HOWSE PROPERTY PROJECT

Environmental Preview Report

Presented to the Government of Newfoundland and Labrador

HML
Howse Minerals Limited

FINAL VERSION

October 2016

Howse Minerals Ltd
215 Water Street
Atlantic Place, Suite 809
St. John’s (Newfoundland) A1C 6M9

Tel: (709) 722-5714
Fax: (709) 722-4298
Email: rsharma@tatasteelcanada.com

Tata Steel Minerals Canada
1000 Sherbrooke West, Suite 1120
Montréal (Québec) H3A 3G4

Tel: (514) 764-6705
Fax: (514) 764-6725
Email: loic.didillon@tatasteelcanada.com

Groupe Hémisphères
1453, Beaubien Street E., Suite 301
Montréal (Québec) H2G 3C6

Tel: (514) 509-6572
Fax: (514) 509-6573
Email: mtrindade@hemis.ca

REPORT PREPARED BY:

Mariana Trindade
Project Manager, PhD Environmental Science
Groupe Hémisphères

Julie Bastien
Project Manager, M.Sc.Water
Groupe Hémisphères

REPORT REVISED BY:

Loïc Didillon
Project Director, M.Sc.
Tata Steel Minerals Canada

PROJECT TEAM

HOWSE MINERALS LIMITED

Rajesh Sharma	Chief Executive Officer, MBA
Loïc Didillon	Project Director, M.Sc., Director, Environment and Permitting
Michael Lewis	Environmental Coordinator, M.Sc.
Lisa Clancey	Environmental Technologist
Coco Calderhead,	Community Affairs, M.Sc.
Jean-François Dion	Environment technician
Rabi Mohanty	Chief – Geology and New Opportunities, M.Sc.
Armand MacKenzie,	Governmental and Stakeholder Relations, LL.L.
Paul Abongwa	Senior Project Geologist, M.Sc.

GROUPE HÉMISPHÈRES

Mariana Trindade	Project Manager, Ph.D., Environmental Science
Julie Bastien	Project Manager, M.Sc. Water, Planning and Drafting
Christian Corbeil	Professional Technician (T.P.), Management and Review
Daniel Néron	Geographer, M.Sc., Drafting
Marie-Ève Dion	Biologist, M.Sc. Env, Field Work and Drafting
Simon Barrette	Biologist, M.Sc. Biol., Field Work and Drafting
Samuel Denault	Biologist, M.Sc. Biol., Drafting
Julie Tremblay	Geomatician, B.Sc. Biology, DESS SIG, Cartography
Élissa Dickoum	Geomatician, Cartography
Raphaël Picard	Anthropologist, MA

T2 Environnement

Hugo T. Robitaille	Senior reviewer

SNC-LAVALIN

Environment and Water Team

Christian Laliberté	Geographer, M.Sc.Env., Drafting

Geneviève Dionne	Anthropologist, Ph.D., Drafting
Christian Fortin	Biologist, M.Sc., Review

Sustainable Mining Development Team

Marie-Hélène Paquette	Civil Engineer, M.Env.
Andrew Peach	Senior Environmental Scientist, P.Geo., EP.
Patrick Scholz	Civil Engineer, M.Eng.
Anh-Long Nguyen	Process Engineer, M.Sc.
Abdel Benlahcen	Geologist, Ph.D.

AECOM

Air, noise and light team

Denis Lalonde	Chemical Engineer
Alexandre Bourget	Environmental Engineer, M.Sc.
James Au	Acoustic Engineer
Brian Bulnes	Acoustic Engineer
Rabih Alkhatib	Vibration Engineer, Ph.D.
Martin Aubé	Astrophysician, Ph.D.

Human Health Risk Assessment Team

Michael Rankin	M.Sc., RPBio., CSAP-Risk Specialist
Michael Sanborn	M.Sc., R.P.Bio
James Phibbs	Environmental Scientist

Golder Associated

Carl Gravel	Geological Engineering
Marc Rougier	Geological Engineering

Geofor

Gilles Fortin	Geological Engineering, Hydrogeology M.Sc.

Journeaux Assoc

Noel Journeaux	Ing., P.Geo., P.Eng

Palmer Environmental Consulting Group

Robin McKillop Geomorphologist, M.Sc., Drafting

Gerald Penney and Associates Limited

Gerald Penney Principal Investigator, M.A.

Blair Temple Archaeologist; report preparation, M.A.

Robert Cuff Historical Research; report preparation, M.A.

Toby Simpson Archaeologist; drafting/digital mapping, B.A.

Lori Temple Cataloguing, B.A.

Miki Lee CCM Conservator, B.A., Dip.

(Refer also to the list of personal communications in the References section)

Recyclable and made of recycled paper
Paper made with wind energy and contributing to the responsible use of forest resources.

This report has been formatted for double-sided printing.

REVISION AND PUBLICATION		
NO	**DATE**	**MODIFICATION OR PUBLICATION DATA**
00	2015-02-09	Preliminary Environmental Impact Statement
01	2016-02-01	Final Environmental Impact Statement
02	2016-04-01	Final Environmental Impact Statement, 2nd version
03	2016-04-14	Final Environmental Impact Statement, 3rd version
04	2016-10-14	Final Environmenta Preview Statement, 4th version

This document should be cited as:

Groupe Hémisphères (2016) *Environmental Preview Report – Howse Property Project.* Submitted to Howse Minerals Limited, Final version of October, 2016, 821 pp. and 24 appendices.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES – VOLUME 1

LIST OF SUPPORTING STUDIES – VOLUME 2

Appendix N. Groupe Hémisphères (2015) *Common Nighthawk Survey* for Howse Mining Project, Labrador, Summer 2015. Technical Report submitted to Howse Minerals Ltd., 11 pp. and 3 appendices.

Appendix O. Gerald Penney Associates Limited (2014) *Goodwood-Timmins Haul Road and Howse Property Historic Resources Impact Assessment, near Schefferville, QC.* Archaeological Investigation Permits #14.42. DRAFT Submitted to Provincial Archaeology Office and Tata Steel Minirals Canada.

LIST OF AVIFAUNA STUDIES – VOLUME 3

LIST OF HEMIS STUDIES – VOLUME 3

Appendix a. AMEC (January 2009) *Fish and Fish Habitat Investigation for the Direct-Shipping Ore Project.* Technical Report prepared for Groupe Hémisphères, 38pp. and 3 appendices.

Appendix b. D'Astous and Trimper (November 2009) *Spring Survey of Caribou in the Vicinity of Schefferville May 2009.* Final report prepared for New Millennium Capital Corp. and Labrador Iron Mines Limited, 17pp. and 2 appendices.

Appendix c. Groupe Hémisphères (2009) *Inventaire 2008 et 2009 des oiseaux nicheurs du future site DSO.* Rapport technique réalisé pour New Millennium Capital Corp., 22p. et 4 annexes.

Appendix d. Groupe Hémisphères (2009) *Reconnaissance de l'habitat du poisson le long de deux tracés hypothétiques de la route principale d'accès entre les secteurs DSO3 et DSO4, projet DSO.* Rapport technique réalisé pour New Millennium Capital Corp., 19p. et 7 annexes.

Appendix e. Groupe Hémisphères et Groupe Synergis (Janvier 2010) *Inventaires du milieu aquatique pour le projet DSO.* Rapport technique réalisé pour le compte de New Millennium Capital Corp., 160p. et 10 annexes.

Appendix f. D'Astous and Trimper (April 2010) *Spring Survey of Caribou in the Vicinity of Schefferville May 2009– Addendum concerning Blue 331.* Final report prepared for New Millennium Capital Corp. and Labrador Iron Mines Limited, 2pp.

Appendix g. D'Astous and Trimper (May 2010) *Spring Survey of Caribou in the Vicinity of Schefferville April-May 2010.* Final report prepared for New Millennium Capital Corp. and Labrador Iron Mines Limited, 10pp.

Appendix h. Groupe Hémisphères (Mai 2010) *Recherche de mesures de compensation relatives à l'habitat du poisson pour le projet DSO.* Rapport technique réalisé pour New Millennium Capital Corp., 79p et 1 annexe.

Appendix i. Groupe Hémisphères et Groupe Synergis (Mai 2011*) Inventaires complémentaires du milieu aquatique potentiellement affecté par les futures activités minières : secteur des gisements Leroy 1 et Sunny 1, unité d'évaluation 2a, Projet DSO*. Rapport technique final réalisé pour New Millennium Capital Corp., 61p. et 6 annexes.

Appendix j. Groupe Hémisphères (Mai 2011) *Plan de mitigation pour la protection du quiscale rouilleux, Projet DSO.* Rapport technique réalisé pour New Millennium Capital Corp., 13p.

Appendix k. Groupe Hémisphères (July 2011) *Spring Survey of Caribou in the Vicinity of the DSO3 Sector.* Final Report submitted to Tata Steel Minerals Canada Ltd., 7pp. and 1 appendix.

Appendix l. Groupe Hémisphères (May 2012) *Spring Monitoring of Caribou in the Vicinity of the DSO3 Sector. Technical* report submitted to Tata Steel Minerals Canada Ltd., 5pp. and 2 appendices.

Appendix m. AMEC (July 2008) Reconnaissance of Potentially Affected Fish Habitat Western Labrador and Eastern Quebec. Technical Report submitted to Groupe Hémisphères, 10pp. and 4 appendices.

LIST OF ABBREVIATIONS AND SYMBOLS

%	Percentage
°C	Degrees Celsius
AANDC	Aboriginal Affairs and Northern Development Canada
ABA	Acid Base Accounting
AIP	Agreement-In-Principle
ALT	Acute Lethality Test
AP	Acid Potential
ARD	Acid Rock Drainage
ASL	Above Sea Level
ASSSCN	Agence de la santé et des services sociaux de la Côte-Nord
ATK	Aboriginal Traditional Knowledge
BCWRM	Brace Centre for Water Resources Management
BP	Before Present
CAM	Conseil des Atikamekws et des Montagnais
CARMA	CircumArctic Rangifer Monitoring and Assessment Network
CCME	Canadian Council of Ministers of the Environment
CEAA	Canadian Environmental Assessment Agency
CEAA (2012)	Canadian Environmental Assessment Act of 2012
CIE	Commission Internationale de l'Éclairage (International Commission on Illumination)
CLSC	Centre Local de Services Communautaires (Local Community Services Centres)
cm	Centimetre
CNA	College of the North Atlantic
CNSC	Canadian Nuclear Safety Commission
CNQA	Cree-Naskapi (of Québec) Act
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSSS	Centre de santé et de services sociaux
dBA	Decibel
DFO	Fisheries and Oceans Canada
DSO	Direct Shipping Ore
EC	Environment Canada
EDC	Effluent Discharge Criteria
EEM	Environmental Effects Monitoring
EIS	Environmental Impact Study
ELAIOM	Elross Lake Area Iron Ore Mine (DSO Project 1a)
EPA	Environmental Protection Act
EPP	Environmental Protection Plan
EPR	Environmental Preview Report

ERP	Environmental Response Plan
FDSN	Federation of Digital Seismograph Networks
FTA	Federal Transit Association
GHG	Greenhouse gases
GNL	Government of Newfoundland and Labrador
GRCH	George River Caribou Herd
ha	Hectare
H_2S	Hydrogen Sulfide
HEU	Habitat Equivalent Units
HML	Howse Minerals Limited
HSE	Health, Safety and Environment
HST	High Subarctic Tundra
IBA	Impact and Benefit Agreement
IDA	International Dark-Sky Association
IOCC	Iron Ore Company of Canada
ITUM	Innu Takuaikan Uashat mak Mani-Utenam
JBNQA	James Bay and Northern Québec Agreement
kg	Kilogram
km	Kilometre
km/h	Kilometre per hour
$L/s/km^2$	Liter per second per square kilometre
LEED	Leadership in Energy and Environmental Design
LGRHA	Labrador-Grenfell Regional Health Authority
LIL	Labrador Innu Lands
LIM	Labrador Iron Mines Ltd.
LIOP	LabMag Iron Ore Project
LISA	Labrador Innu Settlement Area
L/min	Litres per minute
LSA	Local study area
µm	Microgram or one-millionth of a gram
µm/L	Microgram per Liter
$\mu g/m^3$	Microgram per cubic metre
masl	Metres Above Sea Level
MDDEFP	Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs
mg/L	Milligrams per Litre
m	Metre
m^3	Cubic metre
m/d	Metres per day

m^2/d	Square metres per day
m^3/d	Cubic metres per day
m/s	Metres per second
m^3/s	Cubic metres per second
mm	Millimetre
mm/d	Millimetres per day
mm/y	Millimetres per year
MLJ	Matimekush – Lac John
MMER	Metal Mining Effluent Regulations
MN	Nuttli magnitude
MRC	Municipalité régionale de comté (Regional County Municipality)
MSF	Mid Subarctic Forest
Mt	Million tonnes
N	North
NAD	North American Datum
NEB	National Energy Board
NCC	NunatuKavut Community Council
n.a.	Not applicable
n.d.	No data
NEQA	Northeastern Québec Agreement
NHS	National Household Survey
NIMLJ	Nation Innu Matimekush – Lac John
NLBP	Newfoundland and Labrador Benefits Plan
NLDEC	Newfoundland and Labrador Department of Environment and Conservation
NLDOT	Newfoundland and Labrador Department of Transportation
NLMB	Naskapi Local Management Board
NML	New Millennium Iron Corp.
NNK	Naskapi Nation of Kawawachikamach
NNP	Net Neutralization Potential
NO_x	Nitrogen Oxides
NP	Neutralizing Potential
NPR	Neutralization Potential Ratio
NQPA	Naskapi-Québec Partnership Agreement
NTDB	National Topographic Data Base
PFWA	Paul F.Wilkinson & Associates
QNS&L	Québec North Shore & Labrador Railway
RCNM	Roadway Construction Noise Model
RDL	Reported Detection Limit

ROM	Run-of-mine
RNC	Royal Newfoundland Constabulary
RSA	Regional Study Area
RTWQ	Real-Time Water Quality
SARA	Species at Risk Act
SFNQ	La Société Ferroviaire du Nord québécois
SO_x	Sulfur Oxide
SO_2	Sulfur Dioxide
SQ	Sûreté du Québec
SQM	Sky Quality Metres
SS	Suspended Solids
TC	Transport Canada
TCLP	Toxicity Characteristic Leaching Procedure
TEM	Terrestrial Ecosystem Mapping
TLH	Trans Labrador Highway
TML	Transportable Moisture Limit
TSH	Tshiuetin Rail Transportation Inc.
TSMC	Tata Steel Minerals Canada Ltd.
TSS	Total Suspended Solids
US	Upper Shale
UTM	Universal Transverse Mercator
VC	Valued Component
WEP	Women’s Employment Plan
WMP	Water Management Plan

GLOSSARY

Benthos	An organism that lives on or in the bottom of a body of water such as a river, lake, or sea.
Biota	All of the living organisms (including animals, plants, fungi, and micro-organisms) that are found in a particular area.
Biotope	The smallest subdivision of a habitat characterized by a high degree of uniformity in its environmental conditions, and in its plant and animal life.
Chert	A hard, brittle sedimentary rock consisting of microcrystalline quartz.
Chiroptera	Bats, a highly-specialized group of insectivorous mammals and the only mammals capable of flying like birds.
Cobble	A rock fragment, rounded or abraded, that is larger than a pebble and smaller than a boulder.
Conductivity	The transfer of heat from one object to another through direct physical contact.
Decibel	A unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to referenced sound pressure amplitude. The reference pressure is 20 microPascals.
Dissolved oxygen	The oxygen dissolved in water. The amount is usually expressed in parts per million.
Ecoregion	An area of the landscape with characteristic regional climate and landforms, as expressed in typical vegetation physiognomy and composition, soils and topography.
Ecotype	The most detailed ecological classification units within ecoregions, which are used to delineate and describe terrestrial landscapes or, alternatively, ecosystems in this report. Ecotypes occur in predictable landscape positions and feature characteristic landform, site and soil characteristics that can be identified through stereoscopic interpretation of aerial photographs and described in detail during site visits.
Ericaceous	Of or pertaining to a plant family that includes numerous plants, mostly from temperate climates, that normally grow in acidic soils.
Fen	A sedge-dominated, groundwater-fed type of wetland that accumulates peat, but is less acidic than a bog.
Fish habitat	Spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes.
Fluvial	Of or pertaining to a river or rivers.
Freshet	A comparatively short-duration, high rate of flow of freshwater in a stream resulting from heavy rainfall or rapid snow melt.
Glaciofluvial	Pertaining to the sediments (commonly moderately- to well-sorted sand, gravel or cobbles) eroded, transported and deposited by glacial meltwater in ice-contact or proglacial environments.

Herpetofauna (Herptile)	All reptiles and amphibians (e.g., salamanders, frogs, toads, caecilians, snakes, lizards, turtles, tuataras and crocodilians).
Hibernacula	The winter quarters of a hibernating animal.
Hydrometric station	A station on a river, lake, estuary or reservoir where water quantity and quality data are collected and recorded. Such data may include stage (water surface elevation), discharge, sediment concentration, water temperature, chemical and biological properties of water, ice formations and other characteristics.
Impacts and Benefits Agreement	Most simply put, these negotiated, private agreements serve to document in a contractual form the benefits that a local community can expect from the development of a local resource in exchange for its support and cooperation. Their specific content varies, but typically they include provisions on royalties and/or profit-sharing, employment, wider economic development opportunities, and enhanced protection of environmental and socio-cultural amenities. IBAs are novel and noteworthy for a couple of reasons. First, they provide some assurances to, and tangible benefits for, local communities facing a major resource development such as a diamond mine in a way that conventional regulatory mechanisms like environmental effects assessments have never been able to provide. Second, they have largely been established without the explicit involvement of the state, the traditional sovereign authority in all matters of natural resource allocation and development.
Landform	A distinct, three-dimensional feature on the earth's surface that has originated through a particular set of erosional and/or depositional processes and thus can be recognized wherever it occurs.
Local Study Area	The area where the Howse Property Project facilities and activities will be located and in which detailed terrestrial ecosystem mapping was carried out.
Littoral	The shallower parts of a waterbody along the shore; often defined as the area where rooted aquatic macrophytes can grow.
Mesic	Of or pertaining to well-drained soils that retain some water.
Moraine	Landform deposited directly by glacial ice, typically consisting of grains ranging in size from clay to boulders.
Migratory bird	*A legal term in Canada*; it means a migratory bird referred to in the Migratory Birds Convention, and includes the sperm, eggs, embryos, tissue cultures and parts of the bird.
Migrating bird	Bird carrying its seasonal movement from/to breeding grounds and wintering grounds.
Order	A taxonomic group between the Class and the Family.
Particulate matter	Microscopic solid and liquid particles, of various origins, that remains suspended in the air for any length of time.
Permafrost	Perennially frozen soil and/or bedrock typically found in areas with arctic or subarctic climates.
pH	A term used to describe the hydrogen-ion activity of a system; a solution of pH 0 to 7 is acid, pH 7 is neutral, pH over 7 to 14 is alkaline.

