Maritime Iron Project – Provincial Environmental Impact Assessment Registration for Proposed Belledune Iron Processing Facility in Belledune, New Brunswick

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- Section 1: 1.2 Environmental Benefits of the Belledune Iron Processing Facility
- Section 6: 6.3.1 Introduction
- Section 6: 6.3.2 Project Considerations and GHG Benefits

Each of these sections has been included in this document by Stantec at the Client’s request to facilitate the review and use of this document by members of the general public. In addition, the Client has prepared and supplied to Stantec Section 4: First Nations and Public Engagement which describes engagement and consultation processes that have been undertaken by the Client. The Client is solely responsible for the contents of these portions of this document.

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Abbreviations

AADT	Average annual daily traffic
ACB	Air Contaminant Benchmark
AESRD	Alberta Air Quality Model Guideline
AIA	Archaeological Impact Assessment
AIS	Automatic Identification System
AR5	Fifth Assessment Report
ARW	Advanced Research WRE
AS	Archaeological Services
ASETS	Aboriginal Skills Education and Training Strategy
BAT	Best Available Technologies
BET	Biological Effluent Treatment
BF	Blast furnace
BMH	Bulk material handling
BOF	Basic oxygen furnace
BP	Before Present
BPA	Belledune Port Authority
BPIP	Building Profile Input Program
CAAQS	Canadian Ambient Air Quality Standards
CACs	Criteria air contaminants
CALPUFF	The California Puff
CCHIP	Climate Change Hazards Information Portal
CCME	Canadian Council of Ministers of the Environment
CCNB	Collège communautaire du Nouveau-Brunswick
CEO	Chief Executive Officer
CEQG	Canadian Environmental Quality Guidelines
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CRA	Commercial, Recreational or Aboriginal
CSQG	Canadian Sediment Quality Guidelines
CWCS	Canadian Wetland Classification System
CWFIS	Canadian Wildland Fire Information System
CWQG	Canadian Water Quality Guidelines
CWSs	Canada Wide Standards
DFO	Fisheries and Oceans Canada

DRI	Direct reduced iron
DWT	deadweight ton(s)
EA	Environmental Assessment
EAF	Electric arc furnace
ECCC	Environment and Climate Change Canada
ECMC	Ecological Communities of Management Concern
EHS	Emergency, Health and Safety
EIA	environmental impact assessment
EIA Regulation	*Environmental Impact Assessment Regulation 87-83*
EPP	Environmental Protection Plan
ERT	Emergency Response Team
ESA	Environmentally Significant Areas
FEG	FINEX export gas
FWI	Fire Weather Index
GCDWQ	Guidelines for Canadian Drinking Water Quality
GDP	Gross Domestic Product
GED	General Education Diploma
GFA	Ground Fishing Area
GHGs	greenhouse gas
GNB	Government of New Brunswick
GOC	Government of Canada
GWP	Global warming potentials
HCI	hot-compacted iron
HFA	Herring Fishing Area
HFCs	hydrofluorocarbons
HMPS	Hot Metal Pre-Treatment Station
HP	High Pressure
HPI	high-purity iron
IAA	*Impact Assessment Act*
ICF	ICF International Inc.
IKS	Indigenous Knowledge Study
IPCC	Intergovernmental Panel on Climate Change
IT	Innovative Technology
KR	Kanbara Reactor
LAA	Local Assessment Area
LFA	Lobster Fishing Area
LPG (Propane)	Liquefied Petroleum Gas (Propane)

MBCA	*Migratory Birds Convention Act*
MCCs	Motor Control Centres
MCW	Machinery Cooling Water
MFA	Mackerel Fishing Area
MMS	Mi'gmawei Mawiomi Secretariet
MOECC	Ontario Ministry of Environment and Climate Change
MPI	merchant pig iron
MTI	Mi'gmawe'l Tplu'taqnn Inc
Mtpa	Million tonnes per annum
NAAQOs	National Ambient Air Quality Objectives
NARR	North American Regional Reanalysis
NB OWLS	New Brunswick Online Well Log System
NB Power	New Brunswick Power
NB SARA	New Brunswick *Species at Risk Act*
NBCC	New Brunswick Community College
NBDELG	New Brunswick Department of Environment and Local Government
NBDERD	New Brunswick Department of Energy and Resource Development
NBDNR	New Brunswick Department of Natural Resources
NBDTI	New Brunswick Department of Transportation and Infrastructure
NCEP	National Centers for Environmental Prediction
NIR	National Inventory Report
Nm^3/hour	Normal meters cubed per hour
NPRI	National Pollutant Release Inventory
OBPS	output-based pricing system
OLM	ozone limiting method
PASs	Process area substations
PCW	Process Cooling Water
PDA	Project Development Area
PELT	Post Secondary Education, Training and Labour
PES	Pre-feasibility study
PFAL	Protection of Aquatic Life (Freshwater)
PID	Parcel Identifier
PM	Particulate Matter
PNAs	Protected Natural Areas
Ppt	Parts per thousand
PSO	Project site office
RCFA	Rock Crab Fishing Area

RCP	Representative concentration pathways
RDC	Regional Development Corporation
RSI	Risk Sciences International
RTO	Regenerative Thermal Oxidizer
SAR	species at risk
SARA	*Species at Risk Act*
SCFA	Snow Crab Fishing Area
SCI	Strategic Concepts Inc.
SCW	Secondary Cooling Water
SF6	sulphur hexafluoride
SFA	Scallop Fishing Area
SMPEI	Structural, Mechanical, Piping, Electrical and Instrumentation
SOCC	Species of conservation concern
SPTs	Self-Propelled Transporters
STPs	shovel test pits
TERMPOL	Technical Review Process of Marine Terminal Systems and Transhipment Sites
TRC	Technical Review Committee
TSP	Total suspended particulate matter
US EPA	United States Environmental Protection Agency
USM	Unsuitable material
VC	Valued Componant
VOCs	volatile organic compounds
WAWA	Watercourse and Wetland Alteration Regulation
WESP-AC	Wetland Ecological Services Protocol – Atlantic Canada
WHMIS	Workplace Hazardous Materials Information System
WMZ	Wildlife Management Zone
WRF	weather research and forecasting
WSP	WSP Parsons Brinkerhoff

1.0 INTRODUCTION

This is an Environmental Impact Assessment (EIA) registration document for the proposed construction and operation of an iron processing facility in Belledune, New Brunswick (the Project), being considered by Maritime Iron Inc. (Maritime Iron; the Proponent). This document is being submitted to the New Brunswick Department of Environment and Local Government (NBDELG) as part of the EIA process under the New Brunswick *Environmental Impact Assessment Regulation 87-83* of the *Clean Environment Act*.

1.1 THE PROJECT

Maritime Iron intends to build the Belledune Iron Processing Facility in Belledune, New Brunswick. The Project is located on land designated for industrial purposes and currently owned by New Brunswick Power Corporation (NB Power). Physical components will be situated immediately adjacent to NB Power's Belledune Thermal Generating Station and the Port of Belledune industrial lands.

The Project's international technology providers are Primetals (a joint venture of Austria's Siemens and Japan's Mitsubishi) and POSCO in South Korea. The Project will replicate the design of two plants (each will serve as a reference plant for the Project) built and operated by steel maker POSCO in South Korea that use the innovative iron-making technology named FINEX. The FINEX technology process of creating the hot molten metal essentially involves the combination of fine iron ore, flux additive materials, coal, and pure oxygen gas. When the pure oxygen gas combines with the coal it generates the heat necessary to melt the fine iron ore into hot molten metal (containing the iron from the iron ore) while the flux additives generate a hot molten slag (containing the remainder or impurities from the iron ore).

The Project facility will be designed to process iron ore material to achieve an annual average hourly production rate of 180 tonnes per hour of hot molten metal. The Project facility will operate at approximately 95% availability allowing for an annual average production of 1.5 million tonnes of iron product. The pig iron product is a preferred intermediate used in electric arc furnaces which produce steel at a lower greenhouse gas (GHG) intensity compared to the integrated blast furnace/basic oxygen furnace route.

The fine iron ore, coal, and other required bulk materials will be delivered by ship to the Port of Belledune and off-loaded using NB Power's Terminal 2 facility. NB Power's existing covered belt conveyor system will be extended and used to deliver these materials to a covered stockpile at the Project facility. A relatively small quantity of bulk materials will also be delivered by truck directly to the Project facility.

The physical product from the Project facility will be in the form of solid iron ingots cast from the hot molten metal. The solid iron ingots will be bulk trucked from the Project facility to inventory storage at the Port of Belledune's Terminal 3 facility prior to bulk loading onto ships for delivery to steel production customers. Terminal 3 will also be used for inventory storage and shipping of the granulated slag by-product material and will be bulk trucked from the Project facility.

The pure oxygen gas required for the melting process by the Project facility will be generated by an Oxygen Plant that is expected to be built, owned, and operated by a third party with dedicated supply to the Project facility. The Oxygen Plant will be located adjacent to NB Power's Belledune Thermal Generating Station and physically separated from the Project facility.

The pure oxygen gas used by the Project facility combines with various components within the fine iron ore and coal materials and generates an off gas stream. This off gas stream will have a composition and calorific value that allows it to be exported from the Project facility as a by-product gas to NB Power's Belledune Thermal Generating Station (via an interconnecting pipe) and used as a fuel for cleaner energy production.

Additional interconnected services and/or utilities between the Project facility and NB Power's Belledune Thermal Generating Station are expected to be undertaken where determined to be technically feasible. The power supply for the Project facility will be supplied from the NB Power provincial grid.

The facility will be designed and constructed at a cost of almost $1.5 billion (note that all dollar values are in Canadian dollars unless otherwise indicated in this document). The company will also spend approximately $16.8 billion in operating expenditures over a 30-year period for an annual average operating expenditure on goods and services of $570 million. An additional $300 million in sustaining capital will also be required to maintain the facility.

Maritime Iron's operations will generate considerable economic benefits in New Brunswick, and in particular in the Belledune region. It is expected that up to 1,300 full time equivalent jobs will be created during construction, and more than 200 long-term direct permanent jobs will be created during operation. It is estimated that $1.5 billion will be generated in provincial tax revenue, including income tax and corporate tax during construction and operation.

1.2 ENVIRONMENTAL BENEFITS OF THE BELLEDUNE IRON PROCESSING FACILITY

The following section 1.2 has been provided in its entirety by Maritime Iron Inc. and has not been modified by Stantec.

The Belledune Iron Processing Facility proposed by Maritime Iron is a $1.5 billion investment to produce environmentally responsible merchant pig iron for use by electric arc furnace (EAF) steelmakers in North America and Europe. This innovative state-of-the-art facility will be the only one of its kind in North America and will address growing market demand for a regional supplier of high-quality pig iron. The project incorporates many elements that work together to achieve Maritime Iron's core value of Sustainable Ironmaking.

This project reflects a commitment towards the realization of a fundamental environmental principle – the establishment of a Circular Economy in the iron- and steel-making sector. At its most basic level, the circular economy is anchored in a commitment to reuse, recycle, and repurpose with the aim of minimizing the use of resources and reducing waste.

Maritime Iron selected FINEX technology because of its many environmental benefits that help realize Sustainable Ironmaking and the Circular Economy in the following fundamental ways:

- Using innovative technology to eliminate processes and levels of pollution associated with conventional blast furnace ironmaking and basic oxygen furnace steelmaking;
- Recycling and reusing materials in direct support of the circular economy and thereby reducing energy usage for iron and steel production;
- Maximizing use of natural resources by generating higher and more varied outputs from the iron production process; and
- Minimizing waste.

1.2.1 FINEX Technology Features

The FINEX ironmaking process re-purposes piles of iron ore fines with lower re-use potential. Fines are considered unsuitable for conventional blast furnace ironmaking processes without further processing. FINEX ironmaking technology can use iron ore fines directly without the need to pre-process.

Ultimately, as part of the circular economy, the use of iron ore fines by the FINEX technology reduces the level of demand to mine raw resources for ironmaking, resulting in more efficient use of natural resources. In turn, this results in a reduction in energy demand and thus lower emissions, when compared to conventional blast furnace ironmaking processes.

RESULTS:

- More efficient use of natural resources for ironmaking
- Reduced demand for raw natural resources for ironmaking
- Reduced piles of iron ore fines at mining sites that have lower re-use potential
- Reduced energy demand and emissions for mining activities

Innovative FINEX technology eliminates the need for a sintering plant to pre-process iron ore into larger lumps, compared to conventional blast furnace ironmaking facilities.

RESULTS:

- Reduced footprint of the FINEX facility and impact on the physical environment
- Reduced energy intensity for iron processing (~2/3 less energy required)
- Reduced greenhouse gases (GHGs): reduction of 0.4 – 0.7 tonnes of GHGs per tonne of steel produced
- Reduced emissions of nitrogen oxides

Innovative FINEX technology eliminates the need for coke ovens and coking production, compared to conventional blast furnace ironmaking facilities,

RESULTS:

- Significantly reduced use of coke material (only 10% required)
- Use of non-coking coal material used directly, without pre-processing
- Reduced air emission pollutants, such as sulphur oxides
- Reduced energy intensity for iron processing (~2/3 less energy required)
- Reduced greenhouse gases: reduction of 0.1 tonne of GHGs per tonne of steel produced
- Reduced footprint of the facility and impact on the physical environment

FINEX technology contributes to an approximate 40% global greenhouse gas reduction for iron- and electric arc furnace (EAF) steelmaking. As part of the circular economy, EAF steelmakers can use 70% recycled scrap metals. When combined with 30% FINEX pig iron it results in the production of high-quality steel used by the windmill, aviation, and automobile industries.

The production of iron and steel using conventional blast furnace / blast oxygen furnace iron- and steel-making plants requires significantly more iron ore and an increased energy intensity, when compared to the FINEX and EAF processes.

RESULTS:

- More efficient use of iron ore resources by FINEX ironmaking technology for higher-quality steel production (only 30% new iron required for EAF steel production compared to a minimum of 80% new iron used for conventional basic oxygen furnace steel production)
- Maximum output for minimum use of natural resources. 1.5 million tonnes per year of FINEX pig iron produces at least 5 million tonnes per year of EAF steel (using conventional methods, the same iron amount results in only 1.5 million tonnes per year of steel produced)
- Supports the scrap steel recycling industry (70% of inputs to EAF steelmaking is recycled scrap metals), thereby preventing massive landfills

- Lower energy intensity for FINEX/EAF iron and steel production contributes to lower global GHGs

Using FINEX technology eliminates solid waste production. The main solid by-product of the FINEX process is granulated aggregate which is derived from the separation of iron from the ore. As part of the circular economy, the aggregate will be recycled for use in making cement, thus there is no solid waste product from the FINEX ironmaking process. This will contribute significantly to lowering GHG emissions for cement production.

A second solid waste stream, a sludge product resulting from the cleaning of facility filters, represents a minor fraction of the mass balance. This is a non-hazardous stream that could be disposed in a landfill. However, Maritime Iron is looking at options to recapture the sludge: options include selling it to steel refiners or recycling this stream back into the FINEX process as it contains a significant amount of iron.

RESULTS:

- No solid waste piles
- No tailings
- GHG intensity for cement production is reduced by 0.8 tonnes of GHG per tonne of aggregate by recycling use of existing granulated aggregate from pig iron production

FINEX by-product gas can be recycled for cleaner electricity production at the adjacent NB Power Belledune Generating Station rather than emit it into the atmosphere. Recycling and re-purposing the by-product gas demonstrates an environmentally responsible approach to industrial development by maximizing the use of resources (both inputs and outputs) associated with the ironmaking process.

RESULTS:

- Coal use at the generating station will be reduced by over 50% and still generate the same amount of power
- Lower sulphur dioxide and nitrogen oxide air emissions at the NB Power facility due to reduced coal use
- Contributes to the circular economy by enabling cleaner energy production at another facility
- Maintains operations of the NB Power facility beyond 2029 in accordance with Federal regulations for electricity production

Implementation of FINEX in Canada has key benefits compared to other jurisdictions, specifically as it relates to shipping and the energy grid intensity for GHG emissions.

RESULTS:

- By sending Canadian made pig iron to EAF steelmaking markets, Maritime Iron will be helping the world transition away from jurisdictions that use more energy intensive traditional technologies and that have higher GHG emitting electrical grids.
- Belledune, New Brunswick’s geographic location provides a further global GHG displacement opportunity. These jurisdictional considerations would see significantly reduced transportation shipping routes from production to market with the following benefits:
  - Reduction of 1.1 t of CO_2 per tonne of steel by not locating production in China
  - Reduction of 0.2 t of CO_2 per tonne of steel by not locating production in US Gulf Coast

As part of its commitment to minimizing its environmental footprint, Maritime Iron is also looking at additional ways to augment its operational activities through improved environmental practices. For example, the project is planning to capture rainwater and recycle it as part of the cooling system, thereby reducing freshwater usage.

Implementing Maritime Iron's environmentally responsible approach to ironmaking recognizes the need for sustainable economic development that truly takes the environment into account. It is a project that is consistent with the climate plans for both New Brunswick and Canada and shows the world a path forward towards responsible industrial development.

1.3 PROJECT TITLE AND PROPONENT INFORMATION

The proponent for the proposed undertaking is as follows:

Name of Undertaking:	Belledune Iron Processing Facility
Name of Proponent:	Maritime Iron Inc.
Mailing Address of Proponent:	Bay Adelaide Centre-East Tower 22 Adelaide Street West, Suite 2020 Toronto ON, M5H 4E3 Canada
Principal Proponent Contact	Rinaldo Stefan Chief Operating Officer Bay Adelaide Centre-East Tower 22 Adelaide Street West, Suite 2020 Toronto ON, M5H 4E3 Canada 905-399-4789 rinaldo.stefan@maritimeiron.com
Principal Contact Person for the Purposes of Environmental Impact Assessment:	Grant Gaudet EHS Manager Bay Adelaide Centre-East Tower 22 Adelaide Street West, Suite 2020 Toronto ON, M5H 4E3 Canada 647-607-8029 grant.gaudet@maritimeiron.com

1.4 PROPERTY OWNERSHIP AND INTEGRATION WITH BELLEDUNE GENERATING STATION

The Belledune Iron Processing Facility will be located on land that is currently owned by NB Power and is designated for industrial development. Comprehensive commercial agreements are to be negotiated between Maritime Iron and NB Power that will include ownership and infrastructure usage rights and/or transfer of the property for the Belledune Iron Processing Facility.

The various points of integration between the Belledune Iron Processing Facility and the Belledune Generating Station as described herein are based on the current design of the Belledune Iron Processing Facility as presented in this document. Comprehensive commercial agreements governing integration between the two facilities are to be negotiated between Maritime Iron and NB Power.

The Project will not require the use of provincial Crown land.

1.5 REGULATORY FRAMEWORK

This section provides an overview of the anticipated regulatory processes that could be applicable to the Project, including federal and provincial environmental assessment requirements and the roles of regulatory authorities.

1.5.1 Provincial

This section provides a brief description of the anticipated provincial environmental impact assessment, approval and permitting processes that may apply to the Project.

1.5.1.1 New Brunswick Environmental Impact Assessment Regulation

The New Brunswick *Environmental Impact Assessment Regulation 87-83* (EIA Regulation) under the *Clean Environment Act* governs the EIA process in the province. The EIA Regulation requires that all undertakings listed in “Schedule A” of the Regulation (including their proposed construction, operation, modification, extension, abandonment, demolition or rehabilitation) require registration and a “Determination Review” led by NBDELG to review the Project’s information and potential environmental effects. At the conclusion of the Determination Review, the NBDELG’s technical review committee (TRC) will recommend to the New Brunswick Minister of Environment and Local Government as to whether a proposed undertaking can proceed, with or without conditions, or whether it requires a more detailed “Comprehensive Review”.

The Project is an undertaking under the EIA Regulation, according to item (a) of Schedule A the regulation, as follows:

> *“(a) all* commercial extraction or processing of a mineral as defined in the *Mining Act”*

Therefore, as a mineral processing facility, the Project is required under Section 5(1) of the EIA Regulation to be registered with NBDELG and will undergo, at minimum, a Determination Review, coordinated by NBDELG.

1.5.1.2 New Brunswick Water Quality Regulation

The New Brunswick *Water Quality Regulation – Clean Environment Act*, administered by NBDELG, requires a permit to be issued for the construction, modification, or operation of any source, wastewater works, or waterworks.

1.5.1.3 New Brunswick Clean Air Act – Air Quality Regulation

The New Brunswick *Air Quality Regulation – Clean Air Act*, administered by NBDELG, requires a permit to be issued for the construction, modification, or operation of any source of emissions.

1.5.1.4 New Brunswick Species at Risk Act

The New Brunswick *Species at Risk Act* (NB *SARA*) is administered by the New Brunswick Department of Energy and Resource Development (NBDERD) and is intended to protect species from extirpation and extinction. Species that are included in the *Prohibitions Regulation* of NB *SARA* currently have some regulatory protection. Schedule A of the *Prohibitions Regulation* lists species in New Brunswick that are classified as being extirpated, endangered, threatened, or of special concern. The NB *SARA*, by way of Section 28(2), prohibits the killing, harming, harassing, or taking of any species listed in Schedule A.

1.5.1.5 New Brunswick Watercourse and Wetland Alteration Regulation–Clean Water Act

The New Brunswick *Watercourse and Wetland Alteration Regulation–Clean Water Act* requires a watercourse and wetland alteration (WAWA) permit to be issued for any activity carried out within 30 metres of a watercourse or wetland.

1.5.1.6 New Brunswick Fish and Wildlife Act

The New Brunswick *Fish and Wildlife Act* protects all fish and wildlife species from angling, hunting, trapping, and other forms of intentional take except under the authority of permits or licenses.

1.5.1.7 Other Potential Provincial Permit Requirements

The following table contains a representative list of potential additional permits, approvals, and authorizations that may apply to the Project.

Table 1.1 Other Potential Provincial Permit Requirements

Permit, Approval, or Authorization	Issuing Provincial Agency
Archaeological Field Research Permit (*Heritage Conservation Act)*	Archaeological Services, Heritage Branch, Department of Tourism, Heritage, and Culture
Site Alteration Permit (*Heritage Conservation Act)*	Archaeological Services, Heritage Branch, Department of Tourism, Heritage, and Culture
Highway Usage Permit (*Highway Act*)	Highway Usage Permit Section, Property Services Branch, Department of Transportation and Infrastructure
Work Permit (*Forest Fires Act*)	Forest Fire Management Section, New Brunswick Department of Energy and Resource Development

1.5.2 Federal Environmental Legislation

The primary federal environmental legislation of potential relevance to the Project includes the *Impact Assessment Act*, the *Fisheries Act*, the *Explosives Act*, the *Migratory Birds Convention Act*, and the *Species at Risk Act*. Further details are provided below.

1.5.2.1 Impact Assessment Act

The *Impact Assessment Act* (I*AA*) came into force on August 28, 2019 and defines the requirements for federal environmental assessments (EA) in Canada. *IAA* applies mainly to “designated projects”, which are the physical activities listed under the *Physical Activities Regulations* under *IAA*, as well as physical activities carried out on federal land. The *Physical Activities Regulations* identify physical activities that are considered to be designated projects, thereby requiring an EA under *IAA*.

The Project is not a designated project as defined by the *Physical Activities.* As the Project will not be carried out on federal land, it does not require an EA under I*AA*. Since the Project is neither a designated project nor located on federal land, it is unlikely that an EA under I*AA 2012* would be required. It is expected that federal regulatory agencies having an interest in the Project (e.g., Environment and Climate Change Canada, and Fisheries and Oceans Canada) will be able to participate in the provincial EIA review as members of its TRC.

The Project is located on industrially designated land immediately adjacent to NB Power’s Belledune Thermal Generating Station, and the Port of Belledune’s industrial lands which are federal property. Although the Project will make use of services provided by the Port, Project infrastructure will not be located on federal lands. These services will include the development and use of Port assets. It is important to note, however, that these activities are outside of the control of Maritime Iron and, should there be any regulatory or environmental approvals required, the Port of Belledune will be responsible for obtaining them.

1.5.2.2 Fisheries Act

The federal *Fisheries Act* has recently been amended and come into force (August 28, 2019). The *Fisheries Act* defines the requirements for protecting fish and fish habitat in Canada. Specifically, the Act specifies that any activity that could result in the death of fish and the harmful alteration, disruption or destruction of fish habitat. requires an authorization to be issued, with appropriate offsetting for residual environmental effects of the activity.

Additionally, Section 36(3) of the *Fisheries Act* states that it is illegal to release deleterious substances into a fish-bearing watercourse or waterbody without an authorization. A deleterious substance is considered any substance that has the ability to degrade water quality such that it becomes harmful to fish or fish habitat.

1.5.2.3 Explosives Act

Blasting will likely be required to accomplish construction of the Project. Permits under the federal *Explosives Act* may be required, particularly if an on-site magazine is required.

1.5.2.4 Migratory Birds Convention Act

The federal *Migratory Birds Convention Act* (*MBCA*) contains provisions for the protection and conservation of migratory bird populations, individuals, and their nests within all lands in Canada. The *MBCA* prohibits the killing, harming, or other harassment of migratory birds and their nests. An estimated 450 native species of migratory birds (including their nests and eggs) are protected under the *MBCA*.

1.5.2.5 Species at Risk Act

The federal *Species at Risk Act* (*SARA*) is administered by Environment and Climate Change Canada with the intent to protect species from extirpation or extinction as a result of human activity. The purpose of these provisions under *SARA* is to prevent species at risk from becoming threatened or endangered and to allow for recovery of species that are considered threatened, endangered or extirpated. Section 32(1) affords protection to individuals of species that are listed under *SARA* as extirpated, endangered, or threatened, while Section 33 protects the habitat of these species.

Schedule 1 of *SARA* lists species in Canada that are classified as being extirpated, endangered, threatened, or of special concern. The more than 300 wild plant and animal species listed in Schedule 1 are afforded special measures to protect them and assist in their recovery. These measures include, amongst other things, prohibitions against:

- the killing, harming, or harassment of these species;
- the damage or destruction of their residences; and
- the destruction of any part of their critical habitat.

1.6 CONCORDANCE WITH THE EIA GUIDELINES

Appendix A provides concordance between “A Guide to Environmental Impact Assessment in New Brunswick” (NBDELG 2018) and this document, including the signature of the main proponent contact.

2.0 PROJECT DESCRIPTION

This section is based on information provided by Maritime Iron and describes the Project as it is currently conceived based on conceptual design information available at the time of finalizing the EIA registration. Further detailed engineering design will be completed as the Project progresses, and therefore this information is subject to change as other aspects of planning proceeds. However, as the Project is based on established technology and will be essentially replicating existing operating plants, there should be a lower risk for significant changes in the design information.

This section provides information on the purpose of the Project, the Project location, siting considerations, and selection of Project related technologies. Details on specific Project components and infrastructure, how construction, operation, and decommissioning and abandonment of the Project will be achieved, and the anticipated Project workforce and schedule are also described. This section also includes a description of Project-related emissions and wastes.

2.1 PROJECT OVERVIEW

Maritime Iron is proposing to construct and operate an iron production facility, the Belledune Iron Processing Facility in Belledune, New Brunswick. The iron that will be produced by the Project facility is also known as crude pig iron and is an intermediate product of the steel-making industry. The facility will be capable of producing two product quality types, Merchant Pig Iron (MPI) (basic-purity) and High-purity Pig Iron (HPI), for sale to end-users in the steel-making and foundry industries; the Project itself will not make steel. The Belledune Iron Processing Facility will replicate the design of two existing plants (each will serve as a reference plant for the Project) built and operated by steel maker POSCO in South Korea (Figure 2.1) that use the innovative iron-making technology process named FINEX.

Figure 2.1 POSCO FINEX #3 Plant in Pohang, South Korea (2014)

The Project is located on land currently owned by NB Power, and physical components will be situated immediately adjacent to NB Power's Belledune Thermal Generating Station and the Port of Belledune's industrial lands.

The Project will not include any mining or mineral extraction activities. The iron ore material to be processed will be mined elsewhere and will be procured after it has already been extracted and milled into fines by a third party.

The Project facility will be designed to process iron ore material to achieve an annual average hourly production rate of 180 tonnes per hour of hot molten metal. The Project facility will operate at approximately 95% availability allowing for an annual average production of 1.5 million tonnes of iron product.

The fine iron ore, coal and other bulk materials will be delivered by ship to the Port of Belledune and off-loaded using NB Power's Terminal 2 facility. NB Power's existing covered belt conveyor system will be extended and used to deliver these materials to a covered stockpile at the Project facility. A small quantity of bulk materials will also be delivered by truck directly to the Project facility.

The FINEX iron-making technology process creates hot molten metal using a combination of fine iron ore material, flux additive materials (limestone and dolomite), coal material, and pure oxygen gas. When the pure oxygen gas combines with the coal material, the necessary heat and temperature is generated to melt the fine iron ore material into hot molten metal which largely contains the iron from the iron ore while the flux additive materials generate a hot molten slag which largely contains the remainder material from the iron ore – a mixture of mineral impurities, flux additives, and coal ash. The flux additive materials also serve to facilitate the melting of the fine iron ore material – specifically the non-iron material in the ore – and allows for the resulting hot molten slag to be less viscous and easier to flow at the melting temperature.

The physical product from the Project facility will be in the form of solid iron ingots (approximately 5 kg pyramid shaped per Figure 2.2) cast from the hot molten metal. The solid iron ingots will be bulk trucked from the Project facility to inventory storage at the Port of Belledune's Terminal 3 prior to bulk loading onto ships for delivery to steel production customers.

Figure 2.2 Solid Iron Ingots

Terminal 3 will also be used for inventory storage and shipping of the granulated slag by-product material (an aggregate type material) (Figure 2.3) and will be trucked in bulk from the Project facility.

Figure 2.3 Granulated Slag

The pure oxygen gas required for the melting process by the Project facility will be generated by an Oxygen Plant that is expected to be built, owned, and operated by a third party with dedicated supply to the Project facility. The Oxygen Plant will also supply pure nitrogen gas to the Project facility used for general operating purposes. The Oxygen Plant will be located adjacent to NB Power's Belledune Thermal Generating Station and physically separated from the Project facility.

The pure oxygen gas used by the Project facility combines with various components within the fine iron ore and coal materials and generates a residual off gas stream. This off gas stream will have a composition and energy content (calorific value) that is high enough to be of value as a fuel. The off gas stream will be exported from the Project facility as a by-product gas to NB Power's Belledune Thermal Generating Station (via an interconnecting pipe) where it will be combusted in the existing boiler as an alternative fuel source to coal for generation of electricity. The by-product gas burned in the Belledune Thermal Generating Station's boiler (originally designed to allow for dual-firing) will replace a portion of coal combustion. As a result, direct coal consumption by NB Power's Belledune Thermal Generating Station for power operations will be substantially reduced.

Maritime Iron will work in conjunction with NB Power's Belledune Thermal Generating Station to obtain fresh water for potable and process use, soft water, for the Project facility. The Project facility will make use of existing coal receiving, handling, and storage facilities at NB Power's Belledune Thermal Generating Station. Such interconnected services and/or utilities including steam between the Project facility and NB Power's Belledune Thermal Generating Station are possible to be undertaken (where determined to be technically feasible) because the original design of the generating station allowed for the future expansion of up to four boilers, thus providing sufficient capacity for these services and/or utilities.

Although the Project facility will be closely integrated with NB Power's Belledune Thermal Generating Station under a contractual arrangement between Maritime Iron and NB Power, associated activities at the generating station will be under the care and control of NB Power and are therefore outside the scope of the Project.

The power supply for the Project facility will be supplied from the NB Power provincial grid for highest reliability.

2.2 PURPOSE/RATIONALE/NEED FOR THE UNDERTAKING

The purpose of the Project is to produce an iron product – both basic MPI (basic-purity) and HPI types – for sale as ferrous feedstock material to the steel-making and metal casting industries in North America, Europe, and the Middle East. Steel-making in North America has been transitioning away from the large, integrated steelmakers to smaller electric arc furnace (EAF) steel producers who recycle scrap steel as their primary input. Through recycling steel, these EAF steel producers produce steel in a much more environmentally friendly manner than traditional integrated blast furnace (BF) and basic oxygen furnace (BOF) steel producers. In order for EAF steel producers to produce higher quality steels, a virgin iron product source is required – pig iron or an alternative iron unit.

There are no large-scale dedicated pig iron production facilities in North America, with the result that virtually all pig iron is imported from overseas. These pig iron imports come from iron-making facilities in Russia, Ukraine, Brazil, India and South Africa. North American pig iron imports totaled 5.3 million tonnes in 2017. North American EAF steel producers have stated their desire for a regional supplier of pig iron in order to reduce their geopolitical risk and to simplify and shorten the length of their supply chain. The demand for alternative iron units (including pig iron) is also increasing as the supplies of high-quality scrap steel diminish and the production of high-end steel products from EAF steel mills increases.

The Port of Belledune is approximately 425 kilometers (approximately a one-day sail) from the Port of Sept-Iles and Port Cartier in Quebec, Canada's primary iron ore export terminals. Almost all of the iron ore production in Canada sails past Belledune (Chaleur Bay). Maritime Iron intends to source part of its iron ore used in its Project facility from Canada (Quebec, Labrador, and/or Nunavut), thus keeping a substantial portion of the iron ore value chain within Canada. These iron ore supplies would otherwise be delivered to iron production facilities and integrated steel mills in Europe and Asia.

Maritime Iron estimates that the Project will require almost $1.5 billion of investment and will create approximately 1,300 temporary jobs (on a full-time equivalent basis) at the peak during its three-year construction phase as well as approximately 200 direct permanent jobs during the operation and maintenance phase. In addition to the use of skilled local labour, other positive attributes of the Project include its strategic location, the use of existing infrastructure, energy integration with NB Power, and the use of an environmentally competitive technology.

Integration with NB Power's Belledune Thermal Generating Station will also provide a series of benefits to the region. Under the proposed amendments to coal-fired electricity regulations, coal-fired power plants need to meet the environmental performance standards of natural gas power generation or be phased out by 2030. Through the combustion of the Project facility's by-product gas, NB Power's Belledune Thermal Generating Station can remain operational for the long term – lowering the combined emissions of both facilities and keeping NB Power's Belledune Thermal Generating Station within emissions limits.

NB Power's Belledune Thermal Generating Station is also the largest user of the Port of Belledune and its closure would result in a significant drop in shipping volumes to the Port.

2.3 PROJECT LOCATION AND SITING CONSIDERATIONS

The Project will be located on land currently owned by NB Power at 1558 Main Street (Route 134) in the Village of Belledune, Beresford Parish, Gloucester County, New Brunswick. Project components will be situated immediately adjacent to NB Power's Belledune Thermal Generating Station and the Port of Belledune. This site is located east of Chaleur Sawmills, southwest of the generating station and north and east of Route 134.

The Project Development Area (PDA) is defined as the area of physical disturbance associated with the Project. For the purposes of this assessment, the PDA includes the applicable portions of Parcel Identifier (PID) 20616322, PID 20598090, and PID 20277927. The total area of the PDA is 81.2 hectares (ha) and is shown in Figure 2.4. Locating the Project on available land that is currently owned by NB Power will require Maritime Iron to enter into a negotiated comprehensive commercial agreement for use of those portions of PID 20616322, PID 20598090, and PID 20277927 required for the Belledune Iron Processing Facility.

V:\1214\active\121415659\1_environmental\2_drawings\gis\figures\eia\121415659-201_eia_PDA_20190417.mxd mhuskinsshupe

Sources: Base Data - from the Government of New Brunswick

Service Layer Credits: Service New Brunswick/Service Nouveau Brunswick

Project Development Area

Stantec

121415659 - PROPOSED IRON PROCESSING FACILITY, BELLEDUNE, NEW BRUNSWICK - MARITIME IRON INC.

Figure 2.4

The land on which the Project facility will be located is zoned for “Industrial Type 1” uses. According to the Village of Belledune Rural Plan (Council of the Village of Belledune and Belledune District Planning Commission 2018), permitted uses in this zone include metallurgical plants.

The Project had previously investigated during a pre-feasibility study (PFS) alternatively locating the Belledune Iron Processing Facility on PID 20832465 as a standalone facility that was not integrated with the Belledune Thermal Generating Station. That site is located east of Turgeon Road and south of the Glencore Canada slag pile. In the 1980s, the site had been considered for the development of a nickel refinery and, at that time, some grubbing, grading and earth movement had been performed on the property. Since that time the site has been unoccupied, and vegetation has been left to grow. The PFS concluded that, based on the integration opportunities with NB Power’s Belledune Thermal Generating Station, locating the Project facility as close as possible to the generating station would eliminate the need to build a separate power plant, reduce the length of conveyors from the Port of Belledune, result in less overall land disturbance for the Project, result in fewer overall greenhouse gas emissions, and result in significant savings in capital expenditures.

The location selected for the Project on PID 20616322, PID 20598090, PID 20277927is ideally situated to take advantage of:

- proximity to the Port of Belledune which includes existing infrastructure/facilities (particularly NB Power’s Terminal 2 conveyor from the Port of Belledune) and capacity to accommodate Project-related material receiving, handling, and shipping requirements;
- regionally available source materials from Labrador and Quebec (and possibly Nunavut);
- accessible energy from the main NB Power electrical grid which passes in the immediate vicinity of NB Power’s Belledune Thermal Generating Station; and
- opportunities for integration of several aspects of the Project facility with NB Power’s Belledune Thermal Generating Station.

As discussed in Section 2.2, the Port of Belledune is located within a one-day sail from Canada’s primary iron ore export terminals in Quebec and provides access to customers all along the eastern seaboard of North America, the Great Lakes, and Europe. Thus, the proposed location of the Project facility, approximately 1.5 km from the Port of Belledune, simplifies the raw material and finished product logistics chain through easy access to both iron feed sources and markets. The Port of Belledune has indicated that there is sufficient capacity to accommodate an increase in vessel traffic at the port related to the Project. It is unlikely that a Project-related increase in activity would lead to restrictions or require expansion of the port. The Port of Belledune does not anticipate that Project-related use of the port will require review following the Technical Review Process of Marine Terminal Systems and Transhipment Sites (TERMPOL), as no substantial modifications to the port are planned and the Project will not involve transshipment or the transportation of hazardous goods (J. David, pers. comm. January 4, 2019).

The siting of the Project immediately adjacent to NB Power’s Belledune Thermal Generating Station provides easy access to the NB Power electrical grid for a reliable supply of power and also allows for the following integration opportunities of these two facilities:

- Residual by-product gas from the Project facility will be combusted in the generating station as an alternative fuel source, substantially displacing coal consumption.

- Recycling the Project facility's off gas in this way will substantially reduce GHG emissions from the generating station as well as eliminate the need for the Project to build a competing or redundant power plant. Although the Project will result in an overall increase in coal use between the two facilities, the integrated operation will provide for both higher efficiency, lower GHG intensive iron production than would a standalone facility, and GHG savings when compared to operating both facilities on a standalone basis (see the GHG Valued Component (VC) in Section 6.03 for further details).
- The Project facility will share certain utilities and services with NB Power's Belledune Thermal Generating Station, including raw material receiving, handling, and storage; fresh water supply; and steam. These operational synergies are anticipated to lead to a novel partnership and enhanced productivity for both NB Power and Maritime Iron.

2.4 SELECTION OF TECHNOLOGIES

The conventional blast furnace iron-making method is a part of the traditional integrated steel-making route as shown in Figure 2.5. This requires a sintering plant to pre-process the iron ore material and a coking plant to pre-process the coal material such that the materials will be in a physical form that can be processed properly by the BF into hot molten iron. The molten iron is then immediately transferred in batches to the basic oxygen furnace which processes the iron further into hot molten steel which is subsequently casted / rolled into various finished steel products. The integrated steel-making route typically involves a very large overall footprint and large production capacity to justify the expense of installation of all the required plants.

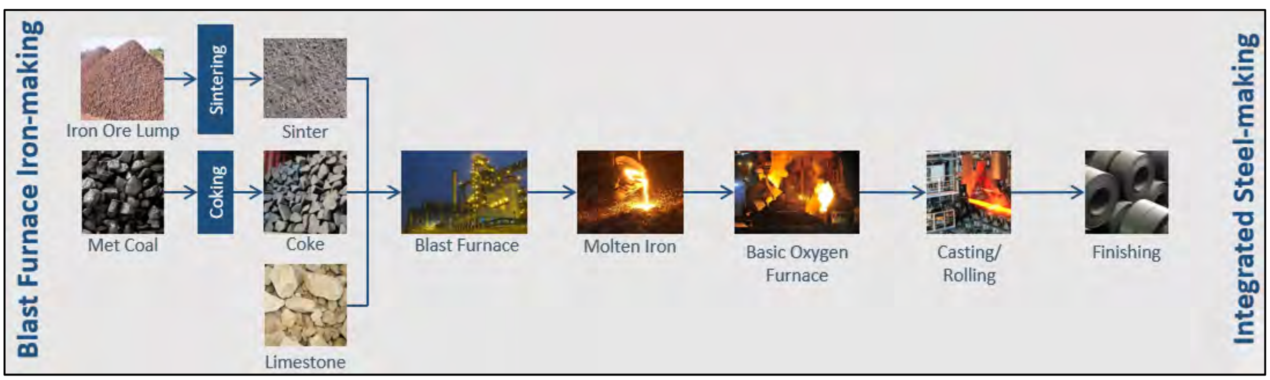


Figure 2.5 Blast Furnace Iron-Making in the Integrated Steel-Making Route

The relatively newer EAF steel-making route relies upon recycled scrap steel and graphite electrodes to produce hot molten steel which is subsequently casted / rolled into various lower value finished steel products. Adding pig iron to the EAF allows for the production of higher value finished steel products equivalent to the traditional blast furnace steel-making route. The EAF steel-making route allows for a substantially smaller overall footprint and smaller production capacity (due to reliance on availability of scrap steel) and less complexity.

The Project will employ the FINEX iron-making technology process, a commercially proven alternative iron-making method (jointly developed by POSCO, South Korea and Primetals Technologies, Austria) for improved efficiency and reduced emissions in comparison with the conventional BF iron-making method.

Unlike conventional BF iron-making, the FINEX process eliminates the need for construction and operation of a coking plant and a sintering plant while still producing a hot molten metal that is identical in quality.

The FINEX iron-making technology process has the following advantages over the conventional blast furnace iron-making method:

- **No coking plant –** Unlike conventional BF iron-making methods, the FINEX process does not require coke ovens or coking production for pre-processing of the coal materials. Non-coking coal material are used directly (without any pre-processing) as the primary reducing agent and energy source to the FINEX process. With only approximately 10% coke material required for the FINEX process, this makes the installation of a dedicated coking plant for the Project unnecessary. This lowers the overall footprint and energy intensity of the Project and reduces GHG emissions substantively over conventional BF iron-making methods **(see the GHG VC in section 6.3 for further details).**
- **No sintering plant –** Unlike conventional BF iron-making methods, the FINEX process will not require sintering production for pre-processing of the iron ore material. Non-sintered fine iron ore material can be used directly (without any pre-processing) as a feed to the FINEX process, thus making installation of a dedicated sintering plant unnecessary for the Project. This lowers the overall footprint and energy intensity of the Project and reduces GHG emissions substantively over conventional BF iron-making methods.
- **Strong environmental performance –** the FINEX process was created to manage emissions and wastes from iron-making responsibly. While the blast furnace iron-making method aims to enrich the hot blast furnace with atmospheric oxygen, the FINEX process uses high-purity oxygen. The FINEX process captures most of the potential air pollutants in an inert state in the slag and all potentially harmful hydrocarbons formed from the use of coal are destroyed as part of the process. In comparison to conventional BF iron-making, the FINEX process has significantly lower emission rates of sulphur oxide (SO_x) and nitrogen oxide (NO_x) gases, as well as dust / particulate matter, due to the use of pure oxygen only (and no direct-contact air streams), along with the elimination of coking and sintering plants. The off gas (generated in the melter gasifier vessel and used for iron reduction) from the FINEX process will be a by-product gas used by the neighbouring NB Power Belledune Thermal Generating Station to produce electricity, substantially reducing its coal usage.
- **Iron ore feed flexibility –** The FINEX process can use iron ore feed types and fines that normally cannot be used by traditional iron-making technologies or can only be used in very limited amounts. The FINEX process does not require premium cost iron ore pellets or lump. This also eliminates the need for expensive pelletizing equipment or a sintering plant, lowering the overall footprint, energy intensity and capital intensity of the Project. This allows Maritime Iron to have feed flexibility in using iron ore raw materials and to be opportunistic in the sourcing of these iron ore raw materials.

The FINEX process is therefore a beneficial replacement for the conventional BF iron-making in the traditional integrated steel-making route (as per the existing POSCO FINEX plants in South Korea) and ideally suited to supply the newer EAF steel-making route as shown in Figure 2.6, especially as a standalone iron-making plant like the Belledune Iron Processing Facility.

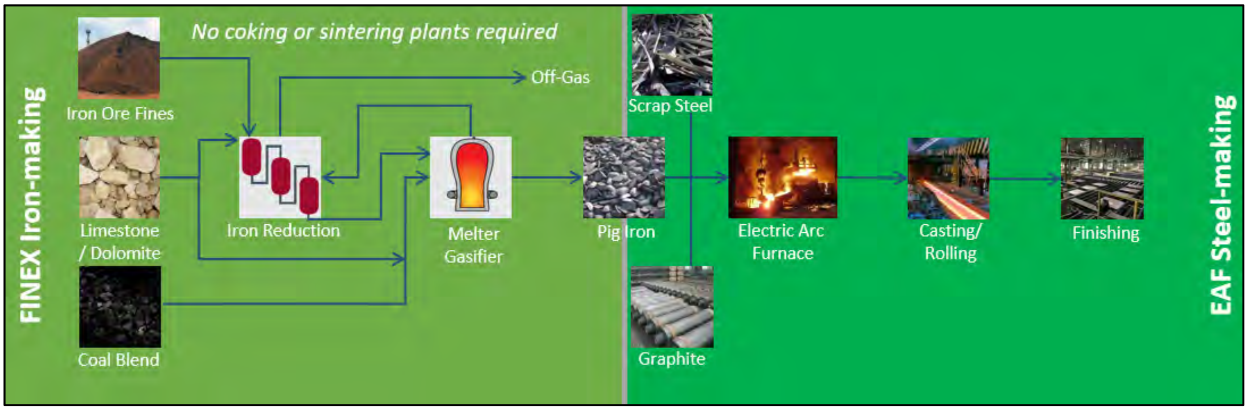


Figure 2.6 FINEX Iron-Making in the EAF Steel-Making Route

2.4.1 Overview of the FINEX Process

The following provides a high-level overview of the FINEX iron-making technology process that will be used by the Project. A key feature of the FINEX process is that iron production is carried out in two separate processing steps. In the first step, fine iron ore is reduced (i.e. oxygen is removed from within the solid iron oxide) in a series of fluidized bed reactor vessels, then made into hot compacted iron (HCI), and then charged into the melter gasifier vessel. In the second step, coal materials are formed into coal briquettes which are charged into the melter gasifier vessel and gasified, providing the necessary energy for melting the HCI in addition to generation of the off gas. Both steps occur within a completely enclosed system of pressure vessels and piping. These main steps in the FINEX process are shown in Figure 2.7 and described further below.

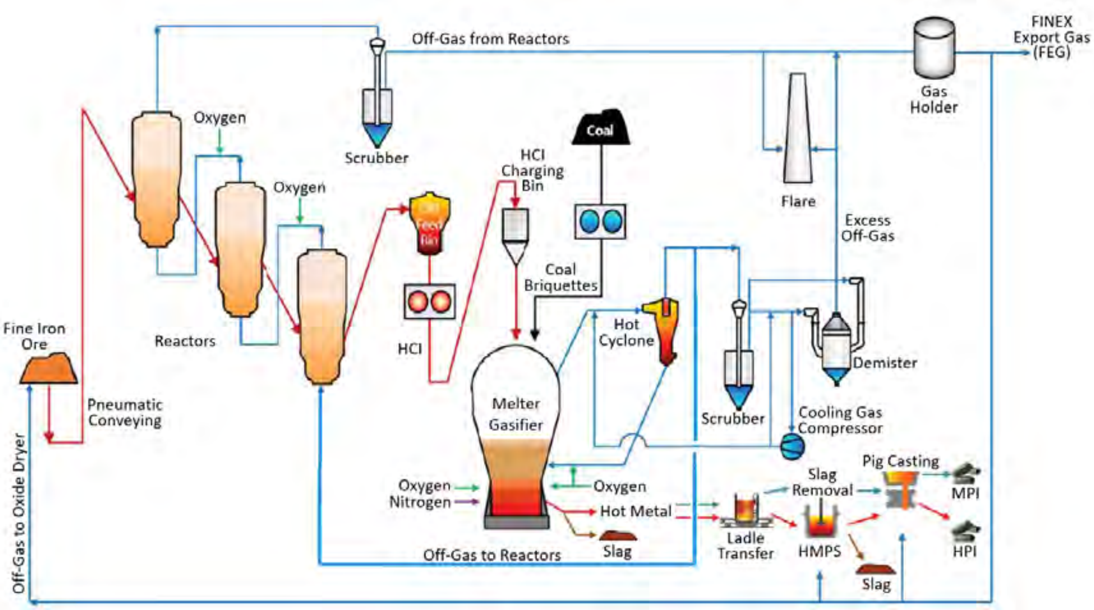


Figure 2.7 FINEX Process Flow Sheet

Moisture is removed from the fine iron ore in the oxide dryer using off gas from the gas holder. The dried fine iron ore is then transported via enclosed pneumatic conveying and charged to a series of three fluidized bed reactor vessels. The off gas generated in the melter gasifier vessel flows through each of the reactors in counter-flow to the fine iron ore direction. The fine iron ore is fluidized by the off gas stream and the fine iron ore is increasingly reduced in each reactor vessel to form direct reduced iron (DRI). Following the exit of the DRI from the last reactor vessel, it is then compacted to HCI and subsequently conveyed to the HCI charging bin at the top of the melter gasifier where it is directly charged, together with the coal materials (non-coking coals in the form of coal briquettes, plus a minor amount of coke), into the melter gasifier vessel. Final reduction and melting of the HCI then takes place inside the melter gasifier vessel.

After the coal materials drop onto the char bed inside the melter gasifier vessel, de-gassing takes place. The released hydrocarbons are immediately dissociated into carbon dioxide (CO_2), carbon monoxide (CO), and hydrogen (H_2) gases. This is due to the high temperatures (exceeding 1,000°C) in the dome of the melter gasifier vessel. Pure oxygen (O_2) injected into the lower part of the melter gasifier vessel gasifies the coal materials, generating heat for melting the HCI as well as a highly valuable off gas (due to the calorific value the of CO and H_2).

The off gas which exits from the dome of the melter gasifier vessel has large dust particles removed in a hot cyclone before the majority is sent to the reactors. A portion of the off gas from the hot cyclone is cooled by a water scrubber (which also removes fine dust particles) and is circulated via a cooling gas compressor to control the off gas temperature entering the hot cyclone. The off gas from the reactors is cooled by a water scrubber (which also removes fine dust particles) and is combined with excess off gas (which exits a demister from the cooling gas compressor circuit) and is sent to the gas holder. A portion of the combined off gas from the gas holder is used for drying and heating purposes while the majority is available as a by-product gas, or more specifically identified as FINEX Export Gas (FEG), for power generation purposes. The by-product gas is normally not sent to the flare which is only used during an emergency situation.

Following melting of the HCI, a physical tapping procedure is carried out exactly in the same manner as in conventional BF practice to release hot metal (hot molten iron) and hot molten slag material from the lower part of the melter gasifier vessel. The quality of FINEX hot molten iron metal produced is identical to excellent blast furnace hot molten iron. The hot molten slag is granulated into a solid aggregate type material via water quenching while the hot molten iron is moved by ladle transfer to the hot metal pre-treatment station (HMPS) for additional removal of phosphorus and sulphur (for HPI) and/or additional slag removal (for HPI & MPI). The hot molten iron is then moved to pig casting where the solid MPI and HPI ingots are prepared. Products are transferred by truck to Terminal 3 at the Port of Belledune for shipment to market.

2.5 PHYSICAL COMPONENTS OF THE PROJECT

2.5.1 Physical Components Within Project PDA

A preliminary three-dimensional (3D) block visualization of the Project is provided in Figure 2.8 which shows the physical location in relation to NB Power's Belledune Thermal Generating Station.

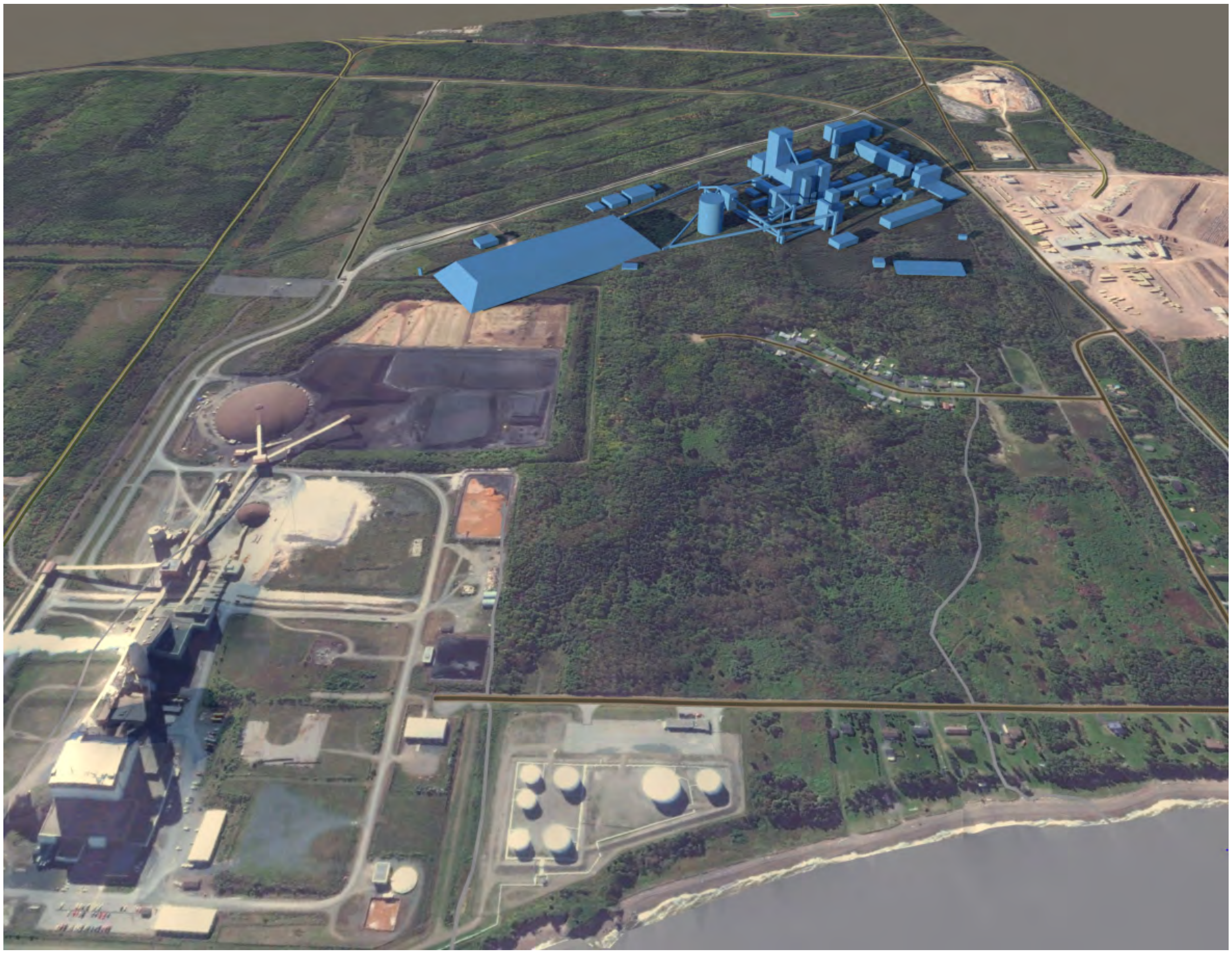


Figure 2.8 Project 3D Block Visualization (Looking South)

The Project will consist of the following physical components:

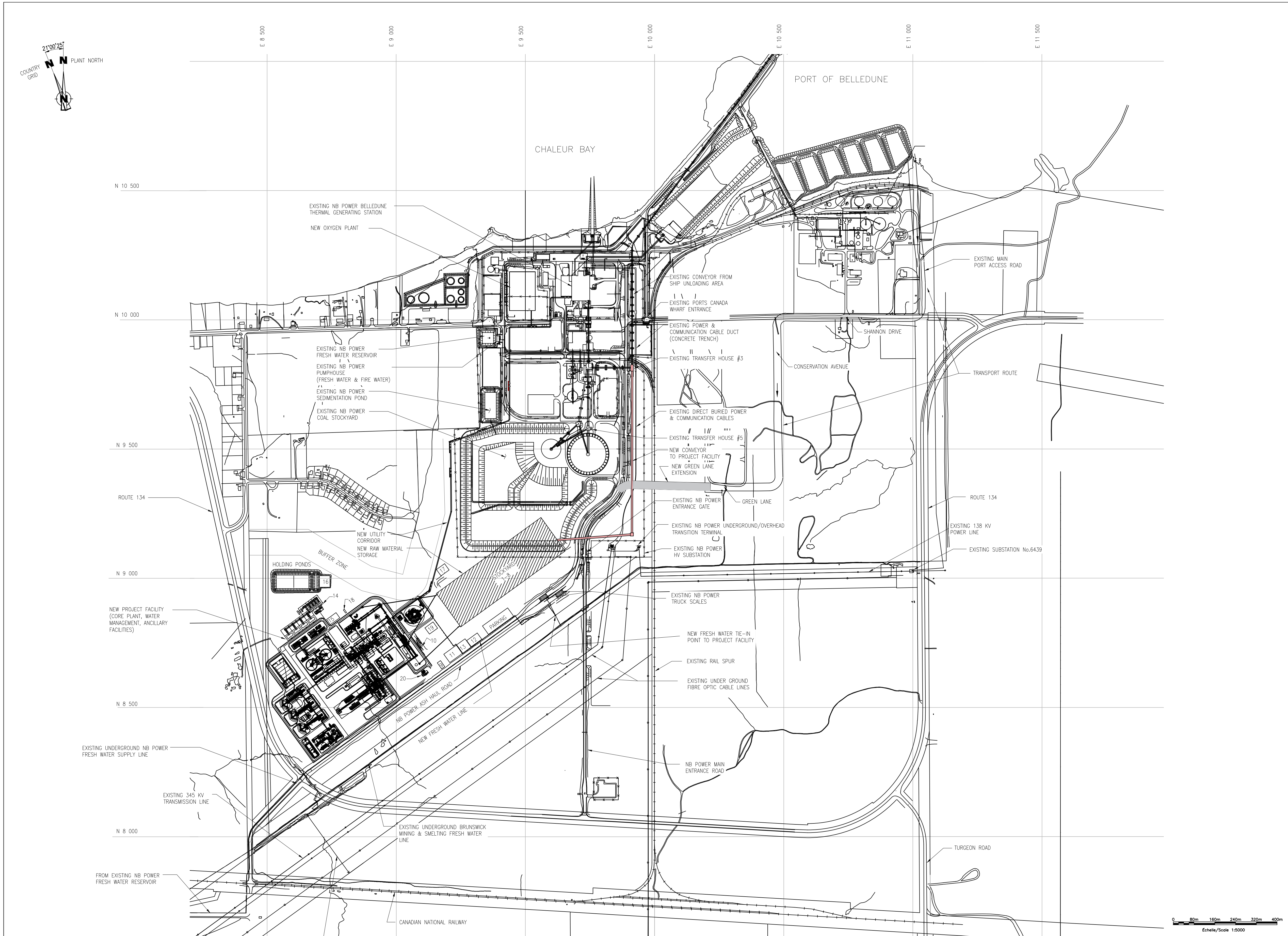
- **Raw Material Storage:** The Raw Material Storage component will be covered and consist of the Stockyard system which will receive large batches of individual raw materials from the Port of Belledune via extension of NB Power's conveyor for covered storage in individual stockpiles. A relatively small quantity of bulk materials will also be delivered by truck directly to the Project facility.
- **Core Plant:** The Core Plant component will consist of the following distinct operating systems required for the FINEX iron-making process:
  - Stock House

  - Coal Briquette
  - Oxide Dryer
  - Reactor
  - Hot Compacted Iron (HCI)
  - Melter Gasifier
  - Cast House
  - Slag Granulation
  - Hot Metal Pre-treatment Station (HMPS)
  - Pig Casting
  - Off gas
  - Utility
- **Water Management:** The Water Management component will consist of water handling systems for rainfall (contact and non-contact) and process water treatment facilities (including clarifiers and biological effluent treatment).
- **Ancillary Facilities:** The Ancillary Facilities component will consist of the remaining items and buildings not directly associated with the Project facility operating systems.
- **Utility Corridor:** The Utility Corridor will contain the interconnecting piping services between the Project facility and the Oxygen Plant and NB Power's Belledune Thermal Generating Station.
- **Oxygen Plant:** The Oxygen Plant will provide the pure oxygen and pure nitrogen required for the Project facility. The Oxygen Plant will be built and operated by a third party.

A preliminary 3D block visualization indicating the main physical components of the Project is provided in Figure 2.9.

Figure 2.9 Project 3D Block Visualization (Looking North East)

A preliminary Overall Site Plan for the Project is provided in Figure 2.10 reflecting the two-dimensional layout of the physical components.



LEGEND:

1-8	STOCKPILES IN STOCKYARD
9	SECURITY GATEHOUSE
10	TRUCK SCALES
11	ADMINISTRATION BUILDING
12	CHANGE HOUSE
13	CENTRAL CONTROL ROOM & LABORATORY
14	MAIN SUBSTATION
15	MAINTENANCE BUILDING
16	FIRE WATER PUMP HOUSE
17	LPG (PROPANE) STORAGE
18	DIESEL FUEL STATION
19	POTABLE WATER PLANT
20	ANCILLARY SUBSTATION

NOTES:

1. GRID COORDINATES SHOWN ARE FOR CONSTRUCTION AS PER PLANT NORTH.

NOT TO BE USED FOR CONSTRUCTION

DRA FOR INFORMATION ONLY

MARITIME IRON Sustainable Ironmaking

MARITIME IRON DWG. No. FM1-MI-01-3400-Z01-00004

PROFESSIONAL SEAL

DESIGN REF.	DRAWING No.	DESCRIPTION
DESIGN	REFERENCE DRAWINGS	

REV	BY	DATE	REVISIONS	CHK	DATE	S.L.	DATE
D	REC	06.09.19	ISSUED FOR E.I.A	–	–	–	–
C	MM	18.03.19	UPDATED AND ISSUED FOR REVIEW	–	–	–	–
B	MM	05.03.19	UPDATED AND ISSUED FOR REVIEW	–	–	–	–
A	MM	28.02.19	ISSUED FOR REVIEW	–	–	–	–

APPROVAL	SIGNATURE	DATE
CLIENT	R. GASPARI	06.09.2019
PROJ. MNGR.	T. FLETCHER	06.09.2019
PROF. ENG.	T. FLETCHER	06.09.2019
PROJECT ENG.	M. KANAREK	06.09.2019
PROCESS ENG.	C. HIZMERI	06.09.2019
D.O. MNGR.	N. HOLMAN	06.09.2019
SECT. LEADER		
CHECKED	M. KANAREK	06.09.2019
DRAWN	M.McINERNEY	07-01-2019

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TITLE PROJECT OVERALL SITE PLAN

SIZE		SHEET:	REV.	SCALE
A0	Figure 2.10	1 OF 1	D	1:5000 U.O.S.

2.5.2 Integration with Other Facilities

Some physical components related to the Project may be undertaken, installed, or used by third-parties in order to provide services to the Project pursuant to requisite service agreements. In certain instances these components may be located outside of the PDA, and in these circumstances Maritime Iron will work in conjunction with the applicable asset owner or third party to obtain access in order to conduct any necessary work to be able to provide required information for the purposes of obtaining permits or the environmental assessment approval related to an integration point. The integration points listed below will be considered in the discussion of the effects of the Project as required.

- Installation of new electrical equipment (e.g., any high voltage transmission lines and 345 kV stepdown transformers) by NB Power to supply power to the Project components from the main provincial grid. The exact location of the new 345 kV stepdown transformers and routing of the power supply to the Project components is yet to be determined by NB Power, however the location is expected to be within an existing NB Power transmission line right-of-way area.
- Installation of new fresh water supply pumps within the existing water reservoir on the Belledune River in order to provide the required flow and pressure to the Project.
- Cooling requirements for the Project facility and/or the Oxygen Plant may be tied into the NB Power Belledune Thermal Generating Station's existing seawater system thus reducing the amount of fresh water requirements. The volume of seawater used would not be expected to exceed NB Power's existing approved withdrawal limits.
- Temporary use of NB Power's graded area located approximately due south of the Route 134 and Ash Haul Road intersection (accessed from Belledune Road) for overflow construction laydown purposes.
- While Maritime Iron will utilize its covered storage for thermal coal within the Stockyard system, the possibility of additionally using the NB Power Belledune Thermal Generating Stations's existing coal dome for thermal coal storage could be considered.
- Use of the previously planned expansion of the Port of Belledune's Terminal 3 land area to accommodate the temporary storage of the Project's products prior to shipping. Any expansion requirements for Terminal 3 are yet to be determined by the Port of Belledune.
- Temporary use of portions of the Port of Belledune's Terminal 3 and/or Terminal 4 land area for construction purposes; mainly the off-loading of equipment and supplies related to building the Project but also temporary construction storage and/or laydown purposes.
- Upgrading / widening of private roads on the Port of Belledune's industrial lands already slated for future development between the PDA and the Port for construction purposes, mainly the movement of equipment and supplies. This will specifically be for the Main Port Access Road, Shannon Drive (including relocation / adjustment of pole utilities as required), Conservation Road, and Green Lane (including extension west to join NB Power's Main Entrance Road). Depending upon the upgrading requirements determined during future Project engineering, the alternative of constructing a temporary diagonal road across these lands could be implemented.
- Temporary use of the Port of Belledune's industrial lands already slated for future development for construction laydown purposes, particularly in the area nearby Shannon Drive and Conservation Road.
- The Port of Belledune's Module Hall located on Route 134 due east of the PDA is anticipated to be used for temporary construction purposes (e.g., storage of equipment and/or materials, small module construction, preparation and application of refractory materials).

2.6 PROJECT ACTIVITIES AND SCHEDULE

Maritime Iron is proposing to begin early works in Q1 2020 in preparation of construction activities, subject to the receipt of all necessary permits, approvals and authorizations. Construction and commissioning is anticipated to be completed in Q4 2022, with initial start-up of the Project facility by end of 2022. The schedule is subject to change pending the timelines for regulatory approval, including the EIA Registration determination. The Project is anticipated to have in excess of 30-year operating life. The project phases, key activities, and anticipated schedule, assuming receipt of required permits and approvals, are outlined in Table 2.1 and Table 2.2.

Table 2.1 Project Activities

Project Phase	Project Activity
Construction	Site Preparation
	Construction of Temporary Facilities
	Construction of Project Components
	Ground Transportation
	Marine Transportation
	Commissioning
	Employment and Expenditure
	Emissions and Wastes
Operation	Iron Production
	Maintenance
	Ground Transportation
	Marine Transportation
	Employment and expenditure
	Emissions and Wastes
Decommissioning and Abandonment	Decommissioning of Facility

Table 2.2 Anticipated Construction Schedule

Construction Activity	2020												2021												2022												2023		
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
Site Preparation			■	■	■	■	■	■	■	■	■	■																											
Construction of Temporary Facilities							■	■	■	■	■	■																											
Construction of Primary Project Components									■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
Construction of Secondary Project Components																				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
Commissioning																											■	■	■	■	■	■	■	■	■	■	■		
Start-Up / Operation																																						■	■

2.7 CONSTRUCTION

The Project construction phase is anticipated to commence in Q1 2020 and be completed in early 2023. Construction activities will be carried out year-round and will be conducted primarily during daylight hours. The Project construction phase will include the following components:

- Site Preparation
- Construction of Temporary Facilities
- Construction of Project Components
- Transportation
- Commissioning
- Employment
- Emissions and Wastes

The Project construction phase will start with early works comprising those activities, such as initial site establishment, necessary to commence a safe and productive construction effort.

2.7.1 Site Preparation

Site preparation activities for the construction of the Project facility include completion of a detailed site survey, clearing of vegetation, and grubbing and removal of unsuitable overburden material (USM). It is conservatively assumed that the entire area of the PDA will be disturbed as part of site preparation. Site preparation will take place in two unique work periods – early works and bulk earth works.

The early works period consists of the site preparation for the eastern area of the site and will be completed during Q2 2020. This eastern area is where the Raw Materials Storage and Ancillary Facilities Project components would eventually be built. The western area is where the Core Plant and Water Management Project components would eventually be built.

Vegetation removed as part of site preparation clearing activities will be transported to a local green waste facility for recycling or mulched on site. Wood that is determined to be suitable as firewood based on tree size and species may be made available to the local biomass plant or to the community. Any suitable topsoil that may be encountered during site clearing and grubbing operations will be stockpiled on site and, where possible, re-used as part of landscaping operations after completion of construction. During the site preparation clearing operation, surface water will be channeled to temporary holding / settlement ponds to allow precipitation of sediment and natural filtration. The sediment from these ponds will not need to be removed from the site, and these ponds will eventually be allowed to naturally dry out and will be filled-in as part of landscaping operations after completion of construction.

During the original development of the NB Power site in the early 1990s, two small access roads were constructed on the proposed site (from the private NB Power Ash Haul Road) and have been used as an area for temporary storage of small amounts of construction debris (i.e., old asphalt and rock materials). These small access roads will be used for early works construction access to the site and any unsuitable material will be removed as part of the construction of the Project facility. These small access roads will be upgraded, reinforced and widened to accommodate early works construction traffic accessing the site.

Site grading will be performed to achieve the design elevations for the construction of the Project components – building and process structure foundations, roadways, temporary facility laydown and storage areas, and other ancillary facilities. During site grading, permanent underground services such as storm water mains, fire water mains, process and sanitary water mains, and possibly electrical duct banks will be placed and backfilled. Material will be excavated using conventional hydraulic, diesel-fueled earth moving equipment such as excavators, backhoes, dozers, loaders, etc. Suitable material will be transported by haulage trucks and re-used on site as engineered fill. Material that is not suitable for structural fill will be stockpiled at site for post-construction landscaping use.

The two access roads to the site from the Ash Haul Road will continue to be used during bulk earth works. These access roads will be complemented by the construction of additional, wider pathway routes from the Ash Haul Road suitable to accommodate the transport of pre-assembled and non-preassembled process equipment and associated loose bulk materials onto the site.

A Preliminary Geotechnical Study of the Project site indicates that sufficient quantities of engineered backfill material do not currently exist at the site. The required quantities of structural fill (possibly up to one million cubic metres based on initial conservative estimates), including various grades of coarse and fine aggregate and granular material, could be procured from several existing commercial quarries which are within close proximity to the site and/or delivered by bulk ship to the Port of Belledune. Imported fill will be transported to site using certified commercial bulk transport trucks. Conventional diesel-fueled dozers, graders, rollers, and compactors will be utilized for placement and stabilization of backfill.

No new quarries or borrow areas are anticipated to supply construction materials required by the Project.

2.7.2 Construction of Temporary Facilities

2.7.2.1 Temporary Site Utilities

Early Works

The grading of a section of the eastern end of the site will be performed first, to create an area for the earthworks contractor to set up an Early Works Site Office, worker facilities, storage yard, and parking area. Temporary power for the early works site will be provided by portable diesel or gasoline fueled generators. It is estimated that there would be approximately two to four generators of 6.5 kW capacity that will be operated during daylight hours for two to three months until temporary power is established in Q2 2020. Potable water will be imported by way of certified water haulage transport trucks, and sanitary waste will be collected in portable, self-contained washroom units and removed and disposed by certified contractors. Fueling of mobile equipment will be performed by mobile fuel trucks from a local commercial source. A local certified security contractor will provide full time site security.

Site Access

The primary road access to the site during the Project construction phase, as well as during the future Project operations phase, will be by way of the existing private NB Power Ash Haul Road. Access from the west will be from the Ash Haul Road's current intersection with Route 134. Access from the east will be from the Ash Haul Road's current intersection with the existing private NB Power Belledune Thermal Generating Station's Main Entrance Road (in the vicinity of the existing NB Power truck weigh scales). Secondary road access to the site will be by way of the extension of the existing private Port of Belledune's Green Lane to the Main Entrance Road.

The western intersection with Route 134 will probably require modifications to accommodate the increased volume of construction traffic, including vehicle turning lanes in both directions on Route 134, widening and addition of turning lanes on the Ash Haul Road, and the addition of traffic lights at the intersection. Maritime Iron will conduct this work in coordination with the New Brunswick Department of Transportation and Infrastructure and planned for execution in Q2 2020.

The eastern intersection with the Main Entrance Road will probably require widening and turning radius reconfiguration to accommodate the oversized loads which will be transported from the Port of Belledune via the new extension of Green Lane to the construction site. Maritime Iron will conduct this work planned for execution in Q2 2020.

Temporary Power

In Q2/Q3 2020, after the completion of early works site grading at the eastern end of the site, A temporary 138 kV Power Distribution Site Load Centre inside the site property boundary. The Site Load Centre will be fed by a part overhead / part underground transmission line from the existing overhead 138 kV NB Power transmission line to NB Power's Belledune Thermal Generating Station. Power from the Site Load Centre will be stepped down and distributed to a number of secondary load centres across the construction work sites. This primary source of construction power may be backed up by a second load centre for redundancy and peaking. In addition, construction power may occasionally be supplied by temporary diesel or gasoline fueled portable generators. It is estimated that there could be approximately ten to fifteen portable generators of 2.5 kW capacity that will be operated intermittently for the full duration of the construction phase.

Site Communications

The Project will procure the services of local service provider(s) to supply, install, service, and maintain a project-dedicated and comprehensive communications network to provide land line telephone, data, internet, and all other essential services.

Temporary Water and Effluent

During the Project construction phase various categories of temporary water will be required, to be addressed as follows.

Fresh Water will be required for tasks such as cement / mortar / grout mixing, general site cleanup, seasonal dust control, hydrostatic testing and flushing of new piping and tanks. This water will be supplied via a new piping tie-in to the existing underground fresh water pipe main which runs from the NB Power water reservoir on the Belledune River to NB Power's Belledune Thermal Generating Station. This new piping tie-in will be installed near the existing NB Power truck weigh scales beneath the Ash Haul Road and will be permanent as it will also be required for the Project operations phase. A new underground supply pipe will be installed to a distribution manifold at a convenient location at the construction site. Fresh water will be distributed to usage points across the construction site by temporary piping and/or by suitable water haulage trucks.

Domestic Water will be required for tasks such as sanitary flushing and cleanup at temporary wash cars, lunchrooms, site offices as well as in certain construction testing or mixing applications which may require certain purity specifications. This water will be supplied from the fresh water supply and a new underground supply pipe will be installed to a distribution manifold at a convenient location at the construction site and distributed to usage points across the site by temporary piping.

Potable Water will be required for human consumption. Services of a certified water purification company will be procured to supply, install, operate, and maintain a sized-for-purpose portable Water Purification Unit capable of treating and maintaining an adequate supply of potable water, using the domestic water supply as described above. In addition, supply contracts will be established with local bottled water suppliers to provide and maintain a sufficient supply of bottled water at the construction site which would be openly available to all personnel at all times. Alternatively, a permanent Water Purification Unit or Potable Water Plant capable of treating fresh water for supply of potable water (required for the Project operations phase) could also be used for the Project construction phase.

During the Project construction phase several categories of effluent will be generated, to be addressed as follows.

Sanitary Effluent will be generated from the sanitary facilities required by site personnel. These facilities will be provided primarily by the installation of modern, efficient, portable washroom units that will contain an appropriate number of toilet and ablution fixtures, in accordance with the relevant codes and standards. These units come equipped with holding tanks for potable water as well as for sanitary waste. During the earlier stages of the Project construction phase, service contracts with certified contractors will be procured to cover the removal of Sanitary Effluent waste. During the later stages of the Project construction phase, sanitary effluent from site washroom units will be treated at a temporary Sewage Treatment Unit located on the construction site, and the collected effluent water will be tested for quality and if deemed acceptable will be either gravity fed or pumped into an existing ditch leaving the Project site which discharges into the Bay of Chaleur. Meanwhile, removal and disposal by certified operators, as described above, may continue for certain washroom / toilet units, depending upon their locations on the construction site.

Surface Water Runoff will be encountered throughout site preparation. During the early stages of site clearing and grading, surface water runoff will be channeled to temporary holding / settlement ponds to allow precipitation of sediment and natural filtration without any water runoff from the site. Permanent holding ponds that will be used during the Project operations phase (part of the Water Management Project component) once constructed will then be used for collection of surface water runoff from across the site. During the Project construction phase, the collected surface water runoff will be tested for quality and if deemed acceptable will be either gravity fed or pumped (at a rate approximately equivalent to the natural pre-development drainage rate) from its holding pond into an existing ditch leaving the Project site which discharges into the Bay of Chaleur. If the water quality is unacceptable, the collected surface water runoff in the holding pond will be treated in-situ and/or removed via vacuum truck for off-site treatment.

2.7.2.2 Temporary Site Facilities and Services

Temporary Buildings

In Q3 2020, temporary buildings will be erected at the commencement of site preparation for the Project construction phase, and after the site clearing and grading of the eastern end of the site has sufficiently progressed. These temporary buildings will be pre-fabricated, modularized structures, designed and installed in compliance with all local building code requirements. Options will be considered for each building for the early design and erection of permanent buildings for the Project operation phase which would also be used during the Project construction phase.

Project Site Office (PSO) will be located on the South edge of the site, West of the main construction site entrance, and will accommodate the Maritime Iron Site Management Team as well as a contingent of consultant engineering and project management staff personnel. The PSO is expected to be approximately 30 metres long by 15 metres wide, single story, but may be designed to accommodate the possibility of adding all or part of an upper level as a contingency toward later workspace requirements.

Site Security / Medical Building will be located at a proper distance east of the PSO, adjacent to the main construction site entrance, and will accommodate the full-time security and medical personnel. This building is expected to be approximately 10 m long by 15 m wide, single story.

Site EHS / Orientation & Training Building will be erected at an adjacent location to the above buildings, and will accommodate the emergency, health, and safety (EHS) personnel of the project management staff. This building is expected to be approximately 10 m wide by 15 m long, single story, with possible consideration for future upward expansion.

In addition to the buildings described above, there will be approximately five individual, single-unit area management “Satellite Project Management” office trailers (approximately 4 m wide by 15 m long) placed at strategic locations across the construction site to accommodate area management team members.

Also, a suitable number of temporary washroom and lunchroom / changeroom structures will be placed at strategic locations across the construction site to accommodate all site personnel. These facilities will be sized and located based on area worker densities and requirements of the New Brunswick *Employment Standards Act*.

Construction Parking, Storage, and Marshalling Areas

In Q3 2020, the area that will eventually be the site of the Raw Material Storage Project component, at the eastern end of the site, will be brought to final grade and configured as the construction parking area. A section of the same area will be cordoned off and will serve as a construction storage and marshalling area. Private vehicles will not be permitted on the actual construction work site. Appropriate fencing, gates, turnstiles, and security check points will be installed to delineate the construction parking area from the actual construction work site. Several additional on-site areas will be designated as contractor storage and marshalling areas.

Site Security

All construction activities performed at the construction site, as well as any potential project activities performed in off-site areas adjacent to the construction site, will be governed by the requirements and procedures contained in Maritime Iron's Security Management Plan. All personnel engaged in any and all activities on the construction site or project activities in off-site areas adjacent to the construction site are expected to comply with all the requirements of the plan. The plan will be a comprehensive compilation of rules, regulations, and procedures intended to provide a safe, secure workplace for all, while protecting the assets of the owner as well as those of contract companies engaged in the work. Some of the key features of the site Security Management Plan are:

- Secure perimeter using fencing with controlled gates
- Site access card system for all site personnel
- Pre-access site orientation for all site personnel
- Screening and chaperoning of all site visitors
- Stringent site traffic control
- Gate search policy

The Security Management Plan will be initiated at the beginning of the Project construction phase and will continue for the full duration of construction, commissioning, and plant start-up, at which time the plan may be replaced by a Plant Operations Security Plan.

Site Security will be a responsibility of Maritime Iron's EHS Manager. A competent and certified site security contractor will be selected, through a competitive tendering process, and will mobilize to site at the beginning of the Project construction phase. Site Security personnel will be carefully screened so that only those with an acceptable level of training, certification, and related experience are dispatched to the Project. Site Security will be maintained on a 24hr / 7-day basis for the full duration of the Project and will be headquartered in the Site Security / Medical Building.

Site Medical Services

Site Medical Services will be provided by a certified and competent medical services contractor which will be selected through a competitive tendering process, under the responsibility of Maritime Iron's EHS Manager. All medical personnel will be carefully screened to confirm that only those with an acceptable level of training, certification, and related experience are dispatched to the Project. The site medical services will provide a high standard of occupational injury and illness treatment at the construction site and will assist in managing treatment to minimize the duration and severity of injuries and illnesses. The Maritime Iron Medical Management Plan will outline the procedures and policies to be followed, including the following key policies:

- Pre-employment medical assessment
- Pre-site access drug and alcohol testing
- Prompt emergency response

Site Medical Services will be maintained on a 24hr / 7-day basis for the full duration of the Project and will be headquartered in the Site Security / Medical Building. Site Ambulance and emergency response will be as per the proximity of nearest hospitals, clinics, medivac, etc.

Site Maintenance Services

Site Maintenance Services will be provided by a certified and competent contractor which will be selected through a competitive tendering process. The scope of the site services contract will include all-season maintenance of site areas (e.g., roadways, parking, and storage areas), janitorial services, as well as mechanical and electrical maintenance (for site offices, lunch rooms, washrooms, etc.). This contractor shall also be responsible for coordination of various sub-contractors engaged in service delivery and removal contracts (e.g., waste sorting and removal, water supply and effluent removal) as described in preceding sections.

Contractor Office / Workshop Facilities

There will be a number of individual office trailers, lunchroom trailers, workshop structures, and storage structures required by third-party contractors that will be working on the construction site. The exact numbers of such structures will depend upon the number of the number of third-party service providers contracted for the work but are currently estimated at 25 to 30 units.

Site Perimeter Fencing

Site perimeter fencing will be installed in stages throughout the Project construction phase. Permanent chain link fencing will be installed along the PDA boundary. Temporary fencing will be used within the construction site during the Project construction phase. Sections of temporary fencing will be adjusted throughout the Project construction phase and in certain locations will be replaced with permanent chain link fencing.

2.7.2.3 Off Site Temporary Facilities

Port of Belledune

The Project intends to use the Port of Belledune's private facilities and industrial lands during the construction phase. The Port of Belledune will provide services to the Project as part of contractual service agreements with Maritime Iron. The Port of Belledune will be responsible for obtaining any environmental or other regulatory approvals or permits that may be required.

Portions of the Port of Belledune's Terminal 3 and/or Terminal 4 land area will be used mainly for the off-loading of equipment and supplies related to building the Project, but also for temporary construction storage and/or laydown purposes.

The Project will have a large amount of pre-assembled and non-preassembled process equipment, as well as loose bulk structural steel, plate work, ductwork, piping material, electrical material, major construction equipment, and numerous other commodities transported to the construction site as ocean freight through the Port of Belledune. Given the large sizes and weights of these items, and the very high volume of large transport traffic required, it has been determined that the existing ground transport route between the Port of Belledune and the construction site is not suitable for a number of reasons, including multiple height restrictions and the risk of frequent and lengthy disruptions to public traffic on existing Route 134. The Project has explored and evaluated several alternate routes and it has been determined that the most practical solution is to carry out some overhead utility relocations and perform widening and stabilization work on sections of existing private roads located on Port of Belledune property already slated for future development. This will include the Main Port Access Road, Shannon Drive (including relocation / adjustment of pole utilities as required), Conservation Road, and Green Lane (including extension west to join NB Power's Main Entrance Road). In addition, the industrial land area nearby Shannon Drive and Conservation Road will be used for laydown purposes.

The Port of Belledune's Module Hall located on Route 134 is anticipated to be used for temporary construction purposes (e.g., storage of equipment and/or materials, small module construction, and preparation and application of refractory materials).

2.7.3 Construction of Project Components

2.7.3.1 Construction of Primary Project Components

Construction of the primary Project components (which will be the Core Plant and portions of Water Management) will commence in Q2 2020. The following describes the construction activities involved by the different types of construction contracts and/or type of discipline work required to be completed.

Civil Contracts

In Q2 2020, civil contractors will commence civil contracts works at the Project site, which will include excavation of native material, preparation of sub-bases by placement and compaction of engineered granular fill, erection of temporary formwork, installation of concrete reinforcing steel systems, and placement and backfilling of approximately 140,000 cubic metres of concrete. One or several qualified and certified heavy industrial civil contractors and sub-contractors will be selected through a competitive bidding process for this work.

In most locations, excavation depth will be to bedrock elevation or slightly above. In some other locations, excavation of a quantity of bedrock will be required. Where bedrock removal is required, either hydraulic rock breakers or conventional localized blasting techniques will be used. Proper measures and procedures will be stringently followed to provide compliance with industry and government regulations. All excavated material that is deemed structurally suitable will be stored at site for use during the backfilling and site grading operations. USM will be removed from site and deposited at approved clean fill deposition sites near the Project site. Excavation work will be carried out by conventional, diesel powered excavators and earthmoving trucks of various ratings and capacities.

As soon as each area is excavated and prepared for concrete placement, engineered formwork will be erected, and reinforcing steel and concrete embedment's (such as anchor bolts, steel plates and angles, etc.) will be placed, secured, and stringently checked for quality assurance prior to concrete placement.

Reinforcing steel and other steel embedded pieces will be procured from off-site certified and qualified suppliers and trucked to site.

Concrete will be pre-mixed in one or more off-site batch plants, under strictly controlled quality control and environmental procedures. Transport to site will be by licensed and certified transport trucks. Placement of concrete in prebuilt forms will normally be performed with chutes directly from the concrete trucks, or with mobile concrete pumps. Concrete trucks will be cleaned at site after discharging their loads and prior to returning to off-site public roads. Individual major concrete pours will be executed on a continuous pour basis to avoid concrete “cold joints” and may require occasional overtime and evening work by concrete crews.

When each concrete placement has achieved the proper number of days of cure time, it will be released for formwork stripping, backfill, and placement of equipment and structures.

In addition to the process for placing wet concrete outlined above, it is possible to use pre-cast concrete sections, which would be designed, custom-built, and delivered to site by one or several regional companies who specialize in this work.

SMPEI Contracts

SMPEI is an industry acronym for Structural, Mechanical, Piping, Electrical and Instrumentation contracts, which represents the majority of the scope in the Project construction phase. SMPEI contractors will be selected through a competitive bidding process in which certified multi-trade contractors from across Canada with extensive experience in constructing heavy industrial projects similar to the Project will be invited to submit expressions of interest and proposals for the work. Tenders will be received and analyzed and finalized contracts will be awarded to the successful bidders, and SMPEI contractors will start mobilizing to site mid-2020.

For the purpose of outlining this work, the following systems, sections, and buildings of the Core Plant and Water Management Project components are involved:

- Stock House
- Coal Briquette
- Oxide Dryer
- Reactor
- Hot Compacted Iron (HCI)
- Melter Gasifier
- Cast House
- Slag Granulation
- Hot Metal Pre-treatment Station (HMPS)
- Pig Casting
- Off gas
- Utility (including Cooling Gas Compressor House and Air Compressor House)
- Water Treatment
- Biological Effluent Treatment (BET)
- Interconnecting Conveyors
- Interconnecting Utility Racks

These systems are discussed in detail in Section 2.8.1.1.

The following sections outline the nature of the work required under various trade disciplines:

Pre-Assembled Construction

The execution of the Project construction phase will include a pre-assembly plan, meaning certain sections of the Project facility will be pre-assembled at off-site locations, transported to site, and either jacked or hoisted into place at the construction site. The Project represents a significant amount of construction work to be executed. The pre-assembly plan will provide the Project with the possibility to both optimize execution schedule and maximize local employment, in addition, on-site work can be performed simultaneously with off-site work, in a less-congested environment, meeting Project safety and schedule targets.

The pre-assemblies are categorized as follows:

- **Process** pre-assemblies will be made up of steel structures, process equipment such as pressure vessels, tanks, pumps, and various machinery components, process ductwork and plate work, interconnecting piping, as well as electrical and instrumentation equipment and wiring.
- **Conveyor Gallery Sections** will include conveyor gallery steel structures, belt conveyor components (such as conveyor tables, rollers, idlers, etc.), siding and roofing, cable tray, lighting, and fire protection piping.
- **Steel Structures** will include conveyor transfer tower structures, exterior stairway sections, and other similar all-steel assemblies.
- **Utility Racks** will consist of pipe rack sections 20 metres to 30 metres long, structural steel structures with process ductwork, piping, insulation, electrical cable tray, and other components pre-installed.
- **Electrical Rooms** will include fully assembled, stand-alone steel and siding buildings which will contain pre-installed high voltage switchgear, transformers, motor control centres, interconnecting cables and wires, climate control systems, lighting, and fire protection systems.
- **Vendor Assemblies** will include major pieces of process or utility equipment which will be pre-assembled to the greatest degree possible at various vendor shops and manufacturing facilities.

Certain pre-assemblies will arrive at the Port of Belledune, mostly in 2021, where they will be offloaded and prepared for ground transport to the plant site. Offloading, ground transporting, and setting the pre-assemblies in place at site will be performed by a highly specialized heavy haul contractor, to be chosen from among the few global companies who are capable of planning and executing this work. Offloading from the ocean vessels will be performed using on-board gear or dock-based mobile cranes. Transporting of pre-assemblies from the Port of Belledune to the construction site will be performed using the contractor's in-house fleet of uniquely designed self-propelled transporters (SPTs). Transport to site will be via the upgraded Port of Belledune industrial roads.

Pre-assemblies that are to be installed "at grade" at the construction site will be maneuvered into place above the pre-set anchor bolts and lowered to their permanent elevation using custom-built hydraulic jacking systems. Pre-assemblies that are to be located above grade level will be lifted and placed using very high capacity conventional cranes and/or a gantry lifting system which have been specifically designed for this type of work.

As each module is installed, the SMPEI contractor will perform installation of structural steel, mechanical systems, ductwork, piping, electrical power and control, and instrumentation connections to pre-assemblies as well as between adjacent pre-assemblies.

Site Assembled (Stick-Built) Construction

Significant sections of the Project facility must be completely assembled at site (i.e. stick-built construction). This is because a large scope of the SMPEI work does not lend itself to the concept of pre-assembly. Site work will involve all trade disciplines, as outlined below:

Structural Steel Installation

All the main process areas of the Core Plant Project component include significant tonnage of very large structural steel members. These members will arrive at site by ocean or road transport either as bulk shipped, pre-fabricated steel or as pre-assembled components (as described above). Stick-built structural steel pieces will be offloaded, handled, and erected by crews of certified and experienced personnel, using a wide variety of hoisting equipment which will range in lifting capacity from several tonnes to several hundred tonnes. All hoisting equipment will be operated by provincially certified crane operators. Wherever possible, structural steel components will be pre-assembled at ground level and hoisted in place. Rules and regulations regarding working at heights (e.g., fall protection, aerial platforms, etc.) will be strictly enforced during this work.

Mechanical Equipment Installation

Mechanical equipment components that have not been pre-assembled will arrive at site by either ocean or road transport and will be offloaded and placed in their designated locations by skilled rigging crews. Mechanical trades will perform accurate final assembly, placement, alignment of and connections to the equipment.

Piping Installation

The technical specifications for the Project facility include a very wide range of process and utility piping sizes, pressure and temperature ranges, classifications, and materials of construction. Where possible, it is preferred to maximize the amount of piping to be pre-assembled. A large quantity of process and utility piping will still require stick-built installation. Bulk orders of pipe, pipe fittings, valves, pipe supports, etc. will be placed through a competitive bidding process, either directly by the owner or through the SMPEI contractor(s). In addition, sub-contracts will be awarded for pre-assembly of sections of piping, known as pipe spools, which could be fabricated at a number of off-site pipe fabrication shops. Individual loose piping system components as well as pipe stools will be erected and stringently inspected and tested and assembled into completed piping systems by the certified and provincially regulated piping trades department of the SMPEI Contractor.

Process Ductwork Installation

There is a substantial quantity of large diameter ductwork (up to 2 metre diameter pipe), of various construction materials, required in the process sections of the Project facility. Where possible, ductwork will be pre-assembled. There will be a significant amount of stick-built ductwork required for module interconnections and in sections of the plant where modularization is not feasible. Contracts will be placed through a competitive bidding process to cover manufacturing and fabrication of duct sections, consisting of straight lengths of duct and attached duct fittings that will be shipped to site as pre-assembled duct spools, similar to the piping pre-fabrication concept outlined above. Specialty trades of the SMPEI contractor will rig and install the duct sections, weld / bolt the sections together, and perform duct integrity testing in accordance with specifications and regulations.

Refractory Installation

Many of the process vessels and interconnecting ductwork to be installed in the hot sections of the process are to be lined with various grades and styles of thermal refractory material. Vessels and ductwork and other hot metal handling equipment and chute work will be shipped from manufacturers without refractory installed, since there is a high risk of substantial damage to the refractory during shipping. Therefore, refractory will either be installed at site, after vessel erection, or possibly at a dedicated facility near the plant site where short distance transport does not pose a risk of refractory damage. Refractory types will include a large quantity of precast brick material as well as loose, castable material, both of which will be installed by qualified refractory application specialty trades people.

Thermal Insulation Installation

Many of the process vessels, most of the process ductwork, and some of the piping systems will require covering by thermal insulation and metal cladding systems. Where possible, insulation will be installed at module assembly facilities prior to shipping to site. However, there will be a requirement for a substantial amount of site-installed insulation at module connections and at stick-built sections of the Project facility. Insulation will be shipped to site as a bulk commodity and installed by crews of workers who specialize in this trade.

Electrical Power and Control & Instrumentation Work

Power supply to the Project facility will be from a new NB Power switchyard. A new 13.8kV main substation will be constructed inside the north Project facility boundary from which power will be distributed to eight or more 4.16kV process area substations (PASs). 600V power will be fed from there to various motor control centres (MCCs) and distributed facility-wide to motors, lighting panels, instrument control panels, and all other electrical devices.

The Main Switchyard will be constructed by a high voltage contractor who specializes in this work. The 4.16kV Process Area Substations will be located inside dedicated electrical building structures (electrical rooms) which may be delivered to site as pre-assembled modules or, depending on the specified materials of construction, may be erected at site. Erection of PASs will be performed by the civil and architectural trades people under the SMPEI Contractor. Installation of internal switchgear, transformers, MCCs, and power and control cable systems will also be installed by the SMPEI Contractor using qualified and provincially certified electrical trades people.

Power to facility-wide motors, lighting, control panels, instruments, and other electrical devices will be by way of a system of cable tray, armored industrial cable and wire, and various electrical devices which will also be installed, verified, and tested by the SMPEI Contractor’s electrical trade specialists.

2.7.3.2 Construction of Secondary Project Components

Construction of the secondary Project components (which will be the Raw Material Storage, Utility Corridor, Ancillary Facilities, and remainder of Water Management) will commence in Q2 2021. The following describes the construction activities involved by the different types of construction contracts and/or type of discipline work required to be completed.

Pre-Assembled Construction

The Raw Material Storage Project component consists of a number of covered belt conveyor galleries and transfer houses which will be used to convey raw materials (such as iron ore, coals, limestone, dolomite, etc.) from the NB Power Belledune Thermal Generating Station's material handling conveyor system and deposit them in an enclosed stockpile area at the eastern end of the site. Also included will be mechanical material reclaim equipment to remove stored raw material from the stockpiles, and belt conveyors to transport materials from the Stockyard system to the Core Plant's Stock House and Coal Briquette systems.

The Raw Material Storage Project component will be procured as an all-inclusive bulk material handling (BMH) package, through a competitive bidding process, from one of several international qualified suppliers who specialize in this work. System machinery, conveyor, and structural components will be shipped to site by sea as pre-assemblies which will be as large as practical. These vendor–assembled units will be offloaded, handled, transported, and placed into position at the construction site by the heavy haul contractor.

The Ancillary Facilities Project component will maximize the use pre-assemblies where practical for each of the individual equipment packages involved.

Site Assembled Stick-Built Construction

This Raw Material Storage Project component work includes mechanical, piping, and electrical hook-ups and interconnections of pre-assembled BMH package modules, as well as erection of any sections of the BMH package that are not pre-assembled.

The Stockyard system of the Raw Material Storage Project component also includes a pre-engineered free-span structure (or equivalent) which will enclose the raw material stockpiles. This structure will be assembled in place at site by site structural work crews.

The Utility Corridor Project Component to NB Power will be made up of a series of sleepers (i.e. ground level support members) which will support the ductwork, piping, and electrical cable to be routed along the corridor. These pieces will be shipped to site as precast concrete or pre-fabricated steel components and placed by site-based work crews. The support system will also feature several road and/or rail spur crossovers that will require elevated structural steel structure, which will also be site-assembled. All of the ductwork, piping, electrical cable systems, thermal insulation, lighting, etc. will be pre-assembled to the greatest degree possible and installed by site-based trade crews.

The Ancillary Facilities Project component will be stick-built for the remainder of the equipment, piping, and cable that cannot be pre-assembled.

2.7.4 Transportation

2.7.4.1 Ground Transportation

Construction material, construction equipment, and facility components which are delivered to the Port of Belledune will be trucked to the Project construction site along a predetermined transport route. This would be expected to be a steady stream of traffic back and forth during daylight hours up to 7 days/week. The route was determined in consideration of constraints related to maneuvering pre-assemblies, overhead clearance, and disturbances to local traffic patterns. The transport route selected makes use of existing private roads owned by the Belledune Port Authority, the Glencore Bulk Plant (if required), and NB Power. The use of public roads will not be required for heavy haul transport.

A small section of additional roadway will be constructed by the Belledune Port Authority on their industrial property. The assessment of this road section will be carried out separately by the Belledune Port Authority and is therefore not included in this assessment.

Some construction equipment and material will also be procured from local sources and is anticipated to be trucked to the Project construction site via existing public roads, including Route 134 and Route 11. The site will be accessed via existing roadways that are currently used for industrial purposes and that have sufficient capacity to support the early construction activities. (Route 134 and the private NB Power Ash Haul Road).

It is also anticipated that the construction work force will commute to and from the Project construction site using public roads (Route 134 and Route 11).

2.7.4.2 Marine Transportation

Most materials and equipment required to construct the Project facility which are not available locally will be delivered to the Port of Belledune via ship or barge. They will arrive in various degrees of pre-assembly or as loose bulk freight components. As discussed in Section 2.7.3.2, pre-assemblies will be transported to the Project by sea on large transport ships or barges, which will be hired by the Project from among the few global companies that specialize in providing this service. Pre-assemblies will arrive at the Port of Belledune, mostly in 2021, where they will be offloaded and prepared for ground transport to the plant site.

The pre-assemblies and bulk construction material will be trucked from the Port to the Project construction site using the selected module transport route. It is anticipated that the number of ships and/or barges will be approximately 10 to 20 per month during the 2021 & 2022 calendar years of the Project construction phase.

2.7.5 Commissioning

As construction activities near completion, the Project facility and associated equipment will start to be commissioned in Q2 2022. Commissioning is anticipated to include testing of equipment, pressure testing of pipe and vessels, fine tuning instrumentation and controls, and training operators.

A commissioning procedures manual will be prepared prior to the start-up of the Project facility for use by operators during commissioning and the subsequent operations phase of the Project. This manual will provide detailed procedures for commissioning the Project facility and associated utilities, including emergency response systems.

Once all commissioning activities have been completed, the initial start-up of the Project facility will occur in Q4 2022. It is anticipated that the initial start-up activities will occur over several weeks resulting in a minimal amount of iron production. Operation activities will then continue to ramp-up towards full capacity commercial iron production over the subsequent weeks. Further information on the operation phase of the project is provided in Section 2.7.

2.7.6 Employment and Expenditures

It is estimated that the Project will entail almost $1.5 billion of investment and will create approximately 1,300 temporary jobs (on a full-time equivalent basis) at the peak during its three-year construction phase. The Project workforce will include a variety of management, accounting and payroll, engineering, and construction personnel.

Construction direct and indirect labour activities will be performed by unionized members.

All workers will be required to provide trade qualification records and certificates upon hiring for work on the Project.

2.7.7 Emissions and Wastes

2.7.7.1 Air Contaminant Emissions

Air contaminant emissions of concern are generally classified as criteria air contaminants (CACs) and include carbon monoxide (CO), nitrogen oxides (NO_X), sulphur dioxide (SO_2), and particulate matter (PM, including its common size fractions PM_{10} and $PM_{2.5}$).

Emissions during the Project construction phase are generally related to the generation of dust and routine emissions from construction equipment. Control measures, such as use of dust suppression techniques, will be used in construction zones as required to reduce the fugitive dust, and routine inspection and maintenance of construction equipment will reduce exhaust fumes. The burning of waste brush/slash material will not be permitted.

Air contaminant emissions are expected to be generally confined to the PDA and are not expected to result in measurable increases in local air quality conditions, or to exceed provincial air quality standards.

2.7.7.2 Greenhouse Gas Emissions

The primary sources of GHGs are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and are reported as carbon dioxide equivalents (CO_2e). During the Project construction phase, the use of heavy construction equipment, the transportation of construction materials and equipment deliveries to and from the construction site, and the use of portable generators on the construction site will all result in limited emissions of GHGs.

2.7.7.3 Sound Emissions

Sound emissions during the Project construction phase are generally associated with the operation of construction equipment. Construction noise will be intermittent, as equipment is operated on an as-needed basis and mostly during daytime hours. Noise sources will be mitigated through the use of mufflers.

2.7.7.4 Surface Water Runoff

Site clearing and other construction activities may result in small amounts of erosion and runoff following precipitation events. A Project-specific environmental protection plan (EPP) will be developed prior to commencement of the Project construction phase activities that will include plans for erosion and sediment control measures. This will include the use of temporary holding / settlement ponds to control surface runoff and allow precipitation of sediment and natural filtration without any water runoff from the construction site. Sedimentation material will not be removed from the construction site, but rather will be allowed to dry out and remain on site.

2.7.7.5 Solid and Hazardous Wastes

Non-hazardous solid wastes generated during the Project construction phase will include brush, extra subsoil and rock, temporary fencing, signs, metal containers, canisters as well as scrap metal, excess concrete and other construction materials, and domestic wastes. Scrap paper and other office wastes will also be generated. Non-hazardous industrial wastes will be separated as recyclable and non-recyclable, with recyclable material collected and transported to a licensed recycling facility. Waste management procedures will comply with provincial solid waste resource management regulations as well as additional municipal and disposal facility requirements. Non-recyclable wastes will be transported off-site to a permitted landfill.

Hazardous materials used during the Project construction phase may include, but are not limited to, propane, diesel, gasoline, hydraulic fluids, motor oil, and grease and lubricants for heavy equipment. Hazardous materials will be stored onsite in separate temporary storage areas provided with full containment. Hazardous materials will be removed from the construction site by a licensed contractor and recycled or disposed of at an approved facility.

2.8 OPERATION AND MAINTENANCE

2.8.1 Iron Production

The Project facility will operate continuously (24 hours per day, 7 days per week) using two operating shifts to produce approximately 1.5 Mtpa of iron. The physical product from the Project facility will be in the form of solid iron ingots cast from the hot molten metal with two product quality types able to be produced:

- Merchant Pig Iron (MPI) (basic purity)
- High-purity Pig Iron (HPI)

The MPI and/or HPI iron ingots produced will be stored at the Port of Belledune prior to loading them onto barges and/or ships for delivery to steel production customers. There will be no storage of the iron ingots within the Project facility.

The FINEX technology process allows for a certain amount of flexibility in the quality of the raw materials used, and thus allows for blending of raw materials from different sources, particularly the fine iron ore and coals. This flexibility will result in slight variations in plant operation while still achieving the quality of the product. The hourly production rate may vary from approximately 160 tonnes per hour of hot molten metal to a peak of approximately 200 tonnes per hour of hot molten metal based on the fine iron ore blend used as raw material. This represents variability that could occur within any given month as a daily hourly average or even up to a weekly hourly average.

2.8.1.1 Description of Operating Systems

The production of iron will occur within the Project facility via the following operating systems:

- Stockyard
- Stock House
- Coal Briquette
- Oxide Dryer
- Reactor
- Hot Compacted Iron (HCI)
- Melter Gasifier
- Cast House
- Slag Granulation
- Hot Metal Pre-treatment Station (HMPS)
- Pig Casting
- Off Gas

These operating systems are described below, the block flow of these operating systems is shown in Figure 2.11, and the physical arrangement of certain key operating systems are shown in Figure 2.12.

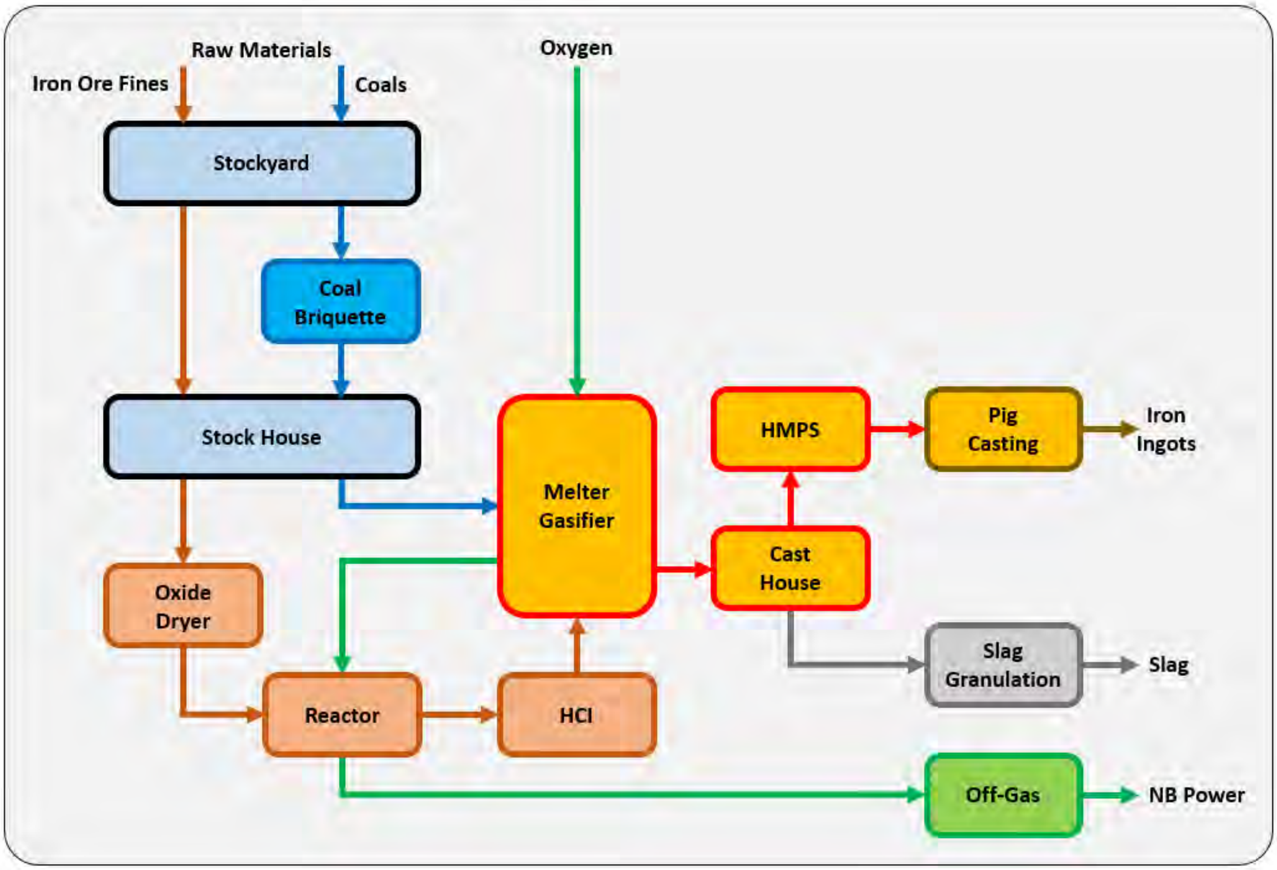

Figure 2.11 Block Flow of Operating Systems

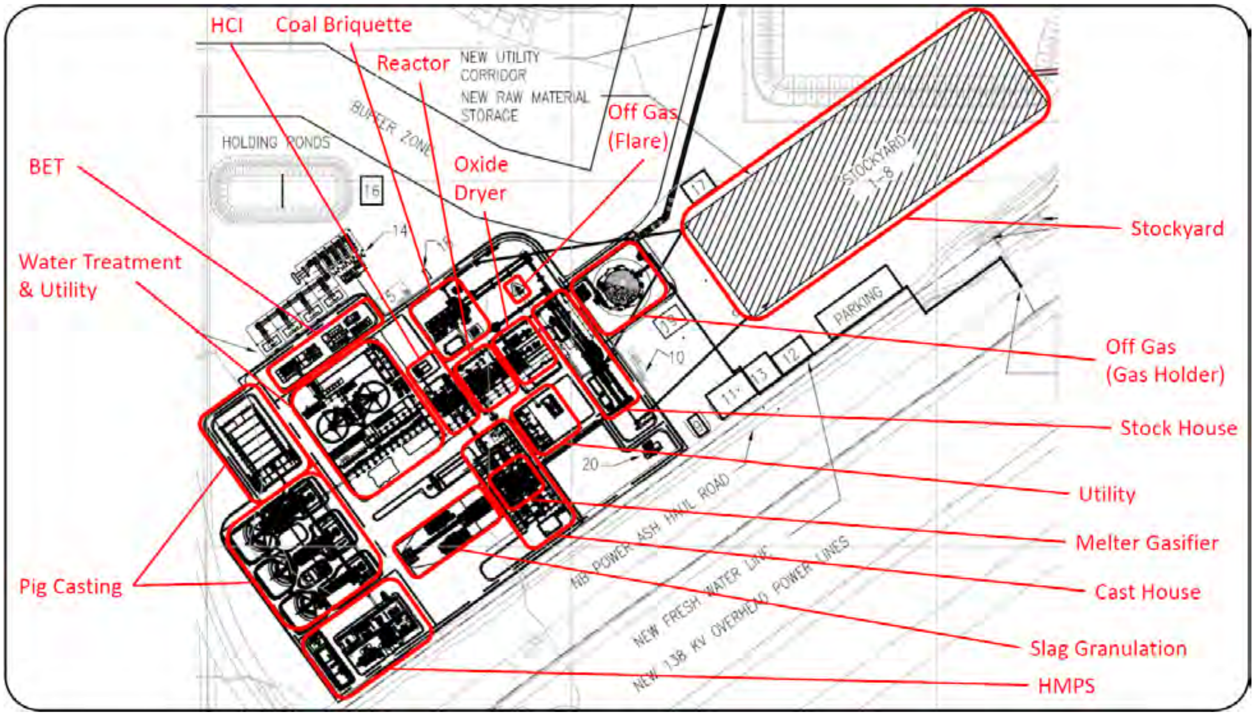

Figure 2.12 Physical Arrangement of Key Operating Systems

Stockyard

The main purpose of the Stockyard system is to receive large batches of individual raw materials from the Port of Belledune via conveyor for storage in individual stockpiles. The raw materials are then transferred in small batches from the individual stockpiles to the Stock House system or Coal Briquette system via conveyors.

A stacker machine will receive a batch of individual raw material and add to an existing stockpile or create a new stockpile of that material at a particular location within the Stockyard system. A stacker machine will normally receive large batches of raw materials via conveyors from ships unloaded at Terminal 2 at the Port of Belledune. A stacker machine will also be able to receive small batches of raw materials via a truck unloading station located within the Stockyard system. Multiple stacker machines could be used.

Multiple reclaimer machines will transfer small batches of individual raw materials from the stockpile location via conveyor to intermediate storage bins in the Stock House system. The reclaimer machines will be capable of operating at the same time as the stacker machines, all handling different individual raw materials.

The stockpiles of raw materials, the truck unloading station, the stacker machines, and the reclaimer machines will all be located within a covered area as protection from the weather elements (particularly to keep the raw materials dry). The covered area will also allow for dust control by using dry de-dusting equipment (bag filter house) with an adequate cycle of air exchanges within the covered area. The fine particles from the bag filter house are collected and recycled via truck to the intermediate storage bins of the Coal Briquetting system, while the air is sent to atmosphere.

Stock House

The main purpose of the Stock House system is to receive small batches of individual raw materials from the covered stockpiles in the Stockyard system via conveyors for intermediate storage in bins. The raw materials stored in the Stock House will be:

- Fine iron ore
- Coke
- Limestone (fine)
- Limestone (lumpy)
- Dolomite (fine)
- Dolomite (lumpy)
- Quartz
- Cold HCI

Coal briquettes formed from coal raw materials in the Coal Briquette system are also sent via conveyor to the Stock House for intermediate storage.

The intermediate storage of these various materials in the Stock House system allows for the required combination of materials via constant weigh feeders and subsequent continuous feeding to downstream operating systems. The fine iron ore is combined with limestone (fine) and dolomite (fine) and continuously conveyed to the Oxide Dryer system. The limestone (lumpy) and dolomite (lumpy) are combined and continuously conveyed to the HCI System, with Cold HCI added only during plant start-up until HCI is produced. The coal briquettes, coke, and quartz are combined and continuously conveyed to the Melter Gasifier system.

Coal Briquette

The main purpose of the Coal Briquette system (or Coal Briquetting system) is to use individual coal materials (semi-soft coking coals and thermal coal) to prepare solid coal briquettes from a combination of the coal materials with a solid starch material as a binder.

The Coal Briquette system receives small batches of individual coal materials from the covered stockpile via conveyor for intermediate storage in bins. Solid starch material is received via truck and pneumatically transferred to intermediate storage bins. Coal fines and dust particles generated within the Coal Briquette system (and other systems handling solid materials) are economically valuable material and need to be recovered. Coal fines and material dust particles are collected from dry de-dusting equipment (including the use of trucks where required) and conveyed to intermediate storage bins.

The intermediate storage of these various materials in the Coal Briquette system allows for the required combination of materials via constant weigh feeders and subsequent continuous preparation of coal briquettes.

The semi-soft coking coals, thermal coal, and recycled coal fines are combined via constant weigh feeders and sent to a dryer to reduce the water moisture content. The dryer heats the coal materials via indirect heating using high pressure (HP) steam. The dried coal materials are then combined with solid starch material and recycled coal dust material via constant weigh feeders and sent to a dry mixer machine so that the material has a uniform consistency. The dry mixed material is then sent to a briquetting machine that compresses and creates solid coal briquettes which are then continuously conveyed to the Stock House for intermediate storage.

Oxide Dryer

The main purpose of the Oxide Dryer system is to reduce the water moisture content of the combined fine iron ore, limestone (fine), and dolomite (fine) material before it is sent to the Reactor system.

The material is continuously charged to the top of the oxide dryer which operates as a fluidized bed allowing direct contact of the charged material with hot gas combusted from a small portion of the off gas stream generated by the Melter Gasifier system. Dried material is continuously removed from the bottom of the oxide dryer and is conveyed to the Reactor system.

The combustion gas continuously leaving the oxide dryer contains moisture and dust particles. The dust particles are economically valuable material and will be recovered. The largest dust particles are separated from the combustion gas using cyclones, with the collected dust particles combined with the dried material sent to the Reactor system. The combustion gas leaving the cyclones still contains fine dust particles which are separated from the combustion gas using dry de-dusting equipment, with the collected fine dust particles combined with the dried material sent to the Reactor system. The remaining moist combustion gas is sent to atmosphere.

Reactor

The main purpose of the Reactor system is to perform reduction of the fine iron ore to create DRI using a large portion of the off gas stream from the Melter Gasifier system. Reduction refers to the process where oxygen is released as a gas from the iron oxides contained in the iron ore.

The combined fine iron ore, limestone (fine), and dolomite (fine) materials dried in the Oxide Dryer system are continuously received into a series of hopper bins. A series of bins is required to allow for the material to be pressurized with nitrogen gas. The dried materials are then transferred to a pressurized vessel that subsequently dispenses the dried materials via screw conveyor to the first of three reactor vessels.

The dried material continuously enters the lower part of the reactor vessel and is fluidized by direct contact with the hot off gas stream that continuously enters the bottom of the reactor vessel. The partially reduced material is continuously removed from the mid-section of the reactor vessel. Controlled amounts of pure oxygen are injected to maintain the required temperature in reactor vessel (the oxygen reacts with components in the off gas to release heat).

To achieve the required amount of reduction of the fine iron ore, three reactors are required where the dried material travels countercurrent to the hot off gas stream. The three reactors are at different heights to allow the material to flow between each reactor. The hot off gas exits at the top of each reactor vessel and subsequently enters the next reactor vessel from the bottom. Four cyclones within each reactor vessel are used to confirm that the majority of material particles do not leave with the off gas.

The off gas leaving its last reactor vessel will still contain some fine dust particles. Due to the large volumetric rate of off gas involved, it is not economically viable to recover these fine dust particles using any dry de-dusting equipment. Instead, wet de-dusting equipment is used whereby the reactor off gas is passed through packed scrubber and demister vessels, and water is injected and sprayed to cool the off gas and physically collect the fine dust particles into the water that pools at the bottom of these vessels. The water with fine dust particles is sent from the vessels to the clarifiers in the Utility system. The off gas from the wet de-dusting equipment is sent to the off gas system.

The hot DRI material leaving its last reactor vessel is continuously transferred to the HCI system using a small portion of the off gas.

Hot Compacted Iron (HCI)

The main purpose of the HCI system is to compact the hot DRI material from the Reactor system in preparation for feeding into the melter gasifier vessel.

The hot DRI material leaving its last reactor vessel in the Reactor system is continuously transferred using off gas to bins in the HCI system. The bins allow for separation of the solid hot DRI material from the off gas. The hot DRI material is continuously charged via gravity to compacting and crushing machines forming the required size of HCI material. The HCI material is then dropped onto a covered conveyor and combined with the limestone (lumpy) and dolomite (lumpy) materials conveyed from the Stock House system for transfer to the Melter Gasifier system.

The off gas from the bins will contain dust particles which are economically valuable material and need to be recovered. The largest dust particles are separated from the off gas using cyclones with the collected dust particles returned to the bins. The off gas leaving the cyclones will still contain some dust particles which are collected using a dry de-dusting filter with the collected particles sent to the crushing machines. The off gas leaving the dry de-dusting filter will still contain some fine dust particles. Wet de-dusting equipment is used whereby the off gas is passed through scrubber vessels, and water is injected and sprayed to cool the off gas and physically collect the fine dust particles into the water that pools at the bottom of these vessels. The water with fine dust particles is sent from the vessels to the clarifiers in the Utility system. The off gas from the wet de-dusting equipment is sent to off gas System.

As the hot DRI material moves through the compacting and crusher machines, and the HCI material, limestone (lumpy), and dolomite (lumpy) materials drop onto the conveyor, there is the potential for dust particles. Therefore, these areas are all swept with nitrogen gas and collected into additional dry-dedusting equipment to recover these dust particles. The largest dust particles are separated from the nitrogen gas using cyclones with the collected dust particles sent to the dust bin. The nitrogen gas leaving the cyclones will still contain some fine dust particles, so bag filter equipment is used to recover these fine dust particles and return them to the dust bin. The remaining nitrogen gas is sent to atmosphere. The particles from the dust bin are recycled via truck to the intermediate storage bins of the Coal Briquetting system.

The HCI system is also used to produce a batch of cold HCI which is required during a plant start-up. The cold HCI is produced by diverting some of the HCI material for a period of time into a water quench tank.

The cold HCI material is removed from the water quench tank by conveyor and subsequently transferred by truck to the covered stockpile containing all the other raw materials. The water quenching of the HCI material generates atmospheric steam which may contain dust particles. Wet de-dedusting equipment is used whereby the steam is passed through a scrubber vessel, and water is injected and sprayed to cool the steam and physically collect any dust particles into the water, that pools at the bottom of the vessel, and is returned to the quench tank. The remaining steam from the wet de-dusting equipment is exhausted to the atmosphere. The water in the quench tank containing particles is sent from the quench tank to the clarifiers in the Utility system.

Melter Gasifier

The main purpose of the Melter Gasifier system is to continuously combine the HCI material, limestone (lumpy) and dolomite (lumpy) materials with the coal briquettes, coke and quartz materials in the melter gasifier vessel where the injection of pure oxygen allows the formation of hot molten iron and hot molten slag.

The HCI, limestone (lumpy), and dolomite (lumpy) materials conveyed from the HCI system are continuously received into a series of hopper bins above the melter gasifier vessel. A series of bins is required to allow for the material to be pressurized with nitrogen gas. The materials are then dispensed by gravity to a screw conveyor for feeding to the top of the melter gasifier vessel.

The coal briquettes, coke, and quartz materials conveyed from the Stock House system are continuously received into a series of hopper bins above the melter gasifier vessel. A series of bins is required to allow for the material to be pressurized with nitrogen gas. The materials are then dispensed by gravity to a screw conveyor for feeding to the top of the melter gasifier vessel.

Pure oxygen gas is continuously injected near the bottom of the melter gasifier vessel. The pure oxygen gas reacts with the coal briquettes and coke material to both release heat (1000°C) and producing off gas; the heat melts the HCI, limestone (lumpy), dolomite (lumpy) and quartz materials into two distinct liquid layers, hot molten iron (lower layer) and non-iron hot molten slag (upper layer), while the gas collects the remaining additional oxygen released from within the HCI material due to final reduction. It is the additives that allow for the formation of the hot molten slag layer. The hot molten iron and hot molten slag liquid layers are removed from the melter gasifier vessel as part of the Cast House system.

The off gas produced in the melter-gasifier vessel contains mainly carbon dioxide, carbon monoxide and hydrogen (note that no pure oxygen gas remains), with a small amount of methane and trace amounts of sulphur dioxide. Since pure nitrogen gas is used for operational purposes, there will also be a small amount of nitrogen in the off gas. The off gas continuously leaving the top of the melter gasifier vessel will contain certain amounts of dust particles. Four parallel cyclones located above the melter gasifier vessel are used so that the majority of material particles do not leave with the off gas. The dust particles collected by the cyclones are returned to the melter gasifier vessel.

The off gas leaving the cyclones will still contain some fine dust particles. A large amount of the off gas from the cyclones is continuously sent to the Reactor system, so further removal of fine dust particles is not required. A medium amount of the off gas from the cyclones is cooled and continuously recycled back to the inlet of the cyclones via compressors; to control the off gas temperature entering the cyclones and being sent to the Reactor system. Before entering the compressors, the off gas is passed through packed scrubber and demister vessels, and water is injected and sprayed to cool the off gas and physically collect the fine dust particles (which could otherwise damage the compressors) into the water that pools at the bottom of these vessels. The water with fine dust particles is sent from the vessels to the clarifiers in the Utility system. The off gas leaving the wet de-dusting equipment is then sent to the compressors.

There will be a small amount of excess off gas leaving the cyclones (not required by the Reactor system or recycled via compressors) that is passed through packed scrubber and demister vessels, and water is injected and sprayed to cool the off gas and physically collect the fine dust particles into the water that pools at the bottom of these vessels. The water with fine dust particles is sent from the vessels to the clarifiers in the Utility system. The excess off gas from the wet de-dusting equipment is then sent to the off gas system.

Cast House

The main purpose of the Cast House system is to remove the hot molten iron and hot molten slag liquid layers from the melter gasifier vessel in batches and subsequently transfer the hot molten iron to the HMPS system and transfer the hot molten slag to the Slag Granulation system.

Two tap hole locations on opposite sides of the Melter Gasifier vessel are normally sealed with clay material. A remote operated drilling machine is used to open one tap hole allowing for both hot molten iron and hot molten slag liquid layers to spout into a trough and flow to a skimmer that separates the hot molten iron (lower layer) from the hot molten slag (upper layer). The hot molten iron flows from the skimmer via a dedicated trough for filling a certain number of individual ladles, alternately one by one using a tilting runner, and then each filled ladle is transferred using a ladle car to the HMPS system. The hot molten slag flows from the skimmer via another dedicated trough directly to the Slag Granulation system. Once the desired batch amount of hot molten iron has been removed from the Melter Gasifier vessel, another remote operated plugging machine is used to seal the tap hole with fresh clay material. After a period of time, this tapping procedure is repeated using the other tap hole on the opposite side.

The number of tapping procedures completed during a typical day and the length of time for withdrawing hot molten material from the Melter vessel per tapping procedure can vary depending on various operational considerations. The annual average hourly production of hot molten iron would still be achieved based on the combination of number of tapping procedures completed per day and the corresponding length of tapping procedure.

Hoods are located above the tap holes, the troughs, skimmer, and runner to continuously suck air and any potential fine particles that may become airborne (from the spouting and flows of hot molten iron and/or hot molten slag) into dry de-dusting equipment (bag filter house). The fine particles from the bag filter house are collected and recycled via truck to the intermediate storage bins of the Coal Briquetting system, while the air is sent to atmosphere.

Slag Granulation

The main purpose of the Slag Granulation system is to quench the hot molten slag from the Cast House system and create solid granules of slag material which is a valuable by-product for the cement producing industry.

The hot molten slag flows in batches from the Cast House system via a trough into an enclosed tank where recycled cooling water is sprayed onto the hot molten slag. Upon direct contact of the cooling water with the hot molten slag, the water is changed to steam and the slag is granulated and partially solidified. Additional cooling water is sprayed at the top of the tank to condense all the steam formed (i.e. no steam is released to atmosphere).

The partially solidified granules of slag material and pooled cooling water form a slurry which flows by gravity into a drum which allows the granulated slag material to be fully solidified. Additional cooling water is sprayed within the drum to condense any additional steam produced. The granulated slag material is removed from the drum via a perforated conveyor belt which also allows for dewatering to occur. The dewatered solidified granulated slag material is conveyed to intermediate storage silos. The warm water from the drum is pumped to a dedicated cooling tower which provides the necessary recycled cooling water.

The granulated slag material is loaded into trucks from the intermediate storage silos for delivery and interim storage external to the Project facility.

In the event that the Slag Granulation system becomes unavailable (e.g., unplanned maintenance and/or repairs), the hot molten slag flow from the Cast House system will be diverted to a large dry slag pit which is open to the atmosphere. To cool and coagulate the hot molten slag material, cool water from a dedicated pond will be directly sprayed with the steam formed going to atmosphere. The remaining warm water is collected and returned by gravity to a dedicated settling pond where it will be allowed to cool naturally. The cooled, coagulated slag material is broken up into small solid chunks using a bucket excavator machine, and subsequently loaded into trucks for delivery and interim storage external to the Project facility.

Hot Metal Pre-treatment Station (HMPS)

The main purpose of the Hot Metal Pre-treatment Station (HMPS) system is to further refine the hot molten iron from the Cast House system. This refinement involves using the Kanbara Reactor (KR) process whereby de-sulphurization and de-phosphorization is achieved through the submersion and rotation of an impeller in the hot molten metal, and subsequent mechanical mixing of the hot molten metal and flux additives.

During the short travel time from the Cast House system to the HMPS system, a small layer of hot molten slag will have formed on top of the hot molten iron.

For production of MPI, a ladle car with hot molten iron arrives from the Cast House system. The ladle car is positioned to allow for the physical skimming of the top layer of hot molten slag from the ladle into a slag pot. The ladle car containing hot molten MPI is then sent to the Pig Casting system.

For production of HPI, a ladle car with hot molten iron arrives from the Cast House system. The ladle car is positioned to allow burnt lime and/or sinter ore powder material to be added to the ladle. The burnt lime and/or sinter ore powder additives are then mixed into the hot molten iron using an impeller. The burnt lime and/or sinter ore additives remove additional impurities from the hot molten iron by forming additional hot molten slag. After mixing is completed, the ladle car is positioned to allow for the physical skimming of the top layer of hot molten slag from the ladle into a slag pot. The ladle car containing hot molten HPI is then sent to the Pig Casting system.

The slag pot with hot molten slag is transferred by truck to a small dry slag pit where the hot molten slag is dumped into the pit from the slag pot using an overhead crane. To cool and coagulate the hot molten slag material, cool water from a dedicated pond will be directly sprayed with the steam formed going to atmosphere. The remaining warm water is collected and returned by gravity to a dedicated settling pond where it will be allowed to cool naturally. The cooled, coagulated slag material is broken up into small solid chunks using a bucket excavator machine, and subsequently loaded into trucks for delivery and interim storage external to the Project facility.

Hoods are located above the slag skimmer and mixer to continuously suck air and fine particles that may become airborne (particularly from the burnt lime and/or sinter ore powder) into dry de-dusting equipment (bag filter house). The fine particles from the bag filter house are collected and recycled via truck to the intermediate storage bins of the Coal Briquetting system, while the air is sent to atmosphere.

Ladle preparation and maintenance is performed in the HMPS system. Before an empty ladle is sent to the Cast House system, warming of the ladle is performed (if required) using a ladle dryer which combusts a small amount of off gas to provide heating. Since the refractory lining of the ladles will degrade over time due to the handling of hot molten iron, the refractory lining of a ladle is maintenance inspected and periodically replaced as required.

Pig Casting

The main purpose of the Pig Casting system is to create the solid iron ingots (approximately 5 kg pyramid shaped) from the holt molten iron. The production of solid iron ingots is identical for MPI and HPI.

A ladle car with hot molten iron arrives from the HMPS system. The ladle is transferred from the ladle car to the pouring device of a pig casting machine via overhead crane. The hot molten iron is poured from the ladle into a trough which allows the hot molten iron to flow into the molds attached to strands of the pig casting machine which are moving in a continuous loop. The empty molds are sprayed with a wet lime coating and subsequently dried of any remaining moisture via combustion of a small amount of off gas to provide heating. The molds once filled with hot molten iron travel away from the pouring end of the pig casting machine and subsequently are sprayed with cool water to quench, solidify, and form the solid “pig” iron ingots. When the molds reach the far end of the pig casting machine, the molds attached to the strands become upside down and the solid iron ingots fall out of the mold (facilitated by the lime coating) onto a pan conveyor which transfers the solid iron ingots to a truck loading station. The empty molds attached to strands return to the pouring device end of the pig casting machine (and are re-sprayed with a wet lime coating).

The solid iron ingots are loaded into trucks, one truck at a time with two truck loading positions, from the pan conveyor collecting the solid iron ingots from the pig casting machines for delivery and interim storage external to the Project facility.

For the water sprayed onto the molds, some of the water is turned into steam and is sent into the atmosphere, while the warm water is collected in open ducts below the pig casting machine and is returned by gravity to a dedicated settling pond where it is allowed to cool naturally.

For the lime spray, lime powder material and graphite powder material are received via truck and pneumatically transferred to intermediate storage bins. The lime and graphite powder materials are fed into a water mixing tank to prepare the proper concentration for the lime spray. The mixed solution is then pumped to the pig casting machines for spraying of the empty molds.

In the unlikely event that pig casting machines cannot accept the next ladle car for a short-term period (e.g., unplanned maintenance and/or repairs), in order to avoid a shutdown of the entire operating plant, the ladle car will be diverted to a large dry pig iron bed which is open to the atmosphere. The ladle car will be positioned at one end of the pig iron bed and the ladle containing hot molten iron will be transferred to a crane which will move, tilt, and pour the hot molten iron material at the top of the sloped bed allowing the iron to cool and solidify. The cooled iron material will be broken up into small solid chunks using a bucket excavator machine, and subsequently loaded into trucks for delivery and interim storage external to the Project facility.

Hoods are located above each pouring device of each pig casting machine and at the pouring point of the pig iron bed to continuously suck air and fine particles that may become airborne into dry de-dusting equipment (bag filter house). The fine particles from the bag filter house are collected and recycled via truck to the intermediate storage bins of the Coal Briquetting system, while the air is sent to atmosphere.

Off Gas

The main purpose of the OFF gas system is to collect the off gas streams from the Reactor system and Melter Gasifier system into a combined off gas stream. Even though the off gas streams have passed through packed scrubber and demister vessels, and water is injected and sprayed to cool the off gas and physically collect the fine dust particles into the water that pools at the bottom, some trace fine particulates will still remain in the off gas.

The off gas stream will be a high calorific gas that can be used for combustion to generate heat and thus can be used to generate power. A small portion of the off gas will be used within the Oxide Dryer system, HMPS system, and Pig Casting system for heating purposes. The remainder of the off gas will be exported as a by-product gas (or more specifically identified as FEG) from the Project facility to NB Power’s Belledune Thermal Generating Station for power generation purposes.

Due to slight fluctuations in the generation of the off gas from the Melter Gasifier system, the off gas streams are combined and routed through a gas holder which provides a large contained gas volume that will buffer these fluctuations and allow for smooth and consistent delivery of the off gas to the various destinations at a constant pressure. The gas holder is not a storage method for the off gas simply due to the volume of gas involved and will only contain less than 10 minutes of off gas flow.

The off gas system also contains a flare stack located upstream of the gas holder that will normally only use LPG (Propane) to maintain the pilot burner. If there is an interruption in the ability to send the off gas stream through the gas holder to the various destinations, and most importantly the off gas exported to NB Power's Belledune Thermal Generating Station, then the off gas will be routed to the flare stack for combustion.

Utility

The remaining Utility system is a collection of individual sub-systems in the Project facility that will support the above operating systems. The Utility system is composed of the following individual sub-systems that involve the gas inputs and utilities that support the operating systems of the Project facility:

- Oxygen
- Nitrogen
- Compressed Air
- High Pressure (HP) Steam
- LPG (Propane)
- Diesel
- Fresh Water
- Soft Water
- Potable Water
- Machinery Cooling Water (MCW)
- Secondary Cooling Water (SCW)
- Process Cooling Water (PCW)
- Slurry Water
- Sludge Water Treatment
- Biological Effluent Treatment (BET)
- Regenerative Thermal Oxidizer (RTO)
- Rain Water
- Fire Water
- Sanitary Sewage

These sub-systems are contained within the Core Plant, Water Management, and Ancillary Facilities physical components of the Project.

The following provides a high-level description of each of these Project facility sub-systems (plus an indication of integration with NB Power's Belledune Thermal Generating Station and/or the Oxygen Plant).

Oxygen sub-system will consist of the interconnecting and distribution pressure piping to all the continuous usage points within the Reactor and Melter Gasifier systems and the intermittent usage points in the Cast House and HMPS systems. Oxygen continuously enters the sub-system via pressure piping connection with the Utility Corridor from the Oxygen Plant (which will produce the oxygen gas) and the oxygen gas will be injected into the operating process and consumed at the individual usage points in the Project facility.

Nitrogen sub-system will consist of various pressure vessels (e.g., accumulators where required), a few nitrogen compressors (to provide boosted higher pressure nitrogen to certain usage points), and the interconnecting and distribution pressure piping to all the continuous (e.g., mechanical seals, purges, etc.)

and intermittent (e.g., blanketing) throughout the Project facility. Nitrogen continuously enters the sub-system via pressure piping connection with the Utility Corridor from the Oxygen Plant (which will produce the nitrogen gas) and the nitrogen is released back to the atmosphere at safe locations via the individual usage points in the Project facility.

Compressed Air sub-system will consist of the air compressors, various pressure vessels (e.g., air dryer, accumulators), and the interconnecting and distribution pressure piping to all the continuous (e.g., instrumentation, control valves) and intermittent (e.g., bag filter cleaning, air tools) usage points throughout the Project facility. Atmospheric air continuously enters the sub-system at the air compressors and the compressed air is released back to the atmosphere via the individual usage points in the Project facility.

High Pressure Steam sub-system will consist of the interconnecting and distribution pressure piping to all the continuous usage points within the Coal Briquette system, the intermittent usage points in the Melter Gasifier and Cast House systems, and for building heating in winter. HP Steam continuously enters the sub-system (at approximately 13 barg pressure) via pressure piping connection with the Utility Corridor from NB Power's Belledune Thermal Generating Station which generates the steam. The Oxygen Plant will also require a regeneration indirect heating medium which may be a high temperature HP Steam (at approximately 13 barg pressure) supplied from NB Power's Belledune Thermal Generating Station via a separate pressure piping connection. Upon indirect heat transfer at the usage points, the HP Steam is not consumed but instead water condensate is formed. Where feasible, the water condensate will continuously exit the Project facility via pump (approximate capacity of 37 m^3/hour) and pressure piping connection with the Utility Corridor to NB Power's Belledune Thermal Generating Station, which will re-use the water condensate for the generation of steam. Where not feasible, individual water condensate will become mixed with the Project facility's nearest internally collected water sub-system (and this would also be the expectation for condensate from the Oxygen Plant).

