0.0	0.0
	Mining	209.1	868.4	0.0
	Open Water	0.0	0.0	868.4
	Past mine feature: Revegetated	156.8	0.0	0.0
	Wetland	253.9	0.0	0.0
Proposed South Mine Pit Expansion	Forest	92.6	0.0	0.0
	Mining	55.4	328.2	0.0
	Open Water	0.0	0.0	328.2
	Past mine feature: Revegetated	170.6	0.0	0.0
	Wetland	9.5	0.0	0.0

Project Area	Cover Type	No Action (2021)	Proposed Project at Mine Closure (2036)	Post Reclamation (approx. 2046)
Plant Site	Forest	0.0	0.0	0.0
	Mining	274.0	284.8	0.0
	Open Water	0.0	0.0	29.7
	Past mine feature: Revegetated	0.0	0.0	255.0
	Wetland	9.5	0.0	0.0
Tailings Basin	Forest	0.0	0.0	0.0
	Mining	645.0	307.2	0.0
	Open Water	1,044.6	1,217.0	0.0
	Past mine feature: Revegetated	931.4	1,196.7	2,720.9
	Wetland	0.0	0.0	0.0
Tailings Pipeline	Mining	14.8	14.8	14.8
Total Acres		**9,214.0**	**9,214.0**	**9,214.0**
	Forest	560.7	0.0	0.0
	Mining	5,431.7	4,022.7	20.1
	Open Water	1,044.6	1,217.0	3,440.4
	Past mine feature: Revegetated	1,445.0	3,974.6	5,753.8
	Wetland	723[2]	0.0	0.0

Source: USGS National Land Cover Database (2001), Keetac Wetland Delineations (Barr 2007), 2007 MNDNR Mine Features Mapping, 2008 aerial photography, Wenck Associates

[1] Table 4.11.2 does not account for revegetation of stockpiles and other mining-related features.

[2] Includes only the wetlands within the current and proposed Keetac footprint. Does not include total wetlands requiring mitigation (761.31 acres) as described in Section 4.6.

The Proposed Project would impact 723 acres of wetlands within the proposed Keetac footprint, while an estimated 174.6 acres of wetlands would be monitored for future potential impacts. Section 4.6 provides greater detail on wetland impacts. A large percentage of the wetland loss would occur in the proposed east stockpile area. Although previously undisturbed by mining, this area has been previously impacted by damming of water from the existing southeast stockpile, which created larger wetland areas. The Proposed Project would result in the loss of approximately 560 acres of forest land.

Forest, wetland, and farmland of statewide importance would be adversely affected by the Proposed Project. The magnitude of the effect would be significant. A recreational snowmobile trail and hundreds of acres of wetlands would be eliminated by the proposed east stockpile, which is considered a significant, adverse effect. Mitigation and/or compensation would be required by the Project Proposer for effects to wetlands and farmland of statewide importance. Prior to reclamation, currently unvegetated stockpile areas would be revegetated under the Proposed Project. This is beneficial in controlling surface water runoff, erosion, and creating habitat. Drained mine pits would eventually refill with water, creating beneficial open water areas.

4.11.2.2 Farmland Soils

Farmland soils are identified as prime farmland or farmland of statewide importance. Soil survey data for Itasca County and St. Louis County was evaluated to determine the presence of the categories of farmlands, as defined above, in the Proposed Project.

Using land cover data, farmland soils were analyzed in this FEIS to identify forest and wetland areas within the project boundary that would likely have farmland soils intact. Other land cover types within the project boundary do not have farmland soils (i.e., open water) or are related to mining activities.

Table 4.11.3 summarizes the farmland soil types as shown on Figure 4.11.1. Potential prime farmland impacted by the Proposed Project is located in the proposed east mine pit expansion. This would impact approximately 41 acres of soils classified as farmland of statewide importance (B34B Majestic-Hibbing complex soils) that are currently covered by forest and/or wetland. Mining and past mine feature: revegetated areas have been altered by mining related activities; therefore, farmland soils identified by the soil survey no longer exist

TABLE 4.11.3 FARMLAND SOIL IMPACTS FOR THE PROPOSED PROJECT

Project Area	Land Cover Type	Farmland Classification	Acres
Proposed East Mine Pit Expansion	Forest	Farmland of Statewide importance	34.55
	Wetland	Farmland of Statewide importance	6.56
		Total	**41.11**
		Total Prime Farmland in Proposed Project Area	**41.11**

Source: USDA, National Agricultural Statistics Service, 2007 Minnesota Cropland Data Layer, Wenck Associates

4.11.2.3 East Stockpile Alternative

As shown on Figure 4.11.3, the East Stockpile Alternative would cause effects similar to those of the Proposed Project. However, the East Stockpile Alternative would reduce the number of acres of forest and wetland that would be adversely affected by the Proposed Project. The overall magnitude of the adverse effects on cover types would still be significant. Table 4.11.4 summarizes the potential effects from the East Stockpile Alternative on cover types.

TABLE 4.11.4 COVER TYPE ACREAGE FOR EAST STOCKPILE ALTERNATIVE

Project Area	Cover Type	No Action (2021)	Mine Closure (2036)	Post Reclamation (approx. 2046)
East Stockpile Alternative	Forest	122.4	0.0	0.0
	Mining (Road)	4.2	4.2	4.2
	Open Water	0.0	0.0	0.0
	Past mine feature: Revegetated	92.5	550.4	550.4
	Wetland	335.5	0.0	0.0
	TOTAL	**554.6**	**554.6**	**554.6**
Proposed East Stockpile	Forest	196.9	0.0	0.0
	Mining (Road)	4.2	4.2	4.2
	Open Water	0.0	0.0	0.0
	Past mine feature: Revegetated	97.2	732.1	732.1
	Wetland	438.0	0.0	0.0
	TOTAL	**736.3**	**736.3**	**736.3**

4.11.3 Mitigation Opportunities

4.11.3.1 Cover Types

> The Proposed Project would necessitate 5,754 acres of revegetated mine features, which is approximately 4,300 acres more than what would be needed with the No Action Alternative.

As described in further detail in Section 3.3.7 – Closure and Mineland Reclamation, Minnesota Rules Chapter 6130 requires reclamation of mined lands following completion of mining activities. Reclamation requirements include re-establishment of vegetation in areas disturbed by mining activities. Reclamation includes the revegetation of stockpiles and other mining features. The Proposed

Project would necessitate 5,754 acres of revegetated mine features, which is approximately 4,300 acres more than what would be needed with the No Action Alternative.

It is difficult to accurately estimate future cover types, since reclamation and revegetation strategies (i.e., planting grassland vs. shrub/grass vs. reforestation) would be defined at a time closer to actual implementation of reclamation. At that time, the appropriate type of revegetation would be agreed upon with MNDNR staff based on wildlife habitat needs, erosion control objectives, forest production considerations, hydrology, inundation, landforms, and other factors.

Additionally, succession (and potentially future human activities in the area) would likely occur in the project area after mine closure and reclamation that could potentially change future post-mining cover types in area plant communities over time. Reclamation revegetation would likely use early succession plant species to improve the chances of successful revegetation. The process of succession would likely change plant communities originally used for reclamation over time until the climax vegetative communities are established. Climax species may only become established if no other disturbances occur on the site. While succession is taking place, land managers may influence the age, class and density of vegetation to meet natural resources objectives.

Mitigation for wetland impacts are discussed in Section for 4.6. Mitigation for wetland impacts would include on-site and off-site wetland mitigation, along with monitoring for potential indirect wetland impacts.

4.11.3.2 Farmland Soils

The Farmland Protection Policy Act (FPPA) requires potential impacts to prime farmlands to be identified and avoided as possible for federally funded projects. Farmlands identified are recorded and given a farmland conversion impact rating. This is used to work with a project proposer to determine avoidance actions. Approximately 41 acres of prime farmlands were identified in the proposed east mine pit expansion. Under FPPA, if a project does not use federal funding, as is the case with the Proposed Project, then no further action beyond identifying potential prime farmland impacts is required by the Project Proposer.

4.12 WATER-RELATED LAND USE MANAGEMENT DISTRICTS

> The state's Shoreland Management Rules, part 6120.3300, subp. 12, indicate that taconite mining within a shoreland is a permitted use, provided the provisions of the Mineland Reclamation Act are satisfied.

Water-related land use management districts are shoreland areas designated by federal, state or local units of government, which have specific restrictions on uses and locations of structures as defined by state rule and by the local zoning ordinance. The FSDD stated that the Proposed Project is not expected to have significant impacts on water-related land use management districts. The state's shoreland and mineland reclamation rules apply to shoreland areas of the Proposed Project. In addition, several local government shoreland ordinances apply to the Proposed Project, including Itasca County, St. Louis County, the City of Nashwauk, the City of Keewatin, and the City of Hibbing. Each of these Shoreland Zoning Ordinances were reviewed and compared to the Proposed Project to determine if project activities would occur within a shoreland area.

4.12.1 Affected Environment

4.12.1.1 Regulatory Framework

The state's Shoreland Management Rules, specifically Minnesota Rules, part 6120.3300, subp. 12, indicate that taconite mining within a shoreland is a permitted use provided the provisions of the Mineland Reclamation Act are satisfied. The state Mineland Reclamation Rules, which implement that Act, states that shorelands are avoidance areas for mining and that mining will only be allowed within shorelands when there is no feasible and prudent alternative (Minnesota Rules, part 6130.1300, subp. B). In addition, Minnesota Rules 6130.1000 requires that all mining sites must incorporate setbacks or separations needed to comply with local land use regulations and requirements of other appropriate authorities. Finally, state Water Law (Minnesota Statute 103F.221) allows municipalities, including counties, to adopt shoreland controls that are stricter than state standards.

Several local units of government have regulatory authority within the Proposed Project vicinity, including the City of Keewatin, the City of Nashwauk, the City of Hibbing, Itasca County, and St. Louis County. The City of Keewatin and the City of Nashwauk do not have a shoreland zoning ordinance. St. Louis County has designated shoreland zones within 1,000 feet of a lake and 300 feet of a stream, but has not designated shoreland zones within or near the Proposed Project.

Figure 4.12.1 shows the shoreland management districts designated by Itasca County and the City of Hibbing in the project vicinity. These shoreland management districts are based on zoning ordinance information from the respective governments.

The current Itasca County Zoning Ordinance went into effect on May 15, 2008. Prior to that time, the County operated under an ordinance developed in 1998, which went through revisions in 2003, 2004, 2005, and 2008. Itasca County designates shoreland overlay districts in its zoning ordinance for County Public Waters to implement the current state shoreland standards described in Minnesota Rules Chapter 6120 for lakes and streams identified on the MNDNR Public Waters Inventory (PWI). These shoreland zones are designated within 1,000 feet and 300 feet of the ordinary high water level (OHW) for lakes and streams, respectively. Itasca County Zoning Ordinance Article 5 – Shoreland Overlay Districts defines specific lake classifications and zoning provisions enacted by the County (see Table 4.12.2).

Overlay-zoning districts incorporate underlying zoning districts and impose additional or varying requirements from the requirements of the underlying zones. When there is conflict between the provisions of the shoreland overlay district and the underlying zoning, the provisions of the shoreland overlay district prevail (County Ordinance – Section 5.2).

Based on information obtained from the Itasca County Environmental Services Department, the Shoreland Overlay District requirements would prevail over other County zoning requirements in the project area. This indicates that a conditional use permit (CUP) or variance would be required if mining activities not listed as allowed land uses in the shoreland ordinance are proposed within a shoreland overlay district.

Within shoreland overlay districts, the current County mining ordinance, Section 3.13 – Extractive Uses (May 2008) requires a 200-foot setback from the OHW for mining-related activities. Mining closer than 200 feet would be permitted through variance only. The County has also designated mining zone locations, which coincide with Article 13 – Iron Mining Overlay Districts of the ordinance. Section 13.3 of the County ordinance indicates that when there is a conflict between the provisions of the Iron Mining Overlay Zoning District and the Shoreland Overlay District, the Shoreland Overlay Zoning District shall prevail. The Proposed Project is located in a Mining Overlay District indicating that a permit-to-mine exists or the area is mine-disturbed ground.

The City of Hibbing Shoreland Zoning Ordinance became effective December 31, 1997, which is being updated and amended. Public hearings for the amendments began in January 2009. These amendments would not impact regulations related to the Proposed Project. Similar to Itasca

County, the City of Hibbing's Shoreland Ordinance designates shoreland zones within 1,000 feet and 300 feet of the OHW of lakes and streams, respectively. The City of Hibbing has designated certain waters with specific classifications, which are listed in Table 4.12.1.

TABLE 4.12.1 CITY OF HIBBING SHORELAND ZONING SETBACK REQUIREMENTS

Lake/Stream Name	Shoreland Zoning Classification	Setback Requirement (feet)
Kelly Lake	General Development	75
Snowshoe Lake	General Development	75
West Swan River	Tributary	100
Welcome Lake	Natural Environment	200

For each of the City's shoreland districts, mineral exploration requires a CUP. A CUP for mining exploration would require a detailed explanation of the purpose, area proposed for exploration, and future operations (i.e., pit activities, plants, overburden/surplus piles). Mining operations are exempt from excavating regulations as indicated by City code Subd. 14 of Section 11.54. Minimum structure setbacks from OHW or bluffs would be required for processing machinery. The MNDNR would be involved if any actual protected water is affected by exploration or mining activities.

Table 4.12.2 lists the water bodies located within the vicinity of the Proposed Project and their classification by the City of Hibbing, Itasca County, and the MNDNR. Also summarized in Table 4.12.2 is the project-related activities that may occur within the 2008 Itasca County Shoreland Overlay Districts as a result of the implementation of the Proposed Project. These impacts are described in greater detail in Section 4.12.2.

4.12.1.2 No Action Alternative

If the Proposed Project is not constructed, it is anticipated that the Project Proposer would continue to operate under existing permits as required by the state and local government for specific mining-related actions taken within a shoreland district of a regulated water body as the mining operation fulfills the Permit to Mine.

TABLE 4.12.2 WATER-RELATED LAND USE MANAGEMENT DISTRICTS IMPACTED

Name	Local Government Jurisdiction	Local Government Public Water Classification	MNDNR Public Waters Inventory (PWI) Status	Proposed Project Activities Impacting the Shoreland Overlay District
Hay Creek	Itasca County	Tributary	Protected Watercourse	• Headwaters within facility boundary • No anticipated shoreland zoning impacts
West Swan River	City of Hibbing	I-2, O, R-R, A-R, A-1, F-A	Protected Watercourse	• No anticipated shoreland zoning impacts
Diversion Channel	Itasca County	Tributary	Protected Watercourse	• No anticipated shoreland zoning impacts
Welcome Creek	City of Keewatin	No shoreland zoning	Protected Watercourse	• No anticipated shoreland zoning impacts
Unnamed Stream to Welcome Creek	City of Keewatin	No shoreland zoning	Protected Watercourse	• No anticipated shoreland zoning impacts
O'Brien Creek	City of Nashwauk	No shoreland zoning	Protected Watercourse	• No anticipated shoreland zoning impacts
Reservoir Four	City of Nashwauk	No shoreland zoning	31-1225 P	• No anticipated shoreland zoning impacts

Name	Local Government Jurisdiction	Local Government Public Water Classification	MNDNR Public Waters Inventory (PWI) Status	Proposed Project Activities Impacting the Shoreland Overlay District
O'Brien Lake	Itasca County	NE1	Not listed	• No anticipated shoreland zoning impacts
Little O'Brien	Itasca County	NE1	Not listed	• No anticipated shoreland zoning impacts
Unnamed Stream T57R22 Sec 15	Itasca County	Tributary	Protected Watercourse	• No anticipated shoreland zoning impacts
Unnamed Stream to Hay Creek	Itasca County	Not listed	Protected Watercourse	• No anticipated shoreland zoning impacts
Welcome Lake	City of Hibbing	NE	69-902 W	• Proposed biomass facility site within shoreland zone
Snowshoe Lake	City of Hibbing	GD	69-900 W	• No anticipated shoreland zoning impacts
Kelly Lake	City of Hibbing	GD	69-901 P	• No anticipated shoreland zoning impacts
Unnamed (Reservoir Two)	Itasca County	Not listed	31-1039 P	• No anticipated shoreland zoning impacts
Unnamed (Reservoir Number Six)	Itasca County	Not listed	31-1229 P	• A portion of the shoreland impact zone lies within the facility boundary
Unnamed (Reservoir Two North)	Itasca County	Not listed	31-1228 P	• A portion of the shoreland impact zone lies within the facility boundary
Unnamed Wetland T57R22 Sec 21,22	Itasca County	NE1	31-38 W	• No anticipated shoreland zoning impacts

4.12.2 Environmental Consequences

Figure 4.12.1 illustrates where actions of the Proposed Project encroach upon the Itasca County and City of Hibbing Shoreland Zoning Districts. GIS was used to determine where potential shoreland zoning impacts (i.e., setbacks for structures and mining activities) from the Proposed Project would occur. A water-related land use management district would be adversely affected because the proposed biomass facility is within a shoreland zone. The effect to the environment is expected to be less than significant. Further detail is provided below.

4.12.2.1 Processing Plant Area

Welcome Lake's overlay district falls within the Proposed Project boundary. Welcome Lake is subject to a 1,000-foot shoreland zone. Portions of the processing plant are located within this zone. As shown on Table 4.12.1 development adjacent to Welcome Lake must meet a 200-foot setback. The existing processing plant is located approximately 900 feet from the shores of Welcome Lake and therefore meets the setback requirement. There is also one small existing structure (Pellet Loading Drive House) on the south side of the plant that is located approximately 360 feet from the shore of Welcome Lake. The Pellet Loading Drive House would not be expanded as part of the Proposed Project and appears to meet the required setback.

The proposed biomass facility would be located within the shoreland zone of Welcome Lake as shown on Figure 4.12.1. This would require local government review and permitting for construction within a shoreland management district. The biomass facility would need to meet all requirements outlined in the permit issued by the City of Hibbing.

4.12.2.2 Stockpile Area

Located west of the Proposed Project boundary is Unnamed Wetland (31-38 W), classified by Itasca County as a Natural Environment wetland, which has a 1,000 foot shoreland overlay district. This wetland's overlay district intersects the west side of the existing northwest stockpile. New impacts are not anticipated with the Proposed Project to Unnamed Wetland (31-38 W). Itasca County shoreland regulations apply within the overlay district for the existing northwest stockpile as approved per the April 18, 2005 permit amendment.

The headwaters of O'Brien Creek flow into Unnamed Wetland (31-38 W) from the north. Itasca County classifies this stream as a tributary and enforces a 300 foot shoreland overlay district. The stream's overlay district intersects the existing northwest stockpile. Adding to the northwest stockpile within the shoreland overlay district would require a CUP or variance, but is not anticipated with the Proposed Project.
Shoreland overlay districts that intersect the Proposed Project stockpiles are relatively small. Impacts from stockpile areas, both existing and proposed, would be reviewed by the local government during the permitting process.

4.12.2.3 Tailings Basin

Two reservoirs, Unnamed (Reservoir Two North, 31-1228 P) and Unnamed (Reservoir Number Six, 31-1229 P), exist west of the tailings basin that are designated as MNDNR Public Waters. Neither of these water bodies is classified by Itasca County; therefore, the 1,000 foot shoreland zone is not required for these lakes. A MNDNR Public Waters Work Permit would be required for alterations below the OHW of these lakes. Portions of the existing outer tailings basin dam are located within the shoreland zone of Reservoir Two North and Reservoir Six. Future alterations to the tailings basin dams would need to be evaluated for impact to the shoreland zone.

4.12.2.4 East Stockpile Alternative

The potential environmental effects from changes in water-related land use management districts from the East Stockpile Alternative are the same as those from the Proposed Project.

4.12.3 Mitigation Opportunities

Based on current regulations, significant impacts from the Proposed Project to water-related land use management districts (shoreland overlay districts) are not anticipated. Shoreland overlay districts of several water bodies intersect existing or proposed facility operations. It appears that proposed activities can avoid shoreland overlay districts if necessary or meet required setbacks. Configuration of the stockpile areas could avoid locating stockpiles within the shoreland overlay districts. If the mining activities can not avoid a shoreland overlay district, approval from the MNDNR would be required. Additionally, the local jurisdiction would require a CUP or variance depending on the type of activity. This would require an application and a local review process. Upon review, the local government would determine whether mitigation is required as part of the local permit. Impacts to wetlands would also be determined along with appropriate mitigation measures during permitting.

The MNDNR has indicated (email correspondence from MNDNR Area Hydrologist) that mining companies could voluntarily adopt state shoreland standards (i.e., setbacks for processing equipment, BMPs for stormwater, vegetation standards) when working near designated public waters (within 1,000 feet of lakes and 300 feet of streams) where there is no MNDNR classification or where a local government is not enforcing state shoreland standards. Welcome Creek, Reservoir Two North, and

Reservoir Six are all designated as public waters by the MNDNR, but were not classified as general development, recreational development, or natural environment. The local government does not require shoreland standards on unclassified water bodies. Designated MNDNR public waters adjacent to the tailings basin could be classified by the MNDNR to provide a basis for local government regulation of the shoreland zones of these reservoirs.

4.13 GEOLOGIC HAZARDS AND SOIL CONDITIONS

The Proposed Project site does not have known sinkholes, shallow limestone formations or karst conditions that would present unusual geologic site hazards to groundwater.

The FSDD stated that significant impacts are not expected in this subject area. The primary concern is the potential for groundwater contamination from process chemicals and hazardous materials used or stored at the project site and seepage from the tailings basins. Measures to prevent and contain spills from processing materials and maintenance/repair of mining equipment to prevent groundwater contamination are identified in this section. Additional information pertaining to solid waste and waste material handling can be found in Section 4.14.

4.13.1 Affected Environment

4.13.1.1 Existing Conditions

The Proposed Project site does not have known sinkholes, shallow limestone formations or karst conditions that would present unusual geologic site hazards to groundwater. However, groundwater would flow into active mining areas where it would combine with surface stormwater and dewatered as described in Section 4.5.

Groundwater elevations, based on MDH records, are presented in Figure 4.13.1. This data was obtained from the County Well Index (CWI), the database of well construction records maintained jointly by the MDH and the Minnesota Geological Survey. CWI data can vary from current conditions due to variations of when and where measurements are taken. In addition, there may be private wells in the area that are not in the current CWI database.

Mine pit water quality is discussed in Section 4.4.1. According to the SEAW, depth to the water table around the mine site is unknown. Very little water is observable draining from the overburden or rock walls in the pits. Bedrock depth is zero only in disturbed areas. Minimum overburden thickness is estimated at 20 to 25 feet in undisturbed areas.

Soil types derived from the Itasca County Soil Survey information were listed in the SEAW. Soil textures primarily include loamy sand, sandy loam, silt loam, and organic soils in the undisturbed areas. Previously disturbed areas are highly variable including some areas with bedrock at the surface to other areas containing deep deposits of glacial overburden.

Soils in the mine area include Nashwauk fine sandy loam and Keewatin silt loam, as well as udorthents. Udorthents are areas where soils have been stripped and highly disturbed, such as cut-and-fill operations and gravel pits. In this context, nearly level udorthents are areas that have been stripped for mining and very steep udorthents are piles of excavated material. Any areas disturbed by mining activity since 1980, such as those previously described, are required to be sloped and vegetated to reclamation standards. Section 3.3.7 provides further discussion on mineland reclamation.

The remaining area, composing over 80 percent of the area to be stripped, is predominantly silt loam and sandy loam soils. Soils in the area are derived from glacial till deposits in glacial moraine formations typical of the Iron Range. The upper horizons of these soils can be erodible, but overall the stripped material should present no obstacles to formation of stockpile pads for rock and lean ore or creation of surface stockpiles.

Stockpiles store three classes of materials: surface overburden, waste rock, and lean ore. Properties of waste rock and lean ore are well known and do not require special procedures. Surface overburden, including soils, is managed in accordance with Minnesota Rules, parts 6130.1000 and 6130.2700 (standards for surface overburden stockpile design and construction) and Minnesota Rules, part 6130.3600 (standards for vegetation of mine features).

The Keetac facility site contains several known underground mine workings from previous mining activities. These include Stevenson, Bennett, and Sargent. The Bennett No. 2 Mine Shaft was documented as part of the cultural resources survey completed for this FEIS. More information on the Bennett No. 2 Mine Shaft, which is located in the waste stripping area and would be mined as part of the Proposed Project, is included in Section 4.17. The Stevenson underground mine has been mined out during previous open pit mining and is not included in underground records provided by the Project Proposer. The Sargent underground mine exists in the waste stripping area and a portion of these mine workings would be mined out as part of the Proposed Project.

4.13.1.2 No Action Alternative

The No Action Alternative results in no additional impacts on Geologic Hazards, as the facility would continue to operate in a similar manner. No changes to the facility or surrounding landscape are needed that are outside the scope of the current permitted activities.

4.13.2 Environmental Consequences

Equipment refueling and maintenance presents the most likely potential pathway for spills to enter the soil and groundwater. Existing soils in unmined areas are fine textured and would not rapidly transmit spilled materials. Areas of active mining could potentially expose spills to fractured bedrock. In these areas, spills could enter the groundwater quickly.

> The existing facility is currently covered by a Spill Prevention Control and Countermeasure Plan (SPCC). The SPCC would be amended for the Proposed Project, which would operate in compliance with the requirements listed in the existing facility SPCC Plan, as well as comply with underground and aboveground storage tank requirements.

Minimal water is seeping from the exterior of the tailings basin. It is anticipated that there would be seepage from the interior into the exterior pond. This seepage would be contained in the exterior pond and decanted into Reservoir #6, and ultimately reused as process water. If in the future, there is seepage from the exterior pond, the tailings basin seepage is anticipated to discharge to groundwater through the bottom of the tailings basin, resulting in groundwater mounding under the basin. This water would flow radially from the tailings basin perimeter, ultimately flowing in the general direction of the surface water in the area. Figure 3.1.3 shows the water flow direction in the inactive area of the tailings basin.

Blasting activity is scheduled to occur approximately twice per week. The Project Proposer has indicated that they would use the same blasting agents as other taconite mines, a blended mixture of ammonium nitrate (AN) and emulsion (a water in oil emulsion that contains ammonium nitrate and fuel oil) mixture of about 94 percent ammonium nitrate (AN) and 6 percent fuel oil (FO), commonly referred to as ANFO. A common form of this mixture is ANFO emulsion or a mixture of ANFO and ANFO emulsion. ANFO emulsion contains ammonium nitrate dissolved in water. The water is dispersed in fuel oil. Because oil surrounds the oxidizer, it is resistant to moisture and therefore more useful in damp conditions. This also increases the density and energy production of the explosive compared to dry granules of ANFO.

Blasting presents a potential for groundwater contamination. Nearly all chemicals are consumed in the detonation process; however, on rare occasions some undetonated blasting material may remain in the blast holes. The small portion of the ammonium nitrate and fuel oil that may remain could be transported by stormwater within the pits. Section 4.4.2 – Surface Water Runoff discusses potential stormwater impacts.

There is the potential for an adverse effect due to the possibility of spills and leaks to occur. If a spill or leak occurs, it is expected that the use of the SPCC Plan would result in a less than significant environmental effect.

4.13.2.1 East Stockpile Alternative

The potential environmental effects on soil conditions or geologic hazards from the East Stockpile Alternative are the same as those identified for the Proposed Project.

4.13.3 Mitigation Opportunities

Areas disturbed by mining after 1980 are required to be sloped and vegetated to reclamation standards. Section 3.3.7 provides further discussion on mineland reclamation requirements.

Refueling activities should include procedures and training for the proper handling of spills and leaks. Refueling vehicles should carry spill containment equipment. On-site aboveground and underground storage tanks are subject to permitting and leak detection under state permits. Uncontained bulk liquids should not be stored in the pit or along haul routes. The Project Proposer has a fuel station in the pit, north of the crushers that has approved secondary containment features. This fuel station would continue to be used in the Proposed Project. The existing facility is covered by a Spill Prevention Control and Countermeasure Plan (SPCC). The SPCC Plan would be amended for the Proposed Project, which would operate in compliance with the requirements listed in the existing facility SPCC Plan, as well as comply with underground and aboveground storage tank requirements.

Waste materials generated at the facility are subject to storage and permitting requirements. The storage and handling of each type of material is discussed in greater detail in Section 4.14 – Solid Wastes, Hazardous Wastes, and Storage Tanks.

4.14 SOLID WASTES, HAZARDOUS WASTES, AND STORAGE TANKS

The FSDD states that, “the EIS will characterize the solid wastes, including dust emissions, and discuss the potential impacts of available disposal options. The EIS will describe liquid materials to be stored on site as well as spill prevention and containment measures. The EIS will include an inventory of tanks and major process consumables.” This section focuses on environmental consequences related to storage and handling of the solid wastes, hazardous wastes, and storage tanks.

4.14.1 Affected Environment

Existing Keetac operations store and use petroleum-based liquids, generate solid waste, and handle and store a small quantity of hazardous waste. These operational activities occur within the wellhead protection region for both the Keetac facility wells and the City of Keewatin wells. Proper solid waste and hazardous waste management are important aspects in protecting the water quality.

Solid waste is generated from all levels of plant operations including: mining, ore processing, and vehicle and facility maintenance. The Keetac facility is classified as a very small quantity generator (VSQG) of hazardous waste (USEPA ID. No. MND071344733), and is not statutorily required to complete hazardous waste reduction assessments or have a hazardous waste minimization plan.

4.14.1.1 No Action Alternative

The No Action Alternative for this project would result in the handling of solid waste, hazardous waste, and storage tanks at Keetac keeping with the current practices. If waste regulations change within the timeframe of the existing Permit to Mine, the Project Proposer would work with the appropriate entities to stay in compliance.

4.14.2 Environmental Consequences

The Proposed Project's mining and processing operations would generate three main types of solid waste. These include:

- Tailings from the concentrating process
- Overburden and waste rock from mining activities
- Process wastes and solid wastes from plant operations

The Proposed Project would increase the quantity for each type of solid waste listed in Table 4.14.1. The Proposed Project requires the handling and storage of hazardous wastes and the use of fuel. The quantities of each of these wastes would also be increased from existing facility levels to accommodate for the Proposed Project. Information about the character of the waste streams generated is provided in Table 4.14.1. To the extent that information was reasonably available, this table provides information on the average annual sources of wastes generated, their estimates or actual quantities, and the proposed method for disposal.

TABLE 4.14.1 DESCRIPTION OF SOLID, SLUDGE, AND HAZARDOUS WASTES

Waste Source	Quantity (estimated)	Description and Proposed Disposal
Solid Wastes		
Construction	To Be Determined	Construction debris generated during construction and ongoing plant operations would be trucked to a demolition landfill
Scrap (ferrous and non-ferrous)	1,776 TPY	Recycled
Demolition/Heavy Industrial Waste	708 TPY	Landfilled at a licensed facility
Refuse[1]	255 cubic yards per year (CYY)	Landfilled at a licensed facility
Passenger waste tires	6.83 TPY	Removed and recycled by a licensed contractor
Commercial waste tires	300 TPY	Removed and recycled by a licensed contractor
Induration/ESP solid waste (particulate matter)	118 – 121 TPD	Landfilled at a licensed facility[2]
Hazardous and Universal Wastes		
Vehicle Batteries	6.92 TPY	Recycled by a licensed contractor
Used oil	108,170 GPY	Removed and recycled/disposed of by a licensed contractor
Used oil filters	34.8 CYY	Removed and recycled/disposed of by a licensed contractor
Electronic Appliances	2,534 lbs per year	Removed and recycled/disposed of by a licensed contractor
Antifreeze	1,860 lbs per year	Removed and recycled/disposed of by a licensed contractor
Fluorescent and HID lamps	3,580 lbs per year	Removed and recycled/disposed of by a licensed contractor

Waste Source	Quantity (estimated)	Description and Proposed Disposal
Lithium and nickel-cadmium batteries	70 lbs per year	Removed and recycled/disposed of by a licensed contractor
Mercury switches and bulk mercury-containing equipment	21.9 lbs per year	Removed and recycled/disposed of by a licensed contractor
Aerosol cans	1,013 lbs per year	Removed and recycled by a licensed contractor

[1] "Refuse means petruscible and non-petruscible solid wastes, including garbage, rubbish,…street cleanings, and market and industrial solid wastes…" Minnesota Rules part, 7035.0300, subp. 89 and 94.
[2] Disposal of material would be dependent on the results of the waste characterization study.

4.14.2.1 Solid Waste and Hazardous Waste

4.14.2.1.1 Tailings

Tailings, coarse and/or finely ground waste rock from the concentrating process, are pumped as a slurry through a pipeline to the tailings basin. The tailings are then allowed to settle out over time. The water is decanted from the tailings basin to Reservoir Six and reused in the process. Although tailings are ground waste rock, tailings basin disposal is regulated by a MPCA NPDES/SDS permit, rather than a MPCA solid waste permit.

Keetac's mining process rejects approximately 70 percent of the total mined low-grade taconite ore as tailings into the tailings basin, which is approximately 13 million long tons per year of taconite process tailings. The Proposed Project would increase the amount of tailings slurry pumped into the tailing basin with an additional 9 million long tons per year. This would require tailings basin modifications, as discussed in Section 3.5.

4.14.2.1.2 Overburden and Waste Rock

Stockpiling is used to store surface overburden and waste rock material. The stockpiles are constructed in various locations around the mine site based on land ownership and mineral rights. Following each phase of mining, where required, the overburden stockpiles are graded, benched, and revegetated in accordance with MNDNR mineland reclamation rules. Proposed stockpile design is further discussed in Section 3.5.

4.14.2.1.3 Process and Solid Wastes from Plant Operations

Where possible, wastes are recycled or reincorporated back into the process. If a waste cannot be recycled or reincorporated back into the process it is required to be handled in accordance with state and federal regulations for proper storage, handling and disposal.

The following Proposed Project wastes are exempt under the Resource Conservation and Recovery Act (RCRA) hazardous waste regulations and include:

- Construction debris waste
- Municipal solid waste (MSW)
- Baghouse dust
- Plant tailings

The ESP on the new indurating line would generate 118 to 121 tons per day of solid waste (i.e., particulate matter), which would require six to seven truck loads per day. Particulate matter from the fired pellets would be collected and disposed of according to the results of the waste characterization study, which would determine whether the particulate matter is hazardous or non-hazardous material. This study can not be conducted until operation of the new line begins to generate solid waste material. It is anticipated that the material would be found to be non-hazardous, since the fired pellets are classified as non-hazardous. Section 4.9.2 provides more detail on particulate matter generated by the ESP.

4.14.2.2 Storage Tanks

The Project Proposer maintains several aboveground storage tanks (AST) and underground storage tanks (UST) at the Keetac facility. The contents stored, storage capacity, location, and secondary containment associated with each AST and UST at the existing Keetac facility are described in Table 4.14.2. The Project Proposer does not anticipate increasing its fuel oil storage capacity, or adding petroleum storage tanks in conjunction with the Proposed Project. An SPCC plan is in place for the existing Keetac facility.

TABLE 4.14.2 STORAGE TANK INFORMATION

Material Stored	Storage Capacity (gallons)	Location	Secondary Containment
Aboveground Storage Tanks (AST)			
Diesel Fuel	20,000	Pit Fueling Station	Yes- concrete floor and dikes
Diesel Fuel	20,000	Pit Fueling Station	Yes- concrete floor and dikes
TO410	500	Pit Fueling Station	Yes- inside plant on diked concrete floor
TO430	500	Pit Fueling Station	Yes- inside plant on diked concrete floor
Lube Oil	400	Crusher #1	Yes- inside building
Lube Oil	400	Crusher #2	Yes- inside building
Fuel Oil	500	Pellet Plant	Yes- inside building
Fuel Oil	1,757,860	Pellet Plant	Yes- clay liner and dike
Fuel Oil	6,000	East of concentrator crane bay	Yes- concrete floor and dike
Diesel Fuel	10,000	Tailings Basin	Yes- clay liner and dike
Lignosulfate	10,000	Tailings Basin	Yes- clay liner and dike
Waste Oil	560	Truck Shop	Yes- inside oil room on concrete floor
Lube Oil	6,000	North Truck Shop	Yes- concrete floor and dike
Lube Oil	6,000	North Truck Shop	Yes- concrete floor and dike
Waste Oil	2,000	North Truck Shop	Yes- concrete floor and dike
Hydraulic Oil	2,000	North Truck Shop	Yes- concrete floor and dike
Waste Oil	1,000	Pelletizer	Yes- inside building
Waste Oil	1,000	Concentrator	Yes- double-walled
Lube Oil	250	Truck Shop	Yes- inside building
Motor Oil	250	Truck Shop	Yes- inside building
Transmission Fluid	250	Truck Shop	Yes- inside building
Magnesium Chloride	10,000	Pellet Loadout	Yes- concrete floor and dike
T-Oil 30	2,000	North Truck Shop	Yes- concrete floor and dike
T-Oil 50	2,000	North Truck Shop	Yes- concrete floor and dike
Antifreeze	2,000	North Truck Shop	Yes- concrete floor and dike
Hydraulic Oil	1,000	Pit Fueling Station	Yes- inside plant on concrete floor
Lube Oil	1,000	Pit Fueling Station	Yes- inside plant on concrete floor
Lube Oil	3,000	Crusher #1	Yes- inside plant
Lube Oil	3,000	Crusher #1	Yes- inside plant
Lube Oil	3,000	Crusher #2	Yes- inside plant
Lube Oil	3,000	Crusher #2	Yes- inside plant
Hydraulic Oil	110	Crusher #1	Yes- inside building
Hydraulic Oil	110	Crusher #2	Yes- inside building

Material Stored	Storage Capacity (gallons)	Location	Secondary Containment
Transmission Fluid	250	Truck Shop	Yes- inside building
Motor Oil	260	Truck Shop	Yes- inside building
Fuel Oil	260	Surface Combustion Basement	Yes- inside building
Antifreeze	500	Pit Fueling Station	Yes- concrete floor and dike
Underground Storage Tanks (UST)			
Unleaded Gasoline	10,000	South of Truck Shop, West of Admin. Building	Double-walled with Cathodic protection

The generation of greater quantities of solid waste and hazardous waste would cause an adverse effect to the environment when it is landfilled. The effect to the environment would be less than significant as the disposal facility would be a permitted facility.

No tanks would be added as part of the Proposed Project, and therefore no effect to the environment due to storage tank leakage would occur.

4.14.2.3 East Stockpile Alternative

The potential environmental effects on solid waste, hazardous waste or storage tanks from the East Stockpile Alternative are the same as those identified for the Proposed Project.

4.14.3 Mitigation Opportunities

4.14.3.1 Tailings

Impacts from tailings and the tailings basin would be mitigated through dam improvements and the reclamation process. All basin, dam and dike areas are required to be vegetated. Tailings dams would be reclaimed as each bench is completed. As soon as a lift or portion of a slope or bench is final and large enough to be economically vegetated, it would be scheduled for planting in the next planting season. Slopes would be graded as necessary, hydroseeded, and mulched. Mineland reclamation is also discussed in Section 3.3.7. Tailings disposal would be regulated by a MPCA NPDES/SDS permit.

4.14.3.2 Overburden and Waste Rock

Impacts associated with overburden and waste rock in the proposed stockpiles would be mitigated through the reclamation process. Rock stockpile and top surfaces and benches would be covered with overburden and planted using conventional methods. Temporary vegetation may be used in inactive areas to control erosion and dust emissions. Section 4.4.3 provides greater detail on erosion control measures. Sections 4.9.2 and 4.16 discuss potential impacts and mitigation measures associated with dust emissions.

Hazardous wastes generated by the Proposed Project would be handled and disposed of by a licensed operator, in accordance with applicable state and federal regulations.

4.14.3.3 Process Wastes

Best management practices are used in handling, storing, and disposing of mining wastes. Solid and hazardous wastes are stored, handled, and disposed of according to Minnesota Rules Chapters 7035 and 7045, respectively. Hazardous wastes generated by the Proposed Project would be handled and disposed of by a licensed operator, in accordance with applicable state and federal regulations.

4.14.3.4 Storage Tanks

The Project Proposer has an existing Major Facility AST permit (AST permit #11153) through the MPCA. Minnesota Rules Chapter 7001 requires a permit for the aboveground storage of liquid substances at a major facility. A major facility is one where the total liquid storage design capacity of all tanks, including indoor tanks, is one million gallons or greater. Changes related to ASTs for the Proposed Project may require a modification to the existing AST permit.

A SPCC plan is required by federal regulations for all facilities at which certain quantities of oil are managed and at which, if a release of petroleum occurred, it would reasonably be expected to reach the navigable waters of the United States. Further state regulation is enforced by the MPCA with the Minnesota Spill Bill, which requires facilities with oil and/or hazardous substance storage at or exceeding one million gallons at any time to prepare a plan that describes facility operations, spill control measures, and a contingency plan outlining emergency spill procedures. The existing Keetac facility has aboveground storage capacity greater than one million gallons. As required, the SPCC plan must be amended whenever a change in design, construction, operation or maintenance affects the potential for a spill incident. The Project Proposer would amend its SPCC plan as necessary prior to commencement of Proposed Project operations.

4.15 TRAFFIC IMPACTS

The FSDD identified traffic related issues as not likely to result in significant impacts. Additional information provided in this section focuses on traffic patterns and impacts due to employees involved in the construction and ongoing operation of the Proposed Project. In order to fully address these items, a Traffic Analysis was completed. This study included the development of peak hour and daily traffic forecasts, the operational analysis of critical intersections, and the development of recommended solutions. Railroad traffic is not anticipated to increase. Additional rail cars may be added to a train, but the number of trips is not anticipated to change; therefore further analysis was not conducted on railroad traffic.

> The traffic analysis recommended mitigation measures for both the construction and operation phase of the Proposed Project.

4.15.1 Affected Environment

The Keetac facility is accessed from TH 169 via local street connections. There are two access roads to the mine site. The primary access is a private extension of 1st Street (CR 16), which is a north/south road through the City of Keewatin. This access is the main entrance and is used for all shift changes, deliveries, and visitors. A second access, located just east of Keewatin, is gate restricted. Three primary streets are used to access the main entrance from TH 169.

- 3rd Avenue (CR 82)
- 1st Street (CR 16)
- 7th Street (CR 82)

Various routes through the City of Keewatin reach the main entrance to the Keetac facility. Potential traffic impacts from the Proposed Project were examined at four key intersections located on the primary access routes.

- 1st Street/3rd Avenue
- TH 169/7th Street
- TH 169/1st Street
- TH 169/3rd Avenue

4.15.1.1 No Action Alternative

During an average weekday, 291 employees enter and exit the existing Keetac facility. A significant number of existing employee trips is associated with two primary shifts (7:00 AM – 3:00 PM and 3:00 PM – 11:00 PM). The remaining trips occur at various times throughout the day. The number of employees and level of traffic is anticipated to remain similar to existing conditions if the Proposed Project is not constructed.

4.15.2 Environmental Consequences

4.15.2.1 Intersection Operations Analysis

The Project Proposer anticipates 170 additional fulltime employees for long-term production, support, and administration. In addition to these long-term employees, there would be a short-term surge of construction employees associated with the Proposed Project. The daily number of construction employees during the peak construction period is estimated to be 500 employees. Daily truck deliveries are anticipated to increase upon completion of the Proposed Project. General deliveries are expected to increase by 15 deliveries per day, and deliveries associated with the biomass component of the Proposed Project are estimated at 25 deliveries per day.

The Proposed Project is expected to be fully operational by late 2013 and would not change existing access locations for the Keetac facility.

To fully account for employee shift changes at the Keetac facility, traffic volume forecasts were developed for two AM hours and two PM hours. Traffic volume forecasts were developed for the 6:00 AM – 7:00 AM, 7:15 AM – 8:15 AM, 2:30 PM – 3:30 PM and 4:00 PM – 5:00 PM hours. The number of vehicle trips at the study intersections during these four hours exceeds other weekday and weekend hours, meaning these hours are the most critical from a traffic operations standpoint.

Forecast and analyses were completed for the year 2012 (start of peak construction period) and 2014 (one year after the Proposed Project is fully operational). Specifically, weekday AM and PM peak hour traffic forecasts were completed for the hours previously identified above. Peak construction traffic volumes are expected to occur in late 2012. Upon completion of construction in late 2013, construction traffic volumes would decline as the Proposed Project becomes fully operational. In 2014, one year after the Proposed Project is fully operational, typical weekday traffic volumes reflect employee trips, deliveries, visitors, and other trips necessary for operation of the Proposed Project.

Traffic analyses were completed for the subject intersections using Synchro, a widely accepted traffic analysis software program. Initial analysis was completed using existing geometrics and intersection control (e.g., stop signs).

4.15.2.2 Results of Analysis

During the construction phase, the Proposed Project is anticipated to generate 250 trips during the weekday 6:00 – 7:00 AM hour and 500 trips during the weekday 4:00 - 5:00 PM hour. No construction trips are anticipated for the 7:15 – 8:15 AM and 2:30 – 3:30 PM hours. All three intersections on TH 169 have adequate capacity with existing geometrics and control to accommodate the anticipated construction traffic. Longer delays for the two stop controlled approaches on 1st Street (primary facility access) at the 3rd Avenue intersection could be experienced during this phase.

After construction at full operational capacity, the Proposed Project is anticipated to generate 86 trips during the weekday 6:00 – 7:00 AM hour, 29 trips during the weekday 7:15 – 8:15 AM hour, 121 trips during the weekday 2:30 – 3:30 PM hour, and 4 trips during the weekday 4:00 – 5:00 PM hour. All four study intersections have adequate capacity with existing geometrics and control to accommodate the Proposed Project while maintaining an acceptable level of service.

The Traffic Analysis also identified an existing potential safety concern at the 1st Street and 3rd Avenue intersection. Southbound, stop controlled vehicles traveling on 1st Street have a partially obstructed view of westbound, uncontrolled vehicles on 3rd Avenue due to vehicles parked along the north curb of westbound 3rd Avenue. With parked vehicles present, this view obstruction may increase the potential for accidents as southbound, stop controlled vehicles begin to cross the intersection and may not fully see oncoming, westbound vehicles. The significance of the situation could be increased during shift changes and from additional trips made by Proposed Project employees exiting Keetac.

Overall, during the construction phase of the Proposed Project, there would be an adverse effect on automobile traffic congestion and also potentially on safety. The magnitude of the effect is considered less than significant. Once construction ends and traffic levels decline, it is anticipated that there would be no effect on traffic congestion or safety.

4.15.2.3 East Stockpile Alternative

The potential environmental effects from traffic related to the East Stockpile Alternative are the same as those identified for the Proposed Project.

4.15.3 Mitigation Opportunities

The Traffic Analysis recommended mitigation measures for both the construction and operation phase of the Proposed Project.

During the construction phase, the intersection of 1st Street/3rd Avenue should be monitored for delays. If delays become excessive, short-term conversion of this intersection from two-way stop to all-way stop control would reduce delays to acceptable levels. The existing two-way stop control condition could be restored after the construction phase is completed.

An existing potential safety concern was identified by the Traffic Analysis. Increased vehicle trips to the Keetac facility from the Proposed Project could increase the potential for an accident. Lengthening the no parking zone along the north curb of the westbound approach at the 1st Street/3rd Avenue intersection would allow a greater view of oncoming vehicles. Restricting parking from 1st Street to the first alley east of the 3rd Avenue intersection would also reduce the potential for view obstruction-related accidents. Installing an all-way stop control, as indicated above for constriction, would control east- and westbound vehicles and further reduce the potential for accidents.

4.16 ODORS, NOISE, AND DUST

> Keetac has two main dust generating areas: the mine and the pellet plant north of TH 169 (area 1) and the tailings basin south of TH 169 (area 2).

The FSDD states that, "odor is not expected to be a significant impact. Noise production is not anticipated to be significant, but will be discussed. If adverse impacts are identified, mitigation will be discussed. Dust (particulate matter) would be generated during construction of the Proposed Project and plant operations. Particulate matter will be evaluated as a part of stationary air emissions" (see Section 4.9). The Noise Study and Supplemental Noise Study were completed for the Proposed Project, which evaluates noise conditions and potential impacts.

4.16.1 Affected Environment

4.16.1.1 Existing Conditions

4.16.1.1.1 Odor

Keetac is an industrial type of facility, which generates various odors through the mining and processing of taconite. Diesel exhaust odors from mining equipment are the main type of odor that is generated by current Keetac operations, which are common to this type of facility. There are no known complaints from nearby residents about odors generated by Keetac.

4.16.1.1.2 Dust

Keetac has two main dust generating areas: the mine and the pellet plant north of TH 169 (area 1), and the tailings basin south of TH 169 (area 2).

The mine and pellet plant generate dust during daily operations. The Project Proposer has conducted studies and implemented actions to minimize dust generation. Sources of dust emissions include blasting, haul roads, stockpiles, materials loading/ unloading, transfer points, and coal distribution. The Fugitive Dust Plan is in place, which prescribes for each source of dust a primary control measure, a contingent control measure, an operating practice to reduce dust, and a means of recordkeeping to identify and manage potential issues.

The tailings basin has had recent dust generation issues. Past winters have not provided significant snowfall, which was the primary mitigation technique used in the winter months. The Fugitive Dust Plan provides control measures for the tailings basin. Additional winter month dust control techniques have been implemented by the Project Proposer. Additional information about fugitive dust can be found in Section 4.9 – Stationary Source Air Emissions.

4.16.1.1.3 Noise

Noise is defined as unwanted sound. Sound travels in wave motion and produces a sound pressure level. This sound pressure level is commonly measured in decibels. Decibels (dB(A)) represent the logarithmic increase in sound energy relative to a reference energy level. The decibel measurement is A-weighted, meaning it is adjusted to reflect how the human ear would perceive the sound level. A sound increase of 3 dB(A) is barely perceptible to the human ear, a 5 dB(A) increase is clearly noticeable and a 10 dB(A) increase is heard twice as loud.

Existing stockpile operations consist of large trucks traveling to the perimeter of each active stockpile layer, depositing waste rock or surface overburden at the edge of the layer, and gradually extending the size of the layer. Once the layer reaches a certain boundary, such as a property line buffer, the next layer is initiated.

As trucks deposit waste rock or surface overburden, a dozer or other equipment levels the dumped waste to provide access by trucks over the dumped rock or surface overburden to the new perimeter for the next round of dumps. The noise study conducted for the Proposed Project assumed that the dozer smoothes the dumped rock after every third dump.
Blasting and drilling, depending on depth, at Keetac are other sources of noise. Blasting breaks rock into smaller sizes so that it can be readily transported and processed efficiently. Blasting activity at Keetac occurs about once per week, depending on atmospheric conditions. Blasting causes ground vibration and air blast (overpressure) after each

detonation. Blasting is an impulse noise of short duration. The walls of the mine pit provide a sound barrier to receptors depending on the depth of the pit and the location of the detonation. Records for existing detonation practices indicate that the Project Proposer has not exceeded 130 dB(A) at the closest receptors, which are 500 feet from the surface wall.

Existing mining activities, trains, local traffic, and TH 169 generate noise throughout the day and night. These sounds are considered ambient sounds, which represent the background sound that is heard on a daily basis. Ambient sound levels monitored for the noise study indicate that L_{50} varied from 33 to 39 dB(A) during the daytime period. The noise level ranges varied depending on the monitoring location (i.e., Kelly Lake or Sawmill Road) and the time of day.

4.16.1.2 Regulatory Framework

4.16.1.2.1 Odors

The MPCA does not have specific state rules regulating odors. At times, however, odors can be an indicator of pollutants that have emission limits. MPCA addresses odor complaints in order to determine if an air emissions permit limit is being exceeded or if a facility does not have an appropriate air emissions permit.

4.16.1.2.2 Dust

Fugitive dust control is regulated in several ways. Minnesota Rules, part 7011.0150 addresses fugitive dust control by describing requirements for preventing particulate matter from becoming airborne. Minnesota Rules, part 6130.3700 requires avoidable dust to be controlled and describes control techniques. Federal rules, as described in 40 CFR Part 63 Subpart RRRRR, National Emission Standards for Hazardous Air Pollutants (NESHAP) for Taconite Iron Ore Processing, regulate fugitive dust and require a fugitive dust control plan. The air permit application has a compliance plan for the applicable regulations for dust control measures.

4.16.1.2.3 Noise

Current noise standards for the State of Minnesota are located in Minnesota Rules, part 7030.0040, subp. 2. The rules for permissible noise vary according to which noise area classification is involved. In a residential setting, for example, the noise restrictions are more stringent than in an industrial setting. The rules also distinguish between night time and daytime noise; less noise is permitted at night. The standards list the sound levels not to be exceeded for 10 and 50 percent of the time in a one-hour survey (L_{10} and L_{50}) for each noise area classification, as follows:

TABLE 4.16.1 APPLICABLE MINNESOTA NOISE STANDARDS

Noise Area Classification		Noise Standard, dB(A)			
		Daytime (7 am to 10 pm)		Night time (10 pm to 7 am)	
		L_{50}	L_{10}	L_{50}	L_{10}
1	Residential	60	65	50	55
2	Commercial	65	70	65	70
3	Industrial	75	80	75	80

The standards are given in terms of the percent of time during a measurement period (typically one hour) during which a particular decibel dB(A) level may not be exceeded. A daytime L_{50} of 60 dB(A), for example, means that during the daytime, noise levels may not exceed 60 dB(A) more than 50 percent of the time (i.e., 30 minutes of an hour).

4.16.1.3 No Action Alternative

Under the No Action Alternative, current noise levels, existing facility odors, and current sources of dust would not change. If the Proposed Project is not constructed, the current impacts from odors, noise, and dust during hours of operations at Keetac would remain significantly unchanged from existing conditions.

4.16.2 Environmental Consequences

4.16.2.1 Odor

The primary environmental concern associated with odors from the facility is the disturbance it may have on local residents. The existing facility emits odors, primarily diesel fuel odors, which are common for a mining facility. Diesel exhaust comes from haul trucks and loaders that operate within the mine and stockpiles. This odor occurs in a periodic nature as trucks and loaders traverse the terrain. Engine revving and large loads cause diesel engines to operate at higher revolutions per minute (RPMs), therefore producing increased exhaust and odor.

The Proposed Project would expand mining into areas outside of the No Action Alternative boundary, as shown on Figure 3.2.1, bringing mining operations closer to residents in Kelly Lake. The potential to detect odors is increased as distance from the source of odor is decreased. Weather conditions also affect the concentration of odor. The expansion of the existing facility is not anticipated to cause new effects from odors associated with mining operations.

4.16.2.2 Noise

The primary concern for noise impacts from the Proposed Project is in the proposed east stockpile area, which is closest to residents in Kelly Lake. This area is the main focus of the noise study for the FEIS. Additionally, a noise analysis was completed for the proposed plant expansion, including the proposed biomass wood chipper.

> The noise study indicates that predicted sound levels during the day would be below Minnesota Noise standards at all receptor sites, but would exceed night time standards at some of the receptor sites.

Noise levels from stockpile equipment operation would cause an adverse effect to the environment due to noise levels increasing at sensitive receptor locations near Kelly Lake. It is anticipated that the effect would be less than significant as the facility would be required to meet state noise standards.

Noise from blasting would increase resulting in an adverse effect to the environment. It is anticipated that air blast overpressure and ground vibration limits would be met and their effects would be less than significant. Additionally, noise from the wood chipper at the biomass plant is expected to cause no discernable increase in noise levels at identified noise receptors. A detailed discussion on the potential effects from noise generated by the Proposed Project is provided in the text that follows.

4.16.2.2.1 Stockpile Equipment Operation

The proposed east stockpile would be located just west of the Kelly Lake residences and north of the railroad track that runs between Kelly Lake and Keewatin, ranging in distance from approximately 1,300 feet to 2,500 feet from the nearest residences. In the vicinity of the proposed east stockpile, is the existing southeast stockpile which has been used in the past and would be used through the last stage of mining in the Proposed Project, and then reclaimed. The proposed east stockpile would be used from 2012 through completion of the Proposed Project, and then reclaimed.

As described previously, existing stockpile operations consist of large trucks traveling to the perimeter of each active stockpile layer, depositing waste rock or surface overburden at the edge of the layer, and gradually extending the size of the layer. The Noise Study completed for the Proposed Project (Barr, 2009AA) assumed that the existing stockpile layering method would be used for the proposed east stockpile. Stockpile activity is assumed to occur along the entire eastern perimeter of the proposed east stockpile. Modeling for the noise study evaluated sources for one dumping site location at a time with all sources (i.e., trucks and dozer) at that single location. The Noise Study used time histories and observations along with operations data from the Project Proposer to determine a rate of twelve trucks per hour for each stockpile track. This rate represents worst-case maximum operating conditions, and provides the basis for calculating the L_{10} and L_{50} levels over an hour that is associated with stockpile operation.

As shown in Figure 4.16.1, the Noise Study identified homes closest to the eastern perimeter of the proposed east stockpile as receptors for the simulation model that was completed for the Proposed Project. None of the receptors were predicted to be in exceedance of daytime noise standards. However, one receptor (home), Residence #3, west of Kelly Lake is predicted to be over the L_{10} night time standard for most of the proposed east stockpile locations modeled. This receptor is also expected to be over the L_{50} night time standard for most of the proposed east stockpile locations modeled. The northern-most (Residence #1) and southern-most (Residence #6) receptors in the Kelly Lake area are predicted to exceed the L_{10} night time standard when proposed east stockpile activity is closest.

Receptors to the south between the proposed east stockpile area and TH 169 were also studied, as shown on Figure 4.16.2. One receptor (home), Residence #6, was predicted to exceed L_{10} night time noise standards when stockpile activity is closest. No other receptors were predicted to exceed day or night time noise standards in this location.

Ambient sound levels are the typical noise levels that are heard on any given day for a certain location and can be used as a reference point for studying the addition of other sources of noise introduced to that location. Ambient sound levels were monitored at two locations in the project area to provide a basis for comparing predicted stockpile noise with existing background levels.

Monitoring indicated that the L_{50} varied between 33 to 39 dB(A) during the daytime period, but was much higher in the early morning period. There are many sources of ambient sound in the area, including existing mining activities, trains, local traffic, and TH 169. The noise study for the Proposed Project estimated that about 150 vehicles per hour use the roadway between 2 and 3 a.m., which is considered the quietest hour of the night. County Road 60 just east of the Kelly Lake residential area carries an estimated 12 vehicles per hour during the early morning hours, which would have little impact on ambient sound levels. Monitored ambient sound levels become less the further the distance from the highway, making highway noise an insignificant contributor at about 2,000 feet.

The Noise Study indicates that predicted sound levels during the day would be below Minnesota Noise standards at all receptor sites, but would exceed night time standards at some of the receptor sites. Overall worst-case noise levels without mitigation are projected to be above existing ambient sound levels, and therefore audible, especially during night time hours.

4.16.2.2.2 Blasting and Overpressure

Blasting, when viewed in slow motion, is essentially a process of sloughing off layers of rock from the mine face with each sequential detonation. As the shockwave from a drill hole reflects off the free face, the tensile strength of the rock is exceeded and it breaks away from the free face. This provides another free face for the second shock (typically 25 to 42 milliseconds [ms] later) to break the rock followed by subsequent shocks from a carefully designed series of detonations. Blast design is a complex procedure that typically takes into account the average size of material desired, fragmentation of rock type, powder factor (kilograms of explosive per cubic meter of rock), charge weight, strength of explosive, sequence and timing of detonations, hole spacing, burden (distance to free face), depth of holes, depth of stemming, and other factors including limitations on ground vibration and air blast.

Blasting techniques/procedures are designed to break and fragment rock into a desired size so that it can be readily transported, crushed and processed efficiently. For the Proposed Project, blasting activity at the Keetac facility would occur about twice per week, which is greater than the No Action Alternative of once per week. The non-electric detonation technique used by Keetac would continue to be used for the Proposed Project. Keetac uses a blend mixture of emulsion, ammonium nitrate (AN) and fuel oil (FO), commonly referred to as blended ANFO. A primer is used in the blend mixture to detonate the explosive. A shock tube with a pyrotechnic fuse (non-electric cap) at the end of it is used to set the primer off. A short section of detonation cord is used to initiate the shock tube and explosives.

Ground vibration and air blast (overpressure) from rock blasting is primarily related to the weight of explosive detonated during any one instant (at least 8 ms from another to be treated as a separate detonation) and distance to a structure or sensitive receptor. As described above, a pattern of drill holes is used to most efficiently break and fragment rock so that it can be hauled to a processing location. The detonation in each of these holes is delayed by 500 ms within a column and 25 to 42 ms between each column to provide time for the previous detonation to break rock and provide a relatively free surface for the next detonation. The amount of explosive used per delay is commonly called the delay weight or weight per delay.

Impacts due to blasting in surface mines include ground vibrations, air blast, flyrock, dust, and fumes. Dust and gases are usually not a problem outside the immediate blasting area. As with air blast, wind direction is important. Excessive fumes can be avoided by utilizing good explosive design techniques. Therefore, this section discusses the potential impacts due to blasting and air overpressure.

4.16.2.2.3 Ground Vibration

Ground vibration is normally characterized by the Peak Particle Velocity (PPV) as measured by an instrument on the ground surface. Ground vibration limits have been established by the MNDNR based on previous recommendations by the U.S. Bureau of Mines (USBM). The State of Minnesota (Minnesota Rules, part 6130.3900, subp. 2) has established a ground vibration limit of 1.0 inches/second (with no specified frequencies). The USBM recommendations are 0.50 inch/second for old homes (plaster) and 0.75 inch per second for modern homes (wallboard) in the low frequency range. Information on the construction of the receptor sites is not available; however, Keetac would be required to comply with these standards.

4.16.2.2.4 Air Overpressure

Air blast is the shockwave propagated through the atmosphere. Flyrock is rock that is blown loose from the free face of the rock and travels beyond the area intended for blasting. Both airblast and flyrock can be minimized by utilizing proper blasting techniques, including drill hole placement, sequencing velocity, face (free face) orientation, and monitoring of explosive weight. Air blast can be affected by wind direction as well. Air blast data can vary from different mines and within the same mine, making it important to gather pre-blast data prior to major construction blast.

Air overpressure or air blast limits have been established by the MNDNR and the USBM. Minnesota Rules, part 6130.3900, subp. 1, Air Overpressure Standards specifies a limit of 130 decibels as measured on a linear peak scale. The USBM has a similar limit although it references certain frequencies.

4.16.2.2.5 Proposed Plant Expansion

The noise analysis for the proposed plant expansion indicated that the proposed biomass wood chipper (shredder) operation at the expansion line would create a new noise source type at the existing plant facility. The analysis found that “given the additional distance from the facility to the nearest receptor (over 4,500 feet to Keewatin homes), the maximum expected noise level from the shredder would be 18 dB(A), blending into the existing background levels in the area” (Barr, 2009V). Noise levels have been monitored in the area and are generally 33-37 dB(A). Addition of decibel levels is performed logarithmically, rather than with basic addition. For example, given a 50 dB(A) source, adding another 50 dB(A) source results in an increase of only 3 dB (53 dB(A) total). If one assumes a level from other conditions at the standard of 50 dB(A), the potential increase from adding an 18 dB(A) source is 0.0027 dB(A), essentially none. If one uses a background level of 30 dB(A) (similar to the lowest monitoring data), the potential increase from adding an 18 dB(A) source is 0.27 dB(A), a change well below the threshold of perception (Barr, 2009V).

Adding an 18 dB(A) source would be negligible and the complete duplication of the existing plant could yield a maximum increase of 3 dB(A), which is well below state noise standards. Therefore the proposed plant expansion and proposed biomass facility is not projected to cause significant impacts or exceed state noise standards.

4.16.2.3 Dust

The Proposed Project would generate dust during construction and plant operations. For an approximately three-year period, construction of mine facilities, haul roads, and buildings would generate dust typical of large-scale construction projects. Construction-related dust impacts are not expected to be significant or sustained. During facility operations, the nearest residential receptor for mining-related dust impacts is located in Kelly Lake at a distance of approximately 1,050 feet from the proposed east stockpile. Fugitive dust from stockpiles and tailings is discussed in Section 4.9.2.

> The facility currently operates under a Fugitive Dust Emissions Control Plan, which outlines measures that are used to control dust sources generated by the facility.

The primary consequence associated with dust from the Proposed Project is the potential for hazy and obstructed visual impairments both in the mine site and at locations surrounding the facility. Additionally, dust accumulation in the surrounding area could also be an issue if dust is not managed properly. The facility currently operates under the Fugitive Dust Plan, which outlines measures that are used to control dust sources generated by the facility. The facility also complies with mineland reclamation standards as outlined in Minnesota Rules Chapter 6130.

There is the potential for increased fugitive dust emissions and for those emissions to have an adverse effect on the environment. The magnitude of the effect is likely to be highly variable, localized and dependent upon the success of dust mitigation efforts and weather conditions. The Proposed Project and the East Stockpile Alternative meet particulate matter concentration limits at their respective ambient air boundaries. The effects of the increased dust emission would be less than significant.

4.16.2.4 East Stockpile Alternative

The East Stockpile Alternative would not change the Proposed Project's potential effects on odor or dust. However, the East Stockpile Alternative would likely reduce noise levels at several nearby receptors.

The East Stockpile Alternative would be located further west of the Kelly Lake area and slightly further north of the railroad track that runs between Kelly Lake and Keewatin compared to the proposed east stockpile. The change in distance for residences located east of the East Stockpile Alternative ranges between approximately 470 to 1,100 feet further away. The change in distance for residences located on the south side of the East Stockpile Alternative ranges between approximately 100 and 200 feet further away. Stockpile operations for the East Stockpile Alternative would be the same as those for the proposed east stockpile as described in Section 4.16.2.2.1. This includes using the East Stockpile Alternative from 2012 through completion of the Proposed Project, at which time it would be reclaimed.

Since the boundaries of the East Stockpile Alternative were moved further away from potential receptors, a noise assessment was completed for this alternative using the same residences (receptors) identified previously for the proposed east stockpile in the Noise Study. According to the Noise Tech Memo (Barr, 2010A):

> *Projected noise impacts associated with the Alternative Stockpile Location are less than those associated with the Proposed Stockpile Location, but remain over the state standard for some receptors. This requires the proposed nighttime offset to remain in place, though the effect on stockpile operations would be reduced under the Alternative Stockpile Location.*

Further analysis completed for the FEIS indicates that of the four residences in the Kelly Lake area identified as exceeding the night time L_{10} noise limit of 55 dBA under the proposed east stockpile (i.e., residences 1, 3, 5, and 6), three of those residences (1, 5, and 6) are expected to meet the noise standard under the East Stockpile Alternative. Residence #3 would experience an estimated noise reduction from 59 dBA to 56 dBA, which is just greater than the state night time noise standard. In the south area, one residence (i.e., #6) was identified as exceeding the night time L_{10} noise limit for the proposed east stockpile. The East Stockpile Alternative is expected to reduce noise levels from an estimated 57 dBA to 56 dBA, which is just greater than the state night time noise standard, but would still exceed the standard. (Wenck, 2010)

The Noise Study used worst-case operational assumptions, which are less likely to actually occur during operations. The Noise Tech Memo further indicates that "many factors reduce noise impacts, such as ground effect, vegetative shielding, ambient noise generated by wind, and other factors that are not included in the modeled predictions" (Barr, 2010). These reduce and minimize the potential impacts from noise on nearby receptors.

For potential impacts from odors and dust, the change between the No Action Alternative to the East Stockpile Alternative is the same as the change between the No Action Alternative to the Proposed Project.

4.16.3 Mitigation and Monitoring Opportunities

4.16.3.1 Odor

Several factors help decrease the effects of odors beyond the facility boundaries. Wind and terrain have a significant effect on decreasing the impacts from diesel odors. Wind helps disperse diesel odors. The height of stockpiles and hills that surround the mine and tailings basin help force odors to travel up and over these vertical barriers which also helps disperse odors and decrease the effect of odors beyond the facility boundary.

4.16.3.2 Noise

4.16.3.2.1 Stockpile Equipment Operation Impacts

Mitigation Opportunities

Mitigation measures were identified as part of the Noise Study and Supplemental Noise Study, which included three main categories of mitigation: treatment of the source (equipment), treatment of the path (terrain), and treatment of the receiver (private residence). The feasibility of mitigation measures identified within each of the categories was briefly evaluated.

The Supplemental Noise Study evaluated several mitigation methods to achieve compliance with Minnesota night time noise standards at the nearest residences. The evaluation focused on reducing the impacts from the dozer since it was identified as a major contributor to the overall sound level associated with stockpile operations.

The Supplemental Noise Study identified two main mitigation methods to reduce noise impacts from the dozer:

1. Adding a quieting package to the dozer equipment, and
2. Establishing night time operational setbacks from the edge of the stockpile.

The Supplemental Noise Study found that adding a quieting package to the dozer slightly reduces the number of dump locations from which an unquieted dozer exceeds night time standards for nearby residences. In order to comply with night time noise standards, night time operational setbacks from the edge of the stockpile were evaluated. These setbacks would increase the distance of heavy equipment operation from residences, thereby creating a buffer between equipment operation and homes during the night time hours. Increasing the distance between the noise source and the receptor decreases the level of sound that would be heard.

The Supplemental Noise Study found that in order to comply with Nighttime L_{10} Standards, heavy equipment use would need to be moved back from the stockpile perimeter. In the Kelly Lake area (Figure 4.16.1), equipment would be moved back between approximately 165 and 650 feet, depending on the stockpile dump location relative to Residence #3. The closer the stockpile dump location is to the receptor (residence), the further from the perimeter the equipment would need to be. Equipment operation at one dump site would exceed Nighttime L_{10} Standards for Residence #1, which would require the equipment use be moved 350 feet back from the perimeter. Three dumps sites would impact Residence #6, therefore equipment would be moved back approximately 180 feet (Barr, 2009BB)

In the south residential area, Residence #6 would be impacted by noise levels exceeding the L_{10} Nighttime Standards from Dump #12. Heavy equipment use is estimated to be moved back no more than 350 feet from the perimeter to meet compliance standards.

Additionally, Minnesota Rules, part 6130.1200 requires a 500-foot setback from all occupied dwellings for mining activities unless allowed by property owner. Minnesota Rules, part 6130.1500 describes buffers and barriers required prior to and during mining. These rules would help reduce noise impacts at the stockpiles to nearby residences.

Monitoring Opportunities

The MPCA and the Project Proposer are working on requirements for noise reduction, which would be included as part of the MPCA Air Emissions Permit for the Proposed Project. Requirements being considered for the permit include using a quieted dozer while operating within setbacks at night. The MPCA would further require the Project Proposer to monitor noise levels and submit a test plan to the agency for approval. If the test plan shows compliance with the night time standard during the day, the setback could be removed for future operations.

Additionally, U.S. Steel has proposed:

> *to conduct daytime sound measurements once the stockpile is operational to determine actual noise levels at nearby residences. If these actual measurements demonstrate impacts below state nighttime noise standards, U.S. Steel proposes to eliminate the night time operating offset.*

This would allow heavy equipment operation closer to the edge of the stockpile by reducing or eliminating the proposed setbacks established for the proposed east stockpile. This would only occur if measurements demonstrated noise standards would be met at nearby residences.

4.16.3.2.2 Blasting and Overpressure Impacts

Minnesota Rules, part 6130.3900, subp. 1C requires collection of detailed information for each production blast. All open pit mining operators are required to keep a blaster's log of production blasts for a period of at least six years containing the following:

(1) date and time of blast,
(2) type of explosive used,
(3) ignition layout with locations of blast holes and time intervals of delay,
(4) pounds of explosives per each delay of eight milliseconds or more;
(5) total pounds of explosives,
(6) type of material blasted,
(7) monitoring locations and results of monitoring when conducted,
(8) meteorological conditions, including temperature inversions, wind speed, and directions as can be determined from the U.S. Weather Bureau, and ground-based observations,
(9) directional orientation of free faces of bench to be blasted, and
(10) other information which the commissioner finds necessary to determine if the standards of Minnesota Rules, part 6130.3800 are achieved.

Regulations exist which have established limits for blasting vibrations and overpressure. These limits would have to be adhered to during the operation of the Proposed Project. For blast source areas closest to receptors, it may be necessary to adjust drill hole density along with delay weights to keep vibrations below the MNDNR and USBM prescribed limits. Air overpressure levels can be maintained through a reduction of delay weights, appropriate stemming depth, use of shock tubes, and depth of burden (distance of blast from free bench face). Atmospheric conditions are critical for sound propagation. Unfavorable conditions, such as low level inversions or winds toward nearby buildings, should be avoided during blasting.

Keetac measures both ground vibration and air overpressure. Multiple monitors are used for every blast to measure the closest residential location and the area most likely to be affected by the atmospheric conditions. Keetac monitors atmospheric conditions (wind direction and velocity, and temperatures aloft) in relation to the blast and residential locations the day prior and the day of a blast. If atmospheric conditions are not conducive to blasting that day, the blast is rescheduled. Atmospheric monitoring is conducted to minimize air shock and dust dispersal over the nearby residential locations.

A report of the monitoring data from each blast is created listing the blast identification, location, pounds of explosives used, number of delays, number of holes blasted, tonnage/volume of material blasted, and results from the blast monitors. This information is used as the blasting record and provides information for future blasts.

4.16.3.3 Dust

Pursuant to Minnesota Rules, part 6130.3700, mining shall be managed to control avoidable dust. Under the requirements of Minnesota Rules Chapter 7011, a Fugitive Dust Plan is in place at the existing facility, which would be updated if necessary, and used for operation of the Proposed Project. Sources and mitigation measures for dust emissions at the Keetac facility are described in Table 4.16.2 These measures consist primarily of water and chemical spray applications, compaction and revegetation of disturbed areas, and stockpiling BMPs.

TABLE 4.16.2 POTENTIAL DUST SOURCES AND MITIGATION MEASURES

Potential Dust Sources	Measures to Mitigate Adverse Impacts
Earth/rock moving for preparation of plant site	Compaction, spraying of haul roads, minimization of open areas, and rapid revegetation of disturbed areas
Construction traffic	Dust suppressant application (water or chemical)
Removal of overburden	Compaction, spraying of haul roads, and good stockpiling practices
Drilling and blasting of rock and taconite	Water sprays, good blasting technology, and adherence to blasting standards
Truck loading and haul traffic	Water sprays, compaction and spraying of haul roads, and good stockpiling practices
Plant and mill operation	Referenced in Section 4.9 Stationary Source Air Emissions
Mine land reclamation (earthmoving)	Compaction, spraying of haul roads, and revegetation of disturbed areas
On-site traffic	Paving of roadways, and the use of dust suppressants
Tailings Basin	Revegetation, open water

The entire project would be required to meet NAAQS at the project ambient air boundary. The probable limiting receptors will be defined by the location of the source and the prevailing wind direction. Dominant winds are from the south-southwest during the summer and from the north-northwest during the winter. Air modeling will be required as a part of the Air Emissions Permitting process for the Proposed Project, and these assumptions would be discussed in more detail and verified as a result of the permitting requirements. Section 4.9 discusses NAAQS compliance modeling that has been completed for the Proposed Project. A more in-depth discussion of dust emissions for the Proposed Project can be found in Section 4.9 – Stationary Source Air Emissions.

4.17 HISTORIC PROPERTIES

This section discusses the Proposed Project's potential effects on historic properties. To identify historic properties potentially affected by the project, cultural resource surveys must be completed. "Cultural resources" is a very general term that includes a wide range of phenomena, including sites with observable evidence of human activities, sites of religious or cultural significance to Indian Tribes that may have no observable evidence, historic structures and buildings, properties associated with the cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the community's cultural identity, as well as natural resources inexorably linked to cultural beliefs and practices. Cultural Resources Management within federal and state agencies seeks to identify and consider all of these types of cultural resources with the goal of balancing development with protection of cultural resources.

For federal agencies the key component of Cultural Resources Management is Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended (16 U.S.C. 470) and the definition of historic property.