Recharge	The replenishment of water in an aquifer. Much of the natural recharge of groundwater occurs in spring and comes from the melting snowpack or from streams in mountainous regions. It can also occur during local heavy rainstorms. Groundwater often discharges into a river or lake, maintaining its flow in dry seasons.
Riparian	Pertaining to the banks of, or area immediately adjacent to, a watercourse.
Roosting site	A daytime retreat or night-time resting place for bats and birds.
Rubble	A loose mass of rough, angular rock fragments, coarser than sand.
Sediment	Bottom material in a lake or a stream that has been deposited after the formation of a lake basin or stream course. It originates from the remains of aquatic organisms, chemical precipitation of dissolved minerals and erosion of surrounding lands.
Shale	Shale is a fine-grained, clastic sedimentary rock composed of mud that is a mix of flakes of clay minerals and tiny fragments (silt-sized particles) of other minerals, especially quartz and calcite. The ratio of clay to other minerals is variable. Shale is characterized by breaks along thin laminae or parallel layering or bedding less than one centimetre in thickness, called fissility.
Sublimation	Process of change from ice (solid state) to water vapour (gaseous state).
Till	Material deposited directly by glacial ice with grains ranging in size from clay to boulders.
Total particulate matter	Any particulate with a diameter less than 100 microns.
Turbidity	A measure of suspended particulates in water.
Veneer	A thin (typically <2 m), commonly discontinuous surficial deposit overlying another material or bedrock.
Waterbody	Pertaining to watercourses, lakes, reservoirs and ponds.
Water table	The upper water level of a body of groundwater.

TABLE OF CONCORDANCE FOR THE ENVIRONMENTAL ASSESSMENT REGISTRATION UNDER THE NEWFOUNDLAND AND LABRADOR ENVIRONMENTAL PROTECTION ACT, SNL 2002

TABLE OF CONCORDANCE FOR THE ENVIRONMENTAL ASSESSMENT REGISTRATION UNDER THE NEWFOUNDLAND AND LABRADOR ENVIRONMENTAL PROTECTION ACT, SNL 2002

GUIDELINE REQUIREMENT		LOCATION IN THE EIS	
		Section	Page
1	**NAME OF UNDERTAKING**	1.1	1-1
2	**PROPONENT**	1.2	1-1
	Contact information	1.2	1-1
	Name of the legal entity	1.1	1-1
3	**THE UNDERTAKING**	2	2-1
	Nature of the undertaking	2.1	2-1
	Purpose/rationale/need for the project	2.4	2-7
4	**PROJECT DESCRIPTION**		
4.1	**Geographical location/physical components/existing environment**	2.3	2-3
	Project components	3	3-1
	Hydrogeological study	Volume 2 Supporting Study B	
	Geotechnical study	Volume 2 Supporting Study A	
	Avifauna field surveys	Volume 3 Avifauna Study	
	Wildlife reports 2009-2012 (copy of reports or summary)	Volume 3 Hemis Study	
	List of wildlife species	Volume 1 Appendix XXIII	
4.2	**Construction**	3.3.1	3-30
	Timeline	1.9	1-29
	List of permits and authorizations	Volume 1 Appendix III	
4.3	**Operations phase**	3.3.2	3-32
5	**ALTERNATIVES**	2.5	2-7
6	**POTENTIAL ENVIRONMENTAL EFFECTS AND MITIGATION**	7	7-1
	Climate change	6.6	33
	GHG emissions	7.3.1	7-9
	Air quality	7.3.2	7-13
	Access to traditional/contemporary use of lands	7.5.2.1	7-319
	George River caribou herd	7.4.3	7-211
7	**EMPLOYMENT AND TRAINING**		
	Timelines for occupations	Table 7-145	7-427
	Listing of National Occupation Codes (NOC)	7.5.3.5	7-426
	Estimate of the number of journey/persons and apprentices per NOC	7.5.3.5	7-426
	Specialized training or training agreements	7.5.3.2	7-370
	Source of the workforce	7.5.3.5	7-406

GUIDELINE REQUIREMENT		LOCATION IN THE EIS	
		Section	Page
	Commitment to provide summary reports	9.3	9-41
	Constraints on employment and contracting opportunities	7.5.3.5	7-406
	Statement regarding the commitment to update the existing DSO Project NLBP and Woman's Employment Plan to include the Howse Project	4.1	4-1
		Volume 1 Appendix X	
8	**PROJECT-RELATED DOCUMENTS**		
	Bibliography	11	11-1
	Supporting studies	Volume 2, 3	
9	**DECOMMISSIONING AND RECLAMATION**	10	10-1

TABLE OF CONCORDANCE FOR THE DESCRIPTION OF A DESIGNED PROJECT UNDER THE CANADIAN ENVIRONMENTAL ASSESSMENT ACT, 2012

GUIDELINE REQUIREMENT		LOCATION IN THE EIS	
		Section	Page
1	**INTRODUCTION AND OVERVIEW**		
1.1	**The proponent**	1.2	1-1
	Contact information	1.2	1-1
	Name of the legal entity	1.1	1-1
	Corporate and management structures	—	—
	Mechanism used to ensure that corporate policies will be implemented and respected for the Project	1.4	1-17
	Key personnel for the preparation of the EIS	1.3	1-4
1.2	**Project Overview**	1.5	1-17
	Overview of the Project	1.5	1-17
	Key project components and activities		
	Project schedule	1.9	1-29
1.3	**Project Location**	2.3	2-3
	Location of the main project site	2.3	2-3
	Current land use	2.3.1	2-4
	Distance from the project facilities and components to any federal lands	2.3.3	2-4
	Environmental significance and value of the geographical setting	2.3.2	2-4
	Environmentally sensitive areas	2.3.2	2-4
	Local and Aboriginal communities	2.3.3	2-4
	Traditional Aboriginal territories, treaty lands, Indian reserve lands	2.3.3	2-4
1.4	**Regulatory framework and the role of government**	1.8	1-27
2	**PROJECT JUSTIFICATION AND ALTERNATIVES CONSIDERED**		
2.1	**Purpose of the project**	2.4	2-7
2.2	**Alternative means of carrying out the project**	2.5	2-7
3	**PROJECT DESCRIPTION**		
3.1	**Project components**	3.1	3-1
	Map of project location and project components	Figure 2-1	2-5
	Tailings management facility	n/a	n/a
	Waste rock, overburden, topsoil, low-grade ore storage and stock piles	3.2.2	3-7
	Open pit	3.2.1	3-5
	Crushing and processing facilities	3.2.7	3-27
	Water management infrastructure and effluent treatment systems	3.2.5	3-9

GUIDELINE REQUIREMENT		LOCATION IN THE EIS	
		Section	Page
	Permanent and temporary linear infrastructure	3.2.3 and 3.2.4	3-7 and 3-8
	Drinking and industrial water requirements	n/a	n/a
	Energy supply	3.2.6	3-27
	Fuel storage systems	3.2.7	3-27
	Waste disposal	3.3.2.7	3-36
3.2	**Project activities**	3.3	3-30
3.2.1	Site preparation and construction	3.3.1	3-30
	Site clearing, excavation	3.3.1.2	3-30
	Blasting	3.3.1.2	3-30
	Borrow materials requirements	n/a	n/a
	Water diversion required	n/a	n/a
	Equipment requirements	3.2.2.6	3-36
	Administrative buildings, garages, other ancillary facilities	n/a	n/a
	Number of employees and transportation of employees	7.5.3.5.2	7-350
3.2.2	Operation	3.3.2	3-32
	Mining plan, ore production, ore stockpiling, concentrate production	3.3.2.13	3-38
	Equipment requirements	3.2.2.6	3-36
	Uses of explosives	3.3.2.9	3-37
	Blasting	3.3.2.3	3-33
	Water management	3.2.5	3-9
	Ore crushing and treatment	3.3.2.4	3-35
	Reagent requirements	3.3.2.4	3-35
	Petroleum products	3.3.2.8	3-36
	Characterization, management, transport and stockpile locations of ore, waste rock, low grade ore, overburden and tailings	3.3.2.1	3-32
	Effluent management, transport and treatment	3.2.5.3	3-13
	Contribution to atmospheric emissions	7.3.1	7-9
	Water recycling	n/a	n/a
	Waste management and recycling	3.3.2.7	3-36
	Number of employees, transportation of employees, work schedule, lodging requirement on site and off site	7.5.3.5.2	7-350
3.2.3	Decommissioning and Reclamation	3.3.3	3-41
	Preliminary outline of a decommissioning and reclamation plan	10	10-1
	Objectives of reclamation	10.1	10-1
	Ownership, transfer and control of the different project components	—	—
	Responsibility for monitoring and maintaining the integrity of the remaining structures	—	—

GUIDELINE REQUIREMENT		LOCATION IN THE EIS	
		Section	Page
	Decommission of permanent facilities	10.4.3	10-1
4	**PUBLIC CONSULTATION AND CONCERNS**		
	Ongoing and proposed consultations and information sessions	4.2.2	4-11
	Distribution of project information during the consultation process	4.2.2	4-11
	Methods and location of the consultation	4.2.2	4-11
	Concerns voiced and incorporation into the project design and EIS	4.3.2	4-20
	Summary of key issues raised in relation to the EIS	4.3.2	4-20
5	**ABORIGINAL GROUPS TO ENGAGE AND ENGAGEMENT ACTIVITIES**		
	Engagement activities undertaken with Aboriginal groups prior to the submission of the EIS	4.2.1	4-6
	Future planned engagement activities	4.2.2	4-11
	How engagement activities allowed Aboriginal groups to understand the Project and evaluate its effects on their communities, activities, potential or established Aboriginal or Treaty rights and other interests	4.2.2	4-11
	Efforts taken to solicit the information required from Aboriginal groups to support the preparation of the EIS	4.3.2	4-20
	Detailed tracking records of engagement activities and all interactions with Aboriginal groups	4.2	4-4
	Meetings with the following potentially affected Aboriginal groups:		
	Innu Nation of Labrador	4.2 and 4.3	4-4 and 4-15
	NunatuKavut Community Council	4.2 and 4.3	4-4 and 4-15
	Naskapi Nation of Kawawachikamach	4.2 and 4.3	4-4 and 4-15
	Innu First Nation of Matimekush-Lac John	4.2 and 4.3	4-4 and 4-15
	Innu First Nation of Uashat mak Mani-Utenam	4.2 and 4.3	4-4 and 4-15
6	**EFFECTS ASSESSMENT**		
6.1	**Project setting and baseline conditions**		
6.1.1	Atmospheric environment	7.3.2	7-13
	Ambient air quality in the project area and, for the mine site, the results of a baseline survey of ambient air quality	7.3.2.1	7-13
	Current ambient noise levels at key receptor points (e.g., Aboriginal communities in Québec, Schefferville Airport), including the results of a baseline ambient noise survey	7.3.3.1	7-56
	Existing ambient night-time light levels at the project site and at any other areas where project activities could have an effect on light levels	7.3.4.1	7-73
	Historical records for total precipitation (rain and snow), mean, max and min temperatures, including the most recent data available	7.3.1.1	7-9
6.1.2	Geology and geochemistry	7.3.5	7-86
	Bedrock and host rock geology of the deposit	7.3.5.1	7-86

GUIDELINE REQUIREMENT		LOCATION IN THE EIS	
		Section	Page
	Geomorphology, topography and geotechnical characteristics of areas proposed for construction of major project components	7.3.5.1	7-86
	Geochemical characterization to predict metal leaching and acid rock drainage	7.3.5.1	7-86
	geological hazards	7.3.5.1	7-86
6.1.3	Topography and soil	7.3.7.1	7-134
	Baseline mapping and description of landforms and soils within the local and regional project area	7.3.7.1	7-134
	Map depicting soil depth by horizon and soil order within the mine site area	—	—
	Suitability of topsoil and overburden for use in rehabilitation	—	—
	Permafrost conditions	7.3.8.1	7-141
	Potential for thaw settlement and terrain instability associated with ground thawing	7.3.8.1	7-141
6.1.4.	Groundwater and surface water	7.3.6	7-100
	Hydrogeological context		
	Physical properties of the hydrogeological units		
	Groundwater flow patterns and rates		
	Hydrogeological, hydrologic, geomorphic, climatic and anthropogenic controls on groundwater flow		
	Temporal changes in groundwater flow		
	Delineation and characterization of groundwater surface water interactions		
	Configuration of frozen ground and taliks and their influence on groundwater flow		
	Monitoring protocol for data collection on existing groundwater		
	Local and regional potable groundwater supplies		
	Delineation of drainage basins	7.3.9.1	7-149
	Hydrological regimes		
	Water body total surface area, bathymetry, maximum and mean depths, water level fluctuations, type of substrate		
	Seasonal groundwater and surface water quality field and lab analytical results	7.3.10	7-168
	Local and regional potable surface water resource	7.3.9.1	7-149
	Sediment quality analysis for key sites likely to receive mine effluents	—	—
6.1.5	Fish and fish habitat	7.4.9.1	7-258
	Characterization of fish populations		
	Description of the biology of fish species in the area		
	List of any fish or invertebrate species at risk		
	Description of the habitat by homogeneous section		

GUIDELINE REQUIREMENT		LOCATION IN THE EIS	
		Section	Page
	Description of natural obstacles that hinder the free passage of fish		
	Maps indicating the surface area of potential or confirmed fish habitat	Figure 7-36	7-265
	Description and location of suitable habitats for fish species at risk	n/a	n/a
6.1.6	Migratory birds and their habitat	7.4.8.1	7-236
	Various ecosystems found in the project area likely to be affected		
	Migratory and non-migratory birds likely to be affected in the project area		
	Year-round migratory bird use of the area		
6.1.7	Species at risk	Presented in each component sections	
	List of all potential or known federally listed species at risk		
	List of federal species designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) for listing in Schedule 1 of the Species at Risk Act		
	Residences, seasonal movements, movement corridors, habitat requirements, key habitat areas, identified critical habitat and/or recovery habitat and general life history of species at risk that may occur in the project area, or be affected by the project	Woodland Caribou: 7.4.3	Woodland caribou: 7-211
6.1.8	Aboriginal peoples	7.5.2.1 and Volume 2 Supporting Study C	7-319
	Baseline information:		
	Location of traditional territory		
	Location of reserves and communities		
	Location of seasonal or permanent hunting camps and cabins		
	Drinking water sources		
	Reliance on country foods		
	Commercial activities		
	Recreational uses		
	Traditional uses currently practiced or practiced in recent history		
	Characterization and location of various ecosystems found in the project area, with a focus on habitat used by Aboriginal peoples or important for species used by Aboriginal peoples		
	Characterization of fish, wildlife plants or other natural resources of importance for traditional use including:		
	Information on surveys		
	Description of the biology of wildlife species		
	Places where fish, wildlife, birds, plants or other natural resources are harvested		
	Access, transportation methods and travel routes for conducting traditional practices		

GUIDELINE REQUIREMENT		LOCATION IN THE EIS	
		Section	Page
	Frequency, recentness, duration or timing of traditional practices		
	Cultural values associated with the area affected by the project and the traditional uses		
	Physical and cultural heritage		
6.2	**Predicted changes to the physical environment**	7.3	7-9
6.2.1	Changes to the atmospheric environment	7.3.2	7-13
	Changes in air quality	7.3.2.2	7-18
	Changes in ambient noise levels	7.3.3.2	7-62
	Changes in night-time light levels	7.3.4.2	7-79
6.2.2	Changes to groundwater and surface water	7.3.9.2	7-159
	Changes to water quality	7.3.10.2	7-174
	Changes to the hydrological and hydrometric conditions	7.3.9.2	7-159
	Changes to groundwater recharge/discharge areas	n/a	n/a
	Changes to water quality attributed to acid rock drainage and metal leaching	n/a	n/a
6.2.3	Changes to the terrestrial landscape	7.4.2.2	7-201
	Overall description of changes related to landscape disturbance	7.4.2.2	7-201
	Changes to migratory bird habitat	7.4.8.2	7-247
	Changes to critical habitat for federally listed species at risk	7.4.3.2	7-218
	Changes to key habitat for species important to Aboriginal current use of resources		
	Changes to species important to Aboriginal current use of resources or to key supporting species		
6.3	**Predicted effects on valued components**		
6.3.1	Fish and fish habitat	7.4.9.2	7-267
	Identification of any potential harmful alteration, disruption or destruction of fish habitat, including calculation of any potential habitat loss		
	Effects of changes to the aquatic environment on fish and their habitat, including:		
	Correlation of project construction timing to key fisheries windows for freshwater and any potential effects resulting from overlapping periods		
	Vibration caused by blasting that may affect fish behavior		
6.3.3	Species at risk	Presented in each component sections	
	Potential effects of the project on federally listed species at risk and their critical habitat	Woodland Caribou: 7.4.3.2	7-218
6.3.4	Aboriginal peoples	7.5.2.1.2	7-331
	Current uses of land and resources for traditional, including:		

GUIDELINE REQUIREMENT		LOCATION IN THE EIS	
		Section	Page
	Effects on resources (fish, wildlife, birds, plants or other natural resources) used for traditional uses (e.g., hunting, fishing, trapping, collection of medicinal plants, use of sacred sites)		
	Effects of alterations made to access areas used for traditional uses		
	Human health considering potential changes to the environment	7.5.2.2.2	7-350
	Socioeconomic conditions	7.5.3.5.2	7-426
	Physical and cultural heritage, and structure, site or thing of historical, archaeological, paleontological or architectural significance to Aboriginal groups	7.5.2.1.2 and 7.5.1.2	7-331
6.4	**Mitigation**		
	Description of standard mitigation practices, policies and commitments that constitute technically and economically feasible mitigation measures and that will be applied as part of standard practice regardless of location	Presented in each component sections See Volume 1 Appendix VI	
	Project's environmental protection plan and its environmental management system	See EPP (Volume 1 Appendix Ia)	
	Mechanisms the proponent would use to require its contractors and subcontractors to comply with these commitments and policies and with auditing and enforcement programs	1.4	1-17
	Description of mitigation measures that are specific to each environmental effect	Presented in related sections See Volume 1 Appendix XVI	
	Actions, works, minimal disturbance footprint techniques, best available technology, corrective measures or additions planned during the Project's various phases to eliminate or reduce the significance of adverse effects	Presented in each component sections See Volume 1 Appendix XVI	
	Other technically and economically feasible mitigation measures that were considered, and an explanation of why they were rejected		
	Responsibility for the implementation of these measures and the system of accountability		
6.5	**Significance of residual effects**		
	Description of the residual environmental effects of the project on the VCs	Presented in related sections	
	Analysis of the significance of the residual environmental effects that are considered adverse		
	Identification of the criteria used to assign significance ratings to any predicted adverse effects.	5.3	5-5
	Section on the use of relevant existing regulatory documents, environmental standards, guidelines	1.8.3	1-28
	Description of the degree of scientific uncertainty related to the data and methods used within the framework of the environmental assessment	Presented in each component sections	
6.6	**Other effects to consider**		
6.6.1	Effects of potential accidents or malfunctions	6.4	6-6
	Analysis of the risks of accidents and malfunctions, effects and preliminary outline of emergency measures		

GUIDELINE REQUIREMENT		LOCATION IN THE EIS	
		Section	Page
	Probability of potential accidents and malfunctions related to the Project, including an explanation of how those events were identified, potential consequences and plausible worse-case scenarios and the effects of these scenarios		
	Identification of the magnitude of an accident and/or malfunction, including the quantity, mechanism, rate, form and characteristics of the contaminants and other materials likely to be released into the environment during the accident and malfunction events		
	Safeguards contingency and emergency response plans		
6.6.2	Effects of the environment on the Project	6.4	6-6
	Effect of local conditions and natural hazards on the Project and how this in turn could result in environmental effect		
	Longer-term effect of climate change	6.6	33
	Details of planning, design and construction strategies intended to minimize the potential environmental effects	2.5	2-7
6.6.3	Cumulative effects assessment	8	8-1
	Identify the VCs most likely to be affected by the Project and other projects and activities:	8.1	8-1
	Fish and fish habitat	8.4	8-4
	Species at risk	n/a	n/a
	Caribou	8.6	8-7
	Migratory birds and their habitat	8.7	8-11
	Current use of lands and resources for traditional purposes by Aboriginal peoples	8.10	8-24
	Health and socioeconomic conditions of Aboriginal peoples	8.8 and 8.9	8-14 and 8-19
	Identify the sources of potential cumulative effects. Specify other projects or activities that have been or are likely to be carried out that could cause effects on each selected VC within the boundaries defined, and whose effects would act in combination with the residual effects of the Project	8.2	8-2
7	**SUMMARY OF THE ENVIRONMENTAL EFFECTS ASSESSMENT**		
	Table summarizing the following key information: Potential environmental effects Proposed mitigation measures Potential residual effects and the significance of the residual environmental effects	Table 7-149	7-440
8	**FOLLOW-UP AND MONITORING PROGRAMS**		
8.1	**Follow-up program**	9	9-30
8.2	**Monitoring Program**		

1 INTRODUCTION

1.1 NAME OF THE UNDERTAKING

The name of the undertaking is "Howse Property Iron Mine – Howse Minerals Limited".