LPG (Propane) sub-system will consist of the pressure vessels, pressure reduction regulator, and interconnecting and distribution pressure piping to all the continuous (e.g., pilot burners) and intermittent (e.g., Pig Casting system) usage points throughout the Project facility. The LPG (Propane) intermittently enters the sub-system as a pressurized liquid via transfer from a delivery truck and will be continuously supplied to usage points in the Project facility as a gas where it will be completely combusted with atmospheric air, and the resulting combustion products will be released to atmosphere at safe locations.

Diesel sub-system will consist of an aboveground storage tank, berm containment, pumps, piping, and instrumented fuel station to allow for the intermittent unloading of diesel fuel supplied by truck and loading of diesel into mobile heavy equipment and transport trucks used within the Project facility.

Fresh Water sub-system will consist of the tanks, pumps, and interconnecting and distribution pressure piping to all the continuous and intermittent usage points throughout the Project facility. Fresh Water continuously enters the sub-system via pressure piping connection with the existing fresh water supply pipe that supplies NB Power's Belledune Thermal Generating Station via the nearby reservoir from the dam of the Belledune River - new pumps will be installed inside an existing pump house in order to supply the increased flow to the Project facility (plus the Oxygen Plant if required via pressure piping connection with the Utility Corridor). The fresh water is used as make-up water to various other Utility water sub-systems in the Project facility (and similarly in the Oxygen Plant if required) and therefore does not exit from this sub-system.

Soft Water sub-system will consist of an indoor storage pond, pumps, and interconnecting and distribution pressure piping to all the continuous and intermittent usage points that are within the Machinery Cooling Water (MCW) sub-system. Soft water intermittently enters the sub-system via transfer from delivery truck. Soft water is continuously supplied to usage points in the MCW sub-system (up to 20 m^3/hour) and is continuously returned from usage points in the MCW sub-system – essentially in a closed circulation loop. Since the soft water will be demineralized water, no purging is required to maintain water quality and thus there is no exit from this sub-system (except for natural evaporation of the soft water from the storage pond).

Potable Water sub-system will consist of a Water Purification Unit or Potable Water Plant (includes storage tanks, pumps, etc.), and interconnecting and distribution pressure piping to all the intermittent (or continuous if required) usage points throughout the Project facility (and to the Oxygen Plant via pressure piping connection with the Utility corridor). Fresh water intermittently (or continuously if required) enters the sub-system via pressure piping connection and subsequently enters the Water Purification Unit or Potable Water Plant which generates the potable water that is then intermittently (or continuously if required) supplied to usage points in the Project facility (and similarly in the Oxygen Plant). As the potable water is used for human consumption and sanitary purposes, there is no exit from this sub-system, but rather the exit will be with the effluent water of the Sanitary Sewage sub-system.

Machinery Cooling Water sub-system will consist of several individual closed loop circuits containing heat exchangers, pumps, and interconnecting pressure piping that continuously remove heat from equipment in the Reactor, HCI, and Melter Gasifier systems and exchanges that heat with the Secondary Cooling Water (SCW) sub-system. The MCW circulation rates for the individual closed loop circuits range from approximately 250 m^3/hour to 1400 m^3/hour. Soft water is continuously supplied to the MCW sub-system (up to 20 m^3/hour), and continuously returned to the Soft Water sub-system, in a closed circulation loop.

Secondary Cooling Water sub-system will consist of a cooling tower, water basin, pumps, heat exchangers, and interconnecting pressure piping that continuously removes heat from the individual closed loop circuits of the MCW sub-system. The majority of water in the SCW sub-system circulates continuously in a closed loop (approximately 2800 m^3/hour), but a small amount of fresh water make-up continuously enters the sub-system via pressure piping connection to the water basin. Water continuously exits the sub-system via the cooling tower (evaporation and drift losses to the atmosphere) and a blowdown to the Slurry Water sub-system.

Process Cooling Water sub-system will consist of a cooling tower, water basin, fans, pumps, heat exchangers, and interconnecting pressure piping that continuously removes heat from various operating systems via direct contact with the process (within the various quench, scrubber, and demister vessels in the other operating systems). Due to the direct contact, the water will contain some absorbed gases and dust particles, and therefore degassing vessels and fans are used to allow these gases to be separated from the water and sent to the RTO sub-system. To remove the dust particles, the water is sent to the Slurry Water sub-system. The majority of water in the PCW sub-system circulates continuously in a closed loop (approximately 1900 m^3/hour), via the Slurry Water sub-system, but a small amount of fresh water make-up continuously enters the sub-system via pressure piping connection to the water basin. Water continuously exits the sub-system via the cooling tower (evaporation and drift losses), via the Slurry Water sub-system, and a blowdown to the BET sub-system.

Slurry Water sub-system will consist of two large clarifiers, various ponds, pumps, and interconnecting pressure piping that allows for the continuous removal of dust particles from the water by sedimentation and concentration into a sludge water. Water continuously enters the sub-system from SCW and PCW sub-systems via pressure piping connection to the clarifiers (approximately up to 7900 m^3/hour), and also intermittently from the Rain Water sub-system. The particle free water continuously exits the sub-system via pressure piping connection to the PCW sub-system. The concentrated sludge water exists the sub-system via pressure piping connection to the Sludge Water Treatment sub-system (approximately 100 m^3/hour).

Sludge Water Treatment sub-system will consist of a tank, rotating screw decanters, hoppers, and interconnecting pressure piping that allows for the continuous separation of sludge solids from water. Sludge water continuously enters the sub-system via pressure piping connection from the Slurry Water sub-system. Water continuously exits the sub-system by pressure piping connection back to the Slurry Water sub-system. The sludge solids (containing up to 30% water content) are continuously accumulated in hoppers and intermittently exits the sub-system by loading into trucks.

Biological Effluent Treatment sub-system will consist of basins, tanks, vessels, pumps, and interconnecting pressure piping that allows for the continuous treatment of water using biological processes before it is released as wastewater from the Project facility. Water continuously enters the sub-system via pressure piping connection from the PCW sub-system (approximately 120 m^3/hour) and via pressure piping connection from the Oxygen Plant (cooling water blowdown purge if required). The treated and tested wastewater continuously exits the sub-system via pump and pressure piping connection with the Utility Corridor and will connect with the outlet piping from the NB Power Belledune Thermal Generating Station's existing water treatment system (i.e. no additional treatment will be required).

Regenerative Thermal Oxidizer sub-system will consist of fans, burners, enclosed ceramic bed media, stack, and interconnecting ducting that allows for the continuous oxidation of gases before they are released from the Project facility. Air and gases continuously enter the sub-system via interconnecting ducting from the PCW sub-system. The RTO sub-system process achieves emission destruction via high temperature thermal oxidation, using the proper mix of temperature, residence time, turbulence, oxygen, and intermittent LPG (Propane) to convert gas pollutants into carbon dioxide and water vapour. The treated gases continuously exit the sub-system via the stack to the atmosphere.

Rain Water sub-system will consist of drainage collection networks throughout the Project facility that will allow for the intermittent collection of rainfall surface runoff, both contact and non-contact. Contact surface water runoff will be generated from that rainfall which physically comes into contact with outdoor process operating equipment and piping (and their associated supporting elements) within the Project facility. All other rainfall within the Project facility will generate non-contact surface runoff water. Non-contact surface water runoff will be directly routed via drainage collection networks and gravity flow into a holding pond. The holding pond would be maintained at a minimal water level such that the maximum pond volume would be available to receive surface water runoff from a storm. Non-contact surface water runoff will be tested and then either gravity fed or pumped (at a rate approximately equivalent to the natural pre-development drainage rate) from the holding pond into an existing ditch leaving the Project site which discharges into the Bay of Chaleur. Contact surface water runoff will be collected and pass through local area sumps that will contain compartments and/or weirs that will trap any sediment, particles, and/or contaminants. The water will then be pumped to the Slurry Water sub-system. The expected flow rates associated with the Rain Water sub-system will be determined in the subsequent project design stage.

Fire Water sub-system will consist of a basin, pumps, hydrants, sprinklers, and interconnecting and distribution pressure piping (both above and below ground) that would allow for the delivery of water throughout the Project facility in the event of a fire. The basin would always contain a sufficient volume of water to meet requirements without requiring any additional supply of water. The initial filling of the basin will use fresh water. Alternatively, this sub-system could be integrated with NB Power Belledune Thermal Generating Station’s fire water supply system, if determined to be feasible. The fire water delivered to the Project facility would be routed to the Rain Water sub-system, where the water would be tested for potential contamination before deciding the appropriate destination for the water. The expected flow rates associated with the Fire Water sub-system will be determined in the subsequent design stage.

Sanitary Sewage sub-system is expected to consist of interconnecting pressure piping, lift stations, pumps that will allow for the intermittent collection of sanitary sewage, including potable water, from various points throughout the Project facility and the Oxygen Plant. The sanitary sewage will be intermittently pumped from the lift stations and sent via pressure piping connection to a permanent Sewage Treatment Unit located at the Project facility. The collected effluent water will be tested for quality and if deemed acceptable will be either gravity fed or pumped into an existing ditch leaving the Project site which discharges into the Bay of Chaleur.

2.8.1.2 Inputs

The following provides information for the inputs (raw materials, gases, and utilities) that will be used by the Project facility (and Oxygen Plant where applicable) for iron production.

Raw Material Inputs

The main raw materials to be used by the Project facility will include mixtures of fine iron ore material and coal material from various sources. The FINEX process is designed to accommodate raw material feed flexibility; as a result, multiple recipes of these main raw materials are considered. The remaining raw materials are flux additives (which serve to facilitate the melting of the fine iron ore and subsequent formation of slag) and supplements to the main raw materials. The upper limits of annual average hourly input requirements (and corresponding annual rate of usage) for raw materials to be used by the Project facility are provided in Table 2.3 with additional description provided below.

Table 2.3 Raw Material Inputs Used by Project Facility

Raw Material	Annual Average Hourly Rate	Corresponding Annual Rate
Fine Iron Ore	320.4 tonnes/hour	Up to 2,666,370 tonnes/year
Semi-Soft Coking Coal	128.5 tonnes/hour	Up to 1,069,380 tonnes/year
Thermal Coal	32.1 tonnes/hour	Up to 267,135 tonnes/year
Starch	8 tonnes/hour	Up to 66,575 tonnes/year
Coke	19.8 tonnes/hour	Up to 164,775 tonnes/year
Limestone (Fine)	19.8 tonnes/hour	Up to 164,775 tonnes/year
Limestone (Lumpy)	11.9 tonnes/hour	Up to 99,030 tonnes/year
Dolomite (Fine)	32.7 tonnes/hour	Up to 272,130 tonnes/year
Dolomite (Lumpy)	2.2 tonnes/hour	Up to 18,310 tonnes/year
Quartz	25 tonnes/hour (only if / when required)	Up to 208,050 tonnes/year (only if / when required)
Burnt Lime	0.5 tonnes/hour	Up to 4,160 tonnes/year
Sinter Ore Powder	1.3 tonnes/hour	Up to 10,820 tonnes/year
Lime Powder	0.2 tonnes/hour	Up to 1,665 tonnes/year
Graphite Powder	0.2 tonnes/hour	Up to 1,665 tonnes/year

Note:
Annual Average Hourly Rates and Corresponding Annual Rates are upper limits, actual rates may be lower. Calculations done based on 8322 hours annual.

Fine Iron Ore material would typically be a 50% / 50% blend of two individual fine iron ores sourced from different origins. Each fine iron ore material will be stored in separate stockpiles in the Stockyard system with intermediate bin storage and blending occurring in the Stock House system.

Coal material would typically be a blend of approximately 80% semi-soft coking coal and 20% thermal coal. The semi-soft coking coal would typically be a 50% / 50% blend of two individual semi-soft coking coals sourced from different origins. The thermal coal could come from the same source currently used by NB Power's Belledune Thermal Generating Station. The exact coal mixture will be slightly adjusted during production to meet operating parameters to achieve the desired production rate of hot molten metal. The overall consumption rate of coal will vary depending on the fine iron ore blend to be processed. Each coal material will be stored in separate stockpiles in the Stockyard system with intermediate bin storage and blending occurring in the Coal Briquette system.

Starch material will be used as a solid binder supplement required for the proper formation of the coal briquettes and otherwise is not important for iron production. The solid starch material would typically be from a single source and will be stored in storage bins in the Coal Briquette system.

Coke material will be used as a supplement to the coal material (coal briquettes) and would typically be from a single source. The consumption of coke will generally remain consistent regardless of the fine iron ore blend to be processed. The coke material will be stored in a separate stockpile in the Stockyard system with intermediate bin storage and the addition to the coal briquettes occurring in the Stock House system.

Limestone (fine & lumpy) material is a flux additive used to purify the hot molten metal by absorbing impurities from the molten hot metal and binding those impurities into a slag material. The limestone (fine & lumpy) material would typically be from several sources. The limestone (fine) and limestone (lumpy) will be stored in separate stockpiles in the Stockyard system with individual intermediate bin storage and the additions occurring in the Stock House system.

Dolomite (fine & lumpy) material is a flux additive used to purify the hot molten metal by absorbing impurities from the molten hot metal and binding those impurities into a slag material. The dolomite (fine & lumpy) material would typically be from several sources. The dolomite (fine), and dolomite (lumpy) will be stored in separate stockpiles in the Stockyard system with individual intermediate bin storage and the additions occurring in the Stock House system.

Quartz material may be used as an additive on an intermittent basis depending on the variability in the blend of the fine iron ore material and would typically be from a single source. The quartz material will be stored in a separate stockpile in the Stockyard system with intermediate bin storage and the addition occurring in the Stock House system.

Burnt Lime & Sinter Ore Powder materials are additional flux additives used only for the production of HPI and would typically each be from a single source. The burnt lime and sinter ore powder materials will be stored in individual storage bins and the additions occurring in the HMPS system.

Lime & Graphite Powder materials are used to create a lime spray for coating the molds of the pig casting machines and would typically each be from a single source. The lime and graphite powder materials will be stored in individual storage bins, with the creation of the lime spray occurring in the Pig Casting system.

Gas Inputs

Gas inputs will be provided to the Project facility by the Oxygen Plant (which only has atmospheric air as a gas input itself). The upper limits of annual average hourly input requirements (and corresponding annual rate of usage) for gases to be used by the Project facility and the Oxygen Plant are provided in Table 2.4 and Table 2.5 with additional description provided below.

Table 2.4 Gas Inputs Used by Project Facility

Gas Input	Annual Average Hourly Rate	Corresponding Annual Rate
Oxygen (95% to 99.6% purity)	Up to 121,000 Nm^3/hour (or approx. 173.1 tonnes/hour)	Up to 1,006,962,000 Nm^3/year (or approx. 1,440,540 tonnes/year)
Nitrogen (approx. 99.9% purity)	Up to 110,000 Nm^3/hour (or approx. 137.7 tonnes/hour)	Up to 915,420,000 Nm^3/year (or approx. 1,145,940 tonnes/year)

Note:
Nm^3/hour = Normal metre cubed per hour at 0°C and 1 atmosphere pressure.

Table 2.5 Gas Inputs Used by Oxygen Plant

Gas Input	Annual Average Hourly Rate	Corresponding Annual Rate
Atmospheric Air	Up to 800,000 Nm^3/hour (or approx. 1,035 tonnes/hour)	Up to 6,657,600,000 Nm^3/year (or approx. 8,613,270 tonnes/year)

Note:
Nm^3/hour = Normal metre cubed per hour at 0°C and 1 atmosphere pressure.

Oxygen gas (95% to 99.6% purity) is used for direct injection within the Reactor system and Melter Gasifier system and is consumed when it reacts with the various raw materials. The pure oxygen gas is continuously delivered to the Project facility via pipe connection from the Oxygen Plant. While the Oxygen Plant could contain a limited amount of inventory storage for the oxygen, there is no storage provided within the Project facility itself.

Nitrogen gas (approximately 99.9% purity) is used for general operating purposes only (e.g., purging / flushing of piping and/or equipment, pressurizing and/or blanketing of equipment, pneumatic conveying of materials) and is not consumed. The nitrogen gas is continuously delivered to the Project facility via pipe connection from the Oxygen Plant (which will also produce nitrogen gas). While the Oxygen Plant could contain a limited amount of inventory storage for the nitrogen, there is no storage provided within the Project facility itself.

Atmospheric Air which naturally consists of approximately 78% nitrogen gas, 21% oxygen gas, and 1% argon gas will be used by the Oxygen Plant and will be further processed (by compression, pressure, and temperature separation techniques) into the pure oxygen gas and pure nitrogen gas required by the Project facility.

Utilities

The upper limits of annual average hourly usage of utilities (and corresponding annual rate of usage) by the Project facility are provided in Table 2.6 with additional description provided below.

Table 2.6 Utilities Used by Project Facility

Utility	Annual Average Hourly Rate	Corresponding Annual Rate
Air	Up to 10,890 Nm^3/hour (or approx. 14.1 tonnes/hour)	Up to 90,626,580 Nm^3/year (or approx. 117,340 tonnes/year)
HP Steam	Up to 37 tonnes/hour	Up to 307,915 tonnes/year
LPG (Propane) (gas)	Up to 450 Nm^3/hour (or approx. 0.9 tonnes/hour) (gas)	Up to 3,744,900 Nm^3/year (or approx. 7,490 tonnes/year) (gas)
Diesel	Up to 0.2 m^3/hour	Up to 1,665 m^3/year
Fresh Water	Up to 610 m^3/hour	Up to 5,076,420 m^3/year
Soft Water	Initial first fill of 100 m^3 (with only periodic top-up during the year if required)	Up to 15 m^3/year (only if required)
Potable Water	Up to 30 m^3/hour	Up to 262,800 m^3/year
Electricity	Up to 69 MW	Up to 580,000 MWh in a year

Note:
Nm^3/hour = Normal metre cubed per hour at 0°C and 1 atmosphere pressure.

The preliminary upper limits of annual average hourly usage of utilities (and corresponding annual rate of usage) by the Oxygen Plant are provided in Table 2.7 and will be confirmed by the plant vendor in the subsequent project design stage; and these quantities for the Oxygen Plant are in addition to the Project facility utilities requirements.

Table 2.7 Utilities Used by Oxygen Plant

Utility	Annual Average Hourly Rate	Corresponding Annual Rate
HP Steam	Up to 10 tonnes/hour	Up to 83,220 tonnes/year
Fresh Water	Up to 250 m^3/hour	Up to 2,080,500 m^3/year
Potable Water	Up to 10 m^3/hour	Up to 83,220 m^3/year
Electricity	Up to 96 MW	Up to 800,000 MWh in a year

The supply of the above utilities to the Oxygen Plant is expected to be integrated with the supply of corresponding utilities to the Project facility (where determined to be feasible) and will be confirmed during the next project design stage.

Air from the atmosphere will be used as compressed air by the Project facility for general operating purposes only (e.g., for control of various instrumentation and control valves). The compressed air will be produced by air compressors located within the Project facility; there is no storage provided within the Project facility itself. This air is not associated with the atmospheric air used by the Oxygen Plant.

HP Steam is used by the Project facility for operation in-direct heating purposes (e.g., drying coal materials in the Coal Briquette system) and is not consumed. HP Steam could also be used for general building heating purposes in winter. High temperature HP Steam is used in the Oxygen Plant for in-direct heating of nitrogen gas used for regeneration of fixed adsorbent bed material. The HP Steam is continuously delivered to the Project facility and to the Oxygen Plant via separate pipe connections from NB Power's Belledune Thermal Generating Station.

LPG (Propane) is used as a gas for very limited combustion purposes (e.g., various pilot burners for the Oxide Dryer system, the Flare Stack in the off gas system, and the RTO sub-system of the Utility system) due to the lack of availability of natural gas supply in the area. The LPG (Propane) will be delivered periodically to the Project facility via truck (as a pressurized liquid) and will be stored on-site in storage bullet pressure vessels as a liquid. The stored liquid LPG (Propane) would be reduced in pressure to allow it to vaporize into a gas for usage.

Diesel is used for fueling the various mobile heavy equipment (e.g., front loaders, excavators, etc.) and dump trucks that will operate exclusively within the Project facility. The transport trucks that will operate outside the Project facility (e.g., delivering inputs, transferring products / by-products to the Port of Belledune, etc.) will obtain diesel fuel from sources not associated with the Project. Note that the Project facility's back-up emergency power generators will not normally consume any diesel.

Fresh Water is used for both direct and in-direct cooling purposes throughout the Project facility, including continuous make-up to replace water purged from the different closed cooling towers in the Utility system and in the Oxygen Plant (if required). Fresh water will be continuously supplied to the Project facility and the Oxygen Plant (if required) via pipe connection with the existing fresh water supply pipe that supplies NB Power's Belledune Thermal Generating Station from the nearby reservoir created by the Belledune River dam. New pumps will be installed at the dam in order to supply the increased flow.

Soft Water is used specifically for indirect cooling purposes for certain sensitive parts of operating machines (e.g., the MCW sub-system in the Utility system) which require demineralized water quality. After the initial first fill of the MCW sub-system, the amount of make-up soft water is expected to be minimal as there is no continuous purge required. Soft water will be initially and then periodically supplied to the Project facility by truck from NB Power's Belledune Thermal Generating Station's demineralized water system.

Potable Water is used throughout the Project facility and Oxygen Plant for human consumption and sanitary purposes. A permanent Water Purification Unit or Potable Water Plant capable of treating fresh water for the supply of the potable water required by the Project facility and Oxygen Plant will be installed within the facility. The fresh water will be obtained from NB Power's Belledune Thermal Generating Station, as described above.

Electricity to power the Project facility and the Oxygen Plant will be obtained from a tie-in with the New Brunswick Main Power Grid, expected to be from the 345 kV Transmission Line with subsequent stepdown to a 138 kV supply. The exact location of the 345 kV to 138 kV transformers and 138 kV lines to the Project facility and Oxygen Plant will be determined when the Load Connection System Impact Study is commissioned by Maritime Iron for completion by NB Power (during the subsequent project design stage). The Main Power Grid will provide a reliable source of electricity that is not dependent on operating conditions at NB Power’s Belledune Thermal Generating Station.

2.8.1.3 Outputs

The following provides information for the outputs (products, by-products, wastes) from the Project facility (and the Oxygen Plant where applicable).

Products

The upper limits of annual average hourly output for product (and corresponding annual rate) from the Project facility is provided in Table 2.8 with additional description provided below.

Table 2.8 Product from Project Facility

Product	Annual Average Hourly Rate	Corresponding Annual Rate
Pig Iron	Up to 200 tonnes/hour	Up to 1,664,400 tonnes/year

Pig Iron is the commercially valuable product from the Project facility that will be in the form of solid iron ingots (approximately 5 kg, pyramid shaped) with two industry recognized product quality types able to be produced - MPI (basic purity) and HPI.

By-Products

The upper limits of annual average hourly output for by-products (and corresponding annual rate) from the Project facility are provided in Table 2.9 with additional description provided below.

Table 2.9 By-Products from Project Facility

By-Product	Annual Average Hourly Rate	Corresponding Annual Rate
Slag (Granulated)	Up to 65 tonnes/hour	Up to 540,930 tonnes/year
FINEX Export Gas (FEG)	Up to 350,100 Nm^3/hour (or approx. 429 tonnes/hour)	Up to 2,913,532,200 Nm^3/year (or approx. 3,570,138 tonnes/year)

Note:
Nm^3/hour = Normal metre cubed per hour at 0°C and 1 atmosphere pressure.

Slag is a commercially valuable by-product from the Project facility that will be in the form of solid granulated slag (e.g., an aggregate type material) which will contain non-iron metal oxides, minerals, and silicon dioxide. The granulated slag produced will be stored at the Port of Belledune prior to loading to barges and/or ships for delivery to cement production client(s). There will only be buffer storage of the granulated slag within the Project facility using intermediate bins to facilitate truck loading for transfer to the Port of Belledune.

FINEX Export Gas is a commercially valuable by-product from the Project facility that will be sent via ducting / piping to NB Power’s Belledune Thermal Generating Station for power generation purposes. The

FEG will flow at an operating pressure from the Project facility's off gas system that will be sufficient for use by NB Power.

Wastes

The upper limits of annual average hourly output for wastes from the Project facility and the Oxygen Plant are provided in Table 2.10 and Table 2.11 with additional description provided below.

Table 2.10 Wastes from Project Facility

Waste	Annual Average Hourly Rate	Corresponding Annual Rate
Sludge	Up to 18 tonnes/hour (includes 30wt% water content)	Up to 149,795 tonnes/year (includes 30wt% water content)
Wastewater	Up to 120 m^3/hour	Up to 998,640 m^3/year
Effluent Water (Sanitary Sewage)	Up to 40 m^3/hour	Up to 332,880 m^3/year

Table 2.11 Wastes from Oxygen Plant

Waste	Annual Average Hourly Rate	Corresponding Annual Rate
Exhaust Air	Up to 569,000 Nm^3/hour (or approx. 736 tonnes/hour)	Up to 4,735,218,000 Nm^3/year (or approx. 6,124,990 tonnes/year)

Note:
Nm^3/hour = Normal metre cubed per hour at 0°C and 1 atmosphere pressure.

Sludge is a solid cake material with a moisture content up to 30 wt% that consists of a concentrated mixture of all the various raw materials used by the Project facility. There will only be buffer storage of the sludge within the Project facility using intermediate hoppers to facilitate truck loading. The non-hazardous sludge material is expected to be transferred by truck to an offsite landfill, either in the nearby region or potentially at an existing site associated with NB Power's Belledune Thermal Generating Station. However, the sludge material with 30 wt% water content does represent a usable feedstock to certain clients, and thus could alternatively be delivered to steel production sites that have a sintering plant and/or to cement production plants. Further, limiting the moisture content to 10 wt% could provide the means for possible recycling of this solid cake material within the Project facility in the future.

Wastewater will be the effluent from the Project facility's final water treatment step, BET sub-system, whereby the treated and tested wastewater continuously exits the BET sub-system via pump and pressure piping connection with the Utility Corridor and will connect with the outlet piping from the NB Power Belledune Thermal Generating Station's existing water treatment system (i.e. no additional treatment will be required).

Effluent Water (Sanitary Sewage) will be based on the Potable Water used and contributions by the personnel at the Project facility and the Oxygen Plant. The effluent water from the Sanitary Sewage sub-system will be tested for quality and if deemed acceptable will be either gravity fed or pumped into an existing ditch leaving the Project site which discharges into the Bay of Chaleur.

Exhaust Air will be leftover portion of the atmospheric air input to the Oxygen Plant that will be returned back to the atmosphere with varying compostion of nitrogen, oxygen, and argon.

2.8.2 Maintenance

Periodically the Project facility will be required to shut down to perform routine maintenance. Whenever possible this activity will be scheduled in advance and will be performed in conjunction with maintenance shutdowns at NB Power's Belledune Thermal Generating Station. Details on the frequency and duration of maintenance activities are provided in Table 2.12 with additional description provided below.

Table 2.12 Maintenance Frequency

Operation Mode	Frequency	Duration
Normal Operation	Continuously	8,322 hour/year
Scheduled Long Shutdowns	2 events/year, 6-month interval	100 hour/event 200 hour/year total
Scheduled Short Shutdowns	5 events/year, 2-month interval	36 hour/event 180 hour/total
Un-Scheduled Shutdowns	1 to 3 events/year	58 hour/year total
Emergency Shutdown	0 events/year	Not applicable

Scheduled Long Shutdowns will involve regular maintenance activities that will require a longer time period to complete, particularly requiring the opening of process equipment for internal cleaning (e.g., Reactor vessels and their internal cyclone components).

Scheduled Short Shutdowns will involve regular maintenance activities that will require a shorter time period to complete, particularly preventative maintenance and lubrication of the various moving / rotating parts of equipment items (e.g., conveyors, pumps, etc.).

Un-Scheduled Shutdowns will typically involve repair activities for an equipment item that can't wait to be completed until the next planned scheduled short or long shutdown. Should an un-scheduled shutdown be required, the approach will be to continue to operate the Project facility for at least 2-4 hours in preparation for the shutdown (a requirement so that hot molten iron will remain sufficiently hot) to do required repairs, but during this preparation time the flow of off gas (or FEG) would be reduced in steps as shutdown is approached in communication with NB Power's Belledune Thermal Generating Station. If the un-scheduled shutdown were to occur within a few weeks of an upcoming short shutdown, then the opportunity may be taken to complete those scheduled short shutdown regular maintenance activities early.

Emergency Shutdown would be an unplanned event where all Project facility operation would be stopped immediately. Interconnected alarms and/or interlocks between the Project facility and NB

Power's Belledune Thermal Generating Station would provide alerts, particularly that the production of by-product gas (or FEG) would have stopped. Based on the operating history of the two existing FINEX plants operated by steel maker POSCO in South Korea, an emergency shutdown of the Project facility is not expected to occur during an operating year.

2.8.3 Ground Transportation

2.8.3.1 Raw Materials

The delivery of raw materials to the Project facility by truck is summarized in Table 2.13.

Table 2.13 Raw Materials Delivered by Truck to Project Facility

Raw Material	Approximate Truck Cargo Capacity	Approximate Frequency [1] (Monday to Friday)
Limestone (fine & lumpy) and Dolomite (fine & lumpy)	40 tonnes/truck (based on bulk density and 1-3% moisture allowance)	16 trucks/week
Starch	40 tonnes/truck (based on bulk density and 1-3% moisture allowance)	3 trucks/week
Burnt Lime and Sinter Ore Powder	40 tonnes/truck (based on bulk density and 1-3% moisture allowance)	4 trucks/week
Lime Powder and Graphite Powder	40 tonnes/truck (based on bulk density and 1-3% moisture allowance)	4 trucks/week

Note:
[1] The number of trucks that will supply raw materials to the Project facility will vary based on plant operation variability; the upper limits have been provided.

The trucks will be standard highway diesel transport trailers (single-end dump or bulk hopper carrier) that will deliver the raw materials to the Project facility's Stockyard system directly from local regional suppliers (and not via the Port of Belledune).

2.8.3.2 Utilities

The delivery of utilities to the Project facility by truck is summarized in Table 2.14.

Table 2.14 Utilities Delivered by Truck to Project Facility

Utility	Approximate Truck Cargo Capacity	Approximate Frequency [1]
LPG (Propane) (liquid)	43 m^3/truck (liquid)	6 trucks/week
Diesel	45 m^3/truck	3 trucks/month

Note:
[1] The number of trucks that will supply utilities to the Project facility will vary based on plant operation variability; the upper limits have been provided.

The trucks will be standard highway diesel transport fuel trailers that will deliver these utilities to the Project facility's Utility system directly from local regional fuels suppliers.

2.8.3.3 Products & By-Products

The shipment of products & by-products from the Project facility by truck is summarized in Table 2.15.

Table 2.15 Products & By-Products Shipped by Truck[1] from Project Facility to the Port of Belledune

Product / By-Product	Approximate Truck Cargo Capacity	Approximate Frequency [2] (24 hours/day, 7-days/week)
Pig Iron (MPI & HPI)	70 tonnes/truck (based on 5kg ingots)	72 trucks/day (approximately 3 trucks every hour)
Slag (Granulated)	70 tonnes/truck	24 trucks/day (approximately 1 truck every hour)

Note:
[1] Trucking will be limited to private Port-owned roads the number of trucks that will ship product & by-product from the Project facility will vary based on plant operation variability; the upper limits have been provided.
[2] The number of trucks that will ship product & by-product from the Project facility will vary based on plant operation variability; the upper limits have been provided.

The trucks will be standard highway diesel transport trailers (single-end dump or side dump) and will transport the pig iron (MPI & HPI) and slag (granulated) from the Project facility to the Port of Belledune's Terminal 3 via private roadways for intermediate storage prior to being loaded onto bulk ships or barges for delivery to customers.

2.8.3.4 Wastes

The shipment of waste from the Project facility by truck is summarized in Table 2.16.

Table 2.16 Waste Shipped by Truck from Project Facility

Waste	Approximate Truck Cargo Capacity	Approximate Frequency [1] (24 hours/day, 7-days/week)
Sludge	70 tonnes/truck (includes up to 30wt% moisture)	6 trucks/day

Note:
[1] The number of trucks that will ship waste from the Project facility will vary based on plant operation variability; the upper limits have been provided.

The trucks will be standard highway diesel transport trailers (single-end dump) and will transport the sludge from the Project facility to an offsite landfill, either in the nearby region or potentially at an existing site associated with NB Power's Belledune Thermal Generating Station.

Alternatively, if the sludge material were able to be sold to a sintering plant and/or to a cement production plant, the trucks would transport the sludge from the Project facility to the Port of Belledune's Terminal 3 via private roadways for intermediate storage prior to being loaded onto bulk ships or barges for delivery to customers.

2.8.4 Marine Transportation

2.8.4.1 Raw Materials

The delivery of raw materials to the Project facility by ship (representing approximately eight ships every month) is summarized in Table 2.17.

Table 2.17 Raw Materials Delivered by Ship to Project Facility

Raw Material	Approximate Vessel Cargo Capacity (2)	Approximate Frequency (1,2)
Fine iron ore	60,000 tonnes/ship (based on bulk density and moisture allowance)	46 ships/year (approximately one ship every 8 days)
Semi-soft coking coal	55,000 tonnes/ship (based on bulk density and 8% moisture allowance	21 ships/year (approximately one ship every 17 days)
Thermal coal	55,000 tonnes/ship (based on bulk density and 12% moisture allowance)	6 ships/year (approximately one ship every 61 days)
Limestone (fine & lumpy) and Dolomite (fine & lumpy)	60,000 tonnes/ship combined (based on bulk density and 1-3% moisture allowance)	9 ships/year (approximately one ship every 41 days)
Quartz	55,000 tonnes/ship (based on bulk density)	4 ships/year (approximately one ship every 91 days)
Coke	20,000 tonnes/ship (based on bulk density and 5% moisture allowance)	9 ships/year (approximately one ship every 41 days)

Note:
[1] The number of ships that will supply raw materials as feedstock for the Project facility will vary based on plant operation variability; the upper limits have been provided.
[2] The approximate vessel cargo capacity and frequency may vary depending on ship availability, shipping location, and the future potential for the Port of Belledune's Terminal 2 to receive larger-sized vessels.

Bulk transportation of all required fine iron ore, semi-soft coking coal, thermal coal, limestone (fine and lumpy), dolomite (fine and lumpy), quartz, and coke materials, regardless of the origin source, will be by ship with unloading via Terminal 2 at the Port of Belledune. The existing belt conveyors will deliver the unloaded raw materials from Terminal 2 to on-site storage at the Project facility in the Stockyard system (approximately 30-day to 90-day supplies, depending on the material). Terminal 2 at the Port of Belledune can accommodate vessels that are compatible with its wharf length of 307 metres and water depth of 14.3 metres at chart datum.

2.8.4.2 Products & By-Products

The shipment of products and by-products from the Project facility by ship is summarized in Table 2.18.

Table 2.18 Products & By-Products Shipped from Project Facility

Product & By-Product	Approximate Vessel Cargo Capacity (1)	Approximate Frequency [(1)]
Pig Iron (MPI & HPI) [(2)]	55,000 tonnes/ship	29 ships/year (approximately one ship every 12 days)
Slag (Granulated) [(2)]	55,000 tonnes/ship	10 ships/year (approximately one ship every 36 days)
Sludge [(3)]	25,000 tonnes/ship (includes up to 30wt% moisture)	6 ships/year (approximately one ship every 60 days)

Note:
[1] The number of ships that will be used for shipments of product and by-product from the Project facility will vary based on plant operation variability; the upper limits have been provided.
[2] Alternatively, a minority of shipments of product and by-product from the Project facility could be by barge (approx. 25,000 tonnes cargo capacity) depending on customer location and requirements.
[3] Alternatively, if the sludge material can be sold to a sintering plant and/or to a cement production plant as a by-product, then the bulk transportation of the sludge will be by ship (or by 25,000 tonnes barge) with loading via Terminal 3 at the Port of Belledune.

Bulk transportation of the pig iron (MPI & HPI) and granulated slag will be by ship and/or barge with loading via Terminal 3 at the Port of Belledune. Mobile heavy equipment, portable cranes and/or fixed cranes (on the ship) will transfer and load the product & by-product materials from their individual Terminal 3 intermediate storage piles. Terminal 3 at the Port of Belledune can accommodate vessels that are compatible with its wharf length of 455 metres and water depth of 11.3 metres at chart datum.

2.8.5 Employment and Expenditure

It is estimated that the Project during the operations phase will entail approximately $570 million of annual operating expenses and will provide for at least 200 direct permanent jobs. The Project facility workforce will include a variety of personnel as per the following categories:

- Management
- Administration (including Finance & Human Resources)
- Information Technology
- Environmental Health & Safety
- Operations
- Supply Chain (Procurement & Logistics)
- Maintenance
- Technicians
- Laboratory
- Engineering
- Site Services

2.8.6 Emissions and Wastes

2.8.6.1 Air Contaminant Emissions

Air contaminant emissions of concern include carbon monoxide (CO), nitrogen oxides (NO_X), sulphur dioxide (SO_2), and particulate matter (PM, including its common size fractions PM_{10} and $PM_{2.5}$) and trace metals.

Emissions during the Project operation phase are generally related to combustion of fuel, process unit operations, operation of heavy equipment and on-road vehicles. Control measures, such as the use of dust collectors (*e.g.*, baghouses) and methods of dust suppression will be used to reduce emissions.

Air contaminant emissions were estimated based on design information provided by Maritime Iron (based on reference plant operating information) and published emission factors. The detailed emissions inventory is provided in Appendix D.

The Project will supply FEG to NB Power's Belledune Thermal Generating Station, which is expected to result in a substantive decrease in SO_2 emissions compared to the existing conditions in the area. The reduction is expected as the FEG will be used at NB Power's Belledune Thermal Generating Station, which will off-set coal combustion and the FEG is expected to have much lower SO_2 emissions intensity compared to thermal coal.

The detailed assessment of air contaminant emissions is provided in Section 6.2.

2.8.6.2 GHG Emissions

The primary GHG emitted from the Project facility is CO_2, as it is generated from the FINEX process principally due to the reduction of iron with coal and the decomposition of limestone and dolomite. Although CH_4 is also present in the by-product gas (or FEG), when combusted it is oxidized to CO_2 and H_2O. Based on the low percentage of CH_4 in the by-product gas (or FEG), it is assumed that all CH_4 will be oxidized to CO_2 (i.e., no CH_4 is directly released to atmosphere).

The Project facility is being designed for integration with NB Power's Belledune Thermal Generating Station to manage overall GHG emissions from the two facilities and make efficient use of shareable infrastructure.

A detailed assessment of GHG emissions is provided in Section 6.3.

2.8.6.3 Sound Emissions

Sound emissions during the Project operation phase are generally associated with the conveyance of various aggregate materials, pump and motor noise from process exquipment such as conveyors and fans, vehicle use, and the operation of compressors at the Oxygen Plant. With the implementation of mitigation including the use of mufflers, and engineering design measures, noise emissions are expected to meet the applicable Health Canada noise exposure guideline levels.

A detailed assessment of sound emissions is provided in Section 6.4.

2.8.6.4 Surface Runoff

Drainage collection networks will be installed throughout the Project facility that will allow for the intermittent collection of rainfall surface runoff, both contact and non-contact. Contact surface water runoff will be generated from that rainfall which physically comes into contact with outdoor process operating equipment and piping (and their associated supporting elements) within the Project facility. All other rainfall within the Project facility will generate non-contact surface runoff water.

Non-contact surface water runoff will be directly routed via drainage collection networks and gravity flow into a holding pond. The holding pond would be maintained at a minimal water level such that the maximum pond volume would be available to receive surface water runoff from a storm. Non-contact surface water runoff will be tested and then either gravity fed or pumped (at a rate approximately equivalent to the natural pre-development drainage rate) from the holding pond into an existing ditch leaving the Project site which discharges into the Bay of Chaleur.

Contact surface water runoff will be collected and pass through local area sumps that will contain compartments and/or weirs that will trap any sediment, particles, and/or contaminants. The water will then be pumped to the Slurry Water sub-system.

2.8.6.5 Wastewater & Effluent Water

Wastewater will be tested and then pumped to a connection with the outlet piping from the NB Power Belledune Thermal Generating Station’s existing water treatment system (i.e. no additional treatment will be required).

Effluent water from on-site treatment of sanitary sewage will be tested and then either gravity fed or pumped into an existing ditch leaving the Project site which discharges into the Bay of Chaleur.

2.8.6.6 Solid and Hazardous Wastes

Sludge generated during Project operation will be temporarily stored within Project facility using intermediate hoppers to facilitate truck loading. The non-hazardous sludge material is expected to be transferred by truck to an offsite landfill, either in the nearby region or potentially at an existing site associated with NB Power’s Belledune Thermal Generating Station. However, the sludge material does represent a usable feedstock to certain clients, and thus could alternatively be delivered to steel production sites that have a sintering plant and/or to cement production plants.

Other non-hazardous industrial wastes will be separated as recyclable and non-recyclable, with recyclable material collected and transported to a licensed recycling facility. Waste management procedures will comply with provincial solid waste resource management regulations as well as additional municipal and disposal facility requirements. Non-recyclable wastes will be transported off-site to a permitted landfill.

Hazardous materials generated during the Project operation phase may include, but are not limited to, used hydraulic fluids, motor oil, and grease and lubricants for heavy equipment. Hazardous materials will be stored onsite in separate temporary storage areas provided with full containment. Hazardous materials will be removed from the Project facility by a licensed contractor and recycled or disposed at an approved facility.

2.9 DECOMMISSIONING AND ABANDONMENT

The Project is planned to operate for more than several decades. When it is decided the Project has reached its end of life, decommissioning/abandonment activities will commence. Details on decommissioning/abandonment activities at the end of the Project’s life will be submitted to NBDELG for review and approval prior to implementation. Decommissioning of the Project will be conducted in accordance with applicable regulatory requirements and approval conditions that are in place at that time.

Maritime Iron will develop a closure plan for the Project. This will contribute to successful closure of the Project footprint at the end of facility life, and proactive considerations of closure needs will reduce changes in Project design, limit the amount of material re-handling, and minimize the environmental effects of the Project.

Design, construction and operation will incorporate techniques to reduce surficial disturbance and, where possible, progressively reclaim areas affected during the construction and operations phases. Stabilizing and rehabilitating surfaces will reduce the potential for degradation of terrestrial, aquatic, and heritage resources due to extended exposure to climatic factors, reducing closure-related capital costs at the cessation of the facilities activities.

3.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

3.1 PHYSICAL SETTING

The Project is located in the Village of Belledune at the boundary between Restigouche and Gloucester Counties, New Brunswick and lies within the Nicholas Denys Ecodistrict of the Northern Uplands Ecoregion. This ecodistrict includes small patches of coniferous forests scattered in a predominantly mixed wood forest (NBDNR 2007). The area is a mixture of forested land, industrial, and residential areas. The project is located adjacent to the Belledune Thermal Generating Station to the northeast, and the Chaleur sawmill is located to the west. There are approximately 30 residences located to the north of the Project along Chaleur Drive.

3.1.1 Topography and Drainage

The Project is located within the Chaleur Bay composite watershed. A review of topographic mapping indicates that surficial drainage within the PDA is north, directly toward Chaleur Bay. Groundwater flow is assumed to follow the topography toward the Bay of Chaleur. The elevation of the PDA ranges from 20 metres to 30 metres above sea level (NRCan 2019).

3.1.2 Bedrock and Surficial Geology

Based on the Bedrock Geology of the Pointe-Verte Area Map, the bedrock geology on the north portion of the PDA is identified as late Silurian aged rocks of the South Charlo formation, consisting of mainly reddish brown to dark grey polymictic pebble-cobble conglomerate locally containing clasts of lower Silurian limestone. The southern portion of the PDA comprises early Silurian aged rocks of the La Vielle Formation consisting of grey to black thin-bedded, nodular micritic limestone, minor light great calcarenite and calcareous sandstone (Wilson 2013).

The surficial geology of the area consists of Late Wisconsinan and/or Early Holocene aged marine sediments deposited in shallow marine water, locally deep, as blanket and plain deposits consisting of sand, silt, and some gravel and clay; generally, 0.5 to 3.0 metres thick (Rampton 1984).

3.2 BIOPHYSICAL SETTING

3.2.1 Atmospheric Environment

The current climate conditions are generally described by the most recent 30-year period (1981 to 2010) for which the Government of Canada (GOC) has developed statistical summaries, referred to as climate normals (GOC 2019). The closest weather station to the Project with available historic data is the Bathurst A Station, located approximately 40 km south of the Port of Belledune. The average daily temperature ranges from -10.8°C (January) to 19.1°C (July). The extreme maximum temperature for the area was 37.4°C (June 2003), and the extreme minimum was -35.6°C (January 1994). The area averages 1,110.1 millimetres of precipitation per year, of which an average of 795.4 millimetres falls as rain and 333.5

centimetres falls as snow. For the majority of the year, the dominant wind direction is west/southwest, with the exception of January and September, during which the dominant wind direction is northeast, November, when it is northwest, and May, when it is south.

There is relatively good air quality experienced in New Brunswick most of the time. This is evidenced by the observed low frequency of exceedance of standards and guidelines and the relatively few industrial air contaminant emissions sources. New Brunswick's contribution to the national total releases of air contaminants is relatively low, approximately 0.87 to 2.78% of the national totals, on average.

Greenhouse gas emissions from activities in New Brunswick were reported as 15,300,000 tonnes CO_2e for the 2016 reporting year (ECCC 2018a). GHG emissions from the Belledune Thermal Generating Plant were reported to the federal GHG reporting program as 2,767,227 tonnes CO_2e for the 2016 reporting year (ECCC 2018a). The Belledune Generating Plant contributes approximately 18% to New Brunswick GHG emissions and is the second largest emitter after the Irving Oil Refinery in Saint John.

National GHG emissions are 704,000,000 tonnes CO_2e, and therefore GHG emissions from New Brunswick account for approximately 2.2% of national emissions. Estimated carbon dioxide equivalent emissions globally were 48,892,000,000 tonnes CO_2e in 2014 (including land use change and forestry) (WRI 2015). Canada's contribution to global GHG emissions is approximately 1.4%.

The acoustic environment in the area is characterized by three main sources: traffic noise from vehicles along nearby streets, noise from ocean waves and marine vessel travel in the area, and noise from the existing generating station. The existing generating station is located east of the Project Area and generates noise during operation (for example, from transformers and turbines).

Further information on the atmospheric environment is provided in Section 6.0.

3.2.2 Water Resources

The Project is located within the Chaleur Bay composite watershed. The closest mapped watercourse, an unnamed tributary to the Belledune River, is located upgradient, approximately 250 metres from the PDA, and is separated from the PDA by Route 134 (NBDNR 2015). Field surveys identified three unmapped waterbodies and one unmapped ephemeral watercourse. The waterbodies are associated with wetlands and appear to be anthropogenic. The ephemeral watercourse links two of the waterbodies. These features do not extend or connect to other features beyond the limits of the PDA. The ephemeral watercourse was dry at the time of survey. A fish survey using an electrofisher could not be conducted in the ponds due to safety concerns because weather was rainy during the site visit. The ponds are assumed to be non-fish bearing as they were not connected to downstream watercourses and no fish were observed.

Based on the results of groundwater samples water well records located within 5 kilometres of the PDA reported by the New Brunswick Online Well Log System, the water quality in the area is generally good to fair, with water quality meeting the GCDWQ (Health Canada 2017a) in the majority of water wells reviewed. However, the sample results of six of the water wells indicated that one or more analyzed parameters exceeded the maximum acceptable concentrations for aesthetic objectives developed for the

GCDWQ. Maximum acceptable concentrations were exceeded for arsenic in one sample, nitrite in one sample, nitrite/nitrate in one sample, and lead in one sample. Aesthetic objectives were exceeded for iron in six of the samples, chloride in one of the samples, and manganese in one of the samples. Total coliform was also detected in four of the samples; and one sample indicated the presence of *E. coli* (NBDELG 2019a).

Further information on fish and fish habitat and water resources is provided in Section 7.0 and Section 8.0.

3.2.3 Terrestrial Environment

The Northern Uplands Ecoregion extends across the northern-most portion of New Brunswick and is seated between the two separate portions of the Highlands Ecoregion. The Northern Uplands Ecoregion is climatically intermediate between the colder Highlands Ecoregion and the slightly warmer and wetter Central Uplands Ecoregion located to the south. The vegetation and fauna within this ecoregion consequently display a mixture of northern and southern affiliations, giving the area an ecologically distinctive character (NBDNR 2007).

The Nicolas Denys Ecodistrict is a narrow, gently sloping strip of land that lies along the coast of the Chaleur Bay. It stretches from the Nepisiguit River, which forms the southern boundary, northward to the Dalhousie Peninsula. The vegetation here is extensively influenced by the long history of human settlement and consists of small patches of coniferous forests scattered in a predominantly mixed wood forest. The low, acidic flatlands are covered with a forest dominated by intolerant hardwoods such as trembling aspen (*Populus tremuloides),* red maple (*Acer rubrum*), and paper birch (*Betula papyrifera*), with associated balsam fir (*Abies balsamea),* white spruce (*Picea glauca*), and eastern white cedar (*Thuja occidentalis*) (NBDNR 2007).

3.2.3.1 Vegetation

Upland plant communities occupy the majority of the PDA, with most of the upland areas occupied by forest. Seven forest types have been identified in the PDA including regeneration to sapling hardwood forest, young to immature hardwood forest, mature to over-mature hardwood forest, young to immature mixed-wood forest, regeneration to sapling softwood forest, young to immature softwood forest, and mature to over-mature softwood forest.

A portion of the PDA is classed as industrial. These areas have been heavily disturbed as a result of being used as borrow pits or during the construction of the coal storage area for the power plant. The species composition of the vegetation cover of these areas varies substantially depending on the intensity of disturbance, whether the disturbance event impeded or increased site drainage and how long ago the disturbance was. Most areas were disturbed many years ago and now support tall shrub thickets that are dominated by speckled alder, willows (*Salix* spp.), red raspberry, young balsam poplar, trembling aspen and paper birch.

Nine wetlands were observed and delineated within the PDA. Several of these wetlands were complexes of multiple wetland classes and types, including freshwater marsh, shallow water wetland, deciduous, coniferous, and mixed wood treed swamp, and tall shrub swamp.

Species at risk (SAR) are species listed as extirpated, endangered, threatened, or special concern by the federal SARA, or the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). No vascular plant SAR were observed during field surveys.

Species of conservation concern (SOCC) are species that have been identified by federal and/or provincial species at risk agencies as being rare in New Brunswick, or their populations may not be considered sustainable. SOCC are here defined to include species that are not SAR, but are ranked S1 (critically imperiled), S2 (imperiled), or S3 (vulnerable) in New Brunswick by the Atlantic Canada Conservation Data Centre (AC CDC 2018a). Three vascular plant SOCC were observed during field surveys, all outside of the PDA: Menzies' rattlesnake plantain (*Goodyera oblongifolia*, *S2*) dotted smartweed (*Polygonum punctatum*, *S3*) and Gmelin's water buttercup (*Ranunculus gmelinii*, *S3*). A number of exotic species were observed within the PDA, two of which are considered invasive by some sources: Canada thistle (*Cirsium arvense*) and common tansy (*Tanacetum vulgare*) (NBISC 2012; NCC 2018).

Further information on vegetation is provided in Section 9.0.

3.2.3.2 Wildlife

The Atlantic Canada Conservation Data Centre (AC CDC) reported historical observations of 79 bird species within a 5 kilometre radius of the PDA including seven SAR and seven SOCC. The following SAR were identified:

- common nighthawk (*Chordeiles minor*)
- eastern wood-pewee (*Contopus virens*)
- bank swallow (*Riparia riparia*)
- barn swallow (*Hirundo rustica*)
- wood thrush (*Hylocichla mustelina*)
- evening grosbeak (*Coccothraustes vespertinus*)
- bobolink (*Dolichonyx oryzivorus*)
- Canada warbler (*Cardellina canadensis*)

The following SOCC were identified:

- common eider (*Somateria mollissima*)
- killdeer (*Charadrius vociferous*)
- black guillemot (*Cepphus grille*)
- common tern (*Sterna hirundo*)
- cliff swallow (*Petrochelidon pyrrhonota*)
- northern mockingbird (*Mimus polyglottos*)
- brown-headed cowbird (*Molothrus ater*)

Three of these SOCC species, common eider, black guillemot, and common tern, are marine birds, and therefore not expected to be found within the PDA. Further information on wildlife is provided in Section 9.0.

3.2.4 Marine Environment

Chaleur Bay is a marine environment located between New Brunswick and Quebec and is connected to the rest of the Gulf of St. Lawrence through the Chaleur Trough, a deep trench that runs from west to east. The bay stretches almost 150 kilometres in length and at its widest reaches 45 kilometres to cover over 3,000 km^2.

Surface water salinity in summer is generally around 28 parts per thousand (ppt), with water temperatures rising to around 18°C by fall. Chaleur Bay becomes stratified during summer months and at water depths of approximately 30–45 metres, the water of the bay is saltier (>30 ppt) and remains cold (below 2°C) throughout the year (Gagnon 1997). Water circulation in the bay is characterized by the outflow of less saline, warmer surface water along the south shore and the inflow of saltier, colder water along the north shore. The south shore water is a mixture of the fresh water from the rivers with the sea water of the bay; this mixed water is swept towards the south shore by the Coriolis force, while the countercurrent running upriver along the north shore is a branch of the Gaspé Current. This circulation is the cause of a small cyclonic eddy in the eastern part of the bay. Strong, steady, westerly winds cause upwellings of deep water and, in winter, create ice-free areas along the north shore between Paspébiac, QC and Grande-Rivière, QC (Bonardelli 1993, Gan et al. 2004).

There are five main commercial fisheries reported in the Belledune area; American lobster, snow crab, rock crab, Atlantic mackerel and Atlantic herring (DFO 2019a). Groundfish and sea scallop fisheries are present in the area, but less effort is directed toward these fisheries (DFO 2019a). Most of the groundfish and snow crab fishery effort occurs at deeper depths and targets snow crab in addition to five groundfish species; Atlantic halibut, winter flounder, American plaice, Turbot/Greenland halibut and redfish (*Sebastes mentella*) (DFO 2019a). Information relative to the five main commercial fish species in Chaleur Bay is presented to give a general understanding of their location and stage of life within Chaleur Bay.

American lobster is abundant in summer on rocky subtidal seabeds (less than 35 metres deep) along areas of Chaleur Bay (Gagnon 1997). Migrations to deeper water occur in winter if bottom cover is not available in the <30 metres water depths (Bowlby et al. 2007, 2008).

Snow crab is abundant on muddy and sandy-mud bottoms at depths of 50–200 metres and is generally located at the mouth of Chaleur Bay. The local fishing fleet targets snow crab where the main concentrations are found, which are in the Chaleur Trough and the Shediac Trough (Gagnon 1997).

Rock crab tends to concentrate in shallow waters and prefers sandy substrate, although it can be observed on all types of substrate and largely remain inshore in the Gulf of St. Lawrence (Bigford 1973). It is widespread and abundant in the southern Gulf of St. Lawrence (Rondea et al. 2014).

Atlantic herring is the primary pelagic species harvested locally. The fishing fleet fishes for herring in spring and fall in the southern part of the Gulf of St. Lawrence. Herring migrates between the wintering ground in the eastern Gulf and the breeding and feeding areas along the shores of Chaleur Bay (LeBlanc et al. 1998; Bosman et al. 2011). The principal spawning grounds in Chaleur Bay are near Carleton and Grande-Rivière on the Quebec coast (Messieh 1987, McQuinn et al. 2012).

Atlantic mackerel is a pelagic species that winters in the Atlantic Ocean and migrates to the southern Gulf of St. Lawrence in summer to breed and feed (Gagnon 1997). In Canadian waters, the southern Gulf of St. Lawrence is generally recognized as being the primary mackerel spawning ground. Spawning in the Gulf occurs mainly in June and July (DFO 2007). Chaleur Bay has been identified as an important environment for the spawning, rearing, and feeding of Atlantic mackerel (Gagnon 1997).

Eight species of marine mammals have been reported in the area at various times of year, including seven species of whales. A 1996 census found two areas where harbour seals and grey seals like to haul themselves out on the rocks: Forillon Peninsula and Percé. Generally, seal populations in the area are small because there are few islands and reefs along the coast (Gagnon 1997). There are also two species of toothed whales (harbour porpoise and white-beaked dolphin) and five species of baleen whales (North Atlantic right whale, minke whale, fin whale, humpback whale and blue whale). The number of sightings is low; however, these larger marine mammals were generally observed off-shore in deeper water, and near the mouth of Chaleur Bay.

North Atlantic right whale and blue whale are both ranked as *endangered* on Schedule 1 of the Federal *Species at Risk Act*. In recent years due to the changing migratory habits of the North Atlantic right whale and their increased presence, the Government of Canada has put in place seasonal speed restrictions in the Gulf of St Lawrence, which include the mouth of Chaleur Bay (Transport Canada 2019).

3.3 SOCIOECONOMIC SETTING

Further information on the socioeconomic environment is provided in Section 12.0

3.3.1 Economic activity and Economic Drivers

Approximately 1,417 people live in the Village of Belledune (Statistics Canada 2016) (most recently available Census data). The unemployment rate is 17.2% (Council of the Village of Belledune and Belledune District Planning Commission 2018). The northeast region of New Brunswick (which includes Restigouche, Gloucester and Northumberland counties) has high percentages of employment levels in the areas of sales and service occupations (27.8%), trades, transport and equipment-related occupations (19.8%), and business, finance and administrative occupations (13.5%) (GNB 2013). Average individual income levels in the region are lower than provincial averages. The average employment income of individuals (full-year and full-time) in the northeast region of New Brunswick is $38,967 compared to $41,412 for the province. Average family income levels in the northeast region are also lower than the provincial average ($56,033 compared to $63,913).

In addition to the Belledune Thermal Generating Station, Belledune is also home to a lead smelter owned by Glencore Canada, a sawmill facility owned by Chaleur Sawmill Associates, and a gypsum processing plant owned by Canadian Gypsum Company (Village of Belledune 2018a).

3.3.1.1 Commercial Fisheries

Commercial fisheries in Chaleur Bay are an important source of employment for coastal communities in the counties of Gloucester and Restigouche and are important to the economy of New Brunswick. Due to the offset in timing of fishing seasons in the area, it is common for individual fishers to hold a license for more than one fishery. Based on the most recent data available from the Fisheries and Oceans Canada (DFO) Gulf Region (2011 to 2016), there are five main commercial fisheries reported in the area; American lobster, snow crab, rock crab, Atlantic mackerel and Atlantic herring (DFO 2019a). Groundfish and Sea scallop fisheries are present in the area but less effort is directed toward these fisheries (DFO 2019a). Most of the groundfish fishery effort occurs outside of the LAA and targets five species; Atlantic halibut, winter flounder, American plaice, Turbot/Greenland halibut and redfish (*Sebastes mentella*) (DFO 2019a).

3.3.2 Land Use

The land on which the Project facility will be located is zoned for “Industrial Type 1” uses. According to the Village of Belledune Rural Plan (Council of the Village of Belledune and Belledune District Planning Commission 2018), permitted uses in this zone include a wide variety of industrial facilities. The Village of Belledune has zoned approximately 5,000 acres for heavy industry and is continuing to develop their 230 acre light industrial park (which is zoned for a further 10,000 acres for future development) (Village of Belledune 2018a).

3.3.3 Transportation Infrastructure

Route 134 (a collector road also known as Main Street) runs along the coast and through the Village of Belledune. It also runs adjacent and south of the Project (Figure 2.8). It was diverted in the 1990’s for the construction of the NB Power Belledune Thermal Generating Station (Council of the Village of Belledune and Belledune District Planning Commission 2018). A private NB Power road (known as Ash Haul Road) runs diagonally from Hodgins Road and Main Street towards the Generating Station. Provincial highway Route 11 (arterial highway) runs parallel to much of Route 134, approximately 3-4 kilometres south. The average annual daily traffic (AADT) counts for Route 134 range between 1,090 and 1,500 near the Project site. The AADT for Route 11 ranges between 3,260 and 3,650 (NBDTI 2016). Traffic on Route 134 decreased from approximately 1,800 AADT in the late 1990’s to less than 1,500 AADT in 2006 (Council of the Village of Belledune and Belledune District Planning Commission 2018). According to the Belledune Rural Plan (2018), the AADT on Route 134 is low in comparison with other coastal routes in the Chaleur region.

A CN rail line (with two sidings) runs adjacent to the existing generating station on land owned by Glencore Canada Corporation (Figure 12.2).

3.3.3.1 Port of Belledune

The Project will make use of services provided by the Belledune Port Authority. The Port of Belledune is a year-round deep-water port that is equipped to handle dry bulk, liquid bulk and general cargo (Village of Belledune 2018a). The Port of Belledune was originally a single terminal facility built in 1968, and has since been expanded three times, in 1995, 1998, and most recently in 2010. In 2000, the Belledune Port Authority was formed to replace the Ottawa-based federal department that had previously been responsible for operations, allowing decisions related to port activities to be made locally. Currently with four terminals, the port ships to more than 25 countries, and handles 24 products including forest products, paper products, and consumables (Belledune Port Authority 2019). The Belledune Port Authority has indicated that there is sufficient capacity to accommodate an increase in vessel traffic at the port related to the Project. It is unlikely that a Project-related increase in activity would lead to restrictions, or require expansion of the port. The Belledune Port Authority does not anticipate that Project-related use of the port will require review following the TERMPOL, as no substantial modifications to the port are planned and the Project will not involve transshipment or the transportation of hazardous goods (J. David, pers. comm. January 4, 2019).

3.3.3.2 Marine Transportation within Chaleur Bay

Based on data on commercial vessel traffic within Chaleur Bay was obtained from DFO for the years 2002 to 2018, Merchant vessels (i.e. tankers, bulk carriers, container carriers and passenger vessels) contribute 47% to 86% of the total vessel traffic depending on the year. Merchant vessel traffic in Chaleur Bay has decreased in recent years with the four most recent years having the lowest percentage of merchant vessel traffic in the years where data is available. However, the total volume of vessel traffic (merchant, fishing, recreational, etc) has increased in recent years.

Further information on marine transportation is provided in Section 12.0.

4.0 FIRST NATIONS AND PUBLIC ENGAGEMENT

The following Section 4.0 has been provided in its entirety by Maritime Iron Inc. and has not been modified by Stantec.

4.1 INTRODUCTION

Maritime Iron's management fully understands the vital importance of establishing and maintaining constructive and productive working relationships with Aboriginal and regional communities near the proposed project area in New Brunswick.

Our team is committed to working in partnership with Aboriginal communities and residents of municipalities or other communities in the Project area to support their social and economic well-being. We accept our responsibility for building a sustainable future not only for our employees but also for the surrounding area.

Maritime Iron is committed to early and ongoing engagement and consultation with local and regional First Nations as well as the public (i.e. other individuals, organizations, and groups) that may be potentially affected by the project or are interested in learning more.

This document provides an overview of Maritime Iron's engagement approach and activities to date with:

- First Nations and Aboriginal Organizations, and
- the Public

4.2 ENGAGEMENT METHODS AND ACTIVITIES WITH FIRST NATIONS AND THE PUBLIC

4.2.1 Engagement Tools

Maritime Iron uses a range of communication tools to share Project-related information, including open house events, meetings, letters, newsletters, email, and phone communications. In those instances where specific issues and concerns were raised by individuals within the First Nations or the public, the approach included more detailed discussions through delivery of presentations, meetings and emails.

The communication tools also include, but are not limited to:

- the Project website;
- Letters, Emails and/or Newsletters;
- In-person meetings with Chiefs, Mayors, Council members and/or technical staff;
- Open houses in communities.

4.2.1.1 Project Website

The Maritime Iron Project website (www.maritimeiron.ca) was launched in June 2018. The Project website contains information on the Project, information on Maritime Iron environmental leadership and sustainable development and contact information for Maritime Iron. The website is maintained by Maritime Iron and updated as new information becomes available. The website has proven to be a successful communication tool. Since the website was launched in June 2018 it has had over 11,000 unique visitors. Maritime Iron has placed a video of the FINEX operation on the website which gives a good account of the FINEX operation. Comments that have been received through the website have been focused almost entirely on employment and contracting opportunities. Going forward, Maritime Iron will continue to maintain and update the Project website to:

- ensure that Project information is current;
- inform users when Project milestones are reached;
- provide access to latest Project-related documents and news releases; and
- advertise upcoming information sessions and community events.

Maritime Iron has received over 230 emails via the website and has responded and will continue to respond to the inquires made through the website.

4.2.1.2 Information Kiosk and Brochures

Maritime Iron will establish an information kiosk in Belledune, New Brunswick located at 2330 Main St. (within the Belledune Village Hall), which is open from 8:00 am to 5:00 pm on weekdays. The kiosk will have information pamphlets and provide an email address that individuals can use to ask Maritime Iron questions.

In addition, subject to community willingness and availability of space, Maritime Iron will offer to establish an information kiosk in Bathurst, Pabineau First Nation and Eel River Bar First Nation. In the interim, project brochures are available in each community Council Office/Town Hall.

4.2.1.3 Notifications for Meeting and/or Community Open Houses

At the direction of their leadership and staff, the Pabineau First Nation and Eel River Bar First Nation community members are notified of the community open houses in several ways, including via the community newsletter, the community FaceBook page, posting on the community billboard, and posting in the First Nation Band Council Offices. In addition, Pabineau First Nation has an electronic SchoolNet system that transmits information by automated telephone message.

4.2.1.4 Open Houses

Open Houses are staffed by members of the Maritime Iron Management team. Various poster boards are laid out within the venue to provide information on various aspects of the Project and a PowerPoint presentation is provided by Maritime Iron.

The open houses are organized into two parts. The first part includes a Maritime Iron presentation that provides an overview of the Project. Information covered by the presentations includes:

- who we are;
- why Belledune and New Brunswick;
- why Maritime Iron;
- what we are not;
- what we are doing;
- how iron production fits into the overall steel production processes;
- overview of the FINEX process;
- how FINEX by-product-gas can extend the NB Power Generating Station life;
- environmental benefits of the project;
- employment and economic benefits of the project;
- the Environmental Impact Assessment process and findings to date;
- engagement approach;
- next steps.

A video presenting information regarding the facility and operations may also be played during the Open Houses. The video includes information on the following:

- 3 stage Fluidized Bed Reactor
- Coal Preparation
- Iron Reduction Process
- Melter Gasifier
- Off Gas Process
- Hot Iron Tapping Procedure
- Benefits of the FINEX Process
  - Direct use of low-cost fine iron ores
  - Direct charging of low-cost non coking coal
  - Generation of a clean export gas for a wide range of downstream applications
  - Product of hot metal in a quality identical to blast furnace hot metal
  - Proven environmentally friendly hot metal production

Posters presented at the open house include an Introduction to the Project; the Innovative FINEX Ironmaking Technology; Environmental Benefits; Cleaner Energy Production; Description of the Facilities; Regulatory Oversight; and Project Economics.

The second part of these meetings includes an opportunity for attendees to raise their questions, concerns and suggestions.

Maritime Iron provides a website address, which includes a Contact Us tab, at the information sessions providing a further opportunity for the members of the First Nation to ask questions of Maritime Iron.

Maritime Iron will return to the communities to address the questions, concerns and suggestions raised during the open house sessions. Maritime Iron is committed to a practical, transparent and respectful approach to adequate and purposeful engagement with the public and First Nations, as well as meaningful consultation with First Nations, and accommodation, as appropriate.

4.3 FIRST NATIONS AND ABORIGINAL ORGANIZATIONS

4.3.1 Overview

Maritime Iron's overall goals are to:

1. Build long-term relationships with the Mi'gmaq First Nation communities,
2. Engage with local and regional First Nations and their organization Mi'gmawe'l Tplu'taqnn Inc. (MTI) during the Environmental Impact Assessment (EIA) Review, and
3. Consult meaningfully and, where appropriate, accommodate to mitigate or minimize potential impacts on Aboriginal and Treaty rights.

Maritime Iron has contacted those Aboriginal communities that may be potentially affected by Maritime Iron's Project so that they are aware of the proposal, able to obtain additional information and express any concerns they may have. Maritime Iron's engagement with the Mi'gmaq First Nations seeks to provide them with a meaningful opportunity to provide input regarding the Project. First Nations will also be informed of how their concerns have been taken into consideration, and where appropriate, addressed in the planning and decision-making process.

Maritime Iron's engagement and consultation is undertaken to fulfil certain obligations of the Belledune Port Authority (federal agent) (BPA) pursuant to the Relationship, Engagement and Consultation Protocol dated May 31, 2018 among BPA, Oinpegitoig First Nation (Pabineau), Ugpi'ganjig First Nation (Eel River Bar), and Mi'gmawe'l Tplu'taqnn Inc. (MTI) (Belledune Port Authority 2018). Although the BPA is ultimately responsible for the duty to consult, as contemplated by that Protocol, the BPA has delegated to Maritime Iron, as a project proponent, certain procedural aspects of BPA's consultation obligations (see Appendix B).

On April 24, 2019, Maritime Iron entered into a Letter of Intent with MTI to provide a foundational basis for the relationship and explore the development of a framework for a variety of agreements and understandings, including an Indigenous Knowledge Study. (See Appendix C).

Towards that end, on July 17, 2019 Maritime Iron, Oinpegitoig First Nation (Pabineau), Ugpi'ganjig First Nation (Eel River Bar), and Mi'gmawe'l Tplu'taqnn Inc. (MTI) signed a Relationship, Capacity and Indigenous Knowledge Study Agreement. As part of this agreement, Maritime Iron will provide funding for community engagement activities, Indigenous Knowledge sharing and integration, travel and associated costs, professional and legal fees, as well as a 3rd party independent technical review of the Project's Environmental Impact Assessment. In addition, Maritime Iron is providing funding for the development of an Indigenous Knowledge Study being led and written by MTI.

In the context of this Agreement, a Liaison Committee has been established and meets at least quarterly in order to review advancement of the Indigenous Knowledge Study and raise questions regarding the Project. Membership in the Liaison Committee includes:

- Chief, Oinpegitoig First Nation (Pabineau)
- Chief, Ugpi'ganjig First Nation (Eel River Bar)
- Co-Chairs, Mi'gmawe'l Tplu'taqnn Inc. (MTI)

- Vice President, Communications and Public Affairs, Maritime Iron Inc.

4.3.2 First Nations Engagement

In general, the Mi'gmaq First Nations have expressed considerable interest in the Project throughout the early stages of the EIA process. Maritime Iron considers it essential to a successful EIA and Project to actively engage members of the First Nations to ensure the EIA is scoped adequately, concerns are identified and addressed as appropriate, and members of the First Nations are able to obtain information regarding the Project so as to ensure on-going dialogue throughout the life of the undertaking.

Maritime Iron recognizes that meetings and discussions with Mi'gmaq First Nations leadership, staff, consultants and community members have been on a without prejudice basis and for information sharing purposes.

Meetings with the First Nation leaders and staff began in September 2016, with Maritime Iron's Chairman and CEO reaching out to the Assembly of First Nations Regional Chief. Maritime Iron has continued to engage and develop a relationship through several meetings with MTI Chiefs and staff members.

From September 2016 through October 2019, Maritime Iron held meetings with various Mi'gmaq First Nation leaders or their representatives, as well as community members and has compiled email and mailing lists of individuals engaged from both the Mi'gmaq of New Brunswick and Gaspé, Québec (see Table 4.1).

A series of ongoing meetings have been undertaken with the Bay of Chaleur region First Nation communities Oinpegitoig (Pabineau) and Ugpi'ganjig (Eel River Bar) with MTI, an association of eight Mi'gmaq communities in New Brunswick. Maritime Iron has met with the three Gaspé Mi'gmaq First Nations (Listuguj, Gesgapegiag and Gespeg) and is also furthering the relationship with Mi'gmawei Mawiomi Secretariet (MMS) and its Assessment Group.

As part of its engagement activities, on December 11, 2018 Maritime Iron's Management team participated, along with other regional businesses including the Belledune Port Authority and New Brunswick Power, in a traditional Mi'gmaq blanket exercise. The exercise was held in the Indian Island First Nation community. Maritime Iron was instrumental in initiating, and assisted in funding, the exercise. Feedback from First Nations facilitators after the exercise was positive.

In addition to developing long-term positive partnerships with First Nations, the goals of Maritime Iron's Aboriginal engagement program for the Project are to identify issues and address concerns related to potential impacts on Aboriginal land uses, to explore opportunities to mitigate the potential environmental effects and enhance the benefits of the Project, and to document assertions of Aboriginal and Treaty rights for consideration by the Provincial and Federal Crowns. To this end, Maritime Iron has undertaken and will undertake activities designed to:

- respect Aboriginal and Treaty rights and develop an understanding of the culture and practices of the Mi'gmaq First Nations;
- provide information and seek input from Mi'gmaq First Nations on the Project;

- identify, document, monitor and consider issues and concerns identified through the engagement process;
- discuss the past, current and future use of land and resources for traditional purposes by Mi'gmaq First Nations and how those activities might be affected by the Project;
- provide early notification of the Project field activities and engagement opportunities associated with the EIA process;
- identify the need for planning, design and management measures that will avoid, mitigate or resolve the issues raised, as appropriate, or otherwise accommodate potential impacts to current and future Aboriginal land uses in the Project area;
- support the Crown's duty to consult and to consider concerns related to the Project's potential environmental effects on asserted Aboriginal and Treaty rights, as well as impacts on traditional way of life.

Throughout the EIA process, Maritime Iron will seek opportunities to meet with First Nations and their representative organizations in order to share information and discuss the Maritime Iron Project. In addition to those described above for the First Nation engagement and consultation, these opportunities may include: phone calls, both formal and informal in-person meetings, emails, and letters.

4.3.2.1 Presentations and Meetings with First Nations and Aboriginal Groups

From September 2016 through October 2019, Maritime Iron held a number of meetings with various Mi'gmaq First Nation leaders or their representatives, as well as community members, and compiled email and mailing lists of individuals from both the Mi'gmaq of New Brunswick and Gaspé, Québec.

Maritime Iron continues to actively meet with, and present information and updates, regarding the Project to a number of First Nations and Aboriginal groups on a without prejudice basis and for informational sharing purposes.

To date, Maritime Iron has met, communicated with, and/or presented Project information to the following First Nations or their representatives, and Aboriginal groups:

- Oinpegitoig First Nation (Pabineau)
- Ugpi'ganjig First Nation (Eel River Bar)
- Mi'gmawe'l Tplu'taqnn Inc. Chiefs and staff (technical and legal)
- Elsipogtog First Nation
- Wolastoqey Nation in New Brunswick
- St. John River Tribal Council (Wolastoqey)
- Chiefs of three (3) Gaspé, Québec Mi'gmaq First Nations (Listuguj, Gesgapegiag, Gespeg)
- Mi'gmawei Mawiomi Secretariat (administrative body for Listuguj, Gesgapegiag, Gespeg)
- Mi'gmawei Mawiomi Business Corporation

4.3.2.2 Open Houses

Maritime Iron has and will continue to hold open houses with First Nation communities.

Community open houses have taken place in Eel River Bar First Nation and Pabineau First Nation at the following locations and times:

- Pabineau First Nations Band Council Office: September 16, 2019 from 12:00 p.m. to 2:30 p.m.

- Eel River Bar First Nations Band Council Office: September 18, 2019 from 5:00 p.m. to 7:30 p.m.

4.3.3 Indigenous and Traditional Knowledge

In September and October 2018, Maritime Iron hired three individuals with expertise in environmental monitoring recommended by MTI and MMS to assist Stantec in its preliminary site analysis. These activities included shovel testing and archeology field work.

On April 24, 2019, Maritime Iron entered into a Letter of Intent with MTI to provide a foundational basis for the relationship and explore the development of a framework for a variety of agreements and understandings, including an Indigenous Knowledge Study. (See Appendix C).

On July 17, 2019 Maritime Iron, Oinpegitoig First Nation (Pabineau), Ugpi'ganjig First Nation (Eel River Bar), and Mi'gmawe'l Tplu'taqnn Inc. (MTI) signed a Relationship, Capacity and Indigenous Knowledge Study Agreement. As part of this agreement, Maritime Iron will fund, through MTI, an Indigenous Knowledge Study (IKS) which includes the area in which the proposed Project is located. In accordance with the Agreement, the IKS will be completed by January 29, 2020.

The information contained in the final IKS will be taken into consideration by Maritime Iron and during the EIA review period. This information will be useful in considering mitigation measures for any potential adverse effects on cultural or traditional uses resulting from the Project.

4.4 ENGAGEMENT WITH THE PUBLIC

Maritime Iron's overall goal is to ensure engagement with the public at large and other key stakeholders during the EIA Review. As outlined on page 24 of "A Guide to Environmental Impact Assessment in New Brunswick", Maritime Iron understands the definition of 'public' to include "all stakeholders (individuals, companies, agencies, organizations, interest groups, etc.) who may be affected by the undertaking. It also includes those who may have local knowledge of the location of the proposed development that may assist in its siting or design."

Maritime Iron has sought to raise awareness of the project so that those potentially affected by Maritime Iron's project are able to obtain additional information about it and express any concerns they may have. Public engagement activities are listed in Table 4.1.

The overarching goals of such engagement are to inform such parties about the Project; assist in the identification of key issues and concerns in respect of the Project; to collect information in respect of the current use of land and resources; and to share information in respect of the Project with local communities, stakeholders and the general public. There are additional objectives around building support for the Project in the community and with governments in respect of the Project's direct and indirect benefits.

4.4.1 Public Engagement

In general, the public has expressed considerable interest in the Project throughout the early stages of the EIA process. Maritime Iron has considered it essential to a successful EIA and Project to actively engage members of the public. This engagement helps Maritime Iron ensure the EIA is scoped adequately, concerns are identified and addressed as appropriate, and members of the public are able to obtain information regarding the Project so as to facilitate on-going dialogue throughout the life of the undertaking.

Maritime Iron remains committed to and active in meeting and presenting the Project as well as updates to a number of individuals, interest groups, stakeholder groups, business groups, and federal, provincial and municipal officials.

Public engagement has included, and will continue to include:

- presentations to local chambers of commerce, regional fishing associations, and neighbourhood groups;
- community open houses; and
- information booths at community events.

4.4.2 Engagement of Elected Representatives and Government Officials

Maritime Iron has engaged municipal, provincial, and federal elected representatives and government officials to provide information about the project and answer questions. Outreach to elected representatives and government officials will continue as required. To date, this has included meetings with:

- Village of Belledune Mayor and Council
- City of Bathurst Mayor and Council
- Member of Parliament for the Federal electoral district of Acadie-Bathurst
- Members of the Provincial Legislative Assembly for the electoral districts of:
  - Restigouche Chaleur
  - Bathurst West-Beresford
  - Campbellton-Dalhousie
  - Bathurst East-Nepisiguit-Saint-Isidore
  - Caraquet
  - Shippagan-Lamèque-Miscou
- Provincial government officials and/or Ministers from the New Brunswick Department of Environment and Local Government, the Department of Energy and Resource Development, the Department of Aboriginal Affairs, and the Department of Post-Secondary Education, Training and Labour.

4.4.3 Engagement of Other Stakeholders

Maritime Iron continues to identify stakeholders that have an interest in this project and engages with representatives of organizations to build an understanding of the Project. This includes:

- New Brunswick Power
- Belledune Port Authority

- WorkSafe NB
- Glencore
- Department of Post-Secondary Education, Training and Labour
- Collège communautaire du Nouveau-Brunswick / New Brunswick Community College
- Trade Unions

4.4.3.1 Career Information Sessions

Maritime Iron will work with the New Brunswick Department of Post-Secondary Education, Training and Labour, Collège communautaire du Nouveau-Brunswick, New Brunswick Community College, Joint Economic Development Initiatives, and local Chambers of Commerce to help in developing the local Aboriginal and non-Aboriginal workforce. The Maritime Iron website will be used to advertise for direct hire employment.

Prior to the start of the Project's construction phase, Maritime Iron will work with its contractor(s) to set up job fairs in local and regional venues. Maritime Iron will provide advance notice of those events, including the time and location, to residents of First Nations and Municipalities in the area through community postings and/or advertising.

Maritime Iron will work with trade unions to promote job opportunities and career development for Aboriginal and non-Aboriginal community members.

New Brunswick Department of Post-Secondary Education, Training and Labour

In January 2019, Maritime Iron engaged with the Department of Post Secondary Education, Training and Labour (PETL) to maximize its programing to develop the Aboriginal and non-Aboriginal work force. This would include but is not limited to: Adult Learning, Apprenticeship and Occupational Certification, General Education Diploma (GED), and Tuition Access Bursary.

In addition to its programming, Maritime Iron will work with PETL to develop a Resource Development Workplace Committee to coordinate the availability of labour, training, apprenticeships, timelines, requirements, etc. An additional meeting took place on September 20, 2019 to understand their processes and provide information on the project.

Collège communautaire du Nouveau-Brunswick (CCNB) / New Brunswick Community College

Maritime Iron has been engaged with CCNB/NBCC since December 12, 2018 to provide information on the Maritime Iron Project and the anticipated skills required for a variety of career opportunities with the Project for Aboriginals and non-Aboriginals. CCNB will be invited to participate in Maritime Iron career information sessions in 2020.

In particular, Maritime Iron plans to work with CCNB to identify and develop a training and skills program geared to Aboriginal students from New Brunswick's First Nation communities. For example, one program could involve CCNB matching Aboriginal students from the program with industry opportunities. Maritime Iron will explore with CCNB opportunities for the company and its contractors to participate in such programs. Maritime Iron will also explore opportunities for training to be provided directly in Mi'gmaq communities.

Trade Unions

Maritime Iron will work with the trade unions who will endeavour to promote membership within the trade unions amongst Aboriginal and non-Aboriginal individuals throughout the construction phase.

Aboriginal Workforce Development Initiative

Through the Aboriginal Skills Education and Training Strategy (ASETS), on February 20, 2019 Maritime Iron met with First Nations' Economic Development Officers and Education and Training Officers. The purpose was to prime the communities' technical staff on the work and career opportunities that the project will provide.

Maritime Iron will continue to engage Aboriginal businesses so they can develop and acquire the capacity to compete for the direct and indirect contracting opportunities associated with the project.

In addition, during open houses held in Pabineau First Nation (September 16, 2019) and Eel River Bar First Nation (September 18, 2019) a Preliminary List of Potential Service and Supply Opportunities was provided to Chiefs and community residents in attendance. The aim is to provide an opportunity for existing Indigenous businesses to plan for future procurement opportunities as well as for individuals to begin to give consideration to whether there is a new business venture they may wish to initiate to support Maritime Iron's future procurement requirements.

Maritime Iron has also started the process of hiring local residents to assist with different aspects of the Project, including using an Aboriginal catering business for our open houses, and hiring Aboriginals for preliminary work/studies undertaken by Stantec or Roy's Consultants on the proposed project area.

4.5 FUTURE CONSULTATION AND ENGAGEMENT PLANS

Maritime Iron remains committed to continuing and expanding its outreach activities, as described above. Through these activities, Maritime Iron seeks to ensure that New Brunswick Aboriginal and non-Aboriginal residents are aware of and understand the Maritime Iron Project and are provided with opportunities to discuss the EIA results, ask questions and raise concerns.

As we move forward, these activities will serve to inform First Nations and the public about the EIA and its results. Following EIA approval and permitting, Maritime Iron will continue its ongoing engagement with the First Nations and the public throughout Construction, Operations, Decommissioning, Reclamation and Closure.

Key objectives of the ongoing engagement program are:

- to ensure transparency and accountability about the company's environmental management and social responsibility performance;

- to ensure there are continuing opportunities to discuss interests and concerns, and to resolve potential issues, related to the Project; and
- to work with Mi'gmaq First Nations and local communities so that the Maritime Iron Project contributes to the well-being and prosperity of the area.

In fulfilling these objectives, Maritime Iron will continue with many of the initiatives carried out to date, including the Project website, newsletters and emails, presentations and meetings, open houses, and the information kiosk. Maritime Iron will also offer tours of the Project site and will host open houses at key milestones during Project implementation.

4.6 SUMMARY OF KEY TOPICS DISCUSSED DURING PUBLIC AND FIRST NATIONS ENGAGEMENT ACTIVITIES TO DATE

Throughout the public and First Nations engagement activities, questions, concerns, comments and issues were raised regarding the Project, in terms of its design and operations, its potential environmental effects, and how concerns may be addressed. A number of these key issues and concerns resulted in changes to the work plans for the EIA, changes to the Project design, or mitigation planned for the Project itself. The issues, comments, questions or concerns raised by the various parties to date have been broad, and often ranged beyond matters relating to the Project design or the EIA. Table 4.1 identifies the meeting dates, location and key topics discussed. This table has been developed based on Maritime Iron's public and Aboriginal engagement activities that have been carried out regarding the Project up to October 2019.

Table 4.1 Summary of Meetings with First Nations and the Public

Meeting Date	Location (Host)	Key Topics Discussed (not an inclusive list of all discussions)
August 21, 2018	Village of Belledune, NB Power and Belledune Port Authority	Site visit with Leadership of NB Power and Belledune Port Authority
November 07, 2018	Village of Belledune, Mayor, Chief Administrative Officer	Introduction to the project
November 09, 2018	Belledune, NB Power	Infrastructure, potential for electricity facility integration, land use
November 29, 2018	Fredericton, DELG, EIA Manager, TRC members, Stantec	Presentation of project, project duration, operations duration, project scope, innovative technology and environmental benefits, global GHG reductions, conveyor system, economic benefits of the project, workforce and training, Indigenous engagement.
December 11, 2018	Indian Island First Nation, MTI	Mi'gmaq Cultural Awareness Blanket Exercise-Maritime Iron Team Participation
December 12, 2018	Bathurst, WorkSafeNB, Manager and Staff	Overview of Project, discussions regarding Health and Safety systems
December 12, 2018	Belledune, Glencore, Plant Manager, and Senior Staff	Water sources
December 12, 2018	Belledune, Belledune Port Authority, VP Finance & Business Development, Director of Engineering & Cargo Development Coordinator	Logistics, Terminal usage
December 12, 2018	Belledune, Belledune Port Authority, Operations Manager	Shipping lanes, marine safety and security
December 12, 2018	Belledune, NB Power, Operations Manager	Project advancement
December 12, 2018	Belledune, Town of Belledune (Mayor and Councillors)	Presentation delivered on project scope
December 12, 2018	Bathurst, Mayor of Bathurst, Director, CCNB	Overview of project, workforce, training, skills requirements for Project
December 13, 2018	Fredericton, DELG, EIA Manager	Shipping data in the Chaleur Bay, engagement progress, Belledune community open house
December 13, 2018	Fredericton, NB AAS, Director Engagement and Consultation, AAS Coordinators	Provided project description for assessment process, capacity funding for MTI
December 13, 2018	Fredericton, Project Manager (NB Power)	Boiler modifications
January 08, 2019	Moncton, MTI Chiefs, Chief of Pabineau, MTI legal counsel and MTI staff	Delivered Presentation of project to MTI Chiefs, general and technical questions, employment opportunities, project partner
January 16, 2019	Miramichi, MTI Chiefs	project potential market attractiveness, pig iron market, project footprint, project partners
January 22, 2019	Bathurst, Regional Chamber of Commerce, Mayor of Bathurst	CBDC involvement with the project labour involvement, local business opportunities, First Nations partnership amongst membership
January 23, 2019	Belledune, Belledune Port Authority, Operations Technician	Marine stevedoring, marine safety, security, marine data
January 23, 2019	Belledune, Glencore, Safety and Environment Manager	Emergency response, marine, land usage
January 23, 2019	Belledune, NB Power, Senior Manager, Special Projects. Project Manager	Boiler study, access road, site access, off site laydowns, utilities, bulk material handling, maintenance planning
January 00, 2019	Belledune, Québec Stevedore Ltd, Operations Manager	Discussion regarding shipping and receiving/loading and unloading of materials to/from site
January 23, 2019	Belledune, Residents of Belledune, Open House (100 participants)	Project introduction, project duration for construction and operations, technology overview, environmental benefits, global GHG reductions, traffic, employment opportunities, training opportunities. Some residents raised historic issues with industrial impacts on their nearby residences and Maritime Iron will continue discussions with these residents to understand priorities and concerns.
January 24, 2019	Bathurst, Northern New Brunswick Regional Mayors	Project Overview, project economic benefits, employment, accommodations, duration of project
January 23, 2019	Elsipogtog First Nation, Director of Economic Development	Project overview, investment opportunities
February 08, 2019	Conference Call, DELG, EIA Manager and Department Manager	EIA Registration options, Marine, Consultations

Table 4.1 Summary of Meetings with First Nations and the Public

Meeting Date	Location (Host)	Key Topics Discussed (not an inclusive list of all discussions)
February 13, 2019	Conference Call, NB Power, Project Manager	Boiler design information
February 12, 2019	Belledune, Chaleur Drive Residents (32 homeowners)	Project Overview and update. Residents raised questions about potential dust, water management, monitoring, environmental review process, operational unplanned events. Residents raised historic issues with industrial impacts on their nearby residences and Maritime Iron will continue discussions with these residents to understand priorities and concerns.
February 12, 2019	Belledune, NB Power, Senior Manager, Special Projects. Project Manager	EIA Process and requirements
February 21, 2019	Belledune, Hodgin's Street East, Curry Drive and Carl's Lane (28 homeowners)	Project Overview and update. Residents raised questions about potential dust, water management, monitoring, environmental review process, operational unplanned events, employment opportunities. Residents raised historic issues with industrial impacts on their nearby residences and Maritime Iron will continue discussions with these residents to understand priorities and concerns.
February 21, 2019	Belledune, Baie de Chaleur Fishermen (28 local fishermen)	Project Overview, marine concerns, effluent concerns, employment opportunities
February 22, 2019	Listuguj, Québec, Mi'gmawei Mawiomi Secretariat (MMS) Former Director of MMS, GPA	Overview of the Maritime Iron project, MMS history among communities to manage sustainable business, education and skills training
February 22, 2019	Listuguj, Québec, Mi'gmawei Mawiomi Secretariat (MMS), Director of Consultation, Assistant Director of Consultation, Environnemental Monitor	Project overview, general and technical questions, marine, training, skills, education, employment opportunities
February 20,2019	Moncton Economic Development Officers, Education & Training Officers from all 9 MTI members. JEDI, CCNB, PETL	Project overview, training skills, education and employment and contracting opportunities
February 4, 2019	Eel River Bar First Nation Chief and Council	Project overview, training, education and employment and contracting and investment opportunities.
February 27, 2019	Mi'gmawei Mawiomi Business Corporation (MMBC) Executive Director and staff	Project overview, project partner
March 08, 2019	Meeting with NB Power	Project advancement
March 08, 2019	Meeting with NBAAS	Overview of the engagement and consultation document
March 19, 2019	Meeting with NB Power	Project advancement
March 19, 2019	Meeting with Northern New Brunswick regional business group	Update on project and potential business opportunities
March 19, 2019	Meeting with the Town of Belledune Village Manager	Update on project
March 19, 2019	Meeting with MTI Chief	Skills and Trades, Marine Traffic, IK Study
March 19, 2019	Open house with Chaleur Drive homeowners (34 homeowners)	Update on project and responses provided to some questions raised in earlier meeting. Residents raised historic issues with industrial impacts on their nearby residences and Maritime Iron will continue discussions with these residents to understand priorities and concerns.
March 19, 2019	Open house with Hodgin's, Curry and Carl Lane homeowners (28 homeowners)	Update on project and responses provided to some questions raised in earlier meeting. Residents raised historic issues with industrial impacts on their nearby residences and Maritime Iron will continue discussions with these residents to understand priorities and concerns.
March 20, 2019	Meeting with Belledune Port Authority, VP Finance & Business Development	Project advancement
April 15, 2019	Meeting with Belledune Village Mayor and council	Overview of the Project to Mayor and council
April 15, 2019	Meeting with Glencore	Project update
May 07, 2019	Meeting with CCNB, Program Manager and Training Coordinator	Discussions regarding potential training needs for the construction and operations phases of the project.

Table 4.1 Summary of Meetings with First Nations and the Public

Meeting Date	Location (Host)	Key Topics Discussed (not an inclusive list of all discussions)
May 23, 2019	Meeting with Pabineau Chief and Council	Roadways, Shipping, Jobs, IKS, Pow Wow Presented information regarding the project
May 29, 2019	Meeting with Pabineau Chief and MTI IKS Manager	Provided a draft copy of the EIA document. Reviewed current document with Chief and Manager.
June 04, 2019	Attended Flag Raising Ceremony of the Mi'gmaq Grand Council Flag at the Port of Belledune	In attendance to celebrate having the Mi'gmaq Grand Council Flag raised at the Port of Belledune
June 20, 2019	Fredericton, DELG Government Officials	Project overview, process for EIA submission
June 21, 2019	Bathurst, Chaleur Chamber of Commerce (~60 participants)	Project overview
July 02, 2019	Miramichi - Fishermen's Pow Wow	Maritime Iron attended 3-day event with information booth and pamphlets to share information about the Maritime Iron project
July 10, 2019	Bathurst, DELG government officials	Project overview, permitting process
July 17, 2019	Eel River Bar First Nation, Chief and Council	Project overview
July 18, 2019	Chaleur Drive homeowners	Provided details regarding EIA Valued Environmental Components (e.g. air quality, noise). Residents raised historic issues with industrial impacts on their nearby residences and Maritime Iron will continue discussions with these residents to understand priorities and concerns.
July 18, 2019	Hodgin's, Curry and Carl Lane homeowners	Provided details regarding EIA Valued Environmental Components (e.g. air quality, noise). Residents raised historic issues with industrial impacts on their nearby residences and Maritime Iron will continue discussions with these residents to understand priorities and concerns.
July 17, 2019	Meeting with BPA, Operations Manager	DFO Procedures, Permitting requirements, Material Handling
July 20,2019	Bathurst Hospitality Days	Maritime Iron attended 1-day event with information booth and pamphlets to share information about the Maritime Iron project
July 22, 2019	Meeting with NB Power, Director of Energy Projects, Senior Specialist Environment Assessment & Operations, Project Manager, Manager of Business development	Discussions regarding EIA requirements and submission
July 22, 2019	Fredericton, Signing Ceremony with Chiefs of Pabineau, Eel River Bar First Nations, and MTI Co-Chairs	Maritime Iron, Pabineau, Eel River Bar and MTI had a ceremony and dinner celebrating the *Relationship, Capacity, and Indigenous Knowledge Study Agreement* signed by all parties.
August 13, 2019	Liaison Committee with Chiefs of Pabineau and Eel River Bar First Nations, and MTI Co-Chairs	Update on IK Study, open house planning, First Nations business opportunities, as well as presentation on EIA Findings for Water Management, Freshwater Fish and Fish Habitat, Terrestrial, Heritage Resources, Air Emissions, Transportation.
August 13, 2019	MLA, Bathurst East-Nepisiguit-Saint Isidore	Project overview and update
August 13, 2019	MLA, Bathurst West-Beresford	Project overview and update
August 13, 2019	MLA, Campbellton-Dalhousie	Project overview and update
August 14, 2019	MLA, Caraquet	Project overview and update
August 14, 2019	MP, Acadie-Bathurst	Project overview and update
August 15, 2019	MLA, Restigouche Chaleur	Project overview and update
Sept. 16, 2019	Pabineau Council	Project update was provided and discussion included review of the *Relationship, Capacity, and Indigenous Knowledge Study Agreement.*
Sept. 16, 2019	Pabineau Community Open House (32 participants)	Presentation about the Maritime Project, (including technology overview, environmental benefits, local and global GHGs, opportunity for integration with NB Power Generating Station, and project economics), EIA Findings for Water Management, Freshwater Fish and Fish Habitat, Terrestrial, Heritage Resources, Air Emissions, Transportation. Agenda also included review of the *Relationship, Capacity, and Indigenous Knowledge Study Agreement*, as well as future procurement opportunities for the Project and training plans. Information boards were displayed in the room and 2 project brochures were distributed to all participants.
Sept. 16, 2019	Presentation to Bathurst City Council	Overview of the Project (Presentation)

Table 4.1 Summary of Meetings with First Nations and the Public

Meeting Date	Location (Host)	Key Topics Discussed (not an inclusive list of all discussions)
Sept. 16, 2019	Presentation to Village of Belledune Council	Overview of the Project (Presentation)
Sept. 18, 2019	Meeting with Executive Director, Community Business Development Corporation, and Chamber of Commerce	Review of the potential business services that maybe required during the construction and operation phases of the project. Accommodations availability in the region was also discussed.
Sept. 18, 2019	Meeting with DELG Bathurst Office, Approvals Engineer, Impact Management Branch	Discussion regarding permitting process
Sept. 18, 2019	Eel River Bar First Nation Community Open House (20 participants)	Presentation about the Maritime Project, (including technology overview, environmental benefits, local and global GHGs, opportunity for integration with NB Power Generating Station, and project economics), EIA Findings for Water Management, Freshwater Fish and Fish Habitat, Terrestrial, Heritage Resources, Air Emissions, Transportation. Agenda also included review of the *Relationship, Capacity, and Indigenous Knowledge Study Agreement*, as well as future procurement opportunities for the Project and training plans. Information boards were displayed in the room and 2 project brochures were distributed to all participants.
Sept. 20, 2019	Meeting with Program Officer, Employment and Continued Learning Services	Discussion regarding Labour Force Training Program
Sept. 30, 2019	Québec Mayors of Pointe-à-la-Croix, Carleton-sur-Mer, New Richmond, Bonaventure and NB Mayors of Belledune and Bathurst	Presentation about the Maritime Project, (including technology overview, environmental benefits, local and global GHGs, opportunity for integration with NB Power Generating Station, and project economics)
Oct. 2, 2019	MLA, Shippagan-Lamèque-Miscou	Project Overview

5.0 ENVIRONMENTAL ASSESSMENT METHODS AND SCOPE

The EIA methods for the Project have been developed to meet the regulatory requirements of a registration under the New Brunswick *Environmental Impact Assessment Regulation*. This approach has been developed in accordance with the EIA Guidelines released by NBDELG (2018).

The Project-related environmental effects are assessed using a standard framework for each Valued Component (VC). Residual Project-related environmental effects (i.e., those environmental effects that remain after the planned mitigation measures have been applied) are characterized for each individual VC.

The environmental effects assessment methodology for each VC involves the following generalized steps, as shown graphically in Figure 5.1.

- Scope of Assessment – This involves the scoping of the VC, including: the rationale for selection of the VC; the applicable regulatory and policy setting; selection of environmental effects and measurable parameters; and description of temporal and spatial boundaries. This step relies upon the scoping undertaken by the study team based on its professional judgment and experience with past EIAs of a similar nature; preliminary discussions with regulatory authorities; and consideration of the early input of the public, stakeholders, and First Nations (as applicable).
- Existing Conditions – Establishment of existing (baseline) environmental conditions for the VC as well as spatial and temporal boundaries of the assessment.
- Assessment of Project-Related Environmental Effects – Project-related environmental effects are assessed. The assessment includes descriptions of how an environmental effect will occur, the mitigation and environmental protection measures proposed to reduce or eliminate the environmental effect, and the characterization of the residual environmental effects of the Project. The focus is on residual environmental effects (i.e., the environmental effects that remain after planned mitigation has been applied). All applicable phases of the Project are assessed, as are accidents, malfunctions, and unplanned events. The evaluation also considers the Effects of the Environment on the Project.

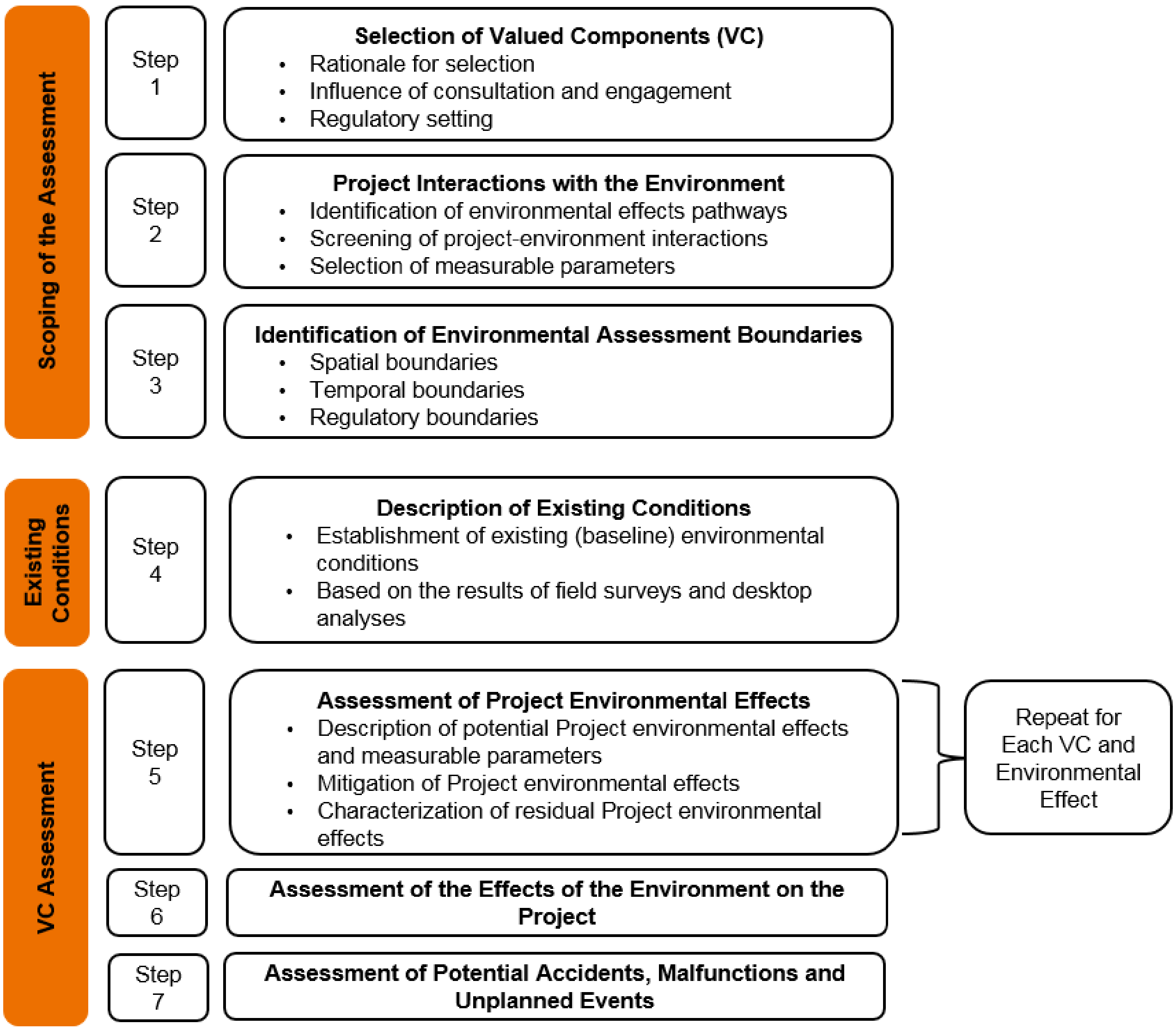

Figure 5.1 Summary of Environmental Impact Assessment Methods

5.1 IDENTIFICATION OF POTENTIAL INTERACTIONS BETWEEN THE PROJECT AND THE ENVIRONMENT

Based on the Project description (Section 2.0), the environmental setting (Section 3.0), and EIA methods described above, the potential interactions between the Project and the environment are summarized in Table 5.1.

Table 5.1 Potential Interactions between the Project and the Environment

Project Phases	Atmospheric Environment	Freshwater Fish and Fish Habitat	Water Resources	Terrestrial Environment	Heritage Resources	Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons[1]	Socioeconomic Environment
Construction							
Site Preparation	-	-	-	✓	✓	✓	✓
Construction of Temporary Facilities	-	-	-	✓	✓	-	-
Construction of Project Components	-	-	✓	✓	✓	-	-
Ground Transportation	-	-	-	-	-	-	✓
Marine Transportation	-	-	-	-	-	✓	✓
Commissioning	-	-	-	-	-	-	-
Employment and Expenditure	-	-	-	-	-	-	✓
Emissions and Wastes	✓	-	-	✓	-	-	✓
Operation and Maintenance							
Iron Production	-	-	-	-	-	✓	-
Maintenance	-	-	-	✓	-	-	-
Ground Transportation	-	-	-	-	-	-	✓
Marine Transportation	-	-	-	-	-	✓	✓
Employment and expenditure	-	-	-	-	-	-	✓
Emissions and Wastes	✓	-	-	✓	-	-	✓
Decommissioning and Abandonment	Decommissioning and abandonment activities will be evaluated in accordance with regulations in place at that time.						

[1] Interactions to be confirmed upon completion of Indigenous Knowledge Summary, see Section 11.0

✓ indicates an interaction

- indicates no interaction

Decommissioning and abandonment activities are not expected to occur until the end of life of the Project, which is expected to be at least 30 years from the start of the operation and maintenance phase. It is not possible to determine with any certainty the potential environmental effects of decommissioning and abandonment activities, nor the regulations and policies that might apply. Therefore, neither the decommissioning and abandonment phase, nor potential activities to be conducted as a part of it, are assessed in detail as part of this EIA; they will be evaluated in accordance with regulations in place at that time.

6.0 ASSESSMENT OF ENVIRONMENTAL EFFECTS ON ATMOSPHERIC ENVIRONMENT

6.1 RATIONALE FOR SELECTION AS A VALUED COMPONENT

Atmospheric environment has been selected as a VC because changes in the atmospheric environment, specifically with respect to air quality, greenhouse gas emissions, and sound quality, may be affected by Project activities.

Air quality is defined as a measure of the constituents of ambient and includes the presence and the quantity of these constituents, including air contaminants, in the atmosphere. Air quality may have effects on vegetation, wildlife, or human health. Whether air quality is good or bad is defined by comparing levels of contaminants in the ambient air to established air quality criteria, which are set to be protective of human health or the environment. The principle contaminants of concern related to this Project are those generated by combustion of fuel, process unit operations, operation of heavy equipment and on-road vehicles, which primarily include nitrogen oxides (NO_X), sulphur dioxide (SO_2), total suspended particulate matter (TSP), particulate matter less than 10 microns, particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) and trace metals as follows:

- Mercury (Hg)
- Iron oxide (Fe_2O_3)
- Calcium oxide (CaO)
- Silicon dioxide (SiO_2)
- Phosphorous Pentoxide (P_2O_5)
- Titanium dioxide (TiO_2)
- Potassium oxide (K_2O)
- Sulphur trioxide (SO_3)
- Arsenic (As)
- Cadmium (Cd)
- Chromium (Cr)
- Copper (Cu)
- Nickel (Ni)
- Vanadium (V)
- Zinc (Zn)

These contaminants were identified because guidelines exist for their concentrations in ambient air and because these contaminants are likely to be generated during construction and operation and maintenance phases of the Project. The trace metals specifically were identified based on available data for raw materials (trace metals content) for particulate-based emissions from the Project.

GHG emissions may contribute to global climate change. Of particular interest are emissions of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). The combined emissions of such GHG are reported as carbon dioxide equivalent (CO_2e), using the global warming potentials (GWPs) adopted by Environment and Climate Change Canada (ECCC). These GWPs are recommended by the Intergovernmental Panel on Climate Change (IPCC) (IPCC 2014). GHG emissions are reported as tonnes of CO_2e. Two types of GHGs are regularly considered in GHG assessment, direct emissions and indirect emissions. GHG emissions from the operation of sources under the control of Maritime Iron, required onsite for the production of pig iron are considered direct emissions. GHG emissions required by the Project that occur offsite such as from the use of grid electricity, in which GHG emissions are generated by third parties such as NB Power, are indirect emissions. These are not owned by the Project proponent. As GHGs are of global concern, major sources of direct onsite emissions and indirect emissions are considered in this assessment.

Sound quality is characterized by the sound pressure level in the ambient air due to both anthropogenic sources (e.g., vehicles) and natural sources (e.g., bird song), as well as by the frequency (i.e., tone) of the sound and the effect the sound has on humans (e.g., enjoyment or disruption). While the sound pressure level and frequency of a sound source can be quantified, the effect of unwanted sound (noise) is not easily quantified. Sound pressure levels are measured in decibels (dB). For environmental assessments where humans are the focus, an A-weighted dB scale (dBA) is used to report sound pressure levels.

In this assessment, the potential changes to the Atmospheric Environment as a result of the Project are considered. The scope of the assessment is based on applicable regulations and policies, professional judgement of the study team, and knowledge of potential interactions.

6.2 AIR QUALITY

6.2.1 Regulatory Context

Air quality in New Brunswick is regulated by the *Air Quality Regulation* under the New Brunswick *Clean Air Act*. The regulation and act provide measures to regulate the release of air contaminants to the atmosphere from "sources", provide testing and monitoring provisions, and establish maximum permissible ground-level concentrations of specified air contaminants in ambient air, among other requirements. The New Brunswick Air Quality Objectives (NBDELG 2017a) apply to ambient air and were established under the *Clean Air Act* in 1997. These values are also shown in Table 6.1.

Applicable federal air quality criteria considered in the assessment were the National Ambient Air Quality Objectives (NAAQOs), Canada Wide Standards (CWSs), and the Canadian Ambient Air Quality Standards (CAAQS). The NAAQOs were established by the federal government in the early 1970s to protect human health and the environment by setting objectives for the following common air pollutants, among others: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), sulphur dioxide (SO_2) and total suspended particulates. The objectives are denoted as "Desirable", "Acceptable" and "Tolerable" ranges for ground-level concentrations of air contaminants.

The CWSs are based on intergovernmental agreements developed under the Canadian Council of Ministers of the Environment (CCME) Canada-wide Environmental Standards Sub-Agreement, which operates under the broader CCME Canada-wide Accord on Environmental Harmonization. The CWSs are intended to address key environmental protection and health risk issues that require concerted action across Canada. The CWSs represent cooperation toward a common goal, but confer no specific authority to any federal, provincial, or territorial government.

The CAAQS are being implemented to reduce emissions and ground-level concentrations of various air contaminants nationally. The CAAQS have been endorsed by the Canadian Council of Ministers of the Environment (CCME) for sulphur dioxide (SO_2), fine particulate matter ($PM_{2.5}$), ozone and more recently, for nitrogen dioxide (NO_2). These CAAQS are adopted for the 2020 to 2025 period and are lowered beyond 2025. For this assessment, predicted concentrations are compared with the CAAQS adopted for the 2020 to 2025 period. The CAAQS values are shown in Table 6.1.

The CCME has yet to publish a guidance document on the procedures and methodologies that one should follow to determine if measured concentrations of SO_2 or NO_2 exceed the CAAQS. However, it is our understanding of the federal guidance that model predictions should not be directly compared to the CAAQS, because these are intended to be compared with measured ambient air quality data and are not considered directly applicable to industrial fence-line concentrations. As such, although the predicted ground-level concentrations of CACs are compared to both the CAAQS and the New Brunswick *Air Quality Regulation*, only exceedances against the New Brunswick *Air Quality Regulation* are considered in the residual effects assessment.

Table 6.1 shows the provincially and federally regulated air contaminants, some of which are not expected to be released from the Project-related sources in substantive quantities.

Table 6.1 Summary of Federal NAAQOs, CWSs, and CAAQSs; and Provincial New Brunswick Air Quality Objectives

Contaminant and Units (alternative units in brackets)	Averaging Time Period	Canada Wide Standards (CWSs)	Canadian Ambient Air Quality Standards (CAAQSs)	National Ambient Air Quality Objectives (NAAQOs)			New Brunswick Air Quality Objectives
Sulphur dioxide (SO_2)*, $\mu g/m^3$	1 hour	-	183[2] 170[2]	450	900	-	900
	24 hour	-	-	150	300	800	300
	Annual	-	13[3] 10[3]	30	60	-	60
Nitrogen dioxide (NO_2), $\mu g/m^3$	1 hour	-	133[4] 79[4]	-	400	1,000	400
	24 hour	-	-	-	200	300	200
	Annual	-	32[5] 23[5]	60	100	-	100
Total Particulate Matter (PM), $\mu g/m^3$	24 hour	-	-	-	120	400	120
	Annual	-	-	60	70	-	70

Table 6.1 Summary of Federal NAAQOs, CWSs, and CAAQSs; and Provincial New Brunswick Air Quality Objectives

Contaminant and Units (alternative units in brackets)	Averaging Time Period	Canada Wide Standards (CWSs)	Canadian Ambient Air Quality Standards (CAAQSs)	National Ambient Air Quality Objectives (NAAQOs)			New Brunswick Air Quality Objectives
$PM_{2.5}$, $\mu g/m^3$	24 hour	30[1]	27[6]	-	-	-	-
	Annual		8.8[7]				-
Hydrogen sulphide (H_2S), $\mu g/m^3$	1 hour	-	-	-	-	-	15
	8 hour	-	-	-	-	-	5

Notes:

[*] The objectives for sulphur dioxide are 50% lower in Saint John, Charlotte and Kings counties as compared to the rest of New Brunswick.

[A] CCME (2014), Canada-Wide Standards for Respirable Particulate Matter and Ozone. The Respirable Particulate Matter Objective is referenced to the 98th percentile over three consecutive years; the Ozone Objective is referenced to the on 4th highest 8-hour average annual value, averaged over three consecutive years.

[1] The 3-year average of the annual 99th percentile of the SO_2 daily-maximum 1-hour average concentrations

[2] The average over a single calendar year of all the 1-hour average SO_2 concentrations

[3] The 3-year average of the annual 98th percentile of the NO_2 daily-maximum 1-hour average concentrations

[4] The average over a single calendar year of all the 1-hour average NO_2 concentrations

[5] The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations

[7] The 3-year average of the annual average concentrations.

Source: CCME (2014a), CCME (2014b), CCME (2014c)

In addition to these contaminants specifically regulated provincially and federally, select trace metals will be evaluated for the Project due to small amounts of these compounds being present in some of the dust that will be emitted from the facility. As there are no ambient thresholds in New Brunswick for these compounds, the Ontario Air Contaminant Benchmark (ACB) List will be considered to evaluate potential effects. The values for the Ontario limits are listed in Table 6.2.

Table 6.2 Summary of Ontario Air Contaminant Benchmarks for Trace Metals

Air Contaminant	CAS#	Averaging Period	Limit (µg/m3)	Limiting Effect	Source
Mercury (Hg)	7439-97-6	24-hour	2	Health	Standard
Iron oxide (Fe_2O_3)	1309-37-1	24-hour	25	Soiling	Standard
Calcium oxide (CaO)	1305-78-8	24-hour	10	Corrosion	Standard
Silicon dioxide (SiO_2)	7631-86-9	24-hour	5	Health	SL-MD
Phosphorous Pentoxide (P_2O_5)	1314-56-3	24-hour	1	Health	SL-JSL
Titanium dioxide (TiO_2)	13463-67-7	24-hour	34	Health	Guideline

Table 6.2 Summary of Ontario Air Contaminant Benchmarks for Trace Metals

Air Contaminant	CAS#	Averaging Period	Limit (µg/m3)	Limiting Effect	Source
Potassium oxide (K_2O)	12136-45-7	24-hour	1.5	Health	SL-PA
Sulphur trioxide (SO_3)	7446-11-9	24-hour	5	Health	SL-JSL
Arsenic (As)	7440-38-2	24-hour	0.3	Health	Guideline
Cadmium (Cd)	7440-43-9	24-hour	0.025	Health	Standard
Chromium (Cr) [1]	7440-47-3	24-hour	0.5	Health	Standard
Copper (Cu)	7440-50-8	24-hour	50	Health	Standard
Nickel (Ni)	7440-02-0	Annual	0.04	Health	Standard
Vanadium (V)	7440-62-2	24-hour	2	Health	Standard
Zinc (Zn)	7440-66-6	24-hour	120	Particulate	Standard

Source: Government of Ontario (2018)
[1] Non-hexavalent forms
SL-JSL – screening level – jurisdictional screening level
SL-MD – screening level – Ministry Derived
SL-PA – screening level – Previously Accepted

6.2.2 Spatial Boundaries

The assessment of potential environmental interactions between the Project and air quality is focused on a PDA and a LAA.

The PDA for the Project is defined as the area of physical disturbance associated with the construction, operation, and maintenance of the Project. As described in Section 2.5, for the purposes of this assessment, the PDA includes the land within the property boundaries of PID 20616322, PID 20598090, and PID 20277927. The PDA is depicted on Figure 2.4.

The LAA for air quality is defined as the area within which the environmental effects of the Project can be measured or predicted. For considering a potential change in air quality, the LAA for air quality follows the domain chosen for air dispersion modelling, which focuses on the activities occurring within the Project Area and covers an area of 20 km by 20 km, centered near the location of the Project.

The LAA for a change in air quality is shown in Figure 6.1.

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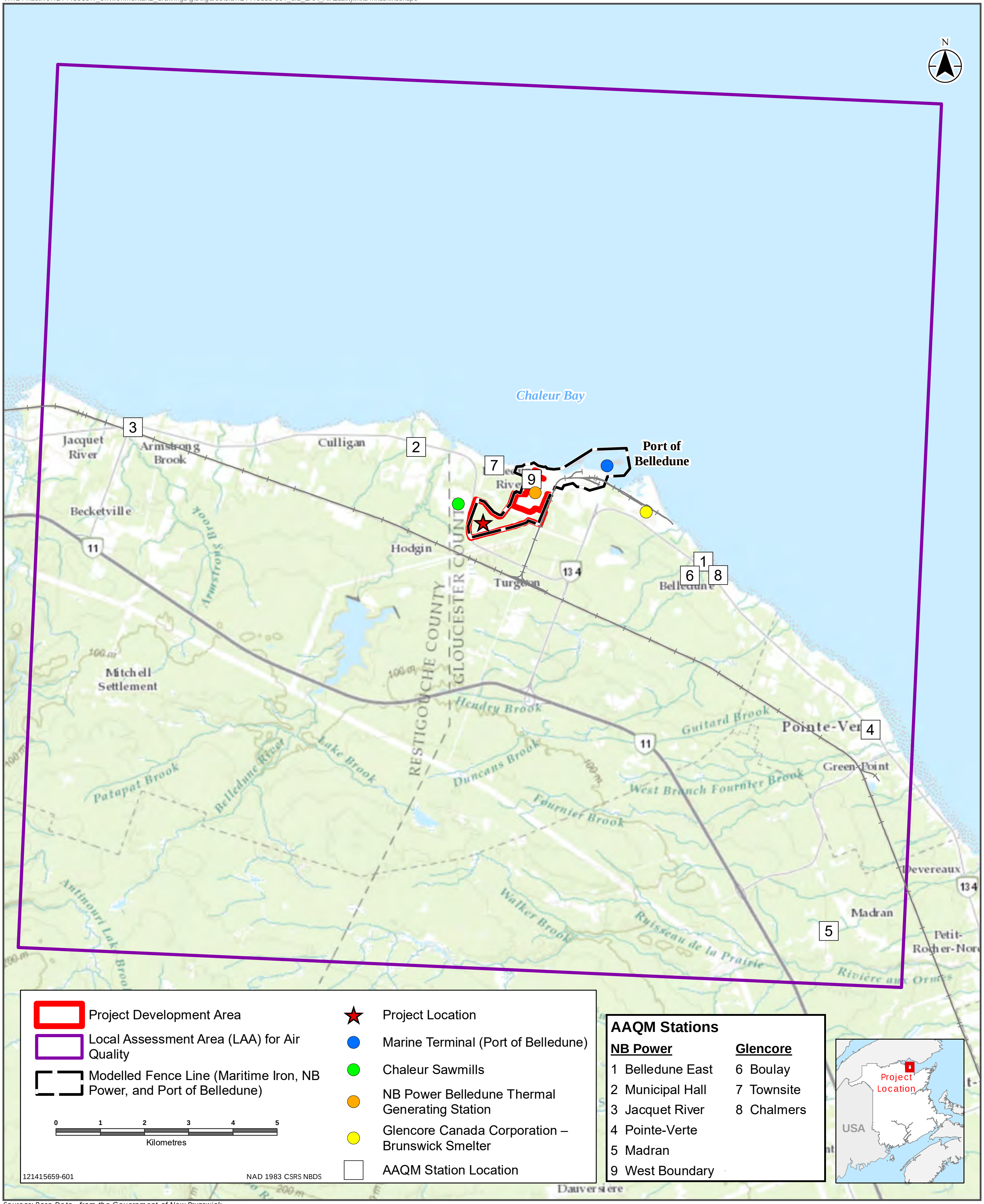


Sources: Base Data - from the Government of New Brunswick

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Local Assessment Area for Air Quality

Stantec

Figure 6.1

6.2.3 Temporal Boundaries

The temporal boundaries for the assessment of the potential environmental effects on air quality include:

- Construction – scheduled to begin in Q1 2020 and last for approximately three years; and
- Operation and maintenance – scheduled to begin in Q1 2023 and continue for the life of the new facilities, currently anticipated to be in excess of 30 years.

6.2.4 Existing Conditions for Air Quality

6.2.4.1 Approach and Methods

Ambient Air Quality

Key information for existing air quality included data provided in the most recently published New Brunswick Air Quality Monitoring Results Report for 2016 (NBDELG 2019b), the most recent year available for this publication at the time of writing. Ambient air quality data for 2017 and 2018 are not yet available from NBDELG. The report summarizes data obtained from the air quality monitoring network that has been operated by the government and industry in New Brunswick to monitor ambient concentrations of various air contaminants in selected New Brunswick communities. The monitoring network was designed by NBDELG primarily to monitor compliance with ambient air quality objectives and standards.

Information on ambient air quality has also been provided by NB Power that includes monthly ambient air quality reports for the Belledune Thermal Generating Station as well as ambient air quality data logged at the six monitoring stations operated by NB Power. The monthly reports include copies of the Belledune Air Quality Network and Meteorological Data along with the Supplementary Control System Operational Reports. The data provided covers 2016 and 2017.

Information was also provided by Glencore that includes daily and annual average ambient air quality data collected at the Brunswick Smelter. The data provided covers 2015 to 2017 period.

There have been no substantive changes to larger scale sources/releases of air contaminants in the LAA in recent years. Therefore, ambient air quality data collected in 2016-2017 is considered representative of the existing conditions within the LAA.

Local Emissions Sources

Annual release summaries for large industrial facilities near the Project were obtained from the Environment and Climate Change Canada (ECCC) National Pollutant Release Inventory (NPRI). The NPRI is a public inventory of annual releases, disposals and transfers of over 320 pollutants from more than 7,000 facilities across Canada (ECCC 2019a). Selected air contaminant releases from the most recent five years available (2013 to 2017) were obtained for Glencore’s Brunswick Smelter and NB Power’s Belledune Thermal Generating Station. The NB Power and Glencore facilities are the largest emitters in the area of the Project, therefore these facilities were selected for review of existing conditions.

Ambient Air Quality

The nearest NBDELG operated ambient air quality monitoring station to the Project site is located in Bathurst. The Bathurst station is approximately 40 kilometres to the southeast of the Project site. Air contaminant concentrations of nitrogen oxides, ozone and particulate matter with aerodynamic diameters less than or equal to 2.5 microns are measured at the Bathurst station. There were no exceedances of the NBDELG objectives at the Bathurst station in 2016 (NBDELG 2019b).

The industry-operated air quality monitoring stations that are located closest to the Project are NB Power's Belledune Thermal Generating Station monitors (six stations) and Glencore's Brunswick Smelter monitors (three stations), located in the Belledune area. The parameters measured at each station are shown in Table 6.3. The locations of the ambient monitors in the Belledune area are shown in Figure 6.1, above.

Table 6.3 Industry Operated Air Quality Monitoring Stations – Belledune Area

Operator	Station	Air Contaminants Measured
NB Power	Belledune East	NO_2, SO_2 and $PM_{2.5}$
	Municipal Hall	
	Jacquet River	SO_2
	Pointe-Verte	
	Madran	
	West Boundary	TSP and $PM_{2.5}$
Glencore	Boulay	SO_2, TSP and trace metals
	Townsite	
	Chalmers	

In 2016 there were no exceedances of the NBDELG objectives for the air contaminant concentrations measured at the NB Power operated stations.

There were exceedances of the one-hour sulphur dioxide objective on 2 separate occasions at the Glencore operated stations in 2016. Both exceedances were recorded at the Boulay station, one on March 5 and the other on June 17. During each SO_2 exceedance, the Brunswick Smelter was either shut down or partially shut down, as per their Air Quality Action Plan (NBDELG 2019b).

For TSP, there were two exceedances of the NBDELG 24-hour objective in 2016 at the Glencore operated stations, one at the Boulay station on March 7 and one at the Townsite station on May 30. Based on additional analyses of the material collected in the samples, it was determined that it is unlikely that the Brunswick Smelter contributed substantively to the measured exceedances on those dates (NBDELG 2019b).

There were no other exceedances reported at the three Glencore stations in 2016.

Background Concentrations

Existing Conditions for air quality are characterized in the assessment area using background concentrations of air contaminants of concern based on ambient air quality data measured near the Project. These measured background concentrations are combined with the air quality dispersion modelling results to assess the Project combined with other sources air contaminant emissions in the LAA. The background concentrations include/cover emissions from nearby non-industrial sources and industrial facilities such as the Chaleur Sawmill, Glencore's Brunswick Smelter, NB Power's Belledune Thermal Generating Station, as well as existing marine vessel traffic at the Port of Belledune.

The background concentrations are estimated using ambient air quality data available from the following monitoring stations:

- NB Power operated – Belledune and West Boundary monitoring stations
- Glencore operated – Townsite and Boulay monitoring stations

These stations were selected because the highest measurements were observed here (based on the estimates for background).

The background concentrations were estimated based the approach described in the Alberta Air Quality Model Guideline (AESRD 2013). The background values were estimated using the most recent years of ambient data available, 2016 and 2017. The hourly background concentrations are based on the 90^{th} percentile of the hourly measurements. The 24-hour background concentrations are based on the maximum of the daily averages of the hourly measurements with values greater than the 90^{th} percentile excluded from the average calculation. In cases where the 24-hour background concentrations are based on measurements taken over 24-hours, the background is estimated as the 90^{th} percentile of the annual 24-hour measurements. Annual average background concentrations are based on average of the annual hourly or 24-hour measurements, with the hourly concentrations greater than the 90^{th} percentiles excluded from the average. The stations with the highest background concentrations are selected for the assessment.

The background concentrations estimated for trace metals are based on the annual average concentrations from ambient air quality data provided by Glencore, as available. The 24-hour average background concentrations were estimated based on the annual average values provided, converted using the relationship identified in the Ontario Ministry of Environment and Climate Change (MOECC) Air Dispersion Modelling Guideline for converting average periods (Ontario MOECC 2018).

The background concentrations used in the assessment to characterize existing conditions in the LAA are provided in Table 6.4. The background concentrations were estimated using the most recent complete year ambient data for each air contaminant.

Table 6.4 Background Concentrations used in Assessment

Contaminant	Average Period	AAQM Station Location	Calculation Basis	Background Concentration (µg/m^3)
SO_2	1-hour	NB Power – Belledune	2016 Hourly 90th percentile	13.1
	24-hour		2016 maximum daily average, calculated using the hourly concentration measurements with hourly values greater than the 90th percentile excluded from the average	4.7
	Annual		Annual average of 2016 hourly concentration measurements - values >90th percentile excluded from average	0.6
NO_2	1-hour		2017 Hourly 90th percentile	9.4
	24-hour		Maximum daily average, calculated using the 2017 hourly concentration measurements with hourly values greater than the 90th percentile excluded from the average	8.6
	Annual		Annual average of 2017 hourly concentration measurements - values greater than 90th percentile excluded from average	5.9
TSP	24-hour	NB Power - West Boundary Site	90th percentile of 2017 24-hour concentration measurements	57.9
	Annual		Annual average of 2017 24-hour concentration measurements - values greater than 90th percentile excluded from average	20.7
$PM_{2.5}$	24-hour		90th percentile of 2017 24-hour concentration measurements	9.5
	Annual		Annual average of 2017 24-hour concentration measurements - values greater than 90th percentile excluded from average	4.4
As	24-hour	Glencore - Townsite	Converted to 24-hour average from annual average based on the procedure outlined in the Ontario MOECC Air Dispersion Modelling Guideline for Ontario (pg. 47) [1]	0.10
	Annual		Annual Average from Glencore provided data	0.02
Cd	24-hour		90th percentile of 2017 24-hour concentration measurements	0.02

Table 6.4 Background Concentrations used in Assessment

Contaminant	Average Period	AAQM Station Location	Calculation Basis	Background Concentration (µg/m^3)
	Annual		Annual Average from Glencore provided data	0.007
Zn	24-hour		Converted to 24-hour average from annual average based on the procedure outlined in the Ontario MOECC Air Dispersion Modelling Guideline for Ontario (pg. 47) [1]	0.36
	Annual		Annual Average from Glencore provided data	0.07

Notes:

[1] Ontario MOECC average period conversion relationship: $C_1 = C_0 \times (t_0/t_1)^{0.28}$, Where,

C_1 = concentration at average period 1 (e.g., 24-hour)

C_0 = concentration at average period 0 (e.g., annual – 8760-hour)

t_1 = average period time 1 (24-hour)

t_0 = average period time 0 (8760-hour)

Local Emissions Sources

The existing air contaminant emissions in New Brunswick, presented below, are from data reported to the NPRI for 2017 (ECCC 2019a). This is the most recent year of quality assured, published data at the time of the assessment. The NPRI requires industrial facilities to report specific air contaminant emissions to ECCC when facility reporting thresholds are met. The closest reporting industrial facilities to the PDA are NB Power's Belledune Thermal Generating Station (immediately adjacent to the northeast of the Project site) and Glencore's Brunswick Smelter (approximately 2 km east of the Project site). The locations of nearby industrial facilities are shown in Figure 6.1, above. The air contaminant emissions from 2013-2017, as reported to the NPRI, are listed in Table 6.5 and Table 6.6 for these two facilities.

Table 6.5 Belledune Thermal Generating Station Air Contaminant Emissions (2013-2017)

Reporting Year	Combustion Gases (tonnes)		Particulate Matter (tonnes)	
	Sulphur Dioxide (SO_2)	Nitrogen Oxides as Nitrogen Dioxide (NO_x as NO_2)	PM total	$PM_{2.5}$
2017	3,828	5,031	33	17
2016	3,776	6,246	106	54
2015	3,744	4,510	80	41
2014	3,663	5,737	13	6.6
2013	4,341	5,967	26	13

Table 6.6 Brunswick Smelter Air Contaminant Emissions (2013-2017)

Reporting Year	Combustion Gases (tonnes)		Particulate Matter (tonnes)	
	Sulphur Dioxide (SO_2)	Nitrogen Oxides as Nitrogen Dioxide (NOx as NO_2)	PM total	$PM_{2.5}$
2017	9,605	251	44	16
2016	9,802	237	47	17
2015	10,486	200	49	16
2014	8,575	131	47	14
2013	8,584	137	61	11

In 2017, 69 New Brunswick facilities reported criteria air contaminant emissions to the NPRI. Table 6.7 provides a summary of provincial and national air contaminant emissions as reported to the NPRI for the 2017 calendar year.

Table 6.7 Comparison of Provincial and National Air Contaminant Emissions (2017)

Value	Combustion Gases		Particulate Matter	
	Sulphur Dioxide (SO_2)	Nitrogen Oxides as Nitrogen Dioxide (NOx as NO_2)	PM total	$PM_{2.5}$
Provincial (NB) Total Reported (tonnes), 2017	20,126	12,708	3,500	1,047
National Total Reported (tonnes), 2017	874,808	589,818	403,710	52,592
2017 Provincial Percent of National Total (%)	2.30%	2.15%	0.87%	1.99%

Source: 2017 NPRI (ECCC 2019a)

New Brunswick's contribution to the national total releases of air contaminants is relatively low, approximately 0.87% to 2.78% of the national totals, on average. There is relatively good air quality experienced in New Brunswick most of the time. This is evidenced by the observed low frequency of exceedance of standards and guidelines and the relatively few industrial air contaminant emissions sources.

6.2.5 Potential Project Interactions with Air Quality

Activities and components could potentially interact with air quality to result in adverse environmental effects on air quality. In consideration of these potential interactions, the assessment of Project-related environmental effects on air quality is therefore focused on the potential environmental effects listed in Table 6.8. These potential environmental effects will be assessed in consideration of specific measurable parameters, also listed in Table 6.8.

Table 6.8 Potential Environmental Effects and Measurable Parameters for Atmospheric Environment

Potential Environmental Effect	Measurable Parameter
Change in Air Quality	• Emissions of SO_2, NO_2, TSP, $PM_{2.5}$, PM_{10} and trace metals and ground level (ambient) concentrations in units of micrograms per cubic meter (µg/m^3).

Table 6.9 identifies the physical activities that may interact with the VC and result in an environmental effect. These interactions are discussed in detail in the following sections, including potential environmental effects, mitigation and environmental protection measures, and residual environmental effects.

Many activities being carried out for the Project may create emissions or noise and interact with air quality. Because of this, the assessment is conducted for one all-encompassing category in each phase called “emissions and wastes”, to reflect the fact that emissions would be generated from various activities at various times across the Project lifecycle. Emissions and wastes (e.g., particulate matter/dust) are assessed collectively rather than separately for each individual activity.

Table 6.9 Potential Project Interactions

Project Activity	Potential Environmental Effect Change in Atmospheric Environment
Construction	
Site Preparation (*e.g.,* clearing, grubbing)	-
Construction of Facility Footprint (including excavation and installation of building foundations and creation of storage areas, and construction of ancillary infrastructure)	-
Installation of Equipment (including fluidized bed reactors and melter gasifier and ancillary equipment)	-
Employment and Expenditure	-
Emissions and Wastes	✓
Operation	
Production of Pig Iron	-
Ground Transportation (including trucking of burnt lime material, limestone and dolomite material)	-
Employment and expenditure	-
Emissions and Wastes	✓

Notes:
✓ indicates an interaction
- indicates no interaction

6.2.5.1 Potential Effects to Air Quality During Construction

The construction of the Project components has the potential to interact with air quality in the following ways:

- Air contaminants generated from the combustion of fossil fuels (e.g., diesel and gasoline) by heavy mobile equipment
- Fine particulate matter (dust) generated by earth moving activities
- Fine particulate matter (dust) generated by equipment movements on unpaved (access) roads

Burning of debris is not expected as part of the project. Air contaminant emissions from trucking of materials and equipment to the site have been excluded from the effects assessment. The Project is being designed to use marine transport wherever feasible, and trucking air contaminant emissions will be small and managed to reduce the potential for fine particulate matter in dust to be generated from equipment movements.

6.2.5.2 Potential Effects to Air Quality During Operation and Maintenance

The operation and maintenance of the Project has the potential to interact with air quality in the following ways:

- Air contaminants released from the normal operation of the Belledune Iron Processing Facility. Releases of NO_X, SO_2, particulate matter (TSP, PM_{10} and $PM_{2.5}$) and trace metals are expected.
- Air contaminants released from the combustion of fossil fuels or off gas in stationary combustion (heating). Releases of NO_X, SO_2, particulate matter (TSP, PM_{10} and $PM_{2.5}$) are expected.
- Particulate matter emissions associated with liquid drift (water droplets containing dissolved solids) releases from cooling tower operation.
- Air contaminants released from internal combustion engines associated with Project related marine vessel traffic while in the Port of Belledune. Releases of NO_X, SO_2, particulate matter (TSP, PM_{10} and $PM_{2.5}$) are expected.
- Air contaminants released from flaring of pilot gas during normal operation. Releases of NO_X, SO_2, particulate matter (TSP, PM_{10} and $PM_{2.5}$) are expected.
- Air contaminants released from flaring of the FINEX process off gas during non-routine flaring events when the NB Power Belledune Thermal Generating Station is off-line and not able to receive the by-product gas (normally FINEX Export Gas (FEG) which is used for power generation purposes). Releases of NO_X, SO_2, particulate matter (TSP, PM_{10} and $PM_{2.5}$) and trace metals are expected.

Although the Project will be integrated with NB Power's Belledune Thermal Generating Station, it is expected that air contaminant emissions from this facility are considered as part of the measured background concentrations that are added to the model predicted concentrations. It is also assumed the background concentrations will cover other nearby industrial sources, including Glencore's Brunswick Smelter, the Chaleur Sawmill, and existing marine vessel traffic at the Port of Belledune.

6.2.6 Mitigation for Air Quality

Interactions between Project activities and air quality will be managed through the use of various mitigation measures. The following mitigation measures specific to air quality have been identified for this Project.

During construction:

- Manage vehicle and equipment emissions by conducting regular maintenance on all machinery and equipment
- Control construction-related fugitive road dust, through measures such as speed limits on Project-controlled gravel roads and road watering on an as-needed basis;
- Prohibit the burning of waste materials; and
- Reduce haul distances to disposal sites.