The following discussion defines the regulatory framework for the consideration of historic properties, which federal agencies must follow, as well as the results of archival research and the Phase I and Phase II cultural resources surveys conducted for the Proposed Project. It also describes the USACE's consultation with federally recognized Indian Tribes to identify properties of religious and cultural significance to those tribes.

> Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (Advisory Council) a reasonable opportunity to comment on such undertakings.

Archival and background research for the Proposed Project was conducted in the spring of 2008. A subsequent Phase I cultural resources survey was conducted in the fall of 2008 to identify any archaeological sites, historic buildings, structures, or landscapes that are potentially eligible for listing on the National Register of Historic Places (NRHP) and may be potentially affected by the Proposed Project. A Phase II evaluation of one mine site identified during the Phase I survey was completed to determine its eligibility for listing on the NRHP.

4.17.1 Regulatory Framework

4.17.1.1 Summary

Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (Advisory Council) a reasonable opportunity to comment on such undertakings. By engaging the State Historic Preservation Office (SHPO) in the Section 106 review, the federal agency provides the Advisory Council an opportunity to comment on the undertaking. The Section 106 process seeks to accommodate historic preservation concerns with the needs of federal undertakings through consultation among the agency officials, tribal nations, and other parties with an interest in the effects of the undertaking on historic properties, commencing at the early stages of project planning. The goal of consultation is to identify historic properties (properties eligible for National Register listing) potentially affected by the undertaking, assess the undertaking's effects on those properties, and seek ways to avoid, minimize or mitigate adverse effects on historic properties. A federal undertaking includes issuing permits which, for the Proposed Project, includes the CWA Section 404 permit.

4.17.1.2 Law and Regulation

The Proposed Project would require a CWA Section 404 permit from the USACE for wetland impacts. The issuance of a USACE permit for the Proposed Project is considered to be an undertaking, which must undergo a review by the USACE pursuant to Section 106 of the NHPA of 1966, as amended:

> *The head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The head of any such Federal agency shall afford the Advisory Council on Historic Preservation established under Title II of this Act a reasonable opportunity to comment with regard to such undertaking.* (16 U.S.C. 470f)

The Advisory Council promulgated 36 CFR Part 800, a regulation that implements Section 106 by providing procedures for a federal agency's historic preservation responsibilities and the Advisory Council's commenting responsibilities. The procedures outlined in this regulation are commonly referred to as the Section 106 process. Central to the Section 106 process is the term "historic property." 36 CFR Part 800 defines a historic property as follows:

> *. . . any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria* (36 CFR § 800.16 (l)(1)).

For a cultural resource to be included in or considered eligible for inclusion in the NRHP, it must be a tangible property such as a district, site, building, structure, or object, that is greater than 50 years old, retains its historic integrity, and meets one or more of the NRHP Criteria for Evaluation. The NRHP Criteria for Evaluation are as follows:

> *The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling and association, and:*
>
> *A. That are associated with events that have made a significant contribution to the broad patterns of our history; or*
> *B. That are associated with the lives of persons significant in our past; or*
> *C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or*
> *D. That have yielded, or may be likely to yield, information important in prehistory or history (36 CFR § 60.4).*

If a cultural resource meets the requirements of the NRHP, the USACE, as a federal agency, must consider the effect of the undertaking (i.e., the Proposed Project) on that historic property and provide the Advisory Council an opportunity to comment. However, the Advisory Council does not typically become involved in the review of individual Section 106 cases. The criteria for Advisory Council involvement are found in Appendix A to 36 CFR Part 800.

The Code of Federal Regulations 36 CFR § 800.3(c) directs the Federal agency to identify and consult with the appropriate SHPO or Tribal Historic Preservation Office (THPO) if the undertaking would occur on, or affect historic properties, on tribal lands. Section 101(b)(3) of the NHPA provides for the establishment of SHPOs to provide guidance and assistance to federal agencies. Section 101(d)(2) of the NHPA allows the assumption of SHPO responsibilities on tribal lands by federally recognized Indian Tribes. For an undertaking that would occur on, or affect historic properties, on tribal lands where the tribe has not assumed the SHPO responsibilities, the federal agency is directed to consult with the Indian Tribe in addition to and on the same basis as the SHPO (36 CFR § 800.3(d)).

Once the agency has identified the appropriate SHPO, THPO, or Tribal representative as the case may be, 36 CFR § 800.3(f)(2) requires the federal agency to make a reasonable, good faith effort to identify Indian Tribes that may attach religious and cultural significance to historic properties in the area of potential effects (APE) and invite them to be consulting parties. The APE is the area in which the federal agency is responsible for the identification of historic properties. The Advisory Council's regulation defines the APE as:

> *… the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking.….* (36 CFR § 800.16(d).

For the purpose of the discussion in this section, direct effects physically alter the historic property in some way and indirect effects are further removed in time or space and diminish some aspect of the historic property, but do not physically alter it.

The USACE is consulting with the Minnesota SHPO and three federally recognized Indian Tribes that have expressed an interest in consultation: 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 (Ojibwe Bands). Consultation with the Ojibwe Bands is required under the NHPA, because the Proposed Project may affect historic properties of religious and cultural significance to the Ojibwe Bands. It is important to note that a historic property's religious and cultural significance to the Ojibwe Bands is not tied to continual or physical use of the property.

> The earliest inhabitants of Minnesota date back about 10,000 years, moving into the area after the last glaciation of the Pleistocene. The archaeological remains of these Paleo-Indian people are difficult to locate.

Within the regulatory framework, it is important to note that Federal agencies are in a trust relationship with the Ojibwe Bands. The USACE must also comply with treaties, including the 1855 and 1854 treaties with the Chippewa. In traditional tribal culture and cosmology, natural resources hold significance beyond that ascribed by the general public. The Ojibwe Bands have emphasized the importance of natural resources to their people, stating that natural resources play an integral role in their society and culture including religious practices. Natural resources cannot be separated from cultural resources. However, for a cultural resource to be afforded consideration under the NHPA it must qualify as a historic property. Consideration of natural resource impacts, or impacts to cultural resources that do not qualify for the NRHP, are addressed in light of federal tribal trust responsibilities and treaty rights within the 1855 Ceded Territory. This is discussed in Section 4.18.

4.17.2 Affected Environment

4.17.2.1 Cultural Context

4.17.2.1.1 Pre-European Contact

Pre-contact cultural history in northern Minnesota may be divided into three major traditions: Paleo-Indian, Archaic, and Woodland. It is believed that people were present in the Keetac mine area during all three of these periods. Cultural histories that integrate American Indian history and Euroamerican history are generally divided into the Contact and Post-Contact Periods (Gronhovd et al., 2009). For the purposes of this FEIS, this discussion will provide information on the Post-Contact, occurring after the Woodland Tradition period.

The earliest inhabitants of Minnesota date back about 10,000 years, moving into the area after the last glaciation of the Pleistocene. The archaeological remains of these Paleo-Indian people are difficult to locate, since the sites are small, contain few artifacts, are few in number, and may be deeply buried beneath more recent sediments. These sites are recognized by archaeologists by scatters of lanceolate (lance-like) projectile points (Dobbs, 1990a; Dobbs, 1990b).

The Paleo-Indian people were followed by Archaic people, likely Paleo-Indian descendants. This cultural transition occurred about 8,000 years before present. Material remains of activities of Archaic people, including large notched and stemmed projectile points, have been more frequently discovered and excavated by archaeologists than Paleo-Indian material (Anfinson, 1987; Wilford, 1941, 1955, and 1960). Archaic Period people developed woodworking tools including axes and adzes, as well as punches to facilitate manufacture of clothing from animal skins. Trade networks connected the Archaic Period inhabitants of Minnesota with resources as far away as the Gulf of Mexico. During the Archaic Period, people in the Great Lakes region began making tools from copper, which occurred as a raw material in the form of nuggets. Tools fashioned from copper include spear points, knives, fishhooks, and awls—the first metal tools known in the New World (Risjord, 2005). Other sources indicate that copper tools appear in archaeological contexts during the initial Archaic between 6,000 and 7,000 years ago (Beukens, 1992).

During the Woodland Period, beginning around 1000 BC, people began making pottery and burying their dead in mounds. Woodland people continued to make and use copper tools and also favored tools made of antler and bone. Later during the Woodland Period, people began using the bow and arrow. Minnesota was occupied by Siouxian speaking people, some of whom were ancestral Dakota. They followed a typical Eastern Woodland subsistence pattern, maintaining a seasonal cycle of practicing maple sugaring in the spring, fishing and small-game hunting and gathering in the summer, harvesting wild rice in the fall, and large-game hunting in winter. The seasonal cycle included congregating into larger groups during the summer when resources were more plentiful, and then separating into smaller bands during the winter, to be supported by stored supplies and fresh large game (Risjord, 2005). Based on analysis of plant residues found on ceramic food vessels from archaeological sites, wild rice is known to have been used for food since the Woodland Period (Thompson et al,. 1994).

The focus of these Eastern Woodland lifeways shifted during the mid-17th Century as European explorers with trade goods began to enter the region and native populations changed. Other tribes began migrating into the area, pressuring the Dakota.

4.17.2.1.2 Post-Contact

French fur traders were among the first Europeans to arrive in northeastern Minnesota in the 1650s. As early as 1660, Sault Ste. Marie, traditionally a seasonal gathering place during the whitefish run, became a year-round stopping place for Ojibwe Bands due to the opportunity to trade with Europeans (Meyer, 1994). The French knew the Ojibwe as Saulteurs and then as Outchibouec (French), later the Americans knew them as the Chippewa. Anishinabe is what they call themselves. The Dakota were the people living in what is now northern Minnesota at the time of French contact. European trade, primarily for furs, created tension among the tribes of the region. As the Ojibwe moved westward, the Dakota were pushed southward, and possibly further west (Gibbon, 2002).

The Ojibwe people came from the east, migrating westward along the shores of Lake Superior from the St. Lawrence River Valley. Pressures from European trade and from their Iroquois neighbors are often cited as motivation for this move (Risjord, 2005), but this explanation for westward migration is an Euro-American perspective. According to the Ojibwe migration story, a prophet at the third of the seven fires beheld a vision from the Creator calling the Anishinabe to move west until they found the place “where food grows on the water.”

According to the Anishinabe, they migrated through the Great Lakes region, guided by a vision of a *miigis* (cowrie shell) or Sacred Megis (Meyer, 1994; Benton-Banai, 1979). Anishinabe oral tradition relates a 500-year journey, beginning in 900 AD. Groups settled at various locations along the way with some groups continuing westward to settle along the northern forest areas of the western great lakes in the US and Canada. The Bois Forte Band occupied the Keewatin, Hibbing area prior to settling at Nett Lake and Vermilion. Keewatin (giiwedin) is Anishinabe for North.

The Ojibwe are primarily a Woodland people and the bands living in northern Minnesota relied heavily on plants from the region, such as wild rice, spruce root, birch and cedar bark, sage, and maple sap. Wild berries such as blueberries, highbush cranberries, pin cherries, chokecherries and wintergreen berries were used as medicine as well as food. Ojibwe used birch bark for their canoes and houses, and furs and skins for clothing and shoes (Gronhovd et al., 2009).

> The primary treaty affecting the Ojibwe of northeastern Minnesota was signed on September 30, 1854, which retained the right to hunt and fish within the treaty area. It allowed Bois Forte to choose their reservation location near Lake Vermilion.

Ojibwe gathered in large groups during the summer months when food sources were plentiful and divided into smaller family groups during the winter months. There were four major camps. Spring camps were in the sugar bush and fishing locations. The summer was a time for the berry picking and hunting camp. In the fall, it was the wild rice harvest and fishing camp while winter camp was a time for storytelling, sewing and repairing, snaring rabbits, and surviving. The camps were located where resources were available.

Beginning in 1837, Ojibwe treaties with the U.S. government opened the way for European–American settlement. Minnesota became a Territory of the United States in 1849. White settlement eventually pushed the Ojibwe off their lands and onto reservations. In fact, the Ojibwe “signed more treaties with the United States than any other tribe; fifty-one! North of the border, the Ojibwe have ‘touched the pen’ more than thirty times with the French, British, and Canadians” (Sultzman, 2000).

The primary treaty affecting the Ojibwe of northeastern Minnesota was signed on September 30, 1854. This treaty ceded the lands located within Minnesota’s arrowhead region to the

United States; however they retained the right to hunt and fish within the treaty area. Additionally, the Bois Forte retained the right to choose their reservation location within the heart of the ceded territory, near Lake Vermilion.

In 1855 another treaty was signed. The Ojibwe of the Mississippi ceded the lands to the west of the 1854 Ceded Territory to the United States government. This cession resulted in the creation of reservations at Mille Lacs, Rabbit Lake, Gull Lake, Pokagomon Lake, Sandy Lake, Leech Lake, Winnibigoshish Lake, Cass Lake, and on islands in Rice Lake.

Within a decade however, the Minnesota legislature requested a geological survey of the Vermilion area. State Geologist, Henry H. Eames, and his brother (R.E. Eames) conducted the survey in northeastern Minnesota during the summers of 1865 and 1866. In the vicinity of Vermilion Lake, they recorded hematite deposits between 50 and 60 feet thick and varying between 65 percent and 80 percent pure, and they also believed that they discovered gold and silver (Merrill, 1920:242; Walker, 1979:21). When the men returned in October 1865, one inadvertently mentioned the possibility of gold in the Vermilion region and launched the Minnesota gold rush. As prospectors rushed north into the traditional Ojibwe homeland, they quickly realized that no easy way of transporting men and machinery to Vermilion Lake existed. In September of 1865, gold prospectors took the first step in establishing year-round transportation by opening a sled road from Duluth to Lake Vermilion and the presumed gold fields (Walker, 1979:21).

Despite the investors' hesitations to invest in the Lake Vermilion region, the government ratified the Treaty of 1866 removing the Bois Forte Chippewa to a 100,000-acre reservation near Nett Lake. In 1866 Thomas Clark and George Stuntz also began cutting a trail from Duluth to Lake Vermilion, and in July 1869 Stuntz, with ten men to assist him, set out to build a year-round road. This road was to extend from Duluth to the Bois Forte reservation area, but by the end of the season the men had only cut a 12-foot wide path from Duluth to Lake Vermilion (Walker, 1979:22). By the time Stuntz finished the road, the Minnesota legislature refused to appropriate any more money towards further geological surveys, and thus ended the Minnesota gold rush (Merrill, 1920). Although little to no mineral wealth came from the gold rush, it facilitated the opening of the only year-round road into northeastern Minnesota, and dramatically impacted the Bois Forte Chippewa. In 1881, the Bois Forte reservation was re-established at Lake Vermilion, but the size was reduced dramatically (Minnesota Indian Affairs Council, 2007).

4.17.2.1.3 Iron Range History

Minnesota's iron deposits are concentrated in three separate areas, or ranges: the Vermilion, Mesabi, and Cuyuna. The Vermilion Range is located the farthest north. It extends approximately 100 miles, from the western end of Vermilion Lake to Gunflint Lake, and varies in width from two to 18 miles. Ores from the Vermilion Range are among the richest in Minnesota, ranging from about 63 percent to almost 70 percent metallic iron (Wirth, 1937:3). The Mesabi Range extends from near Grand Rapids on the Mississippi River to Birch Lake, varying from two to ten miles wide. The Keetac mine is within the Mesabi Range. In addition to being the largest of Minnesota's ranges, the Mesabi was the state's most prolific producer. The Cuyuna Range is the southernmost, smallest, and almost assuredly least known of Minnesota's three iron ranges. It is approximately 65 miles long, varying from less than a mile to just over nine miles wide (Wirth, 1937:2).

The presence of iron in northeastern Minnesota was first recorded in 1734, but it was not until 1848 that first formal geological survey determined that iron existed in Minnesota, and was not until 1865 that the Minnesota legislature took an interest in Minnesota's mineralogical

The presence of iron in northeastern Minnesota was first recorded in 1734, but it was not until 1848 that first formal geological survey determined that iron existed in Minnesota.

potential (Walker, 1979). The surveys commissioned by the legislature in the 1860s recorded hematite deposits between 50 and 60 feet thick and varying between 65 percent and 80 percent pure iron.

Gold prospector George Stuntz had quickly realized that there was little chance of making a fortune off Minnesota's gold, but was determined to see Minnesota's iron resources developed. Stuntz spent many years trying to interest investors, and finally, in 1875, interested Charlemagne Tower, a Pennsylvania industrialist and attorney. Before proceeding, however, Tower initiated another geological expedition to examine ores on the Vermilion and the Mesabi ranges (Walker, 1979:28). The results of this survey indicated that the Mesabi ores were very poor and not worth developing, but the Vermilion ores were extremely rich and could prove to be very lucrative if developed (Minnesota Iron Company, 1883).

In 1882, Tower formed the Minnesota Iron Company, acquired large tracks of land, and built the Duluth and Iron Range Railroad to pursue and develop the iron resources on the Vermilion Iron Range (Minnesota Iron Company, 1882a; 1882b). In conjunction with these endeavors, Tower also began extracting ore at the Soudan Mine on the Vermilion Iron Range. On July 31, 1884, after months of anticipation, the Duluth and Iron Range Railroad reached the Soudan Mine. The following day the first shipment of Minnesota iron ore, totaling 220 tons, left the Soudan Mine (Soudan Mine Collection, 1884). The Soudan ore as well as ores from the other Vermilion Range mines were hauled by railroad to Agate Bay and Two Harbors, Minnesota, where they were loaded onto ore ships and hauled to processing centers such as Cleveland and Pittsburgh (Walker, 1979:61).

Within a few years the Vermilion Range had several other mines that were fully operational. The Chandler Mine located near Ely, Minnesota, began operating in 1888, the Pioneer Mine in 1889, the Zenith Mine in 1892, and the Savoy and Sibley Mines in 1899 (Walker, 1979:69-70).

By 1890, approximately 34 separate mine workings including 14 pits or shafts that were to at least some degree successful, two that were unsuccessful, and 20 small numbered workings were underway at Soudan (MGL, 1982:110-136). The Soudan Mine operated primarily as an open pit mine for several years until the pits became too deep and precarious. Therefore, in 1893, the Soudan Mine started underground shaft mining (MGL, 1982). Between 1884 and 1895 the Vermilion Range shipped 84,487,601 tons of ore (Walker, 1979:258). The Soudan Mine continued to shaft mine the hard, pure hematite until the early 1960s, when a method for efficiently processing taconite pellets was developed.

The development of the taconite pelletizing process suddenly made mining the ore from the Mesabi Range much more profitable. The Mesabi was the fifth Lake Superior range to open and the second in Minnesota (Reynolds, 1989:197). Located south-southwest of the Vermilion Range, the Mesabi is Minnesota's largest range, encompassing approximately 400 square miles. The ore on the Mesabi Range differs greatly from that of the Vermilion Range. The Mesabi's ore is lower quality than the hard, pure hematite of the Vermilion Range. The ore also tends to be powdery, soft, and runs in horizontal beds ranging from a few inches to several hundred feet thick (Reynolds, 1989; Walker, 1979:85). In addition to lying in horizontal layers, the Mesabi ore also rests under ten to two hundred feet of glacial till, which requires removal before the ore can be mined (Walker, 1979:85).

Although investors were aware of the existence of the Mesabi Range, active development did not occur until after the Vermilion Range was established. This was probably due to an oversight that occurred during the 1875 expedition funded by Charlemagne Tower. During this survey, geologists tested both the Vermilion and Mesabi's ore, but they did not travel beyond the far eastern edge of the Mesabi Range when gathering their samples. Since the far eastern edge of the Mesabi Range contained poorer quality ore than other parts, the geologists recommended that Tower abandon plans to develop the Mesabi Range and focus on the Vermilion Range (Minnesota Iron Company, 1883).

Despite Tower's abandonment of the range, the Merritt family was set on developing the Mesabi. The Merritts were primarily responsible for the discovery, promotion, and development of the Mesabi Range and formed the Mountain Iron Company in 1890 to achieve these goals (Walker, 1979). The Merritts shipped the first Mesabi Range ore from the Mountain Iron Mine, located near the town of Mountain Iron, in 1892 (Walker, 1979:89; Reynolds, 1989).

West of the Mountain Iron Mine, ore was discovered in the Keewatin area in 1904 and the Forest and St. Paul mines were the first to open. The Great Northern Railroad reached the mines in 1909 and the Mississippi and Bennett mines began shipping shortly thereafter (Writers Program, 1941: 137-38).

Investors such as Frank Hibbing saw the potential of the western Mesabi. Hibbing formed the Lake Superior Iron Company and began operations at three separate locations: the Hull, Rust, and Mahoning Mines. These mines eventually would grow to such a size that they would combine, becoming the largest, and most productive open pit mine in the world (Walker, 1979:95). The Hull-Rust-Mahoning Mine, which was listed as a National Historic Landmark (NHL) in 1966, is located adjacent to the Proposed Project area.

The period of significance for the natural ore mining is 1892 to 1954, beginning with the first ore shipment from the Mountain Iron Mine. By 1954, with the decline of the ore industry after the Korean War, many of the mines were idled, and over time most of the mill buildings and rail spurs were removed.

The period of significance for exploration and development of mining is 1866 to 1910, encompassing the entire first period of mine exploration and the opening of mining districts across the Mesabi Range. After that period a new group of corporate investors brought comprehensive mining methods and were assisted by a nearly completed transportation network.

> Although the horizontal formation of most of the Mesabi did not require underground shafts, open pit mining prevailed on the Western Mesabi, although underground methods were used for drainage and exploration and the methods of underground mining changed through time.

Although the horizontal formation of most of the Mesabi did not require underground shafts, they were nevertheless useful in the early phase of a mine because there were no heavy start-up costs for removing masses of overburden and poor ore (Walker, 1979:132; Leith, 1903:283). Many mines that were opened with underground methods were later stripped and operated as an open pit. Open pit mining prevailed on the Western Mesabi, although underground methods were used for drainage and exploration and the methods of underground mining changed through time.

During the late 1800s and early 1900s, mines and settlements were established all over the Mesabi Range, eventually making the Mesabi Range Minnesota's most prolific iron ore producer shipping 1,718,766,230 tons of ore between 1889 and 1895 (Walker, 1979:258). In fact, by 1901, the Mesabi Range's four largest mines (the Fayal, Mountain Iron, Adams, and Mahoning) shipped more iron ore than "the Mesabi's closest rival," the *entire* Menominee Range by Iron Mountain, Michigan (Walker, 1979:230). Conversely however, Michigan's Fayal Mine alone almost matched the entire Vermilion Range iron ore output (Walker, 1979:230).

The Proposed Project is located in the Keewatin area of the Western Mesabi Iron Range in western St. Louis and eastern Itasca counties. The current size of the Keetac mine is due to the incorporation of the Forrest Pit (1904), Bray (1909), Mississippi (1910), Prindle (1923), the southern half of the Stevenson (1900), and the northwestern portion of the Bennett (1913) mines into the existing mine (Gronhovd et al., 2009). The existing mine appears to be the third largest mine on the Iron Range, the largest being the compilation of open pit mines located just north of Hibbing that comprise the NHL, Hull-Rust-Mahoning Mine Historic District, which is a National Historic Landmark (NHL).

Changes to the landscape in the last 50 years related to mining are a reflection of the continued historic use of the mining resources and reflect the evolving nature of mining on the Iron Range from mining high grade iron ore to mining low grade ore for taconite pellet production. The incorporation of many smaller open pit mines into large pits occurred during the historic iron ore mining period due to changes in technology and production methods.

4.17.2.2 Area of Potential Effects

> As part of the Section 106 process, the USACE must consult with federally recognized Indian Tribes to identify historic properties of religious and cultural significance that may be affected by the Proposed Project.

The USACE-proposed APE (Figure 4.17.1) is a combination of minor watershed boundaries, normal high water extent along certain streams, noise modeling contours near Kelly Lake, the ambient air quality permit boundary, and the potential for visual impacts. Portions of O'Brien and Hay Lake watersheds are not included in the APE, because surface water flows indicate that it is unlikely mine runoff would affect areas upstream in those watersheds and those areas are also unlikely to be affected by noise, dust, or groundwater impacts.

The size of the APE is due to the consideration of potential water quality and ground water impacts and the potential effects on historic properties of religious and cultural significance to the Ojibwe Bands. Swan Lake was included in the APE because of potential water quality effects. Consultation with the Ojibwe Bands is a dynamic process and may result in changes to the APE as the nature of historic properties of importance to the Bands and what might constitute an effect on those properties is more fully understood.

The APE as it relates to potential effects on architectural properties, mining landscapes, or archaeological sites has been coordinated with the SHPO and includes primarily areas of direct effect such as ground disturbance and indirect effects such as visual effects. The SHPO has concurred with that APE, which is a subset of the larger APE.

4.17.2.2.1 Phase I Identification of Historic Properties

As part of the Section 106 process, a Phase I survey to identify archaeological sites, structures and buildings, and mining landscapes was completed within the APE for the Proposed Project. A work plan for this Phase I survey was developed by the Project Proposer and approved by USACE and SHPO prior to conducting the survey. The Phase I survey consisted of archival research and field survey (Gronhovd and Goltz, 2008).

Archival Research

As a result of the archival research 11 previously inventoried architectural properties located within one mile of the Proposed Project were identified. No archaeological sites have been previously inventoried within a mile of the Proposed Project (see Figure 4.17.1 and Table 4.17.1).

TABLE 4.17.1 PREVIOUSLY INVENTORIED ARCHITECTURAL PROPERTIES WITHIN ONE MILE OF THE PROPOSED PROJECT AREA

Inventory No.	Property Name	T	R	S	¼, ¼ Sections	Address	NRHP Status
IC-KWC-001	Keewatin High School	57	22	25	NW-NE	xxx 3rd St., Keewatin	Not Evaluated
IC-KWC-002	Robert L. Downing High School	57	22	25	NW-NE	xxx 3rd St., Keewatin	Not Evaluated
IC-KWC-003	Keewatin Watertower	57	22	25	SW-NE	113 1st Ave., Keewatin	Not Evaluated
IC-KWC-004	Keewatin City Hall	57	22	25	NW-NE	SE corner 2nd St. & 3rd Ave., Keewatin	Not Evaluated
IC-KWC-005	Bray Mine Superintendant's House & Workers Housing	57	22	25	NE-NW	xxx 3rd Ave., Keewatin	Not Evaluated
IC-KWC-006	Bennett Mine Superintendant's House	57	22	25	SE-NW	xxx 2nd Ave., Keewatin	Not Evaluated
IC-KWC-007	Francis Higgins Memorial Presbyterian Church	57	22	25	NW-NE	xxx 3rd Ave., Keewatin	Not Evaluated
IC-KWC-008	First National Bank Building	57	22	25	NW-NE	NW corner 1st St. & 3rd Ave., Keewatin	Not Evaluated
IC-KWC-009	St. Paul Location House	57	21	20	SE-NW	xxx 1st Ave., Keewatin	Not Evaluated
SL-SZT-009	Bridge No. 5232	57	22	25	NW-SE	CSAH 76 under BN INC, Stuntz Twp	Not Evaluated
SL-HBC-159	Hull-Rust-Mahoning Mine Historic District	57	20	5-7		off 3rd Ave. E., Hibbing	National Historic Landmark
		57	21	1-4, 9-12, 14, 15			
		58	20	29-32			
		58	21	33-36			

Only one of these properties is located in close proximity to the APE for the Proposed Project. That is the Hull-Rust-Mahoning Mine Historic District (SL-HBC-159).

> The Proposed Project cannot avoid affecting the Bennett No. 2 Shaft site; therefore, a Phase II evaluation was performed to determine the site's eligibility for listing on the NRHP. As a result of the Phase II survey, the Bennett No. 2 Shaft was recommended as eligible for listing on the NRHP.

The Hull-Rust-Mahoning Mine Historic District is composed of 54 sites including 53 contiguous historic mines and a fragment of the original town of Hibbing. The district, at the time of its designation as an NHL in 1966, derived part of its significance from the fact that it contained the largest open pit iron mine in the world. In 1966, the Hull-Rust-Mahoning open pit mine was approximately three miles long (east-west) by one and one half miles wide (north-south) at its widest point. The project is anticipated to have no effect on this NHL.

4.17.2.2.2 Phase I Field Survey

The Phase I survey work conducted for the Proposed Project consisted of two components. One component was to identify pre-contact and historic archaeological sites, and the other component was to identify historic buildings, structures, and mining properties including mining landscapes.

The Phase I archaeological survey included all areas slated for earth moving activities. For the Proposed Project, this includes all areas proposed for expansion of the mine, additional stockpiles and haul roads, and alterations to the existing tailings basin, as well as other areas that may be impacted by construction as shown in Figure 4.17.1.

Within these areas of potential disturbance, evaluation of topography and current and previous mining activities was used to define six areas that had not been impacted by modern mining activities and appeared to have moderate to high archaeological potential. Survey of these six areas involved a walkover to identify surface features as well as areas warranting subsurface testing.

One archaeological site, a homestead site, was located in Township 56 Range 21 Section 4 in Survey Area 6, outside and to the east of the existing tailings basin. Three cellar holes were located which appear to represent the remains of three buildings that made up a homestead, as well as associated artifacts which indicate the homestead was occupied sometime in the 1920s or 1930s (Gronhovd et al., 2009). In addition to the homestead, an existing railroad grade was identified within the proposed east stockpile area, but was not recommended for further evaluation.

The survey for architectural properties and mining landscapes included all areas within the Proposed Project boundaries and all areas visible from the Proposed Project. Additional research was conducted to review historic mining maps, historic photographs, local histories, mining journals, manuscripts, historic plat maps and other sources of information to assess the nature of mining activities in the area and the potential for structures, features, and landscapes relating to the area's industrial past.

The architectural property and mining landscape survey identified the Bennett No. 2 Shaft Mine (see Figure 4.17.1). The Bennett No. 2 Shaft site is located in the proposed south mine pit expansion. During the survey, several structural and archaeological remains of the Bennett No. 2 Shaft were located, including mine shafts, tailings piles, structural ruins of the dry house and engine house, and remains of a railroad trestle and railroad grade.

> The identification of historic properties of religious and cultural significance to the Ojibwe Bands is ongoing. Consultation will be completed prior to issuance of the Record of Decision (ROD).

Both the homestead and the Bennett No. 2 Shaft site were recommended as potentially eligible for listing on the NRHP. No other properties potentially eligible for listing on the NRHP were identified as a result of the Phase I surveys.

The identification of historic properties of religious and cultural significance to the Ojibwe Bands is ongoing. Sheet 18 of the Trygg maps, which are a series of maps based on the original plats and field notes of the United States Land Surveys, shows an Indian village on the east side of Swan Lake. The Bois Forte Band occupied the Keewatin/Hibbing area prior to settling at Nett Lake and Vermilion. The USACE will continue to consult with the Ojibwe Bands to develop and implement an identification plan for the APE.

Because the identification of historic properties of religious and cultural significance to the Ojibwe Bands has not been completed, the USACE has drafted a programmatic agreement (PA) with provisions for the development and implementation of the identification plan for these properties. This PA shall be executed prior to the ROD and incorporated as a special condition into any permit the USACE may issue for the Proposed Project. The consultation history for the Proposed Project is described in Chapter 6.0.

4.17.2.2.3 Phase II Evaluation

Only the Bennett No. 2 Shaft Mine was evaluated to determine its eligibility for listing on the NRHP. The Phase II evaluation was conducted in accordance with the requirements of 36 CFR 800.4, and in consultation with the USACE. During the Phase II evaluation, various foundations and artifacts related to the Bennett No. 2 Shaft Mine were uncovered. These indicated that the mine operated between 1925 and 1951, which falls within the period of significance for natural ore mining on the Mesabi Iron Range, and that the site retains a high degree of integrity. As a result of the Phase II survey, the Bennett No. 2 Shaft was recommended as eligible for listing on the NRHP. A shaft mine dating to the natural ore mining period with this level of integrity is rare on the Mesabi Iron Range.

4.17.2.3 No Action Alternative

Historic properties identified in the FEIS would not be impacted under the No Action Alternative.

4.17.3 Environmental Consequences

> Phase III data recovery will be required as mitigation for adverse effects to the Bennett No. 2 Shaft Mine, an NRHP eligible site.

The Bennett No. 2 Shaft Mine would be adversely affected by the Proposed Project. The USACE has consulted with the SHPO concerning avoidance of adverse effect. The SHPO and the USACE agree that there is no practicable project avoidance of the Bennett No. 2 Shaft Mine. The USACE has notified the Advisory Council on Historic Preservation of this adverse effect. The USACE and the SHPO have also reviewed and concurred on a data recovery plan for this historic property. Once executed, the Programmatic Agreement for the Proposed Project will stipulate implementation and completion of the data recovery plan.

Impacts to the homestead site that were identified during the Phase I field surveys would be avoided by the Proposed Project. Any permit that the USACE may issue for the Proposed Project would be conditioned to require avoidance. If this Proposed Project changes effects to property, its eligibility for listing on the NRHP would need to be evaluated, and mitigation may be required if it is to be adversely affected.

At the time of FEIS preparation, the USACE was consulting with the Ojibwe Bands to identify properties of traditional religious and cultural importance within the APE, but had not completed that process. Historic properties of religious and cultural significance to the Ojibwe Bands may be adversely affected by the Proposed Project. Once executed, the PA for the Proposed Project will stipulate how consultation pertaining to these historic properties will be completed.

Because the Bennett #2 mine shaft, recommended as eligible for listing on the NRHP, would be destroyed, the effect to the historic property is adverse and significant. No effects are anticipated to the Hull-Rust-Mahoning Mine Historic District or the homestead site as it would be avoided by the Proposed Project.

At this time no TCPs have been identified, and therefore no effect to these properties has been identified. However, a programmatic agreement could result in identifying TCPs, which could change this determination.

4.17.3.1 East Stockpile Alternative

The potential environmental effects on historic properties related to the East Stockpile Alternative is the same as those identified for the Proposed Project.

4.17.4 Cumulative Effects

Cumulative effects to historic properties may be viewed from several different perspectives: impacts to historic structures, impacts to archaeological resources, and impacts to properties of traditional religious and cultural significance to the Ojibwe Bands.

Within the Proposed Project area there is a significant historic mining property, the Bennett No. 2 Shaft Mine, that has both archaeological and structural components. Adjacent to the Proposed Project there is the Hull-Rust-Mahoning Mine Historic District. Continued mining on the Mesabi Iron Range has in many cases eliminated, or altered, the landscape or structures resulting from prior mining activity, which may qualify for the NRHP. This is a cumulative effect of mining on historic mining properties that is inherent in the mining industry itself. The Hull-Rust-Mahoning Mine Historic District, a NHL, is the result of cumulative mining activity. There were no other historic buildings or structures identified within the APE.

Cumulative effects to archaeological resources as viewed from a traditional archaeological perspective would suggest that those impacts would not be significant. The footprint of the Proposed Project is not on, or adjacent to, any major waterways or lakes. Therefore, the potential for pre-contact archaeological resources would be considered to be low to moderate. Archaeological resources of the post-contact period may occur anywhere on the landscape. The background research and surveys conducted for the Proposed Project failed to identify any pre-contact archaeological resources, but did identify a homestead site and the Bennett Shaft Mine. Impacts to the Bennett No. 2 Shaft Mine would be mitigated and are also discussed in the previous paragraph. Impacts to the homestead would be avoided. Therefore, cumulative effects to archaeological resources should not be significant.

Cumulative effects to archaeological resources should not be significant.

The specifics of cumulative effects to historic properties of traditional religious and cultural significance to the Ojibwe Bands are relatively unknown. However, historic documentation and oral history clearly document Ojibwe occupation and use of the area immediately adjacent to the Proposed Project. The Bois Forte Band has ancestral ties to the Keewatin area and the Trygg Maps document a village site on Swan Lake at the time of the United States Land Office surveys in the mid to late 1800s. Landscapes such as the Laurentian Divide are part of Ojibwe oral history and traditional practices. From the signing of treaties in the nineteenth century to the expansion of mining operations today, there is little doubt that mining activities on the Mesabi Iron Range have significant cumulative effects to historic properties of traditional religious and cultural significance to the Ojibwe Bands; however, the details concerning these impacts are poorly understood at this time. A significant amount of consultation with the Ojibwe Bands remains to be done to take into account project effects on these properties.

4.17.5 Mitigation Opportunities

Mitigation occurs when a property that is eligible for listing on the NRHP would be adversely affected by a proposed project. A Phase II evaluation typically includes recommendations for project alternatives that would avoid impacts to the property. If impacts are unavoidable, the federal agency and the SHPO consult to resolve the adverse effect and agree on the appropriate treatment for the historic property (36 CFR § 800.6). If the historic property is significant primarily for its potential contribution to answering important research questions, Phase III data recovery may be the appropriate treatment. This is true primarily for archaeological resources.

Data recovery is intended to remove and record the archaeological information at a site through physical excavation and/or documentation. Each archaeological site is unique; therefore, research design is specific to the needs of a particular site. Phase III data recovery is more intensive than Phase I and Phase II investigations. The research is more detailed and focused on specific items identified in the Phase II survey. Due to the unique nature of a site, requirements for data recovery are determined through a process of consultation between the appropriate federal agency and the SHPO.

The adverse effect on the Bennett No. 2 Shaft Mine will be mitigated through data recovery. The data recovery plan has been approved by the SHPO and USACE. The provisions of the plan will be completed prior to any work that may affect the Bennett No. 2 Shaft Mine. Once executed, the PA will stipulate all mitigation work that must be completed prior to beginning any project activities that may affect the Bennett No. 2 Shaft Mine.

Historic properties of religious and cultural significance to the Ojibwe Bands may be adversely affected by the Proposed Project. If historic properties are identified, tribes would be consulted for possible mitigation.

4.18 FEDERAL TRUST RESPONSIBILITIES TO INDIAN TRIBES

This section discusses the Federal Trust responsibilities to the Ojibwe Bands in the 1854 and 1855 ceded territories as well as the historic treaty rights in those ceded territories that may be impacted as a result of the Proposed Project. The discussion centers on the importance of natural resources to the Ojibwe Bands and the cultural impacts that may result from the Proposed Project.

> The Proposed Project is located in the 1855 ceded territory. Potential impacts from the Proposed Project to plants, animals, and other resources are of concern due to cultural importance to American Indian Tribes.

4.18.1 Regulatory Framework

The regulatory framework that applies to the Proposed Project relates to the 1854 and 1855 treaties and the federal trust responsibility. The Ojibwe Bands' inherent right to hunt and fish in the 1854 Ceded Territory is specifically addressed in the 1854 Treaty. The 1855 Treaty does not specifically address these rights. The Proposed Project is located in the 1855 ceded territory. The USACE is the lead federal agency responsible for consultation with American Indian tribes for the Proposed Project. Additional information about consultation is discussed in Chapter 6.0.

4.18.1.1 Federal Trust Doctrine

The USACE is part of the U.S. Department of Defense (DoD), which can set policies and operational requirements for federal agencies housed in the DoD. In October 1998, the DoD adopted the American Indian and Alaska Native Policy. This policy established principles for agencies to follow when:

> *interacting and working with federally-recognized American Indian and Alaska Native governments (hereinafter referred to as "tribes"). These principles are based on tribal input, federal policy, treaties, and other federal statutes. The DoD policy supports tribal self-governance and government-to-government relations between the federal government and tribes…Concerns should be addressed prior to reaching decisions on matters that may have the potential to significantly affect the protected tribal resources, tribal rights, or Indian lands* (DoD, 1998).

The trust responsibilities for the DoD are derived from the U.S. constitution, treaties, statutes, and executive orders, which define a unique legal relationship between the United States and Indian Tribes. The DoD policy requires consultation with Tribes. Consultation must recognize this unique legal relationship of the United States to Federally Recognized Indian Tribes and be conducted on a government-to-government basis in recognition of inherent tribal sovereignty. The Corps trust responsibility toward the Ojibwe Bands is partially satisfied through the tribal consultation that occurs during the Section 106 process as described in Section 4.17 and Chapter 6.0. However, impacts occurring to tribal resources that do not qualify as historic properties may result in social, cultural, and economic impacts and must be considered under the federal trust responsibilities and the responsibility owed to the Bands as a result of treaty rights in the ceded territories.

4.18.1.2 Treaties and Treaty Rights

The current and proposed Keetac footprint is located in the 1855 Ceded Territory. This territory was ceded by the Mississippi, Pillager, and Lake Winnibigoshish bands of Chippewa (Ojibwe) to the United States. The Proposed Project is located approximately 12 miles west of another historic ceded territory, the 1854 Ceded Territory. This territory was ceded under the 1854 Treaty between the Chippewa of Lake Superior and the United States. Figure 4.18.1 shows the general location and boundaries of the ceded territories and tribal reservations within those territories.

1854 Treaty Rights and Ceded Territory

On September 30, 1854, the Bands of Chippewa residing near Lake Superior ceded the lands within the 1854 Treaty boundary to the United States government. Article 11 of the 1854 Treaty states that those that “reside in the territory hereby ceded, shall have the right to hunt and fish therein, until otherwise ordered by the President” (1854 Treaty Authority). In 1858, a letter responding to a protest of the Fond du Lac tribe that they needed the wild rice lakes to the south of their reservation stated that these southern lakes areas shall be added back to the Fond du Lac reservation, thus modifying the 1854 Treaty (Vennum, 1988: 261).

Treaty rights have been tested and upheld in a series of District and Supreme Court cases over the years. Tribes have filed suit against the State of Minnesota claiming harvest rights in both the 1854 and the 1837 ceded territories. In each case, legal rulings have confirmed that tribal communities do retain rights to hunt, fish, and gather plant resources (e.g., wild rice, maple sugar, etc.) in ceded territories (i.e., on and off reservation lands). Tribes continue to exercise their treaty rights. Tribes also work with other government jurisdictions in the co-management of natural resources within these ceded territories.

The Ceded Territory Conservation Code of the 1854 Treaty Authority was enacted as an ordinance pursuant to the Constitution and Bylaws of the 1854 Treaty Authority. This ordinance controls and regulates hunting, fishing, trapping, and gathering of resources for subsistence use in the 1854 ceded territory. The ordinance requires that all Band Members (enrolled members of the Bois Forte or Grand Portage Bands) carry a Ceded Territory identification card at all times while taking, possessing or transporting wild animals or plants.

Band Members with a Ceded Territory identification card can exercise their right to hunt, fish, trap, and gather for subsistence use on public lands and waters open to the public (publically owned and accessible to the public without charge) within the 1854 ceded territory. Similar to Minnesota state regulations, Band Members can also exercise their right to hunt, fish, trap, and gather on private property with landowner permission within the 1854 ceded territory. Commercial harvest (for the purposes of sale or barter) of fish, wildlife, and plants is regulated by the Ceded Territory Conservation Code and individual Bands' regulations. There is no commercial harvest allowed of big game, waterfowl, or small game, except furbearers through trapping. Commercial fishing is regulated with a special permit for both game and non-game fish species.

Gathering of wild rice for subsistence use is regulated by the 1854 Treaty Authority Code. Wild rice gathering activities can occur on federal, state, and county owned waters or managed waters that are open to the public within the boundaries of the 1854 ceded territory, but are restricted by seasonal regulations, harvest closure areas, watercraft type, and harvest methods.

Additionally, the Ceded Territory Conservation Code of the Fond du Lac Band of Lake Superior Chippewa was adopted by the Fond du Lac Band to regulate hunting, fishing, trapping, gathering, and resource management in the 1854 ceded territory. This Conservation Code regulates the harvesting activities of Fond du Lac Band members and is also intended to protect their rights under the 1854 Treaty.

The Fond du Lac Conservation Code requires current season issue tags for certain activities, in addition to a Ceded Territory License and/or Permit. This Code also requires that all Band Members (enrolled members of the Fond du Lac Band) carry a Ceded Territory identification card at all times while hunting, fishing, trapping, gathering or transporting wild animals or plants. Specific regulations for harvesting activities under this Code can be found in the amended Ceded Territory Conservation Code of the Fond du Lac Band of Lake Superior Chippewa, ordinance #02/92.

1855 Treaty Rights and Ceded Territory

In February of 1855, the Mississippi, Pillager, and Winnibigoshish bands of Chippewa (Ojibwe) ceded the lands within the 1855 Treaty boundary to the United States government. This cession resulted in the creation of reservations at Mille Lacs, Rabbit Lake, Gull Lake, Pokegama Lake, Sandy Lake, Leech Lake, Winnibigoshish Lake, Cass Lake, and on Islands in Rice Lake (US, 1900).

The closest reservation within the 1855 ceded territory to the Proposed Project belongs to the Leech Lake Band of Ojibwe (LLBO). This reservation is approximately 80 miles west of the Proposed Project, placing it within the 50 mile distance for LLBO's Treatment as an Affected Sovereign/State (TAS) designation for air quality. The Leech Lake Reservation encompasses over 864,000 acres within the reservation boundaries. and over 28,000 acres in size. Hunting and fishing agreements between the LLBO and the State of Minnesota were established in 1972, which prompted the LLBO to establish the Leech Lake Conservation Department in 1975. This department enforces natural resource regulations on reservation lands. These regulations apply to both tribal members and non-tribal members. The department enforces fish and game laws; regulates logging, wild rice harvesting, and plant resources; writes fire and wood cutting permits; and provides general protection of natural resources on the LLBO reservation.

4.18.2 Affected Environment

4.18.2.1 Resources Important to the Ojibwe Bands

While natural resources are generally important to the citizens of Minnesota for various reasons, including environmental, recreational, and economic, the Ojibwe world view inextricably links natural resources to spiritual beliefs and cultural identity. This section of the FEIS provides a discussion of the importance of natural resources to the Ojibwe Bands and the potential project effects on those resources, which must be considered in the USACE permit decision making process. The USACE is involved in an ongoing consultation process with the Ojibwe Bands to identify natural resources of importance to them, which may be affected by the project.

> Wild rice is very important to the Ojibwe and central to their identity. Wild rice is used as a subsistence food source and is a culturally, spiritually, and historically significant resource.

In traditional American Indian culture, many of the resources important to Indian Tribes are also natural resources. For the Ojibwe Bands, cultural practices and religious beliefs are tied to many plant and animal species that do not qualify for listing on the NRHP. Cultural impacts may result from the loss of public access to land where important resources are present, or an adverse effect on animal and plant populations associated with traditional practices.

Several specific natural resources important to Tribes were identified during the EIS scoping process and during formal consultation. These included wild rice, moose, deer, furbearers, grouse, and maple tree stands (sugar bushes). During consultation, impacts to wild rice were raised as of particular concern. The cultural significance of wild rice is summarized below.

> *Natural wild rice has been hand harvested as a source of food in the Great Lakes region for thousands of years. The Ojibwe people have a special cultural and spiritual tie to natural wild rice. Known to their people as Manoomin, it is revered as a special gift from the Creator* (MNDNR, 2008A).

Wild rice is very important to the Ojibwe and central to their identity. It is used for subsistence and is a culturally, spiritually, and historically significant. The Anishanabe (Ojibwe) stayed in Minnesota due to the abundance of wild rice. According to *Sacred Food as Medicine*, the Anishanabe believe that wild rice will always grow where they live. They consider wild rice a special gift as both food and medicine. This belief is “reflected in the Ojibwe use of wild rice as a food to promote recovery from sickness as well as for ceremonial purposes” (Vennum, 1988).

According to the MNDNR 2008 study, annual sales of state licenses for wild rice harvesting peaked in 1968 at over 16,000. In recent years, annual sales have averaged fewer than 1,500. In many instances, though, tribal harvesters are not required to buy state licenses. It is thought that more than 3,000 tribal members participate in wild rice harvesting, providing a statewide total (tribal and nontribal) of 4,000-5,000 individuals annually. A recent MNDNR survey found the estimated average annual hand harvest of natural stands to be 430 pounds of unprocessed natural wild rice per hand harvest individual in 2006 (MNDNR, 2008A). Therefore, the estimated amount of hand harvested wild rice is 2 million pounds per year.

Additionally, moose, deer, and furbearers are harvested primarily for their meat and hides. Maple tree stands (sugar bushes) produce sap, which is collected and boiled into maple sugar. These natural resources have historically been significant to the Ojibwe way of life.

4.18.2.2 No Action Alternative

With the No Action Alternative there would be no potential to abrogate treaty rights in the 1855 ceded territory or the 1854 ceded territory and there would be no further degradation of the natural environment and its resources.

4.18.3 Environmental Consequences

> Access to approximately 440 acres of state-owned land in the proposed east stockpile area would be lost due to the Proposed Project.

During final scoping of the EIS, the Fond du Lac Band, Leech Lake Band, and the 1854 Treaty Authority expressed concerns about potential direct, indirect, and cumulative effects to natural resources in the region. In general, concern was expressed about project air emissions and wetland losses as well as impacts to groundwater resources and treaty rights and the resulting economic and social impacts to the Ojibwe Bands. Potential biological impacts related to natural resources are discussed in other sections of this FEIS, including a discussion on wild rice resources in Section 4.7, cumulative effects to wild rice in Section 5.4, fisheries in Section 4.1.2, and wildlife in Section 4.2. Potential impacts to resources important to Indian Tribes are described below and in Section 4.22 – Socioeconomics.

4.18.3.1 Resources Important to the Ojibwe Bands

The list of natural resources important to the Ojibwe Bands is lengthy and the prioritization of those resources difficult. Potential impacts to plants and animals are of great concern to the Bands. In particular, impacts to game species, such as moose, deer, grouse, and furbearers, were identified as specific concerns during the EIS process. Potential biological impacts to fisheries, wildlife, and threatened and endangered species are discussed in Sections 4.1.2, 4.2, and 4.3, respectively.

According to *The Plants of the Ojibwe,* a publication of the Great Lakes Indian Fish and Wildlife Commission (GLIFWC, 1993), a number of plants have been identified as significant for subsistence, economic, cultural, spiritual, and/or medicinal purposes. This plant list was compared to the results from the MNDNR Natural Heritage database query generated for the Proposed Project. None of the plants listed in the database query were plants included in *The Plants of the Ojibwe*. Most plants listed in *The Plants of the Ojibwe* are common to northeastern Minnesota. These plant populations are not anticipated to be significantly impacted by the Proposed Project. The 2008 botanical survey located one individual pale moonwort that would be impacted by the Proposed Project. Two populations totaling 22 individuals of the proposed state proposed endangered trianglelobe moonwort would also be removed as a result of the Proposed Project. The Proposed Project would not remove any individuals of the special concern species clustered bur reed found on the site. Specific impacts to plants are discussed in Section 4.3.

Section 4.7 identified that water level changes in Swan Lake are not anticipated to have a significant impact on wild rice. Impacts to wild rice in Swan Lake or Hay Lake from increased sulfate concentrations are expected to be adverse; however, the significance of the effect is unknown. Over time, the sulfate levels from the Proposed Project would decrease in order to meet the state water quality standard, which could lead to a beneficial effect. It is not anticipated that wild rice resources known to be used by the Ojibwe would be impacted from a cultural standpoint. The opportunity to gather wild rice remains in the Proposed Project area. Cumulative effects including water quality impacts affecting wild rice are discussed in Sections 4.7 and 5.4. The opportunity to gather wild rice could be impacted if wild rice resources are negatively impacted.

Section 5.5 provides an analysis of potential cumulative effects from mercury emissions, which have the potential to impact air quality in both the 1854 and 1855 ceded territories. The analysis concluded that mercury emissions from the Proposed Project would add additional mercury to the environment as discussed in sections 4.9.7 and 5.5. An increase in mercury loading and fish contamination are anticipated in the six lakes analyzed for potential mercury impacts (tables 4.9.21, 5.5.2). These lakes are in the 1855 Ceded Territory. The contribution of the Proposed Project to cumulative mercury loading and fish contamination is small (Table 5.5.2). The MPCA

TMDL goal for mercury concentration in fish is 0.20 ppm, a concentration that is exceeded by a large margin in all six lakes evaluated in the 1855 ceded territory.

A discussion of mitigation for mercury contamination is discussed in Section 4.9.7.4.

Refer to Section 5.13 for a discussion of fish consumption risk and ecological risks from emission sources generated by the Proposed Project. The chemicals thought to be most contributing to human health risk are dioxin, arsenic, and PAHs. The analysis indicates that emission sources from the Proposed Project do not pose a risk to ecological receptors above the USEPA guidelines for screening level risk assessments. Based on that analysis, cultural impacts from emissions sources by the Proposed Project are not anticipated.

The Proposed Project is located within the 1855 ceded territory on both public land (leased from the State of Minnesota) and private property owned by the Project Proposer. The Proposed Project would not limit access to lands within the 1854 ceded territory, and is not expected to significantly impact treaty rights to hunt, fish, and gather in the 1854 ceded territory.

Approximately 440 acres of the proposed east stockpile area are located on state-owned land within the 1855 ceded territory. This area was accessible to the public via snowmobile trail until the end of 2008, at which time the Project Proposer entered into a lease agreement for mining activities with the state of Minnesota. Figure 4.18.2 shows the lands currently owned by the state of Minnesota, as well as the state land leased by the Project Proposer, which is not accessible to the public. Other lands shown as state-owned on the figure are already leased and part of the existing mining operation. These areas are closed and will remain closed to public access. The loss of public access to a portion of the proposed east stockpile area creates a lost opportunity to hunt, gather, and use this land.

4.18.3.2 East Stockpile Alternative

The potential environmental effects on public access within the vicinity of the East Stockpile Alternative is the same as those identified for the Proposed Project.

4.18.4 Mitigation Opportunities

Mitigation for the loss of access to state-owned land is not proposed. In the past, the Project Proposer has allowed public access for activities on its private lands located away from the Keetac mine and active mining areas. Mitigation for potential wild rice impacts are discussed in Sections 4.7 and 5.4. Sulfate removal technologies are discussed in Section 4.4.1. Impacts to the Ojibwe Bands resulting from the Proposed Project may require mitigation if they rise to the level of significance. Ongoing consultation between the USACE pursuant to federal trust responsibility will define those impacts prior to signing the ROD.

4.19 RECREATIONAL TRAILS

> The Proposed Project would impact the Hibbing South Spur snowmobile trail.

The Project Alternatives Section of the FSDD states that, “the Proposed Project will likely impact snowmobile trails. If adverse impacts are identified,…new trail locations will be included and evaluated in the EIS.” The FSDD also stated that a map of the snowmobile trails and Mesabi Trail would be included in the EIS. The FSDD stated that significant impacts to trails are not expected. This section provides information on the recreational trails in proximity to the Proposed Project.

4.19.1 Affected Environment

There are several recreational trails running through the Proposed Project area as shown on Figure 4.19.1. These include the Mesabi Trail (a walking and biking trail) as well as two snowmobile trails.

4.19.1.1 Snowmobile Trails

The snowmobile trail system in Minnesota is partially funded by the MNDNR Minnesota Trails Assistance Program, also known as the Grants-in-Aid Program (GIA). The goal of this program is the creation and maintenance of locally initiated trails that are financially assisted by the state. Part of the financial assistance from the state includes preparing maps of the trails. There are two GIA snowmobile trails that cross the Proposed Project area: the Lawron Trail and the Hibbing South Spur (see Figure 4.19.1). The Lawron Trail (Trail #148) is sponsored by Itasca County, while the Hibbing South Spur (Trail #206) is sponsored by St. Louis County. Ownership of the trails remains private, but the snowmobile clubs and respective counties have worked with landowners to obtain easements in order to route trails and operate snowmobiles across private property. Under M.S. 604A.21 – Civil Liability Limitations, landowners are exempt from liability of recreational users on their property as long as the landowner is allowing access to the property without charging a fee.

4.19.1.2 Mesabi Trail

The Mesabi Trail is owned, operated and maintained by the St. Louis and Lake Counties Regional Railroad Authority. This walking and bicycling trail is planned to be extended along the length of the Iron Range from Grand Rapids to Ely. It is a paved trail closed to motorized vehicles with exception of a few short Mesabi Trail segments that allow snowmobiles to connect to another trail. Major trail funding is from federal, state, and local grantors.

The trail segment between Nashwauk and Hibbing is complete. From Nashwauk, the trail extends eastward past O'Brien Lake Reservoir to the north side of the City of Keewatin. The trail turns south through Keewatin then east along TH 169 before turning north along the east side of CSAH 60 and then through Kelly Lake. The trail then continues north of Kelly Lake, turns east crossing over CSAH 60 and goes to Letonia. Figure 4.19.1 shows the location of the Mesabi Trail alignment.

4.19.1.3 No Action Alternative

Under the No Action Alternative, no trails would be impacted.

4.19.2 Environmental Consequences

Impacts to recreational trails were considered for any direct Proposed Project activities that prohibit or eliminate the use of a trail, such as land alterations due to mining. Trails would also be impacted by the designated AAQB, which limits public access within that boundary. As part of the Proposed Project's PSD air permit application, an air quality modeling analysis was completed in order to demonstrate compliance with applicable state and federal ambient air quality standards. The Proposed Project must be able to show compliance with state and federal ambient air quality standards in locations where the general public has access. In the air quality modeling analysis, the Project Proposer was required to define the AAQB. The Project Proposer plans to restrict public access to the site using a combination of natural physical barriers, signage, gates, fencing, and patrols. Public recreational trails inside the Project Proposer's AAQB would be relocated outside of the AAQB prior to project operation.

> Public trails must be located outside a facility's Ambient Air Quality Boundary (AAQB).

4.19.2.1 Snowmobile Trails

4.19.2.1.1 Hibbing South Spur Trail (Trail #206)

The Proposed Project would impact the Hibbing South Spur snowmobile trail as shown on Figure 4.19.1. Hibbing South Spur connects to the Alborn Trail on the southeast side of the tailings basin and continues north across TH 169 through the proposed east stockpile.

One segment of the Hibbing South Spur Trail would be impacted by the Proposed Project. This trail segment runs from approximately the BNSF railroad tracks to the north side of Kelly Lake and would need to be relocated outside of the proposed east stockpile and AAQB. Another location for the trail has not yet been identified, and therefore the effect to the trail is potentially significant. However, the effect to recreation in the area is less than significant.

Use of existing railroad crossings by snowmobiles on the Hibbing South Spur Trail may not be available for a new reroute of the trail. Reroute alignments would try to use existing crossings, but would be dependent on where private property access is granted for the reroute alignment. New crossings would require Burlington Northern Santa Fe Railroad approval, crossing alterations to the railroad track, and warning signage.

The Hibbing Chisholm Path Blazers Club (Club) investigated trail alternatives, checking on potential use of private property and railroad crossings.

> Based on the current timelines for construction and operation of the Proposed Project, the snowmobile trails may need to be rerouted for use by 2013.

Alternative Route #1

The most promising route is to continue utilizing the majority of the existing route with modifications in the Kelly Lake area. The Club is working with the Project Proposer and private property owners to determine alternative routes, which would allow the trail to remain west of the Kelly Lake residential area and along the east edge of the Proposed Project outside of the AAQB and north of the railroad tracks. Moving the existing trail corridor east, out of the Proposed Project area, would move the trail closer to residential areas in Kelly Lake. This has the potential to create noise impacts and potential safety issues for residents. Construction of a new trail would require land clearing, which includes tree cutting and removal.

Alternative Route #2

If an alternative trail route in the Kelly Lake area is not feasible, the existing trail corridor would close, and there would be no trail along the eastern edge of the Proposed Project, creating dead ends at two points in the trail. The trail segment south of the existing southeast stockpile would start/end at the railroad tracks and head south. The trail segment north of Kelly Lake would start/end just west of the intersection of the Hibbing South Spur trail and the Mesabi Trail and head northeast. This would disconnect the Hibbing South Spur Trail and its connections to other trails within the area’s snowmobile trail network.

Depending on where the trail is rerouted, signs, fences, or other deterrents may be used to keep snowmobiles on the trail and away from active mining operations while on Keetac property.

4.19.2.1.2 Lawron Trail (Trail #148)

The Proposed Project would not affect the present route of the Lawron Trail. The current route of this trail connects to the Alborn Trail on the southwest side of the tailings basin along the O'Brien Diversion Channel, then proceeds into the City of Nashwauk, where it continues north along the west side of the existing northwest stockpile. Direct impacts from the Proposed Project are not anticipated to the Lawron Trail.

4.19.2.2 Mesabi Trail

The existing Mesabi Trail is outside of the Proposed Project Boundary; therefore, the project would not affect this trail segment.

4.19.2.3 East Stockpile Alternative

Air quality modeling to predict 1-hour emission levels for NO_2 was used to determine whether the Hibbing South Spur snowmobile trail would be required to relocate. The results of this modeling data indicate that the East Stockpile Alternative would not impact the Hibbing South Spur snowmobile trail, and therefore the trail would not have to be relocated. However, since PM_{10} is very close to the standard, the MPCA has recommended that the Project Proposer accept permit conditions requiring remodeling of particulate emissions if changes occur at the facility that affect any particulate emission source or rate, and/or change the source location and stack parameters.

4.19.3 Mitigation Opportunities

4.19.3.1 Hibbing South Spur Trail (Alternative Route #1)

The Project Proposer has been working with the Club to identify the trail segments that would need to be rerouted as a result of the Proposed Project. The Project Proposer has committed to provide advance notification of the need to close the trail so that the Club has enough time to make the necessary arrangements to reroute the trail. If the trail reroute location identified by the Club includes any portions of Keetac property, the Project Proposer would assist the Club with Keetac property access issues. The Project Proposer is cooperating with the Club in allowing use of their land as available.

If necessary, the relocated Hibbing South Spur Trail alignment would be finalized and constructed as landowner permission is gained. No analysis of the potential environmental impacts associated with the reroute is included as part of this FEIS since the exact route has not been identified.

Based on the current timelines for construction and operation of the Proposed Project, the snowmobile trails may need to be rerouted for use by 2013. If the Proposed Project moves forward as planned, St. Louis County would remain the local sponsor for the new snowmobile trail working with the Club, MNDNR, the Project Proposer, and landowners to get it constructed. This would require following the MNDNR guidelines and acquiring necessary permits for new snowmobile trail construction.

City of Hibbing zoning ordinance Section 8.50 allows for operation of a snowmobile on non-major roadways, such as city streets. The ordinance provides greater detail for traffic control and other regulations of snowmobile use within the city limits. A trail reroute alignment could potentially use non-major roadways for the trail if no other alignment options were available.

The MNDNR Snowmobile Trails Assistance Program offers GIA for capital improvements of GIA funded and maintained trails. These grants are reimbursed based on where eligible costs are matched at up to 65 percent. A guideline for project eligibility is that the total cost of the project should be approximately 20 percent or more of the existing maintenance and grooming grant. Major reroute projects involving existing GIA trails are considered a priority for this funding. MNDNR may require environmental review for the Grants-in-Aid trail relocation, consistent with state regulatory requirements, once a reroute alignment is finalized.

4.20 VISUAL IMPACTS

The SEAW evaluated potential visual impacts associated with the Proposed Project. The FSDD stated that visual impacts from the Proposed Project are not anticipated to be significant. Additional information about potential visual effects due to lighting, structures, and operations are discussed below, as well as mitigation options for potential impacts.

4.20.1 Affected Environment

> Reclamation of the stockpiles occurs according to permit requirements, which include revegetation. As vegetation grows, the visual impacts of stockpiles decrease. Existing vegetation and topography also reduce the visual impact of existing mining activities.

4.20.1.1 Existing Conditions

The Keetac plant site is approximately one mile north of TH 169 and slightly less than one mile to the nearest residence in the City of Keewatin. The plant facilities are visible from the highway and from parts of the city. There is an elevated railroad bed between the plant site and TH 169, which limits the view of general operations at the plant from TH 169. Numerous trees limit the view of the plant from the City of Keewatin.

There are several potential air emissions plumes at the existing Keetac facility. These plumes are most visible during cold winter months. Their formation is dependent on many factors, including air temperature, exhaust temperature, air moisture, exhaust moisture, and wind conditions. These air emissions plumes are not consistently visible due to the nature of the conditions required for formation. At times, the plant can have several air emissions plumes, and at other times, there may not be any plumes.

At its closest point, the mine is approximately one-third of a mile from the City of Keewatin. Mining activities occur 24 hours per day. Site lighting includes both fixed and mobile vehicle lighting. Haul trucks at night cause sporadic vehicle lighting, visible to the surrounding landscape.

Mining activities are visible from County Highways 79 and 63, as well as from Kelly Lake. Additionally, several small neighborhoods and homesteads in the area are in visual contact with current mining activities. The existing northwest stockpile and existing southeast stockpile are both visible to residential areas in Kelly Lake and Keewatin. Reclamation of the stockpiles occurs according to permit requirements, which include revegetation. As vegetation grows, the visual impacts of stockpiles decrease. Existing vegetation and topography also reduce the visual impact of existing mining activities.

The tailings basin is south of TH 169 and is visible from the highway. From the exterior dam, it appears as a vegetated slope; tailings disposal activities occur within the exterior dam. The tailings basin pipeline stretches across TH 169 depositing tailings from the concentrating process to the active portion of the tailings basin. The tailings basin pipeline is visible from TH 169. Its visual sight impact is consistent with other tailings basin pipelines in the area. The tailings basin is visible from several surrounding residences and from the City of Keewatin.

4.20.1.2 No Action Alternative

There would be no additional visual impacts from the No Action Alternative as the facility has operated as such for some time and no additional changes are needed to continue to operate. The visual impacts associated with the No Action Alternative would be consistent with those described in Section 4.20.1.1 – Existing Conditions.

4.20.2 Environmental Consequences

4.20.2.1 Proposed Action Alternative

4.20.2.1.1 Plant Site

Current infrastructure at the Keetac plant including parking lots, rail yards, and travel routes are sufficient to accommodate the Proposed Project. No additional travel infrastructure would be required to support the Proposed Project. At night, these areas are to be lit to normal safety standards, but at the time of the FEIS preparation, no specific plans for additional lighting had been prepared. The Project Proposer would decide on the location and types of additional lighting during the final design phase of the Proposed Project.

> The proposed east stockpile would be visible from County Highways 79 and 63, and residences located at Kelly Lake.

Air emissions plumes from stacks at the plant are one of the main visual impacts associated with the Proposed Project. The Proposed Project would add an air emissions plume. The existing plumes would not be affected by the Proposed Project. Air emissions plumes would be visible during cold weather when a condensation plume can form.

4.20.2.1.2 Mine Pit

Mine site operations would be conducted 24 hours per day. The Proposed Project would require both fixed lighting and vehicle lighting during the night. Lights and vehicle operations in the mine pit should not be a visibility issue as they would be below the ground surface.

4.20.2.1.3 Stockpile Areas

Two new surface overburden stockpiles would be used for the Proposed Project: the proposed east stockpile and the proposed south stockpile. The view of the proposed south stockpile has some screening from existing berms and mature trees. The proposed east stockpile would be visible from County Highways 79 and 63 and residences located at Kelly Lake. The proposed east stockpile would add potential visual impacts to Kelly Lake.

Lights from heavy haul trucks may be visible to the surrounding landscape during hauling of overburden and waste rock to the top of the stockpiles, which would eventually reach heights of approximately 300 feet above the existing ground level. At least one portable light tower would normally be stationed at the truck dumping station on the stockpile and would be visible from a distance as the stockpiles increase in height.

4.20.2.1.4 Tailings Basin

The Proposed Project would raise the tailings basin dam by approximately 58 feet from the estimated No Action Alternative elevation. For the No Action Alternative, the tailings basin is estimated to be at 1,554 mean sea level (MSL) elevation. For the twenty-five year planned operating period for the Proposed Project, the tailings basin would increase in height to approximately 1,612 feet MSL by the year 2036.

4.20.2.2 Visual Effects Analysis

The Proposed Project's mining activities, including proposed stockpile and tailings basin locations, were digitally evaluated using existing and proposed topographical elevations (digital elevation model or DEM) to determine visual impacts to the surrounding landscape, primarily to the City of Keewatin, residents of Kelly Lake, the Hull Rust Mahoning Mine View in Hibbing, Minnesota, and other locations within adjacent watersheds. Figure 4.20.1 shows the location of the DEM sites evaluated for visual impacts from the proposed east stockpile, proposed south stockpile, and the tailings basin at the completion of the Proposed Project. The DEM is a worst case scenario as it accounts for topography only and does not incorporate other screening such as trees. Tables 4.20.1, 4.20.2, and 4.20.3 summarize the results of the DEM analysis for the tailings basin, proposed south stockpile, proposed east stockpile, and East Stockpile Alternative. Distances for the proposed east stockpile and East Stockpile Alternative were measured from each stockpile's center point as this would be the highest point of that mine feature.

TABLE 4.20.1 VISUAL EFFECTS – TAILINGS BASIN

Vantage Point on Landscape	Project Feature (measured at highest elevation)	Distance (miles)	Visible (Yes/No)
Central Kelly Lake Development	No Action Alternative TB	3.6	No
	Proposed Tailings Basin	3.6	No
Development at Intersection of Old Hwy 169 and TH 169	No Action Alternative	2.1	No
	Proposed Tailings Basin	2.1	No
Hull Rust Mine View	No Action Alternative TB	7.2	No
	Proposed Tailings Basin	7.2	No
NE Keewatin	No Action Alternative TB	2.5	No
	Proposed Tailings Basin	2.5	No
North Kelly Lake Development	No Action Alternative TB	4.3	No
	Proposed Tailings Basin	4.3	No
North Nashwauk	No Action Alternative TB	5.8	No
	Proposed Tailings Basin	5.8	No
North West Shore Swan Lake	No Action Alternative TB	7.6	No
	Proposed Tailings Basin	7.6	No
NW Keewatin	No Action Alternative TB	2.9	Yes
	Proposed Tailings Basin	2.9	Yes
SE Keewatin	No Action Alternative TB	2.1	No
	Proposed Tailings Basin	2.1	Yes
South Kelly Lake Development	No Action Alternative TB	3.4	Yes
	Proposed Tailings Basin	3.4	Yes
South Nashwauk	No Action Alternative TB	5.6	No
	Proposed Tailings Basin	5.6	No
SW Keewatin	No Action Alternative TB	2.7	No
	Proposed Tailings Basin	2.7	No
West Central Shore Swan Lake	No Action Alternative TB	8.0	No
	Proposed Tailings Basin	8.0	No

TABLE 4.20.2 VISUAL EFFECTS – PROPOSED SOUTH STOCKPILE

Vantage Point on Landscape	Project Feature (measured at highest elevation)	Distance (miles)	Visible (Yes/No)
Central Kelly Lake Development	Proposed South Stockpile	4.0	No
Development at Intersection of Old Hwy 169 and TH 169	Proposed South Stockpile	3.2	Yes
Hull Rust Mine View	Proposed South Stockpile	7.7	No
NE Keewatin	Proposed South Stockpile	1.0	Yes
North Kelly Lake Development	Proposed South Stockpile	4.5	No
North Nashwauk	Proposed South Stockpile	3.6	No
North West Shore Swan Lake	Proposed South Stockpile	6.9	No
NW Keewatin	Proposed South Stockpile	0.4	Yes
SE Keewatin	Proposed South Stockpile	1.1	Yes
South Kelly Lake Development	Proposed South Stockpile	4.0	No
South Nashwauk	Proposed South Stockpile	3.8	No
SW Keewatin	Proposed South Stockpile	0.4	No
West Central Shore Swan Lake	Proposed South Stockpile	7.8	No

TABLE 4.20.3 VISUAL EFFECTS – PROPOSED PROJECT AND EAST STOCKPILE ALTERNATIVE

Vantage Point on Landscape[1]	Project Feature (measured at highest elevation)	Distance (miles)	Visible (Yes/No)
Central Kelly Lake Development	Proposed East Stockpile	0.7	Yes
	East Stockpile Alternative	0.7	Yes
Development at Intersection of Old Hwy 169 and TH 169	Proposed East Stockpile	1.3	Yes
	East Stockpile Alternative	1.3	Yes
Hull Rust Mine View	Proposed East Stockpile	4.4	No
	East Stockpile Alternative	4.4	No
NE Keewatin	Proposed East Stockpile	2.3	Yes
	East Stockpile Alternative	2.3	Yes
North Kelly Lake Development	Proposed East Stockpile	1.2	Yes
	East Stockpile Alternative	1.2	Yes
North Nashwauk	Proposed East Stockpile	6.9	No
	East Stockpile Alternative	6.9	No
North West Shore Swan Lake	Proposed East Stockpile	9.9	No
	East Stockpile Alternative	9.9	No
NW Keewatin	Proposed East Stockpile	2.9	Yes
	East Stockpile Alternative	2.9	Yes
SE Keewatin	Proposed East Stockpile	2.5	No
	East Stockpile Alternative	2.5	No
South Kelly Lake Development	Proposed East Stockpile	0.9	Yes
	East Stockpile Alternative	0.9	Yes
South Nashwauk	Proposed East Stockpile	7.1	No
	East Stockpile Alternative	7.1	No
SW Keewatin	Proposed East Stockpile	3.0	Yes
	East Stockpile Alternative	3.0	Yes
West Central Shore Swan Lake	Proposed East Stockpile	10.6	No
	East Stockpile Alternative	10.6	No

[1] From vantage point center point to feature center point

Residents in the City of Keewatin, Kelly Lake, and surrounding neighborhoods can view several areas of Keetac, including the plant site, tailings basin, and stockpiles. The proposed south stockpile, proposed east stockpile, and tailings basin would be visible to local residents. The extent of the visibility is dependent on the proximity to the Proposed Project. Swan Lake and Nashwauk residents would have little to no visibility of the Proposed Project, while Kelly Lake and Keewatin residents would see at least a portion or all of the Proposed Project. The Hull Rust Mahoning Mine View, located in Hibbing, Minnesota, is recognized as a National Historic Landmark. The visitor's center and overlook are approximately four miles from the Proposed Project, while the boundaries of the landmark are less than one-quarter mile. The DEM showed that the proposed stockpiles and tailings basin would not be visible from the visitor's center and overlook. Section 4.17 discusses the significance of the Hull Rust Mahoning Mine in greater detail.

The taconite processing plant would create an additional air emissions plume, which would cause an adverse visual effect. This effect is expected to be less than significant. Mine site operations lighting would have no effect on the environment as the majority of the lighting would be below ground level. The proposed east stockpile would have an adverse and significant visual effect due to its height and proximity to residents. The increased tailings basin height would cause an adverse visual effect, however the effect is anticipated to be less than significant relative to its existing elevation and proposed height increase.

4.20.2.3 East Stockpile Alternative

Although the East Stockpile Alternative would move the stockpile further west of the residents in Kelly Lake (approximately 470 - 1,100 feet) the visual effect would still be adverse and significant due to stockpile height and proximity to residents. At the center point, the East Stockpile Alternative's maximum height would be 200 feet greater than the proposed east stockpile.

4.20.3 Mitigation Opportunities

Due to the proximity of the plant site to TH 169, plant facilities are visible from the highway. An elevated railroad bed between the plant and TH 169 and mature trees that help block the visual sight line to the plant help minimize visual impacts. Additional trees and vegetation could be planted to assist in screening of the plant site.

Some of the local topography is forested with deciduous tree species that average 60 to 80 feet at maturity. These tree species help to screen full, unobstructed, views of mining activities from several sensitive areas including Kelly Lake, residences in the City of Keewatin, and TH 169. Reclamation of the proposed stockpiles and tailings basin includes revegetation that would change the view to include a vegetated slope. Introduction of tress could further block the view in some areas. Other measures, though not required, include construction of vegetated barrier berms between homes and the mine site. These measures would also help reduce noise impacts.

The Project Proposer can consider options to help minimize light pollution on the surrounding area during night time operations. The Project Proposer lights the grounds using directional lighting, which is designed to direct the light to the ground where it is needed. Additionally, shielded light reflectors, light covers, and the lowering of light masts could be used to reduce stray night time light from mining activities.

4.21 INFRASTRUCTURE AND PUBLIC SERVICES

The FSDD states that, "the EIS will discuss the ability of the City of Nashwauk and the City of Keewatin to accommodate future infrastructure demand due to population growth [and] socioeconomic issues, including demographic and employment trends." The potential impact to nearby water supply systems is discussed in Section 4.5 – Groundwater Resources. Information on socioeconomics is presented in Section 4.22.