1.2 PROPONENT

In order to acquire a 100% share of the Howse Property, Tata Steel Mineral Canada Ltd. (TSMC) created Howse Minerals Limited (HML), a wholly-owned subsidiary based in St. John's, Newfoundland and Labrador. HML has acquired a 100% participating interest in the mineral licenses comprising the Howse Property and is responsible for managing and operating the Howse Property. HML was appointed the Operator and legal owner of the Howse Property and is therefore considered the proponent for this undertaking.

TSMC is a joint venture between Tata Steel Ltd. and New Millennium Iron Corp. (NML), which was established in October 2010. Tata Steel Ltd. owns 80% of the company shares, while NML owns the remaining 20%. TSMC is part of Tata Steel Group, which is a Fortune 500 company and is among the top 10 steel producers in the world. The Tata Steel Group has over 81,000 employees spread over five continents. TSMC is developing iron ore deposits in Québec and Newfoundland and Labrador, Canada. Tata Steel Ltd. is part of the Tata Group.

Name of Corporate Body:	Howse Minerals Ltd.
Chief Executive Officer:	Rajesh Sharma, CEO and Managing Director
Address:	215 Water Street, Atlantic Place, Suite 809
	St. John's, Newfoundland A1C 6M9
Telephone:	709-722-5714
Fax:	709-722-4298
Email:	rsharma@tatasteelcanada.com

Project Director:	Loïc Didillon, director environment and permitting, Tata Steel Minerals Canada
Address:	1000 Sherbrooke West, Suite 1120
	Montréal, Québec H3A 3G4
Telephone:	514-764-6705
Fax:	514-764-6725
Email:	loic.didillon@tatasteelcanada.com

Rajesh Sharma holds an MBA (marketing and operations) from XLRI, Jamshedpur and an engineering degree (E&C) from IIT Roorkee. He also successfully completed a scholarship program on globalization and leadership from the London School of Economics in 2002. He has over 20 years' experience in various businesses with the Tata Group. He has lived and worked in various geographies in the continents of Asia, Africa, North America and Europe.

In November 2010, he was appointed CEO and managing director of TSMC. Prior to this, Mr. Sharma was executive in charge of Southern Africa for Tata Steel, responsible for new investments and acquisitions in mining and minerals related to the steel industry.

Mr. Sharma has diverse cross-functional and cross-industry experience with the Tata Group. His experience encompasses leading large-scale start-up companies, international investments and acquisitions and heading global business units, amongst others. He is also a regular speaker at business seminars and conferences in connection with the mining industry, and has addressed national and international audiences.

Loïc Didillon moved to Canada from France in 2003 with a Master's degree in ecology, biology and environment. Prior to that, he worked in the environment sector in France (pulp and paper industry), Switzerland (*Université de Neuchâtel*), Guadeloupe (research hospital center), and Corsica (regional district of Ghunsani). Since moving to Canada, Mr. Didillon has worked with the St. Charles River Basin Council in the City of Québec, in the mining industry as an environmental superintendent in Val d'Or, as a biologist and environmental advisor at the Biotechnology Research Institute, as an environmental advisor at Bell Canada's head office and with SNC-Lavalin as an environmental senior officer for a project in Libya. Mr. Didillon has been working as environment and permitting senior manager at TSMC head office since August 2011.

Michael Lewis joined TSMC in the spring of 2014 after several years in the forestry sector. He has a Master's degree in environmental management from the University of New Brunswick and has worked for the forest management agencies of Alberta, British Columbia, and New Brunswick, as well as with private silviculture operations. Mr. Lewis is now the environmental coordinator at TSMC's direct shipping ore (DSO) site in Labrador's Menihek region.

Coco Calderhead has a Bachelor's degree from the University of Victoria and a Master's degree from *Université du Québec à Montréal*, both in geography. Since 1996, Ms. Calderhead has worked in British Columbia, Tanzania, Ontario and Québec at the government, educational, First Nation and business levels. She has expertise in Aboriginal labour market matters, capacity-building, project implementation and coordination, organizational policy analysis and development, and Aboriginal community relations. Since 2011, she has held the position of manager, community relations, for TSMC and HML.

Rabi Mohanty (M.Sc., applied geology; M.Tech., mineral resource development and management) is a geologist with around 25 years of experience in exploration, resource estimation, quality control in mines, due diligence of mineral deposits and feasibility studies of mining projects. He has also has a post-graduate diploma in geostatistics from the geosciences department, Paris School of Mines, France. He has gained experience in metallic mines and deposits, but mostly in iron ore deposits located in various parts of the globe. He has been working in Canada since 2011 as one of the key members in the Taconite feasibility study and as a leader for the Howse exploration project. He successfully fulfilled the duties of chief – geology and minerals at TSMC before moving to his present position, chief – geology and new opportunities.

Armand MacKenzie has been a consultant on legal issues for the Innu Nation in Québec/Labrador most of his life. He was born in Labrador, where his parents and grandparents taught him how to hunt and live off the land. He later became interested in human rights issues and graduated from law school at the University of Ottawa.

As a lawyer, he had a private practice for fifteen years working for the Aboriginal communities, while being involved in land claims negotiations in Québec. He campaigned internationally for greater Innu self-determination, representing the Innu Council of Nitassinan at the United Nations, UNESCO, OAS and at the CBD. He argues that the Innu deserve fair compensation for being relocated off mineral-rich lands that were once their traditional hunting and gathering territory. He also participated in the drafting of the *United Nations Declaration on the Rights of Indigenous Peoples* and the *Inter-American Declaration on the Rights of Indigenous Peoples*.

More recently, with the Innu from Sept-Iles, he successfully led the negotiations of three impacts and benefits agreements and two exploration agreements and helped ITUM in partnering in two joint-ventures operating with mining companies in Québec-Labrador.

He is now with TSMC working for the CEO&MD, acting as the senior director on government and stakeholders relations.

Paul Abongwa (P.Geo., M.Sc., MST.) earned B.Sc. and M.Sc. degrees from the University of Yaoundé I. He later obtained a Master's degree in natural resources engineering at the department of chemical engineering, Lulea University of Technology, Sweden, with a specialization in mineral exploration. Mr. Abongwa has worked as a senior geologist and field manager and has vast knowledge of the trough, having been involved in projects throughout the Québec-Labrador Trough, from Grenville up to Ungava.

Mr. Abongwa is currently senior project geologist on the Howse Project. He previously worked as a mining and exploration geologist for more than 10 years, and in the course of his career, has worked on different types of deposits, and iron deposits in particular, in Africa, Scandinavia and Asia. As a geologist, he has been involved in project supervision, training and supervision of technical personnel. He is a member in good standing of the *Ordre des Géologues du Québec*.

Andrew Garrity (Eng., BSc.) is a Mining Engineer with a bachelor's degree from the University of Arizona. As a student he worked for two different Freeport-McMoRan copper mines. After receiving his degree Mr. Garrity went to work for Mintec Inc., producers of MineSight software. As a MineSight Specialist Mr. Garrity provided support and training to all types of mining operations across the globe. In 2013 Mr. Garrity came to Montreal to train the TSMC mining team to use MineSight software for their operation. In October 2014 Andrew Garrity joined the TSMC team.

Mr Debasis Kundu (B.Tech (Hons.) in Mining Engineering) from Indian Institute of Technology (BHU), India and M.Tech (Dist.) in Environmental Science and Engineering from Indian School of Mines, Dhanbad. He was appointed Vice President (Technical) in April, 2013.

Mr Kundu joined Tata Steel in 1989 and worked in various capacities in iron ore, manganese and dolomite mines. In 2001, he was appointed as Head (Planning), Mines Division entrusted with the responsibility of raw-material planning for the integrated steel operations in Jamshedpur, Tata Sponge and Ferro-Manganese Plant, Joda. Mr Kundu played a key role in the capacity enhancement of iron ore mines from 7.2 to 12.8 MTPA. He was also responsible for raw-material planning for the newly built 3 MTPA Steel Plant in Orissa.

In 2008-09, Mr Kundu had a brief spell in Santa Fe Mining, Chile as General Manager (Mines) responsible for the development of a green-field magnetite project.

From 2009 onwards, Mr Kundu has been involved in scanning and selecting iron ore projects in several countries around the world, which ultimately led to Tata Steel taking an Investment Decision in the Direct Shipping Ore (DSO) Project and a Feasibility Study for the Taconite projects in Northern Canada with New Millennium.

In a career spanning over 25 years in the mineral industry, Mr Kundu has made note-worthy contributions in technological aspects for mineral exploration, extraction, beneficiation and sales. In his present capacity as Vice President (Technical), Mr Kundu is responsible for long-range planning of the DSO Project, technical support for new mineral acquisition, permitting, project financing, sales and future investment avenues in taconites.

Lisa Clancey (P. Tech.) is a certified environmental technologist with the Association of Engineering Technician and Technologists of Newfoundland and Labrador. Ms. Clancey graduated from the Environmental Technology Program from College of the North Atlantic in 2005. Ms. Clancey is experienced in Phase I, II and III environmental site assessments for various residential, commercial, and industrial sites, as well as up-, mid- and down-stream oil and gas facilities for due diligence and real estate transactions. In addition, Ms. Clancey is experienced in conducting detailed site assessments, environmental field reports, pre-site assessments, groundwater well installation and monitoring, borehole logging and reporting, as well as the creation of Standard Operating procedures.

Jean-Francois Dion is an experienced environmental and geological field technician. Mr. Dion graduated from the Mining Technology program at the Cégep de Thetford in 2012. He is experienced in implementing and conducting regulatory environmental monitoring programs related to federal and provincial mining regulations as well as conducting environmental characterization sampling programs and redacting field data reports. In addition, he is experienced with wastewater treatment and has also worked on grassroots and advanced mineral exploration ventures and a wide variety of silviculture operations in Québec, Alberta and British-Columbia.

1.3 CONSULTANTS

The various consultants working on the EIS are presented in Figure 1-1. The consultant mandated by HML for the EIS and biophysical components of the Howse Project is Groupe Hémisphères. The resource person is Mariana Trindade and her contact information is:

Name of consultant:	Groupe Hémisphères
Project manager:	Mariana Trindade
Address:	1453, rue Beaubien Est, Suite 301
	Montréal, Québec H2G 3C6
Telephone:	514-509-6572
Fax:	514-509-6573
Email:	mtrindade@hemis.ca

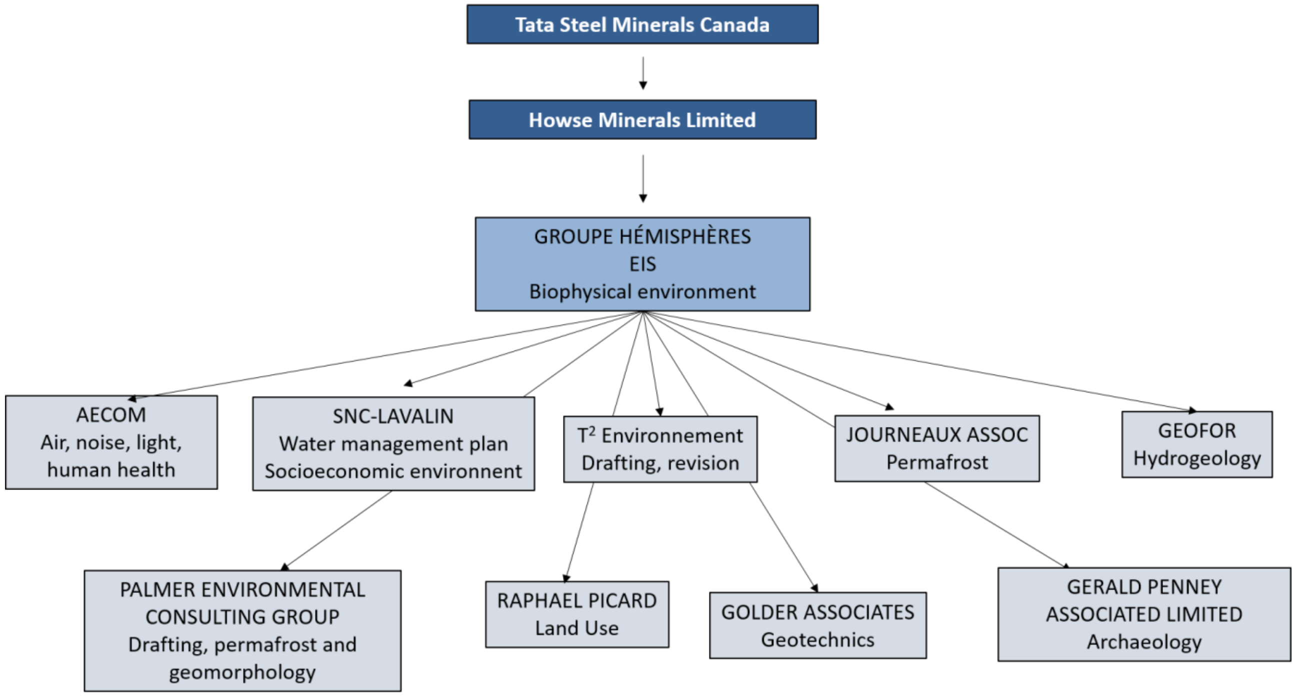


Figure 1-1 Project Flowchart

1.3.1 Groupe Hémisphères

Groupe Hémisphères is an environmental consulting firm founded in 2004 by three experienced environmental professionals: Mr. Daniel Néron, geographer, Mr. Hugo Thibaudeau Robitaille, biologist and Mr. Christian Corbeil, senior technician and professional technologist. They opened their first office in Beaumont and a second one in Montréal in 2006. Note that the Beaumont office moved to Lévis in 2012, joining the Québec Urban Community. The company has been active in all regions of Québec, including the north, as well as in Labrador.

Groupe Hémisphères employs a multidisciplinary team of professionals that has strong knowledge of the various environmental issues related to the characterization and management of aquatic, riparian and terrestrial ecosystems, as well as environmental impact studies (EIS) and stream management. Knowing all the legal aspects related to working in these various natural environments is part of the commitment of Groupe Hémisphères, which always executes its projects in accordance with current legislation and following the best practices put forward by the government.

To meet the current needs of its clients, Groupe Hémisphères uses a georeferenced approach and delivers digital information in common or desired format. Its respect for budgets and deadlines makes Groupe Hémisphères a reliable and renowned firm. Groupe Hémisphères is well-positioned in the environmental market in Québec as a contractor, customer or partner with many large engineering firms located in Québec, such as AMEC, SNC-Lavalin Environment and AECOM. The company also has a network of professional subcontractors in certain specialties to complement its expertise when necessary. Since 2004, Groupe Hémisphères also has a supply arrangement with Public Works and Government Services Canada.

Groupe Hémisphères is managing the production of the EIS report and is involved more specifically in the terrestrial ecosystem, aquatic and hydrological studies, as well as in the description of the biological environment.

Mariana Trindade (PhD, Environmental studies) holds a doctoral degree in physical geography, and a diploma in Environmental Impact Assessment with a background in biology. She has 10 years of multidisciplinary environmental research experience relating the abiotic and biotic components.

Mrs Trindade has worked on studies on the effects of climate variability and change on terrestrial systems, such as caribou habitat, caribou diet, vulnerability of alpine ecosystems to climate (dendroclimatology), forest ecology (relating harvesting practices to revegetation characteristics) and disturbance studies (fire, ice and wind), and distance modelling of biological data. With a strong multidisciplinary background, she has nearly 15 years of experience with field work in remote locations across Canada.

Mrs Trindade started with Groupe Hémisphères in 2015 as a biologist and project manager and is responsible the coordination of the supplemental studies and the revisions and writing of the Final EIS.

Julie Bastien (M.Sc. Water) is a biologist with a Master's degree in water sciences. She has more than 10 years of professional experience in greenhouse gas, water quality and environmental evaluations. She has worked on various EIS for mining, pipeline, hydroelectric powerplant and railway projects. As a project manager, Ms. Bastien conducted and participated in the biophysical field surveys for the baseline study of a rare earths mining project near Kuujjuaq, Québec. She was involved in the environmental studies related to the GENESIS project (IOCC-Rio Tinto), the Québec North Shore & Labrador (QNS&L) railway (IOCC-Rio Tinto) and the Mont-Wright iron mine (ArcelorMittal). She was part of the UNESCO/International Hydropower Association greenhouse gas working group, and as such, participated in writing the Greenhouse Gas Measurement Guidelines for Freshwater Reservoirs. She has done field surveys and presentations in South America, Africa, Oceania and Asia.

Ms. Bastien was the project manager and was responsible for the integration of the whole EIS study and the terrestrial fauna component of the project.

Christian Corbeil (Wild. Man. Tech.), a member of the *Ordre des Technologues professionnels du Québec*, has 25 years of experience in environmental research and investigation, as well as in the technical management and administration of projects pertaining to wastewater, soil and water characterization, ecological surveys and the rehabilitation of contaminated sites.