During operation and maintenance:

- Sources of substantive air contaminant emissions will be equipped with emissions controls such as dust collectors (primarily consisting of baghouses) to reduce particulate matter (TSP, PM_{10} and $PM_{2.5}$) and trace metal releases.
- The wastewater treatment process will include a regenerative thermal oxidizer (RTO) to combust any volatile organic compounds (VOCs) generated as a by-product from the treatment of process wastewater. The inclusion of the RTO will result in reduced releases of VOCs.
- Storage piles of aggregate materials and feedstocks will be covered / stored indoors to protect against moisture and thus will reduce/prevent fugitive dust and associated trace metals emissions.
- Material conveying will use covered conveyors and transfer points which will reduce fugitive dust and associated trace metals emissions.
- Water sprays will be used in areas of the process to reduce potential fugitive emissions of dust and trace metals.
- The Oxygen Plant will be electrically driven as opposed to including additional combustion sources, which avoids associated air contaminant emissions with that process.
- The Project will be integrated with the adjacent NB Power Belledune Thermal Generating Station to combust the by-product gas (or FEG) for power generation purposes. Without integration, the Belledune Iron Processing Facility would have considered constructing an independent power facility as part of the Project to combust the by-product gas generated in the FINEX process that is not required for process heating. The integration of the Belledune Iron Processing Facility with NB Power's Belledune Thermal Generating Station would displace more than 50% of current coal consumption considering the previous 5 year average annual load factor (380 MW). This is expected to result in a substantive reduction in overall SO_2 emissions from the NB Power Belledune Thermal Generating Station due to the coal off-set by the lower sulphur content of the FEG. It is also possible that there could be reductions in other air contaminant releases because of the off-set coal and potential lower emissions intensities associated with the produced by-product gas. As a minimum it is expected that the future emissions of other air contaminants (excluding SO_2) would be consistent with the existing conditions, if not reduced.
- Low-sulphur marine diesel will be consumed in marine vessel internal combustion engines and auxiliary boilers to comply with regulations for fuel sulphur limits within North American waters, resulting in reduced emissions of SO_2 and particulate matter.
- Air contaminant emissions from equipment will be managed by conducting regular maintenance on all machinery and equipment.
- Environmental monitoring during construction will include visual checks for dust levels and implementation of dust suppression as needed.

6.2.7 Characterization of Residual Project-Environmental Interactions for Air Quality

6.2.7.1 Construction

Construction activities will include site preparation and infrastructure installation and are expected to occur for approximately three years. Air contaminant emissions of combustion gases from operation of heavy equipment and fugitive dust (particulate matter including TSP, PM_{10} and $PM_{2.5}$) from earth moving and handling activities and equipment movements are expected during construction. Air contaminant releases during construction are short-term and, with the mitigation measures to be employed, emissions are expected to be lower in magnitude than during operation of the Project. As such, air contaminant releases from construction activities are not expected to result in adverse air quality conditions.

The construction phase is not likely to cause poor air quality in the Village of Belledune and Project-related releases of air contaminants to the atmosphere are not likely to cause the ambient air quality standards to be exceeded.

Based on the above, the residual environmental effects of the Project are not expected to be substantive, although construction activities would add to existing air contaminant concentrations in the PDA, emissions would be low in magnitude, and generally confined to the PDA. Based on our experience with construction project air contaminant emissions, the main concern in relation to air quality is dust, which can approach ambient objective limits in dry, windy periods. During the construction period, dust emissions are not likely to cause poor air quality in the Village of Belledune, as they are low in magnitude and mitigation would be used to control dust emissions to maintain good air quality near the Project. Other air contaminants are not expected to contribute measurably to existing ambient levels most of the time during construction, as they are low in magnitude, transient and temporary, and limited to a localized area onsite.

6.2.7.2 Operation and Maintenance

Changes to air quality as a result of the Project air contaminant emissions associated with operation and maintenance are assessed using a numerical atmospheric dispersion model in combination with ambient background air contaminant concentrations. The background concentrations are intended to account for consideration of the existing conditions with respect to air quality in the LAA.

Dispersion models simulate transport, dispersion, transformation, and deposition processes in the atmosphere. Dispersion models are used to predict ambient air quality changes for a wide range of meteorological conditions and account for local terrain influences. Because of the many uncertainties associated with the application of dispersion models, the model results can be viewed as "best estimates" relative to the decision-making process when standardized model approaches are adopted (U.S. EPA, 2005). Dispersion models are used to predict how releases of air contaminants to the atmosphere can affect ground-level concentrations during a variety of meteorological conditions and terrain influences.

Air Contaminant Emissions

Project Sources

Air contaminant emissions were estimated based on design information provided by Maritime Iron (based on reference plant operating information) and published emission factors. The design information includes stack gas properties, activity data, stack concentrations of dust, NO_X and SO_2 as well as flare gas volumes and compositions for flaring events. This information was used in conjunction with AP-42 published emissions factors from the United States Environmental Protection Agency (US EPA) to estimate air contaminant emissions of particulate matter and combustion gases. Published emission factors from the US EPA AP-42 were used in conjunction with source characteristics and operating information to estimate TSP emissions from the cooling towers and combustion gas emissions from the pilot flare. Air contaminant releases from the other Project sources were estimated based on the source characteristics, operating information and stack concentrations provided by Maritime Iron (based on reference plant operating information).

Maritime Iron also provided process feedstock and material composition information which was used to estimate trace metal emissions from various dust sources. The trace metal emissions are assumed to be contained within the particulate matter released from various sources associated with the FINEX process.

The Project sources of air contaminant emissions during the operation and maintenance phase are provided in Table 6.10. The source locations are shown in Figure 6.2. The red crosshair symbols represent point source locations. The detailed emissions inventory is provided in Appendix D.

Table 6.10 Project Sources of Air Contaminant Emissions – Normal Operation

Source ID (abbreviation)	Description
CDA_STK	Cast House dry de-dusting system stack
CP_STK3	Coal Briquette wet de-dusting
CP_STK2	Coal Briquette dry de-dusting
HMPT_STK	HMPS dry de-dusting filter
HCI_STK1	HCI various dry de-dusting points
HCI_STK2	HCI bag filter unit
OREDRYER	Oxide Dryer bag filter unit for dry de-dusting
PCMSTK	Pig Casting dry de-dusting filter
GRSTK1	Reactor de-dusting dry oxide handling
BOP1	Existing transfer tower dust collector
BOP2	New transfer tower dust collector
BOP3	Iron ore, limestone, dolomite stockpile transfer point dust collector
BOP4	Coal and coke stockpile transfer point dust collector
BOP5	Iron ore, limestone, dolomite stock house transfer point dust collector
BOP6	Coal Briquette transfer point dust collector

Table 6.10 Project Sources of Air Contaminant Emissions – Normal Operation

Source ID (abbreviation)	Description
CT1_CBT	Slag Granulation cooling tower
CT2_CBT	Slag Granulation cooling tower
CT3_CBT	Slag Granulation cooling tower
CT4_CBT	Slag Granulation cooling tower
FLARE	Flare Stack
CP_STK1	Coal Briquette dry de-dusting for receiving
CF1	Stock House ore dry de-dusting
CF2	Stock House coal dry de-dusting
MGS1	Melter Gasifier de-dusting system #1
MGS2	Melter Gasifier de-dusting system #2
CM_RTO	Water Treatment regenerative thermal oxidizer
CT1_PRO	Process cooling tower
CT2_PRO	Process cooling tower
CT3_PRO	Process cooling tower
CT4_PRO	Process cooling tower
CT5_PRO	Process cooling tower
CT6_PRO	Process cooling tower
CT7_PRO	Process cooling tower
CT8_PRO	Process cooling tower
CT1_SEC	Secondary cooling tower
CT2_SEC	Secondary cooling tower
CT3_SEC	Secondary cooling tower
CT4_SEC	Secondary cooling tower
CT5_SEC	Secondary cooling tower

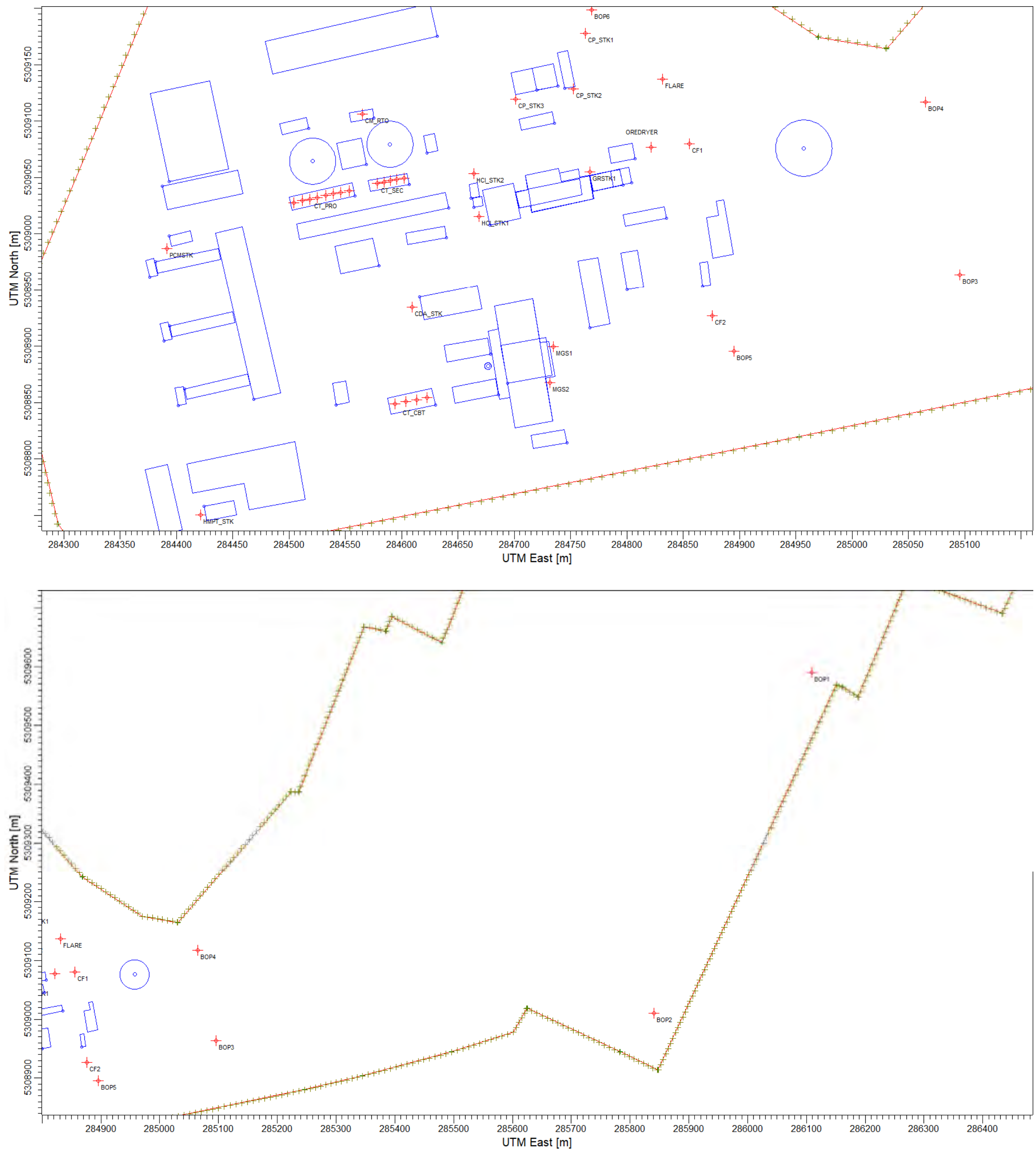


Figure 6.2 Project Source Locations

The total estimated Belledune Iron Processing Facility annual emissions, based on an expected operating year of 347 days, are provided in Table 6.11. Air contaminant releases from individual sources are broken down in the dispersion modelling section below.

Table 6.11 Total Facility Annual Emissions – Normal Operation

Air Contaminant	Total Facility Emissions (tonnes/year)	Air Contaminant	Total Facility Emissions (tonnes/year)
TSP	125	TiO_2	0.10
PM_{10}	125	K_2O	0.11
$PM_{2.5}$	125	SO_3	0.20
NO_X	318	As	3.24E-04
SO_2	133	Cd	1.38E-04
Hg	1.09E-06	Cr	2.32E-04
Fe_2O_3	28.0	Cu	3.16E-05
CaO	13.9	Ni	1.67E-04
SiO_2	11.5	V	1.11E-03
P_2O_5	0.32	Zn	2.99E-04

Since the Project will generate more off gas than what the FINEX process requires for heating demand, the additional off gas will be supplied as a by-product gas (or FEG) to NB Power's Belledune Thermal Generating Station reducing the coal consumption). This off-set coal (due to the supplied FEG) is expected to result in a substantive reduction of SO_2 emissions from NB Power's Belledune Thermal Generating Station.

Project Related Marine Vessel Traffic

Air contaminant releases from marine vessel traffic associated with the operation of the Project while in the Port of Belledune were also considered in the assessment. The air contaminant releases were estimated using expected vessel traffic information provided by Maritime Iron and published emission factors. The methodology provided in the Current Methodologies in Preparing Mobile Source Port-related Emission Inventories document prepared by ICF Consultants for the US EPA was used to estimate the air contaminant releases from Project-related marine vessel traffic, while in port (ICF 2009). This includes releases occurring during maneuvering and while at berth. Releases from marine vessels in transit are not assessed as it is considered outside of the scope of the assessment.

Releases of NO_X, SO_2 and particulate matter (TSP, PM_{10} and $PM_{2.5}$) from marine vessel traffic were quantified. Air contaminant emissions are released from the combustion of fuel oil in internal combustion engines and auxiliary boilers on the ships. Most ocean-going vessels are equipped with main propulsion engines as well as auxiliary engines. The main engines provide power to drive the ship and auxiliary engines provide power on board the ship. The auxiliary boilers provide heat to the fuel to reduce viscosity and to heat water for use on the ship (ICF 2009). Releases were estimated assuming the vessels consume low sulphur (0.1%) marine diesel as regulated starting in January 2020 to meet SO_2 emission requirements in North American waters.

The vessel traffic associated with the Project includes bulk carrier vessel types to supply feedstocks and ship product to market as well as associated tugboat traffic. Based on information provided by Maritime Iron, two tugs accompany each vessel from the pilot station to berth (inbound) and from berth to the pilot station (outbound), except for Laker size class vessels, as tugs are not required for these smaller vessels. The information used to estimate the air contaminant releases includes the number of vessels, vessel size classes expected, and time in-port. This information is summarized in Table 6.12. The complete marine emissions inventory is provided in Appendix D.

Table 6.12 Marine Vessel Information

Summary	Vessel Size Class	Assumed Vessel Size (DWT)	Vessels Per Year	Vessel in Port (hour/year)			Tugs present (hour/year)
				Hoteling	Maneuvering	OGV Total	
Supply Vessels	Panamax	80,000	86	6,192	172	6,364	258
	Handysize	30,000	9	324	18	342	27
Product Vessels	Handymax	60,000	39	2,262	78	2,340	117
	Laker	30,000	85	3,060	85	3,145	0
Total			219	11,838*	353	12,191*	402

Notes:
* total hours are greater than 1 year, as two vessels can be at berth or in port at the same time
OGV ocean going vessel
DWT dead weight tonnage – measure of what a ship can carry combined mass of the ballast water, fresh water, crew, cargo, fuel and supplies

The approximate locations of the marine vessels as considered in the dispersion model are shown in Figure 6.3. Since the marine vessels are mobile sources and the emissions estimates and modelling consider the time at berth (at the jetty) as well as maneuvering from the pilot station to the jetty, the marine vessel locations shown in the figure (as modelled) represent an approximate location where a vessel may be present at a given time, not necessarily where they are berthed. The red crosshair symbols represent the point source locations in the model. For the purpose of the dispersion modelling, the two largest vessel types were assumed to be in port (somewhere between the jetty and pilot station) to establish the potential worst-case ground-level concentrations resulting from Project-related marine vessel traffic.

Figure 6.3 Marine Vessel Locations

The estimated annual air contaminant releases from Project-related marine vessel traffic are provided in Table 6.13.

Table 6.13 Annual Emissions Project-related Marine Vessels

Air Contaminant	Emission Rate (tonnes/year)					
	Supply Vessels		Product Vessels		Assist Tugboats	Total
	Panamax	Handysize	Handymax	Laker		
NO_X	30.7	1.40	10.4	10.9	4.01	57.4
SO_2	1.28	0.06	0.45	0.50	0.53	2.83
TSP	0.51	0.02	0.18	0.20	0.29	1.20
PM_{10}	0.51	0.02	0.18	0.20	0.29	1.20
$PM_{2.5}$	0.47	0.02	0.16	0.18	0.29	1.13

Dispersion Modelling

The California Puff (CALPUFF) dispersion modelling system used to complete this study; was used to predict the maximum ground level concentrations of the substances of interest in the LAA during the normal operation of the Project as well as during flaring events.

The CALPUFF model is a non-steady-state Gaussian puff dispersion model that incorporates simple chemical transformation mechanisms, complex terrain algorithms and building downwash. It is suitable for estimating ground-level concentrations on local and regional scales, from tens of meters to hundreds of kilometers. The core of this modelling system consists of a meteorological model, CALMET, a transport and dispersion model, CALPUFF, and a post-processor model, CALPOST, which is designed to report the concentrations of the air contaminants of interest.

The CALPUFF model was chosen over AERMOD as it has better algorithms to handle complex terrain and it is more applicable for coastal locations such as Belledune, NB.

CALMET Meteorological Modelling

Meteorology influence the manner in which air contaminant emissions from industrial and natural sources disperse into the atmosphere, and hence have a direct effect on air quality. Atmospheric dispersion of emissions is governed by the amount of turbulence that exists in the mixed layer of air in contact with the ground. Turbulence levels are dependent on thermal effects (e.g., vertical temperature stratification) and mechanical effects caused by topography, surface roughness, and wind speed. The height of the mixing layer determines the vertical extent to which emissions are able to diffuse. Meteorology varies with time of day and year and can vary from location to location because of terrain and land cover influences on turbulence and wind field.

The CALMET model was initialized using weather research and forecasting (WRF) modelled data. CALMET uses the 3-D WRF data as an initial guess of the meteorological conditions within the domain before applying the influence of terrain and geophysical surface characteristics (albedo, bowen ratio, surface roughness). CALMET will then combine the WRF model data with any surface observational data or upper air data used to “fine tune” the site-specific meteorology for use in CALPUFF.

The WRF modelled data are further described in the following sub-sections.

<u>Weather Research and Forecasting (WRF) Modelling</u>

To initialize the WRF model, the National Centers for Environmental Prediction (NCEP) 32 km resolution North American Regional Reanalysis (NARR) gridded analysis data was used as input to the Advanced Research WRF (ARW) model to produce five-years of meteorological data (2013 – 2017) on a 4-km grid resolution using the Stantec high performance computing cluster.

The NARR incorporates various sources of observational data including:

- temperatures, winds, and moisture from radiosondes;
- pressure data from surface observations, and dropsondes;
- pibals (pilot balloons used for measuring ceiling height and upper level winds);
- aircraft temperatures and winds;
- satellite radiance (a measure of heat) from polar (orbiting Earth) satellites; and
- cloud drift winds from geostationary (fixed at one location viewing Earth) satellites.

This data was then modelled by WRF to refine the grid to a 4-km resolution in the Mesoscale meteorological domain. The WRF model domain consisted of an approximate 100 km x 100 km area centered near Belledune, NB.

In addition to the modelled surface meteorological data (extracted from WRF), upper air data from “pseudo-stations” was also extracted from the WRF model, since there are no upper air stations located within the CALMET study domain.

Meteorological Data

The meteorological data required by the CALPUFF model to predict plume dispersion and transport includes surface weather data (i.e., wind velocities and direction, temperature, atmospheric stability, and mixing layer depth), and upper air data (i.e., pressure, altitude, temperature, relative humidity, wind speed and direction). The optimum approach to running CALMET is to use both meteorological modelled data (i.e. WRF model data) and observation data (site-specific data) from nearby surface weather stations. Surface wind and temperature data are readily available from meteorological stations, but atmospheric stability and mixing layer depth are calculated from additional raw meteorological data including: cloud cover, snow cover, and solar radiation. However, for this assessment, WRF data alone were used to initialize CALEMT.

CALMET Meteorological Modelling

The latest version of CALMET (version 6.5.0) was used for this study. The CALMET model was run for a five-year period, 2013 to 2017. A horizontal grid spacing of 500 m was selected for the CALMET modelling and the study area was 50 km by 50 km.

The CALMET model was initialized using the 4 km grid WRF data at various levels of the atmosphere within the model domain.

The CALMET predicted winds at the Project site covering the 2013 to 2017 model period are shown in Figure 6.4. The winds are predicted to occur most frequently from the west and west-northwest directions. The highest wind speeds also occur most frequently from the west and northwest directions.

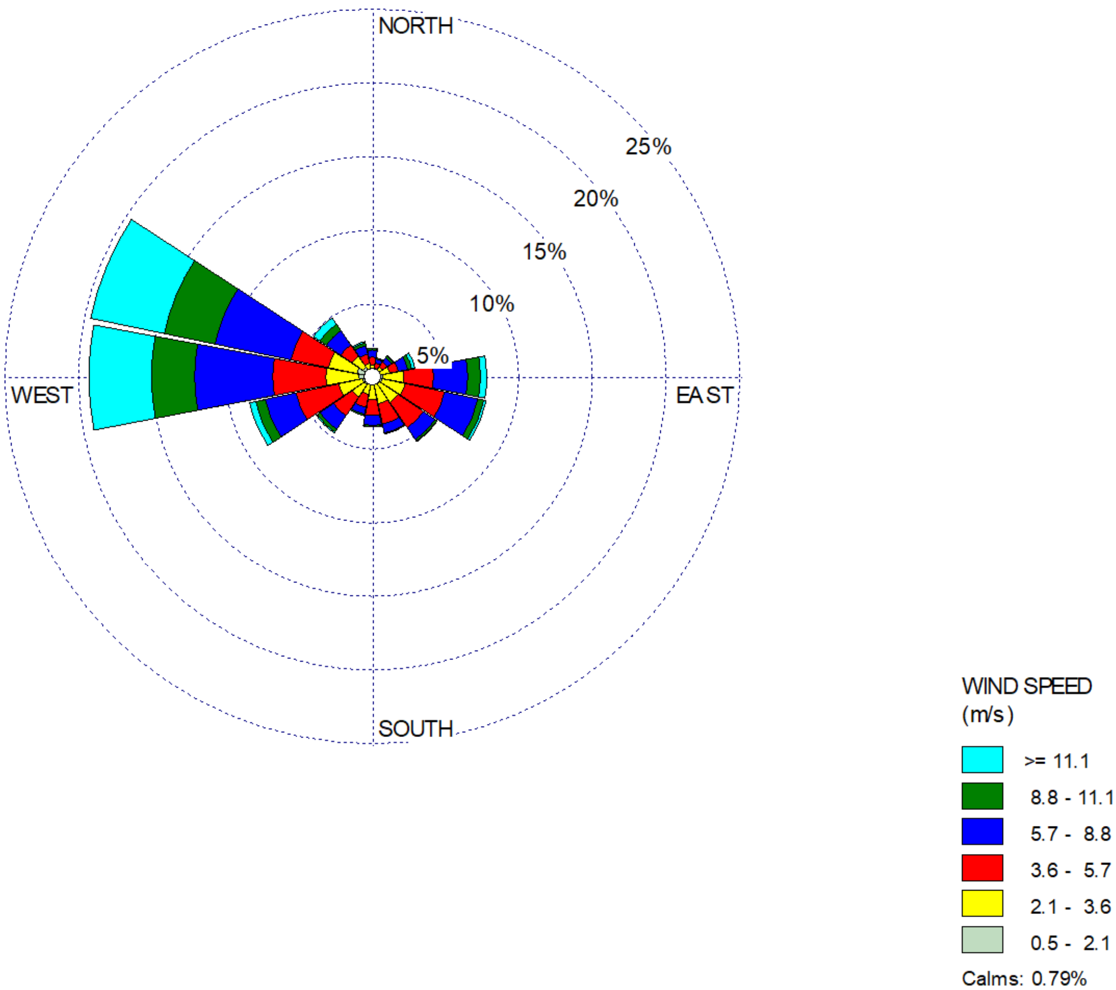


Figure 6.4 CALMET Predicted Winds at the Project Site (2013 to 2017)

CALPUFF Modelling

The latest version of the CALPUFF dispersion model (version 7.2.1) was used to predict ground-level concentrations of the contaminants of concern expected to be release from the Project in substantive quantities. The modelling was conducted to in support of the air quality assessment. The model domain is equal to the area of the LAA, consisting of a 20 km by 20 km area centered near the Project location.

Model inputs

Project-related releases from sources of air contaminants associated with the FINEX process as well as marine vessel traffic at the Port of Belledune were modelled.

The process sources were modelled based on operating information and source characteristics provided by Maritime Iron, as described in the Emissions section, above.

Most sources operate for 347 days per year and are considered to operate continuously in the model. Since some unit operations are batch processes, releases only occur periodically. The batch source operations were incorporated in the modelling for the following sources:

- Cast House dry de-dusting system stack (CDA_STK) – operates 14 hours per day
- HMPS dry de-dusting stack (HMPT_STK) – operates 18 hours per day
- Pig Casting dry de-dusting filter (PCMSTK) – operates 17 hours per day

The source data required to run the CALPUFF model includes the following:

- the physical location(s) of the point source(s) of air contaminants
- the emission rate(s) of the selected contaminant(s)
- the physical height of the emission source (stack height) and its exit diameter (stack exit diameter)
- exhaust gas exit velocity
- exhaust gas temperature

The model input source characteristics are provided in Table 6.14. Sources with horizontal exhaust points were modelled in accordance with the methodology defined in the Ontario Air Dispersion Modelling Guideline (MOECC 2018). The flare stack equivalent exhaust characteristics are estimated using the Alberta ERCBFlare spreadsheet (AENV 2003).

Table 6.14 Project Sources – Model Inputs – Source Characteristics

Source ID *	Release Orientation	Stack Height (m)	Stack Diameter (m)	Exit Velocity (m/s)	Modelled Diameter (m)	Modelled Velocity (m/s)	Stack Temperature (K)
CDA_STK	Vertical	24.0	5.6	12.0	5.6	12.0	373
CP_STK3	Vertical	20.0	2.3	9.9	2.3	9.9	293
CP_STK2	Vertical	20.0	0.8	10.2	0.8	10.2	358
HMPT_STK	Vertical	20.0	2.4	22.0	2.4	22.0	298
HCI_STK1	Vertical	16.0	1.2	17.7	1.2	17.7	348
HCI_STK2	Vertical	18.0	1.5	17.7	1.5	17.7	533
OREDRYER	Vertical	24.0	3.7	12.4	3.7	12.4	373
PCMSTK	Vertical	21.0	3.0	15.0	3.0	15.0	373
GRSTK1	Horizontal	26.0	1.2	13.3	6.0	0.5	293
BOP1	Vertical	10.0	0.4	17.7	0.4	17.7	293
BOP2	Vertical	10.0	0.4	17.7	0.4	17.7	293
BOP3	Vertical	30.0	1.2	17.7	1.2	17.7	293
BOP4	Vertical	30.0	1.2	17.7	1.2	17.7	293
BOP5	Vertical	10.0	0.4	17.7	0.4	17.7	293
BOP6	Vertical	10.0	0.5	17.7	0.5	17.7	293
CT1_CBT	Vertical	32.0	6.0	5.7	6.0	5.7	323
CT2_CBT	Vertical	32.0	6.0	5.7	6.0	5.7	323
CT3_CBT	Vertical	32.0	6.0	5.7	6.0	5.7	323
CT4_CBT	Vertical	32.0	6.0	5.7	6.0	5.7	323
FLARE	Vertical	70.0	1.6	-	1.6	5.6	1,273
CP_STK1	Vertical	17.0	1.4	34.9	1.4	34.9	293
CF1	Vertical	18.0	1.8	12.0	1.8	12.0	293
CF2	Vertical	21.0	2.4	12.0	2.4	12.0	293
MGS1	Horizontal	2.8	0.3	21.2	1.2	0.1	373
MGS2	Vertical	97.0	1.0	13.8	1.0	13.8	293
CM_RTO	Vertical	15.0	1.2	9.6	1.2	9.6	363
CT1_PRO	Vertical	17.0	6.0	16.4	6.0	16.4	322
CT2_PRO	Vertical	17.0	6.0	16.4	6.0	16.4	322
CT3_PRO	Vertical	17.0	6.0	16.4	6.0	16.4	322
CT4_PRO	Vertical	17.0	6.0	16.4	6.0	16.4	322
CT5_PRO	Vertical	17.0	6.0	16.4	6.0	16.4	322

Table 6.14 Project Sources – Model Inputs – Source Characteristics

Source ID *	Release Orientation	Stack Height (m)	Stack Diameter (m)	Exit Velocity (m/s)	Modelled Diameter (m)	Modelled Velocity (m/s)	Stack Temperature (K)
CT6_PRO	Vertical	17.0	6.0	16.4	6.0	16.4	322
CT7_PRO	Vertical	17.0	6.0	16.4	6.0	16.4	322
CT8_PRO	Vertical	17.0	6.0	16.4	6.0	16.4	322
CT1_SEC	Vertical	14.5	6.0	7.1	6.0	7.1	308
CT2_SEC	Vertical	14.5	6.0	7.1	6.0	7.1	308
CT3_SEC	Vertical	14.5	6.0	7.1	6.0	7.1	308
CT4_SEC	Vertical	14.5	6.0	7.1	6.0	7.1	308
CT5_SEC	Vertical	14.5	6.0	7.1	6.0	7.1	308

Notes:
* Source descriptions are provided in Table 6.10

The modelled emission rates from the FINEX process sources are provided in Table 6.15.

Table 6.15 Project Sources – Model Inputs – Emission Rates

Source ID	Emission Rates (g/s)																			
	TSP	PM_{10}	$PM_{2.5}$	NO_X	SO_2	Hg	Fe_2O_3	CaO	SiO_2	P_2O_5	TiO_2	K_2O	SO_3	As	Cd	Cr	Cu	Ni	V	Zn
CDA_STK	1.11	1.11	1.11	-	-	-	0.001	0.29	0.26	0.011	1.11E-03	1.11E-03	0.008	-	-	-	-	-	-	-
CP_STK3	0.20	0.20	0.20	-	-	6.48E-09	0.002	0.006	0.013	2.19E-04	2.01E-04	2.42E-04	1.95E-04	5.77E-07	3.98E-09	5.96E-08	1.59E-08	2.58E-08	3.58E-08	1.19E-07
CP_STK2	0.02	0.02	0.02	-	-	6.94E-10	8.57E-05	7.35E-05	1.14E-03	2.04E-05	2.04E-05	2.45E-05	2.04E-05	6.20E-08	-	-	-	-	-	-
HMPT_STK	0.47	0.47	0.47	-	-	-	0.157	0.229	0.018	2.50E-03	4.73E-04	4.73E-04	4.73E-04	-	-	-	-	-	-	3.37E-06
HCI_STK1	0.08	0.08	0.08	0.92	0.39	3.40E-10	0.063	0.005	0.004	8.11E-05	8.11E-05	8.68E-05	7.04E-05	6.43E-07	3.63E-07	5.09E-07	4.18E-08	4.20E-07	2.91E-06	5.12E-07
HCI_STK2	0.08	0.08	0.08	-	-	3.50E-10	0.065	0.005	0.004	8.35E-05	8.35E-05	8.94E-05	7.26E-05	6.62E-07	3.74E-07	5.25E-07	4.30E-08	4.33E-07	2.99E-06	5.27E-07
OREDRYER	0.51	0.51	0.51	5.71	2.45	2.04E-09	0.404	0.029	0.028	5.10E-04	5.10E-04	5.40E-04	4.49E-04	4.09E-06	2.30E-06	3.16E-06	2.45E-07	2.64E-06	1.85E-05	3.16E-06
PCMSTK	0.41	0.41	0.41	4.54	1.95	-	6.08E-07	1.07E-04	0.006	4.05E-04	4.05E-04	4.05E-04	4.05E-04	-	-	-	-	-	-	3.04E-09
GRSTK1	0.07	0.07	0.07	-	-	2.91E-10	0.058	0.004	0.004	7.27E-05	7.27E-05	7.70E-05	6.40E-05	5.83E-07	3.29E-07	4.51E-07	3.49E-08	3.76E-07	2.64E-06	4.51E-07
BOP1	0.008	0.008	0.008	-	-	4.11E-10	0.007	0.004	0.008	8.23E-06	8.23E-06	1.65E-05	8.23E-06	7.41E-08	4.11E-08	1.48E-07	4.11E-08	6.58E-08	3.29E-07	1.23E-07
BOP2	0.008	0.008	0.008	-	-	4.11E-10	0.007	0.004	0.008	8.23E-06	8.23E-06	1.65E-05	8.23E-06	7.41E-08	4.11E-08	1.48E-07	4.11E-08	6.58E-08	3.29E-07	1.23E-07
BOP3	0.10	0.10	0.10	-	-	1.93E-09	0.087	0.051	0.092	9.67E-05	9.67E-05	1.93E-04	9.67E-05	8.71E-07	4.84E-07	1.74E-06	4.84E-07	7.74E-07	3.87E-06	1.45E-06
BOP4	0.10	0.10	0.10	-	-	4.84E-09	4.84E-04	3.87E-04	0.007	9.67E-05	9.67E-05	1.93E-04	9.67E-05	3.68E-07	-	-	-	-	-	-
BOP5	0.008	0.008	0.008	-	-	1.65E-10	0.007	0.004	0.008	8.23E-06	8.23E-06	1.65E-05	8.23E-06	7.41E-08	4.11E-08	1.48E-07	4.11E-08	6.58E-08	3.29E-07	1.23E-07
BOP6	0.014	0.014	0.014	-	-	6.80E-10	6.80E-05	5.44E-05	9.52E-04	1.36E-05	1.36E-05	2.72E-05	1.36E-05	5.17E-08	-	-	-	-	-	-
CT1_CBT	0.08	0.08	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT2_CBT	0.08	0.08	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT3_CBT	0.08	0.08	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT4_CBT	0.08	0.08	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLARE	0.005	0.005	0.005	0.30	0.008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CP_STK1	0.24	0.24	0.24	-	-	8.21E-09	0.001	8.69E-04	0.014	2.41E-04	2.41E-04	2.90E-04	2.41E-04	7.34E-07	-	-	-	-	-	-
CF1	0.14	0.14	0.14	-	-	5.58E-10	0.11	0.008	0.008	1.39E-04	1.39E-04	1.48E-04	1.23E-04	1.12E-06	6.30E-07	8.65E-07	6.69E-08	7.22E-07	5.06E-06	8.65E-07
CF2	0.26	0.26	0.26	-	-	7.46E-09	0.001	8.54E-04	0.017	2.66E-04	2.55E-04	3.04E-04	2.55E-04	6.67E-07	-	-	-	-	-	-
MGS1	0.006	0.006	0.006	-	-	1.66E-10	2.36E-05	1.90E-05	3.68E-04	5.90E-06	5.67E-06	6.76E-06	5.67E-06	1.48E-08	-	-	-	-	-	-
MGS2	0.05	0.05	0.05	-	-	1.51E-09	2.15E-04	1.73E-04	0.003	5.39E-05	5.18E-05	6.18E-05	5.18E-05	1.35E-07	-	-	-	-	-	-
CM_RTO	-	-	-	0.48	0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT1_PRO	0.04	0.04	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT2_PRO	0.04	0.04	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT3_PRO	0.04	0.04	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT4_PRO	0.04	0.04	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT5_PRO	0.04	0.04	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT6_PRO	0.04	0.04	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 6.15 Project Sources – Model Inputs – Emission Rates

Source ID	Emission Rates (g/s)																			
	TSP	PM_{10}	$PM_{2.5}$	NO_X	SO_2	Hg	Fe_2O_3	CaO	SiO_2	P_2O_5	TiO_2	K_2O	SO_3	As	Cd	Cr	Cu	Ni	V	Zn
CT7_PRO	0.04	0.04	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT8_PRO	0.04	0.04	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT1_SEC	0.06	0.06	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT2_SEC	0.06	0.06	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT3_SEC	0.06	0.06	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT4_SEC	0.06	0.06	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT5_SEC	0.06	0.06	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
\- indicates air contaminant emissions are not available from a given source

Air contaminant releases from Project-related marine vessel traffic at the Port of Belledune were modelled and combined with Project sources. The modelled emissions were estimated using expected marine vessel traffic, typical vessel specifications for the classes expected during the operation of the Project and the methodology and emission factors from the Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories: Final Report (ICF 2009).

The largest vessel types expected were considered in the modelling (Panamax and Handymax size classes) and maximum (max) hourly, maximum daily and annual average emissions were modelled. The maximum emissions were established based on the activities in the Port of Belledune that result in the highest emissions. The emission factors incorporate load factors for the main and auxiliary engines for specific vessel sizes and types to account for less efficient operation of the propulsion engines at lower loads while in port.

For max hourly emissions, vessel maneuvering results in the highest emission rates, as the main engines are operating. The max hourly emissions include releases from the main engine, auxiliary engine and auxiliary boiler. For max daily, since maneuvering only occurs for up to one hour over a 24-hour period, hotelling (at berth) results in the largest emission rates. For max daily emissions, releases occur from the auxiliary engine and boiler, which are assumed to operate continuously over the 24-hour period.

The model input source characteristics are estimated based on similar vessel types and sizes based on previous experience with marine diesel engines and vessels. The modelled source characteristics are provided in Table 6.16.

Table 6.16 Marine Vessel – Model Inputs – Source Characteristics

Source	Stack Height (m)	Base Elevation (m)	Stack Diameter (m)	Release Orientation	Velocity (m/s)		Exit Temperature (K)
					Assumed	Modelled	
PANAMAX	35.0	0	1.75	Vertical	15	15.0	773
HANDYMAX	30.0	0	1.20	Vertical	15	15.0	773
TUG1	8.40	0	0.42	45	10	7.10	773
TUG2	8.40	0	0.42	45	10	7.10	773
TUG3	8.40	0	0.42	45	10	7.10	773
TUG4	8.40	0	0.42	45	10	7.10	773

The modelled emission rates from marine vessels are shown in Table 6.17.

Table 6.17 Marine Vessel – Model Inputs – Emission Rates

Source	Emission Rates (g/s)				
	TSP	PM_{10}	$PM_{2.5}$	NO_X	SO_2
Max Hourly - 2 vessels (supply and product vessels and associated tugs) maneuvering near jetty - Panamax and Handymax					
PANAMAX	0.156	0.156	0.143	9.832	0.317
HANDYMAX	0.134	0.134	0.126	8.919	0.289
TUG1	0.102	0.102	0.099	1.384	0.184
TUG2	0.102	0.102	0.099	1.384	0.184
TUG3	0.102	0.102	0.099	1.384	0.184
TUG4	0.102	0.102	0.099	1.384	0.184
Max Daily - 2 vessels hotelling (at jetty), Tugs based on maneuvering activities					
PANAMAX	0.019	0.019	0.017	1.102	0.049
HANDYMAX	0.017	0.017	0.016	0.980	0.045
TUG1	0.004	0.004	0.004	0.058	0.008
TUG2	0.004	0.004	0.004	0.058	0.008
TUG3	0.004	0.004	0.004	0.058	0.008
TUG4	0.004	0.004	0.004	0.058	0.008
Annual Average - 2 vessels and tugs with emissions based on annual vessel traffic and time in port					
PANAMAX	0.016	0.016	0.015	0.972	0.041
HANDYMAX	0.006	0.006	0.005	0.330	0.014
TUG1	0.002	0.002	0.002	0.032	0.004
TUG2	0.002	0.002	0.002	0.032	0.004
TUG3	0.002	0.002	0.002	0.032	0.004
TUG4	0.002	0.002	0.002	0.032	0.004

Building Profile Input Program

The presence of buildings and structures can affect the way air contaminants are dispersed in the atmosphere from nearby emission sources. Building downwash can occur when wind flows over and around buildings; on the lee side of certain buildings, turbulent wake zones can be created, reducing plume rise and forcing exhaust gases towards the ground.

Building downwash effects (due to potential interactions of structures at the site with exhaust plumes) were considered in the model using the Building Profile Input Program (BPIP). The PRIME module of CALPUFF was used to model downwash.

The building layout and three-dimensional renderings of the buildings in the model are illustrated in Figure 6.5 and Figure 6.6. The red crosshair symbols represent point sources in the model. The three-dimensional rendering of the marine vessels (approximate locations as considered in the model) is shown in Figure 6.7.

Figure 6.5 Building Layout

Figure 6.6 Project Site – Three-dimensional Rendering of Buildings

Figure 6.7 Marine Terminal – Three-dimensional Rendering of Marine Vessels

Receptor Grid

The receptor grid used in the model was developed based on the Ontario Ministry of the Environment and Climate Change Air Dispersion Modelling Guideline for Ontario (Ontario MOECC 2018). The nested receptor grids in the near field were expanded to cover nearby residential areas to the Project site.

The receptor grid spacing for the nested grids (as outlined in the AQMG) is as follows:

- 10 m spacing along the property boundary
- 20 m spacing from the sources out to 500 m
- 50 m spacing from the sources from 500 m to 1 km
- 100 m spacing from the sources from 1 to 1.5 km
- 200 m spacing from 1.5 to 2.0 km
- 500 m spacing from 2.0 to 4.8 km
- 1,000 m spacing beyond 4.8 km to the edge of the LAA (approximate 10 km radius from the Project site)

Gridded receptors that fall within the modelled fence line (includes NB Power's Belledune Thermal Generating Station and the Port of Belledune, i.e., within the property boundaries of the contiguous sites) were removed from the model, as the objective of the study is to assess potential environmental effects to ambient air quality offsite, within the LAA.

Figure 6.8 shows the locations of the gridded receptors on a map of the modelling domain, which consists of a 20 km x 20 km area (equal to the area of the LAA), centered near the Project.

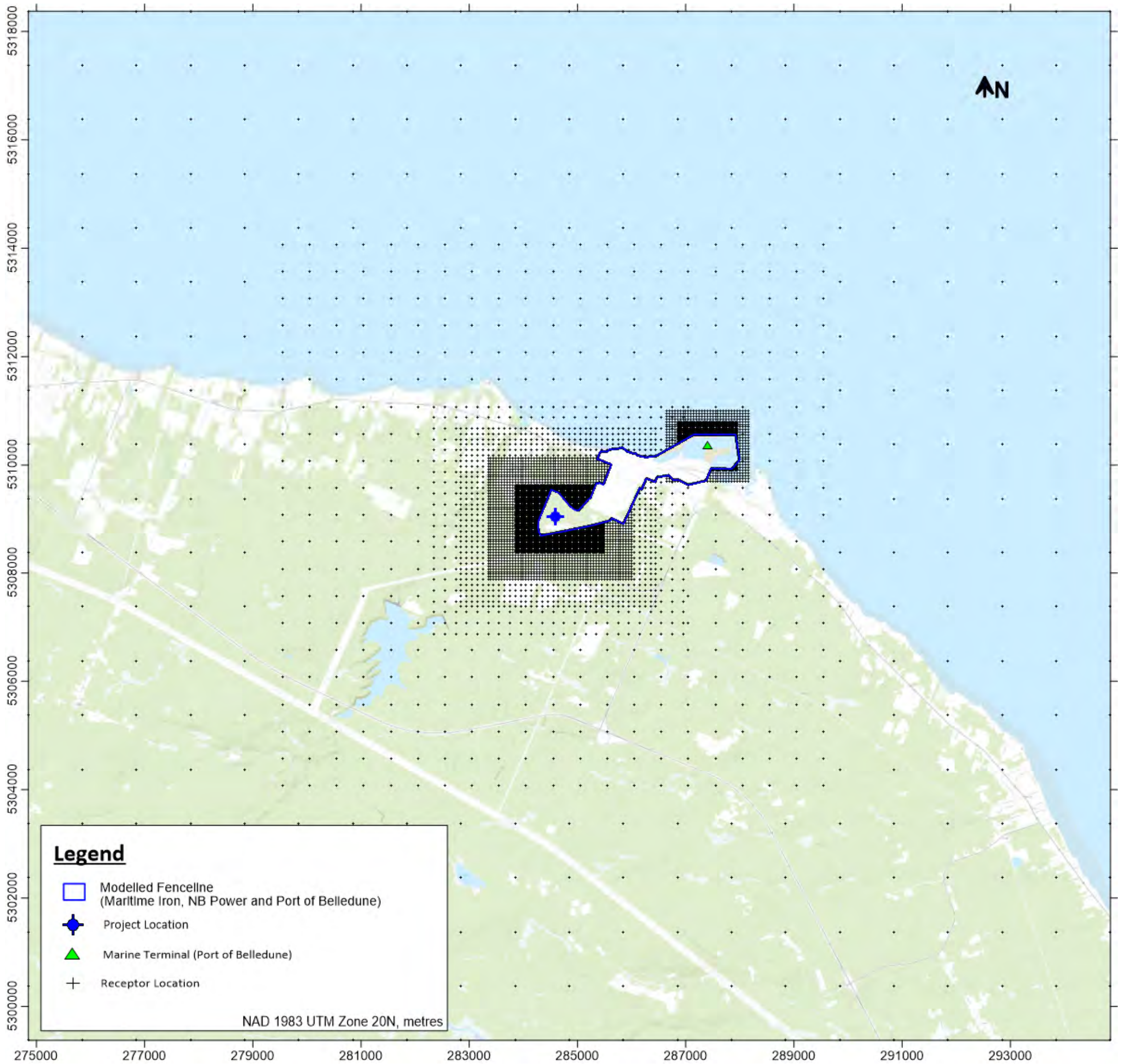


Figure 6.8 Receptor Grid

<u>Conversion of NO_X to NO_2</u>

Nitrogen oxides (NO_X) are the sum of nitrogen dioxide (NO_2) and nitric oxide (NO). Releases of NO_X from the combustion of fuel consist mainly of NO, with some NO_2. In ambient air, NO converts to NO_2 at rates dependent on atmospheric conditions at the time (primarily related to ambient ozone (O_3) concentrations). Since NO_2 has adverse health effects at much lower concentrations than NO, regulatory criteria only exist for NO_2. For the air quality assessment, the ozone limiting method (OLM) was used to estimate the conversion of NO_X to NO_2, i.e., predict ground-level NO_2 concentrations based on the model results for

NO_X. The OLM was applied to the predicted NO_X concentrations based on the relationship identified in the Alberta Air Quality Model Guideline (AESRD 2013), as follows:

If O_3 concentration > 0.9 × NO_X concentration, then NO_2 Concentration = NO_X concentration,

Otherwise NO_2 concentration = O_3 concentration + 0.1 × NO_X concentration

The concentrations in the relationship above are in ppb.

The ozone concentration used in the OLM calculations is 42 ppb, which is the 90th percentile of the hourly ozone concentrations measured at the NBDELG Bathurst monitoring station, covering the period of April 2018 to April 2019. The ambient data were obtained from the NBDELG Air Quality Data Portal (NBDELG 2019c).

<u>Model Results – Operation</u>

The maximum predicted concentrations of the air contaminants of concern released during normal operation of the Project combined with measured background concentrations (to account for existing conditions) are provided in Table 6.18.

The maximum predicted concentrations due to releases from Project sources and associated marine vessel traffic are below the respective air quality objectives and standards. The combined air contaminant concentrations are also below the respective objectives and standards.

The predicted concentrations for select compounds are also shown graphically in Figure 6.9 to Figure 6.11. The isopleths (or concentration contour plots) were generated for maximum predicted 24-hour $PM_{2.5}$, CaO and SiO_2 concentrations. Plots were prepared for these contaminants as the Project contribution to these predicted concentrations results in concentrations closest to the objectives and standards. The highest concentrations generally occur along or just outside the modelled fence line.

Table 6.18 Maximum Predicted Concentrations – Normal Operation + Background

Air Contaminant	CAS#	Average Period	Background Concentration (µg/m³)	Maximum Predicted Concentration (µg/m³)	Project + Background (µg/m³)	NBDELG Max Permissible GLC (µg/m³)	Ontario MOE Air Quality Standard (µg/m³)	Canadian Ambient Air Quality Standards / Newfoundland AAQS (µg/m³)	Percent of Objective or Standard
TSP	NA-1	24-hour	57.9	13.5	71.4	120	-	-	60%
TSP	NA-1	Annual	20.7	4.49	25.2	70	-	-	36%
$PM_{2.5}$	NA-2	24-hour	9.5	13.5	23.0	NA	-	27	85%
$PM_{2.5}$	NA-2	Annual	4.4	4.49	8.9	NA	-	10	89%
PM_{10}	NA-3	24-hour	NA	13.5	NA	NA	-	50 *	27%
NO_2	10102-44-0	1-hour	9.4	144	154	400	-	113	38%
NO_2	10102-44-0	24-hour	8.6	38.7	47.3	200	-	-	24%
NO_2	10102-44-0	Annual	5.9	6.99	12.9	100	-	32	13%
SO_2	7446-09-5	1-hour	13.1	67.3	80.4	900	-	-	9%
SO_2	7446-09-5	24-hour	4.7	16.5	21.1	300	-	-	7%
SO_2	7446-09-5	Annual	0.6	2.98	3.6	60	-	-	6%
Hg	7439-97-6	24-hour	NA	3.22E-07	NA	NA	2	-	<1%
Fe_2O_3	1309-37-1	24-hour	NA	4.45	NA	NA	25	-	18%
CaO	1305-78-8	24-hour	NA	5.54	NA	NA	10	-	55%
SiO_2	7631-86-9	24-hour	NA	1.48	NA	NA	5	-	30%
P_2O_5	1314-56-3	24-hour	NA	0.0652	NA	NA	1	-	7%
TiO_2	13463-67-7	24-hour	NA	1.27E-02	NA	NA	34	-	<1%
K_2O	12136-45-7	24-hour	NA	1.45E-02	NA	NA	1.5	-	<1%
SO_3	7446-11-9	24-hour	NA	4.31E-02	NA	NA	5	-	<1%
As	7440-38-2	24-hour	0.10	5.21E-05	0.10	NA	0.3	-	32%
Cd	7440-43-9	24-hour	0.02	2.43E-05	0.02	NA	0.025	-	76%
Cr	7440-47-3	24-hour	NA	3.40E-05	NA	NA	0.5	-	<1%
Cu	7440-50-8	24-hour	NA	6.64E-06	NA	NA	50	-	<1%
Ni	7440-02-0	Annual	NA	6.84E-06	NA	NA	0.04	-	<1%
V	7440-62-2	24-hour	NA	1.95E-04	NA	NA	2	-	<1%
Zn	7440-66-6	24-hour	0.36	8.65E-05	0.36	NA	120	-	<1%

Notes:

* Newfoundland and Labrador Ambient Air Quality Standard

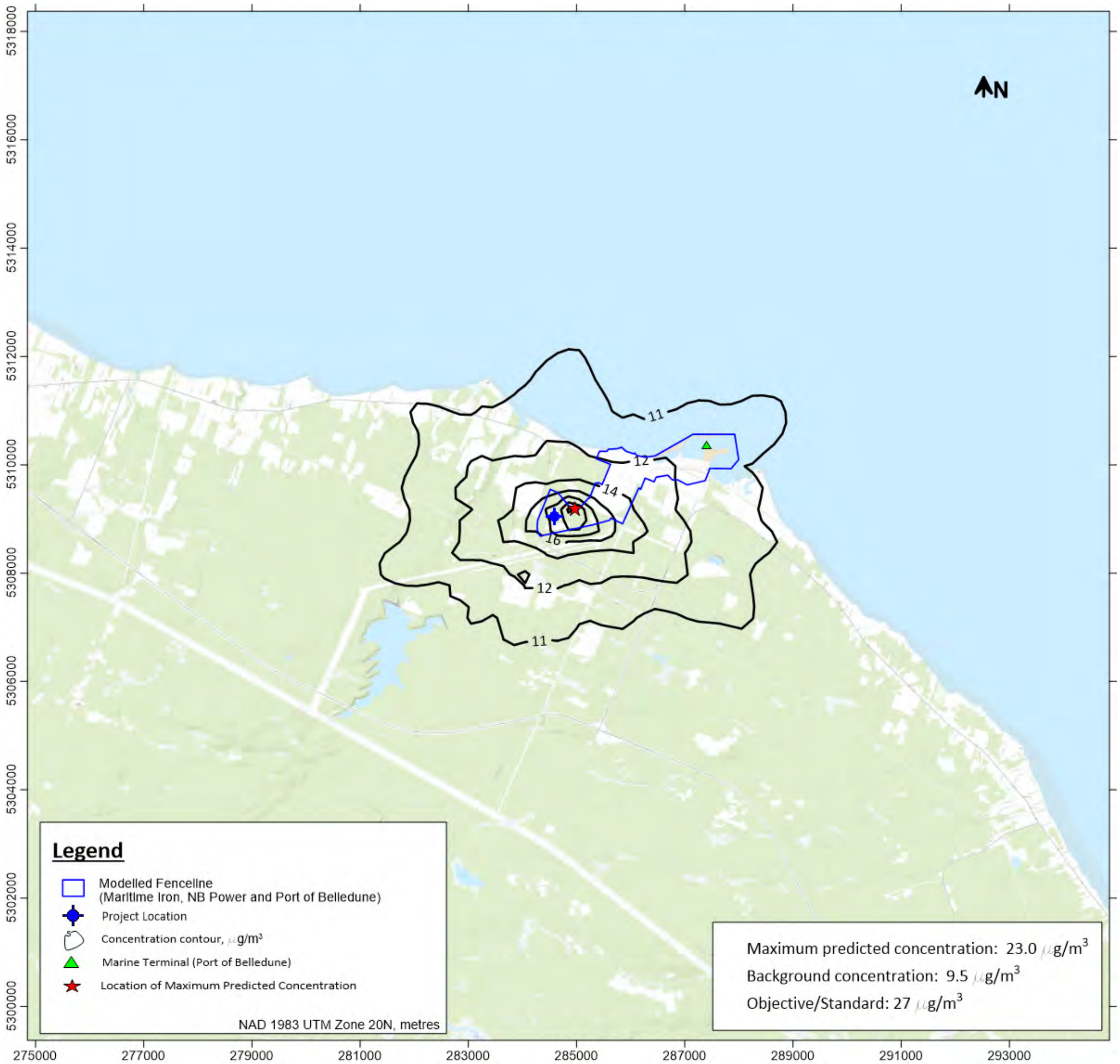


Figure 6.9 Maximum Predicted 24-hour $PM_{2.5}$ Concentrations (Including Background)

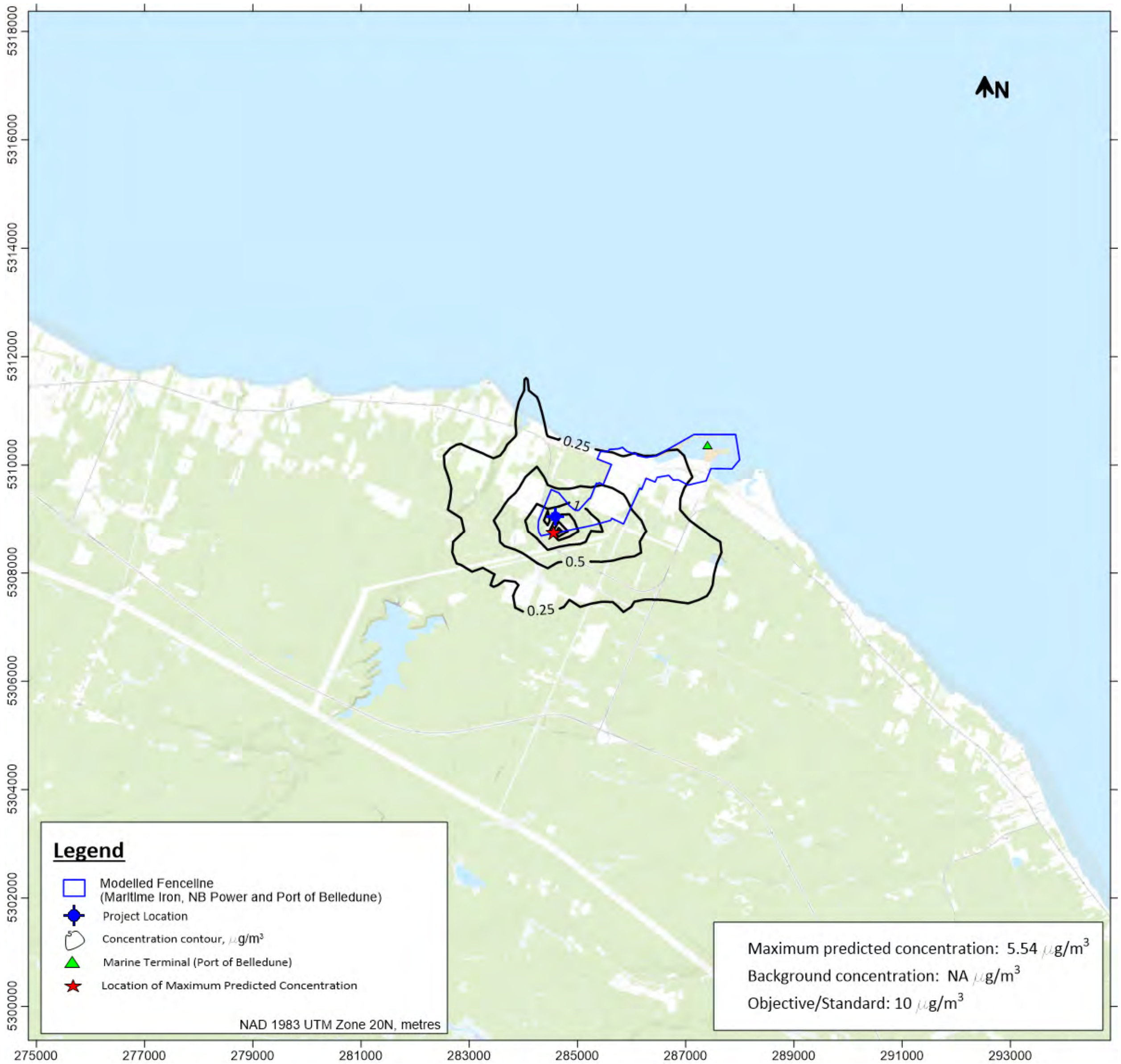


Figure 6.10 Maximum Predicted 24-hour CaO Concentrations

Figure 6.11 Maximum Predicted 24-hour SO_2 Concentrations

Flaring Event Modelling

Flaring of the produced off gas would occur during periods when NB Power's Belledune Thermal Generating Station is off-line and unable to accept the FEG. This would occur during planned or unexpected shut-downs of NB Power's Belledune Thermal Generating Station, where the off gas would be sent to the Belledune Iron Processing Facility's flare stack to be combusted. Based on information provided by Maritime Iron the flaring event is only expected to occur approximately once per year.

There were two cases considered for a flaring event, one where NB Power's Belledune Thermal Generating Station is unable to accept the FEG for an extended period, more than 24-hours, and the other where the FEG cannot be accepted for shorter periods, less than four hours.

For the first case the Belledune Iron Processing Facility operation would be shut down. When this occurs, it is expected to require four hours to shut down the process. For the first hour, the off gas would be at the maximum production rate, typical of normal operation. The off gas production rate would then decrease step-wise, dropping by 25% each hour until the facility can be shut-down (over four hours). This flaring case was considered for max hourly emissions in the model.

The other flaring case would occur during short-term shutdowns of NB Power's Belledune Thermal Generating Station, lasting less than 4 hours. When short-term shutdowns occur, the Belledune Iron Processing Facility would continue operating, sending the off gas to the flare stack until NB Power's Belledune Thermal Generating Station can accept it again. This flaring case was considered for max daily emissions in the model. The releases from the flare stack for the max daily emissions were prorated based on the event lasting for four hours, i.e., the maximum off gas production rate was assumed to be flared for four hours, the remaining 20 hours were assumed to be based on the flare stack operating on pilot gas.

Flare source characteristics were estimated based on the off gas properties and production rate using the Alberta ERCBFlare spreadsheet (AENV 2003). The off gas properties are shown in Table 6.19. The estimated flare source characteristics are shown in Table 6.20

Table 6.19 FINEX Process Off Gas / By-Product Gas (or FEG) Properties

FINEX Process / By-Product Gas (or FEG) to NB Power	Value
FINEX Export Gas (FEG) Flow (Nm^3/hr)	318,200
FINEX Export Gas (FEG) Calorific Value (kcal/Nm^3)	1,679
FINEX Export Gas (FEG) Composition (vol%)	
CO	38.2
CO_2	27.7
H_2	16.2
H_2O	6.4
CH_4	1.2
N_2	10.3
SO_2	0.0093

Table 6.20 Estimated Flare Event Source Characteristics

Source	Equivalent Stack Height (m)	Stack Diameter (m)	Equivalent Diameter (m)	Equivalent Velocity (m/s)	Flare Gas Temperature (K)
FLARE	106	1.60	7.06	41.6	1,273

The max hourly and max daily flare event emissions are provided in Table 6.21.

The other Project sources would continue to operate with emissions and source characteristics similar to normal operation for both max hourly and max daily flare events. Thus, these sources were modelled with source characteristics and emissions equivalent to normal operation. Releases from marine vessels were also considered in the model, consistent with normal operation, as there could be vessels present during a flaring event.

Flare Event Model Results

The maximum predicted concentrations of the air contaminants of concern released during a flaring event are combined with measured background concentrations (to account for existing conditions) in Table 6.22.

The maximum predicted concentrations due to releases during a flaring event (with Project-related marine vessel traffic at the Port of Belledune) are below the respective air quality objectives and standards. The combined air contaminant concentrations are also below the respective objectives and standards.

The maximum predicted concentrations as a result of a flaring event are similar to predicted concentrations resulting from air contaminant releases associated with normal operation. This is likely due to the high temperature and large equivalent flare stack parameters estimated for the flare during an event (equivalent stack height >100 m and equivalent velocity of > 40 m/s). The high temperature and larger stack height and velocity allow for more plume rise and result in the exhaust plume travelling further downwind before impinging at the ground-level, allowing for more dilution prior to reaching the ground. As such, the releases from the flare stack during an event do not contribute substantively to the maximum predicted concentrations that result from air contaminant releases from the other Project sources or marine vessels.

Table 6.21 Flare Event Model Emissions

Source ID	Emission Rates (g/s)																			
	TSP	PM_{10}	$PM_{2.5}$	NO_X	SO_2	Hg	Fe_2O_3	CaO	SiO_2	P_2O_5	TiO_2	K_2O	SO_3	As	Cd	Cr	Cu	Ni	V	Zn
FLARE	Max Hourly																			
	14.0	14.0	14.0	19.6	6.43	1.81E-07	7.10	0.59	0.81	0.014	0.014	0.016	0.013	8.45E-05	4.05E-05	5.70E-05	4.70E-06	4.69E-05	3.25E-04	5.72E-05
	Max Daily																			
	2.34	2.34	2.34	3.52	1.08	3.02E-08	1.18	0.099	0.13	2.37E-03	2.33E-03	2.60E-03	2.13E-03	1.41E-05	6.75E-06	9.50E-06	7.84E-07	7.82E-06	5.41E-05	9.53E-06

Table 6.22 Maximum Predicted Concentrations – Flare Event + Background

Air Contaminant	CAS#	Average Period	Background Concentration ($\mu g/m^3$)	Maximum Predicted Concentration ($\mu g/m^3$)	Project + Background ($\mu g/m^3$)	NBDELG Max Permissible GLC ($\mu g/m^3$)	Ontario MOE Air Quality Standard ($\mu g/m^3$)	Canadian Ambient Air Quality Standards / Newfoundland AAQS ($\mu g/m^3$)	Percent of Objective or Standard
TSP	NA-1	24-hour	57.9	13.6	71.5	120	-	-	60%
$PM_{2.5}$	NA-2	24-hour	9.5	13.6	23.1	NA	-	27	86%
PM_{10}	NA-3	24-hour	NA	13.6	NA	NA	-	50 *	27%
NO_2	10102-44-0	1-hour	9.4	144	154	400	-	113	38%
NO_2	10102-44-0	24-hour	8.6	38.5	47.1	200	-	-	24%
SO_2	7446-09-5	1-hour	13.1	67.3	80.4	900	-	-	9%
SO_2	7446-09-5	24-hour	4.7	16.5	21.1	300	-	-	7%
Hg	7439-97-6	24-hour	NA	3.22E-07	NA	NA	2	-	<1%
Fe_2O_3	1309-37-1	24-hour	NA	4.71	NA	NA	25	-	19%
CaO	1305-78-8	24-hour	NA	5.17	NA	NA	10	-	52%
SiO_2	7631-86-9	24-hour	NA	1.48	NA	NA	5	-	30%
P_2O_5	1314-56-3	24-hour	NA	0.065	NA	NA	1	-	7%
TiO_2	13463-67-7	24-hour	NA	0.012	NA	NA	34	-	<1%
K_2O	12136-45-7	24-hour	NA	0.014	NA	NA	1.5	-	<1%
SO_3	7446-11-9	24-hour	NA	0.043	NA	NA	5	-	<1%
As	7440-38-2	24-hour	0.10	5.31E-05	0.10	NA	0.3	-	32%
Cd	7440-43-9	24-hour	0.02	2.56E-05	0.02	NA	0.025	-	77%
Cr	7440-47-3	24-hour	NA	3.55E-05	NA	NA	0.5	-	<1%
Cu	7440-50-8	24-hour	NA	6.64E-06	NA	NA	50	-	<1%
V	7440-62-2	24-hour	NA	2.05E-04	NA	NA	2	-	<1%
Zn	7440-66-6	24-hour	0.36	8.10E-05	0.36	NA	120	-	<1%

Notes:

* Newfoundland and Labrador Ambient Air Quality Standard

6.2.8 Summary and Recommendations

The construction, operation and maintenance of the Project will result in air contaminant emissions; however, the magnitude of the releases will be limited and well managed.

Construction related emissions (primarily dust from equipment movements) have the potential to decrease air quality, however, the change in air quality is not expected to be substantive, because existing air quality is considered good and adequate, mitigation is available and planned to manage the emissions of air contaminants from construction. Timing is applicable because wind-borne dust would require mitigation mainly during dry, windy conditions and construction activities would be limited to daytime hours.

To assess a potential change to air quality in the LAA during operation, Project-related releases were combined with measured background concentrations. The measured background concentrations were established for consideration of existing conditions in the LAA. The background concentrations are based on measured data from ambient air quality monitoring stations within the LAA operated by NB Power and Glencore. The releases from the Project-related sources are assessed using computer dispersion modelling.

Air contaminant release estimates for the Project sources and associated in-port marine vessel traffic were prepared. The plume dispersion of the estimated releases was modelled using the CALPUFF modelling system. The predicted air contaminant concentrations were combined with the measured background concentrations, which were then compared with air quality objectives and standards used in assessment.

The combined air contaminant concentrations were below the respective New Brunswick and Ontario air quality objectives and standards.

Flare event releases were also considered for the air quality assessment. A flare event, defined as 100% off gas combustion at the flare stack, would occur when NB Power's Belledune Thermal Generating station is off-line and unexpectedly unable to accept the by-product gas (or FEG) generated by the Belledune Iron Processing Facility operation. This event is expected to occur approximately once per year. During these occurrences, the gas would be sent to the flare stack to be combusted. The air contaminant releases during a flaring event were also modelled to assess the potential impacts to air quality. Similar to normal operation, the resulting flare event ground-level concentrations combined with background are below the respective objectives and standards.

The Project will supply FEG to NB Power's Belledune Thermal Generating Station, which is expected to result in a substantive decrease in SO_2 emissions compared to the existing conditions in the LAA. The reduction is expected as the FEG will be used at NB Power's Belledune Thermal Generating Station, which will off-set coal combustion and the FEG is expected to have much lower SO_2 emissions intensity compared to thermal coal.

With the implementation of mitigation and environmental protection measures as described in this assessment and based on the results of the dispersion modelling (for operation) it is anticipated that there will not be a substantive change in air quality during the construction, operation, and maintenance phases of the Project.

6.3 GREENHOUSE GAS EMISSIONS

The following sections 6.3.1 through 6.3.2 have been provided in their entirety by Maritime Iron Inc. and have not been modified by Stantec.

6.3.1 Introduction

Maritime Iron is proposing to implement FINEX, an innovative technology to produce pig iron that contributes to the lowest carbon intensity for large-scale iron- and steel-making facilities in the world.

Maritime Iron is choosing to develop this $1.5 billion Project in New Brunswick, Canada as part of its commitment to sustainable ironmaking. It is an investment in the global environment, the national economy, and the people of New Brunswick.

Although similar facilities currently operate in Asia, the Maritime Iron facility would be the first of its kind in North America, placing Canada as an innovative leader within the North American iron and steel industry. The positive opportunities associated with implementation of this project should be considered within a global, national, and provincial context.

6.3.1.1 Globally

In the face of environmental concerns, the global steel industry has been advancing energy-saving and recycling technologies as well as new ironmaking and steelmaking processes to replace conventional blast furnace (BF) iron-making and basic oxygen furnace (BOF) steel-making production.

When looking at the full value-chain for iron- and steel-making, the use of FINEX technology to produce pig iron, which supplies electric arc furnace (EAF) steelmakers, will result in an ~40% reduction in global greenhouse gases (GHGs) per tonne of steel produced compared to conventional iron-making and traditional integrated steel-making processes. This represents a GHG reduction of over 4.5 million tonnes CO_2e per year by using EAF with 70% recycled steel (based on the use of 1.5 Mtpa of pig iron for 30% of the iron inputs used in the production of 5 Mtpa of high-quality steel).

6.3.1.2 National Context

The Federal Government's regulations and carbon pricing plan recognize that top performers should be rewarded for using best available technology (BAT) to reduce GHGs. Innovative FINEX ironmaking technology, together with Electric Arc Furnace (EAF) steel making technology, represents an important improvement over technology being used by the conventional blast furnace/basic oxygen furnace iron- and steel-making route and represents the best technological effort to address climate change concerns.

Furthermore, by sending Canadian made pig iron to EAF steelmaking markets, Maritime Iron will be helping the world transition away from jurisdictions that use more energy intensive traditional technologies and that have higher GHG emitting electrical grids. By having robust environmental standards in Canada and using FINEX technology with superior environmental performance, Maritime Iron will be developing and operating an ironmaking facility that is consistent with the climate plans for both New Brunswick and Canada, showing the world a path forward towards responsible industrial development.

In addition, this project supports the Canadian Government's goal of eliminating coal-fired electricity generation in Canada as Maritime Iron's by-product gas will be used to displace over 50% of NB Power's thermal coal consumption at the Belledune Generating Station.

6.3.1.3 Provincial Context

The material reduction in emissions from the existing NB Power Belledune coal-fired generation station will offset much of the emissions from this modern, state of the art FINEX industrial facility. This will allow the NB provincial government to grow the economy with a new state-of-the-art industry while responsibly managing provincial GHG emissions. Furthermore, integrating with the existing power plant reduces direct greenhouse emissions by 1.5 Mtpa compared to building a standalone facility and allows the existing coal fired facility to operate beyond 2029.

Implementing Maritime Iron's environmentally responsible approach to ironmaking recognizes the need for sustainable economic development that truly takes the environment into account.

6.3.2 Project Considerations and GHG Benefits

Maritime Iron's Project brings substantial opportunity from a global GHG benefit perspective. These opportunities are driven by three (3) key factors:

1. Technology;
2. Operating Configuration, and;
3. Jurisdictional advantages.

Technology Opportunity

Many countries do not have the same environmental standards as Canada. For example, in China, where more than half of the world's iron and steel is produced, there are significantly higher emissions related to iron- and steel-making.

In Canada, most of the existing iron- and steel-making facilities are conventional and traditional BF/BOF technology and are not operating on a fully integrated self-sufficient basis. While these facilities are lower emitters than fully integrated self-sufficient facilities in countries like China, they are still higher than the FINEX technology being proposed for Maritime Iron's Project when combined with EAF steelmaking (which will use the pig iron produced by the Project).

Conventional BF ironmaking and BOF steelmaking representing traditional integrated steel production facilities in use globally emit a range of 2.1-3 tonnes of GHGs per tonne of steel produced (WSP 2015). In contrast, the steel produced using FINEX ironmaking and EAF steel-making technology emits only 1.2-1.5 tonnes of GHGs per tonne of steel produced (see Figure 6.13 in section 6.3.6).

This ~40% reduction in GHG emissions for FINEX/EAF iron- and steel-making technology is due to:

- No coking or sintering facilities; and
- Use of 70% recycled scrap steel by EAF steelmakers, thus greatly reducing the energy and iron required to produce high-quality steel (as a result, the iron/pig iron requirement is reduced to 30% input) (WSP 2015).

Based on technology advantages alone, the Maritime Iron Project is aligned with Federal goals to prevent carbon leakage and reduce global GHG intensity. This approach is reflected in other project approvals across the country, such as the LNG Facility in BC (WSP 2015).

Operating Configuration Opportunity

Further global GHG opportunity exists with Maritime Iron Project's by-product gas which can be used for power generation. Maritime Iron can produce more than enough electricity to run its own operations. However, to further reduce the environmental footprint and aid NB Power with long term electricity production, Maritime Iron and NB Power have the opportunity to lower combined GHG emissions through integrated operations. This would be done through:

- Operating configuration considerations for power generation by transfer of Maritime Iron's by-product gas to the adjacent NB Power Belledune Thermal Generating Station with the following significant environmental benefits:
  - A greater than 50% reduction in NB Power's coal use and thus cleaner energy production; and
  - Reduction of 1.5 million tonnes of direct GHGs per year compared to Maritime Iron using an internal power plant.

Jurisdiction Opportunity

In addition to direct and indirect GHG emissions from electricity, GHG emissions would also occur from shipping raw materials and products to and from the Port of Belledune and from the combustion of fossil fuels while marine vessels are docked at the Port of Belledune. Due to the strategic jurisdiction location of the Project site in Belledune in relation to iron ore sources in Canada and proximity to pig iron markets on the United States east coast, shipping GHG emissions from this Project would be less than other jurisdiction alternatives.

Shipping Transportation Effects

The most substantive transportation effects associated with the current pig iron supply chain into North America are associated with shipping of iron ore.

Currently, Canada's iron ore is transported along its typical route around the Cape of Good Hope (South Africa), approximately 28,000 kilometres to countries like China and Korea for processing. In contrast, transportation from Sept-Îles, Québec to Belledune, New Brunswick is approximately 425 kilometres resulting in a reduction of over 600,000 tonnes of GHGs per year for shipments of approximately 2.4 million tonnes of iron ore per year and applying a marine shipping emission factor of 0.01 kg GHG/tonne cargo per km (as per Notgemeinschaft der Flughafen-Anlieger Hamburg E.V. (n.d.)).

Transportation of solid pig iron from countries like Russia to a major pig iron distribution hub like New Orleans is 12,000 km, while from Belledune it is 4,500 kilometres, resulting in a reduction of about 100,000 tonnes of GHGs per year for shipments of approximately 1.5 million tonnes of pig iron per year.

Electrical Grid Intensity Effects

The electric grid intensity in Canada also results in fewer GHG emissions when compared to countries like China. Canada continues to reduce electricity production stemming from higher GHG emitting fuels (e.g. coal). As a result, Canada has a grid intensity of 0.219 kg GHG / kWh while China's grid intensity is 1.07 kg GHG / kWh and US is 0.706 kg GHG / kWh (as per Böhm et al. 2004). Implementing Maritime Iron's Project in Canada represents a reduction of more than 1 million tonnes of GHGs per year for use of 165 MW of power.

Comparison of Effects

Figure 6.12 demonstrates that if an identical integrated FINEX-Power Plant facility was built in Qingdao (China), the Gulf Coast (New Orleans) or Belledune the direct GHGs intensities would be identical. A large difference is represented by the indirect GHGs which take into consideration the grid intensity and the logistic distances.

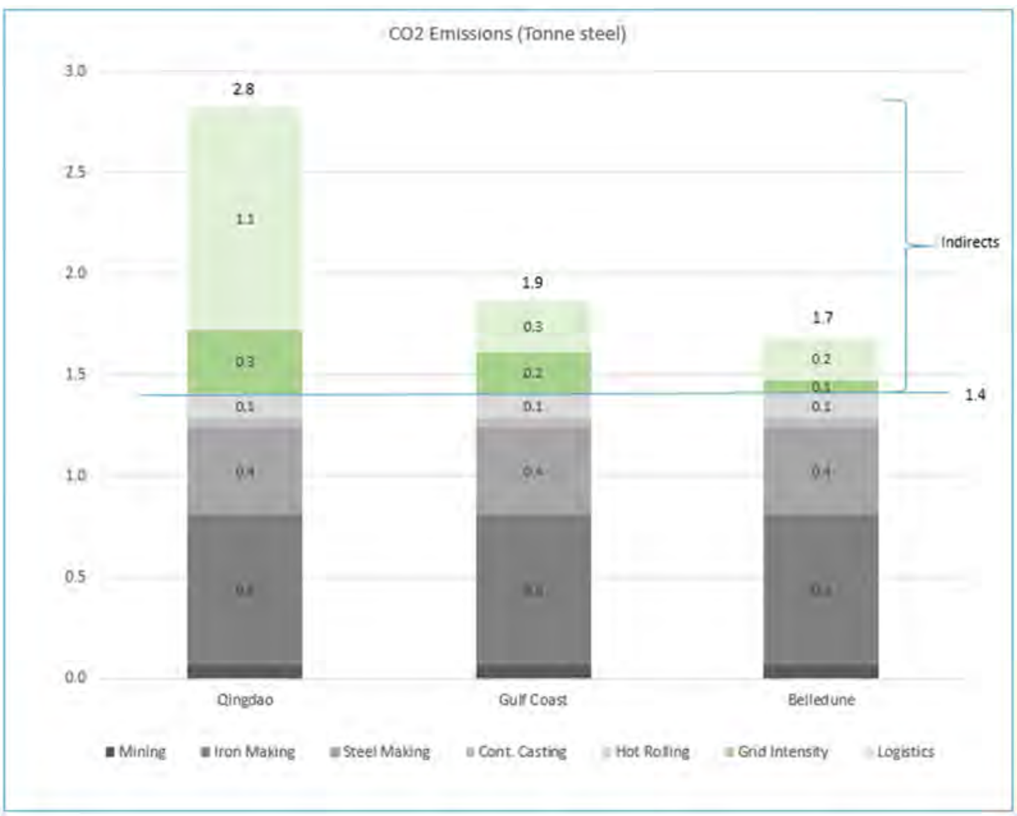


Figure 6.12 CO_2 Emissions from FINEX-Power Plant by Jurisdiction

As represented in the above Figure 6.12, building and operating a similar facility in China would generate indirect emissions of 1.4 t of CO_2 per tonne of steel, while building and operating a similar facility in the U.S. would generate indirect emissions of 0.5 t of CO_2 per tonne of steel.

Building and operating the facility in Belledune as per the current proposed Project would generate the lowest indirect emissions of 0.3 t of CO_2 per tonne of steel.

Belledune, New Brunswick's geographic location provides a further global GHG displacement opportunity. These jurisdictional considerations would see significantly reduced transportation routes from production to market and corresponding local electric grid intensity with the following benefits:

- Reduction of 1.1 t of CO_2 per tonne of steel by not locating production in China; and
- Reduction of 0.2 t of CO_2 per tonne of steel by not locating production in US Gulf Coast.

End of text provided by Maritime Iron Inc.

6.3.3 Regulatory Context

There is currently no provincial legislation regulating the production of GHG emissions from industrial activities in New Brunswick. However, in 2017, the New Brunswick Department of Environment and Local Government (DELG) required industrial facilities that released more than 10,000 tonnes of carbon dioxide equivalent (t CO_2e) per year to report their emissions to ECCC by June 1 each year. Facilities that release over 50,000 t CO_2e per year are also required to submit a GHG management plan to DELG. This was implemented through the industrial air quality approval to operate process under New Brunswick's *Air Quality Regulation*.

Additionally, industrial facilities in New Brunswick that meet certain reporting thresholds are required by federal legislation to quantify and report GHG emissions from their operations to the federal GHG Reporting Program. The GHG Reporting Program does not set limits on the types or quantities of GHGs released.

In June 2019, DELG issued for public comment New Brunswick's proposed approach for the regulation of GHG emissions from the industrial and electricity generation sectors through a New Brunswick output-based pricing system. The draft regulations for such a system have not been published and the province is currently listed as one required to comply with the 2019 federal act and regulations discussed below.

At the federal level, beginning on January 1, 2019, the Government of Canada began implementing an output-based pricing system (OBPS) for industrial facilities across Canada (ECCC 2018b) for the provinces that have not implemented an acceptable provincial program, including New Brunswick (Bennett Jones LLP 2018). Some other provinces have their own systems that have been accepted by ECCC. The applicable legislation, regulations, and other documents relating to the deferral system include (GOC 2018):

- *Greenhouse Gas Pollution Pricing Act (S.C. 2018, c. 12, s. 186)*
- *Output-based Pricing System Regulations (SOR/2019-266)*

- *Notice Establishing Criteria Respecting Facilities and Persons and Publishing Measures (SOR/2018-213)*
- *Greenhouse Gas Emissions Information Production Order (SOR/2018-214)*

The federal OBPS is designed to encourage industrial facilities releasing 50,000 t CO_2e or more per year of GHGs to reduce their GHG emissions. The OBPS sets GHG emissions intensity targets based on the type of activity undertaken at an industrial facility based on the industry-wide emissions intensity average for that activity. Industrial facilities that have higher GHG emissions than the limit imposed by the OBPS will pay a carbon price on the emissions over the limit. If a facility's emissions are below the OBPS limit, the facility will receive credits that can be traded. Schedule 1 of the OBPS lists the covered industrial activities and their sub-activities and the related output-based CO_2e intensity standards (ECCC 2019b). As the Project is using a new-to-Canada industrial technology and processing method, at present there is not a prescribed category for the Project within the regulations. It is anticipated that discussions with ECCC will be required to either confirm the inclusion of FINEX technology within the iron/steelmaking category or create a new category under the regulations to cover the Project.

The first year for which reporting will be required under the OBPS is 2019. Third-party verification of reported GHGs is required for facilities reporting under the OBPS. New facilities are not required to compensate for excess emissions in their first two full calendar years of production and are also not eligible to receive surplus credits in respect of those years.

In conjunction with the requirements on large industrial facilities, a monetary charge on fossil fuels (e.g., natural gas, gasoline) will also be put into place. In the Province of New Brunswick's "New Brunswick's Carbon Pricing Plan" (Province of New Brunswick 2018), the Province has already implemented (in April 2018) carbon pricing of gasoline and diesel using the federally mandated rates. Industrial facilities that report under the OBPS and use fossil fuels as part of their operation are exempt from paying the monetary charge on fuel as they would pay for their GHG emissions through the OBPS.

6.3.4 Spatial Boundaries

The assessment of potential environmental interactions between the Project and greenhouse gas emissions is focused on a PDA and a LAA.

The PDA for the Project is defined as the area of physical disturbance associated with the construction, operation, and maintenance of the Project. As described in Section 2.5, for the purposes of this assessment, the PDA includes the land within the property boundaries of PID 20616322, PID 20598090, and PID 20277927 as well as associated ancillary facilities and temporary work spaces. The PDA is depicted on Figure 2.4.

The LAA for greenhouse gases is defined as the area within which the environmental effects of the Project can be measured or predicted. For considering a potential change in GHGs, an LAA is not relevant. GHG emissions are a regional (e.g., provincial), national, and global concern.

6.3.5 Temporal Boundaries

The temporal boundaries for the assessment of the potential environmental effects on GHG emissions include:

- construction – scheduled to begin in Q1 2020 and last for approximately 3 years; and
- operation and maintenance – scheduled to begin in Q4 2022 and continue for the life of the new facilities, currently anticipated to be in excess of 30 years.

6.3.6 Existing Conditions

6.3.6.1 Approach and Methods

Information on greenhouse gas emissions in New Brunswick and Canada were obtained from Canada's latest National Inventory Report (NIR) (ECCC 2018a), which was released for the 2016 calendar year in 2018. The NIR contains emissions data aggregated to the sector, provincial, and national levels. The NIR is available on-line.

Information regarding the GHG emissions from large industrial facilities in New Brunswick and from other iron producers in Canada and globally was obtained from Canada's federal GHG reporting program (GOC 2018) and various publicly available references for global GHG emissions.

The World Resources Institute's Climate Analysis Indicators Tool provides a comprehensive database for global GHG emissions data of all major sources and sinks. The latest year for GHG emissions on the database was 2014 (WRI 2015).

Emissions from the iron and steel industry are also presented based on several sources, to provide some further context to expected emissions from this industry.

6.3.6.2 Existing Conditions

The 2018 NIR shows GHG emissions from the iron- and steel-making sector in Canada to be approximately 14,810,000 t CO_2e in 2016, consisting of 5,500,000 t CO_2e from stationary combustion activities and 9,310,000 t CO_2e from industrial process emissions. The industrial process emissions are those from coke production activities from a coking plant which is required for traditional blast furnace operations. Emissions from the iron- and steel-making sector (including both stationary combustion and industrial process emissions) in Canada account for approximately 2.1% of Canada's reported 2016 GHG emissions (ECCC 2018a). The majority of these emissions occur in Ontario (92%), with remaining emissions from Québec (7%), Alberta (0.7%), and Saskatchewan (0.7%) (ECCC 2018a).

A summary of GHG emissions from large iron producing facilities in Canada that reported to the federal GHG reporting program in 2016 is presented in Table 6.23. These selected large facilities represent 88% of Canada's reported iron and steel manufacturing emissions. Note that these emissions only include direct onsite emissions (electricity use from offsite generation would not be included). The facilities below are mostly integrated iron and steel facilities; that is, the facilities have more emission sources than those related to the Project as they produce both iron and various types of finished steel whereas the Project is only producing pig iron as described later in this section. For these reasons, the emissions intensities of these facilities are not directly comparable to the Project however they are provided as a general Canadian steel industry GHG profile.

Table 6.23 GHG Emissions from Largest Iron and Steel Industrial Facilities in Canada - 2016

Facility	Processes	Production (Mtpa)	CO_2 (t)	CH_4 (t CO_2e)	N_2O (t CO_2e)	Total (t CO_2e)	Percent of Canada Iron and Steel Emissions
ArcelorMittal Dofasco (Hamilton, ON)	BF iron production, coking, BOF steel-making, steel finishing	Steel, 3.7	4,872,159	15,964	6,317	4,896,817	33%
U.S. Steel Canada Inc. Lake Erie Works (LEW) (Haldimand County, ON)	BF iron production, coking, BOF steel-making, steel finishing	Steel, 2.4	3,131,685	17,732	1,481	3,150,898	21%
Essar Steel Algoma Inc. (Sault Ste. Marie, ON)	BF iron production, coking, BOF steel-making, steel finishing	Steel, 2.3	2,615,843	20,570	9,059	2,645,472	18%
Rio Tinto Fer et Titane Inc. Complexe de Sorel-Tracy (QC)	Ilemenite reduction, iron refining and steel-making, TiO_2 refining	TiO_2 slag, 0.9 Cast iron and steel, 0.7	914,456	108	1,699	917,171	6.2%
ArcelorMittal Montréal Usine de réduction (Contrecoeur, QC)	Direct reduced iron production	Direct reduced iron, 1.6	691,266	395	298	691,959	4.7%
U.S. Steel Canada Inc. Hamilton Works (ON)	Steel finishing, coking	Steel and coke, uses feedstock from LEW	217,829	8,515	1,435	227,779	1.5%
EVRAZ Inc. (Regina, SK)	EAF steel-making	Steel, 1.0	178,582	9	623	179,215	1.2%
Silicium Québec (Bécancour, QC)	Submerged light-arc furnace	Silica ferroalloy, silicium metal, 0.05	173,965	2,638	1,392	177,995	1.2%

Table 6.23 GHG Emissions from Largest Iron and Steel Industrial Facilities in Canada - 2016

Facility	Processes	Production (Mtpa)	CO_2 (t)	CH_4 (t CO_2e)	N_2O (t CO_2e)	Total (t CO_2e)	Percent of Canada Iron and Steel Emissions
ArcelorMittal Montréal Aciérie (Contrecoeur, QC)	EAF steel-making	Steel, 2.0	175,155	25	235	175,415	1.2%

Notes:

Emissions data are from GOC 2018

ArcelorMittal Dofasco and Rio Tinto Fer et Titane also reported emissions from sulphur hexafluoride (SF_6) and hydrofluorocarbons (HFCs), respectively.

Canada Iron and Steel emissions for 2016 are 14,810,000 t CO_2e (ECCC 2018a)

BF – blast furnace

BOF – basic oxygen furnace

EAF – electric arc furnace

Greenhouse gas emissions from activities in New Brunswick were reported as 15,300,000 t CO_2e for the 2016 reporting year (ECCC 2018a). The New Brunswick GHG emissions as reported in the NIR (ECCC 2018a) are shown in Figure 6.13.

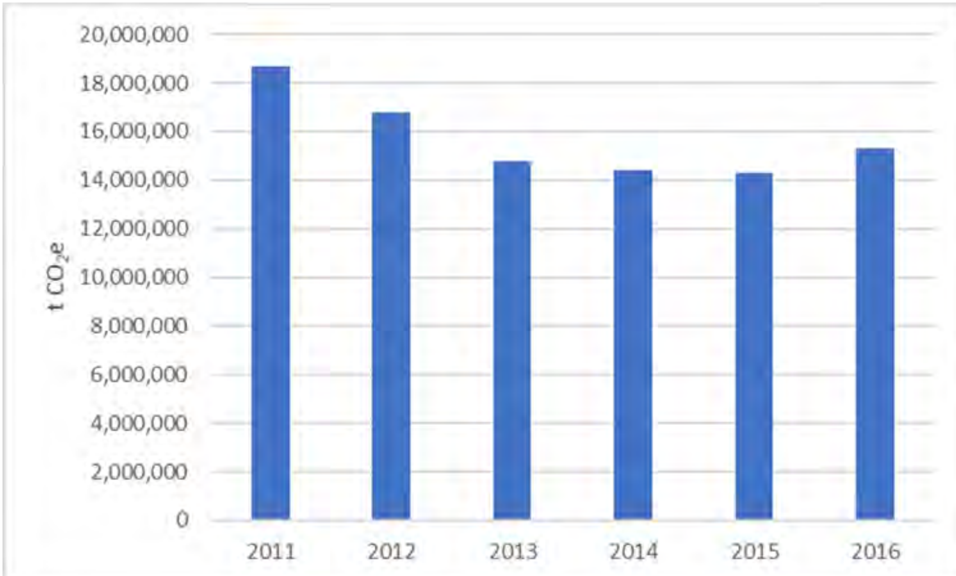


Figure 6.13 Trend in New Brunswick GHG Emissions

New Brunswick GHG emissions decreased between 2011 and 2015 and increased approximately 7% in 2016 over 2015. In the early 2000's New Brunswick's provincial GHG emissions were above 20,000,000 t CO_2e. The reductions have occurred mainly through the loss of industry and fossil fuel electrical generating capacity (ECCC 2018a).

Table 6.24 presents a summary of GHG emissions from the largest industrial facilities in New Brunswick that reported to the federal GHG reporting program in 2016.

Table 6.24 GHG Emissions from Six Largest New Brunswick Industrial Facilities - 2016

Facility	CO_2 (t)	CH_4 (t CO_2e)	N_2O (t CO_2e)	Total (t CO_2e)	Percent of NB Emissions
Irving Oil Refinery (Saint John)	2,985,357	3,348	18,598	3,007,303	20%
NB Power Belledune Thermal Generating Station (Belledune)	2,756,151	587	10,490	2,767,227	18%
Bayside Power Generating Plant (Saint John)	648,689	325	11,592	660,606	4%
NB Power Coleson Cove Generating Station (Saint John)	536,553	123	2,751	539,427	4%

Table 6.24 GHG Emissions from Six Largest New Brunswick Industrial Facilities - 2016

Facility	CO_2 (t)	CH_4 (t CO_2e)	N_2O (t CO_2e)	Total (t CO_2e)	Percent of NB Emissions
Glencore Brunswick Smelter (Belledune)	201,470	186	1,570	203,226	1%
AV Group Nackawic Mill (Nackawic)	69,875	23,208	10,648	103,731	0.7%

Notes: Data are from GOC 2018

GHG emissions from the Belledune Thermal Generating Station were reported to the federal GHG reporting program as 2,767,227 t CO_2e for the 2016 reporting year (GOC 2018). The Belledune Thermal Generating Plant contributes approximately 18% of New Brunswick's GHG emissions and is the second largest GHG emitter in the province after the Irving Oil Refinery in Saint John.

Canada's national GHG emissions are 704,000,000 t CO_2e, and therefore GHG emissions from New Brunswick account for approximately 2.2% of national GHG emissions.

Global GHG emissions were estimated to be 48,892,000,000 t CO_2e in 2014 (from all sources including land use change and forestry) (WRI 2015). Therefore, Canada's contribution to global GHG emissions is approximately 1.4%, and New Brunswick's contribution to global GHG emissions is approximately 0.03%.

Technology Considerations for Steel Production Routes

Almost all the iron produced globally is used directly for steel production. Growth within the global steel market is approximately 4 to 5% annually based on a current production of 1,700 Mtpa (Deloitte 2018).

There are two main routes used for steel production:

- the traditional integrated BF/BOF route, which is based on the production of iron from iron ore raw material, typically using a conventional BF for iron-making, and then using a BOF for steel-making; and
- the recycling EAF route, which uses scrap steel as the main iron bearing raw material in EAF steel-making.

In both cases, the energy consumed comes from solid fuel (mainly coal and coke) and electricity.

The reduction of iron ore to iron in a BF is the most energy-intensive process within the steel industry. The BF/BOF steel production route is more energy intensive and emits more CO_2 than the EAF steel production route (Aichinger and Steffen 2006 in Hasanbeigi et al. 2015). In contrast, the EAF steel production route re-melts scrap metal to produce steel, providing energy savings by recycling scrap.

The Project's production of pig iron would be used as feedstock to the EAF steel production route, creating a new FINEX/EAF route, thereby contributing to an overall reduction of ~40% in the GHG intensity of global iron- and steel-making production on a per tonne of steel basis (WSP 2015). This production route differs from Posco in Asia as they run an integrated facility, which takes liquid iron and feeds directly to their onsite steel production.

The EAF steel production route, due to both its energy and environmental advantages, has been growing aggressively for the last 10 years. The growth within the EAF steel production route is approximately 8% annually and currently represents about 30% of global steel production (World Steel Association 2019). This means that about 70% of global steel is still produced using the more GHG emissions intensive BF/BOF steel production route. Therefore, increased conversion of steel production from BF/BOF to EAF represents the best path forward to reduce global GHGs associated with the production of steel. Maritime Iron's Finex Belledune Iron Processing Facility enabling the EAF steel production route will further support this conversion.

In the FINEX/EAF steel production route, the pig iron produced by the Project would supplement recycled scrap with pig iron to achieve product quality targets for EAF producers. The use of 100% scrap is not conducive to high quality steel-making. In those cases, pig iron is used to supplement scrap to create high quality and premium steel products (e.g., used for wind turbine production, the aviation industry, and to build more fuel-efficient vehicles that produce fewer GHGs).

In terms of reducing agents for iron ore that can be used for pig iron production, natural gas would be the lowest technically feasible GHG emitting option. This option is not feasible in New Brunswick due to inadequate or no availability of natural gas as is the case with the Belledune location. Coal-based reduction of iron ore to produce pig iron, with subsequent charging of pig iron to an EAF, offers the next best option.

In order to assess GHG emissions associated with the two steel production routes, it is important to start from a consistent benchmark of data. The WSP Parsons Brinkerhoff study (WSP 2015) prepared for the Department of Energy and Climate Change and the Department for Business, Innovation and Skills in the UK benchmarked key GHG intensities for various unit operations in the iron and steel industry (WSP 2015). Figure 6.14 below shows Graph 6.2 from a study titled *Industrial Decarbonisation & Energy Efficiency Roadmaps to 2050, Iron and Steel* identifies the direct emissions in blue and indirect emissions in purple (Carbon Trust 2011 in WSP 2015). From this figure, iron-making accounts for the largest share of direct emissions (1.1-1.8 tonne CO_2/tonne hot rolled coil from BF), followed by sintering (in a sintering plant), steel-making and coke making (in a coking plant) (0.4-0.7, 0.2-0.3, and 0.1 tonne CO_2/tonne hot-rolled coil from BF respectively). With regards to indirect emissions, the highest share comes from hot rolling of steel followed by continuous casting of steel (0.2-0.3 and less than 0.1 tonne CO_2/tonne hot-rolled coil from BF respectively).

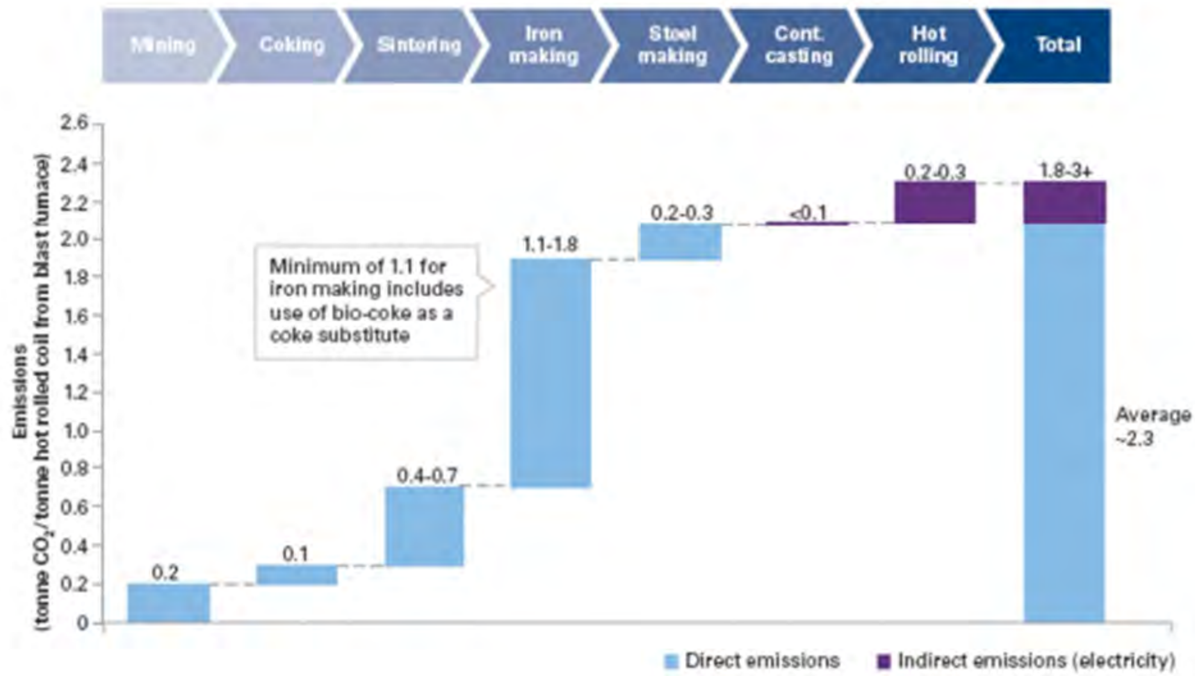


Figure 6.14 Direct and Indirect emissions from the BF-BOF production of steel (Graph 6.2, Carbon Trust (2011) in WSP 2015)

WSP (2015), which reports a 2.1 t GHG/t intensity for steel production is found to be consistent with the European Commission (2012), JRC Scientific and Policy Reports which identifies 2.2 t GHG/t intensity for steel production and also several other various reports.

Overall, GHG intensities in the steel-making industry have been decreasing due to the introduction of new technological developments classified as Best Available Technologies (BAT) or Innovative Technologies (IT) in the European Commissions (2012), JRC Scientific and Policy Reports.

Best Available Technologies are applied to the traditional BF/BOF steel production route and contribute to the environmental improvements in the sector. Even with the inclusion of all BATs, the BF/BOF theoretical emissions limit is such that there is limited opportunity to improve CO_2 emissions (i.e. will remain at about 2.1 t GHG/t steel). The list below identifies the most significant BATs for the BF/BOF steel production route with their associated GHG reduction potentials:

- Power Plant (-0.44 tGHG/t) - an integrated power plant included to process exhaust gases.
- Coke Dry quenching (-0.08 tGHG/t)
- BOF waste heat recovery (-0.05 tGHG/t)
- Continuous casting (-0.12 tghgGHG/t)

Innovative Technologies (IT) are considered separately as they are large scale changes impacting the overall steel production route.

- **Corex / FINEX**, Pig Iron production from iron fines using coal based reduction (-0.81 tGHG/t) – note that FINEX is a further development of Corex.
- **Midrex / HYL**, DRI production by reduction of iron pellets with natural gas (-1.05 tGHG/t) – note that this alternate iron-making technolology would not be feasible in Belledune as it requires natural gas.
- **Direct Sheet Plant**, integration of steel production: casting, rolling etc (-0.07 tGHG/t) – note that this is not applicable to the Project (no casting and rolling).
- **Carbon Capture and Storage**, absorption of CO_2 in a liquid followed by underground storage - not yet commercially available at the scale required by the iron- and steel-making industry.

Using this benchmark data set, it is represented in Figure 6.15 below how the FINEX/EAF steel production route using 70% recycled scrap steel and 30% FINEX pig iron will allow for a substantially lower overall GHG intensity (1.2 - 1.4 t GHG/t steel). This is consistent with the findings of the European Commisions (2012), JRC Scientific and Policy Reports which ultimately concludes that "…only new ITs have the potential to substantially alter CO_2 emissions…".

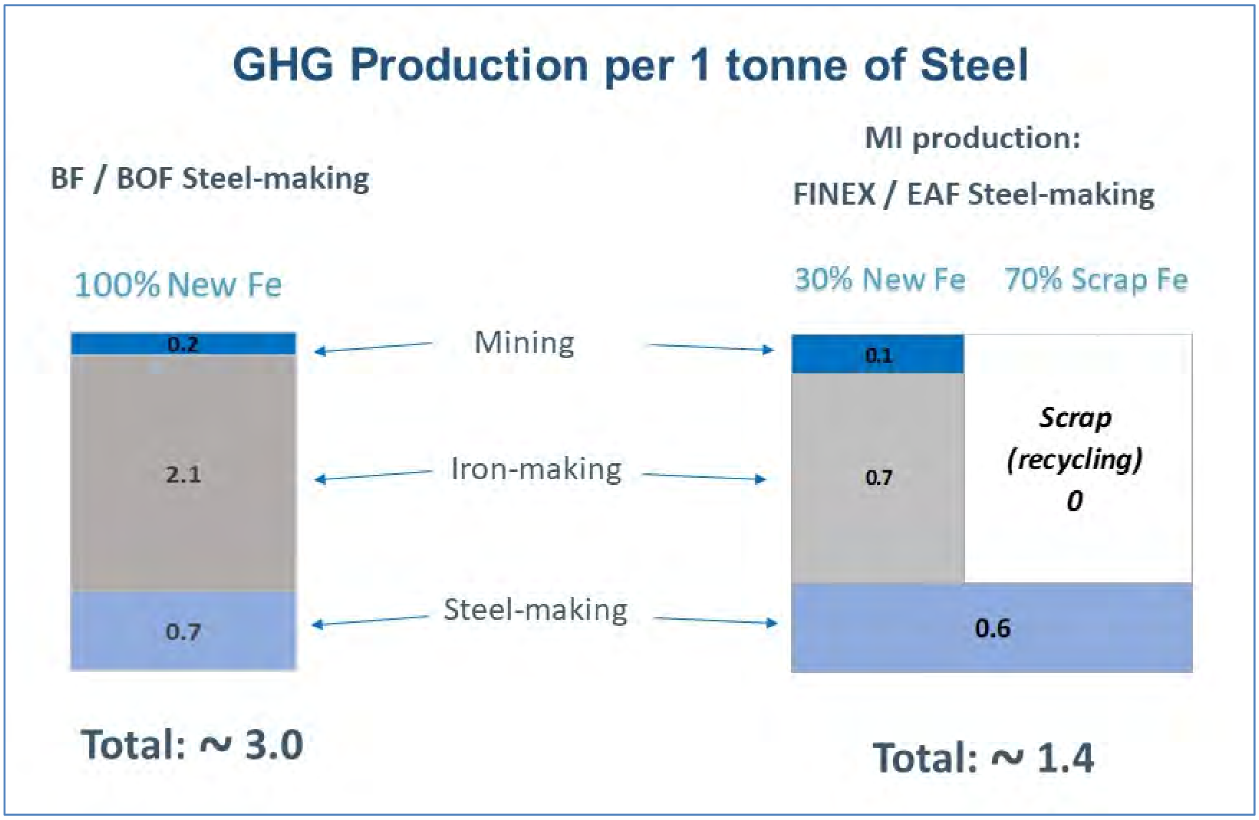


Figure 6.15 Comparison of Traditional BF/BOF Steel-making (WSP 2015) to Maritime Iron Production for FINEX/EAF Steel-making

The above Figure 6.15 compares the conventional BF iron-making method and traditional integrated steel-making route (BF/BOF route) to Maritime Iron's innovative FINEX iron-making and EAF steel-making (FINEX/EAF route).

The BF/BOF steel-making route (left data set) creates:

- 0.2 t CO_2 per tonne of steel to mine the raw materials;
- 2.1 t CO_2 per tonne of steel to produce iron via BF to feed the BOF steel-making process;
- 0.7 t CO_2 per tonne of steel to produce the finished steel product from BOF.

Thus, the total GHG intensity per tonne of steel produced using the BF/BOF route is ~3.0 t CO_2 / t steel (WSP 2015).

The FINEX/EAF steel-making route (right data set) which considers 30% pig iron and 70% scrap (recycled) steel creates:

- 0.1 t CO_2 per tonne of steel to mine the raw materials (particularly since only 30% of new iron (Fe) is required to be produced);
- 0.7 t CO_2 per tonne of steel to produce pig iron via FINEX to feed the EAF steel-making process (particularly since only 30% of new iron (Fe) is required to be produced);
- 0.6 t CO_2 per tonnes of steel to produce the finished steel product from EAF.

Thus, the total GHG intensity per tonne of steel produced using the FINEX/EAF route is ~1.4 t CO_2 / t steel.

Even when accounting for different reporting methodologies and differences in GHG intensities across various jurisdictions, the following Figure 6.16 prepared by Maritime Iron based on the widest values found in published materials provides further comparison of the BF/BOF route and FINEX/EAF route for steel production.

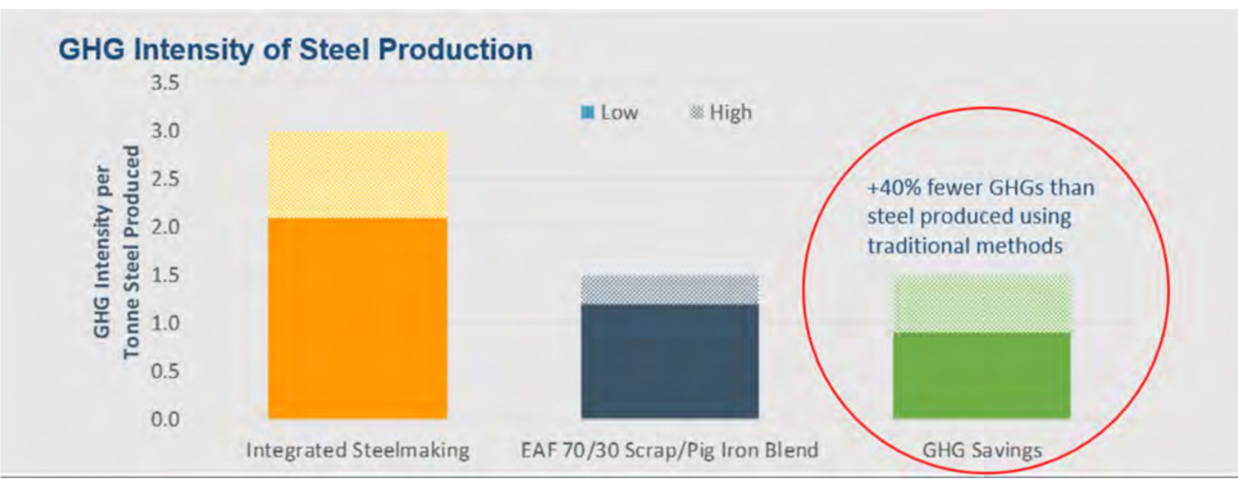


Figure 6.16 Comparative GHG Intensity per Tonne Steel Produced

It can be seen that even when comparing the lowest GHG intensity for a BF/BOF route (2.1 t CO_2 / t steel) to the highest GHG intensity for a FINEX/EAF route (1.5 t CO_2 / t steel) that the FINEX/EAF route allows for steel production at a GHG intensity that is 0.6 t CO_2 / t steel lower than the BF/BOF route.

Additionally, WSP (2015) identifies the transition from BOF to EAF steel-making to be a "significant option to reduce carbon emissions, but it indicates a switch to electricity and reliance on grid decarbonization" would be required. For Canada this is of specific interest due to the low carbon footprint of the electrical grid. The Project has reliance on the New Brunswick electrical grid to supply the FINEX iron-making and Oxygen Plant, therefore any grid GHG intensity reductions that occur in the future would contribute to reductions in indirect Project GHG emissions.

In the face of environmental concerns, the global steel industry has been advancing energy-saving and recycling technologies and developing steel-making processes to replace the conventional BF iron-making and BOF steel-making processes. New iron-making technologies are being developed to replace the traditional integrated BF/BOF steel production route, and support the EAF steel production route, including POSCO's FINEX iron-making process which uses fine iron ore and non-coking coal to reduce energy use to create a sustainable FINEX/EAF steel production route.

6.3.7 Potential Project Interactions with Greenhouse Gases

Activities and components could potentially interact with GHG emissions to result in adverse environmental effects on GHG emissions. In consideration of these potential interactions, the assessment of Project-related environmental effects on GHG emissions is therefore focused on the potential environmental effects listed in Table 6.25. These potential environmental effects will be assessed in consideration of specific measurable parameters, also listed in Table 6.25.

Table 6.25 Potential Environmental Effects and Measurable Parameters for GHG emissions

Potential Environmental Effect	Measurable Parameter
Change in GHG Emissions	• Emissions of GHGs (carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) in units of tonnes of carbon dioxide equivalent per year (t CO_2e/yr).

Table 6.26 identifies the physical activities that may interact with the VC and result in an environmental effect. These interactions are discussed in detail in the following sections, including potential environmental effects, mitigation and environmental protection measures, and residual environmental effects.

Virtually every activity being carried out for the Project may create emissions and interact with GHG emissions. Because of this, the assessment is conducted for one all-encompassing category in each phase called "emissions and wastes", to reflect the fact that emissions would be generated from various activities at various times. Thus, it is valuable to assess emissions and wastes collectively rather than separately for each individual activity.

Table 6.26 Potential Project Interactions

Project Activity	Potential Environmental Effect Change in GHG emissions
Construction	
Site Preparation (e.g., clearing, grubbing)	-
Construction of Project facility Footprint (including excavation and installation of building foundations and creation of storage areas, and construction of ancillary infrastructure)	-
Installation of Equipment (including fluidized bed reactors and melter gasifier and ancillary equipment)	-
Employment and Expenditure	-
Emissions and Wastes	✓
Operation	
Production of Pig Iron	-
Ground Transportation (including trucking of burnt lime material, limestone and dolomite material)	-
Employment and expenditure	-
Emissions and Wastes	✓

✓ indicates an interaction

- indicates no interaction

6.3.8 Potential Effects to GHG Emissions During Construction

The construction of the Project components has the potential to interact with GHG emissions in the following ways:

- CO_2, CH_4, and N_2O emissions from the combustion of fossil fuels in heavy mobile equipment for site preparation and Project facility construction

Burning of debris is not expected as part of the Project. GHG emissions from trucking of materials and equipment to the site have been excluded from the effects assessment as details on the number and distances travelled are not known at this preliminary stage. Typically, GHG emissions from trucking are not substantive in comparison to emissions from heavy mobile equipment while on-site.

6.3.9 Potential Effects to GHG Emissions During Operation and Maintenance

The FINEX process generates a by-product gas that contains CO_2, CO, H_2, CH_4, and N_2. The energy content of the by-product gas is sufficient to use as a fuel source for :

- The Finex facility for drying of raw materials and providing heat to various internal operations; and
- Electricity generation at the NB Power Belledune generating station (Displacing over 50% of current coal consumption)

The CO_2 that is already present in the by-product gas following its generation during pig iron production flows through the NB Power generating station without contributing to any power generation. It is released to the atmosphere along with CO_2 that is the product of NB Power's combustion of the remaining carbon monoxide and methane (CO and CH_4) in the by-product gas.

The operation and maintenance of the Project has the potential to interact with GHG emissions in the following ways:

- CO_2, CH_4, and N_2O emissions from the combustion of off gas at the Project facility (for drying and process heating)
- CO_2, CH_4, and N_2O emissions from the combustion of LPG (Propane) for the flare pilot
- CO_2 in the off gas that is generated through the pig iron-making process (present in the FINEX Export Gas (FEG) sent to NB Power's Belledune Thermal Generating Station and released through the Station's stack)
- CO_2 generated from the combustion or flaring of CO and CH_4 in the off gas that is not sent to NB Power's Belledune Thermal Generating Station (during an emergency event as described further in Section 6.2).

Because the Project facility will be integrated with NB Power's Belledune Thermal Generating Station, GHG emissions will be affected at NB Power's Belledune Thermal Generating Station by the Project. Thus, this assessment includes evaluation of the overall emissions from the integrated site. The following emissions are considered from NB Power's Belledune Thermal Generating Station:

- GHG emissions - CO_2, CH_4, and N_2O emissions associated with coal combustion and by-product gas combustion

Indirect GHG emissions (occurring offsite but required as part of the Project) include those from the use of grid electricity by the Project facility and the Oxygen Plant. Although not under the direct control of Maritime Iron, these emissions have been considered in the assessment because electricity use is a primary energy input for the Project.

Another indirect source of GHGs associated with operation of the Project is the transportation of raw materials, such as ore, coal, and finished product to and from the Port of Belledune. As described in Section 2.0, raw materials and products will be transported via marine vessels through the Port of Belledune. The GHG emissions associated with transportation, including those associated with marine vessel operation at the Port of Belledune, are not under the direct control of Maritime Iron. The considerations for GHG emissions resulting from shipping of raw materials and products is evaluated as part of the assessment of jurisdication benefits for the Project.

6.3.10 Mitigation

Interactions between Project activities and GHG emissions will be managed through the use of various mitigation measures. The following mitigation measures specific to GHG emissions have been identified for this Project.

During construction:

- using construction equipment that is well maintained;
- implementing an idling awareness program to reduce unnecessary idling; and
- reducing haul distances to disposal sites.

During operation and maintenance:

- The product produced by the Project will be used at other facilities using the EAF steel production route, which allows for use of recycled scrap and a substantial reduction in GHG emissions as compared to traditional steel production methods most commonly used globally.
- The location of the Project will substantively reduce shipping distances currently observed in the transportation of iron ore (e.g., ore shipped from Sept-Îles, Québec currently travels approximately 28,000 km to China along its typical route around the Cape of Good Hope (South Africa), while the Project is located approximately 425 km from Sept-Îles). Further, pig iron from the Project is anticipated to be sold to markets in the eastern United States, which is a short sail from the Project.
- Maritime Iron will implement energy efficiency measures where feasible in the design;
- Integration of the Project with NB Power’s Belledune Thermal Generating Station resulting in lower coal use. Without the integration with NB Power’s Belledune Thermal Generating Station, the Project facility would include an internal power plant that combusts the off gas that is not needed for process heating. The internal power plant would produce power for internal consumption and export the residual power (approximately 45 MW) to the NB Power electricity grid. NB Power’s Belledune Thermal Generating Station would continue to produce electricity from coal at typical load. The integration with Project facility allows NB Power’s Belledune Thermal Generating Station to consume over 50% less coal (depending on annual load requirements). Estimates of GHG emissions from the standalone and integrated scenarios are presented in Section 6.3.11.2 below.
- Maritime Iron will work with their supply chain to reduce GHG emissions from upstream and downstream activities as feasible.
- Maritime Iron will comply with any implemented provincial or federal GHG reporting and compliance requirements.

Maritime Iron is committed to the development and management of a Greenhouse Gas Management Plan, with the following elements:

- Climate change policy
- Emission reduction targets
- Greenhouse Gas Emissions Inventory Management Plan
- Energy management, including ongoing plans to identify and evaluate savings initiatives
- Industry GHG benchmark comparisons
- Tracking of greenhouse abatement measures
- Research and development strategy

The Project design team is also considering available feasible measures to reduce energy consumption, and therefore, reduce direct and indirect associated GHG emissions onsite and via electricity use.

6.3.11 Characterization of Residual Project-Environmental Interactions

6.3.11.1 Construction

GHG emissions from heavy construction equipment were estimated based on the anticipated area of site preparation and the typical mobile combustion equipment for site preparation and infrastructure installation. The emissions were calculated for the entire construction period (3 years).

Approximately 53 ha of land will be cleared for the Project and a GHG estimate was completed on this basis. The use of 53 ha is a conservatively high estimate as the 53 ha represents a large majority of the entire Project site, rather than the physical footprint of the Project facility and infrastructure.

The equipment and operating hours included in the estimate were based on typical equipment required for site preparation and construction and engine information from the Caterpillar Performance Handbook (2014).

The GHG emissions associated with construction activities are shown in Table 6.27.

Table 6.27 GHG Emissions from Construction Activities

Activity	GHG Emissions (t CO_2e)
Site preparation	720
Installation of Infrastructure	9,969
Total	**10,670**

GHG emissions are anticipated to be approximately 10,670 t CO_2e over the construction period. These emissions represent approximately 0.07% of New Brunswick's 2016 GHG emissions.

6.3.11.2 Operation and Maintenance

The primary GHG emitted from the Project facility is CO_2, as it is generated from the FINEX process principally due to the reduction of iron with coal and the decomposition of limestone and dolomite. Although CH_4 is also present in the off gas, when combusted it is oxidized to CO_2 and H_2O. Based on the low percentage of CH_4 in the off gas, it is assumed that all CH_4 will be oxidized to CO_2 (i.e., no CH_4 is directly released to atmosphere).

The Project facility is being designed for integration with NB Power's Belledune Thermal Generating Station to manage overall GHG emissions from the two facilities and make efficient use of shareable infrastructure.

FINEX Process Direct GHG Emissions

Direct GHG emissions for the FINEX process are based on anticipated pig iron production levels and engineering estimates of process emissions. In addition to coal and off gas, a small amount of LPG (Propane) is used in the Project for the pilot light in the flare in either scenario. Approximately 3.5 million cubic metres per year of LPG (Propane) is anticipated to be combusted, which represents approximately

5,627 t CO_2e per year. This is negligible to the total GHG emissions and therefore not carried forward. The direct GHG emissions from the Project facility are presented in Table 6.28.

Table 6.28 Direct GHG Emissions from Maritime Iron Project Facility – Operations

Facility	Emissions of CO_2 in By-Product Gas (t CO_2/a)	CO_2 Emissions from Combustion of By-Product Gas (t CO_2/a)	Total Direct GHG Emissions (t CO_2/a)
Maritime Iron	1,573,552	189,280	1,762,832

The total direct emissions of GHG from the Project facility are anticipated to be 1,762,832 t CO_2e per year. These emissions represent approximately 12% of New Brunswick's 2016 GHG emissions (ECCC 2018a). The direct GHG intensity of the FINEX process, is approximately 1.2 tonnes of CO_2 per tonne of pig iron product (based on 1.45 Mtpa pig iron production).

Power Production Direct GHG Emissions

The Project facility exports the by-product gas that is not needed for process heating (the majority of by-product gas is exported) to NB Power's Belledune Thermal Generating Station as a fuel source. The FEG would replace over 50% of coal burned by NB Power's Belledune Thermal Generating Station. The Project facility draws electricity from the NB Power electricity grid for Project electricity needs including for the Oxygen Plant (third-party owned).

By integrating with Maritime Iron, operations at NB Power's Belledune Thermal Generating Station can continue beyond 2029 as the reduced coal use brings the facility in alignment with the *Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity Regulations* and the *Canadian Environmental Protection Act*.

Direct emissions have been estimated for the Project facility and NB Power's Belledune Thermal Generating Station based on the anticipated operating parameters at both facilities with the implementation of the Project.

In addition to the CO_2 contained in the by-product gas, the remaining components CO, H_2, CH_4 are further used for combustion to produce power. This would generate an additional 1.9 million tonnes CO_2 as indicated in Table 6.29.

Table 6.29 Direct CO_2 Emissions from Combustion of By-Product Gas for Power Production – Operations (NB Power Belledune Generating Station)

Facility	Emissions of CO_2 in By-Product Gas (t CO_2/a)	CO_2 Emissions from Combustion of By-Product Gas [1] (t CO_2/a)	Total Direct GHG Emissions (t CO_2/a)
Maritime Iron / NB Power	N/A	1,921,623	1,921,623

Note:
[1] Complete combustion of the by-product gas, resulting in no emissions of uncombusted CO and CH_4.
Source: NB Power

Power Consumption Indirect GHG Emissions

The electricity consumption associated with the Project facility includes up to 69 MW for the Project facility itself as well as up to 96 MW for the third-party Oxygen Plant located adjacent to the Project facility. Although the Oxygen Plant is not anticipated to be under the control of Maritime Iron, the Project facility would not be able to function without the Oxygen Plant and hence the associated indirect GHG emissions are included. The indirect GHG emissions were calculated by Stantec using anticipated electricity demand, Project facility operating hours, and the New Brunswick grid electricity consumption emission factor from the NIR (ECCC 2018a). The indirect GHG emissions are shown in Table 6.30.

Table 6.30 Indirect GHG Emissions from Integrated Maritime Iron Project Facility and Oxygen Plant – Operations

Facility	GHG Emissions from Consumption of Grid Electricity (t CO_2e/a)
Maritime Iron (69 MW)	201,310
Oxygen Plant (96 MW)	280,084
Total (165 MW)	481,394

With the integrated scenario, the by-product gas from Maritime Iron's Project facility would be used by NB Power's Belledune Thermal Generating Station, which would displace over 50% of the coal used by NB Power.

The anticipated CO_2 emissions from NB Power's Belledune Thermal Generating Station from coal combustion and FEG combustion were estimated using information on anticipated flows and composition of FEG, historical coal consumption and CO_2 emissions from NB Power's Belledune Thermal Generating Station, and various assessments performed by NB Power. The CH_4 and N_2O emission from coal combustion at NB Power's Belledune Thermal Generating Station were estimated using a 5-year average coal consumption (2013-2017) and emission factors available from the NIR (ECCC 2018a). For clarity, the NB Power emissions identify CO_2 emitted from both by-product gas (or FEG) and coal combustion.

The GHG emissions from the integrated Maritime Iron Project facility and the NB Power Belledune Thermal Generating Station are presented in Table 6.31.

Table 6.31 Total GHG Emissions from Maritime Iron and NB Power - Integrated Operations

Facility	Direct CO_2 Emissions (t CO_2e/a)	Indirect GHG Emissions from Consumption of Grid Electricity (t CO_2e/a)	Total Direct and Indirect GHG Emissions (t CO_2e/a)
Maritime Iron	1,762,832	481,394	2,244,226
Electricity – FEG Electricity – Coal	1,921,623 1,240,747	100,084	3,262,454
TOTAL	**4,925,202**	**581,478**	**5,506,680**

As described in the Project Description (Section 2.0), a standalone operating scenario configuration was investigated but determined to be less favourable than the integrated scenario configuration that is proposed by this EIA Registration. It is important to note that only the integrated scenario configuration is proposed for the Project, and the standalone scenario configuration is described only for information and comparison purposes to demonstrate the efficiencies that will be realized with integration. These configuration considerations are described in the following section below.

Configuration Considerations

The standalone scenario would entail Maritime Iron building and operating a FINEX facility as well as a power generating facility to take the by-product gas from the FINEX process. Maritime Iron would under such a standalone scenario configuration combust all of the by-product gas in its own power plant, use the generated power for internal consumption (180 MW for the FINEX facility, Oxygen Plant, and Power Plant) and export the balance of 45 MW to the NB Power grid.

NB Power's Belledune Thermal Generating Station would continue to produce electricity from coal at typical load until the end of 2029, after which it could be shut down in accordance with requirements under the *Emissions from Coal-fired Generation of Electricity Regulations.*

The CO_2 emissions associated with this standalone scenario configuration for the Project are summarized in Table 6.32 below.

Table 6.32 Total GHG Emissions from Maritime Iron - Standalone Operation

Facility by Maritime Iron	Emissions of CO_2 in By-Product Gas (t CO_2/a)	CO_2 Emissions from Combustion of By-Product Gas (t CO_2/a)	Indirect GHG Emissions (t CO_2/a)	Total GHG Emissions (t CO_2/a)
Iron Production	1,573,552	189,280	0 (onsite generated)	1,762,832
Power Generation	N/A	2,048,598	0 (onsite generated)	2,048,598
TOTAL	**1,573,552**	**2,237,878**	**0**	**3,811,430**

The estimated GHG emissions from NB Power's Belledune Thermal Generating Station from coal combustion in the standalone scenario were based on historical coal consumption and CO_2 emissions from NB Power's Belledune Thermal Generating Station. The CH_4 and N_2O emission from coal combustion at NB Power's Belledune Thermal Generating Station were estimated using a 5-year average coal consumption (2013-2017) and emission factors available from the NIR (ECCC 2018a). The estimated standalone scenario GHG emissions from NB Power's Belledune Thermal Generating Station are shown in Table 6.33.

Table 6.33 Total Direct GHG Emissions from NB Power's Belledune Thermal Generating Station – Standalone Operation

Facility by NB Power	GHG Emissions from Coal Combustion (t CO_2e/a)	Total Direct GHG Emissions (t CO_2e/a)
Belledune Thermal Generating Station	2,603,932	2,603,932

Thus, for both the Martime Iron and NB Power standalone scenario configuration, the total GHG emissions are shown in Table 6.34.

Table 6.34 Total GHG Emissions from Maritime Iron and NB Power's Belledune Thermal Generating Station – Standalone Operation

Facility	Direct CO_2 Emissions (t CO_2e/a)	Indirect GHG Emissions from Consumption of Grid Electricity (t CO_2e/a)	Total Direct and Indirect GHG Emissions (t CO_2e/a)
Maritime Iron	3,811,430	0	3,811,430
NB Power	2,603,932	163,295	2,767,227
Total	**6,415,362**	**163,295**	**6,578,657**

Notes:
Complete combustion of the by-product gas, resulting in no emissions of uncombusted CH_4, is assumed.
In this standalone scenario configuration, 45 MW of electricity are exported by the Maritime Iron Project facility to the NB Power electricity grid.

In comparison of the GHG emissions between the integrated scenario and standalone scenario configurations, the integrated scenario configuration provides for a direct GHG emissions reduction of 1.1 million tonnes CO_2 as shown in Table 6.35.

Table 6.35 Comparison of Total GHG Emissions from Standalone vs. Integrated Scenario Configurations

Scenario Configuration	Direct GHG Emissions (t CO_2e/a)	Indirect GHG Emissions from Project Electricity (t CO_2e/a)	Total Direct and Indirect GHG Emissions (t CO_2e/a)
Standalone Operation	6,415,363	163,295	6,578,657
Integrated Operations	4,925,202	581,478	5,506,680
Difference (Standalone – Integrated)	**1,490,160**	**-418,183**	**1,071,977**

Considering both direct and indirect GHG emissions, the integration of the Project facility and NB Power's Belledune Thermal Generating Station (integrated scenario configuration) is anticipated to result in an approximate reduction of 16.3% over the standalone scenario configuration. The reduction in direct emissions is 23.3% between the standalone and integrated scenario configurations.

The increased indirect GHG emissions in the integrated scenario configuration is due to the internal power production by Maritime Iron in the standalone scenario configuration (which would not generate any additional GHG emissions as these are already accounted for in the direct GHG emissions).

The following Figure 6.17 provides an overall summary illustration of the CO_2 emissions for these two different scenario configurations - standalone verses integrated operations.

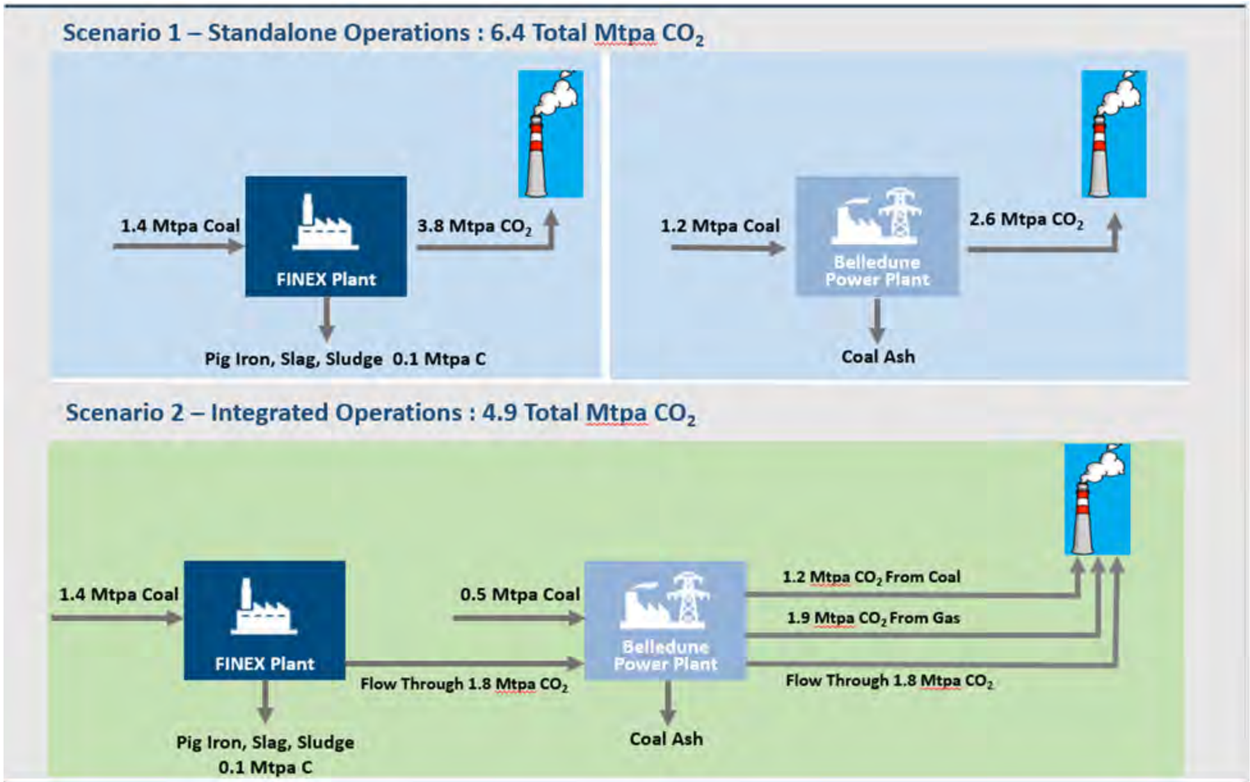


Figure 6.17 Illustration of Standalone vs. Integrated Scenario Configurations

6.3.12 Summary and Recommendations

In relation to GHGs, the Project will be considered a large emitter within the province of New Brunswick and also nationally and would therefore need to comply with existing and proposed GHG regulations as a covered facility; however, the final reporting and compliance requirements cannot be confirmed until discussions are conducted with ECCC regarding the facility technology and appropriate benchmarks. The Project is well-positioned in the global market to provide pig iron competitively and at a lower GHG intensity to North American EAF steel producers, in comparison to pig iron production facilities currently operating in Russia, Ukraine and Asia, the locations of the largest competitors.

From a technology perspective, the Project would contribute to the EAF steel production route, creating a FINEX/EAF route, which is a ~40% lower GHG intensity alternative to the BF/BOF steel production route (WSP 2015).

From a configuration perspective, the integration of the Project with the NB Power Belledune Thermal Generating Station leads to more than 50% reduction in its coal use and would allow the NBP facility to remain operational beyond 2029.

From a jurisdictional perspective, Belledune is the preferred location for the Project as it provides logistic advantages and lower indirect GHG intensity leading to substantial GHG reduction (up to 1.1t GHG/t steel) compared to locations in China or the US.

As the GHG pricing regulations in New Brunswick and Canada are still pending, the Project cannot confirm how regulatory pricing on carbon may affect the Project over the long term; however, in consideration of the current technologies in use globally, Maritime Iron expects to perform well among peers. The contribution to provincial GHG emissions is relatively large because of the energy intensive nature of iron production, at 2.3 million tonnes direct GHG emissions per year, or a 15% increase over 2016 provincial totals. The Project would contribute 0.28% to national GHG emissions and 0.004% to global emissions on an absolute basis compared to historical levels. However, it is expected that based on the market trends, the Project will not result in a change from business as usual global GHG emissions. If the Project were not implemented in New Brunswick, the pig iron production demand would still exist globally and therefore a similar facility would be built elsewhere. The EAF steel production route, due to both its energy and environmental advantages, has been growing approximately 8% annually and currently represents about 30% of global steel production (World Steel Association 2019). This means that about 70% of global steel is still produced using the more GHG emissions intensive BF/BOF steel production route. Therefore, increased conversion of steel production from BF/BOF to EAF represents a way to reduce global GHGs associated with the production of steel.

The steel industry is considered an energy intensive, trade exposed industry. In these industries, carbon leakage is a key consideration in development of these types of projects. Carbon leakage occurs if, in response to carbon caps and emission reduction targets in one jurisdiction, companies decide to reduce or cease production in that jurisdiction and transfer emissions to a jurisdiction whose environmental requirements on carbon pricing are less stringent or non-existent.

In this context, carbon reduction policies or pricing would not have achieved its objective since GHG emissions would not be reduced, but rather moved from one place to another. Carbon leakage can even lead to an increase in GHG emissions at the global level if the displaced activities release more GHGs in the jurisdiction where they are relocated due to lower standards or more polluting energy sources.

Implementing the Project would make it difficult for New Brunswick to achieve its current aspirational climate change goal of 14.8 million tonnes CO_2e by 2020 as it would increase estimated annual emissions to approximately 17 million tonnes CO_2e. Nonetheless, New Brunswick's current government has highlighted that New Brunswick has already made significant progress towards contributing to Canada's 2030 goal of cutting emissions by at least 30% below 2005 levels. Since 2005, the province has reduced its output by 24%, mostly due to closures of industrial facilities, coal and oil-fired power plants, incorporation of wind energy, restructuring in the forestry sector and investments in energy efficiency. The 2030 federal emission target for New Brunswick based on the current target of 30% below 2005 levels would be 14.3 million tonnes CO_2e. Therefore, before 2030, New Brunswick would need to identify opportunities to meet this target through reductions across all sectors, including continued efforts and cooperation by the industrial sector as well as reductions in the transportation and electricity sectors.

With the implementation of mitigation and environmental protection measures as described in this assessment, it is not anticipated that there will be substantial adverse interaction between the Project and GHG emissions during the construction, operation, and maintenance phases of the Project.

6.4 ACOUSTIC ENVIRONMENT

6.4.1 Regulatory Context

There are no noise regulations, standards or criteria currently established by the Province of New Brunswick for limiting sound levels from industrial facilities in general; however, Certificates of Approval issued under the Clean Air Act for industrial facilities are sometimes used to regulate noise. In such cases, the NBDELG generally requires noise emissions from an activity be controlled so as not to cause substantial loss of enjoyment of the normal use of any property, or substantial interference with the normal conduct of business.

Health Canada provides guidance for assessing noise in the document “Guidelines for Evaluating Human Health Impacts in Environmental Assessment” (Health Canada 2017b). Although Health Canada does not regulate or mandate noise emissions from projects, its publication provides guidance for noise assessment. The Health Canada document provides objective limits for sound levels based on day-night equivalent sound levels and change in the estimated percent of people who are highly annoyed (%HA).

The %HA is calculated from the daytime and weighted night-time sound levels. The 15-hour daytime (07:00 to 22:00) equivalent sound level (L_d) and 9-hour night-time (22:00 to 07:00) equivalent sound level (L_n) are averaged. A 10-dB penalty is also applied to the night-time sound level to account for increased sensitivity to noise during the night; this gets added to the baseline measurements and predicted values from the Project for the night time period. This penalty reflects the greater sensitivity or responsiveness of the community to night-time noise effects. The total weighted average sound level (L_{dn}) is calculated for both existing conditions (baseline noise levels) and predicted cumulative noise levels with the facility. The %HA for both baseline and predicted cumulative noise levels is then calculated. Health Canada recommends a change in %HA of less than 6.5% as a suitable threshold criterion for environmental assessment (Health Canada 2017b).

Noise from blasting is regulated in New Brunswick through the *Blasting Code Approval Regulation* under the *Municipalities Act*. The *Blasting Code Approval Regulation* limits peak overpressure (instantaneous blasting noise) to 128 dB (linear) and ground vibration to a peak particle velocity of 12.5 mm/s. These limits assume that blast monitoring for peak overpressure and vibration occurs during blasting. The *Blasting Code Approval Regulations* apply to the nearest designated site, typically a residence or other building. The blasting regulations also typically stipulate pre- and post-blast surveys to assess whether damage has occurred. Whether required by an inspector or not, blasting contractors will generally conduct such surveys where warranted based on proximity to residents to avoid nuisance claims.

6.4.2 Spatial Boundaries

The assessment of potential environmental interactions between the Project and the acoustic environment is focused on a PDA and a LAA.