> Significant impacts to infrastructure are not anticipated from the Proposed Project, which would use existing, major infrastructure currently serving the Keetac facility.

4.21.1 Affected Environment

TH 169 is the main highway running northeast-southwest along the Iron Range and is located between the Proposed Project sites (mine pits, stockpile areas, and plant) and tailings basin. County Road 16 (1^{st} Street) connects TH 169 through the City of Keewatin to the plant site.

Burlington Northern Santa Fe Railroad (BNSF) serves the Iron Range running parallel to TH 169 in the vicinity of the Proposed Project. BNSF owns the track going east of Keewatin that connects directly to the main shipping terminal in Superior, Wisconsin.

The Iron Range is served by two major natural gas pipeline transmission companies (Great Lakes Gas Transmission and Northern Natural Gas). The closest field source delivery point to the Proposed Project site is the Great Lakes Gas Transmission Company facility located in Blackberry Township near U.S. Highway 2.

Electrical transmission lines are located throughout the area, providing electrical power. High voltage transmission lines located near the Proposed Project include a double circuit 115 kV line running along the east side of TH 169 that connects the Nashwauk Substation to the east and the Blackberry Substation further to the south. A 230 kV line is also located approximately 7 miles north of the site connecting to the Shannon Substation north of Chisholm. All of these high voltage transmission lines are owned by Minnesota Power, the regional electrical utility supplier.

4.21.1.1 No Action Alternative

The No Action Alternative for this project would not result in additional impacts on local infrastructure. The necessary infrastructure to continue to operate the facility is in place and no additional infrastructure resources are needed under this alternative.

4.21.2 Environmental Consequences

As described in greater detail in the following paragraphs, the Proposed Project does not require additional infrastructure or public services, and therefore no change or effect is expected to infrastructure or public services. Capacity exists to accommodate anticipated Proposed Project infrastructure and public service needs.

4.21.2.1 Roadways

The Proposed Project is located at an existing site, which is served by TH 169 and County Road 16. These roadways are not expected to need improvement as a result of the Proposed Project.

Additional employees are expected to travel on local service roads, highways, and TH 169 within the Proposed Project vicinity; however, this increased employee traffic is not expected to create traffic congestion. A traffic analysis was completed as part of this FEIS. Results of that analysis are discussed in Section 4.15 – Traffic Impacts.

4.21.2.2 Railroads

A rail siding on the south side of the existing Keetac facility provides access to the existing BNSF railroad tracks, located approximately one mile south of the plant and one mile east of the City of Keewatin. With increased production from the Proposed Project, the number of rail cars would increase, but no modifications or improvements to the siding or the main rail line would be necessary.

4.21.2.3 Gas Pipeline

Natural gas is used at the existing Keetac facility for operation of the indurating furnaces. The Project Proposer proposes to use a mixture of 50 percent biomass and 50 percent natural gas, with coal and fuel oil as backup fuels. The existing natural gas pipeline would accommodate the Proposed Project with no modifications necessary. Biomass would be purchased from a supplier to be processed in the proposed wood chip dryer at the Keetac facility. Further discussion on biomass is found in Section 5.1.

4.21.2.4 Electrical Transmission Lines

Minnesota Power is the regional electric utility company serving the Iron Range and northeastern Minnesota. Minnesota Power’s industrial customers include Keetac and other mining companies, paper mills, and municipalities. Minnesota Power’s transmission network is interconnected with the transmission grid and is part of a regional transmission organization called the Midwest Independent System Operation (MISO).

The power required for the Proposed Project can be provided from existing sources, market sources, market purchases of power, and from power production facilities that are planned or proposed at this time. The Proposed Project does add additional demand to the power supplier. Any new power production facilities constructed would take the Proposed Project into account; however, it has not been identified that new production facilities would be a direct result of the Proposed Project.

4.21.2.5 Water and Sanitary Sewer Services

Dewatering operations, required by the Proposed Project, may decrease the amount of groundwater that is ultimately available to the City of Keewatin. The Project Proposer has negotiated a contingency plan with the City of Keewatin that includes a well monitoring plan for city wells potentially affected by the Proposed Project.

Additionally, according to the City of Nashwauk wellhead protection plan, the nearby LaRue Mine Pit supplies water to the to City of Nashwauk wells via groundwater seepage. MNDNR hydrologic information in the area, however, indicates that the dewatering of Keetac mine pits is not likely to affect the City of Nashwauk water supply. The Project Proposer has negotiated a contingency plan with the City of Nashwauk that includes a well monitoring plan for city wells potentially affected by the Proposed Project.

The MDH well database was queried to determine if any private water wells are likely to be impacted by mine pit dewatering. The available well logs were reviewed for the areas with private wells shown on Figure 4.13.1. The database query found 36 private well records. None of the private wells were screened in the Biwabik Iron Formation (BIF). All but two wells were less than 200 feet deep and screened in the overburden aquifers. Two wells were over 300 feet deep and screened in the Virginia Formation. The reported static water levels were all less than 50 feet, indicating the source aquifers are perched above the BIF. Based on the screened depths and water levels, wells are not anticipated to be impacted by dewatering. Wells not in the database are likely of similar construction and depth, since local drilling companies typically know the area.

Potential impacts on water use are discussed in more detail in Section 4.5. No additional infrastructure relating to water and sewer services at the Keetac facility would be needed as a result of the Proposed Project.

Treatment of domestic wastewater produced by the facility's main processing plant is completed with an onsite wastewater treatment plant (WWTP). The WWTP is designed to treat an average of 40,000 gallons per day (gpd). Sufficient capacity exists within the WWTP that would not require an upgrade with the Proposed Project.

The Keetac facility also generates sanitary wastewater in the coarse crusher facility. In this facility a septic tank and drain field system are used to treat the wastewater. The source of wastewater from the coarse crusher facility is in the crusher's employee shower and change house at a rate less than 10,000 gpd. The coarse crusher facility would not be expanded with the Proposed Project. Wastewater issues are discussed in Section 4.4.1.

4.21.2.6 Socioeconomic Impacts on Infrastructure

An influx of people into these two communities would intensify the existing need for sewer and water improvements, as identified in the *Itasca County Community Readiness Assessment-2008*. The City of Keewatin and the City of Nashwauk would need to evaluate population growth, as there are also larger nearby cities. Combined impacts from additional, large-scale proposed projects in the area could cause housing availability issues during the construction and operation phases for proposed projects on the Iron Range. Socioeconomic analysis completed for this FEIS is discussed in greater detail in Section 4.22.

4.21.2.7 East Stockpile Alternative

The potential environmental effects on infrastructure and public services related to the East Stockpile Alternative is the same as those identified for the Proposed Project.

4.21.3 Mitigation Opportunities

Significant impacts to infrastructure are not anticipated from the Proposed Project, which would use existing, major infrastructure serving the Keetac facility. No improvements to the existing infrastructure have been identified.

Potential water use impacts due to mine pit dewatering are being addressed by contingency plans negotiated between the Cities of Keewatin and Nashwauk and the Project Proposer, which include a well monitoring plan, mitigation response plan, and funding mechanism.

Communities on the Iron Range are preparing for a possible influx of people due to a number of proposed projects in the region. Numerous agencies and organizations are assessing needs and identifying implementation measures to meet those needs. The City of Keewatin and the City of Nashwauk, among other communities in the Proposed Project vicinity, are participating in these planning processes. The City of Keewatin has already requested funding from Iron Range Resources for sewer and water improvements.

4.22 SOCIOECONOMICS

As stated in the FSDD, this section discusses social and economic impacts of the Proposed Project, including “the direct and indirect effects on local economic development, tax base and demand for public services.” In reviewing potential social and economic impacts, the analysis focused on including the nearest cities to the Proposed Project: Grand Rapids, Hibbing, Keewatin, and Nashwauk. These communities have the largest populations within a reasonable commuting distance of the Proposed Project.

The following sections describe in further detail the existing social and economic setting and potential economic, employment, housing, tax revenue impacts, and mitigation opportunities from the Proposed Project.

4.22.1 Affected Environment

4.22.1.1 Population Trends

Based on U.S. Census data, the population trends for cities in the vicinity of the Proposed Project show a general decline between 1980 and 2000, although Itasca County as a whole experienced moderate growth (2.1 percent) during this time period (see Table 4.22.1). St. Louis County experienced a 9.8 percent decline from 1980-2000. Some of the decline in population may be due to the closing or downsizing of some major employers in the area during that time period. For example, the Butler Taconite Facility closed in 1985.

The State Demographer’s population projections, published in 2007, for the cities near the Proposed Project show a continued decline for two of the four cities through 2035, though at a slower rate. Itasca County was projected to grow about 10 percent by 2035, while the state of Minnesota is projected to grow by over 30 percent. St. Louis County was projected to stabilize with a growth rate just under one percent between 2000 and 2035. According to the State Demographer’s Office, the 2007 data projections do not take into account the influence that the Proposed Project and other proposed industrial projects on the Iron Range may have on this area. The population projections are based on historical demographic trends.

TABLE 4.22.1 POPULATION TRENDS

Population	1980	1990	2000	% Change 1980-2000	2020 Projection	2035 Projection	% Change 2000-2035
Grand Rapids	7,934	7,976	7,764	-2.1	8,696	8,389	8.0
Hibbing	21,193	18,046	17,071	-19.5	15,705	15,036	-11.9
Keewatin	1,443	1,118	1,164	-19.3	1,199	1,189	2.1
Nashwauk	1,419	1,026	935	-34.1	928	883	-5.5
Itasca County	43,069	40,863	43,992	2.1	47,630	48,590	10.5
St. Louis County	222,229	198,213	200,528	-9.8	200,490	202,240	0.8
Minnesota	4,075,970	4,375,099	4,919,479	20.7	5,943,240	6,446,300	31

Source: Minnesota State Demographer’s Office (2008)

According to the Socioeconomic Study completed for the Proposed Project, although population projections show an increase in the two-county area in the near future, demographic information shows that the population is growing older, with more people over the age of 55 living in the area than those in their 20s. Because of this trend, significant drops are expected in the available number of workers in the Iron Range for both 2015 and 2020 (DEED, 2006).

4.22.1.2 Minority and Low-Income Populations

The Socioeconomic Study evaluated low-income and minority populations in Grand Rapids, Hibbing, Keewatin, Nashwauk, Itasca County, and St. Louis County for any adverse effects to human health, economic, or social effects. An evaluation of local resources that may assist in the mitigation of any adverse effects was also conducted.

Table 4.22.2 provides population data for the area surrounding the Proposed Project site and for the state of Minnesota as a comparison.

TABLE 4.22.2 MINORITY AND LOW-INCOME POPULATIONS

	% Minority Population	% of Population Below the Poverty Line
Grand Rapids	4.2	11.2
Hibbing	3.1	11.7
Keewatin	2.2	13.7
Nashwauk	1.7	14.6
Itasca County	5.7	10.6
St. Louis County	5.6	12.1
Minnesota	11.8	6.9

Note: Population data reflects 2000 Census totals
Source: U.S. Census Bureau American FactFinder and Dept. of Administration Office of Geographic and Demographic Analysis Land Management Information Center websites.

The 2000 Census data indicates that minority population percentages in St. Louis and Itasca Counties as well as the cities evaluated in Table 4.22.2 are significantly lower than the state of Minnesota as a whole. Minority populations in cities within the Proposed Project vicinity range from 1.7 percent to 4.2 percent. The counties are slightly higher at around 5.6 percent, while the state of Minnesota is 11.8 percent minority.

Additionally, these same cities and counties have percentages of low-income populations higher than the state of Minnesota. Maps generated by the USEPA Environmental Justice Geographic Assessment Tool for the Socioeconomic Study show low-income concentrations in some areas surrounding Grand Rapids and Hibbing of 20 to 30 percent. Areas within and adjacent to the City of Keewatin indicate a poverty rate of 10 to 20 percent.

4.22.1.3 Employment Trends

The average weekly wage in Itasca and St. Louis Counties continued to increase between 1980 and 2000, although the amount of increase varied considerably among the industry classifications (see Table 4.22.3). Average weekly wages in the northeastern Minnesota are typically lower than those in Minnesota as a whole, and are much lower than the metropolitan areas.

TABLE 4.22.3 AVERAGE WEEKLY WAGE BY INDUSTRY

Itasca County	1980	1990	2000	% change 1980-1990	% change 1990-2000	% change 1980-2000
Mining*	unav	unav	unav			unav
Construction	$318	unav	$585			84.0
Manufacturing	$352	$605	$900	71.9	48.8	155.7
Transportation/Utilities	$372	$539	$803	44.9	49.0	115.9
Finance, Insurance, Real Estate	$251	$340	$540	35.5	58.8	115.1
Services	$202	$345	$441	70.8	27.8	118.3
Public Administration	$178	$415	$594	133.1	43.1	233.7
Trade	$153	$214	$300	39.9	40.2	96.1
Total All Industries	**$268**	**$399**	**$527**	**48.9%**	**32.1%**	**96.6%**

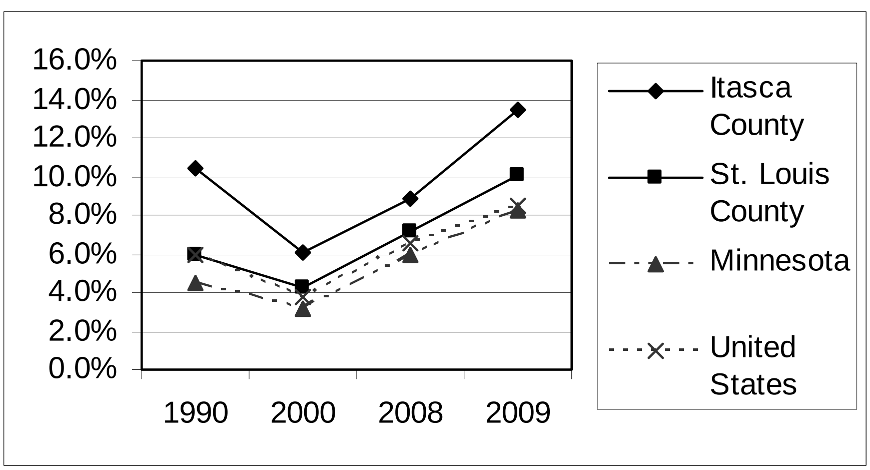
*Data unavailable due to confidentiality rules.

St. Louis County	1980	1990	2000	% change 1980-1990	% change 1990-2000	% change 1980-2000
Mining	$467	$701	$975	50.1	39.1	108.8
Construction	$385	$553	$714	43.6	29.1	85.5
Manufacturing	$274	$438	$621	59.9	41.8	126.6
Transportation/Utilities	$332	$540	$730	62.7	35.2	119.9
Finance, Insurance, Real Estate	$245	$381	$654	55.5	71.7	166.9
Services	$222	$375	$540	68.9	44.0	143.2
Public Administration	$325	$427	$712	31.4	66.7	119.1
Trade	$178	$246	$354	38.2	43.9	98.9
Total All Industries	**$275**	**$392**	**$557**	**42.5%**	**42.1%**	**102.5%**

Source: Data from MN Department of Employment and Economic Development (DEED) website

The rate of unemployment in the vicinity of the Proposed Project has typically been higher than the state and national averages, and the state average is generally lower than the national average. In 1990, unemployment was particularly high in Itasca County (over 10 percent). The closing of Butler Taconite and other Iron Range industry facilities may have contributed to this high unemployment rate.

ILLUSTRATION 4-5 UNEMPLOYMENT TRENDS



Source: Data from MN DEED website (Based on data available through November of each year, except 2009 which is from March 2009)

The Socioeconomic Study indicates that there was job growth in mining sector jobs in 2003-2005, but northeastern Minnesota has experienced a number of industrial facility closings or staff reductions in late 2008. This has increased umemployment rates again on the Iron Range. The slow economy has forced a number of facilities in northeastern Minnesota to shut down, idle their production, and/or reduce production and staff numbers. Illustration 4-4 shows how unemployment has increased since 2000. Itasca and St. Louis counties have unemployment rates higher than the state and national averages.

4.22.1.4 Economic Development

An analysis of the current and proposed operations at the Keetac facility was completed in May 2009 by the University of Minnesota – Duluth (UMD) (i.e., the UMD Economic Study) (UMD, 2009). This analysis used three different variables to determine the impact that Keetac operations has on the local economy. These same variables were used in an analysis to determine the potential impacts that the Proposed Project would have on the economy, which is discussed later in Section 4.22.2.1.1.

The three variables are:

1. Gross output (revenue to businesses, including all project-related expenditures,
   e.g., capital, construction costs, wages),
2. Value added (the portion of the gross output dollars that are available to recirculate in the local economy, i.e., wages [primary source], rents, interest and profits), and
3. Employment (number of jobs created in each industry).

Based on 2007 data, current Keetac operations at full capacity generate $1.2 billion in total output spending and $388 million on value added spending in northeastern Minnesota, primarily Itasca and St. Louis Counties. The existing Keetac facility directly employs 380 people.

Each variable was quantified by inputting the direct expenditures (U.S. Steel spending), and modeling the indirect (other business spending) and induced (consumer spending by employees from the direct and indirect businesses) impacts for 2007 facility operations. Separate model runs for the Proposed Project were completed for 1) construction and 2) operational economic impacts assessment.

Based on 2007 data, current Keetac operations at full capacity generate $1.2 billion in total output spending and $388 million on value added spending in northeastern Minnesota, primarily Itasca and St. Louis Counties. Table 4.22.4 provides a summary of the economic effect of the existing operations of the Keetac facility. The Project Proposer directly spends about $872 million in output, including $272 million in total value-added spending during operations each year, while indirect and induced operations generate an additional $212 million in output for northeastern Minnesota. The existing Keetac facility directly employs 380 people. An additional 690 fulltime, part-time, and/or temporary jobs are estimated to exist around northeastern Minnesota due to Keetac facility operations.

TABLE 4.22.4 CURRENT KEETAC ECONOMIC EFFECT ON NORTHEASTERN MINNESOTA

Shown in 2007$	**Direct effect (Keetac)**	**Indirect effect**	**Induced effect**	**Total Effect**
Output	600 million	134 million	78 million	**813 million**
Value-added	273 million	72 million	44 million	**388 million**
Total Effect	**873 million**	**206 million**	**122 million**	**1.2 billion**
Employment	380	210	299	889

4.22.1.5 No Action Alternative

The market demand for iron ore in part influences how the Keetac facility would operate in the future. Under the No Action Alternative, it is anticipated that the Keetac facility would continue to operate under its existing permits until 2021. As shown in Table 4.22.4 and described above, it is estimated that the Keetac facility would have a similar number of employees and similar economic impact on the local economy annually until 2021. However, these annual economic impacts would be market dependent.

In 2021, the mine would likely close due to a lack of additional ore resources available within the existing Permit to Mine boundary. Closing of the Keetac facility would reduce employment in the area and related economic benefits, both locally, regionally, and statewide. The socioeconomic impacts from the Proposed Project would not be realized under the No Action Alternative.

4.22.2 Environmental Consequences

4.22.2.1 Proposed Action-Related Impacts

Project-related socioeconomic impacts were analyzed for three general categories: economic development, tax base, and demand for public services. Economic development is estimated by the amount of money expended and potential local economic benefits generated and the number of jobs created as a result of the Proposed Action. The impacts on the tax base were estimated based on changes in taxable real estate and taxes contributed by the Project Proposer. The demand for public services was assessed based on what the project facilities would likely require in terms of police and fire services, health care, and schools for employees' families.

4.22.2.1.1 Economic Development Impacts

Barr Engineering used the UMD Economic Study as the basis for the Socioeconomics Study which was completed for the Proposed Project. According to the UMD Economic Study, the completion of the construction phase of the Proposed Project estimated for 2013, as summarized in Table 4.22.5, would generate over $876 million in output (direct, indirect, and induced combined) and $404 million in value-added spending (direct, indirect, and induced combined) in the Arrowhead Region of Minnesota. Most of this output and value-added spending would occur in Itasca and St. Louis Counties where the majority of the people, who are impacted by the Proposed Project, live and work. Of these total dollars spent, the Project Proposer's direct spending would be approximately $832 million in total output (materials, labor, fees, i.e., total project cost) on construction. The remaining $448 million of the $1.3 billion total output dollars would come from indirect and induced expenditures. Approximately $244 million of the total construction spending by the Project Proposer would be value-added spending (wages, rents, interest, and profits). The total construction expenditures are one time costs, which do not recur annually.

TABLE 4.22.5 POTENTIAL ECONOMIC EFFECT FROM CONSTRUCTION OF THE PROPOSED PROJECT ON NORTHEASTERN MINNESOTA

Shown in 2007$	Direct Effect (Keetac)	Indirect Effect	Induced Effect	Total Effect
Output	588 million	143 million	145 million	**876 million**
Value-added	244 million	78 million	82 million	**404 million**
Total Effect	**832 million**	**221 million**	**227 million**	**1.3 billion**
Employment	500 (peak)	116	144	760

At the peak of the four-year construction period, the Proposed Project is anticipated to directly employ 500 people. Indirect and induced impacts from the project could potentially create an additional 260 or more spin-off jobs, including temporary, part-time, and full-time jobs created elsewhere in Itasca and St. Louis Counties. Indirect and induced jobs include retail trade, professional-scientific and technical services, and administrative. These impacts would be short-term and likely end at the completion of the construction period.

In addition, the UMD Economic Study estimates that once the operations of the Proposed Project reach full capacity in about 2013, as summarized in Table 4.22.6, the facility would be generating $843 million in total output spending and $273 million in total value-added spending in Itasca and St. Louis Counties annually for the operating life of the facility. The Project Proposer would be directly spending about $612 million in output, including $191 million in total value-added spending during operations each year, while indirect and induced operations would generate an additional $230 million in economic effect. Once fully operational, the Proposed Project is anticipated to directly employ an estimated 170 people. An additional 228 fulltime, part-time, and/or temporary jobs could potentially be created around northeastern Minnesota.

TABLE 4.22.6 POTENTIAL ECONOMIC EFFECT FROM FULL CAPACITY OPERATION OF THE PROPOSED PROJECT ON NORTHEASTERN MINNESOTA

Shown in 2007$	Direct effect (Keetac)	Indirect effect	Induced effect	Total Effect
Output	421 million	94 million	55 million	**570 million**
Value-added	191 million	50 million	31 million	**273 million**
Total Effect	**612 million**	**144 million**	**86 million**	**843 million**
Employment	170	94	134	398

The UMD Economic Study and Socioeconomic Study provide an in-depth analysis of the estimated impact of the Proposed Project, including the direct, indirect, induced, and total overall effects from the expenditures during construction and operation of the facility.

4.22.2.1.2 Tax Revenue Impacts

According to the Socioeconomic Study, total tax revenue impact for the Proposed Project was tallied by quantifying the amount of residential taxes that would be lost through construction of the Proposed Project versus the federal and state taxes that would be contributed during the first full year of operations of the Keetac facility. Aerial photos were reviewed, which showed no residential properties with structures would be displaced by the Proposed Project, and therefore indicated no loss of tax revenue.

Total estimated federal taxes generated by the Proposed Project in 2013 are $10 million, and total state taxes are estimated at $8.6 million through personal income taxes, indirect businesses taxes, and other taxes.

In 2013, the Socioeconomic Study estimates that the Proposed Project would generate more than $8.5 million in federal taxes and $7.7 million in state taxes in northeastern Minnesota. Total estimated federal taxes generated by the Proposed Project in 2013 are $10 million, and total state taxes are estimated at $8.6 million through personal income taxes, indirect businesses taxes, and other taxes.

4.22.2.1.3 Demand for Public Services

Demand for public services as a result of the Proposed Project may increase, but are not likely to increase substantially. During peak construction of the Proposed Project, demand for public services would likely be higher. The estimated 170 new permanent jobs would bring in new employees and their families. This could create additional demand for local public services, such as police and fire services, healthcare for employees, and schools for employees' families. It is difficult to estimate where the new employees would live. As indicated by 2000 Census data, many people in this region are commuting significant distances to work. This indicates that new employees could locate in any number of communities in the area, thereby diminishing a significant demand for public services or impact in any one community.

Keetac has its own security staff. Local police and sheriff's departments are occasionally asked to respond to an incident at Keetac. The Proposed Project would not increase local law enforcement's current effort in assisting Keetac's security.

Infrastructure needs were assessed for the City of Nashwauk and City of Keewatin as part of the *Itasca County Community Readiness Assessment-2008*. The City of Keewatin is in need of water and sewer improvements totaling almost $900,000. The assessment also recommended that the city develop a five-year road and sidewalk improvement plan.

Water and sewer improvements were also identified as a need for the City of Nashwauk. Additionally, the city's current water treatment facility cannot support the total needs of the proposed Essar Steel project, west of Keewatin. An influx of people into these two communities would intensify the existing need for sewer and water improvements. The Proposed Project alone is not likely to create a large influx of people into the City of Keewatin and the City of Nashwauk. However, cumulative effects from additional, large-scale proposed projects in the area may have a greater impact on housing demand in these two communities.

It is also likely that employees relocating to the Nashwauk area or other nearby communities may have families with children that need educational services. This could place an increased demand on schools in the area to accommodate an influx of new students. Additional teachers may be needed and capacity and adequacy of the existing school buildings would need to be determined as necessary to accommodate demand.

4.22.2.1.4 Minority and Low-Income Populations

Based on data collected and evaluated for the Socioeconomic Study, no significant numbers of minorities are represented within the vicinity of the Proposed Project. The small number of minorities in the area makes it unlikely that the Proposed Project would create a disproportionate impact on minority groups.

The Proposed Project would be located in an area that has poverty rates that are higher than the state average. The Proposed Project would create both temporary and permanent jobs at the Keetac facility, and potentially create additional job creation at other businesses in the area. These new employment opportunities may help reduce the local unemployment and poverty rates in the area.

There would be an economic benefit from the Proposed Project. Based on expected employment figures and total modeled economic effect, the magnitude of the benefit is significant both during and after construction. In so far as the economic benefit stabilizes or improves communities near the project site, there is also a social benefit, the magnitude of which is unknown.

4.22.2.2 East Stockpile Alternative

The potential environmental effects on socioeconomics from the East Stockpile Alternative is the same as those identified for the Proposed Project.

4.22.2.3 Cumulative Effects

While this FEIS focuses on the Proposed Project near Keewatin, it should be noted that there are numerous other industrial projects being proposed within close proximity to the Proposed Project that may further impact the socioeconomics of the area, particularly the need for a capable workforce, housing, and public services. These impacts would be both temporary and long-term. Proposed major projects within the Proposed Project vicinity are listed in Table 4.22.7. The projected number of permanent and construction jobs does not take into account indirect or induced job creation by these projects, which would increase the overall total number of jobs.

TABLE 4.22.7 PLANNED MAJOR EXPANSION PROJECTS IN THE VICINITY OF KEEWATIN

Major Planned Expansions	Project Status	City/Cities	County	# of Projected Permanent Jobs Created	# of Projected Construction Jobs	Construction/ Operational Dates
Mesabi Nugget DRI Plant	Under construction	Hoyt Lakes	St. Louis	**100**	**500**	2007/2009-2010
PolyMet Mining, NorthMet Project	Proposed	Hoyt Lakes	St. Louis	**400**	**500**	2009
Excelsior Energy, Mesaba Energy Project	Proposed	Taconite/ Hoyt Lakes	St. Louis, Lake, Itasca	**107**	**>1500**	2009/2011
Essar Steel Minnesota, LLC.	Under construction	Nashwauk	Itasca	**700**	**2,000**	2008/2010
U.S. Steel Keewatin, Keetac Expansion	Proposed	Keewatin	Itasca, St. Louis	**170**	**500**	2010/2013
Total				**1,477**	**4,100**	

Source: MNDNR, 2007D: Barr, 2009T

If all of these proposed projects are constructed and become operational, there would be a substantial increase in development in a short period of time. While the positive economic benefits of this would be substantial for the region, it may result in some negative impacts as the area grows with the new economy. There would be a demand for a skilled workforce, which would likely require additional people moving into the area, creating a subsequent demand for housing and public services. These demands would need to be anticipated and planned for, including affordable housing, infrastructure needs, job training, schools, local emergency services, and healthcare. The area may experience workforce and housing shortages at certain times during the construction and initial operation of the Proposed Project depending on the timing of other proposed large-scale industrial projects in the area.

Studies in the project area have recently been conducted to examine the potential economic impacts from the construction and operation of the Proposed Project facility and other industrial projects in the vicinity. These studies were completed in an effort to prepare and plan for potential future workforce, housing, and public service needs. The Socioeconomic Study reviewed available regional preparedness studies to provide information on the existing economy and to determine the potential socioeconomic impacts from the Proposed Project on the nearby communities. The four studies reviewed included:

1. *Iron Range Housing Market Analysis* – Bonestroo, Inc., June 2008 (Iron Range Study)
2. *Housing Market Analysis and Demand Estimates for Hibbing, Minnesota* – Maxfield Research Inc., 2005 (Hibbing Study)
3. *Itasca County Housing Impact Analysis* – Rebecca Cohen, May 2006 (Grand Rapids Study)
4. *Itasca County Community Readiness Assessment* – ARDC, January 2008 (Itasca County Study)

Combining data and information from the four studies provides a comprehensive look at employment and housing trends and potential demands within the area surrounding the Proposed Project. The Iron Range Study includes 31 communities and 54 townships covering over 2,000 square miles of portions of Itasca and St. Louis Counties. From east to west, the study area spans more than 100 miles and generally straddles the TH 169 corridor. The Grand Rapids Study includes cities and townships in the central portion of the county where mining and major industrial projects are occurring. The Hibbing Study focuses primarily on the City of Hibbing and areas immediately surrounding the city.

4.22.2.3.1 Employment Impacts

Hibbing Study

During research for the Hibbing Study, interviews were conducted with several major employers in the Hibbing area. Employers, such as U.S. Steel and the Hibbing Community College, mentioned that there is a lack of skilled workers across the Iron Range, and if anything were to hinder regional growth, it is the shortage of skilled workers. Many mining companies in the area recruit from areas outside of the Iron Range to find the skilled labor force they require for daily operation. Employers think the proposed projects are good for the region’s economy. However, they are also concerned that if planned commercial expansions in northeastern Minnesota all start within a short timeframe, there would be an even greater demand and subsequent strain to find skilled workers in the Iron Range area.

According to the Hibbing Chamber of Commerce, mining companies are projecting that as many as 60 percent of their employees would be eligible to retire by 2010, though the actual number of employees who would elect to retire is unknown. With retirements, there would be existing job openings to fill. If new positions are created from the proposed major development projects, efforts to attract workers from outside the region would likely be required.

Grand Rapids Study

The Grand Rapids Study gave consideration to past and current local workforce capacity. The study reported that due to previous layoffs in the late 1980s from large, industrial companies, many skilled workers accepted jobs for which they were over-qualified in order to remain in the Grand Rapids area. These individuals would likely seek positions at the new facilities which better match their skill levels. Subsequently, this could cause a shift in positions in the community that could result in openings at employers who require a different skill set and have lower paying jobs. There were also many workers who chose to commute longer distances to find employment after the downsizing, while others simply moved away from the area. Though many employers plan to recruit locally, it is likely that not all positions created can be filled by the local community.

Itasca County Study

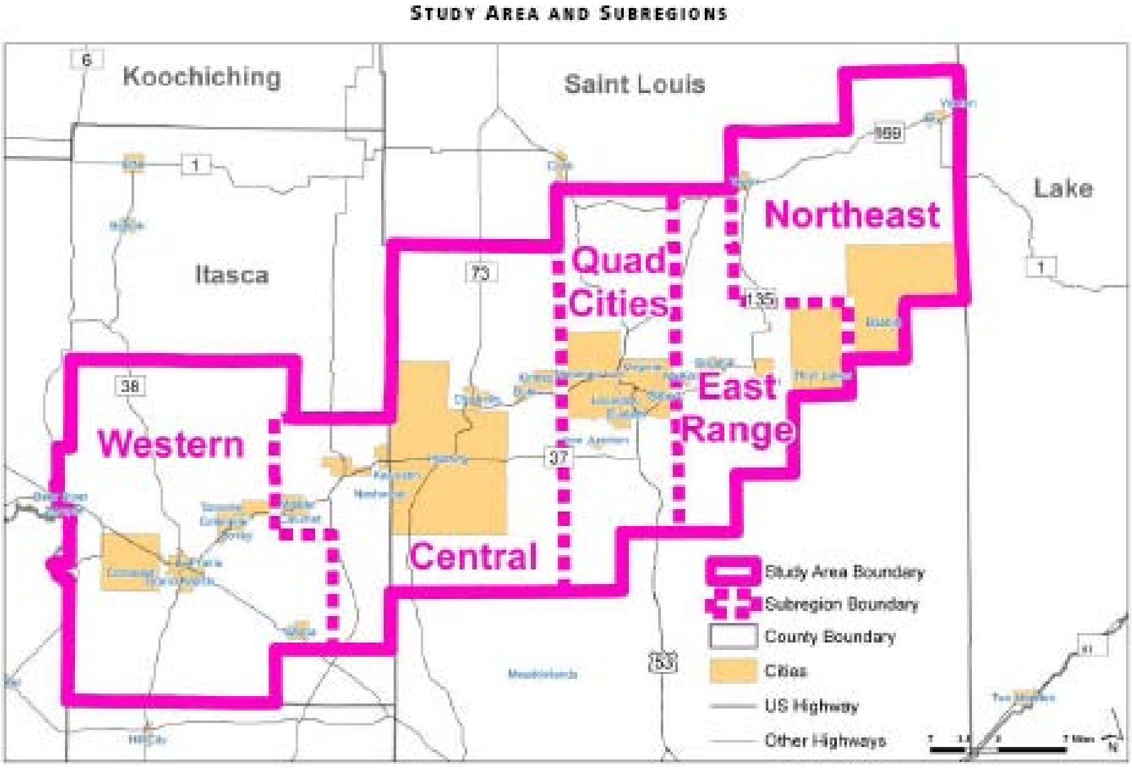
Potential cumulative effects to public services, as identified by the Itasca County Study, were previously discussed above.

4.22.2.3.2 Housing Impacts

Iron Range Study

The Iron Range Study (June 2008) based the housing needs assessment on proposed and pending economic development in the Iron Range region, which was broken into five subregions for analysis in the study. The subregions were developed based on the assumption that few people are willing to commute over 50 miles for jobs, schools, and shopping (see Illustration 4-5). The Proposed Project is located in the Central subregion and borders the Western subregion.

ILLUSTRATION 4-6 IRON RANGE STUDY AREA



Source: Iron Range Housing Analysis as of 2nd Quarter 2008

The study used a housing model based on economic development data that was available at the time of that study's publication to evaluate the potential effects of eight proposed major development projects. Three job growth scenarios (low, medium and high) were used to determine potential housing need between 2008 and 2013. Low growth scenario assumed three proposed projects would reach operations, while medium growth assumed five, and high growth scenario assumed all eight projects would reach operation.

In addition to the permanent and temporary jobs created by these projects, spin-off jobs would likely be created as a result of increased economic activity in the region. Most of these jobs would be in the service sector, such as retail, healthcare, education, and public service.

For the Central region, it is estimated that, depending on the number of development projects completed, the region could experience a housing deficit of 1,079 to 1,350 units. The Western region could require an additional 606 to 811 units. To house temporary workers in the Central region, an additional 100 to 240 units may be necessary, and the Western region could experience demand for 223 to 293 units.

Hibbing Study

The Hibbing Study (2005) offers projections on housing demand and needs based on current population and job growth trends, anticipated retirements from major employers in the area, and creation of new jobs through the development of the Proposed Project and other nearby projects.

Due to the number of variables involved, the Hibbing Study projected population and household growth using three scenarios: low growth, moderate growth, and high growth. For the purposes of this FEIS, the high growth scenario was used because it takes into account population and household growth driven by employment growth due to the Proposed Project and other pending projects in the area, as well as accounts for the need for replacement workers to fill jobs created by a large number of retiring employees over the next decade. The Hibbing Study outlined the estimated housing demand for the high growth scenario and recommended developing 230 to 260 for-sale and rental housing units in Hibbing over the next five years.

Grand Rapids Study

According to the Grand Rapids Study (2006), a 2003 housing study of Grand Rapids found a vacancy rate of only 1.0 percent for market rate general occupancy rental units. As a result, the option of accommodating construction workers in existing rental housing units may be difficult. This means a temporary housing compound may be a primary option for temporary construction employee housing. Permanent housing would also be in demand for employees choosing to relocate to the Grand Rapids area once the Proposed Project becomes operational.

According to the Grand Rapids Study, the affordable housing market in the Grand Rapids area is tight and the influx of additional households expected to fill new jobs at the Proposed Project and other industrial facilities would further intensify this situation. With a limited number of rental units and a low vacancy rate, the rental housing market is initially expected to experience pressure, which may cause rent levels to escalate, causing affordability issues for certain households.

Itasca County Study

Potential cumulative effects to public services, as identified by the Itasca County Study, were previously discussed above.

4.22.3 Mitigation Opportunities

4.22.3.1 Proposed Project-Related Impacts

The increased economic development that the Proposed Project is anticipated to create requires no mitigation. There would be a net gain to the local tax base as a result of the Proposed Project. The taconite taxes paid by the Project Proposer following completion of the Proposed Project and commencement of full operation would provide an influx of money into the local economy. The Proposed Project may increase demand on public services. Taxes paid by the Project Proposer would help offset increased local government spending to provide these services.

4.22.3.2 Cumulative Effects

Many groups and local governments are already aware of the potential impacts resulting from the proposed industrial projects in the region and are working with the Project Proposer and others to prepare for them. Itasca and St. Louis Counties are studying the potential impacts of not only the Proposed Project, but also the other proposed projects in the region. These studies are helping them plan and prepare for the additional infrastructure and public services that would be needed to support the anticipated workforce that may move to the area. As described above, Itasca County conducted a community needs assessment. St. Louis County put together documents to assist local communities plan and prepare for future growth with *Community Assessment Things to Consider*, including guidelines/regulation related to temporary worker housing. Additionally, St. Louis County compiled data and information in October 2007 for a community profile report that outlined population trends, housing, trends, and labor force.

Local governments and other groups have been working together to address the potential growth in the region. In August 2007, partners for the Range Readiness Initiative met for the first time. This group is comprised of elected officials, economic development organizations, educational institutions, representatives of industry and labor, communities, and government agencies. These entities are pooling resources and working cooperatively to plan and respond to potential challenges, issues and opportunities, develop shared strategies and solutions, and focus appropriate technical and financial resources where needed.

4.23 AMPHIBOLE MINERAL FIBERS

> Amphibole mineral fibers have been identified in intrusions occurring in the ore body, but due to the low iron content of the intrusions, the material is classified as waste rock and would not be processed.

The FSDD stated that significant impacts are not expected in this subject area. The primary concern is the potential presence of amphibole minerals in the ore body and the resulting potential for release of amphibole mineral fibers. As the FSDD states, "existing mineralogy and petrology data for the ore body to be mined …[and the identification of] the presence/absence of amphibole minerals" is presented in this section. Mitigation measures are also identified.

This section provides information on amphibole minerals and the potential presence and release of these minerals from the Proposed Project. In general, amphiboles are not expected to be found in the iron ore body that Keetac is and would be processing. Amphibole mineral fibers have been identified in intrusions occurring in the ore body, but due to the low iron content of the intrusions, the material would be treated as waste rock and would not be processed.

4.23.1 Affected Environment

4.23.1.1 Existing Conditions

The Keetac facility mines taconite from the Biwabik Iron Formation. The Biwabik Iron Formation runs the complete northeast-southwest length of the existing mine area. In some locations on the Iron Range, the Biwabik Iron Formation is composed of massive, cherty, iron oxide-rich layers intercalated with slaty, iron silicate-rich layers. This formation has a gross mineralogy of quartz, magnetite, hematite, siderite, ankerite, greenalite, stilpnomelane, and minnesotaite. Across the Mesabi Range, the Biwabik Iron Formation varies in thickness from 180 ft. to 800 ft. (Morey, 1972).

In the eastern end of the Iron Range, the Biwabik Iron Formation has been metamorphosed by intrusions of the Duluth Gabbro Complex (Duluth Complex). The Biwabik Iron Formation is known to have the presence of amphibole minerals associated with the intrusion of the Duluth Complex into the Biwabik Iron Formation. These intrusions have resulted in mineralogical changes in the Biwabik Iron Formation, which is composed of four zones that have characteristic textural and mineralogical features (French, 1968).

- Zone 1 – unaltered taconite
- Zone 2 – transitional taconite
- Zone 3 – moderately metamorphosed taconite
- Zone 4 – highly metamorphosed taconite

The ore body to be mined by the Proposed Project is associated with the west end of Zone 1 as described by French (1968), which has not had contact with the Duluth Complex. The mineralogy of the Biwabik Iron Formation in the Proposed Project area is described below.

4.23.1.1.1 NeoArchean Rocks

Based upon regional mapping by Jirsa, Chandler, and Lively (2005, MGS Map M-163), the northernmost unit of the Proposed Project area is the NeoArchean Giants Range batholith. Based upon limited outcrops in the area, the regional mapping indicated the batholith to be tonalite to granodiorite, typically biotite and/or hornblende-bearing, and locally containing units of schist and dioritic enclaves (Jirsa, Chandler, and Lively, 2005).

4.23.1.1.2 PaleoProterozoic Rocks

Based upon regional mapping by Jirsa, Chandler, and Lively (2005), just north of the Proposed Project area, the NeoArchean rocks are intruded by Kenora-Kabetogama dikes of gabbro to diabase composition. The PaleoProterozoic Animikie Group sedimentary strata unconformably overlay the NeoArchean granite-greenstone terrane and the PaleoProterozoic dikes. Three PaleoProterozoic formations, known as the Animikie Group, include the Pokegama Quartzite (an orthoquartzite of limited natural outcrop), the Biwabik Iron Formation (the uppermost bedrock unit at the mine site which becomes progressively deeper to the south-southeast), and the Virginia Formation (the uppermost bedrock unit south of the mine site that has almost no natural outcrop.

4.23.1.2 Mineral Fibers Study

A review of the Mineral Fibers Study was examined to verify the presence or absence of amphibole minerals in the ore body to be mined by the Project Proposer. This study includes discussions on the mineralogy of the Iron Range in relation to the locations of the Keetac facility and the presence of an intrusive rock formation within the mine site. It also provides results from the analysis of taconite and intrusive rock tailings samples from the Project Proposer's mine site for the presence of amphibole minerals.

The normal forms for all of the amphiboles are prismatic, blocky, or rod-like, acicular crystals. However, certain types of amphiboles, for example grunerite (amosite), riebeckite (crocidolite), tremolite, actinolite and anthophyllite may occur in asbestos forms although these are rare in comparison to the normal varieties. Non-asbestiform prismatic crystals are the common crystalline habits of amphibole minerals with aspect ratios less than 3:1.

The Mineral Fibers Study included analysis of ore samples taken from the No Action Alternative and Proposed Project mining areas. Samples of intrusive rock and halo rock (i.e., rock adjacent to the intrusive rock that was altered by the heat associated with the intrusion) were also collected and these samples were taken from within the existing mining area (the No Action Alternative) and are considered representative of the intrusive rock that may be encountered in the proposed mining areas. The ore, intrusive rock and halo rock samples were examined for mineral fibers. No asbestos minerals or fibrous content were found in the samples taken. However, samples of taconite from the intrusive rock formation and the adjacent taconite surrounding rock affected by the high temperatures associated with intrusive rock showed the presence of amphibole minerals at low concentrations. The primary minerals in the samples of altered rock were quartz (61 percent) and magnetite (20 percent), with amphibole minerals comprising 1.5 percent of the total (81 percent) identified minerals. This analysis shows potential for amphibole minerals to be present associated with the intrusive rock formation, which is located within the No Action Alternative boundary and in the proposed east mine pit expansion.

Amphibole mineral fibers can be potentially released during the taconite pelletizing process; however, hauling or stockpiling of the taconite ore does not release amphibole mineral fibers. The pelletizing process includes pumping slurry to the tailings basin. The Mineral Fibers Study identified that samples from the Project Proposer's existing tailings basin had been collected as part of two previous studies and these previous studies did not identify asbestos minerals, amphibole mineral fibers, nor chrysotile fibers in sampling data taken from the Project Proposer's tailings basin. This indicates that it is unlikely that intrusive rock, containing amphibole minerals, is currently processed with the taconite, or has been processed in any significant quantity in the past at the Keetac facility.

4.23.1.3 No Action Alternative

Under the No Action Alternative, the Keetac facility would continue to mine the existing ore body under its current permits and operating agreements. The No Action Alternative would continue to use existing methods to mine and process taconite with no major changes to facility operations under this alternative. The intrusive rock formation with the potential to contain amphibole mineral fibers has been identified and mapped in the mining areas remaining under the No Action Alternative, as shown on Figure 4.23.1. Currently the intrusive rock formation is identified as waste rock and is separated from the taconite ore into in-pit stockpiles, so that the waste rock is not processed with the taconite. The No Action Alternative would continue to mine within the No Action Alternative boundary, and continue to separate the intrusive formation rock and other waste rock from the taconite ore by placing it in in-pit stockpiles. These handling methods have and would continue to reduce the likelihood that amphibole minerals would be processed with the taconite.

4.23.2 Environmental Consequences

4.23.2.1 Mineral Fibers on the Mesabi Iron Range

Fibers-related data are available from several sources for taconite mining operations on the west end of the Iron Range, including sampling at the Keetac mine site. Mineralogical and specialized microscopic analyses conducted by Zanko et al.,(2003) and the MDH (Ring, 1981) show that coarse taconite tailings sample composites from five western Iron Range taconite mines did not indicate the presence of the six regulated asbestos minerals, nor did they contain amphibole minerals.

The first observation of grunerite and other amphibole minerals in the Biwabik Iron Formation occurs approximately 3 miles east of Biwabik, which is approximately 55 miles east of the taconite deposit to be mined by the Project Proposer. The presence of the amphibole minerals near Biwabik is associated with the intrusion of the Duluth Complex into the Biwabik Iron Formation. Figure 4.23.2 identifies the boundary from which MNDOT will not accept tailings for use in transportation projects. Tailings from the Mesabi Iron Range that are produced east of Range 15W are not accepted due to the potential for the presence of amphibole and asbestiform fibers. Intrusions of the Biwabik Iron Formation by the Duluth Complex have not been found in the western part of the Iron Range, but other intrusions occur on the western end of the range, including in the ore body proposed to be mined by the Project Proposer.

Minerals identified from tailings samples from the western part of the Iron Range are different than minerals from tailings generated by taconite operations in the eastern Iron Range near Babbitt. The tailings samples from the western part of the Iron Range are composed primarily of magnetite or hematite, stilpnomelane, minnesotaite, and greenalite. Fibers that have been observed in tailings samples from the western part of the Iron Range are non-amphibole. These samples have had low aspect ratios (close to 3:1) and did not appear likely to break into long thin fibers (Zanko et al., 2003).

4.23.2.2 Proposed Action Alternative

The Proposed Project would expand the existing mine pit in order to continue mining taconite from the Biwabik Iron Formation, which runs the complete northeast-southwest length of the Proposed Project area. Additionally, an intrusive rock formation in the form of a narrow dike, running north-south, is present in the proposed east mine pit expansion. As previously described above, analysis of samples completed for the Mineral Fibers Study show the presence of amphibole minerals in low concentrations in the intrusive rock formation.

> Based on available data from sampling, mineral content, quantity of waste rock, and mining techniques, it is unlikely that amphibole mineral fibers would be processed. Thus, there is little chance that amphibole mineral fibers would be released into the ambient environment.

During iron ore mining, the intrusive rock formation would be removed with other waste rock and segregated from the taconite ore part of the proposed east mine pit expansion. Potential generation of airborne amphibole content is low (i.e., about 1 to 3 percent of the minerals in the intrusion) and the formation locations are well known (Figure 4.23.1). This would allow the Project Proposer to avoid potential impacts from the presence of amphibole minerals with proper handling methods (i.e., separating and stockpiling).

Based on available data from ore samples, tailings basin samples, mineral content, quantity of the total waste rock of the proposed east mine pit expansion, and mining techniques to be employed (e.g., targeted removal and separation of intrusive rock formations), amphibole mineral fibers are not intended to be processed. Thus, there is little chance that amphibole mineral fibers would be released into the ambient environment.

Amphibole minerals are not intended to be processed. However, due to the remote possibility of amphibole fibers being released into the air from processing, there is the potential for an adverse effect to air quality. The significance of this potential effect to human health is unknown.

4.23.2.3 East Stockpile Alternative

The potential environmental effects on amphibole mineral fibers related to the East Stockpile Alternative is the same as those identified for the Proposed Project.

4.23.3 Mitigation Opportunities

The intrusion has been delineated, and its location and width are well known. The width of the intrusion ranges between eight and 15 feet for the length of the open mine pit. The intrusion is weathered material that would be excavated, rather than blasted. Proposed Project blasting activities would include separating the waste rock and intrusive rock from the taconite ore before crushing and grinding took place. Appropriate measures would be used during stockpiling to separate waste rock and intrusive rock from the taconite, according to stockpiling requirements, and identified as containing amphibole minerals. Stockpiling would occur as much as possible in-pit or in the existing southeast stockpile area. This would further minimize the likelihood of airborne amphibole mineral fibers potentially being generated from the Proposed Project.

Through the Project Proposer's standard mining and taconite processing methods, the potential for the release of amphibole mineral fibers from the intrusive rock would be reduced. Processing of the intrusive rock causes upset conditions in the concentrator and therefore measures are taken to avoid its introduction into the process. If the intrusive rock material is processed with the taconite, it would be rejected by the concentrator due to its low iron content and therefore sent as slurry to the tailings basin for disposal.

5.0 Cumulative Effects

While a proposed action may or may not be significant by itself, cumulative effects consider the combined, incremental effects of a proposed action with other actions or future, planned actions. The combined or cumulative effects of these can result in the potential degradation of environmental resources in a given area.

Under state and federal law, agencies are required to evaluate potential cumulative effects or impacts of a project when determining the need for, or adequacy of, environmental review documents. Although the state and federal regulations differ somewhat in their definitions and applications of cumulative effects/impacts, the intent of the analysis in this EIS is essentially the same: to assess the magnitude of effects of a proposed action in combination with other actions.

NEPA defines cumulative impact in 40 CFR 1508.7 as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions.…" The state of Minnesota defines "cumulative impact" in Minnesota Rules, part 4410.0200, subp. 11 using a definition similar to the federal definition. Minnesota Rules, part 4410.1700, subp. 7 defines a cumulative potential effects criteria in determining the potential for significant environmental effects.

The cumulative effects analysis completed for this EIS was defined by the FSDD. The following were evaluated with respect to the potential cumulative effects in the Keetac EIS:

The specific topics addressed and the corresponding sections in Chapter 5.0 include:

Section 5.1 – Biomass
Section 5.2 – Climate Change
Section 5.3 – Surface Water Resources
- 5.3.1 – Water Levels
- 5.3.1 – Aquatic Habitat and Fisheries

Section 5.4 – Wild Rice Resources
Section 5.5 – Mercury Emissions, Deposition and Bioaccumulation
Section 5.6 – Wildlife Habitat Loss/Fragmentation and Travel Corridor Obstruction
Section 5.7 – Threatened and Endangered Species and Species of Concern
Section 5.8 – Inter-basin Transfer of Water
Section 5.9 – Loss of Wetlands
Section 5.10 – Water Quality
Section 5.11 – Class I Areas – Potential Cumulative Effect to Air Quality
- 5.11.1 – PM_{10} and $PM_{2.5}$ Air Concentrations
- 5.11.2 – Cumulative Effects Analysis – Class I Visibility

Section 5.12 – Ecosystem Acidification Resulting from Deposition of Air Pollutants
Section 5.13 – Risk Assessment
- 5.13.1 – Human Health
- 5.13.2 – Ecological Risk Assessment

The reasonably foreseeable future actions, geographic extent, timeframe, and scope of analysis for each of the subject areas listed were defined in the SEAW and FSDD, both of which address the requirements of MEPA and NEPA. The scoping process defined the projects and level of assessment to be included in each of the cumulative effects analyses for the Keetac EIS, based on 1) the geographic extent for cumulative effects analysis, as determined for each subject area and 2) the criterion that foreseeable future projects should include only projects that are reasonably assured of moving forward. The specific assumptions applicable to each of the cumulative effects studies are defined in the sections that follow for each of the subject areas.

5.1 BIOMASS

> The Proposed Project would include the use of 50,000 oven dried tons (ODT) of woody biomass (equivalent to 100,000 tons of green woody biomass) per year as a supplemental fuel source.

The FSDD states that the EIS analysis would define a biomass procurement area, discuss the viability of using biomass as a fuel source, examine the biomass supply and demand for biomass in relation to current and reasonably foreseeable future woody biomass projects, and determine the potential cumulative environmental impacts associated with increased biomass use and harvest in Minnesota. Analysis in this section of the FEIS focuses primarily on those issues related to biomass requirements for the Proposed Project, biomass supply and demand in Minnesota, and potential cumulative environmental impacts associated with increased biomass harvest.

There is a variety of potential biomass fuel sources. Woody biomass may be comprised of roundwood, logging residue, mill residues, urban wood waste, and wood chips. Agricultural biomass may include corn stalks, grasses, seed hulls, and livestock litter. Energy facilities that use biomass for fuel to generate electricity may operate using a single biomass source or a combination of multiple biomass sources. The Proposed Project intends to use woody biomass and this section addresses these forms of biomass. For the purpose of this FEIS "biomass" would be woody biomass sources and defined as follows:

- Roundwood: Consists of harvested, merchantable trees. Roundwood would be brought to Keetac as whole trees and chipped on-site or as wood chips processed at the procurement site by the logging company.
- Residual Biomass: Woody material that cannot be used as roundwood, including non-merchantable fine woody debris (tops and limbs) and brush. Residual biomass is also called slash or logging residue.
- Mill Residues: Wood and bark residues produced in processing logs into lumber, plywood, and paper. The Project Proposer's Minntac facility currently uses mill residues as a major source.
- Wood Chips: Roundwood or logging residue that has been processed in a wood chipper creating uniform wood chips approximately three inches in size. Sources include urban tree services, land salvage sites (clearing for road right-of-ways, utility corridors, etc.), and non-merchantable trees that are harvested during forest management practices (fire suppression/prevention, diseased tree removal, thinning, site access, etc.).

Over the past decade there has been an increase in the search for and use of renewable energy sources in Minnesota and across the United States. In 2007, the Minnesota legislature passed a bill establishing a renewable energy standard where electric utilities shall provide 25 percent of retail electric sales from eligible energy technologies by 2025 (Minnesota Statutes § 216B.1691). Biomass is considered to be an eligible energy technology along with wind, hydroelectric, and hydrogen. Utilities and private industries have turned to biomass as a fuel source to replace traditional fossil fuels to help meet this legislative mandate. In addition to being renewable, biomass also has the potential for lower net emissions of greenhouse gases and other pollutants when compared to fossil fuels (namely coal) due to the uptake of carbon during tree growth. However, as the trend toward biomass use increases, concerns about the available woody biomass supply and potential environmental impacts of increased woody biomass harvest have surfaced. The Project Proposer intends to use woody biomass as a supplemental fuel source in the new grate kiln furnace for the restarted taconite production line. As a result, there is the potential for the Proposed Project to contribute to the cumulative effects of woody biomass demand or potential environmental impacts associated with increased woody biomass harvest in Minnesota.

The Proposed Project would include the use of 50,000 oven dried tons (ODT) of woody biomass (equivalent to 100,000 tons of green woody biomass) per year as a supplemental fuel source. A new wood handling facility would be constructed as part of the Proposed Project; it would include wood storage areas; a wood chipper (to allow for roundwood, dead trees, or undersized logs to be processed into wood chips on-site); a wood chip conveyor belt drier; and a pneumatic system for delivering the dried wood chips to the grate kiln furnace. The Project Proposer uses woody biomass as a fuel source at their Minntac facility located in Mountain Iron, Minnesota. The Minntac facility would be supplied approximately 50,000 ODT of woody biomass per year, from the Keetac drier, to supplement its existing need. The total amount of woody biomass that would be used by the two facilities is 100,000 ODT per year. The proposed new wood handling facility would handle and process the woody biomass for both the Proposed Project and Minntac facilities.

5.1.1 Affected Environment

There are 16.7 million acres of forest in Minnesota (Miles et al., 2008). Timberland (forest land that is producing or capable of producing 20 ft^3/acre/year of wood) constitutes approximately 90 percent (15.4 million acres) of Minnesota's forest lands (Miles et al., 2008). Timberlands in Minnesota are controlled by a mix of private and public ownership. Biomass is only harvested on timberlands. Non-industrial private forest (NIPF) landowners constitute the largest ownership at 36 percent, state ownership is second highest at 24 percent, counties own 16 percent, federal agencies own 17 percent, and private forest industry/corporations companies own 8 percent (Miles et al., 2007).

5.1.1.1 Procurement Area

Due to the location of the Proposed Project in northeast Minnesota, the Project Proposer potentially could purchase woody biomass from suppliers in Minnesota, northern Wisconsin, and southern Ontario. The Project Proposer prepared the Biomass CI Study which addresses the potential cumulative effects of biomass fuel used by the Proposed Project. The Biomass CI Study assumed all biomass used by the Proposed Project would be purchased solely from suppliers in Minnesota. This provides the EIS with an in-state maximum use evaluation of potential impacts that would occur related to biomass harvest within Minnesota. Details of biomass supply and demand estimates and potential environmental impacts associated with the Proposed Project are provided in the Biomass CI Study.

Two biomass procurement areas for the Proposed Project were evaluated within the Biomass CI Study specifically: 1) statewide in Minnesota, and 2) in Minnesota within 100 miles of the Proposed Project. From the two procurement areas, four separate procurement scenarios were developed with the following descriptions:

Scenario A:	100 percent utilization of residual biomass procured statewide
Scenario B:	70 percent utilization of roundwood and 30 percent utilization of residual biomass procured statewide
Scenario C:	70 percent utilization of roundwood and 30 percent utilization of residual biomass procured within 100-mile radius of the Proposed Project
Scenario D:	100 percent utilization of residual biomass procured within 100-mile radius of the Proposed Project

While four scenarios have been evaluated in the Biomass CI Study, it is unknown which scenario the Project Proposer would use for the Proposed Project. It is likely that market conditions would determine which scenario or combination of scenarios would occur. In any given year of the Proposed Project the percentage of roundwood and residual biomass utilization would fluctuate.

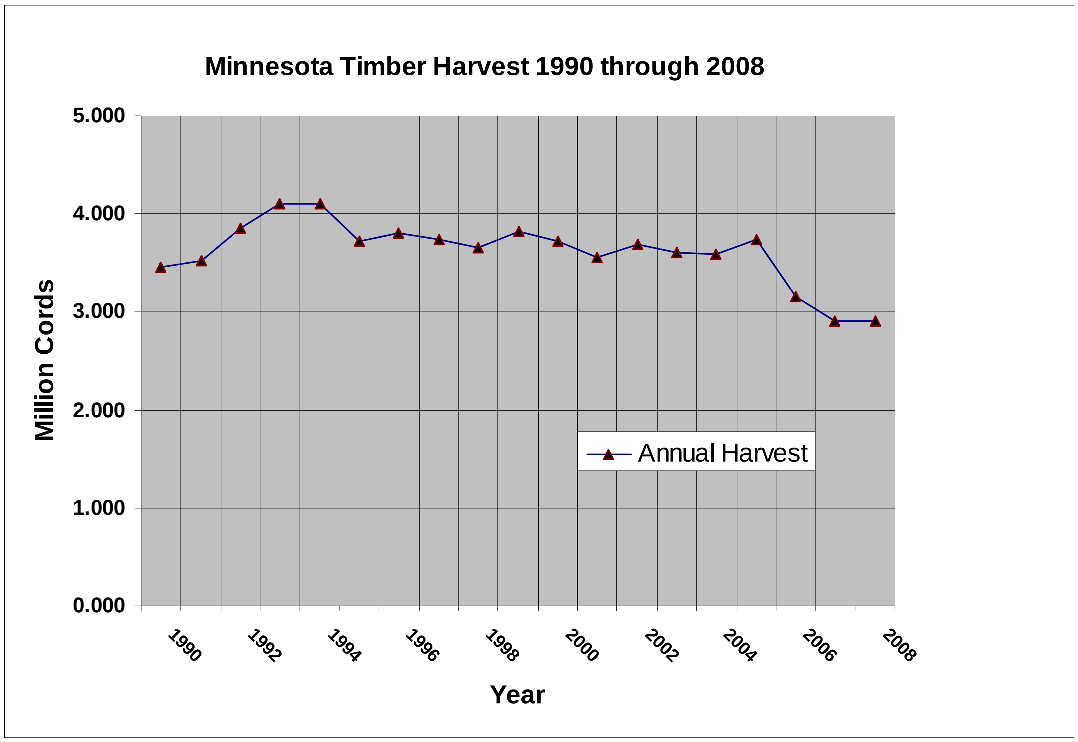
5.1.1.1.1 Biomass Availability

Availability of woody biomass for the Proposed Project, from both procurement areas, is dependent on roundwood harvesting levels. To estimate the supply of roundwood and residual biomass, assumptions are needed for Minnesota's roundwood harvesting trends.

> Current economic conditions have led to decreased roundwood demand and mill shutdowns over the past few years. Roundwood harvest levels for 2009 are expected to remain below 3 million cords; the lowest annual harvest levels seen in Minnesota in the last 25 years.

A Generic EIS (GEIS) examining timber harvesting and forest management in Minnesota was prepared for the Minnesota EQB in 1994 (Poyry, 1994). The GEIS examined roundwood harvest in Minnesota based on timber harvesting trends and projections at that time. The base condition for timber harvesting in Minnesota was determined to be 4 million cords of roundwood per year, which was equal to the harvest in Minnesota in 1990. The GEIS modeled three levels of roundwood harvest: 4.0, 4.9, and 7.0 million cords/year through 2040. Illustration 5-1 depicts the actual annual harvest levels in Minnesota from 1990 – 2008.

ILLUSTRATION 5-1 MINNESOTA TIMBER HARVEST LEVELS



Source: Kilgore et al., 2005; *Minnesota Forest Resources*, MNDNR, revised Dec. 2008B; MNDNR staff oral communication.

In 2005, an assessment of the GEIS was completed by the University of Minnesota, College of Natural Resources; *Staff Paper No. 182 Minnesota Timber Harvesting GEIS: An Assessment of the First 10 Years* (Kilgore et al., 2005) hereafter referred to as the GEIS Report Card. This assessment indicates that from 1990 through 2001, roundwood harvest levels in Minnesota exceeded 4 million cords in two years, 1994 and 1995, and averaged approximately 3.8 million cords for this time period (Kilgore et al., 2005). From 2002 – 2006 average annual harvest levels began to decline to approximately 3.5 million cords (MNDNR, 2008B). Annual roundwood harvest levels have continued to trend downward with estimates from MNDNR staff for 2007 and 2008 at approximately 2.9 million cords, the lowest annual harvest levels seen in Minnesota in the last 25 years.

Current economic conditions have led to decreased roundwood demand and mill shutdowns over the past few years. The harvest of roundwood is necessary to produce residual biomass. As the roundwood harvest decreases, so too does the supply of economically extractable residual biomass. As a result, if the supply of residual biomass decreases, then it may be necessary for projects using woody biomass as fuel (such as the Proposed Project) to supplement their use of residual biomass with the use of roundwood or other biomass sources.

The Biomass CI Study evaluated the potential availability of biomass supply for each of the four defined procurement scenarios. Detailed descriptions of the modeling efforts that were used to estimate the number of acres of each forest cover type, the harvestable acres of each forest cover type, the roundwood harvest volume, and the extractable residual biomass volume for both procurement areas are provided in the study (Kilgore et al., 2009). The analysis determined the average amount of acres harvested for 16 different forest cover types on an annual basis and also determined the amount of roundwood harvested annually from each forest cover statewide based on an annual roundwood harvest of 3.3 million cords (the statewide average harvest 2004 – 2008). Harvest estimates were determined in units of both cords and ODT. In addition to statewide estimates, the portion of acres of each harvested forest cover type within 100 miles of the Proposed Project was also estimated.

Each forest cover type produces a different amount of extractable logging residue that can be harvested and used as residual biomass. In addition, different ownerships manage forests differently which generates varying levels of timber and residual biomass. For the analysis in the Biomass CI Study it was assumed that residual biomass volumes range from 13 percent to 46 percent of roundwood harvest volumes, depending on forest cover type, and that 50 percent of the available residual biomass would be removed (Kilgore et al., 2009). The Minnesota Forest Resources Council's (MFRC discussed in Section 5.1.1.2) *Biomass Harvesting on Forest Management Sites, December 2007*, has an overall goal of leaving approximately 33 percent of the woody biomass (fine woody debris and incidental breakage) generated on harvest sites. From a supply estimate standpoint, 50 percent available residual biomass may be a conservatively low estimate as it does not account for other sources of biomass.

Based on a statewide roundwood harvest level of approximately 3.3 million cords, the amount of extractable residual biomass was estimated in the Biomass CI Study at the statewide level and within 100 miles of the Proposed Project. Results of the analysis of available roundwood and 50 percent extractable residual biomass at this roundwood harvest level are provided in Table 5.1.1.

TABLE 5.1.1 ANNUAL BIOMASS AVAILABILITY

Forest Type Group	Statewide			Within 100 miles of Proposed Project		
	Harvest Acres	Roundwood Harvest Volume (ODT)	Extractable Residual Biomass Removed (ODT)	Harvest Acres	Roundwood Harvest Volume (ODT)	Extractable Residual Biomass Removed (ODT)
Jack Pine	4,855	125,378	14,967	3,294	84,745	10,092
Red Pine	3,873	170,418	13,119	2,958	130,978	10,083
Eastern white pine	648	17,175	1,278	619	23,628	1,759
Balsam fir	5,736	151,984	19,618	4,642	119,680	15,448
White spruce	1,215	17,209	2,186	736	10,980	1,395
Black spruce	14,640	191,088	43,679	12,780	166,801	38,128
Tamarack	13,071	55,472	17,405	9,418	40,400	12,676
Northern white cedar	4,204	10,034	844	3,506	12,872	1,083
Other	255	3,083	1,339	--	--	--
Oak-pine	2,625	102,552	11,254	1,923	70,294	10,659
Oak-hickory	14,113	159,105	20,552	3,746	41,860	5,399
Elm-ash-cottonwood	14,741	66,643	9,648	8,253	38,574	5,585
Maple-birch-beech	20,726	193,956	27,118	10,712	102,245	12,674
Aspen	63,866	2,058,801	206,483	45,275	1,473,433	147,775
Paper birch	10,156	314,339	51,401	8,176	243,945	39,890
Balsam poplar	4,846	125,901	20,964	2,720	80,766	10,208
Total	**179,603**	**3,763,437**	**461,856**	**118,758**	**2,641,201**	**322,854**

Source: Biomass CI Study Kilgore et al., 2009

The results are presented in ODT, which corresponds to units for the required amount of biomass needed for the Proposed Project. The analysis indicates that on an average annual basis there are 3,763,437 ODT of roundwood harvested statewide, with 2,641,201 ODT (70.2 percent of the total statewide volume) harvested within 100 miles of the Proposed Project. This average annual harvest of roundwood across Minnesota would produce 461,856 ODT of extractable residual biomass. Within 100 miles of the Proposed Project this would produce 322,854 ODT of extractable residual biomass on an average annual basis.

5.1.1.1.2 Biomass Utilization for Energy

Many facilities use biomass for energy and other products in Minnesota. There are several existing regional projects on the Iron Range that use biomass for energy and other products including: Laurentian Energy (facilities located in Hibbing and Virginia), Sappi (Cloquet), Valley Forest Wood Products (Marcell), Minnesota Power (Grand Rapids and Duluth), U.S. Steel Minntac (Mountain Iron), Georgia Pacific (Duluth), and Bio-pellets (Deer River). In addition, the environmental review and permitting process has been completed for the proposed Mountain Timber Wood Fuel Pellet Facility project in Mount Iron, Minnesota and is included as a reasonably foreseeable future project in this FEIS.

Based on information obtained from an MNDNR biomass user survey, it is estimated that the current utilization of woody biomass (including roundwood) for energy in Minnesota is approximately 450,000 ODT per year. Existing drivers that are increasing the utilization of biomass for energy include: rising fuel costs, lower demand for forest products and pulpwood, and Minnesota's Next Generation Energy Act, which is an aggressive renewable energy law that mandates that 25 percent of the total energy consumed be derived from renewable sources by 2025 (Robertson, 2008).

Future economic drivers are coming that would encourage an increase in the use of biomass for energy. One example, the 2008 Farm Bill created the Biomass Crop Assistance Program (BCAP) which provides financial assistance to producers or entities that deliver eligible biomass material to designated biomass conversion facilities for use as heat, power, biobased products or biofuels. Initial assistance will be for the Collection, Harvest, Storage and Transportation (CHST) costs associated with the delivery of eligible materials (USDA website, 2009). As of November 2009, the USDA has received public comments on the BCAP DEIS and is preparing a FEIS.

A second example is contained in the 2002 and 2008 Farm Bills, is USDA's Rural Energy for America Program (REAP). Grants are available for biomass projects that include utilizing material from wood or other plant sources to create energy. A recent application period for REAP indicates that more biomass for energy projects are being considered in Minnesota (interview with USDA Rural Development State Environmental Coordinator, 2009).

5.1.1.2 Regulatory Framework

The Minnesota Sustainable Forest Resource Act (SFRA), adopted in 1995, is a key piece of legislation establishing important policies and programs for management of Minnesota's forests. The SFRA was a policy response to implement recommendations developed in the GEIS for addressing timber harvesting impacts in Minnesota. The SFRA (Minnesota Statute 89A) established the following policy for the state:

(1) pursue the sustainable management, use, and protection of the state's forest resources to achieve the state's economic, environmental, and social goals;
(2) encourage cooperation and collaboration between public and private sectors in the management of the state's forest resources;
(3) recognize and consider forest resource issues, concerns, and impacts at the site and landscape levels; and
(4) recognize the broad array of perspectives regarding the management, use, and protection of the state's forest resources, and establish processes and mechanisms that seek and incorporate these perspectives in the planning and management of the state's forest resources.

The SFRA established the Minnesota Forest Resources Council (MFRC), an executive branch entity charged with facilitating the development and implementation of various programs, and advising the Governor and federal, state, county, and local governments on sustainable forest resource policies and practices. In 1999, the MFRC published a guide book (since revised in 2005) for sustainable forest management in Minnesota titled, Sustaining Minnesota Forest Resources: Voluntary Site-Level Forest Management Guidelines for Landowners, Loggers and Resource Managers (MFRC, 2005). The MFRC Guidelines provide guidance on measures to minimize the environmental impacts across a wide range of integrated forest management, which covers a wide variety of management activities (i.e., forest roads, timber harvesting, site preparation, pesticide use, reforestation, timber stand improvement, and recreation management) as well as addressing the protection of important forest resources (i.e., cultural resources, soils, riparian areas, visual quality, water quality, wetlands, and wildlife habitat). The MFRC Guidelines were created to incorporate many of the recommended site-level mitigation measures identified in the GEIS across a variety of forest management practices.

> The MFRC established voluntary site-level forest management and biomass harvesting guidelines in 2005 and 2007. MFRC guidelines and forest best management practices have been adopted on public and forest industry owned lands; what remains under voluntary compliance is the implementation of MFRC guidelines on NIPF lands.

The MFRC created an addendum to the MFRC voluntary site guidelines in 2007 to include two new chapters that provide guidelines and recommendations for: 1) biomass harvesting on forest management sites, and 2) woody biomass harvesting for managing brushlands and open lands (MFRC, 2007). Minnesota was the first state to establish these types of biomass harvesting guidelines (Robertson, 2008).

About the time the SFRA was enacted, the Minnesota Timber Producers Association (MTPA) was meeting to form the Minnesota Logger Education Program (MLEP). The MLEP was established to "…assess training needs of loggers, review, improve, consolidate, and organize existing logger continuing education programming currently being offered throughout Minnesota, and develop new training opportunities that do not currently exist"(MLEP, 2009). The development of the MLEP was an important step of the forest industry that recognized the need for education and training of loggers in the application of the site-level recommendations in the GEIS and MFRC guidelines.

In 2005, the MLEP developed the Minnesota Master Logger Certification (MMLC) program. MMLC is "A performance-based program for loggers that recognizes training, experience, and the application of sound business and sustainable logging practices. Logger certification has been recognized as a way to independently verify the harvest, safety and business practices of participant loggers against specific standards designed to ensure forests are managed and harvested responsibly" (MMLC, 2009). To be certified under the program loggers undergo a third-party audit of their harvest sites. Auditors are measuring a logger's ability in eight areas of responsibility, including: protection of water quality and soils, and adhering to site specific harvest management plans (MMLC, 2009). As of December 31, 2008, 46 master loggers have been certified in Minnesota (MMLC, 2009).

Third-party certification organizations are becoming more prevalent and widely used in Minnesota. These organizations use systems to independently certify the sustainable management and/or harvesting of forests. Some of the more recognized organizations include: Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI), and the Program for the Endorsement of Forest Certification (PEFC).

The MFRC Guidelines for forest management and biomass harvesting are innovative at a state level and the MMLC is a program that has received national recognition. However, the MFRC Guidelines are voluntary on private lands, and MMLC certifications are completely voluntary. The implementation of the MFRC Guidelines has been adopted on public timberlands. State foresters, county land managers, and the USFS ensure their harvest sites follow these guidelines through logger contracts and follow-up site inspections. Similarly forest industry owned lands also implement these guidelines on a regular basis to implement sustainable forest management practices. Therefore implementation of MFRC Guidelines on NIPF lands is less likely than on other ownerships.

The largest ownership share in Minnesota is comprised of NIPF owners; however, all public ownership categories (state, county, and federal), when added together, constitute greater than 50 percent of the total ownership of forested land. MFRC Guidelines and forest best management practices have been adopted on public and forest industry owned lands; what remains under voluntary compliance is the implementation of MFRC Guidelines on NIPF lands. It is estimated that there are over 300 active logging companies (not including urban tree service companies) in Minnesota. Since the MMLC inception in 2005, 46 logging companies have become certified (MMLC, 2009). Interviews completed for this EIS with MMLC loggers in northern Minnesota indicate that their audits are typically done on NIPF lands to ensure they are following the guidelines when their contracts may not specifically have this requirement. This trend in MMLC audits is confirmed in 2008 MMLC Annual Report that indicates 50 percent of the audits were completed on NIPF lands (MMLC, 2009).

> It is estimated that there would be sufficient biomass supply to meet the existing utilization, as well of the needs of the Proposed Project and reasonably foreseeable future projects. It is likely that large projects utilizing biomass for energy and other products in the future would need to utilize roundwood in addition to residual biomass.

Another driver toward implementation of the MFRC Guidelines and third party verification/certification on NIPF lands is seen by the forest products and pulpwood companies' utilization of the wood. In an effort to be more environmentally conscious some of these companies are requiring their suppliers to undergo additional third-party audits. One example is Sappi Cloquet, LLC (located in Cloquet, Minnesota) which requires chain-of-custody audits for sustainable wood certification from FSC, SFI, and PEFC (MPCA, 2009B).

So while the MFRC Guidelines and various certification and verification programs are still largely voluntary, there has been progress made in the recent past (5-10 years) toward implementation of these guidelines on Minnesota timberlands. Logging companies are seeing the advantage of following the forest management guidelines through education, incentives and contracts. Future increased education and incentives at the state and national level, could lead to even greater adherence of MFRC or similar guidelines.

5.1.2 Environmental Consequences

5.1.2.1 Proposed Project Biomass Demand

The Proposed Project would consume 50,000 ODT of biomass per year and the Project Proposer's facility at Minntac would also consume 50,000 ODT of biomass per year, for a total of 100,000 ODT of woody biomass per year. Based on the four scenarios previously described, woody biomass would be a combination of residual biomass and roundwood procured either on a statewide basis or within 100 miles of the Proposed Project.