From 1988 to 1995, he developed his soils and water expertise while performing numerous worksite monitoring, geotechnical survey, sampling, ecological diagnosis and inventory tasks throughout Québec. Since 1995, Mr. Corbeil has supervised several soil, sediment, surface water and groundwater characterization studies. He has also monitored long-term projects for different contexts and regulations and planned many decontamination projects for sites with various problems, and has carried out preliminary tests and authorization certificate applications. His management expertise includes the restoration of sites that have been contaminated by oil, mercury or heavy metals, particularly in remote areas and on islands. He has also interpreted toxicological and ecotoxicological risk-analysis data for such projects and has participated in the federal and provincial environmental assessment processes applicable to them.

Since 2004, Mr. Corbeil has been active in the development of Groupe Hémisphères at every level, such as by setting-up wastewater management tools and developing an innovative work method for watersheds in the context of development projects. He is also actively working on promoting alternative solutions for mixed decentralized sanitation in isolated areas. Over time, Mr. Corbeil has developed a true analysis and communication capability that enables him to contribute in a timely and efficient manner. He has also been involved in the DSO project since 2008.

Mr. Corbeil was responsible for quality control on the project and for the implementation of Groupe Hémisphères' internal system based on ISO 9001 2008 certification.

Daniel Néron (M.Sc. Geog.) is a physical geographer from *Université de Montréal* who has conducted various projects in environmental protection, specializing in the conservation of aquatic and wetland ecosystems. He has conducted several studies on water quality, water regimes, dam management, wetlands and flood-prone areas, legal expertise regarding high waterline delineation, restoration of degraded sites and habitat creation. He is also well-versed in problems related to fish habitat and is able to characterize spawning, rearing and feeding areas.

Mr. Néron started his career as an inspector, and then as a supervisor of special studies in the Lakes Program of the *Ministère de l'Environnement du Québec*. He worked as a hydrologist and as a geomorphologist in charge of numerous projects for Option Environnement inc. for seven years. Mr. Néron has participated in numerous environmental assessments for various levels of government, as well as for industrial clients.

With more than 20 years of experience, Mr. Néron focuses on lake and watercourse protection plans, hydrology and water quality monitoring programs, effects studies, environmental cartography and biodiversity inventories. He has expertise in geomatics and often participates in environmental mapping. He also has been involved with the water quality, aquatic and hydrology aspects of the DSO project over the past five years, such as the water budget of Timmins 1. In the last two year, he has been in charge of the hydrology component of the Taconite Labmag and Kémag studies. Recently, the modeled plume dispersion of the DSO effluent for environmental effects monitoring (EEM) under Metal Mining Effluent Regulations (MMER).

Mr. Néron was responsible for the hydrology study and climate component of the project.

Marie-Ève Dion (M.Sc. Env.) is a biologist with a Master's degree in environmental sciences. She has 10 years of experience in environmental management and has been part of the Groupe Hémisphères' team since May 2006 as a project manager and lead biologist of the Québec office. She is also in charge of ecosystem characterization projects and the species-at-risk survey program. She has been a member of the Association of Biologists of Québec since 2006 and of the Québec Association for Impact Assessment since 2009.

Ms. Dion has been responsible for many dozens of large-scale surveys of plants, aquatics and terrestrial communities in Québec and Labrador, as well as for various wildlife inventories. She has also completed over 40 high watermark delineation and wetland characterization projects, and carried out surveys of species at risk for the National Capital Commission (Gatineau Park), Canada Park, Longueuil and Montréal cities, as well as many projects for Public Works and Government Services Canada. As part of the development of a methodology for assessing the ecological value of wetlands, she conducted the literature review and developed the scoring system criteria.

Since 2006, Ms. Dion has been involved in biological inventories as part of several effects studies for wind farm and mining projects. She has coordinated the drafting of the technical reports and written several sections describing the biological components. She has also completed the assessment of the effects significance of biological components for seven effects studies. She has been involved with the DSO, Taconite and Howse projects over the past six years and is very familiar with the regional context.

Ms. Dion was responsible for the data analysis and effect assessment for the terrestrial ecosystem mapping and wetland components of the project.

Simon Barrette (M.Sc.) is a biologist who has been part of the Groupe Hémisphères team since July 2009. He has a Master's degree in biology with a specialization in ecology from *Université du Québec à Montréal*. He now has eight years of experience as a biologist, including five as a consultant. During his academic career, he participated in research projects in a variety of areas, including animal behavior, forestry, botany and conservation. Prior to joining Groupe Hémisphères, he worked in research in collaboration with several universities and Hydro-Québec and was project manager for a watershed committee.

Mr. Barrette works as a wildlife project manager with Groupe Hémisphères. He has directed several wildlife surveys, mainly concerning ichthyofauna, herpetofauna and bottom-dwelling invertebrates, limnology and terrestrial ecosystems in several regions of Québec, including the north, as well as in Labrador. He has also worked in the collection of data and drafting of environmental characterization and EIS for mining projects in northern Québec and Newfoundland and Labrador and for wind farm projects. In addition to planning and participating in fish habitat and water quality surveys, he developed and implemented the first cycle environmental effect monitoring (EEM) study design for the Elross Lake Area Iron Ore Mine (ELAIOM) project, including the biological and water quality monitoring. Mr. Barrette has been involved with the DSO Taconite and Howse projects over the past five years.

Mr. Barrette was in charge of analyzing data and drafting sections on water quality and aquatic fauna for the project.

Samuel Denault (M.Sc.) is a biologist/ornithologist at Groupe Hémisphères with over 15 years of experience in conducting bird surveys. He obtained his Bachelor's degree in Biology from *Université du Québec à Montréal*, and did graduate studies (M.Sc.) in natural resource sciences at McGill University. Mr. Denault has applied his extensive bird knowledge with various organizations in both the government and not-for-profit sector, including Environment Canada, *Regroupement Québec Oiseaux* and the *Observatoire d'Oiseaux de Tadoussac*. He has also participated in various environmental assessment studies in the boreal ecosystem from Québec to the Northwestern Territories. Mr. Denault has a broad understanding of avian communities breeding in eastern Canada and, as such, is one of the main editors of the Québec Breeding Bird Atlas.

Mr. Denault was responsible for the avifauna component of the project.

Julie Tremblay (B.Sc. biol.) is a biologist, GIS analyst and photo interpreter who has a certificate in geographic information systems. She also started post-graduate studies in geographic information systems. Ms. Tremblay thus has a strong understanding of and high level skills in mapping and spatial analysis. She masters MapInfo and ArcGIS software with the spatial analysis module, and 3D digital station for photo interpretation, among others.

Ms. Tremblay has worked for Groupe Hémisphères since 2008 and is head of the geomatics department. She has been a member of the FloraQuébeca Association since 2014 and has training in vascular plants at risk.

As part of Groupe Hémisphères team, Ms. Tremblay has been responsible for geographical data management and map production for several major projects, including effects studies in northern Québec and Labrador. She has also been responsible for the ecological mapping of wetlands and terrestrial ecosystems and developed automation software algorithms to calculate the ecological value of wetlands using photo-interpretation and data collected in the field. Ms. Tremblay has participated in several flora and fauna surveys, conducted high waterline delineations and wetland characterizations and participated in the development of several methodologies of ecological value assessment. Ms. Tremblay has been involved with the DSO, Taconite and Howse projects over the past six years.

Ms. Tremblay participated to the data analysis and effect assessment for the terrestrial ecosystem mapping and wetland components for the project.

Élissa Dickoum is a geomatician with a Master's degree in both geography and remote sensing and geomatics applied to the environment with five years of experience. Ms. Dickoum has in-depth knowledge in mapping and spatial analysis and is adept at using software such as Mapinfo and ArcGIS.

During her Master's studies, she completed internships as a geographer and geomatician on research issues for the biodiversity conservation of forest habitats, both in mountain ecosystems and agro-forestry. In addition, Ms. Dickoum worked for three years on the development of cartographic services and management of environmental projects involving the development of natural resources as a result of global change.

As part of Groupe Hémisphères team since May 2012, Ms. Dickoum has produced numerous cartographic outputs through various projects, consisting of characterization of ecosystems, constraints analysis and wastewater management. She has been involved with the DSO, Taconite and Howse projects since 2012.

Mrs. Dickoum was responsible for producing the maps for the project.

1.3.2 T2 Environnement

Founded by two passionate biologists with over 40 years of experience, T^2 Environnement provides customized environmental services. T^2 Our mission is to balance development, restoration and the conservation of natural and man-made habitats so as to reduce or eliminate the environmental effects of our private- and public-sector clients' projects in Québec and elsewhere in Canada. Environnement's priority is to help our clients to develop viable projects that maximize the positive effects on the biophysical and social environments while reducing the negative ones. Our team of senior experts has successfully completed major projects with a diversified clientele.During the last 10 years, Mr. T. Robitaille acted as a project director for the completion of large scale environmental impact studies in the field of renewable (forests and wind energy) and non-renewable resources (mining). In this role, Mr. T. Robitaille coordinated multidisciplinary teams of biologists, geologists, geographers and engineers to perform all needed biophysical inventories in remote northern areas and to produce the related technical reports. He also assessed the biophysical effects and proposed targeted mitigation measures to reduce project effects on the environment.

Hugo Thibaudeau Robitaille (M.Sc. Env.) is a project manager and biologist with a Master's degree in Environmental Studies from Université du Québec à Montréal (UQÀM). He has been working as a consulting biologist and soil scientist for more than 20 years with municipalities, governments, industries and private-sector clients.

Mr. T. Robitaille has led and participated in numerous biophysical mapping studies across Canada, including for CHARS in 2014 with a multi-disciplinary terrestrial ecology team focused on documenting the characteristics of terrestrial ecosystems near Cambridge Bay and in northern mainland Nunavut. He has carried out many shoreline and sensitive ecosystem characterization and mapping projects in Québec, Labrador, Canadian Arctic, British Columbia and Asia. He recently coordinated the implementation of a comprehensive program of floristic inventory and predictive ecosystem mapping, including wetlands and sensitive ecosystems, in a subarctic area covering more than 35,000 km^2. He led several major projects on flora and fauna species with status and successfully completed complex ecological restoration projects.

He also directed four major wetland and natural environment conservation plans for municipalities, facilitating the long-term protection of hundreds of km^2 of endangered ecosystems.Mr. Robitaille has been closely involved with the DSO, Taconite and Howse projects over the past ten years. He was in charge of the production of the biophysical components of the Elross Lake Area Iron Ore Mine (ELAIOM) EIS and led the Taconite EIS data collection process.

Mr. Robitaille acted as a senior advisor for the project, and assisted the project team in data and study review and report revision.

1.3.3 Raphaël Picard

Raphaël Picard has studied history (BA), anthropology (MA), public administration (graduate diploma), corporate governance and business management (MBA). He was the chief of the Pessamit Innu First Nation from 2002 to 2012. Prior to this period, he taught community intervention and management with First Nations at Université du Québec à Chicoutimi (1983-1990) and had his own consulting company on public policy analysis, government negotiations and relations, and program development (1990-2002). Since 2012, he has had his own consulting firm (Consultants Innus) which specializes in public relations, counselling for the management of First Nations, land use and the environment, as well as in business development. He has also worked for several Aboriginal and government organizations and sat on a number of boards of directors and sectoral committees.

Mr. Picard was responsible of the land use study.

1.3.4 SNC-Lavalin

SNC-Lavalin is one of the leading engineering and construction groups in the world and a major player in the ownership of infrastructure. With offices in over 50 countries and approximately 45,000 employees, SNC-Lavalin provides EPC and EPCM services to clients in a variety of industry sectors, including oil and gas, mining and metallurgy, environment and water, infrastructure and power. SNC-Lavalin is involved in the project with regard to the water management plan, the socioeconomic environment and the revision of specific sections of the EIS.

Environment and Water Team

Geneviève Dionne is an anthropologist specializing in the integration of socioeconomic issues in EIS and stakeholder engagement. Her experience at the Food and Agriculture Organization of the United Nations led her to work with participatory development approaches (sustainable livelihood approaches) and to promote their integration into the Food and Agriculture Organization's work on sustainable development and emergency projects. She also contributed to field data collection and analysis as part of social effects studies relating to hydropower and mining projects in northern Québec. She works with Aboriginal communities and integrates socioeconomic and land-use issues into project planning processes. As an anthropologist at SNC-Lavalin, she is involved in Environmental and Social Impact Assessments and in stakeholder engagement strategies. She has worked in Sri Lanka, Guatemala, Ecuador, West Africa and Northern Québec. She speaks French, English and Spanish.

Ms. Dionne was responsible for data analysis and effect assessment for the socioeconomic, land use and Aboriginal Traditional Knowledge (ATK) components of the project.

Christian Laliberté is a geographer, Msc. Environment, with 15 years of experience in environmental and social studies. He coordinates environmental and social impact assessment, socioeconomic studies, resettlement action plan, environmental monitoring program and the development of geographic information system. He coordinated socioeconomic and biophysical surveys and participated to public consultations. He acquired a diversified expertise due to his involvement in several major projects in mining, hydroelectric, industrial and transport infrastructure sectors. Mr. Laliberté has been involved in international projects in Canada, Central Asia, Haiti and several African countries. He speaks French and English. Mr. Laliberté contributed to the country food survey and the effect assessment for the socioeconomic, land use and Aboriginal Traditional Knowledge (ATK) components of the project.

M. Laliberté was responsible for data analysis and effect assessment for the socioeconomic, land use and ATK components of the project.

Christian Fortin (M.Sc. Biology) is a biologist with a Master's degree in animal ecology. He has 20 years of experience in the following areas: amphibian, reptile and land mammal ecology, rare species, biodiversity, impact assessments, habitat studies, wildlife surveys and management of beaver-related issues. He has worked on various EIS in hydroelectric, road, wind energy, and mining projects. He is involved in writing proposals, planning and conducting fieldwork, analyzing and writing reports and scientific papers. His previous experiences on caribou include the following projects: Taconite Project (New Millennium Iron – TATA Steel), Raglan Project (Glencore), GENESIS project (IOCC-Rio Tinto), and the extension of Route 167 North to the Otish Mountains (Transports Québec).

Mr. Fortin was a reviewer for the caribou component of the project.

Sustainable Mining Development Team

Marie-Hélène Paquette (Eng., M.Env.) is a civil engineer with 20 years of experience. She holds a Bachelor's degree from *Université de Sherbrooke* and completed a Master's degree in environmental management at *Université de Sherbrooke* in 2010. Ms. Paquette has been involved in several mining environment projects such as mine tailings containment and landfill site projects, including long-term planning, preparation of mine tailings OMS manuals, geotechnical and hydrological studies and preparation of drawings and specifications for various earthworks.

Ms. Paquette was responsible for the Water Management Plan for the project.

Andrew Peach (P.Geo., EP.) is a senior environmental scientist / fisheries biologist. He has a total of 12 years of applied consulting experience, much of which has been gained under a wide range of conditions. Mr. Peach is a registered professional geoscientist in the provinces of Newfoundland and Labrador and Nova Scotia and is a nationally certified environmental professional (fish and wildlife).

Mr. Peach has been involved in numerous environmental, geological, and engineering projects throughout Canada (Newfoundland and Labrador, Nova Scotia, and Ontario) and some within the United States and Africa. Projects have generally involved materials testing; geological, hydrogeological, and geotechnical studies; environmental site assessments (phase I and II); environmental site remediation; federal and provincial environmental assessments; environmental effects monitoring; toxicology studies; and baseline environmental studies related to hydroelectric, transportation, and mining development projects.

Mr. Peach has also worked directly within the mining industry while employed with the IOCC as a geotechnical geologist for the Carol Project in Labrador City, NL.

Mr. Peach participated to the development of the WMP for the project.

Patrick Scholz (Eng., M.Eng.) is a civil engineer specialized in water resources with more than 15 years of experience. Mr. Scholz has provided technical expertise for various hydrologic and hydraulic analyses, including runoff management, hydropower system evaluation, surface water management for mining sites, and inflow forecasting. His assignments included climatic and hydrologic data collection and analyses, flood and low flow analyses, water balance modelling, hydrologic and hydraulic modelling, dam break and dynamic flood routing, river and reservoir flow routing, flood inundation mapping, and hydraulic structure design for water conveyance and storage.

Mr. Scholz participated in the development of the WMP for the project.

Anh-Long Nguyen (Eng., M.Sc.) is a process engineer with 15 years of experience specializing in the water treatment industry for the mining, industrial and municipal sectors. Mr. Nguyen is presently the discipline lead for water treatment in the Sustainable Mine Development group. He has acquired a solid background in the design and development of water treatment processes, including clarification, filtration and membrane systems. He has participated in all project engineering phases, including pre-feasibility studies, basic and detailed engineering, and start-up and commissioning. He has also acted as proposal manager, where he was responsible for a team of specialists (engineers, designers and estimators) for the process design, technical and commercial risk evaluation, cost estimate and proposal preparation.

With SNC-Lavalin, he has participated in the development of a mine site water management plan where he identified water sources, looked at water quality, identified streams requiring treatment, and designed water treatment processes to deal with these streams.

Mr. Nguyen participated in the development of the WMP for the project.

Abdel Benlahcen (Ph.D.) is a professional geologist with Master's and Ph.D. degrees in hydrogeology. He has over 12 years of experience in consulting and research. He is involved in EIS for mining projects, and in groundwater supply and source water protection projects. His experience covers several aspects of hydrogeological field investigations and project management for institutional, mining and industrial projects.

He has experience in geochemical modelling and multivariate geostatistical analysis. He supervises fieldwork for major projects, prepares terms of references for proposals, technical notes and reports. Dr. Benlahcen collaborates in projects of environmental site assessments and the characterization and remediation of contaminated sites. He has extensive knowledge of guidelines and regulations in relation to the environment and is well acquainted with the DSO environment, as he has participated in several hydrogeological studies for related sites between 2008 and 2011.

Mr. Benlahcen participated in the hydrogeology modelling for the project.

1.3.5 AECOM

With nearly 100,000 employees — including architects, engineers, designers, planners, scientists and management and construction services professionals — serving clients in more than 150 countries around the world following the acquisition of URS, AECOM is a premier, fully integrated infrastructure and support services firm. AECOM is involved in the EIS for the air, noise, ambient nighttime light and human health risk assessment studies.

Denis Lalonde (Eng.) is a project manager in the AECOM Montréal office with 25 years of experience in the environmental industry. He earned a Bachelor's degree in chemical engineering from *Université de Sherbrooke* in 1989. He is an expert in the field of air quality, including monitoring, emissions inventories, permitting, modelling, auditing and more. Over the years, he has advised several industrial clients in the mining, petroleum refining, cement, thermal power, incineration and forest products industries. He was an environmental manager with Norbord, an important wood products manufacturer with operations in the

US, Canada and the UK. His international experience has included UNIDO and a four-year posting in Vietnam for a CIDA-funded project on environmental governance strengthening.