The PDA for the Project is defined as the area of physical disturbance associated with the construction, operation, and maintenance of the Project. As described in Section 2.5, for the purposes of this assessment, the PDA includes the land within the property boundaries of PID 20616322, PID 20598090, and PID 20277927. The PDA is depicted on Figure 2.4.

The LAA for the acoustic environment is defined as the area within which the environmental effects of the Project can be measured or predicted. For considering a potential change in noise levels, the LAA for the acoustic environment generally extends from the PDA to 1 km in all directions.

The LAA for a change in acoustic environment is shown on Figure 6.18.

V:\1214\active\121415659\1_environmental\2_drawings\gis\figures\eia\121415659-60X_eia_noise_LAA_r.mxd mblackwood

Sources: Base Data - from the Government of New Brunswick

Service Layer Credits: Service New Brunswick/Service Nouveau Brunswick

Local Assessment Area for Acoustic Environment

Stantec

121415659 - PROPOSED IRON PROCESSING FACILITY, BELLEDUNE, NEW BRUNSWICK - MARITIME IRON INC.

Figure 6.18

6.4.3 Temporal Boundaries

The temporal boundaries for the assessment of the potential environmental effects on the acoustic environment include:

- Construction – scheduled to begin in Q1 2020 and last for approximately 3 years; and
- Operation and maintenance – scheduled to begin in Q1 2023 and continue for the life of the new Facility, currently anticipated to be 30 years.

6.4.4 Existing Conditions for Acoustic Environment

6.4.4.1 Approach and Methods

Baseline noise monitoring was conducted at two locations over a 24-hour period at each location in December 2018 to characterize the existing acoustic environment near noise-sensitive receptors (dwellings) within the LAA. The two monitoring locations are shown on Figure 6.18.

Type 1 sound level meters, Larson Davis model 831, were used to measure and record sound pressure levels in A-weighted decibels (dBA). The A-weighted noise scale is the most commonly used unit to quantify sound as it reflects human hearing. Data was recorded and stored as 1-minute L_{eq} values. The sound level meters were field calibrated with a Larson-Davis Model CA200 precision acoustic calibrator at the beginning and end of the monitoring. The sound level meter was also set to record audio files during high sound levels. Hourly sound pressure level (L_{eq}) were calculated using the measured data. The hourly L_{eq} values were used to estimate day-night baseline sound levels for nearby receptor locations.

6.4.4.2 Description of Existing Conditions

The acoustic environment in the LAA is characterized by traffic noise from the nearby streets, noise from ocean waves and marine vessels, and noise from other human activities and existing industrial facilities. The Project is bounded by a road, saw mill and wood processing facility to the west, a coal-fired power plant to the northeast, a regional truck route to the south, and forest and a residential area to the north.

A summary of the 1-hour L_{eq} measurements for both monitoring locations is presented in Table 6.36. The measured L_{eq} values between 37 and 45 dBA at Chaleur Drive are consistent with sound pressure levels for a typical rural area. A noticeable change in sound level was observed during early-morning commuting hour (8 AM). Higher sound pressure levels during the early night period (10 PM and 12 AM) at Curry Drive might have been due to high winds based on the review of audio files recorded during this period.

Table 6.36 Baseline Sound Pressure Level Monitoring Summary

Time Period	Hourly Sound Levels (1-hour L_{eq}) in dBA	
	Chaleur Drive	Curry Drive
00:00	41	46
01:00	41	41
02:00	39	38
03:00	39	38
04:00	40	37
05:00	41	39
06:00	40	39
07:00	43	40
08:00	45	41
09:00	44	40
10:00	43	39
11:00	40	38
12:00	39	37
13:00	38	40
14:00	38	40
15:00	38	40
16:00	39	39
17:00	41	38
18:00	41	38
19:00	42	44
20:00	40	44
21:00	41	45
22:00	40	50
23:00	40	47

The calculated daytime (L_d), nighttime (L_n) and day-night sound levels (L_{dn}) from measured baseline values for both locations are provided in Table 6.37. The baseline %HA used for assessing the change in the acoustic environment is also provided in Table 6.37.

Table 6.37 Summary of Calculated Baseline L_d, L_n and L_{dn} Sound Levels

Monitoring Location	Sound Levels from the Measurements (dBA)			Baseline %HA
	L_d (7am to 10pm)	L_n (10pm to 7am)	L_{dn}	
Chaleur Drive	41.2	40.2	46.8	1.4
Curry Drive	40.4	38.8	45.4[A]	1.5

Notes:

L_d = average daytime sound pressure level;

L_n = average nighttime sound pressure level;

L_{dn} = total weighted average sound pressure level.

[A] Elevated sound pressure level during night time due to high winds were excluded from the L_{dn} calculation at Curry Drive.

6.4.5 Potential Project Interactions with Acoustic Environment

Project activities and components could potentially interact with the acoustic environment to result in adverse environmental effects. In consideration of these potential interactions, the assessment of Project-related environmental effects on the acoustic environment is therefore focused on the potential environmental effects listed in Table 6.38. These potential environmental effects will be assessed in consideration of specific measurable parameters, also listed in Table 6.38.

Table 6.38 Potential Environmental Effects and Measurable Parameters for Acoustic Environment

Potential Environmental Effect	Measurable Parameter	Rational for Selection of Measurable Parameter
Change in Acoustic Environment	• Sound pressure levels (L_{eq}, L_{dn} dBA, peak dB). • Percent Highly Annoyed (%HA)	• Ambient sound levels are characterized using a A-weighted (dBA) scale. Health Canada specifies an equivalent day-night (L_{dn}) sound level thresholds for projects undergoing an environmental assessment. The L_{dn} is used to predict the change in %HA • Peak dB are estimated for blasting overpressure

Table 6.39 identifies the physical activities that may interact with the VC and result in an environmental effect. These interactions are discussed in detail in the following sections, including potential environmental effects, mitigation and environmental protection measures, and residual environmental effects.

Many of the activities being carried out for the Project may create noise, which is reflected in the "emissions and wastes" category signifying that emissions would be generated from various activities at various times. The VC thus assesses emissions and wastes collectively rather than separately for each individual activity.

Changes in sound pressure levels at nearby receptors due to Project activities during construction and operation were predicted using the commercially available noise modelling software package CADNA/A, a computerized version of the algorithms contained in the ISO 9613-2 standard. This model includes geometrical divergence (distance attenuation), barrier effects due to intervening structures, ground effects, atmospheric absorption, and topography. The model assumes that receptors are always downwind of the source, since it is these conditions which typically lead to the highest sound pressure levels.

Changes in sound pressure level from blasting activities occurring during construction were estimated using the Ontario Ministry of Environment Guideline NPC-119. NPC-119 estimates peak overpressure and peak particle velocity based on the distance between the nearest receptor and the blast and on the charge size used for the blast.

Changes in sound pressure level were estimated at receptor locations that were determined using GIS analysis of spatial data (site layout, known dwelling/property boundaries). Based on this analysis, 35 receptor locations assumed to be residential locations were chosen for this analysis within the LAA. While additional locations were identified within the LAA, they were farther away and in the same direction as the receptor locations chosen for this assessment that are more likely to experience an adverse effect. The receptor locations considered for the assessment are shown in Figure 6.18.

Table 6.39 Potential Project Interactions

Project Activity	Potential Environmental Effect Change in Atmospheric Environment
Construction	
Site Preparation (*e.g.,* clearing, grubbing)	-
Construction of Facility Footprint (including excavation and installation of building foundations and creation of storage areas, and construction of ancillary infrastructure)	-
Installation of Equipment (including fluidized bed reactors and melter gasifier and ancillary equipment)	-
Employment and Expenditure	-
Emissions and Wastes	✓
Operation	
Production of Pig Iron	-
Ground Transportation (including trucking of burnt lime material, limestone and dolomite material)	-
Employment and expenditure	-
Emissions and Wastes	✓

✓ indicates an interaction

\- indicates no interaction

6.4.5.1 Potential Effects to Acoustic Environment During Construction

Construction activities such as land preparation have the potential to increase sound levels at the nearby receptors. The construction of the Project components has the potential to change the acoustic environment through:

- The use of heavy mobile equipment for construction, earth moving and other activities, including engine noise and back-up beepers;
- Material movement, including, scrapping and banging of equipment; and
- Blasting.

Construction noise is typically intermittent and fluctuates during the day. Construction is expected to occur only during daylight hours.

6.4.5.2 Potential Effects to Acoustic Environment During Operation and Maintenance

The operation and maintenance of the Project has the potential to interact with the acoustic environment as follows:

- Through the conveyance of various aggregate materials to the site and throughout the site, including coal, limestone, dolomite, iron ore, and final products;
- Pump and motor noise for driving conveyors, wastewater, fans for de-dusting, cooling, and other activities required for iron processing;
- Vehicle-related emissions transporting materials on and off-site; and
- Compressor operations at the Oxygen Plant.

Noise emissions from the existing Belledune Thermal Generating Station and other nearby industrial facilities are implicitly included in this assessment through inclusion of the baseline noise measurements near the project.

6.4.6 Mitigation for Acoustic Environment

Interactions between Project activities and the acoustic environment will be managed by implementing various mitigation measures. The following mitigation measures have been identified for this Project.

During construction:

- use of well-maintained construction equipment with appropriate mufflers
- time activities to avoid undue nuisance to off-site receptors (e.g., limiting construction activities to between 7:00 am and 7:00 pm, where possible)
- use of acoustical barriers (e.g., engineered materials or stockpiled overburden) near loud sources during construction if feasible
- size construction equipment to the smallest needed to perform the work
- deploy overpressure and vibration monitoring during blasting activities to confirm peak overpressure of less than 128 dB and PPV less than 12.5 mm/s
- limit blast charge sizes to less than 60 kg
- establish a noise management plan, including a noise complaint and response system
- notify nearby residents prior to starting construction activities, including blasting, to avoid or reduce annoyance and disruption

During operation and maintenance:

- use of well-maintained mobile equipment with appropriate mufflers
- maintain a noise complaint and response system
- acoustic louvres used for ventilation openings for the Air Compressor Room, Decanter Room, and Air Fan Room
- sandwich panel wall construction for the buildings that house compressor gas coolers, water treatment, and fans
- sheet metal construction for other enclosed spaces
- routing the pig iron haul route along the south edge of the property
- routing the pig iron haul route along the south edge of the property
- use electric motor with a maximum sound power level rating of 91 dBA for the Reclaimer Conveyor
- use electric motor with a maximum sound power level rating of 98 dBA for the Transfer Belt Conveyor from the new TT
- install air inlet silencers for the Oxygen Plant compressors

Some of the mitigation measures outlined for operation and maintenance include specific acoustic attenuation targets to achieve a desired acoustic performance. Therefore, a summary of the insertion/transmission losses for the mitigation considered for Project operations and maintenance is provided in Table 6.40, including the minimum loss in dB for each octave band for each type of mitigation.

Table 6.40 Acoustic Performance of Mitigation Measures Considered for Project Operation

Mitigation[A]	Insertion/Transmission Losses (dB) by Octave Band (Hz)							
	63	125	250	500	1000	2000	4000	8000
Acoustic Louvres	5	8	12	16	22	18	15	14
Sandwich Panel	22	26	31	36	43	48	50	52
Sheet Metal	3	8	14	20	23	26	27	35
Air House Filter	4	8	9	13	26	27	27	33
Air Inlet Silencer	2	3	4	18	38	46	54	50

Notes:

[A] These acoustic performance data are based on manufacturer specifications or published information for this type of mitigation equipment.

6.4.7 Characterization of Residual Project-Environmental Interactions with Acoustic Environment

6.4.7.1 Construction

Noise emissions are anticipated to occur primarily from earthmoving activities from bulldozers, dump trucks, and other heavy machinery. The construction phase is anticipated to occur for three years and may be nearly continuous during this period. For construction activities lasting longer than one year, Health Canada recommends a quantitative assessment of noise emissions (Health Canada 2017b).

Existing nighttime sound levels will not be affected as construction activities are not planned to occur at night. Sound power levels during construction were based on a construction equipment list provided by Maritime Iron and experience with previous projects of similar size and scope. The equipment list considered for construction is reproduced in Appendix E and is an estimate of the maximum amount of construction equipment expected to operate at one time. The equipment sources were modelled as an area source covering the PDA. Source information used for noise modelling during construction is provided in Appendix E.

The predicted noise levels from project construction activities at the receptor locations is presented in Table 6.41. The resulting change in %HA from project construction is shown in Table 6.42. The change in %HA is predicted to be less than 6.5% and therefore meets the Health Canada guideline for noise exposure when the mitigation measures outlined in Section 6.4.6 are applied.

Table 6.41 Predicted L_{dn} Change during Project Construction

Receptor	Road	Coordinates (UTM 20)		Baseline L_{dn} (dBA)	Predicted L_{dn} (dBA)	Predicted + Baseline L_{dn} (dBA)
		Easting (m)	Northing (m)			
R01	Chaleur Drive	284979	5309450	46.8	39.9	47.6
R02	Chaleur Drive	284963	5309475	46.8	39.3	47.5
R03	Chaleur Drive	284940	5309495	46.8	39.3	47.5
R04	Chaleur Drive	285020	5309485	46.8	38.9	47.5
R05	Chaleur Drive	285004	5309501	46.8	38.3	47.4
R06	Chaleur Drive	284991	5309518	46.8	38.2	47.4
R07	Chaleur Drive	284865	5309709	46.8	35.8	47.1
R08	Chaleur Drive	284924	5309525	46.8	38.8	47.4
R09	Chaleur Drive	284915	5309653	46.8	36.0	47.1
R10	Chaleur Drive	284882	5309695	46.8	35.3	47.1
R11	Chaleur Drive	284790	5309688	46.8	36.1	47.2
R12	Chaleur Drive	284926	5309630	46.8	36.7	47.2
R13	Chaleur Drive	284901	5309678	46.8	35.5	47.1
R14	Chaleur Drive	284768	5309695	46.8	36.3	47.2
R15	Chaleur Drive	284982	5309537	46.8	37.6	47.3
R16	Chaleur Drive	284862	5309640	46.8	36.7	47.2
R17	Chaleur Drive	284844	5309649	46.8	36.6	47.2
R18	Chaleur Drive	284833	5309670	46.8	36.3	47.2
R19	Chaleur Drive	284840	5309718	46.8	35.5	47.1
R20	Chaleur Drive	284915	5309547	46.8	37.8	47.3

Table 6.41 Predicted L_{dn} Change during Project Construction

Receptor	Road	Coordinates (UTM 20)		Baseline L_{dn} (dBA)	Predicted L_{dn} (dBA)	Predicted + Baseline L_{dn} (dBA)
		Easting (m)	Northing (m)			
R21	Chaleur Drive	284972	5309553	46.8	37.4	47.3
R22	Chaleur Drive	284959	5309572	46.8	37.2	47.3
R23	Chaleur Drive	284944	5309592	46.8	37.9	47.3
R24	Chaleur Drive	284875	5309619	46.8	37.4	47.3
R25	Chaleur Drive	284905	5309569	46.8	38.5	47.4
R26	Chaleur Drive	284893	5309588	46.8	38.2	47.4
R27	Hodgins Street	284598	5309926	46.8	32.9	47.0
R28	Chaleur Drive	284813	5309675	46.8	36.3	47.2
R29	Hodgins Street	284539	5309784	46.8	34.4	47.0
R30	Chaleur Drive	284818	5309732	46.8	35.4	47.1
R31	Hodgins Street	284555	5309842	46.8	33.9	47.0
R32	Curry Drive	285276	5310186	45.4	39.2	46.3
R33	Curry Drive	285234	5310206	45.4	37.8	46.1
R34	Curry Drive	285202	5310213	45.4	37.3	46.0
R35	Curry Drive	285166	5310229	45.4	36.6	45.9
R36	Curry Drive	285107	5310252	45.4	35.6	45.8

Table 6.42 Predicted Change to Percent Highly Annoyed (%HA) during Project Construction

Receptor	Baseline %HA	Predicted + Baseline %HA	Change in %HA
R01	1.4	1.6	0.2
R02	1.4	1.6	0.2
R03	1.4	1.6	0.2
R04	1.4	1.6	0.2
R05	1.4	1.6	0.2
R06	1.4	1.6	0.2
R07	1.4	1.5	0.1
R08	1.4	1.6	0.2
R09	1.4	1.5	0.1
R10	1.4	1.5	0.1

Table 6.42 Predicted Change to Percent Highly Annoyed (%HA) during Project Construction

Receptor	Baseline %HA	Predicted + Baseline %HA	Change in %HA
R11	1.4	1.5	0.1
R12	1.4	1.5	0.1
R13	1.4	1.5	0.1
R14	1.4	1.5	0.1
R15	1.4	1.5	0.1
R16	1.4	1.5	0.1
R17	1.4	1.5	0.1
R18	1.4	1.5	0.1
R19	1.4	1.5	0.1
R20	1.4	1.5	0.1
R21	1.4	1.5	0.1
R22	1.4	1.5	0.1
R23	1.4	1.5	0.1
R24	1.4	1.5	0.1
R25	1.4	1.6	0.2
R26	1.4	1.6	0.2
R27	1.4	1.5	0.1
R28	1.4	1.5	0.1
R29	1.4	1.5	0.1
R30	1.4	1.5	0.1
R31	1.4	1.5	0.1
R32	1.2	1.4	0.2
R33	1.2	1.3	0.1
R34	1.2	1.3	0.1
R35	1.2	1.3	0.1
R36	1.2	1.3	0.1

Blasting is anticipated to occur at several locations within the PDA to support construction of the plant layout. Blast overpressure and vibration modelling was completed for the receptor closest to the blasting activities. The predicted peak overpressure and PPV for blasting is summarized in Table 6.43. The peak overpressure and PPV meet the Blasting Code Approval Regulation at the nearest receptor, provided the explosive charge size is below 60 kg.

Table 6.43 Predicted Peak Overpressure and PPV for Blasting

Receptor ID	POR Description	Distance from Blast to Nearest Receptor (m)	Charge Size (kg)	Peak Particle Velocity (mm/sec)	Peak Sound Pressure Level (dB)
R01	Chaleur Drive	384	60	2.1	127

6.4.7.2 Operation and Maintenance

Sound power levels for the various equipment and activities required for iron processing were estimated based on equipment lists provided by Maritime Iron. The equipment list used for sound modelling is reproduced in Appendix F. Noise-generating activities included noise from the processing facilities at the various stages of iron processing, as well as compression operations at the Oxygen Plant to be owned and operated by a third party. The model considered that some sources will be contained within full enclosures or buildings, while others will be outdoors.

Stationary outdoor sources, such as pumps, motors, compressors, and fans, were modelled as point sources. Mobile sources, including haul trucks and other heavy equipment, were modelled as line sources based on their estimated travel path, pass-by frequency, and assumed vehicle speed. Building roofs and walls containing noise-generating activities were modelled as area and vertical area sources, respectively, and included the noise attenuation performances of the wall construction. Building openings, including louvre ventilation, were also considered in the model. Those openings requiring mitigation included mitigation measures described in Section 6.4.6.

The predicted sound pressure levels from the Project are shown using noise contours (isopleths) in Figure 6.19. The predicted L_{dn} values from project operations at the receptor locations are provided in Table 6.44. The predicted change in %HA from baseline conditions are presented in Table 6.45. The change in %HA meets the Health Canada recommended noise exposure guideline at each of the receptor locations with the proposed mitigation measures outlined in Section 6.4.6.

Table 6.44 Predicted L_{dn} Change during Project Operation and Maintenance

Receptor	Road	Coordinates (UTM 20)		Baseline L_{dn} (dBA)	Predicted L_{dn} (dBA)	Predicted + Baseline L_{dn} (dBA)
		Easting (m)	Northing (m)			
R01	Chaleur Drive	284979	5309450	46.8	59.7	59.9
R02	Chaleur Drive	284963	5309475	46.8	59.0	59.3
R03	Chaleur Drive	284940	5309495	46.8	58.5	58.8
R04	Chaleur Drive	285020	5309485	46.8	59.5	59.7
R05	Chaleur Drive	285004	5309501	46.8	58.6	58.9
R06	Chaleur Drive	284991	5309518	46.8	58.1	58.4
R07	Chaleur Drive	284865	5309709	46.8	55.0	55.6
R08	Chaleur Drive	284924	5309525	46.8	58.0	58.3
R09	Chaleur Drive	284915	5309653	46.8	54.4	55.1

Table 6.44 Predicted L_{dn} Change during Project Operation and Maintenance

Receptor	Road	Coordinates (UTM 20)		Baseline L_{dn} (dBA)	Predicted L_{dn} (dBA)	Predicted + Baseline L_{dn} (dBA)
		Easting (m)	Northing (m)			
R10	Chaleur Drive	284882	5309695	46.8	53.8	54.6
R11	Chaleur Drive	284790	5309688	46.8	55.8	56.3
R12	Chaleur Drive	284926	5309630	46.8	56.1	56.6
R13	Chaleur Drive	284901	5309678	46.8	54.1	54.8
R14	Chaleur Drive	284768	5309695	46.8	56.6	57.0
R15	Chaleur Drive	284982	5309537	46.8	56.3	56.8
R16	Chaleur Drive	284862	5309640	46.8	55.9	56.4
R17	Chaleur Drive	284844	5309649	46.8	55.8	56.3
R18	Chaleur Drive	284833	5309670	46.8	55.6	56.1
R19	Chaleur Drive	284840	5309718	46.8	55.0	55.6
R20	Chaleur Drive	284915	5309547	46.8	56.4	56.9
R21	Chaleur Drive	284972	5309553	46.8	56.1	56.6
R22	Chaleur Drive	284959	5309572	46.8	55.8	56.3
R23	Chaleur Drive	284944	5309592	46.8	57.5	57.9
R24	Chaleur Drive	284875	5309619	46.8	56.9	57.3
R25	Chaleur Drive	284905	5309569	46.8	57.9	58.2
R26	Chaleur Drive	284893	5309588	46.8	57.4	57.8
R27	Hodgins Street	284598	5309926	46.8	51.5	52.8
R28	Chaleur Drive	284813	5309675	46.8	55.7	56.2
R29	Hodgins Street	284539	5309784	46.8	54.3	55.0
R30	Chaleur Drive	284818	5309732	46.8	55.0	55.6
R31	Hodgins Street	284555	5309842	46.8	52.3	53.4
R32	Curry Drive	285276	5310186	45.4	52.7	53.7
R33	Curry Drive	285234	5310206	45.4	50.9	52.0
R34	Curry Drive	285202	5310213	45.4	50.5	51.7
R35	Curry Drive	285166	5310229	45.4	50.0	51.3
R36	Curry Drive	285107	5310252	45.4	49.4	50.9

Table 6.45 Predicted Change to Percent Highly Annoyed (%HA) during Project Operation and Maintenance

Receptor	Baseline %HA	Predicted + Baseline %HA	Change in %HA
R01	1.4	7.6	6.2
R02	1.4	7.1	5.7
R03	1.4	6.7	5.3
R04	1.4	7.5	6.1
R05	1.4	6.7	5.3
R06	1.4	6.4	5.0
R07	1.4	4.5	3.1
R08	1.4	6.3	4.9
R09	1.4	4.2	2.8
R10	1.4	3.9	2.5
R11	1.4	4.9	3.5
R12	1.4	5.1	3.7
R13	1.4	4.1	2.7
R14	1.4	5.4	4.0
R15	1.4	5.2	3.8
R16	1.4	5.0	3.6
R17	1.4	4.9	3.5
R18	1.4	4.8	3.4
R19	1.4	4.5	3.1
R20	1.4	5.2	3.8
R21	1.4	5.1	3.7
R22	1.4	4.9	3.5
R23	1.4	5.9	4.5
R24	1.4	5.5	4.1
R25	1.4	6.2	4.8
R26	1.4	5.9	4.5
R27	1.4	3.1	1.7
R28	1.4	4.8	3.4
R29	1.4	4.2	2.8
R30	1.4	4.5	3.1
R31	1.4	3.4	2.0
R32	1.2	3.5	2.3

Table 6.45 Predicted Change to Percent Highly Annoyed (%HA) during Project Operation and Maintenance

Receptor	Baseline %HA	Predicted + Baseline %HA	Change in %HA
R33	1.2	2.8	1.6
R34	1.2	2.7	1.5
R35	1.2	2.6	1.4
R36	1.2	2.4	1.2

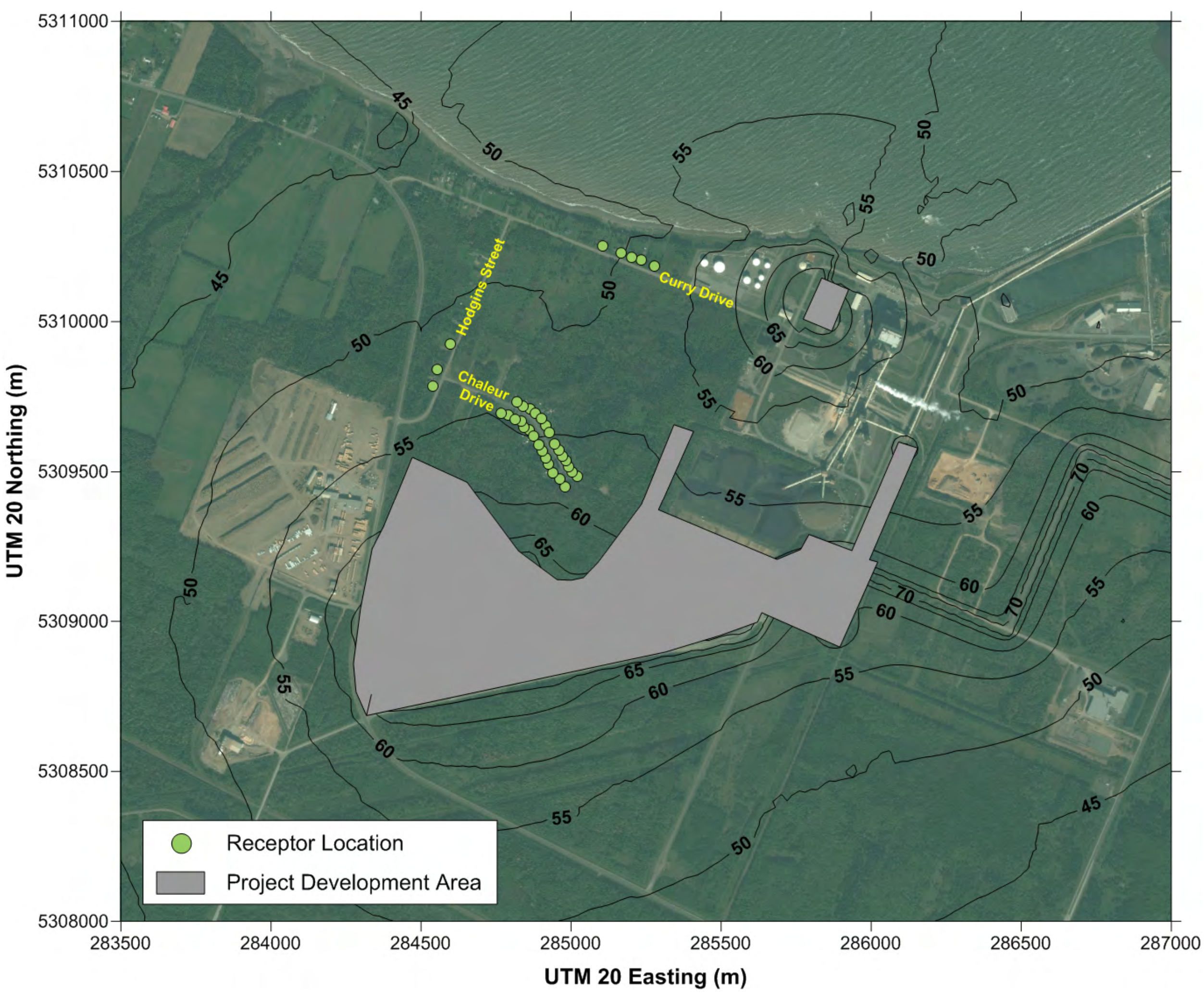


Figure 6.19 Predicted L_{dn} (dBA) Noise Contours from Project Operations

6.4.8 Summary and Recommendations

With the implementation of mitigation as described above, the change in the acoustic environment is expected to meet the applicable noise exposure levels. As a result, substantives changes to the acoustic environment are not anticipated.

7.0 ASSESSMENT OF ENVIRONMENTAL EFFECTS ON FRESHWATER FISH AND FISH HABITAT

This section describes the potential environmental interactions between construction, operation and maintenance of the proposed Belledune Iron Processing Facility and the freshwater fish and fish habitat VC. This section includes an analysis of the potential interactions between Project activities and freshwater fish and fish habitat. Interactions with freshwater fish and fish habitat are not anticipated as there are no known fish-bearing watercourses or waterbodies present within the PDA.

7.1 RATIONALE FOR SELECTION AS A VALUED COMPONENT

Freshwater fish and fish habitat have been selected as a VC because of the potential for this Project to interact with a number of elements of freshwater fish and fish habitat including surface water quality.

In this assessment, the potential changes to the freshwater fish and fish habitat due to the Project are considered. The scope of the assessment is based on applicable regulations and policies, professional judgement of the study team, and knowledge of potential interactions.

7.2 REGULATORY CONTEXT

The assessment of environmental effects of the Project on fish and fish habitat is largely focused on matters related to fish populations and fish habitat, such as water quality and physical fish habitat, and species which are protected by federal and/or provincial legislation (i.e., SAR and SOCC). A description of regulations relevant to only the freshwater fish and fish habitat VC are presented below.

The federal *Fisheries Act* regulates fish and fish habitat from destructive activities in marine and inland waters. Under Section 35, the newly amended *Fisheries Act* prohibits the death of fish and the harmful alteration, disruption or destruction of fish habitat. Under the *Fisheries Act*, the Governor General in Council, on the recommendation of the Minister of Fisheries and Oceans, can authorize and require measures to offset unavoidable harm to fish and fish habitat.

The *Fisheries Act* defines fish habitat as spawning, nursery, rearing or feeding grounds, food supplies, and areas used for migration by fish and other organisms that fish depend on to carry out their life processes. Freshwater fish are defined as fish that live in freshwater for a least a portion of their lifecycle and include parts of a fish, shellfish, crustaceans, and any parts of a shellfish or crustacean, and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish and crustaceans.

Section 36 of the *Fisheries Act* regulates water quality, which prohibits the “deposit of deleterious substances into waters frequented by fish”, unless authorized. A deleterious substance is considered any substance that, when added to water, degrades or alters its quality such that it is harmful to fish, fish habitat or the use of fish by people.

The CCME has established environmental quality guidelines for chemical-specific concentrations in various environmental media (CCME 2018). For the aquatic environment, the Canadian Environmental Quality Guidelines (CEQG) include the Canadian Water Quality Guidelines (CWQG) for the Protection of Aquatic Life (Freshwater) (PFAL) and the Canadian Sediment Quality Guidelines (CSQG) for the PFAL. As the CEQG environmental quality values are guidelines they do not have force of law.

The *New Brunswick Fish and Wildlife Act* regulates the recreational capture of fish (angling) within the province of New Brunswick. The Act is administered and enforced by the NBDERD through the *General Angling Regulation*.

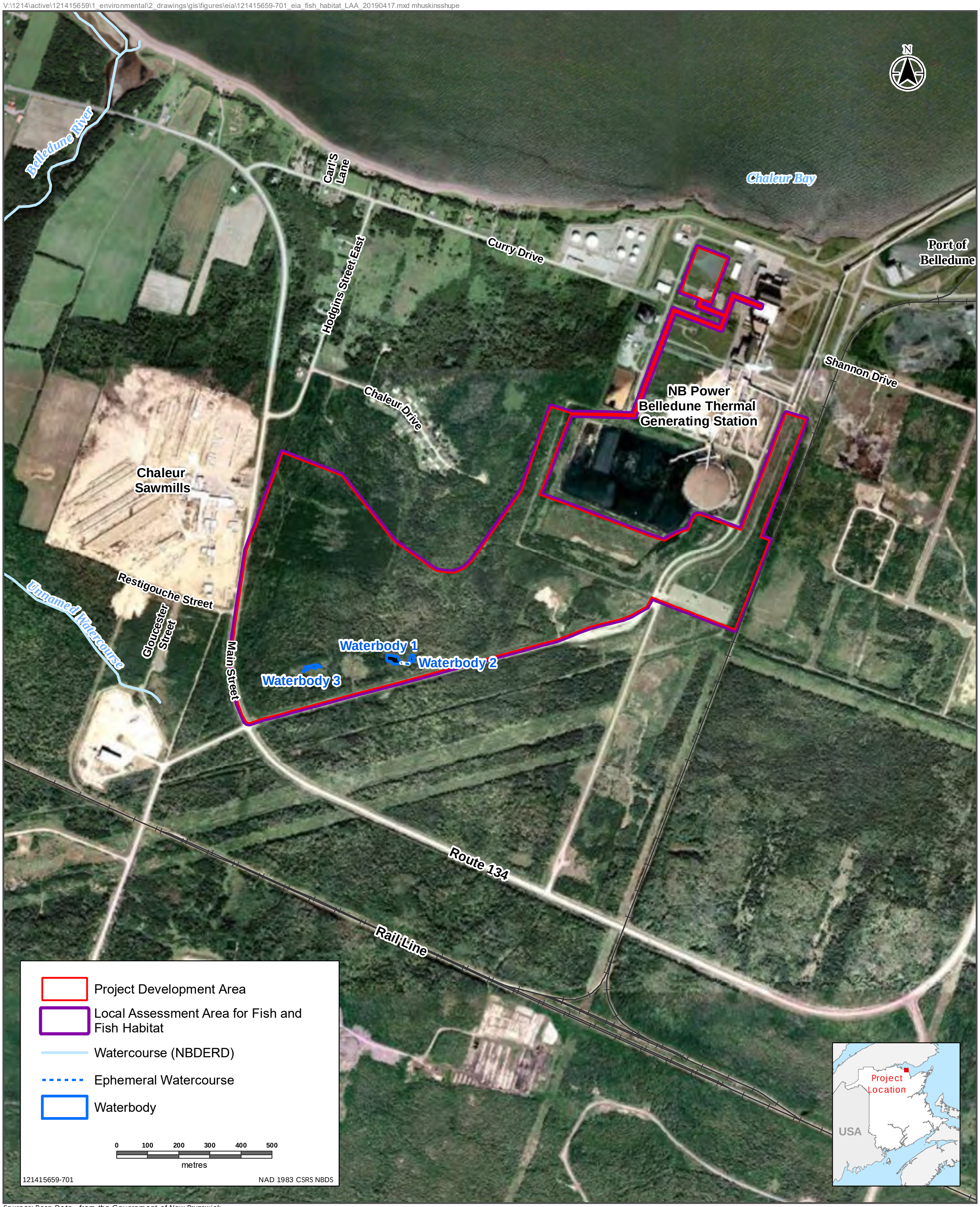
7.3 SPATIAL BOUNDARIES

The assessment of potential environmental interactions between the Project and freshwater fish and fish habitat is focused on a PDA and a LAA.

The PDA for the Project is defined as the area of physical disturbance associated with the construction, operation, and maintenance of the Project. As described in Section 2.5, for the purposes of this assessment, the PDA includes the land within the property boundaries of PID 20616322, PID 20598090, and PID 20277927. The PDA is depicted on Figure 2.4.

The LAA for freshwater fish and fish habitat is defined as the area within which the environmental effects of the Project can be measured or predicted. For the freshwater fish and fish habitat VC, the LAA is the same as the PDA.

The PDA and the LAA are shown on Figure 7.1.



Sources: Base Data - from the Government of New Brunswick

Service Layer Credits: Service New Brunswick/Service Nouveau Brunswick

Local Assessment Area for Fish and Fish Habitat

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Figure 7.1

7.4 TEMPORAL BOUNDARIES

The temporal boundaries for the assessment of the potential environmental effects on freshwater fish and fish habitat include:

- Construction – scheduled to begin in Q1 2020 and last for approximately 3 years; and
- Operation and maintenance – scheduled to begin in Q1 2023 and continue for the life of the facility, currently anticipated to be in excess of 30 years.

The New Brunswick timing window for Projects in and around water is the summer low flow period from June 1 to September 30 to reduce the risk of serious harm to fish and fish habitat.

7.5 EXISTING CONDITIONS FOR FRESHWATER FISH AND FISH HABITAT

7.5.1 Approach and Methods

To characterize the existing conditions for freshwater fish and fish habitat to support the EIA, existing literature and information were reviewed, and field data was collected in 2018.

The review of existing literature included:

- Government publications and websites
- Atlantic Canada Conservation Data Centre data (AC CDC 2018a)

The following provides a description of the methods used in the field data collection and analysis.

Aquatic field surveys were conducted on August 28 and 30, and September 26, 2018 within three unmapped waterbodies and one unmapped ephemeral watercourse within the PDA. The habitat survey was conducted as per New Brunswick Department of Natural Resources (NBDNR) and DFO guidelines, using modified stream habitat methodology and forms (Hooper et al.1995). Fish habitat information collected included habitat type (i.e., riffle, run, pool), substrate type as well as other habitat characteristics (i.e., cover, bank stability). *In situ* water quality parameters measured included water temperature, conductivity and pH (Oakton PCTSTestr 50, Illinois USA). The water quality measurement device was calibrated prior to use.

A fish survey could not be conducted in the ponds due to safety concerns (i.e., electrofishing while raining). The ponds are assumed to be non-fish bearing as they were not connected to downstream watercourses and no fish were observed.

7.5.2 Description of Existing Conditions

7.5.2.1 Fish Habitat

Within the PDA there were three unmapped waterbodies (Waterbody 1, Waterbody 2 and Waterbody 3) and one ephemeral watercourse identified during wetland surveys associated with the EIA (Figure 7.2). The nearest watercourse is located approximately 250 metres from the PDA.

All of the unmapped waterbodies were shallow wetland ponds which appeared to be anthropogenic in origin. The ephemeral watercourse connecting Waterbody 1 and Waterbody 2 was dry at the time of the survey. Waterbody 1 and Waterbody 2 were associated with Wetland 14 while Waterbody 3 was associated with Wetland 23. The water quality and habitat information associated with those ponds is provided in Table 7.1 and Table 7.2, respectively. The pH was within the accepted range (6.5 to 9.0) for the Canadian Water Quality Guidelines protection of freshwater aquatic life.

Table 7.1 *In Situ* Water Quality Parameters for Surveyed Waterbodies

Waterbody	Sample Date	Water Temperature (°C)	pH	Conductivity (µS/cm)
Waterbody 1	Aug. 30, 2018	21.6	8.27	299
Waterbody 2	Aug. 30, 2018	21.7	8.33	257
Waterbody 3	Sep. 26, 2018	10.8	7.61	509

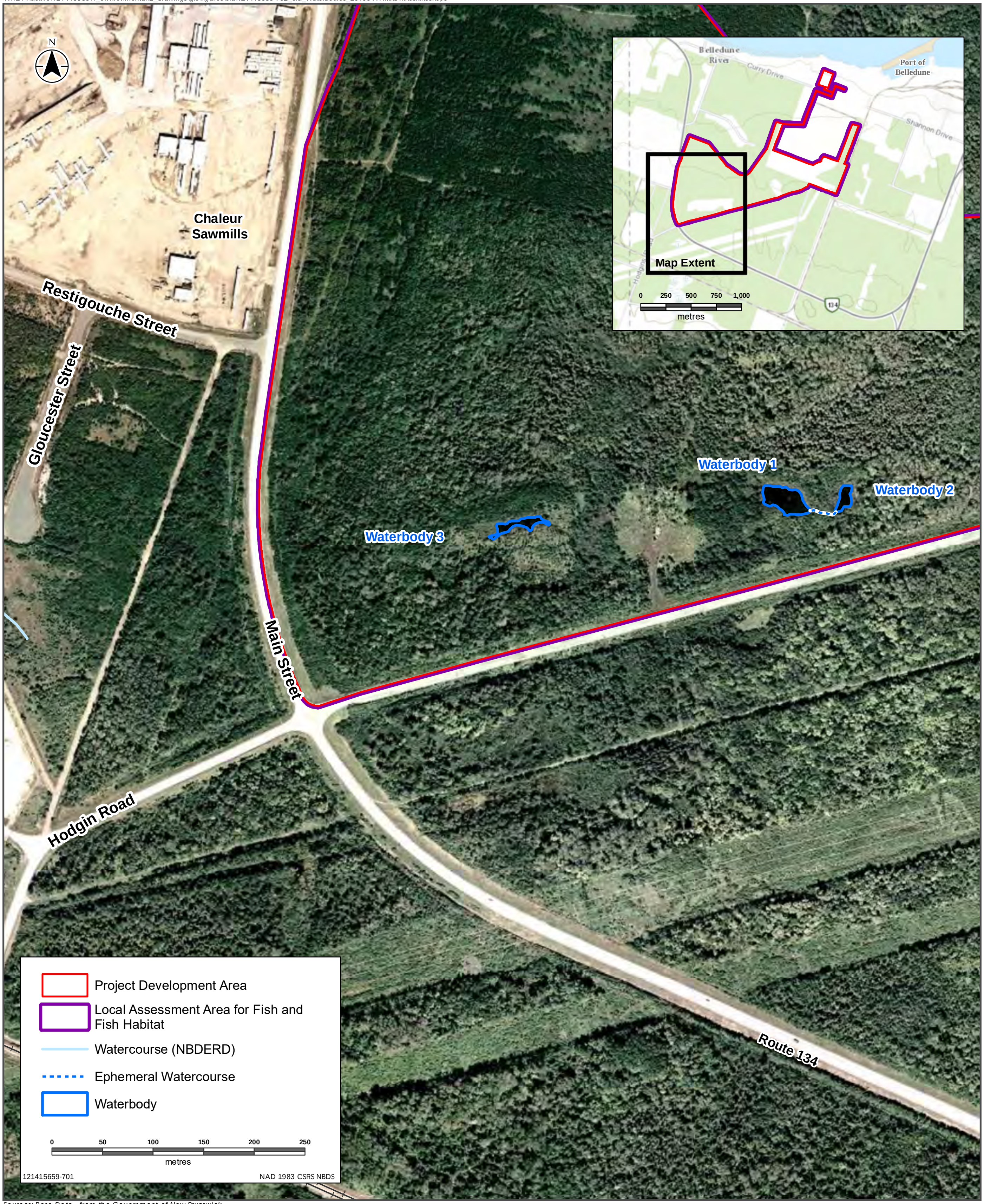
Notes:
* all identified waterbodies are shallow-water wetland ponds. See Table 7.2 and Section 9.0 for more information.

Table 7.2 Summary of Key Fish Habitat Characteristics

Waterbody*	Dominant Habitat	Length and Width (m)	Maximum Depth (m)	Substrate (%)	Dominant Riparian Vegetation (%)	Comments
Waterbody 1 (Wetland 14)	Wetland pond associated with wetland 14	51 x 20 m	0.5	Fines/Organics (70%)	Grass (55%)	Open-water wetland that appeared man-made. The inlet was dry and the outlet was blocked by an old beaver dam.
Waterbody 2 (Wetland 14)	Impounded wetland pond, associated with wetland 14	30 x 12 m	0.7	Fines/Organics (65%)	Shrub (65%)	A 25 m long dry channel ~1m wide connected man-made ponds Waterbody 1 and Waterbody 2
Waterbody 3 (Wetland 23)	Wetland pond, associated with wetland 23	40 x 4 m	0.4	Fines/Organics (100%)	Grass (100%)	Pond with no-inlet or outlet

Notes:
* all identified waterbodies are shallow-water wetland ponds. See Section 9.0 for more information.

None of the waterbodies described above (Waterbody 1 to 3) connect to the ditch located outside of the PDA that flows into Chaleur Bay.



Sources: Base Data - from the Government of New Brunswick

Service Layer Credits: Service New Brunswick/Service Nouveau Brunswick
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Unmapped Waterbodies and Watercourses Within the Local Assessment Area

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Figure 7.2

7.5.2.2 Fish Species

No fish were observed during the field studies in the watercourses or waterbodies within the PDA. Additionally, no connecting watercourses were observed which could facilitate fish passage into the wetlands or man-made ponds from downstream areas that may be fish bearing. Additionally, the ponds were very shallow (<0.7 metres) and would likely have ice to the bottom in winter. This would make them subject to winterkill which would not allow fish populations to be maintained in the ponds. For these reasons, it is assumed that there are no fish species present within the PDA. Fish surveys were conducted in the three ponds in September, 2019, using minnow traps. No fish were captured over two 24-hour periods (checked daily) using two traps per pond.

7.5.2.3 Commercial, Recreational and Aboriginal Fisheries

There are no known, commercial, recreational or Aboriginal fisheries within the PDA.

7.5.2.4 Species at Risk and Species of Conservation Concern

An AC CDC data request and DFO species at risk maps did not identify any aquatic SAR or SOCC (AC CDC 2018a; DFO 2018).

7.6 POTENTIAL PROJECT INTERACTIONS WITH FRESHWATER FISH AND FISH HABITAT

In consideration of potential interactions, the assessment of Project-related environmental effects on freshwater fish and fish habitat is focused on the potential environmental effects listed in Table 7.3. These potential environmental effects will be assessed in consideration of specific measurable parameters, also listed in Table 7.3.

Table 7.3 Potential Environmental Effects and Measurable Parameters for Freshwater Fish and Fish Habitat

Potential Environmental Effect	Measurable Parameter
Change in fish habitat	• Loss of instream habitat (m^2) • Loss of riparian habitat (m^2) • Reduction in Water Quality – Total Suspended Solids (TSS) (mg/L) – Dissolved oxygen (mg/L) – Water temperature (°C)
Change in fish populations	• Direct mortality (number of fish) • Indirect mortality (number of fish)

As shown in Table 7.4, there are no Project activities and components that could result in adverse environmental effects on freshwater fish and fish habitat as there is no known fish and fish habitat within the PDA. The PDA contains a wetland and perceived anthropogenic ponds, however no connecting watercourses were identified that could facilitate fish passage into these bodies from downstream areas that may be fish bearing. No fish were observed or caught and the ponds are shallow and are considered to have the potential for winterkill. As none of the waterbodies (Waterbody 1 to 3) connect to the ditch located outside of the PDA that flows into Chaleur Bay; no interaction is anticipated. The Project will not release waste or other effluent into freshwater fish habitat.

Table 7.4 Potential Project Interactions

Project Activity	Potential Environmental Effect – Change in Fish and Fish Habitat
Construction	
Site Preparation	-
Construction of Temporary Facilities	-
Construction of Project Components	-
Ground Transportation	-
Marine Transportation	-
Commissioning	-
Employment and Expenditure	-
Emissions and Wastes	-
Operation	
Iron Production	-
Maintenance	-
Ground Transportation	-
Marine Transportation	-
Employment and expenditure	-
Emissions and Wastes	-

✓ indicates an interaction
- indicates no interaction

7.7 SUMMARY AND RECOMMENDATIONS

There are no Project activities and components that could potentially interact with freshwater fish and fish habitat and no fish have been observed or caught within the PDA. In the unlikely event that fish species are encountered prior to construction then additional mitigation and offsetting pursuant to the *Fisheries Act* may be required.

8.0 ASSESSMENT OF ENVIRONMENTAL EFFECTS ON WATER RESOURCES

This section includes an analysis of the potential interactions between the construction, and operation and maintenance of the proposed Belledune Iron Processing Facility and the water resources VC. Given the nature of project activities and the location of the nearest water resources, environmental effects of the Project on water resources are not anticipated. Although some localized changes in water resources may occur, they are unlikely to interact with water resources beyond the footprint of the Project.

8.1 RATIONALE FOR SELECTION AS A VALUED COMPONENT

Water resources consists of water that is available for human use and comes from one of two sources: groundwater and surface water. Human use of water resources includes consumption, as well as residential, agricultural, commercial, and industrial use. Water resources has been selected as a VC due to its potable, recreational, and commercial value, and because of the potential for the Project to interact with groundwater and surface waters. The role of surface water as a component of fish habitat is described further in Section 7.0.

In this assessment, the potential changes to the Water Resources as a result of the Project are considered. The scope of the assessment is based on applicable regulations and policies, professional judgement of the study team, and knowledge of potential interactions.

8.2 REGULATORY CONTEXT

The Province of New Brunswick has legislation in place to manage and protect water resources (both surface water and groundwater), including the *Clean Water Act* and the *Clean Environment Act*. Specific regulations under these acts that relate to the protection of water resources include the *Watercourse and Wetland Alteration Regulation-Clean Environment Act*, the *Wellfield Protected Areas Designation Order–Clean Water Act,* the *Water Well Regulation–Clean Water Act,* and the *Potable Water Regulation–Clean Water Act*.

The *Watercourse and Wetland Alteration Regulation–Clean Water Act* requires a watercourse and wetland alteration (WAWA) permit to be issued for activities, including ground disturbance, carried out within 30 metres of a watercourse or wetland.

The *Wellfield Protected Areas Designation Order* defines restrictions in areas around production wells that are used for public water supply systems. The Designation Order restricts the types of activities that can be carried out within the Wellfield Protected Area, thereby reducing the risk of contaminants (e.g., bacteria and viruses, petroleum products, and chlorinated solvents) possibly reaching the wells.

The *Water Well Regulation* defines how water wells are to be constructed in New Brunswick so that water quality is not compromised by local runoff or land use activities. The *Potable Water Regulation* requires water quality testing for all new water wells installed in the province, and for regulated water supply systems. The *Water Well Regulation* applies to all water wells in the LAA, including future water wells.

Although groundwater resources in Canada are generally managed by provincial regulatory bodies as described above, the Guidelines for Canadian Drinking Water Quality (GCDWQ) published by Health Canada are also applicable to groundwater across Canada; however, these have no force of law unless adopted through a regulatory instrument. The GCDWQ are "*established based on current published scientific research related to health effects, aesthetic effects and operational considerations*" (Health Canada 2017a). The New Brunswick Department of Health has adopted many of the GCDWQ that are applicable to municipally and provincially owned and operated water systems (NB OCMOH 2017).

8.3 SPATIAL BOUNDARIES

The assessment of potential environmental interactions between the Project and Water Resources is focused on a PDA and a LAA.

The PDA for the Project is defined as the area of physical disturbance associated with the construction, operation, and maintenance of the Project. As described in Section 2.5, for the purposes of this assessment, the PDA includes the land within the property boundaries of PID 20616322, PID 20598090, and PID 20277927.

The LAA for water resources is defined as the area within which the environmental effects of the Project can be measured or predicted. For considering a potential change in water resources as a result of the Project, the LAA includes the PDA and a 500-metre area surrounding the PDA.

The PDA and the LAA are shown on Figure 8.1.

8.4 TEMPORAL BOUNDARIES

The temporal boundaries for the assessment of the potential environmental effects on Water Resources include:

- Construction – scheduled to begin in Q1 2020 and last for approximately 3 years; and
- Operation and maintenance – scheduled to begin in Q1 2023 and continue for the life of the facility, currently anticipated to be in excess of 30 years.

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Sources: Base Data - from the Government of New Brunswick

Service Layer Credits: Service New Brunswick/Service Nouveau Brunswick

Local Assessment Area for Water Resources

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Figure 8.1

8.5 EXISTING CONDITIONS FOR WATER RESOURCES

8.5.1 Approach and Methods

Information for determining existing conditions were based on a review of the following sources of information:

- New Brunswick Online Well Log System (NB OWLS) water well database containing records of wells drilled since 1995, maintained by the NBDELG (NBDELG 2019a);
- Natural Resources Canada Atlas of Canada - Toporama (NRCan 2019);
- New Brunswick Hydrographic Network geographic dataset (NBDNR 2015); and
- field monitoring.

8.5.2 Description of Existing Conditions

8.5.2.1 Surface Water

The Project is located within the Chaleur Bay composite watershed. A review of topographic mapping indicates that surficial drainage within the PDA is directly toward Chaleur Bay (NRCan 2019). The closest mapped watercourse, an unnamed tributary to the Belledune River, is located upgradient, approximately 250 metres west of the PDA, and is separated from the PDA by Route 134 (NBDNR 2015).

Field surveys identified three unmapped waterbodies (Waterbody-1, Waterbody-2, Waterbody-3) and one unmapped ephemeral watercourse. The waterbodies are associated with wetlands and appear to be anthropogenic. The ephemeral watercourse links two of the waterbodies. These water features do not extend or connect to other features beyond the limits of the PDA.

There are no known surface water intakes or Designated Watershed Protected Areas within the LAA. Water for the Project will be supplied by NB Power through a commercial agreement, from its existing water supply source for its Belledune Thermal Generating Station that currently has excess capacity. No new water supply will be created or sourced as a result of the Project.

8.5.2.2 Groundwater

Groundwater typically occurs in soil deposits (referred to as overburden) or in cracks or crevices in the underlying rock (i.e., fractured bedrock). As groundwater moves through soil and rock, minerals in the soil and rock can be dissolved into the groundwater, resulting in a change in the water quality. As a result, the quantity and quality of groundwater that can be extracted using water wells depends on the geology of an area. Overburden and fractured bedrock formations that can produce useable amounts of groundwater are called aquifers.

The village of Belledune does not have a municipal water supply. Potable water for most residents in the area is provided by private wells (Gemtec 2012). Four groundwater wells were identified within 500 metres of the PDA in a search of the NB OWLS database. Three are drinking water wells associated with the Shaw Resources Chaleur Sawmill, located to the west of the Project. The remaining non-drinking water well is categorized as industrial use and is located to the east. These wells range in depth from approximately 45 metres to 90 metres and the closest is approximately 50 metres from the edge of the PDA (NBDELG 2019a). Potable water for the residents of Chaleur Drive is supplied from a distribution system provided by Glencore's Brunswick Smelter facility. This water comes from the Jacquet River approximately 10 kilometres from the PDA and is chlorinated prior to distribution (Gemtec 2012).

In order to obtain a large enough dataset of potential wells in the area to characterize the water quality in the LAA, groundwater samples reported by the NB OWLS for water well records located within 5 kilometres of the PDA were obtained. This included sample results from 17 groundwater wells. Summary statistics for the analyzed water quality parameters were prepared and are presented on Figure 8.1.

Overall, the water quality in the area is generally good to fair, with water quality meeting the GCDWQ (Health Canada 2017a) in most of the water wells reviewed. However, the sample results of six of the 17 groundwater wells indicated that one or more analyzed parameters exceeded the maximum acceptable concentrations or aesthetic objectives developed for the GCDWQ. Maximum acceptable concentrations were exceeded for arsenic in one sample, nitrite in one sample, nitrite/nitrate in one sample, lead in one sample, and antimony in one sample. Total coliform was also detected in four of the samples; and one sample indicated the presence of *E. coli* (NBDELG 2019a). Aesthetic objectives were exceeded for iron in six of the samples, chloride in one of the samples, manganese in one of the samples, copper in one of the samples, and sodium in one of the samples.

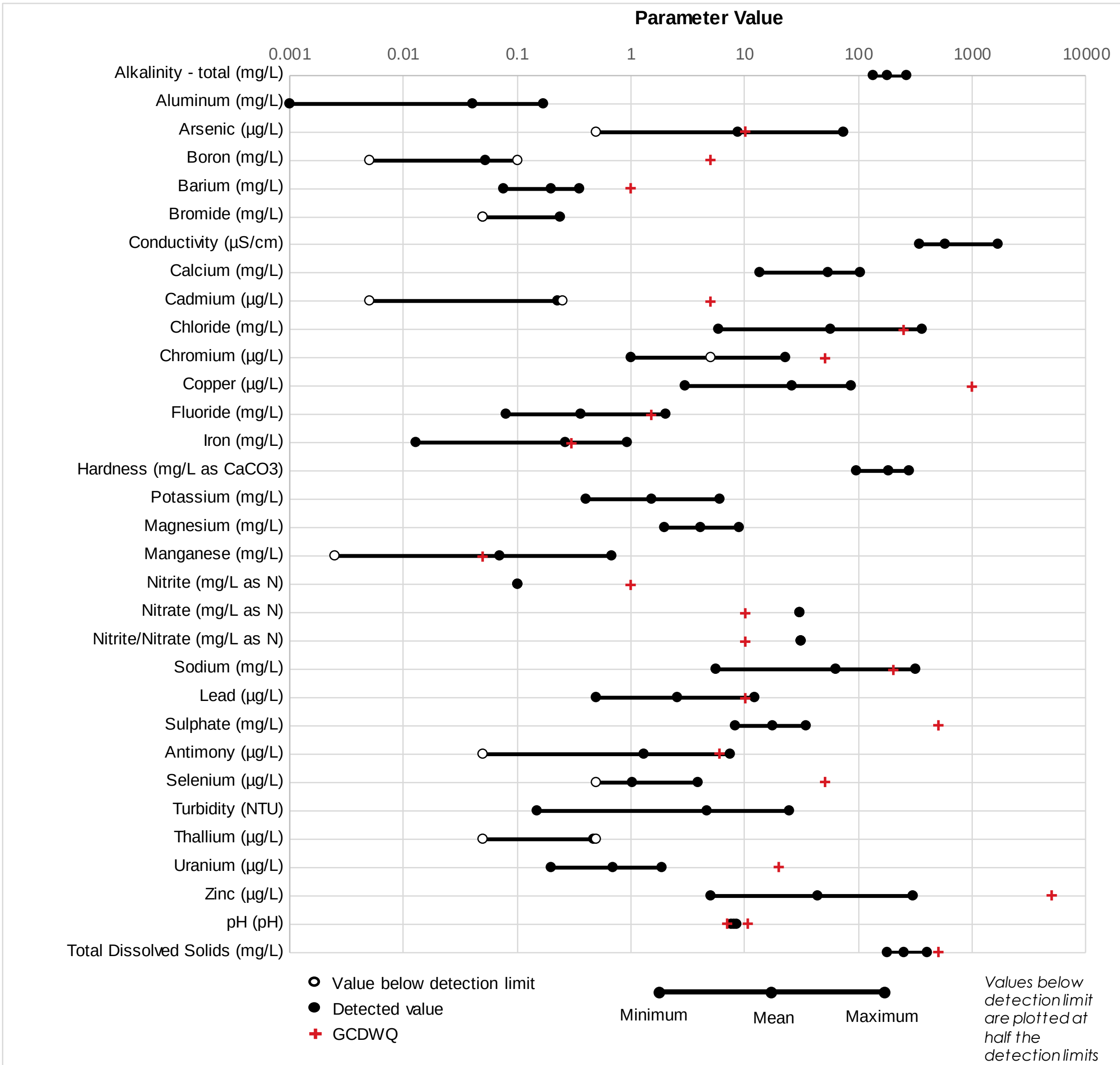

Figure 8.2 Groundwater Chemistry from wells located within 5 kilometres of PDA (NBDELG 2019a)

8.6 POTENTIAL PROJECT INTERACTIONS WITH WATER RESOURCES

Activities and components could potentially interact with water resources to result in adverse environmental effects on groundwater and surface water. In consideration of these potential interactions, the assessment of Project-related environmental effects on Water Resources is therefore focused on the potential environmental effect listed in Table 8.1. This potential environmental effect will be assessed in consideration of specific measurable parameters, also listed in Table 8.1.

Table 8.1 Potential Environmental Effects and Measurable Parameters for Water Resources

Potential Environmental Effect	Measurable Parameter
Change in the quantity and/or quality of water resources	• Change in the quantity (m^3) of groundwater available for human use. • Change in baseline groundwater quality (units of measure are parameter specific, e.g., mg/L for nitrate) • Changes in the rates of surface water runoff (m^3/s). • Changes in baseline surface water quality (units of measure are parameter-specific)

Table 8.2 identifies the physical activities that may interact with the VC and result in an environmental effect. These interactions are discussed in detail in the following sections, including potential environmental effects, mitigation and environmental protection measures, and residual environmental effects. Where no interaction is indicated, a discussion is provided following the table.

Table 8.2 Potential Project Interactions with Water Resources

Project Activity	Potential Environmental Effect Change in Water Resources
Construction	
Site Preparation	-
Construction of Temporary Facilities	-
Construction of Project Components	✓
Ground Transportation	-
Marine Transportation	-
Commissioning	-
Employment and Expenditure	-
Emissions and Wastes	-
Operation and Maintenance	
Iron Production	-
Maintenance	-
Ground Transportation	-
Marine Transportation	-
Employment and expenditure	-
Emissions and Wastes	-

Notes:
✓ indicates an interaction
- indicates no interaction

Activities listed under construction and operation and maintenance that are not anticipated to interact with water resources include ground transportation, marine transportation, commissioning, employment and expenditure, emissions and wastes, and maintenance. These activities do not involve the use or management of groundwater or surface water.

Site preparation, construction of temporary facilities, and iron production involve the use of potable and process water, management of stormwater, and localized changes to the water table; however, they are unlikely to interact with water resources for human use. Activities related to the construction of Project components may interact with water resources; these activities are described in the context of water resources in further detail below.

8.6.1 Surface Water

There are no known surface water resources within the PDA, and no interconnection between the PDA and surface water resources within the LAA. The three unmapped waterbodies and unmapped ephemeral watercourse identified in the PDA appear to be anthropogenic, former borrow pits and are not used for human activity. These features are limited to the PDA and not connected to other surface water features which extend beyond the PDA. The closest mapped watercourse is located approximately 250 metres to the west and upgradient of the PDA and is not anticipated to interact with the Project.

Surface water drainage within the PDA flows directly to Chaleur Bay and does not interact with other mapped surface water features. During construction, beginning with site preparation, surface water runoff will be collected and directed to temporary settlement ponds to remove suspended sediment generated from exposed soils.

During operation, drainage collection networks installed throughout the Project facility will allow for the intermittent collection of rainfall surface runoff, both contact and non-contact. Contact surface water runoff will be generated from that rainfall which physically comes into contact with outdoor process operating equipment and piping (and their associated supporting elements) within the Project facility. Contact surface water runoff will be collected and pass through local area sumps that will contain compartments and/or weirs that will trap any sediment, particles, and/or contaminants. The water will then be pumped to the Slurry Water sub-system for treatment. Treated water will be re-used as part of the Process Cooling Water sub-system. No contact surface water runoff will be released to the environment.

All other rainfall within the Project facility will generate non-contact surface runoff water. Non-contact surface water runoff will be directly routed via drainage collection networks and gravity flow into a holding pond. The holding pond would be maintained at a minimal water level such that the maximum pond volume would be available to receive surface water runoff from a storm. Non-contact surface water runoff will be either gravity fed or pumped (at a rate approximately equivalent to the natural pre-development drainage rate) from the holding pond into an existing ditch leaving the Project site which discharges into the Bay of Chaleur.

Based on this planned approach for surface water management, Project activities are not anticipated to interact with surface water and are not discussed further in this assessment.

8.6.2 Groundwater

Shallow dewatering of excavations during construction of the Project components may cause slight lowering of the groundwater table. This lowering will be localized and is not likely to extend beyond the PDA or interact with groundwater wells within the LAA. Changes in groundwater quality are also not anticipated as a result of dewatering activities during construction.

Limited blasting activity is anticipated as part of construction; and has the potential to interact with groundwater resources, resulting in a potential change in groundwater quantity or quality.

Blasting during construction may cause changes in the yield (increases or decreases) of bedrock groundwater wells located within 500 metres of these activities due to vibration resulting from the blasting. Well yield could increase if new fractures are created by shifting of the bedrock during blasting that can carry more groundwater to the well. Well yield could decrease if open fractures in the bedrock are closed or partially infilled with sediment during blasting activities. The resulting change in well yield (if any) would depend of the following factors: distance between the well and the blasting activities; the physical and chemical properties of the intervening bedrock, the depth of the well relative to the local water table, the yield of the well prior to construction, and the age and condition of the well. Shallow, very low yield wells located in the immediate vicinity of the construction activates would be more susceptible to changes in well yield from blasting. Deeper drilled wells, especially those located further away from the blasting activities, would be expected to have small changes in well yield, if any. Any change in well yield that might arise is expected to be site-specific with any interactions expected within 500 metres of the construction activities.

Blasting of bedrock could cause minor changes to the groundwater quality, particularly the turbidity of the groundwater. Vibration in the bedrock caused by these activities may dislodge or move sediments present in the fractures in bedrock wells, cause sediment to enter the screens of overburden wells, or loosen well casings thereby allowing entry of surface water to a well bore. This may temporarily decrease the clarity of the groundwater (i.e., increase the turbidity) in a well connected to these fractures or unconsolidated formations; however, the turbidity would return to pre-construction conditions shortly after a blasting event as dislodged sediment settles in the fractures. Physical damage to well casings or well collapse with consequent water quality deterioration is less common, due to the distances identified.

8.6.3 Mitigation for Water Resources

Interactions between Project activities and water resources will be managed through the use of various mitigation measures. The following mitigation measures specific to water resources have been identified for this Project.

During construction:

- Notification of landowners near the construction site prior to any blasting activities.
- Conducting a pre-construction water well survey for wells located within 500 metres of blasting activities.
- Establishment of a reporting and arbitration procedure in the unlikely event of a well damage claim.

- Supervision of all blasting by certified professionals.

8.6.4 Characterization of Residual Project-Environmental Interactions for Water Resources

A change in well yield (if any) resulting from blasting would depend on the following factors: distance between the well and the blasting activities, physical and chemical properties of the intervening bedrock, depth of the well relative to the local water table, yield of the well prior to construction, and age and condition of the well. Shallow, very low yield wells located in the immediate vicinity of the construction activates will be more susceptible to changes in well yield from blasting. Deep drilled wells, such as those recorded in the OWLS database, and especially those located further away from the blasting activities, would be expected to have small changes in well yield, if any. Any change in well yield that might arise is expected to be site-specific with any interactions expected within 500 metres of the construction activities.

Blasting activities may also result in a temporary and minor increase in the turbidity of the groundwater in wells within 500 metres of the construction activities. This change is expected to be temporary as the turbidity would return to pre-construction conditions shortly after a blasting event.

Substantial blasting activities are not currently anticipated as part of construction. If required, blasting will be carried out in accordance with best management practices and supervised by certified professionals. A pre-construction water well survey will be conducted for wells located within 500 metres of blasting activities. In the unlikely event that interactions with groundwater should occur during the construction phase, their effects can be mitigated using standard practices, such as rehabilitating a well, deepening a well, replacing a well, or providing water treatment, as necessary.

8.7 SUMMARY AND RECOMMENDATIONS

With the implementation of mitigation and environmental protection measures as described in this assessment, it is not anticipated that there will be substantial interaction between the Project and water resources. A monitoring program will be developed for testing of contact surface water runoff as part of a subsequent Project design stage.

9.0 ASSESSMENT OF ENVIRONMENTAL EFFECTS ON THE TERRESTRIAL ENVIRONMENT

This section includes an analysis of the potential interactions between Project activities and the terrestrial environment. The terrestrial environment VC includes consideration of vegetation communities (including Ecological Communities of Management Concern (ECMC), vascular plant and wildlife species (including SAR and SOCC and their habitats, including wetlands. Interactions between the Project and the terrestrial environment could result in changes to terrestrial habitat, including wetlands, and wildlife SAR and SOCC. Interactions could also result in the introduction or spread of invasive vascular plants. With the implementation of mitigation measures described in this assessment, it is not anticipated that there will be substantial negative effects caused by the Project on the terrestrial environment during any phases of the Project. Although some habitat will be lost as a result of the Project, this habitat is currently fragmented and located within an industrial landscape.

9.1 RATIONALE FOR SELECTION AS A VALUED COMPONENT

The terrestrial environment has been selected as a VC due to:

- The importance placed on it by the people of New Brunswick who recognize the environmental and socioeconomic value
- The potential environmental effects of the Project on vegetation, wildlife, and wetlands
- The regulations that protect vegetation, wildlife, and wetlands
- The relationship between vegetation, wildlife, and wetlands and other VCs, such as fish and fish habitat, and current use of land and resources for traditional purposes by Aboriginal persons

In this assessment, the potential changes to the terrestrial environment as a result of the Project are considered. The scope of the assessment is based on applicable regulations and policies, professional judgement of the study team, and knowledge of potential interactions.

9.2 REGULATORY CONTEXT

A focus of this VC is rare vegetation and wildlife, i.e., SAR and SOCC. SAR include species listed as *extirpated*, *endangered*, *threatened*, or *special concern* in Schedule 1 of the federal *SARA*, the COSEWIC, or the NB *SARA*. SAR ranked *extirpated, endangered*, or *threatened* by *SARA* or NB *SARA* currently have regulatory protection under Schedule 1 of the federal *SARA* or as per the *Prohibitions Regulation* and Section 28 of NB *SARA*. The definition used in this document also includes species on the NB *SARA List of Species at Risk Regulation* and those listed by COSEWIC that are not currently afforded these protections but may become protected within the timeframe of this Project. These species have been included at the request of ECCC based on previous environmental assessments conducted in New Brunswick.

SOCC are species not listed or protected by any legislation, but are considered rare in New Brunswick or their populations may not be considered sustainable. SOCC are herein defined to include species that are not SAR, but are ranked S1 (*critically imperiled*), S2 (*imperiled*), or S3 (*vulnerable*) in New Brunswick by the Atlantic Canada Conservation Data Centre (AC CDC 2017; 2018b).

ECMC are typically vegetation communities that have been identified as fulfilling special management objectives on Crown land in New Brunswick, or areas that have been identified, either through field work or by local conservation organizations, as supporting unique ecological features (e.g., Environmentally Significant Areas (ESA)). Provincially identified forest stands that fulfill biodiversity or wildlife management objectives on Crown land are known as conservation forest, and include protected natural areas, old forest communities, old forest wildlife habitat, deer wintering areas, and watercourse and waterbody buffer zones. ESAs, initially identified by the New Brunswick Nature Trust, support natural features that might be sensitive to disturbance by development. These areas can be of geological or ecological interest and are identified by a single point location in the AC CDC database. These areas have no legislated protection, but can represent known locations or important habitat for plant SAR or SOCC and are thus also considered ECMC.

Wetlands are defined as lands that are permanently or temporarily submerged by water near the soil surface for long enough to maintain wet or poorly drained soils, support plants adapted to saturated soil conditions, and have other biotic conditions characteristic of wet environments (NBDNRE and NBDELG 2002). Wetland conservation is addressed in both *The Federal Policy on Wetland Conservation* (GOC 1991) and the New Brunswick *Wetlands Conservation Policy* (NBDNRE and NBDELG 2002). The federal policy aims to protect wetlands on federal lands and waters or within federal programs where wetland loss has reached critical levels, and also within federally designated wetlands, such as Ramsar sites (GOC 1991). In New Brunswick, regulation and conservation of wetlands are under the jurisdiction of NBDELG. The provincial wetland policy focuses on protecting wetlands in New Brunswick through securement, increasing education and awareness, and maintaining wetland function. These policy goals are enforced through the New Brunswick *Clean Water Act* and associated *Watercourse and Wetland Alteration* (*WAWA) Regulation*, and the New Brunswick *Clean Environment Act* and associated *EIA Regulation*. Currently, NBDELG considers only those wetlands visible on the GeoNB Regulated Wetlands Map (SNB 2011, http//geonb.snb.ca/geonb/) to be regulated under this legislation (NBDELG 2017b).

The MBCA, by way of the *Migratory Birds Regulations* and *Migratory Birds Sanctuary Regulations*, defines the provisions by which an estimated 450 native species of migratory birds (including their nests and eggs) are protected in Canada. Under the MBCA, the killing, harming, harassing, or injuring of migratory birds and their nests is prohibited.

To comply with the provisions of the MBCA, construction activities that require the removal of trees and ground vegetation are normally conducted outside of migratory bird breeding season (mid-April to late August for this region).

9.3 SPATIAL BOUNDARIES

The assessment of potential environmental interactions between the Project and the terrestrial environment is focused on a PDA and a LAA.

The PDA for the Project is defined as the area of physical disturbance associated with the construction, operation, and maintenance of the Project. As described in Section 2.5, for the purposes of this assessment, the PDA includes the land within the property boundaries of PID 20616322, PID 20598090, and PID 20277927. The PDA is depicted on Figure 2.4.

The LAA for the terrestrial environment is defined as the area within which the environmental effects of the Project can be measured or predicted and measured with a reasonable degree of accuracy and confidence (i.e., the zone of influence of the Project on the terrestrial environment). The LAA for the terrestrial environment includes the PDA, and a 500 metre buffer around the PDA.

The PDA and the LAA are shown on Figure 9.1.

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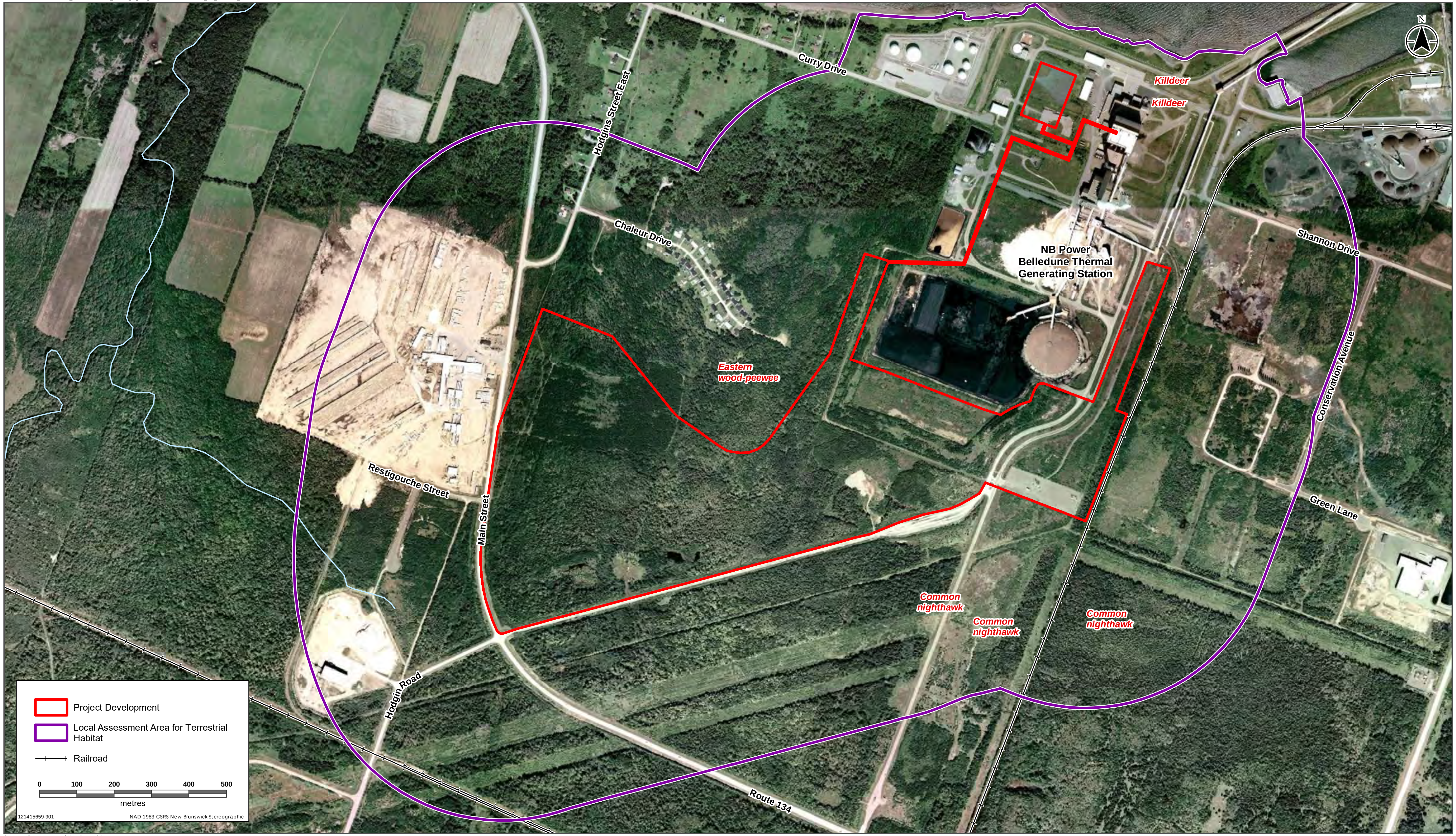

Sources: Government of New Brunswick

Service Layer Credits: Service New Brunswick/Service Nouveau Brunswick

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

Local Assessment Area for the Terrestrial Environment

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Figure 9.1

9.4 TEMPORAL BOUNDARIES

The temporal boundaries for the assessment of the potential environmental effects on the terrestrial environment include:

- Construction – scheduled to begin in Q1 2020 and last for approximately 3 years; and
- Operation and maintenance – scheduled to begin in Q1 2023 and continue for the life of the facility, currently anticipated to be in excess of 30 years.

9.5 EXISTING CONDITIONS FOR THE TERRESTRIAL ENVIRONMENT

9.5.1 Approach and Methods

9.5.1.1 Information Sources

Information on vascular plant SAR and SOCC were obtained from the AC CDC. AC CDC data, including SAR, SOCC, and managed areas, were obtained for the area within 5 kilometres of the Project (AC CDC 2018c). The AC CDC data report obtained for the Project is included in Appendix G.

Information on ECMC was gathered from the AC CDC and NBDERD. The AC CDC maintains data on managed and biologically significant areas within New Brunswick, including ESAs. NBDERD maintains information on conservation forest, including Protected Natural Areas (PNAs) for New Brunswick. Provincial conservation forest information and AC CDC data on managed and significant areas was reviewed to identify ECMC within the LAA.

Land use data were obtained from NBDERD and NBDELG for the LAA. Forest stands were classified into one of three maturity classes: regeneration – sapling, young – immature, or mature – overmature, and one of three species composition classes: hardwood, mixedwood, or softwood. Stands with both hardwood and softwood species, with both equaling less than 70% are considered mixedwood. Data from these sources are from 2007, and thus were over 10 years old at the time of assessment. Similarly, available GeoNB imagery is also from 2007. Some changes to the land use within the PDA were noted during field surveys, most notably, to the ages of forest stands.

Records for wildlife, including avian species, known to have been historically observed within the LAA and surrounding area, were obtained from various sources including the AC CDC and field studies conducted by Stantec during the spring and summer of 2018. AC CDC data, including SAR, SOCC, and managed areas, were obtained within 5 kilometres of the Project (AC CDC 2018c).

9.5.1.2 Field Studies

Field studies were conducted to collect biological data in support of the Project. Bird surveys were conducted in May and June, and vascular plant and wetland surveys were conducted in late August and late September.

Vascular plant and wetland surveys were conducted from August 28-31, 2018, and September 25 and 26, 2018, with some incidental plant observations recorded during other terrestrial surveys. Geographic coordinates of locations of vascular plants were recorded using ArcGIS Collector software on an iPhone paired with a Garmin Glo™ to increase location accuracy. All vascular plant species were recorded when first observed, and plants that were not identifiable in the field were collected and later identified using a dissecting microscope and various floristic keys.

Wetlands were delineated and classified according to the Canadian Wetland Classification System (CWCS; NWWG 1997). This system classifies wetlands to three levels: class, form/subform, and type. There are five wetland classes: bog, fen, swamp, marsh, or shallow water. Form and subform indicate the physical morphology and hydrological characteristics of the wetland. Wetland type distinguishes wetland communities based on one of eight groups of dominant vegetation. Wetland boundary locations were recorded using a Trimble® Geo 7x GPS. Wetland function was assessed using the Wetland Ecological Services Protocol – Atlantic Canada (WESP-AC) method. This method requires both a field and office component and is considered less subjective than other wetland functional assessment methods. The WESP-AC data were entered in the most recent form available on December 7, 2018 (Adamus 2018).

Early breeding bird surveys, targeting diurnal early-nesting species such as woodpeckers and forest breeding raptors were conducted on May 8, 2018. The surveys consisted of ten-minute point counts conducted within the PDA and surrounding LAA, based on a modified fixed-radius point count sampling procedure (Bibby et al. 2000). Surveys were conducted in good weather conditions with light winds and no precipitation. Surveys began near dawn and continued until approximately 1300 hours each survey day. Observers collected data on each bird species observed, and information about environmental conditions. All species observed during the surveys were recorded.

Nocturnal owl surveys were completed on the evening of May 7, 2018. Surveys were generally conducted in accordance with the Guidelines for Nocturnal Owl Monitoring in North America (Takats et al. 2001), and included a two-minute silent listening period followed by a ten-minute period of alternating playbacks and silent listening periods. Surveys began approximately 30 minutes after sunset, and were completed prior to midnight. Survey stations were located at roadside near forested habitat, but avoiding main roads. Information including general noise level, environmental conditions, and the presence of other nocturnal species was recorded.

A breeding bird survey was conducted on June 28, 2018, to provide an overview of breeding bird species present in the LAA. These surveys consisted of area search surveys conducted in the PDA and surrounding area. The survey began near dawn and continued until 1000 hours. Data collected included date and time of survey, and environmental conditions.

Surveys focused on identifying the presence of crepuscular bird species, in particular, common nighthawk (*Chordeiles minor*), were conducted on the evening of June 27, 2018. Survey stations were established near areas with potential to provide breeding opportunities for common nighthawk, including open forest, grasslands, exposed sand and gravel, and other anthropogenic habitats such as farmland and pastures. Roadside surveys were conducted starting approximately 60 minutes before sunset and continued until up to two hours after sunset. Surveys followed a point count sampling procedure (BC RIC 1998). Data collected included date and time of survey, environmental conditions, and background noise level.

Incidental observations of other wildlife species or their sign were made during all biophysical field surveys, including vegetation and wetland surveys.

9.5.2 Description of Existing Conditions

9.5.2.1 Environmental Setting

The Project is located within the Nicholas Denys Ecodistrict of the Northern Uplands Ecoregion. This Ecoregion extends across the northern-most portion of New Brunswick and is seated between the two separate portions of the Highlands Ecoregion. The Northern Uplands Ecoregion is climatically intermediate between the colder Highlands Ecoregion and the slightly warmer and wetter Central Uplands Ecoregion located to the south. The vegetation and fauna within this ecoregion consequently display a mixture of northern and southern affiliations, giving the area an ecologically distinctive character (NBDNR 2007).

The Nicolas Denys Ecodistrict is a narrow, gently sloping strip of land that lies along the coast of the Chaleur Bay. It stretches from the Nepisiguit River, which forms the southern boundary, northward to the Dalhousie Peninsula. The vegetation here is extensively influenced by the long history of human settlement and consists of small patches of coniferous forests scattered in a predominantly mixedwood forest. The low, acidic flatlands are covered with a forest dominated by intolerant hardwoods such as trembling aspen (*Populus tremuloides),* red maple (*Acer rubrum*), and paper birch (*Betula papyrifera*), with associated balsam fir (*Abies balsamea),* white spruce (*Picea glauca*), and eastern white cedar (*Thuja occidentalis*) (NBDNR 2007).

9.5.2.2 Vegetation Communities

Upland plant communities occupy approximately 57% of the PDA, with most of the upland areas occupied by forest (Table 9.1, Figure 9.2). Forest inventory mapping was used to identify and present the distribution of forest types in the PDA. Seven forest types have been identified in the PDA including regeneration to sapling hardwood forest, young to immature hardwood forest, mature to over-mature hardwood forest, young to immature mixed-wood forest, regeneration to sapling softwood forest, young to immature softwood forest, and mature to over-mature softwood forest. Habitat classifications in Table 9.1 are based on NBDERD and NBDELG digital information from 2007, while descriptions provided below also include field observations.

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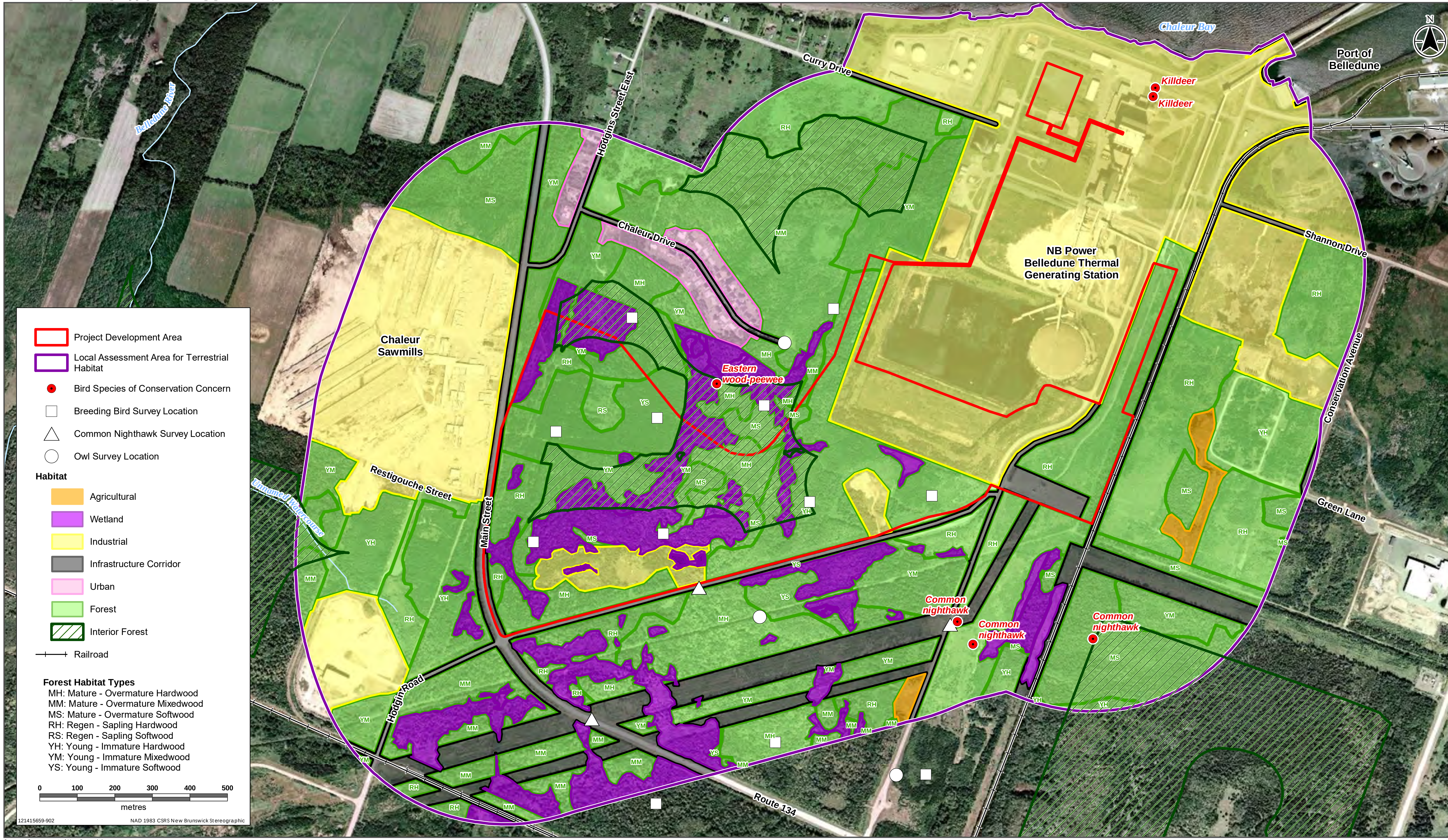

Sources: Government of New Brunswick

Service Layer Credits: Service New Brunswick/Service Nouveau Brunswick

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

Habitats and Locations of Breeding Bird Point Counts and Bird Species at Risk

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Figure 9.2

Table 9.1 Land Use (Including Vegetation Communities) within the PDA and LAA

Land Use	PDA		LAA	
	Area (ha)	% of PDA	Area (ha)	% of LAA
Agricultural	-	-	2.5	0.5
Industrial	18.7	23.1	148.5	32.2
Infrastructure	2.8	3.4	38.1	8.3
Urban	-	-	6.1	1.3
Forest	46.2	57.0	455.5	49.0
Regenerating - Sapling Hardwood	10.6	13.0	60.7	13.2
Young - Immature Hardwood	14.1	17.4	35.7	7.7
Mature - Overmature Hardwood	6.6	8.2	24.1	5.2
Young - Immature Mixedwood	4.4	5.4	31.1	6.8
Mature - Overmature Mixedwood	0.1	0.1	36.9	8.0
Regenerating - Sapling Softwood	1.2	1.5	1.2	0.3
Young - Immature Softwood	6.8	8.4	10.4	2.3
Mature - Overmature Softwood	2.4	3.0	255.4	5.5
Wetland	13.5	16.6	40.0	8.7
Shallow Water Wetland	0.2	0.2	0.2	0.03
Freshwater Marsh	0.7	0.9	1.2	0.3
Coniferous Treed Swamp	3.3	4.0	7.7	1.7
Mixedwood Treed Swamp	1.0	1.2	11.2	2.4
Deciduous Treed Swamp	6.0	7.4	8.1	1.8
Tall Shrub Swamp	2.3	2.9	11.6	2.5
Total	81.2	100.1 [1]	690.7	100.0

Note:
Land use was determined through a combination of field observation, NBDERD forest and non-forest data, and aerial photo interpretation.
[1] This number is higher than 100 due to rounding.

Regeneration to sapling hardwood forest is found in three stands on the western margin of the PDA. These stands appear to be less than 20 years of age. The canopy is composed of a mixture of tall shrubs and regenerating trees. The dominant species of the canopy include speckled alder (*Alnus incana*), paper birch, trembling aspen, pin cherry (*Prunus pensylvanica*), and balsam poplar (*Populus balsamifera*). The shrub understory is composed mostly of red raspberry (*Rubus ideaus*), beaked hazelnut (*Corylus* *cornuta*), and red osier dogwood (*Cornus sericea*). Regeneration to sapling hardwood forest comprises 13% of the PDA.

Young to immature hardwood forest occurs as a single stand that occupies much of the eastern half of the PDA and makes up 17.4% of the PDA. This stand is estimated to be approximately 30 years old. The tree canopy is composed largely of balsam poplar, trembling aspen, and paper birch. Mountain maple (*Acer spicatum*) and beaked hazelnut are the dominant species of the shrub understory.

Mature to over-mature hardwood stands are found at four locations in the PDA and occupy 8.2% of the PDA. These stands are estimated to be at least 60 years in age, and older stands are characterized by moderate mortality of overstory trees, particularly balsam poplar. The tree canopy of these stands is typically composed of a mixture of trembling aspen, paper birch, yellow birch (*Betula alleghaniensis*), sugar maple (*Acer saccharum*), and balsam poplar. The dominant trees of the shrub layer include mountain maple, red osier dogwood, beaked hazelnut, and advanced regeneration of balsam fir.

Young to immature mixedwood forest is found just south of a jack pine plantation. The most abundant species of the tree canopy include paper birch, eastern white cedar, yellow birch, balsam fir, trembling aspen and balsam poplar. The shrub understory is moderately dense and is composed largely of a mixture of speckled alder, mountain maple, red osier dogwood, beaked hazelnut, and advanced regeneration of balsam fir. Young to immature mixedwood forest comprises 5.4% of the PDA. Mature to over-mature mixedwood is largely outside of the PDA.

One stand of regeneration to sapling softwood forest is found in the PDA. It occupies 1.5% of the PDA and is largely surrounded by a jack pine (*Pinus banksiana*) plantation (discussed below). This area was either not planted with jack pine or the plantings may have failed. This stand is characterized by an open tree canopy composed of scattered white spruce. The shrub understory is patchy and is composed largely of patches of red raspberry, speckled alder, and red osier dogwood.

One young to immature softwood forest stand is found in the PDA. It is located on the top of a low hill near the northwestern corner of the PDA. This stand is a jack pine plantation that is approximately 20 years old. The canopy of this stand is composed almost entirely of jack pine with a few trembling aspen mixed in. The shrub understory is very sparse and consists of a few small patches of red osier dogwood that are found under gaps in the tree canopy. The jack pine plantation occupies 8.4% of the PDA.

Five stands of mature to over-mature softwood forest are found near the center of the PDA. These stands are typically found in imperfectly drained areas adjacent to wetland. Approximately 3% of the PDA is occupied by these stands. The species that dominate the tree canopy include balsam fir, eastern white cedar, white spruce, and trembling aspen. Mountain maple and advanced regeneration of balsam fir and eastern white cedar are the most abundant species of the shrub understory.

Approximately 23% of the PDA is classed as industrial. These areas have been heavily disturbed as a result of being used as borrow pits or during the construction of the coal storage area for the power plant. The species composition of the vegetation cover of these areas varies substantially depending on the intensity of disturbance, whether the disturbance event impeded or increased site drainage and how long ago the disturbance was. Most areas were disturbed many years ago and now support tall shrub thickets that are dominated by speckled alder, willows (*Salix* spp.), red raspberry, and young balsam poplar, trembling aspen and paper birch. The industrial areas at the eastern end of the PDA include sites that have continued to be disturbed until recently. These areas are characterized by poorly vegetated surfaces that support a sparse cover of forbs and grasses including Canada blue grass (*Poa compressa*), black knapweed (*Centaurea nigra*), common Timothy (*Phleum pretense*), Queen Anne's lace (*Daucus carota*), white sweet-clover (*Melilotus albus*), and Canada horseweed (*Conyza canadensis*).

The remainder of the PDA, approximately 16.6%, is classified as wetland. Wetland habitats are described in Section 9.5.2.5.

9.5.2.3 Interior Forest

Interior forest is here defined as patches of mature forest greater than 10 hectares in size, and at least 100 metres from an "edge" (e.g., clearcuts, industrial or other anthropogenic areas, linear features such as roads or transmission lines, or waterbodies and open wetlands greater than 0.1 hectares). Some wildlife species are particularly sensitive to fragmentation and prefer or require interior forest habitat for various life stages. These species, known as interior species, include black-throated blue warbler, hermit thrush, Canada warbler, and ovenbird (LandOwner Resource Centre 2000). Interior forest patches at least partially within the LAA were determined using vegetation community data updated with the results of field surveys conducted in 2018 (Section 9.5.2.2). Because the forest data available are over 10 years old, stands listed as "regenerating" in the NBDERD forest data (i.e., clearcuts) were not buffered for this exercise as they are likely no longer in a regenerating stage.

There are currently four patches of interior forest contiguous with the LAA, totaling approximately 111.3 hectares. One of the patches is 20.9 hectares in size and is partially within the PDA. The remaining three patches of interior forest are all located outside of the PDA, and are 11.4 hectares, 34.8 hectares, and 44.2 hectares in size.

9.5.2.4 Vascular Plant Species, Including SAR and SOCC

In total, 258 vascular plant species were observed during botanical surveys conducted in support of the Project (Appendix H, Table H.1). No vascular plant SAR and three vascular plant SOCC were observed. All SOCC were observed outside of the current PDA. Menzies' rattlesnake plantain (*Goodyera oblongifolia*, *S2*) was observed in two locations: approximately 115 metres south of Main Street (Route 134) and approximately 125 metres north of Main Street (Figure 9.3). Both locations are less than 10 metres from the boundary of a mixedwood treed swamp. Dotted smartweed (*Polygonum punctatum*, *S3*) was observed within a tall shrub swamp approximately 95 metres south-southeast of the PDA. Gmelin's water buttercup (*Ranunculus gmelinii*, *S3*) was observed on the edge of a tall shrub swamp approximately 160 metres south-southeast of the PDA. A number of exotic species were observed within the PDA, two of which are considered invasive by some sources: Canada thistle (*Cirsium arvense*) and common tansy (*Tanacetum vulgare*) (NBISC 2012; NCC 2018).

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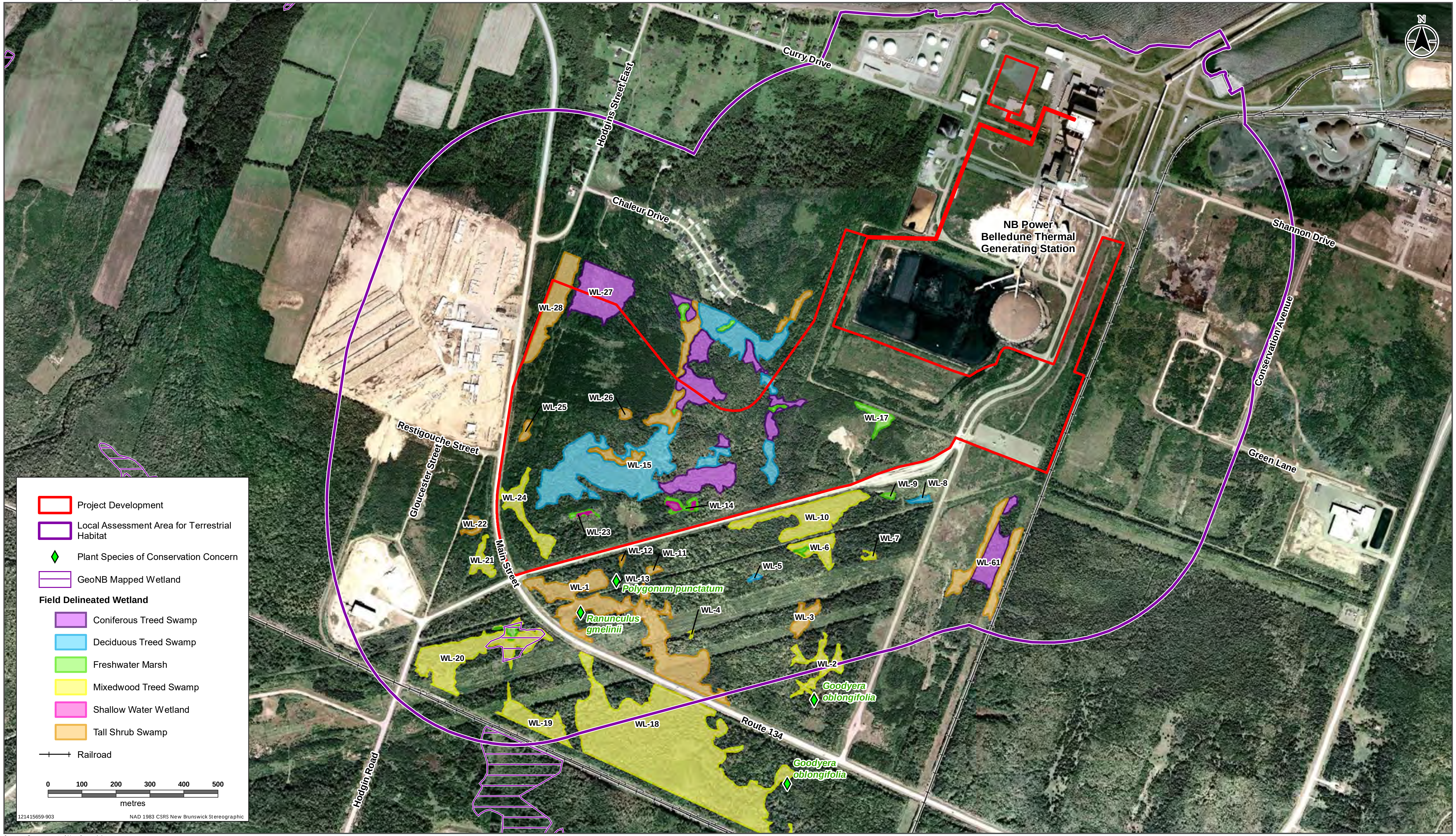


Sources: Government of New Brunswick

Service Layer Credits: Service New Brunswick/Service Nouveau Brunswick

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

Vascular Plant Species of Conservation Concern and Wetlands within the Local Assessment Area

Stantec

121415659 - PROPOSED IRON PROCESSING FACILITY, BELLEDUNE, NEW BRUNSWICK - MARITIME IRON INC.

Figure 9.3

9.5.2.5 Wetlands

Nine wetlands were observed and delineated within the PDA. Several of these wetlands were complexes of multiple wetland classes and types (Table 9.2, Figure 9.3). Wetlands can extend past the boundaries of the PDA; the total amount of wetland reported in Table 9.2 is therefore greater than that reported within the PDA in Table 9.1, with 6.8 hectares extending outside of the PDA.

Table 9.2 Wetlands within the PDA

Wetland ID	Wetland Class and Type	Area (ha)[1]
14	Freshwater marsh, shallow water wetland	0.3
15	Deciduous treed swamp, coniferous treed swamp, tall shrub swamp, freshwater marsh	14.2
17	Freshwater marsh	0.4
23	Freshwater marsh, shallow water wetland	0.1
24	Mixedwood treed swamp	1.0
25	Tall shrub swamp	0.2
26	Tall shrub swamp	0.1
27	Coniferous treed swamp	2.3
28	Tall shrub swamp	1.7
	Total	20.3

Note:
[1] Wetlands can extend past the boundaries of the PDA; the total amount of wetland reported in this table is therefore greater than that reported within the PDA in Table 9.1.

Wetland 14

Wetland 14 is a 0.3 hectares shallow water wetland and freshwater marsh complex that appears to be of anthropogenic origin. It is likely that this wetland was once a borrow pit. The shallow water wetland component of the wetland is classified as submerged aquatic discharge basin water (National Wetlands Working Group 1997). Wetland 14 consists of two basins that are connected by a small channel (called waterbodies (Waterbody 1 and Waterbody 2) in Section 7.5.2.1). There is no apparent outflow and it appears that most water is lost to groundwater or evaporation. During spring freshet or heavy precipitation events some surface water may decant via a shallow declivity and flow into the adjacent Wetland 15. Water depth averages approximately 1 metres with a maximum depth of approximately 1.5 metres. The bottom of the basin is carpeted with the macro-algae chara (*Chara* sp.). Alpine pondweed (*Potamogeton alpinus*) are scattered throughout the pond. A fringe of freshwater marsh is present around most of the margin of the wetland. It averages approximately 2 metres in width. It is classified as graminoid-dominated isolated basin marsh. The dominant plant species include cyperus-like sedge (*Carex pseudocyperus*), broad-leaved cattail (*Typha latifolia*), and spotted Joe-Pye weed (*Eupatorium maculatum*). Scattered shrubs are present including shining willow (*Salix lucida*), pussy willow (*Salix discolor*), and cottony willow (*Salix eriocephala*).

Wetland 14 scored higher for water storage and delay, water quality support, and aquatic habitat grouped functions, despite not providing fish habitat. The wetland scored moderate for aquatic support and lower for transition habitat, such as songbird, raptor, and mammal habitat, pollinator habitat, and native plant habitat. The wetland's ecological condition is moderate, and the wetland risk (sensitivity and stressors) scored higher (Appendix I, Table I.1).

Wetland 15

Wetland 15 is the largest wetland in the PDA, totaling 14.2 hectraes. It is composed entirely of swamp and is located in a shallow depression between hills that drains towards the north. Wetland 15 has an irregular shape with three distinct seepage track lobes. There are no inlets, and a single outlet was noted, outside of the PDA. There are five types of swamp present in the wetland. Deciduous treed flat swamp is the most common type of swamp in Wetland 15. It is characterized by a relatively open tree canopy that is composed largely of balsam poplar along with some paper birch, and balsam fir. The shrub layer consists mainly of advanced regeneration of balsam fir as well as mountain maple, eastern white cedar, white spruce, trembling aspen, and beaked hazelnut. The ground vegetation layer consists mainly of woodland horsetail (*Equisetum sylvaticum*), fowl manna grass (*Glyceria striata*) along with dwarf red raspberry (*Rubus pubescens*), common lady fern (*Athyrium filix-femina*), wild sarsaparilla (*Aralia nudicaulis*), and ostrich fern (*Matteuccia struthiopteris*).

There are areas throughout the deciduous treed flat swamp portions of Wetland 15 that have experienced heavy mortality of balsam poplar. These areas have a sparse tree layer composed of a few surviving balsam polar and paper birch. The shrub layer is moderately dense and consists largely of a mixture of balsam poplar saplings and red osier dogwood along with scattered trembling aspen and speckled alder. The ground vegetation is well-developed and consists of a mixture of meadow horsetail (*Equisetum pretense*), purple-stemmed aster (*Symphyotrichum puniceum*), spotted jewelweed (*Impatiens capensis*), fowl manna grass, spotted Joe-Pye weed, and common wooly bulrush (*Scirpus cyperinus*).

Coniferous treed flat swamp is found several locations in the wetland usually at the landward edge of the wetland. These stands are usually dominated by a relatively dense tree layer composed mainly of eastern white cedar along with some paper birch. The shrub layer is sparse and consists of a mixture of red elderberry (*Sambucus racemosa*), mountain maple, and beaked hazelnut. Spinulose wood fern (*Dryopteris carthusiana*) is the most abundant ground vegetation species. Other common ground vegetation species include wild sarsaparilla and spotted jewelweed.

A long seepage track is present at the eastern end of Wetland 15. This seepage track supports coniferous treed drainageway swamp. Tree cover is composed mostly of eastern white cedar along with smaller amounts of paper birch and white spruce. The ground vegetation layer is dominated by advanced regeneration of balsam fir and speckled alder. Other common shrub species include red osier dogwood, mountain maple and saplings of paper birch and eastern white cedar. The ground vegetation layer consists of a moss carpet that is punctuated by patches of cinnamon fern (*Osmunda cinnamomea*), naked bishop's-cap (*Mitella nuda*), twinflower (*Linnaea borealis*), fowl manna grass, and spotted jewelweed.

Wetland 15 contains a drainage that appears to provide a source of water to ditches downstream and eventually forms an unmapped watercourse outside of the PDA. No continuous channel is present within the PDA; however, a series of narrow depressions form intermittent pools of static water within the wetland. The intermittent channel is flanked by tall shrub-dominated riverine swamp. This wetland type is characterized by a dense cover of speckled alder underlain by red raspberry. Tree cover is patchy, consisting of scattered balsam poplar. The ground vegetation layer is composed of a mixture of fowl manna grass, spotted jewelweed, cinnamon fern, ostrich fern, and purple-stemmed aster.

Wetland 15 scored higher for aquatic support and transition habitat grouped functions, moderate for water storage and delay and aquatic habitat functions, and lower for water quality support functions. The wetland's ecological condition and risk (sensitivity and stressors) both scored higher (Appendix I, Table I.2).

Wetland 17

Wetland 17 is a forb-dominated isolated basin marsh. This wetland has been highly-modified by past anthropogenic activities. The northern edge of the wetland is bounded by infill deposited as part of the construction of a fence line around the coal storage area. The southern side of the wetland is bounded by what appear to be overburden spoil piles. It is not clear whether the wetland was infilled by deposition of these materials or created as a result of impedance of drainage caused by deposition of the materials. There is no tree cover in this wetland and shrub cover is limited to a fringe of speckled alder, cottony willow, Bebb's willow (*Salix bebbiana*), and shining willow around the landward edge of the wetland and a few small patches in the interior of the wetland. The ground vegetation layer is dominated by a mixture of wild mint (*Mentha arvensis*), spotted Joe-Pye weed, broad-leaved cattail, bluejoint reed grass (*Calamagrostis canadensis*), and common wooly bulrush. This wetland probably floods in the early spring and gradually drains during the late spring months.

Wetland 17 scored higher for water storage and delay, water quality support, and aquatic support grouped functions. The wetland scored moderate for aquatic habitat and transition habitat, such as songbird, raptor, and mammal habitat, pollinator habitat, and native plant habitat. The wetland's ecological condition is moderate, and the wetland risk (sensitivity and stressors) scored higher (Appendix I, Table I.3).

Wetland 23

Wetland 23 is very similar to Wetland 14. It is an abandoned borrow pit that now supports a submerged aquatic discharge basin water (Waterbody 3; see Section 7.5.2.1) that is fringed by graminoid-dominated isolated basin marsh. It consists of a long linear basin with no inflow or outflow. The submerged aquatic discharge basin water supports a patchy carpet of chara while the graminoid-dominated isolated basin marsh is characterized by a dense ground vegetation layer composed mostly of broad-leaved cattail with a moss carpet on the ground surface. Other common ground vegetation species include creeping bentgrass (*Agrostis stolonifera*), northern bugleweed (*Lycopus uniflorus*), and sedge (*Carex* spp.). Shrub cover consists mostly of shining willow along with lesser amounts of upland willow (*Salix humilis*), balsam willow (*Salix pyrifolia*), and balsam poplar.

Wetland 23 scored higher for water storage and delay, water quality support, and aquatic habitat grouped functions, despite not providing fish habitat. The wetland scored moderate for aquatic support and lower for transition habitat, such as songbird, raptor, and mammal habitat, pollinator habitat, and native plant habitat. The wetland's ecological condition and wetland risk (sensitivity and stressors) are moderate (Appendix I, Table I.4).

Wetland 24

Wetland 24 is a mixedwood treed basin swamp located at the western edge of the PDA. There are no inlets to this wetland and it appears to drain via the ditch along Main Street. Wetland 24 is traversed by a cross-country ski trail. The surface of the cross-country ski trail follows the existing topography (no cutting or filling) and has no apparent effect on the hydrology of the wetland. The vegetation of this wetland is characterized by a relatively open tree canopy and well-developed shrub and ground vegetation layers. The tree layer is composed of a mixture of paper birch, red maple, balsam fir and eastern white cedar. The shrub layer consists mostly of speckled alder along with lesser amounts of red osier dogwood, mountain maple, beaked hazelnut, and Canada fly honeysuckle (*Lonicera canadensis*). Blue-joint reed grass, cinnamon fern, and dwarf red raspberry are the most abundant ground vegetation species. Other common ground vegetation species include sensitive fern (*Onoclea sensibilis*), rough-stemmed goldenrod (*Solidago rugosa*), sphagnum moss (*Sphagnum* spp.), and spotted Joe-Pye weed.

Wetland 24 scored higher for water storage and delay, water quality support, and transition habitat grouped functions. The wetland scored moderate for aquatic support and aquatic habitat. The wetland's ecological condition and wetland risk (sensitivity and stressors) are higher (Appendix I, Table I.5).

Wetland 25

Wetland 25 is a small tall shrub-dominated basin swamp found along the western edge of the PDA. This wetland has no inlet or outlet. It is bounded on the western side by an old road bed or possibly a buried pipeline. Construction of this feature has deepened the wetland basin on the western side. The cross-country ski trail that passes through Wetland 24 also passes through the centre of Wetland 25. The trail follows the existing terrain and has no apparent effect on the hydrology of the wetland. Tree cover consists of a few scattered trembling aspen and balsam poplar. Shrub cover is dense and consists mainly of speckled alder and red osier dogwood along with scattered cottony willow, Bebb's willow, and pussy willow. The ground vegetation layer is also dense and is composed of a mixture of dwarf red raspberry, blue-joint reed grass, reed canary grass (*Phalaris arundinacea*), and sensitive fern.

Wetland 25 scored higher for water storage and delay, water quality support, aquatic support and transition habitat grouped functions. The wetland scored moderate for aquatic habitat. The wetland's ecological condition is moderate, and the wetland risk (sensitivity and stressors) scored higher (Appendix I, Table I.6).

Wetland 26

Wetland 26 is a small tall shrub-dominated basin swamp. There is no inlet to the wetland and there is a poorly defined channel at the eastern end of the wetland that may facilitate drainage of the wetland during spring freshet or heavy precipitation events. The vegetation of this wetland is characterized by a sparse tree overstory, a moderately-dense shrub layer and a dense ground vegetation layer. Scattered trembling aspen and paper birch form the tree layer. The shrub layer consists of a mixture of speckled alder, shining willow, red osier dogwood, mountain maple, red elderberry, and chokecherry (*Prunus virginiana*). The ground vegetation layer is heterogenous, consisting of a mixture of tufted yellow loosestrife (*Lysimachia thyrsiflora*), sensitive fern, spotted jewelweed, rough-stemmed goldenrod, spotted Joe-Pye weed, and interrupted fern (*Osmunda claytoniana*).

Wetland 26 scored higher for water storage and delay, water quality support, aquatic support and transition habitat grouped functions. The wetland scored moderate for aquatic habitat. The wetland's ecological condition and wetland risk (sensitivity and stressors) are higher (Appendix I, Table I.7).

Wetland 27

Wetland 27 is a relatively-large coniferous treed seepage swamp situated on a north facing slope in the northwest corner of the PDA. There has been heavy mortality of balsam poplar in the tree canopy of this wetland. The tree layer consists of a patchy cover of eastern white cedar, balsam fir, paper birch, and trembling aspen. The shrub and ground vegetation layers are both well-developed. The shrub layer is mostly a mixture of red osier dogwood, mountain maple, and balsam fir regeneration, along with lesser amounts of paper birch and eastern white cedar saplings, as well as speckled alder and beaked hazelnut. The ground vegetation layer is dominated by fowl manna grass and spotted jewelweed. Other common ground vegetation species include spotted Joe-Pye weed, rough-stemmed goldenrod, cinnamon fern, and purple-stemmed aster.

Wetland 27 scored higher for water storage and delay, water quality support, aquatic support and transition habitat grouped functions. The wetland scored moderate for aquatic habitat. The wetland's ecological condition and wetland risk (sensitivity and stressors) are higher (Appendix I, Table I.8).

Wetland 28

Wetland 28 was once part of Wetland 27; however, the two are now separated by a woods road. Wetland 28 is a tall shrub-dominated seepage swamp. The vegetation of this wetland is characterized by a dense shrub layer composed largely of speckled alder and red osier dogwood along with small amounts of chokecherry, mountain maple, red maple, and beaked hazelnut. Tree cover consists of scattered patches of paper birch. Dwarf red raspberry, spotted jewelweed, and ostrich ferns are the most abundant ground vegetation species. Other frequently encountered ground vegetation species include sensitive fern, rough-stemmed goldenrod, and common lady fern.

Wetland 27 scored higher for water storage and delay, water quality support, aquatic support and transition habitat grouped functions. The wetland scored moderate for aquatic habitat. The wetland's ecological condition is higher, and the wetland risk (sensitivity and stressors) scored moderate (Appendix I, Table I.9).

9.5.2.6 Ecological Communities of Management Concern

There are no ECMC within the PDA or LAA. The closest ECMC is the Little Belledune Point Area ESA, which is located nearly 2 kilometres northeast of the LAA. This ESA is significant for plants, birds, and geology; however, it is thought that many of the rare plants previously observed in this ESA have been extirpated (Tims and Craig 1995). There are other ESAs that are closer, such as the Chapel Point Shoreline ESA which is located approximately 840 metres northeast of the LAA; however, this ESA is significant for fossil geology and has little relevance to the terrestrial environment.

Jacquet River Gorge Protected Natural Area (PNA) is located approximately 6 kilometres south-southeast of the PDA. As a Class 2 PNA, it was established in 2003 to protect land representative of the Northern Uplands Ecoregion. Over 50% of the forests within Jacquet River Gorge are considered "old forest wildlife habitat", and several wildlife and vascular plant SAR and SOCC have been observed within the PNA (NBDERD 2017).

9.5.2.7 Bird Species at Risk and Species of Conservation Concern

The AC CDC reported historical observations of 79 bird species within a 5 kilometres radius of the PDA (Appendix J, Table J.1; AC CDC 2018c). This list includes seven SAR and seven SOCC.

No owl species were observed during surveys. May 2018 diurnal point counts detected the presence of 26 species (Table 9.3), including three woodpecker species (downy woodpecker, hairy woodpecker, northern flicker), and one forest-breeding raptor (northern flicker). None of these are considered SAR or SOCC.

Table 9.3 Bird Species Observed During Spring Field Surveys

Common Name	Scientific Name	AC CDC S-Rank [1]
herring gull	*Larus argentatus*	*S5*
great black-backed gull	*Larus marinus*	*S5*
osprey	*Pandion haliaetus*	*S4S5B,S5M*
northern goshawk	*Accipiter gentilis*	*S4*
downy woodpecker	*Dryobates pubescens*	*S5*
hairy woodpecker	*Dryobates villosus*	*S5*
northern flicker	*Colaptes auratus*	*S5B,S5M*
American crow	*Corvus brachyrhynchos*	*S5*
common raven	*Corvus corax*	*S5*
tree swallow	*Tachycineta bicolor*	*S4B,S4M*
red-breasted nuthatch	*Sitta canadensis*	*S5*
ruby-crowned kinglet	*Regulus calendula*	*S4B,S5M*
hermit thrush	*Catharus guttatus*	*S5B,S5M*
American robin	*Turdus migratorius*	*S5B,S5M*

Table 9.3 Bird Species Observed During Spring Field Surveys

Common Name	Scientific Name	AC CDC S-Rank [1]
purple finch	*Haemorhous purpureus*	*S4S5B,SUN,S5M*
American goldfinch	*Spinus tristis*	*S5*
American tree sparrow	*Spizelloides arborea*	*S5N,S5M*
chipping sparrow	*Spizella passerina*	*S5B,S5M*
savannah sparrow	*Passerculus sandwichensis*	*S4S5B,S5M*
song sparrow	*Melospiza melodia*	*S5B,S5M*
white-throated sparrow	*Zonotrichia albicollis*	*S5B,S5M*
dark-eyed junco	*Junco hyemalis*	*S5*
red-winged blackbird	*Agelaius phoeniceus*	*S4B,S4M*
common grackle	*Quiscalus quiscula*	*S5B,S5M*
chestnut-sided warbler	*Setophaga pensylvanica*	*S5B,S5M*
yellow-rumped warbler	*Setophaga coronata*	*S5B,S5M*

Note:
[1] S1 = *critically imperiled*, S2 = *imperiled*, S3 = *vulnerable*, S4 = *apparently secure*, S5 = *secure*, SNA = *not applicable* (typically exotic species) S#S# = a numeric range rank used to indicate any range of uncertainty about the status of the species or community. B= Breeding, M = Migrant. (AC CDC 2018c)

June field surveys (area searches and nightjar surveys) targeting forest-breeding species reported the presence of 56 species of birds within and surrounding the PDA. This list includes two SAR (eastern wood-pewee and common nighthawk) and one SOCC (killdeer) (Table 9.4).

Table 9.4 Records of Bird SAR and SOCC Reported Within 5 km of the Project Site

Common Name	Scientific Name	SARA Status	COSEWIC Status	NB SARA Status	AC CDC S-Rank[1]	Data Source
SAR						
common nighthawk	*Chordeiles minor*	Schedule 1, *threatened*	*special concern*	*threatened*	*S3B, S4M*	Stantec[2]
eastern wood-pewee	*Contopus virens*	Schedule 1, *special concern*	*special concern*	*special concern*	*S4B, S4M*	AC CDC, Stantec
bank swallow	*Riparia*	Schedule 1, *threatened*	*threatened*	-	*S2S3B, S2S3M*	AC CDC
barn swallow	*Hirundo rustica*	Schedule 1, *threatened*	*threatened*	*threatened*	*S2B, S2M*	AC CDC
wood thrush	*Hylocichla mustelina*	Schedule 1, *threatened*	*threatened*	*threatened*	*S1S2B, S1S2M*	AC CDC
evening grosbeak	*Coccothraustes vespertinus*	no schedule, no status	*special concern*	-	*S3B, S3S4N*	AC CDC

Table 9.4 Records of Bird SAR and SOCC Reported Within 5 km of the Project Site

Common Name	Scientific Name	SARA Status	COSEWIC Status	NB SARA Status	AC CDC S-Rank[1]	Data Source
bobolink	*Dolichonyx oryzivorus*	Schedule 1, *threatened*	*threatened*	*threatened*	*S3B, S3M*	AC CDC
Canada warbler	*Cardellina canadensis*	Schedule 1, *threatened*	*threatened*	*threatened*	*S3B, S3M*	AC CDC
SOCC						
common eider	*Somateria mollissima*	-	-	-	*S3B, S4M, S3N*	AC CDC
killdeer	*Charadrius vociferus*	-	-	-	*S3B, S3M*	AC CDC, Stantec
black guillemot	*Cepphus grylle*	-	-	-	*S3*	AC CDC
common tern	*Sterna hirundo*	-	Not at Risk	-	*S3B, SUM*	AC CDC
cliff swallow	*Petrochelidon pyrrhonota*	-	-	-	*S2S3B, S2S3M*	AC CDC
northern mockingbird	*Mimus polyglottos*	-	-	-	*S2B, S2M*	AC CDC
brown-headed cowbird	*Molothrus ater*	-	-	-	*S3B, S3M*	AC CDC

Notes:

[1] S1 = *critically imperiled*, S2 = *imperiled*, S3 = *vulnerable*, S4 = *apparently secure*, S5 = *secure*, SNA = *not applicable* (typically exotic species) S#S# = a numeric range rank used to indicate any range of uncertainty about the status of the species or community. B= Breeding, M = Migrant. (AC CDC 2018c)

[2] Species observed during field surveys conducted for the Project

"-" = Status not assigned

Three SOCC species identified by the AC CDC, including common eider, black guillemot, and common tern, are marine birds, and are not expected to be found within the PDA. A discussion of the SAR listed in Table 9.4 is provided below. The one SOCC recorded in the field (killdeer) was recorded outside the PDA, within NB Power's Belledune Thermal Generating Station property, near the coast in open habitat adjacent a parking area.

Common Nighthawk

The common nighthawk is a medium-sized bird which nests in almost all of North America, and in some parts of Central America. This species occurs in all of the Canadian provinces and territories with the exception of Nunavut (COSEWIC 2007). The common nighthawk is considered *threatened* under Schedule 1 of SARA and under NB SARA, and Special Concern under COSEWIC. The AC CDC ranks common nighthawk as S3B,S4M, indicating the breeding population is considered *vulnerable* and the migrating population is *apparently secure* in New Brunswick.

Common nighthawks are most commonly observed in a wide range of open, vegetation-free habitats including beaches, recently cleared forests, rocky outcrops, and grasslands. The species has probably benefited from newly opened habitats created by the forestry industry (COSEWIC 2007). There is potentially suitable habitat for this species in the PDA and LAA, and the species was observed in the LAA during field surveys in 2018.

Eastern Wood-pewee

The eastern wood-pewee (*Contopus virens*) is a small passerine which breeds in much of Canada from Saskatchewan to the Maritimes provinces (COSEWIC 2012a). This species is ranked as *threatened* by COSEWIC and NB SARA. The AC CDC ranks this species as S4B,S4M, indicating that the breeding and migrating populations of this species is considered *apparently secure* in New Brunswick.

During breeding, the eastern wood-pewee is generally associated with the mid-canopy layer within forest clearings and edges of hardwood and mixed forest stands (COSEWIC 2012a). In migration periods this species utilizes a variety of habitats including edges, and clearings (COSEWIC 2012a). Potentially suitable habitat for this species is found within the PDA and LAA, and the species was detected at a habitat edge of a coniferous treed swamp and a mature mixedwood stand during field surveys in 2018.

Bank Swallow

The bank swallow is a small insectivorous passerine with an extensive distribution, occurring on every continent except Antartica and Australia (COSEWIC 2013). The bank swallow is ranked as *threatened* under Schedule 1 of SARA and under NB SARA, and S2S3B, S2S3M by the AC CDC indicating that the breeding and migrating populations of this species are considered between *imperiled* and *vulnerable* in New Brunswick.

Bank swallows breed in a variety of natural and man-made sties with vertical banks, including riverbanks, coastal bluffs, gravel pits, road cuts and stockpiles of soil. These sites are often situated near open terrestrial habitat used for aerial foraging (such as grasslands, meadows, and pastures). The only potential habitat observed within the PDA was some anthropogenic soil piles that showed no evidence of past or recent use by bank swallows. This species was not noted during field surveys in 2018.

Barn Swallow

The barn swallow is a small passerine that is closely associated with rural human settlements. This species is the most widespread swallow in the world and is known to breed in all provinces and territories in Canada (COSEWIC 2011). The barn swallow is ranked as *threatened* under Schedule 1 of SARA and under NB SARA, and S2B,S2M by the AC CDC indicating that the breeding and migrating populations of this species are considered *imperiled* in New Brunswick.

Following European settlement of North America, barn swallows shifted from nesting in caves and on ledges to nesting largely in man-made structures. This insectivorous species prefers open habitats for foraging such as pastoral lands, shorelines, and cleared rights-of-way. Some potentially suitable habitat for this species is available in the LAA, but none was detected in the PDA as there are no man-made structures within the PDA. Adjacent man-made structures are industrial in nature and in active use. This species was not noted during field surveys in 2018.

Wood Thrush

The wood thrush is a medium-sized passerine which breeds in southeastern Canada from southern Ontario east to Nova Scotia (COSEWIC 2012). Wood thrush is ranked as *Threatened* under Schedule 1 of SARA and by COSEWIC and NB SARA. The AC CDC ranks wood thrush as S1S2B,S1S2M indicating that the breeding and migratory populations of this species are between *imperiled* and *critically imperiled* in New Brunswick.

In Canada, wood thrush nests mainly in second-growth and mature deciduous and mixed forests. The presence of a well-developed understory layer with saplings appears to be an important habitat factor. This species prefers large forest mosaics but may be found in smaller forest fragments. There is little potentially suitable habitat for this species present in the PDA and surrounding LAA. This species was not noted during field surveys in 2018.

Evening Grosbeak

The evening grosbeak is a brightly coloured, heavyset finch species of northern coniferous forests. This species breeds in all of the Canadian provinces and territories except Nunavut (COSEWIC 2016). Evening grosbeak is ranked as *special concern* by COSEWIC, and as S3B,S3S4N by the AC CDC, indicating that the breeding population of this species are considered *vulnerable* in New Brunswick, and that the migrating population is considered between *vulnerable* and *apparently secure* in New Brunswick.

This species is dependent upon insect outbreaks, which makes defining its preferred nesting habitat difficult. It is generally associated with older coniferous and mixed forests but can utilize various habitats if insect prey are abundant (MBBA 2018). Outside of breeding season, this species relies upon seed crops from various trees in boreal forests but is also attracted to ornamental trees which produce seeds or fruit, and bird feeders stocked with sunflower seeds. There is potentially suitable habitat for this species in the PDA and LAA. This species was not noted during field surveys in 2018.

Bobolink

The bobolink is a medium-sized passerine which breeds in the southern part of all Canadian provinces (COSEWIC 20110). This species is ranked as *threatened* on Schedule 1 of SARA and NB SARA, and as S3B,S3M by the AC CDC, indicating that the breeding and migratory populations of this species are considered *vulnerable* in New Brunswick.

Bobolink nested in tall-grass prairie habitats prior to the settlement of North America, but as this habitat became converted to agricultural land, and as the forests of eastern North America were cleared to hayfields and meadows, bobolink have adapted to nesting in forage crops such as hayfields and pastures dominated by a variety of species including clover (*Trifolium* spp.) and Timothy (*Phelum pratense*). This species is also known to occur in various grassland habitats including graminoid peatlands and abandoned fields. Some potentially suitable habitat for this species exists within the LAA, though none was noted within the PDA. This species was not noted during field surveys in 2018.

Canada Warbler

Canada warbler is a small and brightly coloured passerine. Approximately 80% of the entire breeding range of this species is located in Canada (COSEWIC 2008), where it can be found breeding in every province and territory except Newfoundland and Labrador and Nunavut. Canada warbler is ranked as *threatened* on Schedule 1 of SARA and under NB SARA, and S3B,S3M by the AC CDC, indicating that the breeding and migrating populations of this species are considered *vulnerable* in New Brunswick.

Canada warblers breed in a wide range of forest types, including hardwood, softwood, and mixedwood forests. It is often associated with moist mixedwood forest, mature cedar swamps, and riparian shrub forests on slopes and ravines (COSEWIC 2008). The presence of a well-developed shrub layer also seems to be associated with preferred Canada warbler habitat. There is potentially suitable habitat for this species within the PDA and LAA.

9.5.2.8 Other Wildlife SAR and SOCC

Information available from the AC CDC indicates that no other wildlife SAR or SOCC have been reported within 5 kilometres of the PDA. Mammal species observed (or evidence thereof) within the LAA during terrestrial fieldwork conducted during the spring and summer of 2018 included:

- Moose (*Alces alces*)
- North American porcupine (*Erethizon dorsatum*)
- Red squirrel (*Tamiasciurus hudsonicus*)
- Eastern chipmunk (*Tamias striatus*)
- Beaver (*Castor canadensis*)
- Muskrat (*Ondatra zibethicus*)
- Eastern coyote (*Canis latrans*)
- Red fox (*Vulpes vulpes*)
- Black bear (*Ursus americanus*)
- Snowshoe hare (*Lepus americanus*)

Each of these species are considered *secure* in New Brunswick.

The following provides a discussion of other wildlife SAR and SOCC in New Brunswick and the potential for their presence in the PDA.

Bats

In late 2014, three bat species native to New Brunswick (little brown myotis (*Myotis lucifugus*), long-eared myotis (*Myotis septentrionalis),* and tri-colored bat (*Perimyotis subflavus*)) were listed as *endangered* under SARA and NB SARA following precipitous population declines as a result of white nose syndrome (WNS). WNS, which is caused by the introduced fungus *Pseudogymnoagscus destructans*, has resulted in the populations of these species being reduced by over 99% in New Brunswick (Parks Canada 2015).

No records of hibernacula for these species were reported by the AC CDC within 5 kilometres of the PDA (AC CDC 2018a), and no potential roost trees were observed during field surveys conducted in the summer of 2018.

Herptiles

Three species of turtle, native to New Brunswick, are considered SAR: wood turtle (*Glyptemys insculpta*), ranked as *threatened* under SARA and NB SARA, eastern painted turtle (Sternotherus odoratus) ranked as *special concern* by COSEWIC, and common snapping turtle (*Chelydra serpentina*), ranked as *special concern* under SARA and *NB* SARA). Neither of these species were historically identified within 5 kilometres of the PDA by the AC CDC (AC CDC 2018a). No suitable habitat for any of these species was observed within the PDA, and no turtles were observed during field surveys conducted during the summer of 2018.

Monarch

The monarch (*Danaus plexippus*) is a migratory species of butterfly native to New Brunswick. Monarchs are dependent upon the presence of milkweeds (*Asclepias* spp.) to complete their life cycle and are typically found in open and periodically disturbed habitats, including roadsides, fields, wetlands, prairies, and open forests in which the plants grow. This species is ranked as *special concern* under SARA and NB SARA, and as *endangered* by COSEWIC (COSEWIC 2016b). In New Brunswick, the AC CDC ranks monarch as S3B,S3M, indicating both the breeding and migratory populations are considered *vulnerable*. No historical records of this species were identified within 5 kilometres of the PDA by the AC CDC (AC CDC 2018a), and no milkweed plants were encountered during vegetation and wetland surveys conducted in the summer of 2018.

9.6 POTENTIAL PROJECT INTERACTIONS WITH THE TERRESTRIAL ENVIRONMENT

Activities and components could potentially interact with the terrestrial environment to result in adverse environmental effects on the terrestrial environment. In consideration of these potential interactions, the assessment of Project-related environmental effects on the terrestrial environment is therefore focused on the potential environmental effect listed in Table 9.5. This potential environmental effect will be assessed in consideration of specific measurable parameters, also listed in Table 9.5.

Table 9.5 Potential Environmental Effects and Measurable Parameters for the Terrestrial Environment

Potential Environmental Effect	Measurable Parameter
Change in the terrestrial environment	• Loss or alteration of terrestrial habitat (hectares) • Loss of vascular plant or wildlife SAR or SOCC (number of individuals or population) • Introduction or spread of invasive vascular plant species (number of individuals) • Change in wetland function

Table 6.39 identifies the physical activities that may interact with the VC and result in an environmental effect. These interactions are discussed in detail in the following sections, including potential environmental effects, mitigation and environmental protection measures, and residual environmental effects. Where no interaction is indicated, a discussion is provided following the table.

Table 9.6 Potential Project Interactions

Project Activity	Potential Environmental Effect Change in the Terrestrial Environment
Construction	
Site Preparation	✓
Construction of Temporary Facilities	✓
Construction of Facility Footprint	✓
Construction of Ancillary Facilities	✓
Ground Transportation	-
Marine Transportation	-
Commissioning	-
Employment and Expenditure	-
Emissions and Wastes	✓
Operation and Maintenance	
Iron Production	-
Maintenance	✓
Ground Transportation	-
Marine Transportation	-
Employment and Expenditure	-
Emissions and Wastes	✓

Notes:
✓ indicates an interaction
- indicates no interaction

During the construction phase, the following Project activities are not expected to interact with the terrestrial environment in a substantive way:

- Ground transportation
- Marine transportation
- Commissioning
- Employment and expenditure

Ground transportation will occur within the boundaries of existing roads and infrastructure, and on private roads owned by the Belledune Port Authority. Though there is some potential for collisions with wildlife, if this was to occur it would be considered an accidental and unplanned event and is addressed as such in

Section 14.0. Marine transportation associated with construction will occur within the marine environment and is not anticipated to interact with the terrestrial environment. Commissioning will occur within the footprint of the facilities once they are constructed. These areas will have been previously disturbed during the site preparation and building construction activities of the Project, and no further interactions with the terrestrial environment are anticipated. These Project activities may result in the production of dust, light and noise, which are considered under emissions and wastes and will be discussed under that Project activity. Employment and expenditure during construction is not expected to have any interactions with the terrestrial environment.

During the operation phase the following Project activities are not expected to interact with the terrestrial environment in a substantive way:

- Iron production
- Ground transportation
- Marine transportation
- Employment and expenditure

Iron production will occur within constructed facilities and is not expected to have any interaction with the terrestrial environment. As stated above for the construction phase, ground transportation is not expected to result in planned interactions with the terrestrial environment. Iron production and ground transportation may result in the production of dust, light and noise, which are considered under emissions and wastes and will be discussed under that Project activity. As with construction, marine shipping associated with operation will occur within the marine environment and is not anticipated to interact with the terrestrial environment. Employment and expenditure during operation is also not expected to have any interactions with the terrestrial environment.

9.6.1 Potential Effects to the Terrestrial Environment During Construction

This section describes how Project activities during the construction phase could interact with the terrestrial environment, if no mitigation measures are in place. The site preparation, construction of temporary facilities, construction of facility footprint, construction of ancillary facilities, and emissions and wastes Project activities have the potential to result in adverse environmental interactions with the terrestrial environment, which could result in changes to the terrestrial environment including plant and wildlife SAR and SOCC, and wetlands, including:

- Direct loss or alteration of terrestrial habitat for vascular plants and wildlife (including wetlands)
- Direct loss of vascular plant or wildlife SAR or SOCC
- Indirect loss or alteration of terrestrial habitat for adjacent plant and wildlife communities through the introduction of edge effects and sensory disturbance
- Potential introduction of invasive plant species
- Direct and indirect alteration to wetland habitat and function

The majority of potential effects to the terrestrial environment during construction will occur through site preparation. Site preparation of the Project includes clearing and grubbing of the facility footprint and will result in the direct loss of terrestrial habitat, including wetlands. Clearing will remove trees and shrubs and damage other plants. Grubbing will completely remove vegetation, including vascular plant SAR or

SOCC, if present. Depending on the extensiveness of the grubbing, topsoil and the associated seedbank could be removed, and machinery working on site will compact remaining soil layers. Removing soil can change the habitat quality for any plants that may later regenerate within the footprint.

Site preparation activities can have indirect interactions with terrestrial habitat resulting from habitat fragmentation and edge effects. Edge effects can occur though removal of adjacent vegetation, particularly overstory trees, resulting in changes to abiotic factors such as temperature, humidity, wind, and light availability. Changes to these terrestrial habitat conditions can alter which plant species can survive in an area. SAR and SOCC are often rare because they have very specific habitat requirements. If SAR or SOCC are within areas adjacent to cleared and grubbed areas, they may be adversely affected by the changes resulting from edge effects. Edges also provide greater access for invasive plants to colonize an existing vegetation community. Most invasive plants are good colonizers and strong competitors, and can easily out-compete native vegetation, particularly in disturbed habitats. Invasive species can be introduced and spread throughout the PDA by use of equipment that was used in areas with invasive plants.

Indirect effects on adjacent plant communities may also occur as a result of localized changes in hydrology associated with the loss of wetland area within the PDA. The presence of the Project will result in the loss of wetlands currently within the PDA. The absence of these wetlands may result in changes to hydrology of the areas adjacent to the PDA. The replacement of the water storage capacity of wetlands removed from the PDA during the construction phase with impervious surfaces could result in increased water flow into wetlands adjacent to the PDA. However, depending on the extent of water that is directed into holding ponds, there could be a decreased amount of water entering adjacent wetlands. A change in hydrology, whether an increase or decrease or simply a change in timing of water flow, could result in a change of species composition of vegetation growing directly adjacent to the PDA, and could change the boundaries of wetlands adjacent to the PDA.

Small mammal and herptile populations with limited dispersal capabilities are particularly susceptible to edge effects and habitat fragmentation. Individuals isolated from populations in small habitat fragments are more prone to local extirpation since these habitat fragments may be too small to support a population. Habitat fragments which are large enough to support a population may not be large enough to provide enough animals to rebuild a population, should it be heavily affected by disease or predation. Isolation of the fragment can also impair the immigration of new animals into an area where a local population has been extirpated. Impaired immigration can also adversely affect populations by restricting gene flow between populations, leading to inbreeding.

Habitat fragmentation and edge effects can also affect highly mobile species such as birds. During the breeding season, some species may be reluctant to cross clearings including those of roadways or transmission lines, where they are at an increased of detection or capture by predators. This can result in populations becoming isolated in resultant habitat fragments.

Edge effects and habitat fragmentation resulting from construction activities can also result in changes in indirect mortality through herbivory or predation (i.e., through increasing access for larger herbivors and predators), or through nest parasitism. Nest predators and nest parasites (such as brown-headed cowbirds) occur more frequently closer to forest edges (Lloyd et al. 2005; Rich et al. 1994).