Based on the analysis in the Biomass CI Study, it is estimated that there would be sufficient biomass supply to meet the existing utilization as well of the needs of the Proposed Project and reasonably foreseeable future projects. Details about biomass supply and demand estimates and potential environmental impacts associated with the Proposed Project are provided in the Biomass CI Study**.** An MNDNR biomass user survey estimates that current statewide forest-derived (non-mill residue) woody biomass (including roundwood) utilization for energy and other products is approximately 450,000 ODT per year. It is likely that large projects utilizing biomass for energy and other products in the future would need to use roundwood in addition to residual biomass.

Residual biomass, on a per ton basis, would be less expensive for the Project Proposer to obtain than roundwood when demand levels for roundwood are normal to high and when the distances to truck the material are shorter. The likelihood for the Project Proposer to procure roundwood goes up as demand from timber and pulpwood markets goes down, naturally due to the decrease in market costs of roundwood as market demand slows. Market demands have a significant influence on biomass energy user's utilization of roundwood versus residual biomass.

5.1.2.2 Environmental Impact Analysis

> The GEIS and Thunderhawk EIS provide additional information on potential cumulative effects associated with roundwood biomass harvest.

The GEIS for timber harvesting in Minnesota conducted an analysis of potential environmental impacts that could result from increased timber harvesting (Poyry, 1994[4]). This analysis focused on the potential impacts of roundwood harvest under three different harvest scenarios, as outlined in Section 5.1.1.1.1. The GEIS for timber harvesting in Minnesota identified potential significant impacts from roundwood harvest under the defined base harvest scenario of 4 million cords per year over a 50-year analysis period. The identification of potentially significant impacts in the GEIS was the basis for the establishment of the SFRA and the forest management guidelines developed by the MFRC.

The current roundwood harvest in Minnesota is between 2.8 and 3.0 million cords per year, which is below the GEIS base harvest scenario of potential impacts, even when including the potential additional roundwood harvest for the Proposed Project. As a result, the potential impacts identified within the GEIS under the base harvest scenario (as supplemented by the Thunderhawk EIS[4] and GEIS Report Card[4]) are applicable as an estimate of potential impacts from roundwood harvest when adding impacts of the Proposed Project to the current harvest. However, the GEIS, which was published 1994, did not give serious considerations to two important stressors affecting forest ecosystems, climate change and invasive species. Nor did the GEIS apply the science of landscape ecology (i.e., it was lacking a strong spatial component).

In 2006, an EIS was completed for the UPM/Blandin Paper Company modification and expansion of their existing paper mill located in Grand Rapids, Minnesota (MNDNR, 2006C). The Thunderhawk EIS used a harvest scenario of 3.67 million cords per year, which is less than the base harvest scenario of the GEIS, to assess the potential significant environmental impacts to the same categories identified in the GEIS. Similar to the GEIS, the Thunderhawk EIS assessed potential impacts associated with roundwood harvest using applicable portions of the GEIS, GEIS Report Card, and other recent studies. The current roundwood harvest in Minnesota is below the harvest levels described in the Thunderhawk EIS, even with the additional harvest that would be required by the Proposed Project. As a result, potential impacts from roundwood harvest described in the Thunderhawk EIS and potential impacts from roundwood harvest for the Proposed Project are applicable when determining the cumulative effect of impacts associated with the current harvest scenario, the Proposed Project and other projects in the area.

The Biomass CI Study defined four different procurement scenarios for biomass acquisition for the Proposed Project as outlined in Section 5.1.1.1. Procurement Scenarios B and C include the Proposed Project using 70 percent roundwood to meet biomass needs. The potential impacts from roundwood harvest described in the GEIS and Thunderhawk EIS are applicable to the potential impacts from the Proposed Project use of biomass under procurement Scenarios B and C because the addition of the Proposed Project would not result in roundwood harvest levels exceeding those that have already been analyzed in the GEIS and Thunderhawk EIS.

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[4] This reference document is available on the MNDNR's website (http://www.dnr.state.mn.us/input/environmentalreview/keetac/index.html) and at several libraries.
Duluth Public Library, 520 West Superior Street, Duluth, MN
Minneapolis Public Library – Tech. and Science, 300 Nicollet Mall, Minneapolis, MN
Hibbing Public Library, 2020 E 5th Avenue, Hibbing, MN
Keewatin Public Library, 125 3rd Avenue W., Keewatin, MN
MNDNR Library, 500 Lafayette Road, St. Paul, MN
Legislative Reference Library, 645 State Office Building, 100 Rev. Dr. Martin Luther King Jr. Blvd., St. Paul, MN
This document is also available by request of the MNDNR.

However, the GEIS and Thunderhawk EIS did not assess potential impacts related to the harvest of additional extractable residual biomass in Minnesota. Procurement Scenarios A and D include the use of 100 percent residual biomass to supply the needs of the Proposed Project. Of these two scenarios, the one with the potential for the greatest environmental impacts is Scenario D, which assumes that all biomass for the Proposed Project would be obtained within a 100-mile radius of the Proposed Project. Scenario D would concentrate biomass harvesting, and the associated potential environmental impacts, into a smaller geographic area. As a result, for this EIS, the potential impacts associated with residual biomass harvest focus on the potential impacts associated with procurement Scenario D. Analysis for the EIS was simplified by excluding Scenario A, and only evaluating Scenario D, which represents the worst-case scenario.

While residual biomass harvesting has occurred on some level for many years in Minnesota, greater utilization of residual biomass has been increasing. In response to increasing interest in utilizing residual biomass, the MFRC voluntary site guidelines were revised in 2007 to include recommendations for residual biomass harvest and management from timber harvest sites. The MFRC forest biomass harvesting guidelines recommend a minimum of 33 percent of the residual biomass be left on-site to lessen the potential impacts to areas of concern such as soil erosion, water quality, soil nutrients, and wildlife habitat.

As discussed in Section 5.1.1.2, the MFRC Guidelines have been adopted on managed forest lands under state, federal, and county government control. Surveys of loggers in northern Minnesota indicate that the biomass harvesting guidelines are implemented to some extent on private lands as well (Robertson, 2008), but the amount of logging residue removed from sites will vary depending on site conditions, the logging company’s individual policy on residual biomass management, and landowners' intent. However, increased logging residue removal and biomass harvesting guidelines have been implemented for only the past few years. As a result, there has not been sufficient time elapsed for studies to be conducted to determine if short term or long term site or landscape level impacts are occurring or if the guidelines are protective of all conditions identified as potentially significant areas of concern in the MFRC forest biomass harvesting guidelines. Therefore, the potential impacts discussed in this FEIS with respect to potential cumulative effects related to residual biomass harvest from the Proposed Project and other existing projects are estimates. Several studies are underway to help improve the understanding of impacts related to residual biomass harvesting.

While residual biomass harvesting has occurred on some level for many years in Minnesota, greater utilization of residual biomass has been increasing.

Scoping for the Biomass CI Study identified potential environmental impacts associated with residual biomass harvesting for the following topics.

- Soil nutrient levels
- Saproxylic insects
- Biological diversity
- Water quality
- Fish and wildlife habitat

5.1.2.2.1 Soil Nutrient Levels

MFRC forest biomass harvesting guidelines are designed to maintain soil productivity. In most cases, if the guidelines are followed, residual biomass harvesting in addition to roundwood harvesting would not create increased impacts to soil productivity (MFRC, 2007). Soil productivity impacts may occur on sites where excessive residual biomass (smaller limbs and branches high in nutrient levels) is removed. Removing additional biomass above the guidelines removes more nutrients otherwise available in the soil. MFRC guidelines indicate that if multiple harvest rotations fail to leave at least 33 percent of residual biomass, soil nutrient levels might be diminished on some sites. These losses would be greater and occur sooner on shallow nutrient poor soils and organic soils. MFRC forest biomass harvesting guidelines state that based on current available information, the soil nutrient levels would be protected, if the guidelines are followed.

5.1.2.2.2 Saproxylic Insects

Saproxylic insects are a diverse, species-rich group of insects that depend on dead wood that is generally produced in mature forest stands under natural forest conditions. As a forest matures and older trees die-off, or when dead wood is created through events such as blow downs, saproxylic insects facilitate decay of dead wood and nutrient cycling within forests. Concern has been raised in the United States, Canada, and Europe that intensively managed forests interrupt the life cycle of saproxylic insects, potentially impacting population sizes and species diversity (Langor, et al., 2008; Grove, 2002; Schiegg, 2001). Issues relating to saproxylic insects were not considered in the GEIS or the Thunderhawk EIS and are not specifically addressed with the MFRC guidelines, with the exception that the guidelines recommend leaving coarse woody debris for wildlife habitat enhancement.

In an intensively managed forest site, leaving a combination of some dead trunks as well as some limbs and tops (residual biomass) after logging would provide the best habitat to protect saproxylic insect populations and diversity. Schiegg (2001) found that limbs and tops of beech trees in Switzerland hosted more species of diptera (true flies) and coleoptera (beetles) than trunks, even though there was considerable species overlap between trunks and limbs. Additionally, more threatened species of beetles were found on limbs as opposed to trunks during the study. The MFRC recommendations of leaving a minimum of 33 percent of residual biomass would provide the necessary tops and limbs habitat to lessen potential impacts on saproxylic insect diversity and abundance. Where MFRC forest biomass harvesting guidelines are not followed and little or no residual biomass is left on-site, significant impacts to saproxylic insects may occur.

Other studies suggest that the distribution of on-site residual biomass can affect saproxylic insect populations. If all residual biomass is concentrated into slash piles and then left for a significant time before being processed as biomass for fuel, the slash piles could attract saproxylic insects that begin to colonize the wood piles. These saproxylic insects would then experience mortality when the biomass is chipped and then burned as fuel (Hedin et al., 2008). As a result, it may be best to process residual biomass soon after roundwood harvest to prevent creating ecological traps for populations of saproxylic insects. The Hedin study also recommends that if biomass piles could not be chipped soon after roundwood harvest, that the top portions of the slash piles be removed and left on-site as the upper portions of the piles will contain the highest density and diversity of saproxylic insect individuals and species (Hedin et al., 2008).

The above studies represent a sampling of research investigating potential impacts to saproxylic insects as a result of forest management. The research generally suggests that coarse woody debris, including a mix of trunks, limbs and tops, are necessary to maintain healthy populations and diversity of saproxylic insects (Jacobs et al., 2007). Based on the existing research, the increased cumulative residual biomass harvesting that would occur as a result of the combined effect of the Proposed Project and other projects could result in impacts to saproxylic insect populations. The magnitude of these impacts would increase on sites where little or no residual biomass is left on-site or on sites where slash piles are burned for disposal.

5.1.2.2.3 Biological Diversity

Programs are being developed, such as the Minnesota Forest Legacy Partnership, that are focused on acquiring land and perpetual conservation easements on lands that offer among other things, opportunity to maintain and enhance biological diversity for plants and wildlife.

A division of the MNDNR Ecological Services; the Minnesota County Biological Survey (MCBS) "systematically collects, interprets, and delivers baseline data on the distribution and ecology of rare plants, rare animals, native plant communities, and functional landscapes needed to guide decision making" (MNDNR, 2009). The MCBS conducts surveys statewide to assign significance rankings of high, outstanding, moderate, and below biological diversity to sites ranging from 10s to thousands of acres. In addition, the surveys identify locations of threatened and endangered species, which are entered into the MNDNR Natural Heritage Information System (NHIS) database (threatened and endangered species discussed in Sections 4.3 and 5.7).

The MNDNR recommends to loggers and forest management organizations to review the NHIS and MCBS sites of biodiversity significance, along with the MFRC guidelines prior to site harvesting on state land. The MFRC forest biomass harvesting guidelines recommend avoiding harvest of residual biomass in identified rare native plant communities, except under certain circumstances. The USFS recommends to loggers on federal land certain guidelines and regulations that affect harvest methods before a permit is issued.

Programs are being developed, such as the Minnesota Forest Legacy Partnership, that are focused on acquiring land and perpetual conservation easements on lands that offer among other things, opportunity to maintain and enhance biological diversity for plants and wildlife.

Potential impacts to biological diversity appear to be more prevalent during site selection for timber harvesting than a determination whether or not to remove the residual biomass.

5.1.2.2.4 Water Quality

MFRC forest biomass harvesting guidelines recommend leaving the residual biomass from a minimum of one in five trees per acre. In addition it is believed that an additional 10 to 15 percent of incidental breakage during logging would occur and in some cases that amount is greater (Robertson, 2008). The guidelines further recommend the spreading of the residual biomass across the site to minimize the areas of exposed surface disturbance. These practices are intended to prevent channeling of surface runoff and sediment transport in to wetlands and surface waters. Not following the guidelines would increase the potential for soil erosion and surface water sedimentation. Through the use of filter strips and water diversion tactics, the MFRC Guidelines aim to reduce the amount of sediment and nutrient movement into wetlands and other water bodies.

It is important to note that the 2005 MFRC voluntary site guidelines do not address re-entry into sites for the purpose of biomass harvesting, nor do they address additional removal of stand components. The additional harvesting traffic has the potential for increased soil surface disturbance. The MFRC forest biomass harvesting guidelines discourage re-entry into timber harvest sites as it "… increases the potential for sediment movement into wetlands through disturbance of erosion control features and rehabilitated infrastructure" (MFRC, 2007).

MFRC forest biomass harvesting guidelines recommend leaving the residual biomass from a minimum of one in five trees. The guidelines further recommend the spreading of the residual biomass across the site to minimize the areas of exposed surface disturbance.

The MFRC Guidelines also recommend avoiding re-entry of sites across non-frozen wetlands. Likewise, wetland soils are especially vulnerable to compaction and rutting as a result of logging machinery, as well as alteration of soil structure that may hinder air and water movement through the soil (Rummer, 2004). If re-entry is necessary, the MFRC forest biomass harvesting guidelines also recommend restricting biomass harvesting traffic to existing infrastructure (e.g., roads, skid trails, landings).

5.1.2.2.5 Fish and Wildlife Habitat

A concern of forest management related to wildlife habitat is that harvesting large, similarly aged stands or creating clear cuts does not mimic all aspects of natural process of forest succession and disturbance (MFRC, 2007). As a result, there is the potential for impacts to the quality, diversity and availability of wildlife habitat on managed and harvested sites.

One of practices that have been employed to lessen wildlife habitat impacts resulting from forest harvesting is to leave residual biomass, as a mix of both coarse and fine woody debris. Residual biomass and slash piles provide habitat to many wildlife species and is important for small mammal, bird, amphibian or insect species that are unable to easily disperse to new habitat after site harvest. Residual biomass that is left after roundwood harvest also provides shelter to sensitive plant species, especially those species that would be susceptible to dry conditions after canopy removal. Due to the importance of residual biomass as habitat for certain species, there is the potential for impacts to wildlife populations and overall wildlife diversity in the event that all residual biomass is harvested from logging sites.

As residual biomass harvesting activity increases on timber harvest sites, the potential for filter strip disturbance increases. Attention must be paid to the amount of non-merchantable material and coarse woody debris that should be harvested or retained within filter strips. Studies have shown that patches of both coarse and fine woody debris should be retained in order to maintain critical populations of amphibians, reptiles, and terrestrial and aquatic invertebrates (Batzer et al., 2005).

The MFRC Guidelines recommend that forest management attempt to mimic natural disturbance patterns by leaving a combination of snags, and downed coarse and fine woody debris (MFRC, 2007). Following MFRC Guidelines for residual biomass management lessens the potential for impacts to wildlife habitat, populations and diversity. On sites where MFRC Guidelines are not followed and most or all of the residual biomass is removed from the harvest site, there is the increased potential for significant impacts to wildlife habitat, wildlife diversity, or sensitive wildlife populations.

Overall, the cumulative effect to forests from biomass removal would be adverse because harvested biomass would not be available to provide benefits to the forest ecosystem, such as regenerate soils, provide saproxylic insect habitat or decrease soil erosion. However, the magnitude of the effects is expected to be less than significant.

5.1.3 Mitigation Opportunities

The MFRC Guidelines recommend that forest management attempt to mimic natural disturbance patterns by leaving a combination of snags, and downed coarse and fine woody debris.

The SFRA of 1995 was the state's policy to address the GEIS goals. Out of the SFRA, the MFRC was formed and created the guidelines needed for site-level forest management and long-term forest sustainability. Concurrently, the logging industry recognized the need to educate and train loggers in site-level forest management and created the master logger education program, which led to certification of loggers through the MMLC. Other non-profit organizations have formed in the past ten years dedicated to sustainable forestry and acquisition of lands with high and outstanding biological diversity. Much has been done since the GEIS and likely more will be done in the future. The ability to have the MFRC Guidelines implemented on NIPF lands continues to be an area of improvement.

Biomass utilization for energy and other products is on the increase in Minnesota and indications are that this trend will continue. The Project Proposer intends to use available biomass sources to fuel the new grate kiln indurating line and supply their Minntac facility with an equivalent amount as the Proposed Project. Based on the results of the Biomass CI Study, no mitigation has been proposed.

In an effort to ensure the source of the biomass used at these facilities is procured from sites that adhere to the minimum standards set forth in the MFRC Guidelines, the Project Proposer could implement one or more of the following:

- Procure biomass from suppliers that have MMLC or similar certification status.
- Develop an audit program that would allow for credible third-party verification of sustainable forest management practices.
- Maximize procurement from other biomass sources such as: diseased tree removal, thinning operations, urban tree services, and fire management efforts.

5.2 CLIMATE CHANGE

Section 5.2 addresses the cumulative effects of climate change on the environment. The Intergovernmental Panel on Climate Change (IPCC) defines climate change as follows.

> *Climate change in IPCC usage refers to a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the United Nations Framework Convention on Climate Change (UNFCCC), where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods* (IPCC, 2007B).

Throughout this section of the FEIS, the UNFCCC definition will be used since anthropogenic drivers of climate change are the focus of this section of the FEIS.

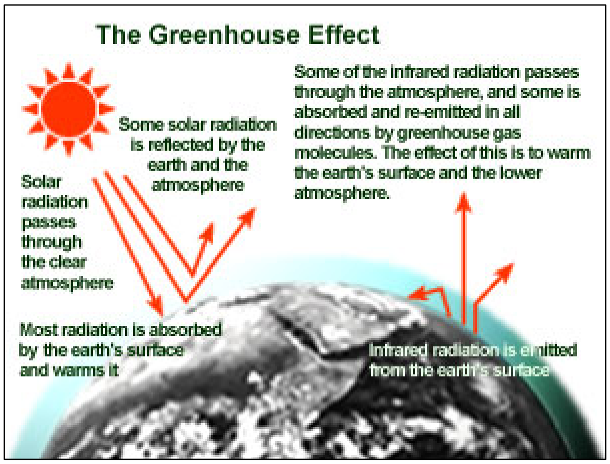
The class of compounds characterized as greenhouse gases (GHG) continues to be the focus of ongoing scientific study, as well as increasing public and political discussion. As defined by the IPCC, "Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds" (IPCC, 2007A).

In the context of this report, GHGs will specifically refer to those compounds with the properties defined above and addressed in the Kyoto Protocol and the USEPA Greenhouse Gas Reporting Rule, excluding other specified fluorinated compounds, as well as being listed in Minnesota's Next Generation Energy Act. These GHGs include:

- Carbon Dioxide (CO_2),
- Methane (CH_4),
- Nitrous Oxide (N_2O),
- Sulfur Hexafluoride (SF_6),
- Hydrofluorocarbons (HFCs), and
- Perfluorocarbons (PFCs).

The IPCC states that changes in atmospheric concentrations of GHGs and aerosols, land cover, and solar radiation are drivers of climate change. As mentioned above, GHGs absorb and emit radiation. As GHG concentrations change, absorption and emission of radiation changes. The resulting positive and negative changes in the energy balance are expressed as radiative forcing, which compares warming and cooling influences (IPCC, 2007B). Illustration 5-2 displays general information about the absorption and emission of radiation in the atmosphere.

ILLUSTRATION 5-2 THE GREENHOUSE EFFECT



Source: MPCA, 2009D

IPCC defines radiative forcing relative to preindustrial conditions defined at 1750 "as a measure of the influence a factor has in altering the balance of incoming and outgoing energy in the Earth-atmosphere system and is an index of the importance of the factor as a potential climate change mechanism." IPCC expresses radiative forcing relative to preindustrial conditions defined at 1750 in units of watts per square meter (W/m2). "There is very high confidence that the global average net effect of human activities since 1750 has been one of warming, with a radiative forcing 1.6 W/m^2." By comparison, changes in solar irradiance since 1750 have been estimated as increasing radiative forcing 0.12 W/m^2. Therefore, the IPCC states, "Most of the observed increase in global average temperature since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations." Additionally, the IPCC cites "discernible human influences extend beyond average temperature to other aspects of climate, including temperature extremes and wind patterns" (IPCC, 2007C).

Based on the mechanisms of radiative forcing as discussed above and the properties of GHGs, humans have had a role in affecting the climate since the beginning of industrialization in 1750. IPCC concludes with 90 percent certainty that global temperatures are increasing as a result of human contributions of GHGs. Anthropogenic emissions of greenhouse gases have significantly increased since 1750 and atmospheric CO_2 concentrations were far higher in 2005 than the natural range over the last 650,000 years (IPCC, 2007C). To put this in context of natural drivers, the United Stated Geological Survey (USGS) states that human activities now account for more than 130 times the amount of CO_2 emitted by volcanoes on a yearly basis (Gerlach et al., 2002). Human activities contributing GHGs to the atmosphere include, but are not limited to, burning of fossil fuels, deforestation, land use change, and other general activities associated with industrialization or transportation among others.

This EIS incorporates new and evolving research and guidance on the state, federal, and international levels that recognize potential consequences of GHGs on climate change. Accordingly, this analysis accounts for GHG emissions associated with the Proposed Project, and recognizes the potential environmental effects from climate change due to anthropogenic global GHG emissions to which the Proposed Project contributes.

With ever-increasing amounts of data available for analysis, the USEPA has stated that scientists know the following with virtual certainty (greater than 99 percent chance that the result is true) (USEPA, 2007, http://www.epa.gov/climatechange/science/stateofknowledge.html):

- An "unequivocal" warming trend of about 1.0 to 1.7°F occurred from 1906-2005. Warming occurred in both the Northern and Southern Hemispheres, and over the oceans (IPCC, 2007C).
- Increasing greenhouse gas concentrations tend to warm the planet.
- Human activities are changing the composition of Earth's atmosphere. Increasing levels of greenhouse gases like carbon dioxide (CO_2) in the atmosphere since pre-industrial times are well-documented and understood.
- The atmospheric buildup of CO_2 and other greenhouse gases is largely the result of human activities such as the burning of fossil fuels.
- The major greenhouse gases emitted by human activities remain in the atmosphere for periods ranging from decades to centuries. It is therefore virtually certain that atmospheric concentrations of greenhouse gases will continue to rise over the next few decades (USEPA, 2007).

The IPCC's most recent report, *Assessment Report 4* (AR4), finds, as summarized in the *Synthesis Report*, the following.

> *Most of the observed increase in global average temperatures since the mid-20th century is very likely [greater than 90 percent confidence] due to the observed increase in anthropogenic GHG concentrations. This is an advance since the TAR's [Third Assessment Report's] conclusion that "most of the observed warming over the last 50 years is likely [greater than 66% confidence] to have been due to the increase in GHG concentrations. {*[Working Group I] *WGI 9.4, SPM* [Summary For Policy Makers]*}*, (p. 39, 2009, Climate Change Synthesis 2007: Synthesis Report)

With such high certainty (90 percent – 99 percent), the statements lead to the following line of reasoning.

1. Warming across the globe is occurring,
2. Most of the warming has very likely (greater than 90 percent certainty) been caused by GHGs, and
3. Most of the GHGs are anthropogenic.

A proper accounting and evaluation of GHG emissions for new projects will help develop a more complete characterization of a project's overall GHG footprint. Neither the Federal Government nor the state of Minnesota has developed a method to quantitatively model the global climate change impacts of the GHG emissions of a single project of this scale or to quantitatively determine significance of impacts specific to GHG emissions. Therefore, this analysis accounts for GHG emissions associated with the Proposed Project, and recognizes the potential environmental effects from climate change due to anthropogenic global GHG emissions to which the Proposed Project contributes.

This FEIS and the Climate Change Report for the Keetac Mine Expansion accounts for GHG emissions from the Proposed Project including alternatives and potential effects. The following sections discuss various aspects of GHGs and climate change.

5.2.1 Affected Environment

5.2.1.1 Temperature

Because GHGs trap heat, the dominant measure for documenting, gauging, and modeling climate change associated with emissions is temperature. Impacts to resources have been tied to increases in temperature associated with GHGs. Historical temperature trends illustrate the rise in temperatures that scientists have tied to GHG emissions. According to global models, future temperatures are projected to continue rising. However, the rate of rise may not necessarily be the same as the current rate of rise (i.e., the rise could be slower) (IPCC, 2007C).

Historical temperature trends in Minnesota and the United States are detailed in the Climate Change Report. The report shows that temperatures in Minnesota have risen as those in the United States have risen. Additionally, seasonal trends in Minnesota and across the U.S. also correspond.

According to different scenarios assessed by the IPCC, average global temperature by end of this century is projected to increase by 3.2 to 7.2 °F compared to the average temperature in 1990. The uncertainty range of this estimate is (2.0 to 11.5 °F) (FR, 2009A).

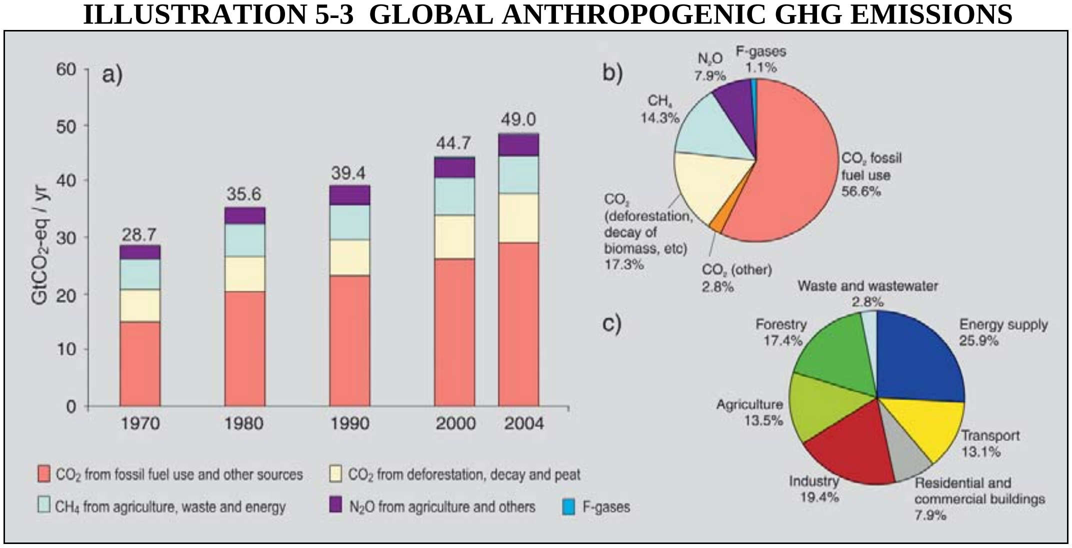
5.2.1.2 GHG Trends – Historic and Current

> Currently, anthropogenic GHG emissions are expected to continue increasing.

Scientists, as referenced above and discussed in following sections, show that anthropogenic GHG emissions do impact the climate. Anthropogenic GHG emissions are expected to continue increasing. The continued increase in anthropogenic GHG emissions is expected to further influence the climate (IPCC, 2007C). The following section discusses the observed and expected trends in anthropogenic GHG emissions.

Global GHG emissions were an estimated 49 billion metric CO_2-equivalent (CO_2-e) tons in 2004, up from 28.7 billion metric tons (Gt) Co_{2}-ein 1970. Of this, CO_2 emissions were an estimated 38 Gt CO_{2}-e in 2004, up from 21 Gt CO_{2}-e in 1970. The CO_2 emissions represent 77 percent of GHG emissions over that period, although emissions of other GHGs (CH_4, N_2O, SF_6, HFCs, and PFCs) increased from 0.43 Gt CO_2-e per year in the period 1970 to 1994 to 0.92 Gt CO_2-e per year from 1994 to 2004. The sources and rates from 2004, on a global scale, are displayed in Illustration 5-3 (IPCC, 2007C).

ILLUSTRATION 5-3 GLOBAL ANTHROPOGENIC GHG EMISSIONS



Source: IPCC, 2007C

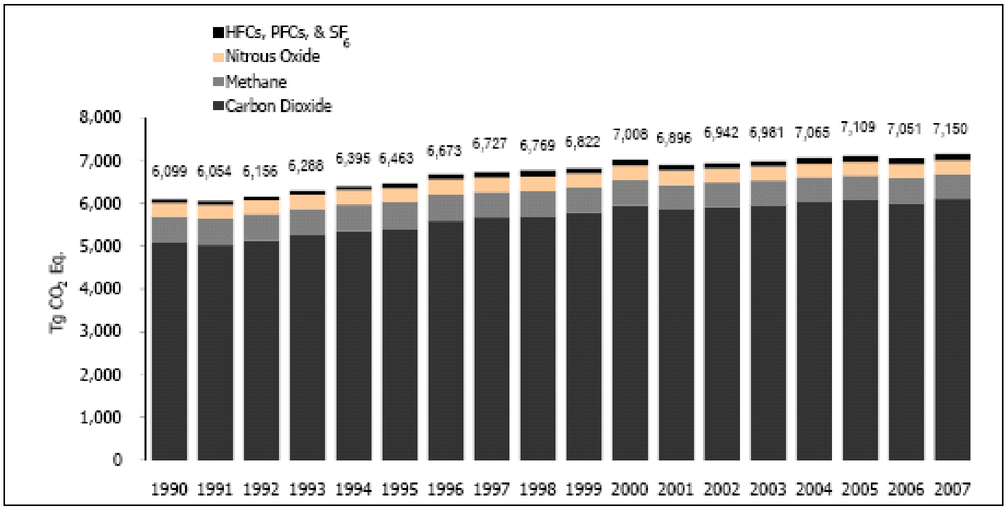
As shown in Illustration 5-3, fossil fuel combustion accounted for the majority of GHG emissions. From a sector perspective, energy supply emitted the most GHGs while industry represented 19.4 percent of GHG emissions (IPCC, 2007C). The industry sector includes production of lime and cement, steel, aluminum, hydrogen, ammonia, and solvent, among others. While complete and accurate global emissions data has not been published by the IPCC for 2007, the emissions and sector contributions have been projected to follow similar trends.

In the United States, GHG emissions in 2007 were an estimated 7.15 billion metric CO_2-e tons, increasing about 17 percent from 1990 levels. The 2007 total is a 1.4 percent increase over 2006 emissions. Greenhouse gases have continued to grow at an average annual rate of 0.9 percent since 1990, which is slightly slower than average annual population growth of 1.1 percent. Examining subsets of the data, GHG emissions have increased at an average annual rate of 1.4 percent from 1990 to 2000 versus an average annual rate of 0.3 percent from 2000 to 2006. The USEPA lists the following reasons for the most recent GHG emissions increases.

- Cooler winter and warmer summer conditions led to an increase in heating fuel and electricity demand;
- Electricity generation from fossil fuels increased;
- Hydropower generation decreased despite the increase in electricity demand (USEPA, 2009A).

Illustration 5-4 and 5-5 taken from the most recent U.S. inventory of GHG emissions published by USEPA displays the increase in greenhouse gas emissions by gas.

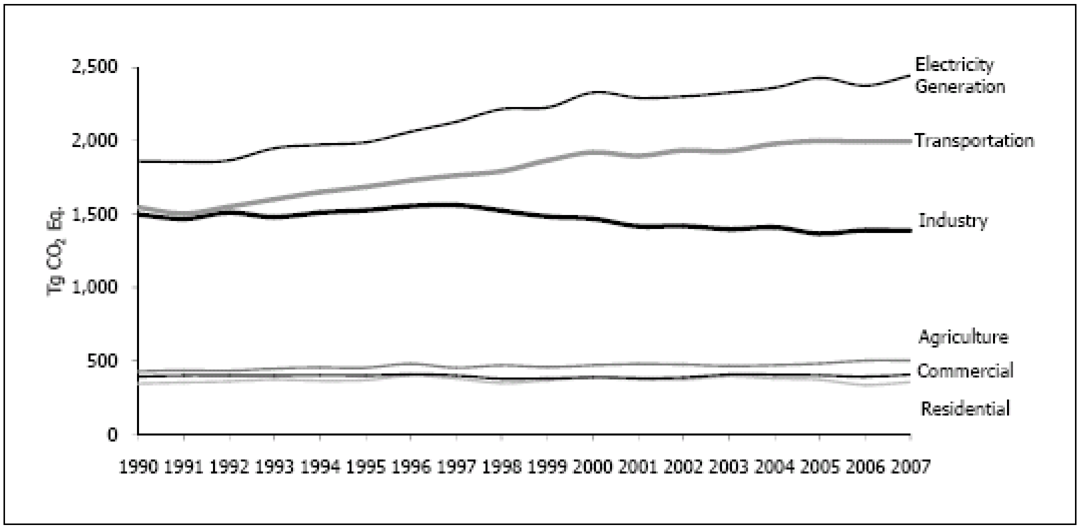
ILLUSTRATION 5-4 U.S. GREENHOUSE GAS EMISSIONS BY GAS



Source: USEPA, 2009A

As illustrated, CO_2 represented the largest amount of GHG emissions at 85.4 percent of the total. Representing 80.2 percent, fossil fuel combustion accounts for the largest source of overall GHG emissions, as well as CO_2 emissions. Comparable to global emissions, the industrial sector contributed 20 percent of the U.S. emissions. However, the direct industrial emissions in U.S. have decreased since 1990 and remained flat over the last few years (USEPA, 2009A). By contrast, direct industrial emissions plus indirect emissions associated with the purchase and consumption by industrial firms of electricity generated off-site have increased 8 percent since 1990 (USEPA, 2007A). The following illustration displays the emissions by sector prior to distributing electricity consumed in each.

ILLUSTRATION 5-5 EMISSIONS ALLOCATED TO ECONOMIC SECTORS



Source: USEPA, 2009A

Within the industrial sector, iron and steel production emits the most GHGs at 78.1 million metric tons CO_2-e in 2007. (Note: These emissions do not account for electricity consumption or land use changes. The USEPA treats electricity as a separate entity in the Energy sector.) This is a 1.6 percent increase from 2006. However, it is important to note that iron and steel related GHG emissions have decreased 18.9 percent since 2000 due to restructuring of the industry (production decrease), technological improvements (efficiency improvements), and increased scrap utilization (USEPA, 2009A). The specific reduction attributed to technological improvements is not apparent from the data included in the USEPA report. Minnesota-specific data provides figures for comparison inside the steel industry. For the taconite industry in the State, the Minnesota Department of Revenue shows a 13 percent decline in processing of taconite, approximately 45 million tons in 2000 compared to 39 million tons in 2006 (MN Department of Revenue, 2008).

In comparison, taconite processing GHG emissions dropped 16 percent from 1.9 million tons CO_2-e to 1.6 million tons CO_2-e over the same time period. The numbers do exclude fossil fuel combustion, similar to the USEPA inventory (MPCA, 2009D). The decrease in GHG emissions for taconite processing in Minnesota is greater than the decrease in taconite processing. However, the emissions associated with portions of the process may be occurring in different states. That is, some of the decrease could be from efficiency improvements and other GHG reductions beyond production decreases in addition to various process operations being completed at other locations not accounted for in the Minnesota inventory.

Specific to MPCA and MNDNR areas of responsibility, GHG emissions are also increasing in Minnesota. Table 5.2.1 presents Minnesota's GHG emissions from 1970 to 2006 by economic sector.

TABLE 5.2.1 GREENHOUSE GAS EMISSIONS IN MINNESOTA BY ECONOMIC SECTOR

Greenhouse Gas Emissions by Sector (million tons CO_2-equivalent)										
	1970	**1980**	**1990**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Agriculture	20.4	24.7	22.2	22.8	22.3	23.4	23.4	23.5	23.8	23.5
Commercial	8.8	6.1	5.9	6.5	6.6	7.1	6.9	6.7	6.8	6.1
Electric Utility	21.9	30.4	41.1	51.6	53.2	53.5	54.8	54.3	55.2	56.0
Residential	11.8	10.5	7.8	9.6	9.5	9.0	9.4	9.2	8.4	8.0
Transportation	22.6	28.1	31.1	40.4	40.8	41.5	41.6	41.8	41.8	41.0
Industrial	18.0	13.2	14.1	18.0	15.5	15.5	15.5	16.5	16.6	16.4
Waste	3.2	4.3	5.6	2.9	2.8	2.4	2.0	1.7	1.6	1.4
Total	**106.7**	**117.4**	**127.7**	**151.7**	**150.8**	**152.3**	**153.6**	**153.7**	**154.1**	**152.5**

Source: MPCA, 2009D

As represented in Table 5.2.1, the MPCA states that the GHG emissions increased about 43 percent from 1970 to 2006. However, emissions from 2005 to 2006 declined 1.6 million CO_2-e tons. In general, MPCA explains the trends within the figure accordingly: MPCA contends that "most of the historical growth in emissions occurred between 1985 and 1995, a period of rapidly declining real energy prices" (MPCA, 2009D). Accounting for the majority of the growth in emissions in Minnesota, electricity and transportation accounted for 64 percent of the emissions in Minnesota in 2006, as compared to 42 percent of emissions in 1970. Approximately 1.05 percent of 2006 GHG emissions in Minnesota came from taconite processing, up slightly from 0.94 percent of 1970 GHG emissions in Minnesota. For industry overall, the sector contributed 16.4 million tons CO_2-e in 2006 or 10.75 percent of Minnesota's GHG emissions. This is compared to the 18 million tons CO_2-e emitted by the industrial sector in 1970 which represented 16.87 percent of Minnesota's GHG emissions. Additionally, the industry sector contributed the fourth most GHG emissions behind the previously mentioned sectors and agriculture. Again, it should be noted that the electricity consumption as well as land use change emissions are not distributed among the sectors in the Minnesota inventory (MPCA, 2009D).

5.2.1.3 Possible Future Conditions

5.2.1.3.1 GHG Trends and Associated Surface Temperature Change-Projected

After examining historic and current trends in GHG emissions on a global and national scale, the IPCC states, "There is high agreement and much evidence that with current climate change mitigation policies and related sustainable development practices, global GHG emissions will continue to grow over the next few decades" (IPCC, 2007C). The IPCC uses several projection scenarios on which to examine future climate change.

Detailed in the *Special Report on Emissions Scenarios* (SRES), the scenarios developed by the IPCC "cover a wide range of main driving forces of future emissions, from demographic to technological and economic development." Scenarios account for new developments in the future from different structures for energy systems to land-use change.

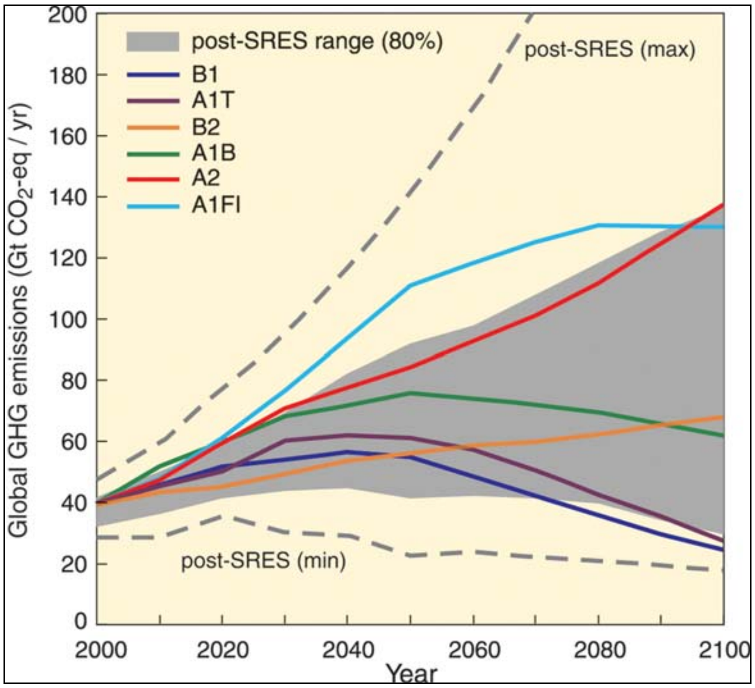
The scenarios are summarized as follows.

- A1 – This assumes very rapid economic growth throughout the world. The human population is assumed to peak in the middle of the century. It also includes a rapid introduction of new and more efficient technology. The types of technology introduced distinguish the subdivision of A1.
  - A1FI – Technology is fossil intensive.
  - A1T – Technologies are non-fossil energy resources.
  - A1B – Technology is balanced across all sources.

- A2 – This scenario accounts for a very heterogeneous world with high population growth. The scenario includes slow economic development and also assumes slow technological change.
- B1 – This scenario assumes a convergent world with a population peaking in the middle of the century, the same as A1. However, the economic structure changes rapidly to service and information.
- B2 – This scenario uses a world with intermediate population and economic growth. In this scenario, solutions for economic, social, and environmental sustainability are emphasized at a local level (IPCC, 2007C).

The scenarios are presented in Illustration 5-6.

ILLUSTRATION 5-6 SCENARIOS FOR GHG EMISSIONS FROM 2000 TO 2100 IN THE ABSENCE OF ADDITIONAL CLIMATE POLICIES

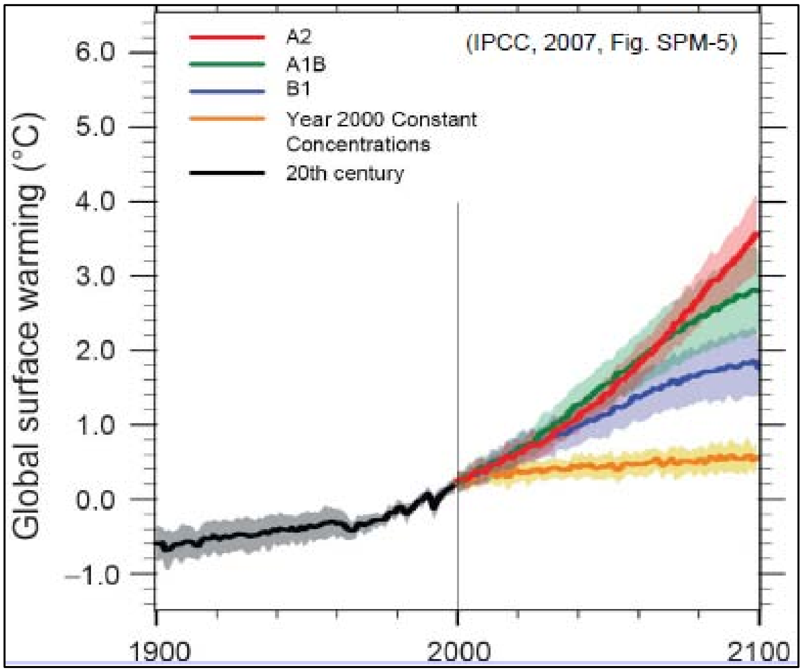


Source: IPCC, 2007C

Projections associated with these scenarios are treated qualitatively with regard to uncertainty. While no likelihood has been attached to individual scenarios, IPCC states that there is high agreement with much evidence that global GHG emissions will continue to grow over the next few decades with current policies and practices relating to both mitigation and sustainability development. SRES scenarios project increases of baseline global GHG emissions of 25 percent to 90 percent between 2000 and 2030 (IPCC, 2007C).

Tied to the projected increases in GHG emissions, the IPCC shows a resulting global average surface temperature increase for each of the SRES scenarios. The projected surface temperature increases for each scenario are displayed below in Illustration 5-7. Each temperature increase can be linked to the GHG emissions for the corresponding scenario from the previous figure.

ILLUSTRATION 5-7 SPECIAL REPORT ON EMISSION SCENARIOS (SRES) SURFACE TEMPERATURE INCREASES



Source: IPCC, 2007C

Nationally, the Department of Energy (DOE) projects that U.S. CO_2 emissions under the reference scenario will increase from 6 billion metric tons in 2007 to 6.4 billion metric tons in 2030, a 7 percent increase. Projections for no GHG concern and the previously introduced house bill Lieberman-Warner from the 110th Congress (LW110) are also presented in the following table. No GHG concern assumes that investment decisions will not consider GHG emissions. That is, entities will not make investments in new technology for the direct purpose of reducing GHG emissions (DOE, 2009).

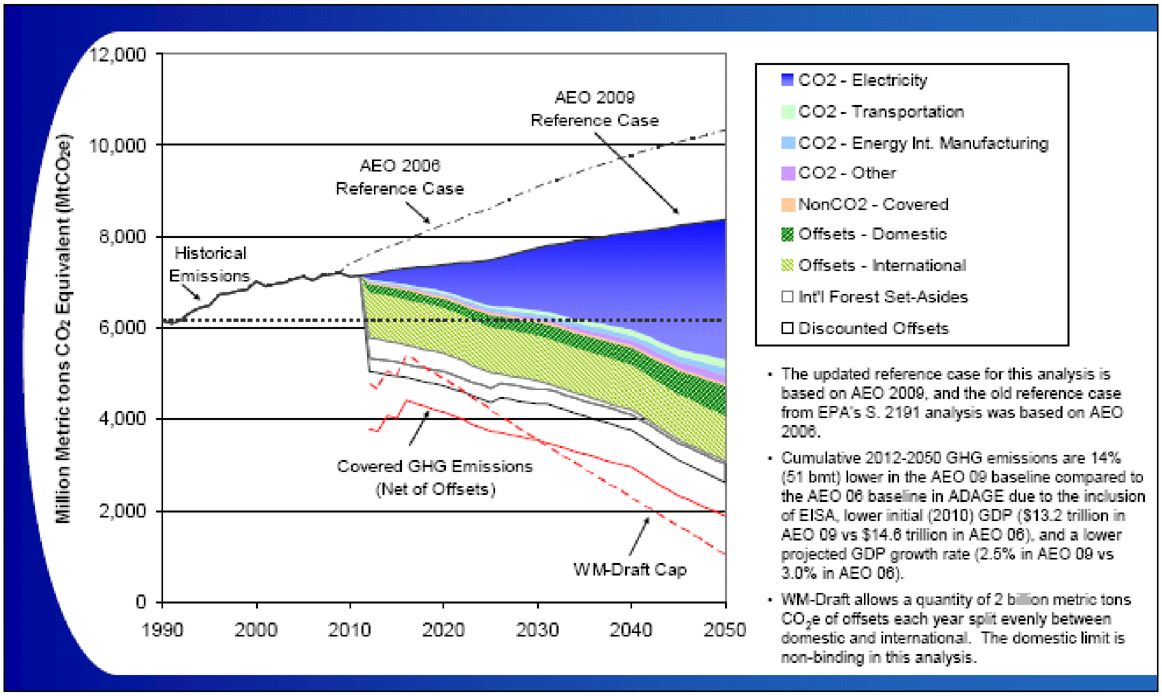
TABLE 5.2.2 SUMMARY PROJECTIONS FOR ALTERNATIVE GHG CASES, 2020 AND 2030

		2020			2030		
State	**2007**	**Reference**	**No GHG Concern**	**LW110**	**Reference**	**No GHG Concern**	**LW110**
Carbon dioxide emissions (million metric tons) Electric Power Sector, By Fuel							
Petroleum	66	40	40	37	41	42	36
Natural gas	376	357	340	325	378	321	260
Coal	1,980	2,089	2,142	1,685	2,299	2,494	868
Other	12	12	12	12	12	12	12
Total	**2,433**	**2,497**	**2,534**	**2,059**	**2,729**	**2,869**	**1,176**
Total carbon dioxide emissions, all sectors	**5,991**	**5,982**	**6,044**	**5,436**	**6,414**	**6,745**	**4,615**

Source: DOE, 2009

After the introduction of Waxman-Markey Bill (discussed in Section 5.2.1.4.3), the USEPA was requested to analyze the impact of the Bill. Illustration 5-8 displays the projections from various scenarios presented in the Bill.

ILLUSTRATION 5-8 REFERENCE CASE FOR USEPA PRELIMINARY ANALYSIS OF THE WAXMAN-MARKEY DRAFT



Source: USEPA, 2009B

The projections in Illustration 5-8 present the USEPA analysis of actions proposed by Waxman-Markey Draft versus the DOE reference cases.

5.2.1.3.2 Climate Change Impacts

Temperature and climatic changes of just a few degrees can have significant resource, ecosystem, economic, and social impacts.

Regionally, mean annual air temperatures have increased 1°F since 1979. The surface water temperature of Lake Superior is observed to be rising at 2°F per decade. Projected climate changes for the Midwest include more frequent heat waves that are more severe and longer lasting. Hot days will be more frequent with heat wave seasons being more than twice as great under the higher emissions scenario (SRES A2) compared to the lower emissions scenario (SRES B1) (USGRCP, 2009).

Future precipitation in the Midwest is likely (2/3 chance) to increase throughout winter and spring. The frequency and intensity of heavy downpours continues increasing in the U.S. Increases in heavy precipitation occurred in the Northeast and the Midwest in the greatest amount over the past 50 years. Extreme events increase surface runoff and cause poorer water quality, through the delivery of nutrients, pesticides, and other residential and industrial pollutants (USGRCP, 2009).

The following information originates from the MPCA *ER Cumulative Impacts-AC PCA Text* document (MPCA, 2009C). Where applicable, the information has been supplemented to provide more detail on potential impacts. Increasing temperatures cause earlier onset of spring biophysical processes, such as leaf and insect emergence, and also extend the growing season. If species do not all respond to changes in similar ways, the timing of interdependent seasonal life-cycle events may become mismatched, such as insect hatching and migratory bird arrival, leading to species decline.

Species adapted to cold climates are already observed undergoing range shifts out of the Great Lakes basin into Canada. Species that cannot adapt will become extinct and local extirpations may become common. The abundance and distribution of tree and vertebrate species would decrease over the next century, and 15-35 percent of species may be unable to avoid extinction. In addition, climate change would relax the temperature constraints to invasive species along the northern edges of their present ranges, where winter conditions previously prevented their survival (MPCA, 2009C).

As the climate warms, the forests will change; this means that landscape, wildlife, ecology, land-uses and occupations will be affected. If trends continue in Minnesota, aspen and birch forests will be replaced by hardwood forests of oak and hickory as well as elm and ash. The spruce and fir forests along the Canadian border will migrate further north. The northern Great Lakes are home to a cool climate forest that are rare in the United States. With warming, the unique landscape of the boreal forest of the BWCAW - the last remnant of boreal forests in the continental U.S. outside of Maine – will likely not survive. These forest changes may occur if the current forest does not reproduce at its southern margin, and does expand its range to the north, slowly moving into Canada, or it may be abrupt, brought by disease, insects, drought and wildfire.

Sustainability of fisheries is closely linked to temperature, water flows, and lake levels. Water temperatures are expected to increase, and many lakes may no longer be able to support cold-water species, which will be found only in deep lakes and at the northern edge of the basin. Warm-water fish will be increasingly common. Surface-fed streams will be most affected, and likely will not be able to support cold-water fish like brook trout and rainbow trout. Such species will shift north of the Great Lakes basin. Those cold-water streams that can sustain cold-water fish may need intensive management to maintain Great Lakes spawning grounds. Fisheries are also sensitive to other co-occurring pressures, including habitat loss, water pollution, invasive and introduced species, and over-exploitation.

Similarly, ice cover would decline as water and temperatures warm. This would allow for longer shipping seasons potentially increasing economic activity. However, evaporation in turn would also increase as the climate warms. Evaporation could lead to decreased water levels, which would require more extensive dredging to accommodate vessels. Specifically, "the Great Lakes are projected to fall no more than 1 foot by the end of the century, but under a higher emissions scenario, they are projected to fall between 1 and 2 feet (USGRCP, 2009).

Moderate climate change, meaning temperature increases on the lower end of the projected ranges, could likely (2/3 chance) increase agricultural yields and food production, with some regional and annual variability. Areas in higher latitudes would experience more positive effects on the growing season. The extended growing seasons for higher latitudes could produce more crops though some production is expected to be offset by the effect of extreme rainfall events. This is opposed to the lower latitude that could see reduced crop yields as temperatures begin to surpass ideal growing temperatures (USGRCP, 2009).

Fuel use for winter heating should decline in the Great Lakes region as it warms resulting in a reduction in GHG emissions. However, electricity use for summer cooling probably will increase and may result in the need for new power plants and increased GHG emissions. The change in heating demand relative to cooling demand would determine the net increase or decrease in GHG emissions. Industries, energy supply, and transportation networks are sensitive to weather extremes that exceed their safety margins.

Many human diseases are sensitive to weather. Examples include cardiovascular and respiratory illnesses due to heat waves or air pollution, or altered transmission of infectious diseases. It is possible however that risks to human health from climate change may be mitigated by health care, technology, and accessibility. Respiratory disorders exacerbated by warming-induced deterioration in air quality and surface ozone concentrations may increase with a warmer climate, even though emissions reductions may be occurring. Ozone damages lung tissue, and poses risks to individuals with asthma and other respiratory diseases. Sickness and death due to pneumonia, bronchial infections and other diseases associated with winter climates could decline.

5.2.1.4 Regulatory Framework

GHG emissions in Minnesota are subject to limited direct federal or state regulation in the industrial and public sectors. However, this could change rapidly. Several international, federal, and local initiatives aim to address climate change through GHG emission reduction. The current status of GHG initiatives and regulatory frameworks changes daily. Numerous bodies and organizations are addressing climate change on various levels. Within a static document that requires a specific process of reviews and submittals spread across even a short time period, the most recent changes cannot be fully incorporated. While certain actions are anticipated throughout 2010, the actual form and mechanism of the regulations or programs cannot be predetermined based on the current environment. The significant changes and initiatives have been updated as appropriate and possible for the Final EIS. Therefore, the following information summarizes some of the actions that have been considered or initiated through the most recent period of review and comment. The summaries provide information through May 2010.

5.2.1.4.1 Final Federal Rules and Findings

- Endangerment Finding – On December 7, 2009, the USEPA Administrator found that, under the Clean Air Act section 202(a), greenhouse gases in the atmosphere endanger both the public health and the environment for current and future generations. The Administrator also found that the combined emissions of GHGs from new motor vehicles and new motor vehicle engines contribute to pollution that endangers public health and welfare under CAA section 202(a) (FR, 2009B). The finding does not actually set requirements for industry or other entities, but the finding did provide the necessary steps for finalizing the light-duty vehicle emissions standards as well as the tailoring rule.

- Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporate Average Fuel Economy Standards – On April 1, 2010, the USEPA and DOT National Highway Traffic Safety Administration established rules in accordance with the Fuel Economy Standards Increase. The rule applies to passenger cars, light-duty trucks, and medium-duty passenger vehicles starting with model years 2012 through 2016. These vehicles would be required to meet an estimated combined average emissions level of 250 grams of carbon dioxide per mile. The equivalent fuel economy is approximately 35.5 mpg. The administration projects that the policy will save 1.8 billion barrels of gas and reduce GHG emissions by approximately 960 million metric tons (EPA and DOT, 2010).

- USEPA Mandatory Reporting of Greenhouse Gases Rule – USEPA issued the Final Mandatory Reporting of Greenhouse Gases Rule on September 22, 2009. The final rule requires reporting of GHG emissions from large sources and suppliers in the U.S. In general, the rule applies to those facilities emitting over 25,000 metric tons of GHGs on a CO_2-e basis. The USEPA specifically requires facilities in the iron and steel industry to report if emissions of GHGs are greater than or equal to 25,000 metric tons of CO_2-e. Taconite iron ore processing is specifically listed as a process that falls within the source category of iron and steel production. Sources of emissions to be considered for the threshold are stationary combustion, iron and steel production processes, miscellaneous use of carbonates, and other source categories. Owners or operators are required to collect emission data; calculate GHG emissions; and follow the specified procedures for quality assurance, missing data, recordkeeping, and reporting. Emissions and calculation process required for annual reporting are:

  - CO_2 process emissions from each taconite indurating furnace, basic oxygen furnace, nonrecovery coke oven battery combustion stack, coke pushing process; sinter process, EAF, argon-oxygen decarburization vessel, and direct reduction furnace.
  - CO_2, methane (CH_4), and nitrous oxide (N_2O) emissions from each stationary fuel combustion unit. Stationary combustion units include, but are not limited to, byproduct recovery coke oven battery combustion stacks, blast furnace stoves, boilers, process heaters, reheat furnaces, annealing furnaces, flame suppression, ladle reheaters, and any other miscellaneous combustion sources (except flares). Emissions under subpart C are reported by following the requirements in 40 CFR part 98, subpart C (General Stationary Fuel Combustion Sources). The information sheet on General Stationary Fuel Combustion Sources summarizes the rule requirements for calculating and reporting emissions from these units.
  - CO_2, CH_4, and N_2O emissions from flares according to the requirements in 40 CFR part 98, subpart Y (Petroleum Refineries) using the default CO_2, CH_4, and N_2O emission factors for coke oven gas and blast furnace gas.

- USEPA Prevention of Significant Deterioration (PSD) and Title V Greenhouse Gas Tailoring Rule (Tailoring Rule) – On May 13, 2010, EPA issued the Tailoring Rule for regulating greenhouse gas (GHG) emissions under the Clean Air Act (CAA). The final rule sets thresholds for GHG emissions for air permitting under the New Source Review Prevention of Significant Deterioration (PSD) and Title V Operating Permit programs for new and existing industrial facilities. The rule "tailors" CAA permitting programs to limit the number and size of facilities subject to the new PSD and title V permits requirements. The final rule includes a phased process for regulating GHGs:
  - Step 1 (January 2, 2011 – June 30, 2011) - Only sources currently undergoing federal permitting under CAA for other pollutants (newly-constructed or modified in a way that significantly increases emissions of a pollutant other than GHGs) would be subject to permitting GHGs under PSD.
    - For these projects, increases of 75,000 tpy or more of GHG (CO_2–e basis) would trigger Best Available Control Technology (BACT) requirements for GHGs.
    - For the operating permit program, only sources currently subject to the program would be subject to title V requirements for GHGs.
    - During this time, no sources would be subject to CAA permitting requirements due solely to their GHG emissions.
  - Step 2 (July 1, 2011 – June 30, 2013) – For the first time PSD permitting requirements will cover new construction projects with GHG emissions of at least 100,000 tpy even if they do not exceed permitting thresholds for any other pollutant.
    - Modifications at existing facilities that increase GHGs by at least 75,000 tpy will be subject to permitting even if they do not significantly increase emissions of any other pollutant. Title V operating permit requirements will apply to sources based on their GHG emissions even if they would not apply based on emissions of any other pollutant.
    - Facilities that emit at least 100,000 tpy of CO_2–e will be subject to title V requirements and must apply within 1 year after becoming subject to the program (i.e. on or before July 1, 2012) unless state rules dictate otherwise.
    - Sources subject to GHG permitting requirements under step 1 will continue to be subject to GHG permitting requirements.
  - Step 3 – EPA has committed to completing another rulemaking no later than July 1, 2012 to establish a step 3 that would take effect on July 1, 2013.

The Proposed Project is subject to PSD for particulate and sulfur dioxide emissions. Thus, it is covered under Step 1 above. The Project Proposer must determine if the net increase in CO_2–e emissions associated with the Proposed Project would equal or exceed 75,000 tons per year. If so, a BACT analysis for GHGs must be completed as part of the air permit application.

- Energy Conservation Standards and Test Procedures for General Service Fluorescent Lamps and Incandescent Reflector – The initiative is designed to save energy by increasing efficiency for fluorescent lighting.

5.2.1.4.2 Proposed Federal Rules

- USEPA Mandatory Reporting Rule of Greenhouse Gases Update – On March 22, 2010, Administrator Jackson signed four new proposed rules that amend the Mandatory Greenhouse Gas Reporting Rule. These proposals would require reporting of emissions data from the oil and natural gas, industries that emit fluorinated greenhouse gases, and from facilities that inject and store carbon dioxide (CO_2) underground for the purposes of geologic sequestration or enhanced oil and gas recovery. In addition, EPA has proposed to add three new reporting requirements to the General Provisions (Subpart A) of the rule. EPA plans to finalize all four of these proposals this year.

5.2.1.4.3 Other Federal, Regional or International Initiatives, Proposed Legislation or Ongoing Activities

- American Clean Energy and Security Act of 2009 (ACES a.k.a. Waxman-Markey) – The U.S. House of Representatives has passed a measure that would address energy and security in the U.S. ACES is under review by the Senate. The bill encompasses several aspects of clean energy and global warming by promoting new sources, energy efficiency, and regulation. From a GHG perspective, the bill affects GHG emissions directly because proposes a cap-and-trade program to control GHG emissions. The bill would require the federal government to set a limit on GHG emissions and reduce that limit over time. GHG emitters would have the option to trade emissions credits from the government or other emitters. The bill calls for a 17 percent reduction below 2005 levels in U.S. greenhouse gas emissions by 2020. The following presents some of the provisions as related by USEPA.
  - *Title I – Clean Energy*
    - *Subtitle A* - Combined Efficiency and Renewable Electricity Standard
    - *Subtitle B* - Carbon Capture and Sequestration
    - *Subtitle C* - Clean Transportation
    - *Subtitle D* - State Energy and Environmental Deployment Accounts
  - *Title II – Energy Efficiency*
    - *Subtitle A* - Building Energy Efficiency Programs
    - *Subtitle B* - Lighting and Appliance Energy Efficiency Programs
    - *Subtitle C* - Transportation Efficiency
    - *Subtitle D* - Industrial Energy Efficiency Programs
      - *Section 241, Industrial Plant Energy Efficiency Standards:* Requires the Secretary of Energy to establish standards for industrial energy efficiency and to seek recognition of result by American National Standards Institute.
      - *Section 242, Electric and Thermal Energy Efficiency Award Programs:* Creates an award program for innovation in increasing the efficiency of thermal electric generation processes, including encouragement for utilities to capture and separately market excess thermal energy.
      - *Section 243, Clarifying Election of Waste Heat Recovery Financial Incentives:* Clarifies Section 451 of the Energy Independence and Security

Act of 2007 to ensure that those who recover waste energy can elect to receive the incentive grants provided in that section, or tax credits provided for combined heat and power, but not both.

    - *Subtitle E* - Improvements in Energy Savings Performance Contracting
    - *Subtitle F* - Public Institutions
    - *Subtitle G* - Miscellaneous
  - *Title III – Reducing Global Warming*
    - *Subtitle A* - Title VII of the Clean Air Act to provide a declining limit on global warming pollution and to hold industries accountable for pollution reduction under the limit.
    - Amends the Clean Air Act by adding "*Title VII – Global Warming Pollution Reduction Program"* that establishes a cap and trade system for greenhouse gases.
      - Economy-wide coverage phased in over time: All electricity sources
      - Producers and importers of CO_2 , N_2O, PFCs, SF_6 , or other designated gases in amounts greater than 25kt CO_2-e
      - Industrial sources larger than 25kt CO_2-e
      - GHG emission targets for covered sectors (targets decline in each calendar year):
        - 2012: 4,627 Mt CO_2-e (3 percent below 2005 emissions levels for covered sectors)
        - 2020: 5,056 Mt CO_2-e (17 percent below 2005 emissions levels for covered sectors)
        - 2030: 3,533 Mt CO_2-e (42 percent below 2005 emissions levels for covered sectors)
        - 2050: 1,035 Mt CO_2-e (83 percent below 2005 emissions levels for covered sectors)
  - Title IV addresses competitiveness issues and the transition to a clean energy economy. *Title IV – Transition to a Clean Energy Economy*
    - *Subtitle A* - Ensuring Domestic Competitiveness
    - *Subtitle B* - Green Jobs and Worker Transition
    - *Subtitle C* - Consumer Assistance
    - *Subtitle D* - Exporting Clean Technology
    - *Subtitle E* - Adapting to Climate Change

- American Power Act (aka Kerry-Lieberman) – On May 12, 2010, Senators Kerry and Lieberman introduced the American Power Act to address energy and climate change. The proposed legislation could replace the current Clean Energy and American Power Act of 2009. Some of the main provisions in The American Power Act released on May 12, 2010 include the following:
  - Utility (in 2012) and industry (in 2016) cap-and-trade
  - Capped sectors to reduce emissions by 17 percent over 2005 levels by 2020 and 83 percent by 2050
  - $70 billion for clean/natural gas transportation over the next 10 years
  - Restricts EPA's ability to regulate GHGs under several CAA section

- American Recovery and Reinvestment Act (ARRA) – The ARRA included over $60 billion in clean energy investments.
  - $11 billion for a smart grid to move renewable energy from the rural places it is produced to the cities where it is mostly used
  - $5 billion for low-income home weatherization projects
  - $4.5 billion to green federal buildings and cut our energy bill
  - $6.3 billion for state and local renewable energy and energy efficiency efforts

- $600 million in green job training programs – $100 million to expand line worker training programs and $500 million for green workforce training
- $2 billion in competitive grants to develop the next generation of batteries to store energy (Whitehouse.gov, 2009).

- Appliance Efficiency Increase – The initiative is designed to save twice the amount of energy produced by all the coal-fired power plants in America in any given year by implementing more aggressive efficiency standards for common household appliances (Whitehouse.gov, 2009).

- Clean Energy Jobs and American Power Act of 2009, S. 1733 (a.k.a. Kerry-Boxer) – On September 30, 2009, the Senate issued a counterpart to the House Bill (H.R. 2454) discussed above. The Senate version introduces similar concepts and mechanisms for addressing climate change, energy security, and renewable energies. However, some differences do exist. The following is a summary of key topics as analyzed by USEPA. Any noted differences are relative to H.R. 2454:
  - *Cap Level* – 20 percent below 2005 baseline in 2020; cumulative number of allowances set at 130.6 Gt CO_2-e
  - *Coverage* **–** Differences in coverage are negligible
  - *Offset Limits* – 2 billion ton limit overall; 1.5 billion ton domestic limit; 0.5 billion ton international limit; up to extra 0.75 billion tons of international offsets if domestic usage below 0.9 billion tons
  - *Strategic Reserve* – 3.5 billion cumulative allowances from 2012-2050; minimum reserve auction price is $28 in 2012 rising at 5 percent through 2017 and rising at 7 percent thereafter
  - *Energy Efficiency and Renewable Energy Provisions* – less stringent building codes; slightly lower energy efficiency-related allocations; and no Combined Efficiency and Renewable Energy Standard
  - *Performance Standards* – Uncapped sources treated as domestic offsets
  - *Carbon Capture Sequestration* – 4.19 billion allowances; fixed advanced payment incentive for first 20 GW, reverse auction thereafter
  - *Energy Intensive, Trade Exposed Industries* – Similar to H.R. 2454
  - *Transportation* – Similar to H.R. 2454
  - *Domestic Agriculture and Forestry Offsets* – Similar to H.R. 2454

- Kyoto Protocol – The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) is an amendment to the international treaty on climate change, assigning mandatory targets for the reduction of GHG emissions to signatory nations. Countries that ratify the Kyoto Protocol commit to reduce their emissions of carbon dioxide (CO_2) and five other GHGs, or engage in emissions trading if they maintain or increase emissions of these gases. Governments are separated into two general categories: developed countries, referred to as Annex 1 countries (which have accepted GHG emission reduction obligations) and developing countries, referred to as Non-Annex 1 countries (which have no GHG emission reduction obligations). As of August 2007, a total of 171 countries and other governmental entities have ratified the agreement (representing over 62 percent of emissions from Annex I countries). Developing countries, such as India and China, which have ratified the Protocol, are not required to reduce carbon emissions under the present agreement despite their relatively large populations. It should be noted that the U.S. never ratified the Kyoto Protocol.

- NEPA Climate Change Guidance – The White House Council on Environmental Quality (CEQ) proposed four steps on February 18, 2010 in an attempt to update NEPA specifically in regard to climate change. CEQ released initial draft guidance for public comment on when and how Federal agencies must consider GHG emissions and climate change in their actions. The primary points of the guidance include:

- Explanation for how Federal agencies should analyze the environmental impacts of GHG emissions and climate change when they describe the environmental impacts under NEPA;
- Includes a presumptive threshold of 25,000 metric tons of carbon dioxide equivalent emissions from the proposed action to trigger a quantitative analysis;
- Instructs agencies on how to assess the effects of climate change on the proposed action and their design;
- However; the draft guidance does not apply to land and resource management actions and does not propose to regulate GHGs (CEQ, 2010).

- Ongoing Scientific Review of Intergovernmental Panel on Climate Change (IPCC) – Recognizing the problem of potential global climate change, the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP) established the Intergovernmental Panel on Climate Change (IPCC) in 1988. It is open to all members of the United Nations and the WMO. The role of the IPCC is to understand the risk of human-induced climate change, its potential impacts, and options for adaptation and mitigation. The IPCC does not carry out research nor does it monitor climate-related data or other relevant parameters. It bases its assessment mainly on peer-reviewed and published scientific/technical literature. The IPCC has completed four assessment reports, developed methodology guidelines for national GHG inventories, special reports and technical papers. The IPCC has three working groups and an emissions inventory task force.

- Regional Greenhouse Gas Initiative (RGGI) – "RGGI is the first mandatory, market-based effort in the United States to reduce greenhouse gas emissions. Ten Northeastern and Mid-Atlantic states will cap and then reduce CO_2 emissions from the power sector 10 percent by 2018" (RGGI, 2009).

- Securities and Exchange Commission Climate Change Disclosure Guidance – On January 27, 2010, the Securities and Exchange Commission (SEC) released interpretive guidance about climate change. The Commission's interpretive releases do not create new legal requirements nor modify existing ones, but are intended to provide clarity and enhance consistency for public companies and their investors. Specifically, the SEC's interpretative guidance highlights the following areas as examples of where climate change may trigger disclosure requirements:
  - Impact of Legislation and Regulation: When assessing potential disclosure obligations, a company should consider whether the impact of certain existing laws and regulations regarding climate change is material. In certain circumstances, a company should also evaluate the potential impact of pending legislation and regulation related to this topic.
  - Impact of International Accords: A company should consider, and disclose when material, the risks or effects on its business of international accords and treaties relating to climate change.
  - Indirect Consequences of Regulation or Business Trends: Legal, technological, political and scientific developments regarding climate change may create new opportunities or risks for companies. For instance, a company may face decreased demand for goods that produce significant greenhouse gas emissions or increased demand for goods that result in lower emissions than competing products. As such, a company should consider, for disclosure purposes, the actual or potential indirect consequences it may face due to climate change related regulatory or business trends.
  - Physical Impacts of Climate Change: Companies should also evaluate for disclosure purposes the actual and potential material impacts of environmental matters on their business (SEC, 2010).

- The Climate Registry – The Climate Registry is a nonprofit organization created as a collaborative effort to account for GHG emissions in a consistent and transparent manner while establishing a common data infrastructure for voluntary and mandatory reporting and emissions reductions programs. Members of The Climate Registry agree to document, verify, and publicly disclose their GHG emissions to The Registry. MNDNR, MPCA, and the Metropolitan Council of Minnesota have all joined The Climate Registry and committed to reporting GHG emissions. As of April 2010, 39 U.S. States and 17 Mexican and Canadian Provinces are part of the effort. Of the 39 States, Minnesota was a founding member.

- United Nations Framework Convention on Climate Change (UNFCCC) – This convention sets an overall framework for intergovernmental efforts to address climate change. Specifically, "It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases." Under the Convention, the 192 ratifying governments:
  - gather and share information on greenhouse gas emissions, national policies and best practices;
  - launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries;
  - cooperate in preparing for adaptation to the impacts of climate change United Nations Framework Convention on Climate Change (UNFCCC, 2009).

- United Nations Climate Change Conference in Copenhagen (COP15) – The COP15 conference is the fifteenth Conference of the Parties under the United Nations' Framework Convention on Climate Change. The participants of the Copenhagen conference attempted to develop and adopt a successor treaty to the Kyoto Protocol, which expires in 2012. Countries that attended the COP15 pledged to cut GHG emissions and support the reduction efforts of developing countries. No binding emissions limits or reductions were signed; though, a temperature rise of 2 degrees was set as a limit. The conference set a path for more discussion on specific emissions reductions at a subsequent conference in Mexico at the end of 2010 (UNFCCC, 2010).

- Western Climate Initiative (WCI) – The WCI has designed a cap-and-trade program in an effort to reduce GHG emissions. The program will cover almost 90 percent of GHG emissions in the member Western States (WCI, 2009).

5.2.1.4.4 Recent Minnesota or Midwestern Legislation and Initiatives

- Midwestern Greenhouse Gas Reduction Accord – In November 2007, nine Midwestern states and two Canadian premiers signed the Midwestern Greenhouse Gas Reduction Accord. Through the Accord, governors of the six member states and one province agreed to establish a Midwestern GHG reduction program to reduce GHG emissions in their states, as well as a working group to provide recommendations regarding the implementation of the Accord.

  The Accord goals are:
  - Establish GHG reduction targets and timeframes consistent with MGA member states' targets,
  - Develop a market-based and multi-sector cap-and-trade mechanism to help achieve those reduction targets,
  - Establish a system to enable tracking, management, and crediting for entities that reduce GHG emissions, and

- Develop and implement additional steps as needed to achieve the reduction targets, such as a low-carbon fuel standard and regional incentives and funding mechanisms.

As of May 7, 2010, the Midwestern Governors Association Cap and Trade Advisory Group finalized recommendations for a path forward. These recommendations include, but are not limited to:

- Preference for action by Congress,
- Reduction of GHG emissions by 18 percent or 20 percent below 2005 by end of 2020,
- Reduction of GHG emissions by 80 percent by 2050 below 2005,
- Inclusion of electric generation facilities, imported power, industrial combustion sources; industrial process sources; fuels used in the residential , commercial, and industrial building sectors; and transportation fuels under the cap,
- Exclusion of biomass and biofuels from cap,
- Reporting at 20,000 TPY of GHG emissions,
- Hybrid system of allocations and auctions, and
- Offsets limited to 20 percent of reduction requirements.

- Minnesota Ban on New Power Plants – Minnesota has banned the construction of new large energy facilities in the State that would contribute to GHG emissions until a cap and trade system is implemented (Minnesota Statutes 216 H.03).

- Minnesota Annual Legislative Proposal Report on Greenhouse Gas Emissions Reduction – Under this report, the Minnesota Department of Commerce and the MPCA annually must develop and present to the Legislature policy recommendations to achieve the GHG emission reductions set in the Next Generation Energy Act of 2007 (Minnesota Statutes 216H.07 subd 4).

- Minnesota Biennial Greenhouse Gas Emissions Reduction Report - The MPCA must report progress toward the Next Generation Energy Act goals on a biennial basis (Minnesota Statutes 216H.07 subd 3).

- Minnesota Greenhouse Gas Emissions Reporting – In order to track progress in meeting the goals of the emissions reductions, Minnesota will establish a greenhouse gas inventory reporting system. The reporting is designed to inform strategy to achieve reduction goals (Minnesota Office of the Revisor of Statutes 216H.021, 2009).

- Minnesota High-Global Warming Potential (GWP) GHG Reporting – By statute, manufacturers of a high-GWP greenhouse gas that is sold in Minnesota must report to the MPCA the total amount of each high-GWP greenhouse gas sold to a purchaser in the state during the previous year (MN Legislature, 2008B). In addition, purchasers of these compounds must report their purchases to the MPCA if in aggregate they are in excess of 10,000 CO_2-e tons (Minnesota Statutes 216H.11).

- Minnesota Next Generation Energy Act of 2007 – The statute establishes statewide GHG reduction goals from a 2005 baseline of 15 percent by 2015, 30 percent by 2025, and 80 percent by 2050. The bill also endorses the Governor's Minnesota Climate Change Advisory Group as the entity to develop a comprehensive GHG emission reduction plan to meet those goals (Minnesota Statutes 216h.02).