Mr. Lalonde was director of the air, noise and light and human health risk assessment studies and corresponding EIS sections for the project.

Alexandre Bourget has been working at the AECOM Montréal office since 2012 as an environmental engineer, after earning his B.Eng. in biotechnology process engineering at *Université de Sherbrooke* in 2008, and completing his M.Sc. in civil engineering at Université Laval in 2011. During the last three years, he led the technical aspect of a transition project from MOBILE to MOVES for the transportation simulation system of the Québec Ministry of Transportation and participated in several air dispersion modelling projects (CALPUFF, AERMOD) for impact studies. He also participated in various risk assessment modelling projects using industry hazard analysis tools such as PHAST and ALOHA. Since 2012, Mr. Bourget has been regularly involved in air dispersion modelling studies in the environmental permitting of the DSO project.

Mr. Bourget was responsible for the air quality study for the project.

Niloofar Sokhandan is a meteorologist in the Industrial Environment group at the AECOM Montréal office. She earned her master's degree in Atmospheric Science and Meteorology at UQAM in Montreal Québec in 2013. As a member of the TRAQ research group at McGill University, she developed the use of the CALPUFF air model to assess the effects of transportation on public health in Montreal.

Ms. Sokhandan worked on the air quality study for the project.

James Au is an acoustic engineer with AECOM's acoustics, noise, and vibration group. He has been working in acoustics and noise control consulting engineering since 2008. Mr. Au's general areas of expertise include sound and vibration measurement, sound and vibration ambient monitoring, acoustic software modelling (Cadna/A and EASE), building acoustics, and mechanical noise assessment and abatement; transportation services, including road and rail noise and vibration effect, noise barrier analysis, and Ministry of Transportation Ontario highway noise assessment; and environmental services, including Ministry of Environment certificates of approval (air and noise), environmental assessments, and construction noise and vibration assessments.

Mr. Au was responsible for the noise study for the project.

Brian Bulnes is an acoustic engineering intern with the acoustics, noise, and vibration group. He has been working in the field of acoustics, noise, and vibration since October, 2013. He earned a Bachelor's degree in mechanical engineering in 2013 from the University of New Brunswick. Mr. Bulnes has experience in noise and vibration environmental assessments, sound measurement, sound and vibration monitoring, noise from transportation services, noise barrier analysis, acoustic software modelling (CadnaA), and construction noise and vibration assessments.

Mr. Bulnes worked on the noise study for the project.

Rabih Alkhatib, Ph.D., is a senior vibration engineer with the acoustics, noise, and vibration group. He has 13 years of experience in the areas of structural vibration, wind engineering, damping systems, finite element analysis, multi-body dynamics, noise, acoustics, structural health monitoring, and vibration measurements. Dr. Alkhatib has conducted numerous studies related to modelling and simulation of structural vibration induced by wind, footfall, blasting and machines. He has also designed passive and active vibration control systems and worked on projects involving environmental vibration, structure and ground borne noise.

Dr. Alkhatib was in charge of the blast vibration and overpressure modelling potions of the project's noise study.

Martin Aubé earned his Ph.D. degree in remote sensing from *Université de Sherbrooke*, Canada, and a Master's degree in astrophysics from Université Laval, Canada. Dr. Aubé is a teacher in the *Cégep de Sherbrooke* physics department, where he is researcher/coordinator of GRAPHYCS research group. He is an associate professor in the applied geomatics department at *Université de Sherbrooke*. Among many other affiliations, he is an associate researcher at *Centre d'applications et de recherche en télédétection* and a researcher at the *Centre de recherche en astrophysique du Québec*. Dr. Aubé was awarded the Excellence in Research award in 2014 by Québec's research council (FRQNT) and is Principal of Logis-Logique SENC.

Mr. Aubé was responsible for the ambient light study for the project.

Mike Rankin (M.Sc., RPBio., and CSAP Risk Specialist). Mr. Rankin has over 28 years of Canadian and international consulting and industrial chemical sector experience in human and ecological toxicology and contaminant health risk assessment and has direct relevant experience in environmental impact assessment as applied in Canada and internationally. He is a Registered Professional Biologist and a member of the BC Roster of Contaminated Sites Approved Professionals (CSAP-Risk Specialist). His practice focuses on risk management, remedial options and sustainability decisions in the context of human, terrestrial, and aquatic receptors and diverse contaminants (e.g., petroleum hydrocarbons, PAHs, metals, chlorinated dioxins/furans, chlorinated solvents). He is an experienced leader of multidisciplinary teams resolving regulatory and environmental contaminant issues including: environmental social impact assessment e.g., oil and gas sector initiatives (LNG, oilsands projects), mining, contaminated site risk assessment/management, Province of BC regulatory risk assessment guidance for petroleum hydrocarbons, instructor of environmental risk assessment, and regulatory/corporate toxicology reviews. International work experience derives from USA, Cuba, Guatemala, Thailand, Vietnam, Laos, Cambodia, Malaysia, Mongolia, Madagascar, Tanzania, Peru and Chile.

Mr. Rankin was responsible for the human health risk assessment study for the project.

James Phibbs (M.Sc., RPBio., PBiol.) is a biologist with AECOM in Winnipeg with more than nine years of experience investigating contaminated sites and conducting risk assessments. James has a Bachelors of Science, in Forestry focusing on logging effect on aquatic systems. James also completed a M.Sc. degree in environmental toxicology focusing on the aquatic effect of non-uranium metals in lakes down gradient of an active uranium mill in northern Canada. James has authored or co-authored five papers based on this research and presented at international conferences on aspects of toxicology and risk assessment related to metal mining in Canada.

James has experience conducting human health and ecological risk assessments in wild lands settings following both federal and provincial guidance for risk assessment. Since joining AECOM, James has focused on remote and complex contaminated sites with a specific emphasis on abandoned mine site investigation and risk assessment for government and private mining clients. Mr. Phibbs was responsible for the human health risk assessment study for the project.

Mr. Phibbs worked on the human health risk assessment study for the project.

Mike Sanborn (M.Sc. RPBio) is an Environmental Scientist (Level 5/Experienced) with over ten year's total experience (ten of which have bene at AECOM) as an environmental consultant and risk assessment specialist. Mike manages small environmental projects, and routinely manages components of large environment investigations. Mike has extensive experience in the design, implementation, and conduct of environmental investigations involving water quality, sediment quality, chemical tracers, contaminant fate and transport, and toxicity testing. In addition, he has extensive field experience in the sampling of marine and freshwater aquatic environments, marine and freshwater sediment, as well as extensive scientific laboratory experience relating to environmental chemistry, metals speciation, geochemistry and biological observations.

Mike has considerable experience in the conduct of human health and ecological risk assessments, particularly in support of the development or reclamation of mining projects. Mike has a good understanding of statistics which he brings to his risk assessment and site investigation work. Mike attempts to identify and provide novel scientifically defensible approaches to environmental issue where appropriate, providing added value to the project team and his clients. Since joining AECOM, Mike has been involved in the preparation of large environmental effects statements, detailed site investigations and the conduct of detailed human health and ecological risk assessments. Mike has been involved in several projects which have been met with regulatory approval under both federal and provincial jurisdictions.

Mr. Sanborn was a contributing author of the human health assessment study.

1.3.6 Golder Associates

Golder is an employee-owned, global organization providing consulting, design, and construction services in their specialist areas of earth, environment, and energy through technical excellence, innovative solutions and award winning client service. Golder is involved in the geotechnical study for the EIS.

Carl Gravel (Eng., M.Sc.A.) has a Bachelor's degree in geological engineering (2009) and a Master's degree in mineral engineering (2012), both from *École Polytechnique de Montréal*. In 2011, he joined Golder Associates Ltd. in Montréal where he is involved in mining geotechnical projects. His specializations include geotechnical site investigations, geotechnical rock mass characterization, and open pit rock mechanics studies and design.

Mr. Gravel was involved in the geotechnical field investigation for the project and was responsible for the preparation of the geotechnical study.

Marc Rougier (Eng., B.Sc. Hons.) is a geological engineer with more than 22 years of international experience. His fields of expertise are geotechnical engineering applied to mine projects, soil and rock slope stability, and applied geology and hydrogeology. Mr. Rougier acts as the technical lead on rock mechanics, engineering geology, hydrogeological and geotechnical design studies for open pit and underground mines, waste dumps, earth dams, quarries and tunnels, and highway, park and residential rock cuts. This includes landslide and terrain hazard assessments. Mr. Rougier also acts as overall project manager for multidisciplinary bankable feasibility studies, with emphasis on: mine geotechnics, hydrogeology, mine waste management and environmental baseline data collection, including wildlife, aquatics, geochemistry, hydrology and air.

Mr. Rougier was the technical lead for the project geotechnical study.

1.3.7 Geofor

Gilles Fortin (Eng., M.Sc.) graduated in geological engineering from *Université du Québec à Chicoutimi* in 1975 and received a Master's degree in Environment from *Université de Montréal* in 1992. He is currently president of the firm GEOFOR Environnement, which is specialized in hydrogeology. Since 2008, Mr. Fortin has been regularly involved as a hydrogeologist in the environmental permitting of the DSO project near Schefferville. He planned and managed all field campaigns aimed at determining groundwater configuration and characteristics, as well as the anticipated effect of mining activities on groundwater. He supervised modelling of the dewatering of ore bodies, report writing and preparation of applications for certificates of authorization.

Mr. Fortin was responsible for the hydrogeology study for the project.

1.3.8 Gerald Penney Associates Limited

Gerald Penney Associates is a Newfoundland-based private archaeological and heritage resource consulting company with 28 years of leadership in historic resource assessment and mitigation. The firm is the largest of its kind in eastern Canada, with a reputation for technical expertise, interpersonal skills and imaginative approaches.

Along with three archaeologists and a historian on staff, Gerald Penney Associates is associated with a number of professionally-qualified consultants and researchers. They bring multi-disciplinary ethnographic, documentary, and cartographic expertise as well as valued historical perspective to heritage investigations. They not only "cover off" regulatory compliance – the fundamentals of cultural resource management are its team members' specialty. While the company's professional focus is by definition reflective, its approach is forward-looking, respecting the lessons and the current value of the past.

Gerald Penney Associates was responsible for the archaeology study for the project.

Gerald Penney (M.A.) has an unparalleled background as a consulting archaeologist in Newfoundland and Labrador. As principal investigator, Mr. Penney, who has held more archaeological investigation permits than anybody in the Province, has built a dedicated and professional staff, emphasizing a team approach to projects that maximizes the members' varied skills and abilities. His company has grown in step with the Province's historic resources regulatory regime.

Blair Temple (M.A.), who has 17 years of experience in conducting Stage 1, 2 and 3 Historic Resources assessments, led the HRIA investigation. He specializes in historic era investigations and has been employed by Gerald Penney Associates since 2006, where his responsibilities include background research, field investigations and report writing.

Robert Cuff (M.A.), Gerald Penney Associates historian, has broad research interests in the social, economic, and political history of Newfoundland and Labrador. He has more than 25 years of experience in relating heritage and historical themes to the general public in a variety of media, including five years as managing editor of the *Encyclopedia of Newfoundland and Labrador*.

Toby Simpson (B.A.) is Gerald Penney Associates archaeological AutoCAD technician/surveyor, with 20 years of experience working on a variety of complex projects involving site consolidation and conservation for public access, in the UK and Middle East, and (since 2007) in Newfoundland and Labrador. His specialist knowledge and surveying experience assist in interpreting historic cartography and geotechnical data, and in precise recording of historic structures and archaeological features.

Lori Temple (B.A.), who holds a B.A. from Memorial University of Newfoundland, has been employed at The Rooms in various capacities for 15 years (mainly with the Provincial Museum of Newfoundland and Labrador). Currently Collections Manager for Archaeology and Ethnology, Provincial Museum, she catalogues and curates all artifacts for Gerald Penney Associates under contract.

Miki Lee (B.A.), a trained professional conservator, has been contract employed by The Rooms for the past 10 years. She has provided consultant conservation services to various archaeologists, and conducts all conservation requirements for Gerald Penney Associates.

1.3.9 Journeaux Assoc

Noel Journeaux (Eng., M.S.C.E, F.ASCE) graduated in geological engineering from Queen's University in 1960 and received a Master's degree in civil engineering from Purdue University in 1962. Mr. Journeaux has civil engineering and engineering geology permits in Alberta Ontario,Québec, Newfoundland and Labrador, and Nunavut. He is also a Fellow of the American Society of Civil Engineers. Mr. Journeaux has been working in the field of geotechnical engineering for more than 45 years. He has strong experience in foundation design of several project types; namely, dams, bridges, maritime ports, excavations, tunnels and underground transport systems. Also, he is an expert in design of foundations in the warm permafrost of the west and the cold permafrost of the east Canada. Mr. Journeaux has been elected in 2015 to be a member of the technical committee of BNQ a member of the National Standards System (NSS) preparing guidelines for geotechnical investigation and foundation design in permafrost. Such experience has been gained in different sectors such as the mining, energy, transportation, construction and environment. Since 2007, Mr. Journeaux is the president of Journeaux Assoc. Division of Lab Journeaux Inc., a company that provides geotechnical laboratory testing and engineering services. Since TATA steel minerals started the construction of its production plant in Schefferville 2012, Journeaux Assoc. has been involved in the geotechnical and quality control aspect of projects involving the foundation for the dome, railway, water tank, screening structure and administration building. In 2014, Journeaux Assoc. conducted intensive geotechnical field investigation to design pit slopes in the discontinuous permafrost of different pits to be mined in the south area DSO 3 and in the north area DSO 4.

Mr. Journeaux was responsible for the evaluation of permafrost presence in Howse deposit.

1.4 CORPORATE POLICIES

HML recognizes that Project operations can have a direct effect on the environment, and its primary environmental concerns are human health, environmental awareness and conservation of plants and wildlife. HML is committed to conducting its operations responsibly so as to minimize and eliminate, where possible, these effects on the environment. All employees, including contractors, follow safe and efficient practices to control environmental damage above, below, or at the surface during all operations.

TSMC has developed an Environmental Protection Plan (EPP) to attain its environmental goals (Volume 1 Appendix Ia). To effectively manage and implement the EPP, several mechanisms have been identified, including adequate communication with environmental personnel and other personnel on site, annual environmental performance reviews, environmental orientation, and regular hazard analyses and tool box meetings that incorporate environmental issues. Section 6.2.1 presents an overview of TSMC's EPP document.

1.5 OVERVIEW OF THE PROJECT AND SCOPE

HML is planning to mine the iron ore deposit at the Howse Property with the support of adjacent infrastructure. The Howse Property Project is located 25 km northwest of Schefferville, Québec, in Labrador, between Kauteitnat (also known as Irony Mountain, 840 m asl), Pinette Lake and HML's DSO Project 1a. The center of the pit is located at 67°8'19.07"W, 54°54'31.18"N and the mineral rights of the property are registered under HML in the form of two map-staked licenses, 021314M and 021315M, which replace license

0201430M. The Howse Property is located on provincial Crown land, without any particular zoning. The Project area also lies outside areas for which there is a land use plan.

The Howse Project can be brought into production in a relatively short period of time and at a low capital cost. The Project requires few new installations and some of the required infrastructure (e.g. the railway, the road network, camp, mining equipment and explosives storage) are already in place at the nearby DSO project complex, which was recently put into operation.

A conventional in-pit drill and blast operation mining method will be used at the Howse Property. The extracted iron ore will be processed at a facility adjacent to the existing rail loop. As such, material will be hauled by truck to HML's DSO project rail loop loading area (less than 5 km from the Project) for crushing, and then shipped by train to Sept-Îles.

The construction of some new infrastructure will be required to mine the deposit at the Howse Property. The main physical works and activities involved for the Project are:

- open pit: approximately 105 ha 3D surface area and 78 ha projected surface area (footprint) with a maximum depth of 195 m. The production rate is expected to be 1, 304 kt of dry ore in the first year and 3, 043 kt/year in subsequent years until 2022. The maximum planned production is 9, 130 kt/year (25, 000 t/day), which will be reached in 2023 (see Table 1-2);
- stockpiles/dumps (overburden and topsoil): approximately 67.8 ha 3D surface area (63.5 ha projected surface area) of overburden and roughly 3.15 ha of 3D surface area (3.0 projected surface area) for topsoil; surrounded by peripheral ditches linked to a sedimentation pond;
- waste rock dumps (waste material): about 43.4 ha 3D surface area (39 ha projected area); surrounded by peripheral ditches linked to a sedimentation pond;
- a crushing and screening facility located near the rail loop at the DSO site; There will be one Primary Jaw crusher, and two secondary cone crushers. The specification sheets for the crushers are available in Volume 1 Appendix II;
- Howse haul road: an existing road from past IOCC mining activities will be upgraded (0.95 km), and 1.2 km of road will be built over a disturbed area to link the Howse Property to the existing TSMC DSO project road network;
- power generation;
- bypass road; at the request of local First Nation communities, the proponent is committed to the establishment of a bypass road at the Howse site. Alternatives to the configuration of these roads and their effects are discussed in Section 2.5.3;
- new site infrastructure: will consist of 3 trailers (washrooms, office, lunchroom) and parking spaces for the haul trucks and pickups;
- water management infrastructure: peripheral wells will be installed around the pit to lower the water table below the elevation of the mining operation. Dewatering will be carried out by means of two diesel-powered pumps and drained to a sedimentation pond, located at the north and south ends of the pit. All snowmelt and runoff water (draining all Howse Project planned physical works) will be collected with ditches and drained to sedimentation ponds before being discharged into the environment; and
- transport of ore and of solid, liquid and hazardous wastes from the Howse Property Project to the DSO Project Complex.

Apart from some dust increase due to vehicle traffic, the Howse Property Project will not add any pressure to the DSO Project plant complex activities. Previously-assessed quantities for ore processing will not be exceeded: no tailings or tailings process water will be generated by the Howse Property Project. The capacity of the worker's camp will never exceed its limit of 192 workers, and no increase in domestic waste is therefore expected from the Howse Property Project. Domestic solid waste generated by the mine operations will be disposed at the TSMC-approved landfill site.

Some areas could not be considered for infrastructure construction due to topography and the presence of sensitive environments, i.e., the Irony Mountain area, wetlands, and Burnetta and Goodream creeks. The proposed layout was selected in order to accommodate Aboriginal rights or interests, after consultation with Aboriginal organizations and family trapline holders, to minimize the visual effects and the environmental effects on wetlands, water quality and fish habitat.

The approved facilities at TSMC's DSO project plant complex that have been recently put into operation and that HML plans to use include: a processing plant, a rail car loading system, an existing railway track from former IOCC operations, a camp to accommodate the workers, offices, a warehouse, workshops, garages, a laboratory, a landfill, and a wastewater treatment facility. All these facilities are not part of the scope of the current EIS.