Construction activities, including site preparation and construction of various facilities, may produce sensory disturbance to wildlife within the PDA and adjacent areas of the LAA through increased activity, noise, and illumination at night. Sensory disturbance could cause indirect loss of terrestrial habitat for wildlife species through reduced habitat effectiveness (i.e., habitat avoidance), as well as an increase in indirect mortality risk to wildlife. Sensory disturbance could result in certain wildlife species suffering reduced breeding and rearing success through reduced productivity and nest abandonment (Bayne *et al.* 2008). Some wildlife, including small mammals, reptiles, and amphibians, might move out from cover in response to disturbance (particularly noise or vibration) which could increase mortality risk from exposure to predation.

If construction activities take place during the breeding bird season (mid-April through late-August), there is potential that the Project will result in the direct loss of young birds which have not fledged. Clearing and grubbing activities during this time can lead to reduced productivity of bird species, including SAR and SOCC, through sensory disturbance and the direct loss of young birds which are unable to leave the area. The Project may lead to increased bird mortality resulting from collision with construction equipment. Although birds can collide with non-illuminated structures, light sources have been shown to be an attractant to migrating birds. This phenomenon is heightened at night or during inclement weather (Avery *et al.* 1976; Ogden 1996; Wiese *et al.* 2001; Longcore and Rich 2004).

Site preparation of the PDA will result in permanent wetland loss within the PDA and could result in various levels of change in wetland function within the LAA. Project activities which occur adjacent to wetlands that are located outside the PDA (including construction of various facilities) could result in a change in hydrology or erosion and siltation within wetlands or portions of wetlands which are not directly disturbed by the Project.

9.6.2 Potential Effects to the Terrestrial Environment During Operation

This section describes how Project activities during the Operation phase could interact with the terrestrial environment, if no mitigation measures are in place. Project activities associated with maintenance and emissions and wastes during Operation have the potential to result in adverse environmental interactions with the terrestrial environment, which could result in changes to the terrestrial environment including plant and wildlife SAR and SOCC, including:

- Indirect loss or alteration of terrestrial habitat resulting from sensory disturbance to wildlife, edge effects, and localized changes in hydrology associated with the loss of wetland area in the PDA
- Direct loss of SAR or SOCC through, flaring, collision with transmission lines and through vegetation management
- Potential introduction or spread of invasive plant species

Though most of the changes to vegetation communities and wildlife habitat will occur during the construction phase, operation activities have the potential to result in adverse environmental interactions with the terrestrial environment and wildlife activity. During operation, increased activity, noise, and illumination within the PDA could cause an indirect loss of terrestrial habitat loss as result of reduced habitat effectiveness if species avoid the area. Ongoing edge effects and sensory disturbance resulting from operation of the Project could also result in certain wildlife species suffering reduced productivity and nest abandonment (Bayne *et al.* 2008).

It is possible that, on rare occasion, NB Power's Belledune Thermal Generating Station may not be able to accept the by-product gas or FEG (i.e*.,* off gas) from the Project. This would be the case during maintenance shutdowns, which are expected to occur approximately seven times per year. Maritime Iron will coordinate their shutdowns with NB Power such that both facilities are shut down at the same time so that flaring of off gas would not be required. If for some reason NB Power were not able to accept FEG outside of a maintenance shut down, flaring may be required. NB Power would notify Maritime Iron of such an upcoming situation, and the timing of flaring would be scheduled to occur in daylight hours and not during peak migration periods to avoid potential attraction of, and consequently harm to, migrating birds including SAR/SOCC.

The presence of electrical power lines associated with operation of the Project has potential to result in wildlife (including bird SAR/SOCC) mortality through wildlife strikes. Power line collisions have recently been estimated to be the third leading cause of human-related mortality of birds in Canada, behind predation by feral cats and domestic cats (Calvert *et al*. 2013).

Birds that are attracted to power lines may be electrocuted when there is inadequate separation between energized conductors or energized conductors and grounded hardware. Most electrocutions occur on medium-voltage distribution lines (4 to 34.5 kilovolts (kV)), in which the spacing between conductors may not be adequate to allow birds to pass through (APLIC 2012). Poles with energized hardware such as transformers can be especially hazardous, even to small birds, as the numerous energized parts are closely spaced. Dry feathers can act as insulation, so contact must be made between fleshy parts, such as the wrists, feet, or other skin, for electrocution to occur (APLIC 2012).

Collisions between birds and equipment present during construction could result in a Project-related increase in bird mortality. The Project is not within a known migration pathway (USFWS 2019); however, there is still potential that some migrating birds may pass through the area. Lighted equipment can attract birds during migration periods, a phenomenon that is most pronounced at night and in poor weather (low visibility) conditions (Avery et. al 1976; Longcore and Rich 2004; Ogden 1996; Wiese et al. 2001). Nocturnal migrants (*i.e.*, most passerines) are generally high-flyers (i.e., over 150 metres, EC 2007) and are not at risk of suffering collision with Project infrastructure in flight. Diurnal migrants, including waterfowl, waterbirds, and raptors, have more variable flight, and could potentially interact with Project infrastructure.

During operation, vegetation management within the PDA and associated power line have potential to result in adverse environmental interactions, including direct loss of SAR or SOCC within or adjacent to the areas undergoing vegetation management. These areas will have been disturbed during initial construction activities. Vegetation within these corridors, particularly that of the transmission line may provide nesting habitat for some bird species. If vegetation management occurs during the breeding bird season, there is potential that the Project will result in the direct loss of young birds that are unable to leave the nest.

Overall, the operation of the Project is not expected to result in further physical disturbance of the terrestrial environment that did not already occur during construction but may result in some small-scale effects due to sensory disturbance to wildlife resulting in possible avoidance of the area. Substantive interactions between the Project and the terrestrial environment during operation is not expected.

9.6.3 Mitigation for the Terrestrial Environment

Interactions between Project activities and the terrestrial environment will be managed through the use of various mitigation measures. The following mitigation measures specific to the terrestrial environment have been identified for this Project.

During construction:

- Avoid, to the extent feasible, known locations of plant and wildlife SAR and SOCC.
- Restrict disturbance and clearing activities to the minimum amount required, particularly around wetlands.
- Employ standard erosion and sedimentation control measures, particularly to avoid silt laden runoff into wetlands.
- Implement standard dust control measures to avoid siltation of wetlands.
- Use quarried, crushed material for road building in and near wetlands, to reduce the risk of introducing or spreading exotic and/or invasive vascular plant species.
- Operate vehicles and equipment on previously disturbed areas, wherever feasible.
- Limit size of temporary workspaces.
- Allow for natural regeneration when possible, and when not possible, use a native seed mix for re-vegetation.
- Restore temporarily disturbed areas to pre-construction conditions.
- Rehabilitate access roads that are no longer needed.
- When possible, avoid construction activities, particularly clearing, in areas of native vegetation during the normal breeding season for migratory birds (mid-April through late-August 31). Where clearing is required during the breeding bird season, bird surveys will be conducted, and if evidence of active nests are found a 30 m buffer zone will be established until fledging.
- Limit the length of linear facilities, and locate linear facilities within existing rights-of-way adjacent to other linear facilities, where possible, to reduce the potential for fragmentation and creation of edge effects.
- Establish buffers and protect active migratory bird nests until fledging, upon their discovery in work areas during construction.
- Use noise arrest mufflers on equipment to reduce potential environmental effects of noise.
- Use full cut-off lighting during construction to reduce attraction to migrating birds.

During operation and maintenance:

- Use noise arrest mufflers on equipment to reduce potential environmental effects of noise.
- Avoid vegetation management activities aside from lawn care in areas of native vegetation during the normal breeding season for migratory birds (mid-April through late-August).
- Maritime Iron will coordinate their shutdowns with NB Power such that both facilities are shut down at the same time to reduce the potential for flaring of off gas.

The mitigation described above will limit the interaction of the Project with terrestrial habitat, including wetlands, and will also reduce the potential for wildlife mortality that might be caused by the Project. Some loss of wetland and upland habitat is unavoidable; however, the mitigation will reduce potential interactions with plant and wildlife SAR/SOCC and wetlands. While not planned, it is possible that some mortality of wildlife could occur, but the mitigation will reduce potential interactions. Habitat for vegetation and wildlife species will remain available in the surrounding landscape.

9.6.4 Characterization of Residual Project-Environmental Interactions for the Terrestrial Environment

9.6.4.1 Construction

The construction phase of the Project will result in the loss of up to 81.2 hectares of terrestrial habitat, which includes 46.2 hectares of forest, which is largely young-immature developmental class, and 13.5 hectares of wetland, comprised mostly of field-identified treed swamp. This will result in the loss of the 20.9 hectares interior forest patch that is currently partially within the PDA but will not result in a change to the remaining three patches of interior forest. This loss will occur primarily through site preparation activities. This loss represents approximately 10% of similar forested habitat and 34% of wetland within the surrounding LAA, although the percent of wetland is likely an overestimation, as wetlands were delineated in the field within the PDA but not throughout the LAA; wetland delineation identifies previously-unmapped wetlands and ultimately leads to an increased amount of wetland within the surveyed area, relative to unsurveyed areas. Many of the more important functions provided by the wetlands and other habitats within the PDA, such as providing habitat for vascular plant and wildlife SAR and SOCC, will be maintained within the LAA and particularly within the surrounding ecodistrict. No vascular plant SAR or SOCC were identified within the PDA; thus, no vascular plant SAR or SOCC are expected to be lost as a result of the Project.

Alteration of adjacent terrestrial habitats will occur through edge effects, largely through changes in light levels and sound disturbance. These edge effects will occur in habitats that contain no remaining interior forest, and are currently fragmented by roads and trails, and located near industrial and urban land uses. These effects are not expected to be a new interaction with wildlife using these habitats, as much of the PDA and adjacent habitats currently experience edge effects from the existing fragmentation. In addition, with mitigation, noise associated with construction activities will be diminished. Thus, the effect of sound disturbance on the breeding success of avian species, including avian SAR, will be reduced.

During site preparation, the same Project activities that will lead to a loss of vegetation communities could cause the loss of bird SAR and SOCC. One bird SAR (eastern wood-pewee) was identified within the PDA, and several others have potential to be found in the PDA as there is suitable habitat present for them. The loss of terrestrial habitat as a result of the Project could potentially reduce the availability of habitat used by eastern wood-pewee, common nighthawk, evening grosbeak, and Canada warbler, though the extent of removal will be small in comparison to available habitat in and near the LAA. There are no features of the terrestrial habitat within the PDA affected by the Project that will eliminate habitat for these species that is not available elsewhere in the LAA.

No loss of suitable terrestrial habitat for barn swallow, wood thrush, bank swallow, and bobolink is expected as a result of the Project; these species are unlikely to occur in the PDA.

No vascular plant SAR or SOCC were identified within the PDA. With the implementation of mitigation described in Section 9.6.3, it is not anticipated that the construction phase of the project will interact with vascular plant or wildlife SAR or SOCC.

The introduction or spread of invasive vascular plant species could occur during the construction phase through the use of equipment that was used in areas with invasive plants, and can result in changes to vegetation communities. With the implementation of mitigation described in Section 9.6.3, such as removing known instances of invasive species from the PDA prior to construction, and cleaning construction equipment prior to arrival on site, the spread of invasive species and resultant change to the terrestrial environment is expected to be negligible.

As surveys have identified no vascular plant SAR or SOCC, with the mitigation described in Section 9.6.3, the construction of the Project is not expected to interact directly with SAR or SOCC. However, the Project will result in low adverse changes to vegetation communities and wildlife habitat (including wetland) within the PDA and LAA, and will increase fragmentation slightly within the LAA. These vegetation communities and wildlife habitat are common in the LAA and surrounding area. Changes will occur in a single event, and will be reversible after decommissioning.

9.6.4.2 Operation

During operation, there is potential for the Project presence and maintenance to result in ongoing indirect habitat loss as a result of edge effects and sensory disturbance within the PDA. The PDA will have been previously disturbed during construction. These interactions will occur in habitats that will have been previously disturbed, are currently fragmented by roads and trails, and located near industrial and urban land uses, thus the species inhabiting these areas are expected to be accustomed to these disturbances.

The presence of associated power line infrastructure may also result in direct loss of birds, possibly including SAR/SOCC through strikes, and during vegetation management activities. The habitat within the transmission line right of way will have been previously cleared during construction. This interaction will be mitigated through Project design and conducting vegetation management activities (aside from lawn care) outside of the normal breeding bird season where possible.

With mitigation described in Section 9.6.3, the operation of the Project is not expected to cause a measurable change from baseline conditions that would be outside the range of natural variability or that would affect the ongoing viability of vegetation communities and vascular plant SAR and SOCC in the surrounding ecodistrict.

9.7 SUMMARY AND RECOMMENDATIONS

With the implementation of mitigation and environmental protection measures as described in this assessment, it is not anticipated that there will be substantial negative effects caused by the Project on the terrestrial environment during any phases of the Project. Although some habitat will be lost as a result of the Project, this habitat is currently fragmented and located within an industrial landscape. The Project as planned is not anticipated to result in any substantial changes in vegetation communities or wildlife habitat within the LAA, and no SAR or SOCC (vascular plant or wildlife) are expected to be lost as a result of the Project as planned.

10.0 ASSESSMENT OF ENVIRONMENTAL EFFECTS ON HERITAGE RESOURCES

This section describes the potential environmental interactions between construction, and operation and maintenance of the proposed Belledune Iron Processing Facility and the Heritage Resources VC.

Heritage resources are non-renewable resources consisting of places, buildings, objects, or sediment deposits located above or below the ground. Every heritage resource is unique, and its significance lies in the story it tells and how this story contributes to human history by broadening our understanding of our shared human past. As non-renewable resources, damage to, or loss of heritage resources would mean a permanent loss of the resources and also the wider contextual information they may have provided. Heritage resources are closely tied to the landscapes in which they are embedded, which means that a heritage site is always more than the heritage resources it contains.

Undocumented heritage resources, where present, are typically located on or in the soil or rock layers of the earth. If heritage resources are present within the PDA for this Project, interactions would only be anticipated during construction as this is the only phase of the Project where surface or sub-surface ground disturbance is anticipated. No heritage resources are known to be present within the PDA, and a management plan will be in place should an unknown resource be discovered during construction. Accordingly, substantive interactions between the Project and heritage resources are not anticipated.

10.1 RATIONALE FOR SELECTION AS A VALUED COMPONENT

Heritage resources are those resources related to activities from the past that remain to inform present and future societies of that past. Heritage resources are relatively permanent, although highly tenuous, features of the environment. If present, their integrity is highly susceptible to construction and ground-disturbing activities. Heritage resources have been selected as a VC in recognition of the interest of provincial and federal regulatory agencies which are responsible for the effective management of these resources, the general public, and Aboriginal persons that have an interest in the preservation and management of heritage resources related to their history and culture. They include consideration of historical, archaeological, built heritage, and palaeontological resources. Heritage resources will focus on archaeological, built heritage, and palaeontological resources, as resources that would be understood to be “historical” are captured under one of these heritage resource types.

Project activities that include surface or sub-surface ground disturbance have the potential to interact with heritage resources, where these resources are present. Accordingly, construction represents the Project phase with the greatest potential for interaction with heritage resources, as it is during this phase that ground-breaking and earth moving activities will take place.

In this assessment, the potential changes to heritage resources as a result of the Project are considered. The scope of the assessment is based on applicable regulations and policies, professional judgement of the study team, and knowledge of potential interactions.

10.2 REGULATORY CONTEXT

Heritage resources in New Brunswick are regulated under the *Heritage Conservation Act* (2010). The regulatory management of heritage resources is the mandate of the New Brunswick Department of Tourism, Heritage, and Culture, and is administered by its Archaeological Services (AS) Branch (for archaeological resources), Historic Places Section (for built heritage resources), and Natural Sciences Section (for paleontological resources).

The review for heritage resources has been undertaken through the completion of historical, archaeological, built heritage, and palaeontological research. The Province of New Brunswick provides guidance for conducting archaeological impact assessments, such as the *Guidelines and Procedures for Conducting Professional Archaeological Assessments in New Brunswick* (the “Archaeological Guidelines”; Archaeological Services 2012).

Consultation and engagement activities have been ongoing as part of the heritage resources component of the Project. During the background research for heritage resources, regional experts and regulatory agencies were contacted in order to gather information on potential heritage resources within the PDA.

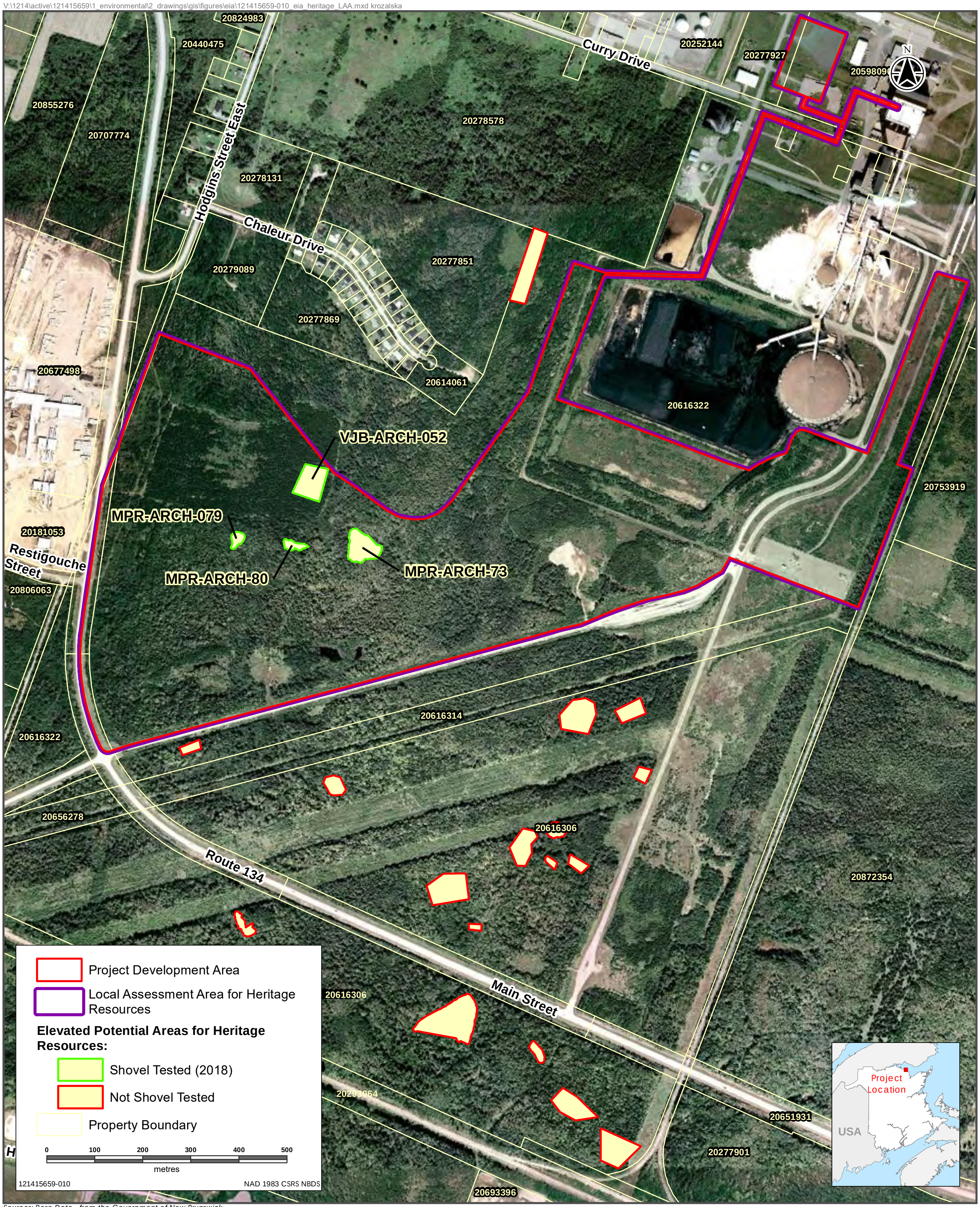
10.3 SPATIAL BOUNDARIES

The assessment of potential environmental interactions between the Project and heritage resources is focused on a PDA and a LAA.

The PDA for the Project is defined as the area of physical disturbance associated with the construction, and operation and maintenance phases of the Project. As described in Section 2.5, for the purposes of this assessment, the PDA includes the land within the property boundaries of PID 20616322, PID 20598090, and PID 20277927. The PDA is depicted on Figure 2.4.

The LAA for heritage resources is defined as the area within which the environmental effects of the Project can be measured or predicted. The LAA for heritage resources is limited to the PDA, as it is only within the PDA that construction and ground-disturbing activities could interact with heritage resources. Heritage resources located outside of the PDA are discussed in the “existing conditions” section below only inasmuch as they inform this assessment regarding the potential for unknown heritage resources within the PDA, however these resources will not be directly affected by the Project and are not considered further in this assessment.

The PDA, which is also the LAA for heritage resources, is shown on Figure 10.1.



Sources: Base Data - from the Government of New Brunswick

Service Layer Credits: Service New Brunswick/Service Nouveau Brunswick

Local Assessment Area and Delineated Areas of Elevated Potential for Heritage Resources

Stantec

Figure 10.1

10.4 TEMPORAL BOUNDARIES

The temporal boundaries for the assessment of the potential environmental effects on heritage resources include:

- Construction – scheduled to begin in Q1 2020 and last for approximately 3 years; and
- Operation and maintenance – scheduled to begin in Q1 2023 and continue for the life of the facility, currently anticipated to be in excess of 30 years.

10.5 EXISTING CONDITIONS FOR HERITAGE RESOURCES

10.5.1 Approach and Methods

An Archaeological Impact Assessment (AIA) is required for an EIA in New Brunswick. In advance of the AIA conducted for this Project, information on the existing conditions (i.e., known information) regarding heritage resources is gathered through a combination of documentary research, consultation, and field survey.

The following sources were consulted to gather an understanding of the general and specific history in the area of review:

- Published, unpublished, and on-line works about local history, the environment, and previous archaeological work carried out in the area;
- The Archaeological Potential Map of the area of review, provided by AS, depicts areas with high and medium potential for Pre-Contact Period archaeological sites, based on anthropological, geographic, and geological data;
- Provincial archaeological sites database;
- Representatives from AS;
- Documents in the New Brunswick Archives;
- Department of Natural Resources historic aerial photographs; and
- The Canadian Register of Historic Places and the New Brunswick Register of Historic Places databases.

For information regarding archaeological resources, AS was contacted to request the most recent Archaeological Potential Map for the PDA and surrounding areas. The Archaeological Potential Map presents information from a variety of heritage related databases, as well as identifies areas with elevated potential for archaeological resources. Typically, the shoreline areas of all watercourses and coastlines are considered by AS as having either “high” potential (0–50 metres from the watercourse bank or coastline) or “medium” potential (50–80 metres from watercourse bank or coastline) for Pre-Contact archaeological resources, regardless of the size of the watercourse. Confluences of any two watercourses are considered to have “high” potential for Pre-Contact archaeological resources within 100 metres from the watercourse banks. Also included are potential palaeo shorelines that may have been present as early as 13,000 years before present. Together, these areas are referred to as elevated potential zones.

The field component of the AIA involved archaeological field survey (walkover) of the entire PDA, including sections of the PDA that were later discarded from the Proponent's preferred siting locations. The PDA was assessed via a walkover in consideration of the results of the Archaeological Potential Map data (AS 2018) and following the *Guidelines and Procedures for Conducting Professional Archaeological Assessments in New Brunswick* (the Guidelines) (AS 2012), as well as the professional judgement of the Stantec Archaeology Team. Walking pre-defined transects within the PDA, any areas of elevated potential for archaeological resources were identified. Where they occurred, these areas were delineated and labeled as "Polygons" using handheld GIS devices with 1-3 metre accuracy. Polygons are typically identified for additional archaeological mitigation (e.g., shovel testing).

In addition to the walkover, the AIA also involved archaeological mitigation through shovel testing at any areas identified as having elevated archaeological potential and delineated as polygons within the Project PDA. The shovel testing program was supervised and completed under a permit issued by AS to a provincially permitted archaeologist who supervised the work and was completed as required under the Guidelines (AS 2012). Both the walkover and the shovel testing for this Project were completed in September and October 2018 and the results are described below.

Built Heritage Resources are typically identified through a review of federal and provincial databases for built heritage resources. There are no built heritage resources within the PDA.

A knowledge of the geology of the PDA provided information on the potential for there to be fossils in bedrock layers that may be encountered during construction.

10.5.2 Description of Existing Conditions

The sections below describe the existing conditions for heritage resources. Archaeological resources, built heritage, and palaeontological resources were considered when describing existing conditions as part of this VC.

10.5.2.1 Setting

The Project is located in the Nicolas Denys (Chaleur) Ecodistrict of the Northern Uplands ecoregion. The geological landscape of this ecodistrict is dominated by coastal cliffs and linear outcroppings where ridges of diabase rock intrudes the area. Many large rivers flow through the area before draining into Chaleur Bay including the Charlo, Jacquet, Nepisiguit, and Tetagouche rivers, and the climate is relatively dry and cool with temperature extremes that are moderated by Chaleur Bay (NBDNR 2007).

The surficial geology within the PDA is characterized by Late Wisconsinan morainal sediments composed of blanket, clay, gravel, sand, and silt, generally 0.5 to 3 metres thick. There are some nearby intrusions of Pre-Quaternary rock of various age and lithologies as well as some ice contact deposits including eskers, kames, and kettle complexes (Rampton 1984). The bedrock geology within the PDA is composed predominantly of Early to Late Silurian felsic and mafic volcanic rocks and sedimentary rocks (NBDNR 2000; 2007).

10.5.2.2 Archaeological Resources

Pre-Contact Period

The Pre-contact period is defined as the period of human occupation of the lands of eastern Canada for the entirety of the timeframe from the first arrival of humans, approximately 11,500 years Before Present (BP), up to the time of contact between these Aboriginal populations, and the European explorers when they first encountered North America, generally interpreted to be approximately 500 years BP.

A review of the Archaeological Potential Map for the Project indicated that there are no registered Pre-contact Period archaeological sites located inside the PDA. However, there is one registered archaeological site (ClDl-1) located approximately 1.2 kilometres northwest of the PDA, at the mouth of the Belledune River. This site was identified during a survey by the Archaeological Survey of Canada in 1968 and is listed as a Pre-Contact general activity site. One biface and one flake were recovered from an active agricultural field (ClDl-1, 1968). In addition, approximately two-thirds of the PDA overlays potential marine palaeo shorelines in which post glacial landforms may be encountered that have the potential to contain heritage resources.

Archaeological evidence from Debert, Nova Scotia, and Pennfield, New Brunswick, indicates that the first peoples to inhabit what is now the southern portion of modern-day New Brunswick likely arrived in that region at the end of the Pleistocene (McMillan and Yellowhorn 2004; Suttie et al. 2013), approximately 11,000 years BP. Much of what is now northern New Brunswick would have remained under glacial ice sheets until around 10,600 BP, when the initial Wisconsinan deglaciation during the Allerød warm period began. However, due to the dynamic nature of the environment, with such events as the Younger Dryas ice re-advance, followed by another deglaciation, much of this area would likely not have been suitable for human occupation until after about 9,000 years BP (Bonnichsen et al. 1985; Cwyner et al. 1994; Seaman 2006). As was the case throughout what is now Canada, as the glaciers melted, human populations moved into each area as soon as climatic and subsistence conditions allowed and there is evidence of the permanent human occupation of what is now northern New Brunswick, such as the villages found at Metepenagiag, near Miramichi, dating back several thousand years.

The PDA lies within the traditional territory of the Aboriginal people of the Mi’kmaq First Nation, specifically the Gespe’g (Gespegeog) District (NBDNR 2007; Mi’gmaq-Mi’kmaq Online 2018). Artifacts recovered from archaeological sites along coastal areas, Mount Carleton Provincial Park, and around the Town of Bathurst show evidence of Aboriginal occupation through the region for at least the last 4,000 years (NBDNR 2007; High County Research and Development 1972). Artifacts potentially dating to the Palaeo-Indian period have been identified as close as Stonehaven, approximately 40 kilometres southeast of the PDA (Stantec 2010). *Oinpegitjoig*, one of the largest settlements, was located in what is now Bathurst Harbour at the mouth of the Nepisiguit River. The Nepisiguit River supplied Aboriginal peoples with access to salmon and other resources and provided a major route to the St. John River system and Wolastoqiyik territory through a number of portages (Ganong 1899; NBDNR 2007). Ganong identified the Mi’kmaq name for Belledune as either *Meskeeseegeach* or *Edelwisooltedichulnook*, meaning the place where cranberries are picked (Ganong 1899; Rayburn 1975).

As part of the AIA for this Project, field components including a walkover survey and shovel testing were completed in the fall of 2018 (Stantec 2019). The walkover, conducted in September 2018, identified a total of twenty-one areas of elevated potential for sub-surface Pre-contact archaeological resources. Outside of these twenty-one areas, the PDA had in general low potential for Pre-contact archaeological resources due to previous heavy disturbance of the area from industrial development (mostly from the NB Power Belledune Thermal Generating Station) and topographical conditions such as extensive wetland environments not conducive to human settlement. No above-surface features, artifacts, or deposits of Pre-contact archaeological significance were discovered during the walkover.

Only four of the twenty-one areas of elevated archaeological potential identified during the walkover are situated within the finalized PDA and these four areas were subjected to archaeological shovel testing that was completed in October 2018. The four areas, delineated as polygons, are depicted on Figure 10.1 and include:

- MPR-ARCH-073
- MPR-ARCH-079
- MPR-ARCH-080
- VJB-ARCH-052

Three of these areas (MPR-ARCH-073, MPR-ARCH-079, and MPR-ARCH-080) overlap with possible palaeo shorelines and can be characterized as consisting of flat, well-drained terrace features in open mature or semi-mature mixed wood that are hemmed in by surrounding wetland environments. Polygon VJB-ARCH-052 is located in a flat well-drained area to the immediate west of a wetland and is situated amongst a commercial jack pine stand.

All four areas were categorized as having medium archaeological potential whereby shovel testing was completed using a 10-metre-wide grid system. A total of 76 shovel test pits (STPs) were excavated within the four areas and this work included the participation of members of the Aboriginal community. Test pits reached an average depth of 41 centimetres with all STPs ending at a compact hard pan consisting of gravelly silty-sand. No archaeological resources were identified during the shovel testing of the four assessment areas. No further archaeological investigations are recommended at any of the four areas.

Historic Period

The Historic Period is defined as the period from the arrival of mostly European-derived peoples to North America, approximately 500 years ago, until the modern era.

A review of the Archaeological Potential Map for the Project (Archaeological Services 2018) indicated that there are no registered Historic Period archaeological sites located inside, or within a 3 kilometre radius of, the PDA. There are at least three historic cemeteries nearby which are located along the coastline and well outside of the PDA for the Project.

Despite earlier visits to the area by European fishermen, Historic Period occupation of the general area of the PDA did not begin until early French explorers began visiting and occupying coastal areas in the late 17th Century (NBDNR 2007). Nicholas Denys, an explorer and trader, was one of the first non-Aboriginal settlers in the general area. Denys built a fortified house in Bathurst Harbour in 1668, where he wrote on the natural history of the area (NBDNR 2007).

The community of Belledune itself was established by Francois Guitard in 1824, and its name translates to “pretty sand dunes” (Rayburn 1975; Village of Belledune 2018). Guitard was born in Fauxbourg, France and served under Napoleon Bonaparte in Italy and Egypt. After his military service, Guitard headed to North America to establish a new life and was granted land in the area that became Belldune in the 1820’s (PANB 1825; Village of Belledune 2018). Additional immigrants of Scottish and Irish descent moved to the area from Miramichi after the great fire of 1825 (Village of Belledune 2018).

As part of the AIA for this Project, the walkover survey found no above-surface features, artifacts, or deposits of historical significance and no Historic period resources were discovered during the shovel testing of the four areas of elevated archaeological potential discussed previously.

10.5.2.3 Existing Built Environment

There are no buildings of heritage value located anywhere within the PDA. Furthermore, a search of the Canadian Register of Historic Places (CRHP 2017) and the New Brunswick Register of Historic Places (NBRHP 2017) revealed that, as far as these records go, there were never any registered historic places or heritage sites located within the PDA. A review of historic aerial photography from 1944 confirms that no built structures were present at that time (NBDNR 1944-A7402-39). Therefore, potential environmental effects of the Project on features of built heritage will not be discussed further in this report.

10.5.2.4 Paleontological Resources

While no specific paleontological study has be undertaken for this Project, the geological formations within the PDA are comprised of a mixture of Early to Late Silurian volcanic and sedimentary rocks (NBDNR 2000; 2007). Areas with sedimentary rock have potential to contain fossils; therefore, it is possible that interactions could occur between Project activities and fossil resources.

10.6 POTENTIAL PROJECT INTERACTIONS WITH HERITAGE RESOURCES

Project activities could potentially interact with heritage resources resulting in adverse environmental effects on archaeological, built heritage, and paleontological resources. In consideration of these potential interactions, the assessment of Project-related environmental effects on heritage resources is therefore focused on the potential environmental effects listed in Table 10.1. These potential environmental effects will be assessed in consideration of specific measurable parameters, also listed in Table 10.1.

Table 10.1 Potential Environmental Effects and Measurable Parameters for Heritage Resources

Potential Environmental Effect	Measurable Parameter
Change in heritage resources	• Presence of a heritage resource that is considered important to understanding the Province’s past and is adversely affected by construction prior to the implementation of mitigation.

Table 10.2 identifies the physical activities that may interact with heritage resources and if so, could result in an environmental effect. These interactions are discussed in the following sections, including potential environmental effects, mitigation and environmental protection measures, and residual environmental effects. Where no interaction is indicated, a discussion is provided following the table.

Table 10.2 Potential Project Interactions

Project Activity	Potential Environmental Effect Change in Heritage Resources
Construction	
Site Preparation	✓
Construction of Temporary Facilities	✓
Construction of Project Components	✓
Ground Transportation	-
Marine Transportation	-
Commissioning	-
Employment and Expenditure	-
Emissions and Wastes	-
Operation and Maintenance	
Iron Production	-
Maintenance	-
Ground Transportation	-
Marine Transportation	-
Employment and expenditure	-
Emissions and Wastes	-

Notes:
✓ indicates an interaction
- indicates no interaction

Activities listed under construction that are not anticipated to interact with heritage resources include: ground transportation, marine shipping, commissioning, employment and expenditure, and emissions and wastes as they will not involve ground-breaking activities. Clean-up and/or revegetation may involve back blading but will occur within the existing previously disturbed construction footprint and therefore, no new ground disturbing activities will occur. Activities during operation and maintenance will not involve ground disturbance, so will not interact with heritage resources. Therefore, no environmental effects with heritage resources will occur from these activities, and given the lack of interaction with heritage resources, they will not be discussed further in this VC.

10.6.1 Potential Effects to Heritage Resources During Construction

Undocumented heritage resources, where present, are typically located in the soil or rock layers of the earth and therefore potential interactions between these resources, if they are present, and the Project would take place during construction. Construction activities that could result in a potential interaction with heritage resources include site preparation (e.g., clearing, grubbing, detouring and ditching, excavation and blasting, if required), temporary facilities, and construction of Project components. Groundbreaking, earth moving, and in-filling activities will be limited to areas of the PDA where major construction components and activities are anticipated. These activities will largely be carried out by mechanical means and have the potential to interact with heritage resources as these activities may result in some ground disturbance. Any equipment that may need to be installed will take place after foundations and other surface and subsurface infrastructure are installed and will not interact with heritage resources.

10.6.2 Mitigation for Heritage Resources

Interactions between Project activities and heritage resources will be managed through the use of various mitigation measures. It is recommended that the following mitigation measures be implemented specific to heritage resources, as applicable, for the Project:

- If the location of the proposed Project and/or boundaries of the PDA are altered from that reviewed/mitigated during the 2018 AIA, the findings and recommendations should be reviewed in consideration of the new design of the Project prior to any ground-breaking construction activities; and,
- The environmental protection plan to be developed for the Project will include a heritage resources discovery response protocol that clearly describes the responses of contractors and Maritime Iron staff in the event of an unanticipated discovery of heritage resources, such as an artifact, or potential fossils, during construction. The response should include immediately notifying AS.

10.6.3 Characterization of Residual Project-Environmental Interactions for Heritage Resources

10.6.3.1 Construction

In the unlikely event that a heritage resource (i.e., archaeological or paleontological) is encountered, if it is damaged and determined by provincial agencies to be important, then the interaction would be adverse. However, with the implementation of the mitigation described above, this interaction is unlikely and, if it were to occur, would be further mitigated by the implementation of the heritage resources discovery response plan that will be included in the environmental protection plan to be developed for the Project.

10.7 SUMMARY AND RECOMMENDATIONS

In consideration of the above and considering the nature of the interactions between the Project and heritage resources as well as the planned implementation of known and proven mitigation and environmental protection measures as described in this assessment, as well as adherence to applicable legislation and guidelines, the interaction between the heritage resources and the Project is not anticipated to be substantive during any phases of the Project, and there is a low likelihood of an adverse effect. At this time, follow-up work or additional archaeological assessment is not warranted or recommended.

11.0 CURRENT USE OF LAND AND RESOURCES FOR TRADITIONAL PURPOSES BY ABORIGINAL PERSONS

Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons (Current Use) is a VC because Aboriginal persons carry out traditional activities that use the land and resources as an integral part of their lives and culture. Current Use includes, but is not limited to, the practice of hunting, trapping, fishing, gathering, and following Aboriginal customs, practices and traditions on ancestral lands.

All cultural activities, hunting, fishing, gathering and traditional uses by Aboriginal must be taken into consideration as described in the *Guide to Environmental Impact Assessment in New Brunswick*, pursuant to Section 5(2) of the New Brunswick *Environmental Impact Assessment Regulation 87-83*. As a Crown agency, NBDELG has a duty to consult with Aboriginal peoples prior to carrying out any activity or authorization that might infringe upon Aboriginal and treaty rights held by Aboriginal peoples. The New Brunswick Duty to Consult Policy (2011) provides direction to the provincial government on consultation with the Mi'kmaq and Wolastoqey (Maliseet) First Nations of New Brunswick.

There are many areas in New Brunswick which have historical and cultural significance to Aboriginal peoples. These areas include locations where Aboriginal persons continue to pursue traditional activities that are an element of a practice, custom, or tradition integral to the distinctive culture of the Aboriginal group.

Engagement activities with First Nation leaders and organizations in northern New Brunswick have been initiated by Maritime Iron and are on-going. The exact nature, scope, and detail of Aboriginal engagement is determined with the First Nation individuals and organizations involved. Maritime Iron is committed to continuing engagement of, and dialogue with, First Nation groups that may have an interest in the Project by providing information about the Project and its potential environmental effects and responding to questions or concerns that may arise.

The PDA is currently forested and has the potential to be used for traditional purposes by Aboriginal persons.

Maritime Iron has commissioned an Indigenous Knowledge Study (IKS) to determine how the area is being used. This study is being funded by Maritime Iron through Mi'gmawe'l Tplu'taqnn Inc. (MTI) and is in progress. Once the IKS has been completed it will be reviewed to assess the potential effects of the Project on current use of land and resources for traditional purposes by Aboriginal persons. The IKS will be made available to NBDELG under separate cover.

Maritime Iron has entered into a Letter of Intent with the Mi'gmaq communities of Oinpegitjoig (Pabineau First Nation), Ugpi'ganjig (Eel River Bar) (the "First Nation Communities") and Mi'gmawe'l Tplu'taqnn Inc ("MTI").

Maritime Iron and MTI intend that the 'Relationship, Engagement and Consultation Protocol' signed by the Belledune Port Authority, First Nation Communities, and MTI on May 31, 2018 will guide and direct the activities of the parties. The Belledune Port Authority has delegated certain aspects under the protocol agreement to Maritime Iron.

12.0 ASSESSMENT OF ENVIRONMENTAL EFFECTS ON THE SOCIOECONOMIC ENVIRONMENT

This section includes an analysis of the potential interactions between construction, and operation and maintenance of the proposed Belledune Iron Processing Facility and the socioeconomic environment VC. Interactions between the Project and the socioeconomic environment could result in changes to land use, transportation, commercial fisheries, employment and/or the economy. With the implementation of mitigation measures described in this assessment, it is not anticipated that there will be substantial negative effects caused by the Project on the socioeconomic environment during any phases of the Project. Nearby residents may experience some loss of enjoyment of property resulting from Project effects such as noise, vibration, emissions and dust (mitigation discussed in Section 12.6.2 and in the Atmospheric Environment VC, Section 6). However, the land on which the proposed Project will be located is zoned for industrial use, and the nearby subdivision is currently proximal to several existing industrial facilities. Overall, the Project will result in positive economic and employment benefits.

12.1 RATIONALE FOR SELECTION AS A VALUED COMPONENT

The socioeconomic environment has been selected as a VC due to the potential for this Project to interact with land use, transportation, commercial fisheries employment and the economy during Project construction and operation and maintenance. The scope of the assessment is based on applicable regulations and policies, professional judgement of the study team, and knowledge of potential interactions.

12.2 REGULATORY CONTEXT

Land use planning in New Brunswick is guided by the *New Brunswick Community Planning Act* within unincorporated areas and the *New Brunswick Municipalities Act* in incorporated areas such as cities, towns and villages. The Chaleur Regional Planning Commission provides land use and regional planning services for Belledune, where the proposed Project would be sited, and other surrounding areas including Bathurst, Beresford, Nigadoo, Petit-Rocher, Pointe-Verte, as well as surrounding unincorporated areas. The Village of Belledune Rural Plan was adopted by village council in 2008 and is updated regularly, with the most recent plan update published on May 23, 2018 (Council of the Village of Belledune and Belledune District Planning Commission 2018).

The Regional Development Corporation (RDC) is the Crown Corporation that plans, coordinates and implements regional and economic development initiatives for New Brunswick under the *Regional Development Corporation Act*.

Operation and maintenance of highway infrastructure is largely regulated through the New Brunswick *Highway Act* and *Motor Vehicle Act*.

For the purpose of this assessment commercial fisheries include the catching of fish and shellfish for profit by Aboriginal and non-aboriginal fishers. Traditional Aboriginal fisheries are addressed in the Current Use of Lands and Resources for Traditional Purposes by Aboriginal Persons (Section 11.0).

Commercial fisheries in Chaleur Bay are guided under the federal *Fisheries Act*. Provisions under the *Fisheries Act* protect fish and fish habitat, including fisheries resources, and apply specific regulations governing commercial fisheries. Section 35 of the *Fisheries Act* restricts work, undertakings or activities that result in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery. Section 36 of the *Fisheries Act* prohibits the release or deposit of deleterious substances in water frequented by fish or in any water where fishing is conducted.

Commercial fishing activities in Chaleur Bay fall within the jurisdiction of four sets of regulations under the *Fisheries Act*: *Maritime Provinces Fishery Regulations*; *Atlantic Fishery Regulations*; *Aboriginal Communal Fishing Licenses Regulations*; and *Fishery (General) Regulations*. The mandate of each set of regulations is outlined below.

- The *Maritime Provinces Fishery Regulations* govern fishing activity in inland and adjacent tidal waters of the provinces of New Brunswick, PEI and Nova Scotia.
- The *Atlantic Fishery Regulations* provide for the management and allocation of fishery resources off the Atlantic coast of Canada.
- *Aboriginal Communal Fishing Licenses Regulations* provide for the management and allocation of Aboriginal fishery resources within Canada.
- *Fishery (General) Regulations* provide for the management of fishing activity within Canada that fall outside of the regulations described above including recreational fishing activities under the jurisdiction of DFO and that are beyond the scope of provincial fishery regulations.

12.3 SPATIAL BOUNDARIES

The assessment of potential environmental interactions between the Project and the socioeconomic environment is focused on a PDA and a LAA.

The PDA for the Project is defined as the area of physical disturbance associated with the construction, operation, and maintenance of the Project. For the purpose of this assessment, the PDA includes the land within the property boundaries of PID 20616322, PID 20598090, and PID 20277927 and the marine navigational approaches to the Port of Belledune bounded by Lobster Fishing Area (LFA) 23 within Chaleur Bay.

The LAA for the socioeconomic environment is defined as the area within which the environmental effects of the Project can be measured or predicted with reasonable accuracy. The LAA for transportation, employment, commercial fisheries and the economy includes the County of Gloucester, the County of Restigouche (Belledune is located on the border of these two counties) and LFA 23 within Chaleur Bay, as the economic benefits from the Project may be wide spread within these areas. The environmental effects on land use are anticipated to be more localized thus the LAA consists of a 500 metre buffer on each side of the PDA.

The PDA and the LAAs are shown on Figure 12.1 and Figure 12.2.

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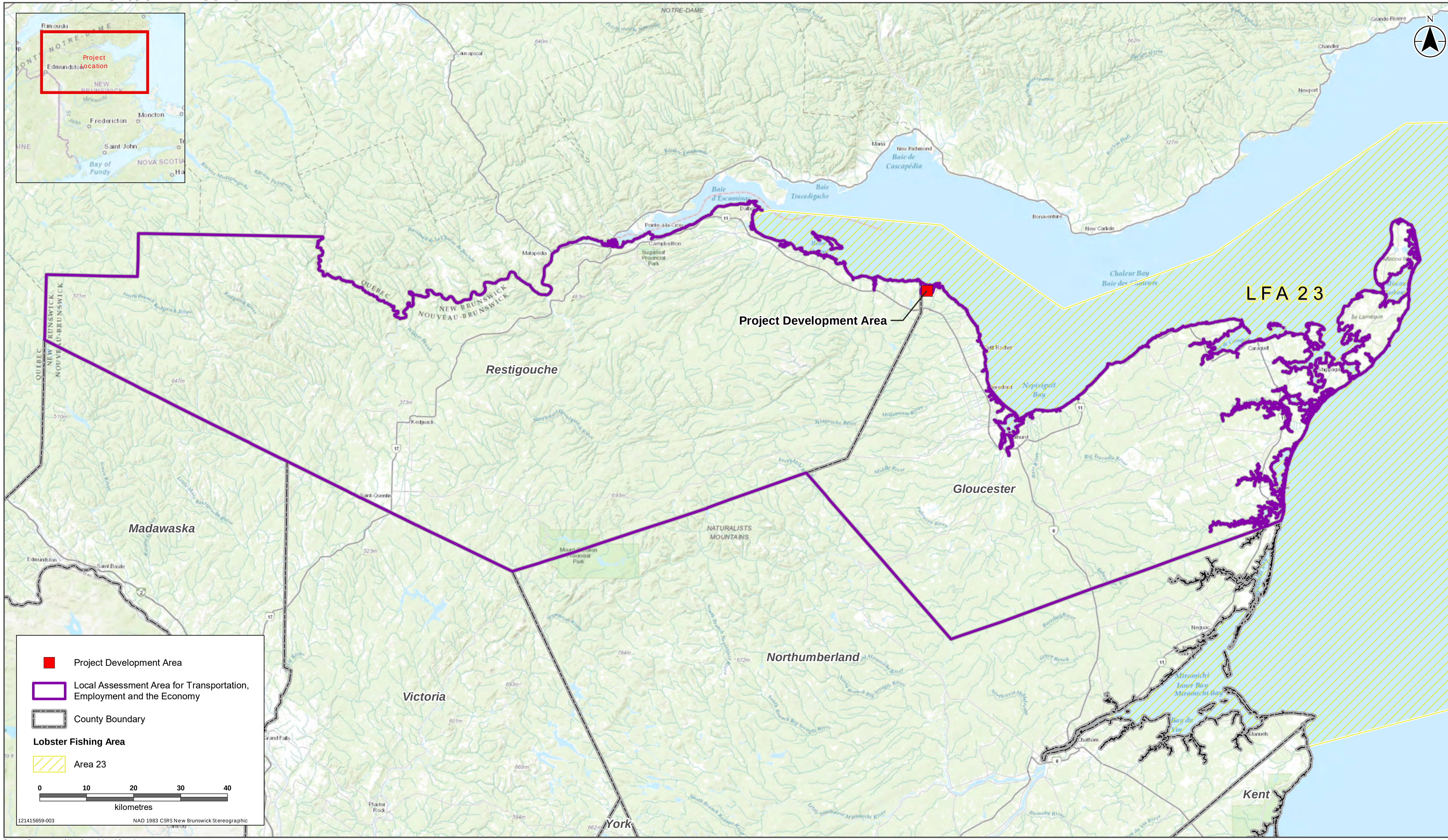

Sources: Government of New Brunswick and Canada

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Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

Local Assessment Area for Transportation, Employment, Commercial Fisheries and the Economy

Stantec

121415659 - PROPOSED IRON PROCESSING FACILITY, BELLEDUNE, NEW BRUNSWICK - MARITIME IRON INC.

Figure 12.1

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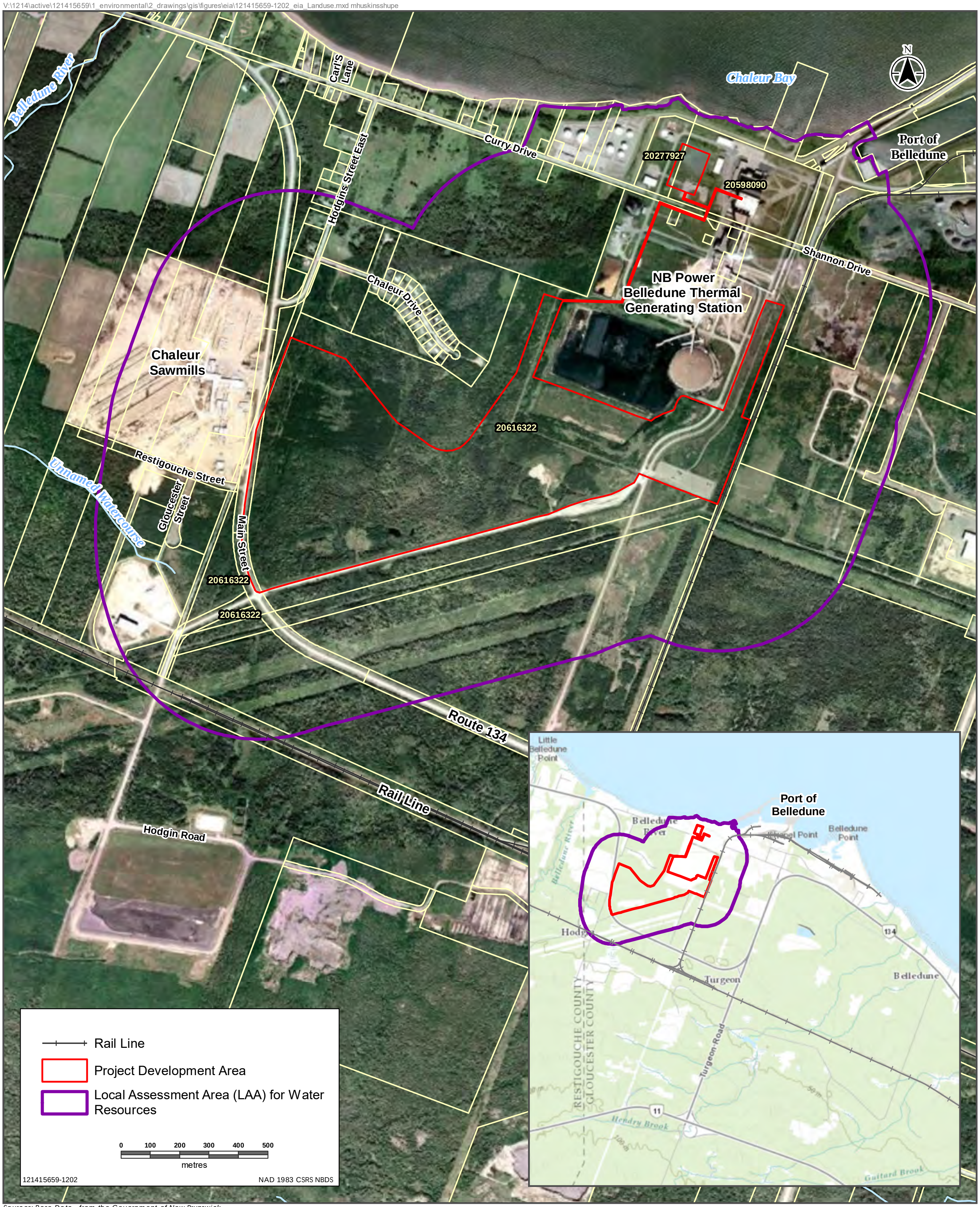

Sources: Base Data - from the Government of New Brunswick

Service Layer Credits: Service New Brunswick/Service Nouveau Brunswick
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Local Assessment Area for Land Use

Stantec

121415659 - PROPOSED IRON PROCESSING FACILITY, BELLEDUNE, NEW BRUNSWICK - MARITIME IRON INC.

Figure 12.2

12.4 TEMPORAL BOUNDARIES

The temporal boundaries for the assessment of the potential environmental effects on the socioeconomic environment include:

- Construction – scheduled to begin in Q1 2020 and last for approximately 3 years; and
- Operation and maintenance – scheduled to begin in Q1 2023 and continue for the life of the facility, currently anticipated to have a in excess of 30-year operating life.

12.5 EXISTING CONDITIONS FOR THE SOCIOECONOMIC ENVIRONMENT

12.5.1 Approach and Methods

Information on baseline conditions was primarily obtained from spatial analysis and research. Baseline research included a review of statistical data sources and published reports. These reports include published maps and aerial photography, reports released by GNB (various departments), and past project assessments and technical reports that were reviewed for relevant information.

12.5.2 Description of Existing Conditions

12.5.2.1 Land Use

The Project is located on land currently owned by NB Power at 1558 Main Street in the Village of Belledune, Beresford Parish, Gloucester County, New Brunswick. Project components will be situated immediately adjacent to NB Power's Belledune Thermal Generating Station and the Port of Belledune. The parcel identification numbers for the Project property are 20616322, 20598090, and 20277927.

The land on which the Project facility will be located is zoned for "Industrial Type 1" uses. According to the Village of Belledune Rural Plan (Council of the Village of Belledune and Belledune District Planning Commission 2018), permitted uses in this zone include a wide variety of industrial facilities. The Village of Belledune has zoned approximately 5,000 acres for heavy industry and is continuing to develop their 230 acre light industrial park (which is zoned for a further 10,000 acres for future development) (Village of Belledune 2018a).

There is a residential street, Chaleur Drive, located north of the Project, with 30 residences located on the street. The closest residence is 230 metres from the PDA of the Project (Figure 12.2).

The LAA is primarily forested land (226 hectares, or 49% of the total area), followed by industrial land (148 hectares, or 32%), wetlands (40 hectares, or 9%) and land classified as infrastructure (38 hectares, or 8%) (based on NBDELG habitat classifications; (Figure 9.2).

The nearest mineral claim is approximately 390 metres to the south of the PDA, and the nearest oil and gas license is approximately 112 kilometres south.

Hunting, boating, recreational water use, fishing and snowmobiling are popular recreational activities in the general area of the Project. The LAA is within Wildlife Management Zone 5 (WMZ 5), which is open to hunting, trapping and snaring; WMZ 5 is closed to deer hunting for the 2018-2019 hunting season (NBDERD 2018). Snowmobile trail # 305 runs parallel to Route 11 and comes within approximately 3.5 kilometres (southwest) of the Project. The trail is maintained by the New Brunswick Federation of Snowmobile Clubs (NBFSC 2018). During the spring and summer of 2018, when Stantec was conducting field studies, some sparsely marked trails were noted in the wooded area south of Chaleur Drive. These trails could be used for cross-country skiing, snowshoeing and perhaps other recreational uses such as hiking.

12.5.2.2 Transportation

Route 134 (a collector road also known as Main Street) runs along the coast and through the Village of Belledune. It also runs adjacent and south of the Project (Figure 12.2). It was diverted in the 1990's for the construction of the NB Power Belledune Thermal Generating Station (Council of the Village of Belledune and Belledune District Planning Commission 2018). A private NB Power road (known as Ash Haul Road) runs diagonally from Hodgins Road and Main Street towards the Belledune Thermal Generating Station. Provincial highway Route 11 (arterial highway) runs parallel to much of Route 134, approximately 3-4 kilometres south. The AADT counts for Route 134 range between 1,090 and 1,500 near the Project site. The AADT for Route 11 ranges between 3,260 and 3,650 (NBDTI 2016). Traffic on Route 134 decreased from approximately 1,800 AADT in the late 1990's to less than 1,500 AADT in 2006 (Council of the Village of Belledune and Belledune District Planning Commission 2018). According to the Belledune Rural Plan (2018), the AADT on Route 134 is low in comparison with other coastal routes in the Chaleur region.

A CN rail line (with two sidings) runs adjacent to the existing generating station on land owned by Glencore Canada Corporation (Figure 12.2). The Port of Belledune is a year-round deep-water port that is equipped to handle dry bulk, liquid bulk and general cargo (Village of Belledune 2018a).

12.5.2.3 Commercial Fisheries

Commercial fisheries in Chaleur Bay are an important source of employment for coastal communities in the counties of Gloucester and Restigouche and are important to the economy of New Brunswick. There are several active fishing harbors in the area LAA. The closest are the Pointe Verte and Petit-Rocher harbours, located approximately 8.5 kilometres east and 17 kilometres southeast of the Port of Belledune, respectively.

Due to the offset in timing of fishing seasons within the LAA, it is common for individual fishers to hold a license for more than one fishery. Fisheries are managed by DFO through regulations under the *Fisheries Act*, and DFO sets the catch or quota limits, fishing seasons, and gear restrictions in consultation with industry and stakeholders for the targeted species. The federal regulations have been developed to promote the longevity of the industry and healthy fish populations, and are subject to change based on new data, research and environmental conditions. Fishery specific landing data is gathered by DFO and this data is available through online resources and data requests (DFO 2019a).

Based on the most recent data available from DFO Gulf Region (2011 to 2016), there are five main commercial fisheries reported within the Project LAA: American lobster, snow crab, rock crab, Atlantic mackerel and Atlantic herring (DFO 2019a). Groundfish and Sea scallop fisheries are present within the LAA but less effort is directed toward these fisheries (DFO 2019a). Most of the groundfish fishery effort occurs outside of the LAA and targets five species: Atlantic halibut, winter flounder, American plaice, Turbot/Greenland halibut and redfish (*Sebastes mentella*) (DFO 2019a).

Within a given year, effects on commercial fisheries are most likely to occur within the regulated fishing seasons. Table 12.1 lists the current commercial fisheries and regulated seasons.

Table 12.1 Regulated Seasons for Commercial Fisheries in the RAA

Species	Area Location	Season
Lobster	Lobster Fishing Area (LFA) 23	Typically, late April to late June (Actual dates subject to change each year).
Snow Crab	Snow Crab Fishing Area (SCFA) 12	Typically, April to June (Start dates subject to change each year).
Rock Crab	Rock Crab Fishing Area (RCFA) 23	Typically, August to October (Actual dates subject to change each year).
Herring	Herring Fishing Area (HFA) 16B	Spring: April 1 to May 31. Fall: typically, late-August to early September. Roe Fishery: typically, late August
Mackerel	Mackerel Fishing Area (MFA) 16	Typically, June to December.
Groundfish	Groundfish Fishing Area (GFA) 4T6, GFA 4T3a	May 15 to May 14, Year-round.
Scallop	Scallop Fishing Area (SFA) 21a, SFA21b	SFA 21a was closed from 2016-2018 based on low catches (TBD for 2019) SFA 21B – early May to early August (Actual dates subject to change each year).

Aquaculture leases are present within Chaleur Bay, though mostly are contained within Caraquet Bay, Shippagan Bay, and Miscou Harbour. The closest aquaculture lease to the Project is a pair of aquaculture leases in Heron Channel, both are greater than 25 kilometres from the PDA (NBAAF 2019).

Traffic density was obtained through the Automatic Identification System (AIS) operated by DFO and the Canadian Coast Guard and is shown in Figure 12.3. This figure displays the marine traffic separation scheme through the Gulf of St. Lawrence (parallel lines starting at the Cabot Strait) and other common marine routes including the route from the entrance to Chaleur Bay to the Port of Belledune (outlined). Although AIS traffic includes almost all merchant shipping, a fraction of the total traffic is still missing. For instance, although part of the in-shore fishing fleet is equipped with AIS, an unknown and spatially variable proportion is not. Despite the prominent fishing activity in the Gulf of St. Lawrence, little traffic from fishing vessels is reported in AIS. As such, the traffic density included in Figure 12.1 does not include marine traffic from local fishers.

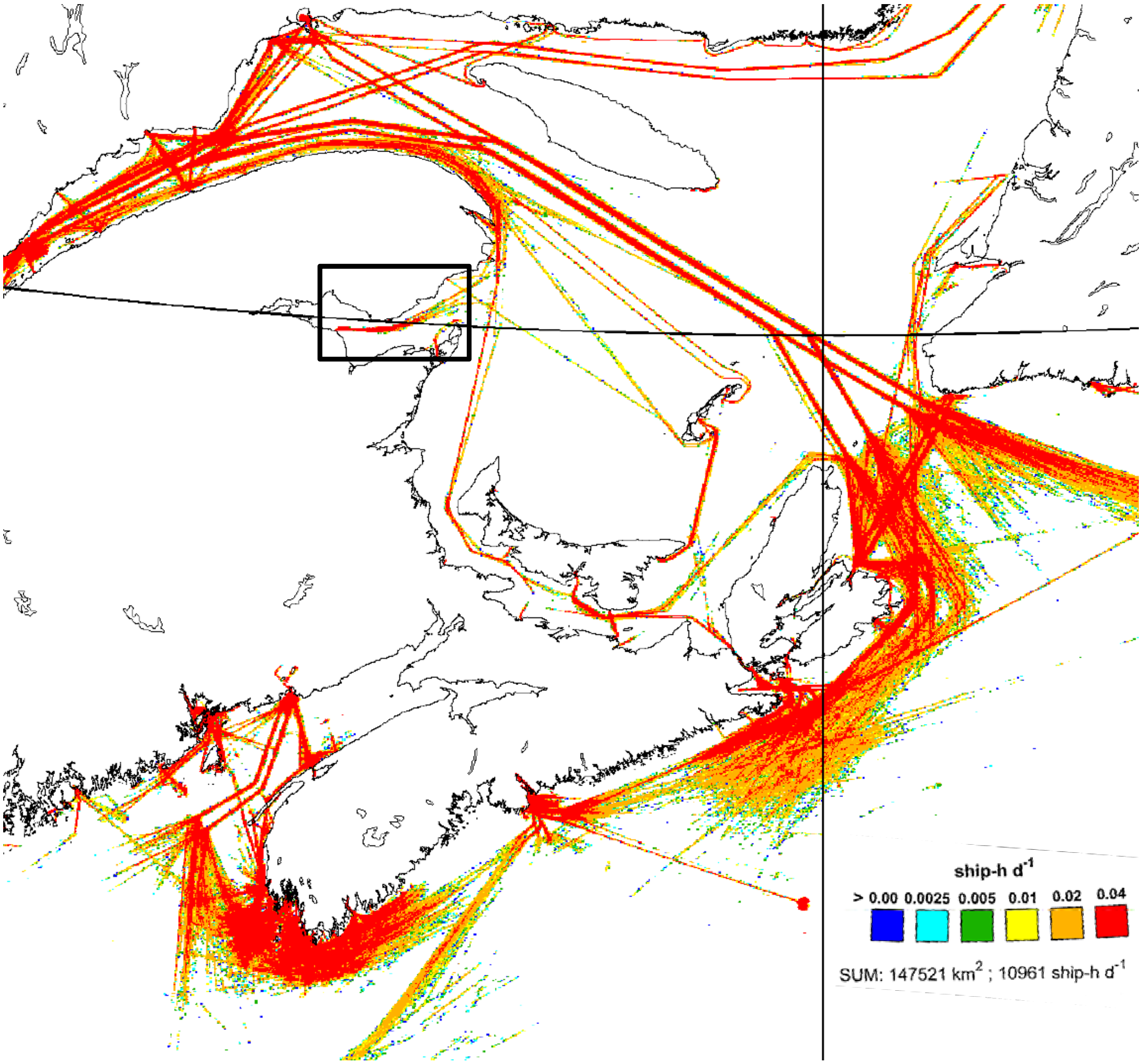

Figure 12.3 Map of the daily Automatic Identification System traffic density of all ships in 2013 (95th Percentile) (Simard et al. 2014)

Data on commercial vessel traffic within Chaleur Bay was obtained from DFO for the years 2002 to 2018, Merchant vessels (i.e. tankers, bulk carriers, container carriers and passenger vessels) contribute 47% to 86% of the total vessel traffic depending on the year. Merchant vessel traffic in Chaleur Bay has decreased in recent years with the four most recent years having the lowest percentage of merchant vessel traffic in the years where data is available (Table 12.2). The total number of vessels has increased in recent years.

Table 12.2 Vessel Traffic in Chaleur Bay 2002 to 2018

Year	Vessel Type		
	Merchant Bulk Vessels	Total All Merchant Vessels	Total All Vessels
2002	46	100	149
2003	63	146	181
2004	60	180	208
2005	57	162	202
2006	49	143	180
2007	52	150	186
2008	64	159	185
2009	63	158	189
2010	57	137	193
2011	54	128	153
2012	54	123	143
2013	53	117	157
2014	49	93	129
2015	47	98	204
2016	65	123	211
2017	57	82	173
2018	94	131	255

Source: DFO 2019a

12.5.2.4 Employment and Economy

Approximately 1,417 people live in the Village of Belledune (Statistics Canada 2016) (most recently available Census data). The unemployment rate is 17.2% (Council of the Village of Belledune and Belledune District Planning Commission 2018). The northeast region of New Brunswick (which includes Restigouche, Gloucester and Northumberland counties) has high percentages of employment levels in the areas of sales and service occupations (27.8%), trades, transport and equipment-related occupations (19.8%), and business, finance and administrative occupations (13.5%) (GNB 2013). Average individual income levels in the region are lower than provincial averages. The average employment income of individuals (full-year and full-time) in the northeast region of New Brunswick is $38,967 compared to $41,412 for the province. Average family income levels in the northeast region are also lower than the provincial average ($56,033 compared to $63,913).

For the construction portion of the project Maritime Iron anticipates that the the trade capabilities required do exist in the province through various construction trade unions and in the open market. For the operations skillsets required New Brunswick has had much industry close in recent years but has a workforce familiar with industrial plant and mineral processing.

In addition to the Belledune Thermal Generating Station, Belledune is also home to a lead smelter owned by Glencore Canada, a sawmill facility owned by Chaleur Sawmill Associates, and a gypsum processing plant owned by Canadian Gypsum Company (Village of Belledune 2018a).

Emergency services within the LAA are provided by a volunteer fire department, the New Brunswick EMS Ambulance Service, and the R.C.M.P. (Belledune 2018b).

Health services are provided by the Vitalité Health Network, with hospitals located in Campbellton and Bathurst.

The nearest community college campuses (New Brunswick Community College, or Collège Communautaire du Nouveau-Brunswick) are located in Bathurst and Campbellton.

There are no hotels located in Belledune, but there are several options for temporary lodging in the neighboring communities of Bathurst, Charlo, and Campbellton.

12.6 POTENTIAL PROJECT INTERACTIONS WITH THE SOCIOECONOMIC ENVIRONMENT

Activities and components could potentially interact with the socioeconomic environment to result in adverse or positive environmental effects on land use, transportation, employment and the economy. In consideration of these potential interactions, the assessment of Project-related environmental effects on the socioeconomic environment is focused on the potential environmental effect listed in Table 12.3. This potential environmental effect will be assessed in consideration of specific measurable parameters, also listed in Table 12.3.

Table 12.3 Potential Environmental Effects and Measurable Parameters for the Socioeconomic Environment

Potential Environmental Effect	Measurable Parameter
Change in the socioeconomic environment (land use, transportation, or employment and economy).	• Area (hectare) of land affected (e.g. access restrictions, recreational land use, loss of private land) • Change in traffic volumes • Consistency with established land use and/or economic development plans • Measurable changes to surrounding land uses (e.g., air and noise emissions) (as determined in the Atmospheric Environment VC) • Direct employment (# jobs) • Project expenditures on goods and services • Availability of accommodations in the LAA (such as vacancy rates, inventory levels)

Table 6.39 identifies the physical activities that may interact with the VC and result in an environmental effect. These interactions are discussed in the following sections, including potential environmental

effects, mitigation, and residual environmental effects. Where no interaction is indicated, a discussion is provided following the table.

Table 12.4 Potential Project Interactions

Project Activity	Potential Environmental Effect (Change in the Socioeconomic Environment)
Construction	
Site Preparation	✓
Construction of Temporary Facilities	-
Construction of Project Components	-
Ground Transportation	✓
Marine Transportation	✓
Commissioning	-
Employment and Expenditure	✓
Emissions and Wastes	✓
Operation	
Iron Production	-
Maintenance	-
Ground Transportation	✓
Marine Transportation	✓
Employment and Expenditure	✓
Emissions and Wastes	✓

Notes:
✓ indicates an interaction
- indicates no interaction

Potential environmental effects may result from emissions and wastes from construction and operation and maintenance (construction of temporary facilities, construction of Project components, marine transportation, commissioning, iron production, and maintenance); accordingly, these potential effects are captured under emissions and wastes Project activity listed in Table 12.4. These include measurable changes to surrounding land uses (e.g., air and noise emissions) (as determined in the Atmospheric Environment VC) (Table 12.3).

12.6.1 Potential Effects to the Socioeconomic Environment During Construction, and Operation and Maintenance

During construction, there will be altered/restricted access to land that may have previously been used for recreational purposes, such as skiing or hiking. The PDA will experience disturbance from site preparation.

Noise, vibration, emissions and dust related to construction activities could cause short-term nuisance issues for businesses and residents in the area during construction, especially those located along Chaleur Drive. Some of these potential effects, such as noise and emissions, may exist throughout the operation and maintenance phase of the Project.

An increase in traffic associated with construction has the potential to cause delays and disrupt local traffic patterns in the transportation network leading to and from the PDA and surrounding area. The construction phase of the Project will result in an increase in passenger vehicles and heavy-duty trucks transporting workers, materials and equipment to and from the site. Materials will be predominantly transported on private roads and Port roads, and public highways will be avoided, where possible. An increase in traffic associated with operation and maintenance of the Project including transporting additive materials (e.g. starch, burnt lime material, sinter ore powder, lime powder, graphite powder, and limited quantities of limestone and dolomite), is also expected, but to a lesser extent than during construction. The Proponent is consulting with the New Brunswick Department of Transportation and Infrastructure (NBDTI) regarding potential mitigation measures that may be implemented on existing public roads around the Project, potentially including traffic lights and additional turning lanes at the intersection with the Ash Haul Road. In consultation with NBDTI, if these mitigation measures are implemented, temporary lane or road closures may be required to allow for their implementation.

Routine marine transportation is expected to overlap with commercial fishing seasons during construction and operation of the Maritime Iron facility. Marine transportation during construction and operation could result in a change to the net income of local commercial fishers within the LAA if Project shipping interferes with fishing effort. A change in commercial or Aboriginal commercial fishing activities within the LAA may include a temporary loss of access to fishing grounds during a fishing season due to marine vessel movement during construction or operation, or the loss of fishing gear from vessel entanglements.

Construction is anticipated to be beneficial for both employment and the economy, since local employment and business opportunities will be created. The nature and magnitude of the construction work may require additional resources beyond what both the regional labour and business community may be able to supply, however, it is anticipated that the provincial economy will benefit from this undertaking.

Operation and maintenance activities are expected to have a positive effect on the economy, resulting in increased long-term economic activity and employment in Northern New Brunswick. The Project will create approximately up to 1,300 direct temporary jobs during its 3-year construction phase and at least 200 direct permanent jobs during the operation and maintenance phase. During construction the Project workforce will mainly consist of construction positions but will also include a variety of engineering, management, accounting and payroll personnel. Increased demand for labour, goods and services, and accommodations due to Project activities during construction and operation will generate revenue for businesses in the region and associated increased tax revenue for governments. An economic impact study on the Project was conducted by Strategic Concepts Inc. (SCI) which estimated that a total of $1.5 billion will be generated in provincial tax revenue, including income tax and corporate tax during construction and operation (SCI 2019).

Maritime Iron estimates an initial capital investment for the Project of almost $1.5 billion during construction and an additional $150 million for the construction of the Oxygen Plant by a third party. Additional Capital investments of $300 million during the operating life of the Project facility are also anticipated. The annual operating expenditures during operation are estimated to be approximately $570 million, totaling approximately $16.8 billion over the life of the project. (SCI 2019).

It is estimated that the operation of the Project will directly contribute approximately $0.44 billion to New Brunswick's gross domestic product (GDP) annually during operation. Over the life of the Project, SCI estimates approximately $1.5 billion will be received by local workers and businesses through labour incomes and profits, including total income averaging $25 million per year during operation (SCI 2019).

Integration between the Project and the NB Power's Belledune Thermal Generating Station (*i.e.,* the combustion of the Project facility's by-product gas or FEG) will also allow for continued operation of the Belledune Thermal Generating Station past the January 1, 2030 phase out date for coal-fired power plants described in proposed amendments to coal-fired electricity regulations. SCI estimates that this would result in the continuation of approximately 120 direct full-time positions at the Belledune Thermal Generating Station (SCI 2019).

During construction, temporary housing and accommodation will be utilized beyond the current baseline but the targeting of local labour should ease any impact on the market.

12.6.2 Mitigation for the Socioeconomic Environment

Interactions between Project activities and the socioeconomic environment will be managed through the use of various mitigation measures. The following mitigation measures specific to the socioeconomic environment have been identified for this Project.

- The proponent will join the existing community liaison committee to increase opportunities to provide project information and exchange information related to public issues and concerns that may arise.
- The proponent will, either directly or through business and labour partners, hold job fairs to inform interested members of the public of the potential opportunities associated with the Project, and to increase opportunities for local benefits from the Project.
- Through the construction planning phase, information sessions will be held with local training institutions, labour groups and other community interest groups regarding skill set requirements to enable local workforce training.
- Maritime Iron will work with the New Brunswick Department of Post Secondary Education, Training and Labour, CCNB, NBCC, JEDI, Aboriginal Skills Education Training FN-MTI, construction trades unions and other groups to identified skills and trade gaps and work together to put training in place for First Nations and local workers.
- The proponent will, either directly or through business partners and local business groups such as the Chamber of Commerce, hold contractor information sessions to inform interested members of the business community of the potential opportunities associated with the Project, and to increase opportunities for local benefits from the Project.
- Maritime Iron's website will be used to enable local businesses to express interest in participation in the Project.
- Consultation with local residents is underway to understand any concerns the community may have and to implement mitigation measures where necessary.

- A high-level assessment of local accommodation availability during construction will be completed if it is determined that the available workforce is likely to require significant housing.
- Residents and institutions will be notified of the schedule for construction activities and their likely duration, particularly those related to clearing activities, access restrictions and blasting.
- Mitigation described in the Atmospheric Environment VC (sections 6.2.6 and 6.4.6), such as dust control, will be used to reduce nuisance effects.
- A 100 metre buffer of land will be left around the Chaleur Drive residences, as per the Village of Belledune Zoning Plan.
- The Proponent is consulting with NBDTI regarding potential mitigation measures that may be implemented on existing public roads around the Project, potentially including traffic lights and additional turning lanes at the intersection with the Ash Haul Road.
- Alternative route access will be provided during construction activities, when required.
- Highway flaggers will be used to control traffic flow, when required.
- The public will be notified about long delays, road closures, detours, or disruptions to the transportation network.
- Materials will be transported on private (proponent) roads and Port roads, and public highways will be avoided where possible.
- Carpooling or buses will be used to transport workers to and from the site during the construction period where feasible.
- Encouragement of the use of established approaches by Project-related vessels (note that the final decisions regarding approaches are at the discretion of vessel captains and pilots and can be affected by environmental conditions including weather and currents).
- The Port of Belledune requires non-Canadian registered vessels to use the services of an Atlantic Pilotage Authority licensed pilot.

12.6.3 Characterization of Residual Project-Environmental Interactions for the Socioeconomic Environment

Some short-term disruption to land access is expected. However, access to the PDA is already limited due to the presence of the Belledune Thermal Generating Station, and since it is private land (owned by NB Power). Certain areas of the LAA will experience permanent disturbance from site preparation and construction of the Facility. However, the development of the Project is consistent with the established land use and economic development plans for the Village of Belledune. The PDA is zoned for industrial land use, and the Village of Belledune considers itself to be a major industrial center for northern New Brunswick, striving to attract and maintain industries that would “contribute to the long term benefit of the community in terms of job opportunities and economic returns” (Council of the Village of Belledune and Belledune District Planning Commission 2018).

During construction, local residents may experience some temporary noise, vibration, emissions and dust associated with construction activities during the three-year construction phase. Mitigation described in the Atmospheric Environment VC (Sections 6.2.6 and 6.4.6) will be used to reduce these effects. Some of these effects may persist during the operation and maintenance of the Project.

While construction activities are expected to cause some delays for vehicular traffic and local traffic patterns, such disruptions will be temporary and intermittent in nature. Notification will be provided in advance to local residents and businesses, and alternative routes for traffic will be available to reduce the effect. An increase in traffic associated with operation and maintenance of the Project is also expected, but to a lesser extent than during construction, and within the capacities of public roads. The increase in passenger vehicles and heavy trucks transporting workers, materials, and equipment to and from the site during all Project phases will be managed through the mitigation measures listed above. Road closures during construction, if required, will be limited and short-term.

The Belledune Iron Processing Facility is anticipated to increase merchant vessel traffic by 10 to 20 vessels per month during construction and on average 12 vessels per month during operation. This results in a 47 to 94% increase in ships transiting Chaleur Bay during construction and approximately a 56% increase in merchant vessel traffic during operation. However, merchant vessel traffic in Chaleur Bay has decreased in recent years with the four most recent years having the lowest percentage of merchant vessel traffic in the years where data is available (Table 12.4).

Vessel entanglement in stationary fishing gear and temporary displacement of fishers from fishing grounds are the most likely interactions between CRA fishers and marine transportation. This is most likely to occur during the shipment of equipment to the Port of Belledune during construction and movement of raw materials and product to/from the Port during operation. Displacement from fishing grounds would be short term and localized to the Port of Belledune approaches. Fishing gear loss may occur but is expected to be limited to stationary gear located in the approaches to the Port of Belledune. The federal government has exclusive legislative jurisdiction over navigation and shipping, such as the establishment of shipping lanes. Transport Canada is the federal lead in regulating shipping in Canada and is responsible for federal transportation policies and programs. While the Proponent cannot enforce the establishment and location of shipping lanes, they will continue to encourage the use of established approaches by Project-related vessels. That is to say, Project vessels will use the same approaches currently used by vessels entering and exiting the Port of Belledune. The use of established approaches will reduce the loss of fishing gear from vessel entanglements and no loss of fishing grounds to vessel traffic will occur as new approaches are not planned.

With the implementation of mitigation measures the magnitude of the effect of the Project on CRA fishing catches in the LAA is anticipated to be low. Measurable changes to the net income of commercial fishers as a result of the Project are not anticipated.

Increased demand for labour, goods and services due to Project activities during construction will create temporary, short-term increases in employment in the LAA and generate revenue for regional businesses and associated increased tax revenue for governments. This will also occur during the operation and maintenance phase, to a lesser degree. The Project is expected to produce positive effects on the local economy, especially during construction of the Project, through increased accommodation occupancy in local hotels/motels, and increased spending on goods and services. Overall, the increased business and economic growth will enable further development in services and infrastructure development in the region.

12.7 SUMMARY AND RECOMMENDATIONS

With implementation of the mitigation measures described in this assessment, it is not anticipated that there will be substantial negative effects caused by the Project on the socioeconomic environment during any phases of the Project. Residents in surrounding areas may experience some temporary Project effects such as noise, vibration, emissions and dust. These nuisance effects will be limited to the extent practical and consistent with permit conditions and regulatory requirements; mitigation is described in the Atmospheric Environment VC (Section 6.0).

The land on which the proposed Project will be located is zoned for industrial use, and Chaleur Drive is currently proximal to several existing industrial facilities. Potentially adverse effects resulting from restricted access to the PDA are not anticipated to have a measurable overall effect on recreational activities in the area; access is currently limited due to the presence of the Belledune Thermal Generating Station, and because the land is privately owned. The development of the Project is consistent with the established land use and economic development plans for the Village of Belledune.

Increases in traffic volumes and/or changes to traffic patterns will be short-term and intermittent during construction. It is expected that traffic will also increase during the operation and maintenance phase of the Project, but not nearly as much as during construction. Commercial fisheries in Chaleur Bay are an important source of employment for coastal communities in the counties of Gloucester and Restigouche. Routine marine shipping operations are expected to overlap with commercial fishing seasons during construction and operation of the Maritime Iron facility. With the implementation of mitigation measures the Project is not expected to result in measurable changes to the net income of commercial fishers. The Project will create up to approximately 1,300 temporary jobs during its three-year construction phase, and at least 200 direct permanent jobs during the operation and maintenance phase. Increased demand for labour, goods and services due to Project activities will generate revenue for regional businesses and associated increased tax revenue for governments. Overall, the Project will result in positive economic and employment benefits, since local employment and business opportunities will be created.

13.0 ASSESSMENT OF EFFECTS OF THE ENVIRONMENT ON THE PROJECT

This section includes an assessment of the potential effects of the environment on the proposed Belledune Iron Processing Facility. Effects of the environment on the Project is not technically a VC; however, it is assessed here for continuity in the assessment of potential interactions between the Project and the environment. Effects of the environment on the Project can be caused by environmental forces, environmental conditions and natural hazards interacting with the Project, such as climate and climate change, seismic activity and natural forest fires. Effects of the environment can result in damage to Project infrastructure and/or equipment, or changes to Project schedule. With the implementation of mitigation measures described in this assessment, such as careful engineering design, it is not anticipated that there will be substantial effects of the environment on the Project.

13.1 RATIONALE FOR SELECTION AS A VALUED COMPONENT

Effects of the environment on the Project has been identified for assessment due to the potential for environmental forces, environmental conditions and natural hazards to interact with the Project. Interactions between the environment and the Project may include naturally occurring events associated with climate and weather, climate change, seismic activity, and natural forest fires.

If adverse effects of the environment on the Project are not accounted for or are left unmanaged, they can result in adverse changes to Project construction schedule, Project components, and cost. Typically, these effects are identified and considered during this planning stage and addressed through Project engineering and design, scheduling, operational procedures, and mitigative measures that are implemented in consideration of anticipated environmental conditions.

13.2 SPATIAL BOUNDARIES

The assessment of potential environmental interactions between effects of the environment on the Project is focused on the PDA, as described below.

The PDA for the Project is defined as the area of physical disturbance associated with the construction, operation, and maintenance of the Project. As described in Section 2.5, for the purposes of this assessment, the PDA includes the land within the property boundaries of PID 20616322, PID 20598090, and PID 20277927. The PDA is depicted on Figure 2.4.

13.3 TEMPORAL BOUNDARIES

The temporal boundaries for the assessment of the potential effects of the environment on the Project include:

- construction – scheduled to begin in Q1 2020 and last for approximately 3 years; and

- operation and maintenance – scheduled to begin in Q4 2022 and continue for the life of the facility, currently anticipated to be in excess of 30 years.

13.4 EXISTING CONDITIONS FOR EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Information on the existing environment was primarily obtained from research, which included a review of statistical data sources and published reports. These published reports include the Governments of New Brunswick and Canada (various departments), scientific literature, and past project assessments/technical reports reviewed for relevant information.

13.4.1 Climate and Climate Change

Climate is characterized by the long-term prevalence of meteorological/weather conditions experienced by a region (ECCC 2017b), which can include parameters such as temperature, precipitation, wind, humidity, fog, sunshine and cloudiness. Current climate conditions are generally described by statistical data collected over the most recent 30-year period.

The climate of a region can also be influenced by other factors, such as topography. For example, mountains and hills can influence the movement of air and precipitation. As indicated on Figure 13.1, the elevation of the PDA ranges from 10 m to 35 m above sea level, but the main facility is between 25 m and 35 m (NRCan 2019). Surficial drainage within the PDA flows north, toward Chaleur Bay.

Climate change is defined as a change in the state of climate, that can be identified by changes in the mean and/or variability of its properties and persists for an extended period of time. Climate change can be caused by natural events such as solar cycles or volcanic eruptions and/or by human activities that cause changes to the atmosphere or changes to land use (IPCC 2014).

GHG emissions, released from human activities and urban development, are acknowledged to be a contributing factor to climate change by the IPCC (IPCC 2014). A GHG is any gas (natural or anthropogenic) that contributes to global warming. Greenhouse gases absorb and trap heat that is radiated by the earth, preventing it from escaping to the atmosphere. This natural phenomenon is known as the “greenhouse effect”; an increase in GHGs in the atmosphere intensifies the effect by increasingly trapping heat within the atmosphere, thereby intensifying potential for global warming and associated effects (EPA 2016).

Predictions of future climate change trends are derived from mathematical/statistical models and software. There is an overall consensus among the climatological community that, over the next century, Atlantic Canada is likely to experience warmer temperatures, increased precipitation, more frequent storm events, increased storm intensity, and increased flooding (NBDELG 2010; Lemmen et al. 2008; Lines et al. 2005). The climate projection data reviewed herein (the most recently available forecasts, discussed below) supports this as well.

The following section presents a climate profile of the village of Belledune, including a summary of the baseline "current climate" (based on long-term historical data) and future climate change projections for the area.

13.4.1.1 Climate Profile and Climate Change Projections

The Climate Change Hazards Information Portal (CCHIP), created by Risk Sciences International (RSI), was used to develop this climate profile and climate change assessment for Belledune. The CCHIP organizes data from weather stations across Canada and presents that data alongside future climate change projections for those locations (CCHIP 2018).

Current climate change projections are commonly based on four GHG concentrations trajectories adopted by the IPCC in their Fifth Assessment Report (AR5) (IPCC 2013). These trajectories are referred to as "representative concentration pathways" (RCP) and are indicative of the potential range of radiative forcing values that could result in GHG-related heating of the planet, as compared to pre-industrial values (Moss et al. 2010). The four RCP values are RCP2.6, RCP4.5, RCP6, and RCP8.5, and represent scenarios in which GHG-related heating of the planet occurs at a rate of 2.6 Watts per square metre (W/m^2), 4.5 W/m^2, 6 W/m^2, and 8.5 W/m^2, respectively. The climate profile presented below is based on the "business as usual" greenhouse gas concentrations scenario, RCP8.5 (which assumes GHG emissions will continue to rise in the future and will not plateau or decrease).

Sources: Base Data - from the Government of New Brunswick

Service Layer Credits: Service New Brunswick/Service Nouveau Brunswick

Topography of Project Area

Stantec

Figure 13.1

Temperature

Table 13.1 and Figure 13.2 depict baseline and projected future changes in daily mean temperature in Belledune.

Table 13.1 Average Change in Average Daily Mean Temperature from a Baseline of 1981 – 2010 (Belledune, NB)

Season	1981-2010 Baseline (°C)	Average Increase in Mean Temperature from 1981-2010 Baseline (°C)		
		RCP8.5*		
		2020s	2050s	2080s
Annual	4.5	1.3	3.2	5.4
Winter	-8.8	1.7	4.0	6.3
Spring	2.7	1.2	3.0	5.0
Summer	17.1	1.3	3.1	5.2
Autumn	6.9	1.2	3.0	5.0

Note:
RCP = representative concentration pathway

According to the CCHIP results, temperatures have been rising in Belledune and will continue to do so in the future. Winter has historically seen the most drastic warming temperatures over time. Winter is also projected to see the most drastic warming in the future, from an average daily mean temperature of -8.8 °C in the baseline (1981 – 2010) to above -2.5°C in the 2080s.

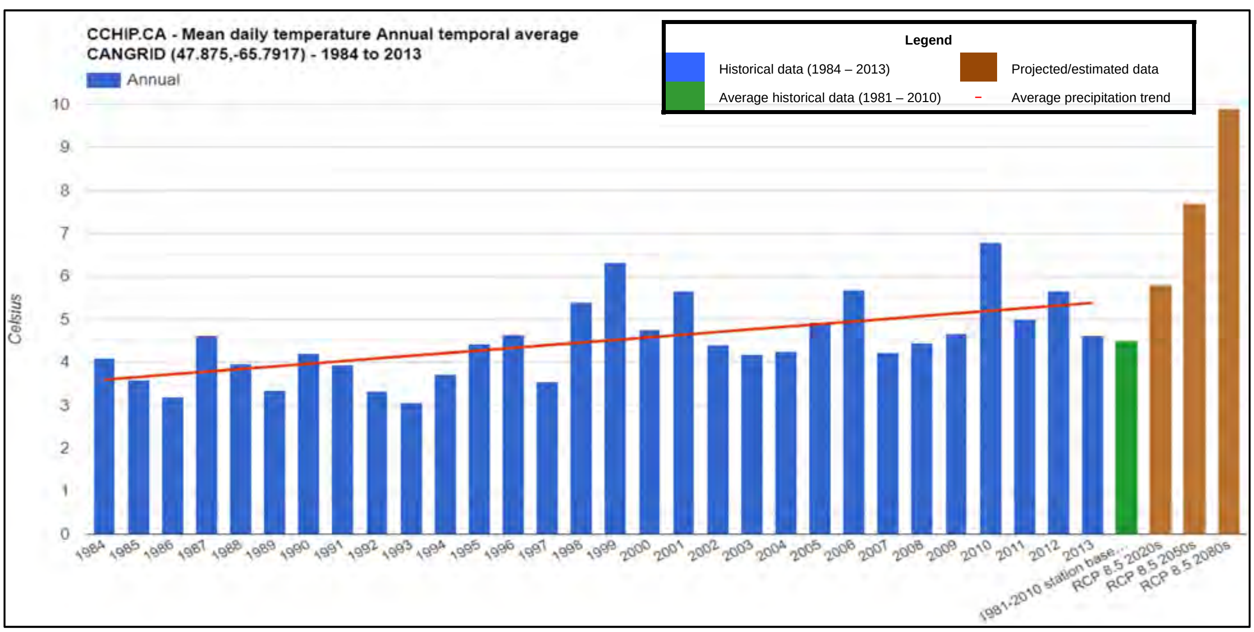

Figure 13.2 Annual Temporal Average – Mean Daily Temperature (Belledune, NB)

Precipitation

Table 13.2 and Figure 13.3 depict baseline and projected future changes in precipitation in Belledune. When considering annual precipitation, it should be noted that snowfall depth equates to a liquid depth of precipitation by a factor of about 10 millimetres (mm) snow to 1mm precipitation.

Table 13.2 Average Increase in Total Annual and Seasonal Precipitation from 1981 – 2010 Baseline (Belledune, NB)

Season	1981-2010 Baseline (mm)	Average Total Precipitation from 1981-2010 Baseline (mm)		
		RCP8.5		
		2020s	2050s	2080s
Annual	964	999	1044	1080
Winter	215	228	243	256
Spring	223	233	248	261
Summer	259	267	274	278
Autumn	268	271	280	284

Note:
RCP = representative concentration pathway

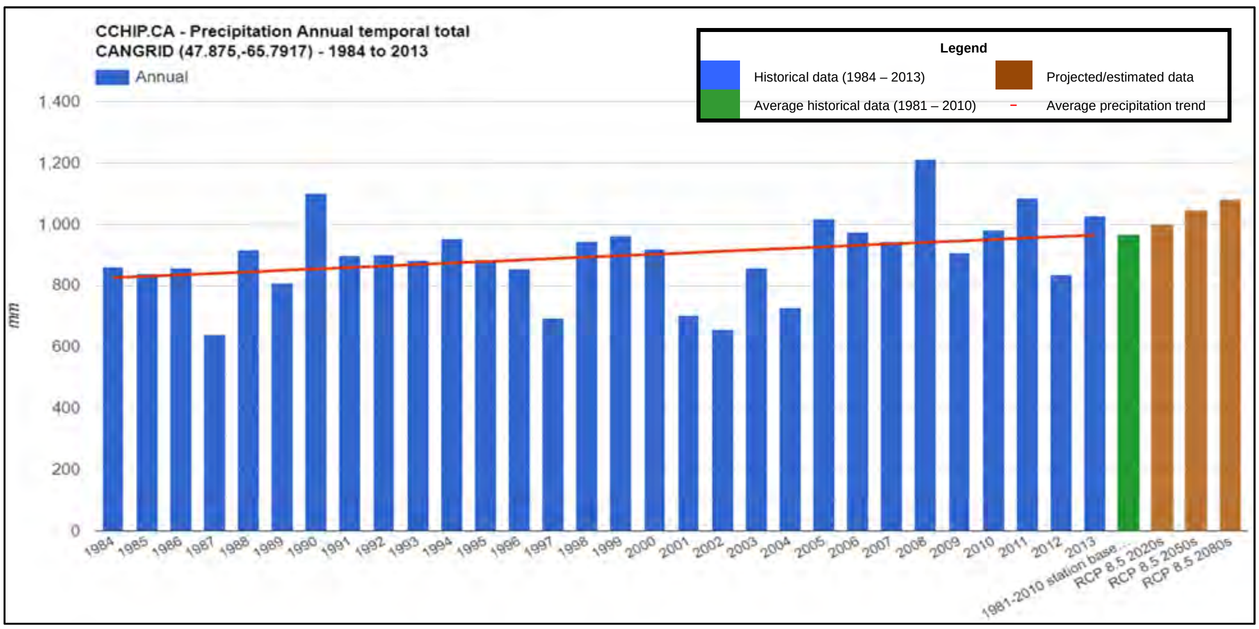

Figure 13.3 Annual Precipitation – Temporal Total (Belledune, NB)

During the baseline period (1981 – 2010), there have been increases in precipitation; these increases have been in spring and autumn, while precipitation in the summer and winter months have stayed relatively consistent over time. Precipitation is expected to continue increasing in the future in all seasons

(Table 13.2 and Figure 13.3), with the greatest potential increases being in winter (19.3%) and spring (16.9%) by the 2080s. The CCHIP results also indicated that precipitation events are likely to become more intense over time (more mm of precipitation per hour).

Table 13.3 and Table 13.4 display the total historical and projected precipitation event accumulation amounts (mm) in specific time duration (5 minutes to 24 hours) for various return periods (2 years to 100 years).

Table 13.3 Historical Precipitation Event Accumulation (mm), Gridded dataset, 49.9°N,-65.833°E

Duration of Event	Return Periods (years)					
	2	5	10	25	50	100
5 min	5.42	7.6	9.09	11.04	12.56	14.13
10 min	7.97	11.68	14.33	17.92	20.79	23.84
15 min	9.61	14.07	17.34	21.91	25.66	29.73
30 min	12.22	17.66	21.89	28.19	33.73	39.44
1 h	15.88	21.85	25.9	31.18	35.25	39.44
2 h	21.09	27.26	31.18	36.02	39.59	43.15
6 h	31.81	40.54	46.19	53.3	58.61	63.97
12 h	39.37	50.4	57.46	66.19	72.57	78.86
24 h	47.14	60.37	68.26	77.35	83.53	89.24

Table 13.4 Projected Precipitation Event Accumulation (mm), Gridded dataset, 49.9°N, -65.833°E, RCP 8.5, 2041-2100

Duration of Event	Return Periods (years)					
	2	5	10	25	50	100
5 min	7.35	10.64	13.05	16	17.87	20.32
10 min	10.82	16.36	20.58	25.96	29.59	34.29
15 min	13.05	19.7	24.91	31.74	36.52	42.76
30 min	16.6	24.73	31.45	40.84	48	56.73
1 h	21.57	30.59	37.2	45.18	50.18	56.73
2 h	28.63	38.17	44.79	52.2	56.35	62.07
6 h	43.19	56.76	66.36	77.23	83.43	92.02
12 h	53.45	70.57	82.55	95.91	103.29	113.43
24 h	64.01	84.54	98.06	112.07	118.9	128.37

As the results in Tables 13.3 and 13.4 indicate, an increase in precipitation can be expected for all rainfall events. The projected percentage increase in precipitation from the historic data to the period of 2041 –

2011 under RCP 8.5 range from 35.5% to 44.9%. For example, within a two year period, the precipitation amount that would accumulate in 5 minutes is expected to increase from 5.42 mm (Table 13.3) to 7.35 mm (Table 13.4). Increases in precipitation will be considered and incorporated into the planning, design, construction and operation of the Project.

Tropical Disturbances

Tropical disturbances, such as hurricanes and tropical storms, can cause substantial impacts in the Maritime provinces. Figure 13.4 shows the storm centres of historical tropical disturbances which have been tracked within 100 kilometres of Belledune[1]. Between 1851 – 2017, there have been 8 extratropical cyclones recorded within 100 km of Belledune, and one tropical cyclone of tropical storm intensity (34-63 knots, or 63 – 112 km/hour winds).

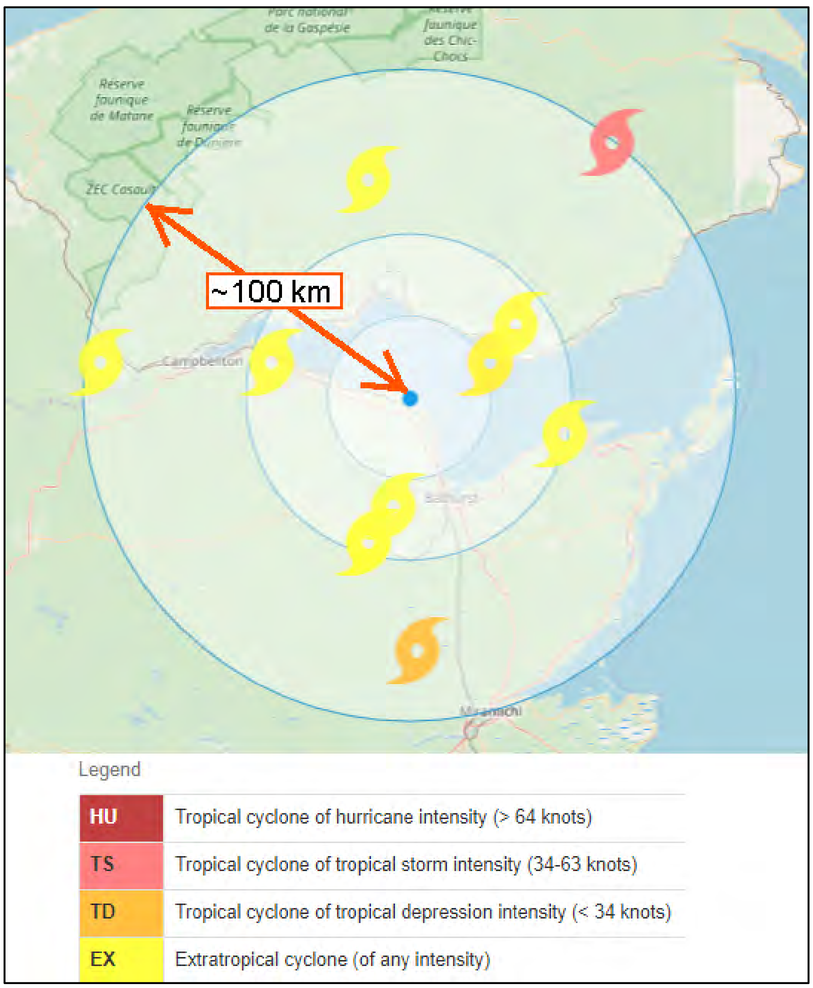

Figure 13.4 Recorded Historical Tropical Disturbances within 100 km of the PDA, Atlantic Hurricane Database 1851 – 2017

[1] Storm centres are only reported every 6 hours, so it is possible that the storm centres below may have tracked even closer to Belledune, depending on their tracking before and after reporting to the Atlantic Hurricane Database.

Climate predictions for the future occurrences of tropical disturbances under the effects of climate change are not available specifically for Belledune. However, historic trends for hurricanes suggest there has been an increase in both hurricane intensity and frequency over the last 50 years. On the assumption that these trends have been the result of climate change to date, these trends can be reasonably extrapolated into the coming decades to anticipate an increase in hurricane frequency and intensity in and around Belledune.

13.4.2 Seismic Activity

Seismic activity is characterized by the local geography of an area and the movement and/or fracture of rocks within the Earth. These movements release seismic waves that cause vibration of the ground, otherwise known as earthquakes (NRCan 2016a).

The Project is located within the Northern Appalachians Seismic Zone, which includes New Brunswick and parts of New England, as far south as Boston, Massachusetts. Historically, seismic activity in this area has been low, although there have been earthquakes with a magnitude of 4 or less (on the Richter scale) near Belledune (NRCan 2016b). According to the Natural Resources Canada (2015), the level of seismic hazard in Northern New Brunswick can be elevated, depending on several factors such as topographical conditions, spectral acceleration and probability.

It is unlikely that an earthquake with a magnitude of less than 5 would cause damage (NRCan2016c). The most substantive earthquake to have occurred in New Brunswick was in 1982 (magnitude of 5.7 on the Richter scale) in central New Brunswick, west of Miramichi.

13.4.3 Natural Forest Fires

The Canadian Wildland Fire Information System (CWFIS) is a computer-based fire management information system that monitors the short-term and long-term forest fire danger conditions across Canada. The CWFIS system creates fire danger maps throughout the year and during forest fire season, which generally occurs in the summer between May and September (NRCan 2018a). The Fire Weather Index (FWI), a component of CWFIS, is a numeric rating system for the intensity of forest fires and can be used as a general index of the danger of forest fires throughout the forested areas of Canada (NRCan 2018b). The FWI in the Project area is rated as 0-5 during forest fire season (based on data collected between 1981 – 2010). This is the lowest possible range of FWI risk, with the highest being a rating of over 30 (NRCan 2018c).

13.5 POTENTIAL PROJECT INTERACTIONS FOR EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Interactions may occur between the environment and the Project that could result in changes to Project schedule or operation. In consideration of these potential interactions, the assessment of the potential effects that the environment could have on the Project are focused on the potential effects listed in Table 13.5. These potential effects will be assessed in consideration of specific measurable parameters, also listed in Table 13.5.

Table 13.5 Potential Effects and Measurable Parameters for Effects of the Environment on the Project

Potential Effect	Measurable Parameter
Changes to Project schedule or operation	• Changes to Project schedule (e.g., construction delays) • Damage to Project infrastructure and/or equipment

Climate and climate change have the potential to interact with the Project and result in potential adverse effects. These interactions are discussed in detail in the following sections, including potential effects, mitigation and environmental protection measures, and residual effects.

Project structures will be built in accordance with comprehensive engineering design and compliance with standards, codes and best practices to withstand minor seismic activity (as per the latest National Building Code of Canada (NBCC 2015)). As such, it is not anticipated that there will be any likely interaction between seismic activity and the Project. As such, seismic activity is not considered further in this report.

The likelihood of a major forest fire event occurring in the vicinity of the Project that would cause substantive damage to the Project or interruption of Project-related activities or phases is low. If a fire was to occur, emergency response plans would be implemented to control and extinguish the flames. Therefore, natural forest fires are not considered further in this report.

13.5.1 Potential Interactions of Effects of the Environment on the Project During Construction, Operation and Maintenance

13.5.1.1 Climate and Climate Change

Increased temperatures, especially in the fall and winter, could result in later freeze up, more liquid precipitation occurring later into the fall and winter, as well as wetter, heavier snow.

Extreme precipitation has the potential to result in flooding (especially during snowmelt events and winter rain events where natural drainage is hindered), erosion, and other events such as access roads being washed out. As mentioned in Section 13.4.1, surficial drainage within the PDA flows north, toward Chaleur Bay. Sedimentation could also occur as a result of flooding. Failures of sedimentation control structures could occur from heavy precipitation events during construction.

Wet and heavy snow, freezing rain, and ice could potentially damage infrastructure and construction equipment, if ice builds to a point where structures are unable to withstand the weight. These conditions can also cause electricity outages.

Extreme precipitation, storms and hurricanes could cause a delay in the receipt construction materials, additional effort for snow clearing and removal, the inability for workers to access the site, or could cause an interruption to Project construction or operation and maintenance. High winds, especially those greater than 90 km/hour, have the potential to damage buildings, fences, and other outdoor structures, as well as break trees and tree limbs, which can strike and damage Project infrastructure and equipment.

13.5.2 Mitigation for Effects of the Environment on the Project

Interactions between the environment and Project activities will be managed through the use of various mitigation measures. The following mitigation measures have been identified to mitigate potential effects of the environment on the Project.

During construction:

- The Project will be constructed to meet engineering codes, standards, and best management practices, which include applicable building safety and industry codes (as per the latest National Building Code of Canada (NBCC 2015), as well as standards for weather variables associated with climate. These standards and codes provide factors of safety regarding effects of the environment and Project-specific activities and events.
- The Project design, including the selection of materials and equipment to be used, will consider normal and extreme weather/climate conditions that may be encountered throughout the life of the Project. The Project design will consider predictions for climate change and will include measures for climate adaptation (for example, considering revised snow load calculations in building design, considering climate change and precipitation forecasts in stormwater management system design, and considering future climate conditions and extreme weather events in emergency response planning).
- Delays due to poor weather will be anticipated and can often be predicted, and allowance for them will be included in the construction schedule. Work will also be scheduled, where feasible, to avoid predicted times of extreme weather for the safety of crews and Project infrastructure.

During operation and maintenance:

- A maintenance and safety management program will be implemented in consideration of potential effects of the environment on the Project.
- The proponent will evaluate potential needs for additional climate change adaption based on updated climate forecasts during the operational lifetime and operating experience with the facility.
- Contingency plans will be implemented, including emergency back-up power for necessary operations.

13.5.3 Characterization of Residual Project-Environmental Interactions for Effects of the Environment on the Project

Effects of the environment, including climate, weather, and potential climate change, will be considered and incorporated into the planning, design, construction and operation of the Project, which could reduce the potential for damage to infrastructure and/or equipment, and changes to construction and operation of the Project. Delays due to poor weather will be anticipated and can often be predicted ahead of time, and allowance for them will be included in the construction schedule. Maintenance programs will prevent the deterioration of Project infrastructure and will help the Project stay within the applicable design criteria, best management practices/standards/codes, and will maintain the reliability of the Project. Therefore, residual effects of the environment are anticipated to be generally low and infrequent.

13.6 SUMMARY AND RECOMMENDATIONS

Project construction techniques, best practices, scheduling and design codes account for effects of the environment, such as extreme weather as a result of potential future climate change. With the implementation of mitigation measures as described in this assessment including Project design to consider measures for climate adaptation, it is anticipated that there will be low potential for substantial interaction between or adverse effects from the environment and the Project during any phase of the Project.

14.0 ACCIDENTS, MALFUNCTIONS, AND UNPLANNED EVENTS

This section describes potential accidents, malfunctions and unplanned events, which are upset conditions or other events that are not part of any planned activity or normal operation of iron processing facility but that may occur and have the potential to result in adverse environmental effects if there were to occur. While accidents, malfunctions, and unplanned events could occur during any phase of the Project, many of them can be prevented and addressed by good planning and design, communication, worksite health, safety, and environmental training of personal, emergency response planning, vehicle and equipment maintenance, and mitigation.

Mitigative planning and response procedures are also described below.

14.1 ENVIRONMENTAL PROTECTION PLAN

A project-specific Environmental Protection Plan (EPP) will be developed for construction, and operation and maintenance of the Project. The EPP will describe and present the mitigation measures that are to be implemented during the construction and operation phases of the Project to reduce potential adverse environmental effects. The EPP will provide instructions to Project personnel for planning and implementing construction and operation activities in order to reduce potential adverse environmental effects and comply with regulatory commitments. The EPP will act as a key reference to the measures, obligations, and commitments that are to be implemented and monitored throughout the duration of the Project.

In addition to mitigation measures to be implemented during construction and operation of the Project, the EPP will include the following:

- An emergency response plan will be used as a training guide and reference manual to provide guidance to the Emergency Response Team (ERT) members in preparing for and responding safely and effectively to site emergencies.
- A spill response plan will provide information and training on for emergency response crews responsible for spill response.
- A traffic management plan will identify safe driving and working practices including the planning and management of vehicle and pedestrian routes.
- A wildlife management strategy will provide mitigation specific to wildlife.

In the event of an accident, malfunction, or unplanned event, the implementation of these plans and procedures will reduce the potential for and adverse consequences of environmental effects.

14.2 APPROACH

This discussion of the potential environment effects of accidents, malfunctions, or unplanned events includes:

- consideration of the potential event that could occur during the life of the Project;
- description of the Project planning and safeguards established to minimize the potential for such occurrences to happen;

- consideration of the contingency or emergency response procedures applicable to the event; and
- a determination of the potential residual environmental effects in the unlikely event that these accidents, malfunctions, or unplanned events do happen.

14.3 IDENTIFICATION OF CREDIBLE ACCIDENTS, MALFUNCTIONS, OR UNPLANNED EVENTS

Based on the nature of the Project, knowledge of the environment within which the Project is located, and operational experience of the reference plants, the following credible accidents, malfunctions, and unplanned events have been selected for consideration in this assessment and are described in greater detail in the following sections:

- Fire or Explosion: Includes an unmanaged or uncontrolled fire or explosion in a Project component or facility during construction or operation.
- Hazardous Material Spill: Spills of hazardous materials (e.g., fuel, petroleum products) used on-site or in Project components during construction and operation.
- Vehicle Accident: Project-related vehicle accidents that could occur on road transportation networks during construction and operation.
- Vessel Collision: Project-related vessel accident that could occur within the inshore fishing area (e.g., vessel grounding, vessel-to-vessel collision, or vessel-to-marine mammal collision).

14.4 ASSESSMENT OF ACCIDENTS, MALFUNCTIONS, AND UNPLANNED EVENTS

14.4.1 Fire or Explosion

There is potential that fire or explosion could occur because of Project activities. A fire or explosion affecting Project components would likely involve Project infrastructure, a vehicle, or other heavy equipment used during construction or operation and maintenance activities. It is also possible that Project-related machinery could ignite a fire or nearby combustible materials (e.g., grass, brush, trees).

A fire or explosion could release emissions to the atmosphere, affect infrastructure adjacent to the PDA, endanger lives or result in loss of life for humans and biota, and affect the ability of Aboriginal persons and the public to use areas surrounding the PDA.

If uncontrolled, a fire could also affect vegetation, wildlife, and wildlife habitat in forested areas within and surrounding the PDA. Naturally occurring forest fires that could potentially affect the Project are assessed as an effect of the environment on the Project (Section 13.0).

Where blasting is required, there is also the potential for an unmanaged or uncontrolled detonation of an explosive associated with blasting during construction, or the detonation of an explosive that results in property damage from fly rock or vibration levels that are higher than standard, associated with that blasting.

14.4.1.1 Risk Management and Mitigation

The following risk management and mitigation measures will be applied to reduce the probability of a fire and associated adverse effects:

- Vehicles on-site will be equipped with fire extinguishers that are sized and rated as fit for purpose;
- Project infrastructure will have strategically positioned heat and smoke detectors and alarms, as well as automatic sprinklers and extinguishers as applicable;
- Project infrastructure will be equipped with sensors and emergency shut off controls as appropriate;
- Project staff will be trained in the use of fire extinguishers and related fire suppression equipment and procedures, and will be familiar with the location of the nearest extinguisher and associated supplies;
- Vehicles will avoid parking in areas with long grass to reduce the risk of fire caused by the heated vehicle undercarriage, and vehicles will not be allowed to idle when not in use;
- Smoking will only be permitted in designated areas equipped with proper butt disposal receptacles;
- Debris from clearing activities will be managed and disposed of to reduce risk of fire and the magnitude of the fire, should one occur;
- Flammable or explosive materials will be stored in appropriate containers in designated storage areas.
- Waste that may be soaked with flammable or explosive materials (e.g., oily rags) will be stored in appropriate containers, kept away from flammable materials, and disposed of in an acceptable manner as soon as possible.

Where blasting is required during construction, the following mitigation measures will be applied to reduce the probability of an accidental detonation of an explosive and any associated adverse effect:

- Blasting will be conducted by qualified and certified blasting personnel in accordance with the applicable laws, regulations, and orders of the:
  - *Explosives Act* and its regulations;
  - Workplace Health and Safety regulator in New Brunswick;
  - New Brunswick Department of Natural Resources;
  - Natural Resources Canada; and
  - *Transportation of Dangerous Goods Act* and its regulations;
- The manufacturing, storage and transportation of explosives will follow the strict requirements of the *Explosives Act*, *Transportation of Dangerous Goods Act*, and their regulations.
- Pre-blast structure surveys, vibration monitoring, blast effect control measures, and effective blast area security and warning methods will be considered in the blast planning process and executed as deemed necessary.

In the unlikely event that a fire or explosion does occur, potential environmental effects will be reduced by following an emergency response and contingency plan that will be part of the Project-specific EPP, which will include procedures for:

- Response protocols with emergency departments;
- Reducing the spread of fire; and
- Evacuation planning including route identification and muster locations.

14.4.1.2 Potential Residual Environmental Effects

If fire or explosion were to occur, there is potential for a temporary decrease in air quality arising from the smoke that is generated. There is also potential for a fire or explosion to result in loss of or damage to infrastructure or equipment, and restricted access to the area.

As the PDA will be cleared of vegetation, if a fire were to occur it is expected to be small and easily extinguished, resulting in minimal smoke generation and damage to infrastructure. In the unlikely event that a fire was widespread, there is potential to result in wildlife species at risk mortality or destruction of wildlife species at risk habitats, vegetation, and wetlands. There is also potential for damage to infrastructure on nearby properties. However, with planned mitigation and response procedures, the occurrence of a widespread fire that affects species at risk, or nearby properties is unlikely.

Thus, in the unlikely event of a fire, and in consideration of the mitigation to be implemented, and the response measures to be undertaken, the residual adverse environmental effects during all phases of the Project are not anticipated to be substantive.

14.4.2 Hazardous Material Spill

A spill of hazardous material can occur in any environment where fuels, lubricants, hydraulic fluid, paints, and corrosion and fouling inhibitors are used or stored. Hazardous materials may be used during construction, and operation and maintenance of the Project. A spill of hazardous materials could result from equipment spills, spills from vehicles, an on-site trucking accident, or tank leak or rupture that occurs within the PDA, with vehicle use being the most common source of hazardous materials on-site. Potential scenarios involving the release of hazardous material would most likely be rupture of a hydraulic line, loss of fuel from a vehicle, or an oil spill from the new reactors.

A large spill may affect groundwater and soil, and surface water contamination may occur. This may adversely affect the quality of groundwater, fish and fish habitat, and wetland habitat, and result in the ingestion/uptake of contaminants by wildlife and limit the ability of these resources to be used by Aboriginal persons and by the public.

14.4.2.1 Risk Management and Mitigation

The following mitigation measures will be applied to reduce the likelihood of a spill:

- Routine preventative maintenance and inspection of hydraulic equipment and vehicles is to be undertaken to avoid a hazardous material release;
- Hazardous materials will not be stored on-site in large quantities, and secondary containment (e.g., drip trays) will be used in areas of storage and transfer;
- Preventative measures, including daily vehicle inspections, inspection of hazardous material storage areas, and buffers surrounding sensitive areas (e.g., wetlands), will be implemented;
- Vehicles, heavy equipment, and on-site buildings will be equipped with spill kits and drip trays of an appropriate size and composition;

- Fueling stations will be equipped with automatic shut-off nozzles and emergency isolation mechanisms;
- Storage of all dangerous goods will comply with the Workplace Hazardous Materials Information System (WHMIS) requirements; and
- Transportation of dangerous goods will comply with Transport Canada's *Transportation of Dangerous Goods Act*.

In the unlikely event that an accidental spill of a hazardous material does occur, potential environmental effects will be reduced by following the spill response procedures in an emergency response and contingency plan that will be part the Project-specific EPP, which will include protocols for:

- spill containment and clean-up;
- notification and reporting; and
- required training, including emergency spill response scenarios.

14.4.2.2 Potential Residual Environmental Effects

Depending on the quantity and type of material released and the location of the spill, a hazardous material spill could potentially seep into groundwater system, runoff into surrounding environments and affect surface water, fish and fish habitat, wildlife, and wildlife habitat, as well as vegetation and wetlands. Remediation efforts may also increase the demand for emergency services and restrict the use of the area and resources for traditional purposes by Aboriginal persons, as well as public use.

Given the expected limited spill volume, the low likelihood of large spill scenarios, and anticipated effectiveness of response plans (including spill containment), it is not likely that these spills would result in a release to adjacent properties.

In the unlikely scenario of a hazardous material being spilled and then reaching a sensitive environmental feature (e.g., wetland), and/or resulting in a protected species being harmed, an adverse environmental effect could result. A substantive effect arising from these possibilities, however, is considered highly unlikely as immediate measures will be taken to stop the spill and isolate and contain the affected area as soon as possible. An assessment of the affected area will be completed, and remediation will be undertaken as required.

There is a low likelihood that, if a spill of hazardous materials were to occur, it would result in adverse effects to the environment because of the mitigation and response measures that will be undertaken (e.g., spill containment and clean-up). Accordingly, the residual adverse environmental effects of a hazardous material spill during all phases of the Project are not anticipated to be substantive.

14.4.3 Vehicle Accident

During the construction and operation and maintenance of the Project, various vehicles will be in motion around the Project site and there is the potential for a vehicle collision to occur, including a vehicle-to-vehicle collision, vehicle-to-pedestrian collision, or vehicle collision with surrounding private property, Project infrastructure, or wildlife.

If a project-related vehicle accident were to occur, injury or loss of life, loss or damage to a vehicle, equipment or Project infrastructure could affect the socioeconomic environment due to damage to personal property owned by individuals. If a vehicle accident involved an animal, it would likely result in injury or mortality to the wildlife involved. There is also potential for fire and hazardous materials to be released into the environment, these scenarios are discussed separately in previous sections.

14.4.3.1 Risk Management and Mitigation

As will be outlined in a traffic management plan that will be part of the Project-specific EPP, the following mitigation measures will be applied to reduce the probability of a vehicle accident and any associated environmental effects.

- Traffic control measures (e.g., signage, speed limits, restricted areas) will be implemented, as needed, to reduce the likelihood of vehicle collisions.
- Security measures will be in place during construction to prevent the general public from accessing the work site.
- Project staff will operate vehicles with due care and attention while on-site.
- Safety measures such as the use of backup alarms, designated parking areas, and proper storage of tools and materials in vehicles will be implemented.
- The use of cellphones while operating a vehicle will be prohibited.
- Project staff will be appropriately licensed to operate vehicles on-site.
- Oversized loads will be transported to the Project site by licensed service providers.
- Vehicle drivers are expected to observe traffic rules and trucks will use only designated truck routes.
- All Project-related vehicles will abide by speed limits.
- In the case of a vehicle collision, the appropriate authorities will be notified.

If a vehicle collision results in a hazardous material spill or fire, the emergency response and contingency plan will be initiated.

14.4.3.2 Potential Residual Environmental Effects

The most likely effect of a vehicle accident during construction would be the damage or loss of a vehicle, damage to infrastructure, and potential for related work stoppage. The worst case involving a vehicle collision would most likely involve loss of life, fire, or the release of a hazardous material, although the probability of these events occurring is considered very low. The likelihood of a vehicle accident resulting in a serious injury or loss of life is reduced with the application of mitigation as described above.

In consideration of the low likelihood of an animal strike, or vehicle accident resulting in serious injury or loss, and the mitigation and response measures to be undertaken, the residual adverse environmental effects of a vehicle collision during all phases of the Project are not anticipated to be substantive.

14.4.4 Vessel Collision

Chaleur Bay area hosts a variety of commercial fishing activities, including fisheries for lobster, snow crab, rock crab, Atlantic mackerel and Atlantic herring, as well as groundfish and scallop (DFO 2019b).

The Port of Belledune is located approximately 8.5 kilometres from the Pointe-Verte Small Craft Harbour, an active fishing harbour. Eight species of marine mammals have been observed in the Chaleur Bay area at various times of year, including the North-Atlantic right whale and the blue whale, which are both ranked as *endangered* on Schedule 1 of the Federal *Species at Risk Act*. The number of sightings is low; however, these larger marine mammals were generally observed off-shore in deeper water, and near the mouth of Chaleaur Bay.

During construction and operation of the Project, a number of marine vessels will transit to and from the Port of Belledune to deliver equipment during construction and deliver raw materials and export product during operation. Given the proximity to commercial fishing activities and the potential presence of large marine mammals in Chaleur Bay there is potential for a vessel grounding, vessel-to-vessel collision, and vessel-to-marine wildlife collision to occur. Vessel based fishing activities occur in the nearshore waters surrounding the Port and there is the potential for Project related vessels to damage fishing gear.

If a vessel collision were to occur, loss or damage to a vessel, fishing gear, or infrastructure at the Port of Belledune could affect the socioeconomic environment. Injury to humans or wildlife, or loss of life, could also occur.

There is also potential for fire and hazardous materials to be released into the environment as a result of such collisions; these are addressed in previous sections.

14.4.4.1 Risk Management and Mitigation

The following mitigation measures will be applied to reduce the probability of a vehicle or vessel collision, or vessel interaction with marine wildlife, and associated environmental effects.

- Project-related vessels will abide by established speed limits and will make use of established shipping lanes, anchorages and pilotage authority.
- Project-related vessels will abide by all restrictions to vessel operation enacted for the protection of marine species at risk, including vessel speed limits and potential exclusion zones related to the North Atlantic Right Whale.
- On vessels, deck lighting will be minimized whenever it is safe and practical to do so, and the use of unnecessary lighting will be avoided, to reduce the risk of attracting marine wildlife.
- Vessel-to-vessel and vessel-to-land communication systems will be in place and functioning.
- Vessel operators will adhere to all applicable Acts and Regulations administered by or in conjunction with Transport Canada, including the *Collision Regulations*.
- Communication and liaison with commercial and Aboriginal fishers will be ongoing during construction and operation, as necessary

14.4.4.2 Potential Residual Environmental Effects

Due to the dispersed nature of marine wildlife populations, the implementation of the mitigation described above, and the limited number and slow speeds of vessels involved, the probability of a ship strike involving a marine species is considered low. For the same reasons, a vessel grounding or vessel-to-vessel collision is unlikely to occur during these Project activities. Therefore, in consideration of the mitigation to be implemented, residual environment effects arising from a vessel collision are not anticipated to be substantive.

14.5 SUMMARY

Given the adherence of Project-related activities to the mitigation measures and response plans in the Project-specific EPP that will be developed prior to construction, adverse environmental interactions related to accidents, malfunctions and unplanned events are not likely to occur during the construction, operation and maintenance, or decommissioning and abandonment of the Project.

15.0 SUMMARY OF PROPOSED MITIGATION

Table 15.1 below is a summary of mitiation proposed throughout this registration document.

Table 15.1 Summary of Proposed Mitigation

#	Chapter/Valued Component	Project Phase	Proposed Mitigation/Compensation Measure	Location within EIA Registration Document where Mitigation Measure is Identified
1.	Project Description	Construction	Vegetation removed as part of site preparation clearing activities will be transported to a local green waste facility for recycling or mulched on site	2.7.1
2.			Any suitable topsoil that may be encountered during site clearing and grubbing operations will be stockpiled on site and, where possible, re-used as part of landscaping operations after completion of construction	2.7.1
3.			During the site preparation clearing operation, surface water will be channeled to temporary holding / settlement ponds to allow precipitation of sediment and natural filtration. The sediment from these ponds will not need to be removed from the site, and these ponds will eventually be allowed to naturally dry out and will be filled-in as part of landscaping operations after completion of construction.	2.7.1
4.			During the early stages of site clearing and grading, surface water runoff will be channeled to temporary holding / settlement ponds to allow precipitation of sediment and natural filtration without any water runoff from the site.	2.7.2
5.			During the Project construction phase, the collected surface water runoff will be tested for quality and if deemed acceptable will be either gravity fed or pumped (at a rate approximately equivalent to the natural pre-development drainage rate) from its holding pond into an existing ditch leaving the Project site which discharges into the Bay of Chaleur. If the water quality is unacceptable, the collected surface water runoff in the holding pond will be treated in-situ and/or removed via vacuum truck for off-site treatment.	2.7.2
6.			Control measures, such as use of dust suppression techniques, will be used in construction zones as required to reduce the fugitive dust, and routine inspection and maintenance of construction equipment will reduce exhaust fumes. The burning of waste brush/slash material will not be permitted	2.7.7
7.			Hazardous materials will be removed from the construction site by a licensed contractor and recycled or disposed of at an approved facility	2.7.7
8.	Atmospheric Environment – Air Quality	Construction	Manage vehicle and equipment emissions by conducting regular maintenance on all machinery and equipment.	6.2.6
9.			Control construction-related fugitive road dust, through measures such as speed limits on Project-controlled gravel roads and road watering on an as-needed basis.	6.2.6
10.			Prohibit the burning of waste materials.	6.2.6
11.			Reduce haul distances to disposal sites.	6.2.6
12.		Operation	Sources of substantive air contaminant emissions will be equipped with emissions controls such as dust collectors (primarily consisting of baghouses) to reduce particulate matter (TSP, PM10 and PM2.5) and trace metal releases.	6.2.6
13.			The wastewater treatment process will include a regenerative thermal oxidizer (RTO) to combust any volatile organic compounds (VOCs) generated as a by-product from the treatment of process wastewater. The inclusion of the RTO will result in reduced releases of VOCs.	6.2.6
14.			Storage piles of aggregate materials and feedstocks will be covered / stored indoors to protect against moisture and thus will reduce/prevent fugitive dust and associated trace metals emissions.	6.2.6
15.			Material conveying will use covered conveyors and transfer points which will reduce fugitive dust and associated trace metals emissions.	6.2.6
16.			Water sprays will be used in areas of the process to reduce potential fugitive emissions of dust and trace metals.	6.2.6
17.			The Oxygen Plant will be electrically driven as opposed to including additional combustion sources, which avoids associated air contaminant emissions with that process.	6.2.6

Table 15.1 Summary of Proposed Mitigation

#	Chapter/Valued Component	Project Phase	Proposed Mitigation/Compensation Measure	Location within EIA Registration Document where Mitigation Measure is Identified
18.	Atmospheric Environment – Air Quality	Operation	The Project will be integrated with the adjacent NB Power Belledune Thermal Generating Station to combust the FEG for power generation purposes. Without integration, the Belledune Iron Processing Facility would have considered constructing an independent power facility as part of the Project to combust the off gasgenerated in the FINEX process that is not required for process heating. The integration of the Belledune Iron Processing Facility with NB Power's Belledune Thermal Generating Station allows for approximately 45% of current coal consumption depending on annual load requirements. This is expected to result in a substantive reduction in overall SO2 emissions from the NB Power Belledune Thermal Generating Station due to the coal off-set by the lower sulphur content of the FEG. It is also possible that there could be reductions in other air contaminant releases because of the off-set coal and potential lower emissions intensities associated with the produced by-product gas. As a minimum it is expected that the future emissions of other air contaminants (excluding SO2) would be consistent with the existing conditions, if not reduced.	6.2.6
19.			Low-sulphur marine diesel will be consumed in marine vessel internal combustion engines and auxiliary boilers to comply with regulations for fuel sulphur limits within North American waters, resulting in reduced emissions of SO2 and particulate matter.	6.2.6
20.			Air contaminant emissions from equipment will be managed by conducting regular maintenance on all machinery and equipment.	6.2.6
21.			Environmental monitoring during construction will include visual checks for dust levels and implementation of dust suppression as needed.	6.2.6
22.	Atmospheric Environment – GHG Emissions	Construction	Using construction equipment that is well maintained.	6.3.8
23.			Implementing an idling awareness program to reduce unnecessary idling.	6.3.8
24.			Reducing haul distances to disposal sites.	6.3.8
25.		Operation	The product produced by the Project will be used at other facilities using the EAF steel production route, which allows for use of recycled scrap and a substantial reduction in GHG emissions as compared to traditional steel production methods most commonly used globally.	6.3.8
26.			The location of the Project will substantively reduce shipping distances currently observed in the transportation of iron ore (e.g., ore shipped from Sept-Îles, Québec currently travels approximately 17,000 km to China, while the Project is located approximately 200 km from Sept-Îles). Further, pig iron from the Project is anticipated to be sold to markets in the eastern United States, which is a short sail from the Project.	6.3.8
27.			Maritime Iron will implement energy efficiency measures where feasible in the design.	6.3.8
28.			Integration of the Project with NB Power's Belledune Thermal Generating Station resulting in lower coal use. Without the integration with NB Power's Belledune Thermal Generating Station, the Project facility would include an internal power plant that combusts the by-product gas that is not needed for process heating. The internal power plant would produce and export to the NB Power electricity grid approximately 156 MW. NB Power's Belledune Thermal Generating Station would continue to produce electricity from coal at typical load. The integration with Project facility allows NB Power's Belledune Thermal Generating Station to consume 55% less coal (depending on annual load requirements).	6.3.8
29.			Maritime Iron will work with their supply chain to reduce GHG emissions from upstream and downstream activities as feasible.	6.3.8
30.			Maritime Iron will comply with any implemented provincial or federal GHG reporting and compliance requirements in the future.	6.3.8
31.	Atmospheric Environment – Acoustic	Construction	Use of well-maintained construction equipment with appropriate muffler.	6.4.6
32.			Time activities to avoid undue nuisance to off-site receptors (e.g., limiting construction activities to between 7:00 am and 7:00 pm, where possible).	6.4.6
33.			Use of acoustical barriers (e.g., engineered materials or stockpiled overburden) near loud sources during construction if feasible.	6.4.6
34.			Size construction equipment to the smallest needed to perform the work.	6.4.6

Table 15.1 Summary of Proposed Mitigation

#	Chapter/Valued Component	Project Phase	Proposed Mitigation/Compensation Measure	Location within EIA Registration Document where Mitigation Measure is Identified
35.	Atmospheric Environment – Acoustic	Construction	Deploy overpressure and vibration monitoring during blasting activities to confirm peak overpressure of less than 128 dB and PPV less than 12.5 mm/s.	6.4.6
36.			Limit blast charge sizes to less than 60 kg.	6.4.6
37.			Establish a noise management plan, including a noise complaint and response system.	6.4.6
38.			Notify nearby residents prior to starting construction activities, including blasting, to avoid or reduce annoyance and disruption.	6.4.6
39.		Operation	Use of well-maintained mobile equipment with appropriate mufflers.	6.4.6
40.			Maintain a noise complaint and response system.	6.4.6
41.			Acoustic louvres used for ventilation openings for the Air Compressor Room, Decanter Room, and Air Fan Room.	6.4.6
42.			Sandwich panel wall construction for the buildings that house compressor gas coolers, water treatment, and fans.	6.4.6
43.			Sheet metal construction for other enclosed spaces.	6.4.6
44.			Routing the pig iron haul route along the south edge of the property.	6.4.6
45.			Use electric motor with a maximum sound power level rating of 91 dBA for the Reclaimer Conveyor.	6.4.6
46.			Use electric motor with a maximum sound power level rating of 98 dBA for the Transfer Belt Conveyor from the new TT.	6.4.6
47.			Install air inlet silencers for the Oxygen Plant compressors.	6.4.6
48.	Fish and Fish Habitat	All phases	There are no Project activities and components that could potentially interact with freshwater fish and fish habitat as it is assumed that there are no fish present within the PDA. In the unlikely event that fish species are found to be present then additional mitigation and offsetting for serious harm under the *Fisheries Act* may be required.	7.7
49.	Water Resources	Construction	Notification of landowners near the construction site prior to any blasting activities.	8.6.3
50.			Conduct a pre-construction water well survey for wells located within 500 m of blasting activities.	8.6.3
51.			Establishment of a reporting and arbitration procedure in the unlikely event of a well damage claim.	8.6.3
52.			Supervision of all blasting by certified professionals.	8.6.3
53.	Terrestrial Environment	Construction	Avoid, to the extent feasible, known locations of plant and wildlife SAR and SOCC.	9.6.3
54.			Restrict disturbance and clearing activities to the minimum amount required, particularly around wetlands.	9.6.3
55.			Employ standard erosion and sedimentation control measures, particularly to avoid silt laden runoff into wetlands.	9.6.3
56.			Implement standard dust control measures to avoid siltation of wetlands.	9.6.3
57.			Use quarried, crushed material for road building in and near wetlands, to reduce the risk of introducing or spreading exotic and/or invasive vascular plant species.	9.6.3
58.			Equipment arriving on site should be cleaned before arriving on site to reduce the potential for spread of invasive plant species	9.6.3
59.			Operate vehicles and equipment on previously disturbed areas, wherever feasible.	9.6.3
60.			Limit size of temporary workspaces.	9.6.3
61.			Allow for natural regeneration when possible, and when not possible, use a native seed mix for revegetation.	9.6.3
62.			Restore temporarily disturbed areas to pre-construction conditions.	9.6.3
63.			Rehabilitate access roads that are no longer needed.	9.6.3

Table 15.1 Summary of Proposed Mitigation

#	Chapter/Valued Component	Project Phase	Proposed Mitigation/Compensation Measure	Location within EIA Registration Document where Mitigation Measure is Identified
64.	Terrestrial Environment	Construction	When possible, avoid construction activities, particularly clearing, in areas of native vegetation during the normal breeding season for migratory birds (mid-April through late-August). Where clearing is required during the breeding bird season, bird surveys will be conducted, and if evidence of active nests are found a 30 m buffer zone will be established until fledging.	9.6.3
65.			Limit the length and locate linear facilities within existing right-of-ways adjacent to other linear facilities, where possible, to reduce the potential for fragmentation and creation of edge effcts.	9.6.3
66.			Establish buffers and protect active migratory bird nests until fledging, upon their discovery in work areas during construction.	9.6.3
67.			Use noise arrest mufflers on equipment to reduce potential environmental effects of noise.	9.6.3
68.			Use full cut-off lighting during construction to reduce attraction to migrating birds.	9.6.3
69.		Operation	Use noise arrest mufflers on equipment to reduce potential environmental effects of noise	9.6.3
70.			Avoid vegetation management activities aside from lawn care in areas of native vegetation during the normal breeding season for migratory birds (mid-April through late-August). Where vegetation management is required during the breeding bird season, bird surveys will be conducted, and if evidence of active nests are found a 30 m buffer zone will be established until fledging.	9.6.3
71.			Maritime Iron will coordinate their shutdowns with NB Power such that both facilities are shut down at the same time to reduce the potential for flaring of off gas.	9.6.3
72.	Heritage Resources	Operation	If the location of the proposed Project and/or boundaries of the PDA are altered from that reviewed/mitigated during the 2018 AIA, the findings and recommendations should be reviewed in consideration of the new design of the Project prior to any ground-breaking construction activities.	10.6.2
73.			The environmental protection plan to be developed for the Project should include a heritage resources discovery response protocol that clearly describe the responses of contractors and Maritime Iron staff in the event of an unanticipated discovery of heritage resources, such as an artifact, or potential fossils, during construction. The response should include immediately notifying AS.	10.6.2
74.	Socioeconomic Environment	Construction	The proponent will join the existing community liaison committee to increase opportunities to provide project information and exchange information related to public issues and concerns that may arise.	12.6.2
75.			The proponent will, either directly or through business and labour partners, hold job fairs to inform interested members of the public of the potential opportunities associated with the Project, and to increase opportunities for local benefits from the Project.	12.6.2
76.			Through the construction planning phase, information sessions will be held with local training institutions, labour groups and other community interest groups regarding skill set requirements to enable local workforce training.	12.6.2
77.			Maritime Iron will work with the New Brunswick Department of Post Secondary Education, Training and Labour, CCNB, NBCC, JEDI, Aboriginal Skills Education Training FN-MTI, construction trades unions and other groups to identified skills and trade gaps and work together to put training in place for First Nations and local workers	12.6.2
78.			The proponent will, either directly or through business partners and local business groups such as the Chamber of Commerce, hold contractor information sessions to inform interested members of the business community of the potential opportunities associated with the Project, and to increase opportunities for local benefits from the Project.	12.6.2
79.			Maritime Iron's website will be used to enable local businesses to express interest in participation in the Project.	12.6.2
80.			A high-level assessment of local accommodation availability during construction will be completed if it is determined that the available workforce is likely to require significant housing.	12.6.2
81.			A 100 m buffer of land will be left around the Chaleur Drive residences, as per the Village of Belledune Zoning Plan	12.6.2
82.			The Proponent is consulting with the New Brunswick Department of Transportation and Infrastructure (NBDTI) regarding potential mitigation measures that may be implemented on existing public roads around the Project, potentially including traffic lights and additional turning lanes at the intersection with the Ash Haul Road.	12.6.2

Table 15.1 Summary of Proposed Mitigation

#	Chapter/Valued Component	Project Phase	Proposed Mitigation/Compensation Measure	Location within EIA Registration Document where Mitigation Measure is Identified
83.	Socioeconomic Environment	Construction	Alternative route access will be provided during construction activities, when required.	12.6.2
84.			Highway flaggers will be used to control traffic flow, when required.	12.6.2
85.			The public will be notified about long delays, road closures, detours, or disruptions to the transportation network.	12.6.2
86.			Materials will be transported on private roads and Port roads, and public highways will be avoided where possible	12.6.2
87.			Carpooling or buses will be used to transport workers to and from the site during the construction period where feasible.	12.6.2
88.			Encouragement of the use of established approaches by Project-related vessels (note that the final decisions regarding approaches are at the discretion of vessel captains and pilots and can be affected by environmental conditions including weather and currents).	12.6.2
89.			The Port of Belledune requires non-Canadian registered vessels to use the services of an Atlantic Pilotage Authority licensed pilot.	12.6.2
90.	Effects of Environment	Construction	The Project will be constructed to meet engineering codes, standards, and best management practices, which include applicable building safety and industry codes (as per the latest National Building Code of Canada (NBCC 2015), as well as standards for weather variables associated with climate. These standards and codes provide factors of safety regarding effects of the environment and Project-specific activities and events.	13.5.2
91.			The Project design, including the selection of materials and equipment to be used, will consider normal and extreme weather/climate conditions that may be encountered throughout the life of the Project. The Project design will consider predictions for climate change and will include measures for climate adaptation (for example, considering revised snow load calculations in building design, considering climate change and precipitation forecasts in stormwater management system design, and considering future climate conditions and extreme weather events in emergency response planning).	13.5.2
92.			Delays due to poor weather will be anticipated and can often be predicted, and allowance for them will be included in the construction schedule. Work will also be scheduled, where feasible, to avoid predicted times of extreme weather for the safety of crews and Project infrastructure.	13.5.2
93.		Operation	A maintenance and safety management program will be implemented in consideration of potential effects of the environment on the Project.	13.5.2
94.			The proponent will evaluate potential needs for additional climate change adaption based on updated climate forecasts during the operational lifetime and operating experience with the facility.	13.5.2
95.			Contingency plans will be implemented, including emergency back-up power for necessary operations.	13.5.2

16.0 CONCLUSION

This EIA registration document describes the planned development and the associated environmental effects of the construction and operation of an iron processing facility in Belledune, New Brunswick proposed by Maritime Iron Inc. This document is being submitted to NBDELG as part of the EIA process under the *New Brunswick Environmental Impact Assessment Regulation 87-83* of the *Clean Environment Act*.