- MPCA GHG Footprint Guidance – The MPCA published General Guidance for Carbon Footprint Development in Environmental Review in July 2008. The guidance contains CO_2 emission factors for fuel combustion and electricity providers (MPCA, 2008E).

- Minnesota Public Utilities Commission GHG Consideration in Resource Planning – In developing resource plans for the acquisition of new energy sources, electric utilities are mandated to consider the external costs of emitted CO_2 (Minnesota Statutes 216H.06).

- Minnesota Renewable Energy Standard – This standard calls for 25 percent of the electricity produced by the state's utilities to come from renewables by 2025 (Minnesota Statutes 216B.1691 subd 2a).

- Minnesota Sustainable Building 2030 Bill – The bill implements requirements for buildings to meet energy efficiency targets of the 2030 Challenge in order to receive state funding (Minnesota Statutes 216B.241, subd. 9).

The Project Proposer is potentially subject to PSD and Title 5 permitting under the Tailoring Rule. It is not completely clear how the various GHG initiatives will additionally impact the steel industry as a whole, or specific facilities in particular. For anticipating other future regulatory needs, developing a GHG inventory will be a crucial step for companies in order to assess potential project impact and regulatory applicability.

5.2.2 Environmental Consequences

> The estimated total greenhouse gas emissions from the Proposed Project are 758,500 tons per year (688,099.6 metric tons). This includes land use changes but not biogenic emissions.

As GHG concentrations in the atmosphere continue to increase, the IPCC anticipates that the climate will warm at a rate that may or may not be linear (MPCA, 2009A). Whether the climate changes are based on stabilization concentrations, time dependent concentrations, or total emissions; increases in GHG concentrations cause increases in temperature. Climate models project varying degrees of changes over different regions. MPCA states, "Given the wide variety of factors that must be taken into account, it is difficult to predict how climate change will ultimately affect Minnesota" (MPCA, 2009D). However, the IPCC indicates the following.

- *More specific information is now available across a wide range of systems and sectors concerning the nature of future impacts, including some fields not covered in previous assessments* (WGII TS.4, SPM).

- *Studies since the TAR have enabled more systematic understanding of the timing and magnitude of impacts related to differing amounts and rates of climate change* (WGII SPM; IPCC, 2007).

- Moreover, the Committee on Environment and Natural Resources states, "While there will always be uncertainties associated with the future extent of climate change, the response of ecosystems to climate impacts, and the effects of management, it is both possible and essential for management practices to help protect climate-sensitive ecosystems [V.1.f]" (USGRCP, 2008). With the ever-increasing body of knowledge, results from IPCC as well as some recently developed models show a changing climate with increasing temperatures across the entire U.S. as a result of increasing GHG emissions.

While the greenhouse gas emissions of any single project may be small when compared to global emissions, any additional GHG emissions to the atmosphere contributes to the global concentrations of these gases. The estimated total greenhouse gas emissions from the Proposed Project are 758,500 tons per year (688,099.6 metric tons). This includes 33,500 tons per year of biogenic emissions from land use changes but does not account for biogenic emissions from combustion of biomass.

TABLE 5.2.3 SETTING AND PROPOSED PROJECT GHG EMISSIONS COMPARISON

	Total Emissions [1]	Project Emissions as Proportion of Total
Estimated Global Emissions (2004 data from IPCC 2007) [2]	54,013 million tons	0.0014%
Estimated National Emissions (2007 data)	7,882 million tons	0.0096%
Estimated State Emissions (2006 data) [3]	152.5 million tons	0.497%
Estimated Sector Emissions (2007 data)	85.3 million tons [4]	0.889%
Required Emission Reductions in Next Gen Energy Act	Reduce 21.9 million tons by 2015	No requirement specific to Project at this point;

[1] Biogenic emissions associated with the combustion of biomass are not included in the emissions totals based on methodology used in the global, national, and state inventories. The project total does include emissions from land-use changes.
[2] More recent data are not available; therefore, 2004 data was used.
[3] 2007 data are not available; therefore, 2006 data was used.
[4] Total does not reflect electricity consumption for sector based on available data.

5.2.3 Project Relation to Climate Change

Climate change could have additional impacts on natural resources evaluated in other sections of the FEIS. Consideration of this issue begins with acknowledgment that the incremental climate change impacts from the project-related emissions cannot be determined with existing science. It is known however that the Proposed Project's contribution to total state, national and global emissions is very low. The potential difference between climate change effects with and without the Proposed Project is so small as to make the two alternatives indistinguishable with current science.

The potential global cumulative effects associated with climate change could further affect the following analysis areas.

- Air Quality – Worsening of air quality from increased project emissions could be exacerbated by climate change. Increasing temperatures, as projected, could lead to more hazy days and reduce visibility based on an increase in hydrocarbon emissions and sulfur dioxide oxidation. Depending on precipitation frequency and amount, visibility could be affected by changes in rainfall. If rainfall were less frequent, visibility could be reduced. However, more frequent and heavier precipitation events could improve visibility from what is predicted.
- Water – Direct impacts to water as a result of the Proposed facility expansion could be exacerbated by climate change. Depending on permitting and mine operations, water flows, stream temperatures, and chemical composition potentially could be affected beyond what might be expected from the operation of the facility itself.
- Wildlife – If the Proposed Project would directly affect landcover, climate change could prove to be another, additional impact to wildlife habitat on top of direct project effects.

In general, increased greenhouse gas emissions from the Proposed Project contribute to a cumulative adverse effect on the earth's climate. Based on the best science available, there is the potential that climate change generally could have significant effect on terrestrial and aquatic systems and economies worldwide. However, determining the significance of any single project is beyond the capabilities of current science.

5.2.4 Mitigation Opportunities

Several opportunities for mitigation exist for GHG emissions. These can range from design changes to other measures such as offset creation and purchase.

The IPCC lists some opportunities for mitigation suggested for various industries. Measures include using more efficient motors and furnace improvements as well as using natural gas and biomass as fuel as opposed to alternatives (IPCC, 2007C). Other mitigation options involve the purchase of carbon offsets through one of several carbon exchanges that have established markets under voluntary cap and trade programs. Furthermore, carbon offsets can be created by pursuing additional projects that result in net GHG emissions reduction. These options present general guidance for mitigation.

As opposed to general mitigation options, specific mitigation opportunities related to the Proposed Project are presented. As discussed in Section 3.3.5.1.2, the Proposed Project has avoided potential GHG emissions relative to standard projects through various means:

- fuel mixing (i.e., use of biomass and natural gas),
- furnace improvements,
- heat recycling,
- motor efficiency, and
- logistical changes
    - fuel shipping and types based on site location
    - distribution to end users based on location and means.

These design changes, or engineering and logistical changes, would result in emissions avoided for the overall facility GHG emissions when compared to the scenario with no reductions. Some of the options that have been used to avoid emissions for the Proposed Project have been quantified in Table 5.2.4.

TABLE 5.2.4 OPTIONS FOR AVOIDING EMISSIONS FOR PROPOSED PROJECT

Industrial Technology	Avoided Emissions (TPY CO_2-e)
Energy Efficiency	11,300
Fuel Switching	80,000
Power Recovery	65,400

Source: Barr, 2009F

Energy efficiency for the Proposed Project includes process improvements and efficient motors. Fuel switching incorporates the emissions avoided by switching from 100 percent coal to 50 percent biomass and 50 percent natural gas. Power recovery includes gas stream heat recovery and waste heat use for drying. Logistical changes also account for a net avoidance of 92,000 TPY CO_2-e from product shipping – avoided (94,000 TPY CO_2-e) less a slight emission (2,000 TPY CO_2-e) associated with the additional transport of combustion fuels to the facility (Barr, 2009F). Under regulation as proposed under ACES, some measures deemed without regulation to be uneconomic may prove to be appropriate. More detailed information on emissions avoidance and alternatives can be found in Section 3.3.5.1.2 of this FEIS.

5.3 SURFACE WATER RESOURCES

5.3.1 Water Levels

The FSDD identified that the EIS must investigate the potential for cumulative effects on stream flow and lake level changes. The proximity of Essar Steel to the Proposed Project results in common water resources being influenced by both projects.

In the cumulative effects analysis it is recognized that mining activities have been occurring on the Iron Range for over a century and that changes have occurred to watershed boundaries, stream flows, and lake levels prior to the initiation of the Proposed Project.

Swan Lake and Swan River were identified as the water resources that should be investigated in the FSDD for cumulative effects associated with Proposed Project. A description of these resources is provided in Section 4.1.1, but is further elaborated on in a cumulative perspective in this section. A quantitative analysis of these potential cumulative effects is provided in this section.

5.3.1.1 Affected Environment

The Essar Steel project and the Proposed Project have the potential to impact Swan Lake and Swan River.

5.3.1.1.1 Swan Lake

Swan Lake is located downstream of both the Proposed Project and Essar Steel. Swan Lake has inflows from Oxhide Creek, Snowball Creek, Pickerel Creek, O'Brien Creek downstream of TH 169, Hay Creek, Hart Creek, and Lebron Creek. Of the inlets into Swan Lake, Oxhide Creek, O'Brien Creek downstream of TH 169, Snowball Creek, and Hay Creek have been identified as being affected by the project.

Swan Lake is controlled by a weir located in the southwest corner of the lake, which is set at an elevation 1335.0 feet. The OHW for Swan Lake is 1336.3 and the average water level is 1335.8 for the period of record (Barr, 2006A).
Neither project would be directly appropriating or discharging water into Swan Lake. However, both projects would be altering some aspect of the watershed areas, flow pathways, and volumes discharged into Swan Lake. The changes to lake levels were quantified cumulatively for Swan Lake.

5.3.1.1.2 Swan River

Swan River exits Swan Lake in the southwest corner of the lake. The Swan River flows south and eventually discharges into the Mississippi River. Changes in lake levels in Swan Lake have the potential to change flows in Swan River.

A USGS flow gauging station was maintained from 1964 through 1990 on the Swan River five miles downstream of where it exits Swan Lake. Based on the USGS flow record, average daily flow has ranged from as low as 5 cfs during periods of summertime low flow conditions to more than 700 cfs during springtime high flow conditions. The average flow determined by the MNDNR was 61.1 cfs (MNDNR, 2007D).

5.3.1.2 Environmental Consequences

Cumulative physical impacts to Swan Lake and Swan River due to the Essar Steel and Proposed Project are described below.

5.3.1.2.1 Swan Lake

The Proposed Project would discharge additional water via Hay Creek to Swan Lake, while the Essar Steel project would result in decreased flows in Oxhide Creek and Snowball Creek due to plant needs and a decrease in watershed size. The cumulative effects of the proposed changes in inflows were examined to determine the net change in Swan Lake water levels in Water Quantity and Quality Report. A summary of these impacts are provided in Table 5.3.1.

TABLE 5.3.1 SWAN LAKE LEVEL IMPACTS

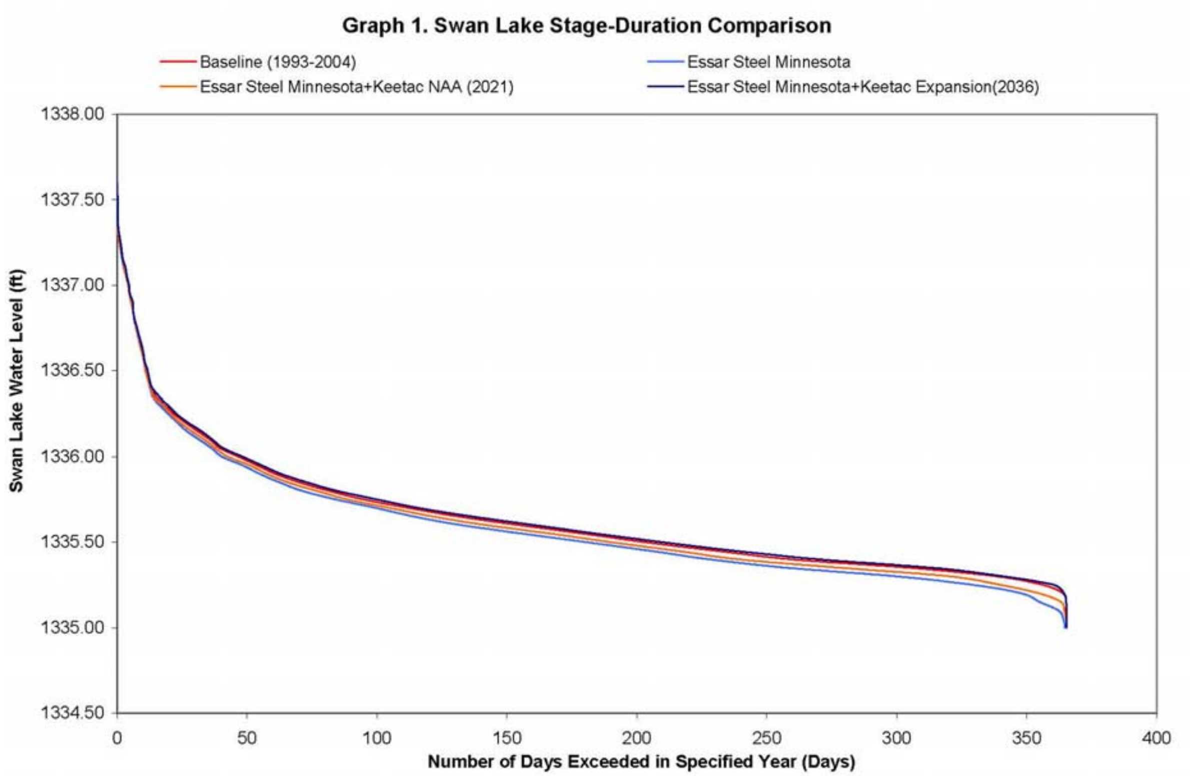
Scenario Description	Year	Inflow Change (cfs)[1]	Average Lake Level (ft)[1]	Change in Average Lake Level (ft)
Current	2009	0.0	1335.64	0.0
Essar Steel	2036	-6.46 [1]	1335.58	-0.06
Essar Steel + Keetac No Action Alternative	2036	-3.46 [2]	1335.61	-0.03
Essar Steel + Proposed Project	2036	0.64	1335.65	+0.01

1 No Action Alternative Memo

2 Water Quantity and Quality Report Assume difference in inflow charge is change in Hay Creek flow = 4.0 cfs.

The results of the analysis indicate the Proposed Project and Essar Steel project would raise the elevation of Swan Lake in relationship to existing conditions. The increase in elevation as a result of the Proposed Project is 0.01 feet which is a minor increase that would be difficult to detect. A graph was developed to compare the baseline water levels of Swan Lake to the water levels with the effects from the Essar Steel project, the Essar Steel project with the Keetac No Action Alternative, and the combined effects of Essar Steel and the Proposed Project (see Illustration 5-9 from No Action Alternative Memo).

ILLUSTRATION 5-9 SWAN LAKE STAGE – DURATION COMPARISON



Source: No Action Alternative Memo

In summary, the cumulative effects from the Essar Steel project and the Proposed Project would be minimal and should not significantly affect lake levels on Swan Lake.

5.3.1.2.2 Swan River

The Swan River flow pathways would not be impacted by the Proposed Project or Essar Steel. The estimated average flow from Swan River from the Essar Steel project and Proposed Project would result in an increase of the average flow in Swan River by 0.64 cfs or some 1 percent by the year 2036 from current conditions. This increase is within the historical range (1937-2008) of flows recorded in the river. The minimal impacts on Swan Lake, as the headwaters for the Swan River, would correlate to minimal changes in flow for the Swan River. As a result, the projected increase in lake levels from the combined projects is not likely to alter the flow regime of the Swan River in a measureable manner, and therefore no discernable cumulative effect to lake levels in Swan Lake and no discernable cumulative effect to stream flow in Swan River are expected.

5.3.1.3 Mitigation Opportunities

The offset of the proposed projects on lake levels and stream flows limits the potential for significant impacts during average operation years. As noted in the Minnesota Steel EIS, the timing of phases is a critical component of their augmentation plan and is a resource which the Proposed Project should incorporate into potential mitigation plan.

Mitigation from the Minnesota Steel EIS recommended continuous monitoring of water levels in Swan Lake, especially early in the Essar Steel project during times of dewatering and providing augmentation flows. Mitigation from the Minnesota Steel EIS also recommended installing an orifice plate on the existing Swan Lake outlet weir or reconstructing the weir to allow water to be discharged from Swan Lake to the Swan River during periods when lake levels drop.

As discussed in the Minnesota Steel EIS, monitoring of water levels, installation of the orifice, as well as its design and discharge capacity could be considered during the permitting process for each facility and responsibilities could be assigned to both the Proposed Project and Essar Steel.

5.3.2 Aquatic Habitat and Fisheries

> The water bodies that have the potential for cumulative effects from the Proposed Project and the Essar Steel project are Swan Lake and Swan River.

The impact area for the Proposed Project has the potential to affect several lakes and streams. Additionally, there are other projects in the region that have the potential to impact the same lakes and streams affected by the Proposed Project. The SEAW and the FSDD indicate that the EIS would include an examination of the potential cumulative effects on water flow changes, water quality, lake level changes, and stream channel changes to determine the associated cumulative effects to aquatic habitat and fisheries. The lakes and streams in the Proposed Project area that may also be impacted by other regional projects include Swan Lake and Swan River. A description of the impacted water bodies, the potential cumulative effects on fisheries and aquatic resources and the recommended mitigation efforts are provided.

5.3.2.1 Affected Environment

While there are numerous mining and industrial projects across the Iron Range, only the proposed Essar Steel (formerly known as Minnesota Steel) project currently has the potential to impact water bodies that may also be potentially impacted by the Proposed Project. The water bodies that have the potential for cumulative effects from the Proposed Project and the Essar Steel project are Swan Lake and Swan River. A general description of each water body is provided.

5.3.2.1.1 Swan Lake

Swan Lake is the largest recreational resource in the area near the Proposed Project. The primary management fisheries species identified by the MNDNR for the lake are walleye and northern pike, with black crappie listed as secondary management species. Recreation activities on Swan Lake include open water fishing, ice fishing, boating, and water skiing. A detailed physical description of Swan Lake, along with descriptions of the fish community and recreational activity in the basin, is provided in Section 4.1.2. Swan Lake is located approximately eight miles southwest of Keetac. The other regional project that has the potential to impact Swan Lake is Essar Steel, which is located approximately two miles north of the lake. Swan Lake is located downstream of both the Proposed Project and Essar Steel. Neither project would be directly appropriating from the Swan Lake basin or discharging water directly into the Swan Lake basin. However, both projects would be altering some aspect of the watershed areas, flow pathways, and/or water quality of water bodies that discharge into Swan Lake. Changes to the upstream contributing water bodies of Swan Lake were examined to determine the potential cumulative effects to the fisheries and aquatic resources of Swan Lake.

5.3.2.1.2 Swan River

Swan River begins as the outlet from Swan Lake at the southwest corner of the basin, approximately six miles south of the City of Nashwauk. The Swan River flows west and then south for approximately 70 miles through Itasca County until it discharges into the Mississippi River in northern Aitkin County. The USGS maintained a flow gauging station from 1964 through 1990 on the Swan River, located near Calumet, Minnesota, approximately five river miles downstream from the headwaters of the river at Swan Lake. Based on the USGS flow record, average daily flow has ranged from as low as 5 cfs during periods of summertime low flow conditions to more than 700 cfs during springtime high flow conditions. Over the 26-year USGS flow record, the average daily flow for the Swan River is 64 cfs. Water quality monitoring has been conducted recently on the Swan River by the MPCA at stations along the river near Trout Lake, as part of a study examining wastewater treatment needs for the Bovey-Colerain area. Monitoring parameters on the Swan River have mainly included water transparency (a surrogate measure used to estimate turbidity) and temperature. Based on the data collected from 2005 through 2008, the waters of Swan River are clear, with an average transparency value of 97 cm (the majority of the values were recorded as greater than 100 cm based on the 100 cm tube used for the readings). None of the 127 recorded water transparency measurements were below the 20 cm MPCA water quality standard for water transparency.

Based on a query of the MPCA EDA website, the MPCA has not conducted biological monitoring of the fish or macroinvertebrate communities in the Swan River. The MNDNR does not manage the fish community of the Swan River. The MNDNR Grand Rapid Fisheries Office stated that the Swan River is not a highly used fishery, which is due largely to the prevalence of high quality lake fishing opportunities in the Grand Rapids area. Based on the MNDNR public water access GIS layer, there are no designated public access points along the Swan River. The Swan River is not a designated canoe route and as a result, there are no designated canoe camp sites located along the river. However, there are numerous road crossings that afford people access to the Swan River. The river receives a modest amount of localized use for recreational activities such as canoeing and fishing, but it is not a destination fishery. Based on the connectivity of the Swan River to Swan Lake and the Mississippi River there is a known game fish population in the river including walleyes, northern pike, and smallmouth bass. Other species likely present in the Swan River include sport fish species such as bluegill, black crappie, yellow perch, channel catfish, and non-game species such as various minnows, suckers, darters, and redhorses.

5.3.2.2 Environmental Consequences

The cumulative physical changes to the watersheds, lake levels and stream flows of the water resources located in the vicinity of Proposed Project are described in Section 5.3.1. The physical impacts to these water bodies from the Proposed Project, considered in conjunction with other regional projects were used to determine the potential for cumulative effects to the fisheries and aquatic resource of each water body.

Changes to water levels, water flows, or water quality of a water body that would cause the loss of a critical habitat element or a significant change in a required water quality parameter of target management species were considered to be an impact to the fisheries resources of that water body. Target management species of Swan Lake and Swan River are walleye, northern pike and black crappie. Water level and water quality changes in Swan Lake and Swan River from Proposed Project activities would be small, and therefore would not cause a cumulative effect on fish or aquatic habitat. Additionally, there is enough available habitat in Swan Lake and Swan River that fish populations would not decline. Potential effects on fisheries resources for Swan Lake and the Swan River are described in greater detail below.

5.3.2.2.1 Swan Lake

Direct impacts to Swan Lake in the form of water appropriations from the lake or direct discharges to the lake would not occur as a result of the either the Proposed Project or other regional projects. However, changes to the upstream contributing water bodies of Swan Lake were examined to determine the potential cumulative effects to the fisheries and aquatic resources of Swan Lake. Additionally, neither the Proposed Project nor the Essar Steel project would discharge directly to Swan Lake, but both projects would discharge to water bodies that flow into Swan Lake. With the exception of sulfate, general water quality parameters of concern are not anticipated to change within Swan Lake. Cumulative effects may result in Swan Lake from projected increases in sulfate concentrations.

> The small increase in lake level elevations from the combined projects would not result in increased shoreline erosion or alter lakeshore property owner's access to the lake. Additionally, these estimated changes in water levels would not result in a significant impact to aquatic habitat or spawning areas for the target management species of Swan Lake (walleye, northern pike and black crappie).

The Proposed Project would discharge additional water to Hay Creek, via the O'Brien Diversion Channel, which would result in additional inflows to Swan Lake. Conversely, the Essar Steel project would result in a decrease in the Swan Lake watershed, and ultimately a decrease in inflows, due to the creation of the Essar Steel tailings basin, as well as decreases in the contributing watersheds of Snowball Creek, Oxhide Creek, and O'Brien Creek. The cumulative effects of the proposed changes in inflows were examined to determine the net change in Swan Lake water levels in Water Quantity and Quality Report. The analysis determined that combined effects of the Proposed Project and Essar Steel would result in a slight increase of less than 0.1 feet in elevation of Swan Lake levels, when compared to baseline pre-project conditions. A graph comparing the baseline water levels of Swan Lake to the water levels with the effects from the Essar Steel project and the combined effects of Essar Steel and the Proposed Project was developed to provide a visual representation of the changes (see Illustration 5-9 Swan Lake Duration Comparison). This small increase in lake levels is estimated to occur approximately 5 percent of the time over the course of a year under worst-case net-increased flows resulting from the cumulative projects. Under a normal water year conditions, the potential cumulative effects would be less. These estimated changes to Swan Lake water levels are small and would not alter angler access to Swan Lake. The small increase in lake level elevations from the combined projects would not result in increased shoreline erosion or alter lakeshore property owner's access to the lake. Additionally, these estimated changes in water levels would not result in a significant impact to aquatic habitat or spawning areas for the target management species of Swan Lake (walleye, northern pike and black crappie). Impacts to the populations of target management species in Swan Lake are not anticipated.

The Water Quantity and Quality Report examined the cumulative effects of Essar Steel and the Proposed Project on sulfate levels in Swan Lake. The potential impacts to Swan Lake sulfate levels were previously estimated at 3.3 mg/L as a result of the Essar Steel project (Wenck, 2006). The cumulative effects to Swan Lake sulfate levels over the life of the two projects is an increase in the in-lake mean concentration from 28.8 mg/L to 38.8 mg/L. The MPCA water quality standards for Class 2(B) waters does not include a standard for sulfate. The USEPA drinking water standard for sulfate is 250 mg/L. Sulfate exhibits a wide range of concentrations in lakes in Minnesota. A recent study undertaken by the MPCA and the USEPA randomly sampled lakes across the state of Minnesota, with testing for over 20 water quality parameters (personal communication – Steve Heiskary, MPCA). There were 66 lakes sampled in the study, with sulfate concentrations ranging from 0 to 417 mg/L. The average sulfate concentration for all 66 lakes was 37. 8 mg/L while the median sulfate concentration was 6.7 mg/L. The cumulative effects of the combined projects would result in an increase in the sulfate concentrations in Swan Lake, but the concentrations would remain within the range of values found in lakes across Minnesota. The increase in sulfate concentrations in Swan Lake is not expected to impact the fish community or recreational activity within the lake.

Overall, the potential cumulative effects from Essar Steel and the Proposed Project on Swan Lake due to the changes in lake water levels, available habitat, and water quality are expected to be relatively minor and should not negatively affect aquatic habitat, fish populations, or angler success.

5.3.2.2.2 Swan River

The flow pathways of water to the Swan River from Swan Lake would not be impacted by either the Essar Steel or the Proposed Project. Swan Lake serves as the inflow source at the headwaters of the Swan River. As described above the combined projects would result in a slight increase in the water levels of Swan Lake. While Swan Lake is the headwaters of the Swan River, the river has many tributaries and a large watershed. As a result, the projected increase in lake levels from the combined projects is not likely to alter the flow regime of the Swan River in a measureable manner. With the exception of sulfate, general water quality parameters of concern are not anticipated to change within Swan Lake. Sulfate concentrations are expected to increase in Swan Lake over the combined life of the two projects but the final projected sulfate concentrations are within the range of conditions that occur in lakes and rivers. Impacts to the water quality of the Swan River as a result of the cumulative effects of the combined Proposed Project and Essar Steel project are not anticipated. The Swan River is known to contain game fish species and likely supports a small to moderate amount of local angling and recreation activity. There are no designated public access points along the Swan River but people can access the river at road crossings. These public roads access points to the Swan River would not be affected by the cumulative effects of the combined projects.

5.3.2.3 Mitigation Opportunities

The potential cumulative effects of the Proposed Project and the Essar Steel project on Swan Lake and the Swan River are expected to be minor.

> Impacts to the fish community, the required fish habitat, angler access or angler success for either Swan Lake or the Swan River are not anticipated.

The Essar Steel project would reduce flows to Swan Lake and the Swan River while the Proposed Project would increase discharges to the lake and river. The combined effects of the two projects almost cancel each other out, but ultimately result in a slight increase (less than 0.1 ft under all conditions) in Swan Lake levels, and as a result Swan River flows. Water quality parameters in general are not anticipated to change within either Swan Lake or the Swan River and changes in sulfate concentrations are predicted to be minor. Impacts to the fish community, the required fish habitat, angler access or angler success for either Swan Lake or the Swan River are not anticipated.

The cumulative water level impacts to Swan Lake, and ultimately the Swan River, were estimated to be small based on the Water Quantity and Quality Report. However, the Minnesota Steel EIS indicated that the timing of some of the project activities may result in a decrease in flows from Swan Lake to Swan River during conditions of extreme low flow.

Mitigation from the Minnesota Steel EIS recommended continuous monitoring of water levels in Swan Lake, especially early in the project during times of dewatering (MNDNR, 2006B). Mitigation from the Minnesota Steel EIS also recommended installing an orifice plate on the existing Swan Lake outlet weir or reconstructing the weir to allow water to be discharged from Swan Lake to the Swan River during periods when lake levels drop.

A potential mitigation option for the Proposed Project would be that the Project Proposer coordinate with Essar Steel to ensure that water levels are being monitored, and if necessary that the proper modifications are made to the outlet weir of Swan Lake and that the weir is properly operated to protect flows from Swan Lake into Swan River. As discussed in the Minnesota Steel EIS, monitoring of water levels, installation of the orifice, as well as its design and discharge capacity could be considered during the permitting process for each facility and responsibilities could be assigned to both the Proposed Project and Essar Steel.

5.4 WILD RICE RESOURCES

A discussion of the cultural, ecological, and economic importance of wild rice to the state of Minnesota and its people and potential impacts to the resource from the Proposed Project is discussed in Section 4.7. This section analyzes the potential cumulative effects that the Proposed Project along with other proposed projects and activities could have on the wild rice resources within the vicinity of the Proposed Project.

Additionally, a number of project-related studies and additional literature was used to evaluate potential cumulative effects on wild rice. A completed list of these documents can be found in Chapter 8 – References, and summaries of the documents can be found in Appendix M.

5.4.1 Introduction

> Swan Lake and Swan River were the only water bodies identified containing wild rice that could potentially experience cumulative effects from the Proposed Project and other projects.

Four water bodies that receive discharges from Keetac have been identified as containing wild rice: Swan Lake, Swan River, Hay Creek, and Hay Lake. Of these four water bodies, Swan Lake and Swan River were determined to have the potential for cumulative effects based on known present and future water discharges. Potential impacts to Hay Lake and Hay Creek from the Proposed Project are discussed in Section 4.7. Potential impacts to Swan Lake and Swan River associated with only the Proposed Project are also discussed in Section 4.7. This section examines the potential cumulative effects to wild rice resources in Swan Lake and Swan River due to the Proposed Project and other projects discharging to these water bodies.

The City of Keewatin and the City of Nashwauk WWTPs discharge to water bodies up stream of Swan Lake which feeds Swan River. Their discharges are not expected to change over time, and their influence on current hydrology and water chemistry is minor. Essar Steel is expected to discharge to Swan Lake during the life of the Proposed Project, thereby changing future water levels and water chemistry. These changes at Essar Steel are considered with the Proposed Project's potential impacts in this cumulative effects evaluation. The two WWTPs were also considered in this cumulative effects analysis, but their influence was minor and does not impact the results.

Essar Steel's Project will modify watershed boundaries for Swan Lake. In addition, Essar Steel will consume a significant amount of water for operation that will result in reduced runoff and stream volumes to Swan Lake. Oxhide and Snowball creeks are the main tributaries to Swan Lake. These creeks will be impacted by the need for process water and dewatering of pits, thus reducing groundwater inputs and watershed area which contribute to the stream flow volumes of these creeks. As part of the Essar Steel project, an augmentation plan was developed that will pump water from the Hill Annex Mine and Pits 1 and 2 (Figure 1.1) to augment flows in Snowball and Oxhide creeks. The average annual augmented flow will be 3.3 and 0.5 cfs for Oxhide and Snowball creeks respectively. The augmentation rates were approved as part of the Minnesota Steel EIS and result in a slightly lower average annual stream flow in both creeks. The reduction in flows lowers the volume to Swan Lake and results in the average elevation in Swan Lake being lowered by 0.03 ft.

Essar Steel would also increase sulfate loads to Swan Lake by two routes: the first with the dewatering flows from Pits 1 & 2 and Pit 5; the second from tailings basin water loss to groundwater. The associated increase concentration in Swan Lake due to the additional loads is estimated to be an average of 3.3 mg/L (Wenck, 2006).

The City of Keewatin WWTP discharges into Welcome Creek, downstream of the Project Proposer's permitted discharge (SD 002) and upstream of Reservoir Two North and is regulated by an NPDES permit. The WWTP discharges at an average rate of 100gpm (0.22 ft^3/s) and loading to project areas is not anticipated to change over the life of the Proposed Project.

The City of Nashwauk discharges approximately 20 million gallons annually from their treatment lagoons into Reservoir Two during the spring time, which is regulated through an NPDES permit. The volume and loads associated with this discharge are not anticipated to change during the life of the Proposed Project.

5.4.2 Factors Influencing Wild Rice Health

Wild rice requires specific habitat conditions for optimum growth. A detailed summary describing wild rice habitat and its life cycle can be found in Section 4.7. There are a number of factors that can affect the health of wild rice. Two factors directly related to the Proposed Project thought to have the potential to influence the health of wild rice are water levels and sulfate concentrations.

Two factors directly related to the Proposed Project thought to have the potential to influence the health of wild rice are water levels and sulfate concentrations.

Rapid water level increases are detrimental to wild rice, especially during the floating leaf stage of growth during which time wild rice seedlings can be uprooted if water levels rise too much or too quickly. A second condition that can impact wild rice stands is a change in water chemistry and sulfur toxicity. Of concern are discharges that release sulfate in concentrations that could impact waters that contain wild rice. A discussion on water quality parameters that influence sulfate, such as hardness and chloride, is provided in Sections 4.4.1 and 4.7.

Studies have been completed on wild rice stands that have found sulfate concentrations between 50 mg/L to 282 mg/L with healthy wild rice populations. Recent sampling showed reliable sulfate level ranges in Swan Lake were between 46 to 78 mg/L (Barr, 2009W). The effects of sulfate on wild rice growth and production are unclear. There are no known long-term studies examining the potential effect of sulfate concentrations on the natural cycle of wild rice (Bavin and Berndt, 2008B; Moyle, 1944a; Peden, 1982; Minnesota Power)[5].

The potential impacts to wild rice stands that receive discharge from the Keetac facility and Essar Steel are changes to water levels or sulfate concentrations. In general, other potential threats to wild rice include loss of genetic diversity between stands, introduction of invasive species, and climate change (MNDNR, 2008A).

5.4.3 Regulatory Framework

As described in more detail in Section 4.7, Minnesota has water quality standards for Class 4 waters that address wild rice and set a sulfate concentration limit of 10 mg/L. Minnesota Rules, part 7050.0224, subp. 2 states:

> *The quality of Class 4A waters of the state shall be such as to permit their use for irrigation without significant damage or adverse effects upon any crops or vegetation usually grown in the waters or area, including truck garden crops. The following standards shall be used as a guide in determining the susceptibility of the waters for such uses….*
>
> *Sulfates (SO_4) – 10 mg/L, applicable to water used for production of wild rice during periods when the rice may be susceptible to damage by high sulfate levels.*

An NPDES permit from the MPCA would be required for the Proposed Project. The NPDES permit would regulate facility discharge to meet water quality standards. MPCA staff has reviewed and considered the available information for each of these projects, including site specific wild rice data and water quality data. Based on the information and data received to date, MPCA staff has determined that it cannot at this time support a sulfate value other than 10mg/L as the applicable ambient standard for waters used for the production of wild rice that may be impacted by the Proposed Project. The USACE requires project compliance with state water quality standards before it will issue a Section 404 permit. The Essar Steel project has already acquired their NPDES permits.

5.4.4 Affected Environment

Swan Lake and Swan River were the only identified water bodies that contain wild rice and could experience cumulative effects from receiving discharge water from the Keetac facility and other projects. Thus, they will be the only water bodies analyzed for potential cumulative effects. As part of the EIS the Project Proposer completed a wild rice survey and water quality sampling on Swan Lake, Moose Lake, and Hay Lake. Moose Lake, as shown in Figure 4.7.1, contains wild rice and does not receive any discharge from Keetac or Essar Steel. Moose Lake serves as a reference water body for the area. A summary of the survey and sampling data is provided in Table 5.4.1 (Barr, 2009W). Figures 4.7.1 through 4.7.4 provide aerial overviews of the wild rice stands and monitoring locations.

[5] Many documents concerning wild rice and sulfate were provided by the Project Proposer to the MNDNR and are available upon request. These documents, including several additional studies were reviewed and summarized. This summary is included in Appendix M.

TABLE 5.4.1 WILD RICE MONITORING RESULTS

Water Body	Swan Lake	Swan River [1]
Wild Rice Stand (ac)	50	~ 1.0 [3]
Density (stems/m^2)	33-80	~10-40 [3]
Sulfate Levels (mg/L) 95% Confidence Intervals	25-30 (Main Lake) 3.9-26.1 (Southwest Bay)	25-30 [4]
Annual Range of Water Level (ft) [5]	1.5	1.5

[1] Data from approximately 2.0 mile segment of river from Swan Lake outlet to dam controlling Swan Lake
[2] Data from 1.4 mile segment of Hay Creek from Hay Lake outlet toward Swan Lake
[3] Estimated based on field observation by Mike Crotteau 9-11-09 and 9-15-09 and interpretation of stem counts from Wild Rice and Sulfate Data Submittal Study.
[4] Sulfate levels in the main lake of Swan Lake range the same as sulfate levels in river, and would be representative of sulfate levels monitored in lake.
[5] Change in water level due is average annual change

5.4.4.1 Swan Lake and Swan River

The MNDNR report (MNDNR, 2008A), a recent survey (Barr, 2009W) and a MNDNR Survey (Crotteau, 2009A) identified Swan Lake as containing an estimated 50 acres of wild rice. Beginning at State Highway 65, Crotteau surveyed the mouth of Swan River to the dam downstream. As indicated by the Wild Rice and Sulfate Data Submittal, the majority of the wild rice in Swan Lake is located in the southwest bay of the lake. The southwest bay is relatively shallow compared to the rest of the lake; this may be a primary reason for greater wild rice presence. Figures 4.7.2 and 4.7.3 depict the extent and density of wild rice in the southwest bay of Swan Lake and Swan River (Barr, 2009W; Crotteau, 2009A). Based on the MNDNR Harvester Survey (MNDNR, 2006A), 11 respondents reported harvesting on Swan Lake, indicating the wild rice stand was still used as a harvesting resource in 2006.

Sulfate levels monitored in Swan Lake demonstrate great variability throughout the year and also variability throughout the lake. Results of samples in the main body of the lake varied from results in the southwest bay, where the majority of the wild rice is present. Sulfate levels in the southwest bay of Swan Lake during 2009 were between 7-11 mg/L, except for a spike of 48 mg/L, which occurred during a two-week period in July. The main portion of the lake exhibited sulfate levels between 23-38 mg/L during the same time period, except for a similar spike of 51 mg/L. The southwest bay is an isolated bay that has no major inlets, which limits potential mixing with the rest of the lake. This is why the concentrations are lower throughout the year. The reasoning for the variation in sulfate concentrations throughout the year is presently unknown.

The annual seasonal water level fluctuation in Swan Lake is 1.5 feet (No Action Alternative Memo) indicating the fluctuations occur at a gradual enough rate to allow wild rice to grow.

The Swan River also contains small and sparse stands of wild rice from the outlet to the dam controlling the Swan Lake elevation (Crotteau, 2009A). There is a denser stand (~1.0 acre) of wild rice immediately upstream of the dam. The density of the wild rice stands (10-30 stems/m^2) in the Swan River were not measured but were visually estimated based on actual densities measured in Swan Lake and from an interpretation of qualification statements (Crotteau, 2009A).

There were no sulfate concentrations measured in the Swan River, but based on sulfate levels measured in Swan Lake (23-51 mg/L) it is reasonable to assume similar values would be detected in the Swan River. Along with sulfate levels, it can be assumed water level fluctuations in the Swan River up to the dam are also similar to Swan Lake and are gradual enough to enable wild rice to grow.

5.4.5 Environmental Consequences

The potential sulfate concentrations presented in this section represent effects without additional controls or project modifications that would be required to meet the 10 mg/L sulfate standard.

> There are no conclusive studies which demonstrate what the impacts to wild rice stands are based on increases in sulfate concentration; however, research has found that wild rice may tolerate a wide range of sulfates as naturally occurring wild rice stands have been found growing in waters with sulfate concentrations between 50 and 282 mg/L.

5.4.5.1 Swan Lake and Swan River

A summary of the predicted changes to lake level elevation and range of sulfate concentrations in Swan Lake are provided in Table 5.4.2. The current concentration range is based on the 95 percent confidence interval of the 2009 sampling. The projected sulfate concentrations are based on the current range plus the modeled increase (Water Quantity and Quality Report). It was assumed that changes in sulfate concentrations in the main body of the lake would be representative of changes experienced in the southwest bay, where wild rice is present.

TABLE 5.4.2 CUMULATIVE CHANGES IN LAKE LEVEL AND SULFATE CONCENTRATIONS – SWAN LAKE

	Current (2010)	No Action Alternative (2021)	Proposed Project (2036)
Lake Level (ft) [1]	1335.64	1335.61	1335.65
Sulfate Concentration Main Body (mg/L) [2]	25-30	32-38	35-40

[1] Increase based on Water Quantity and Quality Report
[2] Hay Lake/Swan Lake Sulfate Concentration Memo (95% Confidence Interval)
See Illustration 5-10 for detailed projection of sulfate concentrations

Based on model results, the Swan River (as the outlet for Swan Lake) would likely also experience a similar fluctuation in water level.

The change in sulfate concentrations in the main portion of the lake would also be representative of levels detected in Swan River. Wild rice is present in the Swan River at sulfate concentrations greater than 28 mg/L, indicating stands would continue to exist at the higher sulfate concentration.

The modeling assumes the southwest bay would experience a similar sulfate concentration increase resulting in a range between 14-36 mg/L. Wild rice grows in Swan Lake at sulfate concentrations greater than the concentrations currently in the southwest bay, indicating stands should continue to exist, but the impact to the extent and densities is uncertain and should be incorporated into a monitoring plan.

The potential cumulative environmental effects from the Proposed Project on wild rice in Swan Lake and Swan River could potentially be adverse, but has uncertain significance. The cumulative effect of the two projects would not significantly impact the average water level in Swan Lake, compared with the 1.5 foot natural annual range of water level change in the lake. However, the potential for cumulative effects to wild rice stem density, seed production or geographic extent in Swan Lake and Swan River from increased sulfate discharge is unknown.

5.4.6 Monitoring and Mitigation

Proposed Project potential impacts include water quality and quantity, and biological impacts. The potential impacts to the health of wild rice are uncertain and would likely become apparent over time as positive, negative, or no effect. This requires monitoring and potentially mitigation. Potential water quality impacts are more certain, as the current ambient levels of sulfate in the affected water bodies exceed the state standard of 10 mg/L. The Proposed Project would discharge additional sulfate into the water bodies, potentially causing an increase in existing sulfate concentration levels. This water quality impact requires mitigation and special permit conditions. Since these are potential cumulative effects, other projects in the vicinity discharging to these water bodies could also require mitigation and special permit conditions.

5.4.6.1 Monitoring

Monitoring efforts could document changes to wild rice in Swan Lake, the southwest bay of Swan Lake, and Swan River. Monitoring efforts could potentially include:

- Conducting follow-up field surveys to monitor the extent of wild rice and track changes in density and distribution of wild rice,
- Monitoring water levels in Swan Lake and Swan River during critical life cycle stages of wild rice to reflect brief and long-term changes in mining activity, and/or
- Monitoring sulfate concentrations in Swan Lake and Swan River to capture brief and long-term changes in mining activity.

> Should mitigation be required, preliminary mitigation alternatives have been identified based on the present understanding of the Proposed Project. These include, but are not limited to; wild rice habitat restoration, sulfate removal technologies, alternate water discharge location, and/or water reuse.

5.4.6.2 Mitigation

Section 5.4.5 identified that water level changes in Swan Lake and Swan River are not expected to change significantly. The impact of sulfate concentration changes to wild rice is uncertain, but may require further investigation and/or mitigation if monitoring determines there are significant impacts to wild rice. A detailed discussion of mitigation is provided in Section 4.7 of the FEIS.

5.5 MERCURY EMISSIONS, DEPOSITION AND BIOACCUMULATION

The FSDD stated that an analysis would be completed to determine if the potential local deposition of mercury from the project would significantly increase mercury contamination of fish, either alone or as a result of the cumulative local deposition with other nearby, recent or proposed emission sources. The analysis would be conducted using the MPCA Mercury Risk Estimation Method (MMREM) for the Fish Consumption Pathway. MMREM is a simplified screening model to assess the effect of a new or expanded mercury emission source on fish contamination (FSDD, 2008).

A mercury cumulative effects analysis was completed for the Proposed Project. The cumulative analysis evaluated the potential impacts from mercury deposition and bioaccumulation in fish, as a result of reasonably foreseeable future actions that might affect the amount of mercury emitted in the immediate area around the Proposed Project. The results of the analysis are described in the Mercury CI Study. Information in this section focuses on issues related to cumulative mercury impacts.

The potential link between sulfate in tailings basin discharge water and the potential for increased mercury methylation was qualitatively addressed in the Mercury CI Study and in the Screening Level Ecological risk Assessment. Local sulfate deposition and potential impacts was qualitatively addressed in the Acidification CI Study. Specific information on mercury emissions and speciation is presented in Section 4.9.7.

5.5.1 Affected Environment

The Minnesota Statewide Mercury TMDL states:

> *Mercury is a toxic pollutant and eating mercury-contaminated fish is the primary route of exposure for most people and wildlife. Mercury has accumulated in fish throughout the world because of human activities that emit mercury to the environment. Even lakes in natural pristine areas contain fish with high mercury concentrations, because mercury is deposited from the atmosphere and can travel long distances from its emission source.*
>
> *Mercury contamination of fish is expected to be proportional to atmospheric deposition of mercury if the proportion of mercury that is methylated is constant. However, it is likely that the proportion has increased, relative to natural levels, because of other anthropogenic changes. Sulfate-reducing bacteria (SRB) have been shown to be responsible for most of the transformation of deposited mercury into methylmercury. Atmospheric deposition of sulfate is thought to have stimulated the activity of SRB in geographic areas that are naturally sulfate-poor and, therefore, have increased the proportion of mercury that is methylated.* (MPCA, 2009I)

The relationship of mercury methylation to sulfate loading can vary by ecosystem. For some ecosystems there may be no apparent relationship for others a relationship may exist. In areas naturally poor in sulfate, one would not expect atmospheric sulfate deposition to result in uniform increases in fish mercury among lakes because SRB activity primarily occurs in organic-rich, low-oxygen environments, such as wetlands, which are not uniformly distributed. In addition, one would not expect atmospheric deposition of sulfate to be a major control on the production of methylmercury in surface waters that are already enriched in sulfate. Sulfate enrichment can occur from the natural mineral weathering of sulfur-containing rock, enhanced weathering due to mining activities, or the pumping of sulfate-rich groundwater. Thus, it is likely that atmospheric sulfate deposition has increased mercury methylation in watersheds low in sulfate, but that the degree of increase varied a great deal among lakes. The cumulative effect of sulfur dioxide emissions and sulfate discharged in water is discussed in Sections 5.12 and 5.10, respectively.

5.5.1.1 Mercury Speciation, Transport, and Environmental Fate

As described in Section 4.9.7.1.1, the speciation of mercury in stack emissions determines the fate and range of transport of mercury emissions. Air emission species of mercury and their relative ability to be transported include:

- Elemental mercury (Hg^0): This form of mercury can be transported long distances, having an average residence time in the atmosphere of several months to a year or more. This form of mercury has an atmospheric deposition rate that is very slow, perhaps 100 times slower than oxidized mercury, but not zero. In the MMREM modeling conducted for this project, more than 10 percent of the potential increase in deposition to nearby lakes is attributed to increased emissions of elemental mercury (Mercury CI Study), simply because projected emissions of elemental mercury exceed oxidized mercury by a factor of 15. The MMREM model assumes that oxidized mercury deposits 110 times faster than elemental mercury.
- Oxidized mercury (Hg^{2+}): This is a water-soluble form of mercury that has a relatively high potential to be captured by air pollution control systems. If oxidized mercury is emitted from a facility, the propensity for the oxidized mercury to associate with water and particles tends to result in a significant proportion of oxidized mercury being

deposited relatively close to an emission source, typically within 100 kilometers (62 miles) of the emission source.

- Particle-bound mercury (Hg_p): This form of mercury also has a relatively high potential to be captured by air pollution control systems. If particle-bound mercury is emitted from a facility, there also is a tendency for coarse particles (greater than 2.5 microns) to be deposited locally within 100 kilometers of a facility and for fine particles (less than 2.5 microns) to be transported further.

5.5.1.2 Mercury Methylation and Bioaccumulation

The relationship among mercury air emissions, deposition to aquatic ecosystems, and mercury accumulation in fish is complex. Mercury deposited in lake sediment and wetlands can be transformed into methylmercury by bacteria, especially bacteria that consume sulfate, known as sulfate-reducing bacteria. Methylmercury readily bioaccumulates in the food chain and accounts for nearly all the mercury present in fish. Due to the importance of sulfate-reducing bacteria in mercury methylation, it may be possible to obtain reductions in methylmercury formation by decreases in sulfate pollution, including sulfate deposited from the emissions of sulfur dioxide. Section 5.12 discusses the cumulative effect analyses related to the acidifying potential of sulfate deposition.

Mercury methylation production in aquatic ecosystems depends on the presence of multiple reactants, in particular sulfate and organic matter. Any one of these reactants can limit the production of methylmercury and therefore the bioavailability of mercury to fish. A scientific assumption made in the model, used by the MPCA and other regulatory agencies (e.g., USEPA) for TMDL studies, is that for any given lake the amount of mercury accumulating in fish is roughly proportional to atmospheric mercury deposition, assuming other factors remain unchanged for ecosystems where the atmosphere is the overwhelming source of mercury, as is the case in Minnesota.

Note that the proportionality assumption does not imply that similar atmospheric deposition of mercury and sulfate should result in similar concentrations of mercury in fish in different lakes. Even when mercury and sulfate deposition are uniform, the efficiency of mercury methylation and delivery to surface water varies significantly across the landscape because of variation in hydrology and conditions that favor the sulfate-reducing bacteria that methylate mercury.

Consequently, the assumption of proportionality is thought to be valid for each lake, but not among lakes. In other words, each lake has its own linear relationship between mercury deposition and mercury in fish, but the slope is different in different lakes. Increasing atmospheric mercury deposition by 5 percent to a lake’s watershed will result in the mercury content of the lake's fish rising by 5 percent, but the beginning concentration may vary widely among lakes due to variation in methylation efficiency. Using the assumption of proportionality in each lake, the Mercury CI Study estimated the potential impact of the proposed projects on mercury bioaccumulation in fish by assessing the extent to which the projects are likely to increase mercury deposition in the study area.

5.5.1.3 Summary of the Mercury CI Study

Modeling and calculations conducted for the MMREM analysis of the effect of cumulative mercury emissions on fish contamination in nearby lakes was completed for the Proposed Project and three other nearby projects. In addition, MMREM results for only the Proposed Project were used to assess human health and ecological risks discussed in Sections 4.9.8 and 5.13, respectively.

5.5.1.3.1 Critical Elements

The following elements are included in the Mercury CI Study:

- Summary of state actions and the state's current statewide Mercury TMDL strategy which calls for a 75 percent reduction in Minnesota's mercury emissions from taconite facilities.
- Assessment of potential emission increases from nearby recent and proposed facilities that could reasonably be expected to significantly contribute to mercury contamination of nearby lakes.
- Assessment of potential cumulative atmospheric deposition of mercury to nearby lakes.
- Assessment of the degree of increase in mercury in fish tissue.

5.5.1.3.2 Recent and Future Projects

The following projects and their respective emission increases are included in the Mercury CI Study analysis:

- Excelsior Energy, Mesaba Project - proposed Coal-Fired Integrated Gasification Combined Cycle (IGCC) Power Plant
- Laurentian Energy Authority - Wood Fired Boiler Project
- Essar Steel Minnesota, LLC (formerly Minnesota Steel) - Mining/Taconite/DRI/Steel Plant
- Proposed Project

The Mercury CI Study is based on an estimate of mercury emissions that includes potential mercury emission increases. Potential mercury emission reductions from the Proposed Project and other sources were not considered in the analysis.

5.5.1.3.3 Parameters

The following parameters were used to define the extent of the analysis for the Mercury CI Study:

- The list of specific future projects assessed in addition to the Proposed Project, including type, geographic limits, and project status.
  - Figure 4.9.5.1 shows the general locations of the reasonably foreseeable projects assessed for cumulative effects. The projects and regulatory actions selected as reasonably foreseeable for this analysis are listed in Section 5.5.1.3.2.
- A mercury screening analysis was conducted for the Proposed Project and the other three projects included in the cumulative effect analysis (Table 5.5.1).
  - The following lakes were included in the analysis: Big Sucker Lake, Coons Lake, Horsehead Lake, Kelly Lake, O'Brien Lake, and Swan Lake.
  - AERMOD dispersion modeling of the Proposed Project potential emissions and the other three projects in the cumulative effect analysis was completed as part of the mercury screening. The results show that mercury concentrations are significantly diluted within the nearest 6.2 miles, declining from greater than a 2 percent increase over background to less than 0.25 percent of existing background at distances of over 12 miles from a source (Acidification CI Study). Because the estimated air emissions have a greater proportion of oxidized mercury than background air, in this case a potential 2 percent increase in total mercury air concentration corresponds to a potential 8 percent increase in mercury deposition, and a potential 0.25 percent increase in total mercury air concentration corresponds to a potential 1 percent increase in deposition. The greatest potential increase in mercury loading to a lake is estimated to be 5.5 percent (Table 5.5.2), less than 8 percent, because a lake does not happen to be located at the site of greatest deposition.

- Mercury emissions from the Proposed Project and the other future projects in the zone of interest were assumed to have the potential to cause mercury impacts within a 15-mile radius from each individual project. It is unlikely that the proposed projects farther away could add to the cumulative mercury impact to a significant degree.

5.5.2 Environmental Consequences

Table 5.5.1 summarizes the estimated future mercury emissions for the recent and reasonably foreseeable future projects assessed in the Mercury CI study.

TABLE 5.5.1 RECENT AND PROPOSED PROJECTS EVALUATED IN THE MERCURY CI STUDY

Project	Location	Potential Mercury Emissions (pounds/year)
Excelsior Energy – West Range Site	Subject to State Site Process	54
Essar Steel Minnesota (Minnesota Steel)	Nashwauk	81
Laurentian Wood-Fired Energy Project	Virginia/Hibbing	7.3
Proposed Project	Keewatin	76
	Total	**218.3**

Source: Barr, 2009R; Table 1.

When compared to existing regional mercury deposition rates, the Mercury CI Study indicates that mercury deposition would potentially increase variable amounts among the six area lakes, depending on how close the source is to each lake and the average atmospheric dispersion of mercury emissions over the landscape, as determined by local wind patterns (Table 5.5.2).

TABLE 5.5.2 POTENTIAL INCREASE IN MERCURY LOADING AND FISH CONCENTRATIONS
(Due to Cumulative Effects of Multiple Facilities and the Proposed Project Alone)

A	B	C	D	E	F	G
		Cumulative	**Cumulative**		**Keetac Alone**	**Keetac Alone**
Lake	Ambient Fish Mercury Concentration (ppm)	Increase in mercury loading and fish contamination (%)	Increase in fish mercury (ppm)	Proportion of Cumulative Due to Keetac alone (%)[2]	Increase in mercury loading and fish contamination (%)	Increase in fish mercury (ppm)
	(Appendix D[1])	(Calculated from Appendix D[1])	(Calculated from columns B and C)	(Table 3[1])	(Calculated from columns C and E)	(Calculated from columns B and F)
Big Sucker Lake	0.48	3.90%	0.019	5.10%	0.20%	0.001
Coons Lake	0.48	1.50%	0.007	33.80%	0.50%	0.002
Horsehead Lake	0.48	1.40%	0.007	58.70%	0.80%	0.004
Kelly Lake	0.48	2.80%	0.013	78.30%	2.20%	0.011
O'Brien Lake	0.59	2.50%	0.015	16.00%	0.40%	0.002
Swan Lake	0.42	5.50%	0.023	14.50%	0.80%	0.003

[1] Source: Barr, 2009R
[2] Percentages for O'Brien and Swan account for different modeled mercury air concentrations over the lake as compared to over the watershed.

Table 5.5.2 is based on the following assumptions:

- Mercury speciation of facility emissions will be comprised of approximately 93 percent elemental, 6 percent oxidized, and 1 percent particle-bound mercury,
- Modeled mercury emissions are based on the recent and reasonably foreseeable new facilities within 15 miles of the Proposed Project (including the Proposed Project),
- It is unlikely that any projects outside a 15-mile radius would appreciably impact the lakes near Keetac, based on modeling (Mercury Control Alternatives Evaluation),
- Current deposition of mercury in the Keewatin, Minnesota, area is assumed to be 12.5 $ug/m^2/yr$, and
- Mercury concentrations in fish will be proportional to atmospheric mercury loading to each lake.

Potential mercury emissions from the Proposed Project are estimated at 76 pounds per year, or 35 percent of the total new emissions (218.3 lb) from the four projects evaluated in the cumulative effects report (Table 5.5.1).

The emission of 218 pounds per year of mercury to the atmosphere from the reasonably foreseeable future projects (including the Proposed Project) should be considered in relation to the following information:

- By adding 218 pounds per year of mercury emissions from the proposed future projects, Minnesota's emissions would increase by about 6.5 percent at the time that Minnesota's TMDL implementation plan contains an ultimate statewide mercury emission goal of 789 pounds in 2025. A needed reduction of about 75 percent from 2005 emissions.
- Minnesota's statewide mercury emissions are primarily elemental and in 2005 were estimated to be 1.67 short tons (3,341 pounds) or approximately 0.06 percent of global emissions. Worldwide emissions of mercury are approximately 2,400 metric TPY (5,300,000 pounds).

> The MPCA TMDL goal for mercury concentrations in fish is 0.20 ppm, a concentration that is currently exceeded by large margins for walleye and northern pike in all six lakes (Table 5.5.2).

Analysis of the estimated potential cumulative effect of the four projects taken together shows that Swan Lake would experience the greatest increase in fish mercury concentrations, 0.023 ppm or 5.5 percent (Table 5.5.2), of which 0.020 ppm (86 percent) is due to Essar Steel emissions and 0.003 ppm is due to the Proposed Project (Table 3, Acidification CI Study). The least impacted among the six lakes is Horsehead Lake, which is predicted to receive a 1.4 percent increase in mercury; this corresponds to a 0.007 ppm increase in mercury concentrations which are in the fish.

The MPCA TMDL goal for mercury concentrations in fish is 0.20 ppm, a concentration that is exceeded by large margins for walleye and northern pike in all six lakes (Table 5.5.2).

The cumulative effect to mercury concentrations in fish is adverse as fish mercury concentrations (ppm) would increase. The cumulative magnitude of the effect would be significant as mercury concentrations in fish in lakes analyzed are already above the MPCA's TMDL goal for walleye and northern pike. Additional discussion of the ecological risk associated with mercury deposition is discussed in Section 5.13.2, Ecological Risk Assessment.

5.5.3 Mitigation Opportunities

Two of the four projects included in the cumulative effects assessment are under development and do not yet have air emission permits (the Proposed Project and Excelsior Energy's Mesaba Energy), while the other two already have permits issued.

The Project Proposer is responsible for addressing mitigation for the Proposed Project. The mitigation plans are described in Section 4.9.7. The environmental review for the Excelsior Energy project was conducted by the federal government and the Minnesota Department of Commerce, and did not incorporate mitigation requirements related to Minnesota's mercury reduction strategy. The facility still needs to address mercury emissions under the MPCA's "New and Expanding Source" guidelines of the mercury reduction strategy.

The Laurentian Energy project is operating, and the Essar Steel project is just now under construction. Each of these two facilities has specific reduction goals as emission sources identified in Minnesota's mercury reduction strategy (MEI, 2008). Laurentian Energy is subject to the strategy that describes how industrial boilers will work to minimize their emissions, while Essar Steel's facility is already included in the taconite mining sector initiative to reduce that sectors' mercury emissions by 75 percent by 2025.

5.6 WILDLIFE HABITAT LOSS/FRAGMENTATION AND TRAVEL CORRIDOR OBSTRUCTION

> The mining industry has physically altered the landscape by creating large sheer-wall mine pits, stockpiles, tailings basins, haul roads and associated structures, which have resulted in a permanent loss of original habitat and physical barriers to wildlife movement.

Keetac is located within the portion of the Iron Range that has been altered as a result of mining activity, and as such the Proposed Project has the potential to contribute to the overall landscape alteration in this portion of the Iron Range. A discussion of the potential contribution to the cumulative effects on wildlife habitat loss, habitat fragmentation and wildlife travel corridor obstruction in the Iron Range resulting from Proposed Project is provided.

The SEAW and FSDD committed that an analysis would be performed to assess the cumulative effects to wildlife habitat loss and/or fragmentation and wildlife travel corridor obstruction, potentially affected by the Proposed Project. Effects related to past, present, and reasonably foreseeable future actions will be evaluated through a semi-quantitative analysis of pre-settlement vegetation, existing wildlife habitat, and existing wildlife travel corridors. The cumulative effects analysis was performed as a special study for the Proposed Project, as defined in the FSDD. This section summarizes the results of that analysis.

5.6.1 Affected Environment

Mining activity on the Iron Range has created a unique landscape resulting in geologic disturbances, habitat loss, and the creation of physical barriers. These landscape alterations, combined with other human induced (i.e., logging) and natural forms (i.e., wild fires) of disturbance, have impacted the wildlife habitat and overall species distribution in the Arrowhead Region of Minnesota.

5.6.1.1 Summary of Issues/Overview

Wildlife habitat loss, fragmentation, and travel corridor obstruction have been influenced by a variety of factors along the Iron Range and in northeastern Minnesota. The mining industry has physically altered the landscape by creating large sheer-wall mine pits, stockpiles, tailings basins, haul roads and associated structures, all of which have resulted in a permanent loss of original habitat and creation of physical barriers to wildlife movement. The mineral deposits of the Iron Range are located in a relatively narrow, long, linear band of material, and as a result the mining activities that have altered the landscape are concentrated in this area.

Other human activities in this region of Minnesota, such as logging, have resulted in a shift of available habitat types including a reduction of mature upland pine forests and lowland deciduous forests, and an increase in early successional cover types such as upland shrub or aspen/white birch forests. Development within municipalities adjacent to the Iron Range has contributed to the loss of wildlife habitat with the creation of linear features, such as highways and railroads, increasing wildlife travel corridor obstruction.

5.6.1.2 Summary of the Study Area and Scope

The study area for the cumulative effects analysis for wildlife habitat loss, fragmentation and corridor obstruction was not specifically defined in the FSDD or the SEAW. The SEAW states that an evaluation will "choose an appropriate analysis area, a baseline time and condition." The overall study area that was considered in the Wildlife CE Study was the entire Iron Range and a five-mile buffer around the 2007 MNDNR Mining Features dataset of the Iron Range (Figure 5.6.1). This study area was used for a detailed description of the pre-settlement vegetation, existing wildlife habitat, existing wildlife corridors and assessment of cumulative effects of reasonably foreseeable projects. A discussion of the project specific impacts on threatened, endangered and environmentally sensitive species is provided in Section 4.3.2. A discussion of the cumulative effects of mining and or activities in the Iron Range on threatened, endangered and environmentally sensitive species is provided in Section 5.7.

5.6.1.3 Pre-Settlement Vegetation

The reconstruction of historic or pre-settlement vegetative conditions is limited by the availability and accuracy of relevant datasets; however, past efforts have been undertaken to reconstruct the pre-settlement vegetative communities in northeastern Minnesota. The SEAW identified Marschner's map of original vegetation of Minnesota (recreated by Miron Heinselman in 1975) as a potential base dataset for the FEIS. Marschner's map included 16 vegetation categories across Minnesota using large scale (1:500,000) land survey maps compiled from 1850 through 1905. However, due to limitations in mapping scale it was determined that there were large sources for potential error in Marschner's map and it was not used in the analysis for this FEIS.

An additional dataset estimating pre-settlement vegetation was developed by White and Host (2001), which classified and mapped eight habitat classes. Even though the White and Host dataset is only available for the Northern Superior Uplands and not the entire study area, it was determined that this dataset provided a more accurate representation of pre-settlement vegetation in the study area. This is due to the quantitative accuracy tests used to verify vegetative community determinations. The Project Proposer used the White and Host (2001) dataset to map the pre-settlement vegetation in the study area and in the Proposed Project area. The Northern Superior Uplands covers 643,000 acres of the Iron Range study area, which is 1,003,000 acres in size (Figure 5.6.2). The pre-settlement vegetation in the Northern Superior Uplands was dominated by a variety of forested habitat types including mesic white-pine/red-pine forest; lowland conifer forest; and dry mesic jack pine-black spruce forest. Table 5.6.1 provides the areas for each habitat type in the White and Host (2001) dataset for the Northern Superior Uplands.

TABLE 5.6.1 PRE-SETTLEMENT VEGETATION ACROSS THE NORTHERN SUPERIOR UPLANDS PORTION OF THE STUDY AREA

Pre-Settlement Vegetation[1]	Area (acres)	Percent
Dry Mesic Jack Pine-Black Spruce	116,609	18.1
Mesic Aspen-Birch-Fir-Spruce	95,784	14.9
Dry Mesic/Mesic White Pine-Red Pine	228,596	35.5
Sugar Maple	27,648	4.3
Rich Swamp	6,333	1.0
Lowland Conifer	134,480	20.9
Non-forested Wetland	4,779	0.7
Open Water	28,865	4.5
Total	**643,094**	**100**

[1] Vegetation Categories from White and Host 2001.

5.6.1.4 Existing Wildlife Habitat

Many of the forested cover types have shifted over time from the pre-settlement vegetation communities described in Section 5.6.1.3. The vast majority of the shift in vegetation from pre-settlement conditions to the existing conditions can be attributed to human related disturbance such as logging and mining activities. These have either removed habitat or facilitated the establishment of different habitat types. The determination of existing wildlife habitat and vegetation across the Iron Range was estimated by merging several datasets, in order to capture the details and advantages of each.

The base dataset for the analysis was the Gap Analysis Program (GAP) land cover. It was created in the early 1990s and provides the most recent large-scale, high quality dataset for the Iron Range. Several developed land use categories from the 2001 National Land Cover Data (NLCD) were merged into the GAP dataset. The MNDOT railroad layer (with a 20 foot buffer applied) and the MNDNR 2007 Mining Features layer were then merged into the combined GAP/NLCD data to create the final existing conditions data layer. The combination of the above datasets gives the most accurate overall picture of the existing habitat, as well as the areas where habitat has been lost or altered, across the study area. A list of terrestrial vertebrate wildlife species that may be found in and around the Keetac mine is in Appendix K.

The study area (defined as a five-mile buffer to the MNDNR 2007 Mining Features dataset) is a little over 1,000,000 acres in size. The land cover dataset that was created for the study area as described above includes 25 land use/habitat categories. Of the 25 categories, 12 categories have a vegetative cover of some form (forests, grass, shrubs) covering 753,000 acres (75 percent) of the study area (Figure 5.6.3). The remaining categories are a developed or altered land use that provides minimal or no wildlife habitat or limited ecological value. The existing vegetative cover across the study area is summarized in Table 5.6.2. Four of the five most abundant habitat types present in the study area are an early-successional disturbance community. This includes aspen/white birch forest, upland shrub, lowland shrub, and grassland.

TABLE 5.6.2 EXISTING WILDLIFE HABITAT VEGETATION IN THE STUDY AREA[1]

Habitat Type[2]	Area (acres)	Percent
Aspen/White Birch	277,692	27.7
Upland Shrub	101,459	10.1
Lowland Shrub	95,535	9.5
Lowland Conifer Forests	92,329	9.2
Grassland	64,931	6.5
Pine	43,542	4.3
Upland Conifer Forest	24,408	2.4
Upland Deciduous Forest	23,387	2.3
Lowland Deciduous Forest	17,429	1.7
Marsh	6,731	0.7
Upland Conifer -Deciduous Mix	5,293	0.5
Lowland Conifer-Deciduous Mix	222	0.0
Developed and Open Water	249,740	24.9
Total	**1,002,698**	**100**

[1] All developed or disturbed cover types are combined.
[2] Existing land cover categories developed from a combination of USGS NLCD 2001 dataset; GAP dataset; 2007 MNDNR Mine Features dataset; and MNDOT Railroads dataset (Barr, 2009).

5.6.1.5 Wildlife Corridors

The activities associated with the mining industry have created an impact on the landscape due to the linear orientation of the mineral deposits in the Iron Range. The creation of deep sheer-wall mine pits, large stockpiles and tailings basins, and haul roads and associated structures have not only eliminated wildlife habitat but also created physical barriers to wildlife travel and dispersal. Some areas along the Iron Range either have not been impacted or have been only minimally impacted by mining. These areas now serve as wildlife travel corridors between large tracts of habitat located to the north and south of the Iron Range. The importance of travel corridors varies with the extent of mining alteration in areas adjacent to the corridor, the species that use the corridor, and the quality of available habitat within the corridor.

The concern associated with wildlife corridor loss relates to both short-term and long-term impacts on a variety of species. The main concern is associated with the life history requirements of large mammals, such as black bear, moose, and gray wolf, which have large home ranges and exhibit dispersal and migratory behavior. As travel corridors are lost or severely altered, the feeding, reproductive, and migratory behaviors of these large mammals could be altered. It is possible that and populations of species north and south of the Iron Range would be cut off from each other and unable to inter-mix. Additionally, certain small mammals, birds, reptiles, and insects are considered corridor dwellers that exist within corridors for all or large portions of their life history, and would also be impacted by further corridor loss or alteration.

In recent years, the MNDNR has taken an active stance in recognizing the importance of the remaining wildlife travel corridors along the Iron Range. As inactive mining operations are restarted or when existing facilities propose to expand, there is the potential for further wildlife travel corridor loss or a reduction in travel corridor quality. One study was completed that attempted to identify travel corridors across the Iron Range, rate the quality of the existing corridors, and assess the potential for impacts to these corridors based on known and proposed reasonably foreseeable actions in the region. (In 2006, Emmons and Oliver Resources, Inc. [EOR] completed the Cumulative Effects Analysis on Wildlife Habitat Loss/Fragmentation and Wildlife Corridor Obstruction/Landscape Barriers in the Mesabi Iron Range and Arrowhead Regions of Minnesota [EOR, 2006] study.) The EOR Study identified 13 corridors across the Iron Range, determining that one corridor would experience direct loss, one would experience fragmentation, four would experience isolation, and seven would experience no impacts or minimal impacts/isolation due to future foreseeable actions.

The conclusions of the EOR Study indicate that based on reasonably foreseeable actions, there is the potential for significant cumulative effects to the quality and/or availability of travel corridors on the Iron Range. The EOR Study for the region is conservative because it treated all historic mining features as lost habitat or absolute barriers to travel. However, not all mining features are truly lost habitat. Some features such as revegetated stockpiles and shallow, marsh-like tailings basins providing some habitat for certain species, albeit at a lower overall ecological value compared to native habitat. Overall, the study provides a good initial estimate of existing wildlife travel corridors on the Iron Range and potential impacts or loss of travel corridors due to future mining activities. Since the completion of the EOR Study, additional potential projects have been proposed, which merited further investigation of wildlife travel corridor obstruction on the Iron Range.

The FSDD outlined that a special cumulative effects study examining wildlife habitat loss/fragmentation and travel corridor obstruction would be completed as part of the FEIS for the Proposed Project. The Wildlife CE Study was completed by the Project Proposer with the target of addressing the issues identified in the FSDD. This study used the MNDNR 2007 Mining Features in a GIS analysis to identify areas across the Iron Range that have experienced different levels of landscape alteration, disturbance or habitat loss. High Impact areas were defined as those mining features that created an absolute physical barrier to wildlife, which includes mine pits, in-pit activities, and operational plants and buildings. Moderate Impact areas were defined as those areas that have exhibited some change in topography, community structure or diversity from the original habitat, but do not create an absolute physical barrier to wildlife movement. Moderate Impact areas include revegetated stockpiles, tailings basins, borrow areas, settling ponds, and haul roads.

Upon defining and identifying Moderate Impact and High Impact areas across the Iron Range, the Wildlife CE Study used several criteria to identify existing wildlife travel corridors including:

- Largely undeveloped areas with few Moderate Impact barriers within the corridor
- No significant barriers presented by High Impact land uses
- At least 300 feet across at its narrowest point to buffer against edge effects from adjacent land uses
- Relatively linear and non-complex contiguous areas, meaning not significantly impacted by several small "high impact" features.

The Wildlife CE Study identified Moderate Impact areas in some wildlife travel corridors. These areas were identified because they may impede the movement of some species. The highest quality corridors have the largest amount of natural or un-impacted landscape and habitat.

The Wildlife CE Study identified 18 wildlife travel corridors (Figure 5.6.4) across the Iron Range, of which nine were identified as high quality corridors and nine were identified as moderate quality corridors. Of the 18 corridors, two are immediately adjacent to the Proposed Project and two additional corridors are located in relative close proximity (less than 10 miles) to the Proposed Project. The discussion of the potential contribution of the Proposed Project on cumulative effects to wildlife travel corridor obstruction in the Iron Range will focus on these four corridors.

5.6.2 Environmental Consequences

5.6.2.1 Wildlife Habitat Loss and Fragmentation

5.6.2.1.1 Habitat Alterations Compared to Pre-settlement Conditions

> Overall, across the 643,000 acre Northern Superior Uplands portion of the study area, 390,000 acres or just over 60 percent of pre-settlement vegetation has been altered.

There are challenges involved in determining the changes in pre-settlement vegetation compared to existing conditions. Much of this is due to pairing up different habitat classes described in the White and Host (2001) dataset with categories in the National Land Cover Dataset (NLCD, 2001) and GAP dataset used to describe existing habitat conditions. The White and Host (2001) pre-settlement vegetation dataset, used covers only the Northern Superior Uplands portion of the study area, which constitutes approximately 643,000 of 1,003,000 total acres. However, it is felt that the changes from pre-settlement vegetation to the existing ecological conditions within the Northern Superior Uplands are likely similar to the shifts that have occurred across the overall study area, due to the similar type of disturbance (i.e., mining, logging) in the region. There were eight identified pre-settlement vegetation types in the Northern Superior Uplands that were compared with 23 cover types from the combined NLCD and GAP dataset.

There are two facets to the differences between pre-settlement vegetation and existing wildlife habitat. The first is the loss of habitat and the second is habitat alteration (i.e., a shift from one habitat/vegetation type to an alternate habitat/vegetation type). High Impact mining features, such as mine pits, in-pit activities, and operational plants and buildings, have lead to habitat loss. However, the majority of impacts to pre-settlement vegetation have occurred due to Moderate Impact mining activities or logging activities. These impacts have mainly led to a shift from mature forests to early successional disturbance communities, as opposed to a loss of habitat.

Overall, in the Northern Superior Uplands portion of the study area, 390,000 acres or just over 60 percent of pre-settlement vegetation has been altered. A comparison of the change from pre-settlement vegetation communities to the existing ecological conditions is provided in Table 5.6.3. Mesic white pine-red pine forests have experienced the most dramatic shift with a decrease of over 203,000 acres, which equates to an 89 percent loss from pre-settlement to current conditions. Dry mesic jack pine-black spruce forests experienced a loss of 95,552 acres, an 82 percent decrease from pre-settlement to current conditions. Other vegetation communities that experience significant loss from pre-settlement to current conditions include a loss of 70,216 acres (52 percent) of lowland conifer forest and a 16,498-acre loss (60 percent) of deciduous upland forests (sugar maple).

One pre-settlement vegetation community experienced a significant increase in distribution under current conditions. Mesic aspen-birch-fir-spruce forests have expanded by 89,300 acres, which is a 93 percent increase, across the Northern Superior Uplands portion of the study area from pre-settlement to current conditions. Aspen-white birch forests are an early successional community, and the increase of this habitat in the study area is mainly due to this forest community re-vegetating areas that were disturbed due to logging or mining activities. Aspen-white birch forests now account for 185,000 acres or 29 percent of the Northern Superior Uplands portion of the study area. There are three vegetative communities that are now fairly prevalent across the Northern Superior Uplands portion of the study area that were not present during pre-settlement conditions, including upland shrub, lowland shrub, and grassland. Similar to aspen-white birch forests, these three vegetative communities are early successional communities that have increased as a result of disturbance in the region. Upland shrub, lowland shrub and grassland communities now account for 160,600 acres or 25 percent of the existing habitat in the study area.