1.6 ENVIRONMENTAL ASSESSMENT PROCESSES AND REQUIREMENTS

In accordance with the Newfoundland and Labrador *Environmental Protection Act* (EPA), SNL 2002 and *Environmental Assessment Regulations, 2003,* "[...] anyone who plans a project that could have a significant effects on the natural, social or economic environment" is required to submit a Project Registration to the Department of Environment and Conservation for examination. The process consists of up to five steps: 1) registration and review, 2) Minister's decision and, if required, 3) preparation of guidelines for an Environmental Preview Report (EPR) or EIS, 4) proponent preparation of EPR or EIS and EPR/EIS review, and 5) Minister's decision. There are definitive timelines associated with each of the five steps.

At the federal level, the Project is a "designated project" in accordance with paragraph 16(a) of the *Regulations Designating Physical Activities* under the Canadian Environmental Assessment Act, 2012 (CEAA, 2012), which describes the following activity: "the construction, operation, decommissioning and reclamation of a new metal mine, other than a rare earth element mine or gold mine, with an ore production capacity of 3,000 t/day or more". Based on the Project Description submitted to the Canadian Environmental Assessment Agency, referred as "the Agency", the potential for the Project to cause adverse environmental effects, and comments received from the public during a 20-day comment period, the Agency decided that a complete EIS was required under CEAA (2012).

Three federal agencies are designated as "responsible authorities": the Agency, the National Energy Board (NEB) and the Canadian Nuclear Safety Commission (CNSC). In this project, the Agency is the designated responsible authority.

The federal EA process officially begins with the proponent submitting a Project Description to the Agency (or to the NEB or the CNSC, as applicable) in accordance with the Guide issued by the Agency in July 2012. The Agency then has 45 days, including a 20-day public comment period, to decide whether an EIS is required. Additionally, the Minister may refer a project to a review panel up to 60 days after the posting of the Notice of Commencement.

The process is subject to strict timelines: in the case of the Agency EIS, the Minister must render a decision within 365 days of the EA commencing (i.e. Notice of Commencement). Exceptions can be made under certain conditions: the Minister can extend these timelines by three months, and the federal cabinet can extend them further. These timelines apply solely to the functions of the Agency and the review panels, and do not factor in the time taken by the proponent to discharge its responsibilities.

A variety of forums for public participation exists for both CEAA (2012) and Newfoundland and Labrador EIS to comment on a draft EIS report and, in the case of review panels, to participate in public hearings. Public participation is achieved through the Canadian Environmental Assessment Registry website, as well as the Department of Environment and Conservation website, where key project information and documents are posted as the process unfolds.

CEAA (2012) contains specific references to the inclusion of Aboriginal peoples in the EIS process through cooperation and communication, and defines environmental effect as effects that specifically cause changes to Aboriginal health and socioeconomic conditions, physical and cultural heritage, current use of land and resources for traditional purposes, and structures, sites or items of historical, archaeological, paleontological or architectural significance. Aboriginal consultations is also required by the provincial government as per the Government of Newfoundland and Labrador (GNL)'s Aboriginal Consultation Policy on Land and Resource Development Decisions.

A regional environmental study as per the Agency's definition of "a focused assessment of the development potential of an area, which examines the cumulative effects of the forecasted development scenarios" has not been or is not being carried out in the region where the Project will be located.

1.7 PROXIMITY TO OTHER PROJECTS

The Project is located in the vicinity of other DSO projects proposed by TSMC and LIM (Figure 1-2 and Table 1-1).

Table 1-1 Other DSO Projects in the Area

PROJECT	PROPONENT	DEPOSITS	PROVINCE	STATUS	ENVIRONMENTAL ASSESSMENT
DSO 1	TSMC	Gill	Labrador	-	n/a
DSO 2	TSMC	Star Creek 2,3 Ferriman 6 Sawmill 1 Lance Ridge 1 Fleming 6 Fleming 7X	Québec	Exploration is planned between 2014 and 2016 to validate historical records. As per historical records, the iron grade for DSO2 material is not in line with our already-established DSO grade production schedule. Therefore, all DSO2 material will be mined after the plan stabilization. All DSO2 deposits are very small. Hence, it is not economically viable to start mining at this time. Mining of DSO 2 is not in TSMC's current plans.	n/a
DSO 3 (Project 1a; Also known as the ELAIOM project)	TSMC	Timmins 1,3N,3S, 4,6, 7 Fleming 7N	Labrador	Timmins 1: past IOCC mine, now a fish habitat Timmins 3S: past IOCC mine, not planned to be mined Timmins 6: past IOCC mine. Timmins 6 is partially on TSMC	Provincial (NL) EIS completed

PROJECT	PROPONENT	DEPOSITS	PROVINCE	STATUS	ENVIRONMENTAL ASSESSMENT
				property and partially on LIM property Operational: Timmins 4: 2012-2014 and 2018 (not mined in 2015 and 2016 and will probably close in 2017) Fleming7N: mined only in 2014, and 2018-2022 Timmins 7: planned for 2018-2020 Timmins 3N: This pit's schedule is dependent on the outcome of the Howse Project. Currently, it is planned for 2024-2026, which would be the earliest possible time, if Howse Property Project operations start in 2017.	
DSO 3 (Project 1b)	TSMC	Ferriman 4	Québec	Exploration done in 2008. Ferriman 4's potential is very small. Hence, its development is planned for 2028-2032	n/a
DSO 4 (Project 2a)	TSMC	Goodwood Sunny 1 Leroy	Québec (N of 55◦N)	Goodwood: Construction and development planned for 2016. 2017 and 2019-2027 Sunny 1: Planned for 2029-2030 Leroy: Planned for 2027-2031	Provincial (QC) EIS completed
DSO 4 (2b)	TSMC	Kivivic 1C,2,3N,4,5	Labrador	Kivivik 1C: Started in 2015 and will be operational to 2027 Kivivik 2: Started in 2015, to 2025 3N: no current plans Kivivik 4: Planned for 2025-2028 Kivivik 5: Planned for 2020-2027	Provincial and federal EIS not required
Stage 1	LIM	James Redmond 2B & 5 Knob Lake 1	Labrador	Bankrupcy process	Provincial (NL) EIS completed
Stage 2	LIM	Houston 1 & 2	Labrador	Bankrupcy process	Provincial and federal EIS not required
Stage 2	LIM	Malcom 1	Québec	Bankrupcy process	n/a
Stage 4 & 5	LIM	Sawyer Lake Astray Lake Kivivic 1a, 1b	Labrador	Bankrupcy process	n/a

PROJECT	PROPONENT	DEPOSITS	PROVINCE	STATUS	ENVIRONMENTAL ASSESSMENT
Taconite (KéMag / LabMag)	NML (TSMC partnered with NML for the feasibility study) and other potential partners if the project goes ahead.	KéMag/ LabMag	KéMag (Québec) LabMag (Labrador)	Re-evalaution of the project. NEWTAC project is being considered	n/a

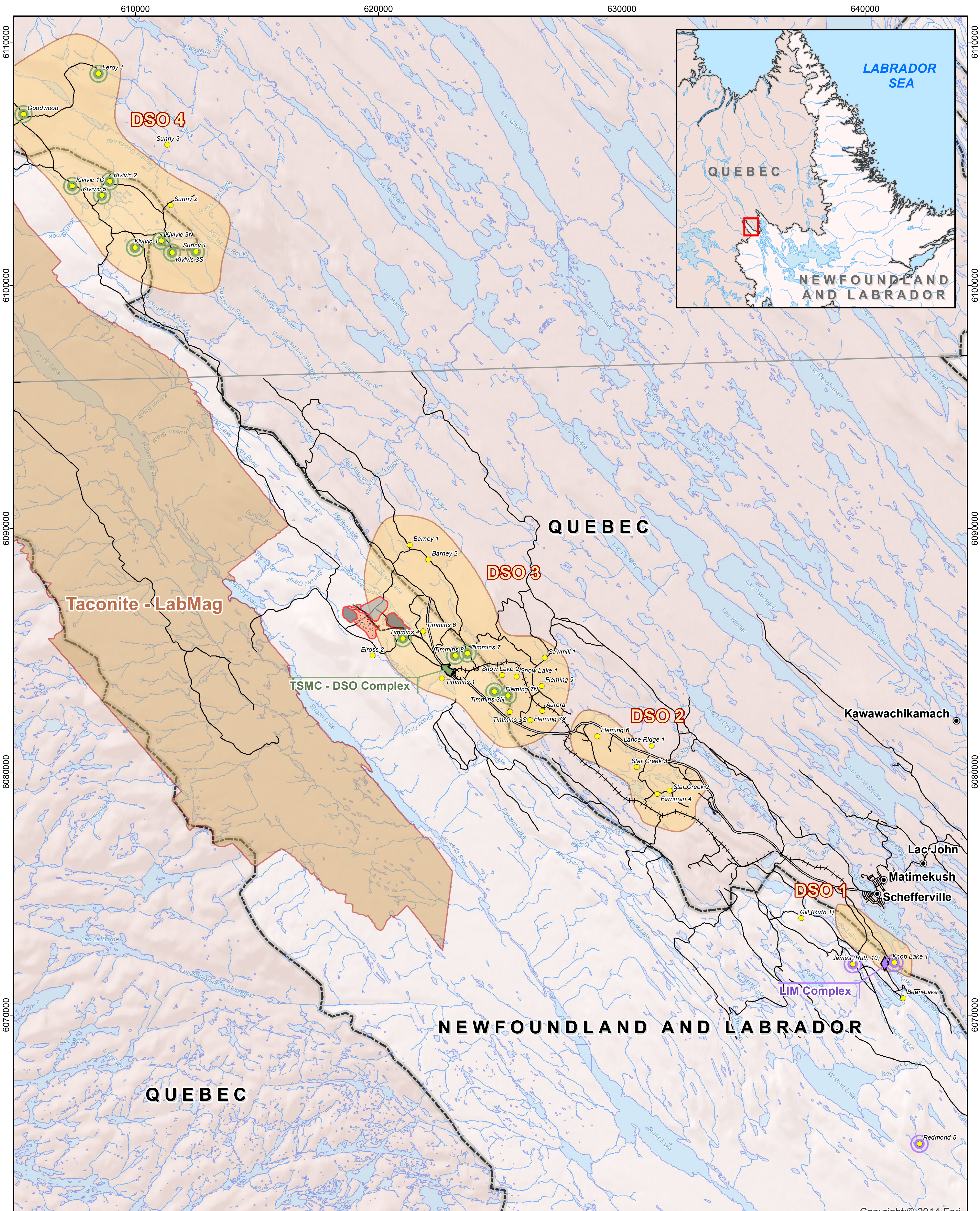
These projects are independent of each other. However, the TSMC projects listed in Table 1-1 will utilize the same TSMC rail loop loading area to ship the iron ore by train. Also, depending on the grade of the material mined from the different pits, the DSO plant complex could be used for all the DSO projects listed in Table 1-1, as long as the usage of the plant remains within the pre-approved limits. Also, if the Taconite project goes ahead, the only potential link with other projects would be the use of the road from DSO3 to DSO4. The Taconite Project is under revision and a NEWTAC project is being studied, based on market conditions.

Due to delay in construction of the access road leading to DSO 4, TSMC is currently planning on working to develop DSO 3 and Howse. Although it is possible that some of the ore from DSO 1 and DSO 2 might use the various facilities at TSMC's DSO project, it is currently impossible to provide more details on their reliance on these facilities. It is also worth noting that it is not in TSMC's or HML's current plans to develop any other pits than those listed in Table 1-1.

TSMC's DSO 3 Project 1a is also known as the ELAIOM. Groupe Hémisphères, the environmental consulting firm that prepared this EIS, was also actively involved with NML and TSMC in the preparation of the Project Description, Project Registration and EIS for TSMC's DSO 3 Project 1a (ELAIOM). Table 1-2 lists the annual production rates for the ROM ore for the Howse Property, along with TSMC's other DSO projects.

Table 1-2 Anticipated Production Rates for the Howse Property and TSMC's DSO Project

PROJECT YEAR	2016 (MT)	2017 (MT)	2018 (MT)	2019 (MT)	2020 (MT)	2021 (MT)	2022 (MT)	2023 (MT)	2024 (MT)	2025 (MT)	2026 (MT)	2027 (MT)	2028 (MT)	2029 (MT)	2030 (MT)	2031 (MT)	2032 (MT)	TOTAL
Howse Property	0	0	1.3	3.0	3.0	3.0	3.0	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	5.2	46.09
DSO 3 (1a)	2.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11.3
DSO 4 (2a)	0	0	5.5	5.5	4.7	4.5	4.5	4.7	0.5	0	0	0	0	0	0	0	0	29.9
DSO 4 (2b)	0	3.0	3.2	2.3	0.4	0	0	0	0	0	0	0	0	0	0	0	0	10.6
Total	2.6	3.0	10.0	10.8	8.1	7.5	7.5	7.7	3.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.6	82.3



LEGEND

Infrastructure and Mining Components

- DSO - Deposit
- LIM Actual or Planned Deposit Operation
- LIM Complex
- TSMC Actual or Planned Deposit Operation
- DSO Complex - TSMC
- DSO - Other Site
- Taconite - LabMag

Howse Infrastructures

- Proposed Howse Pit
- Proposed Topsoil/Overburden Stockpile
- Proposed Site Infrastructure
- Proposed Waste Dump/In-Pit Dump

Basemap

- Town
- Railroad
- Road
- Watercourse
- Water body
- Provincial Boundary

FILE, PROJECT, DATE, AUTHOR:
GH-0571 , PR185-19-14, 2015-10-21, edickoum

N

0 2 4 6 8 10
Kilometers

UTM 19N NAD 83

SCALE: 1:150 000

SOURCES:

Basemap
Government of Canada, NTDB, 1:50,000, 1979
SNC Lavalin, Groupe Hémisphères, Hydrology update, 2013.

Infrastructure and Mining Components
New Millennium Capital Corp., Mining sites and roads
THowse Minerals Limited/ MET-CHEM, Howse Deposit Design for General Layout., 2015

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Location

Howse Minerals Limited

GroupeHemispheres

5731, rue Saint-Louis,
Bureau 201, Lévis (QC)
Canada, G6V 4E2

1453, rue Beaubien est,
Bureau 301, Montréal (QC)
Canada, H2G 3C6

Figure 1-2

1.8 REGULATORY FRAMEWORK AND THE ROLE OF GOVERNMENT

In addition to approval under the provincial and federal EA process, the Project will also require a number of other environmental permits and authorizations from the following departments / agencies:

Government of Canada:

- Environment Canada and Climate Change
  - Canadian Wildlife Service
- Natural Resources Canada
- NAV Canada / Transport Canada
- Fisheries and Oceans Canada

Government of Newfoundland and Labrador:

- Service NL
  - Engineering and Inspections Division
  - Engineering Services DivisionOperations Division
  - Program and Support Services Division
- Department of Natural Resources
  - Mineral Lands Division
  - Mines Branch
- Department of Environment and Conservation
  - Pollution Prevention Division
  - Water Resources Management Division

1.8.1 Effects on federal lands

According to the Canadian Environmental Assessment Act (2012), "federal lands" means lands that belong to Her Majesty in right of Canada, or that Her Majesty in right of Canada has the power to dispose of, and all waters on and airspace above those lands, other than lands under the administration and control of the Commissioner of Yukon, the Northwest Territories or Nunavut.

- the following lands and areas, namely,
  - the internal waters of Canada;
  - the territorial sea of Canada;
  - the exclusive economic zone of Canada; and
  - the continental shelf of Canada.
- reserves, surrendered lands and any other lands that are set apart for the use and benefit of a band and are subject to the *Indian Act*, and all waters on and airspace above those reserves or lands.

Based on this definition, the Howse Project is not on federal land. It is also important to note that the Project is not in the vicinity of commercial or navigable waters, parks or any infrastructure under the federal authority.

1.8.2 Components enabled by federal authorizations and permits

A list of the potential permits and authorizations required for the Project is presented in Volume 1 Appendix III. The table below provides a list of federal authorization and permits and the location, in the present text, where the potential environmental effects associated with these permits are assessed.

PERMIT/AUTHORIZATION LEGISLATION/REGULATION DEPARTMENT/AGENCY	DESCRIPTION OF POTENTIAL ENVIRONMENTAL EFFECTS IN DOCUMENT
Letter of Advice or Authorization for Works or Undertakings Affecting Fish Habitat ▪ *Fisheries Act* ▪ Fisheries and Oceans Canada	Any activities in or near water that may support a fishery: Sections 6.4, 7.3.10, 7.4.9, 7.5.2.2 and 8.4, as well as Volume 2, Supporting studies D
Compliance Standard / letter of acceptance ▪ *Fisheries Act*, Section 36(3), Deleterious Substances ▪ Environment Canada	Any run-off from the Project site being discharged to receiving waters: Section 6.4
Compliance Standard ▪ *Migratory Birds Convention Act* and *Regulations* ▪ Canadian Wildlife Service, Environment Canada	Any activities which could result in the mortality of migratory birds and endangered species and any species under federal authority: Sections 6.3, 7.4.3, 7.4.4, 7.4.7, 7.4.8, 7.4.9, 7.5.2.2, 8.4, 8.6 and 8.7
Policy ▪ Federal Policy on Wetland Conservation ▪ Environment Canada	Any disruption of wetland habitat: Sections 7.4.1 and 8.5

1.8.3 Other guidelines

The following is a list of existing regulatory documents, environmental standards, guidelines or objectives used in the Howse EIS document to assess the level of the effect of the Project on a component. Details on the documents presented below can be found in the component's Effects Assessment section (Chapter 7). The documents are listed in the order in which they appear in the document.

- Canadian Dam Safety Guidelines (2007)
  - published by the Canadian Dam *Association*
- Environmental Guidelines for Mining Operations
  - compiled by the United Nations Department of Economic and Social Affairs (UNDESA) and the United Nations Environment Programme Industry and Environment (UNEP)
- *Newfoundland and Labrador Regulation 39/04, Schedule A – Table I: Ambient Air Quality Standards at Reference Conditions*
  - Air Pollution Control Regulation, 2004
  - Guidelines for Ambient Air Monitoring, December 16, 2010 (NL guidance document GD-PPD-065).
- Québec Clean Air Regulation

  - Environment Quality Act (Chapter Q-2, ss. 31, 35, 115.27, 115.34, 124.0 and 124.1)
  - Atmospheric quality standards, Sections 197 and 198 and Schedule K of the Clean Air Regulation, Q-2, r. 4.1
- Air Pollution Control Regulations, 2004
- Equipment noise data was gathered from manufacturer data, previous equipment measurements, BSI British Standards (BSI, 2008), and Roadway Construction Noise Model (RCNM) data (USDT, 2006a)
- Canadian Environmental Protection Act, 1999
  - Federal $PM_{2.5}$ standards published on May 25, 2013: Sections 54 and 55 of the Canadian Environmental Protection Act, 1999.
  - For other pollutants, the federal government sets national ambient air quality objectives (NAAQOs) on the basis of recommendations from the Federal–Provincial Working Group on Air Quality Objectives and Guidelines consisting of representatives from both the health and environment departments. NAAQOs are structured in three-tiered: maximum desirable levels, maximum acceptable levels and maximum tolerable levels. Maximum acceptable levels are listed in the table.
- Ontario's Ambient Air Quality Criteria
  - Standards Development Branch Ontario Ministry of The Environment, April 2012
- Government of Newfoundland and Labador, Department of Environment and Conservation
  - Guidelines for Plume Dispersion Modelling (2012)
- Government of Québec
  - Sampling Guide for Environmental Analysis
  - Booklet 4. Sampling of Atmospheric Emissions from Stationary Sources (MDDEFP, 2006).
  - Quebec Guidelines for Stationary Noise Sources for Type I Zoning Area
  - Directive 019 Sur l'Industrie Minière, March 2012
- Ontario's Ministry of the Environment.
  - Guidelines on Information Required for Assessment of Blasting Noise and Vibration.
- International Commission on Illumination
- CCME guidelines
  - Surface Water Quality Guidelines for the Protection of Aquatic Life
- Metal Mining Effluent Regulation (MMER) guidelines
- Fisheries and Oceans Canada
  - Guidelines for the Use of Explosives in or near Canadian Fisheries Waters
- Health Canada, Toxicological Reference Values and Chemical-Specific Factors, Version 2.0

1.9 PROJECT SCHEDULE

The Construction phase for the Howse Property is expected to start in 2017 subject to regulatory and environmental approvals.