Maritime Iron is proposing to construct and operate an iron processing facility, the Belledune Iron Processing Facility in Belledune, New Brunswick. The iron that will be produced by the Project facility is also known as crude pig iron and is an intermediate product of the steel-making industry. The facility will be capable of producing two product quality types, Merchant Pig Iron (MPI) (basic-purity) and High-purity Pig Iron (HPI), for sale to end-users in the steel-making and foundry industries; the Project itself will not make steel. The Project will use the innovative iron-making technology named FINEX. The FINEX technology process of creating the hot molten metal essentially involves the combination of fine iron ore, flux additive materials, coal, and pure oxygen gas. When the pure oxygen gas combines with the coal it generates the heat necessary to melt the fine iron ore into hot molten metal (containing the iron from the iron ore) while the flux additives generate a hot molten slag (containing the remainder or impurities from the iron ore).

The Project is located on land currently owned by New Brunswick Power, and physical components will be situated immediately adjacent to NB Power's Belledune Thermal Generating Station and the Belledune Port Authority's industrial lands. The off-gas stream from the Project will have a composition and calorific value that allows it to be exported from the Project facility as a by-product gas (or FEG) via an interconnecting pipe and used as a fuel for energy production by the Belledune Thermal Generating Station.

The Project will not include any mining or mineral extraction activities. The iron ore material to be processed will be mined elsewhere and will be procured after it has already been extracted and milled into fines by a third party.

The Project will consist of the following physical components:

- **Raw Material Storage:** a covered stockyard system which will receive large batches of individual raw materials from the Port of Belledune via extension of NB Power's conveyor for covered storage in individual stockpiles. A relatively small quantity of bulk materials will also be delivered by truck directly to the Project facility.
- **Core Plant:** The Core Plant component will consist of the following distinct operating systems required for the FINEX iron-making process:
  - Stock House
  - Coal Briquette
  - Oxide Dryer
  - Reactor
  - Hot Compacted Iron (HCI)
  - Melter Gasifier

  - Cast House
  - Slag Granulation
  - Hot Metal Pre-treatment Station (HMPS)
  - Pig Casting
  - Off gas
  - Utility
- **Water Management:** water handling systems for rainfall (contact and non-contact) and process water treatment facilities (including clarifiers and biological effluent treatment).
- **Ancillary Facilities:** the remaining items and buildings not directly associated with the Project facility operating systems.
- **Utility Corridor: i**nterconnecting piping services between the Project facility and the Oxygen Plant and NB Power's Belledune Thermal Generating Station.
- **Oxygen Plant:** The Oxygen Plant will provide the pure oxygen and pure nitrogen required for the Project facility. The Oxygen Plant will be built and operated by a third party.

In accordance with the requirements the *New Brunswick Environmental Impact Assessment Regulation– Clean Environment Act*, this EIA Registration has provided Project-related information available at the early stage of its development and has described the potential environmental effects of the Project. The key elements of this report are as follows.

- A Project Description of the proposed elements of the Belledune Iron Processing Facility is provided, including a discussion of how the Project would be constructed and operated for the duration of its service life as well as consideration of alternatives to the Project. Project-related aspects including emissions and wastes and employment and expenditure are also described. Project-planning and management strategies to minimize the environmental footprint of the Project are also introduced.
- A high-level summary of the environmental setting for the Project is provided to introduce general physical, biological, and socioeconomic conditions applicable in the general area of the Project.
- The scope of the EIA, including the scope of the Project, and the methods that were to be used to describe the environmental effects of the Project are discussed. The means by which the public, stakeholders, and First Nations were engaged as part of the Project, were described.
- An assessment of potential environmental effects of the Project on each VC of relevance and importance to this EIA is conducted. Seven VCs are identified as relevant and important to the EIA of the Project: atmospheric environment; freshwater fish and fish habitat, water resources, terrestrial environment; socioeconomic environment; heritage resources; and current use of land and resources for traditional purposes by Aboriginal persons. Additionally, effects of the environment on the Project as well as the effects of potential accidents, malfunctions, and unplanned events, are described.
- Where applicable, follow-up or monitoring measures to verify the environmental effects predictions of this EIA or to verify the effectiveness of mitigation to reduce environmental effects are identified.

The EIA predicts that there will be no substantive adverse residual environmental effects from the Project during all phases assessed and in consideration of normal activities of the Project as planned. Positive environmental effects are predicted for the socioeconomic environment as they relate to employment, incomes, and government revenues during both the construction and operation phases.

Overall, it is predicted that, with planned mitigation and the implementation of best practices to avoid or minimize adverse environmental effects, the residual environmental effects of the Project, the effects of the environment on the Project, and accidents, malfunctions and unplanned events during all phases are not considered substantive.

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17.1 PERSONAL COMMUNICATION

Jeffrey David, Director of Engineering, Belledune Port Authority, January 4, 2019

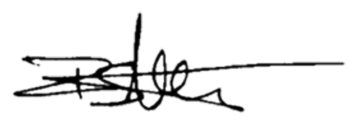
Appendix A CONCORDANCE TABLE

Guide Page/Section	Description	Location in Application
1.0 a - d	**The Proponent**	
	• Name of the Proponent • Address of the Proponent • Principal Proponent Contact • Principal Contact Person for Purposes of the EIA	Proponent information is provided in Section 1.3.
1.0 e	**Property Ownership**	
	• Note that if the proponent is not the owner of the land, written consent of the landowner should be provided to the EIA Branch unless the proponent indicates that: a) the project is proceeding under a right of expropriation granted by legislation, or b) in the case of linear facilities (power transmission line, pipeline, highway, etc.) the proponent is still in the process of lease or purchase negotiations. • If the project will be located on or affect Crown Land (including Crown Reserve Roads, coastal lands below the high water mark and most lake and river beds), the proponent must indicate the extent of the affected	Information on property ownership is provided in Section 1.4. A letter of consent from the land owner (NB Power) will be provided under separate cover. The Project is not located on Crown Land.
2 a - b	**The Project Description**	
	• Project Name • Project Overview • This should be a written description sufficiently complete to allow the EIA Project Manager to readily identify the scope of the undertaking and to determine which agencies should be represented on the Technical Review Committee (TRC).	A detailed Project description is provided in Section 2.0. This includes a Project overview in Section 2.1.
2.0 c	**Purpose/Rationale/Need for undertaking**	
	• Describe the market potential, benefit to society, economic benefits, job creation benefits, consumer and/or industrial demand, and other relevant issues that make the proposal viable and desirable for the local and/or the New Brunswick economy. If the undertaking is being conducted to remedy a specific environmental, social or economic problem (e.g., a risk to public safety, a deteriorating facility or structure, an impaired ability to achieve an economic, social or environmental benefit, flooding, erosion, unstable soils, etc.), details of the problem should be provided. • Include a brief discussion of the alternatives that could fulfill the same goal or provide the same benefits or results as described above (alternative designs, alternative actions, etc.). Consideration of the results of the "do-nothing" approach should also be provided; in other words what would be the consequences/results of not implementing the undertaking? The rationale for choosing the selected alternative should be clearly stated. If there are no reasonable alternatives to the proposal, this should be stated and justified in the registration document.	The purpose/rational/need for the undertaking is discussed in Sections 2.2, 2.3 and 2.4. Further information on the economic benefits of the Project is provided in Section 12.
2.0 d	**Project Location**	
	A detailed description of the geographic location must be provided and must include the following elements: • The parcel identification numbers (PIDs) as referenced by Service New Brunswick (found at the top of the Assessment and Tax Notice); • The street address (if available), community name, parish, and county; • The latitude and longitude; and • A map showing the location of the site relative to well-known existing features such as residential areas, roads, railways, and airports. A 1:50,000 scale map available from Service New Brunswick (see Appendix "A" on page 27) can be used as the basis of the location plan. A GIS shape file of the project site should be provided to help facilitate the technical review. In the case of modifications to existing facilities or structures, a description of the location of the proposed modification relative to current facilities and structures must also be provided. This can be done by showing the location of the footprint (limits, borders or edges) of the modification in comparison to existing facilities and structures.	A detailed description of the Project location is provided in Section 2.3 and illustrated on Figure 2.4.
2.0 e	**Sitting Considerations**	
	Discuss the considerations that were taken into account in choosing the location of the undertaking, including but not limited to the following: • The specific siting requirements of the proposed undertaking (e.g., land availability and ownership, access to utilities such as water supply and electricity, access to transportation, proximity to other required or desirable features, site gradients, soil capability, etc.); • A brief discussion of the alternative locations considered during the site selection process, and route selection process (if applicable) and the reasons why these alternative locations were rejected. If there are no reasonable alternative sites or routes, this should be stated and justified in the registration document; • A list of any ecological and cultural considerations that were taken into account as part of the site selection and/or route selection (e.g., avoidance of sensitive natural features and sensitive land uses, etc.); and • Local planning authorities (where they exist) should be consulted prior to site selection; • In areas where archaeological resources may be present, the Department of Tourism, Heritage and Culture might require that a Heritage Resource Impact Assessment (HRIA) be conducted by a licensed professional archaeologist in accordance with guidelines established by the Archaeological Services Branch. The results must be submitted to the Archaeological Services Branch for review. Archaeological Services may identify measures to minimize the potential to impact any important archaeological resources identified as a result of the HRIA. If the archaeological resource is extensive or is of exceptional import, Archaeological Services may recommend either site-specific mitigation measures or avoidance of the area completely. The proponent is therefore encouraged to conduct the HRIA as early as possible in the planning phase of the undertaking; • Built heritage resources generally include buildings, structures, sites and cultural landscapes. Impacts to built heritage resources must be avoided or minimized. Alterations to protected provincial historic sites require approval from the Department of Tourism, Heritage and Culture • If activities related to the project will be located within 30 metres of a wetland (see link to the Wetlands Home Page in Appendix "A") the proponent is advised to consult with DELG prior to submitting the registration document. • If the project will be located within Zone A or B as identified in A Coastal Areas Protection Policy for New Brunswick, the proponent Is advised to consult with the appropriate Regional Wetland Biologist. • Normally, the appropriate zoning is in place prior to EIA registration, however there are some situations where rezoning is required for project implementation. In these situations the proponent should consult with DELG prior to submitting the registration document.	Information on siting considerations for the Project is provided in Section 2.3. Further information on archaeological and heritage resources is provided in Section 10.0, and on the terrestrial environment is provided in Section 9.0.

Guide Page/Section	Description	Location in Application
2.0 f	**Physical Components and Dimensions of the Project**	
	• A site plan to scale showing the parcel identification numbers(s) and the proposed location(s) of the project's various physical components, buildings, access roads, infrastructure, areas to be disturbed, etc. These locations must be shown relative to the environmental features on and near the site • A recent colour aerial photograph of the location (See Appendix "A" for sources) showing the photo reference number and scale, and annotated with the site boundaries and the various physical components as described above. The annotated air photo can also serve as the site plan (above) provided that all relevant information required for the site plan is clearly shown and the photo image is not obscured. • An artist's conceptual drawing of the major buildings or structures (if available and applicable); • The following information is typically required and may be indicated on the site plan or annotated aerial photograph or provided in writing as appropriate (please note that all units must be consistent and should be metric if possible): o The dimensions of the subject property (i.e., length of property boundaries); o The total area of the site; o The total area of the portion of the site to be developed (if different from the above); o A description of any required land acquisition (e.g., temporary or permanent easements, lease, rental or purchase of land); o A description of all physical components, structures and infrastructure (temporary or permanent) required for the project, regardless of who will be responsible for their construction (e.g.,, buildings, storage facilities, pipelines, pump houses, sewers, watermains, power transmission lines, transportation facilities (e.g., temporary or permanent access roads, parking areas, driveways, docks, wharfs, loading bays, etc.), other structures, etc.); o The size of the main component(s) (e.g., length of roads, surface area and total floor area of buildings, etc.); o A description of any proposed external lighting (e.g., light standards for parking areas and roads, security lighting, hazard lighting on high structures such as emission stacks, antennas, towers, etc.); o The estimated total area of new impervious surfaces (roof-tops, asphalt roads, asphalt parking lots, etc.); o A description of any set-backs, buffers or fences that will be incorporated in the site design, including the set-backs between any proposed works and sensitive natural or cultural features (including but not limited to watercourses, wetlands, adjacent properties, dwellings, schools, parks, etc.); o A description of any off-site lands, facilities and processes that will be affected or required during the construction, operation or maintenance of the undertaking (e.g., due to off-site processing, storage, transportation of raw materials or completed products, temporary work room or laydown areas, etc.); and o A description of the types of activities that may be directly associated with, or may occur as a result of, the construction, operation or maintenance of the undertaking (e.g., increased vehicular traffic, transportation of raw materials or completed products, etc.).	Information on the size of the site, location of the Project and various Project components is provided in Section 2.3 and Figure 2.4. A detailed site drawing is provided as Figure 2.10. The Project components are described in further detail in Section 2.5, Section 2.7, and Section 2.8.
2.0 g	**Construction Details**	
	• Identify the approximate duration of the total construction period including site preparation, construction and commissioning. If construction will be staged, please list the approximate order of each stage and its approximate duration (e.g., Step 1: access road construction, 2 days; Step 2: site clearing and grading, 1 week; Step 3: foundation construction and framing, 4 weeks; etc.); • State the estimated hours of construction (e.g., 7 a.m. to 5 p.m., Monday to Saturday); • List the equipment and construction procedures that will be used to construct the major features of the undertaking (e.g., excavation of trench using backhoe, site clearing using a bulldozer, placing of shoreline erosion protection using barge-mounted crane, blasting of bedrock, etc.); • Identify the proposed date of first physical construction-related activity on site and include a proposed construction and commissioning schedule; • Indicate the number of employees required during construction; • Identify potential sources of pollutants during the construction period(s), including noise, light, airborne emissions, liquid effluents, hazardous materials, and solid waste materials; • Indicate the ultimate fate of all wastes, emissions and effluents generated during construction, including their discharge/disposal locations, if applicable; • Provide details of how the site will be accessed, and how, where and when the access will be constructed and controlled (if required) including details of any required detours or other impacts on movements of vehicles and people; • Provide details on clearing and grubbing activities and the fate of any topsoil and merchantable timber removed during these activities; • If numerous truckloads of material or equipment are required, a transportation plan may be necessary; • Identify the origin of any required fill materials (rock fill, topsoil, granular materials etc.); and • Provide a description of any construction/excavation/grading required in or near sensitive areas such as wetlands, watercourses, wildlife habitat, Environmentally Significant Areas, or other sensitive areas identified under 3.0 – Description of the Existing Environment	Information regarding the construction phase of the Project is provided in Section 2.6 and Section 2.7. Further information on construction activities near sensitive areas is provided in Section 9.6.

Guide Page/Section	Description	Location in Application
2.0 h	**Operations and Maintenance Details**	
	Provide the following information using maps, diagrams, tables, flow charts, or written descriptions, as appropriate: • Describe the key features of the operation, (i.e.,, all routine activities, processes, and operations, including any pollution control or waste treatment equipment or facilities, and including all anticipated routine maintenance requirements and activities, and their timing); • State the estimated daily water use and the source of the water supply; • State the design capacity of any pumps or pipelines for conveying water, wastes, product, etc.; • Describe the proposed production capacity; • Identify the proposed mode of production (i.e., batch, continuous, seasonal, etc.); • Indicate the number of employees required during operation; • Identify the estimated period of operation and number of shifts (e.g., 1 shift, 8 hours per day, 5 days per week); • State the estimated life span or duration of the main facilities and activities; • If applicable, identify the total area of land to be disturbed annually for the duration of activities related to the undertaking (e.g., for peat extraction, quarrying, etc.); • Provide a description of the type and quantity of all raw materials, intermediate products, final products and by-products, including waste products such as stack discharges, other airborne fumes, fugitive emissions, liquid effluents, hazardous materials, solid waste, etc.; • Provide a description of all storage locations for raw materials, intermediate products, finished products, and wastes (e.g., storage tanks, bins, hoppers, storage yards, etc.); • Describe the energy requirements and how the required power will be obtained or brought to the site (hydro transmission line, gas pipeline, generator, oil tanker truck, etc.); • Describe the sources of all raw materials used during routine operations; • Indicate the ultimate fate of all wastes, emissions and effluents including their discharge/disposal locations if applicable; • Indicate the number of trucks/vehicle traffic that would arrive and/or leave the site daily.	Information regarding the operation phase of the Project is provided in Section 2.8. Further information on Project-related emissions is provided in Section 6.0.
2.0 i	**Future Modifications, Extensions, or Abandonment**	
	• Note that any modification, extension, or abandonment of an existing or previously registered undertaking will normally require a separate registration if the details of those activities are not known at the time of registration. For new undertakings, details on decommissioning/abandonment at the end of the project's life are typically addressed with a Condition requiring submission and approval of a decommissioning plan prior to implementation should the project receive EIA approval. To confirm assessment requirements for such proposals, please contact the EIA Branch. • For some types of new undertakings, site closure or rehabilitation plans must be submitted at the time of registration. Where applicable, this requirement is indicated in the appropriate sector-specific guidelines.	Information regarding the decommissioning phase of the Project is provided in Section 2.9.
2.0 j	**Documents Related to the Undertaking**	
	• Details of previous EIA registrations (e.g., project name, submission date(s), EIA file number(s), etc.); • Copies of any available reports describing environmental studies (research, monitoring, design work, site investigations, surveys, etc.) already completed in relation to the undertaking or the location where it will take place; • Copies of all relevant, available correspondence previously received from any municipal, provincial or federal government agency or department with respect to the undertaking or the location where it will take place; • A list of all of the above documents; • A list of applications submitted to any municipal, provincial or federal agency concurrently with the EIA registration. • Any work within 30 metres of a watercourse or wetland requires a Watercourse and Wetland Alteration (WAWA) Permit. Proponents are advised to submit an application for a Permit early in the EIA review as it can take 6 to 8 weeks processing time for a standard WAWA permit.	No prior environmental studies were conducted to support this assessment.
2,3	**Public and First Nations Involvement during the Determination Review**	
	• Demonstration that the affected public and stakeholders have been given the opportunity to review and comment on the proposed undertaking • Engagement of First Nations as appropriate (as per Duty to Consult First Nations) • Satisfactory summary of engagement with First Nations, the public and potentially affected stakeholders including responses to identified concerns. • All other relevant provincial, federal or municipal regulatory requirements must be complied with and all required permits and approvals must be obtained • A financial security may be required as a Condition of Determination.	Information on past public and First Nations involvement is provided in Section 4.0 and Table 4.1.
3	**Description of Existing Environment**	
	• This description must include all features that are either found at the proposed project site or are likely to be affected, including but not limited to those listed below. These features should be described in writing and their locations should be shown on the site plan (see 2.0 (f) Physical Components and Dimensions of the Undertaking, above). Representative photographs of key environmental features would also be useful (e.g., showing shorelines, wetlands and watercourses, vegetation, physical features, etc.). • Links to sources of information of assistance in describing the existing environment including government-produced maps, reports and databases are provided in Appendix "A" - Selected Resources on page 27.	A description of the existing environment is provided in Section 3.0. Further information on the existing environment is provided for each Valued Component in Section 6.0 to Section 12.0

Guide Page/Section	Description	Location in Application
3.0 a	**Physical and Natural Features**	
	• Site topography (maximum and minimum site elevation, and maximum and minimum gradients); • Surface drainage (e.g., "the majority of the property drains toward the southwest"); • Watercourses, rivers, streams, drainage ditches, and wetlands. Mapped and unmapped watercourses and wetlands should be identified on the ground and proponents should include air photos, shapefiles or GIS points and data sheets if applicable; • Coastal features including those protected under A Coastal Areas Protection Policy for New Brunswick; • Geology, groundwater and soils at the location, if these have the potential to affect or be affected by project implementation (e.g., if septic systems, landfills, waste disposal sites, ponds, building foundations, significant excavations and re-grading, etc. are required); • Environmental features or conditions that could affect the undertaking (e.g., acid-generating rock, unstable slopes, areas vulnerable to flooding, ice jams, storm surges, etc.); • All private or municipal water wells, municipal wellfields, and protected watersheds (i.e., municipal surface water supplies) located in proximity to or that could be affected by activities related to the proposed undertaking; • Existing ambient air quality; • Existing ambient noise levels; • Existing vegetation (extent of forest cover, main vegetation type or tree species, etc.); • The type, extent, and significance of any fish or wildlife populations and/or habitat; • Any known presence of species at risk (legally-listed species) or other species of conservation concern; • The presence of potential habitat for species at risk, for sites where there is a reasonable expectation of occurrence of those species; • Any known presence of critical or sensitive habitat (e.g., old growth forest); • The presence of other environmentally significant areas, including but not limited to National Wildlife Areas, Migratory Bird Sanctuaries, game reserves, RAMSAR (wetlands of international significance) sites, Important Bird Areas (IBAs), Western Hemisphere Shorebird Reserve Network (WHSHRN) sites, and designated critical habitats for species at risk etc.; • If the undertaking would result in the removal, disturbance or alteration of a natural or biological feature, site-specific information may be required from field investigations conducted by appropriate specialists. Examples include alteration of a watercourse, impacts to species at risk, or disturbance of a wetland. • Watercourses in New Brunswick are defined as: A feature in which the primary function is the conveyance or containment of water, which includes: a) the bed, banks and sides of any watercourse that is depicted on the New Brunswick Hydrographic Network layer (available on GeoNB Map Viewer); b) the bed, banks and sides of any incised channel greater than 0.5 metres in width that displays a rock or soil (mineral or organic) bed, that is not depicted on New Brunswick Hydrographic Network layer (available on GeoNB Map Viewer); water/flow does not have to be continuous and may be absent during any time of year; or c) a natural or man-made basin (i.e. lakes and ponds).	A description of the existing environment, including physical and natural features is provided in Section 3.0. Further information on the existing surface water and groundwater are provided in Sections 7.5 and 8.5. Further information on existing ambient air quality and noise levels is provided in Section 6.2.4 and Section 6.4.4. Further information on the existing terrestrial environment are provided in Section 9.5.
3.0 b	• List all federally, provincially, or locally recognized recreational sites or features, tourism features or attractions, tourism operations, cultural activities, hunting, fishing, gathering, traditional uses by First Nations, etc. on the subject property or adjacent lands; • List all federally, provincially, or locally recognized heritage and/or built heritage resources/areas (e.g., historic sites, historic buildings or structures, national or provincial parks, fossil site, archaeological sites, etc.) in relation to the proposed undertaking and adjacent lands.	Information on existing recreational use is provided in Section 12.5. Information on heritage resources is provided in Section 10.5.
3.0 c	**Existing and Historic Land Uses**	
	• Identify the ownership of adjacent properties; • Provide a general description of the use and land cover of the site of the proposed undertaking and adjacent • Provide a description of known previous uses of the site of the proposed undertaking and adjacent lands (e.g • Describe the type and extent of any known or suspected contamination resulting from previous uses of the s	Information on existing and historic land uses is provided in Section 2.3, Section 10.5, and Section 12.5.
4	**Identification of Environmental Impacts**	
	• For each stage of the undertaking (construction, operation and maintenance), identify the anticipated impacts (if any) on the environmental features identified in the previous section. These should include impacts of the undertaking on the environment (e.g., loss of wildlife habitat, emissions to air and water, etc.) and vice-versa (e.g., seasonal flooding, extreme weather events, climate change scenarios, etc.). Consideration should also be given to impacts that may result from any accidental events, malfunctions, • Result in the net loss of wetland functions or the net loss of Provincially Significant Wetland? • Result in an Activity in Zone A or B as defined in A Coastal Areas Protection Policy for New Brunswick that is not listed as an acceptable activity? • Result in the deposit of a deleterious substance harmful to fish or migratory birds? (prohibited by federal legislation), • Emit effluent in excess of relevant provincial or federal legislation, policies, guidelines or standards? • Result in the loss of individuals of a threatened or endangered species listed by the federal Species at Risk Act (SARA), Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or the New Brunswick Species at Risk Act, or damage or destruction of an individual residence or critical habitat? • Compromise the conservation of a species of special concern listed by SARA or COSEWIC, listed as 'sensitive' or 'may be at risk' by ERD, or listed as S1, S2 or S3 by the Atlantic Canada Conservation Data Centre (ACCDC), • Have the potential to impact migratory birds, thereby requiring appropriate pre-construction surveys to take place (if not, provide a justification of why not, which could include, but not necessarily be limited to, the location of the project and/or the timing of project activities)? • Result in the emission of contaminants into the atmosphere that would result in an exceedance of local, regional or national objectives or standards?	The assessment of the environmental effects of the Project is provided in Sections 6.0 to Section 12.0. An assessment of accidents, malfunctions, and unplanned events is provided in Section 14.0.

Guide Page/Section	Description	Location in Application
5	**Summary of Proposed Mitigation**	
	• Describe the measures that will be used to reduce or eliminate the environmental impacts identified in the previous section. A wide variety of measures can be employed depending on the type of undertaking and its physical setting. Mitigation measures should be considered as a hierarchy in which primary attention and priority is given to opportunities to avoid impacts. When these opportunities have been exhausted or it has been demonstrated that they are not feasible, then measures aimed at reducing impacts can be considered. Finally consideration can be given to measures that compensate for significant unavoidable impacts.	Mitigation measures are presented in Section 6.2.6, Section 6.3.10, Section 6.4.6, Section 8.6.3, Section 9.6.3, Section 10.6, and Section 12.6. A summary of mitigation measures is provided in Section 15.0.
5.0 C	**Impact Compensation**	
	• Selecting an alternative location or design for project components or infrastructure to avoid impacts to sensitive environmental features (such as impacts to wetlands that would result in net loss of wetland functions); • Within the registration document or at some point during the EIA Review, proponents will make a commitment to implement mitigation measures. Specific details of these measures can be described in conditions attached to the Certificate of Determination. If the proposed undertaking is allowed to proceed, an additional condition will normally be attached requiring adherence to all obligations and commitments contained in the registration document, as well as all those identified in subsequent correspondence during the EIA Review. • There will typically be a requirement that the proponent prepare a summary table of all terms and conditions to be updated and submitted to DELG on a regular basis, to indicate the proponent's progress in meeting each of the conditions.	Information on siting considerations is provided in Section 2.3. A summary of mitigation measures is provided in Section 15.0. Maritime Iron has created a commitment register to track obligations and commitments contained in the registration document, and through correspondence with regulators, stakeholders, First Nations, and the public.
6	• Where applicable, an on-going dialogue throughout the life of the undertaking (e.g., through the establishment of community liaison committees, the provision of contact information to adjacent property owners, etc.) is encouraged. Such dialogue ensures that the proponent and interested New Brunswickers are mutually aware of issues as they develop and have a forum for discussion. In addition, it may form part of the mitigative measures in response to anticipated environmental impacts. • A description of how the public and First Nations (see Duty to Consult First Nations page 6) input has been or will be sought and considered in relation to the proposed undertaking.	A description of First Nations and public and stakeholder engagement activities is provided in Section 4.0 and in Table 4.1.
7	• List the permits, licenses, approvals, and other forms of authorization required for the undertaking in addition to its requirements under the EIA Regulation. See Examples of Other Permits Licences and Approvals on page 32 for links to websites that provide additional information.	An overview of the anticipated regulatory processes that could be applicable to the Project is provided in Section 1.5.
8	**Funding**	
	If applications for a grant or loan of capital funds from any government agency have been or will be submitted, please identify the agency.	Applications for government funding has been or are intended to be made to: Opportunities New Brunswick, Regional Development Corporation (New Brunswick), Atlantic Canada Opportunities Agency, the Strategic Innovation Fund, National Research Council, and Export Development Canada.
9	**Signature**	
	Signature of Main Proponent Contact	 Rinaldo Stefan, Chief Operating Officer 2-Oct-19 Date

Appendix B BELLEDUNE PORT AUTHORITY LETTER OF DELEGATION OF CERTAIN PROCEDURAL ASPECTS OF CONSULTATION

Appendix B Belledune Port Authority Letter of Delegation of Certain Procedural Aspects of Consultation
October 2, 2019

PORT OF/DE BELLEDUNE

Belledune Port Authority
Administration portuaire de Belledune

info@portofbelledune.ca

112, promenade Shannon Drive
Belledune, NB E8G 2W2 Canada

Tel./Tél. : (506) 522-1200
Fax: (506) 522-0803

DELEGATION OF CERTAIN PROCEDURAL ASPECTS OF CONSULTATION

By means of this letter, I, as the **President and Chief Executive Officer of the Belledune Port Authority**, a Federal Agent, delegate the authority herein described to **Maritime Iron**, a body incorporated in Canada through the person holding the title of **President and Chief Executive Officer of Maritime Iron** on the following terms and conditions:

1. The Delegate is cognizant of and agrees to the terms and principles of the Relationship, Engagement, and Consultation Protocol signed on May 31st, 2018 between the co-owners, namely:

   The Belledune Port Authority, Oinpegitoig First Nation (Pabineau), Ugpi'ganjig First Nation (Eel River Bar), and Mi'gmawe'l Tplu'taqnn Inc. (MTI);

2. The Protocol identifies a full list of consultation tasks including determining the scope of consultation required and evaluating the adequacy of the consultation and accommodation to be carried out, and are therefore matters that are reserved exclusively to the Belledune Port Authority and or Federal and /or Provincial regulatory bodies. These include:
   - Determining whether the duty to consult is triggered;
   - Identifying the communities to which the Crown owes a consultation duty;
   - Any determination of the required depth of consultation based on an assessment of the strength of aboriginal claims any adverse impact of the project;
   - Determining prior to a decision to proceed with the project whether the consultation undertaken has been sufficient, and;
   - Determining what accommodation, if any, is required.

3. The subject matter of this delegation includes the day- to- day operational or procedural acts of consultation. Specifically, these include:
   - Notifying MTI, MMS, and their respective First Nation members and providing them with project information;
   - Considering the reasonable request for capacity funding;
   - Meeting with the communities;
   - Receiving community input about possible adverse impacts on rights;
   - Keeping consultation records;
   - Relaying community feedback to the Belledune Port Authority throughout the engagement and consultation processes, and;
   - Proposing accommodation measures to the communities and the Crown/Port.

4. The effective date of this delegation is January 1st, 2019.

5. This delegation is made pursuant to the Belledune Port Authority's mandate under the Canada Marine Act and its Letters Patent and the decisions of the courts of Canada.

Delegating Official (Print)

Name: ______________________

Title: President + CEO

Acknowledgment & Agreement

Signature: ______________________

Title: CEO

Date: April 5, 2019

Appendix C LETTER OF INTENT

Appendix C Letter of Intent
October 2, 2019

LETTER OF INTENT

Among

MARITIME IRON INC (Maritime Iron)

And

MI'GMAWE'L TPLU'TAQNN INC. (Mi'gmawe'l Tplu'taqnn) representing for the purposes of this Letter of Agreement 6 of its member First Nations: Amlamgog (Fort Folly); Esgenoôpetitj; L'nui Menikuk (Indian Island); Natoaganeg (Eel Ground); Metepenagiag Mi'kmaq; Tjipõgtõtjg (Buctouche),

And

Oinpegitjoig First Nation (Pabineau),

And

Ugpi'ganjig First Nation (Eel River Bar).

Each a Party and Collectively the Parties

Maritime Iron Inc., a company incorporated under the Canada Business Act is developing a world class, low cost merchant pig iron facility situated on the unceded terrritory of the Mi'gmaq People on the property held by NB Power and the Belledune Port Authority (the "Project").

The Mi'gmaq communities of **Oinpegitjoig (**Papineau First Nation), **Ugpi'ganjig** (Eel River Bar First Nation), Mi'gmawe'l Tplu'taqnn and Maritime Iron are committed in good faith to:

1) maintain and foster sustainable long-term relationships that are transparent and respectful.
2) support the revitalization of the Mi'gmaq communities while encouraging greater opportunities for Mi'gmaq participation in sustainable, lawful, and respectful economic development.
3) Facilitate strong economic links between the Mi'gmaq communities in the region and the Project.

This Letter of Intent is designed to enable the Parties to explore the development of a framework for a variety of Agreements and Understandings including but not limited to; 1) Indigenous Knowledge Study,2) Cooperation and Relationship Agreement, 3) Impact and Benefit Agreement, 4) Environmental Protection Agreement.

The Parties agree that the "Relationship, Engagement and Consultation Protocol" (Protocol) signed by the Belledune Port Authority and First Nation communities and MTI on May 31, 2018 will guide and direct the activities by the Parties to this Letter of Agreement.

The subject Agreements shall:

a) Define the roles and responsibilities of the Parties in the various aspects of their relationship(s).
b) Prescribe the steps for a practical, transparent and respectful approach to the jointly determined subject matter for the agreements and Understandings.
c) Create a joint steering committee to oversee the development and adoption of the proposed Agreements and Understandings.

The resulting Agreements and Understandings are intended to form a part of the documentation of the developing long term relationship.

This letter of intent is non-binding and shall not be interpreted as consent to or a letter of support for the Project.

Agreed to and signed on this 24th day of April ,2019

Chief David Peter Paul,
Oinpegitjoig First Nation

Maritime Iron Inc.
Per: Greg McKenzie, Chairman & CEO

Chief Everett Martin,
Ugpi'ganjig First Nation

Chief George Ginnish, Co-Chair
Mi'gmawe'l Tplu'taqnn Incorporated

Chief Rebecca Knockwood, Co-Chair
Mi'gmawe'l Tplu'taqnn Incorporated

Appendix D MARITIME IRON PIG IRON (POSCO) FACILITY – EMISSIONS INVENTORY

Appendix D Maritime Iron Pig Iron (POSCO) Facility – Emissions Inventory
October 2, 2019

Maritime Iron Pig Iron (POSCO) Facility - Emissions Inventory

Developed by: C. Lyons
Date: 28-Feb-19
Project number: 121415659

Releases of nitrogen oxides (NOx), sulphur dioxide, particulate matter (dust) and speciated compounds in the dust from the sources associated with the operation are estimated using this spreadsheet.

The emissions are estimated using operationlal information, source parameters and stack concentrations provided by Maritime Iron.

Based on speciation information provided by Maritime Iron, emissions of non-CACs are expected to include Hg, Fe_2O_3, CaO, SiO_2, P_2O_5, TiO_2,K_2O and SO_3.
Only compounds/contaminants with appicable Ontario Ministry of Environment Air Contaminant Benchmark criteria are carried forward in the assessment.

Additional details are provided in each individual worksheet.

The estimated emissions are used in the CALPUFF model. The model period covers 2013 to 2017. The model input parameters to be used directly in the CALPUFF Source set up tool Macro are provided in the "SrcTool Inputs - Model Input" worksheet.

Revision Log:

Name	Date	Comments
Chris Lyons	20-Feb-19	Started sheet.
Chris Lyons	4-Mar-19	Made adjustments based on quality review comments - modified slag granulation CT PM emissions to EF basis and added some description text.
Chris Lyons	5-Mar-19	Addressed independent review comments.
Chris Lyons	19-Mar-19	Updated sheet to include pilot flaring for normal operation - split out emissions summary and model input tables for each - normal op and flaring event. Added updated info received from Maritime Iron - stack temp (stack #6), SO2 and Nox emissions added from stack #10 and updated TDS info from slag granulation CTs.
Chris Lyons	25-Mar-19	Addressed quality/client review comments. Added velocity calcs to Cooling Tower calc sheet.
Chris Lyons	1-Apr-19	Added Annual Emissions Calc Tab
Chris Lyons	2-Apr-19	Added additional trace metals based on new information provided by Maritime Iron, tabs updated include: Annual Emissions - Normal Op, Emissions Summary sheets, SrcTool Inp sheets, Summary of Stack Conc, Summary of Dust speciation, BOP Transfer Pts Dust Spec, Dust Emissions Points and Material Info
Maritime Iron	4-Apr-19	Revised dust stack concentrations - based on refined emissions information. Values updated in *Emissions Table* , *Emissions Table Stn Mod* , *Transfer Point Src Info* tabs
Chris Lyons	10-Apr-19	Added 24hr emissions calcs for flaring event - added "Emis Sum Flare Event - 24hr" and updated "SrcTool Inp - Mod Inp - Flr Ev"
Chris Lyons	11-Apr-19	In response to review comments - April 10-11, 2019, yes that is correct, according to Maritime Iron the flare is the only source with exhaust gases still expected to have a dust (PM) concentration up to 40 mg/Nm3, the other sources are expected to have dust concentrations up to 5 mg/Nm3.
Chris Lyons	24-Apr-19	Based on new info from Maritime Iron a new 24hr flaring event scenario is considered, where NB Power has a short-term shut down (over 4 hours) resulting in flaring to occur until the Belledune power plant can accept produced gas. As such all other sources operate continuously over the full 24 hour period. The 24hr flaring event calcs have been updated accordingly.
Chris Lyons	April 29. 2019	Added offset SO2 emissions calcs due to offset coal at the NB Power Belledune power plant from off-gas received from MI (NBPower SO2 (NPRI) tab)

Reviewed by	Date Reviewed	Comments
Christina Varner	1-Mar-19	Reviewed Feb 28 version of inventory. Comments are in yellow highlighted cells. Dark green are cells I checked and found to be good. No issues detected.
Mike Murphy	4-Mar-19	reviewed methods and some numbers; several questions to address; but I did find that the calcs I reviewed were good
Christina Varner	20-Mar-19	Reviewed March 19 version of inventory, specfically Flare Pilot sheet, Normal Op Emission Summary (for flare), and Normal Op Model Input (for flare). Dark green are cells I checked and found to be good. Light green used for flare line on emissions summary sheet. One issue noted and some questions/suggestions commented.
Christina Varner	3-Apr-19	Reviewed April 2 version of inventory. Spot checked cells associated with metals in the tabs listed by Chris Lyons (e.g., Annual Emissions - Normal Op). Consistent use of formulas. No errors noted. No comments in sheet.
Christina Varner	April 10-11, 2019	Reviewed April 10 version of the inventory for flare 24 hr calculations and the updated flare event source tool tabs. Flare TSP for 24 hr case is still 40 mg/Nm3; is this correct? The calculation of flaring emissions as sum of emissions prorated for the decrease in emissions makes sense and would represent the average kg/hr over the 24 hr period. For non-flare sources, the calculated emissions are correctly prorated for the four hours of the flaring event. SrrcTool Inp Mod Flr Ev has correct lookups to max hour sheet and conversion to g/s. The max daily section of the SrcTool Inp Mod Flr Ev is correctly referring to the 24 hr sheet and converting to g/s. Did not check whether source information (e.g., temperature) were correctly referenced.
Christina Varner	2-May-19	Reviewed sheet "NBPower SO2 (NPRI)" in April 29 version of spreadsheet. Comments on yellow cells. Checked cells that were OK are green. Suggested edits for clarity. No issues noted.

Annual Emissions - Normal Operation

Annual Facility Operating Hours 8322 hr/yr

			Air Contaminant Emissions (tonner/yr)																	
Source	**Hours Op per day**	**Hour Op per Year**	**TSP**	**NOX**	**SO2**	**Hg**	**Fe2O3**	**CaO**	**SiO2**	**P2O5**	**TiO2**	**K2O**	**SO3**	**As**	**Cd**	**Cr**	**Cu**	**Ni**	**V**	**Zn**
CDA_STK	14	4855	19.47	-	-	-	0.02	4.98	4.47	0.19	0.02	0.02	0.13	-	-	-	-	-	-	-
CP_STK3	24	8322	5.95	-	-	1.9E-07	0.07	0.17	0.39	0.01	0.01	0.01	0.01	1.7E-05	1.2E-07	1.8E-06	4.8E-07	7.7E-07	1.1E-06	3.6E-06
CP_STK2	24	8322	0.61	-	-	2.1E-08	2.6E-03	2.2E-03	0.03	6.1E-04	6.1E-04	7.3E-04	6.1E-04	1.9E-06	-	-	-	-	-	-
HMPT_STK	18	6242	10.64	-	-	-	3.54	5.15	0.41	0.06	0.01	0.01	0.01	-	-	-	-	-	-	7.6E-05
HCL_STK1	24	8322	2.45	27.48	11.78	1.0E-08	1.90	0.15	0.11	2.4E-03	2.4E-03	2.6E-03	2.1E-03	1.9E-05	1.1E-05	1.5E-05	1.3E-06	1.3E-05	8.7E-05	1.5E-05
HCL_STK2	24	8322	2.53	-	-	1.0E-08	1.96	0.16	0.11	2.5E-03	2.5E-03	2.7E-03	2.2E-03	2.0E-05	1.1E-05	1.6E-05	1.3E-06	1.3E-05	9.0E-05	1.6E-05
OREDRYER	24	8322	15.27	171.07	73.32	6.1E-08	12.10	0.88	0.83	0.02	0.02	0.02	0.01	1.2E-04	6.9E-05	9.5E-05	7.3E-06	7.9E-05	5.5E-04	9.5E-05
PCMSTK	17	5895	8.60	96.37	41.30	-	1.3E-05	2.3E-03	0.13	0.01	0.01	0.01	0.01	-	-	-	-	-	-	6.5E-08
GRSTK1	24	8322	2.18	-	-	8.7E-09	1.73	0.13	0.12	2.2E-03	2.2E-03	2.3E-03	1.9E-03	1.7E-05	9.8E-06	1.4E-05	1.0E-06	1.1E-05	7.9E-05	1.4E-05
BOP1	24	8322	0.25	-	-	1.2E-08	0.22	0.13	0.23	2.5E-04	2.5E-04	4.9E-04	2.5E-04	2.2E-06	1.2E-06	4.4E-06	1.2E-06	2.0E-06	9.9E-06	3.7E-06
BOP2	24	8322	0.25	-	-	1.2E-08	0.22	0.13	0.23	2.5E-04	2.5E-04	4.9E-04	2.5E-04	2.2E-06	1.2E-06	4.4E-06	1.2E-06	2.0E-06	9.9E-06	3.7E-06
BOP3	24	8322	2.90	-	-	5.8E-08	2.61	1.54	2.75	2.9E-03	2.9E-03	0.01	2.9E-03	2.6E-05	1.4E-05	5.2E-05	1.4E-05	2.3E-05	1.2E-04	4.3E-05
BOP4	24	8322	2.90	-	-	1.4E-07	0.01	0.01	0.20	2.9E-03	2.9E-03	0.01	2.9E-03	1.1E-05	-	-	-	-	-	-
BOP5	24	8322	0.25	-	-	4.9E-09	0.22	0.13	0.23	2.5E-04	2.5E-04	4.9E-04	2.5E-04	2.2E-06	1.2E-06	4.4E-06	1.2E-06	2.0E-06	9.9E-06	3.7E-06
BOP6	24	8322	0.41	-	-	2.0E-08	2.0E-03	1.6E-03	0.03	4.1E-04	4.1E-04	8.2E-04	4.1E-04	1.5E-06	-	-	-	-	-	-
CT1_CBT	24	8322	2.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT2_CBT	24	8322	2.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT3_CBT	24	8322	2.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT4_CBT	24	8322	2.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLARE	24	8322	0.14	8.95	0.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CP_STK1	24	8322	7.23	-	-	2.5E-07	0.03	0.03	0.40	0.01	0.01	0.01	0.01	2.2E-05	-	-	-	-	-	-
CF1	24	8322	4.18	-	-	1.7E-08	3.31	0.24	0.23	4.2E-03	4.2E-03	4.4E-03	3.7E-03	3.4E-05	1.9E-05	2.6E-05	2.0E-06	2.2E-05	1.5E-04	2.6E-05
CF2	24	8322	7.73	-	-	2.2E-07	0.03	0.03	0.50	0.01	0.01	0.01	0.01	2.0E-05	-	-	-	-	-	-
MGS1	24	8322	0.17	-	-	5.0E-09	7.1E-04	5.7E-04	0.01	1.8E-04	1.7E-04	2.0E-04	1.7E-04	4.4E-07	-	-	-	-	-	-
MGS2	24	8322	1.57	-	-	4.5E-08	0.01	0.01	0.10	1.6E-03	1.6E-03	1.9E-03	1.6E-03	4.1E-06	-	-	-	-	-	-
CM_RTO	24	8322	-	14.30	6.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT1_PRO	24	8322	1.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT2_PRO	24	8322	1.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT3_PRO	24	8322	1.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT4_PRO	24	8322	1.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT5_PRO	24	8322	1.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT6_PRO	24	8322	1.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT7_PRO	24	8322	1.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT8_PRO	24	8322	1.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT1_SEC	24	8322	1.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT2_SEC	24	8322	1.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT3_SEC	24	8322	1.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT4_SEC	24	8322	1.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CT5_SEC	24	8322	1.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	**-**	**-**	**125.26**	**318.16**	**132.76**	**1.1E-06**	**27.98**	**13.87**	**11.52**	**0.32**	**0.10**	**0.11**	**0.20**	**3.2E-04**	**1.4E-04**	**2.3E-04**	**3.2E-05**	**1.7E-04**	**1.1E-03**	**3.0E-04**

Maritime Iron Pig Iron Facility Emissions

The source characteristics for each source considered in the dispersion modelling are summarized in this sheet. The emission rates in kg/hr are calculated using the provided stack concentrations, flow rates and material speciation.
The non-criteria (contaminants aside from TSP, NOx and SO2) are estimated based on the composition of the dust emissions based on the material types handled in each area of the process (eg thermal coal, coke, quartz).

Equivalent source parameters are estimated here also, based on release orientation (based on Guidance from the Ontario MOE Dispersion Model Guide) and for the Flare (based on the Alberta Flare Model and provided flare gas properties).

Cells below containing light blue text indicates different formulae/calc methodology than the surrounding cells. Cells containing black text have similar formulae/calc methodology.

The assumed moisture content of the sources is based on saturated ambient air (at 1 atm and 25'C), based on the information provided by Maritime Iron.

Summary of Emissions

Release Orientation	Table ID	Source_ID	Process Area	Stack Flow		Stack Height	Stack Diameter	Exit Velocity	Modelled Diameter	Modelled Velocity	Stack Temp
				Am3/s	Nm3/s	(m)	(m)	(m/s)	(m)	(m/s)	K
Vertical	15	CDA_STK	Cast House Dedusting System Stack (491K92) #15	291.35	222.82	24.00	5.56	12.00	5.56	12.00	373.15
Vertical	5	CP_STK3	Wet dedusting coal briqueting (593K10) #5	41.13	39.75	20.00	2.30	9.90	2.30	9.90	293.15
Vertical	4	CP_STK2	Dry Coal Dedusting - coal briqueting (592K10) #4	5.13	4.08	20.00	0.80	10.20	0.80	10.20	358.15
Vertical	27	HMPT_STK	Hot Metal Pre-treatment System De-dusting Filter #27	99.53	94.67	20.00	2.40	22.00	2.40	22.00	298
Vertical	10	HCL_STK1	Various HCL Dedusting points (249K51) #10	20.02	16.38	16.00	1.20	17.70	1.20	17.70	348.15
Vertical	9	HCL_STK2	HCL Bag Filter Unit (249K15) #9	31.28	16.88	18.00	1.50	17.70	1.50	17.70	533.15
Vertical	6	OREDRYER	Bag filter unit for dry dedusting (127K12) #6	133.33	101.97	24.00	3.70	12.40	3.70	12.40	373.15
Vertical	22	PCMSTK	Pig Casting Machine Dedusting filter (479K15) #22	106.03	81.09	21.00	3.00	15.00	3.00	15.00	373.15
Horizontal	7	GRSTK1	Reactor Dedusting dry oxide handling (128K21) #7	15.04	14.54	26.00	1.20	13.30	6.00	0.53	293.15
Vertical	BOP1	BOP1	existing transfer tower	1.70	1.65	10.00	0.35	17.70	0.35	17.70	293.15
Vertical	BOP2	BOP2	New transfer tower	1.70	1.65	10.00	0.35	17.70	0.35	17.70	293.15
Vertical	BOP3	BOP3	I/O, L/S, D/M Stockpile	20.02	19.35	30.00	1.20	17.70	1.20	17.70	293.15
Vertical	BOP4	BOP4	Coal and Coke Stockpile	20.02	19.35	30.00	1.20	17.70	1.20	17.70	293.15
Vertical	BOP5	BOP5	I/O, L/S, D/M Stockhouse	1.70	1.65	10.00	0.35	17.70	0.35	17.70	293.15
Vertical	BOP6	BOP6	Coal Briquetting	2.82	2.72	10.00	0.45	17.70	0.45	17.70	293.15
Vertical	16	CT1_CBT	slag granulation - ct1 #16	160.00	N/A	32.00	6.00	5.66	6.00	5.66	323.15
Vertical	17	CT2_CBT	slag granulation ct2 #17	160.00	N/A	32.00	6.00	5.66	6.00	5.66	323.15
Vertical	18	CT3_CBT	slag granulation ct3 #18	160.00	N/A	32.00	6.00	5.66	6.00	5.66	323.15
Vertical	19	CT4_CBT	slag granulation ct4 #19	160.00	N/A	32.00	6.00	5.66	6.00	5.66	323.15
Vertical	29	FLARE	#29	27.71	6.33	70.00	1.60	-	1.60	5.65	1,273
Vertical	3	CP_STK1	Coal Briquetting - Coal Dedusting For Receiving (591K10) #3	49.96	48.28	17.00	1.35	34.90	1.35	34.90	293.15
Vertical	1	CF1	Ore Dedusting For Stock House (196K10) #1	28.86	27.89	18.00	1.75	12.00	1.75	12.00	293.15
Vertical	2	CF2	Coal Dedusting For Stock House (198K10) #2	53.39	51.59	21.00	2.38	12.00	2.38	12.00	293.15
Horizontal	12	MGS1	Dedusting System (393P01) #12	1.50	1.15	2.80	0.30	21.20	1.16	0.10	373.15
Vertical	13	MGS2	Dedusting System (391K01) #13	10.84	10.47	97.00	1.00	13.80	1.00	13.80	293.15
Vertical	30	CM_RTO	Water Treatment Regenerative thermal oxidizer #30	10.86	8.53	15.00	1.20	9.60	1.20	9.60	363.15
Vertical	not in table	CT1_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15
Vertical	not in table	CT2_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15
Vertical	not in table	CT3_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15
Vertical	not in table	CT4_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15
Vertical	not in table	CT5_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15
Vertical	not in table	CT6_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15
Vertical	not in table	CT7_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15
Vertical	not in table	CT8_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15
Vertical	not in table	CT1_SEC	Secondary Cooling Towers	200.00	N/A	14.50	6.00	7.07	6.00	7.07	308.15
Vertical	not in table	CT2_SEC	Secondary Cooling Towers	200.00	N/A	14.50	6.00	7.07	6.00	7.07	308.15
Vertical	not in table	CT3_SEC	Secondary Cooling Towers	200.00	N/A	14.50	6.00	7.07	6.00	7.07	308.15
Vertical	not in table	CT4_SEC	Secondary Cooling Towers	200.00	N/A	14.50	6.00	7.07	6.00	7.07	308.15
Vertical	not in table	CT5_SEC	Secondary Cooling Towers	200.00	N/A	14.50	6.00	7.07	6.00	7.07	308.15

Source_ID	Air Contaminant Emissions (kg/hr)																	
	TSP	NOX	SO2	Hg	Fe2O3	CaO	SiO2	P2O5	TiO2	K2O	SO3	As	Cd	Cr	Cu	Ni	V	Zn
CDA_STK	4.0	0.0	0.0	0.0E+00	3.9E-03	1.0E+00	9.2E-01	4.0E-02	4.0E-03	4.0E-03	2.7E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CP_STK3	0.7	0.0	0.0	2.3E-08	8.0E-03	2.0E-02	4.6E-02	7.9E-04	7.2E-04	8.7E-04	7.0E-04	2.1E-06	1.4E-08	2.1E-07	5.7E-08	9.3E-08	1.3E-07	4.3E-07
CP_STK2	0.1	0.0	0.0	2.5E-09	3.1E-04	2.6E-04	4.1E-03	7.3E-05	7.3E-05	8.8E-05	7.3E-05	2.2E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
HMPT_STK	1.7	0.0	0.0	0.0E+00	5.7E-01	8.3E-01	6.6E-02	9.0E-03	1.7E-03	1.7E-03	1.7E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-05
HCL_STK1	0.3	3.3	1.4	1.2E-09	2.3E-01	1.9E-02	1.3E-02	2.9E-04	2.9E-04	3.1E-04	2.5E-04	2.3E-06	1.3E-06	1.8E-06	1.5E-07	1.5E-06	1.0E-05	1.8E-06
HCL_STK2	0.3	0.0	0.0	1.3E-09	2.4E-01	1.9E-02	1.3E-02	3.0E-04	3.0E-04	3.2E-04	2.6E-04	2.4E-06	1.3E-06	1.9E-06	1.5E-07	1.6E-06	1.1E-05	1.9E-06
OREDRYER	1.8	20.6	8.8	7.3E-09	1.5E+00	1.1E-01	9.9E-02	1.8E-03	1.8E-03	1.9E-03	1.6E-03	1.5E-05	8.3E-06	1.1E-05	8.8E-07	9.5E-06	6.7E-05	1.1E-05
PCMSTK	1.5	16.3	7.0	0.0E+00	2.2E-06	3.9E-04	2.2E-02	1.5E-03	1.5E-03	1.5E-03	1.5E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-08
GRSTK1	0.3	0.0	0.0	1.0E-09	2.1E-01	1.5E-02	1.4E-02	2.6E-04	2.6E-04	2.8E-04	2.3E-04	2.1E-06	1.2E-06	1.6E-06	1.3E-07	1.4E-06	9.5E-06	1.6E-06
BOP1	0.0	0.0	0.0	1.5E-09	2.7E-02	1.6E-02	2.8E-02	3.0E-05	3.0E-05	5.9E-05	3.0E-05	2.7E-07	1.5E-07	5.3E-07	1.5E-07	2.4E-07	1.2E-06	4.4E-07
BOP2	0.0	0.0	0.0	1.5E-09	2.7E-02	1.6E-02	2.8E-02	3.0E-05	3.0E-05	5.9E-05	3.0E-05	2.7E-07	1.5E-07	5.3E-07	1.5E-07	2.4E-07	1.2E-06	4.4E-07
BOP3	0.3	0.0	0.0	7.0E-09	3.1E-01	1.8E-01	3.3E-01	3.5E-04	3.5E-04	7.0E-04	3.5E-04	3.1E-06	1.7E-06	6.3E-06	1.7E-06	2.8E-06	1.4E-05	5.2E-06
BOP4	0.3	0.0	0.0	1.7E-08	1.7E-03	1.4E-03	2.4E-02	3.5E-04	3.5E-04	7.0E-04	3.5E-04	1.3E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
BOP5	0.0	0.0	0.0	5.9E-10	2.7E-02	1.6E-02	2.8E-02	3.0E-05	3.0E-05	5.9E-05	3.0E-05	2.7E-07	1.5E-07	5.3E-07	1.5E-07	2.4E-07	1.2E-06	4.4E-07
BOP6	0.0	0.0	0.0	2.4E-09	2.4E-04	2.0E-04	3.4E-03	4.9E-05	4.9E-05	9.8E-05	4.9E-05	1.9E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT1_CBT	0.29	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT2_CBT	0.29	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT3_CBT	0.29	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT4_CBT	0.29	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
FLARE	0.017	1.1	0.028906	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CP_STK1	0.9	0.0	0.0	3.0E-08	3.6E-03	3.1E-03	4.9E-02	8.7E-04	8.7E-04	1.0E-03	8.7E-04	2.6E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CF1	0.5	0.0	0.0	2.0E-09	4.0E-01	2.9E-02	2.7E-02	5.0E-04	5.0E-04	5.3E-04	4.4E-04	4.0E-06	2.3E-06	3.1E-06	2.4E-07	2.6E-06	1.8E-05	3.1E-06
CF2	0.9	0.0	0.0	2.7E-08	3.8E-03	3.1E-03	6.0E-02	9.6E-04	9.2E-04	1.1E-03	9.2E-04	2.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
MGS1	0.0	0.0	0.0	6.0E-10	8.5E-05	6.8E-05	1.3E-03	2.1E-05	2.0E-05	2.4E-05	2.0E-05	5.3E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
MGS2	0.2	0.0	0.0	5.4E-09	7.7E-04	6.2E-04	1.2E-02	1.9E-04	1.9E-04	2.2E-04	1.9E-04	4.9E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CM_RTO	0.0	1.7	0.7	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT1_PRO	0.16	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT2_PRO	0.16	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT3_PRO	0.16	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT4_PRO	0.16	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT5_PRO	0.16	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT6_PRO	0.16	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT7_PRO	0.16	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT8_PRO	0.16	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT1_SEC	0.22	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT2_SEC	0.22	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT3_SEC	0.22	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT4_SEC	0.22	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT5_SEC	0.22	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Max	4.01	20.56	8.81	2.95E-08	1.45	1.03	0.92	0.04	4.01E-03	4.01E-03	0.03	1.47E-05	8.30E-06	1.14E-05	1.74E-06	9.51E-06	6.66E-05	1.21E-05
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg	0.45	1.10	0.46	3.37E-09	0.09	0.06	0.05	0.001	3.59E-04	3.99E-04	9.41E-04	9.97E-07	4.26E-07	7.16E-07	9.73E-08	5.16E-07	3.41E-06	1.00E-06
Total	17.6	41.9	18.0	0.0	3.5	2.3	1.8	0.1	1.4E-02	1.6E-02	3.7E-02	3.9E-05	1.7E-05	2.8E-05	3.8E-06	2.0E-05	1.3E-04	3.9E-05

Modelled pseudo diameter and velocity for sources with horizontal release points estimated using Ontario MOE Guidance
(Air Dispersion Modelling Guideline for Ontario, February 2017 - https://files.ontario.ca/admgo-id50_aoda_v2b.pdf)

Source_ID	Process Area	Stack Flow Am3/s	Nm3/s	Assumed Moisture	Stack Temp K	Air Contaminant Stack Concentrations (mg/Nm3) TSP	NOX	SO2	Hg	Fe2O3	CaO	SiO2	P2O5	TiO2	K2O	SO3	As	Cd	Cr	Cu	Ni	V	Zn
CDA_STK	Cast House Dedusting System Stack (491K92) #15	291.35	222.82	0.026	373.15	5	N/A	N/A	0	0.0048	1.28	1.147	0.0498	0.005	0.005	0.0338	0	0	0	0	0	0	0
CP_STK3	Wet dedusting coal briqueting (593K10) #5	41.13	39.75	0.033	293.15	5	N/A	N/A	0.000000163	0.0556	0.13925	0.324	0.0055	0.00505	0.0061	0.0049	1.45E-05	1E-07	1.5E-06	4E-07	6.5E-07	9E-07	0.000003
CP_STK2	Dry Coal Dedusting - coal briqueting (592K10) #4	5.13	4.08	0.027	358.15	5	N/A	N/A	0.00000017	0.021	0.018	0.28	0.005	0.005	0.006	0.005	1.52E-05	0	0	0	0	0	0
HMPT_STK	Hot Metal Pre-treatment System De-dusting Filter #27	99.53	94.67	0.033	298	5	N/A	N/A	0	1.6625	2.4225	0.19375	0.026375	0.005	0.005	0.005	0	0	0	0	0	0	3.56E-05
HCL_STK1	Various HCL Dedusting points (249K51) #10	20.02	16.38	0.028	348.15	5	56	24	2.075E-08	3.87165	0.315	0.2194	0.00495	0.00495	0.0053	0.0043	3.92E-05	2.22E-05	3.11E-05	2.55E-06	2.57E-05	0.000177	3.13E-05
HCL_STK2	HCL Bag Filter Unit (249K15) #9	31.28	16.88	0.018	533.15	5	N/A	N/A	2.075E-08	3.87165	0.315	0.2194	0.00495	0.00495	0.0053	0.0043	3.92E-05	2.22E-05	3.11E-05	2.55E-06	2.57E-05	0.000177	3.13E-05
OREDRYER	Bag filter unit for dry dedusting (127K12) #6	133.33	101.97	0.026	373.15	5	56	24	0.00000002	3.9615	0.28905	0.2707	0.005	0.005	0.0053	0.0044	4.01E-05	2.26E-05	0.000031	2.4E-06	2.59E-05	0.000181	0.000031
PCMSTK	Pig Casting Machine Dedusting filter (479K15) #22	106.03	81.09	0.026	373.15	5	56	24	0	7.5E-06	0.001325	0.074975	0.004998	0.004998	0.005	0.004995	0	0	0	0	0	0	3.75E-08
GRSTK1	Reactor Dedusting dry oxide handling (128K21) #7	15.04	14.54	0.033	293.15	5	N/A	N/A	0.00000002	3.9615	0.28905	0.2707	0.005	0.005	0.0053	0.0044	4.01E-05	2.26E-05	0.000031	2.4E-06	2.59E-05	0.000181	0.000031
BOP1	existing transfer tower	1.70	1.65	0.033	293.15	5	N/A	N/A	0.00000025	4.5	2.65	4.75	0.005	0.005	0.01	0.005	0.000045	0.000025	0.00009	0.000025	0.00004	0.0002	0.000075
BOP2	New transfer tower	1.70	1.65	0.033	293.15	5	N/A	N/A	0.00000025	4.5	2.65	4.75	0.005	0.005	0.01	0.005	0.000045	0.000025	0.00009	0.000025	0.00004	0.0002	0.000075
BOP3	I/O, L/S, D/M Stockpile	20.02	19.35	0.033	293.15	5	N/A	N/A	0.0000001	4.5	2.65	4.75	0.005	0.005	0.01	0.005	0.000045	0.000025	0.00009	0.000025	0.00004	0.0002	0.000075
BOP4	Coal and Coke Stockpile	20.02	19.35	0.033	293.15	5	N/A	N/A	0.00000025	0.025	0.02	0.35	0.005	0.005	0.01	0.005	0.000019	0	0	0	0	0	0
BOP5	I/O, L/S, D/M Stockhouse	1.70	1.65	0.033	293.15	5	N/A	N/A	0.0000001	4.5	2.65	4.75	0.005	0.005	0.01	0.005	0.000045	0.000025	0.00009	0.000025	0.00004	0.0002	0.000075
BOP6	Coal Briquetting	2.82	2.72	0.033	293.15	5	N/A	N/A	0.00000025	0.025	0.02	0.35	0.005	0.005	0.01	0.005	0.000019	0	0	0	0	0	0
CT1_CBT	slag granulation - ct1 #16	160.00	N/A	N/A	323.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT2_CBT	slag granulation ct2 #17	160.00	N/A	N/A	323.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT3_CBT	slag granulation ct3 #18	160.00	N/A	N/A	323.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT4_CBT	slag granulation ct4 #19	160.00	N/A	N/A	323.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FLARE	#29	27.71	6.33	0.008	1273	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CP_STK1	Coal Briquetting - Coal Dedusting For Receiving (591K10) #3	49.96	48.28	0.033	293.15	5	N/A	N/A	0.00000017	0.021	0.018	0.28	0.005	0.005	0.006	0.005	1.52E-05	0	0	0	0	0	0
CF1	Ore Dedusting For Stock House (196K10) #1	28.86	27.89	0.033	293.15	5	N/A	N/A	0.00000002	3.9615	0.28905	0.2707	0.005	0.005	0.0053	0.0044	4.01E-05	2.26E-05	0.000031	2.4E-06	2.59E-05	0.000181	0.000031
CF2	Coal Dedusting For Stock House (198K10) #2	53.39	51.59	0.033	293.15	5	N/A	N/A	1.445E-07	0.02055	0.01655	0.3207	0.00515	0.00495	0.0059	0.00495	1.29E-05	0	0	0	0	0	0
MGS1	Dedusting System (393P01) #12	1.50	1.15	0.026	373.15	5	N/A	N/A	1.445E-07	0.02055	0.01655	0.3207	0.00515	0.00495	0.0059	0.00495	1.29E-05	0	0	0	0	0	0
MGS2	Dedusting System (391K01) #13	10.84	10.47	0.033	293.15	5	N/A	N/A	1.445E-07	0.02055	0.01655	0.3207	0.00515	0.00495	0.0059	0.00495	1.29E-05	0	0	0	0	0	0
CM_RTO	Water Treatment Regenerative thermal oxidizer #30	10.86	8.53	0.027	363.15	N/A	56	24	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT1_PRO	Process Cooling Tower	465.00	N/A	N/A	322.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT2_PRO	Process Cooling Tower	465.00	N/A	N/A	322.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT3_PRO	Process Cooling Tower	465.00	N/A	N/A	322.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT4_PRO	Process Cooling Tower	465.00	N/A	N/A	322.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT5_PRO	Process Cooling Tower	465.00	N/A	N/A	322.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT6_PRO	Process Cooling Tower	465.00	N/A	N/A	322.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT7_PRO	Process Cooling Tower	465.00	N/A	N/A	322.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT8_PRO	Process Cooling Tower	465.00	N/A	N/A	322.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT1_SEC	Secondary Cooling Towers	200.00	N/A	N/A	308.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT2_SEC	Secondary Cooling Towers	200.00	N/A	N/A	308.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT3_SEC	Secondary Cooling Towers	200.00	N/A	N/A	308.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT4_SEC	Secondary Cooling Towers	200.00	N/A	N/A	308.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT5_SEC	Secondary Cooling Towers	200.00	N/A	N/A	308.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Moisture content based on saturate ambient air at 25'C and 101.3 kPa

Psat @25'C 3.297049777 kPa
3.25473818 MC vol %

Maritime Iron Pig Iron Facility Emissions - Flaring Event

The source characteristics for each source considered in the dispersion modelling are summarized in this sheet. The emission rates in kg/hr are calculated using the provided stack concentrations, flow rates and material speciation.
The non-criteria (contaminants aside from TSP, NOx and SO2) are estimated based on the composition of the dust emissions based on the material types handled in each area of the process (eg thermal coal, coke, quartz).

Equivalent source parameters are estimated here also, based on release orientation (based on Guidance from the Ontario MOE Dispersion Model Guide) and for the Flare (based on the Alberta Flare Model and provided flare gas properties).

Cells below containing light blue text indicates different formulae/calc methodology than the surrounding cells. Cells containing black text have similar formulae/calc methodology.

The assumed moisture content of the sources is based on saturated ambient air (at 1 atm and 25'C), based on the information provided by Maritime Iron.

Max hourly flare event emissions are based on the maximum hourly emissions expected during a flaring event where generated off-gas is flared when shut-downs of the Belledune power plant occur for extended periods.
The other sources are assumed to operate as during normal operation during the four hour period of the event.

Summary of Emissions

Release Orientation	Table ID	Source_ID	Process Area	Stack Flow		Stack Height (m)	Stack Diameter (m)	Exit Velocity (m/s)	Modelled Diameter (m)	Modelled Velocity (m/s)	Stack Temp K	Air Contaminant Emissions (kg/hr)																	
				Am3/s	Nm3/s							TSP	NOx	SO2	Hg	Fe2O3	CaO	SiO2	P2O5	TiO2	K2O	SO3	As	Cd	Cr	Cu	Ni	V	Zn
Vertical	15	CDA_STK	Cast House Dedusting System Stack (491K92) #15	291.35	222.82	24.00	5.56	12.00	5.56	12.00	373.15	4.0	0.0	0.0	0.0E+00	3.9E-03	1.0E+00	9.2E-01	4.0E-02	4.0E-03	4.0E-03	2.7E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	5	CP_STK3	Wet dedusting coal briqueting (593K10) #5	41.13	39.75	20.00	2.30	9.90	2.30	9.90	293.15	0.7	0.0	0.0	2.3E-08	8.0E-03	2.0E-02	4.6E-02	7.9E-04	7.2E-04	8.7E-04	7.0E-04	2.1E-06	1.4E-08	2.1E-07	5.7E-08	9.3E-08	1.3E-07	4.3E-07
Vertical	4	CP_STK2	Dry Coal Dedusting - coal briqueting (592K10) #4	5.13	4.08	20.00	0.80	10.20	0.80	10.20	358.15	0.1	0.0	0.0	2.5E-09	3.1E-04	2.6E-04	4.1E-03	7.3E-05	7.3E-05	8.8E-05	7.3E-05	2.2E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	27	HMPT_STK	Hot Metal Pre-treatment System De-dusting Filter #27	99.53	94.67	20.00	2.40	22.00	2.40	22.00	298	1.7	0.0	0.0	0.0E+00	5.7E-01	8.3E-01	6.6E-02	9.0E-03	1.7E-03	1.7E-03	1.7E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-05
Vertical	10	HCL_STK1	Various HCL Dedusting points (249K51) #10	20.02	16.38	16.00	1.20	17.70	1.20	17.70	348.15	0.3	3.3	1.4	1.2E-09	2.3E-01	1.9E-02	1.3E-02	2.9E-04	2.9E-04	3.1E-04	2.5E-04	2.3E-06	1.3E-06	1.8E-06	1.5E-07	1.5E-06	1.0E-05	1.8E-06
Vertical	9	HCL_STK2	HCL Bag Filter Unit (249K15) #9	31.28	16.88	18.00	1.50	17.70	1.50	17.70	533.15	0.3	0.0	0.0	1.3E-09	2.4E-01	1.9E-02	1.3E-02	3.0E-04	3.0E-04	3.2E-04	2.6E-04	2.4E-06	1.3E-06	1.9E-06	1.5E-07	1.6E-06	1.1E-05	1.9E-06
Vertical	6	OREDRYER	Bag filter unit for dry dedusting (127K12) #6	133.33	101.97	24.00	3.70	12.40	3.70	12.40	373.15	1.8	20.6	8.8	7.3E-09	1.5E+00	1.1E-01	9.9E-02	1.8E-03	1.8E-03	1.9E-03	1.6E-03	1.5E-05	8.3E-06	1.1E-05	8.8E-07	9.5E-06	6.7E-05	1.1E-05
Vertical	22	PCMSTK	Pig Casting Machine Dedusting filter (479K15) #22	106.03	81.09	21.00	3.00	15.00	3.00	15.00	373.15	1.5	16.3	7.0	0.0E+00	2.2E-06	3.9E-04	2.2E-02	1.5E-03	1.5E-03	1.5E-03	1.5E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-08
Horizontal	7	GRSTK1	Reactor Dedusting dry oxide handling (128K21) #7	15.04	14.54	26.00	1.20	13.30	6.00	0.53	293.15	0.3	0.0	0.0	1.0E-09	2.1E-01	1.5E-02	1.4E-02	2.6E-04	2.6E-04	2.8E-04	2.3E-04	2.1E-06	1.2E-06	1.6E-06	1.3E-07	1.4E-06	9.5E-06	1.6E-06
Vertical	BOP1	BOP1	existing transfer tower	1.70	1.65	10.00	0.35	17.70	0.35	17.70	293.15	0.0	0.0	0.0	1.5E-09	2.7E-02	1.6E-02	2.8E-02	3.0E-05	3.0E-05	5.9E-05	3.0E-05	2.7E-07	1.5E-07	5.3E-07	1.5E-07	2.4E-07	1.2E-06	4.4E-07
Vertical	BOP2	BOP2	New transfer tower	1.70	1.65	10.00	0.35	17.70	0.35	17.70	293.15	0.0	0.0	0.0	1.5E-09	2.7E-02	1.6E-02	2.8E-02	3.0E-05	3.0E-05	5.9E-05	3.0E-05	2.7E-07	1.5E-07	5.3E-07	1.5E-07	2.4E-07	1.2E-06	4.4E-07
Vertical	BOP3	BOP3	I/O, L/S, D/M Stockpile	20.02	19.35	30.00	1.20	17.70	1.20	17.70	293.15	0.3	0.0	0.0	7.0E-09	3.1E-01	1.8E-01	3.3E-01	3.5E-04	3.5E-04	7.0E-04	3.5E-04	3.1E-06	1.7E-06	6.3E-06	1.7E-06	2.8E-06	1.4E-05	5.2E-06
Vertical	BOP4	BOP4	Coal and Coke Stockpile	20.02	19.35	30.00	1.20	17.70	1.20	17.70	293.15	0.3	0.0	0.0	1.7E-08	1.7E-03	1.4E-03	2.4E-02	3.5E-04	3.5E-04	7.0E-04	3.5E-04	1.3E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	BOP5	BOP5	I/O, L/S, D/M Stockhouse	1.70	1.65	10.00	0.35	17.70	0.35	17.70	293.15	0.0	0.0	0.0	5.9E-10	2.7E-02	1.6E-02	2.8E-02	3.0E-05	3.0E-05	5.9E-05	3.0E-05	2.7E-07	1.5E-07	5.3E-07	1.5E-07	2.4E-07	1.2E-06	4.4E-07
Vertical	BOP6	BOP6	Coal Briquetting	2.82	2.72	10.00	0.45	17.70	0.45	17.70	293.15	0.0	0.0	0.0	2.4E-09	2.4E-04	2.0E-04	3.4E-03	4.9E-05	4.9E-05	9.8E-05	4.9E-05	1.9E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	16	CT1_CBT	slag granulation - ct1 #16	160.00	N/A	32.00	6.00	5.66	6.00	5.66	323.15	0.29	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	17	CT2_CBT	slag granulation ct2 #17	160.00	N/A	32.00	6.00	5.66	6.00	5.66	323.15	0.29	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	18	CT3_CBT	slag granulation ct3 #18	160.00	N/A	32.00	6.00	5.66	6.00	5.66	323.15	0.29	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	19	CT4_CBT	slag granulation ct4 #19	160.00	N/A	32.00	6.00	5.66	6.00	5.66	323.15	0.29	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	29	FLARE	#29	1628.50	350.84	106.11	1.60	-	7.06	41.58	1,273	50.5	70.7	23.1	6.5E-07	2.6E+01	2.1E+00	2.9E+00	5.1E-02	5.0E-02	5.6E-02	4.6E-02	3.0E-04	1.5E-04	2.1E-04	1.7E-05	1.7E-04	1.2E-03	2.1E-04
Vertical	3	CP_STK1	Coal Briquetting - Coal Dedusting For Receiving (591K10) #3	49.96	48.28	17.00	1.35	34.90	1.35	34.90	293.15	0.9	0.0	0.0	3.0E-08	3.6E-03	3.1E-03	4.9E-02	8.7E-04	8.7E-04	1.0E-03	8.7E-04	2.6E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	1	CF1	Ore Dedusting For Stock House (196K10) #1	28.86	27.89	18.00	1.75	12.00	1.75	12.00	293.15	0.5	0.0	0.0	2.0E-09	4.0E-01	2.9E-02	2.7E-02	5.0E-04	5.0E-04	5.3E-04	4.4E-04	4.0E-06	2.3E-06	3.1E-06	2.4E-07	2.6E-06	1.8E-05	3.1E-06
Vertical	2	CF2	Coal Dedusting For Stock House (198K10) #2	53.39	51.59	21.00	2.38	12.00	2.38	12.00	293.15	0.9	0.0	0.0	2.7E-08	3.8E-03	3.1E-03	6.0E-02	9.6E-04	9.2E-04	1.1E-03	9.2E-04	2.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Horizontal	12	MGS1	Dedusting System (393P01) #12	1.50	1.15	2.80	0.30	21.20	1.16	0.10	373.15	0.0	0.0	0.0	6.0E-10	8.5E-05	6.8E-05	1.3E-03	2.1E-05	2.0E-05	2.4E-05	2.0E-05	5.3E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	13	MGS2	Dedusting System (391K01) #13	10.84	10.47	97.00	1.00	13.80	1.00	13.80	293.15	0.2	0.0	0.0	5.4E-09	7.7E-04	6.2E-04	1.2E-02	1.9E-04	1.9E-04	2.2E-04	1.9E-04	4.9E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	30	CM_RTO	Water Treatment Regenerative thermal oxidizer #30	10.86	8.53	15.00	1.20	9.60	1.20	9.60	363.15	0.0	1.7	0.7	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	not in table	CT1_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15	0.16	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	not in table	CT2_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15	0.16	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	not in table	CT3_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15	0.16	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	not in table	CT4_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15	0.16	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	not in table	CT5_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15	0.16	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	not in table	CT6_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15	0.16	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	not in table	CT7_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15	0.16	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	not in table	CT8_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15	0.16	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	not in table	CT1_SEC	Secondary Cooling Towers	200.00	N/A	14.50	6.00	7.07	6.00	7.07	308.15	0.22	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	not in table	CT2_SEC	Secondary Cooling Towers	200.00	N/A	14.50	6.00	7.07	6.00	7.07	308.15	0.22	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	not in table	CT3_SEC	Secondary Cooling Towers	200.00	N/A	14.50	6.00	7.07	6.00	7.07	308.15	0.22	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	not in table	CT4_SEC	Secondary Cooling Towers	200.00	N/A	14.50	6.00	7.07	6.00	7.07	308.15	0.22	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Vertical	not in table	CT5_SEC	Secondary Cooling Towers	200.00	N/A	14.50	6.00	7.07	6.00	7.07	308.15	0.22	0.0	0.0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
											Max	50.52	70.73	23.13	6.52E-07	25.55	2.13	2.90	0.05	0.05	0.06	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
											Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											Avg	1.75	2.89	1.05	2.01E-08	0.74	0.11	0.12	0.00	1.65E-03	1.84E-03	2.12E-03	8.80E-06	4.16E-06	5.98E-06	5.31E-07	4.85E-06	3.34E-05	6.28E-06
											Total	68.08	112.65	41.10	7.83E-07	29.05	4.43	4.69	0.11	6.44E-02	7.16E-02	8.28E-02	3.43E-04	1.62E-04	2.33E-04	2.07E-05	1.89E-04	1.30E-03	2.45E-04

Modelled psuedo diameter and velocity for sources with horizontal release points estimated using Ontario MOE Guidance
(Air Dispersion Modelling Guideline for Ontario, February 2017 - https://files.ontario.ca/admgo-id50_aoda_v2b.pdf)

		Stack Flow		Assumed	Stack Temp	Air Contaminant Stack Concentrations (mg/Nm3)																	
Source ID	**Process Area**	**Am3/s**	**Nm3/s**	**Moisture**	**K**	**TSP**	**NOx**	**SO2**	**Hg**	**Fe2O3**	**CaO**	**SiO2**	**P2O5**	**TiO2**	**K2O**	**SO3**	**As**	**Cd**	**Cr**	**Cu**	**Ni**	**V**	**Zn**
CDA STK	Cast House Dedusting System Stack (491K92) #15	291.35	222.82	0.026	373.15	5	N/A	N/A	0	0.0048	1.28	1.147	0.0498	0.005	0.005	0.0338	0	0	0	0	0	0	0
CP STK3	Wet dedusting coal briqueting (593K10) #5	41.13	39.75	0.033	293.15	5	N/A	N/A	0.000000163	0.0556	0.13925	0.324	0.0055	0.00505	0.0061	0.0049	1.45E-05	1E-07	1.5E-06	4E-07	6.5E-07	9E-07	0.000003
CP STK2	Dry Coal Dedusting - coal briqueting (592K10) #4	5.13	4.08	0.027	358.15	5	N/A	N/A	0.00000017	0.021	0.018	0.28	0.005	0.005	0.006	0.005	1.52E-05	0	0	0	0	0	0
HMPT STK	Hot Metal Pre-treatment System De-dusting Filter #27	99.53	94.67	0.033	298	5	N/A	N/A	0	1.6625	2.4225	0.19375	0.026375	0.005	0.005	0.005	0	0	0	0	0	0	3.56E-05
HCL STK1	Various HCL Dedusting points (249K51) #10	20.02	16.38	0.028	348.15	5	56	24	2.075E-08	3.87165	0.315	0.2194	0.00495	0.00495	0.0053	0.0043	3.92E-05	2.22E-05	3.11E-05	2.55E-06	2.57E-05	0.000177	3.13E-05
HCL STK2	HCL Bag Filter Unit (249K15) #9	31.28	16.88	0.018	533.15	5	N/A	N/A	2.075E-08	3.87165	0.315	0.2194	0.00495	0.00495	0.0053	0.0043	3.92E-05	2.22E-05	3.11E-05	2.55E-06	2.57E-05	0.000177	3.13E-05
OREDRYER	Bag filter unit for dry dedusting (127K12) #6	133.33	101.97	0.026	373.15	5	56	24	0.00000002	3.9615	0.28905	0.2707	0.005	0.005	0.0053	0.0044	4.01E-05	2.26E-05	0.000031	2.4E-06	2.59E-05	0.000181	0.000031
PCMSTK	Pig Casting Machine Dedusting filter (479K15) #22	106.03	81.09	0.026	373.15	5	56	24	0	7.5E-06	0.001325	0.074975	0.0049975	0.0049975	0.005	0.004995	0	0	0	0	0	0	3.75E-08
GRSTK1	Reactor Dedusting dry oxide handling (128K21) #7	15.04	14.54	0.033	293.15	5	N/A	N/A	0.00000002	3.9615	0.28905	0.2707	0.005	0.005	0.0053	0.0044	4.01E-05	2.26E-05	0.000031	2.4E-06	2.59E-05	0.000181	0.000031
BOP1	existing transfer tower	1.70	1.65	0.033	293.15	5	N/A	N/A	0.00000025	4.5	2.65	4.75	0.005	0.005	0.01	0.005	0.000045	0.000025	0.00009	0.000025	0.00004	0.0002	0.000075
BOP2	New transfer tower	1.70	1.65	0.033	293.15	5	N/A	N/A	0.00000025	4.5	2.65	4.75	0.005	0.005	0.01	0.005	0.000045	0.000025	0.00009	0.000025	0.00004	0.0002	0.000075
BOP3	I/O, L/S, D/M Stockpile	20.02	19.35	0.033	293.15	5	N/A	N/A	0.0000001	4.5	2.65	4.75	0.005	0.005	0.01	0.005	0.000045	0.000025	0.00009	0.000025	0.00004	0.0002	0.000075
BOP4	Coal and Coke Stockpile	20.02	19.35	0.033	293.15	5	N/A	N/A	0.00000025	0.025	0.02	0.35	0.005	0.005	0.01	0.005	0.000019	0	0	0	0	0	0
BOP5	I/O, L/S, D/M Stockhouse	1.70	1.65	0.033	293.15	5	N/A	N/A	0.0000001	4.5	2.65	4.75	0.005	0.005	0.01	0.005	0.000045	0.000025	0.00009	0.000025	0.00004	0.0002	0.000075
BOP6	Coal Briquetting	2.82	2.72	0.033	293.15	5	N/A	N/A	0.00000025	0.025	0.02	0.35	0.005	0.005	0.01	0.005	0.000019	0	0	0	0	0	0
CT1 CBT	slag granulation - ct1 #16	160.00	N/A	N/A	323.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT2 CBT	slag granulation ct2 #17	160.00	N/A	N/A	323.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT3 CBT	slag granulation ct3 #18	160.00	N/A	N/A	323.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT4 CBT	slag granulation ct4 #19	160.00	N/A	N/A	323.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FLARE	#29	1628.50	350.84	0.008	1273	40	56	266	0.000000516	20.227	1.68916	2.2994	0.04048	0.03988	0.04438	0.03648	0.000241	0.000115	0.000162	1.34E-05	0.000134	0.000925	0.000163
CP STK1	Coal Briquetting - Coal Dedusting For Receiving (591K10) #3	49.96	48.28	0.033	293.15	5	N/A	N/A	0.00000017	0.021	0.018	0.28	0.005	0.005	0.006	0.005	1.52E-05	0	0	0	0	0	0
CF1	Ore Dedusting For Stock House (196K10) #1	28.86	27.89	0.033	293.15	5	N/A	N/A	0.00000002	3.9615	0.28905	0.2707	0.005	0.005	0.0053	0.0044	4.01E-05	2.26E-05	0.000031	2.4E-06	2.59E-05	0.000181	0.000031
CF2	Coal Dedusting For Stock House (198K10) #2	53.39	51.59	0.033	293.15	5	N/A	N/A	1.445E-07	0.02055	0.01655	0.3207	0.00515	0.00495	0.0059	0.00495	1.29E-05	0	0	0	0	0	0
MGS1	Dedusting System (393P01) #12	1.50	1.15	0.026	373.15	5	N/A	N/A	1.445E-07	0.02055	0.01655	0.3207	0.00515	0.00495	0.0059	0.00495	1.29E-05	0	0	0	0	0	0
MGS2	Dedusting System (391K01) #13	10.84	10.47	0.033	293.15	5	N/A	N/A	1.445E-07	0.02055	0.01655	0.3207	0.00515	0.00495	0.0059	0.00495	1.29E-05	0	0	0	0	0	0
CM RTO	Water Treatment Regenerative thermal oxidizer #30	10.86	8.53	0.027	363.15	N/A	56	24	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT1 PRO	Process Cooling Tower	465.00	N/A	N/A	322.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT2 PRO	Process Cooling Tower	465.00	N/A	N/A	322.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT3 PRO	Process Cooling Tower	465.00	N/A	N/A	322.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT4 PRO	Process Cooling Tower	465.00	N/A	N/A	322.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT5 PRO	Process Cooling Tower	465.00	N/A	N/A	322.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT6 PRO	Process Cooling Tower	465.00	N/A	N/A	322.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT7 PRO	Process Cooling Tower	465.00	N/A	N/A	322.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT8 PRO	Process Cooling Tower	465.00	N/A	N/A	322.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT1 SEC	Secondary Cooling Towers	200.00	N/A	N/A	308.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT2 SEC	Secondary Cooling Towers	200.00	N/A	N/A	308.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT3 SEC	Secondary Cooling Towers	200.00	N/A	N/A	308.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT4 SEC	Secondary Cooling Towers	200.00	N/A	N/A	308.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CT5 SEC	Secondary Cooling Towers	200.00	N/A	N/A	308.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Moisture content based on saturate ambient air at 25'C and 101.3 kPa

Psat @25'C 3.2970498 kPa
3.2547382 MC vol %

Maritime Iron Pig Iron Facility Emissions - Flaring Event Max Daily

The source characteristics for each source considered in the dispersion modelling are summarized in this sheet. The emission rates in kg/hr are calculated using the provided stack concentrations, flow rates and material speciation.
The non-criteria contaminants (contaminants aside from TSP, NOx and SO2) are estimated based on the composition of the dust emissions based on the material types handled in each area of the process (eg thermal coal, coke, quartz).

Equivalent source parameters are estimated here also, based on release orientation (based on Guidance from the Ontario MOE Dispersion Model Guide) and for the Flare (based on the Alberta Flare Model and provided flare gas properties).

Cells below containing light blue text indicates different formulae/calc methodology than the surrounding cells. Cells containing black text have similar formulae/calc methodology.

The assumed moisture content of the sources is based on saturated ambient air (at 1 atm and 25'C), based on the information provided by Maritime Iron.

Based on information provided by Maritime Iron a new 24hr flaring event scenario is considered, where NB Power has a short-term shut down (over 4 hours) resulting in flaring to occur until the Belledune power plant can accept produced gas.
As such all other sources operate continuously over the full 24 hour period. The 24-hour flare emissions are estimated assuming the event lasts for 4-hours and are prorated on that basis, and the pilot gas emissions
are assumed to occur the remainder of the 24 hour period, which are prorated and added to the prorated flare event emissions.

Summary of Emissions

Release Orientation	Table ID	Source_ID	Process Area	Stack Flow		Stack Height	Stack Diameter	Exit Velocity	Modelled Diameter	Modelled Velocity	Stack Temp
				Am3/s	Nm3/s	(m)	(m)	(m/s)	(m)	(m/s)	K
Vertical	15	CDA_STK	Cast House Dedusting System Stack (491K92) #15	291.35	222.82	24.00	5.56	12.00	5.56	12.00	373.15
Vertical	5	CP_STK3	Wet dedusting coal briqueting (593K10) #5	41.13	39.75	20.00	2.30	9.90	2.30	9.90	293.15
Vertical	4	CP_STK2	Dry Coal Dedusting - coal briqueting (592K10) #4	5.13	4.08	20.00	0.80	10.20	0.80	10.20	358.15
Vertical	27	HMPT_STK	Hot Metal Pre-treatment System De-dusting Filter #27	99.53	94.67	20.00	2.40	22.00	2.40	22.00	298
Vertical	10	HCL_STK1	Various HCL Dedusting points (249K51) #10	20.02	16.38	16.00	1.20	17.70	1.20	17.70	348.15
Vertical	9	HCL_STK2	HCL Bag Filter Unit (249K15) #9	31.28	16.88	18.00	1.50	17.70	1.50	17.70	533.15
Vertical	6	OREDRYER	Bag filter unit for dry dedusting (127K12) #6	133.33	101.97	24.00	3.70	12.40	3.70	12.40	373.15
Vertical	22	PCMSTK	Pig Casting Machine Dedusting filter (479K15) #22	106.03	81.09	21.00	3.00	15.00	3.00	15.00	373.15
Horizontal	7	GRSTK1	Reactor Dedusting dry oxide handling (128K21) #7	15.04	14.54	26.00	1.20	13.30	6.00	0.53	293.15
Vertical	BOP1	BOP1	existing transfer tower	1.70	1.65	10.00	0.35	17.70	0.35	17.70	293.15
Vertical	BOP2	BOP2	New transfer tower	1.70	1.65	10.00	0.35	17.70	0.35	17.70	293.15
Vertical	BOP3	BOP3	I/O, L/S, D/M Stockpile	20.02	19.35	30.00	1.20	17.70	1.20	17.70	293.15
Vertical	BOP4	BOP4	Coal and Coke Stockpile	20.02	19.35	30.00	1.20	17.70	1.20	17.70	293.15
Vertical	BOP5	BOP5	I/O, L/S, D/M Stockhouse	1.70	1.65	10.00	0.35	17.70	0.35	17.70	293.15
Vertical	BOP6	BOP6	Coal Briquetting	2.82	2.72	10.00	0.45	17.70	0.45	17.70	293.15
Vertical	16	CT1_CBT	slag granulation - ct1 #16	160.00	N/A	32.00	6.00	5.66	6.00	5.66	323.15
Vertical	17	CT2_CBT	slag granulation ct2 #17	160.00	N/A	32.00	6.00	5.66	6.00	5.66	323.15
Vertical	18	CT3_CBT	slag granulation ct3 #18	160.00	N/A	32.00	6.00	5.66	6.00	5.66	323.15
Vertical	19	CT4_CBT	slag granulation ct4 #19	160.00	N/A	32.00	6.00	5.66	6.00	5.66	323.15
Vertical	29	FLARE	#29	1628.50	350.84	106.11	1.60	-	7.06	41.58	1,273
Vertical	3	CP_STK1	Coal Briquetting - Coal Dedusting For Receiving (591K10) #3	49.96	48.28	17.00	1.35	34.90	1.35	34.90	293.15
Vertical	1	CF1	Ore Dedusting For Stock House (196K10) #1	28.86	27.89	18.00	1.75	12.00	1.75	12.00	293.15
Vertical	2	CF2	Coal Dedusting For Stock House (198K10) #2	53.39	51.59	21.00	2.38	12.00	2.38	12.00	293.15
Horizontal	12	MGS1	Dedusting System (393P01) #12	1.50	1.15	2.80	0.30	21.20	1.16	0.10	373.15
Vertical	13	MGS2	Dedusting System (391K01) #13	10.84	10.47	97.00	1.00	13.80	1.00	13.80	293.15
Vertical	30	CM_RTO	Water Treatment Regenerative thermal oxidizer #30	10.86	8.53	15.00	1.20	9.60	1.20	9.60	363.15
Vertical	not in table	CT1_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15
Vertical	not in table	CT2_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15
Vertical	not in table	CT3_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15
Vertical	not in table	CT4_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15
Vertical	not in table	CT5_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15
Vertical	not in table	CT6_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15
Vertical	not in table	CT7_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15
Vertical	not in table	CT8_PRO	Process Cooling Tower	465.00	N/A	17.00	6.00	16.45	6.00	16.45	322.15
Vertical	not in table	CT1_SEC	Secondary Cooling Towers	200.00	N/A	14.50	6.00	7.07	6.00	7.07	308.15
Vertical	not in table	CT2_SEC	Secondary Cooling Towers	200.00	N/A	14.50	6.00	7.07	6.00	7.07	308.15
Vertical	not in table	CT3_SEC	Secondary Cooling Towers	200.00	N/A	14.50	6.00	7.07	6.00	7.07	308.15
Vertical	not in table	CT4_SEC	Secondary Cooling Towers	200.00	N/A	14.50	6.00	7.07	6.00	7.07	308.15
Vertical	not in table	CT5_SEC	Secondary Cooling Towers	200.00	N/A	14.50	6.00	7.07	6.00	7.07	308.15

Source_ID	Air Contaminant Emissions (kg/hr)																	
	TSP	NOx	SO2	Hg	Fe2O3	CaO	SiO2	P2O5	TiO2	K2O	SO3	As	Cd	Cr	Cu	Ni	V	Zn
CDA_STK	4.0E+00	0.0E+00	0.0E+00	0.0E+00	3.9E-03	1.0E+00	9.2E-01	4.0E-02	4.0E-03	4.0E-03	2.7E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CP_STK3	7.2E-01	0.0E+00	0.0E+00	2.3E-08	8.0E-03	2.0E-02	4.6E-02	7.9E-04	7.2E-04	8.7E-04	7.0E-04	2.1E-06	1.4E-08	2.1E-07	5.7E-08	9.3E-08	1.3E-07	4.3E-07
CP_STK2	7.3E-02	0.0E+00	0.0E+00	2.5E-09	3.1E-04	2.6E-04	4.1E-03	7.3E-05	7.3E-05	8.8E-05	7.3E-05	2.2E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
HMPT_STK	1.7E+00	0.0E+00	0.0E+00	0.0E+00	5.7E-01	8.3E-01	6.6E-02	9.0E-03	1.7E-03	1.7E-03	1.7E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-05
HCL_STK1	2.9E-01	3.3E+00	1.4E+00	1.2E-09	2.3E-01	1.9E-02	1.3E-02	2.9E-04	2.9E-04	3.1E-04	2.5E-04	2.3E-06	1.3E-06	1.8E-06	1.5E-07	1.5E-06	1.0E-05	1.8E-06
HCL_STK2	3.0E-01	0.0E+00	0.0E+00	1.3E-09	2.4E-01	1.9E-02	1.3E-02	3.0E-04	3.0E-04	3.2E-04	2.6E-04	2.4E-06	1.3E-06	1.9E-06	1.5E-07	1.6E-06	1.1E-05	1.9E-06
OREDRYER	1.8E+00	2.1E+01	8.8E+00	7.3E-09	1.5E+00	1.1E-01	9.9E-02	1.8E-03	1.8E-03	1.9E-03	1.6E-03	1.5E-05	8.3E-06	1.1E-05	8.8E-07	9.5E-06	6.7E-05	1.1E-05
PCMSTK	1.5E+00	1.6E+01	7.0E+00	0.0E+00	2.2E-06	3.9E-04	2.2E-02	1.5E-03	1.5E-03	1.5E-03	1.5E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-08
GRSTK1	2.6E-01	0.0E+00	0.0E+00	1.0E-09	2.1E-01	1.5E-02	1.4E-02	2.6E-04	2.6E-04	2.8E-04	2.3E-04	2.1E-06	1.2E-06	1.6E-06	1.3E-07	1.4E-06	9.5E-06	1.6E-06
BOP1	3.0E-02	0.0E+00	0.0E+00	1.5E-09	2.7E-02	1.6E-02	2.8E-02	3.0E-05	3.0E-05	5.9E-05	3.0E-05	2.7E-07	1.5E-07	5.3E-07	1.5E-07	2.4E-07	1.2E-06	4.4E-07
BOP2	3.0E-02	0.0E+00	0.0E+00	1.5E-09	2.7E-02	1.6E-02	2.8E-02	3.0E-05	3.0E-05	5.9E-05	3.0E-05	2.7E-07	1.5E-07	5.3E-07	1.5E-07	2.4E-07	1.2E-06	4.4E-07
BOP3	3.5E-01	0.0E+00	0.0E+00	7.0E-09	3.1E-01	1.8E-01	3.3E-01	3.5E-04	3.5E-04	7.0E-04	3.5E-04	3.1E-06	1.7E-06	6.3E-06	1.7E-06	2.8E-06	1.4E-05	5.2E-06
BOP4	3.5E-01	0.0E+00	0.0E+00	1.7E-08	1.7E-03	1.4E-03	2.4E-02	3.5E-04	3.5E-04	7.0E-04	3.5E-04	1.3E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
BOP5	3.0E-02	0.0E+00	0.0E+00	5.9E-10	2.7E-02	1.6E-02	2.8E-02	3.0E-05	3.0E-05	5.9E-05	3.0E-05	2.7E-07	1.5E-07	5.3E-07	1.5E-07	2.4E-07	1.2E-06	4.4E-07
BOP6	4.9E-02	0.0E+00	0.0E+00	2.4E-09	2.4E-04	2.0E-04	3.4E-03	4.9E-05	4.9E-05	9.8E-05	4.9E-05	1.9E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT1_CBT	2.9E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT2_CBT	2.9E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT3_CBT	2.9E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT4_CBT	2.9E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
FLARE	8.4	12.7	3.9	1.1E-07	4.3	0.4	0.5	8.5E-03	8.4E-03	9.3E-03	7.7E-03	5.1E-05	2.4E-05	3.4E-05	2.8E-06	2.8E-05	1.9E-04	3.4E-05
CP_STK1	8.7E-01	0.0E+00	0.0E+00	3.0E-08	3.6E-03	3.1E-03	4.9E-02	8.7E-04	8.7E-04	1.0E-03	8.7E-04	2.6E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CF1	5.0E-01	0.0E+00	0.0E+00	2.0E-09	4.0E-01	2.9E-02	2.7E-02	5.0E-04	5.0E-04	5.3E-04	4.4E-04	4.0E-06	2.3E-06	3.1E-06	2.4E-07	2.6E-06	1.8E-05	3.1E-06
CF2	9.3E-01	0.0E+00	0.0E+00	2.7E-08	3.8E-03	3.1E-03	6.0E-02	9.6E-04	9.2E-04	1.1E-03	9.2E-04	2.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
MGS1	2.1E-02	0.0E+00	0.0E+00	6.0E-10	8.5E-05	6.8E-05	1.3E-03	2.1E-05	2.0E-05	2.4E-05	2.0E-05	5.3E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
MGS2	1.9E-01	0.0E+00	0.0E+00	5.4E-09	7.7E-04	6.2E-04	1.2E-02	1.9E-04	1.9E-04	2.2E-04	1.9E-04	4.9E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CM_RTO	0.0E+00	1.7E+00	7.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT1_PRO	1.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT2_PRO	1.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT3_PRO	1.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT4_PRO	1.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT5_PRO	1.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT6_PRO	1.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT7_PRO	1.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT8_PRO	1.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT1_SEC	2.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT2_SEC	2.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT3_SEC	2.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT4_SEC	2.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CT5_SEC	2.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Max	8.43	20.56	8.81	1.09E-07	4.26	1.03	0.92	0.04	0.01	0.01	2.7E-02	5.1E-05	2.4E-05	3.4E-05	2.8E-06	2.8E-05	1.9E-04	3.4E-05
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg	0.67	1.40	0.56	6.16E-09	0.20	0.07	0.06	1.7E-03	5.74E-04	6.39E-04	1.14E-03	2.30E-06	1.05E-06	1.59E-06	1.70E-07	1.24E-06	8.41E-06	1.88E-06
Total	26.0	54.6	21.8	2.4E-07	7.8	2.7	2.3	6.6E-02	2.2E-02	2.5E-02	4.4E-02	9.0E-05	4.1E-05	6.2E-05	6.6E-06	4.8E-05	3.3E-04	7.3E-05

Modelled psuedo diameter and velocity for sources with horizontal release points estimated using Ontario MOE Guidance
(Air Dispersion Modelling Guideline for Ontario, February 2017 - https://files.ontario.ca/admgo-id50_aoda_v2b.pdf)

		Stack Flow		Assumed Moisture Fraction	Stack Temp
Source_ID	**Process Area**	**Am3/s**	**Nm3/s**		**K**
CDA STK	Cast House Dedusting System Stack (491K92) #15	291.35	222.82	0.026	373.15
CP STK3	Wet dedusting coal briqueting (593K10) #5	41.13	39.75	0.033	293.15
CP STK2	Dry Coal Dedusting - coal briqueting (592K10) #4	5.13	4.08	0.027	358.15
HMPT STK	Hot Metal Pre-treatment System De-dusting Filter #27	99.53	94.67	0.033	298
HCL STK1	Various HCL Dedusting points (249K51) #10	20.02	16.38	0.028	348.15
HCL STK2	HCL Bag Filter Unit (249K15) #9	31.28	16.88	0.018	533.15
OREDRYER	Bag filter unit for dry dedusting (127K12) #6	133.33	101.97	0.026	373.15
PCMSTK	Pig Casting Machine Dedusting filter (479K15) #22	106.03	81.09	0.026	373.15
GRSTK1	Reactor Dedusting dry oxide handling (128K21) #7	15.04	14.54	0.033	293.15
BOP1	existing transfer tower	1.70	1.65	0.033	293.15
BOP2	New transfer tower	1.70	1.65	0.033	293.15
BOP3	I/O, L/S, D/M Stockpile	20.02	19.35	0.033	293.15
BOP4	Coal and Coke Stockpile	20.02	19.35	0.033	293.15
BOP5	I/O, L/S, D/M Stockhouse	1.70	1.65	0.033	293.15
BOP6	Coal Briquetting	2.82	2.72	0.033	293.15
CT1 CBT	slag granulation - ct1 #16	160.00	N/A	N/A	323.15
CT2 CBT	slag granulation ct2 #17	160.00	N/A	N/A	323.15
CT3 CBT	slag granulation ct3 #18	160.00	N/A	N/A	323.15
CT4 CBT	slag granulation ct4 #19	160.00	N/A	N/A	323.15
FLARE	#29	1628.50	350.84	0.008	1273
CP STK1	Coal Briquetting - Coal Dedusting For Receiving (591K10) #3	49.96	48.28	0.033	293.15
CF1	Ore Dedusting For Stock House (196K10) #1	28.86	27.89	0.033	293.15
CF2	Coal Dedusting For Stock House (198K10) #2	53.39	51.59	0.033	293.15
MGS1	Dedusting System (393P01) #12	1.50	1.15	0.026	373.15
MGS2	Dedusting System (391K01) #13	10.84	10.47	0.033	293.15
CM RTO	Water Treatment Regenerative thermal oxidizer #30	10.86	8.53	0.027	363.15
CT1 PRO	Process Cooling Tower	465.00	N/A	N/A	322.15
CT2 PRO	Process Cooling Tower	465.00	N/A	N/A	322.15
CT3 PRO	Process Cooling Tower	465.00	N/A	N/A	322.15
CT4 PRO	Process Cooling Tower	465.00	N/A	N/A	322.15
CT5 PRO	Process Cooling Tower	465.00	N/A	N/A	322.15
CT6 PRO	Process Cooling Tower	465.00	N/A	N/A	322.15
CT7 PRO	Process Cooling Tower	465.00	N/A	N/A	322.15
CT8 PRO	Process Cooling Tower	465.00	N/A	N/A	322.15
CT1 SEC	Secondary Cooling Towers	200.00	N/A	N/A	308.15
CT2 SEC	Secondary Cooling Towers	200.00	N/A	N/A	308.15
CT3 SEC	Secondary Cooling Towers	200.00	N/A	N/A	308.15
CT4 SEC	Secondary Cooling Towers	200.00	N/A	N/A	308.15
CT5 SEC	Secondary Cooling Towers	200.00	N/A	N/A	308.15

Moisture content based on saturate ambient air at 25'C and 101.3 kPa

Psat @25'C	3.2970498	kPa
	3.2547382	MC vol %

Operating Schedule - Batch Process Souces that are not expected to not operate continuously

Source	ID	Group	Hour of Day																								total hours per day
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
15	CDA_STK	CDA	1	1	1	0.5	0	0	0	1	1	1	0.5	0	1	1	1	0.5	0	0	0	1	1	1	0.5	0	14
27	HMPT_STK	HMPT	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	18
22	PCMSTK	PCM	1	1	1	1	0.5	0	0	0	1	1	1	1	1	1	1	1	0.5	0	0	0	1	1	1	1	17

Operating Schedules provided by Maritime Iron

Cast House Dedusting System Stack (491K92) #15 – dust emissions

While the air fan associated with this system may run 24hours, 7days/week, the tapping operation which allows molten iron & slag material to flow within the Cast House, and hence the source of dust emissions is a batch process. The model is to consider an averaging factor for the batch operation will be for cumulatively only 14hours out of 24hour day.

This would approximately happen as follows: 7am-8am No Tapping, 8am Tapping Operation #1 starts and molten iron & slag material flows, 11:30am Tapping Operation #1 stops (material flow stops), 11:30am to 1pm No Tapping, 1pm Tapping Operation #2 starts, 4:30pm Tapping Operation #2 stops, 4:30pm to 7pm No Tapping. Repeat for 7pm to 7am.

Bag filter unit for dry dedusting (127K12) #6 – dust and combustion gas emissions

This operation can be considered to be continuous 24h/day normal operating mode at this time.

Hot Metal Pre-treatment System De-dusting Filter #27 – dust emissions

While the air fan associated with this system may run 24hours, 7days/week, the KR operation within the HMPS (which is only used during HPI production – so approximately 2,378 annual operating hours vs remainder being MPI production), and hence the source of dust emissions is a batch process. The model is to consider an averaging factor for this HPI batch operation which will be for cumulatively only 18hours out of 24hour day (for 100 days/year).

The HPI batch operation would approximately happen as follows: 7am to 9am No KR operation (no dust generation), 9am to 6pm KR operations completed in near continuous operation that results in dust generation, 6pm to 7pm No KR operation, Repeat for 7pm to 7am.

Pig Casting Machine Dedusting filter (479K15) #22 – dust and combustion gas emissions

While the air fan associated with this system may run 24hours, 7days/week, the Pig Casting Machine operation which involves the pouring of molten iron material (regardless of HPI or MPI production), and hence the source of dust, SOx, NOx emissions is a batch process. The model is to consider an averaging factor for the batch operation will be for cumulatively only 17hours out of 24hour day.

The Pig Casting operation would approximately happen as follows: 7am to 9am No Casting operation (no dust, SOx, NOx emissions), 9am to 5:30pm Casting operations completed in near continuous operation that results in dust, SOx, NOx emissions, 5:30pm to 7pm No Casting operation, Repeat for 7pm to 7am. This is for MPI operation, for HPI operation the start/stop timing would be shifted by 1 hour (10am to 6:30pm).

Flare – during flaring event – dust and combustion gas emissions

The pilot gas (LPG(Propane)) to the flare will be a continuous 24h/day normal operating mode. The separate flare event where the large amount of off gas is sent to the flare can be expected to occur for up to 4 hours which will allow for an orderly plant shutdown. Therefore, the model is to consider these as two separate modes of operation and presumably two separate model runs.

The separate flare event is unplanned and could start at any time during a 24h window.

Maritime Iron Pig Iron Facility Emissions

Stack concentrations are summarized in this worksheet from the provided information (from Maritime Iron) from the Emissions Tables. Concentrations of trace metals/compounds are estimated here based typical dust composition from a given area of the process (eg coal dust, dolomite, limestone) and the expected trace compound concentrations provided.

Stack concentrations for the transfer point sources (BOP) are based on the material resulting in the maximum contaminant concentration (these cells contain light blue text).
The varying text colour indicates different formulae/calc methodology than the surrounding cells. Cells containing black text have similar formulae/calc methodolgy.

Summary of Stack Concentrations

			Air Contaminant Stack Concentrations (mg/Nm3)																		
Table ID	**Source_ID**	**Process Area**	**TSP**	**NOx**	**SO2**	**Hg**	**Fe2O3**	**CaO**	**SiO2**	**P2O5**	**TiO2**	**K2O**	**SO3**	**As**	**Cd**	**Cr**	**Cu**	**Ni**	**V**	**Zn**
15	CDA_STK	Cast House Dedusting System Stack (491K92) #15	<5	N/A	N/A	0	0.0048	1.28	1.15	0.0498	0.0050	0.0050	0.0338	0	0	0	0	0	0	0
5	CP_STK3	Wet dedusting coal briqueting (593K10) #5	<5	N/A	N/A	1.63E-07	0.0556	0.14	0.32	0.0055	0.0051	0.0061	0.0049	1.45E-05	1.00E-07	1.50E-06	4.00E-07	6.50E-07	9.00E-07	3.00E-06
4	CP_STK2	Dry Coal Dedusting - coal briqueting (592K10) #4	<5	N/A	N/A	1.70E-07	0.0210	0.0180	0.28	0.0050	0.0050	0.0060	0.0050	1.52E-05	0	0	0	0	0	0
27	HMPT_STK	Hot Metal Pre-treatment System De-dusting Filter #27	<5	N/A	N/A	0	1.66	2.42	0.19	0.0264	0.0050	0.0050	0.0050	0	0	0	0	0	0	3.56E-05
10	HCL_STK1	Various HCL Dedusting points (249K51) #10	<5	<56	<24	2.08E-08	3.87165	0.32	0.22	0.0050	0.0050	0.0053	0.0043	3.92E-05	2.22E-05	3.11E-05	2.55E-06	2.57E-05	1.77E-04	3.13E-05
9	HCL_STK2	HCL Bag Filter Unit (249K15) #9	<5	N/A	N/A	2.08E-08	3.87165	0.32	0.22	0.0050	0.0050	0.0053	0.0043	3.92E-05	2.22E-05	3.11E-05	2.55E-06	2.57E-05	1.77E-04	3.13E-05
6	OREDRYER	Bag filter unit for dry dedusting (127K12) #6	<5	<56	<24	2.00E-08	3.96	0.29	0.27	0.0050	0.0050	0.0053	0.0044	4.01E-05	2.26E-05	3.10E-05	2.40E-06	2.59E-05	1.81E-04	3.10E-05
22	PCMSTK	Pig Casting Machine Dedusting filter (479K15) #22	<5	<56	<24	0	7.50E-06	0.0013	0.074975	0.0050	0.0050	0.0050	0.0050	0	0	0	0	0	0	3.75E-08
7	GRSTK1	Reactor Dedusting dry oxide handling (128K21) #7	<5	N/A	N/A	2.00E-08	3.96	0.29	0.27	0.0050	0.0050	0.0053	0.0044	4.01E-05	2.26E-05	3.10E-05	2.40E-06	2.59E-05	1.81E-04	3.10E-05
BOP1	BOP1	existing transfer tower	<5	N/A	N/A	2.50E-07	4.50	2.65	4.75	0.0050	0.0050	0.0100	0.0050	4.50E-05	2.50E-05	9.00E-05	2.50E-05	4.00E-05	2.00E-04	7.50E-05
BOP2	BOP2	New transfer tower	<5	N/A	N/A	2.50E-07	4.50	2.65	4.75	0.0050	0.0050	0.0100	0.0050	4.50E-05	2.50E-05	9.00E-05	2.50E-05	4.00E-05	2.00E-04	7.50E-05
BOP3	BOP3	I/O, L/S, D/M Stockpile	<5	N/A	N/A	1.00E-07	4.50	2.65	4.75	0.0050	0.0050	0.0100	0.0050	4.50E-05	2.50E-05	9.00E-05	2.50E-05	4.00E-05	2.00E-04	7.50E-05
BOP4	BOP4	Coal and Coke Stockpile	<5	N/A	N/A	2.50E-07	0.0250	0.02	0.35	0.0050	0.0050	0.0100	0.0050	1.90E-05	0	0	0	0	0	0
BOP5	BOP5	I/O, L/S, D/M Stockhouse	<5	N/A	N/A	1.00E-07	4.50	2.65	4.75	0.0050	0.0050	0.0100	0.0050	4.50E-05	2.50E-05	9.00E-05	2.50E-05	4.00E-05	2.00E-04	7.50E-05
BOP6	BOP6	Coal Briquetting	<5	N/A	N/A	2.50E-07	0.0250	0.02	0.35	0.0050	0.0050	0.0100	0.0050	1.90E-05	0	0	0	0	0	0
16	CT1_CBT	slag granulation - ct1 #16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
17	CT2_CBT	slag granulation ct2 #17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18	CT3_CBT	slag granulation ct3 #18	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
19	CT4_CBT	slag granulation ct4 #19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
29	FLARE	#29	<40	<56	266	5.16E-07	20.23	1.69	2.30	0.0405	0.0399	0.0444	0.0365	2.41E-04	1.15E-04	1.62E-04	1.34E-05	1.34E-04	9.25E-04	1.63E-04
3	CP_STK1	Coal Briquetting - Coal Dedusting For Receiving (591K10) #3	<5	N/A	N/A	1.70E-07	0.0210	0.0180	0.28	0.0050	0.0050	0.0060	0.0050	1.52E-05	0	0	0	0	0	0
1	CF1	Ore Dedusting For Stock House (196K10) #1	<5	N/A	N/A	2.00E-08	3.96	0.29	0.27	0.0050	0.0050	0.0053	0.0044	4.01E-05	2.26E-05	3.10E-05	2.40E-06	2.59E-05	1.81E-04	3.10E-05
2	CF2	Coal Dedusting For Stock House (198K10) #2	<5	N/A	N/A	1.45E-07	0.0206	0.0166	0.32	0.0052	0.0050	0.0059	0.0050	1.29E-05	0	0	0	0	0	0
12	MGS1	Dedusting System (393P01) #12	<5	N/A	N/A	1.45E-07	0.0206	0.0166	0.32	0.0052	0.0050	0.0059	0.0050	1.29E-05	0	0	0	0	0	0
13	MGS2	Dedusting System (391K01) #13	<5	N/A	N/A	1.45E-07	0.0206	0.0166	0.32	0.0052	0.0050	0.0059	0.0050	1.29E-05	0	0	0	0	0	0
30	CM_RTO	Water Treatment Regenerative thermal oxidizer #30	N/A	<56	<24	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
not in table	CT1_PRO	Process Cooling Tower	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
not in table	CT2_PRO	Process Cooling Tower	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
not in table	CT3_PRO	Process Cooling Tower	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
not in table	CT4_PRO	Process Cooling Tower	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
not in table	CT5_PRO	Process Cooling Tower	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
not in table	CT6_PRO	Process Cooling Tower	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
not in table	CT7_PRO	Process Cooling Tower	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
not in table	CT8_PRO	Process Cooling Tower	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
not in table	CT1_SEC	Secondary Cooling Towers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
not in table	CT2_SEC	Secondary Cooling Towers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
not in table	CT3_SEC	Secondary Cooling Towers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
not in table	CT4_SEC	Secondary Cooling Towers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
not in table	CT5_SEC	Secondary Cooling Towers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Cooling Tower Emissions Calculations

Cooling tower drift and PM emissions are calculated here using the US EPA AP-42 Emission Factors (Ch 13.4) and information provided by Maritime Iron, including cooling water circulation flow rates and estimated total dissolved solids (TDS) concentrations.

Drift Emissions Calculations

Cooling Tower	Circulating Water Flow per cell (USGal/hr)	Drift Losses		Total Dissolved Solids (TDS)	PM Emissions (kg/hr)	
		(USGal/hr)	(kg/hr)	ppm	EF Basis	TDS Basis
Process CTs	221,561	44.31	167.5	961.5	1.91	0.16
Secondary CTs	309,524	61.90	234	961.5	2.67	0.22
Slag Granulation CTs	33,069	6.61	25	3205	0.29	0.08

1 microsiemen/centimetre (us/cm) electrical current (EC) = 0.641 ppm TDS
PM emissions for the Process and secondary CTs used in the model are based on the vlaues estimated using TDS provided by Maritime Iron, emissions also estimated using US EPA AP-42 emission factor basis for the slag granulation CTs as TDS info is not available for these CTs. PM emissions from the process and secondary CTs are also estimated using Efs for comparison with the TDS based estimates.

Exhaust Gas Velocity Calcs

Cooling Tower	Air Flow per cell (Am3/s)	Diamerter (m)	Velocity (m/s)
Process CTs	465	6.0	16.45
Secondary CTs	200	6.0	7.07
Slag Granulation CTs	160	6.0	5.66

AP-42 Emission Factors - Chapter 13.4 Wet Cooling Towers

Table 13.4-1 (Metric And English Units). PARTICULATE EMISSIONS FACTORS FOR WET COOLING TOWERSa

Tower Typed	Total Liquid Driftb				PM-10c		
	Circulating Water Flowb	g/daL	lb/103 gal	EMISSION FACTOR	g/daLe	lb/103 gal	EMISSION FACTOR RATING
Induced Draft (SCC 3-85-001-01, 3-85-001-20, 3-85-002-01)	0.020	2.0	1.7	D	0.023	0.019	E —
Natural Draft (SCC 3-85-001-02, 3-85-002-02)	0.00088	0.088	0.073	E	ND	ND	

a References 1-17. Numbers are given to 2 significant digits. ND = no data. SCC = Source Classification Code.
b References 2,5-7,9-10,12-13,15-16. Total liquid drift is water droplets entrained in the cooling tower exit air stream. Factors are for % of circulating water flow (10-2 L drift/L [10-2 gal drift/gal] water flow) and g drift/daL (lb drift/103 gal) circulating water flow. 0.12 g/daL = 0.1 lb/103 gal; 1 daL = 101 L.
c See discussion in text on how to use the table to obtain PM-10 emission estimates. Values shown above are the arithmetic average of test results from References 2,4,8, and 11-14, and they imply an effective TDS content of approximately 12,000 parts per million (ppm) in the circulating water.
d See Figure 13.4-1 and Figure 13.4-2. Additional SCCs for wet cooling towers of unspecified draft type are 3-85-001-10 and 3-85-002-10.
e Expressed as g PM-10/daL (lb PM-10/103 gal) circulating water flow.

Available online: https://www3.epa.gov/ttn/chief/ap42/ch13/final/c13s04.pdf

Cooling Tower Operational Information

Process Cooling Tower (831H01)
Total circulating water flow = 6,700 m3/h @ 49C Normal Operation, 8,000 m3/h @ 53C Maximum Design
Number of cells = 8 (maximum design = 1,000m3/h water per cell)
Air flow per cell = 465 m3/s (very preliminary approximation at maximum design)
Circulating water TDS = 1,000 to 2,000 uS/cm (assumed expected range of operation)

Secondary Cooling Tower (829H01)
Total circulating water flow = 5,850 m3/h @ 35C Normal Operation, 6,500 m3/h @ 40C Maximum Design
Number of cells = 5 (maximum design = 1,300m3/h water per cell)
Air flow per cell = 200 m3/s (very preliminary approximation at maximum design)
Circulating water TDS = 1,000 to 2,000 uS/cm (assumed expected range of operation)

Slag Granulation Cooling Tower (466H01)
Total circulating water flow = 500 m3/h @ 85C Maximum Design
Number of cells = 4 (maximum design = 125m3/h water per cell)
Air flow per cell = 160 m3/s (very preliminary approximation at maximum design)
Circulating water TDS = Assume 5,000 uS/cm*
*This cooling tower is a non-traditional operation. The only usage is spraying of cooled water from the cooling tower basin onto hot molten slag in the open air slag pit. Any remaining hot water runoff is collected into a settling pond (where solid particles will collect at bottom), overflow water from settling pond enters hot water pond where water is pumped back to the top of the cooling tower. There is no blowdown from this system. Make-up water is required due to losses from the cooling tower and losses from evaporation in the slag pit.

PS – The above information is partially based on information previously available from PEC with the remainder being preliminary approximation by myself.
If any additional information happens to be supplied from PEC in the future, then the above information could be updated.

Info provided by Richard Gaspari - Maritime Iron email received Dec 11, 2018

Flare Emissions calculations - Flare Event

CALCULATION SHEET FOR FLARES

VER. 3.0

USER SUPPLIED INPUTS (GREY CELLS)

Total Gas Flow Rate at Reference Temperature (m^3/s):	88.3889	
Actual Stack Diameter (m)	1.6	
Stack Height (m):	70.0	
Heat Radiation Loss (%)	25	
Conversion Efficiency for SO_2 (%)	100	all S as SO2 in flare gas feed
Ambient Temperature (K):	277.14	An Avg temp at Belledune (1971-2000 Cliimate Normals)
Standard Temperature (K):	293	

Gas Component	Gas Fraction	Gas Flow Rate	Low Heat Value at 15.6C and 101.3kPa	Heat Release
		m^3/s	MJ/m^3	MJ/s
CO	0.382	33.7646	12.4	419.56
CO2	0.277	24.4837	0.0	0
H2	0.162	14.319	10.1	144.63
H2O	0.064	5.65689	0.0	0
CH4	0.012	1.06067	32.8	34.796
N2	0.103	9.10406	0.0	0
SO2 (ppm)	0.000093	0.00822	0.0	0
		0		0
		0		0
		0		0
			Total Heat Release Rate (MJ/s)	598.98

Total Heating Value (MJ/m^3)	6.7767
Total Heat Release Rate (cal/s)	1E+08
Buoyancy Flux (m^4/s^3)	3976.5

ADDITIONAL NUMBERS FOR INPUT INTO ISC3 MODEL OR SCREEN3 AS POINT SOURCE OPTION

Equivalent Stack temperature (K):	1,273
Actual Exit Velocity (m/s):	41.6
Effective Stack Height (m)	106.1
Equivalent Stack Diameter (m):	7.062
Emission Rate of SO_2 (g/s):	23.134

Flaring information provided by Maritime Iron - Email from Richard Gaspari dated Dec 11, 2018

1. The flare will be open flame.

2. During operation of the plant, the flare (pilot burner) will be kept lit by LPG (100% propane composition) at minimal flow.

3. The flare would only be required to operate if the off-gas flow to NB Power's Belledune Generating Station could not be consumed (i.e. an operation interruption occurs at NB Power). In this situation, the off-gas normally sent to NB Power would be diverted to the flare. Depending on the nature of the NB Power interruption, and the expected timing for NB Power to return to normal operation again, the off-gas would continue to be sent to flare. However, since the plant will generally require up to 4 hours of continued operation to prepare for an orderly shutdown (required to deal with the molten iron within the plant's equipment), it is expected that the maximum duration for off-gas flaring can be considered 4 hours (i.e. the plant would not continue to operate beyond 4 hours if NB Power could not accept the off-gas). During this 4 hour period, the generation of off-gas, and thus the off-gas sent to the flare, will be reduced in an approximately step-wise fashion until shutdown (it can be assumed 25% reduction of the original off-gas generation flow after each hour – 100% during first hour, 75% during second hour, 50% during third hour, and 25% during fourth hour).

4. It can be assumed that an operation interruption at NB Power would occur (at most) only 1 time per year.

5. The normal off-gas flow to NB Power (FINEX Export Gas (FEG)) and composition as per PEC's Rev.B H&MB information would be per the following:

Off-Gas to NB Power	OPTION-A	OPTION-B	Density	LHV
FINEX Export Gas (FEG) Flow (Nm3/h)	318,200	317,600	(kg/m3)	(MJ/kg)
FINEX Export Gas (FEG) Calorific Value (kcal/Nm3)	1,679	1,567		
FINEX Export Gas (FEG) Composition (vol%)				
CO	38.2	34.8	1.14	10.9
CO2	27.7	30.8	1.98	0
H2	16.2	16.1	0.0841	120.1
H2O	6.4	6.4	1.27	0
CH4	1.2	1.2	0.656	50.009
N2	10.3	10.9	1.165	0
SO2 (ppm)	93	93	2.279	0

(SO2 - 93 ppm ~ 266 mg/Nm3) added from Email from Richard Gaspari - Feb 8, 2019

note this assumption is conservative and is not expected to occur every year, it is not part of our expected typical operating year, but is to be considered for modelling / permitting purposes because it can happen in any given year.

Regarding the typical operating year of our plant, the following summary is provided:

Normal Operation will be 95% Full Operation = 8,322 hr/year

Shutdowns that are initiated by Maritime:

- Scheduled / Planned Long (100 hr) Shutdown = Approx. 1 every 6 months = 2 x 100 = 200 hr/year total
- Scheduled / Planned Short (36 hr) Shutdown = Approx. 1 every 2 months = 5 x 36 = 180 hr/year total
- Un-Scheduled / Un-Planned Shutdown = Expect at least 1 per year = 58 hr/year total
- Emergency Shutdown = None expected (no occurrences based on existing POSCO plant operation since start-up)

Shutdowns that are initiated by Maritime will not result in flaring as the off-gas flow would still be accepted by NB Power even while the off-gas flow decreases until it stops altogether; and NB Power would correspondingly switch and ramp-up use of alternate fuel source(s) to maintain required power generation during a Maritime shutdown.

Note that if an NB Power interruption occurred during a given year, Maritime would use the forced shutdown as an opportunity to pull forward and complete the next scheduled short or long shutdown early in order to maintain the overall annual target of 95% full operation.

Flare Emissions calculations - Pilot

CALCULATION SHEET FOR FLARES

VER. 3.0

USER SUPPLIED INPUTS (GREY CELLS)

Total Gas Flow Rate at Reference Temperature (m^3/s):	0.1153	
Actual Stack Diameter (m)	1.6	
Stack Height (m):	70.0	
Heat Radiation Loss (%)	25	
Conversion Efficiency for SO_2 (%)	99	
Ambient Temperature (K):	277.14	An Avg temp at Belledune (1971-2000 Cliimate Normals)
Standard Temperature (K):	293	

Gas Component	Gas Fraction	Gas Flow Rate	Low Heat Value at 15.6C and 101.3kPa	Heat Release	
		m^3/s	**MJ/m^3**	**MJ/s**	
Propane (C3H8)	0.945	0.1089375	88.3	9.6236	
Ethane (C2H6)	0.025	0.00288194	60.7	0.175	
1-Propene (C3H6)	0.025	0.00288194	81.3	0.2342	
Butane (C4H10)	0.0125	0.00144097	110.9	0.1598	
Ethyl Mercaptan (C2H6S)	0.000025	2.8819E-06	-	neg	heat of combustion assumed neg given small fraction of ehtly mercatan
			Total Heat Release Rate (MJ/s)	10.193	

Total Heating Value (MJ/m^3)	88.419
Total Heat Release Rate (cal/s)	2E+06
Buoyancy Flux (m^4/s^3)	67.667

ADDITIONAL NUMBERS FOR INPUT INTO ISC3 MODEL OR SCREEN3 AS POINT SOURCE OPTION

Equivalent Stack temperature (K):	1,273
Actual Exit Velocity (m/s):	0.1
Effective Stack Height (m)	75.2
Equivalent Stack Diameter (m):	25.507
Emission Rate of SO_2 (g/s):	0.008

Pilot Flaring information provided by Maritime Iron - Email from Richard Gaspari dated Mar 11, 2019

5. LPG info provided/assumed as follows:

LPG Pilot Gas		LHV
LPG Max Flow (Nm3/h)	415	(KJ/m3)
LPG Composition (vol%)		
Propane (C3H8)	94.5	88341
Ethane (C2H6)	2.5	60732
1-Propene (C3H6)	2.5	81262
Butane (C4H10)	1.25	110920
Ethyl Mercaptan (C2H6S)	0.0025	-

LHV from: https://www.engineeringtoolbox.com/heating-values-fuel-gases-d_823.html

Regarding the typical operating year of our plant, the following summary is provided:
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Shutdowns that are initiated by Maritime:
Scheduled / Planned Long (100 hr) Shutdown = Approx. 1 every 6 months = 2 x 100 = 200 hr/year total
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Emergency Shutdown = None expected (no occurrences based on existing POSCO plant operation since start-up)
Shutdowns that are initiated by Maritime will not result in flaring as the off-gas flow would still be accepted by NB Power even while the off-gas flow decreases until it stops altogether; and NB Power would correspondingly switch and ramp-up use of alternate fuel source(s) to maintain required power generation during a Maritime shutdown.

Note that if an NB Power interruption occurred during a given year, Maritime would use the forced shutdown as an opportunity to pull forward and complete the next scheduled short or long shutdown early in order to maintain the overall annual target of 95% full operation.

US EPA AP-42 Emission Factors - Chapter 13.5 Industrial Flaring

Contaminant	**Emission Fator**	**Unit**	**Calculated Emission Rate (kg/hr)**
NOX	0.068	lb/MMBTU	1.074985182
PM (soot)	40	ug/L	0.0166

1 MJ = 947.8171 BTU

https://www3.epa.gov/ttn/chief/ap42/ch13/final/C13S05_02-05-18.pdf

Dust Component Mass Fractions

The modelled component concentrations in dust for each material/feedstock (as provided by Maritime Iron) are summarized here.

Mass Fractions	Hg	Fe2O3	CaO	SiO2	P2O5	TiO2	K2O	SO3	As	Cd	Cr	Cu	Ni	V	Zn
Fine Iron Ore	2.5E-09	0.9	0.005	0.048	0.001	0.001	0.001	0.001	9.0E-06	5.0E-06	5.0E-06	0	5.0E-06	4.0E-05	5.0E-06
Thermal Coal	0.00000005	0.001	0.002	0.06	0.001	0.001	0.002	0.001	0	0	0	0	0	0	0
Semi-Soft Coking Coal	0.00000003	0.005	0.004	0.055	0.001	0.001	0.001	0.001	3.8E-06	0	0	0	0	0	0
Coke	0	0.005	0.002	0.07	0.001	0.001	0.001	0.001	0	0	0	0	0	0	0
Limestone (Fine & Lumpy)	0.00000002	0.003	0.53	0.02	0.001	0.001	0.002	0	7.0E-07	1.0E-06	1.2E-05	3.0E-06	5.0E-06	1.0E-06	1.5E-05
Dolomite (Fine & Lumpy)	0.00000001	0.002	0.36	0.02	0.001	0.001	0.001	0	1.0E-06	1.0E-06	1.8E-05	5.0E-06	8.0E-06	1.7E-05	1.5E-05
Quartz	0	0	0.001	0.95	0	0	0	0	0	0	0	0	0	0	0
Starch	0	0.001	0.001	0.001	0.002	0.001	0.0015	0.001	0	0	0	0	0	0	0
Burnt Lime	0	0	0.92	0.03	0.001	0.001	0.001	0.001	0	0	0	0	0	0	1.5E-05
Sinter Ore Powder	0	0.7	0.1	0.05	0.01	0.001	0.001	0.001	0	0	0	0	0	0	0
Lime Powder	0	0.003	0.53	0.02	0.001	0.001	0.002	0	0	0	0	0	0	0	1.5E-05
Graphite Powder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron Dust	0	0	0	0.015	0.001	0.001	0.001	0.001	0	0	0	0	0	0	0
Slag Dust	0	0.0015	0.4	0.35	0.015	0.001	0.001	0.01	0	0	0	0	0	0	0

	Hg	Fe2O3	CaO	SiO2	P2O5	TiO2	K2O	SO3	As	Cd	Cr	Cu	Ni	V	Zn
Concentration	**ppmw**	**wt%**	**wt%**	**wt%**	**wt%**	**wt%**	**wt%**	**wt%**	**ppmw**	**ppmw**	**ppmw**	**ppmw**	**ppmw**	**ppmw**	**ppmw**
Fine Iron Ore	<0.0025	90	0.5	4.8	0.1	<0.1	<0.1	<0.1	9	<5	<5	0	<5	40	5
Thermal Coal	0.05	<0.1	0.2	6	<0.1	<0.1	0.2	<0.1	0	0	0	0	0	0	0
Semi-Soft Coking Coal	0.03	0.5	0.4	5.5	<0.1	<0.1	<0.1	<0.1	3.8	0	0	0	0	0	0
Coke	0	0.5	0.2	7	<0.1	<0.1	<0.1	<0.1	0	0	0	0	0	0	0
Limestone (Fine & Lumpy)	0.02	0.3	53	2	<0.1	<0.1	0.2	n/a	0.7	<1	12	3	5	1	15
Dolomite (Fine & Lumpy)	0.01	0.2	36	2	<0.1	<0.1	0.1	n/a	1	<1	18	5	8	17	15
Quartz	0	n/a	0.1	95	n/a	n/a	n/a	n/a	0	0	0	0	0	0	0
Starch	0	<0.1	<0.1	0.1	0.2	<0.1	0.15	<0.1	0	0	0	0	0	0	0
Burnt Lime	0	n/a	92	3	<0.1	<0.1	<0.1	<0.1	0	0	0	0	0	0	15
Sinter Ore Powder	0	70	10	5	1	<0.1	<0.1	<0.1	0	0	0	0	0	0	0
Lime Powder	0	0.3	53	2	<0.1	<0.1	0.2	n/a	0	0	0	0	0	0	15
Graphite Powder	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	0	0	0	0	0	0
Iron Dust	0	n/a	n/a	1.5	<0.1	<0.1	<0.1	<0.1	0	0	0	0	0	0	0
Slag Dust	0	0.15	40	35	1.5	<0.1	<0.1	1	0	0	0	0	0	0	0

Tranfer Point Dust Speciation

Material component stack concentrations are estimated for each material type transferred at each point based on the expected dust concentrations for each release point.