A variety of human-related activities in the study area have resulted in a loss of habitat as compared to pre-settlement conditions. This includes not only mining operations but also other industrial facilities such as: municipalities, residential development, farming and agriculture, roads and highways, and railroads. Based on the land cover analysis of the existing conditions within the Northern Superior Forests portion of the study area, 139,200 acres (22 percent) of land is in some form of human-developed land cover. The majority of these areas offer little or no habitat or ecological value to wildlife.

TABLE 5.6.3 COMPARISON OF PRE-SETTLEMENT VEGETATION TO CURRENT LAND COVER CONDITIONS

Pre-settlement Vegetation[1]	Acres	Existing Land Cover[2]	Acres	Gain (Loss) Acres	Gain (Loss) Percent
Dry Mesic Jack Pine-Black Spruce	116,609	Upland Conifer Forest	21,057	(95,552)	(81.9)
Mesic Aspen-Birch-Fir-Spruce	95,784	Aspen/White Birch; Upland Conifer-Deciduous Mix	185,073	89,289	93.2
Dry Mesic/Mesic White Pine-Red Pine	228,596	Pine	24,980	(203,616)	(89.1)
Sugar Maple	27,648	Upland Deciduous Forest	11,150	(16,498)	(59.7)
Rich Swamp	6,333	Lowland Deciduous Forest; Lowland Conifer Deciduous Mix	7,160	827	13.1
Lowland Conifer	134,480	lowland Conifer Forest	64,264	(70,216)	(52.2)
Non-forested Wetland	4,779	Marsh	3,459	(1,321)	(27.6)
Open Water	28,865	Aquatic	26,065	(2,800)	(9.7)
Cover Not Present During Pre-settlement	--	Upland Shrub	77,882	77,882	n/a

Pre-settlement Vegetation[1]	Acres	Existing Land Cover[2]	Acres	Gain (Loss) Acres	Gain (Loss) Percent
Cover Not Present During Pre-settlement	--	Lowland Shrub	61,428	61,248	n/a
Cover Not Present During Pre-settlement	--	Grassland	21,343	21,343	n/a
Cover Not Present During Pre-settlement	--	Moderate Impact - MNDOT Railroads	616	616	n/a
Cover Not Present During Pre-settlement	--	High Impact - 2007 MNDNR Mine Features	32,277	32,277	n/a
Cover Not Present During Pre-settlement	--	Moderate Impact - 2007 MNDNR Mine Features	67,367	67,367	n/a
Cover Not Present During Pre-settlement	--	GAP - Cropland	6,222	6,222	n/a
Cover Not Present During Pre-settlement	--	USGS NLCD 2001 - Cultivated Crops	1,678	1,678	n/a
Cover Not Present During Pre-settlement	--	GAP - Mixed Development	3,905	3,905	n/a
Cover Not Present During Pre-settlement	--	GAP - Barren	949	949	n/a
Cover Not Present During Pre-settlement	--	USGS NLCD 2001 - Barren Land	6,544	6,544	n/a
Cover Not Present During Pre-settlement	--	USGS NLCD 2001 - Developed High Intensity	574	574	n/a
Cover Not Present During Pre-settlement	--	USGS NLCD 2001 - Developed Low Intensity	5,427	5,427	n/a
Cover Not Present During Pre-settlement	--	USGS NLCD 2001 - Developed Medium Intensity	2,224	2,224	n/a
Cover Not Present During Pre-settlement	--	USGS NLCD 2001 - Developed Open Space	11,450	11,450	n/a
Total	**643,094**	**Total**	**643,094**		

[1] Pre-settlement vegetation categories from White and Host (2001).
[2] Existing land cover categories developed from a combination of USGS NLCD 2001 dataset; GAP dataset; 2007 MNDNR Mine Features dataset; and MNDOT Railroads dataset (Barr, 2009).

Impacts to pre-settlement vegetation have occurred within the current and proposed Keetac footprint. The area of disturbance in the current and proposed Keetac footprint would be approximately 9,214 acres of which approximately 7,130 acres has been previously disturbed or converted to a developed land cover. The alterations to pre-settlement vegetation account for approximately 3 percent of the 390,000 acres of pre-settlement vegetation that has been altered in the Northern Superior Uplands portion of the study area.

5.6.2.1.2 Potential Future Habitat Loss and Fragmentation

The study area (defined as a five-mile buffer to the MNDNR 2007 Mining Features dataset) is a little over 1,000,000 acres in size. Under existing conditions, approximately 753,000 acres of vegetative cover provides habitat to wildlife (Table 5.6.2). The remaining 249,800 acres of the study area is covered by a variety of human disturbed land uses that provide little or no habitat or ecological value to wildlife.

To estimate impacts to existing wildlife habitat as a result of reasonably foreseeable future projects, a list of known or proposed potential future projects in the study area was generated. The list of reasonably foreseeable future projects includes future mining impacts for all mine permits that have been approved or are under review by the MNDNR, as well as other large, planned projects in the study area. The final list includes the following 11 projects:

- Essar Steel (formerly Minnesota Steel)
- US Steel – Keetac
- US Steel – Minntac
- ArcelorMittal Minorca (former Mittal Minorca Ispat Inland)
- PolyMet Mining Inc. (Northmet Project)

- Northshore Mining (Peter Mitchell Mine Pits Expansion)
- Cliffs Erie Pellet Transfer Facility
- Mesabi Nugget (Phase II Project)
- Hibtac
- MN Power Syl Laskin Energy Center
- Hoyt Lakes to Babbitt Connector Highway

The above reasonably foreseeable future projects would result in the disturbance of approximately 2 percent of the total area (see Figure 5.6.5). Future impacts would result in impacts to 14,341 acres of existing vegetated habitats, while 4,439 acres of the impacts would occur on developed or disturbed land uses. Future impacts to existing vegetated habitats are presented in Table 5.6.4. A discussion of impacts to threatened, endangered and environmentally sensitive species as a result of the future reasonably foreseeable future actions is provided in Section 5.7.

A total of 6,430 acres of aspen/white birch forests would be impacted due to future projects, which is 34.2 percent of the total future impact area. Aspen/white birch forests are the most prevalent vegetated habitat in the study area, covering 277,692 acres or some 27.7 percent of the total study area. The projected future loss of 6,430 acres is 2 percent of the existing aspen/white birch forest habitat in the study area (Table 5.6.4).

Other habitats comprising the largest percentage of future project impacts include 2,201 acres of upland shrub (10.8 percent of future impacts), 1,199 acres of lowland conifer forest (6.4 percent of future impacts), 1,078 acres of lowland shrub (5.7 percent of future impacts) and 1,049 acres of pine forests (5.6 percent of future impacts). For each of the vegetated habitats, the estimated future impacts accounts for less than 2.5 percent of the total available in the study area for each habitat type. Future projects would result in impacts to 786 acres of upland deciduous forests, which is 4.2 percent of the total future impacts. This constitutes 3.4 percent of the total available upland deciduous forest habitat in the study area, which is the largest percentage of impacts to a single habitat type in the study area.

TABLE 5.6.4 REASONABLY FORESEEABLE FUTURE IMPACTS TO EXISTING WILDLIFE HABITAT VEGETATIVE COVER TYPES IN THE STUDY AREA[1]

Existing Habitat Type[2]	Area (acres)	Percent of Total Impacts	Percent of Total Habitat Impacted
Aspen/White Birch	6,430	34.2	2.3
Upland Shrub	2,021	10.8	2.0
Lowland Conifer Forest	1,199	6.4	1.3
Lowland Shrub	1,078	5.7	1.1
Pine	1,049	5.6	2.4
Upland Deciduous Forest	786	4.2	3.4
Grassland	616	3.3	0.9
Upland Conifer Forest	545	2.9	2.2
Aquatic	306	1.6	0.5
Lowland Deciduous Forest	200	1.1	1.1
Marsh	103	0.5	1.5
Upland Conifer/Deciduous Mix Forest	11	0.1	0.2
Lowland Conifer Deciduous Mix	0	0.0	0
Previously Developed or Disturbed Land	4,439	23.6	2.3
Total	**18,781**	**100**	**--**

[1] All developed or disturbed cover types are combined.
[2] White and Host 2001

Two percent of the existing available vegetated wildlife habitat in the study area would be impacted as a result of the future projects. Compared to impacts from previous mining, logging, agriculture and municipal development, these projected future impacts are relatively minor. However, future impacts to certain habitats could still be considered important due to the past historic loss and the amount of remaining available habitat in the region. For example, it is estimated that future projects would impact 1,049 acres of pine forest, which is 2.4 percent of existing pine forest habitat in the study area. However, based on estimates of impacts to pre-settlement vegetation in the Northern Superior Uplands portion of the study area, pine forests have experienced a historic decline of 89 percent in the region. Even a small additional loss of pine forest habitat could impact wildlife species that require specialized habitat, such as pine forests.

Impacts to habitat types that have experienced the most severe historic loss in the study area, including pine forests (89 percent historic reduction), upland conifer forest (82 percent historic reduction), upland deciduous forests (60 percent historic reductions), and lowland conifer forest (52 percent historic reduction) should be minimized to the maximum extent practicable.

5.6.2.2 Travel Corridor Obstruction

> Due to the anticipated loss of Corridor #3 (due to Essar Steel Mining Activities) and Corridors #5 and #6 (due to Hibtac Mining Activities) Corridor #4 would likely be the only usable corridor for an approximate 25-mile span on the Iron Range from the City of Taconite to the City of Chisholm (Figure 5.6.6). The maintenance of Corridor #4 would therefore be critical to overall wildlife travel and dispersal across this section of the Iron Range. The Proposed Project would not impact Corridor #4.

As previously mentioned, 18 wildlife travel corridors were identified across the Iron Range. Two corridors, #4 and #5, are adjacent to Keetac with Corridor #4 located on the west and Corridor #5 located on the east (Figure 5.6.6). Two additional corridors are located in close proximity (less than 10 miles) to Keetac, these are Corridor #3 located seven miles west and Corridor #6 located five miles east. The cumulative effects analysis of this FEIS focuses on these four corridors because they are the main corridors on the Iron Range that could be used by wildlife near Keetac.

5.6.2.2.1 Corridor #3

Corridor #3 is close to one-mile wide and is interrupted by a 600-foot wide open mining pit (former Butler Mine – now Essar Steel) in the center of the corridor. The western half of the corridor is comprised mainly of “Moderate Impact” mining features while the eastern half is mainly undeveloped natural habitat. Overall this corridor is considered a high quality corridor due to the prevalence of natural habitat. This corridor is located adjacent to the Essar Steel project area, approximately seven miles west of Keetac. It is assumed that over the next 30 years this corridor would be lost due to activities approved in the Essar Steel permit to mine. Wildlife would be forced to travel to corridors #2 or #4 to cross the west end of the Iron Range. The Proposed Project would not contribute to the loss of this corridor.

5.6.2.2.2 Corridor #4

Corridor #4 is located adjacent to the western edge of the Project Area, and is relatively narrow at 800 feet in width (Figure 5.6.6). Corridor #4 is constricted by impassable boundaries on each side with the LaRue Pit to the west and the Perry Pit to the east. It is considered a moderate quality corridor due to the narrow center constricted by the mine pits, the prevalence of Moderate Impact features such as stockpiles and the limited amount of undeveloped natural habitat. Stockpiles to the north and south of the eastern edge of the LaRue Pit extend across the majority of Corridor #4, but do not completely bisect the corridor. Although these stockpiles have revegetated, their relatively high elevations would make this corridor impassable to certain species, such as small mammals (i.e., rodents), reptiles and amphibians that are incapable of navigating the steep terrain. O'Brien Creek runs through the center of Corridor #4, and this riparian area of the creek likely serves as a travel corridor for upland mammals as well as semi-aquatic species. It is unlikely that direct impacts to the O'Brien Creek riparian area would be permitted and are not part of the Proposed Project. The likely regulatory protection of O'Brien Creek should ensure that this corridor remains open and available. As a result, the corridor would continue to provide habitat and safe passage for species not requiring wide corridors or that have become accustomed to moderate disturbance from existing mining activities.

5.6.2.2.3 Corridor #5

Corridor #5 is located adjacent to the eastern edge of Keetac (Figure 5.6.6). It is one of the narrowest corridors identified in the Barr Study at approximately 350 feet wide. This corridor has limited habitat and ecological value due to the narrow width and the prevalence of historic and active mining features scattered throughout the corridor. The corridor remains open due to the presence of habitat adjacent to County Road 79 which is oriented north to south through the center of the corridor. However, the corridor is bordered on both sides by active mine pits and an active haul road which intersects this corridor on the north end. The majority of the habitat within Corridor #5 has been previously impacted by past mining activities and also municipal development within the City of Hibbing. It is anticipated that this corridor would be lost over time due in part to the creation of the new stockpile area for the Proposed Project which would eliminate the forested and wetland habitat along the southwest corner of the corridor. However, the main contributor to the loss of this corridor would be the expansion of mining activities at Hibtac. The expansion of active mine pits and stockpile areas would remove the majority of the remaining habitat along the north end of Corridor #5 and make the corridor either unusable or impassable to wildlife.

5.6.2.2.4 Corridor #6

Corridor #6 is located approximately five miles east of Keetac and is relatively wide at 2,400 feet (Figure 5.6.6). The corridor is considered a Moderate Quality Corridor, due to developments that border or intersect the corridor including TH 169, the City of Chisholm, and Hibtac's active open mine pit. The habitat within the corridor is also considered of moderate value due to the presence of partially revegetated stockpiles. It is anticipated that this corridor would be lost in future years due to the eastward expansion of the Hibtac mining activities on the north end of the corridor. This would essentially turn Corridor #6 into a dead end for wildlife attempting to disperse or migrate from the south to the north in this area of the Iron Range. The Proposed Project would not contribute to the loss of Corridor #6.

5.6.2.2.5 Project Relation to Wildlife Habitat Loss and Corridor Obstruction

The Proposed Project would result in impacts to approximately 1,283 acres of land within the study area, which is 7 percent of future impacts from reasonably foreseeable future projects.

The majority of future impacts to vegetated wildlife habitat from the Proposed Project would be to early successional habitats that are abundant in the study area, including aspen white birch forest, upland shrub and lowland shrub communities. The Proposed Project would have little to no impact on mature forest communities including upland conifer forest, upland deciduous forests, pine forests, and lowland conifer forests. The Proposed Project would contribute to the overall future cumulative effects to wildlife habitat, but not disproportionately as compared to other future projects.

Overall, the Proposed Project would have a minimal impact on wildlife travel corridors on the Iron Range. Of the four corridors located within 10 miles of Keetac, the Proposed Project would not contribute to the impacts to three of the corridors, while contributing to some habitat loss of the fourth corridor.

Due to the anticipated loss of Corridor #3 (due to Essar Steel Mining Activities) and Corridors #5 and #6 (due to Hibtac Mining Activities) Corridor #4 would likely be the only usable corridor for an approximate 25-mile span on the Iron Range from the City of Taconite to the City of Chisholm (Figure 5.6.6). The maintenance of Corridor #4 would therefore be critical to overall wildlife travel and dispersal across this section of the Iron Range. The Proposed Project would not impact Corridor #4, and there are no known or proposed projects that would impact this corridor.

The cumulative effect to wildlife corridors is adverse and potentially significant because the Proposed Project's encroachment on Corridor #5 is part of on-going, large-scale wildlife corridor encroachment that in some cases will be permanent.

Additionally, the cumulative effect to wildlife corridors from the East Stockpile Alternative is also adverse and potentially significant. However, the magnitude of the effect is smaller than that of the Proposed Project. The distance of the East Stockpile Alternative from Kelly Lake residential areas would increase by approximately 470 to 1,100 feet, which in turn would increase the width of Corridor #5. The footprint of the East Stockpile Alternative is approximately 250 acres less than the Proposed Project footprint. These stockpile footprints would be located entirely within moderate quality Corridor #5. Less of the wildlife corridor would be obstructed with the East Stockpile Alternative, leaving more undisturbed wildlife habitat on the east side of the stockpile compared to the Proposed Project.

5.6.3 Mitigation and Monitoring

Expanded mining activities would result in the cumulative loss of wildlife habitat and wildlife travel corridors across the Iron Range. Analysis of planned future projects in the study area indicates that wildlife habitat would be lost in the study area but that approximately 54 percent of future impacts would occur to early successional habitats that are relatively abundant in the study area including aspen/white birch forest, upland shrub and lowland shrub communities. An additional 23 percent of future impacts would occur on some form of previously developed or disturbed land.

Studies that provided a comprehensive look at wildlife travel corridor availability across the entire Iron Range identified several corridors that would experience impacts ranging from habitat alteration/loss to complete corridor closure or loss (Figure 5.6.7) (EOR, 2006 and Wildlife CE Study). Due to the potential future impacts to both wildlife habitat and wildlife travel corridors, attempts to minimize or mitigate impacts from mining and development should be made where feasible. The following land reclamation practices could be examined in the region including:

- Ensure that Corridor #4 remains open and is minimally impacted or altered as a result of future projects;
- Encourage in-pit stockpiling were feasible, especially in the saddles between mine pits, which could serve to maintain existing wildlife corridors, facilitate the creation of new wildlife travel corridors or create shallow littoral habitat within mine pits that would provide habitat for aquatic species as well as travel routes for semi-aquatic species;
- Ensure implementation of practices required under Minnesota Mineland Reclamation Rules (Minnesota Rules Chapter 6130) that would facilitate the re-establishment of vegetated wildlife habitat such as limiting slopes and/or lift heights of stockpiles or establishing vegetation on stockpiles, tailings basins or overburden areas upon completion of disturbance of an area;
- Consider requiring monetary contributions from proposed projects as part of the permitting process that could be used by the MNDNR or the USFS to manage or create mature forest habitats that have experienced the greatest amount of historical impacts in the region (i.e., pine forests, upland conifer

forests, or upland deciduous forests). Funds could be contributed to an existing program such as the Forest Stewardship Program or other program. A practice of this nature would provide a mechanism for each project to contribute to the mitigation for impacts to the overall loss of wildlife habitat and/or travel corridor obstruction without placing a disproportionate amount of the burden, blame or responsibility on any one project, developer or land owner. Monetary contributions are an acceptable mitigation strategy in the MNDNR Takings Permit Process or would be a practice similar to buying wetland mitigation credits from a wetland bank.

5.7 THREATENED AND ENDANGERED SPECIES AND SPECIES OF CONCERN

> The information in Section 4.3.1 of this FEIS determined that the Proposed Project would not result in direct impacts to Federal or state listed animal species but that Proposed Project would result in the taking of several state listed threatened or endangered plant species.

The FSDD stated that the EIS analysis will include an evaluation of the potential cumulative effects to state and federally-listed threatened and endangered species and state species of special concern. Analysis in this section of the FEIS focuses primarily on those issues related to listed plant and animal species that may be cumulatively impacted by past projects, the Proposed Project, and other reasonably foreseeable future projects in the region.

Based on the information presented in Section 4.3.1 of this FEIS, the MNDNR and USACE determined that the Proposed Project would not result in direct impacts to federal or state listed animal species but that Proposed Project would result in the taking of several state listed threatened or endangered plant species. This section will analyze the Proposed Project's contribution to the potential cumulative effects related to past, present, and reasonably foreseeable future actions for both threatened and endangered plant and animal species. The potential cumulative effects will be evaluated through a semi-quantitative summary of the species that may be impacted and number of populations of each species that may be affected.

The FSDD defined several special studies to be conducted as part of the cumulative effects analysis for the FEIS. The results of special studies conducted by the Project Proposer are described in several reports including: the Plant CE Study, the Wildlife CE Study, and the Lynx Survey. This section summarizes the results of the analysis from the above special studies, as well as additional information relating to the potential cumulative effects to state or federally-listed threatened, endangered, or special concern plant and animal species in the Iron Range.

5.7.1 Threatened and Endangered Plant Species

5.7.1.1 Affected Environment

Threatened and Endangered species are regulated at both federal and state levels. In Minnesota, threatened, endangered and special concern species are regulated under Minnesota Rules, parts 6212.1800 to 6212.2300. At the federal level, the Endangered Species Act of 1973, as amended (16 U.S.C. §§ 1531 – 1544) was used as the basis for the regulations pertaining to plant and animal species that have been federally designated as threatened or endangered. Additional details describing the regulatory framework protecting threatened and endangered species is provided in Section 4.3.1.

The study area for this analysis was defined as the Iron Range and a five-mile buffer around the 2007 MNDNR Mining Features dataset of the Iron Range (Figure 5.6.1). This study area was used for a detailed description of the abundance and distribution of the state and federally-listed threatened and endangered species and assessment of the cumulative effects of reasonably foreseeable projects. A larger spatial scale was used to assess the relationship between species survival and persistence within the study area and the entire state.

The projects identified as potentially impacting the state and federally-listed threatened and endangered plant species considered in the assessment include the Proposed Project, Mittal Minorca East Reserve/Ispat Inland, PolyMet Mining Inc., and Mesabi Nugget Phase II.

5.7.1.1.1 Scope of the Special Studies

The Plant CE Study, as listed in the EIS Related Studies section, identifies threats to the survival and persistence of each species within the study area as a result of foreseeable future mining projects.

The analysis of cumulative effects assessed three time periods: past, present, and the reasonably foreseeable future. Past impacts include approximated species losses since the time of European settlement. Impacts in the reasonably foreseeable future are forecasted for 25 years, consistent with the Project Proposer's mining plan.

To make this determination, assessments were made of each species' distribution within the state and study area, as well as an assessment of population sizes and demographics, habitat specificity, and response to anthropogenic disturbance. A summary of occurrences, known habitats, and response to anthropogenic disturbance is presented in this section.

The assessment considers past actions that may have affected the distribution and abundance of the study species. Foreseeable future impacts were also considered, including industrial and mine projects in the study area that may potentially impact sensitive species. The potential impacts are based on proposed mine plans and botanical surveys that have been reported to the MNDNR.

The analysis used information from the MNDNR's Natural Heritage Information System (NHIS) Element Occurrence entries in the database, including descriptions of observed habitat type and mapping of the statewide distribution for each species. The analysis also used information from recent botanical surveys conducted within the study area. Analysis of past losses was based on available historic habitat mapping and information about changing habitat conditions over time. Data on land use and habitat is from the Wildlife CE Study.

Based on a review of the MNDNR NHIS database, the SEAW identified three state-listed threatened and endangered species and one species of special concern in the vicinity of the Proposed Project. The SEAW also stated that a site-specific botanical survey would be conducted to identify state or federally-listed plant species within the Proposed Project. The botanical survey, conducted in 2008, identified a state-listed endangered plant species, pale moonwort (*Botrychium pallidum)*; a state-listed threatened plant species, St. Lawrence grapefern (*Botrychium rugulosum*); a species proposed for state listing as endangered, upswept moonwort (*Botrychium ascendens*); and a state special concern species, clustered bur reed (*Sparganium glomeratum*). Section 4.3.1 of this FEIS describes project-specific impacts to these species. The cumulative effects analysis was performed for the state listed plant species that are anticipated to be impacted by the Proposed Project.

In order to assess cumulative effects to the three protected *Botrychium* species, information about the species was summarized in a diagram of different forms of rarity. The forms of rarity have been described by creating combinations of classifications of population size, habitat breadth, and geographic range (Rabinowitz, et al., 1981). For the purpose of this cumulative analysis, a small population is defined as typically fewer than 50 stems; small habitat breadth is defined as two or fewer general habitat types; and small geographic range is defined as occurring in five or fewer Ecological Classification System (ECS) subsections within the state. The rarity of each species within Minnesota is described in Table 5.7.1 below.

TABLE 5.7.1 BOTRYCHIUM SPECIES RARITY SUMMARY

Population Size	Habitat Breadth	Geographic Range	
		Small	Large
Small	Small	Upswept Moonwort	--
	Large	--	Pale Moonwort St. Lawrence Grapefern
Large	Small	--	--
	Large	--	--

Source: Rabinowitz, et al, 1981.

5.7.1.1.2 Existing Conditions

Table 5.7.1 summarizes the known populations and, where available, the known individuals for the state listed *Botrychium* species in the study area. A detailed description of populations was not compiled for clustered bur reed, because the species is not formally protected as a state threatened or endangered species, and the Proposed Project would not directly impact the populations located at Keetac.

While upswept moonwort is not listed as a state threatened or endangered species because it was only recently discovered in the state in 1998, the MNDNR proposes to list it as an endangered species in the state. The database search included only two locations with no estimates of population size. However, recent botanical surveys in the Iron Range have located 13 new populations in the study area of this cumulative assessment, including seven populations at Keetac.

All of the known populations of the species in the state are located in areas with anthropogenic disturbances including mine tailings basins, roadsides, or abandoned roads. The known populations of the species are typically found in partially shaded microsites in early successional forest dominated by balsam poplar, aspen, or paper birch (SLERA).

Pale moonwort is listed as a state-listed endangered species. However, the MNDNR has proposed to reclassify the pale moonwort as a special concern species because it has been recently found in central and northeastern Minnesota and is likely to be found in other locations. The database search includes 74 records of the species in the state, with 14 of those records within the study area. Recent botanical surveys in the Iron Range have located 13 new populations, including three populations at Keetac. Similar to upswept moonwort, all of the known populations of the species in the state are associated with anthropogenic disturbance including mine tailings basins, roadsides or abandoned roads. The known populations of the species in the study area are typically found in partially shaded microsites in early successional forest dominated by balsam poplar, aspen, or paper birch. Outside of the study area, the species is typically found in openings in hardwood, mixed, or pine forests or under partial shade (Plant CE Study).

St. Lawrence grapefern is listed as a state-listed threatened species, although the MNDNR proposes to reclassify it as a special-concern species due to recent well documented broad distribution in central and northeast Minnesota. The database search includes 76 records of the species in the state, with 12 of the records within the study area. Recent surveys in the Iron Range have located eight new populations, including two populations at Keetac. As with the other listed *Botrychium* species found at Keetac, all of the known populations of the species in the state are associated with anthropogenic disturbances including mine tailings basins, roadsides, or abandoned roads.

The known populations of the species in the study area are typically found in partially shaded areas in early successional forest dominated by balsam poplar, aspen, or paper birch. Outside of the study area, the species is typically found in openings or under partial shade associated with pine forest, hardwood forest, or mixed forest (Plant CE Study).

Clustered bur reed is a state special concern species typically found in shallow inundated wetlands. The database search includes 162 records of the species in the state. The botanical survey conducted at Keetac found four populations of the species, which would not be directly impacted by the Proposed Project.

5.7.1.1.3 Past Losses

Past losses of the species have likely occurred with a correlation to lost habitat. In very general terms, it is difficult to quantify habitat loss in the state of Minnesota over the past 100 years. Changes in the land use in the study area have likely led to a loss of habitat for *Botrychium* species. In the late 19th Century, it is estimated that approximately 56 percent of the study area was covered by upland forest (Plant CE Study). Openings in these forests likely provided habitat for species of *Botrychium*. Presently, approximately 37 percent of the existing landscape in the study area is upland forest, and approximately 12 percent of the landscape is comprised of mine and railroad areas (Plant CE Study). Portions of these land cover types provide existing habitat for *Botrychium*.

Upswept moonwort was only recently discovered in the state, and all of the known occurrences in the state are found in highly disturbed areas resulting from large scale impacts of land use and land management. Its distribution is widespread in western North America with a few disjunct populations in central and northeastern North America. While there is no evidence of the species occurring in the study area prior to European settlement, it is possible that the species existed in the study area (Plant CE Study).

Since 56 percent of the study area was historically covered with upland forest, openings in these forests would likely have provided habitat for pale moonwort and St. Lawrence grapefern. Although recent records of these species in the study area report them in disturbed areas, records outside of the study area indicate that a majority of populations occur in or near forest openings. Therefore, it is reasonable to assume that the two species also would have occurred in natural forest and forest edge ecosystems within the study area and were likely a part of the pre-settlement flora. Although it is difficult to estimate with certainty their original distribution and abundance, it is likely that the nearly 20 percent reduction in forest habitat since pre-settlement times has resulted in some past losses of these two species.

Potential habitat has been reduced in the study area by 20 percent for *Botrychium* species. However, there are other complexities influencing plant distribution. Key factors include habitat quality, availability of spore source, the disturbance regime, microclimate conditions, and the presence of water (Plant CE Study).

Shallow inundated wetlands, the preferred habitat of clustered bur reed, are abundant throughout the study area and across northern Minnesota. The Wetland Delineation Report found that 26 percent of the pre-settlement study area was wetland. Although not all wetlands provide appropriate habitat for the species, potential habitat was abundant. Therefore, it is likely that clustered bur reed was present and regionally widespread prior to settlement. Historically, approximately 6 percent of the study area was open wetland that could have provided habitat for the species. Since less than 5 percent (Plant CE Study) of historic wetlands have been lost in the study area, it is not likely that significant past losses have occurred to clustered bur reed.

5.7.1.2 Environmental Consequences

> Cumulative mine impacts could result in the takings of the majority of known individuals of upswept moonwort in the state. Cumulative mine impacts could pose a threat to the persistence and survival of the species within the region and state.

5.7.1.2.1 Foreseeable Future Conditions

Projects proposed in the study area in the foreseeable future (approximately 25 years) that may impact the listed species were assessed as a means of estimating the potential extent of the listed species loss. The takings from future projects, as described in the Plant CE Study, should be considered a preliminary estimate of potential impacts, since all of the possible takings have not been approved or permitted by the MNDNR. Proposed takings are summarized in Table 5.7.2.

TABLE 5.7.2 POPULATION SUMMARY AND PROPOSED TAKINGS IN THE STUDY AREA

Species	Pale Moonwort	St. Lawrence Grapefern	Upswept Moonwort
State Status	Minnesota Endangered	Minnesota Threatened	Proposed Endangered
Known Populations	28	20	13
Known Individuals	--	--	110
Proposed Impacted Populations	21	18	4
Proposed Impacted Individuals	136	172	76
Proposed Project Known Populations	3	2	7
Proposed Project Known Individuals	23	7	37
Proposed Project Impacted Populations	1	2	2
Proposed Project Impacted Individuals	1	7	22

Source: Plant CE Study.

Two mine expansion projects that may impact upswept moonwort have been proposed in the study area. Thirteen populations comprised of 110 individuals have been identified in the study area. Proposed takings may impact as many as 76 individuals (69 percent of known plants). The Proposed Project would impact 22 individuals at two sites (20 percent of known plants).

Four proposed mine expansion projects would potentially impact populations of pale moonwort consisting of 136 individuals. Takings from the Proposed Project would consist of one individual from one population.

Three proposed mine expansion projects would potentially impact populations of St. Lawrence grapefern consisting of 172 individuals. Takings from the Proposed Project would consist of seven individuals at two sites, representing all of the individuals found at Keetac.

Although proposed takings of individuals from existing populations would result in an overall decrease in the known populations of the listed plant species, continued mine development and subsequent succession on disturbed and reclaimed mine areas are also expected to create suitable habitat for these species. As long as source populations survive in the area, it is expected that the *Botrychium* species potentially would be able to disperse and recolonize new sites.

> For pale moonwort and St. Lawrence grapefern, the cumulative effects of the Proposed Project and other projects in the study area do not appear to threaten the survival and persistence of the species.

Because clustered bur reed is a special concern species that is not regulated by the MNDNR, project specific takings information was not assessed. However, given the number of populations of clustered bur reed in the region and the small reduction of wetlands from pre-settlement periods, it is believed the Proposed Project would not cause the overall abundance and distribution of this species to decline significantly (Plant CE Study).

5.7.1.2.2 Other Potential Future Impacts

The primary risks to individual populations of *Botrychium* species appear to be disturbances and loss of suitable habitat through forest succession. The primary risks to a meta-population are absence of suitable microsites for colonization, loss of local source populations, and limitations of dispersal to unoccupied, suitable habitats. Other potential future impacts to the species of interest within Minnesota include anything that may alter forest composition, reduce forest cover, or change the availability of moisture in the soil.

All three *Botrychium* species tend to occur in upland areas around wetlands, and under shaded areas between the wetland edge and the forest edge. The plants and their associated mycorrhizae depend on the availability of moisture in the soil. Logging and other land use changes that remove vegetative cover and the shade it provides can cause a rise in the water table due to reduced evapotranspiration in areas with perched water tables and limited opportunities for drainage (Plant CE Study).

Mine stockpiles and tailings basins create permanent edges in the surrounding forest that can provide good habitat for *Botrychium*, but mine pits may also interrupt surface water flow and the availability of moisture in the soil. Most wetlands and water bodies in the Proposed Project area are perched on impermeable layers and are not hydrologically connected to groundwater supplies. Therefore, alterations to surface water flow can result in impacts to soil moisture.

Logging and development have probably had the greatest impact on forest habitats and extension of the species of interest across the state of Minnesota over the last 100 years. Both are expected to continue to impact forests in the future. Development impacts would likely occur in the proximity of existing development, while logging would likely continue to impact the more remote portions of the state.

Mining activities have altered large tracts of Minnesota's forest habitat in the past. Future mining activities would likely have less of an impact, since areas proposed for mine expansion have in most cases already been disturbed by previous mining activities. Mining activities would possibly even create favorable conditions for *Botrychium* within tailings basins as long as suitable forest habitat remains.

Invasive exotic species have impacted native plant and animal species elsewhere in the state of Minnesota. It is not unreasonable to expect that their arrival in the forests of northern Minnesota would have similar impacts on the species of interest.

5.7.1.2.3 Summary of Cumulative Effect Assessment

The cumulative effects to state threatened, endangered, and proposed endangered plant species are expected to be adverse and significant as individual plants would be destroyed. The designation as threatened or endangered connotes that the populations of the plants are low, and further effects may harm the survival of the species in the state.

For pale moonwort and St. Lawrence grapefern, the cumulative effects of the Proposed Project and other projects in the study area do not appear to threaten the survival and persistence of the species. Pale moonwort and St. Lawrence grapefern exist in small population sizes in the study area, but have a large breadth of occupied habitat, large geographic ranges, and many known populations throughout Minnesota. The proposed east mine pit expansion area would result in the loss of one individual pale moonwort. Additionally, the proposed east mine pit expansion area would also result in the loss of seven individual St. Lawrence grapefern. These are adverse effects that would be significant due to state endangered species status. A MNDNR Takings Permit would be required if destruction of these plant species cannot be avoided. Potentially suitable habitat is abundant in the region, and mine reclamation and forest management and succession would likely continue to create new habitat for the foreseeable future. Additionally, the proposed reclassification of these two state species as special concern, instead of the current state threatened or endangered status indicates that these species are not as rare as they were once thought to be. Therefore, it is believed that cumulative effects from the Proposed Project and other projects in the study area do not pose a threat to the overall survival of pale moonwort or St. Lawrence grapefern in the region or state.

However, for upswept moonwort, cumulative mine impacts represent a potentially large impact to the species within the region and within the state, due to the species' few known occurrences in the state, small population size, and limited habitat range. While potentially suitable habitat is common in the region, and mining reclamation and forest succession would likely create new habitat, small population sizes and discontinuous distribution limit the number of spores that may reach suitable unoccupied habitat patches.

The proposed east mine pit expansion area would result in the loss of 22 individual upswept moonwort (*Botrychium ascendens*) plants. Cumulatively, this could result in the takings of the majority of known individuals of upswept moonwort in the state. This is an adverse effect that would be significant due to its state proposed endangered species status. A MNDNR Takings Permit would be required if destruction of this plant species cannot be avoided. Cumulative mine impacts could pose a threat to the persistence and survival of the species within the region and state.

The change between the No Action Alternative to the East Stockpile Alternative is the same as the change between the No Action Alternative to the Proposed Project. However, the footprint of the proposed east stockpile would be reduced under the East Stockpile Alternative. This would not reduce the effects to the known locations of T&E plants, but could reduce the potential for additional effects to unknown plant locations that may be found in suitable habitat adjacent to the project boundary.

5.7.1.3 Mitigation Opportunities

Expanded mining activities from the Proposed Project are not expected to be a substantial contributor to future statewide cumulative effects to St. Lawrence grapefern and pale moonwort. Most of the mining impacts would occur in areas that have been impacted in the past by mining, and some of the mining impacts may be temporary impacts. However, for upswept moonwort, expanded mining activities represent a potentially large impact to the species within the region and within the state.

Since the location of taconite deposits pre-determines where mining is feasible, relocation options to avoid impacting a population of a listed plant are not practicable. Even if a population is avoided, the impacts to the area surrounding the population would likely indirectly impact the individuals in the population.

An appropriate mitigation strategy for *Botrychium*, a genus whose ecology and life history are not well understood, would be to provide research data to develop a better understanding of the ecology and distribution of the indicated species. Research that correlates the occurrences of *Botrychium* species to the disturbance regime (age, length, type of disturbance) and physical conditions (soils, hydrology, associated vegetation) at those locations would aid in establishing favorable growing conditions and the restoration of *Botrychium* populations in and around the tailings basins at the end of mining operations.

Although transplantation of individuals generally has not been considered an acceptable mitigation strategy, a portion of this research might include transplanting the impacted *Botrychium* populations to a suitable habitat in the vicinity of the mining area, to allow a way to minimize impact and evaluate the effectiveness of transplanting as a mitigation strategy. Other recent projects in the area have transplanted *Botrychium* populations as part of their monitoring studies. Initial results of the Enbridge Pipeline monitoring study for transplanted *Botrychium* populations indicated a 69 percent survival rate of *Botrychium* transplants after 3 years.

Essar Steel also proposed a transplanting plan and subsequent monitoring as mitigation for proposed impacts to *Botrychium* species on their site. By initiating a similar transplanting plan and monitoring the results of the transplanting, the Project Proposer could provide additional information to assist in evaluating the effectiveness of transplanting as a mitigation strategy.

> An appropriate mitigation strategy for *Botrychium* would be to provide research data to develop a better understanding of the ecology and distribution of the species.

5.7.2 Threatened and Endangered Animal Species

5.7.2.1 Affected Environment

Threatened and Endangered species are regulated at both federal and state levels. In Minnesota, threatened, endangered and special concern species are regulated under Minnesota Rules, parts 6212.1800 to 6212.2300. At the federal level, the Endangered Species Act of 1973, as amended (16 USC §§ 1531 – 1544) is the basis for the regulations pertaining to plant and animal species that have been federally-designated as threatened or endangered. Additional details describing the regulatory framework protecting threatened and endangered species is provided in Section 4.3.1.

5.7.2.1.1 Scope of the Special Studies

Two studies relating to potential cumulative effects on state or federally-listed animal species were completed for the Proposed Project. The first was the Wildlife CE Study, as listed in the EIS Related Studies section, which was a desk-top analysis that focused on changes to wildlife habitat and travel corridors across the Iron Range and how these changes potentially impacted federal and state threatened and endangered species. The study area for the Wildlife CE Study was defined as a five mile buffer to the 2007 MNDNR Mining Features dataset of the Iron Range (Figure 5.6.1).

The Wildlife CE Study included a detailed GIS analysis of changes to historical vegetation over time, an assessment of the current vegetative cover and wildlife habitat conditions in the study area and potential cumulative future impacts on vegetative cover and wildlife habitat from 11 known permitted or potential projects in the study area. Also identified were 18 existing wildlife travel corridors that allow wildlife to access large, relatively undisturbed habitat tracts located north and south of the Iron Range.

The Wildlife CE Study described varying levels of potential future impacts to the 18 corridors, ranging from no impacts to complete loss, and discussed how these impacts to travel corridors could impact wildlife. A detailed description of the changes to pre-settlement vegetation, potential future impacts to vegetative cover and wildlife habitat, and the impacts to wildlife travel corridors from reasonably foreseeable future projects in the Iron Range is discussed in Section 5.6 of the FEIS. The results of the Wildlife CE Study as they relate to federal or state listed threatened or endangered species are described in this section.

The second study addressing potential cumulative effects on federal or state listed animal species was the Lynx Study. This study included field snow tracking surveys for Canada lynx during the winter of 2009. The study area for the Canada lynx tracking surveys included an area within six miles of the proposed disturbance area for the Keetac and Essar Steel projects, covering approximately 72 square miles, with some additional survey conducted to the northwest and southeast of the study area.

The survey areas were determined based on discussions with the USFWS. The area surveyed for lynx was not as large as the study area for the two other cumulative effects studies discussed, but does include significant areas outside the area directly impacted by the Proposed Project. It therefore provides useful information relating to potential cumulative effects to Canada lynx and their habitat on the Iron Range. The Lynx Study summarized the findings of the 2009 snow tracking surveys for lynx, included details of past survey efforts for lynx across the Iron Range, assessed lynx habitat availability and suitability in the study area, discussed potential effects to lynx from the Proposed Project (as well as other types of human activity along the Iron Range), and discussed conservation measures that could be employed to provide benefits to lynx in the region.

The FSDD committed that the EIS would assess potential cumulative effects of populations of state and federally-listed threatened or endangered species that may be affected by the Proposed Project. The Wildlife CE Study identified three federally protected species, the Canada lynx, gray wolf, and bald eagle; all of which are known to occur in the Iron Range. The study also identified seven state listed animal species either known to occur or having the potential to exist within the 5-mile buffer to the 2007 MNDNR Mining Features dataset of the Iron Range that defines the study area. All seven species are listed as threatened in Minnesota and includes: eastern spotted skunk, Laurentian tiger beetle, Peregrine falcon, trumpeter swan, Wilson's phalarope, wood turtle, and Blanding's turtle. All seven of the state species listed as threatened have no special status under federal rules, indicating that their populations and habitat are stable on a national level. There are no known animal species listed as endangered on the Minnesota list that are likely to occur in the study area.

The potential for cumulative effects to the above listed threatened and endangered species were described based on potential future habitat and corridor loss in the report. Impacts to individual populations of threatened or endangered species were not assessed. A detailed discussion of potential cumulative effects to pre-settlement vegetation, wildlife habitat loss and wildlife travel corridor obstruction is provided in Section 5.6.

5.7.2.1.2 Existing Conditions

The Wildlife CE Study discussed the general status of the three federally protected species and seven state listed species in the study area and across northern Minnesota. The study area consists of a 5-mile buffer of the 2007 MNDNR Mining Features dataset. The study also discussed the distribution, preferred habitat, and life histories of the three federal and seven state listed species. Information relating to the life history and habitat requirements of the Canada lynx was provided in the Lynx Study. A general description of the habitat and life histories of the federal and state listed species, based on the Wildlife CE Study, Lynx Study, and information available on the MNDNR Rare Species Guide website (MNDNR, 2009) and USFWS website (www.fws.gov), is provided.

Federally Listed or Protected Species

Canada lynx are specialized predators that have adapted to hunting in deep snow conditions of the boreal forests. The boreal forests are prevalent across most of Canada but extend south into the northern portions of the United States. Northern Minnesota, Wisconsin, and Michigan represent the southern extent of the range for Canada lynx in the Midwest. Lynx were listed as threatened on the Federal Endangered Species List in 2000. Lynx populations are not in jeopardy in Canada and are offered no special status there. Lynx populations in the United States are part of a larger metapopulation whose core is located in the boreal forests of central Canada (USFWS, 2000).

The Minnesota Natural Heritage and Nongame Research Program collected records of 435 confirmed and unconfirmed Canada lynx sightings from 2000 – 2006. The majority of these sightings were within Cook, Lake, and St. Louis counties. There were 16 records of lynx sightings in Itasca County during this same period. A trapping and radio-telemetry study of lynx in northeastern Minnesota (Cook, Lake, and St. Louis Counties) indicates there are at least 110 lynx based on confirmed genetic records and possibly as many as 250 lynx living in the area (Moen et al, 2008).

Gray wolves in Minnesota are part of the distinct population segment identified by the USFWS as the Western Great Lakes population of gray wolves. This population of gray wolves has responded to management and protection efforts, has exceeded recovery goals, and continues to thrive under state management.

Gray wolves in Minnesota are part of the distinct population segment identified by the USFWS as the Western Great Lakes Population of gray wolves. This population of gray wolves has responded to management and protection efforts, has exceeded recovery goals, and continues to thrive under state management. Within Minnesota the MNDNR estimates that the current population of gray wolves is 2,921 animals, as of the 2007/2008 survey. This is above the management plan goal of a population of at least 1,600 wolves to ensure long term survival. There have been no significant changes or fluctuations in the population of the gray wolf in Minnesota over the last 10 years. According to the MNDNR, there are few areas of the state that are not occupied by the gray wolf, which indicates the species has made a full recovery in Minnesota.

Although the bald eagle is no longer a federally listed threatened or endangered species, it is still federally protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. In Minnesota, bald eagles are typically found nesting in large trees near bodies of water or large rivers, including the Mississippi and St. Croix Rivers, mainly in the northern forested portion of the state. The current bald eagle population in Minnesota is stable, with the species beginning to re-occupy portions of its former range in southern Minnesota. An estimate of known nests was combined with a random survey in 2005, which determined there are approximately 1,300 active bald eagle nests in Minnesota. Based on this estimate Minnesota has the third most bald eagle nests in the United States, behind only Alaska and Florida.

State Listed Species

In Minnesota, peregrine falcons, state-listed threatened species, traditionally nested on cliff ledges along lakes and rivers. However, the peregrine falcon also uses ledges, bridges, and utility towers in urban areas as nest sites. They have also been observed nesting along the steep walls of abandoned mine pits that have filled with water. Peregrine falcons are the most wide spread raptor in the world. A survey in Minnesota in 2007 determined that there were 52 breeding pairs of peregrine falcons in the state that fledged 94 young (MNDNR, 2009A).

The trumpeter swan, state-listed threatened species, is a large aquatic bird that uses small marshes or bays of lakes with abundant emergent vegetation. Ideal habitat conditions include at least 100 meters of open water to provide adequate room for take off, low levels of human disturbance (although trumpeter swans have been observed nesting in urban marshes), and muskrat houses or beaver lodges to provide nesting platforms. Management efforts to re-introduce trumpeter swans in Minnesota have been successful. The MNDNR indicates that the trumpeter swan population in Minnesota is now more than 2,400 birds, exceeding recent management goals (MNDNR, 2009).

Eastern spotted skunks, state-listed threatened species, are normally found in areas that are relatively open but that have sufficient cover and travel corridors, such as hedgerows, thickets, fence rows, and riparian woodlands. Due to its preference for this type of habitat, it is thought that the numerous small farms that were homesteaded in the late 1800s and early 1900s facilitate the expansion of the eastern spotted skunks range into southern Minnesota. The northern portions of the Midwest are thought to be the northern-most extent of the eastern spotted skunk. The population size of eastern spotted skunk in Minnesota is not known, although it is likely low based on trapping survey efforts in the mid-1990s by the MNDNR. In 1993, survey efforts resulted in the documentation of four animals in the state but no confirmed populations. In 1995, intensive live trapping efforts as part of the MNDNR County Biological Survey captured no eastern spotted skunks (MNDNR, 2009).

The Wilson's phalarope, state-listed threatened species, is a long-legged shorebird that is most commonly found in wetland habitats such as wet prairies, fens or other grass- or sedge-dominated wetlands in Minnesota. Wilson’s phalarope prefers abundant short vegetation in or adjacent to shallow open water. As a result, human altered habitats such as shallow pastures provide suitable conditions for the species. In Minnesota the Wilson's phalarope is considered a priority species under the MNDNR Nongame Wildlife Program 10 year strategic plan. The Wilson's phalarope has been documented in 32 counties in Minnesota, but it is most common in the western and northern most counties (MNDNR, 2009).

The Laurentian tiger beetle, state-listed threatened species, uses open or edge areas in northern coniferous forests. It prefers sandy or rocky edges along forests including abandoned gravel or sand pits, sand or gravel roads, and sparsely vegetated rock outcrops (MNDNR, 2009A). It is possible that limited disturbance resulting in forest edge and sandy or rocky conditions creates habitat for the beetle. The distribution of the Laurentian tiger beetle in Minnesota is estimated by the MNDNR to be north of the Laurentian divide. Survey efforts have discovered 50 locations of the beetle in St. Louis, Koochiching, and Lake of the Woods Counties since 2000. The distribution and population of the Laurentian tiger beetle is still under initial survey.

The necessary habitat for Blanding’s turtles, state-listed threatened species, includes sandy upland areas adjacent to wetland complex. In Minnesota, the Blanding’s turtle appears to be able to use a wide variety of calm, shallow wetland types and riverine habitats. Female turtles may nest in sandy agricultural fields, which can be hazardous to the survival of both the adult turtles and the nest. Blanding’s turtles have been documented in 50 counties across Minnesota, although individual populations are typically small due to the limited mobility of the species. The major cause of mortality to Blanding’s turtles in Minnesota is death from vehicles as turtles attempt to cross roads from wetlands to upland nesting areas (MNDNR, 2009). The main threat to the long-term stability of Blanding’s turtle is the loss of sandy upland nesting areas.

Wood turtles, state-listed threatened species, prefer aquatic habitat including small- to medium-sized, fast moving streams and rivers within forests. Wood turtles will use upland grassy areas but are typically found within one-quarter mile of the stream. Wood turtles have been documented in 15 counties in Minnesota. Research efforts through MNDNR Nongame Wildlife Program, County Biological Surveys, and USFS are underway to determine the extent and distribution of wood turtles in Minnesota.

5.7.2.1.3 Past Losses

All animal species depend on the proper habitat conditions to provide the necessary conditions required for feeding, resting, breeding, dispersal and refuge. Across the Iron Range and Minnesota, a variety of habitat alterations have occurred as a result of activities such as mining, logging, agriculture and urban development. The loss of native habitat is often a major contribution to the decline in the abundance or distribution of a species. However, the decline of a species may also be caused by a reduction of a prey species, changes in climatic conditions or the presence of toxins in the environment. The populations of the three federally-protected and seven state listed species discussed have declined for many reasons.

Federally Listed or Protected Species

Within Minnesota and across the United States, the decline of bald eagles was attributed to widespread use of the pesticide dichlorodiphenyltrichloroethane (DDT). Populations of bald eagles began to increase after the banning of DDT in 1972. The bald eagle was removed from the Federal Endangered Species list in 2007, due to population increases across the U.S. However, the bald eagle is still federally protected through the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

The reduction of gray wolf populations in the United States was a result of a combination of habitat reduction, a reduction in available prey and human elimination efforts. Gray wolves were almost completely eliminated from the United States by 1930 and by 1960 gray wolves were essentially eliminated from Wisconsin and Minnesota, even though populations remained in Canada. The listing of the gray wolf as endangered on the federal endangered species list in 1978 made it illegal to kill a wolf; this allowed wolf populations a chance to expand in the Great Lakes region. The USFWS has identified gray wolves in Minnesota as part of the Western Great Lakes Population, whose populations have exceeded management goals.

Based on trapping records, Canada lynx in Minnesota have experienced some population fluctuations over the last 80 years that can be attributed to the 10-year population cycle that is typical of the lynx-snowshoe hare relationship. Trapping records indicate that harvest of lynx in Minnesota was approximately 400 animals per year for more than 40 years (AECOM, 2009B). The season for lynx harvest was closed in 1984 and remains closed. The southern end of the boreal forest in northern Minnesota is the southern extent of the range of Canada lynx. Historic impacts to the mature conifer forests in northern Minnesota from logging and mining have reduced the amount of available lynx habitat.

Within Minnesota and across the United States, the decline of bald eagles was attributed to widespread use of the pesticide dichlorodiphenyltrichloroethane (DDT). Populations of bald eagles began to increase after the banning of DDT in 1972.

The reasons for the rapid decline of the Peregrine falcon worldwide are not entirely known. Some losses were likely due to a reduction of available habitat and an increase in human disturbance. However, similar to the bald eagle, it is believed that the widespread use of the pesticide DDT negatively impacted breeding and nesting success. The elimination of the use of DDT, management efforts, and the species ability to adapt to using urban habitats for nesting (i.e., bridges, building ledges) have led to the resurgence of Peregrine falcons in

Minnesota. In 1996, the Peregrine falcon was upgraded from endangered to threatened on the Minnesota endangered species list. In 1999, the Peregrine falcon was removed from the federal endangered species list (MNDNR, 2009A).

At the time of settlement, the trumpeter swan was common across Minnesota and the prairie-pothole region. Trumpeter swans used the shallow, marshy wetlands as breeding and nesting sites. However, as the prairie areas of the state were settled and converted to farmland the swans were over-hunted and the populations quickly dwindled. Lead poisoning which originated from lead shot used for hunting and as fishing sinkers, also lead to the decline of trumpeter swans. At the time of the first endangered species list in Minnesota in 1984, trumpeter swans were considered extirpated from the state. Recovery efforts in Minnesota and across the Midwest have lead to an increase in the populations and distribution of trumpeter swans. The trumpeter swan population currently exceeds the management goals set for Minnesota (MNDNR, 2009A).

The MNDNR estimated that eastern spotted skunks expanded their range north into Minnesota around 1900. The prevalence of small farms created the proper burrow, travel and feeding habitat preferred by the skunks. Trapping records indicate that eastern spotted skunks were prevalent in Minnesota in the 1940s, with a peak recorded harvest of 19,400 animals in 1946. However, by 1965 there were less than 1,000 skunks harvested. The MNDNR indicated that recent intensive survey efforts have produced few confirmed skunk locations, with only six eastern spotted skunks documented over the last 16 years. It is believed that the consolidation of small farms into large farms lead to a loss of the thicket, hedgerow and burrowing habitat required by the skunks, which contributed to its decline. However there are also likely other unknown causes that also led to the decline of the species, due to its current scarcity in the state.

Wilson’s phalarope was prevalent across most of the prairie-pothole region in Minnesota and other portions of the Midwest. According to the MNDNR, prior to 1900 it was reported to be abundant in almost every large slough or shallow lake. The species experienced a sudden, dramatic decline between 1900 and 1920. The wetland habitat preferred by the species is susceptible to drainage or degradation due to agricultural activities. Intensive surveys conducted in the mid-1990s resulted in relatively few documented occurrences of Wilson’s phalarope. As a result, the species was reclassified from a special concern species to threatened in Minnesota in 1996. However, new breeding records in Alaska, Massachusetts, and New Mexico indicate the species is expanding outside of its known breeding range on a national level.

The Laurentian tiger beetle was first discovered in Minnesota in 1958. According to the MNDNR it was documented in 5 locations by 1979. It is has been documented in four counties in northern Minnesota. It was given a status of threatened in Minnesota due to its limited distribution in the State but it is not known if its historical range covered a large portion of the state. The Laurentian tiger beetle is still under initial review in Minnesota until more can be learned about its distribution and populations. Due to the limited amount of available information related to the species within the state, management plans or goals have not been developed.

The Blanding’s turtle is fairly well distributed across Minnesota, documented in over 50 counties across the state. Its range extends from the northern Midwestern States across the Great Lakes region and into New England. Historically the Blanding’s turtle was more widespread across the central and eastern portions of the United States. Minnesota is the northwestern extent of the range of the Blanding’s turtle. The loss and degradation of wetland habitat and mortality on roads are the reasons for the decline of the species. Blanding’s turtles are slow moving, unable to easily disperse to new habitat and have relatively low recruitment (i.e., breeding/nesting success). As a result, the species is unable to quickly rebound from population or habitat losses.

The range of the wood turtle extends across the northern Great Lakes States, eastward through New England. However, the MNDNR estimates that due to its dependence on forested streams and rivers in areas with well-drained soils, that wood turtles were probably never uniformly distributed across its range. It is likely that wood turtles were abundant within specific locations where habitat conditions were optimal. The loss of properly forested stream habitat due to human disturbance (such as logging or agriculture) is the likely reason for the decline of the species in Minnesota. The wood turtle has a low reproductive success rate so human induced mortality and habitat loss resulted in a direct loss to wood turtle populations.

5.7.2.2 Environmental Consequences

5.7.2.2.1 Foreseeable Future Conditions

> Significant cumulative effects to federally or state listed threatened and endangered species are not anticipated as a result of proposed future projects within 10 miles of the Proposed Project.

For all of the federal and state threatened and endangered species in the study area, the main threats to the continued existence of each species is further habitat loss caused by human disturbance and activities. The Wildlife CE Study examined the potential habitat loss from reasonably foreseeable future projects. The reasonably foreseeable future projects were identified with the study area defined as a five-mile buffer to the MNDNR 2007 Mine Features dataset. The Wildlife CE Study identified 11 projects across the Iron Range having the potential to impact wildlife habitat and the species that use it.

The Proposed Project is located on the west end of the Iron Range. The footprint of the proposed expansion is relatively small compared to the overall Iron Range. As a result, the Proposed Project would not contribute to the overall potential federal and state threatened and endangered species impacts across the entire Iron Range, but rather only a smaller area located in relative close proximity to the Project Site. The potential for cumulative effects to federal and state threatened and endangered species would be limited to the Proposed Project and other future projects within 10 miles of the Project Site. This is a similar approach that was used to examine the potential cumulative contributions for the Proposed Project to impacts on wildlife travel corridors Section 5.6. The reasonably foreseeable future projects within 10 miles of the Proposed Project include Essar Steel and Hibtac.

The three identified reasonably foreseeable future projects (Keetac, Essar Steel and Hibtac) would result in an impact to 9,180 acres of land. A total of 6,551 acres of the 9,180 acres of future impacts (71 percent) would result in impact to vegetated wildlife habitat. The remaining potential future impacts would occur on previously developed or disturbed land that would not result in the loss of wildlife habitat. A large percentage of the estimated future impacts to vegetated wildlife habitat would occur on early successional habitats that are abundant across the Iron Range. There would be 3,204 acres of aspen/white birch forest impacted; 1,294 acres of upland shrub cover impacted; and 550 acres of lowland shrub cover impact. Impacts to these two cover types account for 5,046 acres or 77 percent of the projected future cumulative effects to vegetated wildlife habitat in the vicinity of the Proposed Project. Habitat types such as aspen-white birch forests, shrublands and grasslands are prevalent across the Iron Range and in northern Minnesota. This is because they are cover types that have become established following human disturbance such as logging or mining. As a result of the prevalence of these habitats across the study area, the potential cumulative effects from proposed future projects would not be a significant loss of these cover types in the region.

Federally-Listed or Protected Species

> The proposed future projects would likely not result in significant impacts to either Canada lynx or gray wolf. Both species have large home ranges and the total area of cumulative effects is small compared to the large areas utilized by these species.

There were three federally-protected species identified as either known to occur or likely occur within the Iron Range study area in the Wildlife CE Study. Significant cumulative effects to the three federally-protected species identified in the study area, specifically the Canada lynx, gray wolf and bald eagle are not anticipated as a result of reasonably foreseeable future projects, including the Proposed Project and other projects occurring within close proximity to the project site. This is due to several factors including the type of habitats that would be impacted from the future projects, the large home ranges used by each species, the mobility of each species and the tolerance to mining activities. Bald eagles use large, mature trees near open water for nesting and feeding. The majority of habitat disturbance from the reasonably foreseeable future projects would be to habitats that do not contain the proper mature trees required by bald eagles. Additionally, habitat adjacent to open water areas now used by bald eagles near the future project areas, including small to large natural lakes, reservoirs and tailings basins would not be significantly impacted by the proposed future projects. Bald eagles have been observed using nests within relative close proximity to active mine sites indicating they have potentially adapted to mine related activities.

The proposed future projects would likely not result in significant impacts to either Canada lynx or gray wolf. Both species have large home ranges and the total area of cumulative effects is small compared to the large areas used by these species. Surveys for Canada lynx have been conducted in association with the Keetac and Essar Steel Projects. Each study failed to confirm the presence of Canada lynx in the areas around the two project sites. The three proposed future projects are outside of the area designated as critical habitat for lynx in Minnesota. The field surveys determined that it is possible that Canada lynx occasionally use or travel through the area the area within 10 miles of the Proposed Project that would be potentially impacted by the three proposed future projects (AECOM, 2009B). However, the proposed future activities would not result in the loss of critical habitat or population level impacts to the species.

The gray wolf is known to be a habitat generalist, capable of adapting to a wide variety of cover and vegetation conditions. The majority of the vegetated habitat that would be impacted within 10 miles of the Proposed Project is early successional cover such as aspen/white birch forest and shrub land that is abundant in the area. Gray wolves have been spotted on or around mine sites indicating they are potentially tolerant of mining activities. Significant impacts to gray wolf populations or gray wolf habitat from the proposed future projects within 10 miles of the Proposed Project are not anticipated.

State Listed Species

> Significant cumulative impacts to the state listed species Peregrine falcon, trumpeter swan, eastern spotted skunk, Wilson's phalarope, Laurentian tiger beetle, Blanding's turtle, or wood turtle are not anticipated as a result of future proposed mining projects.

There were seven state-listed species identified as potentially occurring within the Iron Range study area in the Wildlife CE Study. The NHIS records indicate that peregrine falcons have been documented nesting on cliffs created by the mine pits at the Hibtac site. The proposed future projects would create additional cliff like habitats through open pit mining and would not reduce this type of habitat in the area. Additionally, the peregrine falcon has adapted to using man-made structures, such as building ledges or bridges, as nesting sites. The peregrine falcon prefers open habitat for aerial hunting of avian prey. The proposed future activities associated with the three mining projects are not anticipated to significantly impact peregrine falcon populations or habitat in the area.

There is some suitable trumpeter swan habitat in the vicinity of the three identified future proposed projects. Trumpeter swans prefer shallow marsh wetland habitat with abundant emergent vegetation and open water areas sufficient for take off and landing. There are natural lakes and wetlands along the Iron Range, as well as created wetland habitat that may become suitable for trumpeter swans within the areas that would be cumulatively impacted. Some wetland habitat would be impacted the future proposed projects. However, the majority of future wetland impacts would be mainly to shrub swamps or lowland conifer swamp forests not used by trumpeter swans. A small amount of open water marsh habitats, totaling approximately 30 acres would be cumulatively impacted by proposed future projects identified within 10 miles of the Proposed Project. Additionally, wetland mitigation areas would be required for all wetland impacts from future projects, such as those that would be created near the tailings basins for the Proposed Project. The mitigation areas may create some habitat that is suitable for trumpeter swans, which would help to offset the loss of marsh habitat. The proposed future projects may disturb some local pairs of swans, but would not likely result in population level impacts to the species.

The extent of the eastern spotted skunk within the Iron Range of Minnesota is not well known. Populations of the eastern spotted skunk dropped dramatically from the 1940s through the 1960s. Survey efforts conducted in the mid-1990s collected very few animals. The habitat that helped the eastern spotted skunk to expand its range into Minnesota (including small, rural farms with hedge rows and wind breaks for den sites) is not prevalent near the proposed future projects. Due to the limited amount of eastern spotted skunk habitat and lack of confirmed populations in the region, cumulative effects to the eastern spotted skunk populations from the proposed future projects are not anticipated.

Wilson’s phalarope was once prevalent across the prairie pot-hole region of the Midwest. The species is currently most common in western and northwestern counties in Minnesota but the extent of the species is still being explored in the state. The species has been documented to occur within the Laurentian Mixed Forest province, but not within the limits of the study area. Suitable grassy wetland habitat exists along the Iron Range that could be used by the species. The proposed future projects would result in impacts to some wetland habitats including marsh and lowland shrublands. However, all future projects that result in wetland impacts would be required to provide wetland mitigation that may create some suitable habitat for Wilson’s phalarope. The required creation of new wetland habitat would help to offset potential impacts to Wilson’s phalarope. Some disturbance to local individual Wilson’s phalarope may occur as a result of impacts to marsh habitat from the three future proposed projects. However, population-level impacts are not expected because Wilson’s phalarope’s distribution is limited along the Iron Range, and its wetland habitat would be maintained through required mitigation; cumulative population level impacts to the species are not anticipated.

The extent of the Laurentian tiger beetle within Minnesota is still under investigation by the MNDNR (2009). It is not known if beetle populations are present along the Iron Range. The beetle uses sandy or gravel habitats that are created by disturbance such as gravel pit mining or roads. As a result, the proposed future projects may provide an increase in the habitat available in the area. Traffic along gravel roads may result in impacts to local to Laurentian tiger beetles utilizing the adjacent gravel habitat, but this would not result in population level impacts. Due to the lack of documented populations of Laurentian tiger beetles in the area and the potential for the future projects to create additional habitat, significant cumulative effects to the Laurentian tiger beetle from the proposed future projects are not anticipated.

The Blanding's turtle has been documented in the Iron Range; suitable habitat is abundant in the form of shallow lakes and wetlands. Additionally, human disturbances since the time of settlement have lead to an increase in grassland habitats for nesting used by Blanding's turtle. Impacts to wetland habitats by proposed future projects would require mitigation to replace lost habitat that would lessen potential impacts to the species. Turtle mortality from vehicles traveling along roads is a common threat to the species and may occur locally as a result of the proposed future projects. Due to the overall prevalence of available habitat in area and the low amount of projected future impacts to grassland or wetland habitats, significant cumulative effects to Blanding's turtle populations are not anticipated as a result of the future proposed projects.

The wood turtle requires fast moving streams with woody habitat, which is abundant across the Iron Range. The future proposed projects may result in some impacts to wood turtle habitat if stream flows are altered. However, the combined impacts from all projects are difficult to assess. For example, the Essar Steel project as analyzed during the FEIS (MNDNR, 2007D) had the potential to interrupt flows to creeks downstream of the mine pits that could result in low flows or slowing moving water within the streams. Suggested mitigation for the impacts to stream flows was to provide augmentation flows to the affected creeks which should help to offset potential impacts. Alternatively, the proposed Keetac Project would slightly increase stream flows for systems such as Hay Creek, with the increase flows being less likely to impacts wood turtles. Additionally, direct impacts to riparian woody habitat would not likely be permitted for the future proposed mining projects. Overall, due to the prevalence of available woody riparian stream habitat and the low potential for direct project impacts to woody riparian habitat, cumulative effects to wood turtle populations are not anticipated.

5.7.2.2.2 Other Potential Future Impacts

The potential threats to rare or endangered animals in Minnesota are habitat loss and human disturbance. Logging, mining and development around towns would continue to occur across the Iron Range and throughout Minnesota. Logging and development have had an impact on forest habitats and the species of interest across the state of Minnesota over the last 100 years. Development impacts would likely occur in the proximity of existing development, while logging would likely continue to impact the more remote portions of the state. Mining activities have altered large tracts of Minnesota's forest habitat in the past. Future mining activities would likely have less of an impact, since areas proposed for mine expansion have in most cases already been disturbed by previous mining activities. Cumulative effects to wildlife habitat and wildlife travel corridors from proposed future projects in the Iron Range are discussed in detail in Section 5.6.

5.7.2.2.3 Summary of Cumulative Effect Assessment

Significant cumulative effects to federally- or state-listed threatened and endangered animal species are not anticipated as a result of proposed future projects. However, some disturbance or mortality to local individuals may occur and small impacts to local habitat conditions would likely occur as a result of proposed future projects.

No cumulative effect is expected to bald eagles as the only nest in the project area would not be damaged or moved. Bald eagle habitat would not be compromised by past, present or reasonably foreseeable projects. There are no indications that Canada lynx are near the mine site. A detailed site investigation completed for the Proposed Project found no trace of the Canada lynx. No effect on the Canada lynx is expected. There is potential for individual gray wolves to be adversely affected by project activities and loss of habitat. However, the cumulative effect to the Western Great Lakes population of gray wolves is expected to be less than significant. The change between the No Action Alternative to the East Stockpile Alternative is the same as the change between the No Action Alternative to the Proposed Project.

As a result of the cumulative effects analysis, it is recommended the MNDNR and USACE be notified in the event that state or federally-listed threatened or endangered species are identified on or near project sites. Some species, such as bald eagle or trumpeter swan, may be easily observed or identified in the context of daily activities at a mine site, while others such as the Laurentian tiger beetle or the Blanding's turtle may not be noticed or identified. It is possible that a trumpeter swan pair may be observed nesting in a marsh intended for a future stockpile or tailings activity. A peregrine falcon nest may be discovered on a mine cliff where blasting or mining is planned or a bald eagle nest may be located in a large tree where tree clearing is planned. If a protected species is observed, the MNDNR should be contacted prior to commencing with the planned activities in order: 1) for an assessment to be made of potential impacts to the species discovered and 2) to determine if the species can be relocated or if mitigation is potentially needed.

5.7.2.3 Mitigation Opportunities

Significant cumulative future impacts from proposed mining projects within 10 miles of the Proposed Project are not anticipated to the federally protected species Canada Lynx, gray wolf, or bald eagle. Additionally, significant cumulative effects to the state listed species Peregrine falcon, trumpeter swan, eastern spotted skunk, Wilson's phalarope, Laurentian tiger beetle, Blanding's turtle, or wood turtle are not anticipated as a result of future proposed mining projects. Due to the lack of potential cumulative effects to federally or state listed threatened and endangered animal species from the proposed future projects, specific mitigation is not proposed.

5.8 INTER-BASIN TRANSFER OF WATER

The FSDD stated that the FEIS analysis provides a brief summary of the policies and regulation relating to inter-basin transfers, as well as validate and update runouts identified by the Herr and Gleason (2007) study within Keetac and Hibtac. The FSDD stated that the EIS analysis will not evaluate downstream impacts because water quantities stemming from this issue are not expected to change due to application of mitigation.

> An inter-basin transfer, in hydrologic terms, is the physical transfer of water (surface and groundwater resources) from one watershed to another.

An inter-basin transfer, in hydrologic terms, is the physical transfer of water (surface and groundwater resources) from one watershed to another. Inter-basin transfers (diversion or exports) in the Great Lakes-St. Lawrence River Basin (Great Lakes Watershed) are regulated by the Great Lakes Compact (2008). The Great Lakes Compact is a contract between each of the eight Great Lakes Watershed states including Minnesota. States must comply with the terms and duties of the Great Lakes Compact, as well as international treaties and agreements between the United States and Canada.

Analysis in this section of the FEIS focuses on those issues related to policies and regulations, runouts, and preliminary engineering alternatives for mitigation.

5.8.1 Affected Environment

5.8.1.1 Existing Conditions

> The Central mega lake runout is approximately 30 feet higher in elevation than the West mega lake runout. Without mitigation, an unintended and unauthorized inter-basin transfer out of the Great Lakes-St. Lawrence River Basin could occur.

Due in part to northeastern Minnesota's climate and geology, more water flows into a surface mining open pit from precipitation, water runoff, and groundwater seepage, than flows out from groundwater losses and evaporation. The net gain of water for a surface mining open pit water balance requires mining operations to dewater the pits, in order to extract minerals for processing. When a mining operation stops, including dewatering, the pits fill up with water until equilibrium is reached through ground water and/or surface water outflow. According to Herr and Gleason, approximately 13,000 acres of natural ore pits and another 18,000 acres of taconite pits presently exist along the Iron Range. Ultimately when mining operations cease along the Iron Range, abandoned mining pits have the potential to form mega pits. As documented by Herr and Gleason, the mega pits are expected to fill with water creating mega lakes along the Central Iron Range. The continental divide between the Great Lakes Watershed and the Mississippi River Watershed, shown in Figure 5.8.1, separates the Central mega lake watershed boundary from the West mega lake watershed boundary. The Proposed Project is 98 percent in the headwaters of the Mississippi River Watershed and 2 percent in headwaters of the Great Lakes Watershed in the Lake Superior sub-watershed (Figure 5.8.1).

Since the late-1800s, natural iron ore and taconite mining have permanently changed the landscape and watercourse both above and below the ground. The presence of historic mining features, both surface (open pits and tailing piles) and subsurface (underground tunnels and shafts), and natural geologic elements influence the potential for inter-basin transfers to occur. Proposed projects along the Iron Range must consider historical and natural features to mitigate inter-basin transfer impacts.

Surface mining features (open pits and tailing piles) have the potential to divert water from one watershed to another. Provisional MNDNR mapping has documented that historic surface mining features have shifted the location of the Laurentian Divide. The Laurentian Divide is a crest of low rocky hills that creates a continental divide across North America. On the northern side of the Laurentian Divide is the Hudson Bay watershed where water flows to the Arctic Ocean. On the southern side of the Laurentian Divide water flows to the Atlantic Ocean, by one of two watersheds. The Great Lakes Watershed (by way of the five Great Lakes and St. Lawrence Seaway) discharges to the Gulf of St. Lawrence. The Mississippi River Watershed discharges to the Gulf of Mexico. In rural Hibbing (northeast of the Proposed Project outside of EIS analysis boundary), these divides meet forming a triple watershed junction where a drop of water can take one of three differing journeys to an ocean. The Proposed Project would not change the present day location of the Laurentian Divide, shown in Figure 5.8.1.

Existing subsurface mining features (underground tunnels and shafts) as well as naturally occurring faults in the region have the potential to physically transfer water from one watershed to another. The MNDNR has mapped some of the underground mine workings between Hibtac's operations, west of TH 169 (Hull-Rust-Mahoning Pit), and the Pillsbury/Leonard/Burt/Monroe/Dunwoody pits, near Chisholm. MNDNR's provisional mapping confirms the presence, extent, and potential to physically transfer water between pits underground. Both pits are within the Great Lakes Watershed and will ultimately constitute the Central mega lake.

The MNDNR has not mapped underground mine workings near the Proposed Project, but underground mine workings are likely to exist since natural ore mining historically took place in the vicinity of the Proposed Project. The known underground mine workings near the Keetac facility site are described in Section 4.13.1.1.

Provisional Minnesota Geological Survey (MGS) fault mapping along the Iron Range confirms the presence and extent of faults between existing pits. As shown in Figure 5.9.1, a large fault in a northwest-southeast orientation, called the Lamberton Fault, bi-sects the continental divide between the Great Lakes Watershed and the Mississippi River Watershed. The Lamberton Fault is a subsurface hydrologic conduit between the Lamberton pit in the Mississippi River Watershed and Carmi-Carson pit in the Great Lakes Watershed (Maki, et al., 2001). The Proposed Project ultimate pit limit boundary is entirely in the Mississippi River Watershed, but the proposed east mine pit expansion would eventually connect with Hibtac's Lamberton pit west of County Highway 79 (Maki, et al., 2001). Protection of key pit water runout locations and elevations for the Central and West mega lakes would be critical to equalizing outflow to both the Great Lakes Watershed and the Mississippi River Watershed.

Herr and Gleason document the Central and West mega lake watershed boundaries. The adjoining watersheds have comparable soils, land use, land cover, watershed to lake surface area ratios, and surface runoff water quality. If the Central and West mega lakes maintain similar runout elevations in respective major watersheds, the mega lake water surface elevations and discharges could equalize to both the respective watersheds across the continental divide. In the Herr and Gleason study, key future pit water runouts along the Iron Range were preliminarily identified for long-range planning purposes. Based on Herr and Gleason study, the Central mega lake runout is approximately 30 feet higher in elevation than the West mega lake runout. Without mitigation, an unintended, unauthorized inter-basin transfer out of the Great Lakes-St. Lawrence River Basin could occur.

5.8.1.2 Regulatory Framework

The Great Lakes are a valuable regional, national, and international resource of the United States and Canada. Communities in the Great Lakes Watershed rely on water use for bulk cargo shipping, recreational boating, tourism, and fishing. About 40 million Americans and Canadians rely on the Great Lakes waters for drinking water supply (Hall, 2008). Eight states (Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania, and New York, as well as the provinces of Ontario and Quebec) surround the Great Lakes and share jurisdiction and rights to over 95 percent of the fresh surface water in the United States (Hall, 2008). The Clean Water Act (1972) and following amendments protect interstate water quality and ecological sustainability. As the Hall report states, the Great Lakes Compact builds on over a century of agreements to protect water rights, including.