The duration of the Construction phase, which includes: pit development, upgrading/construction of the Howse haul road, upgrading of a bypass road, construction of two sedimentation/transfer ponds and corresponding ditches, site infrastructure pad, site clearing and construction of a crushing and screening facility, is estimated at roughly 7 to 10 months based on 12-hour shifts.

Mining activities (Operations phase) at the Howse Property are expected to be ongoing until 2032, for a total of 15 years. The mine will be operational year-round, but the ore will only be mined, crushed, screened and shipped by train from April to mid-October (or November, depending on the weather), with day and night shifts. For the remaining months, overburden stripping is planned, and crews will work on restoring the overburden and waste rock stockpiles/dump.

The Decommissioning and Reclamation phase will be ongoing during the Operations phase as a result of the Proponent's in-Pit mining technique, which will allow for progressive site restoration. The Proponent estimates that this phase will last 5 years after mine closure, and the schedule will depend on progress of mining and the closure of dumps.

2 THE UNDERTAKING

The following sections present the undertaking and define the Project's rationales.

2.1 NATURE OF THE UNDERTAKING

2.1.1 The Undertaking

HML is planning to develop the iron ore deposit at the Howse Property with the support of adjacent mining infrastructure. The deposit is located in Newfoundland and Labrador along the Labrador Trough, between Irony Mountain, Pinette Lake and Timmins 4 (the site of TSMC's current operation). The Howse Project minimizes its footprint by sharing numerous existing facilities with TSMC's current adjacent operations. In order to connect the Howse Property to the existing road network, approximately 0.95 km of existing road from past IOCC mining operations will be upgraded and 1.2 km of new road will be built on a disturbed area (Figure 3-1). At the request of local First Nation communities, HML will support First Nations in the upgrading of an existing road in order to provide full acces to the Howells River Valley via a bypass road. The Proponent is currently assessing two bypass route Alternatives, and the details are discussed in Section 2.5.3. HML proposes to use a conventional open pit drill and blast operation mining method. The extracted iron ore will be crushed and screened, hauled by truck to the TSMC's DSO project rail loop loading area (less than 5 km from the Project), and subsequently shipped by train to Sept-Îles. Therefore, little additional infrastructure will need to be built.

Pit development is expected to be completed in 2017 to allow for ore production to also begin in 2017, pending regulatory approval.

HML will ensure that all permits and authorizations from appropriate regulatory agencies are obtained prior to the start of the Construction and Operations phases in order to comply with the laws and regulations of both governments.

2.1.2 Capital Cost

The capital cost is not expected to exceed $100 million.

2.1.3 Service Agreements

Multiple service agreements exist between HML and service providers. A list of categories and some examples are provided in Table 2-1.

Table 2-1 Examples of Service Provider Agreements

SERVICE PROVIDER CATEGORY	EXAMPLE
Transportation	Air Inuit, Provincial Airlines, QNS&L, Tshiuetin
Road maintenance	Mamu
Lodging	Sodexo
Mining	Grey Rock, Naskapi Heavy Machinery, Met-Chem
Consultants	WSP, Groupe Hémisphères, Sikumiut
Others	Biogénie, Naskapi Waste Management, Pétroles Naskinnuk

2.1.4 Related Projects

HML does not have other related projects. However, since HML is a division of TSMC, TSMC DSO Project Phases I and II are considered related projects. Information on the TSMC infrastructure that will be used for the Howse Property Project is provided in Section 3.1.

2.2 PREVIOUS ENVIRONMENTAL ASSESSMENTS

Environmental assessments have been prepared for projects in the vicinity of the proposed undertaking; the most relevant are listed in Table 2-2. A portion of the Howse Property Project intersects with the TSMC DSO 3 Project Phase 1 (ELAIOM) (Figure 1-2), for which an EIS has been accepted. The following deposits, identified in Figure 1-2, are not the property of TSMC: Snow Lake 1, Snow Lake 2, Sunny 3, Barney 2, Elross 2, Fleming 9, Aurora, Ferriman 6 and Bean Lake.

Table 2-2 List of Previous Environmental Assessments

PROJECT (REF. NUMBER)	OWNER	LOCATION	ENVIRONMENTAL ASSESSMENT PROCESS	DATES
Elross Lake Area Iron Ore Mine (ELAIOM-DSO Project 1a) (80067)	New Millennium Capital Corporation, now TSMC	Western Labrador, 10 km northwest of Schefferville, Québec	Project Registration	Registered May 5, 2008
			Provincial (NL) Environmental Impact Statement required	EIS submitted January 6, 2010
			Federal Environmental Impact Statement not required	Released January 5, 2011
Joyce Lake Direct Shipping Iron Ore Project (80015)	Labec Century Iron Ore	Western Labrador, 20 km northeast of Schefferville, Québec	Project Registration	Registered on October 15, 2012
			Provincial (NL) Environmental Impact Statement required	EIS ongoing
Joan Lake Direct Shipping Ore Project (DSO 2b)	New Millennium Capital Corp., now TSMC	Western Labrador, 45 km northwest of Schefferville, Québec	Project Registration	Registered January 20, 2010
			Provincial (NL) and Federal Environmental Impact Statement not required	Released on March 24, 2011
DSO Project 2a (Goodwood, Leroy 1, Sunny 1 and Kivivic 3S Deposits)	New Millennium Capital Corp., now TSMC	Northern Québec, 50 km northwest of Schefferville, Québec	Environmental Impact Statement submitted to the Government of Québec Federal Environmental Impact Statement not required	Certificat d'autorisation (authorization certificate) delivered on January 11, 2013 by the Government of Québec
Schefferville Iron Ore Mine (James and Redmond Properties)	Labrador Iron Mines Ltd.	Western Labrador, near Schefferville, Québec	Project Registration	Registered May 5, 2008
			Provincial (Environmental Impact Statement required	EIS submitted December 21, 2008

PROJECT (REF. NUMBER)	OWNER	LOCATION	ENVIRONMENTAL ASSESSMENT PROCESS	DATES
			Federal Environmental Impact Statement not required	Revised EIS submitted August 25, 2009 Released February 12, 2010

TSMC's DSO project is divided into two phases and five assessment groups for EIS purposes (Table 2-3). EA documents for infrastructure located in Labrador are assessed under the GNL's EPA and the CEAA (2012). For infrastructure located in Québec, north of the 55th parallel, EIS are analyzed under the James Bay and Northern Québec Agreement s23, whereas for infrastructure located in Québec, south of the 55th parallel, EIS are analyzed under Québec's Environment Quality Act and the CEAA (2012).

For assessment group 1a of the ELAIOM/DSO project EIS, component studies were conducted for fish and fish habitat, archaeological and heritage sites, gender equity, Schefferville Innu and Naskapi land and resource use and traditional ecological knowledge, hydrogeology, breeding birds, terrestrial ecosystem mapping, commuter mining and Aboriginal health. A helicopter-based survey of caribou was also carried out in collaboration with LIM in May 2009. No additional studies were conducted for assessment group 2a of the ELAIOM/DSO project EIS.

Table 2-3 ELAIOM/DSO Project Division for EIS Purposes

MINING STAGE	ASSESSMENT GROUP	DEPOSITS	PROVINCE
Phase I	1a	Timmins 3N, 4 and 7; Fleming 7N	Labrador
Phase I	1b	Ferriman 4 (and haul road)	Québec
Phase II	2a	Leroy 1, Goodwood, Sunny 1, Kivivic 3S	Québec (north of 55th parallel)
Phase II	2b	Kivivic 1C, 2, 3N, 4, 5; Timmins 8	Labrador
Phase II	2c	Barney 1, 2; Sawmill 1; Fleming 6, 7X; Timmins 3S; Star Creek 2	Québec (south of 55th parallel)

2.3 GEOGRAPHICAL LOCATION

The Howse Property is located 25 km northeast of Schefferville. Figure 2-1 shows the geographical location of the Howse Property in relation to TSMC's DSO project complex and other existing infrastructure. The center of the pit is located at 67°8'19.07"W, 54°54'31.18"N. The entire Property lies in the province of Newfoundland and Labrador. The mineral rights are registered to LIM (49%) and HML (51%) in the form of two map-staked licenses, 021314M and 021315M, as listed in Table 2-4, which replace licence 0201430M.

Table 2-4 Mineral Licences

LICENCE	CLAIMS	AREA (HA)	ISSUANCE DATE	RENEWAL DATE	REPORT DUE DATE
021314M	32	797	Dec. 16, 2004	Dec. 16, 2014	Feb. 14, 2014
021315M	7	181	Dec. 16, 2004	Dec. 16, 2014	Feb. 14, 2014

2.3.1 Land Zoning and Land Use Plans

There is no zoning in the Project area, and the Project area lies outside areas for which there is a land use plan. As mentioned above, the Property is registered to LIM (49%) and HML (51%).

2.3.2 Sensitive Areas

There are no protected areas such as national, provincial or regional parks in the Project area. Wetlands cover an area of 391 ha. There are no flora or fish species at risk, but there are three terrestrial fauna species at risks and four bird species at risk in the vicinity of the Project. For a depiction of the distribution of wetlands, caribou and avifauna in relation to the Howse Project, please refer to their effects assessment sections (Chapter 7): Figure 7-33, Figure 7-34, and Figure 7-35, respectively.

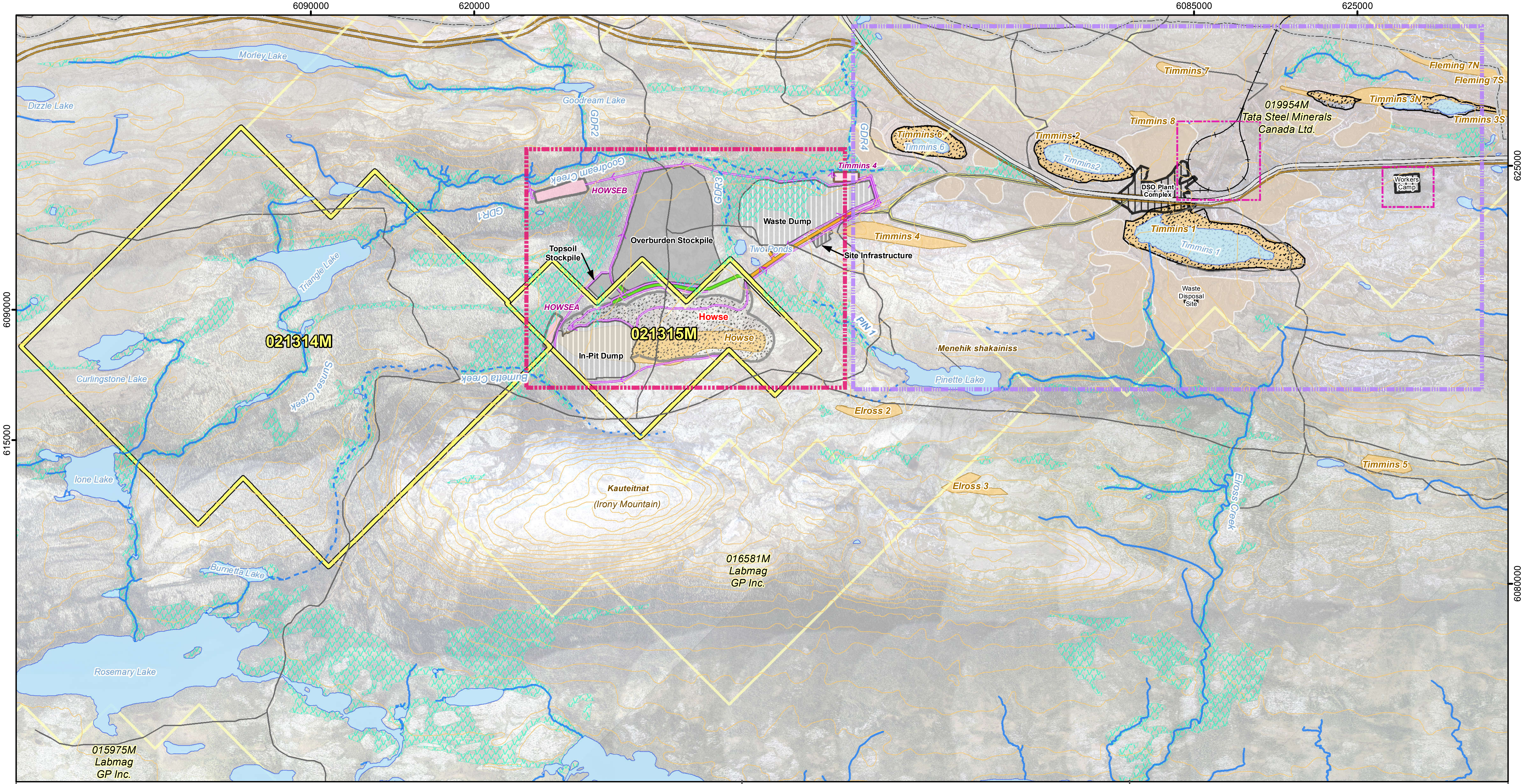
Two Aboriginal communities use the land in the vicinity of the Project: the Naskapi and the Innu. Pinette Lake has recreation value for the Aboriginal people of the area. Irony Mountain is of cultural and historical value for the local communities and Aboriginal people, especially the Innu.

2.3.3 Proximity to Federal Lands

The Howse Property is located on provincial Crown land. The distance of the Project (as the crow flies) from federal lands is shown in Table 2-5.

Table 2-5 Distance from the Nearest Federal Lands

<table>
<tr><th></th><th>FEDERAL LAND</th><th>APPROXIMATE DISTANCE FROM THE HOWSE PROPERTY
(km)</th></tr>
<tr><td rowspan="5">Québec</td><td>Schefferville Airport</td><td>24</td></tr>
<tr><td>Matimekush (Aboriginal community)</td><td>24</td></tr>
<tr><td>Lac John (Aboriginal community)</td><td>25</td></tr>
<tr><td>Kawawachikamach (Aboriginal community)</td><td>25</td></tr>
<tr><td>3 Wing Bagotville (Military base)</td><td>780</td></tr>
<tr><td rowspan="4">Labrador</td><td>Wabush Airport</td><td>222</td></tr>
<tr><td>Sheshatshiu (Aboriginal community)</td><td>479</td></tr>
<tr><td>Natuashish (Aboriginal community)</td><td>404</td></tr>
<tr><td>5 Wing Goose Bay (Military base)</td><td>472</td></tr>
</table>



LEGEND

Infrastructure and Mining Components

Howse Proposed Infrastructures

- Proposed Howse Pit
- Proposed Topsoil/Overburden Stockpile
- Proposed Waste Dump/In-Pit Dump
- Proposed Site Infrastructure
- Proposed Sedimentation Pond
- Proposed Ditch and Outlet
- Haul road - Upgrade
- Haul road - New Construction
- DSO Project Truck Road
- Howse Project Area
- Howse and DSO Shared

Existing Components

- Existing Railroad
- Road to DSO Area 4
- Existing Sedimentation Pond
- DSO Howse - Claim Labrador Iron Mines Limited(49%)/ Howse Minerals Ltd.(51%)
- Other Claim
- DSO Only

Elross Lake Area Iron Ore Mine (ELAIOM)

- Plant Infrastructure Footprint
- Existing Dump
- Existing Pit
- Deposit

Basemap

- Permanent Watercourse
- Intermittent Watercourse
- Storm Runoff
- Disappearing Stream
- Artesian Spring
- Water body
- Contour Line (50 ft)
- Provincial Border
- Existing Road
- Main Access Road
- Wetland

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0572a , PR185-19-14, 2016-03-21, edickoum

N

0 500 1 000 1 500 2 000
Meters

UTM 19N NAD 83

SCALE: 1:30 000

SOURCES:
Basemap
Government of Canada, NTDB, 1:50,000, 1979 Government of NL and government of Quebec, Boundary used for claims
SNC Lavalin, Groupe Hémisphères, Hydrology update, 2013

Infrastructure and Mining Components
New Millennium Capital Corp., Mining sites and roads
Howse Minerals Limited/ MET-CHEM Howse Deposit Design for General Layout, 2015

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Howse Property and TSMC DSO Project Infrastructure

Howse Minerals Limited

GroupeHemispheres

5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2

1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 2-1

2.4 PURPOSE OF THE PROJECT

By developing the Howse Property, the proponent is aiming to secure a steady supply of high-quality iron ore at a fair market price for Tata Europe or India and Asia. The Tata Steel Group intends to sieze the geographical opportunity of easy access to the pre-existing rail line and the proximity of an existing camp in the development of the Howse Project. As such, the Project can be brought into production in a relatively short period of time and at a low capital cost, because it requires few new installations, and some of the required infrastructure (e.g., railway, access road, camp, mining equipment and explosives storage area) is already in place at the nearby TSMC DSO project complex, which was recently put into operation.

The proponent will take a new approach to mining based on a partnership with First Nation groups and the signing and implementation of IBAs and other agreements, which will be implemented for the Howse Property Project. The latter will create local jobs and contracts and will stimulate local businesses. To date, up to $250 million has been given to First Nations and local businesses and communities in stakeholder benefits. The Howse Project will maintain those business relations.

At the regional level, many economical spin-offs are expected from the project. Namely, 138 direct new jobs will be created and approximately 800 existing jobs will be maintained. Further, businesses throughout Newfoundland and Labrador and Québec will receive income from the Project.