Transfer Point	Material Type	Stack Concentrations (mg/Nm3)														
		Hg	Fe2O3	CaO	SiO2	P2O5	TiO2	K2O	SO3	As	Cd	Cr	Cu	Ni	V	Zn
BOP1	Fine Iron Ore	1.3E-08	4.5	0.03	0.24	0.005	0.005	0.005	0.005	4.5E-05	2.5E-05	2.5E-05	0	2.5E-05	2.0E-04	2.5E-05
BOP1	Thermal Coal	2.5E-07	0.005	0.01	0.30	0.005	0.005	0.01	0.005	0	0	0	0	0	0	0
BOP1	Semi-Soft Coking Coal	1.5E-07	0.03	0.02	0.28	0.005	0.005	0.005	0.005	1.9E-05	0	0	0	0	0	0
BOP1	Coke	0	0.03	0.01	0.35	0.005	0.005	0.005	0.005	0	0	0	0	0	0	0
BOP1	Limestone (Fine & Lumpy)	1.0E-07	0.015	2.65	0.10	0.005	0.005	0.01	0	3.5E-06	5.0E-06	6.0E-05	1.5E-05	2.5E-05	5.0E-06	7.5E-05
BOP1	Dolomite (Fine & Lumpy)	5.0E-08	0.01	1.8	0.10	0.005	0.005	0.005	0	5.0E-06	5.0E-06	9.0E-05	2.5E-05	4.0E-05	8.5E-05	7.5E-05
BOP1	Quartz	0	0	0.005	4.75	0	0	0	0	0	0	0	0	0	0	0
BOP2	Fine Iron Ore	1.3E-08	4.5	0.03	0.24	0.005	0.005	0.005	0.005	4.5E-05	2.5E-05	2.5E-05	0	2.5E-05	2.0E-04	2.5E-05
BOP2	Thermal Coal	2.5E-07	0.005	0.01	0.30	0.005	0.005	0.01	0.005	0	0	0	0	0	0	0
BOP2	Semi-Soft Coking Coal	1.5E-07	0.03	0.02	0.28	0.005	0.005	0.005	0.005	1.9E-05	0	0	0	0	0	0
BOP2	Coke	0	0.03	0.01	0.35	0.005	0.005	0.005	0.005	0	0	0	0	0	0	0
BOP2	Limestone (Fine & Lumpy)	1.0E-07	0.015	2.65	0.10	0.005	0.005	0.01	0	3.5E-06	5.0E-06	6.0E-05	1.5E-05	2.5E-05	5.0E-06	7.5E-05
BOP2	Dolomite (Fine & Lumpy)	5.0E-08	0.01	1.8	0.10	0.005	0.005	0.005	0	5.0E-06	5.0E-06	9.0E-05	2.5E-05	4.0E-05	8.5E-05	7.5E-05
BOP2	Quartz	0	0	0.005	4.8	0	0	0	0	0	0	0	0	0	0	0
BOP3	Fine Iron Ore	1.3E-08	4.5	0.03	0.24	0.005	0.005	0.005	0.005	4.5E-05	2.5E-05	2.5E-05	0	2.5E-05	2.0E-04	2.5E-05
BOP3	Limestone (Fine & Lumpy)	1.0E-07	0.015	2.65	0.10	0.005	0.005	0.01	0	3.5E-06	5.0E-06	6.0E-05	1.5E-05	2.5E-05	5.0E-06	7.5E-05
BOP3	Dolomite (Fine & Lumpy)	5.0E-08	0.01	1.8	0.10	0.005	0.005	0.005	0	5.0E-06	5.0E-06	9.0E-05	2.5E-05	4.0E-05	8.5E-05	7.5E-05
BOP3	Quartz	0	0	0.005	4.8	0	0	0	0	0	0	0	0	0	0	0
BOP4	Thermal Coal	2.5E-07	0.005	0.01	0.30	0.005	0.005	0.01	0.005	0	0	0	0	0	0	0
BOP4	Semi-Soft Coking Coal	1.5E-07	0.03	0.02	0.28	0.005	0.005	0.005	0.005	1.9E-05	0	0	0	0	0	0
BOP4	Coke	0	0.03	0.01	0.35	0.005	0.005	0.005	0.005	0	0	0	0	0	0	0
BOP5	Fine Iron Ore	1.3E-08	4.5	0.03	0.24	0.005	0.005	0.005	0.005	4.5E-05	2.5E-05	2.5E-05	0	2.5E-05	2.0E-04	2.5E-05
BOP5	Limestone (Fine & Lumpy)	1.0E-07	0.015	2.65	0.10	0.005	0.005	0.01	0	3.5E-06	5.0E-06	6.0E-05	1.5E-05	2.5E-05	5.0E-06	7.5E-05
BOP5	Dolomite (Fine & Lumpy)	5.0E-08	0.01	1.8	0.10	0.005	0.005	0.005	0	5.0E-06	5.0E-06	9.0E-05	2.5E-05	4.0E-05	8.5E-05	7.5E-05
BOP5	Quartz	0	0	0.005	4.8	0	0	0	0	0	0	0	0	0	0	0
BOP6	Thermal Coal	2.5E-07	0.005	0.01	0.30	0.005	0.005	0.01	0.005	0	0	0	0	0	0	0
BOP6	Semi-Soft Coking Coal	1.5E-07	0.03	0.02	0.28	0.005	0.005	0.005	0.005	1.9E-05	0	0	0	0	0	0
BOP6	Coke	0	0.03	0.01	0.35	0.005	0.005	0.005	0.005	0	0	0	0	0	0	0

BOP1	existing transfer tower	This will handle batch transfers of individual materials unloaded from ships – iron ore, thermal coal, semi-soft coking coal, coke, limestone, dolomite, quartz (based on the shipping delivery frequency for each material).
BOP2	New transfer tower	This will handle batch transfers of individual materials unloaded from ships – iron ore, thermal coal, semi-soft coking coal, coke, limestone, dolomite, quartz (based on the shipping delivery frequency for each material).
BOP3	I/O, L/S, D/M Stockpile	This will handle batch transfers of individual iron ore, limestone, dolomite, quartz materials.
BOP4	Coal and Coke Stockpile	This will handle batch transfers of individual thermal coal, semi-soft coking coal, coke materials.
BOP5	I/O, L/S, D/M Stockhouse	This will handle batch transfers of individual iron ore, limestone, dolomite, quartz materials.
BOP6	Coal Briquetting	This will handle batch transfers of individual thermal coal, semi-soft coking coal, coke materials.

Transfer materials provided by Maritime Iron - Richard Gaspari by email - Maritime Iron - Emissions info (POSCO Update) rec'd Feb 25 2019

Dust Source Compositions

Dust Emission Point #	Plant System	Fine Iron Ore	Thermal Coal	Semi-Soft Coking Coal	Coke	Limestone (Fine & Lumpy)	Dolomite (Fine & Lumpy)	Quartz	Starch	Burnt Lime	Sinter Ore Powder	Lime Powder	Graphite Powder	Iron Dust	Slag Dust	Comments
	wt% in dust from emission points															
1	**Stock House**	88	-	-	-	6	6	<1	-	-	-	-	-	-	-	
2	**Stock House**	-	17	68	10	-	-	<1	4	-	-	-	-	-	-	
3	**Coal Briquetting**	-	20	80	-	-	-	-	-	-	-	-	-	-	-	
4	**Coal Briquetting**	-	20	80	-	-	-	-	-	-	-	-	-	-	-	
5	**Coal Briquetting**	-	19	76	<1	<1	<1	<1	-	<1	<1	<1	<1	-	-	
6	**Ore Dryer**	88	-	-	-	6	6	<1	-	-	-	-		-	-	
7	**Reactor**	88	-	-	-	6	6	<1	-	-	-	-	-	-	-	
9	**HCI**	86	-	-	-	7	6	-	-	-	-	-	-	-	-	
10	**HCI**	86	-	-	-	7	6	-	-	-	-	-	-	-	-	
12	**Melter Gasifier**	-	17	68	10	-	-	<1	4	-	-	-	-	-	-	
13	**Melter Gasifier**	-	17	68	10	-	-	<1	4	-	-	-	-	-	-	
15	**Cast House**	-	-	-	-	-	-	-	-	-	-	-	-	36	64	
22	**Pig Casting Machine**	-	-	-	-	-	-	-	-	-	-	0.05	0.05	99.9	-	
27	**Hot Metal Pre-Treatment**	-	-	-	-	-	-	-	-	47.5	47.5	-	-	5	-	
29	**Flare Stack**	56	6	24	3.7	4.5	4	<1	1.5	-	-	-	-	-	-	
32	**Water Treatment**	56	6	24	3.7	4.5	4	<1	1.5	-	-	-	-	-	-	
33	**Water Treatment**	56	6	24	3.7	4.5	4	<1	1.5	-	-	-	-	-	-	

Info from provided Dust Emission Points Table dated Feb 22, 2019 - Richard Gaspari - RE: Maritime Iron - Emissions info (POSCO Update)

total

Dust Emission Point #	Plant System	Fine Iron Ore	Thermal Coal	Semi-Soft Coking Coal	Coke	Limestone (Fine & Lumpy)	Dolomite (Fine & Lumpy)	Quartz	Starch	Burnt Lime	Sinter Ore Powder	Lime Powder	Graphite Powder	Iron Dust	Slag Dust
	mass fraction in dust from emission points														
1	**Stock House**	0.88	0	0	0	0.06	0.06	0.01	0	0	0	0	0	0	0
2	**Stock House**	0	0.17	0.68	0.1	0	0	0.01	0.04	0	0	0	0	0	0
3	**Coal Briquetting**	0	0.2	0.8	0	0	0	0	0	0	0	0	0	0	0
4	**Coal Briquetting**	0	0.2	0.8	0	0	0	0	0	0	0	0	0	0	0
5	**Coal Briquetting**	0	0.19	0.76	0.01	0.01	0.01	0.01	0	0.01	0.01	0.01	0.01	0	0
6	**Ore Dryer**	0.88	0	0	0	0.06	0.06	0.01	0	0	0	0	0	0	0
7	**Reactor**	0.88	0	0	0	0.06	0.06	0.01	0	0	0	0	0	0	0
9	**HCI**	0.86	0	0	0	0.07	0.06	0	0	0	0	0	0	0	0
10	**HCI**	0.86	0	0	0	0.07	0.06	0	0	0	0	0	0	0	0
12	**Melter Gasifier**	0	0.17	0.68	0.1	0	0	0.01	0.04	0	0	0	0	0	0
13	**Melter Gasifier**	0	0.17	0.68	0.1	0	0	0.01	0.04	0	0	0	0	0	0
15	**Cast House**	0	0	0	0	0	0	0	0	0	0	0	0	0.36	0.64
22	**Pig Casting Machine**	0	0	0	0	0	0	0	0	0	0	0.0005	0.0005	0.999	0
27	**Hot Metal Pre-Treatment**	0	0	0	0	0	0	0	0	0.475	0.475	0	0	0.05	0
29	**Flare Stack**	0.56	0.06	0.24	0.037	0.045	0.04	0.01	0.015	0	0	0	0	0	0
32	**Water Treatment**	0.56	0.06	0.24	0.037	0.045	0.04	0.01	0.015	0	0	0	0	0	0
33	**Water Treatment**	0.56	0.06	0.24	0.037	0.045	0.04	0.01	0.015	0	0	0	0	0	0

Hg

Dust Emission Point #	Plant System	Total	Fine Iron Ore	Thermal Coal	Semi-Soft Coking Coal	Coke	Limestone (Fine & Lumpy)	Dolomite (Fine & Lumpy)	Quartz	Starch	Burnt Lime	Sinter Ore Powder	Lime Powder	Graphite Powder	Iron Dust	Slag Dust
	mass fraction															
1	**Stock House**	**4E-09**	2.2E-09	0	0	0	1.2E-09	6E-10	0	0	0	0	0	0	0	0
2	**Stock House**	**2.89E-08**	0	8.5E-09	2.04E-08	0	0	0	0	0	0	0	0	0	0	0
3	**Coal Briquetting**	**3.4E-08**	0	1E-08	2.4E-08	0	0	0	0	0	0	0	0	0	0	0
4	**Coal Briquetting**	**3.4E-08**	0	1E-08	2.4E-08	0	0	0	0	0	0	0	0	0	0	0
5	**Coal Briquetting**	**3.26E-08**	0	9.5E-09	2.28E-08	0	2E-10	1E-10	0	0	0	0	0	0	0	0
6	**Ore Dryer**	**4E-09**	2.2E-09	0	0	0	1.2E-09	6E-10	0	0	0	0	0	0	0	0
7	**Reactor**	**4E-09**	2.2E-09	0	0	0	1.2E-09	6E-10	0	0	0	0	0	0	0	0
9	**HCI**	**4.15E-09**	2.15E-09	0	0	0	1.4E-09	6E-10	0	0	0	0	0	0	0	0
10	**HCI**	**4.15E-09**	2.15E-09	0	0	0	1.4E-09	6E-10	0	0	0	0	0	0	0	0
12	**Melter Gasifier**	**2.89E-08**	0	8.5E-09	2.04E-08	0	0	0	0	0	0	0	0	0	0	0
13	**Melter Gasifier**	**2.89E-08**	0	8.5E-09	2.04E-08	0	0	0	0	0	0	0	0	0	0	0
15	**Cast House**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	**Pig Casting Machine**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	**Hot Metal Pre-Treatment**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	**Flare Stack**	**1.29E-08**	1.4E-09	3E-09	7.2E-09	0	9E-10	4E-10	0	0	0	0	0	0	0	0
32	**Water Treatment**	**1.29E-08**	1.4E-09	3E-09	7.2E-09	0	9E-10	4E-10	0	0	0	0	0	0	0	0
33	**Water Treatment**	**1.29E-08**	1.4E-09	3E-09	7.2E-09	0	9E-10	4E-10	0	0	0	0	0	0	0	0

Fe2O3																
Dust Emission Point #	**Plant System**	**Total**	**Fine Iron Ore**	**Thermal Coal**	**Semi-Soft Coking Coal**	**Coke**	**Limestone (Fine & Lumpy)**	**Dolomite (Fine & Lumpy)**	**Quartz**	**Starch**	**Burnt Lime**	**Sinter Ore Powder**	**Lime Powder**	**Graphite Powder**	**Iron Dust**	**Slag Dust**
	mass fraction															
1	**Stock House**	**0.7923**	0.792	0	0	0	0.00018	0.00012	0	0	0	0	0	0	0	0
2	**Stock House**	**0.00411**	0	0.00017	0.0034	0.0005	0	0	0	0.00004	0	0	0	0	0	0
3	**Coal Briquetting**	**0.0042**	0	0.0002	0.004	0	0	0	0	0	0	0	0	0	0	0
4	**Coal Briquetting**	**0.0042**	0	0.0002	0.004	0	0	0	0	0	0	0	0	0	0	0
5	**Coal Briquetting**	**0.01112**	0	0.00019	0.0038	0.00005	0.00003	0.00002	0	0	0	0.007	0.00003	0	0	0
6	**Ore Dryer**	**0.7923**	0.792	0	0	0	0.00018	0.00012	0	0	0	0	0	0	0	0
7	**Reactor**	**0.7923**	0.792	0	0	0	0.00018	0.00012	0	0	0	0	0	0	0	0
9	**HCI**	**0.77433**	0.774	0	0	0	0.00021	0.00012	0	0	0	0	0	0	0	0
10	**HCI**	**0.77433**	0.774	0	0	0	0.00021	0.00012	0	0	0	0	0	0	0	0
12	**Melter Gasifier**	**0.00411**	0	0.00017	0.0034	0.0005	0	0	0	0.00004	0	0	0	0	0	0
13	**Melter Gasifier**	**0.00411**	0	0.00017	0.0034	0.0005	0	0	0	0.00004	0	0	0	0	0	0
15	**Cast House**	**0.00096**	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00096
22	**Pig Casting Machine**	**0.0000015**	0	0	0	0	0	0	0	0	0	0	0.0000015	0	0	0
27	**Hot Metal Pre-Treatment**	**0.3325**	0	0	0	0	0	0	0	0	0	0.3325	0	0	0	0
29	**Flare Stack**	**0.505675**	0.504	0.00006	0.0012	0.000185	0.000135	0.00008	0	0.000015	0	0	0	0	0	0
32	**Water Treatment**	**0.505675**	0.504	0.00006	0.0012	0.000185	0.000135	0.00008	0	0.000015	0	0	0	0	0	0
33	**Water Treatment**	**0.505675**	0.504	0.00006	0.0012	0.000185	0.000135	0.00008	0	0.000015	0	0	0	0	0	0

CaO																
Dust Emission Point #	**Plant System**	**Total**	**Fine Iron Ore**	**Thermal Coal**	**Semi-Soft Coking Coal**	**Coke**	**Limestone (Fine & Lumpy)**	**Dolomite (Fine & Lumpy)**	**Quartz**	**Starch**	**Burnt Lime**	**Sinter Ore Powder**	**Lime Powder**	**Graphite Powder**	**Iron Dust**	**Slag Dust**
	mass fraction															
1	**Stock House**	**0.05781**	0.0044	0	0	0	0.0318	0.0216	0.00001	0	0	0	0	0	0	0
2	**Stock House**	**0.00331**	0	0.00034	0.00272	0.0002	0	0	0.00001	0.00004	0	0	0	0	0	0
3	**Coal Briquetting**	**0.0036**	0	0.0004	0.0032	0	0	0	0	0	0	0	0	0	0	0
4	**Coal Briquetting**	**0.0036**	0	0.0004	0.0032	0	0	0	0	0	0	0	0	0	0	0
5	**Coal Briquetting**	**0.02785**	0	0.00038	0.00304	0.00002	0.0053	0.0036	0.00001	0	0.0092	0.001	0.0053	0	0	0
6	**Ore Dryer**	**0.05781**	0.0044	0	0	0	0.0318	0.0216	0.00001	0	0	0	0	0	0	0
7	**Reactor**	**0.05781**	0.0044	0	0	0	0.0318	0.0216	0.00001	0	0	0	0	0	0	0
9	**HCI**	**0.063**	0.0043	0	0	0	0.0371	0.0216	0	0	0	0	0	0	0	0
10	**HCI**	**0.063**	0.0043	0	0	0	0.0371	0.0216	0	0	0	0	0	0	0	0
12	**Melter Gasifier**	**0.00331**	0	0.00034	0.00272	0.0002	0	0	0.00001	0.00004	0	0	0	0	0	0
13	**Melter Gasifier**	**0.00331**	0	0.00034	0.00272	0.0002	0	0	0.00001	0.00004	0	0	0	0	0	0
15	**Cast House**	**0.256**	0	0	0	0	0	0	0	0	0	0	0	0	0	0.256
22	**Pig Casting Machine**	**0.000265**	0	0	0	0	0	0	0	0	0	0	0.000265	0	0	0
27	**Hot Metal Pre-Treatment**	**0.4845**	0	0	0	0	0	0	0	0	0.437	0.0475	0	0	0	0
29	**Flare Stack**	**0.042229**	0.0028	0.00012	0.00096	0.000074	0.02385	0.0144	0.00001	0.000015	0	0	0	0	0	0
32	**Water Treatment**	**0.042229**	0.0028	0.00012	0.00096	0.000074	0.02385	0.0144	0.00001	0.000015	0	0	0	0	0	0
33	**Water Treatment**	**0.042229**	0.0028	0.00012	0.00096	0.000074	0.02385	0.0144	0.00001	0.000015	0	0	0	0	0	0

SiO2																
Dust Emission Point #	**Plant System**	**Total**	**Fine Iron Ore**	**Thermal Coal**	**Semi-Soft Coking Coal**	**Coke**	**Limestone (Fine & Lumpy)**	**Dolomite (Fine & Lumpy)**	**Quartz**	**Starch**	**Burnt Lime**	**Sinter Ore Powder**	**Lime Powder**	**Graphite Powder**	**Iron Dust**	**Slag Dust**
	mass fraction															
1	**Stock House**	**0.05414**	0.04224	0	0	0	0.0012	0.0012	0.0095	0	0	0	0	0	0	0
2	**Stock House**	**0.06414**	0	0.0102	0.0374	0.007	0	0	0.0095	0.00004	0	0	0	0	0	0
3	**Coal Briquetting**	**0.056**	0	0.012	0.044	0	0	0	0	0	0	0	0	0	0	0
4	**Coal Briquetting**	**0.056**	0	0.012	0.044	0	0	0	0	0	0	0	0	0	0	0
5	**Coal Briquetting**	**0.0648**	0	0.0114	0.0418	0.0007	0.0002	0.0002	0.0095	0	0.0003	0.0005	0.0002	0	0	0
6	**Ore Dryer**	**0.05414**	0.04224	0	0	0	0.0012	0.0012	0.0095	0	0	0	0	0	0	0
7	**Reactor**	**0.05414**	0.04224	0	0	0	0.0012	0.0012	0.0095	0	0	0	0	0	0	0
9	**HCI**	**0.04388**	0.04128	0	0	0	0.0014	0.0012	0	0	0	0	0	0	0	0
10	**HCI**	**0.04388**	0.04128	0	0	0	0.0014	0.0012	0	0	0	0	0	0	0	0
12	**Melter Gasifier**	**0.06414**	0	0.0102	0.0374	0.007	0	0	0.0095	0.00004	0	0	0	0	0	0
13	**Melter Gasifier**	**0.06414**	0	0.0102	0.0374	0.007	0	0	0.0095	0.00004	0	0	0	0	0	0
15	**Cast House**	**0.2294**	0	0	0	0	0	0	0	0	0	0	0	0	0.0054	0.224
22	**Pig Casting Machine**	**0.014995**	0	0	0	0	0	0	0	0	0	0	0.00001	0	0.014985	0
27	**Hot Metal Pre-Treatment**	**0.03875**	0	0	0	0	0	0	0	0	0.01425	0.02375	0	0	0.00075	0
29	**Flare Stack**	**0.057485**	0.02688	0.0036	0.0132	0.00259	0.0009	0.0008	0.0095	0.000015	0	0	0	0	0	0
32	**Water Treatment**	**0.057485**	0.02688	0.0036	0.0132	0.00259	0.0009	0.0008	0.0095	0.000015	0	0	0	0	0	0
33	**Water Treatment**	**0.057485**	0.02688	0.0036	0.0132	0.00259	0.0009	0.0008	0.0095	0.000015	0	0	0	0	0	0

P2O5

Dust Emission Point #	Plant System	Total	Fine Iron Ore	Thermal Coal	Semi-Soft Coking Coal	Coke	Limestone (Fine & Lumpy)	Dolomite (Fine & Lumpy)	Quartz	Starch	Burnt Lime	Sinter Ore Powder	Lime Powder	Graphite Powder	Iron Dust	Slag Dust
	mass fraction															
1	**Stock House**	**0.001**	0.00088	0	0	0	0.00006	0.00006	0	0	0	0	0	0	0	0
2	**Stock House**	**0.00103**	0	0.00017	0.00068	0.0001	0	0	0	0.00008	0	0	0	0	0	0
3	**Coal Briquetting**	**0.001**	0	0.0002	0.0008	0	0	0	0	0	0	0	0	0	0	0
4	**Coal Briquetting**	**0.001**	0	0.0002	0.0008	0	0	0	0	0	0	0	0	0	0	0
5	**Coal Briquetting**	**0.0011**	0	0.00019	0.00076	0.00001	0.00001	0.00001	0	0	0.00001	0.0001	0.00001	0	0	0
6	**Ore Dryer**	**0.001**	0.00088	0	0	0	0.00006	0.00006	0	0	0	0	0	0	0	0
7	**Reactor**	**0.001**	0.00088	0	0	0	0.00006	0.00006	0	0	0	0	0	0	0	0
9	**HCI**	**0.00099**	0.00086	0	0	0	0.00007	0.00006	0	0	0	0	0	0	0	0
10	**HCI**	**0.00099**	0.00086	0	0	0	0.00007	0.00006	0	0	0	0	0	0	0	0
12	**Melter Gasifier**	**0.00103**	0	0.00017	0.00068	0.0001	0	0	0	0.00008	0	0	0	0	0	0
13	**Melter Gasifier**	**0.00103**	0	0.00017	0.00068	0.0001	0	0	0	0.00008	0	0	0	0	0	0
15	**Cast House**	**0.00996**	0	0	0	0	0	0	0	0	0	0	0	0	0.00036	0.0096
22	**Pig Casting Machine**	**0.0009995**	0	0	0	0	0	0	0	0	0	0	0.0000005	0	0.000999	0
27	**Hot Metal Pre-Treatment**	**0.005275**	0	0	0	0	0	0	0	0	0.000475	0.00475	0	0	0.00005	0
29	**Flare Stack**	**0.001012**	0.00056	0.00006	0.00024	0.000037	0.000045	0.00004	0	0.00003	0	0	0	0	0	0
32	**Water Treatment**	**0.001012**	0.00056	0.00006	0.00024	0.000037	0.000045	0.00004	0	0.00003	0	0	0	0	0	0
33	**Water Treatment**	**0.001012**	0.00056	0.00006	0.00024	0.000037	0.000045	0.00004	0	0.00003	0	0	0	0	0	0

TiO2

Dust Emission Point #	Plant System	Total	Fine Iron Ore	Thermal Coal	Semi-Soft Coking Coal	Coke	Limestone (Fine & Lumpy)	Dolomite (Fine & Lumpy)	Quartz	Starch	Burnt Lime	Sinter Ore Powder	Lime Powder	Graphite Powder	Iron Dust	Slag Dust
	mass fraction															
1	**Stock House**	**0.001**	0.00088	0	0	0	0.00006	0.00006	0	0	0	0	0	0	0	0
2	**Stock House**	**0.00099**	0	0.00017	0.00068	0.0001	0	0	0	0.00004	0	0	0	0	0	0
3	**Coal Briquetting**	**0.001**	0	0.0002	0.0008	0	0	0	0	0	0	0	0	0	0	0
4	**Coal Briquetting**	**0.001**	0	0.0002	0.0008	0	0	0	0	0	0	0	0	0	0	0
5	**Coal Briquetting**	**0.00101**	0	0.00019	0.00076	0.00001	0.00001	0.00001	0	0	0.00001	0.00001	0.00001	0	0	0
6	**Ore Dryer**	**0.001**	0.00088	0	0	0	0.00006	0.00006	0	0	0	0	0	0	0	0
7	**Reactor**	**0.001**	0.00088	0	0	0	0.00006	0.00006	0	0	0	0	0	0	0	0
9	**HCI**	**0.00099**	0.00086	0	0	0	0.00007	0.00006	0	0	0	0	0	0	0	0
10	**HCI**	**0.00099**	0.00086	0	0	0	0.00007	0.00006	0	0	0	0	0	0	0	0
12	**Melter Gasifier**	**0.00099**	0	0.00017	0.00068	0.0001	0	0	0	0.00004	0	0	0	0	0	0
13	**Melter Gasifier**	**0.00099**	0	0.00017	0.00068	0.0001	0	0	0	0.00004	0	0	0	0	0	0
15	**Cast House**	**0.001**	0	0	0	0	0	0	0	0	0	0	0	0	0.00036	0.00064
22	**Pig Casting Machine**	**0.0009995**	0	0	0	0	0	0	0	0	0	0	0.0000005	0	0.000999	0
27	**Hot Metal Pre-Treatment**	**0.001**	0	0	0	0	0	0	0	0	0.000475	0.000475	0	0	0.00005	0
29	**Flare Stack**	**0.000997**	0.00056	0.00006	0.00024	0.000037	0.000045	0.00004	0	0.000015	0	0	0	0	0	0
32	**Water Treatment**	**0.000997**	0.00056	0.00006	0.00024	0.000037	0.000045	0.00004	0	0.000015	0	0	0	0	0	0
33	**Water Treatment**	**0.000997**	0.00056	0.00006	0.00024	0.000037	0.000045	0.00004	0	0.000015	0	0	0	0	0	0

K2O

Dust Emission Point #	Plant System	Total	Fine Iron Ore	Thermal Coal	Semi-Soft Coking Coal	Coke	Limestone (Fine & Lumpy)	Dolomite (Fine & Lumpy)	Quartz	Starch	Burnt Lime	Sinter Ore Powder	Lime Powder	Graphite Powder	Iron Dust	Slag Dust
	mass fraction															
1	**Stock House**	**0.00106**	0.00088	0	0	0	0.00012	0.00006	0	0	0	0	0	0	0	0
2	**Stock House**	**0.00118**	0	0.00034	0.00068	0.0001	0	0	0	0.00006	0	0	0	0	0	0
3	**Coal Briquetting**	**0.0012**	0	0.0004	0.0008	0	0	0	0	0	0	0	0	0	0	0
4	**Coal Briquetting**	**0.0012**	0	0.0004	0.0008	0	0	0	0	0	0	0	0	0	0	0
5	**Coal Briquetting**	**0.00122**	0	0.00038	0.00076	0.00001	0.00002	0.00001	0	0	0.00001	0.00001	0.00002	0	0	0
6	**Ore Dryer**	**0.00106**	0.00088	0	0	0	0.00012	0.00006	0	0	0	0	0	0	0	0
7	**Reactor**	**0.00106**	0.00088	0	0	0	0.00012	0.00006	0	0	0	0	0	0	0	0
9	**HCI**	**0.00106**	0.00086	0	0	0	0.00014	0.00006	0	0	0	0	0	0	0	0
10	**HCI**	**0.00106**	0.00086	0	0	0	0.00014	0.00006	0	0	0	0	0	0	0	0
12	**Melter Gasifier**	**0.00118**	0	0.00034	0.00068	0.0001	0	0	0	0.00006	0	0	0	0	0	0
13	**Melter Gasifier**	**0.00118**	0	0.00034	0.00068	0.0001	0	0	0	0.00006	0	0	0	0	0	0
15	**Cast House**	**0.001**	0	0	0	0	0	0	0	0	0	0	0	0	0.00036	0.00064
22	**Pig Casting Machine**	**0.001**	0	0	0	0	0	0	0	0	0	0	0.000001	0	0.000999	0
27	**Hot Metal Pre-Treatment**	**0.001**	0	0	0	0	0	0	0	0	0.000475	0.000475	0	0	0.00005	0
29	**Flare Stack**	**0.0011095**	0.00056	0.00012	0.00024	0.000037	0.00009	0.00004	0	0.0000225	0	0	0	0	0	0
32	**Water Treatment**	**0.0011095**	0.00056	0.00012	0.00024	0.000037	0.00009	0.00004	0	0.0000225	0	0	0	0	0	0
33	**Water Treatment**	**0.0011095**	0.00056	0.00012	0.00024	0.000037	0.00009	0.00004	0	0.0000225	0	0	0	0	0	0

SO3

Dust Emission Point #	Plant System	Total	Fine Iron Ore	Thermal Coal	Semi-Soft Coking Coal	Coke	Limestone (Fine & Lumpy)	Dolomite (Fine & Lumpy)	Quartz	Starch	Burnt Lime	Sinter Ore Powder	Lime Powder	Graphite Powder	Iron Dust	Slag Dust
	mass fraction															
1	**Stock House**	**0.00088**	0.00088	0	0	0	0	0	0	0	0	0	0	0	0	0
2	**Stock House**	**0.00099**	0	0.00017	0.00068	0.0001	0	0	0	0.00004	0	0	0	0	0	0
3	**Coal Briquetting**	**0.001**	0	0.0002	0.0008	0	0	0	0	0	0	0	0	0	0	0
4	**Coal Briquetting**	**0.001**	0	0.0002	0.0008	0	0	0	0	0	0	0	0	0	0	0
5	**Coal Briquetting**	**0.00098**	0	0.00019	0.00076	0.00001	0	0	0	0	0.00001	0.00001	0	0	0	0
6	**Ore Dryer**	**0.00088**	0.00088	0	0	0	0	0	0	0	0	0	0	0	0	0
7	**Reactor**	**0.00088**	0.00088	0	0	0	0	0	0	0	0	0	0	0	0	0
9	**HCI**	**0.00086**	0.00086	0	0	0	0	0	0	0	0	0	0	0	0	0
10	**HCI**	**0.00086**	0.00086	0	0	0	0	0	0	0	0	0	0	0	0	0
12	**Melter Gasifier**	**0.00099**	0	0.00017	0.00068	0.0001	0	0	0	0.00004	0	0	0	0	0	0
13	**Melter Gasifier**	**0.00099**	0	0.00017	0.00068	0.0001	0	0	0	0.00004	0	0	0	0	0	0
15	**Cast House**	**0.00676**	0	0	0	0	0	0	0	0	0	0	0	0	0.00036	0.0064
22	**Pig Casting Machine**	**0.000999**	0	0	0	0	0	0	0	0	0	0	0	0	0.000999	0
27	**Hot Metal Pre-Treatment**	**0.001**	0	0	0	0	0	0	0	0	0.000475	0.000475	0	0	0.00005	0
29	**Flare Stack**	**0.000912**	0.00056	0.00006	0.00024	0.000037	0	0	0	0.000015	0	0	0	0	0	0
32	**Water Treatment**	**0.000912**	0.00056	0.00006	0.00024	0.000037	0	0	0	0.000015	0	0	0	0	0	0
33	**Water Treatment**	**0.000912**	0.00056	0.00006	0.00024	0.000037	0	0	0	0.000015	0	0	0	0	0	0

As

Dust Emission Point #	Plant System	Total	Fine Iron Ore	Thermal Coal	Semi-Soft Coking Coal	Coke	Limestone (Fine & Lumpy)	Dolomite (Fine & Lumpy)	Quartz	Starch	Burnt Lime	Sinter Ore Powder	Lime Powder	Graphite Powder	Iron Dust	Slag Dust
	mass fraction															
1	**Stock House**	**8.02E-06**	7.92E-06	0	0	0	4.20E-08	6.00E-08	0	0	0	0	0	0	0	0
2	**Stock House**	**2.58E-06**	0	0	2.584E-06	0	0	0	0	0	0	0	0	0	0	0
3	**Coal Briquetting**	**3.04E-06**	0	0	3.04E-06	0	0	0	0	0	0	0	0	0	0	0
4	**Coal Briquetting**	**3.04E-06**	0	0	3.04E-06	0	0	0	0	0	0	0	0	0	0	0
5	**Coal Briquetting**	**2.91E-06**	0	0	2.888E-06	0	7.00E-09	1.00E-08	0	0	0	0	0	0	0	0
6	**Ore Dryer**	**8.02E-06**	7.92E-06	0	0	0	4.20E-08	6.00E-08	0	0	0	0	0	0	0	0
7	**Reactor**	**8.02E-06**	7.92E-06	0	0	0	4.20E-08	6.00E-08	0	0	0	0	0	0	0	0
9	**HCI**	**7.85E-06**	7.74E-06	0	0	0	4.90E-08	6.00E-08	0	0	0	0	0	0	0	0
10	**HCI**	**7.85E-06**	7.74E-06	0	0	0	4.90E-08	6.00E-08	0	0	0	0	0	0	0	0
12	**Melter Gasifier**	**2.58E-06**	0	0	2.584E-06	0	0	0	0	0	0	0	0	0	0	0
13	**Melter Gasifier**	**2.58E-06**	0	0	2.584E-06	0	0	0	0	0	0	0	0	0	0	0
15	**Cast House**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	**Pig Casting Machine**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	**Hot Metal Pre-Treatment**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	**Flare Stack**	**6.02E-06**	5.04E-06	0	9.12E-07	0	3.15E-08	4.00E-08	0	0	0	0	0	0	0	0
32	**Water Treatment**	**6.02E-06**	5.04E-06	0	9.12E-07	0	3.15E-08	4.00E-08	0	0	0	0	0	0	0	0
33	**Water Treatment**	**6.02E-06**	5.04E-06	0	9.12E-07	0	3.15E-08	4.00E-08	0	0	0	0	0	0	0	0

Cd

Dust Emission Point #	Plant System	Total	Fine Iron Ore	Thermal Coal	Semi-Soft Coking Coal	Coke	Limestone (Fine & Lumpy)	Dolomite (Fine & Lumpy)	Quartz	Starch	Burnt Lime	Sinter Ore Powder	Lime Powder	Graphite Powder	Iron Dust	Slag Dust
	mass fraction															
1	**Stock House**	**4.52E-06**	4.40E-06	0	0	0	6.00E-08	6.00E-08	0	0	0	0	0	0	0	0
2	**Stock House**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	**Coal Briquetting**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	**Coal Briquetting**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	**Coal Briquetting**	**2.00E-08**	0	0	0	0	1.00E-08	1.00E-08	0	0	0	0	0	0	0	0
6	**Ore Dryer**	**4.52E-06**	4.40E-06	0	0	0	6.00E-08	6.00E-08	0	0	0	0	0	0	0	0
7	**Reactor**	**4.52E-06**	4.40E-06	0	0	0	6.00E-08	6.00E-08	0	0	0	0	0	0	0	0
9	**HCI**	**4.43E-06**	4.30E-06	0	0	0	7.00E-08	6.00E-08	0	0	0	0	0	0	0	0
10	**HCI**	**4.43E-06**	4.30E-06	0	0	0	7.00E-08	6.00E-08	0	0	0	0	0	0	0	0
12	**Melter Gasifier**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	**Melter Gasifier**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	**Cast House**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	**Pig Casting Machine**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	**Hot Metal Pre-Treatment**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	**Flare Stack**	**2.89E-06**	2.80E-06	0	0	0	4.50E-08	4.00E-08	0	0	0	0	0	0	0	0
32	**Water Treatment**	**2.89E-06**	2.80E-06	0	0	0	4.50E-08	4.00E-08	0	0	0	0	0	0	0	0
33	**Water Treatment**	**2.89E-06**	2.80E-06	0	0	0	4.50E-08	4.00E-08	0	0	0	0	0	0	0	0

Cr

Dust Emission Point #	Plant System	Total	Fine Iron Ore	Thermal Coal	Semi-Soft Coking Coal	Coke	Limestone (Fine & Lumpy)	Dolomite (Fine & Lumpy)	Quartz	Starch	Burnt Lime	Sinter Ore Powder	Lime Powder	Graphite Powder	Iron Dust	Slag Dust
	mass fraction															
1	Stock House	6.20E-06	4.40E-06	0	0	0	7.20E-07	1.08E-06	0	0	0	0	0	0	0	0
2	Stock House	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Coal Briquetting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Coal Briquetting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Coal Briquetting	3.00E-07	0	0	0	0	1.20E-07	1.80E-07	0	0	0	0	0	0	0	0
6	Ore Dryer	6.20E-06	4.40E-06	0	0	0	7.20E-07	1.08E-06	0	0	0	0	0	0	0	0
7	Reactor	6.20E-06	4.40E-06	0	0	0	7.20E-07	1.08E-06	0	0	0	0	0	0	0	0
9	HCI	6.22E-06	4.30E-06	0	0	0	8.40E-07	1.08E-06	0	0	0	0	0	0	0	0
10	HCI	6.22E-06	4.30E-06	0	0	0	8.40E-07	1.08E-06	0	0	0	0	0	0	0	0
12	Melter Gasifier	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Melter Gasifier	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	Cast House	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	Pig Casting Machine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	Hot Metal Pre-Treatment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	Flare Stack	4.06E-06	2.80E-06	0	0	0	5.40E-07	7.20E-07	0	0	0	0	0	0	0	0
32	Water Treatment	4.06E-06	2.80E-06	0	0	0	5.40E-07	7.20E-07	0	0	0	0	0	0	0	0
33	Water Treatment	4.06E-06	2.80E-06	0	0	0	5.40E-07	7.20E-07	0	0	0	0	0	0	0	0

Cu

Dust Emission Point #	Plant System	Total	Fine Iron Ore	Thermal Coal	Semi-Soft Coking Coal	Coke	Limestone (Fine & Lumpy)	Dolomite (Fine & Lumpy)	Quartz	Starch	Burnt Lime	Sinter Ore Powder	Lime Powder	Graphite Powder	Iron Dust	Slag Dust
	mass fraction															
1	Stock House	4.80E-07	0	0	0	0	1.80E-07	3.00E-07	0	0	0	0	0	0	0	0
2	Stock House	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Coal Briquetting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Coal Briquetting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Coal Briquetting	8.00E-08	0	0	0	0	3.00E-08	5.00E-08	0	0	0	0	0	0	0	0
6	Ore Dryer	4.80E-07	0	0	0	0	1.80E-07	3.00E-07	0	0	0	0	0	0	0	0
7	Reactor	4.80E-07	0	0	0	0	1.80E-07	3.00E-07	0	0	0	0	0	0	0	0
9	HCI	5.10E-07	0	0	0	0	2.10E-07	3.00E-07	0	0	0	0	0	0	0	0
10	HCI	5.10E-07	0	0	0	0	2.10E-07	3.00E-07	0	0	0	0	0	0	0	0
12	Melter Gasifier	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Melter Gasifier	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	Cast House	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	Pig Casting Machine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	Hot Metal Pre-Treatment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	Flare Stack	3.35E-07	0	0	0	0	1.35E-07	2.00E-07	0	0	0	0	0	0	0	0
32	Water Treatment	3.35E-07	0	0	0	0	1.35E-07	2.00E-07	0	0	0	0	0	0	0	0
33	Water Treatment	3.35E-07	0	0	0	0	1.35E-07	2.00E-07	0	0	0	0	0	0	0	0

Ni

Dust Emission Point #	Plant System	Total	Fine Iron Ore	Thermal Coal	Semi-Soft Coking Coal	Coke	Limestone (Fine & Lumpy)	Dolomite (Fine & Lumpy)	Quartz	Starch	Burnt Lime	Sinter Ore Powder	Lime Powder	Graphite Powder	Iron Dust	Slag Dust
	mass fraction															
1	Stock House	5.18E-06	4.40E-06	0	0	0	3.00E-07	4.80E-07	0	0	0	0	0	0	0	0
2	Stock House	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Coal Briquetting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Coal Briquetting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Coal Briquetting	1.30E-07	0	0	0	0	5.00E-08	8.00E-08	0	0	0	0	0	0	0	0
6	Ore Dryer	5.18E-06	4.40E-06	0	0	0	3.00E-07	4.80E-07	0	0	0	0	0	0	0	0
7	Reactor	5.18E-06	4.40E-06	0	0	0	3.00E-07	4.80E-07	0	0	0	0	0	0	0	0
9	HCI	5.13E-06	4.30E-06	0	0	0	3.50E-07	4.80E-07	0	0	0	0	0	0	0	0
10	HCI	5.13E-06	4.30E-06	0	0	0	3.50E-07	4.80E-07	0	0	0	0	0	0	0	0
12	Melter Gasifier	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Melter Gasifier	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	Cast House	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	Pig Casting Machine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	Hot Metal Pre-Treatment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	Flare Stack	3.35E-06	2.80E-06	0	0	0	2.25E-07	3.20E-07	0	0	0	0	0	0	0	0
32	Water Treatment	3.35E-06	2.80E-06	0	0	0	2.25E-07	3.20E-07	0	0	0	0	0	0	0	0
33	Water Treatment	3.35E-06	2.80E-06	0	0	0	2.25E-07	3.20E-07	0	0	0	0	0	0	0	0

V																
Dust Emission Point #	Plant System	Total	Fine Iron Ore	Thermal Coal	Semi-Soft Coking Coal	Coke	Limestone (Fine & Lumpy)	Dolomite (Fine & Lumpy)	Quartz	Starch	Burnt Lime	Sinter Ore Powder	Lime Powder	Graphite Powder	Iron Dust	Slag Dust
	mass fraction															
1	**Stock House**	**3.63E-05**	3.52E-05	0	0	0	6.00E-08	1.02E-06	0	0	0	0	0	0	0	0
2	**Stock House**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	**Coal Briquetting**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	**Coal Briquetting**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	**Coal Briquetting**	**1.80E-07**	0	0	0	0	1.00E-08	1.70E-07	0	0	0	0	0	0	0	0
6	**Ore Dryer**	**3.63E-05**	3.52E-05	0	0	0	6.00E-08	1.02E-06	0	0	0	0	0	0	0	0
7	**Reactor**	**3.63E-05**	3.52E-05	0	0	0	6.00E-08	1.02E-06	0	0	0	0	0	0	0	0
9	**HCI**	**3.55E-05**	3.44E-05	0	0	0	7.00E-08	1.02E-06	0	0	0	0	0	0	0	0
10	**HCI**	**3.55E-05**	3.44E-05	0	0	0	7.00E-08	1.02E-06	0	0	0	0	0	0	0	0
12	**Melter Gasifier**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	**Melter Gasifier**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	**Cast House**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	**Pig Casting Machine**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	**Hot Metal Pre-Treatment**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	**Flare Stack**	**2.31E-05**	2.24E-05	0	0	0	4.50E-08	6.80E-07	0	0	0	0	0	0	0	0
32	**Water Treatment**	**2.31E-05**	2.24E-05	0	0	0	4.50E-08	6.80E-07	0	0	0	0	0	0	0	0
33	**Water Treatment**	**2.31E-05**	2.24E-05	0	0	0	4.50E-08	6.80E-07	0	0	0	0	0	0	0	0

Zn																
Dust Emission Point #	Plant System	Total	Fine Iron Ore	Thermal Coal	Semi-Soft Coking Coal	Coke	Limestone (Fine & Lumpy)	Dolomite (Fine & Lumpy)	Quartz	Starch	Burnt Lime	Sinter Ore Powder	Lime Powder	Graphite Powder	Iron Dust	Slag Dust
	mass fraction															
1	**Stock House**	**6.20E-06**	4.40E-06	0	0	0	9.00E-07	9.00E-07	0	0	0	0	0	0	0	0
2	**Stock House**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	**Coal Briquetting**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	**Coal Briquetting**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	**Coal Briquetting**	**6.00E-07**	0	0	0	0	1.50E-07	1.50E-07	0	0	1.50E-07	0	1.50E-07	0	0	0
6	**Ore Dryer**	**6.20E-06**	4.40E-06	0	0	0	9.00E-07	9.00E-07	0	0	0	0	0	0	0	0
7	**Reactor**	**6.20E-06**	4.40E-06	0	0	0	9.00E-07	9.00E-07	0	0	0	0	0	0	0	0
9	**HCI**	**6.25E-06**	4.30E-06	0	0	0	1.05E-06	9.00E-07	0	0	0	0	0	0	0	0
10	**HCI**	**6.25E-06**	4.30E-06	0	0	0	1.05E-06	9.00E-07	0	0	0	0	0	0	0	0
12	**Melter Gasifier**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	**Melter Gasifier**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	**Cast House**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	**Pig Casting Machine**	**7.50E-09**	0	0	0	0	0	0	0	0	0	0	7.50E-09	0	0	0
27	**Hot Metal Pre-Treatment**	**7.13E-06**	0	0	0	0	0	0	0	0	7.13E-06	0	0	0	0	0
29	**Flare Stack**	**4.08E-06**	2.80E-06	0	0	0	6.75E-07	6.00E-07	0	0	0	0	0	0	0	0
32	**Water Treatment**	**4.08E-06**	2.80E-06	0	0	0	6.75E-07	6.00E-07	0	0	0	0	0	0	0	0
33	**Water Treatment**	**4.08E-06**	2.80E-06	0	0	0	6.75E-07	6.00E-07	0	0	0	0	0	0	0	0

Fine Iron Ore

n/a	wt%	C_xH_y
3.5	wt%	FeO
90	wt%	Fe_2O_3
0.5	wt%	CaO
4.8	wt%	SiO_2
0.4	wt%	Al_2O_3
0.5	wt%	MgO
0.2	wt%	MnO
0.1	wt%	P_2O_5
<0.1	wt%	TiO_2
<0.1	wt%	Na_2O
<0.1	wt%	K_2O
<0.1	wt%	SO_3
<0.0025	ppm	Hg
9	ppm	As
<5	ppm	Cd
<5	ppm	Cr
<5	ppm	Ni
8	ppm	Pb
40	ppm	V
5	ppm	Zn

Thermal Coal

91.3	wt%	C_xH_y
<0.1	wt%	FeO
<0.1	wt%	Fe_2O_3
0.2	wt%	CaO
6	wt%	SiO_2
2	wt%	Al_2O_3
0.2	wt%	MgO
<0.1	wt%	MnO
<0.1	wt%	P_2O_5
<0.1	wt%	TiO_2
<0.1	wt%	Na_2O
0.2	wt%	K_2O
<0.1	wt%	SO_3
0.05	ppm	Hg

Semi-Soft Coking Coal

89.9	wt%	C_xH_y
<0.1	wt%	FeO
0.5	wt%	Fe_2O_3
0.4	wt%	CaO
5.5	wt%	SiO_2
2.6	wt%	Al_2O_3
1	wt%	MgO
<0.1	wt%	MnO
<0.1	wt%	P_2O_5
<0.1	wt%	TiO_2
<0.1	wt%	Na_2O
<0.1	wt%	K_2O
<0.1	wt%	SO_3
0.03	ppm	Hg
3.8	ppm	As
23	ppm	B
46	ppm	F
0.4	ppm	Se
200	ppm	Cl

Coke

87.9	wt%	C_xH_y
<0.1	wt%	FeO
0.5	wt%	Fe_2O_3
0.2	wt%	CaO
7	wt%	SiO_2
3	wt%	Al_2O_3
<0.1	wt%	MgO
<0.1	wt%	MnO
<0.1	wt%	P_2O_5
<0.1	wt%	TiO_2
<0.1	wt%	Na_2O
<0.1	wt%	K_2O
<0.1	wt%	SO_3

Limestone (Fine & Lumpy)

43.6	wt%	CO_2
<0.1	wt%	FeO
0.3	wt%	Fe_2O_3
53	wt%	CaO
2	wt%	SiO_2
0.5	wt%	Al_2O_3
0.4	wt%	MgO
<0.1	wt%	MnO
<0.1	wt%	P_2O_5
<0.1	wt%	TiO_2
<0.1	wt%	Na_2O
0.2	wt%	K_2O
n/a	wt%	SO_3
0.02	ppm	Hg
0.7	ppm	As
<1	ppm	Cd
12	ppm	Cr
3	ppm	Cu
5	ppm	Ni
1	ppm	V
15	ppm	Zn

Dolomite (Fine & Lumpy)

45.3	wt%	CO_2
<0.1	wt%	FeO
0.2	wt%	Fe_2O_3
36	wt%	CaO
2	wt%	SiO_2
0.4	wt%	Al_2O_3
16	wt%	MgO
<0.1	wt%	MnO
<0.1	wt%	P_2O_5
<0.1	wt%	TiO_2
<0.1	wt%	Na_2O
0.1	wt%	K_2O
n/a	wt%	SO_3
0.01	ppm	Hg
1	ppm	As
<1	ppm	Cd
18	ppm	Cr
5	ppm	Cu
8	ppm	Ni
17	ppm	V
15	ppm	Zn

Quartz

n/a	wt%	C_xH_y
n/a	wt%	FeO
n/a	wt%	Fe_2O_3
0.1	wt%	CaO
95	wt%	SiO_2
4	wt%	Al_2O_3
0.9	wt%	MgO
n/a	wt%	MnO
n/a	wt%	P_2O_5
n/a	wt%	TiO_2
n/a	wt%	Na_2O
n/a	wt%	K_2O
n/a	wt%	SO_3

Starch

99.5	wt%	C_xH_y
<0.1	wt%	FeO
<0.1	wt%	Fe_2O_3
<0.1	wt%	CaO
0.1	wt%	SiO_2
<0.1	wt%	Al_2O_3
<0.1	wt%	MgO
<0.1	wt%	MnO
0.2	wt%	P_2O_5
<0.1	wt%	TiO_2
<0.1	wt%	Na_2O
0.15	wt%	K_2O
<0.1	wt%	SO_3

Burnt Lime

n/a	wt%	CO_2
n/a	wt%	FeO
n/a	wt%	Fe_2O_3
92	wt%	CaO
3	wt%	SiO_2
1.5	wt%	Al_2O_3
3.5	wt%	MgO
<0.1	wt%	MnO
<0.1	wt%	P_2O_5
<0.1	wt%	TiO_2
<0.1	wt%	Na_2O
<0.1	wt%	K_2O
<0.1	wt%	SO_3
15	ppm	Zn

Sinter Ore Powder

n/a	wt%	C_xH_y
10	wt%	FeO
70	wt%	Fe_2O_3
10	wt%	CaO
5	wt%	SiO_2
1	wt%	Al_2O_3
2	wt%	MgO
1	wt%	MnO
1	wt%	P_2O_5
<0.1	wt%	TiO_2
<0.1	wt%	Na_2O
<0.1	wt%	K_2O
<0.1	wt%	SO_3

Lime Powder

43.6	wt%	CO_2
<0.1	wt%	FeO
0.3	wt%	Fe_2O_3
53	wt%	CaO
2	wt%	SiO_2
0.5	wt%	Al_2O_3
0.4	wt%	MgO
<0.1	wt%	MnO
<0.1	wt%	P_2O_5
<0.1	wt%	TiO_2
<0.1	wt%	Na_2O
0.2	wt%	K_2O
n/a	wt%	SO_3
15	ppm	Zn

Graphite Powder

100	wt%	C
n/a	wt%	FeO
n/a	wt%	Fe_2O_3
n/a	wt%	CaO
n/a	wt%	SiO_2
n/a	wt%	Al_2O_3
n/a	wt%	MgO
n/a	wt%	MnO
n/a	wt%	P_2O_5
n/a	wt%	TiO_2
n/a	wt%	Na_2O
n/a	wt%	K_2O
n/a	wt%	SO_3

Iron Dust

4	wt%	C
94.5	wt%	Fe
n/a	wt%	Fe_2O_3
n/a	wt%	CaO
1.5	wt%	SiO_2
<0.1	wt%	Al_2O_3
<0.1	wt%	MgO
<0.1	wt%	MnO
<0.1	wt%	P_2O_5
<0.1	wt%	TiO_2
<0.1	wt%	Na_2O
<0.1	wt%	K_2O
<0.1	wt%	SO_3

Slag Dust

<0.1	wt%	C
0.1	wt%	FeO
0.15	wt%	Fe_2O_3
40	wt%	CaO
35	wt%	SiO_2
12	wt%	Al_2O_3
8	wt%	MgO
2	wt%	MnO
1.5	wt%	P_2O_5
<0.1	wt%	TiO_2
<0.1	wt%	Na_2O
<0.1	wt%	K_2O
1	wt%	SO_3

Info from provided Dust Emission Points Table dated Feb 22, 2019 - Richard Gaspari - RE: Maritime Iron - Emissions info (POSCO Update)

** Fine Iron Ore trace metals info provided by Maritime Iron - email from Richard Gaspari March 8, 2019*

The following is trace metal info obtained from a proposed supplier for the Fine Iron Ore material – per their e-mail reply, the info is based on an annualized composite sample and the analysis is performed to a more extensive chemistry by a renown 3rd party lab (SGA in Germany). They indicated that over the years levels do not vary notably.

Typical levels of the following found in their Fine Iron Ore material for 2017 average testing:

Arsenic (As)	0.0009%
Cadmium (Cd)	<0.0005%
Chromium (Cr)	<0.0005%
Mercury (Hg)	*Not tested by supplier lab, but previous customer had detected once at <2.5 ppb level
Lead (Pb)	0.0008%
Nickel (Ni)	<0.0005%
Vanadium (V)	0.004%
Zinc (Zn)	0.0005%

This composition information would supplement the Fine Iron Ore information previously provided.

*** Semi-soft Coking Coal trace metals info provided by Maritime Iron - email from Richard Gaspari March 8, 2019*

**** Limestone and Dolomite trace metals info provided by Maritime Iron - email from Richard Gaspari March 8, 2019*

Summary of Annual SO2 Emissions - NB Power Belledune

Offset SO2 emissions due off-gas supplied to NB Power Belledune from Maritime Iron facility are estimated in this sheet. Annual SO2 releases from the NB Power Belledune power plant are taken from the NPRI reports (2013 to 2017).

Assumed HHV of Coal	11,318.90	BTU/lb	provided by MI (from NBPower - Avg of Dec 2017 - Mar 2018 data) email from Richard Gaspari March 13, 2019 - RE: Maritime Iron - Emissions info (POSCO Update)
Assumed S content of Coal	0.59	%	provided by MI (from NBPower - Avg of Dec 2017 - Mar 2018 data) email from Richard Gaspari March 13, 2019 - RE: Maritime Iron - Emissions info (POSCO Update)

Year	Release Quantity tonnes per year	Capacity Factor	Load Factor	Coal/Pet Coke Consumption tonnes per year	Energy From Coal MMBTU	Estimated SO2 EF lb/MMBTU	Energy required from coal after Offset from MI Off-gas MMBTU per year	Offset SO2 Emissions at Belledune tonnes	
2017	3,828	65.2	78	1,149,777	28,631,264	0.29	10,987,740	1,666	44%
2016	3,776	76.4	79	1,293,292	32,205,014	0.26	14,561,490	1,376	36%
2015	3,744	58.5	83	989,171	24,631,921	0.33	6,988,397	1,989	53%
2014	3,663	78	80	1,304,819	32,492,055	0.25	14,848,530	1,296	35%
2013	4,341	76	79	1,285,881	32,020,469	0.30	14,376,944	1,699	39%
							Average	1,605	41%

SO2 from MI facility operations 132.76 tonnes per year

Est Avg Reduction in SO2 emissions (2013 to 2017)	***1,470***	***tonnes per year***

Annual SO2 data from:
https://pollution-waste.canada.ca/national-release-inventory/archives/index.cfm?do=facility_history&lang=En&opt_npri_id=0000001698&opt_report_year=2017

Annual SO2 from Maritime Iron Off Gas

Annual SO2	693.07	tonnes per year (SO2 from MI off-gas based on flaring event info provided by MI)
Off-gas Flow	88.39	m3/s
Off-gas HHV	7.03	MJ/m3
Energy from Off-gas	621.34	MW
	18,614,904	GJ/yr
	17,643,524	MMBTU/yr

Conversions	
947817.1	BTU/GJ
2200	lb/tonne
0.0041868	MJ/kcal

Maritime Iron - Marine Terminal Emissions Inventory

Developed by: C. Lyons
Date: 5-Apr-19
Project number: 121415659

Releases of criteria air contaminants (nitrogen oxides (NOx), sulphur dioxide (SO2), particulate matter (PM)) and greenhouse gases (GHGs) from Marine Vessel Traffic in the Port of Belledune associated with the Project are estimated using this spreadsheet.

The emissions are estimated using vessel information provided by Maritime Iron and the methodologies provided in the Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories: Final Report (April 2009), Prepared for the United States Environmental Protection Agency (US EPA) by ICF Consultants.

Additional details are provided in each individual worksheet.

The estimated emissions are used in the CALPUFF model. The model period covers 2013 to 2017. The model input parameters to be used directly in the CALPUFF Source set up tool Macro are provided in the "Source Tool" worksheet.

Revision Log:

Name	**Date**	**Comments**
Chris Lyons	6-Mar-19	Started sheet.
Chris Lyons	9-Apr-19	Addressed review comments - added additional description text for clarity and updated Tug emissions to include 2 tugs per vessel (except Laker vessels, which do not require tugs). Addressed review comments and highlighting removed.

Reviewed by	**Date Reviewed**	**Comments**
Christina Varner	8-Apr-19	Made edits in Log description for clarity. Checked cells that are OK are coloured dark green. Comments are in cells with yellow highlighting. Some issues noted with tug counts and potentially calculation of emissions.

Model Input Emissions

Max hourly emissions assume two vessels - the largest supply (Panamax) and product (Handymax) ships maneuvering in port with 2 associated tugs per OGV, as these vessel types and activity result in the maximum hourly emission rates. See the *Maximum Emission Calcs* tab for details.

Max daily emissions assume two vessels - the largest supply (Panamax) and product (Handymax) ships hotelling (at berth) in port over a 24 hour period with 2 associated tugs per OGV present for 1 hour of the 24 hour period, which results in the maximum daily emission rates. See the *Maximum Emission Calcs* tab for details.

Annual emissions are estimated assuming the two largest vessel class types (supply vessel - Panamax and product vessel Handymax) in port over the year, based on the expected time per year with these vessel types in port as provided by Maritime Iron. The emissions are a combination of manuevering and hotelling activities. See the *Annual Emission Calcs* tab for details.

Additional details on the vessels as provided by Maritime Iron, such as expected vessels per year, duration in port and for each activity are provided in *Vessel Info* tab.

For all three emission scenarios, for the purpose of the model, vessels are assumed to be loacted near the jetty.

	Emission Rates (g/s)																			
Source	**TPM**	**PM10**	**PM2.5**	**NOx**	**SO2**	**Hg**	**Fe2O3**	**CaO**	**SiO2**	**P2O5**	**TiO2**	**K2O**	**SO3**	**As**	**Cd**	**Cr**	**Cu**	**Ni**	**V**	**Zn**
Max Hourly - 2 vessels (supply and product vessels and associated tugs) maneuving near jetty - Panamax and Handymax																				
PANAMAX	0.156	0.156	0.143	9.832	0.317	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HANDYMAX	0.134	0.134	0.126	8.919	0.289	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUG1	0.102	0.102	0.099	1.384	0.184	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUG2	0.102	0.102	0.099	1.384	0.184	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUG3	0.102	0.102	0.099	1.384	0.184	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUG4	0.102	0.102	0.099	1.384	0.184	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Max Daily - 2 vessels hotelling (at jetty), Tugs based on maneuvering activities																				
PANAMAX	0.019	0.019	0.017	1.102	0.049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HANDYMAX	0.017	0.017	0.016	0.980	0.045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUG1	0.004	0.004	0.004	0.058	0.008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUG2	0.004	0.004	0.004	0.058	0.008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUG3	0.004	0.004	0.004	0.058	0.008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUG4	0.004	0.004	0.004	0.058	0.008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Average - 2 vessels and tugs with emissions based on annual vessel traffic and time in port																				
PANAMAX	0.016	0.016	0.015	0.972	0.041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HANDYMAX	0.006	0.006	0.005	0.330	0.014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUG1	0.002	0.002	0.002	0.032	0.004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUG2	0.002	0.002	0.002	0.032	0.004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUG3	0.002	0.002	0.002	0.032	0.004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUG4	0.002	0.002	0.002	0.032	0.004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Metals emissions not estimated from marine vessel, values are place holders for model files so runs are consistent for combining in the Postutil post-processor

Modelled Source Parameters

Source	UTM Location (km)		Stack Height (m)	Base Elevation (m)	Stack Diameter (m)	Release Orientation	Velocity (m/s)		Assumed Exit Temperature (K)
	X	Y					Assumed	Modelled	
PANAMAX	287.57507	5310.45368	35	0	1.75	Vertical	15	15.0	773.15
HANDYMAX	287.31537	5310.44931	30	0	1.2	Vertical	15	15.0	773.15
TUG1	287.568737	5310.409786	8.4	0	0.42	45	10	7.1	773.15
TUG2	287.42988	5310.401787	8.4	0	0.42	45	10	7.1	773.15
TUG3	287.303531	5310.413273	8.4	0	0.42	45	10	7.1	773.15
TUG4	287.183881	5310.403701	8.4	0	0.42	45	10	7.1	773.15

Vessel exhuast stack characteristics are assumed based on previous experience with similar marine vessels

Marine Vessel Emission Estimation - Maximum Hourly and Daily EMISSION RATES

MAXIMUM EMISSION RATES	Operation Phase				
	Marine Terminal Operations				Total
	Supply Bulk Carrier - Panamax	Assist Tugboats	Product Bulk Carrier - Handymax	Assist Tugboats	
Number of Vessels in Port area at One Time [a]	1	2	1	2	6
Maximum Vessel Size (DWT) [a]	80,000	-	60,000	-	-
Main Engine Rating Power (kW) [b,c]	12,789	1,540	11,282	1,540	-
Auxiliary Engine Rating Power (kW) [c]	2,698	100	2,380	100	-
Auxiliary Boiler Energy (kW) [c]	109	-	109	-	-
Operating Mode while in Port	Hotelling/ Manuevering	-	Hotelling/ Manuevering	-	-
Time Manuevering (hrs) - 1hr inbound 1hr outbound [a]	2	2	2	2	
Time Hotelling (hrs) [a]	72	1	58	1	
Manuevering					
Main Engine Emissions					
NO_x (g/s)	5.08	2.60	4.72	2.60	15.00
CO (g/s)	0.82	0.29	0.72	0.29	2.12
HC (g/s)	0.47	0.13	0.33	0.13	1.06
PM_{10} (g/s)	0.09	0.19	0.08	0.19	0.55
$PM_{2.5}$ (g/s)	0.08	0.19	0.07	0.19	0.52
SO_2 (g/s)	0.16	0.34	0.15	0.34	0.99
Auxiliary Engine Emissions					
NO_x (g/s)	4.69	0.17	4.14	0.17	9.16
CO (g/s)	0.37	0.02	0.33	0.02	0.74
HC (g/s)	0.13	0.01	0.12	0.01	0.27
PM_{10} (g/s)	0.06	0.01	0.05	0.01	0.14
$PM_{2.5}$ (g/s)	0.06	0.01	0.05	0.01	0.13
SO_2 (g/s)	0.14	0.02	0.12	0.02	0.31
Auxiliary Boiler Emissions [b]					
NO_x (g/s)	0.06	-	0.06	-	0.12
CO (g/s)	0.01	-	0.01	-	0.01
HC (g/s)	0.003	-	0.003	-	0.01
PM_{10} (g/s)	0.01	-	0.01	-	0.01
$PM_{2.5}$ (g/s)	0.005	-	0.005	-	0.01
SO_2 (g/s)	0.02	-	0.02	-	0.03
TOTAL HOURLY MAXIMUM HOURLY EMISSIONS - Manuevering					
NO_x (g/s)	**9.8**	**2.77**	**8.92**	**2.77**	**24.3**
CO (g/s)	**1.19**	**0.31**	**1.05**	**0.31**	**2.87**
HC (g/s)	**0.61**	**0.14**	**0.45**	**0.14**	**1.34**
PM_{10} (g/s)	**0.16**	**0.20**	**0.13**	**0.20**	**0.70**
$PM_{2.5}$ (g/s)	**0.14**	**0.20**	**0.13**	**0.20**	**0.66**
SO_2 (g/s)	**0.32**	**0.37**	**0.29**	**0.37**	**1.34**
TOTAL HOURLY MAXIMUM DAILY EMISSIONS - Manuevering					
NO_x (g/s)	**0.41**	**0.12**	**0.37**	**0.12**	**1.01**
CO (g/s)	**0.05**	**0.01**	**0.04**	**0.01**	**0.12**
HC (g/s)	**0.03**	**0.01**	**0.02**	**0.01**	**0.06**
PM_{10} (g/s)	**0.01**	**0.008**	**0.01**	**0.008**	**0.03**
$PM_{2.5}$ (g/s)	**0.01**	**0.008**	**0.01**	**0.008**	**0.03**
SO_2 (g/s)	**0.013**	**0.015**	**0.012**	**0.015**	**0.056**
Hotelling					
Auxiliary Engine Emissions					
NO_x (g/s)	1.04	0.17	0.92	0.17	2.30
CO (g/s)	0.08	0.02	0.07	0.02	0.19
HC (g/s)	0.03	0.01	0.03	0.01	0.07
PM_{10} (g/s)	0.01	0.01	0.01	0.01	0.05
$PM_{2.5}$ (g/s)	0.01	0.01	0.01	0.01	0.05
SO_2 (g/s)	0.03	0.02	0.03	0.02	0.10
Auxiliary Boiler Emissions [b]					
NO_x (g/s)	0.061	-	0.061	-	0.12
CO (g/s)	0.006	-	0.006	-	0.01
HC (g/s)	0.003	-	0.003	-	0.01
PM_{10} (g/s)	0.005	-	0.005	-	0.01
$PM_{2.5}$ (g/s)	0.005	-	0.005	-	0.01
SO_2 (g/s)	0.017	-	0.017	-	0.03
TOTAL HOURLY MAXIMUM EMISSIONS - Hotelling					
NO_x (g/s)	**1.102**	**0.17**	**0.980**	**0.17**	**2.42**
CO (g/s)	**0.088**	**0.02**	**0.079**	**0.02**	**0.21**
HC (g/s)	**0.033**	**0.01**	**0.029**	**0.01**	**0.08**
PM_{10} (g/s)	**0.019**	**0.01**	**0.017**	**0.01**	**0.06**
$PM_{2.5}$ (g/s)	**0.017**	**0.01**	**0.016**	**0.01**	**0.06**
SO_2 (g/s)	**0.049**	**0.02**	**0.045**	**0.02**	**0.14**
TOTAL DAILY MAXIMUM EMISSIONS - Hotelling					
NO_x (g/s)	**1.102**	**0.007**	**0.980**	**0.007**	**2.10**
CO (g/s)	**0.088**	**0.001**	**0.079**	**0.001**	**0.17**
HC (g/s)	**0.033**	**3.60E-04**	**0.029**	**3.60E-04**	**0.06**
PM_{10} (g/s)	**0.019**	**5.18E-04**	**0.017**	**5.18E-04**	**0.04**
$PM_{2.5}$ (g/s)	**0.017**	**5.02E-04**	**0.016**	**5.02E-04**	**0.03**
SO_2 (g/s)	**0.049**	**9.35E-04**	**0.045**	**9.35E-04**	**0.10**

[a] Vessel size, vessels per year and time in port provided by Maritime Iron - See *Vessel Info* tab

[b] According to the US EPA "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data",
EPA420-R-00-002, February 2000:
Bulk Carriers and Tankers HP = 9070 + 0.101 x DWT (1 HP = 0.7457 kW)

[c] According to "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories: Final Report (April 2009)", prepared for the US EPA by ICF Consulting:
- Assist Tugboat Propulsion Engine Power = 1,540 kW and Assist Tugboat Auxiliary Engine Power = 100.2 kW (Table 3-10)
- Auxiliary Boiler Energy Output - Bulk Carriers = 109 kW (from Table 2-17)

Assumptions

Auxillary engine power ratings for Bulk Carriers scaled from "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories: Final Report (April 2009)", Table 2-4 based on the difference in the main engine size in the table and actual size

Marine Vessel Emission Estimation - ANNUAL EMISSION RATES - Supply and Product Vessels

ANNUAL EMISSION RATES	Operation Phase						Operation Phase		Operation Phase ANNUAL AVERAGE IN PORT Emission Rates (g/s) for Dispersion Modelling					
	Marine Terminal Operations					Total	Bulk Carriers							
	Supply Vessels		Product Vessels		Assist Tugboats		Maneuver.	Hotelling	Supply Vessels	Product Vessels	Assist Tugboat1	Assist Tugboat1	Assist Tugboat3	Assist Tugboat4
	Bulk Carrier - Panamax	Bulk Carrier - Handysize	Bulk Carrier - Handymax	Bulk Carrier - Laker					Panamax	Handymax				
Number of Vessels per Year [a]	86	9	39	85	268	487	-	-	-	-	-	-	-	-
Maximum Vessel Size (DWT) [a]	80,000	30,000	60,000	30,000	-	-	-	-	-	-	-	-	-	-
Main Engine Rating Power (kW) [b,c]	12,789	9,023	11,282	9,023	1,540	-	-	-	-	-	-	-	-	-
Auxiliary Engine Rating Power (kW) [c]	2,698	1,904	2,380	1,904	100	-	-	-	-	-	-	-	-	-
Auxiliary Boiler Heat (kW) [c]	109	109	109	109	-	-	-	-	-	-	-	-	-	-
Maneuvering Time per Vessel - inbound + outbound (hrs) [a]	2	2	2	1	-	-	-	-	-	-	-	-	-	-
Loading/Unloading Time per Vessel (Hotelling) (hrs) [a]	72	36	58	36	-	-	-	-	-	-	-	-	-	-
Total Time in Port per Vessel (Manoev. + Hotelling) (hrs)	74	38	60	37	-	-	-	-	-	-	-	-	-	-
Total Time Maneuvering (hrs/yr)	172	18	78	85	-	353	-	-	-	-	-	-	-	-
Total Time Hotelling (hrs/yr)	6,192	324	2,262	3,060	-	11,838	-	-	-	-	-	-	-	-
Total Time in Port (hrs/yr)	6,364	342	2,340	3,145	804	12,995	-	-	-	-	-	-	-	-
Main Engine Emissions (Maneuvr. and Hotelling)														
NO_x (tonnes/year)	3.15	0.23	1.26	1.10	3.76	9.5	5.74	-	0.100	0.040	0.030	0.030	0.030	0.030
CO (tonnes/year)	0.50	0.04	0.20	0.18	0.42	1.34	0.92	-	0.016	0.006	0.003	0.003	0.003	0.003
HC (tonnes/year)	0.29	0.02	0.12	0.10	0.19	0.72	0.53	-	0.009	0.004	0.002	0.002	0.002	0.002
PM10 (tonnes/year)	0.06	0.004	0.02	0.02	0.28	0.38	0.10	-	0.002	0.001	0.002	0.002	0.002	0.002
PM2.5 (tonnes/year)	0.05	0.004	0.02	0.02	0.27	0.36	0.09	-	0.002	0.001	0.002	0.002	0.002	0.002
SO_2 (tonnes/year)	0.10	0.01	0.04	0.03	0.50	0.68	0.18	-	0.003	0.001	0.004	0.004	0.004	0.004
CO2 (tonnes/year)	156	11.5	62.5	54	265	550	285	-	-	-	-	-	-	-
CH4 (tonnes/year)	6.6E-04	4.9E-05	2.6E-04	2.3E-04	0.035	0.04	0.001	-	-	-	-	-	-	-
N2O (tonnes/year)	0.005	3.8E-04	0.002	0.002	0.008	0.02	0.009	-	-	-	-	-	-	-
Aux Engine Emissions (Maneuvr. and Hotelling)														
NO_x (tonnes/year)	26.1	1.1	8.6	9.1	0.24	45.2	5.29	39.7	0.828	0.274	0.002	0.002	0.002	0.002
CO (tonnes/year)	2.07	0.08	0.68	0.72	0.03	3.58	0.42	3.14	0.066	0.022	2.2E-04	2.2E-04	2.2E-04	2.2E-04
HC (tonnes/year)	0.75	0.03	0.25	0.26	0.01	1.31	0.15	1.14	0.024	0.008	9.9E-05	9.9E-05	9.9E-05	9.9E-05
PM10 (tonnes/year)	0.34	0.01	0.11	0.12	0.02	0.60	0.07	0.51	0.011	0.004	1.4E-04	1.4E-04	1.4E-04	1.4E-04
PM2.5 (tonnes/year)	0.32	0.01	0.11	0.11	0.02	0.57	0.06	0.49	0.010	0.003	1.4E-04	1.4E-04	1.4E-04	1.4E-04
SO_2 (tonnes/year)	0.79	0.03	0.26	0.28	0.03	1.39	0.16	1.20	0.025	0.008	2.6E-04	2.6E-04	2.6E-04	2.6E-04
CO2 (tonnes/year)	1,298	53.2	430	453	17.23	2,251	263	1,971	-	-	-	-	-	-
CH4 (tonnes/year)	0.008	3.1E-04	0.002	0.003	0.002	0.02	0.002	0.011	-	-	-	-	-	-
N2O (tonnes/year)	0.06	0.002	0.019	0.020	5.0E-04	0.10	0.01	0.09	-	-	-	-	-	-
Auxiliary Boiler Emissions														
NO_x (tonnes/year)	1.39	0.07	0.51	0.69	-	2.66	0.08	2.58	0.044	0.016	-	-	-	-
CO (tonnes/year)	0.14	0.01	0.05	0.07	-	0.27	0.01	0.26	0.004	0.002	-	-	-	-
HC (tonnes/year)	0.07	0.00	0.03	0.03	-	0.13	0.004	0.13	0.002	0.001	-	-	-	-
PM10 (tonnes/year)	0.12	0.01	0.04	0.06	-	0.23	0.01	0.22	0.004	0.001	-	-	-	-
PM2.5 (tonnes/year)	0.10	0.01	0.04	0.05	-	0.20	0.01	0.19	0.003	0.001	-	-	-	-
SO_2 (tonnes/year)	0.40	0.02	0.15	0.20	-	0.76	0.02	0.74	0.013	0.005	-	-	-	-
CO2 (tonnes/year)	640	34.41	235	316	-	1,226	35.5	1,191	-	-	-	-	-	-
CH4 (tonnes/year)	0.001	0.000	0.001	0.001	-	0.003	7.7E-05	0.003	-	-	-	-	-	-
N2O (tonnes/year)	0.06	0.00	0.02	0.03	-	0.11	0.003	0.10	-	-	-	-	-	-
TOTAL ANNUAL EMISSIONS														
NO_x (tonnes/year)	**30.7**	**1.4**	**10.4**	**10.9**	**4.0**	57.4	11.1	42.2	**0.972**	**0.330**	**0.032**	**0.032**	**0.032**	**0.032**
CO (tonnes/year)	**2.71**	**0.13**	**0.94**	**0.97**	**0.45**	5.19	1.35	3.40	**0.086**	**0.030**	**0.004**	**0.004**	**0.004**	**0.004**
HC (tonnes/year)	**1.11**	**0.06**	**0.39**	**0.40**	**0.20**	2.16	0.68	1.27	**0.035**	**0.012**	**0.002**	**0.002**	**0.002**	**0.002**
PM10 (tonnes/year)	**0.51**	**0.02**	**0.18**	**0.20**	**0.29**	1.20	0.18	0.73	**0.016**	**0.006**	**0.002**	**0.002**	**0.002**	**0.002**
PM2.5 (tonnes/year)	**0.47**	**0.02**	**0.16**	**0.18**	**0.29**	1.13	0.16	0.68	**0.015**	**0.005**	**0.002**	**0.002**	**0.002**	**0.002**
SO_2 (tonnes/year)	**1.28**	**0.06**	**0.45**	**0.50**	**0.53**	2.83	0.36	1.93	**0.041**	**0.014**	**0.004**	**0.004**	**0.004**	**0.004**
CO2 (tonnes/year)	**2,095**	**99**	**727**	**823**	**282**	4,027	583	3,162	-	-	-	-	-	-
CH4 (tonnes/year)	**0.010**	**0.000**	**0.003**	**0.004**	**0.04**	0.05	0.003	0.014	-	-	-	-	-	-
N2O (tonnes/year)	**0.119**	**0.006**	**0.042**	**0.050**	**0.01**	0.22	0.024	0.192	-	-	-	-	-	-

[a] Vessel size, vessels per year and time in port provided by Maritime Iron - See *Vessel Info* tab

[b] According to the US EPA "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data", EPA420-R-00-002, February 2000:
Bulk Carriers and Tankers HP = 9070 + 0.101 x DWT (1 HP = 0.7457 kW)

[c] According to "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories: Final Report (April 2009), prepared for the US EPA by ICF Consulting:
- Assist Tugboat Propulsion Engine Power = 1,540 kW and Assist Tugboat Auxiliary Engine Power = 100.2 kW (Table 3-10)
- Auxiliary Boiler Energy Output - Bulk Carriers = 109 kW (from Table 2-17)

Assumptions

Auxillary engine power ratings for Bulk Carriers scaled from "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories: Final Report (April 2009)", Table 2-4 based on the difference in the main engine size in the table and actual size

Marine Vessel Emission Estimation - Bulk Carrier Emission Factors

Emission Factors [a]	Main Propulsion Engines		Auxiliary Engines		Auxiliary Boilers [a, g]	Assist Tugboats [a]
	Maneuvering	Hotelling	Maneuvering	Hotelling		
Bulk Carrier/Harbour Craft Load Factor [a, b, f]	0.07	-	0.45	0.10	-	0.31
Fuel Type	Marine Gas Oil (MGO)		Marine Gas Oil (MGO)		MGO	MGO
Average Sulphur Content (%) [a]	0.1		0.1		0.1	0.1
NO_x (g/kWh) [c, d, e]	13.20	-	13.90	13.90	2.00	9.80
CO (g/kWh) [c, d, e]	1.10	-	1.10	1.10	0.20	1.10
HC (g/kWh) [c, d, e]	0.50	-	0.40	0.40	0.10	0.50
PM_{10} (g/kWh) [c, d, e]	0.19	-	0.18	0.18	0.17	0.72
$PM_{2.5}$ (g/kWh) [c, d, e]	0.17	-	0.17	0.17	0.15	0.70
SO_2 (g/kWh) [c, d, e]	0.40	-	0.42	0.42	0.57	1.30
CO_2 (g/kWh)	646.08	-	690.71	690.71	922.97	690.00
CH_4 (g/kWh)	0.004	-	0.004	0.004	0.002	0.090
N_2O (g/kWh)	0.031	-	0.031	0.031	0.080	0.020
Emission Factor Adjustment Factors at 7% Load (Table 2-15):						
NO_x	1.45	-	-	-	-	-
CO	2.79	-	-	-	-	-
HC	3.52	-	-	-	-	-
PM_{10}	1.79	-	-	-	-	-
$PM_{2.5}$	1.79	-	-	-	-	-
SO_2	1.49	-	-	-	-	-
CO2	1.47	-	-	-	-	-

[a] **Based on "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories: Final Report (April 2009)", prepared for the US EPA by ICF Consulting**

[b] At lower speeds, the Propeller Law should be used to estimate ship propulsion loads:

$LF = (AS/MS)^3$,

where: LF = load factor (%),
AS = actual speed (knots), and
MS = maximum speed (knots).

Assumptions for Maneuvering Bulk Carriers: Inbound AS = 5 knots, and
Outbound AS = 8 knots.

Since the average cruise speed for bulk carriers is 14.50 knots (Table 2-6) and the load factor at cruise speed is 83%,
$MS = AS / LF^{1/3} = 14.5 / 0.83^{1/3} = 15.43$ knots.

[c] Propulsion Engine Emission Factors (g/kWh), Table 2-9, medium-speed diesel (MSD) engines using Marine Gas Oil (MGO) with an assumed sulphur content of 0.1%, as required in North American waters (within 200 km of shore)

[d] Auxiliary Engine Emission Factors (g/kWh), Table 2-16, engines fired with Marine Gas Oil (MGO) with an assumed sulphur content of 0.1%, as required in North American waters (within 200 km of shore)

[e] Category 2 Harbor Craft Emission Factors for Tier 1 engines category 2 (g/kWh), Table 3-8

[f] Auxiliary Engine Load Factors (g/kWh), Table 2-7, bulk carrier, hotelling and manuvering

[g] Auxiliary Boiler Emission Factors (**g/kWh**), Table 2-9, based on steam turbine Efs, as per ICF document recommendations
Engine types for Bulk Carriers assumed to be MSD (medium speed diesel)

Marine Vessel Info Provided by MI

The following table is for incoming raw materials unloaded at Port of Belledune's Terminal 2:

Material	Approximate Vessel Cargo Capacity	Approximate Frequency	Assumed Vessel Size Class	Assumed Vessel Capacity (DWT)	Class Range (DWT)	Time at Berth (hrs)	Manuevering Time (in port) (hrs)	Notes
Supply Vessels								
Fine iron ore	60,000 tonnes/ship (based on bulk density and moisture allowance)	46 ships/year (approximately one ship every 8 days)	Panamax	80,000	65,000 - 80,000	72	2	**Via Canadian sources (Quebec, Labrador, Nunavut)**
Semi-soft coking coal	55,000 tonnes/ship (based on bulk density and 8% moisture allowance	21 ships/year (approximately one ship every 17 days)	Panamax	80,000	65,000 - 80,000	72	2	**Via Atlantic crossings only (Europe, Western Russia)**
Thermal coal	55,000 tonnes/ship (based on bulk density and 12% moisture allowance)	6 ships/year (approximately one ship every 61 days)	Panamax	80,000	65,000 - 80,000	72	2	**Via Columbia (Atlantic side)**
Limestone (fine & lumpy) and dolomite (fine & lumpy)	60,000 tonnes/ship combined (based on bulk density and 1-3% moisture allowance)	9 ships/year (approximately one ship every 41 days)	Panamax	80,000	65,000 - 80,000	72	2	**Via Canadian source (Newfoundland)**
Quartz	55,000 tonnes/ship (based on bulk density)	4 ships/year (approximately one ship every 91 days)	Panamax	80,000	65,000 - 80,000	72	2	**Via Atlantic Coast only**
Coke	20,000 tonnes/ship (based on bulk density and 5% moisture allowance)	9 ships/year (approximately one ship every 41 days)	Handysize	30,000	20,000 - 40,000	36	2	**Via Atlantic Coast only (Alternate will be Laker class via Great Lakes)**
Product Vessels								
Pig Iron	25,000 tonnes/barge	64 barges/year (approximately one barge every 6 days)	Laker	30,000	20,000 - 30,000	36	1	**Via Great Lakes (Ontario, Erie)**
	55,000 tonnes/ship	29 ships/year (apprximately one ship every 12 days)	Handymax	60,000	35,000 - 60,000	58	2	**Via Atlantic Coast & Gulf of Mexico**
Slag	25,000 tonnes/barge	21 barges/year (approximately one barge every 17 days)	Laker	30,000	20,000 - 30,000	36	1	**Via Great Lakes (Ontario, Erie)**
	55,000 tonnes/ship	10 ships/year (apprximately one ship every 36 days)	Handymax	60,000	35,000 - 60,000	58	2	**Via Atlantic Coast & Gulf of Mexico**
Note: The number of ships that will supply raw materials as feedstock for the Project facility will vary based on plant								

Summary	Vessel Size Class	DWT	Vessels Per Year	Total Hours with Vessel in Port/yr Hotelling	Manuevering	OGV Total	Hours with Tugs present	
Supply Vessels	Panamax	80,000	86	6192	172	6364	258	
	Handysize	30,000	9	324	18	342	27	
Product Vessels	Handymax	60,000	39	2262	78	2340	117	
	Laker	30,000	85	3060	85	3145	0	tugs not required for Laker vessels
							804	Tug Hours per year (2 tugs assumed per vessel)
			tugs per yr	268	804			

The following information is for outgoing product & by-product loaded at Port of Belledune's Terminal 3:

Pig iron

Will be loaded onto ships or barges at Terminal 3 for delivery to various clients. It is anticipated that due to the size (pyramidal shaped ingots, with likely dimensions of between 7 x 10 x 15 cm to 8 x 15 x 20 cm) and weight (5kg to 8kg) of the pig iron ingots, the shipments of pig iron will average approximately 25,000 tonnes/barge or 55,000 tonnes/ship. Approximate frequency will be 64 barges/year (approximately one barge every 6 days) if only barges used. Approximate frequency will be 29 ships/year (approximately one ship every 12 days) if only ships used. Approximate frequency is most likely to be a mix of barges and ships depending on client order size & destination.

Slag

Will be loaded onto ships or barges at Terminal 3 for delivery to various clients. The shipments of slag will average approximately 25,000 tonnes/barge or 55,000 tonnes/ship. Approximate frequency will be 21 barges/year (approximately one barge every 17 days) if only barges used. Approximate frequency will be 10 ships/year (approximately one ship every 36 days) if only ships used. Approximate frequency is most likely to be a mix of barges and ships depending on client order size & destination.

Note that the above information will be confirmed as part of the on-going Project Description work but is not likely to change.

Questions

How long in port (at berth (loading and unloading) and manuevering (from pilot station to jetty and from jetty to pilot station)) for each vessel?
At berth = 36 to 72 hours depending on load transfer size, Pilot station to jetty = up to 1 hour, Jetty to pilot station = up to 1 hour (except for Lakers which do not require pilot so only up to 30 min travel times).
Is there any specs available for the barges? Not able to find much online any larger than 5k tonnes cargo capacity
Acceptable to assume equivalent small ships instead of barges - see comments in table below.
Number of tugs required for each vessel type while in port? Do tugs remain during loading/unloading?
Two tugs are used to/from pilot station to/from jetty, tugs leave once ship is at jetty, tugs return 1 hour before ship leaves jetty (except for Lakers which do not require any tugs).

Vessel Sizes, approx dimensions

Vessel Name	Oceanic	WUZH0U8	Belatlantic	UBC Santos
Type	Bulk Carrier	Bulk Carrier	Bulk Carrier	Bulk Carrier
DWT	82471	76005	63318	31700
Gross tonnage	43158	41303	36318	19748
Vessel Dimensions				
Length (m)	229	225	199	172
Width (m)	32	32	32	27
Draught (m)	10.4	11.3	9.6	8.9

(green shading) approximate dimensions used for BPIP - downwash calculation inputs for model

Vessel Info from FleetMon Database - https://www.fleetmon.com/vessels/

Appendix E NOISE CONSTRUCTION EQUIPMENT

Appendix E Noise Construction Equipment
October 2, 2019

Table E.1 Quantity of Noise Construction Equipment

Name	Number
D8T Crawler	1
345/349 Excavator	1
740 Articulated Truck	2
Grader	1
Loader	1
Backhoe	1
Roller	1
Water Pump	1
Scraper	1
Chainsaw	1
Boom Truck	1
Total	**12**

MARITIME IRON PROJECT – PROVINCIAL ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR PROPOSED BELLEDUNE IRON PROCESSING FACILITY IN BELLEDUNE, NEW BRUNSWICK

Appendix E Noise Construction Equipment
October 2, 2019

Appendix F NOISE OPERATION CALCULATIONS

Appendix F Noise Operation Calculations
October 2, 2019

Equipment / Tag	Type	Motor (No.)	Indoor? Outdoor?	Z Elev. (m)	Motor HP (hp)	Pump/Fan Type	Pump/Fan Capacity	Operating Status
Core Plant								
Stockhouse (CF)								
Tripper Belt Conveyor (Bin feed - Raw Materials)	Drive System	1	Indoor	42	100	n/a	n/a	Operating
Belt Conveyor 165F01	Drive System	1	Indoor	19	125	n/a	n/a	Operating
Belt Conveyor 165F11	Drive System	1	Indoor	34.5	60	n/a	n/a	Operating
Belt Conveyor 165F21	Drive System	1	Indoor	39	30	n/a	n/a	Operating
Belt Conveyor 175F01	Drive System	1	Indoor	15	75	n/a	n/a	Operating
Belt Conveyor 175F11	Drive System	1	Indoor	18	100	n/a	n/a	Operating
Belt Conveyor 175F12	Drive System	1	Indoor	15	30	n/a	n/a	Operating
Belt Conveyor (Bin feed - Coke)	Drive System	1	Indoor	36	200	n/a	n/a	Operating
Belt Conveyor 185F01	Drive System	1	Indoor	3	15	n/a	n/a	Operating
Belt Conveyor 185F03	Drive System	1	Indoor	5	30	n/a	n/a	Operating
Belt Conveyor 185F11	Drive System	1	Indoor	7	125	n/a	n/a	Operating
Belt Conveyor 533F21	Drive System	1	Indoor	32	30	n/a	n/a	Operating
Belt Conveyor 536F11	Drive System	1	Indoor	13.5	60	n/a	n/a	Operating
Belt Conveyor 536F12	Drive System	1	Indoor	12.5	60	n/a	n/a	Operating
I D Fan for Ore Dedusting Baghouse	Dust Collector	1	Outdoor	1	125	Centrifugal (Fan ID=1.5m)	100,000 Nm3/h	Operating
I D Fan for Coal Dedusting Baghouse	Dust Collector	1	Outdoor	1	150	Centrifugal (Fan ID=2.0m)	200,000 Nm3/h	Operating
Oxide Dryer (GH)								
Fan for Fluidizing Air 122C11	Fluidization	1	Outdoor	1	100	Centrifugal (Fan ID=2.0m)	250,000 Nm3/h	Operating
Fan for Main Burner Combustion Air 122C12	Combustion Air	1	Outdoor	1	75	Centrifugal (Fan ID=1.5m)	150,000 Nm3/h	Operating
Fan for Freeboard Burner Combustion Air 122C21	Combustion Air	1	Outdoor	1	60	Centrifugal (Fan ID=1.0m)	70,000 Nm3/h	Operating
Vibrating Screen for Dryer 123D21	Vibration	1	Outdoor	8	60	n/a	n/a	Operating
Fan for Dry Dedusting System 127C11	Dust Collector ID Fan	1	Outdoor	1	200	Centrifugal (Fan ID=2.5m)	500,000 Nm3/h	Operating
Chain Conveyor for Dedusting Unit 127F41	Dust Collector Dust Handling	1	Outdoor	5	5	n/a	n/a	Operating
Chain Conveyor for Dedusting Unit 127F42	Dust Collector Dust Handling	1	Outdoor	5	5	n/a	n/a	Operating
Chain Conveyor for Dedusting Unit 127F43	Dust Collector Dust Handling	1	Outdoor	3.8	7.5	n/a	n/a	Operating
Chain Conveyor for Dedusting Unit 127F44	Dust Collector Dust Handling	1	Outdoor	2.7	7.5	n/a	n/a	Operating
Bucket Elevator 127F45	Dust Collector Dust Handling	1	Outdoor	27	15	n/a	n/a	Operating
FEG Compressor 122C31	Compressor Noise	1	Outdoor	1	50	Centrifugal	30,000 Nm3/h	Operating
Reactor (GR)								
Bucket Elevator 124F01	Drive System	1	Outdoor	61	75	n/a	n/a	Operating
Fan for Dedusting System 128C12	Dust Collector	1	Outdoor	30	60	Centrifugal (Fan ID=1.0m)	60,000 Nm3/h	Operating
Screw Conveyors 125F11	Drive System	1	Outdoor	3	5	n/a	n/a	Operating
Screw Conveyors 125F31	Drive System	1	Outdoor	3	5	n/a	n/a	Operating
Screw Conveyors, 128F11	Drive System	1	Outdoor	31	5	n/a	n/a	Operating
HCI (GL)								
Hot DRI Compactors 244A11	Compacting Reuced Iron	1	Outdoor	29.5	75	n/a	n/a	Operating
Hot DRI Compactors 244A21	Compacting Reuced Iron	1	Outdoor	29.5	75	n/a	n/a	Operating
Hot DRI Compactors 244A31	Compacting Reuced Iron	1	Outdoor	29.5	75	n/a	n/a	Operating
Hot DRI Compactors 244A41	Compacting Reuced Iron	1	Outdoor	29.5	75	n/a	n/a	Operating
Hot DRI Compactors 244A51	Compacting Reuced Iron	1	Outdoor	29.5	75	n/a	n/a	Operating
Hot DRI Compactors 244A61	Compacting Reuced Iron	1	Outdoor	29.5	75	n/a	n/a	Operating
HCI Crushers 244A12	Crushing Hot Compaced Iron	1	Outdoor	25	60	n/a	n/a	Operating
HCI Crushers 244A22	Crushing Hot Compaced Iron	1	Outdoor	25	60	n/a	n/a	Operating
HCI Crushers 244A32	Crushing Hot Compaced Iron	1	Outdoor	25	60	n/a	n/a	Operating
HCI Crushers 244A42	Crushing Hot Compaced Iron	1	Outdoor	25	60	n/a	n/a	Operating
HCI Crushers 244A52	Crushing Hot Compaced Iron	1	Outdoor	25	60	n/a	n/a	Operating
HCI Crushers 244A62	Crushing Hot Compaced Iron	1	Outdoor	25	60	n/a	n/a	Operating
ID Fan for Bag Filter Unit 249C11	Dust Collector	1	Outdoor	2.5	75	Centrifugal (Fan ID=1.5m)	100,000 Nm3/hr	Operating
Hot HCI Conveyor (Pan Conveyor) 254F11	HCI Handling	1	Outdoor	88	300	n/a	n/a	Operating
Apron Conveyor 254F01	Handling Dust	1	Outdoor	13	30	n/a	n/a	Operating
Apron Conveyor Quench Cooling System 247A31	Handling Sludge	1	Outdoor	5	30	n/a	n/a	Operating
Apron Conveyor Quench Cooling System 247A51	Handling Sludge	1	Outdoor	5	30	n/a	n/a	Operating
Drag Chain Conveyor Cooling System 247F32	Handling Sludge	1	Outdoor	4	30	n/a	n/a	Operating
Drag Chain Conveyor Cooling System 247F52	Handling Sludge	1	Outdoor	4	30	n/a	n/a	Operating
Cold Material Product Conveyor 247F91	Handling Cold HCI	1	Outdoor	8	50	n/a	n/a	Operating
Bucket Elevator 249F16	Handling Dust Collector Dust	1	Outdoor	20	25	n/a	n/a	Operating
Flow Chain Conveyor 249F15	Handling Dust Collector Dust	1	Outdoor	3	10	n/a	n/a	Operating
Melter Gasifier (CC), Cooling Gas Compressor (CGC)								
Coal Bucket Elevator 322F01	Handling Coal	1	Outdoor	93	125	n/a	n/a	Operating
Coal Screw Conveyor 323F01	Handling Coal	1	Outdoor	63	25	n/a	n/a	Operating
HCI Screw Conveyor 333F11	Handling Hot Compacted Iron	1	Outdoor	46	25	n/a	n/a	Operating
HCI Screw Conveyor 333F21	Handling Hot Compacted Iron	1	Outdoor	46	25	n/a	n/a	Operating
Cooling Gas Compressors 367C11	Gas Compressor	1	Indoor	2.5	100	Centrifugal	100,000 Nm3/h	Operating
Cooling Gas Compressors 367C21	Gas Compressor	1	Indoor	2.5	100	Centrifugal	100,000 Nm3/h	Operating
Cooling Gas Compressors 367C31	Gas Compressor	1	Indoor	2.5	100	Centrifugal	100,000 Nm3/h	Spare
Waste Gas Fan for Coal Dedusting System 391C01	Dedusting Fan	1	Outdoor	93	25	Centrifugal	40,000 Nm3/hr	Operating
Screw Conveyor 391F03	Handling coal Dust	1	Outdoor	90	5	n/a	n/a	Operating
Cast House (CA, CB), Slag Granulation (CBT), Dedusting Cast House (CDA)								
Waste Gas fan 491C01	Drive System	1	Outdoor	4	200	Centrifugal (Fan ID=2.75m)	500,000 Nm3/hr	Operating
Waste Gas fan 491C11	Drive System	1	Outdoor	4	200	Centrifugal (Fan ID=2.75m)	500,000 Nm3/hr	Spare
Dust Chain Conveyor 491F01	Drive System	1	Outdoor	5	10	n/a	n/a	Operating
Dust Chain Conveyor 491F02	Drive System	1	Outdoor	5	10	n/a	n/a	Operating
Discharge Screw Conveyor 1, 491F31	Drive System	1	Outdoor	5	5	n/a	n/a	Operating
Discharge Screw Conveyor 2, 491F32	Drive System	1	Outdoor	5	5	n/a	n/a	Operating
Collecting Dust Chain Conveyor 491F41	Drive System	1	Outdoor	4	15	n/a	n/a	Operating
Bucket Elevetor 491F42	Drive System	1	Outdoor	19	45	n/a	n/a	Operating
Cooling Tower Fan 466H01.1	Drive System	1	Outdoor	37	100	n/a	n/a	Operating
Cooling Tower Fan 466H01.2	Drive System	1	Outdoor	37	100	n/a	n/a	Operating
Cooling Tower Fan 466H01.3	Drive System	1	Outdoor	37	100	n/a	n/a	Operating
Cooling Tower Fan 466H01.4	Drive System	1	Outdoor	37	100	n/a	n/a	Operating
Belt Conveyor RX465F01	Drive System	1	Outdoor	23	60	n/a	n/a	Operating
Pig Casting Machine (PCM)								
Pig Casting Machine #1 472A11	Drive System	1	Indoor	10	75	n/a	n/a	Operating
Pig Casting Machine #1 472A31	Drive System	1	Indoor	10	75	n/a	n/a	Operating
Pig Casting Machine #1 472A51	Drive System	1	Indoor	10	75	n/a	n/a	Operating
Swing Conveyor 473A12	Drive System	1	Indoor	8	45	n/a	n/a	Operating
Swing Conveyor 473A32	Drive System	1	Indoor	8	45	n/a	n/a	Operating
Swing Conveyor 473A52	Drive System	1	Indoor	8	45	n/a	n/a	Operating
Combustion Air Fan 474C01	Drive System	1	Indoor	1.5	5	Centrifugal (Fan ID=0.5m)	10,000 Nm3/hr	Operating
Combustion Air Fan 474C02	Drive System	1	Indoor	1.5	5	Centrifugal (Fan ID=0.5m)	10,000 Nm3/hr	Operating
Combustion Air Fan 474C03	Drive System	1	Indoor	1.5	5	Centrifugal (Fan ID=0.5m)	10,000 Nm3/hr	Spare
ID fan for Dust Collector 479C11	Drive System	1	Indoor	2	75	Centrifugal (Fan ID=1.5m)	100,000 Nm3/hr	Operating
Flow Chain Conveyor 479F14	Drive System	1	Indoor	4	7.5	n/a	n/a	Operating
Air Compressor Room (ACR)								
Air Compressor for General Air 841C01	Drive System	1	Indoor	1.5	200	Centrifugal	2500 Nm3/h	Operating
Air Compressor for General Air 841C02	Drive System	1	Indoor	1.5	200	Centrifugal	2500 Nm3/h	Operating
Air Compressor for General Air 841C03	Drive System	1	Indoor	1.5	200	Centrifugal	2500 Nm3/h	Operating
Air Compressor for General Air 841C04	Drive System	1	Indoor	1.5	200	Centrifugal	2500 Nm3/h	Operating
Air Compressor for General Air 841C05	Drive System	1	Indoor	1.5	200	Centrifugal	2500 Nm3/h	Spare

Air Fan (Turbo) 841C11	Drive System	1	Indoor	1.5	50	Centrifugal (Fan ID=1.0m)	50,000 Nm3/h	Operating
Air Fan (Turbo) 841C12	Drive System	1	Indoor	1.5	50	Centrifugal (Fan ID=1.0m)	50,000 Nm3/h	Operating
Air Fan (Turbo) 841C13	Drive System	1	Indoor	1.5	50	Centrifugal (Fan ID=1.0m)	50,000 Nm3/h	Operating
Air Fan (Turbo) 841C14	Drive System	1	Indoor	1.5	50	Centrifugal (Fan ID=1.0m)	50,000 Nm3/h	Operating
Air Fan (Turbo) 841C15	Drive System	1	Indoor	1.5	50	Centrifugal (Fan ID=1.0m)	50,000 Nm3/h	Spare
Air Fan (Turbo) 841C16	Drive System	1	Indoor	1.5	50	Centrifugal (Fan ID=1.0m)	50,000 Nm3/h	Spare
Coal Briquetting Plant (CP)								
Raw Coal Feed Conveyor from TT	Drive System	1	Indoor	45	60	n/a	n/a	Operating
Constant Weight Feeder (CFW) 511W01	Drive System	1	Indoor	27	15	n/a	n/a	Operating
Constant Weight Feeder (CFW) 511W02	Drive System	1	Indoor	27	15	n/a	n/a	Operating
Constant Weight Feeder (CFW) 511W03	Drive System	1	Indoor	27	15	n/a	n/a	Operating
Constant Weight Feeder (CFW) 511W04	Drive System	1	Indoor	27	15	n/a	n/a	Operating
Belt Conveyor 511F11	Drive System	1	Indoor	36	30	n/a	n/a	Operating
Coal Dryer 523D01	Drive System	1	Indoor	14	150	n/a	n/a	Operating
Coal Crusher 523D11	Drive System	1	Indoor	9	60	n/a	n/a	Operating
I D fan for Dry Dedusting System 492k10	Drive System	1	Indoor	1.5	45	Centrifugal (Fan ID=1.0m)	25,000 Nm3/hr	Operating
Chain Conveyor 492F02	Drive System	1	Indoor	6	15	n/a	n/a	Operating
Bucket Elevator 533F14	Drive System	1	Indoor	49	50	n/a	n/a	Operating
Constant Weight Feeder (CFW) 521W01	Drive System	1	Indoor	45	15	n/a	n/a	Operating
Transfer Screw 521F11	Drive System	1	Indoor	45	10	n/a	n/a	Operating
1st Mixer 526M01	Drive System	1	Indoor	40	40	n/a	n/a	Operating
weigh Feeder 521W02	Drive System	1	Indoor	48	30	n/a	n/a	Operating
weigh Feeder 521W03	Drive System	1	Indoor	48	30	n/a	n/a	Operating
weigh Feeder 521W04	Drive System	1	Indoor	48	30	n/a	n/a	Operating
weigh Feeder 521W05	Drive System	1	Indoor	48	30	n/a	n/a	Operating
Reversible Belt Conveyor 531F11	Drive System	1	Indoor	35	30	n/a	n/a	Operating
Reversible Belt Conveyor 531F12	Drive System	1	Indoor	35	30	n/a	n/a	Operating
Constant Weight Feeder (CFW) 531W11	Drive System	1	Indoor	23	25	n/a	n/a	Operating
Constant Weight Feeder (CFW) 531W12	Drive System	1	Indoor	23	25	n/a	n/a	Operating
Constant Weight Feeder (CFW) 531W13	Drive System	1	Indoor	23	25	n/a	n/a	Operating
Constant Weight Feeder (CFW) 531W14	Drive System	1	Indoor	23	25	n/a	n/a	Operating
Transfer Screw 532F01	Drive System	1	Indoor	13	30	n/a	n/a	Operating
Transfer Screw 532F02	Drive System	1	Indoor	13	30	n/a	n/a	Operating
Transfer Screw 532F03	Drive System	1	Indoor	13	30	n/a	n/a	Operating
Transfer Screw 532F04	Drive System	1	Indoor	13	30	n/a	n/a	Operating
Bucket Elevator 523F23	Drive System	1	Indoor	68	150	n/a	n/a	Operating
Transfer Screw 523F21	Drive System	1	Indoor	5	10	n/a	n/a	Operating
Briquetting Machine 533D01	Drive System	1	Indoor	6.5	50	n/a	n/a	Operating
Briquetting Machine 533D02	Drive System	1	Indoor	6.5	50	n/a	n/a	Operating
Briquetting Machine 533D03	Drive System	1	Indoor	6.5	50	n/a	n/a	Operating
Briquetting Machine 533D04	Drive System	1	Indoor	6.5	50	n/a	n/a	Operating
Belt Conveyor 533F11	Drive System	1	Indoor	21	100	n/a	n/a	Operating
Belt Conveyor 533F12	Drive System	1	Indoor	8	60	n/a	n/a	Operating
Hot Metal Pre-Treatment Station (HMPS)								
Dedusting System BB111 Motor 1	Drive System	1	Indoor	1.5	50	n/a	n/a	Operating
Dedusting System BB111 Motor 2	Drive System	1	Indoor	1.5	50	n/a	n/a	Operating
Impeller BA417 Motor	Drive System	1	Indoor	22	150	n/a	n/a	Operating
Water Treatment (CM)								
Pump for Make Up Water System 818P01	Drive System	1	Indoor	1.5	125	Centrifugal	200 m3/hr	Operating
Pump for Make Up Water System 818P02	Drive System	1	Indoor	1.5	125	Centrifugal	200 m3/hr	Spare
Pump for Soft Water System 812P01	Drive System	1	Indoor	1.5	15	Centrifugal	20 m3/hr	Operating
Pump for Soft Water System 812P02	Drive System	1	Indoor	1.5	15	Centrifugal	20 m3/hr	Spare
Pump for Soft Water System 812P11	Drive System	1	Indoor	1.5	350	Centrifugal	500 m3/hr	Intermittent
Pump for Glad and Seal Water System 817P01	Drive System	1	Indoor	1.5	50	Centrifugal	70 m3/hr	Operating
Pump for Glad and Seal Water System 817P02	Drive System	1	Indoor	1.5	50	Centrifugal	70 m3/hr	Spare
Pump for Glad and Seal Water System 817P11	Drive System	1	Indoor	1.5	45	Centrifugal	100 m3/hr	Operating
Pump for Glad and Seal Water System 817P12	Drive System	1	Indoor	1.5	45	Centrifugal	100 m3/hr	Spare
Pump for Machinery Cooling Water System Reactor 821P01	Drive System	1	Indoor	1.5	75	Centrifugal	250 m3/hr	Operating
Pump for Machinery Cooling Water System Reactor 821P02	Drive System	1	Indoor	1.5	75	Centrifugal	250 m3/hr	Spare
Pump for Machinery Cooling Water System HCl 822P01	Drive System	1	Indoor	1.5	450	Centrifugal	700 m3/hr	Operating
Pump for Machinery Cooling Water System HCl 822P02	Drive System	1	Indoor	1.5	450	Centrifugal	700 m3/hr	Spare
Pump for Machinery Cooling Water System HCl 822P03	Drive System	1	Indoor	1.5	100	Centrifugal	200 m3/hr	Intermittent
Pump for Machinery Cooling Water System Non Critical 823P01	Drive System	1	Indoor	1.5	150	Centrifugal	350 m3/hr	Operating
Pump for Machinery Cooling Water System Non Critical 823P02	Drive System	1	Indoor	1.5	150	Centrifugal	350 m3/hr	Spare
Pump for Machinery Cooling Water System Critical + Tuyer 824P01	Drive System	1	Indoor	1.5	400	Centrifugal	650 m3/hr	Operating
Pump for Machinery Cooling Water System Critical + Tuyer 824P02	Drive System	1	Indoor	1.5	400	Centrifugal	650 m3/hr	Operating
Pump for Machinery Cooling Water System Critical + Tuyer 824P03	Drive System	1	Indoor	1.5	400	Centrifugal	650 m3/hr	Spare
Pump for Machinery Cooling Water System Critical + Tuyer 824P04	Drive System	1	Indoor	1.5	250	Centrifugal	400 m3/hr	Intermittent
Pump for Machinery Cooling Water System-Stave 826P01	Drive System	1	Indoor	1.5	600	Centrifugal	1400 m3/hr	Operating
Pump for Machinery Cooling Water System-Stave 826P02	Drive System	1	Indoor	1.5	600	Centrifugal	1400 m3/hr	Operating
Pump for Machinery Cooling Water System-Stave 826P03	Drive System	1	Indoor	1.5	600	Centrifugal	1400 m3/hr	Spare
Pump for Machinery Cooling Water System-Stave 826P04	Drive System	1	Indoor	1.5	375	Centrifugal	900 m3/hr	Intermittent
Pump for Machinery Cooling Water System- Auxiliary 828P01	Drive System	1	Indoor	1.5	350	Centrifugal	1000 m3/hr	Operating
Pump for Machinery Cooling Water System- Auxiliary 828P02	Drive System	1	Indoor	1.5	350	Centrifugal	1000 m3/hr	Spare
Pump for Secondary Cooling Water System 829P01	Drive System	1	Indoor	1.5	350	Centrifugal	2800 m3/hr	Operating
Pump for Secondary Cooling Water System 829P02	Drive System	1	Indoor	1.5	350	Centrifugal	2800 m3/hr	Operating
Pump for Secondary Cooling Water System 829P03	Drive System	1	Indoor	1.5	350	Centrifugal	2800 m3/hr	Spare
Pump for Secondary Cooling Water System 829P04	Drive System	1	Indoor	1.5	250	Centrifugal	1800 m3/hr	Intermittent
Pump for Process Cooling Water Pond (Cold) 832P01	Drive System	1	Indoor	1.5	1500	Centrifugal	1900 m3/hr	Operating
Pump for Process Cooling Water Pond (Cold) 832P02	Drive System	1	Indoor	1.5	1500	Centrifugal	1900 m3/hr	Operating
Pump for Process Cooling Water Pond (Cold) 832P03	Drive System	1	Indoor	1.5	1500	Centrifugal	1900 m3/hr	Operating
Pump for Process Cooling Water Pond (Cold) 832P04	Drive System	1	Indoor	1.5	1500	Centrifugal	1900 m3/hr	Spare
Pump for Process Cooling Water Pond (Cold) 832P05	Drive System	1	Indoor	1.5	500	Centrifugal	600 m3/hr	Intermittent
Pump for Process Cooling Water Pond (Cold) 833P01	Drive System	1	Indoor	1.5	750	Centrifugal	1500 m3/hr	Operating
Pump for Process Cooling Water Pond (Cold) 833P02	Drive System	1	Indoor	1.5	750	Centrifugal	1500 m3/hr	Operating
Pump for Process Cooling Water Pond (Cold) 833P03	Drive System	1	Indoor	1.5	750	Centrifugal	1500 m3/hr	Spare
Pump for Process Cooling Water Pond (Hot) 831P01	Drive System	1	Indoor	1.5	500	Centrifugal	2800 m3/hr	Operating
Pump for Process Cooling Water Pond (Hot) 831P02	Drive System	1	Indoor	1.5	500	Centrifugal	2800 m3/hr	Operating
Pump for Process Cooling Water Pond (Hot) 831P03	Drive System	1	Indoor	1.5	500	Centrifugal	2800 m3/hr	Operating
Pump for Process Cooling Water Pond (Hot) 831P04	Drive System	1	Indoor	1.5	500	Centrifugal	2800 m3/hr	Spare
Process Coolong Tower 831H01 - Fan1	Drive System	1	Outdoor	13	125	n/a	n/a	Operating
Process Coolong Tower 831H01 - Fan2	Drive System	1	Outdoor	13	125	n/a	n/a	Operating
Process Coolong Tower 831H01 - Fan3	Drive System	1	Outdoor	13	125	n/a	n/a	Operating
Process Coolong Tower 831H01 - Fan4	Drive System	1	Outdoor	13	125	n/a	n/a	Operating
Process Coolong Tower 831H01 - Fan5	Drive System	1	Outdoor	13	125	n/a	n/a	Operating
Process Coolong Tower 831H01 - Fan6	Drive System	1	Outdoor	13	125	n/a	n/a	Operating
Process Coolong Tower 831H01 - Fan7	Drive System	1	Outdoor	13	125	n/a	n/a	Operating
Process Coolong Tower 831H01 - Fan8	Drive System	1	Outdoor	13	125	n/a	n/a	Operating
Secondary Coolong Tower 829H01 - Fan1	Drive System	1	Outdoor	13	125	n/a	n/a	Operating
Secondary Coolong Tower 829H01 - Fan2	Drive System	1	Outdoor	13	125	n/a	n/a	Operating
Secondary Coolong Tower 829H01 - Fan3	Drive System	1	Outdoor	13	125	n/a	n/a	Operating
Secondary Coolong Tower 829H01 - Fan4	Drive System	1	Outdoor	13	125	n/a	n/a	Operating
Secondary Coolong Tower 829H01 - Fan5	Drive System	1	Outdoor	13	125	n/a	n/a	Operating
Screw Decanter 835D01	Drive System	1	Indoor	8.7	60	Centrifugal	35 m3/hr	Operating
Screw Decanter 835D02	Drive System	1	Indoor	8.7	60	Centrifugal	35 m3/hr	Operating
Screw Decanter 835D03	Drive System	1	Indoor	8.7	60	Centrifugal	35 m3/hr	Operating
Screw Decanter 835D04	Drive System	1	Indoor	8.7	60	Centrifugal	35 m3/hr	Spare
Screw Classifier 834D01	Drive System	1	Outdoor	6	10	Centrifugal	70 tonne/hr	Operating
Screw Classifier 834D02	Drive System	1	Outdoor	6	10	Centrifugal	70 tonne/hr	Spare
Clarifier #1 834C01 (Water Clarifier with Rotating Bridge)	Drive System	1	Outdoor	8.5	5	Centrifugal	0.25 rpm for bridge	Operating
Clarifier #2 834C02 (Water Clarifier with Rotating Bridge)	Drive System	1	Outdoor	8.5	5	Centrifugal	0.25 rpm for bridge	Operating

Air Fan #1 841C11	Drive System	1	Indoor	1	20	Centrifugal	15,000 m3/hr	Operating
Air Fan #2 841C12	Drive System	1	Indoor	1	20	Centrifugal	15,000 m3/hr	Operating
Air Fan #3 841C13	Drive System	1	Indoor	1	20	Centrifugal	15,000 m3/hr	Operating
Air Fan #4 841C14	Drive System	1	Indoor	1	20	Centrifugal	15,000 m3/hr	Operating
Air Fan #5 841C15	Drive System	1	Indoor	1	20	Centrifugal	15,000 m3/hr	Operating
Air Fan #6 841C16	Drive System	1	Indoor	1	20	Centrifugal	15,000 m3/hr	Spare
RTO Fan	Drive System	1	Outdoor	1	35	Centrifugal	40,000 m3/hr	Operating
Balance Of Plant (BOP)								
Stockyard (Bulk Material Handling)								
Transfer Belt Conveyor (From NB Power TT)	Drive System	1	Outdoor	8	600	n/a	n/a	Operating
Transfer Belt Conveyor (From New TT)	Drive System	1	Outdoor	4	350	n/a	n/a	Operating
Stacker Belt Conveyor and Tripper	Drive System	1	Outdoor	2	500	n/a	n/a	Operating
Stacker Boom Belt Conveyor	Drive System	1	Outdoor	13	100	n/a	n/a	Operating
Reclaimer Conveyor (Coal and Coke)	Drive System	1	Outdoor	2	150	n/a	n/a	Operating
Reclaimer Conveyor (Iron Ore, Limestone & Dolomite)	Drive System	1	Outdoor	2	200	n/a	n/a	Operating
Dedusting System (NB Power TT)	Dust Collector	1	Outdoor	6	10	n/a	n/a	Operating
Dedusting System (New TT)	Dust Collector	1	Outdoor	5	10	n/a	n/a	Operating
Dedusting System (Coal & Coke Stockpile and Reclaimer Conv)	Dust Collector	1	Outdoor	2	125	n/a	n/a	Operating
Dedusting System (Ores Stockpile and Reclaimer Conv)	Dust Collector	1	Outdoor	2	125	n/a	n/a	Operating
Feed Belt Conveyor (Coal)	Drive System	1	Outdoor	32	300	n/a	n/a	Operating
Feed Belt Conveyor (Iron Ore, Limestone & Dolomite)	Drive System	1	Outdoor	30	250	n/a	n/a	Operating
Oxygen Plant								
Main Air Compressors	Drive System	2	Indoor		35000	Centrifugal	n/a	Operating
Booster Air Compressor	Drive System	1	Indoor		25000	Centrifugal	n/a	Operating
Booster Nitrogen Compressor	Drive System	1	Indoor		11500	Centrifugal	n/a	Operating
Water Chiller	Drive System	1	Indoor		800	n/a	n/a	Operating
Cryogenic Pumps	Drive System	2	Indoor		230	n/a	n/a	Operating
Cryogenic Pumps	Drive System	2	Indoor		165	n/a	n/a	Operating
Transfer Pumps	Drive System	2	Indoor		150	n/a	n/a	Operating
Boiler Pumps	Drive System	2	Indoor		165	n/a	n/a	Operating
Lube Oil Pumps	Drive System	2	Indoor		60	n/a	n/a	Operating
Lube Oil Pump	Drive System	1	Indoor		55	n/a	n/a	Operating
Lube Oil Pump	Drive System	1	Indoor		50	n/a	n/a	Operating
Lube Oil Pump	Drive System	1	Indoor		35	n/a	n/a	Operating
Cooling Water Pumps	Drive System	4	Outdoor		600	n/a	n/a	Operating
Cooling Tower Fans	Drive System	5	Outdoor		200	n/a	n/a	Operating

Appendix G AC CDC DATA REPORT

MARITIME IRON PROJECT – PROVINCIAL ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR PROPOSED BELLEDUNE IRON PROCESSING FACILITY IN BELLEDUNE, NEW BRUNSWICK

Appendix G AC CDC Data Report
October 2, 2019

Atlantic Canada Conservation Data Centre
Centre de données sur la conservation du Canada atlantique

DATA REPORT 6105: Belledune, NB

Prepared 11 July 2018
by J. Churchill, Data Manager

CONTENTS OF REPORT

Map 1. A 100 km buffer around the study area

1.0 PREFACE

The Atlantic Canada Conservation Data Centre (ACCDC) is part of a network of NatureServe data centres and heritage programs serving 50 states in the U.S.A, 10 provinces and 1 territory in Canada, plus several Central and South American countries. The NatureServe network is more than 30 years old and shares a common conservation data methodology. The ACCDC was founded in 1997, and maintains data for the jurisdictions of New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador. Although a non-governmental agency, the ACCDC is supported by 6 federal agencies and 4 provincial governments, as well as through outside grants and data processing fees. URL: www.ACCDC.com.

Upon request and for a fee, the ACCDC queries its database and produces customized reports of the rare and endangered flora and fauna known to occur in or near a specified study area. As a supplement to that data, the ACCDC includes locations of managed areas with some level of protection, and known sites of ecological interest or sensitivity.

1.1 DATA LIST

Included datasets:

Filename	Contents
BelleduneNB_6105ob.xls	All Rare and legally protected *Flora and Fauna* in your study area
BelleduneNB_6105ob100km.xls	A list of Rare and legally protected *Flora and Fauna* within 100 km of your study area
BelleduneNB_6105ma.xls	All *Managed Areas* in your study area
BelleduneNB_6105sa.xls	All *Significant Natural Areas* in your study area
BelleduneNB_6105bc.xls	Rare and common *Colonial Birds* in your study area
BelleduneNB_6105bb.xls	Common *Breeding Birds* in your study area

1.2 RESTRICTIONS

The ACCDC makes a strong effort to verify the accuracy of all the data that it manages, but it shall not be held responsible for any inaccuracies in data that it provides. By accepting ACCDC data, recipients assent to the following limits of use:

a) Data is restricted to use by trained personnel who are sensitive to landowner interests and to potential threats to rare and/or endangered flora and fauna posed by the information provided.
b) Data is restricted to use by the specified Data User; any third party requiring data must make its own data request.
c) The ACCDC requires Data Users to cease using and delete data 12 months after receipt, and to make a new request for updated data if necessary at that time.
d) ACCDC data responses are restricted to the data in our Data System at the time of the data request.
e) Each record has an estimate of locational uncertainty, which must be referenced in order to understand the record's relevance to a particular location. Please see attached Data Dictionary for details.
f) ACCDC data responses are not to be construed as exhaustive inventories of taxa in an area.
g) The absence of a taxon cannot be inferred by its absence in an ACCDC data response.

1.3 ADDITIONAL INFORMATION

The attached file DataDictionary 2.1.pdf provides metadata for the data provided.

Please direct any additional questions about ACCDC data to the following individuals:

Plants, Lichens, Ranking Methods, All other Inquiries
Sean Blaney, Senior Scientist, Executive Director
Tel: (506) 364-2658
sblaney@mta.ca

Animals (Fauna)
John Klymko, Zoologist
Tel: (506) 364-2660
jklymko@mta.ca

Plant Communities
Sarah Robinson, Community Ecologist
Tel: (506) 364-2664
srobinson@mta.ca

Data Management, GIS
James Churchill, Data Manager
Tel: (902) 679-6146
jlchurchill@mta.ca

Billing
Jean Breau
Tel: (506) 364-2657
jrbreau@mta.ca

Questions on the biology of Federal Species at Risk can be directed to ACCDC: (506) 364-2658, with questions on Species at Risk regulations to: Samara Eaton, Canadian Wildlife Service (NB and PE): (506) 364-5060 or Julie McKnight, Canadian Wildlife Service (NS): (902) 426-4196.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in New Brunswick, please contact Stewart Lusk, Natural Resources: (506) 453-7110.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in Nova Scotia, please contact Sherman Boates, NSDNR: (902) 679-6146. To determine if location-sensitive species (section 4.3) occur near your study site please contact a NSDNR Regional Biologist:

Western: Duncan Bayne
(902) 648-3536
Duncan.Bayne@novascotia.ca

Western: Jason Power
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Eastern: Terry Power
(902) 563-3370
Terrance.Power@novascotia.ca

For provincial information about rare taxa and protected areas, or information about game animals, fish habitat etc., in Prince Edward Island, please contact Garry Gregory, PEI Dept. of Communities, Land and Environment: (902) 569-7595.

2.0 RARE AND ENDANGERED SPECIES

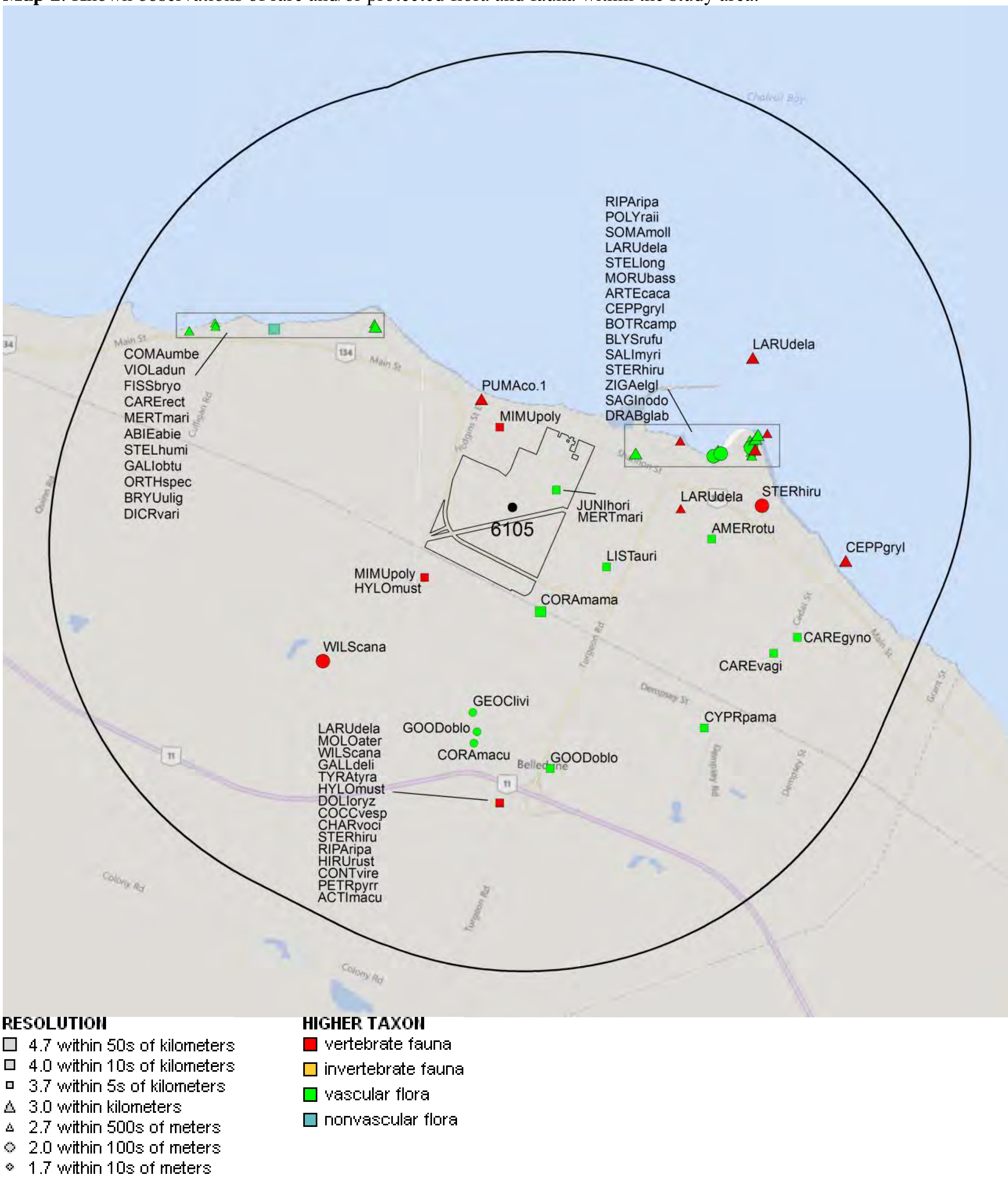
2.1 FLORA

The study area contains 51 records of 25 vascular, 5 records of 5 nonvascular flora (Map 2 and attached: *ob.xls).

2.2 FAUNA

The study area contains 36 records of 20 vertebrate, no records of invertebrate fauna (Map 2 and attached data files - see 1.1 Data List). Please see section 4.3 to determine if 'location-sensitive' species occur near your study site.

Map 2: Known observations of rare and/or protected flora and fauna within the study area.

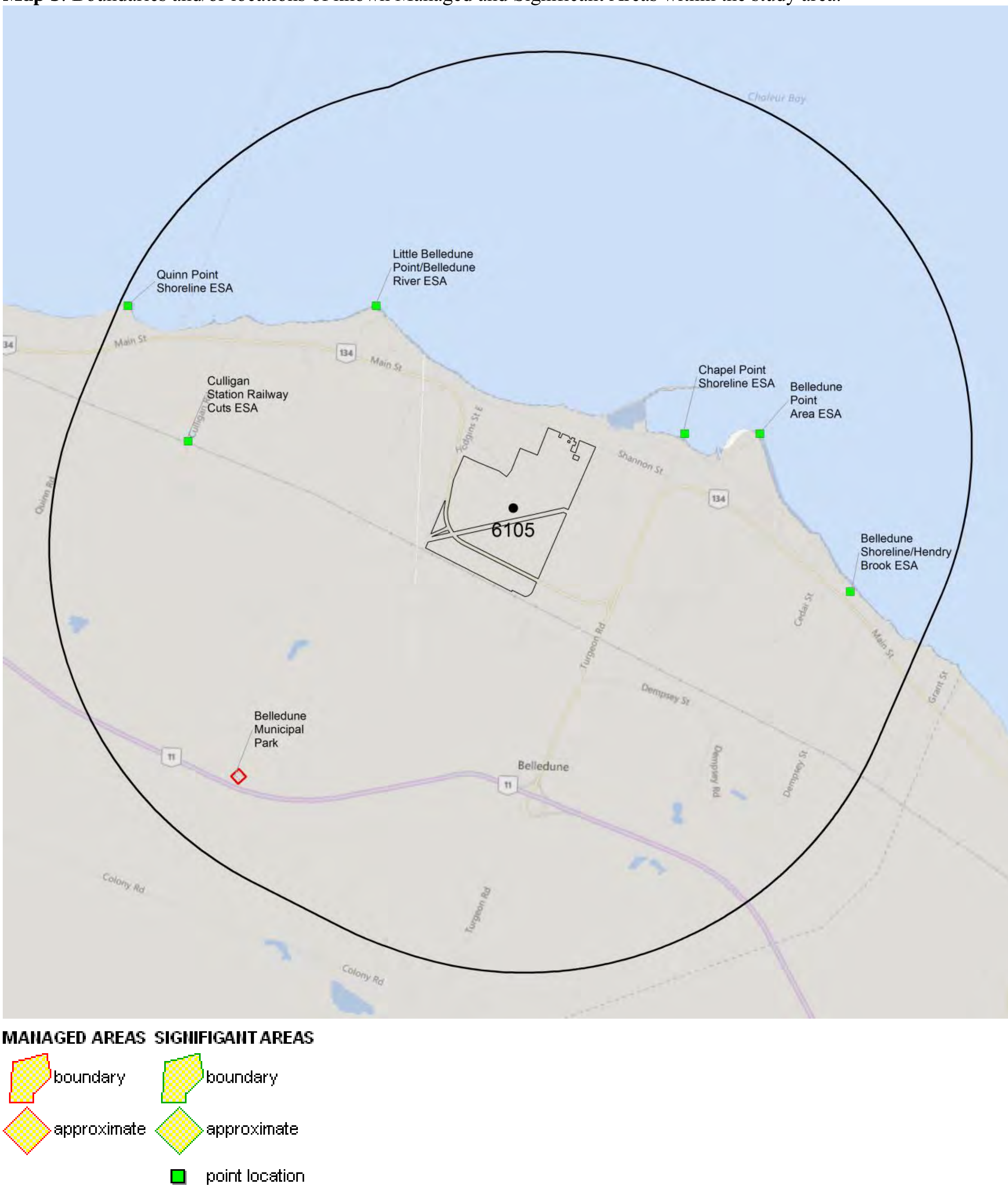


3.0 SPECIAL AREAS

3.1 MANAGED AREAS
The GIS scan identified 1 managed areas in the vicinity of the study area (Map 3 and attached file: *ma*.xls).

3.2 SIGNIFICANT AREAS
The GIS scan identified 6 biologically significant sites in the vicinity of the study area (Map 3 and attached file: *sa*.xls).

Map 3: Boundaries and/or locations of known Managed and Significant Areas within the study area.



4.0 RARE SPECIES LISTS

Rare and/or endangered taxa (excluding "location-sensitive" species, section 4.3) within the study area listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation (± the precision, in km, of the record). [P] = vascular plant, [N] = nonvascular plant, [A] = vertebrate animal, [I] = invertebrate animal, [C] = community. Note: records are from attached files *ob.xls/*ob.shp only.

4.1 FLORA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
N	*Bryum uliginosum*	a Moss				S2S3	3 Sensitive	1	4.0 ± 9.0
N	*Orthotrichum speciosum*	Showy Bristle Moss				S2S3	5 Undetermined	1	4.0 ± 9.0
N	*Dicranella varia*	a Moss				S3S4	4 Secure	1	4.0 ± 9.0
N	*Fissidens bryoides*	Lesser Pocket Moss				S3S4	4 Secure	1	4.0 ± 9.0
N	*Abietinella abietina*	Wiry Fern Moss				S3S4	4 Secure	1	4.0 ± 9.0
P	*Draba glabella*	Rock Whitlow-Grass				S1	2 May Be At Risk	7	2.9 ± 0.0
P	*Stellaria longipes*	Long-stalked Starwort				S1	2 May Be At Risk	5	3.3 ± 0.0
P	*Zigadenus elegans ssp. glaucus*	Mountain Death Camas				S1	2 May Be At Risk	7	3.3 ± 0.0
P	*Sagina nodosa*	Knotted Pearlwort				S2	3 Sensitive	2	1.8 ± 1.0
P	*Carex gynocrates*	Northern Bog Sedge				S2	3 Sensitive	2	4.2 ± 5.0
P	*Blysmus rufus*	Red Bulrush				S2	3 Sensitive	2	3.4 ± 1.0
P	*Amerorchis rotundifolia*	Small Round-leaved Orchis				S2	2 May Be At Risk	3	2.7 ± 4.0
P	*Cypripedium parviflorum var. makasin*	Small Yellow Lady's-Slipper				S2	2 May Be At Risk	1	3.9 ± 2.0
P	*Goodyera oblongifolia*	Menzies' Rattlesnake-plantain				S2	3 Sensitive	2	3.0 ± 0.0
P	*Galium obtusum*	Blunt-leaved Bedstraw				S2?	4 Secure	1	3.0 ± 1.0
P	*Salix myricoides*	Bayberry Willow				S2?	3 Sensitive	1	3.3 ± 0.0
P	*Corallorhiza maculata var. maculata*	Spotted Coralroot				S2S3	3 Sensitive	1	1.4 ± 10.0
P	*Listera auriculata*	Auricled Twayblade				S2S3	3 Sensitive	1	1.5 ± 5.0
P	*Artemisia campestris ssp. caudata*	Field Wormwood				S3	4 Secure	1	2.8 ± 0.0
P	*Stellaria humifusa*	Saltmarsh Starwort				S3	4 Secure	1	4.9 ± 0.0
P	*Comandra umbellata*	Bastard's Toadflax				S3	4 Secure	1	4.6 ± 0.0
P	*Viola adunca*	Hooked Violet				S3	4 Secure	1	3.1 ± 0.0
P	*Carex vaginata*	Sheathed Sedge				S3	3 Sensitive	2	4.0 ± 4.0
P	*Carex recta*	Estuary Sedge				S3	4 Secure	1	4.7 ± 0.0
P	*Mertensia maritima*	Sea Lungwort				S3S4	4 Secure	2	0.6 ± 2.0
P	*Geocaulon lividum*	Northern Comandra				S3S4	4 Secure	1	2.8 ± 0.0
P	*Juniperus horizontalis*	Creeping Juniper				S3S4	4 Secure	1	0.6 ± 2.0
P	*Corallorhiza maculata*	Spotted Coralroot				S3S4	3 Sensitive	1	3.2 ± 0.0
P	*Polygonum raii*	Sharp-fruited Knotweed				SH	0.1 Extirpated	3	3.3 ± 1.0
P	*Botrychium campestre*	Prairie Moonwort				SH	2 May Be At Risk	1	3.3 ± 0.0

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened	Threatened	S1S2B,S1S2M	2 May Be At Risk	2	1.5 ± 7.0
A	*Hirundo rustica*	Barn Swallow	Threatened	Threatened	Threatened	S2B,S2M	3 Sensitive	2	3.9 ± 7.0
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened		S2S3B,S2S3M	3 Sensitive	3	2.4 ± 0.0
A	*Wilsonia canadensis*	Canada Warbler	Threatened	Threatened	Threatened	S3B,S3M	1 At Risk	3	3.2 ± 0.0
A	*Dolichonyx oryzivorus*	Bobolink	Threatened	Threatened	Threatened	S3B,S3M	3 Sensitive	1	3.9 ± 7.0
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern			S3B,S3S4N,SUM	3 Sensitive	1	3.9 ± 7.0
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Special Concern	S4B,S4M	4 Secure	1	3.9 ± 7.0
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B,SUM	3 Sensitive	5	2.4 ± 0.0
A	*Puma concolor pop. 1*	Eastern Cougar	Data Deficient		Endangered	SNA	5 Undetermined	1	1.5 ± 1.0
A	*Mimus polyglottos*	Northern Mockingbird				S2B,S2M	3 Sensitive	2	1.1 ± 7.0
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B,S2S3M	3 Sensitive	1	3.9 ± 7.0

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Cepphus grylle*	Black Guillemot				S3	4 Secure	2	2.4 ± 0.0
A	*Charadrius vociferus*	Killdeer				S3B,S3M	3 Sensitive	1	3.9 ± 7.0
A	*Molothrus ater*	Brown-headed Cowbird				S3B,S3M	2 May Be At Risk	1	3.9 ± 7.0
A	*Somateria mollissima*	Common Eider				S3B,S4M,S3N	4 Secure	1	2.4 ± 0.0
A	*Tyrannus tyrannus*	Eastern Kingbird				S3S4B,S3S4M	3 Sensitive	1	3.9 ± 7.0
A	*Actitis macularius*	Spotted Sandpiper				S3S4B,S5M	4 Secure	1	3.9 ± 7.0
A	*Gallinago delicata*	Wilson's Snipe				S3S4B,S5M	4 Secure	1	3.9 ± 7.0
A	*Larus delawarensis*	Ring-billed Gull				S3S4B,S5M	4 Secure	5	2.2 ± 0.0
A	*Morus bassanus*	Northern Gannet				SHB,S5M	4 Secure	1	2.4 ± 0.0

4.3 LOCATION SENSITIVE SPECIES

The Department of Natural Resources in each Maritimes province considers a number of species “location sensitive”. Concern about exploitation of location-sensitive species precludes inclusion of precise coordinates in this report. Those intersecting your study area are indicated below with “YES”.

New Brunswick

Scientific *Name*	Common Name	SARA	Prov Legal Prot	Known within the Study Site?
Chrysemys picta picta	Eastern Painted Turtle			No
Chelydra serpentina	Snapping Turtle	Special Concern	Special Concern	No
Glyptemys insculpta	Wood Turtle	Threatened	Threatened	No
Haliaeetus leucocephalus	Bald Eagle		Endangered	No
Falco peregrinus pop. 1	Peregrine Falcon - anatum/tundrius pop.	Special Concern	Endangered	No
Cicindela marginipennis	Cobblestone Tiger Beetle	Endangered	Endangered	No
Coenonympha nipisiquit	Maritime Ringlet	Endangered	Endangered	No
Bat Hibernaculum		[Endangered][1]	[Endangered][1]	No

1 *Myotis lucifugus* (Little Brown Myotis), *Myotis septentrionalis* (Long-eared Myotis), and *Perimyotis subflavus* (Tri-colored Bat or Eastern Pipistrelle) are all Endangered under the Federal Species at Risk Act and the NB Species at Risk Act.

4.4 SOURCE BIBLIOGRAPHY

The recipient of these data shall acknowledge the ACCDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

# recs	CITATION
96	Lepage, D. 2014. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 407,838 recs.
42	Erskine, A.J. 1992. Maritime Breeding Bird Atlas Database. NS Museum & Nimbus Publ., Halifax, 82,125 recs.
13	Benedict, B. Connell Herbarium Specimens. University New Brunswick, Fredericton. 2003.
10	Hinds, H.R. 1986. Notes on New Brunswick plant collections. Connell Memorial Herbarium, unpubl, 739 recs.
8	Wilhelm, S.I. et al. 2011. Colonial Waterbird Database. Canadian Wildlife Service, Sackville, 2698 sites, 9718 recs (8192 obs).
7	Tims, J. & Craig, N. 1995. Environmentally Significant Areas in New Brunswick (NBESA). NB Dept of Environment & Nature Trust of New Brunswick Inc, 6042 recs.
6	Clayden, S.R. 2007. NBM Science Collections databases: vascular plants. New Brunswick Museum, Saint John NB, download Mar. 2007, 6914 recs.
6	Tims, J. & Craig, N. 1995. Environmentally Significant Areas in New Brunswick (NBESA). NB Dept of Environment & Nature Trust of New Brunswick Inc.
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5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 11644 records of 124 vertebrate and 423 records of 41 invertebrate fauna; 3879 records of 269 vascular, 206 records of 82 nonvascular flora (attached: *ob100km.xls).