- 1909 Boundary Waters Treaty between United States and Canada
- 1978 Great Lake Water Quality Agreement
- 1929, 1930, 1930, 1933, 1967, 1980 Wisconsin v. Illinois cases: The Great Lakes in the Supreme Court
- 1968 The first Great Lakes Compact:
  - Creates the Great Lakes Commission with eight Great Lake State Members.
- 1985 The Great Lakes Charter: A Handshake Agreement.
- 1986 and 2000 Water Resources Development Act: The Diversion Veto
  - Requires that all inter basin transfers be approved unanimously by the Governors of the eight Great Lake States
- 2001 Annex to the Great Lakes Charter
  - Reaffirms and refines the 1968 Great Lakes Compact with input from representatives from Canada, U.S., scientific experts, consultation with Bands and First Nations, and extensive public input.
- 2008 Great Lakes – St. Lawrence River Basin Water Resources Compact (The Great Lakes Compact)

A central component of the Great Lakes Compact is its ban, with limited exceptions, on diversions out of the Great Lakes Watershed. The Great Lakes Compact addresses notification and consultation on requests for inter-basin transfers (Lokkesmoe & Japs, 2007).

The MNDNR is granted authority under Minnesota Rules Chapter 6130 to control possible adverse environmental effects of mining. Minnesota Rules, part 6130.2200 specifically deals with management of runoff in mining areas so that watershed modifications are minimized and runoff from these areas shall be discharged without injury to life, property and natural resources. The mitigation opportunities, related to inter-basin transfer upon mine deactivation, states that any runoff from drainage areas altered by mining shall be discharged into receiving waters within the same watershed as existed before mining. When conditions do not allow discharge into the pre-mining watershed, runoff shall be discharged at locations, and in volumes and rates which can be accepted by the receiving waters without injury to life, property, and natural resources.

Managed properly, there would not be a diversion of water out of the Lake Superior watershed or a discharge to the Lake Superior watershed from the Upper Mississippi River watershed. However, due to mining activity, there is the potential for a transfer of water to occur from one major watershed to another. Either instance would be considered an adverse effect. Due to the Great Lakes Compact, a diversion of any water out of the Lake Superior watershed would be a significant effect to the environment. The change between the No Action Alternative to the East Stockpile Alternative is the same as the change between the No Action Alternative to the Proposed Project.

5.8.2 Mitigation Opportunities

The proposed south mine pit expansion and the proposed east mine pit expansion occur within the Herr and Gleason study West mega pit. Figure 5.8.1 shows the study identified pit water runout elevations near the Perry/ Mesabi Chief pits and the Pillsbury/Leonard/Burt/Monroe/Dunwoody pits. These runouts are important because similar runout elevations must be maintained in order to equalize outflows from the Central and West mega lakes.

The existing and proposed ultimate pit water runout location and elevation were verified around Perry/Mesabi Chief pits (Inter-basin Transfer Memo). As shown in Figure 5.8.1, the existing and proposed ultimate pit water runout location is along the west wall of the Perry Pit near O'Brien Creek. The existing and proposed ultimate pit water runout elevation is 1,430 ft (around 1,427 ft to 1,433 ft AMSL). The Project Proposer has agreed to maintain the existing pit water runout location and elevation of 1,465 ft AMSL, southeast of the Perry Pit and southwest of the Mesabi Chief Pit. As an additional runout protection measure, the Project Proposer has agreed to install a plug in the existing culvert through a railway embankment, located southeast of Perry Pit. The proposed south mine pit expansion would not change the Mesabi Chief Pit water runout location that is along the southwest wall at 1,465 ft AMSL.

The proposed east mine pit expansion would not change the low point elevation of 1,540 ft AMSL located where County Road 79 crosses the continental divide between the Great Lakes Watershed and the Mississippi River Watershed. However, the physical transfer of groundwater due to the proposed east mine pit expansion from one watershed to another is possible due to the presence of the Lamberton Fault.

Herr and Gleason identified a key pit water runout elevation of 1,460 ft AMSL for the Central mega pit. The key pit water runout is located along the south wall of the Pillsbury/Leonard/Burt/Monroe/Dunwoody pit, near Chisholm. The Inter-basin Transfer Memo confirms this key pit water runout location and elevation for the Central mega pit.

In the Inter-basin Transfer Memo, one preliminary engineering alternative for the Central mega pit is presented as shown in Figure 5.9.1. Near Chisholm to the south of the Pillsbury/Leonard/Burt/Monroe/ Dunwoody pit, on the Great Lakes Watershed side of the Central mega pit, a ditch could be built in the future when mining activities cease. Currently, the lowest elevation on the rim of the Pillsbury/Leonard/Burt/Monroe/Dunwoody pit wall is 1,460 ft AMSL. Therefore, in order to produce an equal runout elevation in the Central mega pit with that of the West mega pit, the pit wall of the Pillsbury/Leonard/Burt/Monroe/Dunwoody pit would need to be cut approximately 30 ft in depth to an invert elevation of approximately 1,430 ft (around 1,427 ft to 1,433 ft AMSL). This action would need to be complimented with the construction of a ditch to a tributary of the West Swan River. Given the necessity of 1,430 ft AMSL elevation, the ditch would have a minimum length of 3,200 ft. It is also important to note that the construction of the ditch and the cut in the Pillsbury/Leonard/Burt/Monroe/ Dunwoody pit wall are outside of the Project Proposer's control and would need to be coordinated with Hibtac and MNDNR.

5.9 LOSS OF WETLANDS

> The loss in wetland acreage that occurred between the pre-settlement and existing time periods (2,806 acres) is greater than the projected loss between existing and reasonably foreseeable future time periods (287 acres).

The FSDD stated that the EIS analysis would include a semi-quantitative analysis of cumulative effects on wetlands performed on a watershed basis. The purpose of this analysis would be to characterize wetlands during pre-settlement, existing, and future conditions and compare those conditions in an effort to determine the cumulative effects on wetland resources in these project watersheds. Cumulative effects on deep water habitats (defined as open, deep water pits that developed as a result of mining activities) were also evaluated as part of the analysis.

5.9.1 Affected Environment

5.9.1.1 Summary of Issues/Overview

While the WCA and CWA Section 404 regulate project specific wetland impacts, NEPA establishes a decision making process for determining cumulative effects on protected wetland resources. Similarly, cumulative effects of related or anticipated future projects must also be considered in state rules (Minnesota Rules, part 4410.1700, subp 7B).

A cumulative effects analysis of wetland losses was performed as a special study for the FEIS. The results of the analysis were presented in the Wetland CE Study, as listed in the EIS Related Studies section.

5.9.1.2 Summary of the Wetland CE Study

5.9.1.2.1 Study Area

Because primary wetland functions are directly related to watershed processes, the cumulative effects analysis was performed on a minor watershed level. The study area is located in the O'Brien Creek, Welcome Creek, and Hay Creek minor watersheds. The three watersheds were considered together as a single watershed in order to assess cumulative effects in a watershed context in relation to the diversions and alterations caused by past activities including mining.

The study covered an approximately 68 square mile area between Keewatin and Nashwauk (Figure 5.9.1). The study area is completely within the Mississippi River major watershed. The eastern boundary of the current and proposed Keetac footprint is partially located within the Lake Superior major watershed. However, since no wetland impacts are proposed within the Lake Superior major watershed, as discussed in Section 4.6, it was not included in the Wetland CE Study.

Four mining projects: Essar Steel, Magnetation, Inc., Hibtac, and Keetac, were evaluated for the Wetland CE Study. The Wetland CE Study does not identify any other types of projects in the study area other than mining-related projects.

5.9.1.2.2 Time Period

The Wetland CE Study analysis assessed three time periods: past, existing, and reasonably foreseeable future. The past condition time period represents wetlands, lakes, and deep water habitats as they existed pre-settlement, prior to mining activities and urban development (late 1800s to early 1900s). Available information on historic conditions was used to estimate the past extent of wetlands and water resources to be used as a baseline to analyze existing and future impacts.

The existing conditions time period represents wetlands, lakes, and deep water habitats prior to the development of the Proposed Project and other proposed projects that would impact wetlands.

The reasonably foreseeable future time period represents wetlands, lakes, and deep water habitats that are expected to be present after the conclusion and reclamation of the Proposed Project and the other three foreseeable future mining projects within the study area.

5.9.1.2.3 Wetland Impact Assessment

The wetland impacts addressed in the Wetland CE Study include both direct and indirect impacts. Direct impacts result in wetland loss due to filling or excavation while indirect impacts result in wetland loss due to groundwater drawdown, alteration of the watershed, or fragmentation from the direct loss of portions of wetlands. The cumulative effect on wetlands and other water resources from past actions, the Proposed Project and other proposed projects in the reasonably foreseeable future were compared based on wetland impact acreage and diversity of wetland type.

5.9.1.3 Summary of Historic Baseline Conditions

The Wetland CE Study describes the data sources and methodology used to determine historic baseline conditions. The extent of wetlands was estimated for the pre-settlement time period using either the National Wetland Inventory (NWI) or original survey maps, based on the level of past human disturbance in the area of the watershed.

Human disturbance within the study area was determined through the analysis of several data sources, including 2001 USGS NLCD land cover, MNDOT roads, MNDOT railroads, 2007 MNDNR Mining Features, and 2008 USDA aerial photography.

The original survey maps were developed using data from original Government Land Surveys (Trygg Maps), as well as other historical surveys and sources that were generally created in the late 1800s. The survey maps classified water resources into six types: marshes, bottoms, swamps, lakes, ponds, and rivers.

The Wetland CE Study also used NWI maps, (generated by the USFWS by interpreting black and white aerial photographs from the late 1970s to 1980s), which were assumed to provide a more accurate depiction of wetland resources in the watershed than the original survey maps in areas where it was determined that past human disturbance was limited. The NWI classification differs from the original survey method classification, in that it classifies wetlands into eight types (Type 1 -Type 8) according to the USFWS Circular 39 system as correlated from Cowardin (a description of Circular 39 and other wetland classification systems is included in Section 4.6).

The correlation between the Circular 39 and the original survey types is shown in Table 5.9.1. Wetlands were correlated with the original survey map groupings as bottoms Type 1-2 (seasonally flooded basins and wet meadows), marsh Type 3-5 (shallow to deep marshes), or swamp Type 6-8 (shrub and wooded swamps or bogs) for comparison of wetland quantity and quality in the study area.

The comparison of the wetland resources acreage estimated from original survey and NWI maps showed a difference of less than 1 percent in total acreage between the two mapping methods. Therefore, it was determined that the original survey maps and NWI could be used interchangeably to represent pre-settlement wetland resources. Table 5.9.1 summarizes the historical acreage of wetland resources as estimated in the Wetland CE Study. A total of 11,318 acres of wetlands are estimated to exist in pre-settlement conditions within the study area.

TABLE 5.9.1 PRE-SETTLEMENT WETLANDS

Circular 39 Type	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Total
Original Survey Type	Bottoms		Marsh			Swamp			
Area (acres)	326		260			10,732			11,318
% of Area	3		2			95			100

Source: Barr, 2009A

5.9.1.4 Existing Conditions

The Wetland CE Study describes the methodology used to estimate the existing wetland resources in the study area. The extent of wetland resources was estimated through the use of several sources, including: field and off-site wetland delineations, aerial photograph estimation, USGS National Hydrography Dataset, and NWI maps.

Table 5.9.2 summarizes the existing acreage of wetland resources as estimated in the Wetland CE Study. A total of 8,512 acres of wetlands are estimated to currently exist within the study area.

TABLE 5.9.2 EXISTING WETLANDS

Circular 39 Type	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Total
Original Survey Type	Bottoms		Marsh			Swamp			
Area (acres)	562		2,181			5,769			8,512
% of Area	7		25			68			100

Source: Barr, 2009A

5.9.1.5 Summary of Past Losses

As identified in the Wetland CE Study, the past losses of wetland resources in the study area are due primarily to mining activities, with additional impacts due to urban development, roads, railroads, and agriculture. Comparison of historic and existing wetland areas in Table 5.9.1 and 5.9.2 shows a loss of approximately 2,806 acres of wetlands (a 25 percent loss from the original 11,318 acres). In addition to a decrease in total wetland area, remaining wetlands have undergone a change in type. The data shows a 46 percent decrease in Type 6-8 wetlands, a 72 percent increase in Type 1-2 wetlands, and a 739 percent increase in Type 3-5 wetlands.

Direct impacts by mining include loss of wetland area by excavation of mine pits, development of stockpiles, tailings basins, plant sites, associated roads, pipelines, and railroads. Mining has impacted primarily shrub swamps, wooded swamps and peat bogs (Type 6-8) that were and are still common to the study area and northern Minnesota. Along with the loss of wetland area, wetland functions are lost through the conversion to different wetland types. Mining activities in the study area have created water impoundments through the development of mines, stockpiles, and tailings basins. Surface water flows have been cutoff or redirected around these barriers creating raised water levels in wetlands, as is described further in Section 4.6, in the current and proposed Keetac footprint. These new wetlands have deeper water regimes where little to no emergent vegetation exists. This results in open water wetlands with shallow marsh fringes.

5.9.2 Environmental Consequences

5.9.2.1 Reasonably Foreseeable Future Conditions

Foreseeable future actions over the next 25 years were identified in order to estimate future wetland losses as a result of those actions. The reasonably foreseeable future impacts considered in the Wetland CE Study analysis included the expansion of mining activities at Hibtac, Essar Steel, Magnetation, Inc., and the Proposed Project.

> Although the loss of wetland acreage in the foreseeable future is large when compared to pre-settlement conditions, the loss when compared against existing conditions in the same study area is less dramatic.

Table 5.9.3 summarizes the reasonably foreseeable future wetlands estimated in the Wetland CE Study. The estimate assumes an impact to approximately 985 acres of wetlands from the four mining projects. In addition, Table 5.9.3 accounts for approximately 700 acres of new wetland creation from mining projects to compensate for a portion of the impacts. The Project Proposer is intending to create approximately 600 of those acres. Assuming successful creation, the Project Proposer would be credited approximately 436 acres (75 percent) as partial compensation for Proposed Project wetland impacts.. The overall net change from existing conditions would be a loss of 287 acres of wetland within the study area. Assuming the Project Proposer and other projects are successful in their wetland creation goals, a total of 8,225 acres of wetlands are estimated to exist in the reasonably foreseeable future within the study area.

TABLE 5.9.3 REASONABLY FORESEEABLE FUTURE WETLANDS

Circular 39 Type	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Total
Original Survey Type	Bottoms		Marsh			Swamp			
Area (acres)	812		1,751			5,662			8,225
% of Area	10		21			69			100

Source: Barr, 2009A

In addition to wetlands, deep water habitats would increase in foreseeable future conditions. The Wetland CE Study estimates that deep water habitats would encompass over 3,000 acres in the study area at post reclamation resulting from the four mining projects. This represents a large increase from the approximately 200 acres that currently exists. Active and proposed mine pits would be allowed to naturally refill with ground and surface water to create future deep water habitat.

5.9.2.2 Summary of Cumulative Effects

Table 5.9.4 summarizes the anticipated changes in wetland acreage and type within the study area for the past, existing, and foreseeable future conditions described in the previous sections.

TABLE 5.9.4 SUMMARY OF WETLAND CHANGES

Wetlands -Circular 39 Groups	Pre-settlement Conditions (ac)	Existing Conditions (ac)	Percent Change from Pre-settlement to Existing Conditions	Foreseeable Future Conditions (ac)	Percent Change from Pre-settlement to Foreseeable Future Conditions	Percent Change from Existing to Foreseeable Future Conditions
Type 1-2	326	562	72.4%	812	149.1%	44.5%
Type 3-5	260	2,181	738.6%	1,751	573.3%	-19.7%
Type 6-8	10,732	5,769	-46.2%	5,662	-47.2%	-1.9%
Total	11,318	8,512	-24.8%	8,225	-27.3%	-3.4%

Source: Barr, 2009A

The data shows that cumulative effects to all wetland resources in the study area from pre-settlement to reasonably foreseeable future conditions would result in a 27 percent reduction of wetland coverage and a redistribution of wetland types. Type 6-8 wetlands would decrease from 10,732 acres (95 percent of wetland coverage) to 5,662 acres (69 percent of wetland coverage) during foreseeable future conditions. Type 1-2 wetlands would increase by 486 acres and Type 3-5 wetlands would increase by 1,491 acres.

The change in wetland acreage that occurred between the pre-settlement and existing time periods (-2,806 acres) is greater than the projected change between existing and reasonably foreseeable future time periods (-287 acres). The total wetland acreage would decrease by 3.4 percent in the reasonably foreseeable future compared to existing conditions. A conversion of wetland type would occur with a 2 percent decrease in Type 6-8 wetlands, a 45 percent increase in Type 1-2 wetlands, and a 20 percent decrease in Type 3-5 wetlands.

Since pre-settlement conditions, mining in the study area has been the largest source of wetland acreage loss and the conversion of wetland type. Foreseeable future conditions within the study area estimate wetland acreage loss and deep water habitat gain at over 3,000 acres each from pre-settlement conditions. While the net acreage change is similar, this conversion from wetland (i.e., mainly wooded swamps) to deep water (i.e., refilled mine pits) has an impact on wetland function, primarily habitat and vegetative diversity. These impacts to the wetland functions of wooded swamps can be difficult to replace due to the time needed to create and the intensive management to recreate these environments artificially. Potential factors that may impact wetland functions are summarized in Table 4.6.2 of Section 4.6.

The loss of wetland from existing conditions to reasonably foreseeable future conditions is approximately 300 acres. The location of the ore body, a resource that has been and will likely continue to be permitted for extraction, is predetermined making the avoidance of wetland impacts difficult.

The potential cumulative direct effects to wetlands would be adverse. The magnitude of the direct cumulative effects would be great, and therefore the effect would be significant. Mitigation would be required. The East Stockpile Alternative would still result in an adverse effect to wetlands.

5.9.3 Mitigation

Mitigation of wetland impacts within the study area from the four mining projects are regulated through the WCA and CWA Section 404. Unavoidable wetland impacts must be minimized to the extent practicable. Wetland impacts that are unavoidable and have been minimized to the extent practicable must be mitigated by compensation for the impact. The process of avoidance, minimization, and mitigation is termed sequencing. When sequencing determines that unavoidable wetland impacts would occur, a WCA Wetland Replacement Plan Approval, CWA Section 404 Permit, and Section 401 Water Quality Certification are required.

> The location of the ore body, a resource that has been and will likely continue to be permitted for extraction, is predetermined making the avoidance of wetland impacts difficult. As part of the Proposed Project, approximately 436 acres of wetland compensation credit are proposed in-place, in-advance, and within the study area.

The USACE and BWSR have structured the two mitigation programs similarly. WCA Wetland Replacement Plan requirements are detailed in Minnesota Rules, part 8420.0500 (August 2009) and CWA Section 404 requirements are detailed in USACE St. Paul District Policy for Wetland Compensatory Mitigation in Minnesota (January 2009). While the two laws have minor differences in mitigation requirements, the intent of both are the same. To the extent practicable, wetland impacts should be compensated for in-advance, in-place, and in-kind.

In-advance compensation is defined as a wetland mitigation that has been established for at least one full growing season prior to the impacts or by a purchase of credits through an approved wetland bank. In-place compensation is defined as a site on the same, or adjacent, parcel as the impact or within the same bank service area or same major watershed. In-kind compensation is defined as a wetland mitigation that is of a similar type and provides a similar function. In-advance, in-place, and in-kind compensation is intended to replace the lost wetland function before it occurs, within close proximity, and of the same quality as the impact so time does not elapse where wetland functions are lost. As part of the Proposed Project, approximately 436 acres of wetland compensation credit are proposed in-place, in-advance, and within the study area. The remaining wetland compensation credit needed, above what is proposed within the inactive tailings basin discussed in Section 4.6.3, is proposed to occur in-place, in-advance, but outside of the study area. In-kind wetland mitigation is discussed in Section 4.6.3.

5.10 WATER QUALITY

The FSDD indicates that the EIS would address the cumulative effects due to changes in flow and quality of flow in Swan River and Swan Lake. The information was to be determined using computer models to evaluate long term changes in flow regimes. The FEIS will discuss the inclusion and exclusion of water bodies in the analysis.

Cumulative effects were evaluated through the following documents.

- Water Balance/Mine Yield Study
- No Action Alternative Memo
- Water Quantity and Quality Report

In the vicinity of the Proposed Project, another entity, Essar Steel, contributes to the cumulative point loading of pollutants in the same watersheds. The water leaving both of these facilities ends up in Swan Lake, which is the headwaters of the Swan River. The Keewatin and Nashwauk treated wastewater effluent also reaches Swan Lake through Hay Creek. Their discharges are not expected to change in volume or quality in the near future and were not analyzed further in this FEIS.

Sulfate has been identified as the primary water quality concern in review of the potential for cumulative effects from the Proposed Project and Essar Steel.

5.10.1 Affected Environment

Swan Lake is the only water body which receives water from both Essar Steel and Keetac and thus, will be the only body of water analyzed for cumulative effects.

The water contributions from Keetac that enter Swan Lake originate from two main sources at the mining facility. First, mine dewatering removes ground water seepage, accumulated precipitation, and runoff that collects at the base of mining pits. The water from mine dewatering is discharged from the pits and enters O'Brien Creek which flows into O'Brien Reservoir. Water leaves O'Brien Reservoir via the O'Brien Diversion Channel; from there, the water flows into Hay Lake via Hay Creek which then flows into Swan Lake. The second main source is from Keetac's tailings basin discharge. Water is discharged out of the tailings basin through Reservoir Two into the O'Brien Diversion Channel and into Hay Creek.

During mine operation, more dewatering is required as the size and depth of the mine increases. Increased dewatering increases the quantity of water discharged to O'Brien Creek. Because sulfate is present in the dewatering water, the predicted sulfate load was investigated.

The sulfate levels in Swan Lake (2006-2009) have ranged between 23 mg/L to 51 mg/L in the main body of the lake, and in the southwest bay levels have ranged between 6.9 mg/L to 48 mg/L.

The other source of direct discharge water is Reservoir Six which holds clarified process water from the plant facility and tailings basin. Water from Reservoir Six leaves via Reservoir Two and enters the O'Brien Diversion Channel which flows into Hay Creek. From there, the water flows into Hay Lake and leaves Hay Lake via Hay Creek and flows into Swan Lake.

Swan Lake receives water from the Essar Steel project located to the west of Keetac. Essar Steel is the only other facility that has proposed changes that would impact the water quality in Swan Lake.

The sulfate levels in Swan Lake (2006-2009) have ranged between 23 mg/L to 51 mg/L in the main body of the lake (Wild Rice Sulfate Data Submittal). The current (2009) mean sulfate concentration in Swan lake is 28.8 mg/L, based on sulfate levels in the main portion of the lake (Hay Lake/Swan Lake Sulfate Concentration Memo).

5.10.2 Environmental Consequences

Data are available providing water quality information for the Proposed Project (Water Balance/Mine Yield Study). The concentrations of many parameters of concern including: phosphorous, nitrogen, chloride, and trace metals are expected to remain at low levels after the Proposed Project is completed. The levels of such parameters would continue to be monitored through current wastewater monitoring plans. Upgrades would be made to the wet scrubber system in place on the current indurating line to increase the sulfate removal rate from the treated effluent discharged from the scrubber. The Project Proposer has proposed installing nano-filtration or similar technology on the wet scrubber discharge to remove additional sulfate. A dry scrubber is proposed to control air emissions from the new indurating line, therefore no additional wastewater discharges would be created from the new scrubber system.

The current wet scrubber uses lime to precipitate out calcium sulfate as the mechanism to remove sulfate from the air emissions. While the lime successfully removes sulfate, its presence in the discharged wastewater increases the water hardness and conductivity; these latter parameters are secondary concerns. While the sulfate removal would improve with the Proposed Project due to the installation of nano-filtration, an increased discharge load would result (higher volumes, lower concentration). The increased load would result in higher concentrations in downstream water bodies.

Most of the process wastewater from the facility is discharged to the tailings basin. Table 5.10.1 summarizes the changes predicted to occur in the sulfate loading in Swan Lake. These changes are impacted by both the Proposed Project as well as changes at Essar Steel. In the Swan Lake Nutrient Study (Wenck, 2006) it was estimated that the proposed Essar Steel project would incrementally increase the sulfate concentrations in Swan Lake by 3.3 mg/L.

TABLE 5.10.1 PREDICTED SULFATE DISCHARGE LOADINGS

Years	Sulfate Load (TPY)	Change in Sulfate Load (TPY)	Predicted Change in Swan Lake Sulfate Concentration due to Essar Steel (mg/L)	Predicted Change in Sulfate Concentration due to Keetac (mg/L)	Predicted Swan Lake Concentration Mean (mg/L)	Predicted Swan Lake Concentration Range (mg/L) [2]
Current [1]	1039	0	0	0	27.5	24.9 - 30.1
Period I 2012-2016	1019	-19	3.3	-0.3	30.5	27.9 - 33.1
Period II 2017-2021	1049	10	3.3	0.2	31	28.4 - 33.6
Period III 2022-2026	1128	89	3.3	1.5	32.3	29.8 - 34.9
Period IV 2027-2031	1408	370	3.3	6.2	37	34.4 - 39.6
Period V 2032-2036	1440	401	3.3	6.7	37.9	34.9 - 40.1

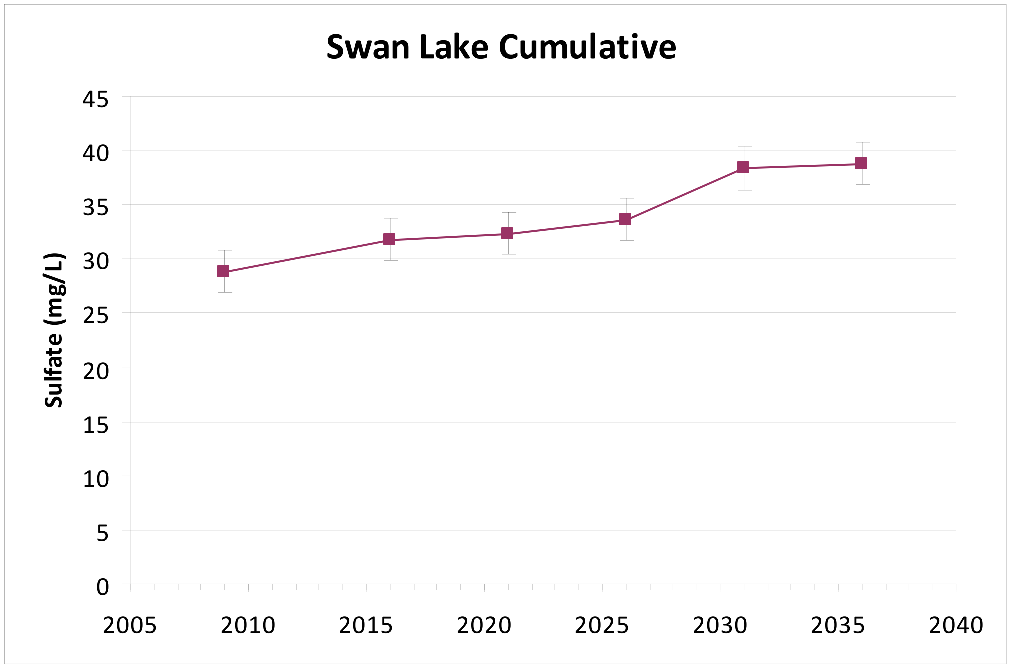
Sources: Hay Lake/Swan Lake Sulfate Concentration Memo (Barr, 2009EE) and Water Quantity and Quality Report (Liesch, 2009A)

[1] Values are measured values from samples collected June - September 2009

[2] Range represents the 95% confidence interval of data collected between June 24, 2009 and December 1, 2009

Illustration 5-10 is the predicted Swan Lake sulfate concentrations mean and ranges through the duration of the Proposed Project.

ILLUSTRATION 5-10 PREDICTED SWAN LAKE SULFATE CONCENTRATIONS



Sources: Barr, 2009EE and Liesch, 2009A

The cumulative sulfate levels expected in Swan Lake would increase by approximately 10 mg/L. The increase in concentration would be a result of increased loads to Swan Lake as a result of mine pit dewatering and increased processing wastewater from the Proposed Project and Essar Steel.

While the sulfate concentrations discharged would decrease over the life of the Proposed Project, the actual loading of sulfate would decrease initially and then increase in later phases due to the increase in dewatering volume. Increases in sulfate loads may have an effect on mercury methylation in Swan Lake. Specifics on mercury levels, mercury methylation, and mitigation measures are discussed in Sections 4.9.7, 5.5, and 5.13.

In the short term, the cumulative effect on water quality in Swan Lake would be adverse as sulfate concentrations in the lake would increase. This would cause a significant effect since Swan Lake already exceeds the state water quality standard for sulfate. However, as progress toward meeting the water quality standard is made, beneficial, long-term effects to water quality would occur to a point where the cumulative effect is less than significant. The change between the No Action Alternative to the East Stockpile Alternative is the same as the change between the No Action Alternative to the Proposed Project.

5.10.3 Monitoring and Mitigation

5.10.3.1 Monitoring

Monitoring levels of the parameters of concern, primarily sulfate, would allow the cumulative effects of the projects to be followed to determine if they differ from estimated levels. Should the levels of sulfate increase above those permitted by governing agencies, the Project Proposer could install additional sulfate removal mechanisms as discussed in Section 4.4.1.

5.11 CLASS I AREAS – POTENTIAL CUMULATIVE EFFECT TO AIR QUALITY

> Minnesota has two Class I areas – the Boundary Waters Canoe Area Wilderness (BWCAW) and Voyageurs National Park.

As required by the FSDD, a cumulative effect analysis for visibility and PM_{10} was conducted relative to Class I PSD area classifications. The cumulative effect analysis differs from the project specific analysis in that the cumulative analysis only assesses visibility, not flora, fauna, and acid deposition. Class I areas include wilderness and national park areas. The Class I area impacts analysis that described modeled impacts due only to the Proposed Project was presented in Section 4.9.5.

5.11.1 PM_{10} and $PM_{2.5}$ Air Concentrations

Federal air emission permitting rules for major sources require that an air quality analysis be conducted to demonstrate that national ambient air quality standards would not be exceeded and that the project would not significantly deteriorate air quality from baseline levels beyond what has been set aside for increase. The allowance for increase, in terms of air quality, is defined as the increment of the national ambient air quality standards that are set aside for increases in ambient air concentrations of certain criteria pollutants. Class I areas have the smallest amount of increase (lowest increment) that is allowed.

A cumulative increment analysis, which includes all increment consuming and expanding sources within 300 km of the Class I area, is required of any major PSD source for which the modeled Class I area impacts of that facility's emissions alone are above the Significant Impact Levels (SILs). The SILs were proposed by USEPA in July 1996 and are used by the FLMs as a benchmark for determining if further analysis is warranted. If The SILs are exceeded, the project would be required to complete an additional analysis of potential impacts. A project with impacts that do not exceed the SILs would not cause or contribute to an ambient air quality violation. Therefore, no additional analysis would be required by USEPA for a project with impacts below the SILs. This approach has been adopted for the FEIS as well.

As demonstrated in Section 4.9, the modeling of the Proposed Project showed that its impacts are below the SILs for PM_{10}. Therefore, the Proposed Project is not required to complete a cumulative increment analysis on the Class I areas. However, while a detailed modeling analysis is not required by USEPA, a semi-quantitative cumulative analysis for PM_{10} was included in the FSDD for the project that is based on monitoring data, emissions inventory data and the potential for actual impacts. In addition, the impacts from the Proposed Project to Minnesota's Class I areas, ambient air quality standards and related air quality values from the emissions of PM_{10} are being evaluated through the air quality permitting process. The FSDD only requires an analysis of PM_{10} and visibility cumulative study. Information for $PM_{2.5}$ was included for reference purposes.

5.11.2 Cumulative Effects Analysis – Class I Visibility

To help determine the potential impacts on visibility in the Class I areas from the Proposed Project when combined with all other concurrent projects, a cumulative effects analysis for visibility was performed. The analysis took into account the Proposed Project along with 14 other projects that were permitted or are in the permitting or environmental review process.

5.11.2.1 Affected Environment

5.11.2.1.1 Summary of Issues/Overview

The USEPA published regulations in July 1999 intended to improve visibility in the nation's Class I areas. On June 15, 2005, USEPA issued final amendments to the July 1999 rule. This rule and amendments are referred to as the Regional Haze Rule. Minnesota has two Class I areas – the Boundary Waters Canoe Area Wilderness (BWCAW) and Voyageurs National Park. In addition, emissions from Minnesota contribute to visibility impairment to Michigan's Isle Royale National Park. The rule requires that by 2064 visibility in the Class I areas reflect no human-made degradation and also requires the installation of Best Available Retrofit Technology (BART) emission controls that reduce visibility impairment, for certain industrial facilities emitting air pollutants such as the Proposed Project. The MPCA has submitted a State Implementation Plan (SIP) to USEPA that describes a 2018 visibility goal that would make reasonable progress towards the ultimate 2064 goal. Minnesota's Regional Haze SIP outlines the 2018 visibility goal which includes a target for 30 percent reduction in combined NOx and SO_2 emissions by 2018 from 2002 levels from point sources in Northeast Minnesota that emit over 100 tons per year of either NOx or SO_2. Increased emissions from the Proposed Project must be considered when determining if the area will meet the 2018 goal.

A cumulative effects analysis assessing the potential visibility impacts on federal Class I areas was performed as a special study for the Proposed Project. The results of the analysis were described in the Visibility CI Study.

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

The Visibility CI Study addresses the impacts from the Proposed Project, the Mesabi Nugget Phase II project near Hoyt Lakes, Minnesota and all other past and reasonably foreseeable proposed projects. A semi-quantitative analysis was performed by the Project Proposer to assess whether the projects outlined above would contribute to visibility impairment in Class I areas. USEPA had defined contributing to visibility impairment as the change in haze index of greater than 0.5 deciview. This is not a threshold assessed as part of this analysis.

5.11.2.1.2 Summary of the Visibility CI Study Scope – Background

Regional Haze and Visibility Impairment

The USEPA (USEPA, 2003A) defines "regional haze" as visibility impairment caused by the cumulative air pollutant emissions from numerous sources over a wide geographic area. Visibility impairment "is the most noticeable effect of fine particles present in the atmosphere, as particle pollution degrades the visual appearance and perceived color of distant objects and reduces the range at which they can be distinguished from the background" (MPCA, 2008D).

The primary pollutant contributing to regional haze in Minnesota's Class I areas is anthropogenic emissions of fine particulate matter ($PM_{2.5}$). $PM_{2.5}$ is composed of ammonium sulfate, ammonium nitrate and organic carbon matter (MPCA, 2008D). Each of these components can be naturally occurring or the result of human activity. The natural levels of these species result in some level of visibility impairment in the absence of any human influences, and would vary with season, daily meteorology, and geography (USEPA, 2003B).

There are two sources of fine particulates: primary and secondary. Fine particulates that are emitted directly into the atmosphere are called primary particulates. Secondary particulates are formed by the chemical transformation of NOx, SO_2, or VOC. Secondary particulates are the main contributor to regional haze. Both sources of fine particulates (primary and secondary) can be transported long distances.

Coarse particles between 2.5 and 10 microns in diameter do contribute to light extinction. But because these particles tend to settle out from the air more rapidly than fine particles and can be found relatively close to their emission sources, the emissions of particles in this size range from the Proposed Project are not likely to impact the Class I Areas (USEPA, 2003B; MPCA, 2008D).

Measuring Visibility

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

<u>Light Extinction Coefficient</u>
The light extinction coefficient is a measure of the absorption of light in a medium. It is calculated as the sum of the atmospheric concentration of each species of interest multiplied by a corresponding coefficient. The light extinction coefficient is referred to as b_{ext} and has units of 10^{-6} m^{-1} or $(10^6\ m)^{-1}$, or as typically labeled, inverse megameters (Mm^{-1}). The IMPROVE network has calculated light extinction coefficients. Monitoring stations at the Class I areas record and calculate visibility impairment based on monitored conditions at each area.

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

5.11.2.1.3 Visibility Impairment "Cumulative Effect" Approach

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

1. Assess the IMPROVE data for Voyageurs National Park and the BWCAW to provide the current status of PM_{10} and $PM_{2.5}$ air concentrations and haze index including a trends analysis where there is sufficient data.
2. Assess available information from the Regional Haze State SIP that identifies emission sources and/or emission source regions as significant contributors to ambient air concentrations in the Class I areas located in Minnesota.
3. Evaluate local, statewide and national SO_2, NOx, and PM_{10} emissions and trends using existing emission inventory data. $PM_{2.5}$ emissions are only evaluated for national trends.
4. Evaluate the cumulative effects from the proposed projects based on the potential increases in SO_2, NOx, and PM_{10} emissions and concurrent reductions from current and reasonably foreseeable projects and the expected decrease in state and national emissions. As in item 3 above, $PM_{2.5}$ emissions are evaluated for the national emissions trends only.

5.11.2.1.4 Analysis Boundaries

The following boundaries were identified to define the extent of the analysis for the 2009 Visibility CI Study:

1. The timeframe for the trends analysis, both past and future
   - The timeframe for this analysis is 1990 to 2035.

2. Other "reasonably foreseeable" actions to be assessed in addition to the Proposed Project
   - The following projects and actions are considered to be underway or "reasonably foreseeable":
     - *Proposed Projects:*
       - Excelsior Energy, Mesaba Energy Project, Coal Gasification Power Plant
       - Laurentian, Wood Fired Energy Project

- Mesabi Nugget Company, Direct Reduced Iron (DRI) Plant
    - Mesabi Nugget Company, Phase II Project
    - Essar Steel (formerly Minnesota Steel Industries), Mining/Taconite/DRI/Steel Plant
    - Northshore Mining Company, Furnace 5 Reactivation Project
    - PolyMet Mining, NorthMet Project
    - SAPPI Cloquet Plant Expansion
    - UPM/Blandin Paper Mill Expansion, Project Thunderhawk
    - Keetac Proposed Project
  - *Emission Reduction Projects*
    - Minnesota Power Taconite Harbor Energy Center Unit 2, Emission Control Modifications
    - Minnesota Power Laskin Energy Center Unit 2, NOx Reductions
    - Minnesota Power Boswell Energy Center Unit 3
    - U. S. Steel Minntac BACT Reductions
    - United Taconite Green Production Project
    - Xcel Energy's Metro Emissions Reduction Project (MERP) and Sherburne County (Sherco) reduction projects
  - *Regulatory and other actions:*
    - Implementation of the Regional Haze Rule and BART Rule
    - Implementation of the CAIR Rule or NOx SIP call (40 CFR parts 51, 72, 75, 96)
    - Implementation of other MACT standards, including reciprocal internal combustion engine, and boiler and process heater
    - State acid rain rule and statewide SO_2 emissions cap
    - Title IV of the 1990 Clean Air Act Amendments
    - On-road mobile source programs
      - 2007 Highway diesel engine standard
      - Tier II/Low sulfur gasoline
    - Non-road mobile source programs
      - Non-road diesel rule
      - Control of emissions from unregulated non-road engines
    - Locomotive/Marine engine reductions
    - Reasonably Achievable Control Technology (RACT) requirements under the Wisconsin and Michigan $PM_{2.5}$ and ozone SIPs

3. The geographic area that may be affected (the "zone of impact").
   - The "zone of impact" is defined as the area of concern to be evaluated for potential cumulative effects due to the above listed actions. Based on the scope defined in the SEAW and FSDD for the Proposed Project, the selected zone of impact is defined as Voyageurs National Park and the BWCAW. Voyageurs National Park is primarily located in St. Louis County, while the BWCAW encompasses parts of St. Louis, Lake, and Cook Counties.

5.11.2.1.5 Assessment of Existing Conditions

An assessment of the baseline visibility conditions for Minnesota's Class I areas is based on monitoring data from the IMPROVE program. Monitor sites from both the BWCAW (monitor ID: BOWA1) and Voyageurs National Park (monitor ID: VOYA2) were included in the analysis. The IMPROVE website (http://vista.cira.colostate.edu/improve) along with the Visibility Information Exchange Web System (VIEWS) (http://vista.cira.colostate.edu/views/Web/Data/DataWizard.aspx), provide ambient air concentrations for particulate speciated by chemical and relative humidity data. The VIEWS website provides the total light extinction coefficient from aerosol measurements and relative humidity.

The data for the BOWA1 location indicates a downward trend for haze index from 1992 to 2006 for the 20 percent best days, 20 percent worst days and the median days. A downward trend in haze index indicates improving visibility. The data for VOYA2 did not show a trend for either improving or degrading haze index.

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

The Regional Haze SIP includes an analysis of the 2018 contributions to light extinction for ammonium sulfate and ammonium nitrate on the 20 percent worst days for BWCAW and Voyageurs National Park for Minnesota and surrounding states. The analysis shows that Minnesota is the single largest contributor to visibility impairment at approximately 30 percent. Much of the remaining contribution is from surrounding states such as Iowa, Illinois, Wisconsin, and others. Northeast Minnesota sources make up approximately 50 percent of the contribution of visibility impairment coming from Minnesota or about 15 percent of the total contribution (MPCA, 2008D).

5.11.2.2 Environmental Consequences

5.11.2.2.1 Summary of Emission Trends

Table 5.11.1 shows the estimated potential emissions of SO_2, NOx, and PM_{10} from each of the proposed projects included in this analysis. Concurrent emission reductions are provided for comparison to the emissions estimated for the proposed projects. Proposed projects were included only if they were not operating for most of 2006. This cutoff date was chosen since the monitoring and emission inventory data used to assess the past or existing conditions includes information up to 2006. Any sources not operating during most of 2006 were not included in the analysis of the existing conditions and therefore need to be considered in the assessment of future cumulative effects.

> Current MPCA estimates indicate that emission reductions at power generation facilities and additional reasonably foreseeable future projects in northeast Minnesota are not enough to meet the current Regional Haze SIP goal. Therefore, additional mitigation or reductions are very likely to be necessary to reach the 2018 goal.

TABLE 5.11.1 MAXIMUM POTENTIAL SO_2, NOx and PARTICULATE EMISSIONS IN COMPARISON TO EMISSION REDUCTIONS

Project	Location in Minnesota	SO_2 (TPY)	NOx (TPY)	PM_{10} [14] (TPY)	BACT / MACT [15]
INCREASES					
Excelsior Energy, Mesaba Energy Project [1]	Taconite or Hoyt Lakes, St. Louis and Itasca	1,390	2,872	503	Yes
Laurentian, Wood Fired Energy Project [2]	Hibbing and Virginia, St. Louis	50	302	40	Yes
Mesabi Nugget DRI Plant [3]	Hoyt Lakes, St. Louis	417	953	514	Yes
Mesabi Nugget Phase II [4]	Hoyt Lakes, St. Louis	7	282	955	Yes
Essar Steel [5]	Nashwauk, Itasca	421	1,505	1,354	Yes
Northshore Mining Company, Furnace 5 Reactivation [6]	Silver Bay, Lake	56	200	149	Yes
PolyMet Mining, NorthMet Project [7]	Hoyt Lakes, St. Louis	30	159	1,175	Yes
SAPPI Cloquet [11]	Cloquet, Carlton	26	7	-5	
UPM/Blandin Paper Mill Expansion, Project Thunderhawk [8]	Grand Rapids, Itasca	213	169	-7	Yes
U. S. Steel Keetac, Expansion [9]	Keewatin, Itasca and St. Louis	124	35	956	
	Total Increases	2,734	6,489	5,634	
REDUCTIONS					
Ainsworth Engineered - Cook OSB [16]	Cook, St. Louis County	-19	-203	-53	
Ainsworth Engineered - Grand Rapids [17]	Grand Rapids, Itasca County	-2	-92	-50	
Minnesota Power Taconite Harbor Energy Center Unit 2, Emission Control Modifications for SO_2, NOx and mercury	Schroeder, Cook	-877	-1,158		
Minnesota Power Laskin Energy Center Unit 2, NOx Reductions [10]	Hoyt Lakes, St. Louis		-1381		
Minnesota Power Boswell Energy Center Unit 3 [10]	Cohasset, Itasca	-11,659	-9,683		
U. S. Steel Minntac BACT Reductions [12]	Mtn. Iron, St. Louis		-1,240		
United Taconite Green Production Project [13]	Forbes, St. Louis	-912 to 39	-2,642 to 39	-58	
	Total Reductions	-13,469 to -12,518	-16,399 to -13,718	-161	
	Net Reductions/Increase	**-10,735 to -9,784**	**-9,910 to -7,229**	**5,473**	

Prepared November and December 2008:

[1] Emission estimates (Phase I and Phase II) based on emissions used in the air quality analysis in the draft EIS, website: http://www.netl.doe.gov/technologies/coalpower/cctc/EIS/mesaba_pdf/Mesaba_DEIS_Appx_B.pdf, accessed on November 29, 2008.

[2] Potential to emit from Technical Support Documents for Virginia Public Utilities (MPCA permit #13700028-005) and Hibbing Public Utilities (MPCA permit #13700027-003).

[3] Mesabi Nugget's Proposed Direct Reduced Iron (DRI) Facility: No crushing/grinding at the site; receive concentrate from offsite. Technical Support Document for MPCA permit 13700318-001.

[4] Preliminary emission estimates Barr Engineering.

[5] Potential to emit from Technical Support Document for Essar Steel (MPCA permit #06100067-002)

[6] Northshore Mining's Furnace 5 Project: reactivating 2 crushing lines, 9 concentrating lines, one pellet furnace (Furnace 5); new sources emissions only (MPCA permit #07500003-003).

[7] PolyMet Mining's Proposed Facility: crushing/grinding of ore, reagent and materials handling, flotation, hydrometallurgical processing. Emission estimates from Barr Engineering report dated November 2008 *Stationary and Mobile Source Emission Calculations for the NorthMet Project –Combined Report (RS57)*, submitted to MNDNR.
[8] Net Emission Increase from Blandin Project Thunderhawk MPCA permit #06100001-009.
[9] U. S. Steel Keewatin, Keetac mine expansion and restart of taconite processing line.
[10] Emission estimates provided by the MPCA from the "Northeast Minnesota Plan Emission Tracking Spreadsheet."
[11] Preliminary net emission change estimates from draft EAW dated 7/1/2008. Plant expansion, new paper machine, new boiler.
[12] Emissions reduction estimates are the permit limits minus the 2006 actuals.
[13] United Taconite Green Production Project – Improvements to concentrator and pellet plant, fuel changes, installation of pollution control equipment. Emission estimates are preliminary and reflect the range of reductions that could occur depending on the final fuel mix chosen. If SO_2 is 39, NOx will likely be close to -2642. If NOx is 39, SO_2 will likely be close to -912.
[14] PM_{10} emission estimates include point and fugitive emissions for all sources at a facility.
[15] MACT = Maximum Achievable Control Technology; BACT = Best Available Control Technology.
[16] Facility shutdown Emission reduction estimate based on average emissions for last 5 years of operation from MPCA emission inventory database.
[17] Facility shutdown Emission reduction estimate based on average emissions for last 5 years of operation from MPCA emission inventory database.

Note: The Ainsworth shutdown is also a reasonably foreseeable action, just like the Proposed Project increases and the MN Power and other taconite decreases. They are within the timeframe and geographic extent covered by the analysis and need to be included.

Emissions of both NOx and SO_2 have been reduced in northeast Minnesota by reductions from power generation facilities. However, both power generation facilities and the mining facilities contribute to visibility impairment in the area. As discussed in Section 5.11.2.1.1, the MPCA has a Regional Haze SIP goal to reduce combined NOx and SO_2 emissions from northeast Minnesota from 2002 levels to 2012 by 20 percent and from 2002 levels to 2018 by 30 percent. Current MPCA estimates indicate that emission reductions at power generation facilities and additional reasonably foreseeable future projects in northeast Minnesota are not enough to meet the current Regional Haze SIP goal. Therefore, additional mitigation or reductions are very likely to be necessary to reach the 2018 goal.

Even though there is a net increase in PM_{10} for all the proposed projects combined, direct PM_{10} emissions are not considered to be a concern for visibility impairment in the BWCAW or Voyageurs National Park as described in Minnesota's Regional Haze SIP (MPCA, 2008D).

5.11.2.2.2 Summary of Visibility Cumulative Effects Analysis

The following items outline the results and environmental consequences of the Visibility CI Study:

1. Class I Area Visibility Gradually Improving or Showing No Trend. Between 1992 and 2006, visibility in the BWCAW on the 20 percent worst days showed a downward trend in haze index, based on a rolling five-year average. The National Park Service has concluded that through 2005, there was no visibility trend for Voyageurs National Park. The same conclusions can be made for the timeframe of the Regional Haze requirements (i.e., 2002 to present).

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

3. Overall Emissions Decreases in Pollutants that are Precursors to Sulfate and Nitrate Particulates. When the emissions from the proposed projects in northeast Minnesota are viewed together with the concurrent emission reduction projects of SO_2 and NOx from power generation facilities in northeast Minnesota, there is a net decrease in emissions of both pollutants in the six-county area of northeast Minnesota. As noted in Section 5.11.2.2.1 above, current MPCA estimates indicate that emission reductions at power generation facilities and additional reasonably foreseeable projects in northeast Minnesota are not enough to meet the current Regional Haze SIP goal. Therefore, additional reductions are necessary to reach the 2018 goal.

4. Fifteen percent of 2018 Visibility Impairment Projected to be Due to Northeast Minnesota Emissions. Monitoring data and modeling done in support of the Minnesota Regional Haze SIP shows that Minnesota sources are expected to contribute approximately 30 percent of the visibility impairment at Minnesota's own Class I areas and approximately 14 percent of the visibility impairment at Isle Royale (MPCA, 2008D). Of the total amount, Northeast Minnesota sources contribute about 15 percent to Minnesota Class I areas only. The remainder is attributed to sources in other states and Canada. Emissions from Minnesota are the single largest contributor to regional haze at its own Class I areas.

5. Net Effect from Proposed Projects to Reduce Emissions.
   The net effect from the proposed projects, the voluntary reductions of power generation facilities and the foreseeable regulatory actions shown in Table 5.11.1 is a likely reduction in emissions of SO_2, and NOx in Minnesota. However as addressed above, the MPCA has developed Regional Haze SIP goals to reduce combined NOx and SO_2 from 2002 levels. The reduction is 20 percent by 2012 and 30 percent by 2018. Based on current projections including the Proposed Project, the reductions addressed in this section are projected to not be enough to meet the 2018 goal. The reductions will be enough to meet the 2012 goal.

There would not be a cumulative effect to visibility as emissions for SO_2 and NO_2 are projected to decrease statewide by the time the project starts up, and the state is on track for meeting the 2012 Regional Haze SIP reduction goals. The change between the No Action Alternative to the East Stockpile Alternative is the same as the change between the No Action Alternative to the Proposed Project.

5.11.2.3 Mitigation Opportunities

As indicated in Section 4.9.5, mitigation for this project has been agreed to for visibility. The Project Proposer has agreed to low NOx combustion on the main burner of the expansion line. The facility is also subject to the Northeast Minnesota plan portion of the Regional Haze SIP, which calls for a 2018 goal of 30 percent reduction in regional emissions from 2002 levels. If additional mitigation is deemed necessary, the mitigation options can be evaluated for their impact on regional emissions and the 2018 goal.

> Mitigation for this project has been agreed to for visibility. The Project Proposer has agreed to low NOx combustion on the main burner of the expansion line.

5.12 ECOSYSTEM ACIDIFICATION RESULTING FROM DEPOSITION OF AIR POLLUTANTS

The Acidification CI Study evaluated whether the cumulative acid precursor emissions from the Proposed Project would cause or significantly contribute to ecosystem acidification in northeast Minnesota. The Acidification CI Study evaluated where the potential cumulative air emissions of SO_2 and NOx from the Proposed Project would cause or contribute to ecosystem acidification in northeast Minnesota. The Acidification CI Study focused on emissions of SO_2 and NOx because they are the two primary pollutants of concern with regard to ecosystem acidification (acid precursors).

5.12.1 Affected Environment

5.12.1.1 Summary of Issues/Overview

The SEAW and FSDD defined a semi-quantitative approach to assess potential cumulative effects of ecosystem acidification.

This semi-quantitative assessment used emission trend analysis to assess the potential for cumulative acidification impacts of these reasonably foreseeable actions. The analysis first summarizes the relationship between acid precursor emissions and acid deposition. It then compares potential acid precursor emissions from the proposed projects to the emissions from existing taconite facilities and coal-fired power plants in the six-county project area (Carlton, Cook, Itasca, Koochiching, Lake, St. Louis). Finally, it summarizes historic nationwide emission trends and predicted future trends to evaluate likely acidification rates in the region.

5.12.1.2 Background Information on the Ecosystem Acidification Process

5.12.1.2.1 Relationship between Emissions and Deposition

Both SO_2 and NOx are long-range transport pollutants. This means that they can travel long distances in the atmosphere while subject to complex atmospheric chemical and physical processes before being washed out or deposited back down onto land, lakes and rivers. In 1985, the MPCA determined that about 90 percent of the acid deposition in northeastern Minnesota is caused by emissions from sources located outside the state, primarily from states to the south and east of Minnesota (MPCA, 1985). If anything, regulations since 1985 have decreased the importance of in-state SO_2 emissions and made acid deposition more of a regional issue (see Source-Receptor Relationships/Models, below). As a result, Minnesota emission sources tend to have a small impact on the amount of acid deposition falling in Minnesota. The MPCA’s analysis, along with similar findings from other states and National Acid Precipitation Assessment Program (NAPAP) (1990) provided the basis for USEPA to develop a national strategy for reducing emissions of SO_2 and NOx rather than relying solely on individual state regulatory actions.

5.12.1.2.2 Acid Precursors/Atmospheric Processes

Acidic deposition occurs when gaseous precursors are converted by atmospheric processes to compounds that are either acidic themselves or can be easily converted to acidic compounds by interactions with terrestrial or aquatic compounds. Sulfur oxides (SOx) and NOx are probably the best recognized acid precursors, and in some cases, ammonia, emitted primarily by livestock operations, can also be an acid precursor. SO_2 is the predominant oxide of sulfur species emitted and the focus of the Acidification CI Study.

Acidic compounds are formed in the atmosphere by a complex group of gas- and aqueous-phase chemical reactions between acid precursors and other atmospheric compounds such as VOC, ozone, and hydrogen peroxide, often catalyzed by sunlight. Air masses can transport these compounds for long distances from their origin (National Research Council, 1983).

5.12.1.2.3 Emission Sources

There are a variety of sources of SO_2 and NOx emissions. Using national data for the period from 1970 to 2007, electric utilities are the major source of SO_x (primarily as SO_2), contributing about two-thirds of all emissions. The other major source categories include industrial fuel use (about 14 percent) and metals processing (3.4 percent). The emissions of SO_2 are primarily related to the sulfur content of the fuels being burned.

In contrast, transportation sources are the major contributor of NOx emissions (about 55 percent, 37.4 percent from highway sources plus 17.5 percent from off-highway), with electric utilities a smaller source of national NOx emissions (about 23 percent). In the case of NOx emissions, the oxides arise from fixation of atmospheric nitrogen at high temperatures, and hence are more dependent on the combustion process than on the properties of the fuel (Husar, 1986).

5.12.1.2.4 Wet Deposition

Wet deposition occurs when aerosols directly combine with droplets of water as they condense during formation of precipitation, or the aerosols can be "washed out" of the atmosphere during a rain or snow event. Deposition of acidic aerosols in this manner is referred to as "acid rain." In general, sulfate (SO_4) is a good proxy for deposition of acidic materials associated with SO_2 emissions, and nitrate (NO_3) is a proxy for the deposition of acidic materials associated with NOx emissions. Sulfate-associated acidity constitutes about 60 percent of acidic deposition, and nitrate-associated acidity about 40 percent (MPCA, 1993).

5.12.1.2.5 Dry Deposition

Some of the acidic aerosols do not fall with precipitation, but instead come directly into contact with and remain on surfaces such as tree leaves. This process is continuous; deposition is not dependent on a precipitation event. Such deposition is referred to as dry deposition or dryfall. Depending on the nature of the atmosphere, the collecting surface, and climatic conditions, dryfall can account for as much or more of the acidic materials delivered to an ecosystem as wet deposition. For example, total wet and total dry depositions are thought to be of approximately equal magnitude over eastern North America (Stenslund et al., 1986). Forest canopies, especially those of conifers, are very efficient at filtering these aerosols from the atmosphere and hence dry deposition is greater in forest than in more open vegetation types (Hultberg, 1985). Some fraction of the nitric acid also remains in the gaseous form, and direct uptake of that gas by plants is an important mode of dry deposition for nitrogen (Lindberg et al., 1986).

5.12.1.2.6 Source-Receptor Relationships/Models

The qualitative or quantitative relationship between the emission of acid precursors at their source(s) and the air concentration and deposition of acidic materials at a receptor (source-receptor relationship – SRR) has considerable uncertainty (Venkatram, 1991).

Throughout the 1980s, the scientific community dedicated significant resources to developing acid deposition modeling capabilities. The NAPAP 1990 Integrated Assessment relied primarily on a then state-of-the-art model called the Regional Acid Deposition Model

(RADM). The model was designed to provide a scientific basis for predicting changes in deposition resulting from changes in sulfur and nitrogen emissions, to predict the levels of acid deposition in certain sensitive receptor regions. Updated versions of RADM are still considered by most modelers to be the highest quality acid deposition model available for the eastern United States (NAPAP, 2005).

The results of most modeling efforts indicate that sulfur deposition at remote receptors is dominated by wet deposition, with the sulfur originating from sources at distances as large as 500 km from those receptors (Venkatram, 1991). On a national basis, for source regions aggregated by state, no one source region contributed more than about 15 percent to the sulfur deposition at remote receptors. Thus, sulfur deposition at remote receptors, including northeastern Minnesota, is *not* dominated by one or two source regions. Source regions as far away as 1,000 km contributed to the deposition, even though their relative contributions are as small as 1 to 2 percent. One analysis indicates that only 13 percent of the wet sulfate deposition in the Upper Midwest region (Iowa, Michigan, Minnesota, and Wisconsin) is derived from sources within the region, with sources in Illinois, Missouri, Indiana, and Texas each contributing about 10 percent of the deposition (Shannon, 1999).

5.12.1.2.7 Effects on Ecosystems

Terrestrial Systems

The most important long-term impact of acid deposition on terrestrial ecosystems is the potential to alter soil properties. Soils are the basic resource or substrate from which the terrestrial ecosystem derives its existence. Soils are resistant to change. Various natural processes tend to both buffer soil properties against change and to restore those properties toward their initial state following disturbance. Accumulation of organic matter and weathering of minerals can rebuild an eroded soil. The amount of acids added annually by atmospheric deposition, even in the worst-cases, is a small portion of the total chemical buffering capacity of surface soils (McFee, 1982).

Aquatic Systems

Acidic deposition can affect water quality by lowering pH levels (i.e., increasing acidity), decreasing acid-neutralizing capacity (ANC), and increasing aluminum concentrations. Direct acidic deposition onto lakes can directly reduce pH, as runoff from sources that have been acidified. The ANC of an aquatic system measures that balance between cations such as calcium and magnesium and strong acid anions (i.e., sulfate and nitrate). The same factors that can lower the pH of aquatic systems therefore can also lower ANC. Finally, just as in soils, as the pH drops in aquatic systems inorganic aluminum can become more available to biota.

Low pH and soluble aluminum can have harmful effects on aquatic biota, reducing both abundance and species diversity. In some cases, although the average water quality in aquatic systems is within the range of tolerance of biota, seasonal acidification can occur. This is the periodic increase in acidity and the corresponding decrease in pH and ANC in streams and lakes caused by a sudden pulse of acids and/or a dilution of base cations (e.g. calcium, magnesium, sodium, potassium) due to spring snowmelt and large rain events (Wigington et al., 1996). These short-term increases in acid inputs can reach levels that are lethal to fish and other aquatic organisms (Baker et al., 1996, Van Sickle et al., 1996). In the United States, effects of acidic deposition on aquatic systems have been most prominent in acid-sensitive areas of New York and other areas of the Northeast.

5.12.1.3 Analysis Boundaries

The following boundaries have been identified to define the extent of the analysis for the Acidification CI Study:

1. The timeframe for the trends analysis, both past and future.
   - The timeframe for this analysis is 1990-2030.

2. The list of specific past and future projects to be assessed in addition to the Proposed Project, including type, geographic limits and project status.
   - Figure 4.9.5.1 shows the general location of the "reasonably foreseeable" projects to be assessed for cumulative effects, as well as the locations of existing taconite facilities and federally protected Class I areas. The projects selected as "reasonably foreseeable" are defined as those that are already underway and are actively moving through the environmental review process or for which a completed data portion of an environmental review document has been submitted to the MNDNR, the MPCA, the Minnesota Department of Commerce (MDOC) or the Minnesota EQB. The following projects and actions are considered to be underway or reasonably foreseeable:
     - *Proposed Projects:*
       - Excelsior Energy, Mesaba Energy Project, Coal Gasification Power Plant
       - Laurentian Wood Fired Energy Project
       - Mesabi Nugget Company's DRI plant (Phase I)
       - Mesabi Nugget Company's Phase II Project (mining and concentrating)
       - Essar Steel Minnesota, Mining/Taconite/DRI/Steel Plant (formerly known as Minnesota Steel Industries)
       - Northshore Mining Company's Furnace 5 Reactivation
       - PolyMet Mining Inc.'s NorthMet Project
       - Sappi Cloquet Plant Expansion
       - UPM/Blandin Paper Mill, Thunderhawk Project
       - Keetac Proposed Project
     - *Emission Reduction Projects:*
       - Minnesota Power Taconite Harbor Energy Center Unit 2, Emission Control Modifications
       - Minnesota Power Laskin Energy Center Unit 2 NOx reductions
       - Minnesota Power's Boswell Energy Center Unit 3
       - U.S. Steel Minntac BACT Reductions
       - United Taconite Green Production Project
     - *Regulatory and other actions:*
       - Minnesota's Acid Rain Rule (Minn. Rule parts 7021.0010-7021.0050)
       - USEPA Acid Rain Program (Title IV of the 1999 Clean Air Act Amendments): Phase II began implementation in 2000
       - Reciprocating Internal Combustion Engine and Boiler Maximum Achievable Control Technology (MACT) Standards, 40 CFR Part 63
       - CAIR, modifying 40 CFR Parts 51, 72, 73, 74, 77, 78, 96 (although this was vacated and remanded to USEPA, it is expected to be re-proposed with the changes required by the court); or the NOx SIP call (40 CFR parts 51, 72, 75, 96)
       - Mobile source reductions
       - Xcel Energy's MERP and Sherco plant reductions.

3. The specific geographic area of concern ("zone of impact"), including resources, ecosystems, and populations of concern.
   - The zone of impact for this analysis is defined as northeast Minnesota and encompasses the area consisting of the following six counties: Carlton, Koochiching, Itasca, St. Louis, Lake, and Cook.

4. The extent and geographic limits of other sources that may affect resources in the zone of impact; for the specific issue under study.
   - The resources of concern – such as low alkalinity seepage lakes in moraine areas such as those found just north of Keewatin or low alkalinity heat-water lakes such as those found in the BWCAW or Voyageurs National Park – are affected by air emissions not only from local and regional sources, but also by sources located throughout the Midwest and throughout the country.

5. Other direct and indirect factors that need to be evaluated, such as ecosystem assimilation capacity, and any potential additive, synergistic, and counterbalancing cumulative effects.
   - The critical assimilation capacity for acidification is the watershed buffering capacity of the area, which was discussed previously in Section 5.12.1.2.

5.12.1.4 Acid Deposition Overview

5.12.1.4.1 Acid Deposition in Minnesota: Regulation, Current Status, Trends

Depending on watershed buffering capacity and other factors, aquatic ecosystems can be harmed when precipitation pH is less than 4.7. The Acid Deposition Control Act of 1982 required the MPCA to identify sensitive resources in the state and adopt an acid deposition standard and emissions control plan. In 1986, the MPCA established an annual wet sulfate deposition standard of 11 kilograms per hectare (kg ha^{-1}). Currently, annual wet sulfate is below the 11 kg ha^{-1} standard and a statewide SO_2 emissions cap of 194,000 tons per year (TPY) (emissions cap effective on January 1, 1994). Currently, annual wet sulfate deposition in northeast Minnesota is below the 11 kg ha^{-1} standard (approximately 5 to 7 kg ha^{-1} in 2007). Total statewide SO_2 emissions are estimated by the MPCA to be approximately 148,000 TPY (120,000 TPY point-source) in 2006 (MPCA, 2008D). Further, these sulfate deposition rates are expected to continue to slowly decline as foreseeable regulatory actions are implemented.

In addition, the National Park Service and the US Forest Service evaluate effects on terrestrial and aquatic ecosystems. The acid deposition impact analysis for the BWCAW and Rainbow Lake Wilderness Area considers the total concentration or deposition including background. The acid deposition impact on terrestrial and aquatic ecosystems is judged to be acceptable by the US Forest Service if ambient air concentrations and/or deposition including background are below the respective "green line."

For Voyageurs National Park and Isle Royale National Park, DATs were calculated for total sulfur and total nitrogen. DATs have been developed by the National Park Service and US Fish and Wildlife Service (USFWS) to evaluate the contribution of additional nitrogen (N) or sulfur (S) to deposition within Class I areas (http:www.nature.nps.gov/air/Pubs/pdf/flag/nsDATGuidance.pdf). The DATs are intended to distinguish where deposition increases may result in adverse ecosystem stresses, as well as where the deposition increases are likely to have a negligible impact on AQRVs.

Project-related deposition was estimated using the CALPUFF modeling system and results for potential terrestrial and aquatic impacts are presented in Tables 4.9.9 and 4.9.10, respectively below. SO_2, S and N impacts from the project are below the green line value or DATs for terrestrial and aquatic ecosystems in the Class I areas. Impacts from the Proposed

Project on the terrestrial nitrogen deposition at Rainbow Lake Wilderness Area are insignificant.

National reductions in SO_2 emissions have reduced acid deposition across the United States, particularly in the eastern one-half of the country. Wet sulfate deposition in northern Minnesota and other parts of the Midwest has declined by about one-third since the early 1980s. For Minnesota and the Upper Midwest region, there is a significant decrease in sulfate for the 1980 to 2007 time period. When only the most recent 10 years of data are evaluated, sulfate deposition in northern Minnesota and the Upper Midwest Region as a whole has not changed significantly since about 1997, despite continued nationwide emission reductions.

When assessing the individual components of nitrogen deposition (nitrate and ammonium), nitrate wet deposition has declined significantly since about 1997 while ammonium wet deposition has increased. This may explain why total inorganic nitrogen deposition has not declined during the 2000 to 2007 time period because the increase in ammonium wet deposition has offset the decreases in nitrate wet deposition. Overall, wet nitrate deposition in Minnesota is expected to remain the same, or decline slightly, over the next decade because of anticipated power plant and mobile source emission reductions. Ammonium wet deposition, which is related primarily to agricultural operations, may continue to increase in the future.

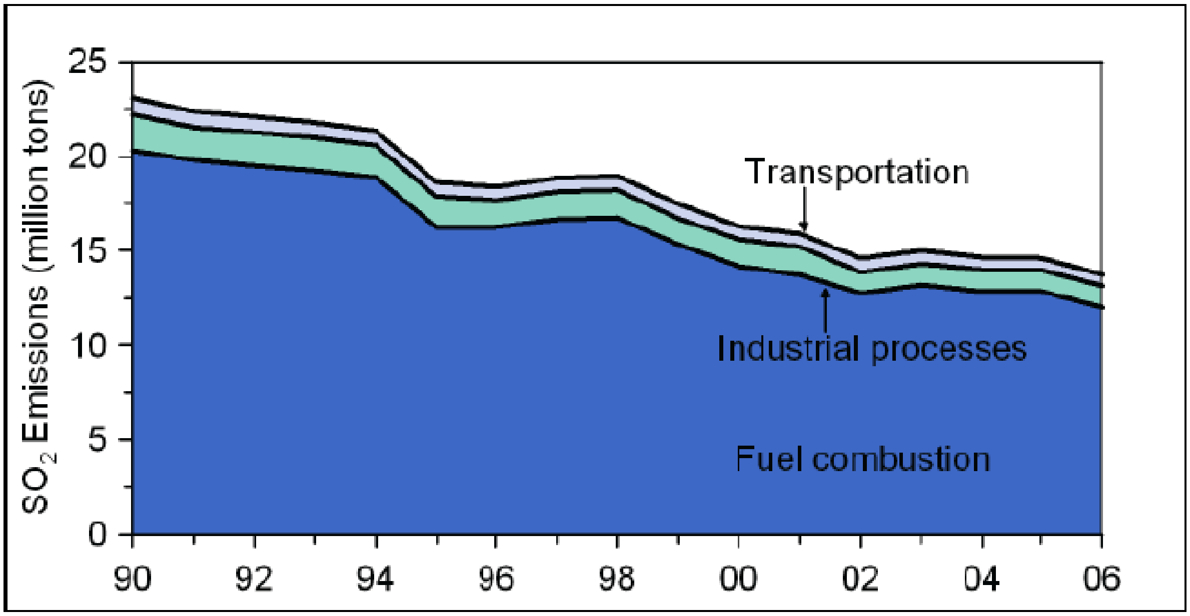
5.12.1.4.2 Cumulative Project Emissions and Statewide Trends

Potential cumulative SO_2 emissions from the reasonably foreseeable projects would be approximately 2,727 TPY. (Actual cumulative emissions from these sources would likely be less). In 1980, statewide actual SO_2 emissions were about 250,000 TPY (MPCA, 1990). Point source emissions, which make up approximately 81 percent of the total emissions, were estimated to be approximately 120,000 TPY (MPCA, 2008D). The potential SO_2 emissions from the proposed projects (2,727 TPY), compared to total statewide actual emissions of approximately 148,000 TPY, represent an approximate increase of 1.8 percent on a statewide basis. When the potential SO_2 emissions from the projects are compared to point source SO_2 emissions only, the potential increase is approximately 2.3 percent.

This potential increase in SO_2 emissions from the proposed projects is expected to be offset by the planned reductions associated with voluntary actions in northern Minnesota or the reductions required by foreseeable regulatory actions. “Reasonably foreseeable actions” in regard to potential emission reductions include those regulatory actions that have been placed on public notice by a government agency (e.g., draft rules or regulations) or there has been a submittal to a regulatory agency that provides details on a planned action being considered. Therefore, even if all the proposed projects on the Iron Range move forward, statewide SO_2 emissions are likely to decline, and will remain below the 194,000 TPY limit identified in Minnesota’s acid rain rule.

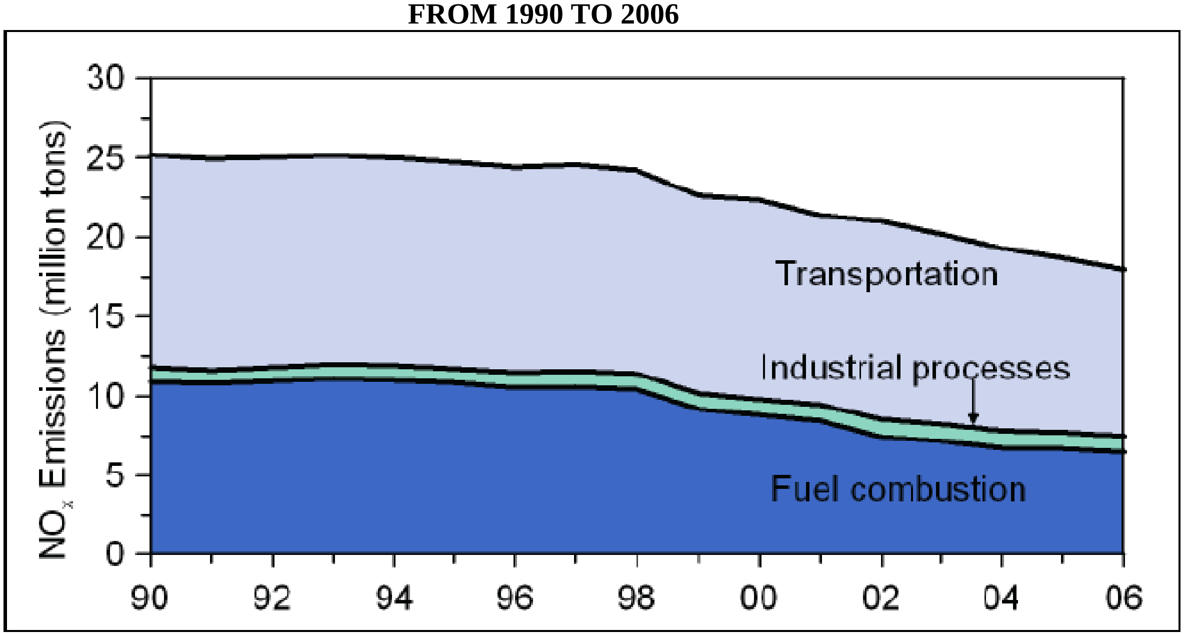
Cumulative potential NOx emissions from the reasonably foreseeable projects are approximately 6,225 TPY. Although point-source NOx emissions have declined recently, total statewide NOx emissions have been increasing gradually since the mid-1980s, and were estimated to have increased to about 466,600 TPY by 2006 (MPCA, 2008D). Therefore, the potential 6,225 TPY increase in NOx emissions due to the projects is about 1.3 percent of total statewide emissions. This potential increase is within the year-to-year variability in actual statewide point-source emissions. Illustrations 5-11 and 5-12 show the national emission trends.

ILLUSTRATION 5-11 NATIONAL SULFUR DIOXIDE EMISSION TRENDS FROM 1990 TO 2006



Source: http://www.epa.gov/airtrends/sulfur.html

ILLUSTRATION 5-12 NATIONAL NITROGEN OXIDE EMISSION TRENDS FROM 1990 TO 2006



Source: http://www.epa.gov/airtrends/sulfur.html

5.12.1.4.3 National Emission Trends

Nationally, SO_2 emissions were about 13.5 million tons per year in 2006, which is about 41 percent below that emitted in 1990 (USEPA, 2008A). In 2010, national SO_2 emission allowances from electric generation units will level off at 8.7 million tons annually. Actual emissions were almost at this level in 2007, but could increase due to the use of previously banked emission allowances. In addition, USEPA's CAIR rule, which was vacated in July 2008 and remanded back to USEPA in December 2008 for revision, but is still in effect, would also require reductions of SO_2 and NOx in eastern and southern states. USEPA expects the CAIR rule and other regulations to reduce national utility SO_2 emissions at full implementation sometime after 2020 (USEPA, 2005).

Nationally, total NOx emissions (mobile plus point sources) have declined about 29 percent since 1990, with the biggest decline starting in about 1999. Point source NOx emissions have declined about 39 percent from 1990 to 2007 and are currently approximately 7.5 million TPY. The decline in national NOx emissions is expected to continue due to regulatory actions. Assuming that CAIR continues to have similar emission reduction requirements, NOx emissions in the affected CAIR states would be capped at 50 percent below existing emissions by a given year, and at 60 percent below existing emissions five years later. As an alternative to CAIR, the NOx SIP will require NOx reductions in the affected states.

5.12.2 Environmental Consequences

The following items outline the results and environmental consequences of the Acidification CI Study:

> The cumulative potential emissions from the proposed projects would not have the potential to cause or significantly contribute to ecosystem acidification.