Taxa within 100 km of the study site that are rare and/or endangered in the province in which the study site occurs. All ranks correspond to the province in which the study site falls, even for out-of-province records. Taxa are listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation (± the precision, in km, of the record).

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Myotis lucifugus*	Little Brown Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	1	95.0 ± 1.0	NB
A	*Charadrius melodus melodus*	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S1B,S1M	1 At Risk	1095	26.1 ± 0.0	NB
A	*Dermochelys coriacea (Atlantic pop.)*	Leatherback Sea Turtle - Atlantic pop.	Endangered	Endangered	Endangered	S1S2N	1 At Risk	1	94.0 ± 1.0	NB
A	*Calidris canutus rufa*	Red Knot rufa ssp	Endangered		Endangered	S2M	1 At Risk	201	29.4 ± 0.0	NB
A	*Rangifer tarandus pop. 2*	Woodland Caribou (Atlantic-Gasp├⌐sie pop.)	Endangered	Endangered	Extirpated	SX	0.1 Extirpated	5	50.1 ± 5.0	NB
A	*Emydoidea blandingii*	Blanding's Turtle - Nova Scotia pop.	Endangered	Endangered				1	100.0 ± 1.0	NB
A	*Sturnella magna*	Eastern Meadowlark	Threatened	Threatened	Threatened	S1B,S1M	2 May Be At Risk	2	51.8 ± 0.0	NB
A	*Ixobrychus exilis*	Least Bittern	Threatened	Threatened	Threatened	S1S2B,S1S2M	1 At Risk	1	44.2 ± 0.0	NB
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened	Threatened	S1S2B,S1S2M	2 May Be At Risk	35	1.5 ± 7.0	NB
A	*Caprimulgus vociferus*	Whip-Poor-Will	Threatened	Threatened	Threatened	S2B,S2M	1 At Risk	16	85.3 ± 0.0	NB
A	*Hirundo rustica*	Barn Swallow	Threatened	Threatened	Threatened	S2B,S2M	3 Sensitive	305	3.9 ± 7.0	NB
A	*Catharus bicknelli*	Bicknell's Thrush	Threatened	Special Concern	Threatened	S2B,S2M	1 At Risk	473	59.0 ± 7.0	NB
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2S3	1 At Risk	25	20.0 ± 0.0	NB
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Threatened	S2S3B,S2M	1 At Risk	163	12.4 ± 5.0	NB
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened		S2S3B,S2S3M	3 Sensitive	246	2.4 ± 0.0	NB
A	*Contopus cooperi*	Olive-sided Flycatcher	Threatened	Threatened	Threatened	S3B,S3M	1 At Risk	248	8.4 ± 5.0	NB
A	*Wilsonia canadensis*	Canada Warbler	Threatened	Threatened	Threatened	S3B,S3M	1 At Risk	296	3.2 ± 0.0	NB
A	*Dolichonyx oryzivorus*	Bobolink	Threatened	Threatened	Threatened	S3B,S3M	3 Sensitive	327	3.9 ± 7.0	NB
A	*Chordeiles minor*	Common Nighthawk	Threatened	Threatened	Threatened	S3B,S4M	1 At Risk	230	25.9 ± 7.0	NB
A	*Anguilla rostrata*	American Eel	Threatened		Threatened	S4	4 Secure	5	13.7 ± 0.0	NB
A	*Vermivora chrysoptera*	Golden-winged Warbler	Threatened	Threatened		SNA	8 Accidental	1	84.5 ± 1.0	NB
A	*Coturnicops noveboracensis*	Yellow Rail	Special Concern	Special Concern	Special Concern	S1?B,SUM	2 May Be At Risk	2	41.2 ± 0.0	NB
A	*Histrionicus histrionicus pop. 1*	Harlequin Duck - Eastern pop.	Special Concern	Special Concern	Endangered	S1B,S1S2N,S2M	1 At Risk	7	23.5 ± 1.0	NB
A	*Falco peregrinus pop. 1*	Peregrine Falcon - anatum/tundrius	Special Concern	Special Concern	Endangered	S1B,S3M	1 At Risk	3	88.2 ± 65.0	NB
A	*Asio flammeus*	Short-eared Owl	Special Concern	Special Concern	Special Concern	S2B,S2M	3 Sensitive	12	24.1 ± 0.0	NB
A	*Bucephala islandica (Eastern pop.)*	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern	Special Concern	S2M,S2N	3 Sensitive	33	34.0 ± 0.0	NB
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Special Concern	S3B,S3M	2 May Be At Risk	77	12.4 ± 5.0	NB
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern			S3B,S3S4N,SUM	3 Sensitive	337	3.9 ± 7.0	NB
A	*Phalaropus lobatus*	Red-necked Phalarope	Special Concern			S3M	3 Sensitive	4	67.3 ± 1.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Phocoena phocoena (NW Atlantic pop.)*	Harbour Porpoise - Northwest Atlantic pop.	Special Concern	Threatened		S4		2	67.4 ± 1.0	NB
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Special Concern	S4B,S4M	4 Secure	200	3.9 ± 7.0	NB
A	*Podiceps auritus*	Horned Grebe	Special Concern		Special Concern	S4N,S4M	4 Secure	3	41.4 ± 0.0	NB
A	*Tryngites subruficollis*	Buff-breasted Sandpiper	Special Concern			SNA	8 Accidental	1	93.5 ± 1.0	NB
A	*Odobenus rosmarus rosmarus*	Atlantic Walrus	Special Concern		Extirpated	SX		4	52.9 ± 1.0	NB
A	*Bubo scandiacus*	Snowy Owl	Not At Risk			S1N,S2S3M	4 Secure	11	20.2 ± 1.0	NB
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1S2B,S1S2M	2 May Be At Risk	1	98.5 ± 0.0	NB
A	*Fulica americana*	American Coot	Not At Risk			S1S2B,S1S2M	3 Sensitive	4	73.8 ± 7.0	NB
A	*Aegolius funereus*	Boreal Owl	Not At Risk			S1S2B,SUM	2 May Be At Risk	12	61.4 ± 7.0	NB
A	*Sorex dispar*	Long-tailed Shrew	Not At Risk	Special Concern		S2	3 Sensitive	14	93.0 ± 1.0	NB
A	*Buteo lineatus*	Red-shouldered Hawk	Not At Risk	Special Concern		S2B,S2M	2 May Be At Risk	5	58.6 ± 1.0	NB
A	*Globicephala melas*	Long-finned Pilot Whale	Not At Risk			S2S3		1	94.8 ± 1.0	NB
A	*Lynx canadensis*	Canadian Lynx	Not At Risk		Endangered	S3	1 At Risk	36	20.6 ± 0.0	NB
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B,SUM	3 Sensitive	380	2.4 ± 0.0	NB
A	*Podiceps grisegena*	Red-necked Grebe	Not At Risk			S3M,S2N	3 Sensitive	4	41.4 ± 0.0	NB
A	*Haliaeetus leucocephalus*	Bald Eagle	Not At Risk		Endangered	S4	1 At Risk	200	24.6 ± 0.0	NB
A	*Puma concolor pop. 1*	Eastern Cougar	Data Deficient		Endangered	SNA	5 Undetermined	18	1.5 ± 1.0	NB
A	*Morone saxatilis*	Striped Bass	E,E,SC			S3	2 May Be At Risk	6	78.5 ± 10.0	NB
A	*Salvelinus alpinus*	Arctic Char				S1	3 Sensitive	8	64.9 ± 1.0	NB
A	*Synaptomys borealis sphagnicola*	Northern Bog Lemming				S1		4	73.4 ± 1.0	NB
A	*Tringa melanoleuca*	Greater Yellowlegs				S1?B,S5M	4 Secure	287	8.1 ± 0.0	NB
A	*Aythya americana*	Redhead				S1B,S1M	8 Accidental	1	84.5 ± 1.0	NB
A	*Bartramia longicauda*	Upland Sandpiper				S1B,S1M	3 Sensitive	4	72.5 ± 1.0	NB
A	*Phalaropus tricolor*	Wilson's Phalarope				S1B,S1M	3 Sensitive	14	62.8 ± 1.0	NB
A	*Progne subis*	Purple Martin				S1B,S1M	2 May Be At Risk	2	66.0 ± 7.0	NB
A	*Thryothorus ludovicianus*	Carolina Wren				S1B,S1M	8 Accidental	2	69.7 ± 0.0	NB
A	*Oxyura jamaicensis*	Ruddy Duck				S1B,S2S3M	4 Secure	12	67.5 ± 8.0	NB
A	*Uria aalge*	Common Murre				S1B,S3N,S3M	4 Secure	3	48.3 ± 0.0	NB
A	*Aythya affinis*	Lesser Scaup				S1B,S4M	4 Secure	34	29.8 ± 0.0	NB
A	*Aythya marila*	Greater Scaup				S1B,S4M,S2N	4 Secure	13	72.9 ± 1.0	NB
A	*Eremophila alpestris*	Horned Lark				S1B,S4N,S5M	2 May Be At Risk	83	8.9 ± 1.0	NB
A	*Sterna paradisaea*	Arctic Tern				S1B,SUM	2 May Be At Risk	22	9.0 ± 0.0	NB
A	*Branta bernicla*	Brant				S1N, S2S3M	4 Secure	61	24.7 ± 8.0	NB
A	*Chroicocephalus ridibundus*	Black-headed Gull				S1N,S2M	3 Sensitive	6	84.5 ± 1.0	NB
A	*Butorides virescens*	Green Heron				S1S2B,S1S2M	3 Sensitive	2	79.8 ± 0.0	NB
A	*Nycticorax nycticorax*	Black-crowned Night-heron				S1S2B,S1S2M	3 Sensitive	276	19.0 ± 0.0	NB
A	*Empidonax traillii*	Willow Flycatcher				S1S2B,S1S2M	3 Sensitive	9	32.1 ± 7.0	NB
A	*Stelgidopteryx serripennis*	Northern Rough-winged Swallow				S1S2B,S1S2M	2 May Be At Risk	4	35.3 ± 0.0	NB
A	*Troglodytes aedon*	House Wren				S1S2B,S1S2M	5 Undetermined	4	19.4 ± 7.0	NB
A	*Rissa tridactyla*	Black-legged Kittiwake				S1S2B,S4N,S5M	4 Secure	23	39.5 ± 0.0	NB
A	*Calidris bairdii*	Baird's Sandpiper				S1S2M	3 Sensitive	5	67.4 ± 1.0	NB
A	*Microtus chrotorrhinus*	Rock Vole				S2?	5 Undetermined	1	95.0 ± 1.0	NB
A	*Mimus polyglottos*	Northern Mockingbird				S2B,S2M	3 Sensitive	34	1.1 ± 7.0	NB
A	*Toxostoma rufum*	Brown Thrasher				S2B,S2M	3 Sensitive	19	38.2 ± 7.0	NB
A	*Pooecetes gramineus*	Vesper Sparrow				S2B,S2M	2 May Be At Risk	42	31.1 ± 7.0	NB
A	*Anas strepera*	Gadwall				S2B,S3M	4 Secure	49	40.0 ± 0.0	NB
A	*Alca torda*	Razorbill				S2B,S3N,S3M	4 Secure	9	19.4 ± 7.0	NB
A	*Pinicola enucleator*	Pine Grosbeak				S2B,S4S5N,S4S5M	3 Sensitive	61	27.7 ± 7.0	NB
A	*Tringa solitaria*	Solitary Sandpiper				S2B,S5M	4 Secure	41	55.3 ± 7.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Oceanodroma leucorhoa*	Leach's Storm-Petrel				S2B,SUM	3 Sensitive	1	79.0 ± 0.0	NB
A	*Chen caerulescens*	Snow Goose				S2M	4 Secure	7	41.4 ± 0.0	NB
A	*Phalacrocorax carbo*	Great Cormorant				S2N,S2M	4 Secure	2	34.7 ± 0.0	NB
A	*Somateria spectabilis*	King Eider				S2N,S2M	4 Secure	2	87.7 ± 1.0	NB
A	*Larus hyperboreus*	Glaucous Gull				S2N,S2M	4 Secure	11	37.2 ± 5.0	NB
A	*Asio otus*	Long-eared Owl				S2S3	5 Undetermined	9	8.4 ± 0.0	NB
A	*Picoides dorsalis*	American Three-toed Woodpecker				S2S3	3 Sensitive	47	54.5 ± 7.0	NB
A	*Salmo salar*	Atlantic Salmon				S2S3	2 May Be At Risk	392	11.7 ± 0.0	NB
A	*Anas clypeata*	Northern Shoveler				S2S3B,S2S3M	4 Secure	70	10.6 ± 7.0	NB
A	*Myiarchus crinitus*	Great Crested Flycatcher				S2S3B,S2S3M	3 Sensitive	15	23.7 ± 0.0	NB
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B,S2S3M	3 Sensitive	191	3.9 ± 7.0	NB
A	*Pluvialis dominica*	American Golden-Plover				S2S3M	3 Sensitive	35	29.4 ± 0.0	NB
A	*Calcarius lapponicus*	Lapland Longspur				S2S3N,SUM	3 Sensitive	4	87.5 ± 1.0	NB
A	*Cepphus grylle*	Black Guillemot				S3	4 Secure	64	2.4 ± 0.0	NB
A	*Loxia curvirostra*	Red Crossbill				S3	4 Secure	33	25.2 ± 5.0	NB
A	*Carduelis pinus*	Pine Siskin				S3	4 Secure	198	8.4 ± 5.0	NB
A	*Cathartes aura*	Turkey Vulture				S3B,S3M	4 Secure	13	9.6 ± 0.0	NB
A	*Rallus limicola*	Virginia Rail				S3B,S3M	3 Sensitive	11	31.1 ± 7.0	NB
A	*Charadrius vociferus*	Killdeer				S3B,S3M	3 Sensitive	466	3.9 ± 7.0	NB
A	*Tringa semipalmata*	Willet				S3B,S3M	3 Sensitive	318	29.4 ± 0.0	NB
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B,S3M	4 Secure	35	8.1 ± 0.0	NB
A	*Vireo gilvus*	Warbling Vireo				S3B,S3M	4 Secure	40	10.6 ± 7.0	NB
A	*Piranga olivacea*	Scarlet Tanager				S3B,S3M	4 Secure	23	38.5 ± 0.0	NB
A	*Passerina cyanea*	Indigo Bunting				S3B,S3M	4 Secure	5	79.6 ± 7.0	NB
A	*Molothrus ater*	Brown-headed Cowbird				S3B,S3M	2 May Be At Risk	96	3.9 ± 7.0	NB
A	*Icterus galbula*	Baltimore Oriole				S3B,S3M	4 Secure	33	25.9 ± 7.0	NB
A	*Somateria mollissima*	Common Eider				S3B,S4M,S3N	4 Secure	129	2.4 ± 0.0	NB
A	*Dendroica tigrina*	Cape May Warbler				S3B,S4S5M	4 Secure	166	10.6 ± 7.0	NB
A	*Anas acuta*	Northern Pintail				S3B,S5M	3 Sensitive	167	33.9 ± 1.0	NB
A	*Mergus serrator*	Red-breasted Merganser				S3B,S5M,S4S5N	4 Secure	136	17.1 ± 7.0	NB
A	*Arenaria interpres*	Ruddy Turnstone				S3M	4 Secure	238	29.4 ± 0.0	NB
A	*Phalaropus fulicarius*	Red Phalarope				S3M	3 Sensitive	1	95.2 ± 0.0	NB
A	*Melanitta nigra*	Black Scoter				S3M,S1S2N	3 Sensitive	111	16.2 ± 18.0	NB
A	*Bucephala albeola*	Bufflehead				S3M,S2N	3 Sensitive	22	24.7 ± 8.0	NB
A	*Calidris maritima*	Purple Sandpiper				S3M,S3N	4 Secure	17	31.8 ± 0.0	NB
A	*Tyrannus tyrannus*	Eastern Kingbird				S3S4B,S3S4M	3 Sensitive	135	3.9 ± 7.0	NB
A	*Actitis macularius*	Spotted Sandpiper				S3S4B,S5M	4 Secure	467	3.9 ± 7.0	NB
A	*Gallinago delicata*	Wilson's Snipe				S3S4B,S5M	4 Secure	214	3.9 ± 7.0	NB
A	*Larus delawarensis*	Ring-billed Gull				S3S4B,S5M	4 Secure	341	2.2 ± 0.0	NB
A	*Dendroica striata*	Blackpoll Warbler				S3S4B,S5M	4 Secure	158	29.0 ± 7.0	NB
A	*Pluvialis squatarola*	Black-bellied Plover				S3S4M	4 Secure	262	29.4 ± 0.0	NB
A	*Limosa haemastica*	Hudsonian Godwit				S3S4M	4 Secure	147	31.8 ± 0.0	NB
A	*Calidris pusilla*	Semipalmated Sandpiper				S3S4M	4 Secure	317	8.1 ± 0.0	NB
A	*Calidris melanotos*	Pectoral Sandpiper				S3S4M	4 Secure	27	67.4 ± 1.0	NB
A	*Calidris alba*	Sanderling				S3S4M,S1N	3 Sensitive	148	29.4 ± 0.0	NB
A	*Morus bassanus*	Northern Gannet				SHB,S5M	4 Secure	131	2.4 ± 0.0	NB
I	*Coenonympha nipisiquit*	Maritime Ringlet	Endangered	Endangered	Endangered	S1	1 At Risk	38	25.6 ± 1.0	NB
I	*Bombus terricola*	Yellow-banded Bumblebee	Special Concern			S3?	3 Sensitive	13	12.8 ± 0.0	NB
I	*Leucorrhinia patricia*	Canada Whiteface				S1	2 May Be At Risk	1	46.7 ± 1.0	NB
I	*Plebejus saepiolus*	Greenish Blue				S1S2	4 Secure	25	9.6 ± 1.0	NB
I	*Strymon melinus*	Grey Hairstreak				S2	4 Secure	8	34.7 ± 0.0	NB
I	*Aeshna juncea*	Rush Darner				S2	3 Sensitive	11	37.4 ± 1.0	NB
I	*Somatochlora*	Clamp-Tipped Emerald				S2	5 Undetermined	3	78.3 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
	tenebrosa									
I	*Coenagrion interrogatum*	Subarctic Bluet				S2	3 Sensitive	4	51.1 ± 1.0	NB
I	*Callophrys henrici*	Henry's Elfin				S2S3	4 Secure	4	70.5 ± 1.0	NB
I	*Desmocerus palliatus*	Elderberry Borer				S3		2	34.5 ± 5.0	NB
I	*Carabus maeander*	a Ground Beetle				S3	5 Undetermined	1	88.9 ± 1.0	NB
I	*Xylotrechus quadrimaculatus*	a Longhorned Beetle				S3		1	83.7 ± 1.0	NB
I	*Xylotrechus undulatus*	a Longhorned Beetle				S3		2	76.7 ± 1.0	NB
I	*Calathus gregarius*	a Ground Beetle				S3	4 Secure	1	24.3 ± 1.0	NB
I	*Hyperaspis disconotata*	a Ladybird Beetle				S3	5 Undetermined	1	9.1 ± 5.0	NB
I	*Euphyes bimacula*	Two-spotted Skipper				S3	4 Secure	2	54.6 ± 0.0	NB
I	*Papilio brevicauda*	Short-tailed Swallowtail				S3	4 Secure	39	25.9 ± 7.0	NB
I	*Papilio brevicauda bretonensis*	Short-tailed Swallowtail				S3	4 Secure	10	29.7 ± 1.0	NB
I	*Lycaena hyllus*	Bronze Copper				S3	3 Sensitive	1	96.4 ± 0.0	NB
I	*Lycaena dospassosi*	Salt Marsh Copper				S3	4 Secure	90	24.2 ± 0.0	NB
I	*Satyrium acadica*	Acadian Hairstreak				S3	4 Secure	3	34.7 ± 0.0	NB
I	*Callophrys polios*	Hoary Elfin				S3	4 Secure	3	58.5 ± 0.0	NB
I	*Callophrys eryphon*	Western Pine Elfin				S3	4 Secure	7	63.8 ± 1.0	NB
I	*Plebejus idas*	Northern Blue				S3	4 Secure	27	51.7 ± 7.0	NB
I	*Plebejus idas empetri*	Crowberry Blue				S3	4 Secure	5	74.0 ± 1.0	NB
I	*Speyeria aphrodite*	Aphrodite Fritillary				S3	4 Secure	2	54.5 ± 1.0	NB
I	*Boloria eunomia*	Bog Fritillary				S3	5 Undetermined	5	58.0 ± 0.0	NB
I	*Boloria chariclea*	Arctic Fritillary				S3	4 Secure	10	53.1 ± 7.0	NB
I	*Boloria chariclea grandis*	Purple Lesser Fritillary				S3	4 Secure	4	56.0 ± 10.0	NB
I	*Polygonia satyrus*	Satyr Comma				S3	4 Secure	12	23.3 ± 0.0	NB
I	*Polygonia gracilis*	Hoary Comma				S3	4 Secure	16	37.1 ± 1.0	NB
I	*Nymphalis l-album*	Compton Tortoiseshell				S3	4 Secure	5	75.9 ± 1.0	NB
I	*Gomphus abbreviatus*	Spine-crowned Clubtail				S3	4 Secure	1	80.3 ± 0.0	NB
I	*Somatochlora albicincta*	Ringed Emerald				S3	4 Secure	22	13.9 ± 1.0	NB
I	*Somatochlora cingulata*	Lake Emerald				S3	4 Secure	16	47.5 ± 1.0	NB
I	*Somatochlora forcipata*	Forcipate Emerald				S3	4 Secure	8	12.6 ± 0.0	NB
I	*Lestes eurinus*	Amber-Winged Spreadwing				S3	4 Secure	1	59.1 ± 1.0	NB
I	*Neohelix albolabris*	Whitelip				S3		1	59.7 ± 1.0	NB
I	*Satyrium liparops*	Striped Hairstreak				S3S4	4 Secure	10	56.2 ± 1.0	NB
I	*Satyrium liparops strigosum*	Striped Hairstreak				S3S4	4 Secure	2	35.0 ± 0.0	NB
I	*Coccinella transversoguttata richardsoni*	Transverse Lady Beetle				SH	2 May Be At Risk	6	36.5 ± 1.0	NB
N	*Arctoa fulvella*	a Moss				S1	2 May Be At Risk	2	95.0 ± 1.0	NB
N	*Grimmia donniana*	Donn's Grimmia Moss				S1	2 May Be At Risk	4	94.8 ± 0.0	NB
N	*Grimmia incurva*	Black Grimmia				S1	2 May Be At Risk	4	94.9 ± 0.0	NB
N	*Kiaeria starkei*	Starke's Fork Moss				S1	2 May Be At Risk	1	95.0 ± 1.0	NB
N	*Pseudoleskeella tectorum*	Rooftop Leskea Moss				S1	2 May Be At Risk	1	59.9 ± 1.0	NB
N	*Syntrichia ruralis*	a Moss				S1	2 May Be At Risk	1	32.2 ± 0.0	NB
N	*Lathagrium auriforme*	a tarpaper lichen				S1		1	32.2 ± 0.0	NB
N	*Ephebe hispidula*	Dryside Rockshag Lichen				S1		1	40.5 ± 0.0	NB
N	*Ephebe perspinulosa*	Thread Lichen				S1		2	40.4 ± 0.0	NB
N	*Leptogium intermedium*	Forty-five Jellyskin Lichen				S1		4	37.4 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
N	*Phaeophyscia hispidula*	Whiskered Shadow Lichen				S1		1	32.1 ± 0.0	NB
N	*Anastrophyllum saxicola*	Curled Notchwort				S1?	6 Not Assessed	1	62.4 ± 0.0	NB
N	*Bryum blindii*	a Moss				S1?	2 May Be At Risk	1	9.6 ± 1.0	NB
N	*Cinclidium stygium*	Sooty Cupola Moss				S1?	2 May Be At Risk	1	15.8 ± 0.0	NB
N	*Tortula cernua*	Narrow-Leafed Chain-Teeth Moss				S1?	2 May Be At Risk	2	9.6 ± 1.0	NB
N	*Dicranum bonjeanii*	Bonjean's Broom Moss				S1?	2 May Be At Risk	1	95.8 ± 0.0	NB
N	*Paludella squarrosa*	Tufted Fen Moss				S1?	2 May Be At Risk	1	15.8 ± 0.0	NB
N	*Seligeria recurvata*	a Moss				S1?	2 May Be At Risk	5	37.0 ± 0.0	NB
N	*Rhizomnium pseudopunctatum*	Felted Leafy Moss				S1?	2 May Be At Risk	1	94.8 ± 1.0	NB
N	*Leptogium burnetiae*	Long-bearded Jellyskin Lichen				S1?		1	32.1 ± 0.0	NB
N	*Peltigera venosa*	Fan Pelt Lichen				S1?	5 Undetermined	1	37.0 ± 0.0	NB
N	*Lophozia heterocolpos*	Whip Notchwort				S1S2	6 Not Assessed	2	69.6 ± 0.0	NB
N	*Metacalypogeia schusterana*	Schuster's Pouchwort				S1S2	6 Not Assessed	1	72.3 ± 0.0	NB
N	*Reboulia hemisphaerica*	Purple-margined Liverwort				S1S2	6 Not Assessed	2	32.2 ± 0.0	NB
N	*Calliergon richardsonii*	Richardson's Spear Moss				S1S2	2 May Be At Risk	1	95.8 ± 1.0	NB
N	*Campylium radicale*	Long-stalked Fine Wet Moss				S1S2	5 Undetermined	1	60.2 ± 10.0	NB
N	*Distichium inclinatum*	Inclined Iris Moss				S1S2	2 May Be At Risk	2	9.6 ± 1.0	NB
N	*Platydictya confervoides*	a Moss				S1S2	3 Sensitive	2	40.5 ± 0.0	NB
N	*Seligeria brevifolia*	a Moss				S1S2	3 Sensitive	1	37.8 ± 0.0	NB
N	*Timmia norvegica var. excurrens*	a moss				S1S2	2 May Be At Risk	2	69.6 ± 0.0	NB
N	*Calypogeia neesiana*	Nees' Pouchwort				S1S3	6 Not Assessed	1	81.3 ± 1.0	NB
N	*Cephalozia connivens*	Forcipated Pincerwort				S1S3	6 Not Assessed	1	99.3 ± 10.0	NB
N	*Lophozia badensis*	Dwarf Notchwort				S1S3	6 Not Assessed	1	9.6 ± 1.0	NB
N	*Lophozia obtusa*	Obtuse Notchwort				S1S3	6 Not Assessed	2	58.4 ± 1.0	NB
N	*Hypnum pratense*	Meadow Plait Moss				S2	3 Sensitive	1	96.7 ± 0.0	NB
N	*Isopterygiopsis pulchella*	Neat Silk Moss				S2	3 Sensitive	1	36.9 ± 0.0	NB
N	*Meesia triquetra*	Three-ranked Cold Moss				S2	2 May Be At Risk	1	41.1 ± 10.0	NB
N	*Platydictya jungermannioides*	False Willow Moss				S2	3 Sensitive	1	76.0 ± 1.0	NB
N	*Pohlia sphagnicola*	a moss				S2	3 Sensitive	1	89.0 ± 1.0	NB
N	*Sphagnum lindbergii*	Lindberg's Peat Moss				S2	3 Sensitive	1	58.3 ± 0.0	NB
N	*Sphagnum flexuosum*	Flexuous Peatmoss				S2	3 Sensitive	1	59.9 ± 1.0	NB
N	*Tayloria serrata*	Serrate Trumpet Moss				S2	3 Sensitive	1	97.3 ± 0.0	NB
N	*Tortula mucronifolia*	Mucronate Screw Moss				S2	3 Sensitive	3	9.6 ± 1.0	NB
N	*Anomobryum filiforme*	a moss				S2	5 Undetermined	1	9.6 ± 1.0	NB
N	*Fuscopannaria leucosticta*	Rimmed Shingles Lichen				S2	2 May Be At Risk	19	13.1 ± 0.0	NB
N	*Nephroma laevigatum*	Mustard Kidney Lichen				S2	2 May Be At Risk	2	40.5 ± 0.0	NB
N	*Peltigera lepidophora*	Scaly Pelt Lichen				S2	5 Undetermined	5	31.8 ± 0.0	NB
N	*Barbilophozia lycopodioides*	Greater Pawwort				S2?	6 Not Assessed	2	60.2 ± 10.0	NB
N	*Anacamptodon splachnoides*	a Moss				S2?	3 Sensitive	1	58.4 ± 0.0	NB
N	*Hygrohypnum montanum*	a Moss				S2?	3 Sensitive	2	95.6 ± 0.0	NB
N	*Trichodon cylindricus*	Cylindric Hairy-teeth Moss				S2?	3 Sensitive	2	94.8 ± 0.0	NB
N	*Plagiomnium rostratum*	Long-beaked Leafy Moss				S2?	3 Sensitive	1	77.2 ± 0.0	NB
N	*Bryum uliginosum*	a Moss				S2S3	3 Sensitive	2	4.0 ± 9.0	NB
N	*Campylium*	a Moss				S2S3	3 Sensitive	2	63.1 ± 1.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
	polygamum									
N	*Orthotrichum speciosum*	Showy Bristle Moss				S2S3	5 Undetermined	3	4.0 ± 9.0	NB
N	*Saelania glaucescens*	Blue Dew Moss				S2S3	3 Sensitive	3	31.8 ± 0.0	NB
N	*Scorpidium scorpioides*	Hooked Scorpion Moss				S2S3	3 Sensitive	3	15.8 ± 0.0	NB
N	*Sphagnum subfulvum*	a Peatmoss				S2S3	2 May Be At Risk	1	95.8 ± 0.0	NB
N	*Cyrtomnium hymenophylloides*	Short-pointed Lantern Moss				S2S3	3 Sensitive	1	37.0 ± 0.0	NB
N	*Collema nigrescens*	Blistered Tarpaper Lichen				S3	3 Sensitive	1	36.9 ± 0.0	NB
N	*Solorina saccata*	Woodland Owl Lichen				S3	5 Undetermined	19	31.9 ± 0.0	NB
N	*Leptogium lichenoides*	Tattered Jellyskin Lichen				S3	5 Undetermined	4	32.2 ± 0.0	NB
N	*Nephroma resupinatum*	a lichen				S3	3 Sensitive	4	33.7 ± 0.0	NB
N	*Peltigera membranacea*	Membranous Pelt Lichen				S3	5 Undetermined	1	64.6 ± 0.0	NB
N	*Dicranella rufescens*	Red Forklet Moss				S3?	5 Undetermined	1	83.8 ± 7.0	NB
N	*Anomodon rugelii*	Rugel's Anomodon Moss				S3S4	3 Sensitive	1	93.3 ± 8.0	NB
N	*Dicranella varia*	a Moss				S3S4	4 Secure	2	4.0 ± 9.0	NB
N	*Encalypta ciliata*	Fringed Extinquisher Moss				S3S4	3 Sensitive	1	31.8 ± 0.0	NB
N	*Fissidens bryoides*	Lesser Pocket Moss				S3S4	4 Secure	2	4.0 ± 9.0	NB
N	*Heterocladium dimorphum*	Dimorphous Tangle Moss				S3S4	4 Secure	1	19.2 ± 1.0	NB
N	*Isopterygiopsis muelleriana*	a Moss				S3S4	4 Secure	2	32.1 ± 0.0	NB
N	*Myurella julacea*	Small Mouse-tail Moss				S3S4	4 Secure	3	31.8 ± 0.0	NB
N	*Abietinella abietina*	Wiry Fern Moss				S3S4	4 Secure	3	4.0 ± 9.0	NB
N	*Leptogium teretiusculum*	Beaded Jellyskin Lichen				S3S4	5 Undetermined	2	37.3 ± 0.0	NB
N	*Cladonia floerkeana*	Gritty British Soldiers Lichen				S3S4	4 Secure	2	35.6 ± 0.0	NB
N	*Vahliella leucophaea*	Shelter Shingle Lichen				S3S4	5 Undetermined	9	31.8 ± 0.0	NB
N	*Nephroma parile*	Powdery Kidney Lichen				S3S4	4 Secure	4	32.4 ± 0.0	NB
N	*Protopannaria pezizoides*	Brown-gray Moss-shingle Lichen				S3S4	4 Secure	15	31.8 ± 0.0	NB
N	*Stereocaulon paschale*	Easter Foam Lichen				S3S4	5 Undetermined	1	31.4 ± 1.0	NB
N	*Pannaria conoplea*	Mealy-rimmed Shingle Lichen				S3S4	3 Sensitive	2	75.4 ± 0.0	NB
N	*Dermatocarpon luridum*	Brookside Stippleback Lichen				S3S4	4 Secure	8	31.8 ± 0.0	NB
N	*Hennediella heimii*	Long-Stalked Beardless Moss				SH	2 May Be At Risk	1	60.2 ± 10.0	NB
P	*Symphyotrichum laurentianum*	Gulf of St Lawrence Aster	Threatened	Threatened	Endangered	S1	1 At Risk	8	84.9 ± 5.0	NB
P	*Symphyotrichum anticostense*	Anticosti Aster	Threatened	Threatened	Endangered	S2S3	1 At Risk	231	67.4 ± 0.0	NB
P	*Symphyotrichum subulatum (Bathurst pop)*	Bathurst Aster - Bathurst pop.	Special Concern	Special Concern	Endangered	S2	1 At Risk	192	11.2 ± 0.0	NB
P	*Pterospora andromedea*	Woodland Pinedrops			Endangered	S1	1 At Risk	16	22.3 ± 0.0	NB
P	*Arnica lonchophylla*	Northern Arnica				S1	2 May Be At Risk	3	39.7 ± 5.0	NB
P	*Erigeron acris ssp. politus*	Bitter Fleabane				S1	2 May Be At Risk	1	70.4 ± 100.0	NB
P	*Betula glandulosa*	Glandular Birch				S1	2 May Be At Risk	26	68.3 ± 0.0	NB
P	*Cynoglossum virginianum var. boreale*	Wild Comfrey				S1	2 May Be At Risk	4	59.9 ± 0.0	NB
P	*Hackelia deflexa var. americana*	Nodding Stickseed				S1	2 May Be At Risk	4	42.9 ± 10.0	NB
P	*Arabis x divaricarpa*	Limestone Rockcress				S1	2 May Be At Risk	12	39.7 ± 5.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	*Cardamine parviflora var. arenicola*	Small-flowered Bittercress				S1	2 May Be At Risk	1	59.5 ± 0.0	NB
P	*Descurainia incana ssp. incana*	Gray Tansy Mustard				S1	2 May Be At Risk	4	65.5 ± 0.0	NB
P	*Draba glabella*	Rock Whitlow-Grass				S1	2 May Be At Risk	8	2.9 ± 0.0	NB
P	*Draba incana*	Twisted Whitlow-grass				S1	2 May Be At Risk	2	55.0 ± 0.0	NB
P	*Moehringia macrophylla*	Large-Leaved Sandwort				S1	2 May Be At Risk	5	32.1 ± 0.0	NB
P	*Stellaria crassifolia*	Fleshy Stitchwort				S1	2 May Be At Risk	1	41.2 ± 5.0	NB
P	*Stellaria longipes*	Long-stalked Starwort				S1	2 May Be At Risk	13	3.3 ± 0.0	NB
P	*Chenopodium capitatum*	Strawberry-blite				S1	2 May Be At Risk	1	43.0 ± 1.0	NB
P	*Vaccinium boreale*	Northern Blueberry				S1	2 May Be At Risk	18	68.4 ± 0.0	NB
P	*Vaccinium uliginosum*	Alpine Bilberry				S1	2 May Be At Risk	5	68.3 ± 0.0	NB
P	*Chamaesyce polygonifolia*	Seaside Spurge				S1	2 May Be At Risk	3	85.5 ± 1.0	NB
P	*Desmodium glutinosum*	Large Tick-Trefoil				S1	2 May Be At Risk	1	94.1 ± 0.0	NB
P	*Pinguicula vulgaris*	Common Butterwort				S1	3 Sensitive	29	80.8 ± 0.0	NB
P	*Polygonum viviparum*	Alpine Bistort				S1	2 May Be At Risk	1	47.8 ± 0.0	NB
P	*Ranunculus lapponicus*	Lapland Buttercup				S1	2 May Be At Risk	1	10.5 ± 0.0	NB
P	*Ranunculus sceleratus*	Cursed Buttercup				S1	2 May Be At Risk	9	11.4 ± 0.0	NB
P	*Amelanchier fernaldii*	Fernald's Serviceberry				S1	2 May Be At Risk	1	91.8 ± 0.0	NB
P	*Salix serissima*	Autumn Willow				S1	2 May Be At Risk	4	16.3 ± 0.0	NB
P	*Saxifraga paniculata ssp. neogaea*	White Mountain Saxifrage				S1	2 May Be At Risk	4	31.9 ± 0.0	NB
P	*Limosella aquatica*	Water Mudwort				S1	2 May Be At Risk	18	65.4 ± 0.0	NB
P	*Carex backii*	Rocky Mountain Sedge				S1	2 May Be At Risk	2	44.6 ± 0.0	NB
P	*Carex bigelowii*	Bigelow's Sedge				S1	2 May Be At Risk	7	88.4 ± 0.0	NB
P	*Carex cephaloidea*	Thin-leaved Sedge				S1	2 May Be At Risk	2	79.8 ± 1.0	NB
P	*Carex glareosa var. amphigena*	Gravel Sedge				S1	2 May Be At Risk	5	42.3 ± 5.0	NB
P	*Carex norvegica ssp. inferalpina*	Scandinavian Sedge				S1	2 May Be At Risk	3	94.2 ± 50.0	NB
P	*Carex rariflora*	Loose-flowered Alpine Sedge				S1	2 May Be At Risk	3	95.7 ± 0.0	NB
P	*Carex viridula var. elatior*	Greenish Sedge				S1	2 May Be At Risk	14	16.1 ± 0.0	NB
P	*Cyperus bipartitus*	Shining Flatsedge				S1	2 May Be At Risk	4	67.4 ± 1.0	NB
P	*Juncus subtilis*	Creeping Rush				S1	2 May Be At Risk	5	65.9 ± 0.0	NB
P	*Juncus trifidus*	Highland Rush				S1	2 May Be At Risk	9	88.4 ± 0.0	NB
P	*Zigadenus elegans ssp. glaucus*	Mountain Death Camas				S1	2 May Be At Risk	10	3.3 ± 0.0	NB
P	*Malaxis brachypoda*	White Adder's-Mouth				S1	2 May Be At Risk	2	17.3 ± 0.0	NB
P	*Platanthera flava var. herbiola*	Pale Green Orchid				S1	2 May Be At Risk	1	80.9 ± 0.0	NB
P	*Catabrosa aquatica var. laurentiana*	Water Whorl Grass				S1	2 May Be At Risk	2	40.6 ± 5.0	NB
P	*Dichanthelium xanthophysum*	Slender Panic Grass				S1	2 May Be At Risk	3	45.7 ± 0.0	NB
P	*Elymus hystrix var. bigeloviana*	Spreading Wild Rye				S1	2 May Be At Risk	2	76.2 ± 0.0	NB
P	*Festuca subverticillata*	Nodding Fescue				S1	2 May Be At Risk	1	93.0 ± 0.0	NB
P	*Puccinellia ambigua*	Dwarf Alkali Grass				S1	5 Undetermined	2	54.4 ± 0.0	NB
P	*Zizania aquatica var. brevis*	Indian Wild Rice				S1	2 May Be At Risk	3	94.5 ± 0.0	NB
P	*Stuckenia filiformis ssp. occidentalis*	Thread-leaved Pondweed				S1	2 May Be At Risk	1	67.8 ± 1.0	NB

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P	*Potamogeton friesii*	Fries' Pondweed				S1	2 May Be At Risk	8	42.8 ± 0.0	NB
P	*Cystopteris laurentiana*	Laurentian Bladder Fern				S1	2 May Be At Risk	1	31.4 ± 0.0	NB
P	*Dryopteris filix-mas*	Male Fern				S1	2 May Be At Risk	2	77.5 ± 0.0	NB
P	*Gymnocarpium robertianum*	Limestone Oak Fern				S1	2 May Be At Risk	2	79.0 ± 0.0	NB
P	*Polystichum lonchitis*	Northern Holly Fern				S1		3	40.9 ± 0.0	NB
P	*Huperzia selago*	Northern Firmoss				S1	2 May Be At Risk	1	88.5 ± 0.0	NB
P	*Bidens heterodoxa*	Connecticut Beggar-Ticks				S1?	2 May Be At Risk	1	95.4 ± 1.0	NB
P	*Galium trifidum ssp. subbiflorum*	Three-petaled Bedstraw				S1?	5 Undetermined	2	89.6 ± 0.0	NB
P	*Carex laxiflora*	Loose-Flowered Sedge				S1?	5 Undetermined	1	76.3 ± 2.0	NB
P	*Rumex aquaticus var. fenestratus*	Western Dock				S1S2	2 May Be At Risk	7	59.9 ± 0.0	NB
P	*Anemone multifida var. richardsiana*	Cut-leaved Anemone				S1S2	5 Undetermined	2	96.7 ± 0.0	NB
P	*Carex crawei*	Crawe's Sedge				S1S2	2 May Be At Risk	17	80.1 ± 0.0	NB
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S1S3	2 May Be At Risk	22	11.2 ± 0.0	NB
P	*Scirpus atrovirens*	Dark-green Bulrush				S1S3	5 Undetermined	32	37.9 ± 0.0	NB
P	*Osmorhiza depauperata*	Blunt Sweet Cicely				S2	3 Sensitive	7	16.7 ± 1.0	NB
P	*Osmorhiza longistylis*	Smooth Sweet Cicely				S2	3 Sensitive	2	63.4 ± 5.0	NB
P	*Solidago simplex var. racemosa*	Sticky Goldenrod				S2	2 May Be At Risk	1	98.2 ± 0.0	NB
P	*Solidago simplex*	Sticky Goldenrod				S2	2 May Be At Risk	2	41.0 ± 0.0	NB
P	*Ionactis linariifolius*	Stiff Aster				S2	3 Sensitive	39	40.4 ± 0.0	NB
P	*Symphyotrichum subulatum*	Annual Saltmarsh Aster				S2	1 At Risk	24	34.0 ± 0.0	NB
P	*Impatiens pallida*	Pale Jewelweed				S2	2 May Be At Risk	1	80.1 ± 1.0	NB
P	*Betula minor*	Dwarf White Birch				S2	3 Sensitive	20	87.3 ± 0.0	NB
P	*Arabis drummondii*	Drummond's Rockcress				S2	3 Sensitive	5	31.4 ± 0.0	NB
P	*Sagina nodosa*	Knotted Pearlwort				S2	3 Sensitive	5	1.8 ± 1.0	NB
P	*Stellaria longifolia*	Long-leaved Starwort				S2	3 Sensitive	1	56.5 ± 0.0	NB
P	*Atriplex franktonii*	Frankton's Saltbush				S2	4 Secure	5	22.3 ± 0.0	NB
P	*Chenopodium rubrum*	Red Pigweed				S2	3 Sensitive	4	40.6 ± 5.0	NB
P	*Hypericum dissimulatum*	Disguised St John's-wort				S2	3 Sensitive	1	91.4 ± 1.0	NB
P	*Shepherdia canadensis*	Soapberry				S2	3 Sensitive	12	23.5 ± 1.0	NB
P	*Astragalus eucosmus*	Elegant Milk-vetch				S2	2 May Be At Risk	7	70.7 ± 0.0	NB
P	*Oxytropis campestris var. johannensis*	Field Locoweed				S2	3 Sensitive	35	51.1 ± 10.0	NB
P	*Gentiana linearis*	Narrow-Leaved Gentian				S2	3 Sensitive	1	90.4 ± 0.0	NB
P	*Nuphar lutea ssp. rubrodisca*	Red-disked Yellow Pond-lily				S2	3 Sensitive	3	69.5 ± 0.0	NB
P	*Polygala senega*	Seneca Snakeroot				S2	3 Sensitive	2	94.1 ± 1.0	NB
P	*Anemone multifida*	Cut-leaved Anemone				S2	3 Sensitive	18	42.3 ± 10.0	NB
P	*Anemone parviflora*	Small-flowered Anemone				S2	3 Sensitive	8	88.0 ± 5.0	NB
P	*Hepatica nobilis var. obtusa*	Round-lobed Hepatica				S2	3 Sensitive	1	17.3 ± 0.0	NB
P	*Ranunculus longirostris*	Eastern White Water-Crowfoot				S2	5 Undetermined	3	37.7 ± 1.0	NB
P	*Crataegus scabrida*	Rough Hawthorn				S2	3 Sensitive	2	45.7 ± 1.0	NB
P	*Rosa acicularis ssp. sayi*	Prickly Rose				S2	2 May Be At Risk	102	40.4 ± 0.0	NB
P	*Galium kamtschaticum*	Northern Wild Licorice				S2	3 Sensitive	3	93.2 ± 1.0	NB
P	*Salix candida*	Sage Willow				S2	3 Sensitive	29	15.8 ± 5.0	NB
P	*Castilleja*	Northeastern Paintbrush				S2	3 Sensitive	14	58.7 ± 1.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
	septentrionalis									
P	*Sagittaria calycina var. spongiosa*	Long-lobed Arrowhead				S2	4 Secure	8	94.4 ± 0.0	NB
P	*Carex concinna*	Beautiful Sedge				S2	3 Sensitive	11	75.4 ± 0.0	NB
P	*Carex granularis*	Limestone Meadow Sedge				S2	3 Sensitive	28	24.5 ± 5.0	NB
P	*Carex gynocrates*	Northern Bog Sedge				S2	3 Sensitive	14	4.2 ± 5.0	NB
P	*Carex hirtifolia*	Pubescent Sedge				S2	3 Sensitive	2	72.7 ± 0.0	NB
P	*Carex livida var. radicaulis*	Livid Sedge				S2	3 Sensitive	3	80.2 ± 0.0	NB
P	*Carex prairea*	Prairie Sedge				S2	3 Sensitive	1	31.2 ± 1.0	NB
P	*Carex rostrata*	Narrow-leaved Beaked Sedge				S2	3 Sensitive	4	58.5 ± 0.0	NB
P	*Carex salina*	Saltmarsh Sedge				S2	3 Sensitive	14	35.6 ± 5.0	NB
P	*Carex sprengelii*	Longbeak Sedge				S2	3 Sensitive	1	51.8 ± 0.0	NB
P	*Carex tenuiflora*	Sparse-Flowered Sedge				S2	2 May Be At Risk	2	80.9 ± 10.0	NB
P	*Eriophorum gracile*	Slender Cottongrass				S2	2 May Be At Risk	9	94.8 ± 0.0	NB
P	*Blysmus rufus*	Red Bulrush				S2	3 Sensitive	44	3.4 ± 1.0	NB
P	*Elodea nuttallii*	Nuttall's Waterweed				S2	3 Sensitive	5	57.7 ± 0.0	NB
P	*Juncus vaseyi*	Vasey Rush				S2	3 Sensitive	29	36.8 ± 5.0	NB
P	*Allium tricoccum*	Wild Leek				S2	2 May Be At Risk	52	67.4 ± 5.0	NB
P	*Amerorchis rotundifolia*	Small Round-leaved Orchis				S2	2 May Be At Risk	13	2.7 ± 4.0	NB
P	*Calypso bulbosa var. americana*	Calypso				S2	2 May Be At Risk	7	12.3 ± 0.0	NB
P	*Coeloglossum viride var. virescens*	Long-bracted Frog Orchid				S2	2 May Be At Risk	4	11.4 ± 1.0	NB
P	*Cypripedium parviflorum var. makasin*	Small Yellow Lady's-Slipper				S2	2 May Be At Risk	4	3.9 ± 2.0	NB
P	*Goodyera oblongifolia*	Menzies' Rattlesnake-plantain				S2	3 Sensitive	32	3.0 ± 0.0	NB
P	*Agrostis mertensii*	Northern Bent Grass				S2	2 May Be At Risk	79	20.4 ± 1.0	NB
P	*Dichanthelium linearifolium*	Narrow-leaved Panic Grass				S2	3 Sensitive	1	55.5 ± 0.0	NB
P	*Piptatherum canadense*	Canada Rice Grass				S2	3 Sensitive	5	45.9 ± 0.0	NB
P	*Poa glauca*	Glaucous Blue Grass				S2	4 Secure	6	31.4 ± 0.0	NB
P	*Puccinellia laurentiana*	Nootka Alkali Grass				S2	3 Sensitive	1	95.5 ± 0.0	NB
P	*Puccinellia phryganodes*	Creeping Alkali Grass				S2	3 Sensitive	2	95.8 ± 0.0	NB
P	*Piptatherum pungens*	Slender Rice Grass				S2	2 May Be At Risk	7	32.2 ± 0.0	NB
P	*Asplenium trichomanes*	Maidenhair Spleenwort				S2	3 Sensitive	6	31.6 ± 0.0	NB
P	*Woodsia alpina*	Alpine Cliff Fern				S2	3 Sensitive	18	37.0 ± 0.0	NB
P	*Lycopodium sitchense*	Sitka Clubmoss				S2	3 Sensitive	2	88.2 ± 0.0	NB
P	*Botrychium minganense*	Mingan Moonwort				S2	3 Sensitive	8	85.1 ± 1.0	NB
P	*Selaginella selaginoides*	Low Spikemoss				S2	3 Sensitive	21	16.1 ± 0.0	NB
P	*Humulus lupulus var. lupuloides*	Common Hop				S2?	3 Sensitive	2	21.4 ± 1.0	NB
P	*Crataegus macrosperma*	Big-Fruit Hawthorn				S2?	5 Undetermined	1	45.7 ± 0.0	NB
P	*Galium obtusum*	Blunt-leaved Bedstraw				S2?	4 Secure	5	3.0 ± 1.0	NB
P	*Salix myricoides*	Bayberry Willow				S2?	3 Sensitive	7	3.3 ± 0.0	NB
P	*Carex vacillans*	Estuarine Sedge				S2?	3 Sensitive	1	67.0 ± 0.0	NB
P	*Platanthera huronensis*	Fragrant Green Orchid				S2?	5 Undetermined	3	49.6 ± 0.0	NB
P	*Solidago altissima*	Tall Goldenrod				S2S3	4 Secure	14	26.8 ± 0.0	NB
P	*Barbarea orthoceras*	American Yellow Rocket				S2S3	3 Sensitive	13	20.4 ± 1.0	NB
P	*Callitriche*	Northern Water-starwort				S2S3	4 Secure	15	42.8 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
	hermaphroditica									
P	*Elatine americana*	American Waterwort				S2S3	3 Sensitive	6	81.2 ± 0.0	NB
P	*Epilobium coloratum*	Purple-veined Willowherb				S2S3	3 Sensitive	1	92.1 ± 0.0	NB
P	*Rumex pallidus*	Seabeach Dock				S2S3	3 Sensitive	6	21.1 ± 0.0	NB
P	*Amelanchier sanguinea var. gaspensis*	Round-Leaved Serviceberry				S2S3	5 Undetermined	2	83.7 ± 0.0	NB
P	*Rubus pensilvanicus*	Pennsylvania Blackberry				S2S3	4 Secure	1	62.8 ± 2.0	NB
P	*Galium labradoricum*	Labrador Bedstraw				S2S3	3 Sensitive	23	10.9 ± 0.0	NB
P	*Valeriana uliginosa*	Swamp Valerian				S2S3	3 Sensitive	10	15.9 ± 0.0	NB
P	*Carex adusta*	Lesser Brown Sedge				S2S3	4 Secure	8	44.2 ± 10.0	NB
P	*Juncus brachycephalus*	Small-Head Rush				S2S3	3 Sensitive	6	16.1 ± 0.0	NB
P	*Corallorhiza maculata var. occidentalis*	Spotted Coralroot				S2S3	3 Sensitive	2	42.0 ± 1.0	NB
P	*Corallorhiza maculata var. maculata*	Spotted Coralroot				S2S3	3 Sensitive	8	1.4 ± 10.0	NB
P	*Listera auriculata*	Auricled Twayblade				S2S3	3 Sensitive	14	1.5 ± 5.0	NB
P	*Stuckenia filiformis*	Thread-leaved Pondweed				S2S3	3 Sensitive	2	67.3 ± 0.0	NB
P	*Stuckenia filiformis ssp. alpina*	Thread-leaved Pondweed				S2S3	3 Sensitive	11	57.8 ± 0.0	NB
P	*Potamogeton praelongus*	White-stemmed Pondweed				S2S3	4 Secure	5	68.1 ± 0.0	NB
P	*Panax trifolius*	Dwarf Ginseng				S3	3 Sensitive	4	74.0 ± 0.0	NB
P	*Arnica lanceolata*	Lance-leaved Arnica				S3	4 Secure	30	31.7 ± 0.0	NB
P	*Artemisia campestris ssp. caudata*	Field Wormwood				S3	4 Secure	6	2.8 ± 0.0	NB
P	*Bidens hyperborea*	Estuary Beggarticks				S3	4 Secure	39	11.3 ± 1.0	NB
P	*Bidens hyperborea var. hyperborea*	Estuary Beggarticks				S3	4 Secure	9	11.5 ± 1.0	NB
P	*Erigeron hyssopifolius*	Hyssop-leaved Fleabane				S3	4 Secure	151	16.6 ± 0.0	NB
P	*Prenanthes racemosa*	Glaucous Rattlesnakeroot				S3	4 Secure	14	66.9 ± 0.0	NB
P	*Tanacetum bipinnatum ssp. huronense*	Lake Huron Tansy				S3	4 Secure	2	91.6 ± 0.0	NB
P	*Symphyotrichum boreale*	Boreal Aster				S3	3 Sensitive	6	17.3 ± 5.0	NB
P	*Betula pumila*	Bog Birch				S3	4 Secure	36	16.1 ± 0.0	NB
P	*Arabis glabra*	Tower Mustard				S3	5 Undetermined	10	52.5 ± 0.0	NB
P	*Arabis hirsuta var. pycnocarpa*	Western Hairy Rockcress				S3	4 Secure	8	32.1 ± 0.0	NB
P	*Cardamine maxima*	Large Toothwort				S3	4 Secure	1	80.0 ± 0.0	NB
P	*Stellaria humifusa*	Saltmarsh Starwort				S3	4 Secure	14	4.9 ± 0.0	NB
P	*Hudsonia tomentosa*	Woolly Beach-heath				S3	4 Secure	37	29.7 ± 1.0	NB
P	*Crassula aquatica*	Water Pygmyweed				S3	4 Secure	8	80.1 ± 0.0	NB
P	*Penthorum sedoides*	Ditch Stonecrop				S3	4 Secure	5	65.4 ± 0.0	NB
P	*Elatine minima*	Small Waterwort				S3	4 Secure	1	13.5 ± 1.0	NB
P	*Astragalus alpinus*	Alpine Milk-vetch				S3	4 Secure	3	84.3 ± 0.0	NB
P	*Astragalus alpinus var. brunetianus*	Alpine Milk-Vetch				S3	4 Secure	34	68.6 ± 1.0	NB
P	*Hedysarum alpinum*	Alpine Sweet-vetch				S3	4 Secure	61	51.0 ± 0.0	NB
P	*Gentianella amarella ssp. acuta*	Northern Gentian				S3	4 Secure	7	41.6 ± 0.0	NB
P	*Geranium bicknellii*	Bicknell's Crane's-bill				S3	4 Secure	6	68.6 ± 1.0	NB
P	*Myriophyllum farwellii*	Farwell's Water Milfoil				S3	4 Secure	1	95.0 ± 0.0	NB
P	*Myriophyllum verticillatum*	Whorled Water Milfoil				S3	4 Secure	5	96.7 ± 0.0	NB
P	*Teucrium canadense*	Canada Germander				S3	3 Sensitive	2	97.6 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	*Nuphar lutea ssp. pumila*	Small Yellow Pond-lily				S3	4 Secure	7	12.2 ± 0.0	NB
P	*Epilobium hornemannii*	Hornemann's Willowherb				S3	4 Secure	32	32.0 ± 0.0	NB
P	*Epilobium strictum*	Downy Willowherb				S3	4 Secure	3	45.6 ± 0.0	NB
P	*Polygonum punctatum*	Dotted Smartweed				S3	4 Secure	1	75.9 ± 0.0	NB
P	*Polygonum punctatum var. confertiflorum*	Dotted Smartweed				S3	4 Secure	3	78.6 ± 0.0	NB
P	*Polygonum scandens*	Climbing False Buckwheat				S3	4 Secure	1	67.7 ± 1.0	NB
P	*Littorella uniflora*	American Shoreweed				S3	4 Secure	1	66.3 ± 1.0	NB
P	*Primula mistassinica*	Mistassini Primrose				S3	4 Secure	11	80.0 ± 0.0	NB
P	*Samolus valerandi ssp. parviflorus*	Seaside Brookweed				S3	4 Secure	15	79.5 ± 2.0	NB
P	*Pyrola minor*	Lesser Pyrola				S3	4 Secure	16	16.2 ± 0.0	NB
P	*Clematis occidentalis*	Purple Clematis				S3	4 Secure	11	16.3 ± 0.0	NB
P	*Ranunculus gmelinii*	Gmelin's Water Buttercup				S3	4 Secure	15	10.9 ± 0.0	NB
P	*Thalictrum venulosum*	Northern Meadow-rue				S3	4 Secure	4	11.8 ± 0.0	NB
P	*Sanguisorba canadensis*	Canada Burnet				S3	4 Secure	61	18.1 ± 0.0	NB
P	*Galium boreale*	Northern Bedstraw				S3	4 Secure	6	12.5 ± 1.0	NB
P	*Salix interior*	Sandbar Willow				S3	4 Secure	17	80.2 ± 0.0	NB
P	*Salix pedicellaris*	Bog Willow				S3	4 Secure	3	83.4 ± 5.0	NB
P	*Comandra umbellata*	Bastard's Toadflax				S3	4 Secure	15	4.6 ± 0.0	NB
P	*Comandra umbellata ssp. umbellata*	Bastard's Toadflax				S3	4 Secure	6	86.8 ± 0.0	NB
P	*Parnassia glauca*	Fen Grass-of-Parnassus				S3	4 Secure	83	16.1 ± 0.0	NB
P	*Limosella australis*	Southern Mudwort				S3	4 Secure	22	24.2 ± 0.0	NB
P	*Veronica serpyllifolia ssp. humifusa*	Thyme-Leaved Speedwell				S3	4 Secure	11	49.7 ± 0.0	NB
P	*Viola adunca*	Hooked Violet				S3	4 Secure	1	3.1 ± 0.0	NB
P	*Viola nephrophylla*	Northern Bog Violet				S3	4 Secure	31	16.1 ± 0.0	NB
P	*Carex arcta*	Northern Clustered Sedge				S3	4 Secure	7	58.3 ± 0.0	NB
P	*Carex atratiformis*	Scabrous Black Sedge				S3	4 Secure	24	11.3 ± 1.0	NB
P	*Carex capillaris*	Hairlike Sedge				S3	4 Secure	37	16.1 ± 0.0	NB
P	*Carex chordorrhiza*	Creeping Sedge				S3	4 Secure	3	96.8 ± 0.0	NB
P	*Carex conoidea*	Field Sedge				S3	4 Secure	2	36.2 ± 10.0	NB
P	*Carex eburnea*	Bristle-leaved Sedge				S3	4 Secure	70	16.3 ± 0.0	NB
P	*Carex garberi*	Garber's Sedge				S3	3 Sensitive	29	13.9 ± 0.0	NB
P	*Carex haydenii*	Hayden's Sedge				S3	4 Secure	3	73.3 ± 0.0	NB
P	*Carex ormostachya*	Necklace Spike Sedge				S3	4 Secure	10	20.7 ± 0.0	NB
P	*Carex rosea*	Rosy Sedge				S3	4 Secure	1	89.0 ± 5.0	NB
P	*Carex tenera*	Tender Sedge				S3	4 Secure	1	93.5 ± 0.0	NB
P	*Carex tuckermanii*	Tuckerman's Sedge				S3	4 Secure	4	59.6 ± 0.0	NB
P	*Carex vaginata*	Sheathed Sedge				S3	3 Sensitive	15	4.0 ± 5.0	NB
P	*Carex wiegandii*	Wiegand's Sedge				S3	4 Secure	17	13.1 ± 0.0	NB
P	*Carex recta*	Estuary Sedge				S3	4 Secure	9	4.7 ± 0.0	NB
P	*Cyperus dentatus*	Toothed Flatsedge				S3	4 Secure	1	77.4 ± 10.0	NB
P	*Eleocharis intermedia*	Matted Spikerush				S3	4 Secure	42	42.6 ± 0.0	NB
P	*Eleocharis quinqueflora*	Few-flowered Spikerush				S3	4 Secure	16	80.8 ± 0.0	NB
P	*Rhynchospora capitellata*	Small-headed Beakrush				S3	4 Secure	29	41.1 ± 0.0	NB
P	*Trichophorum clintonii*	Clinton's Clubrush				S3	4 Secure	39	16.6 ± 0.0	NB
P	*Lemna trisulca*	Star Duckweed				S3	4 Secure	1	73.6 ± 2.0	NB
P	*Triantha glutinosa*	Sticky False-Asphodel				S3	4 Secure	38	20.8 ± 50.0	NB
P	*Cypripedium reginae*	Showy Lady's-Slipper				S3	3 Sensitive	15	16.1 ± 0.0	NB
P	*Liparis loeselii*	Loesel's Twayblade				S3	4 Secure	6	37.2 ± 1.0	NB
P	*Platanthera*	White Fringed Orchid				S3	4 Secure	33	45.0 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
	blephariglottis									
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	3 Sensitive	6	13.2 ± 0.0	NB
P	*Bromus latiglumis*	Broad-Glumed Brome				S3	3 Sensitive	1	59.9 ± 0.0	NB
P	*Dichanthelium depauperatum*	Starved Panic Grass				S3	4 Secure	11	45.7 ± 0.0	NB
P	*Muhlenbergia richardsonis*	Mat Muhly				S3	4 Secure	26	71.9 ± 0.0	NB
P	*Potamogeton obtusifolius*	Blunt-leaved Pondweed				S3	4 Secure	13	17.4 ± 5.0	NB
P	*Potamogeton richardsonii*	Richardson's Pondweed				S3	3 Sensitive	6	66.2 ± 1.0	NB
P	*Xyris montana*	Northern Yellow-Eyed-Grass				S3	4 Secure	17	83.3 ± 1.0	NB
P	*Zannichellia palustris*	Horned Pondweed				S3	4 Secure	25	11.2 ± 0.0	NB
P	*Adiantum pedatum*	Northern Maidenhair Fern				S3	4 Secure	8	71.7 ± 1.0	NB
P	*Cryptogramma stelleri*	Steller's Rockbrake				S3	4 Secure	38	16.3 ± 0.0	NB
P	*Asplenium trichomanes-ramosum*	Green Spleenwort				S3	4 Secure	101	16.3 ± 0.0	NB
P	*Dryopteris fragrans var. remotiuscula*	Fragrant Wood Fern				S3	4 Secure	46	31.8 ± 0.0	NB
P	*Dryopteris goldiana*	Goldie's Woodfern				S3	3 Sensitive	57	70.6 ± 0.0	NB
P	*Woodsia glabella*	Smooth Cliff Fern				S3	4 Secure	16	16.3 ± 0.0	NB
P	*Equisetum palustre*	Marsh Horsetail				S3	4 Secure	7	17.1 ± 0.0	NB
P	*Isoetes tuckermanii*	Tuckerman's Quillwort				S3	4 Secure	1	89.8 ± 1.0	NB
P	*Lycopodium sabinifolium*	Ground-Fir				S3	4 Secure	5	68.6 ± 0.0	NB
P	*Huperzia appalachiana*	Appalachian Fir-Clubmoss				S3	3 Sensitive	17	20.4 ± 1.0	NB
P	*Botrychium lanceolatum var. angustisegmentum*	Lance-Leaf Grape-Fern				S3	3 Sensitive	5	7.1 ± 0.0	NB
P	*Botrychium simplex*	Least Moonwort				S3	4 Secure	4	9.9 ± 0.0	NB
P	*Polypodium appalachianum*	Appalachian Polypody				S3	4 Secure	1	93.4 ± 1.0	NB
P	*Mertensia maritima*	Sea Lungwort				S3S4	4 Secure	9	0.6 ± 2.0	NB
P	*Lobelia kalmii*	Brook Lobelia				S3S4	4 Secure	69	20.3 ± 1.0	NB
P	*Suaeda calceoliformis*	Horned Sea-blite				S3S4	4 Secure	25	25.4 ± 0.0	NB
P	*Myriophyllum sibiricum*	Siberian Water Milfoil				S3S4	4 Secure	24	40.3 ± 1.0	NB
P	*Stachys pilosa*	Hairy Hedge-Nettle				S3S4	5 Undetermined	10	55.3 ± 0.0	NB
P	*Rumex maritimus*	Sea-Side Dock				S3S4	4 Secure	7	85.5 ± 0.0	NB
P	*Rumex maritimus var. fueginus*	Tierra del Fuego Dock				S3S4	4 Secure	1	89.6 ± 0.0	NB
P	*Potentilla arguta*	Tall Cinquefoil				S3S4	4 Secure	15	17.1 ± 0.0	NB
P	*Rubus chamaemorus*	Cloudberry				S3S4	4 Secure	37	47.2 ± 0.0	NB
P	*Geocaulon lividum*	Northern Comandra				S3S4	4 Secure	37	2.8 ± 0.0	NB
P	*Juniperus horizontalis*	Creeping Juniper				S3S4	4 Secure	4	0.6 ± 2.0	NB
P	*Eriophorum russeolum*	Russet Cottongrass				S3S4	4 Secure	23	46.7 ± 0.0	NB
P	*Triglochin gaspensis*	Gasp├⌐ Arrowgrass				S3S4	4 Secure	45	11.3 ± 0.0	NB
P	*Corallorhiza maculata*	Spotted Coralroot				S3S4	3 Sensitive	14	3.2 ± 0.0	NB
P	*Calamagrostis stricta*	Slim-stemmed Reed Grass				S3S4	4 Secure	14	32.2 ± 0.0	NB
P	*Distichlis spicata*	Salt Grass				S3S4	4 Secure	5	26.3 ± 0.0	NB
P	*Potamogeton oakesianus*	Oakes' Pondweed				S3S4	4 Secure	7	12.3 ± 0.0	NB
P	*Polygonum raii*	Sharp-fruited Knotweed				SH	0.1 Extirpated	7	3.3 ± 1.0	NB
P	*Montia fontana*	Water Blinks				SH	2 May Be At Risk	1	70.4 ± 100.0	NB
P	*Aquilegia canadensis*	Red Columbine				SH	2 May Be At Risk	1	43.6 ± 10.0	NB
P	*Phleum alpinum*	Alpine Timothy				SH	2 May Be At Risk	2	94.1 ± 0.0	NB
P	*Gymnocarpium jessoense ssp.*	Asian Oak Fern				SH	2 May Be At Risk	8	75.0 ± 1.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
	parvulum									
P	*Botrychium campestre*	Prairie Moonwort				SH	2 May Be At Risk	1	3.3 ± 0.0	NB

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The recipient of these data shall acknowledge the ACCDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

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Appendix H VASCULAR PLANTS OBSERVED IN THE LAA

Table H.1 Vascular Plants Observed within the LAA

Scientific Name	Common Name	AC CDC S Rank [1]
Abies balsamea	balsam fir	*S5*
Acer pensylvanicum	striped maple	*S5*
Acer rubrum	red maple	*S5*
Acer saccharum	sugar maple	*S5*
Acer spicatum	mountain maple	*S5*
Achillea millefolium	common yarrow	*S5*
Actaea pachypoda	white baneberry	*S4*
Actaea rubra	red baneberry	*S5*
Aethusa cynapium	fool's-parsley	*SNA*
Agrimonia gryposepala	hooked agrimony	*S4*
Agrimonia striata	woodland agrimony	*S5*
Agrostis gigantea	redtop	*SNA*
Agrostis perennans	upland bent grass	*S5*
Agrostis scabra	rough bent grass	*S5*
Agrostis stolonifera	creeping bent grass	*S5*
Anaphalis margaritacea	pearly everlasting	*S5*
Apocynum androsaemifolium	spreading dogbane	*S5*
Aralia nudicaulis	wild sarsaparilla	*S5*
Arctium minus	common burdock	*SNA*
Arisaema triphyllum	Jack-in-the-pulpit	*S5*
Artemisia vulgaris	common wormwood	*SNA*
Athyrium filix-femina	common lady fern	*S5*
Betula alleghaniensis	yellow birch	*S5*
Betula papyrifera	paper birch	*S5*
Bidens cernua	nodding beggarticks	*S5*
Bidens frondosa	devil's beggarticks	*S5*
Brachyelytrum septentrionale	northern shorthusk	*S5*
Calamagrostis canadensis	bluejoint reed grass	*S5*
Callitriche palustris	marsh water-starwort	*S5*
Cardamine diphylla	two-leaved toothwort	*S4S5*
Cardamine pensylvanica	Pennsylvania bittercress	*S5*
Cardamine pratensis	cuckoo flower	*SNA*
Carex arctata	black sedge	*S5*

Table H.1 Vascular Plants Observed within the LAA

Scientific Name	Common Name	AC CDC S Rank [1]
Carex crinita	fringed sedge	*S5*
Carex debilis	white-edged sedge	*S5*
Carex deweyana	Dewey's sedge	*S5*
Carex disperma	two-seeded sedge	*S5*
Carex echinata	star sedge	*S5*
Carex flava	yellow sedge	*S5*
Carex gracillima	graceful sedge	*S5*
Carex hystericina	porcupine sedge	*S4*
Carex intumescens	bladder sedge	*S5*
Carex leptalea	bristly-stalked sedge	*S5*
Carex lurida	sallow sedge	*S5*
Carex projecta	necklace sedge	*S5*
Carex pseudocyperus	cyperuslike sedge	*S5*
Carex retrorsa	retrorse sedge	*S4*
Carex scabrata	rough sedge	*S5*
Carex stipata	awl-fruited sedge	*S5*
Carex trisperma	three-seeded sedge	*S5*
Carex vesicaria	inflated sedge	*S5*
Carex vulpinoidea	fox sedge	*S4S5*
Centaurea nigra	black knapweed	*SNA*
Chamerion angustifolium	fireweed	*S5*
Chelone glabra	white turtlehead	*S5*
Chimaphila umbellata	common pipsissewa	*S5*
Chrysosplenium americanum	American golden saxifrage	*S5*
Cinna latifolia	drooping wood reed grass	*S5*
Circaea alpina	small enchanter's nightshade	*S5*
Cirsium arvense	Canada thistle	*SNA*
Cirsium muticum	swamp thistle	*S5*
Cirsium vulgare	bull thistle	*SNA*
Clematis virginiana	Virginia clematis	*S5*
Clintonia borealis	yellow bluebead lily	*S5*
Conyza canadensis	canada horseweed	*S5*
Coptis trifolia	goldthread	*S5*

Table H.1 Vascular Plants Observed within the LAA

Scientific Name	Common Name	AC CDC S Rank [1]
Corallorhiza trifida	early coralroot	*S4*
Cornus alternifolia	alternate-leaved dogwood	*S5*
Cornus canadensis	bunchberry	*S5*
Cornus rugosa	round-leaved dogwood	*S4*
Cornus sericea	red osier dogwood	*S5*
Coronilla varia	purple crown-vetch	*SNA*
Corylus cornuta	beaked hazel	*S5*
Danthonia spicata	poverty oat grass	*S5*
Dasiphora fruticosa	shrubby cinquefoil	*S4*
Daucus carota	queen anne's lace	*SNA*
Diervilla lonicera	northern bush honeysuckle	*S5*
Doellingeria umbellata	hairy flat-top white aster	*S5*
Dryopteris carthusiana	spinulose wood fern	*S5*
Dryopteris cristata	crested wood fern	*S5*
Dryopteris intermedia	evergreen wood fern	*S5*
Echinochloa crus-galli	large barnyard grass	*SNA*
Elymus repens	quack grass	*SNA*
Epilobium ciliatum	northern willowherb	*S5*
Epilobium palustre	marsh willowherb	*S5*
Epipactis helleborine	helleborine	*SNA*
Equisetum arvense	field horsetail	*S5*
Equisetum pratense	meadow horsetail	*S4*
Equisetum sylvaticum	woodland horsetail	*S5*
Erigeron annuus	annual fleabane	*S4S5*
Eupatorium maculatum	spotted joe-pye-weed	*S5*
Euthamia graminifolia	grass-leaved goldenrod	*S5*
Fagus grandifolia	American beech	*S4*
Fragaria virginiana	wild strawberry	*S5*
Fraxinus nigra	black ash	*S4S5*
Galeopsis tetrahit	common hemp-nettle	*SNA*
Galium aparine	common bedstraw	*SU*
Galium asprellum	rough bedstraw	*S5*
Galium sp.	-	-

Table H.1 Vascular Plants Observed within the LAA

Scientific Name	Common Name	AC CDC S Rank [1]
Galium triflorum	three-flowered bedstraw	*S5*
Gaultheria hispidula	creeping snowberry	*S5*
Geum aleppicum	yellow avens	*S5*
Geum canadense	white avens	*S5*
Geum rivale	water avens	*S5*
Glyceria borealis	northern manna grass	*S5*
Glyceria canadensis	Canada manna grass	*S5*
Glyceria striata	fowl manna grass	*S5*
Goodyera oblongifolia	**Menzies' rattlesnake-plantain**	***S2***
Gymnocarpium dryopteris	common oak fern	*S5*
Hieracium caespitosum	field hawkweed	*SNA*
Hieracium pilosella	mouse-ear hawkweed	*SNA*
Hippuris vulgaris	common mare's-tail	*S4S5*
Hordeum jubatum	foxtail barley	*S5*
Hypericum perforatum	common St. John's-wort	*SNA*
Impatiens capensis	spotted jewelweed	*S5*
Iris versicolor	harlequin blue flag	*S5*
Juncus alpinoarticulatus	a rush	*S4*
Juncus balticus	baltic rush	*S5*
Lactuca biennis	tall blue lettuce	*S5*
Leersia oryzoides	rice cut grass	*S5*
Lemna minor	lesser duckweed	*SNA*
Leontodon autumnalis	fall dandelion	*SNA*
Linaria vulgaris	butter-and-eggs	*SNA*
Linnaea borealis	twinflower	*S5*
Lonicera canadensis	Canada fly honeysuckle	*S5*
Lotus corniculatus	garden bird's-foot trefoil	*SNA*
Ludwigia palustris	marsh seedbox	*S4*
Luzula multiflora	common woodrush	*S5*
Lycopodium annotinum	stiff clubmoss	*S5*
Lycopodium clavatum	running clubmoss	*S5*
Lycopodium dendroideum	round-branched tree-clubmoss	*S5*
Lycopodium hickeyi	Hickey's tree-clubmoss	*S4*

Table H.1 Vascular Plants Observed within the LAA

Scientific Name	Common Name	AC CDC S Rank [1]
Lycopodium obscurum	flat-branched tree-clubmoss	*S5*
Lycopus americanus	American water horehound	*S5*
Lycopus uniflorus	northern water horehound	*S5*
Lysimachia thyrsiflora	tufted yellow loosestrife	*S4*
Maianthemum canadense	wild lily-of-the-valley	*S5*
Maianthemum racemosum	large false solomon's seal	*S5*
Maianthemum stellatum	starry false solomon's seal	*S4S5*
Maianthemum trifolium	three-leaved false soloman's seal	*S5*
Malus pumila	common apple	*SNA*
Matricaria discoidea	pineapple weed	*SNA*
Matteuccia struthiopteris	ostrich fern	*S5*
Melilotus albus	white sweet-clover	*SNA*
Mentha arvensis	wild mint	*S5*
Mimulus ringens	square-stemmed monkeyflower	*S5*
Mitchella repens	partridgeberry	*S5*
Mitella nuda	naked bishop's-cap	*S5*
Moneses uniflora	one-flowered wintergreen	*S5*
Monotropa uniflora	Indian pipe	*S5*
Myosotis laxa	small forget-me-not	*S5*
Nemopanthus mucronatus	mountain holly	*S5*
Oclemena acuminata	whorled wood aster	*S5*
Oenothera biennis	common evening primrose	*S5*
Onoclea sensibilis	sensitive fern	*S5*
Orthilia secunda	one-sided wintergreen	*S5*
Oryzopsis asperifolia	white-grained mountain rice	*S5*
Osmorhiza berteroi	mountain sweet cicely	*S4*
Osmunda cinnamomea	cinnamon fern	*S5*
Osmunda claytoniana	interrupted fern	*S5*
Oxalis montana	common wood sorrel	*S5*
Panicum capillare	common witch grass	*S5*
Petasites frigidus	northern sweet coltsfoot	*S4S5*
Phalaris arundinacea	reed canary grass	*S5*
Phegopteris connectilis	northern beech fern	*S5*

Table H.1 Vascular Plants Observed within the LAA

Scientific Name	Common Name	AC CDC S Rank [1]
Phleum pratense	common timothy	*SNA*
Phragmites australis	common reed	*S4*
Picea glauca	white spruce	*S5*
Pimpinella saxifraga	burnet saxifrage	*SNA*
Pinus banksiana	jack pine	*S5*
Pinus strobus	eastern white pine	*S5*
Plantago major	common plantain	*SNA*
Platanthera aquilonis	tall northern green orchid	*S4*
Platanthera dilatata	white bog orchid	*S4*
Poa compressa	Canada blue grass	*SNA*
Poa pratensis	Kentucky blue grass	*S5*
Polygonum persicaria	spotted lady's-thumb	*SNA*
Polygonum punctatum	dotted smartweed	*S3*
Polygonum sagittatum	arrow-leaved smartweed	*S5*
Populus balsamifera	balsam poplar	*S5*
Populus tremuloides	trembling aspen	*S5*
Potamogeton alpinus	alpine pondweed	*S5*
Potamogeton natans	floating-leaved pondweed	*S5*
Potentilla intermedia	downy cinquefoil	*SNA*
Potentilla recta	sulphur cinquefoil	*SNA*
Prenanthes altissima	tall rattlesnakeroot	*S5*
Prenanthes trifoliolata	three-leaved rattlesnakeroot	*S5*
Prunella vulgaris	common self-heal	*S5*
Prunus pensylvanica	pin cherry	*S5*
Prunus virginiana	chokecherry	*S5*
Pteridium aquilinum	bracken fern	*S5*
Pyrola asarifolia	pink pyrola	*S5*
Pyrola chlorantha	green-flowered pyrola	*S4*
Pyrola elliptica	shinleaf	*S5*
Ranunculus abortivus	kidney-leaved buttercup	*S5*
Ranunculus acris	common buttercup	*SNA*
Ranunculus gmelinii	**Gmelin's water buttercup**	***S3***
Ranunculus hispidus	bristly buttercup	*S4S5*

Table H.1 Vascular Plants Observed within the LAA

Scientific Name	Common Name	AC CDC S Rank [1]
Ranunculus repens	creeping buttercup	*SNA*
Rhamnus alnifolia	alder-leaved buckthorn	*S4S5*
Rhinanthus minor	little yellow rattle	*SNA*
Ribes glandulosum	skunk currant	*S5*
Ribes hirtellum	smooth gooseberry	*S5*
Ribes lacustre	bristly black currant	*S5*
Rosa carolina	Carolina rose	*S4S5*
Rubus idaeus	red raspberry	*S5*
Rubus pubescens	dwarf red raspberry	*S5*
Rumex orbiculatus	greater water dock	*S5*
Salix bebbiana	Bebb's willow	*S5*
Salix discolor	pussy willow	*S5*
Salix eriocephala	cottony willow	*S5*
Salix lucida	shining willow	*S5*
Salix pyrifolia	balsam willow	*S5*
Sambucus nigra	black elderberry	*S5*
Sambucus racemosa	red elderberry	*S5*
Scirpus atrocinctus	black-girdled bulrush	*S5*
Scirpus cyperinus	common woolly bulrush	*S5*
Scirpus hattorianus	mosquito bulrush	*S5*
Scutellaria galericulata	marsh skullcap	*S5*
Scutellaria lateriflora	mad-dog skullcap	*S5*
Setaria viridis	green foxtail	*SNA*
Sium suave	common water parsnip	*S5*
Solanum dulcamara	bittersweet nightshade	*SNA*
Solidago flexicaulis	zigzag goldenrod	*S5*
Solidago macrophylla	large-leaved goldenrod	*S4*
Solidago rugosa	rough-stemmed goldenrod	*S5*
Sonchus arvensis	field sow thistle	*SNA*
Sorbus americana	American mountain ash	*S5*
Sparganium americanum	American burreed	*S5*
Streptopus amplexifolius	clasping-leaved twisted-stalk	*S5*
Streptopus lanceolatus	rose twisted-stalk	*S5*

Table H.1 Vascular Plants Observed within the LAA

Scientific Name	Common Name	AC CDC S Rank [1]
Symphyotrichum cordifolium	heart-leaved aster	*S5*
Symphyotrichum novi-belgii	New York aster	*S5*
Symphyotrichum puniceum	purple-stemmed aster	*S5*
Tanacetum vulgare	common tansy	*SNA*
Taraxacum officinale	common dandelion	*SNA*
Taxus canadensis	Canada yew	*S5*
Thalictrum pubescens	tall meadow-rue	*S5*
Thelypteris noveboracensis	New York fern	*S5*
Thuja occidentalis	eastern white cedar	*S5*
Toxicodendron rydbergii	northern poison oak	*S5*
Trientalis borealis	northern starflower	*S5*
Trifolium dubium	small hop clover	*SNA*
Trifolium pratense	red clover	*SNA*
Trifolium repens	white clover	*SNA*
Trillium cernuum	nodding trillium	*S5*
Trillium erectum	red trillium	*S5*
Tussilago farfara	coltsfoot	*SNA*
Typha angustifolia	narrow-leaved cattail	*S5*
Typha latifolia	broad-leaved cattail	*S5*
Vaccinium myrtilloides	velvet-leaved blueberry	*S5*
Verbascum thapsus	common mullein	*SNA*
Veronica americana	American speedwell	*S5*
Veronica officinalis	common speedwell	*S5*
Viburnum edule	squashberry	*S4?*
Viburnum nudum	northern wild raisin	*S5*
Vicia cracca	tufted vetch	*SNA*
Viola cucullata	marsh blue violet	*S5*

Note:
species in **bold** text are SOCC.
[1] S1 = *critically imperiled*, S2 = *imperiled*, S3 = *vulnerable*, S4 = *apparently secure*, S5 = *secure*, SNA = *not applicable* (typically exotic species) S#S# = a numeric range rank used to indicate any range of uncertainty about the status of the species or community (AC CDC 2018c)

Appendix I WETLAND FUNCTIONAL ASSESSMENT: WESP-AC SCORES FORMS

Appendix I Wetland Functional Assessment: WESP-AC Scores Forms
October 2, 2019

Table I.1 Functional Assessment Scores for Wetland 14

Assessment Area (AA) Results:						
Wetland ID: WL 14						
Date: August 30, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.897, -65.879						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Water Storage & Delay (WS)	7.12	Higher	0.29	Lower	7.21	0.38
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	2.79	Moderate	0.00	Lower	1.86	0.00
Sediment Retention & Stabilization (SR)	10.00	Higher	6.16	Moderate	10.00	3.74
Phosphorus Retention (PR)	10.00	Higher	5.53	Higher	10.00	5.33
Nitrate Removal & Retention (NR)	10.00	Higher	10.00	Higher	10.00	10.00
Carbon Sequestration (CS)	2.02	Lower			5.43	
Organic Nutrient Export (OE)	4.04	Moderate			4.48	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	5.04	Moderate	3.45	Moderate	5.65	3.10
Amphibian & Turtle Habitat (AM)	6.64	Higher	5.66	Moderate	6.81	5.52
Water bird Feeding Habitat (WBF)	8.26	Higher	10.00	Higher	6.57	10.00
Water bird Nesting Habitat (WBN)	6.13	Higher	10.00	Higher	5.24	10.00
Songbird, Raptor, & Mammal Habitat (SBM)	0.00	Lower	0.00	Lower	0.00	0.00

Table I.1 Functional Assessment Scores for Wetland 14

Assessment Area (AA) Results:						
Wetland ID: WL 14						
Date: August 30, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.897, -65.879						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Pollinator Habitat (POL)	0.00	Lower	0.00	Lower	0.00	0.00
Native Plant Habitat (PH)	4.36	Moderate	3.84	Moderate	4.84	3.33
Public Use & Recognition (PU)			1.98	Lower		1.74
Wetland Sensitivity (Sens)			8.14	Higher		4.64
Wetland Ecological Condition (EC)			6.14	Moderate		7.78
Wetland Stressors (STR) (higher score means more stress)			1.75	Lower		2.90
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	7.12	Higher	0.29	Lower	7.21	0.38
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	9.00	Higher	8.62	Higher	9.43	8.18
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	4.00	Moderate	2.30	Moderate	4.32	2.07
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	6.23	Higher	7.57	Higher	5.27	7.55
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	2.90	Lower	2.56	Moderate	3.23	2.22

Table I.1 Functional Assessment Scores for Wetland 14

Assessment Area (AA) Results:						
Wetland ID: WL 14						
Date: August 30, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.897, -65.879						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
WETLAND CONDITION (EC)			6.14	Moderate		7.78
WETLAND RISK (average of Sensitivity & Stressors)			4.95	Higher		3.77

Note:
A score of 0 does not mean the function or benefit is absent from the wetland. It means only that this wetland has a capacity that is equal or less than the lowest-scoring one, for that function or benefit, from among the 98 NB calibration wetlands that were assessed previously.

Table I.2 Functional Assessment Scores for Wetland 15

Assessment Area (AA) Results:						
Wetland ID: WL 15						
Date: August 30, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.899, -65.878						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Water Storage & Delay (WS)	3.50	Moderate	0.24	Lower	4.42	0.32
Stream Flow Support (SFS)	1.60	Lower	0.00	Lower	0.85	0.00
Water Cooling (WC)	7.05	Higher	0.73	Lower	4.70	0.44
Sediment Retention & Stabilization (SR)	1.46	Lower	0.67	Lower	4.16	0.41
Phosphorus Retention (PR)	3.08	Moderate	0.00	Lower	5.09	0.33
Nitrate Removal & Retention (NR)	1.60	Lower	4.75	Moderate	4.82	5.33
Carbon Sequestration (CS)	2.41	Lower			5.60	
Organic Nutrient Export (OE)	7.08	Higher			6.09	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	7.52	Higher	5.06	Moderate	6.52	3.97
Amphibian & Turtle Habitat (AM)	5.88	Moderate	4.10	Moderate	6.41	4.58
Water bird Feeding Habitat (WBF)	7.12	Higher	3.33	Moderate	5.67	3.33
Water bird Nesting Habitat (WBN)	4.31	Moderate	0.00	Lower	3.68	0.00
Songbird, Raptor, & Mammal Habitat (SBM)	9.74	Higher	0.00	Lower	8.07	0.00

Table I.2 Functional Assessment Scores for Wetland 15

Assessment Area (AA) Results:						
Wetland ID: WL 15						
Date: August 30, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.899, -65.878						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Pollinator Habitat (POL)	9.66	Higher	0.00	Lower	7.78	0.00
Native Plant Habitat (PH)	7.76	Higher	6.09	Moderate	6.22	5.28
Public Use & Recognition (PU)			1.15	Lower		1.15
Wetland Sensitivity (Sens)			8.32	Higher		4.69
Wetland Ecological Condition (EC)			7.59	Higher		8.61
Wetland Stressors (STR) (higher score means more stress)			1.45	Lower		2.79
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	3.50	Moderate	0.24	Lower	4.42	0.32
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	2.61	Lower	3.28	Lower	5.26	3.68
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	6.66	Higher	3.49	Moderate	5.53	2.72
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	5.29	Moderate	2.79	Lower	4.78	3.08
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	9.40	Higher	4.06	Moderate	7.72	3.52

Table I.2 Functional Assessment Scores for Wetland 15

Assessment Area (AA) Results:						
Wetland ID: WL 15						
Date: August 30, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.899, -65.878						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
WETLAND CONDITION (EC)			7.59	Higher		8.61
WETLAND RISK (average of Sensitivity & Stressors)			4.88	Higher		3.74

Note:
A score of 0 does not mean the function or benefit is absent from the wetland. It means only that this wetland has a capacity that is equal or less than the lowest-scoring one, for that function or benefit, from among the 98 NB calibration wetlands that were assessed previously.

Table I.3 Functional Assessment Scores for Wetland 17

Assessment Area (AA) Results:						
Wetland ID: WL 17						
Date: August 31, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.899, -64.871						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Water Storage & Delay (WS)	7.67	Higher	0.22	Lower	7.63	0.30
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	5.13	Moderate	0.00	Lower	3.42	0.00
Sediment Retention & Stabilization (SR)	10.00	Higher	1.56	Lower	10.00	0.94
Phosphorus Retention (PR)	10.00	Higher	1.09	Lower	10.00	1.32
Nitrate Removal & Retention (NR)	10.00	Higher	3.44	Moderate	10.00	4.17
Carbon Sequestration (CS)	5.00	Moderate			6.72	
Organic Nutrient Export (OE)	7.13	Higher			6.11	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	7.43	Higher	5.05	Moderate	6.49	3.97
Amphibian & Turtle Habitat (AM)	6.66	Higher	8.39	Higher	6.82	7.18
Water bird Feeding Habitat (WBF)	6.63	Moderate	10.00	Higher	5.27	10.00
Water bird Nesting Habitat (WBN)	6.38	Higher	10.00	Higher	5.45	10.00
Songbird, Raptor, & Mammal Habitat (SBM)	7.56	Higher	10.00	Higher	6.27	10.00

Table I.3 Functional Assessment Scores for Wetland 17

Assessment Area (AA) Results:						
Wetland ID: WL 17						
Date: August 31, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.899, -64.871						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Pollinator Habitat (POL)	8.24	Higher	10.00	Higher	6.63	10.00
Native Plant Habitat (PH)	3.60	Lower	8.80	Higher	4.54	7.63
Public Use & Recognition (PU)			1.90	Lower		1.68
Wetland Sensitivity (Sens)			6.14	Higher		4.04
Wetland Ecological Condition (EC)			5.66	Moderate		7.50
Wetland Stressors (STR) (higher score means more stress)			3.01	Moderate		3.37
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	7.67	Higher	0.22	Lower	7.63	0.30
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	9.37	Higher	2.73	Lower	9.59	3.16
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	6.17	Higher	3.37	Moderate	5.25	2.65
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	5.29	Moderate	7.84	Higher	5.16	7.72
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.35	Moderate	9.80	Higher	6.22	9.61

Table I.3 Functional Assessment Scores for Wetland 17

Assessment Area (AA) Results:						
Wetland ID: WL 17						
Date: August 31, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.899, -64.871						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
WETLAND CONDITION (EC)			5.66	Moderate		7.50
WETLAND RISK (average of Sensitivity & Stressors)			4.58	Higher		3.70

Note:
A score of 0 does not mean the function or benefit is absent from the wetland. It means only that this wetland has a capacity that is equal or less than the lowest-scoring one, for that function or benefit, from among the 98 NB calibration wetlands that were assessed previously.

Table I.4 Functional Assessment Scores for Wetland 23

Assessment Area (AA) Results:						
Wetland ID: WL 23						
Date: September 26, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.897, -65.883						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Water Storage & Delay (WS)	7.41	Higher	0.29	Lower	7.43	0.38
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	4.10	Moderate	0.00	Lower	2.73	0.00
Sediment Retention & Stabilization (SR)	10.00	Higher	1.16	Lower	10.00	0.70
Phosphorus Retention (PR)	10.00	Higher	0.37	Lower	10.00	0.67
Nitrate Removal & Retention (NR)	10.00	Higher	1.25	Lower	10.00	2.22
Carbon Sequestration (CS)	2.40	Lower			5.60	
Organic Nutrient Export (OE)	5.10	Moderate			5.04	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	5.37	Moderate	3.88	Moderate	5.76	3.33
Amphibian & Turtle Habitat (AM)	7.98	Higher	5.32	Moderate	7.52	5.32
Water bird Feeding Habitat (WBF)	7.48	Higher	10.00	Higher	5.95	10.00
Water bird Nesting Habitat (WBN)	7.66	Higher	10.00	Higher	6.54	10.00
Songbird, Raptor, & Mammal Habitat (SBM)	0.00	Lower	0.00	Lower	0.00	0.00
Pollinator Habitat (POL)	0.00	Lower	0.00	Lower	0.00	0.00

Table I.4 Functional Assessment Scores for Wetland 23

Assessment Area (AA) Results:						
Wetland ID: WL 23						
Date: September 26, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.897, -65.883						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Native Plant Habitat (PH)	3.22	Lower	3.84	Moderate	4.38	3.33
Public Use & Recognition (PU)			0.34	Lower		0.57
Wetland Sensitivity (Sens)			4.52	Moderate		3.56
Wetland Ecological Condition (EC)			3.25	Moderate		6.11
Wetland Stressors (STR) (higher score means more)			1.59	Lower		2.84
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	7.41	Higher	0.29	Lower	7.43	0.38
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	9.05	Higher	1.09	Lower	9.45	1.71
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	4.50	Moderate	2.58	Moderate	4.57	2.22
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	6.30	Higher	7.53	Higher	5.76	7.53
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	2.15	Lower	2.56	Moderate	2.92	2.22
WETLAND CONDITION (EC)			3.25	Moderate		6.11

Table I.4 Functional Assessment Scores for Wetland 23

Assessment Area (AA) Results:						
Wetland ID: WL 23						
Date: September 26, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.897, -65.883						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
WETLAND RISK (average of Sensitivity & Stressors)			3.05	Moderate		3.20

Note:
A score of 0 does not mean the function or benefit is absent from the wetland. It means only that this wetland has a capacity that is equal or less than the lowest-scoring one, for that function or benefit, from among the 98 NB calibration wetlands that were assessed previously.

Table I.5 Functional Assessment Scores for Wetland 24

Assessment Area (AA) Results:						
Wetland ID: WL 24						
Date: September 26, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.897, -65.885						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Water Storage & Delay (WS)	6.34	Higher	0.29	Lower	6.61	0.38
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	6.00	Higher	0.00	Lower	4.00	0.00
Sediment Retention & Stabilization (SR)	10.00	Higher	0.84	Lower	10.00	0.51
Phosphorus Retention (PR)	10.00	Higher	0.00	Lower	10.00	0.33
Nitrate Removal & Retention (NR)	10.00	Higher	1.75	Lower	10.00	2.67
Carbon Sequestration (CS)	4.29	Moderate			6.41	
Organic Nutrient Export (OE)	6.27	Higher			5.66	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	7.00	Higher	3.82	Moderate	6.34	3.30
Amphibian & Turtle Habitat (AM)	4.50	Moderate	4.05	Moderate	5.68	4.55
Water bird Feeding Habitat (WBF)	6.02	Moderate	3.33	Moderate	4.79	3.33
Water bird Nesting Habitat (WBN)	3.51	Moderate	2.50	Moderate	3.00	2.50
Songbird, Raptor, & Mammal Habitat (SBM)	7.66	Higher	2.50	Lower	6.35	2.50
Pollinator Habitat (POL)	8.74	Higher	0.00	Lower	7.03	0.00

Table I.5 Functional Assessment Scores for Wetland 24

Assessment Area (AA) Results:						
Wetland ID: WL 24						
Date: September 26, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.897, -65.885						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Native Plant Habitat (PH)	6.75	Higher	5.14	Moderate	5.81	4.46
Public Use & Recognition (PU)			4.01	Moderate		3.19
Wetland Sensitivity (Sens)			7.87	Higher		4.56
Wetland Ecological Condition (EC)			8.55	Higher		9.17
Wetland Stressors (STR) (higher score means more)			2.80	Moderate		3.29
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	6.34	Higher	0.29	Lower	6.61	0.38
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	9.29	Higher	1.31	Lower	9.55	1.92
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	5.91	Moderate	2.54	Moderate	5.17	2.20
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	4.41	Moderate	3.01	Lower	4.19	3.31
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.22	Higher	3.84	Moderate	6.72	3.39
WETLAND CONDITION (EC)			8.55	Higher		9.17

Table I.5 Functional Assessment Scores for Wetland 24

Assessment Area (AA) Results:						
Wetland ID: WL 24						
Date: September 26, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.897, -65.885						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
WETLAND RISK (average of Sensitivity & Stressors)			5.33	Higher		3.92

Note:
A score of 0 does not mean the function or benefit is absent from the wetland. It means only that this wetland has a capacity that is equal or less than the lowest-scoring one, for that function or benefit, from among the 98 NB calibration wetlands that were assessed previously.

Table I.6 Functional Assessment Scores for Wetland 25

Assessment Area (AA) Results:						
Wetland ID: WL 25						
Date: September 25, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.889, -65.885						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Water Storage & Delay (WS)	6.04	Higher	0.27	Lower	6.38	0.35
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	6.00	Higher	0.00	Lower	4.00	0.00
Sediment Retention & Stabilization (SR)	10.00	Higher	1.14	Lower	10.00	0.69
Phosphorus Retention (PR)	10.00	Higher	0.37	Lower	10.00	0.67
Nitrate Removal & Retention (NR)	10.00	Higher	7.19	Moderate	10.00	7.50
Carbon Sequestration (CS)	2.85	Lower			5.79	
Organic Nutrient Export (OE)	8.02	Higher			6.59	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	7.53	Higher	3.46	Moderate	6.52	3.11
Amphibian & Turtle Habitat (AM)	4.55	Moderate	3.86	Moderate	5.71	4.43
Water bird Feeding Habitat (WBF)	5.81	Moderate	2.50	Moderate	4.62	2.50
Water bird Nesting Habitat (WBN)	2.53	Moderate	2.50	Moderate	2.16	2.50
Songbird, Raptor, & Mammal Habitat (SBM)	7.44	Higher	2.50	Lower	6.17	2.50

Table I.6 Functional Assessment Scores for Wetland 25

Assessment Area (AA) Results:						
Wetland ID: WL 25						
Date: September 25, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.889, -65.885						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Pollinator Habitat (POL)	8.49	Higher	0.00	Lower	6.84	0.00
Native Plant Habitat (PH)	5.35	Moderate	5.00	Moderate	5.24	4.34
Public Use & Recognition (PU)			3.68	Moderate		2.95
Wetland Sensitivity (Sens)			5.54	Higher		3.86
Wetland Ecological Condition (EC)			6.39	Moderate		7.92
Wetland Stressors (STR) (higher score means more)			4.17	Moderate		3.79
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	6.04	Higher	0.27	Lower	6.38	0.35
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	9.11	Higher	5.04	Moderate	9.47	5.23
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	6.70	Higher	2.31	Moderate	5.43	2.07
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	4.20	Moderate	2.81	Lower	4.10	3.16
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.79	Higher	3.75	Moderate	6.46	3.31

Table I.6 Functional Assessment Scores for Wetland 25

Assessment Area (AA) Results:						
Wetland ID: WL 25						
Date: September 25, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.889, -65.885						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
WETLAND CONDITION (EC)			6.39	Moderate		7.92
WETLAND RISK (average of Sensitivity & Stressors)			4.86	Higher		3.83

Note:
A score of 0 does not mean the function or benefit is absent from the wetland. It means only that this wetland has a capacity that is equal or less than the lowest-scoring one, for that function or benefit, from among the 98 NB calibration wetlands that were assessed previously.

Table I.7 Functional Assessment Scores for Wetland 26

Assessment Area (AA) Results:						
Wetland ID: WL 26						
Date: September 26, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.899, -65.881						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Water Storage & Delay (WS)	5.93	Higher	0.24	Lower	6.29	0.33
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	6.00	Higher	0.00	Lower	4.00	0.00
Sediment Retention & Stabilization (SR)	10.00	Higher	0.92	Lower	10.00	0.56
Phosphorus Retention (PR)	10.00	Higher	0.74	Lower	10.00	1.00
Nitrate Removal & Retention (NR)	10.00	Higher	3.25	Moderate	10.00	4.00
Carbon Sequestration (CS)	3.06	Lower			5.88	
Organic Nutrient Export (OE)	7.76	Higher			6.45	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	8.47	Higher	3.51	Moderate	6.85	3.14
Amphibian & Turtle Habitat (AM)	4.67	Moderate	3.88	Moderate	5.77	4.45
Water bird Feeding Habitat (WBF)	5.81	Moderate	3.33	Moderate	4.62	3.33
Water bird Nesting Habitat (WBN)	2.59	Moderate	2.50	Moderate	2.22	2.50
Songbird, Raptor, & Mammal Habitat (SBM)	7.50	Higher	2.50	Lower	6.22	2.50

Table I.7 Functional Assessment Scores for Wetland 26

Assessment Area (AA) Results:						
Wetland ID: WL 26						
Date: September 26, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.899, -65.881						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Pollinator Habitat (POL)	8.28	Higher	0.00	Lower	6.66	0.00
Native Plant Habitat (PH)	6.01	Higher	4.95	Moderate	5.51	4.29
Public Use & Recognition (PU)			2.43	Moderate		2.06
Wetland Sensitivity (Sens)			7.59	Higher		4.48
Wetland Ecological Condition (EC)			8.55	Higher		9.17
Wetland Stressors (STR) (higher score means more)			1.75	Lower		2.90
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	5.93	Higher	0.24	Lower	6.29	0.33
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	9.13	Higher	2.44	Lower	9.49	2.93
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	7.01	Higher	2.34	Moderate	5.59	2.09
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	4.21	Moderate	2.91	Lower	4.14	3.25
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.77	Higher	3.72	Moderate	6.40	3.28

Table I.7 Functional Assessment Scores for Wetland 26

Assessment Area (AA) Results:						
Wetland ID: WL 26						
Date: September 26, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.899, -65.881						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
WETLAND CONDITION (EC)			8.55	Higher		9.17
WETLAND RISK (average of Sensitivity & Stressors)			4.67	Higher		3.69

Note:
A score of 0 does not mean the function or benefit is absent from the wetland. It means only that this wetland has a capacity that is equal or less than the lowest-scoring one, for that function or benefit, from among the 98 NB calibration wetlands that were assessed previously.

Table I.8 Functional Assessment Scores for Wetland 27

Assessment Area (AA) Results:						
Wetland ID: WL 27						
Date: September 26, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.903, -65.882						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Water Storage & Delay (WS)	6.16	Higher	0.17	Lower	6.47	0.25
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	6.00	Higher	0.00	Lower	4.00	0.00
Sediment Retention & Stabilization (SR)	10.00	Higher	0.31	Lower	10.00	0.19
Phosphorus Retention (PR)	10.00	Higher	0.00	Lower	10.00	0.33
Nitrate Removal & Retention (NR)	10.00	Higher	1.75	Lower	10.00	2.67
Carbon Sequestration (CS)	3.21	Moderate			5.95	
Organic Nutrient Export (OE)	7.60	Higher			6.37	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	7.90	Higher	3.41	Moderate	6.65	3.09
Amphibian & Turtle Habitat (AM)	4.22	Moderate	5.21	Moderate	5.53	5.25
Water bird Feeding Habitat (WBF)	5.44	Moderate	5.00	Moderate	4.33	5.00
Water bird Nesting Habitat (WBN)	2.59	Moderate	5.00	Moderate	2.22	5.00
Songbird, Raptor, & Mammal Habitat (SBM)	7.76	Higher	5.00	Moderate	6.44	5.00

Table I.8 Functional Assessment Scores for Wetland 27

Assessment Area (AA) Results:						
Wetland ID: WL 27						
Date: September 26, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.903, -65.882						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Pollinator Habitat (POL)	9.32	Higher	0.00	Lower	7.51	0.00
Native Plant Habitat (PH)	6.97	Higher	5.36	Moderate	5.90	4.65
Public Use & Recognition (PU)			2.28	Lower		1.95
Wetland Sensitivity (Sens)			10.00	Higher		5.23
Wetland Ecological Condition (EC)			8.55	Higher		9.17
Wetland Stressors (STR) (higher score means more)			1.58	Lower		2.84
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	6.16	Higher	0.17	Lower	6.47	0.25
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	9.15	Higher	1.22	Lower	9.49	1.86
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	6.64	Higher	2.28	Moderate	5.45	2.06
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	3.94	Moderate	4.13	Moderate	3.97	4.15
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.67	Higher	4.40	Moderate	7.06	4.11

Table I.8 Functional Assessment Scores for Wetland 27

Assessment Area (AA) Results:						
Wetland ID: WL 27						
Date: September 26, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.903, -65.882						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
WETLAND CONDITION (EC)			8.55	Higher		9.17
WETLAND RISK (average of Sensitivity & Stressors)			5.79	Higher		4.04

Note:
A score of 0 does not mean the function or benefit is absent from the wetland. It means only that this wetland has a capacity that is equal or less than the lowest-scoring one, for that function or benefit, from among the 98 NB calibration wetlands that were assessed previously.

Table I.9 Functional Assessment Scores for Wetland 28

Assessment Area (AA) Results:						
Wetland ID: WL 28						
Date: September 26, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.902, -65.884						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Water Storage & Delay (WS)	6.16	Higher	0.17	Lower	6.47	0.25
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower	0.00	0.00
Water Cooling (WC)	6.00	Higher	0.00	Lower	4.00	0.00
Sediment Retention & Stabilization (SR)	10.00	Higher	0.31	Lower	10.00	0.19
Phosphorus Retention (PR)	10.00	Higher	0.00	Lower	10.00	0.33
Nitrate Removal & Retention (NR)	10.00	Higher	4.38	Moderate	10.00	5.00
Carbon Sequestration (CS)	2.85	Lower			5.79	
Organic Nutrient Export (OE)	7.73	Higher			6.44	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	8.23	Higher	3.38	Moderate	6.77	3.07
Amphibian & Turtle Habitat (AM)	4.12	Moderate	5.22	Moderate	5.48	5.26
Water bird Feeding Habitat (WBF)	5.86	Moderate	5.00	Moderate	4.66	5.00
Water bird Nesting Habitat (WBN)	2.53	Moderate	5.00	Moderate	2.16	5.00
Songbird, Raptor, & Mammal Habitat (SBM)	7.37	Higher	5.00	Moderate	6.11	5.00

Table I.9 Functional Assessment Scores for Wetland 28

Assessment Area (AA) Results:						
Wetland ID: WL 28						
Date: September 26, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.902, -65.884						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
Pollinator Habitat (POL)	8.30	Higher	0.00	Lower	6.68	0.00
Native Plant Habitat (PH)	6.73	Higher	4.91	Moderate	5.80	4.26
Public Use & Recognition (PU)			4.26	Moderate		3.36
Wetland Sensitivity (Sens)			5.56	Higher		3.87
Wetland Ecological Condition (EC)			8.55	Higher		9.17
Wetland Stressors (STR) (higher score means more)			2.43	Moderate		3.15
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	6.16	Higher	0.17	Lower	6.47	0.25
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	9.11	Higher	2.97	Lower	9.47	3.42
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	6.86	Higher	2.26	Moderate	5.53	2.05
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	4.18	Moderate	4.13	Moderate	3.97	4.15
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.88	Higher	4.15	Moderate	6.44	4.04

Table I.9 Functional Assessment Scores for Wetland 28

Assessment Area (AA) Results:						
Wetland ID: WL 28						
Date: September 26, 2018						
Observer: M. Crowell and H. Button						
Latitude & Longitude (decimal degrees): 47.902, -65.884						
Wetland Functions or Other Attributes:	**Function Score (normalized)**	**Function Rating**	**Benefits Score (normalized)**	**Benefits Rating**	**Function Score (raw)**	**Benefits Score (raw)**
WETLAND CONDITION (EC)			8.55	Higher		9.17
WETLAND RISK (average of Sensitivity & Stressors)			3.99	Moderate		3.51

Note:
A score of 0 does not mean the function or benefit is absent from the wetland. It means only that this wetland has a capacity that is equal or less than the lowest-scoring one, for that function or benefit, from among the 98 NB calibration wetlands that were assessed previously.

Appendix J AVIAN DATA TABLES

Appendix J Avian Data Tables
October 2, 2019

Table J.1 AC CDC Bird Records within 5 km of the PDA

Common Name	Scientific Name	SARA Rank	COSEWIC Rank	NB SARA Rank	AC CDC Rank[1]
green-winged teal	*Anas crecca*				*S4B,S5M*
ring-necked duck	*Aythya collaris*				*S5B,S5M*
common eider	*Somateria mollissima*				*S3B,S4M,S3N*
mourning dove	*Zenaida macroura*				*S5B,S5M,S4N*
killdeer	*Charadrius vociferus*				*S3B,S3M*
American woodcock	*Scolopax minor*				*S5B,S5M*
Wilson's snipe	*Gallinago delicata*				*S3S4B,S5M*
spotted sandpiper	*Actitis macularius*				*S3S4B,S5M*
black guillemot	*Cepphus grylle*				*S3*
ring-billed gull	*Larus delawarensis*				*S3S4B,S5M*
herring gull	*Larus argentatus*				*S5*
great black-backed gull	*Larus marinus*				*S5*
common tern	*Sterna hirundo*		not at risk		*S3B,SUM*
common loon	*Gavia immer*		not at risk		*S4B,S4M,S4N*
northern gannet	*Morus bassanus*				*SHB,S5M*
osprey	*Pandion haliaetus*				*S4S5B,S5M*
northern harrier	*Circus hudsonius*		not at risk		*S4B,S4S5M*
broad-winged hawk	*Buteo platypterus*				*S5B,S5M*
barred owl	*Strix varia*				*S5*
yellow-bellied sapsucker	*Sphyrapicus varius*				*S5B,S5M*
downy woodpecker	*Dryobates pubescens*				*S5*
northern flicker	*Colaptes auratus*				*S5B,S5M*
American kestrel	*Falco sparverius*				*S4B,S4S5M*
eastern kingbird	*Tyrannus tyrannus*				*S3S4B,S3S4M*
eastern wood-pewee	***Contopus virens***	**Schedule 1, *special concern***	***special concern***	***special concern***	***S4B,S4M***
yellow-bellied flycatcher	*Empidonax flaviventris*				*S4S5B,S5M*

Table J.1 AC CDC Bird Records within 5 km of the PDA

Common Name	Scientific Name	SARA Rank	COSEWIC Rank	NB SARA Rank	AC CDC Rank[1]
alder flycatcher	*Empidonax alnorum*				*S5B,S5M*
least flycatcher	*Empidonax minimus*				*S5B,S5M*
blue-headed vireo	*Vireo solitarius*				*S5B,S5M*
Philadelphia vireo	*Vireo philadelphicus*				*S5B,S5M*
red-eyed vireo	*Vireo olivaceus*				*S5B,S5M*
blue jay	*Cyanocitta cristata*				*S5*
American crow	*Corvus brachyrhynchos*				*S5*
common raven	*Corvus corax*				*S5*
tree swallow	*Tachycineta bicolor*				*S4B,S4M*
bank swallow	***Riparia riparia***	**Schedule 1, *threatened***	***threatened***		***S2S3B,S2S3M***
cliff swallow	*Petrochelidon pyrrhonota*				*S2S3B,S2S3M*
barn swallow	***Hirundo rustica***	**Schedule 1, *threatened***	***threatened***	***threatened***	***S2B,S2M***
black-capped chickadee	*Poecile atricapillus*				*S5*
red-breasted nuthatch	*Sitta canadensis*				*S5*
golden-crowned kinglet	*Regulus satrapa*				*S5*
eastern bluebird	*Sialia sialis*		not at risk		*S4B,S4M*
veery	*Catharus fuscescens*				*S4B,S4M*
Swainson's thrush	*Catharus ustulatus*				*S5B,S5M*
hermit thrush	*Catharus guttatus*				*S5B,S5M*
wood thrush	***Hylocichla mustelina***	**Schedule 1, *threatened***	***threatened***	***threatened***	***S1S2B,S1S2M***
American robin	*Turdus migratorius*				*S5B,S5M*
gray catbird	*Dumetella carolinensis*				*S4B,S4M*
northern mockingbird	*Mimus polyglottos*				*S2B,S2M*
European starling	*Sturnus vulgaris*				*SNA*

Table J.1 AC CDC Bird Records within 5 km of the PDA

Common Name	Scientific Name	SARA Rank	COSEWIC Rank	NB SARA Rank	AC CDC Rank[1]
cedar waxwing	*Bombycilla cedrorum*				*S5B,S5M*
evening grosbeak	***Coccothraustes vespertinus***		***special concern***		***S3B,S3S4N,SUM***
purple finch	*Haemorhous purpureus*				*S4S5B,SUN,S5M*
American goldfinch	*Spinus tristis*				*S5*
chipping sparrow	*Spizella passerina*				*S5B,S5M*
savannah sparrow	*Passerculus sandwichensis*				*S4S5B,S5M*
fox sparrow	*Passerella iliaca*				*S4B,S5M*
song sparrow	*Melospiza melodia*				*S5B,S5M*
Lincoln's sparrow	*Melospiza lincolnii*				*S4B,S5M*
swamp sparrow	*Melospiza georgiana*				*S5B,S5M*
white-throated sparrow	*Zonotrichia albicollis*				*S5B,S5M*
bobolink	***Dolichonyx oryzivorus***	**Schedule 1, *threatened***	***threatened***	***threatened***	***S3B,S3M***
red-winged blackbird	*Agelaius phoeniceus*				*S4B,S4M*
brown-headed cowbird	*Molothrus ater*				*S3B,S3M*
common grackle	*Quiscalus quiscula*				*S5B,S5M*
ovenbird	*Seiurus aurocapilla*				*S5B,S5M*
northern waterthrush	*Parkesia noveboracensis*				*S4B,S5M*
black-and-white warbler	*Mniotilta varia*				*S5B,S5M*
Tennessee warbler	*Oreothlypis peregrina*				*S4B,S5M*
Nashville warbler	*Oreothlypis ruficapilla*				*S5B,S5M*
common yellowthroat	*Geothlypis trichas*				*S5B,S5M*
American redstart	*Setophaga ruticilla*				*S5B,S5M*

Table J.1 AC CDC Bird Records within 5 km of the PDA

Common Name	Scientific Name	SARA Rank	COSEWIC Rank	NB SARA Rank	AC CDC Rank[1]
northern parula	*Setophaga americana*				*S5B,S5M*
magnolia warbler	*Setophaga magnolia*				*S5B,S5M*
bay-breasted warbler	*Setophaga castanea*				*S4B,S4S5M*
yellow warbler	*Setophaga petechia*				*S5B,S5M*
chestnut-sided warbler	*Setophaga pensylvanica*				*S5B,S5M*
black-throated blue warbler	*Setophaga caerulescens*				*S5B,S5M*
Canada warbler	***Cardellina canadensis***	**Schedule 1, *threatened***	***threatened***	***threatened***	***S3B,S3M***

[1] S1 = *critically imperiled*, S2 = *imperiled*, S3 = *vulnerable*, S4 = *apparently secure*, S5 = *secure*, SNA = *not applicable* (typically exotic species) S#S# = a numeric range rank used to indicate any range of uncertainty about the status of the species or community. B= Breeding, M = Migrant. (AC CDC 2018c)

Table J.2 Bird Species Observed During June Field Surveys

Common Name	Scientific Name	Observation Date	Number Observed	Age	Sex	Breeding Evidence	X_NBDS	Y_NBDS	Habitat	SARA Rank	COSEWIC Rank	NB SARA Rank	AC CDC Rank[1]
ruffed grouse	*Bonasa umbellus*	28-Jun-18	1	Adult	Female	Distraction display	2546780	7655095	Mature - Overmature Mixedwood				*S5*
mourning dove	*Zenaida macroura*	28-Jun-18	1	Adult	Male	Singing male present	2546381	7655946	Young - Immature Softwood				*S5B,S5M,S4N*
common nighthawk	*Chordeiles minor*	27-Jun-18	1	Adult	Unknown	Habitat	285530	5308667	Infrastructure	*threatened*	*special concern*	*threatened*	*S3B,S4M*
common nighthawk	*Chordeiles minor*	27-Jun-18	1	Adult	Unknown	Habitat	285568	5308605	Regen - Sapling Hardwood	*threatened*	*special concern*	*threatened*	*S3B,S4M*
common nighthawk	*Chordeiles minor*	27-Jun-18	1	Adult	Unknown	Habitat	285888	5308605	Mature - Overmature Softwood	*threatened*	*special concern*	*threatened*	*S3B,S4M*
killdeer	*Charadrius vociferus*	28-Jun-18	1	Adult	Unknown	Habitat	2547681	7656746	Industrial				*S3B,S3M*
killdeer	*Charadrius vociferus*	28-Jun-18	1	Juvenile	Unknown	Nest with young	2547674	7656723	Industrial				*S3B,S3M*
herring gull	*Larus argentatus*	28-Jun-18	6	Adult	Both	Habitat	2547625	7656609	Industrial				*S5*
belted kingfisher	*Megaceryle alcyon*	28-Jun-18	1	Adult	Unknown	Habitat	2546418	7655470	Freshwater Marsh				*S5B,S5M*
yellow-bellied sapsucker	*Sphyrapicus varius*	28-Jun-18	1	Adult	Unknown	Habitat	2546783	7655106	Tall Shrub Swamp				*S5B,S5M*
black-backed woodpecker	*Picoides arcticus*	28-Jun-18	1	Adult	Unknown	Habitat	2546372	7656008	Mature - Overmature Hardwood				*S4*
downy woodpecker	*Dryobates pubescens*	28-Jun-18	1	Adult	Unknown	Habitat	2546742	7655187	Infrastructure				*S5*
downy woodpecker	*Dryobates pubescens*	28-Jun-18	1	Adult	Unknown	Habitat	2546408	7655487	Shallow Water Wetland				*S5*
hairy woodpecker	*Dryobates villosus*	28-Jun-18	1	Adult	Unknown	Habitat	2546765	7655052	Mature - Overmature Hardwood				*S5*
northern flicker	*Colaptes auratus*	28-Jun-18	1	Adult	Unknown	Visiting nest site	2546929	7654858	Mature - Overmature Mixedwood				*S5B,S5M*
northern flicker	*Colaptes auratus*	28-Jun-18	1	Adult	Unknown	Habitat	2546897	7654893	Mature - Overmature Mixedwood				*S5B,S5M*
eastern wood-pewee	*Contopus virens*	28-Jun-18	1	Adult	Male	Singing male present	2546513	7655958	Coniferous Treed Swamp	*special concern*	*special concern*	*special concern*	*S4B,S4M*
alder flycatcher	*Empidonax alnorum*	28-Jun-18	1	Adult	Male	Singing male present	2546823	7655043	Mature - Overmature Mixedwood				*S5B,S5M*
least flycatcher	*Empidonax minimus*	28-Jun-18	1	Adult	Male	Singing male present	2546856	7654905	Mature - Overmature Mixedwood				*S5B,S5M*
least flycatcher	*Empidonax minimus*	28-Jun-18	1	Adult	Male	Singing male present	2546667	7655157	Young - Immature Mixedwood				*S5B,S5M*
least flycatcher	*Empidonax minimus*	28-Jun-18	1	Adult	Male	Singing male present	2546374	7655315	Mature - Overmature Hardwood				*S5B,S5M*

Table J.2 Bird Species Observed During June Field Surveys

Common Name	Scientific Name	Observation Date	Number Observed	Age	Sex	Breeding Evidence	X_NBDS	Y_NBDS	Habitat	SARA Rank	COSEWIC Rank	NB SARA Rank	AC CDC Rank[1]
least flycatcher	*Empidonax minimus*	28-Jun-18	3	Adult	Male	Singing male present	2546377	7655371	Regen - Sapling Hardwood				*S5B,S5M*
least flycatcher	*Empidonax minimus*	28-Jun-18	1	Adult	Male	Singing male present	2546459	7655991	Tall Shrub Swamp				*S5B,S5M*
least flycatcher	*Empidonax minimus*	28-Jun-18	1	Adult	Male	Singing male present	2547116	7655478	Young - Immature Mixedwood				*S5B,S5M*
blue-headed vireo	*Vireo solitarius*	28-Jun-18	1	Adult	Male	Singing male present	2546914	7654866	Mature - Overmature Mixedwood				*S5B,S5M*
blue-headed vireo	*Vireo solitarius*	28-Jun-18	1	Adult	Unknown	Habitat	2546277	7655172	Mature - Overmature Hardwood				*S5B,S5M*
blue-headed vireo	*Vireo solitarius*	28-Jun-18	1	Adult	Male	Singing male present	2546437	7655491	Freshwater Marsh				*S5B,S5M*
blue-headed vireo	*Vireo solitarius*	28-Jun-18	1	Adult	Male	Singing male present	2546492	7654698	Mixedwood Treed Swamp				*S5B,S5M*
red-eyed vireo	*Vireo olivaceus*	28-Jun-18	1	Adult	Male	Singing male present	2546929	7654859	Mature - Overmature Mixedwood				*S5B,S5M*
red-eyed vireo	*Vireo olivaceus*	28-Jun-18	1	Adult	Male	Singing male present	2546627	7655182	Infrastructure				*S5B,S5M*
red-eyed vireo	*Vireo olivaceus*	28-Jun-18	1	Adult	Male	Singing male present	2547080	7655463	Young - Immature Mixedwood				*S5B,S5M*
red-eyed vireo	*Vireo olivaceus*	28-Jun-18	1	Adult	Unknown	Nest building	2547116	7654988	Young - Immature Softwood				*S5B,S5M*
tree swallow	*Tachycineta bicolor*	28-Jun-18	3	Adult	Unknown	Habitat	2547604	7656081	Regen - Sapling Hardwood				*S4B,S4M*
black-capped chickadee	*Poecile atricapillus*	28-Jun-18	1	Adult	Male	Singing male present	2546929	7654859	Mature - Overmature Mixedwood				*S5*
red-breasted nuthatch	*Sitta canadensis*	28-Jun-18	1	Adult	Unknown	Habitat	2546928	7654858	Mature - Overmature Mixedwood				*S5*
brown creeper	*Certhia americana*	28-Jun-18	1	Adult	Unknown	Habitat	2546826	7654917	Mature - Overmature Mixedwood				*S5*
winter wren	*Troglodytes hiemalis*	28-Jun-18	1	Adult	Male	Singing male present	2546522	7655944	Mature - Overmature Hardwood				*S5B,S5M*
ruby-crowned kinglet	*Regulus calendula*	28-Jun-18	1	Adult	Male	Singing male present	2546422	7655456	Industrial				*S4B,S5M*
ruby-crowned kinglet	*Regulus calendula*	28-Jun-18	1	Adult	Male	Singing male present	2546447	7655657	Mature - Overmature Hardwood				*S4B,S5M*
veery	*Catharus fuscescens*	28-Jun-18	1	Adult	Male	Singing male present	2546732	7655060	Mature - Overmature Hardwood				*S4B,S4M*
veery	*Catharus fuscescens*	28-Jun-18	1	Adult	Unknown	Habitat	2546793	7655167	Tall Shrub Swamp				*S4B,S4M*

Table J.2 Bird Species Observed During June Field Surveys

Common Name	Scientific Name	Observation Date	Number Observed	Age	Sex	Breeding Evidence	X_NBDS	Y_NBDS	Habitat	SARA Rank	COSEWIC Rank	NB SARA Rank	AC CDC Rank[1]
veery	*Catharus fuscescens*	28-Jun-18	1	Adult	Male	Singing male present	2546285	7655316	Regen - Sapling Hardwood				*S4B,S4M*
veery	*Catharus fuscescens*	28-Jun-18	1	Adult	Male	Singing male present	2546857	7655781	Young - Immature Hardwood				*S4B,S4M*
veery	*Catharus fuscescens*	28-Jun-18	1	Adult	Unknown	Adult carrying food	2547116	7655478	Young - Immature Mixedwood				*S4B,S4M*
veery	*Catharus fuscescens*	28-Jun-18	1	Adult	Male	Singing male present	2547279	7655164	Young - Immature Hardwood				*S4B,S4M*
Swainson's thrush	*Catharus ustulatus*	28-Jun-18	1	Adult	Male	Singing male present	2546887	7654886	Mature - Overmature Mixedwood				*S5B,S5M*
Swainson's thrush	*Catharus ustulatus*	28-Jun-18	1	Adult	Male	Singing male present	2546178	7655231	Regen - Sapling Hardwood				*S5B,S5M*
hermit thrush	*Catharus guttatus*	28-Jun-18	1	Adult	Male	Singing male present	2546929	7654859	Mature - Overmature Mixedwood				*S5B,S5M*
hermit thrush	*Catharus guttatus*	28-Jun-18	1	Adult	Unknown	Habitat	2546429	7655924	Young - Immature Softwood				*S5B,S5M*
American robin	*Turdus migratorius*	28-Jun-18	1	Adult	Male	Singing male present	2546929	7654858	Mature - Overmature Mixedwood				*S5B,S5M*
American robin	*Turdus migratorius*	28-Jun-18	1	Adult	Male	Singing male present	2546894	7654986	Mature - Overmature Mixedwood				*S5B,S5M*
American robin	*Turdus migratorius*	28-Jun-18	1	Adult	Female	Adult at nesting site	2546437	7655368	Mature - Overmature Hardwood				*S5B,S5M*
American robin	*Turdus migratorius*	28-Jun-18	1	Adult	Male	Singing male present	2547291	7655629	Regen - Sapling Hardwood				*S5B,S5M*
American robin	*Turdus migratorius*	28-Jun-18	1	Adult	Female	Habitat	2546736	7654646	Mature - Overmature Mixedwood				*S5B,S5M*
gray catbird	*Dumetella carolinensis*	28-Jun-18	1	Adult	Male	Singing male present	2546922	7655814	Young - Immature Hardwood				*S4B,S4M*
cedar waxwing	*Bombycilla cedrorum*	28-Jun-18	1	Adult	Unknown	Habitat	2546803	7654925	Mature - Overmature Mixedwood				*S5B,S5M*
cedar waxwing	*Bombycilla cedrorum*	28-Jun-18	1	Adult	Unknown	Habitat	2546437	7655490	Freshwater Marsh				*S5B,S5M*
cedar waxwing	*Bombycilla cedrorum*	28-Jun-18	1	Adult	Unknown	Habitat	2546818	7654601	Mature - Overmature Softwood				*S5B,S5M*
purple finch	*Haemorhous purpureus*	28-Jun-18	1	Adult	Male	Singing male present	2546881	7654890	Mature - Overmature Mixedwood				*S4S5B,SUN,S5M*
purple finch	*Haemorhous purpureus*	28-Jun-18	1	Adult	Male	Singing male present	2546394	7655677	Deciduous Treed Swamp				*S4S5B,SUN,S5M*
purple finch	*Haemorhous purpureus*	28-Jun-18	1	Adult	Male	Singing male present	2547171	7655063	Regen - Sapling Hardwood				*S4S5B,SUN,S5M*

Table J.2 Bird Species Observed During June Field Surveys

Common Name	Scientific Name	Observation Date	Number Observed	Age	Sex	Breeding Evidence	X_NBDS	Y_NBDS	Habitat	SARA Rank	COSEWIC Rank	NB SARA Rank	AC CDC Rank[1]
white-winged crossbill	*Loxia leucoptera*	28-Jun-18	2	Adult	Unknown	No indication Breeding	2546900	7654877	Mature - Overmature Mixedwood				*S5*
American goldfinch	*Spinus tristis*	28-Jun-18	1	Adult	Unknown	Habitat	2546887	7654886	Mature - Overmature Mixedwood				*S5*
American goldfinch	*Spinus tristis*	28-Jun-18	1	Adult	Male	Singing male present	2547291	7655629	Regen - Sapling Hardwood				*S5*
American goldfinch	*Spinus tristis*	28-Jun-18	1	Adult	Male	Singing male present	2547018	7655426	Young - Immature Mixedwood				*S5*
chipping sparrow	*Spizella passerina*	28-Jun-18	1	Adult	Male	Singing male present	2546820	7655130	Infrastructure				*S5B,S5M*
chipping sparrow	*Spizella passerina*	28-Jun-18	1	Adult	Male	Singing male present	2546396	7655784	Young - Immature Mixedwood				*S5B,S5M*
chipping sparrow	*Spizella passerina*	28-Jun-18	1	Adult	Male	Singing male present	2547077	7655223	Young - Immature Mixedwood				*S5B,S5M*
song sparrow	*Melospiza melodia*	28-Jun-18	1	Adult	Unknown	Habitat	2546680	7655170	Infrastructure				*S5B,S5M*
song sparrow	*Melospiza melodia*	28-Jun-18	1	Adult	Male	Singing male present	2547022	7655728	Freshwater Marsh				*S5B,S5M*
song sparrow	*Melospiza melodia*	28-Jun-18	3	Adult	Male	Singing male present	2547291	7655629	Regen - Sapling Hardwood				*S5B,S5M*
song sparrow	*Melospiza melodia*	28-Jun-18	1	Adult	Male	Singing male present	2547159	7655503	Deciduous Treed Swamp				*S5B,S5M*
white-throated sparrow	*Zonotrichia albicollis*	28-Jun-18	1	Adult	Male	Singing male present	2546779	7655123	Tall Shrub Swamp				*S5B,S5M*
white-throated sparrow	*Zonotrichia albicollis*	28-Jun-18	1	Adult	Unknown	Adult at nesting site	2546277	7655172	Mature - Overmature Hardwood				*S5B,S5M*
white-throated sparrow	*Zonotrichia albicollis*	28-Jun-18	1	Adult	Unknown	Adult carrying food	2546260	7655222	Mature - Overmature Hardwood				*S5B,S5M*
white-throated sparrow	*Zonotrichia albicollis*	28-Jun-18	1	Adult	Male	Singing male present	2546468	7655763	Mature - Overmature Hardwood				*S5B,S5M*
white-throated sparrow	*Zonotrichia albicollis*	28-Jun-18	1	Adult	Unknown	Adult carrying food	2546396	7655784	Young - Immature Mixedwood				*S5B,S5M*
white-throated sparrow	*Zonotrichia albicollis*	28-Jun-18	1	Adult	Unknown	Agitated	2547165	7655469	Young - Immature Mixedwood				*S5B,S5M*
white-throated sparrow	*Zonotrichia albicollis*	28-Jun-18	1	Adult	Male	Singing male present	2547153	7655194	Regen - Sapling Hardwood				*S5B,S5M*
red-winged blackbird	*Agelaius phoeniceus*	28-Jun-18	1	Adult	Male	Singing male present	2546437	7655489	Freshwater Marsh				*S4B,S4M*

Table J.2 Bird Species Observed During June Field Surveys

Common Name	Scientific Name	Observation Date	Number Observed	Age	Sex	Breeding Evidence	X_NBDS	Y_NBDS	Habitat	SARA Rank	COSEWIC Rank	NB SARA Rank	AC CDC Rank[1]
common grackle	*Quiscalus quiscula*	28-Jun-18	10	Adult	Both	No indication Breeding	2546929	7654858	Mature - Overmature Mixedwood				*S5B,S5M*
ovenbird	*Seiurus aurocapilla*	28-Jun-18	1	Adult	Male	Singing male present	2546897	7654924	Mature - Overmature Mixedwood				*S5B,S5M*
ovenbird	*Seiurus aurocapilla*	28-Jun-18	1	Adult	Male	Singing male present	2546671	7655177	Infrastructure				*S5B,S5M*
ovenbird	*Seiurus aurocapilla*	28-Jun-18	1	Adult	Unknown	Habitat	2546245	7654818	Mixedwood Treed Swamp				*S5B,S5M*
northern waterthrush	*Parkesia noveboracensis*	28-Jun-18	1	Adult	Male	Singing male present	2546424	7655477	Shallow Water Wetland				*S4B,S5M*
black-and-white warbler	*Mniotilta varia*	28-Jun-18	1	Adult	Male	Singing male present	2546929	7654858	Mature - Overmature Mixedwood				*S5B,S5M*
black-and-white warbler	*Mniotilta varia*	28-Jun-18	1	Adult	Male	Singing male present	2546263	7655218	Mature - Overmature Hardwood				*S5B,S5M*
black-and-white warbler	*Mniotilta varia*	28-Jun-18	1	Adult	Unknown	Habitat	2546287	7655570	Deciduous Treed Swamp				*S5B,S5M*
Nashville warbler	*Oreothlypis ruficapilla*	28-Jun-18	1	Adult	Female	Habitat	2546929	7654859	Mature - Overmature Mixedwood				*S5B,S5M*
Nashville warbler	*Oreothlypis ruficapilla*	28-Jun-18	1	Adult	Male	Singing male present	2546551	7655081	Infrastructure				*S5B,S5M*
Nashville warbler	*Oreothlypis ruficapilla*	28-Jun-18	1	Adult	Male	Singing male present	2546416	7655586	Mature - Overmature Softwood				*S5B,S5M*
Nashville warbler	*Oreothlypis ruficapilla*	28-Jun-18	1	Adult	Female	Habitat	2546392	7655673	Deciduous Treed Swamp				*S5B,S5M*
mourning warbler	*Geothlypis philadelphia*	28-Jun-18	1	Adult	Male	Singing male present	2546968	7655870	Industrial				*S4B,S5M*
common yellowthroat	*Geothlypis trichas*	28-Jun-18	1	Adult	Male	Singing male present	2546718	7655184	Infrastructure				*S5B,S5M*
common yellowthroat	*Geothlypis trichas*	28-Jun-18	1	Adult	Male	Singing male present	2546459	7655991	Tall Shrub Swamp				*S5B,S5M*
common yellowthroat	*Geothlypis trichas*	28-Jun-18	1	Adult	Male	Singing male present	2546974	7655792	Young - Immature Hardwood				*S5B,S5M*
common yellowthroat	*Geothlypis trichas*	28-Jun-18	1	Adult	Male	Singing male present	2547291	7655629	Regen - Sapling Hardwood				*S5B,S5M*
common yellowthroat	*Geothlypis trichas*	28-Jun-18	1	Adult	Male	Singing male present	2547027	7655144	Agricultural				*S5B,S5M*
common yellowthroat	*Geothlypis trichas*	28-Jun-18	1	Adult	Male	Singing male present	2547088	7655076	Regen - Sapling Hardwood				*S5B,S5M*
American redstart	*Setophaga ruticilla*	28-Jun-18	1	Adult	Male	Singing male present	2546929	7654859	Mature - Overmature Mixedwood				*S5B,S5M*

Table J.2 Bird Species Observed During June Field Surveys

Common Name	Scientific Name	Observation Date	Number Observed	Age	Sex	Breeding Evidence	X_NBDS	Y_NBDS	Habitat	SARA Rank	COSEWIC Rank	NB SARA Rank	AC CDC Rank[1]
American redstart	*Setophaga ruticilla*	28-Jun-18	1	Adult	Male	Singing male present	2546210	7655224	Regen - Sapling Hardwood				*S5B,S5M*
American redstart	*Setophaga ruticilla*	28-Jun-18	1	Adult	Male	Singing male present	2546437	7655492	Freshwater Marsh				*S5B,S5M*
American redstart	*Setophaga ruticilla*	28-Jun-18	1	Adult	Male	Adult carrying food	2546405	7655808	Young - Immature Mixedwood				*S5B,S5M*
American redstart	*Setophaga ruticilla*	28-Jun-18	1	Adult	Male	Singing male present	2547103	7655418	Young - Immature Mixedwood				*S5B,S5M*
American redstart	*Setophaga ruticilla*	28-Jun-18	1	Adult	Male	Singing male present	2546751	7655584	Young - Immature Hardwood				*S5B,S5M*
American redstart	*Setophaga ruticilla*	28-Jun-18	1	Adult	Male	Singing male present	2547123	7655105	Regen - Sapling Hardwood				*S5B,S5M*
magnolia warbler	*Setophaga magnolia*	28-Jun-18	1	Adult	Male	Singing male present	2546799	7655030	Mixedwood Treed Swamp				*S5B,S5M*
magnolia warbler	*Setophaga magnolia*	28-Jun-18	1	Adult	Male	Singing male present	2546817	7655163	Tall Shrub Swamp				*S5B,S5M*
chestnut-sided warbler	*Setophaga pensylvanica*	28-Jun-18	1	Adult	Male	Singing male present	2546374	7655443	Mature - Overmature Hardwood				*S5B,S5M*
black-throated green warbler	*Setophaga virens*	28-Jun-18	1	Adult	Male	Singing male present	2546790	7654889	Mature - Overmature Mixedwood				*S5B,S5M*
rose-breasted grosbeak	*Pheucticus ludovicianus*	28-Jun-18	1	Adult	Unknown	Habitat	2546574	7655873	Mature - Overmature Hardwood				*S4B,S4M*

[1] S1 = *critically imperiled*, S2 = *imperiled*, S3 = *vulnerable*, S4 = *apparently secure*, S5 = *secure*, SNA = *not applicable* (typically exotic) S#S# = numeric range rank used to indicate any range of uncertainty about the status of the species or community. B= Breeding, M = Migrant. (AC CDC 2018c)