1. The potential cumulative emissions from the proposed projects (approximately 2,727 TPY of SO_2; approximately 6,225 TPY of NOx) are small in comparison to statewide emissions of 148,000 TPY SO_2 and 466,600 TPY NOx. The proposed projects would potentially increase statewide SO_2 emissions by 1.8 percent and NOx emissions by 1.3 percent.
2. A cumulative modeling analysis assuming 30 percent control of mercury was conducted for the Proposed Project to estimate the likely impact of the cumulative mercury emissions. Additional mercury control in order to mitigate modeled impacts would be achieved through the use of activated carbon, which achieves much greater mercury control than 30 percent when used at coal-fired electric units. The goal for control at the Proposed Project would be to approach or exceed 80 percent. In addition, Minnesota's implementation of the statewide mercury TMDL includes a goal of reducing total mercury emissions from taconite facilities by 75 percent by 2025. The project proposer has agreed to perform research and development with the intent of reaching the statewide mercury TMDL goal before the 2025 deadline.
3. Existing SO_2 emissions in Minnesota have a small contribution to acid deposition in the state; approximately 10 percent of the acid deposition falling in Minnesota is due to in-state sources. Approximately 90 percent comes from outside the state (MPCA, 1985, Shannon, 1999). The estimated potential increase in SO_2 and NOx emissions from the proposed projects is not expected to increase acid deposition.
4. Current levels of acid deposition in northern Minnesota are below thresholds of concern. Wet sulfate deposition is less than the MPCA standard of 11 kg ha^{-1} (approximately 5 – 7 kg ha^{-1} in 2007), and the pH of precipitation is greater than 4.7. Potential emissions from the proposed projects are not expected to result in a measurable increase in wet sulfate deposition in Minnesota (or in downwind states).
5. Lake survey data from the early 1990s that were evaluated for trends in acidification indicates that Minnesota's aquatic and terrestrial ecosystems have sufficient buffering capacity to withstand current levels, and projected future levels, of acid deposition (Eilers and Bernert, 1997). Similarly, Minnesota's terrestrial ecosystems are well-buffered against negative impacts of acid deposition. Due to this inherent buffering capacity, no adverse impacts to aquatic and terrestrial ecosystems are expected due to the potential emissions from the proposed projects.
6. Minnesota's SO_2 and NOx emissions are expected to continue to decline due to foreseeable voluntary and federally required actions, which would offset potential emissions increases from the proposed projects. Because about 90 percent of Minnesota's acid deposition comes from outside the state, the foreseeable federal regulatory actions and associated national emission reductions should continue to decrease acid deposition in Minnesota.

It was concluded there would not be a cumulative effect to the environment from an increase in SO_2 and NOx emissions from the Proposed Project as the increases would be offset by planned reductions in the state. The statewide reductions keep annual emissions below the acid rain rule limit. Furthermore, ecosystems have sufficient buffering capacity to assimilate an increase in acid rain, if it were to happen.

The change between the No Action Alternative to the East Stockpile Alternative is the same as the change between the No Action Alternative to the Proposed Project.

5.12.3 Mitigation Opportunities

Based on the previous work by the state of Minnesota to assess aquatic and terrestrial ecosystems and their buffering capacity against acid deposition impacts, the estimated contributions from in-state versus out-of-state emission sources, and emissions trends on a state and national level, the cumulative potential emissions from the proposed projects would not have the potential to cause or significantly contribute to ecosystem acidification. Due to anticipated future emission reductions, the risk of ecosystem acidification is likely to continue to decline. Therefore, no additional mitigation strategies are identified for the Proposed Project to address ecosystem acidification.

5.13 RISK ASSESSMENT

5.13.1 Human Health

5.13.1.1 Introduction

This section presents findings from the EIS-related studies that investigated potential impacts to human health from a cumulative perspective. These human health studies include:

- HHSRA results for the Post-Project Total Facility (i.e., if the project were to proceed, results for the existing facility plus the Proposed Project after project implementation),
- Results from the Cumulative Air Emissions Risk Analysis following the MPCA guidance,
- Study of lead exposure from facility emissions,
- Swan Lake drinking water analysis.

Post-Project Total Facility results reflect a multi-pathway analysis of operation of the Proposed Project (along with the existing facility) after 25 years of operation, including mobile and stationary sources. For more discussion of sources and emissions assessed see Section 4.9.8.

In human health risk assessment, “cumulative” may be defined differently dependent on the analysis (multi-pathway, multi-source, multi-chemical, etc.) and therefore the nature of “cumulative” is described for each study presented in this section. Each “cumulative study” was scoped based on the question posed and the data that were available. The Post-Project Total Facility results are cumulative in that they are multi-pathway and include both the existing and proposed facility. Risk estimations from the analysis in Section 4.9.8 from both the existing facility (without the Proposed Project) and the Proposed Project alone were combined and are discussed in this section of Chapter 5.

The FSDD further requires that the HHSRA be supplemented by a cumulative effects analysis describing how nearby projects may interact in such a way as to cause cumulative potential effects. For this reason a cumulative air emissions risk analysis was conducted. The Cumulative Air Emissions Risk Analysis was cumulative in that the study includes the Post-Project Total Facility inhalation risk results and estimated inhalation risks from background measurements of air toxics concentrations. The cumulative analysis for air emissions followed the MPCA Guidance for Cumulative Air Emissions Risk Analyses which is for the inhalation pathway only, due to general limitations in specific local background data from other pathways (e.g. bread basket surveys for ingestion, biomonitoring, etc.).

The FSDD also requires an analysis of potential incremental changes in Swan Lake water chemistry associated with the estimated pollutant contributions from the Essar Steel Project and the Proposed Project. This study is “cumulative” in that it includes multiple sources. The potential change in water quality is to be evaluated by comparing estimated chemical concentrations to respective available water quality standards and ecological benchmark concentrations. The Swan Lake analysis addresses potential impacts from tailings basin discharge/seepage and from atmospheric deposition.

The Cumulative Effects Chapter of this FEIS, include mercury exposure through fish ingestion and lead exposure through ingestion of soil, diet, and drinking water. Both of these studies were assessed in the FEIS through a multi-pathway HHSRA. Results from the analysis of lead emissions are included in this chapter under 5.13.1.3.4. Potential mercury impacts from fish consumption in local lakes were also assessed. Refer to Sections 4.9.7 and 5.13.2 for additional detail on mercury and fish consumption analyses. The Minnesota Mercury Risk Estimation Method (MMREM) was used.

Two levels of fish consumption were considered; a recreational level of approximately 0.4 lbs/week and a higher level of consumption of approximately 3 lbs/week. Tribal representatives have suggested a higher level (a value of roughly 3.5 lbs/week). Such a change would affect results linearly for each lake assessed – increasing results by approximately 13 percent. A discussion of potential impacts from amphibole fibers is included in this FEIS in Section 4.9.8.

This section addresses human health. For a discussion regarding the cumulative effects on other species (non-human) the reader is directed to the Ecological Risk Assessment Section 5.13.2.

The discussion and results presented in this section are based on the HHSRA (Barr, 2009M) and HHSRA Addendum (Barr, 2009L). Please refer to those documents for a more detailed discussion of the analysis. Updates to these documents are also cited in Chapter 8.0 – References and include: Supplemental analysis to the February 2009 HHSRA: *Modeling of final permitted NOx emission rates and updated acute inhalation risks at the property boundary and for the alternative waste rock stockpile location and snowmobile trail, Updated PM_{10} and $PM_{2.5}$ results for Class II Report and Stockpiles Alternative Analysis* (Barr, 2010F), and *Response to Questions for NO_2 Review for the EIS Workshop*. Please refer to those documents for additional detail and analysis.

5.13.1.2 Methodology

5.13.1.2.1 Methodology - HHSRA General

A multi-pathway HHSRA was conducted and inhalation and ingestion exposures were considered including bioaccumulation. Standard risk assessment protocols were used and toxicity values were derived from an MDH/MPCA approved hierarchy of sources. One may review the HHSRA (Barr, 2009M), HHSRA Addendum (Barr, 2009L) and updates for detail. Emissions from Keetac's mining, processing, and mobile sources were included in the assessment and generally consist of particulate, particulate-bound, semi-volatile and volatile (gaseous) emissions.

The HHSRA for the Proposed Project and existing facility are discussed in Section 4.9.8. Illustration 4-4 represents the multi-pathway approach to the analysis. Additional information related to the HHSRA can be found in Appendix G and includes the results for specific locations, quantitative results and ingestion rates. Table 4.9.21 lists the pollutants assessed in the analysis. The location of the receptors (i.e. locations where risks were calculated) is illustrated in Figure 4.9.8.1.

Multiple exposure scenarios were considered (resident, farmer, fisher). Section 4.9.8 and Appendix G provide additional information on these exposure scenarios and exposure levels. A maximum exposure scenario (the Maximum Exposed Individual or MEI) was analyzed that assumes an individual lives at the location of maximum impact for 70 years. This individual inhales outdoor air all day, and eats produce grown from this location. A lesser exposure scenario was also analyzed (the Modified Central Tendency Exposure or MCTE). For more information on MEI and MCTE exposure scenarios refer to Section 4.9.8 and Appendix G.

The risk assessment examines the following types of potential effects on human health:

- Acute, this is a short-term (1-hr) exposure with results expressed by a hazard index (HI)
- Chronic, this is a long term exposure (years -lifetime). Chronic effects are further categorized as:
  - Non-Cancer – results are also expressed by a HI
  - Cancer – Because the assumed relationship between dose and likelihood of cancer is distinct from that of non-cancer endpoints, the results are expressed as the potential additional risk of developing cancer over a lifetime (a number [1, 2, …] per 100,000). A result of 1 in 100,000 for example refers to an upper-bound probability that one individual in a population of one hundred thousand could develop cancer as a result of exposures over a lifetime.

Within each health endpoint (acute, chronic non-cancer, chronic cancer) results are assumed to be additive by pollutant unless otherwise noted.

In Minnesota, a non-cancer hazard index value of 1.0 and an additional lifetime cancer risk of 1 in 100,000 are used as guidelines for interpreting the results of a human health risk assessment. For example, if a project resulted in an HI of less than or equal to 1.0 and an additional lifetime cancer risk of less than or equal to 1 in 100,000 it would be considered not to have the potential for significant adverse health effects for susceptible populations. When risk estimates are above risk guidelines adverse impacts cannot be ruled out and therefore these screening level results require further investigation.

These guidelines have been established to be protective of public health and are viewed only as guidelines, rather than a definitive value with distinct limits. Note that cancer risk estimates should not be considered valid beyond 1 significant digit – for example, a value of 1.2 in 100,000 is not significantly different from 1 in 100,000. Two significant digits are reported here in some cases in order to provide transparency in the presentation of results. The reader is reminded not to judge results based on additional significant digits. Note also that these guidelines were developed for management of risks from individual facilities. No similar guidelines currently exist for cumulative effects.

5.13.1.2.2 Cumulative Air Emissions Risk Analysis

MPCA issued a draft memorandum dated August 21, 2008 (MPCA, 2008A) that specified that air emissions from the following should be considered in the cumulative air emissions risk assessment. The following summarizes what aspects were considered:

- Regional background
- Nearby area sources (i.e., small point sources – household and commercial level)
- Nearby mobile sources (i.e., traffic from nearby roads/highways, etc.)
- Nearby facilities (i.e., large point sources, industrial, proposed or existing)

The MPCA screened the following nearby facilities (existing or proposed) for inclusion in the cumulative air emissions risk analysis. In the screening exercise the MPCA assessed facilities for proximity to the Proposed Project, level of risk, if a past risk assessment was conducted and their location with respect to prevailing wind direction.

MPCA has conducted air toxics monitoring and analyses in Virginia, Hibbing, and Cloquet, Minnesota, but has not conducted air toxics monitoring in Keewatin, Minnesota or other similar sites. The MPCA concluded that the following facilities did not need to be explicitly included in the cumulative HHSRA for the reason noted below:

- Mesaba-Excelsior Energy – distance is too great from the Proposed Project
- Essar Steel (previously Minnesota Steel) – distance in combination with level of risk
- Hibbing Taconite – lack of dispersion modeling data and use of natural gas fuel
- Laurentian Power – Hibbing – low level of risk

The data sets used for the cumulative air emissions risk analysis are from MPCA's ambient air monitoring for air toxic pollutants. This data are for the inhalation pathway only, therefore, the MPCA data and the project analysis data *are only additive for the inhalation pathway* (i.e., only one pathway of the multi-pathway risk assessment). The MPCA specified use of the following as background inhalation risk estimates for the cumulative assessment (MPCA, 2008A):

- Acute Hazard Index (HI) – 0.6
- Chronic Cancer Additional Lifetime Cancer Risk – 5 in 100,000
- Chronic Non-Cancer HI – 1.3

These background inhalation risk estimates are based on the estimated 95 percent upper confidence limit of the mean for data collected from ambient air monitoring sites in Hibbing, Virginia and Cloquet. The MPCA's approach to cumulative air emission risk is discussed in the August 21, 2008 memo (MPCA, 2008H):

> *The ambient air monitors chosen for this cumulative risk assessment are located in larger cities (Virginia population 9,157, and Hibbing population 17, 071), while the residents with the greatest potential impact from the Keewatin Taconite are located in small town (e.g., Keewatin, population 1,164) or rural settings (e.g., along Kelly Lake). For this reason, air concentrations of pollutants monitored at these sites will potentially be higher than more rural or less impacted (traffic, point sources or area sources) sites such as those closer to the Keewatin Taconite facility. The two cities surrounding the ambient monitors are similar to the town of Keewatin in that the surrounding emission sources include mining related sources and coal fired emission sources. These monitored pollutant concentrations, therefore, are a best estimate of finely dispersed air emissions from the existing Keewatin Taconite facility at the location of the hypothetical risk receptors of interest within Keewatin or along Kelly Lake* (MPCA, 2008H).

5.13.1.3 Environmental Consequences

5.13.1.3.1 Acute Results

Post-Project Total Facility

The acute (1-hr) non-cancer results are generally assumed to be additive by pollutant. As a refinement these results may be separated according to the body system potentially impacted (e.g., respiratory, reproductive, eyes). Only the risk result for the respiratory endpoint exceeds the guideline value of 1.0. This result is for an acute, 1-hour exposure at the point of maximum air concentrations. For all other endpoints (i.e., reproductive, eyes, skin contact), the respective HI value is less than 1.0.

The acute results for the respiratory endpoint, when assuming that natural gas alone will be used to fire both the new pellet furnace and the existing pellet furnace at maximum hourly ore throughput, could be as high as 2.7. The risk driver pollutant is NO_2. When using other fuel mixtures such as natural gas and coal for the existing furnace or natural gas and biomass for the new furnace, the estimated upper bound of the acute respiratory hazard index could be as high as 1.6. See Section 3.3.5.1.2 for a description of fuel combustion scenarios.

As discussed in Section 4, the acute hazard quotient assumes a high percent of the total NOx is emitted as NO_2 (the health indicator in NO_x). The EPA approved a refinement for the Class II modeling of hourly NO_2, that if used for this assessment would lower this reported value to between 1.3 and 1.5. This refinement assumed the combustion of 100% natural gas, but includes a more realistic, yet still health-protective, assumption for the portion of NOx that is NO_2 (the health indicator for NOx).

Cumulative Air Emission Risk Analysis

The acute (1-hr) results are separated by toxic endpoints, and within each endpoint results are assumed to be additive by pollutant. The acute, respiratory endpoint HI background value is 0.5. Adding this to the Post-Project Total Facility natural gas alone scenario results in an HI of 3.2 (2.7+0.5). Adding it to the other fuel mixtures results in an HI of 2.1(1.6+0.5). Adding background data for other toxic endpoints results in cumulative HIs less than 1.0 (the highest being 0.7). Similar to earlier discussions, these acute NO_2 hazard quotients for the Post-Project Total Facility use a high assumption for the portion of NOx that is NO_2 (the health indicator for NOx). If the same assumptions used in the Class II modeling protocol were used for the risk analysis, the cumulative respiratory hazard indices discussed above would be 1.0 (fuel mixture) – 2.0 (100% natural gas).

As discussed previously, the background data set is from a combination of available MPCA monitoring sites in Hibbing (carbonyls and volatile organic chemicals), Virginia, (metals) and Cloquet (NO_2), Minnesota. Background data sets from more remote iron range sites (i.e., sites more like Keewatin) were not available. It is not known what level of impact the existing facility has on local background data. Therefore, caution should be used in adding Post-Project Total Facility results to background values.

The existing facility constitutes approximately 79 percent of the Post-Project Total Facility total HI of 2.7 (2.0 of 2.7, see Section 4.9.8.2.1). The Proposed Project could add up to 30 percent of the total HI (0.7 of 2.7, see Section 4.9.8.2.1). Mitigation is being proposed for this potential impact and is discussed later in this section. Additional information related to the HHSRA results can be found in Appendix G.

5.13.1.3.2 Chronic Non-Cancer Results

Post-Project Total Facility

Chronic non-cancer HI results are less than 1.0 in all cases with a maximum HI result of 0.5.

Cumulative Air Emissions Risk Analysis

Chronic non-cancer inhalation risks were also calculated from background air monitoring data from the MPCA. Estimated risks from that data indicate a background HI inhalation maximum of 0.7 for a respiratory endpoint. Post-Project Total Facility risk results, in combination with background inhalation, are less than 1.0 in all cases. As mentioned in the acute results, caution should be used in adding Post-Project Total Facility risk estimates to background risk estimates since the contribution to background of the existing facility is unknown.

5.13.1.3.3 Chronic Cancer Results

Post-Project Total Facility

For the pollutants, the Post-Project Total Facility chronic cancer risk results for the existing permitted facility for the maximum exposure scenario are greater than 1 in 100,000. The results are discussed further below. The results represent an upper bound estimate, actual risks are likely to be lower.

Post-Project Total Facility - Farmer

Available information for the Keewatin area indicates that there are no farms in the area currently that match the farmer exposure scenario. Therefore, the assessment of farmer exposure is theoretical and provided for screening purposes.

The maximum exposure scenario for the hypothetical farmer has a result of 3 in 100,000 which occurs in the Kelly Lake area. Using a lesser exposure scenario (MCTE), the result drops to 0.08 in 100,000 at the same location.

Results at two other hypothetical farm receptors are also greater than 1 in 100,000. One hypothetical farmer location east of the tailings basin boundary has a result of 1.75 in 100,000 for the maximum exposure scenario. This result drops to 0.06 in 100,000 using a lesser exposure scenario (MCTE). A second hypothetical farmer location, north of the processing facility boundary has a result of 1.1 in 100,000 for the maximum exposure scenario. Results for this location drop to 0.04 in 100,000 using a lesser exposure scenario (MCTE).

The exposure pathways which contribute the most to these results are milk and beef consumption. The pollutants which contribute most are dioxins and poly-aromatic hydrocarbons (PAHs). As discussed previously here and in Section 4.9.8, the farmer exposure pathway assumes livestock is home grown and fed home grown feed.

Post-Project Total Facility - Fisher

The maximum exposure scenario for a hypothetical fisher scenario (approximately 3 lbs/week) along Kelly Lake has a result of 2 in 100,000 (at 3.5 lbs/week, the result would be 2.3 per 100,000). Using a lesser exposure scenario (approximately 0.6 lbs/week, MCTE) the result drops to 0.03 in 100,000 at the same location. All other locations have results less than 1 in 100,000. The pollutants most contributing to these results are dioxins, PAHs and arsenic.

Post-Project Total Facility - Resident

The maximum exposure scenario for a hypothetical resident, with a recreational level of fish consumption, has a maximum result of 1.5 in 100,000. This occurs in the Welcome Lake area. This value drops to 0.06 in 100,000 when using a lesser exposure scenario (MCTE). The next highest residential result is 1.2 in 100,000 for a resident located along the southeastern processing facility boundary. Another location on the north tailings basin boundary has a result of 0.99 in 100,000. The exposure pathways contributing most to these results are from produce consumption and inhalation. The pollutants contributing the most to the result are arsenic and dioxins.

Cumulative Air Emissions Risk Analysis

As noted previously, data used for the cumulative air emissions risk analysis is from MPCA ambient air monitoring. These ambient air monitoring data are for the inhalation pathway only, therefore, the MPCA data and the project analysis data *are only additive for the inhalation pathway* (i.e., only one pathway of the multi-pathway analysis).

The background monitoring data results in an estimation of inhalation cancer risk of 5 in 100,000. The background data used was measured in Hibbing, Cloquet and Virginia. Only a subset of the Post-Project Total Facility results are additive to this inhalation value giving a combined result of 5.5 in 100,000.

5.13.1.3.4 Lead

The HHSRA for the Keetac Expansion Project included an analysis of health risks from lead exposures (Barr 2009M). This analysis was based on standard risk assessment methods and practices designed to be protective of public health, including susceptible populations (i.e., children).

The HHSRA analysis employed a USEPA model (the IEUBK model) to estimate incremental increases in childhood blood lead levels resulting from hypothetical lead exposures (i.e., from the maximum predicted lead concentration in air for the Post-Project Total Facility) and potential resulting exposures to lead in other environmental media (i.e., soil, house dust, diet, drinking water, and maternal cord blood).

The results of the IEUBK analysis showed that the potential incremental blood lead concentration (geometric mean) for children (ages 0.5 to 7 years) ranged from 0.6 to 0.8 micrograms per deciliter (ug/dl). Because of the health protective assumptions used to conduct this analysis, the actual incremental increases in blood lead concentrations are likely to be lower than predicted.

Currently, there are no federal or state guidelines for a safe level of lead in blood. The US Centers for Disease Control and Prevention (CDC) has established a guideline of 10 ug/dl of lead in blood for children. This guideline is the lead level at which CDC recommends further action to reduce lead exposures (i.e., evaluation of lead exposures from paint and other sources at home).

The Minnesota Department of Health (MDH) evaluated 2008 blood lead surveillance data for St. Louis and Itasca Counties (MDH, 2009)]. These data indicate that the percentages of children tested with blood lead levels above 10 ug/dl of blood (i.e., CDC guideline) are 1.5 percent for St. Louis County, and 1.0 percent for Itasca County. These rates are similar to the statewide percentage (1.0 percent) for children tested in Minnesota in 2008.

Permit conditions for the Proposed Project will require use of emissions control technology that is designed to capture small particles and the pollutants that are bound to them (e.g. metals such as lead), as well as gaseous pollutants also of potential health concern. For more information about emissions controls, see Section 4.9.3.

Prudent public health practice is to prevent or reduce lead exposures to the extent possible. Federal and state measures implemented since the 1970s have substantially reduced blood lead levels in the US. This decline is attributed primarily to the removal of lead in gasoline. For tips and additional information about how to reduce lead exposures, see the MDH blood lead poisoning prevention web site: http://www.health.state.mn.us/divs/eh/lead/index.html.

5.13.1.3.5 Swan Lake Drinking Water Analysis

A drinking water analysis was conducted to determine the effect of the Proposed Project on chemical concentrations in Swan Lake due to air emissions and potential tailings basin discharge water. This analysis assumes that Swan Lake would be a source of drinking water for an individual for a period of 70 years. There is no information available indicating that Swan Lake is used as a drinking water source.

In this analysis, seepage out of the tailings basin and its potential contribution to Swan Lake was estimated along with atmospheric deposition of chemicals included in the HHSRA. Incremental (i.e., project alone) and Post-Project Total Facility analyses. Results show potential impacts below drinking water standards and low potential incremental impacts from the project.

5.13.1.3.6 Summary of Results – Post-Project Total Facility and Cumulative

- Acute inhalation results indicate levels could be above guidelines. Conditions necessary for this to occur are firing both indurating furnaces with natural gas and operation at 100 percent capacity in all combustion units simultaneously in combination with worst-case meteorological conditions.
- Chronic non-cancer cumulative results are below guidelines.
- Existing background cancer risk is above guidelines. This is similar to other statewide results (MPCA, 2005). The extent of additive assumptions is uncertain, as some level of operation of the existing facility is likely represented by background data.
- Additional lead emissions reflect results below guideline levels.
- Analysis of potential use of Swan Lake as a drinking water source shows that Swan Lake meets drinking water criteria with low potential incremental impacts from the project.

The following determinations are based on the results of the cumulative air emissions risk analysis, and an "adverse effect" was determined based on an estimated increase with the Proposed Project. The "significance" determination is based on a comparison between the risk estimate and the risk comparison values discussed in the methodology section for the HHSRA. These risk comparison values (non-cancer: 1 and cancer: 1 in 100,000) are generally accepted for use in developing facility-specific risk estimates. These determinations include:

- Acute results: there would be a greater potential for a cumulative adverse effect to human health. Worst-case scenario modeling results indicate risks are above human health risk guidelines, and therefore there is a potential that the adverse effect may be significant.

- Chronic non-cancer results: there would be a greater potential for a cumulative adverse effect to human health. The potential effect could be less than significant as the HI is below 1.0 in all cases. The human health risk level is potentially significant as existing background cancer risk is above guidelines.

- Lead results: there would be a greater potential for a cumulative adverse effect to human health from lead. This risk estimate could be less than significant as modeling results are below guideline levels, although there is not an agreed upon threshold for lead exposure.

Drinking water results: there would be a greater potential for cumulative adverse effect to human health for drinking water from Swan Lake. This effect could be less than significant as drinking water criteria are met, and the magnitude of the cumulative effect is small.

5.13.1.3.7 Risk Assessment Uncertainties

Risk assessments include uncertainties at all levels of the analysis – emission rates, emission parameters (i.e., location, height, velocity, etc.), toxicity, additive effects, exposure (i.e., inhalation and ingestion rates), etc. Each of these uncertainties could result in an over or under-estimate of the results. In general risk assessment methods are established to be health protective. In any risk assessment analysis, there are likely to be uncertainties that are unique to that analysis and may greatly influence results. Some of the uncertainties that might impact this risk assessment are listed below.

- There is uncertainty in the consumption rates of the population surrounding the Proposed Project and how long they may be at locations of maximal air concentrations. The maximal exposure assumptions result in over estimations of risk (exposure to maximal air concentrations for 24 hours/day, 365 days per year and a 70 year lifetime, high food consumption rates, etc.).

- The assumption that metals were 100 percent bio-available: The HHSRA assumes that exposure to a particular metal occurs in such a way that 100 percent of the metal can be taken into the body (metabolized). In this analysis, this assumption has the largest affect on arsenic. Metals may or may not be in a chemical form that can be taken up by the human body. This assumption results in an overestimation of risk.

- There is uncertainty as to the toxicity data used for the dioxin/furan group of substances. The toxicity values used for dioxin/furan as part of this analysis were developed by MDH and are referred to as 'provisional'. MDH suggests that using the provisional values is appropriate. Use of the provisional values tends to increase results. Alternative values are available from California Environmental Protection Agency, Office of Environmental Health Hazard Assessment.

- There is uncertainty as to the toxicity data used for arsenic. There is a newer inhalation toxicity value available for Arsenic that is based on more recent data and more studies overall, and would result in a lower estimate of risks but has not undergone state agency review and therefore was not used in this analysis.

- For the cumulative air emissions risk analysis only inhalation pathway background data are available. Background ingestion risk data are generally not available due to limitations on the ability to monitor at multiple locations for multiple pollutants with varying monitoring methods.

- Dioxins and PAHs are semi-volatile gases that are likely to condense onto particles soon after being emitted into the air. Arsenic is a particulate emission. Sources of these emissions are mobile sources (dioxins and PAHs) and the indurating furnaces (dioxins and arsenic). Dioxins/furans are semi-volatile, highly hydrophobic compounds. Shortly after formation during combustion, they are likely to adsorb onto existing particles or condense into particles along with other emissions. The distance they travel (their behavior in the air) is related to the particle size with which they are associated. Available models do not fully account for the physical/chemical behavior of these pollutants.

- There is uncertainty in the estimation of risk for diesel particulate matter (dpm) emissions stemming from emissions estimates and toxicity values. In this analysis, risks from dpm were estimated for the specific individual pollutants potentially on diesel particulates (e.g. PAHs, dioxins/furans, arsenic, etc.). Another manner of estimating risks for dpm is the estimation of risks based on emissions and toxicity values for dpm as a mixture. This uncertainty can result in an under or overestimation of risks.

- For the screening level acute hazard index modeling, 75 percent of the NOx was assumed to be NO_2. This assumption likely overestimates the ratio of NO_2/NOx by approximately 0.5.

Overall, the analysis was based on standard risk assessment methods and assumptions, all of which were designed to be protective of public health.

5.13.1.4 Mitigation

An air emission permit will need to be issued authorizing the project if it is to proceed. That permit can be used to establish various operating limits and technology requirements (air pollution controls, designs to minimize pollution, etc.). Mitigation needed for environmental impacts identified in the EIS may be included in that permit (or other permits as appropriate for the impact needing mitigation).

In this case, mitigation is proposed for acute 1-hr results. Mitigation for NO_x impacts on visibility is discussed in Section 4.9.5.4. Mitigation affecting NO_x to address visibility would also affect this analysis. See 4.9.5.4 for a discussion of visibility mitigation options.

5.13.2 Ecological Risk Assessment

A Screening-Level Ecological Risk Assessment (SLERA) was conducted for the Proposed Project. The purpose of the SLERA is to provide an understanding of the potential upper bound of ecological risks related to air emissions and tailings basin discharge from the Proposed Project to Swan Lake. In addition, the SLERA evaluated cumulative contributions to Swan Lake from the proposed Essar Steel project and the Post-Project Total Facility (existing Keetac facility and the Proposed Project).

The SLERA addressed the potential ecological risks associated with 1) chemical contributions to soil, surface waters, and sediment resulting from potential air emissions from the Post-Project Total Facility, 2) chemical contributions to Swan Lake surface waters and sediment from tailings basin direct discharges plus deposition related to air emissions from the Post-Project Total Facility, and 3) cumulative effects to Swan Lake surface water from the proposed Essar Steel project and from the Post-Project Total Facility.

> When considering all substantial potential pathways (soil exposure, surface water exposure, and sediment exposure) for assessing the potential for ecological effects, emission sources from the Proposed Project do not pose a risk to ecological receptors above the USEPA guidelines for screening level risk assessments.

5.13.2.1 Overview of Methodology

The ecological risk assessment process is based on two major elements: characterization of potential exposure, and characterization of effects. These two elements provide the focus for conducting the three phases of risk assessment: problem formulation, analysis, and risk characterization.

Chemicals potentially emitted from the Proposed Project to the atmosphere may be deposited on soil and surface water, where they may transfer to sediments. Additionally, chemicals may be released from tailings basin discharge. Once deposited or discharged, these chemicals may come into contact with ecological receptors. To assess ecological impacts, the receptors evaluated in the SLERA, to assess ecological impacts, were the potential exposure to soil, surface water, and sediment pathways.

The SLERA considered the impacts of emissions and discharges from the Proposed Project or the Post-Project Total Facility on more than 500 sites/receptors from three exposure pathways. The Chemicals of Interest (COI) were those that the emissions could be quantitatively estimated, considered persistent or capable of bioaccumulation, and that had ecological benchmarks.

Estimates of emission dispersion, transport, and deposition were performed using AERMOD and IRAP, and the resulting exposure concentrations in the water, sediment, and soil were estimated by IRAP. The estimated exposure concentrations for a given COI in a given medium were divided by the most conservative applicable ecological benchmark or Toxicity Reference Value (TRV) that was available to derive an Ecological Screening Quotient (ESQ). The ESQs for chemicals, regardless of chemical, toxic endpoint, species affected, or type of effect, were then summed in a given medium to give a total ESQ. Risk was then characterized based on the total ESQ. If the total ESQ does not exceed 1.0, it is unlikely that adverse ecological effects would occur. For total ESQs greater than 1.0, risk is related to the magnitude of the exceedance. USEPA guidelines characterize the potential for screening level ecological risk as negligible for total ESQ values between 1 and 10, as marginal for total ESQ values between 10 and 100, and as significant for total ESQ values greater than 100.

5.13.2.2 Chemicals of Potential Interest (COPI) and Emissions

A number of potential sources of air emissions are associated with the Proposed Project. These can generally be divided into fugitive dusts from mining sources (mining and ore crushing) and processing sources (concentrator, pelletizer, balling drums, indurating furnace, and pellet handling and storage), and emissions from mobile diesel sources. The SLERA identified chemicals potentially emitted by these processes that could cause adverse ecological effects. Ultimately, 107 COPI were identified. The COPI list was evaluated to determine which chemicals had sufficient data to enable estimation of their emission rates and which had TRVs for the specific pathways under consideration. If those data were not available for a chemical, it was removed from consideration, because risk associated with that chemical could not be accurately estimated. Seventy-six of the original 107 COPI met these criteria and were further evaluated as COI. Fifty-four of the COI had existing parameters in IRAP; the remaining 21 COI and their necessary parameters were entered into the IRAP database. The one remaining chemical, calcium compounds, was evaluated solely based on tailings basin contributions to Swan Lake; data for calcium were not input to IRAP. The COPI list is provided in Table 5.13.1 and the COI list is provided in Table 5.13.2.

TABLE 5.13.1 LIST OF CHEMICALS OF POTENTIAL INTEREST (COPI)[1]

2-Chloroacetophenone	Cyanide	Pentane
5-Methyl chrysene	Dibenzo(a,h)anthracene	Phenanthrene
Acenaphthene	Dichlorobenzenes	Phenol
Acenaphthylene	Dichloroethane, 1,2- (Ethylene Dichloride)	Phosphorous Compounds
Acetaldehyde	Dimethyl Sulfate	Polycyclic Organic Material (POM)
Acetophenone	Dimethylbenzo(a)anthracene, 7,12	Potassium Compounds
Acrolein	Dinitrotoluene, 2,4	Propane
Aluminum Compounds	Dioxins/furans (as TetraCDD, 2,3,7,8-equivalents)	Propionaldehyde
Anthracene	Ethane	Propylene
Antimony Compounds	Ethylbenzene	Pyrene
Arsenic Compounds	Ethylene Dibromide	Selenium Compounds
Barium Compounds	Ethylhexyl phthalate, bis-2	Silver Compounds
Benzo(a)anthracene	Fluoranthene	Sodium Compounds
Benzene	Fluorene	Strontium Compounds
Benzo(a)pyrene	Flourine, Flourides	Styrene
Benzo(b)fluoranthene	Formaldehyde	Sulfur Compounds
Benzo[g,h,i]perylene	Hexane, N	Sulfuric Acid
Benzo(k)fluoranthene	Hydrogen chloride	Tetrachloroethylene (Perchloroethylene)
Benzyl chloride	Hydrogen Cyanide	Thallium (l)
Beryllium	Hydrogen Fluoride	Tin Compounds
Biphenyl	Indeno(1,2,3-cd) pyrene	Titanium Compounds
Boron Compounds	Iron Compounds	Toluene
Bromoform (Tribromomethane)	Isophorone	Trichloroethane
Butadiene, 1,3	Lead Compounds	Vanadium Compounds
Butane	Magnesium Compounds	Vinyl Acetate
Cadmium Compounds	Manganese Compounds	Xylene, Mixture
Calcium Compounds	Mercury Compounds	Zinc Compounds
Carbon disulfide	Methyl bromide (Bromomethane)	
Chloride Salts	Methyl chloride (Chloromethane)	
Chlorine, Chlorides	Methyl ethyl ketone (2-Butanone)	
Chlorobenzene	Methyl Hydrazine	
Chloroethane	Methyl Methacrylate	
Chloroform (Trichloromethane)	Methyl tert butyl ether	
Chromium, hexavalent	Methylcholanthrene, 3	
Chromium, trivalent	Methylene chloride	
Chrysene	Molybdenum Compounds	
Cobalt Compounds	Naphthalene	
Copper Compounds	Naphthalene, 2-Methyl	
Crystalline Silica	Nickel Compounds	
Cumene (Isopropylbenzene)	NOx as NO_2	

Source: SLERA, Revised May 2009
[1]Count 107 chemicals

TABLE 5.13.2 LIST OF CHEMICALS OF INTEREST (COI)

Chemical	Data originally in IRAP	Data Added To IRAP	Ecological Toxicity Value Available (Blank indicates no toxicity value)		
			Water	Soil	Sediment
Acenaphthene	X		X	X	X
Acenaphthylene		X	X	X	
Acetophenone	X			X	
Acrolein	X		X	X	X
Aluminum compounds		X	X	X	
Anthracene	X		X	X	X
Antimony compounds	X		X	X	X
Arsenic compounds	X		X	X	X
Barium compounds	X		X	X	
Benzene	X		X	X	X
Benz(a)anthracene	X		X	X	X
Benzo(a)pyrene	X		X	X	X
Benzo(b)fluoranthene	X		X	X	X
Benzo(k)fluoranthene	X			X	X
Benzo(g,h,i)perylene		X	X	X	
Beryllium compounds	X		X	X	
Boron compounds		X	X	X	
Bromoform	X		X	X	X
Bromomethane	X		X	X	X
Cadmium compounds	X		X	X	X
Calcium compounds			X		
Carbon disulfide	X		X	X	X
Chloride		X	X		
Chlorobenzene	X		X	X	X
Chloroform	X		X	X	X
Chloromethane	X		X	X	
Chromium total [1]	X		X	X	X
Chromium (VI)	X		X	X	
Chrysene	X		X	X	X
Cobalt compounds		X	X	X	
Copper compounds		X	X	X	
Cumene	X		X		
Cyanide	X		X	X	X
Dibenzo(a,h)anthracene	X		X	X	X
Dichlorobenzene, 1,2-	X		X	X	X
Dimethylbenz(a)anthracene, 7,12-		X	X	X	X
Dinitrotoluene, 2,4-	X		X	X	X
Ethylbenzene	X		X	X	X
Fluoranthene	X		X	X	X
Fluorene	X		X	X	X
Fluorine, Fluorides		X	X	X	
Formaldehyde	X			X	
Hexane		X	X		X
Iron compounds [2]		X	X	X	
Isophorone	X		X	X	X

Chemical	Data originally in IRAP	Data Added To IRAP	Ecological Toxicity Value Available (Blank indicates no toxicity value)		
			Water	Soil	Sediment
Lead compounds	X		X	X	X
Magnesium	X		X		
Manganese compounds [3]		X	X	X	
Methyl mercury	X		X	X	X
Methylnapthalene, 2-		X	X	X	
Mercury (elemental)	X		X		
Methyl ethyl ketone	X		X	X	X
Methyl tert-Butyl Ether (MTBE)		X	X	X	
Methyl methacrylate		X	X	X	X
Molybdenum compounds		X	X	X	
Naphthalene	X		X	X	X
Nickel compounds	X		X	X	X
Phenanthrene	X		X	X	X
Phenol	X		X	X	X
Pyrene	X		X	X	X
Selenium compounds	X		X	X	
Silver compounds	X		X	X	X
Sodium compounds		X	X		
Strontium compounds		X	X		
Styrene	X		X	X	X
TCDD, 2,3,7,8- equivalents	X		X	X	X
Tetrachloroethylene	X		X	X	X
Thallium	X		X	X	
Tin compounds		X	X	X	
Titanium compounds [4]	X			X	
Toluene	X		X	X	X
Trichloroethane, 1,1,1-	X		X	X	X
Vanadium compounds		X	X	X	
Vinyl acetate	X		X	X	X
Xylene		X	X	X	X
Zinc	X		X	X	X

Source: Revised Table 2 for the Eco Risk Report (Prepared by Barr Engineering, July 14, 2009)
[1] Emissions of COPI “Chromium compounds” are included and evaluated as “Chromium total” (chromium III).
[2] Emissions of COPI “Iron II oxide” and “Iron III oxide” are included and evaluated as “Iron compounds”
[3] Emissions of COPI “Manganese dioxide” are included and evaluated as “Manganese compounds”
[4] Emissions of COPI “Titanium dioxide” are included and evaluated as “Titanium compounds”

5.13.2.3 Exposure Assessment

The SLERA characterized the exposure setting in order to more thoroughly identify the ecological receptors that might be impacted by exposure to emissions or discharges from the Proposed Project. This included analyzing the environmental setting and reviewing the ecological classifications and natural resources in that setting, including soils, vegetation, wetlands, wildlife, and state-protected species.

The exposure pathway analysis primarily focuses on chemicals potentially emitted to air from the Proposed Project or for the surface water assessment, from the Post-Project Total Facility, with subsequent deposition of those chemicals to soil, surface water, and sediments. The potential concentrations in soil, surface water, and sediments in the specific locations of interest were estimated based on the procedures of USEPA's Human Health Risk Assessment Protocol (HHRAP), including AERMOD and IRAP.

This approach was used to estimate the deposition of particulate metals and semi-volatile, volatile, and very volatile organic compounds (adhering to particles) to soil, surface water, and sediment receptors to produce estimated environmental concentrations (EECs) at each receptor location. Potential deposition of chemicals emitted to the air from the Post-Project Total Facility were estimated using AERMOD and IRAP for approximately 500 receptor sites located in or within 10 km of the ambient air quality boundary of the facility. Wet and dry deposition was modeled, and the chemical concentrations used to estimate exposure at each receptor site for the maximum concentrations achieved at the end of a 25-year modeling period. All metals were assumed to be 100 percent bioaccessible and bioavailable, which is a conservative assumption, particularly so for metals contained in fugitive dust particles since many of them are only sparingly soluble and have very slow release rates due to slow dissolution of the mineral particle matrix.

Swan Lake was selected to assess the potential environmental risk to surface water and sediment receptors. Swan Lake currently receives approximately 7 percent of its surface water inflow from the tailings basin discharge and seepage associated with the existing Keetac facility. Chemical-specific surface water concentrations would be a function of: 1) direct atmospheric deposition to the lake surface and the amount of chemical reaching the lake after being deposited on the terrestrial watershed from the Post-Project Total Facility, and 2) potential contributions from tailings basin discharge and seepage to Hay Creek and O'Brien Creek, including tailings basin discharge from the proposed Essar Steel project.

Potential fish mercury impacts resulting from atmospheric deposition of mercury to five area lakes (Coons, Horsehead, Kelly, O'Brien, and Swan) were evaluated using both IRAP and the MPCA's MMREM, which models local deposition and the potential change in fish mercury concentrations associated with that deposition. Swan Lake receives tailings basin discharge and seeps from both the Post-Project Total Facility and the proposed Essar Steel project. Increased sulfate concentrations in tailings basin discharge resulting from these two projects may increase sulfate concentrations in Swan Lake. The potential impact of increased sulfate concentrations on mercury methylation processes in Swan Lake and their potential to impact fish mercury concentrations were also qualitatively evaluated in the SLERA. Other lakes in the region do not receive tailings basin discharges, and thus were not analyzed for their impacts. The potential ecological risks for mercury are discussed separately below.

5.13.2.4 Toxicity Assessment

The SLERA identified available toxicity benchmarks for each COI for each exposure medium (soil, surface water, sediment). These benchmarks, referred to as TRVs, are media specific and expressed on a concentration basis (e.g., milligrams of chemical per kilogram of soil). They are used to screen ecological effects to receptors inhabiting soil, surface water, and sediment. TRVs are used by the USEPA to select chemicals for evaluation in an ecological risk assessment.

The SLERA uses conservative ecological benchmarks (TRVs) that are intended to be applied at the screening stage of the assessment. The lowest available TRV was selected and used to estimate potential risks in soils, surface water, and sediment. The ecological benchmarks used in the SLERA are intentionally conservative and thus overestimate potential effects and provide confidence that contaminants that could present an unacceptable risk are not screened out early in the SLERA process. The quantitative risk characterization included all COI for which TRVs were available.

5.13.2.5 Risk Characterization

For ecological risk estimation, an ESQ is calculated as the Estimated Environmental Concentration (EEC; the potential exposure calculated for a chemical at a specific receptor site) divided by the TRV for that specific chemical/exposure pathway combination. If the value of an individual ESQ is less than 1.0, it indicates that the specific chemical is unlikely to cause adverse ecological effects. An individual ESQ higher than 1.0 does not necessarily imply that there will be adverse ecological effects or that the risk is unacceptable. ESQs are not statistical measures of the probability that an adverse effect will occur; they only indicate that the exposure level is below or above the specific chemical toxicity threshold.

Individual ESQs are summed to produce a total ESQ, similar to a Hazard Index (HI) used in human health risk assessments. In screening-level risk analyses, if the total ESQ does not exceed 1.0, it is unlikely that adverse ecological effects would occur. For total ESQs greater than 1.0, risk is related to the magnitude of the exceedance. The potential for screening level ecological risk is characterized as negligible for total ESQ values between 1-10, as marginal for total ESQ values between 10-100, and as significant for total ESQ values greater than 100.

5.13.2.5.1 Soil Exposure Pathway

For the soil exposure pathway, all chemical specific ESQs were below 1.0. Likewise, the HI was also less than 1.0. Based on these results, adverse ecological risks for soil receptors from the Post-Project Total Facility would not be expected.

5.13.2.5.2 Surface Water Exposure Pathway - Swan Lake

For the surface water exposure pathway, all chemical specific ESQs resulting solely from atmospheric deposition were below 1.0. Likewise, the HI based on these ESQs was also less than 1.0. Based on these results, adverse ecological risks for surface water resulting from atmospheric deposition from the Post-Project Total Facility would not be expected.

Tailings basin discharge and seeps from the Post-Project Total Facility and the proposed Essar Steel project may also contribute COI to Swan Lake. [NOTE: Revised Project plans for the Essar Steel project incorporate a 100 percent water re-use concept, thus eliminating tailings basin discharge and seepage from that particular project; however, those discharges previously proposed were modeled in the SLERA for the Proposed Project.] Cumulative COI contributions from all of these sources were evaluated in the SLERA. When the lowest TRVs available for all COI species were used, ESQs for magnesium, boron, iron, copper, and cadmium were all greater than 1.0, and the cumulative HI was 26.1.

The TRVs for magnesium, boron, and copper were evaluated for applicability to conditions in the region surrounding Keetac, and alternative TRVs were selected. These screening level benchmarks represent reasonable alternatives that are more closely matched to some of the specific considerations of the site (magnesium and boron) as well as the current state of toxicological information (boron and copper). When these alternative TRVs were used in the risk calculations, the total ESQ decreased to 4.4. This total ESQ is within a screening range of 1-10, and therefore falls into the “negligible risk” category, generally considered acceptable for potential ecological risks. Given the conservatism in the analysis (particularly with respect to the assumption of 100 percent bioavailability and bioaccessibility of all COI which likely overestimates the actual exposure of ecological receptors to metals) no adverse ecological impacts are expected to occur in surface waters in Swan Lake from the chemicals evaluated in the SLERA.

5.13.2.5.3 Sediment Exposure Pathway - Swan Lake

For the sediment exposure pathway, all chemical specific ESQs were below 1.0. Likewise, the HI based on these ESQs was also less than 1.0. Based on these results, adverse ecological risks for sediments resulting from atmospheric deposition from the Post-Project Total Facility would not be expected.

5.13.2.5.4 Mercury

> Due to the complexity of the sulfate - methylmercury relationship, it is not possible with currently available information to accurately assess the probability of a significant change in fish mercury concentrations resulting from the Proposed Project.

Ecological risks associated with atmospheric deposition of mercury resulting from the Post-Project Total Facility were addressed in the SLERA. MMREM modeling of potential ecological risks resulting solely from atmospheric deposition of mercury to surface water and the watersheds for five Keewatin area lakes (i.e., Coons, Horsehead, Kelly, O'Brien, and Swan) showed that Kelly Lake had the highest potential incremental increase of 0.01 mg/L in background fish mercury concentration under a 30 percent control scenario for the new indurating furnace stacks. This is a potential relative increase of 2 percent (Appendix E, Exhibit 4 SLERA) based on worst-case assumptions. All other lakes had lower predicted relative increases in mercury in fish resulting solely from potential increases in atmospheric deposition.

Tailings basin discharge to Swan Lake is predicted in the SLERA to increase sulfate concentrations from 23 mg/L to about 34 mg/L, an increase of about 46 percent. The Proposed Project is predicted to contribute 7.5 mg/L and the proposed Essar Steel project is predicted to contribute another 3 mg/L of sulfate, if there is a direct discharge from the Essar Steel tailings basin. Sulfate has the potential to enhance mercury methylation processes in surface waters. Because methylmercury has a higher bioaccumulation potential than other common forms of mercury, increases in sulfate could possibly lead to increased mercury concentrations in fish.

Sulfate/Mercury Relationship

The relationship between sulfate concentration and methylmercury concentration in water and fish is complex and non-linear, particularly at higher sulfate concentrations. Increasing sulfate concentrations in aquatic systems does not necessarily produce a linear increase in methylmercury concentrations in water and in fish. Other factors may modify, or decrease the response of the system to increasing sulfate concentrations. These other factors may be limiting the potential methylation rate and could include:

- limited availability of neutral mercury species required for uptake by sulfate-reducing bacteria (Benoit, et al., 2003);
- lack of anoxic conditions for sufficient periods of time to stimulate sulfate-reducing bacteria;

- presence of sufficient nitrate ion to provide an alternate and more energetic electron acceptor (Todorova et al., 2009);
- formation of mercury sulfides and their precipitation in sediments (Benoit et al., 2003);
- limited availability of organic matter of sufficient quality (i.e., readily digestible by microbes) as to limit microbial metabolic activity (Benoit et al., 2003); and
- relatively high potential demethylation rates that reduce the net levels of methylmercury present in the water column (Benoit et al., 2003).

The accumulation of persistent toxins, such as mercury, in organisms is the result of a balance between the rate of intake of the chemical and the rate of depuration. Depuration is a term used to describe the overall ability of an organism to rid itself of a toxin. Depuration may occur through respiration, excretion of toxins in bodily wastes, in eggs, spores, or other reproductive bodies, growth and subsequent loss of hair or feathers, or by other means. Intake may occur through consumption of food or water, respiration, or contact with skin or other parts of the organism. Depuration of mercury by most higher organisms is a slow process. Because the rate of depuration is usually much slower than the rate of intake, the overall body burden is generally closely related to mercury intake.

Ecological risk of a potential impact is based on three components.
1. There must be a stressor (in this case, mercury or methylmercury);
2. There must be a receptor (in this case, an organism) that may potentially suffer adverse ecological effects due to the stressor; and
3. There must be an exposure pathway whereby the receptor organism comes into contact with the stressor. In the case of mercury, the exposure pathway is usually through food.

Mercury is ubiquitous in the environment, and state-of-the-science analytical techniques can measure ultra-trace levels of mercury in virtually every part of every ecosystem. However, most ecosystem components (water, air, soil) have insufficient concentrations of mercury to pose a threat to organisms and thus do not represent a significant exposure pathway. Except for highly contaminated sites, direct exposure through intake of water, through respiration, or through dermal contact is generally negligible because the concentrations in these media are far too low to be of concern.

The main exception is exposure through the aquatic food chain, where mercury concentrations increase in organisms situated at higher levels in the food chain, with the highest values generally observed in top predator organisms. This process, called biomagnification, occurs because aquatic food chains are often complex and may have multiple steps or trophic levels. These steps include: primary producers [algae, rooted macrophytes], invertebrate grazers, invertebrate predators, minnows or small fish that eat invertebrate grazers and predators, larger fish that eat minnows, larger predator fish, and top predator fish. There are also multiple trophic levels in the benthic food system as well, each potentially having a higher mercury concentration than the preceding level. Consequently, mercury concentrations in top predator fish can be several thousand to more than a million times higher than total mercury concentrations in water.

Likewise, piscivorous animals (those organisms, including humans, that consume fish as a substantial portion of their diet) may also have a potential risk of exposure to mercury because the concentrations of mercury in the fish in their diets may be sufficiently high as to pose a significant exposure pathway to animals that eat them. Piscivorous animals in the region could include bald eagle, osprey, common loon, heron and egret species, mergansers and other fish-eating duck species, belted kingfishers, mink, fishers, river otters, and others. Mercury levels in these piscivorous species vary depending on both the trophic status of the prey they eat and the relative proportion of their diets constituted by those prey species.

Unlike aquatic ecosystems, terrestrial ecosystems generally have very few trophic levels in the food chain (terrestrial vegetation, grazers or other primary consumers, and possibly one or two levels of predators) and thus have limited potential for biomagnification. Animals or humans consuming terrestrial vegetation or terrestrial animals generally have very low risk of exposure to mercury because the concentrations of mercury in these foods are too low to be of concern. Consequently, nearly all animals that have significant potential risk of exposure to mercury are piscivorous animals.

Mercury Risk Assessment

The MPCA's MMREM approach estimates changes in mercury concentrations in fish resulting from a change in aquatic mercury concentrations based on a "proportionality" concept, wherein the changes in fish concentration are considered to be proportional to changes in aquatic mercury concentrations provided there are no significant changes in the biogeochemical processes involved in mercury methylation or mercury biomagnification processes in the ecosystem of concern.

Mercury exposure risk for piscivorous animals comes almost exclusively from the fish component of their diets; the potential exposure from other parts of their diet is usually negligible. For many piscivorous organisms, fish constitute significantly less than 100 percent of their diet, depending on the availability of other foods and the feeding habits of the particular species or organism. Since their mercury exposure is derived almost exclusively from the fish component of their diets, the potential increase in their mercury levels should be proportional to the potential change in the mercury concentrations in fish multiplied by the fraction of their diet consisting of fish from the lakes of concern.

The MPCA's MMREM approach was used to estimate the potential change in fish concentrations that may result from the Proposed Project for lakes not receiving potential increased sulfate loadings. Estimated potential relative increases in fish mercury concentrations resulting solely from the Proposed Project range from 0.2 percent for Big Sucker Lake to 2.2 percent for Kelly Lake. Consequently, the maximum estimated potential relative increase in mercury levels in piscivorous animals eating fish from the study lakes would also fall in the range of 0.2 percent to 2.2 percent. This approach would be conservative for piscivorous animals whose diet also contains non-fish items (carrion, terrestrial animals, vegetable matter), those that migrate during part of the year, or those that also consume fish obtained from other lakes in the region.

Swan Lake may potentially receive increased sulfate loadings from the Proposed Project and the proposed Essar Steel project. As stated earlier, our current understanding of the complexity of sulfate - methyl mercury relationships is too limited to allow for an accurate assessment of the probability of a significant change in fish mercury concentrations resulting from the Proposed Project. It is possible that an increase in sulfate concentration in Swan Lake waters would have no effect on the methylation of mercury in Swan Lake since concentrations in Swan Lake are already relatively high (23 mg/l) and thus sulfate may not limit the methylation process. If the predicted increase in sulfate concentration does enhance mercury methylation in Swan Lake, it is unlikely that the increase in methyl mercury concentrations in water and mercury concentrations in fish would be a linear function of the increase in sulfate concentration.

Potential increases of mercury concentrations in piscivorous animals whose diet consists solely of fish from Swan Lake would be proportional to the potential increase, if any, in methylmercury concentrations in Swan Lake. Those piscivorous animals whose diet also includes non-fish items, who consume fish obtained from other lakes in the region, or who migrate during part of the year, would have proportionally lower potential exposures and risks.

The one other group of animals and birds that might be potentially at risk to increased exposure to mercury potentially resulting from the Proposed Project are those animals and birds that consume aquatic insects (e.g. mayflies) or other organisms (e.g. frogs) that spend all or part of their lives in aquatic systems. A potential increase in mercury levels in these aquatic insects or other organisms could pose a potential increase in exposure to the birds and animals that prey on them. However, these birds and animals generally experience a lower risk than do piscivorous animals because these insects are lower on the food chain than most fish and thus have lower total mercury concentrations. In addition, these insects and other organisms generally are only available as prey items during a limited part of the year and thus represent a smaller proportion of the overall diet. The potential risk of increased exposure to the birds and animals that prey on them would again be proportional to the relative increase in mercury concentrations in the prey organisms they consume from the study lakes multiplied by the fraction of their total diet that is composed of these insects or other affected prey items.

Although the MMREM model does not directly address mayflies or other aquatic organisms other than fish, the assumption of proportionality behind the MMREM model would predict that all organisms whose life cycle is wholly within the aquatic system receive the same relative potential increase in exposure, an increase proportional to the increase in aquatic mercury levels. The same proportionality arguments would also hold for potential increases in mercury concentration in mayflies or other aquatic organisms in Swan Lake.

Due to the complexity of the sulfate - methylmercury relationship, it is not possible with available information to accurately assess the probability of a significant change in fish mercury concentrations resulting from the Proposed Project. It is possible that an increase in sulfate concentration in Swan Lake waters would have no effect on the methylation of mercury in Swan Lake since sulfate concentrations in Swan Lake are already relatively high (23 mg/L) and thus sulfate may not limit the methylation process. If the predicted increase in sulfate concentration does enhance mercury methylation in Swan Lake, it is unlikely that the increase in methylmercury concentrations in water and mercury concentrations in fish would be a linear function of the increase in sulfate concentration.

Current average background mercury concentrations in northern pike and walleye from Swan Lake are estimated from the MPCA’s June 2008 fish mercury database to be 0.42 mg/Kg (95 percent upper confidence limit of the mean). It is generally agreed that any potential increase in methylmercury concentration due to an increase in sulfate concentrations would not exceed the proportional increase in sulfate concentration (a second order rate linear response). If that qualitative analysis were applied in this instance, then the worst-case scenario would estimate a maximum potential increase in fish mercury concentrations in Swan Lake from 0.42 to 0.59 mg/Kg. This fish mercury concentration would fall at the lower end of walleye and northern pike concentration means (0.5 to 1.2 mg/Kg) observed in lakes in Voyageurs National Park where sulfate concentrations range from about 1 to 3 mg/L. Because sulfate is most likely not limiting to mercury methylation processes in Swan Lake, it is likely that any potential observed increase would be smaller.

If a 100 percent water re-use concept is implemented for the proposed Essar Steel project (as previously discussed), the potential increase in sulfate concentration in Swan Lake would be reduced to a 7.5 mg/L increase. Upper bound estimates on potential fish mercury concentrations would also be correspondingly lower.

5.13.2.6 Uncertainties Analysis

> Due to the relatively high sulfate concentrations currently existing in Swan Lake, it is not likely that a potential increase in Swan Lake sulfate concentrations would produce a proportional increase in fish mercury concentrations and it is possible that fish mercury concentrations may not increase at all.

Uncertainty is inherent in the ecological risk assessment process even if the most accurate data with the most sophisticated models are used. The methodology outlined in the SLERA relies on a combination of point values with varying degrees of embedded conservatism yielding a point estimate of exposure and risk that falls at an unknown percentile of the full distributions of exposure and risk. For this reason, the degree of conservatism in risk estimates cannot be known; instead, it is known that the values combine many conservative factors and are likely to overstate actual risk.

5.13.2.7 Conclusions

When considering all substantial potential pathways (soil exposure, surface water exposure, and sediment exposure) for assessing the potential for ecological effects, emission sources from the Proposed Project do not pose a risk to ecological receptors above the USEPA guidelines for screening-level risk assessments. Increased sulfate concentrations in Swan Lake from tailing basin discharge may enhance mercury methylation processes. However, due to the relatively high sulfate concentrations now in Swan Lake, it is not likely that a potential increase in Swan Lake sulfate concentrations would produce a proportional increase in fish mercury concentrations and it is possible that fish mercury concentrations may not increase at all. Other lakes in the region (Coons, Horsehead, Kelly, and O'Brien) are not impacted by tailings basin discharge. Potential fish mercury concentrations in those lakes are predicted to increase no more than two percent based on worst-case assumptions.

The cumulative ecological effect may be adverse. However, the effects are expected to be less than significant as risk is not calculated to be above USEPA guidelines for screening level risk assessment. The change between the No Action Alternative to the East Stockpile Alternative is the same as the change between the No Action Alternative to the Proposed Project.

The review of the SLERA analysis found that the SLERA followed accepted and reasonable methodologies, and that the conclusions drawn in the assessment are supported by the information presented.

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6.0 Agency Roles and Responsibilities

> The MNDNR serves as the lead state agency in preparing this joint state/federal DEIS and has coordinated with other state and federal agencies. A Memorandum of Understanding (MOU) has been agreed to by the USACE, MNDNR, Bois Forte Band of Chippewa, and the Project Proposer.

The MNDNR and USACE have jointly prepared this FEIS to evaluate the Proposed Project in accordance with MEPA, Minnesota Statute §116D, and NEPA, 42 USC §§ 4321-4347. These two agencies have jointly led the Keetac EIS process.

An EIS is not mandatory for this project under MEPA; however, the Project Proposer and the MNDNR have agreed that a discretionary EIS would be prepared for the Proposed Project in accordance with Minnesota Rules, part 4410.2000, subp. 3B. The EIS is required to meet the applicable requirements of Minnesota Rules, parts 4410.0200 to 4410.7800 that govern the Minnesota Environmental Review Program.

The MNDNR serves as the lead state agency in preparing this joint state/federal FEIS and has coordinated with other state agencies (i.e., MPCA and MDH). The MNDNR participated with the USACE at a public meeting for scoping and another meeting for the DEIS portion of the EIS process.

The USACE is the lead federal agency in preparing this joint state/federal FEIS. The USACE has determined that its action on the permit would be a major federal action that has the potential to significantly affect the quality of the human environment, requiring the preparation of a federal EIS pursuant to NEPA and its implementing regulations (40 CFR 1500-1508). The USACE has coordinated with other federal agencies including the U.S. Environmental Protection Agency (USEPA), U.S. Forest Service (USFS), the U.S. Fish and Wildlife Service (USFWS), and Federal Land Managers (FLMs). The USACE offered the seven federally-recognized Ojibwe bands in northern Minnesota an opportunity to consult with the USACE about the Proposed Project.

Additionally, the Bois Forte Band of Chippewa is a federally recognized Ojibwe band that has participated as a cooperating agency for the NEPA process.

A Memorandum of Understanding (MOU) has been agreed to by the USACE, MNDNR, Bois Forte Band of Chippewa, and the Project Proposer (Appendix D). The goals listed in the MOU of the aforementioned parties in preparation of the FEIS include:

- Evaluate the Proposed Project in accordance with NEPA and MEPA.
- Objectively identify, examine, and analyze the potential environmental, social, and economic impacts of the Proposed Project and reasonable alternatives in order to avoid, minimize, and/or mitigate the adverse impacts of the Proposed Project.
- Appropriately identify, examine and analyze the potential impacts to resources of interest to Ojibwe bands.
- Identify information that assists the Project Proposer in making project-related decisions.
- Ensure public involvement in the preparation and review of the EIS.
- Ensure that sufficient information is provided to assist the USACE, the MNDNR, and other federal, state, and local agencies in regulatory decisions.
- Reduce duplication of effort for the USACE, the MNDNR, the Bois Forte Band of Chippewa, and the Project Proposer.

6.1 EIS PARTICIPANT ROLES

Several state and federal agencies and several Ojibwe bands have participated in the preparation of this FEIS. MEPA and NEPA provided guidance to agencies for evaluation of potential environmental and socioeconomic impacts from the Proposed Project, alternatives, and mitigation options. Agency representatives relied on the framework developed in MEPA and NEPA for completing the EIS process. Following is a list of the agencies involved in this FEIS.

6.1.1 Minnesota Department of Natural Resources

The MNDNR is the RGU for implementation of MEPA for the Proposed Project. Preparation of the EIS involved several divisions of the MNDNR including Lands and Minerals, Ecological and Water Resources, Parks and Trails, and Fish and Wildlife. Participation included review and approval of the work plans, analyses, impact assessments, and technical reports/memoranda prepared for the FEIS. The MNDNR also provided project management guidance for the other participating agencies. The MNDNR is responsible for determining EIS adequacy pursuant to MEPA.

6.1.2 U.S. Army Corps of Engineers

The USACE is the lead federal agency for preparation of the FEIS. The USACE administers Section 404 of the CWA and ensures compliance with NEPA, NHPA, and ESA. The USACE is also responsible for addressing issues related to the federal tribal trust and treaty rights. Consultation concerning the Endangered Species Act is discussed in Section 4.3. A detailed discussion of consultation concerning NHPA and federal trust responsibilities is provided in Sections 4.17 and 4.18. The USACE will use the information provided in the EIS to prepare the federal ROD.

6.1.3 U.S. Fish and Wildlife Service

The USACE is consulting with the USFWS to determine effects to federally-listed threatened and endangered species under Section 7 of the Endangered Species Act. The USACE has submitted a Draft Biological Assessment to the USFWS for piping plover, Canada lynx and gray wolf for the Proposed Project (Appendix O). The USACE has made a determination that the Proposed Project would not affect piping plover or Canada lynx, and that it may affect, but would not adversely affect gray wolf. The USFWS will review the Draft Biological Assessment and either concur with these determinations or not, resulting in formal consultation. The Section 7 consultation process would be completed prior to the USACE completing a ROD for the EIS.

6.1.4 Minnesota Pollution Control Agency

The MPCA was involved in the preparation of the FEIS by reviewing issues of water quality, air quality, wetlands, noise, mercury, solid waste, mineral fibers, and wild rice evaluations.

6.1.5 Minnesota Department of Health

The MDH participated in the review of water quality, mineral fibers, and human health risk assessment evaluations for the EIS.

6.1.6 Federally Recognized Indian Bands

The USACE offered the seven federally-recognized Indian Bands in northern Minnesota an opportunity to consult with the USACE about Section 106 of the NHPA and/or to become a cooperating agency for preparation of the EIS. These Bands were the Bois Forte Band of Chippewa, Fond du Lac Band of Lake Superior Chippewa, Grand Portage Band of Chippewa, Leech Lake Band of Ojibwe, Mille Lacs Band of Ojibwe, Red Lake Band of Chippewa, and White Earth Band of Chippewa.

Three of the Bands, the Bois Forte Band of Chippewa, Fond du Lac Band of Lake Superior Chippewa, and the Grand Portage Band of Chippewa Indians, requested to consult with the USACE. The 1854 Treaty Authority requested to consult with the USACE, and the Bois Forte Band requested to become a cooperating agency. The 1854 Treaty Authority is participating as technical support in the EIS preparation process at the request of the Bois Forte Band. Additionally, the Leech Lake Band of Ojibwe has indicated that the Proposed Project is within 50 miles of their reservation boundary, and therefore their Treatment as an Affected Sovereign/State (TAS) for air quality should be recognized during the environmental review process. Consultation pertaining to federal responsibilities under Section 106 of the NHPA is discussed in Section 4.17, and consultation pertaining to federal tribal trust responsibilities and treaty rights in the 1855 Ceded Territory are discussed in Section 4.18.

6.1.6.1 Section 106 Consultation

The Section 106 consultation process with the USACE, which was underway at the time of DEIS publication, provided the three consulting Bands with an opportunity to express concerns related to historic properties, identify properties of traditional religious and cultural importance, and determine potential mitigation measures as related to the Proposed Project. Two Section 106 consultation meetings have been conducted to date for the Proposed Project. The first consultation among the three consulting Bands, the 1854 Treaty Authority, and the USACE was conducted at the office of the 1854 Treaty Authority in Duluth, Minnesota on February 11, 2009. A second meeting was held on June 8, 2009 between these same parties also at the office of the 1854 Treaty Authority.

During consultation meetings, the USACE requested the three consulting Bands assist in identification of historic properties within the APE of the Proposed Project, as described below, and to assist in identification of potential impacts to natural resources that are important to Bands. Results of the Phase I and Phase II surveys for the project were disclosed to the three consulting Bands and the 1854 Treaty Authority during the June 8, 2009 meeting. No significant archaeological sites important to Indian Bands were identified during the surveys. An analysis of impacts to Historic Properties is included in Section 4.17.

The Bands did not identify any active uses (hunting, fishing, or gathering) of natural resources on or near the Proposed Project. Historic uses were identified. Representatives of the three consulting Bands and the 1854 Treaty Authority identified important locations, traditional resources, potential impacts, and approaches for gathering information within the APE for direct and indirect effects summarized below:

- Access to public lands for hunting or gathering would be lost on or near the Proposed Project.
- The Kelly Lake/Hibbing area was where the Bois Forte Band initially settled before moving to Nett Lake. There was concern that there may be archaeological sites and wild rice areas in the area of the Proposed Project.
- The Laurentian Divide area was identified as being important in the Bois Forte Band tribal history.
- Areas of potential cultural significance may be identified by examining Trygg historical maps for tribal use areas, such as encampments and trails.
- Consultation with Tribal elders may yield important information not found in written records.
- Amounts and quality of water discharged into waterways near the Proposed Project may affect wild rice. Swan Lake, including its associated bays, and upstream tributary rivers are known to contain wild rice.

Meeting notes for both consultation meetings are on file in the project record. A consultation schedule was being formulated at the time of EIS publication. It will be reviewed by the parties participating in the consultation process, finalized, and distributed. Additional consultation meetings are expected in 2009 and 2010, prior to the issuance of the ROD for the Proposed Project, which is anticipated in 2011.

6.1.6.2 Area of Potential Effects

The USACE proposed APE (Figure 4.17.1) is based, in part, on discussions that occurred between the USACE, the three consulting Bands, and the 1854 Treaty Authority in February and June 2009. The USACE considered other information from technical reports (i.e., noise analysis), permit applications (i.e., the Permit to Mine amendment application, ambient air quality permit application) and graphical information (i.e., water flow direction) to further refine APE boundaries.

The USACE proposed APE used for assessing impacts to properties of traditional religious and cultural importance to Indian Bands uses a combination of minor watershed boundaries, the physical extent of surface water impacts based on water flow direction, noise modeling contours near Kelly Lake, the ambient air quality permit boundary, and additional areas based on consultation with affected Indian Bands to delineate an area for assessing effects to potential historic properties. The USACE proposed APE is described in more detail in Section 4.17.

6.1.7 State Historic Preservation Office

As the lead federal agency, the USACE is consulting with the SHPO pursuant to federal responsibilities under Section 106 of the NHPA. Consultation was initiated during project scoping, when initial cultural resources investigations were conducted, and will continue until procedural requirements are satisfied. Consultation pertaining to federal responsibilities under Section 106 of the NHPA is discussed in Section 4.17.

6.1.8 Federal Land Managers

The FLMs (i.e., U.S. Forest Service and the National Park Service) are responsible for protecting air quality related values in designated Class I areas. In Minnesota, Michigan, and Wisconsin, these Class I areas consist of the Boundary Waters Canoe Area Wilderness, Voyageurs National Park, Isle Royale National Park, and Rainbow Lakes Wilderness. The associated FLMs for these areas are the USFS for the Boundary Waters Canoe Area Wilderness, and Rainbow Lakes Wilderness and the NPS for Voyageurs National Park and Isle Royale National Park. The Project Proposer and the MPCA are working closely with FLMs to solicit their input on potential project impacts in advance of the completion of the air permit. This will allow the FLMs to review the Proposed Project and associated mitigation plans to ensure compliance with FLM’s guidelines for protection of air quality related values.

6.1.9 U.S. Environmental Protection Agency

The USEPA was involved in the preparation of the EIS through review and comment on the document. USEPA also, through a third party contractor, reviewed and commented on aquatic resources and wetland technical reports. In addition, representatives from the USEPA Region V participated in a two day workshop in April 2010 related to alternative stockpile locations and wetland impact minimization.

6.1.10 Soil and Water Conservation Districts and Board of Water and Soil Resources

The two Soil and Water Conservation Districts (SWCDs) in Itasca County and St. Louis County were involved in the EIS process. The Board of Water and Soil Resources (BWSR) offices in Duluth and Aitkin County were also involved. These entities reviewed project related studies and draft chapters of the FEIS about potential impacts to wetlands and possible mitigation.

6.2 CLEAN WATER ACT SECTION 404 PERMITTING

As part of the Section 404 permitting process, the USACE will perform a Section 404(b)(1) Guidelines analysis. The USACE can only issue a permit if (1) the Proposed Project passes all elements of the Section 404(b)(1) Guidelines including the requirement that the proposal be the Least Environmentally Damaging Practicable Alternative (LEDPA), and (2) the Proposed Project is determined to be not contrary to the public interest. Because the Project Proposer has not yet applied for a Section 404(b)(1) permit, this analysis has not yet been completed. Therefore, any discussions of the LEDPA in this document are preliminary.

Because of the critical role the Section 404 permitting process plays in identifying a permittable project, it is important to understand the concept of the LEDPA, and in turn, to define what is "environmentally damaging," and what is "practicable." An understanding of the meaning of "environmentally damaging" can be gleaned from 40 CFR 230.10(a): *"… no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.*" The focus of the environmental impacts analysis is on the aquatic ecosystem, but significant non-aquatic impacts will also be considered. The term practicable is described in 40 CFR 230.10(a)(2) as an alternative that is "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes." Additionally, it is important to note that the lack of land ownership does not preclude the consideration of an alternative, as long as the area in question could reasonably be obtained or used by the applicant.

The alternatives analysis found within a NEPA document is often used to inform the Section 404(b)(1) Guidelines analysis, which will be the case here. As indicated by 40 CFR 230.10(a)(4): "*For actions subject to NEPA, where the Corps of Engineers is the permitting agency, the analysis of alternatives required for NEPA environmental documents, including supplemental Corps NEPA documents, will in most cases provide the information for the evaluation of alternatives under these [404(b)(1)] Guidelines."* Under the NEPA process, an environmentally preferred alternative is identified by the agency, which may or may not also be the LEDPA. For example, an alternative with greater impacts to the aquatic environment, but relatively few upland impacts could be identified as the environmentally preferred alternative, but may not meet the definition of the LEDPA if another alternative is available that would have fewer aquatic impacts.

Based on analysis and review completed for the FEIS, the Proposed Project with the East Stockpile Alternative would be the environmentally preferable alternative, and the agencies' preferred alternative for this project. It is also likely that this alternative would be the LEDPA. As stated earlier though, the LEDPA cannot be identified until the Section 404(b)(1) analysis is complete. The LEDPA will be identified prior to and presented in the ROD that will be prepared by the USACE. U.S. Steel Corporation notified the MNDNR and USACE in September 2010 that it intends to pursue the East Stockpile Alternative in the permitting process.

6.3 PUBLIC PARTICIPATION

Public notification, opportunities for the public to obtain information, and public commenting on the Proposed Project began during the project scoping process. In September 2008, the MNDNR in partnership with the USACE prepared a SEAW and a DSDD to provide information about the Proposed Project, identify potentially significant environmental impacts, determine what issues and alternatives would be addressed in the DEIS, and the determined level of analysis required in the EIS. A 30-day public comment period occurred from September 8, 2008 to October 8, 2008, with a public meeting held on October 1, 2008 in Nashwauk, Minnesota. The comments received were considered in making revisions to the DSDD prior to the agencies issuing the FSDD.

The DEIS was published and circulated in accordance with the rules and requirements of Minnesota Rules (EQB Rules) 4410, MEPA, and NEPA requirements. The DEIS was distributed beginning on December 14, 2009until January 26, 2010 to allow for a 45-day comment period to satisfy NEPA requirements and a concurrent 30-day comment period to satisfy MEPA requirements. Written comments were accepted during the public comment periods. Additionally, a public meeting was held on Monday, January 11, 2010 in Hibbing, Minnesota to present information on the DEIS, answer questions, and provide a forum for public comments. Comments received were taken into account in assessing project impacts and potential mitigation for the FEIS. Responses to comments received were prepared and included in the FEIS. The FEIS serves as the complete EIS for the Proposed Project. The USACE and MNDNR will receive comments during a 30-day public comment period.

Following the public comment period on the FEIS, the MNDNR will make a determination of adequacy for the EIS. The USACE will determine whether the EIS satisfies the environmental review requirements of NEPA and will also prepare the federal ROD.

> *The ROD is the final step for federal agencies in the EIS process. The ROD is a document that states what the decision is; identifies the alternatives considered, including the environmentally preferred alternative; and discusses mitigation plans, including any enforcement and monitoring commitments. In the ROD, the agency discusses all the factors, including any considerations of national policy that were contemplated when it reached its decision on whether to, and if so how to, proceed with the proposed action. The ROD will also discuss if all practical means to avoid or minimize environmental harm have been adopted, and if not, why they were not.* (CEQ, 2007)

The state could issue permits after the adequacy determination is completed. If the USACE issues a permit for the project, it would be issued with the ROD.

6.4 LIST OF AGENCIES, ORGANIZATIONS AND INDIVIDUALS TO WHOM COPIES OF FINAL EIS ARE SENT

As part of the requirements of the NEPA, 42 U.S.C. §§ 4321-4347, NEPA's implementing regulations, 40 CFR 1500-1508, and Minnesota Rules 4410, the FEIS is circulated. A list of FEIS recipients is available from the MNDNR upon request.

Pursuant to Minnesota Rules, part 4410.2700, subp. 3, copies of the FEIS will be provided to all persons receiving copies of the entire DEIS; persons who submitted substantive comments on the DEIS; and to the extent possible, any person requesting the FEIS.

7.0 List of Preparers

Name and Affiliation	EIS Responsibility and Qualifications
Minnesota Department of Natural Resources	
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Dave Parenteau	Mining Process & Alternatives Analysis Coordinator B.S. Civil Engineering 10 years in civil engineering and construction management
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