Based on those economic spin-offs, the following assumptions were made:

- The QNS&L and the Chemin de fer Arnaud will benefit from the project through increased ore transportation. In addition, $21 million was invested for the Tshiuetin railway, 60 jobs were created for First Nations communities during the rehabilitation of the railway, and increased revenues are expected for Aboriginal communities throughout the mine life;
- The Sept-Îles Port Authority and companies that work in the port will benefit from the activities associated with unloading trains, storing the ore and loading the ore carriers. Between 150 to 200 jobs are expected (Port de Sept-Îles, 2014). Also, $50 million was invested for the Sept-Îles multi-user port and nearly 1,000 jobs were created during the two years of construction (Port de Sept-Îles, 2014);
- The regional air carriers will benefit from transporting the large number of workers;
- Since the only other commercial link between Schefferville and the outside world is the Port of Sept-Îles, providers of goods and services in Sept-Îles will be in a strategic position to benefit from all phases of the Project.

2.5 ALTERNATIVE MEANS OF CARRYING OUT THE PROJECT

The decision to develop the Howse Property is motivated by the proximity of existing infrastructure, the high cost of maintaining the DSO4 road, ore transportation at current iron prices and the availability and quantity of high-quality iron ore at this location. Consequently, there are no viable alternatives to the Project at the macro scale.

Given that the ability to develop a mining operation is essentially determined by the location of the ore deposit, the only alternative to the Howse Project is the "no-build" scenario, which would reflect a loss of opportunity on several levels:

- given global demand, international investment might move elsewhere;
- locally and regionally, it would preclude the economic benefits associated with operating expenditures, taxation revenues to governments, infrastructure development and job creation;
- local people and First Nations would lose the opportunity to participate in the Project, with its corresponding financial and social benefits; and

- the positive effects identified would be lost if the Project is not built.

Further, the Proponent judges that there are no technically feasible alternatives to the following activities:

- pit wall slope angles (i.e. other than those proposed), because;
    - the Project design is based on the most conservative, standard methods known. As such, in an effort to produce the safest working environment possible, the Proponent has not considered any alternatives in this component of the mine design.
- bench heights through the iron deposit (i.e. other than those proposed), because;
    - the Project design is based on the most conservative, standard methods known. As such, in an effort to produce the safest working environment possible, the Proponent has not considered any alternatives in this component of the mine design.
- power supply (i.e. diesel, hydroelectric, wind-diesel, other);
    - the power supply will be generators, as used for the DSO complex. This will allow the Proponent to connect with the DSO system and reduce its overall number of generators.
- work scheduling (i.e. rotational work schedules on- and off-site);
    - The work schedule for the Howse Project is 12 hour shifts and two weeks rotations;
- use of a Dryer for the Howse Project, because;
    - high-humidity material is un-shippable and unusable during the winter months, and thus not a viable economic option for the Proponent. The dryer prevents wet ore from freezing during shipment.

The following sections present 10 Alternatives that have been considered by the Proponent. All available information is included in the analysis below, which considers economic, environmental, logistics and First Nation’s concerns. In most cases, the Proponent chooses to amalgamate its activities with existing DSO3 infrastructure, a strategy which minimizes the adverse environmental effects to VCs and First Nations, and often provides financial and logistical benefits to the Proponent as well. Final decisions were made where possible, but the Proponent remains adaptable in some cases.

2.5.1 Mine Production Rates (i.e. longer or shorter operations period)

The mine production rate for the Howse Project is 3.04 Mt per year (2018-2022) and 9.13 Mt per year (2023-2031) and 5.22 in 2032. The annual production levels and mine life of the Howse deposit were primarily selected due to the fact that this project will operate in tandem with TSMC’s DSO project.

The Howse Project’s mine life was selected to match the mine life of the DSO project. This will allow for the efficient sharing of infrastructure and personnel which will lower costs and improve efficiency across the two projects. Furthermore, this approach reduces the environmental impact of the Howse project as the disturbances in the area are limited to the same timeframe as the DSO project.

The reason a shorter mine life at a higher production rate was not selected was due to concerns over congestion in the area using 100 tonne trucks, which would increase emissions and dust generation and lead to less efficient mining. Due to the unconsolidated nature of the ore and overburden, larger equipment was not a viable option to increase production due to stability concerns with the larger excavators required.

2.5.2 Pit Method

The nature of the Howse iron ore deposit makes open pit mining the only viable mining method. No in-depth analysis into other mining methods is required due to the geometry and nature of the deposit. Any other mining method would simply be uneconomical or would involve leaving behind significant quantities of quality ore.

It's important to note that open pit mining is always the most economical way to move material on a dollar per tonne basis, due to the nature of using large mining equipment of large blast patterns to break rock. Underground methods are selected when the quantities of waste movement to access the ore become large enough that a higher cost underground mining method becomes more economical due to the fact that it can eliminate that waste movement. This means underground mining methods are preferable typically when an ore body is deep underground.

In the case of the Howse orebody, where an average of only 2.3 tonnes of waste need to be moved to access 1 tonne of ore in order to mine the entire orebody and large mining equipment can be used, this makes any underground mining method innately less economical than open pit mining.

In addition to the economics of open pit vs underground mining, the geometry of the Howse orebody makes it virtually impossible to envision any feasible underground mining method.

The top of the orebody lies 20-30 metres below the surface, and all of the overlying material is overburden, which means that a conventional open pit ramp is by far the safest and most economical way of accessing the orebody. Any underground method would lead to the entire mine being located under loose, unconsolidated rock which would require extensive structural work to ensure stability.

Furthermore, the large size and relative homogeneity of the deposit means that once the ore is contacted, the area to mine is a large expanse stretching 1500 metres in length, up to 300 metres in width, and up to 100 metres in depth. This means that any conventional underground mining method such as Cut & Fill, Sublevel Longhole, etc. is not suitable to this orebody since these methods are designed to target specific quality ore zones within in a large mineralization. The Howse orebody simply cannot be mined anywhere close to its entirety using these methods.

While certain underground mining methods are amenable to large ore bodies, these are not applicable in this case. Room & Pillar is not feasible due to the extensive depth of the deposit and the structural weakness of the ore, which would require massive pillars to ensure stability and thus too large a portion of the orebody would be left behind to never be mined. With other methods such as Sublevel Caving or Block Caving, the ore body is simply too large, close to the surface and too deep for this to be possible or economical.

In summary, there is no doubt that open pit mining is the most efficient and economical way of mining the Howse deposit, and the only mining method that could ensure an extraction of the entire orebody. Furthermore, due to the nature of the orebody and the structural nature of the ore, it's arguable that it would not even be possible to safely mine the deposit using underground mining methods.

Here, we consider the Alternatives to the *type* of open pit mining: the Mixed Conventional and In-Pit Alternative and the Conventional Pit Methods. The Mixed Conventional and In Pit Alternative (2) provides a better economic and environmental Alternative relative the Conventional Pit Method. Further, the Mixed Conventional and In Pit Alternative will also benefit First Nations communities and assist in the Decommissioning and Reclamation phase of the Howse Project. Although a slight logistical challenge is incurred by the Proponent in coordinating the waste transport/pit readiness, the Mixed Conventional and In Pit is therefore chosen as the preferred Alternative.

2.5.2.1 Alternatives Considered

Alternative 1:

Conventional Pit: Under this scenario, all waste piles are accumulated outside the pit, as with conventional open pit mines. The resulting waste pile heights are between 720-740 m in height and combined, they represent a footprint of more than 130 ha. In particular, the waste rock is estimated at 66 ha under this Alternative.

Alternative 2:

Mixed Conventional and In-Pit: A large portion of the waste material will be accumulated inside the mined portion of the Howse pit, resulting in an out-of-pit footprint of approximately 100 ha (namely a footprint of 39 ha for the waste rock). The remainder will be accumulated in nearby waste piles. Waste pile heights vary between 60-70 m in height for this Alternative.

2.5.2.2 Effects on VCs

Alternative 1:

Conventional Pit: Under this Alternative, the waste dumps are estimated to be 27 ha larger than under the Mixed Conventional and In-Pit Alternative.

Larger waste piles are expected to deplete landscape aesthetic and increase the Project footprint. Depending on their exact location (see Alternative 2.5.4), this additional footprint may destroy wetlands and/or wildlife habitat. This Alternative also implies the necessity for a corresponding system to capture runoff, and will require more effort to accomplish complete rehabilitation of the site during the Decommissioning and Reclamation phase.

Under the Conventional Pit Alternative, the Proponent will need to travel longer distances to transport waste material away from the pit, which will increase traffic on site. Consequently, this increased traffic will be more costly, deplete air quality (and GHG emissions), increase dust and noise, and increase the possibility of accidents. These effects are shown to affect the following VCs: air quality, water quality, caribou, avifauna and fish (see Sections 7.3 and 7.4 for Effects on Biophysical VCs). Further, all of these anticipated effects will affect First Nation's use of the land and will increase their concerns over the Project (see Section 4.3 Howse Project EIS Consultations).

Alternative 2:

Mixed Conventional and In-Pit: This Alternative reduces all of the anticipated effects on VCs described under Alternative 1. Under Alternative 2, however, the pit will be 6 ha larger than under Alternative 1. However, this effect is mitigated by the fact that the Mixed Conventional and In-Pit method will result in a smaller footprint (27 ha) incurred by the smaller waste dumps. Overall, the footprint for the Mixed Conventional and In-Pit method is 21 ha smaller than the Conventional Pit method.

2.5.2.3 Rationale for best Alternative selection

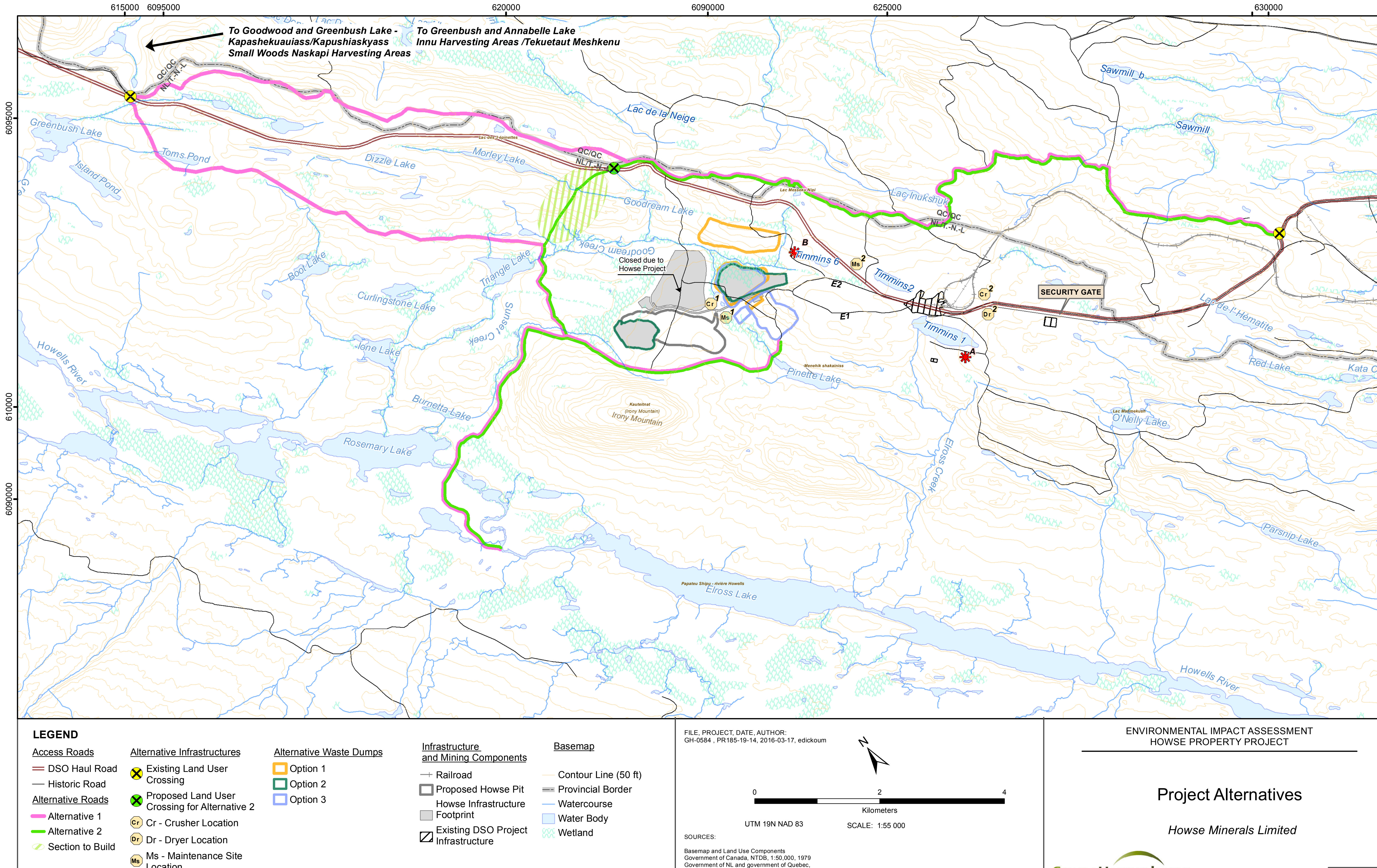
The selected alternative is 2, because it is less costly and incurs less environmental effects on VCs, and it will be preferred by First Nations.

Economics: Alternative 2 is less costly, by an estimated $2.5 million, largely incurred by the lower restoration costs during the Decommissioning and Reclamation phase. Further, the shorter route to transport the waste material under Alternative 2 will reduce fuel costs and the possibility of traffic accidents (which could be costly due to spills etc.).

Environmental: The smaller footprint from the Mixed Conventional and In-Pit Alternative reduces all effects on VCs.

Logistics: Both options are feasible but logistics will be slightly more complex for Alternative 2, as it necessitates additional coordination and waste material location management. However, the Mixed Conventional In-Pit method will facilitate the Decommissioning and Reclamation phase, as the Proponent expects to infill the pit throughout the operations phase, and thus essentially commencing the restoration process early.

Aboriginal: With the reduction of the size of waste dumps and corresponding environmental effects, Alternative 2 should be preferred by First Nations, as it will also result in less obstructed views, due to the correspondingly smaller waste dumps.



To Goodwood and Greenbush Lake - Kapashekuauiass/Kapushiaskyass Small Woods Naskapi Harvesting Areas
To Greenbush and Annabelle Lake Innu Harvesting Areas /Tekuetaut Meshkenu
Closed due to Howse Project
SECURITY GATE
Greenbush Lake
Toms Pond
Island Pond
Dizzle Lake
Morley Lake
Lac de la Neige
Goodream Lake
Goodream Creek
Lac Inukshuk
Sawmill
Timmins 6
Timmins2
Timmins 1
Boot Lake
Triangle Lake
Curlingstone Lake
Sunset Creek
Jone Lake
Howells River
Burnetta Lake
Rosemary Lake
Irony Mountain
Pinette Lake
Elross Creek
Elross Lake
Lac de l'Hématite
Red Lake
O'Nelly Lake
Parsnip Lake
QC/QC NL/T.-N.-L
615000
6095000
620000
6090000
625000
630000
6080000
6075000
610000
LEGEND
Access Roads
DSO Haul Road
Historic Road
Alternative Roads
Alternative 1
Alternative 2
Section to Build
Alternative Infrastructures
Existing Land User Crossing
Proposed Land User Crossing for Alternative 2
Cr - Crusher Location
Dr - Dryer Location
Ms - Maintenance Site Location
Explosive facility Location
Alternative Waste Dumps
Option 1
Option 2
Option 3
Infrastructure and Mining Components
Railroad
Proposed Howse Pit
Howse Infrastructure Footprint
Existing DSO Project Infrastructure
Basemap
Contour Line (50 ft)
Provincial Border
Watercourse
Water Body
Wetland
*Hydronyms are oriented along the direction of water flow
FILE, PROJECT, DATE, AUTHOR:
GH-0584 , PR185-19-14, 2016-03-17, edickoum
0 2 4
Kilometers
UTM 19N NAD 83
SCALE: 1:55 000
SOURCES:
Basemap and Land Use Components
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,
Mining Components
Howse Minerals Limited/
MET-CHEM Howse Deposit Design
for General Layout., 2015
Groupe Hémisphères, Hydrology and update, 2013
ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT
Project Alternatives
Howse Minerals Limited
GroupeHemispheres
5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 2-2

2.5.3 Bypass Road Locations

The location of the Howse Project requires that a section of road used by First Nations to access Pinette Lake and the Howells river valley be closed (see Figure 2-2). At the request of local First Nations Communities, the Proponent has upgraded an existing IOCC road and therefore made available the Timmins-Kivivik bypass road since August 2015, and this to accommodate First Nations' interests. The Timmins-Kivivik bypass road was an existing road that was in disrepair, built by IOCC, and was upgraded in consultation with First Nations. The Proponent does not assume ownership of this road, but is committed to its maintenance bi-annually in order to continue to accommodate First Nation's access to the land. With this mitigation measure, the Proponent is also on the same breath providing will provide additional access to the Howells River and Pinette Lake via this a bypass road.

Section 2.5.3.1 presents an analysis of the bypass road alternatives the Proponent is considering beyond the Timmins-Kivivik bypass road. Both bypass road Alternatives use the Timmins-Kivivik bypass road, which maintains access to traditional recreational and harvesting lands above the Howse and DSO activities. This bypass road starts and ends at two existing crossings (see Figure 2-2). Currently, First Nations' well-being, environmental considerations and legal options are all being considered by the Proponent in making a final decision between the bypass road alternatives.Figure 4-1 depicts the Alternatives described below.

2.5.3.1 Alternatives Considered

Alternative 1:

North Road – Greenbush: This road already exists in its entirety as it is an existing road that was built by IOCC. It connects to the Timmins-Kivivik bypass road via the Greenbush crossing to Triangle Lake, then to the Howells River and Pinette Lake, using an existing historic road between the planned Howse Pit and Irony Mountain. This Alternative is approximately 16 km longer than Alternative 2. The Proponent does not assume ownership of this road, but is committed to its maintenance bi-annually in order to continue to facilitate First Nations access to the land.

Alternative 2:

North Road – Triangle Lake: This Alternative connects to the Timmins-Kivivik bypass road between Morley Lake and Goodream Lake, via a crossing that will need to be built by the Proponent. From this crossing, the road will join Alternative 1 at Triangle Lake and follow the same course as Alternative 1. However, a section of road between the new crossing and Triangle Lake will need to be built (see Figure 2-2). The Proponent does not assume ownership of this road, but is committed to its maintenance bi-annually in order to continue to facilitate First Nations access to the land.

2.5.3.2 Effects on VCs

Alternative 1:

North Road – Greenbush: Since this road already exists (and is currently being used by light vehicles), it will have minimal negative effect on biophysical VCs. However, this Alternative requires a longer commute for local people to access the land (approximately 16 km), and so it may have a small effect on local air quality. Although this Alternative ensures that access to the land is preserved, it affects this the Access to Land VC by reducing the quality of the access. Further, the longer commute may result in more vehicle accidents and noise, which has been shown to affect wildlife (see Sections 7.4.3 and 7.4.8).

Alternative 2:

North Road – Triangle Lake: This Alternative requires the construction of approximately 1.3 km of new road to connect the Timmins-Kivivik bypass road to the existing road network. This section, depending on its exact route, which will be decided by the Proponent should this Alternative be retained, may cross wetlands, and will have to cross two streams. It is therefore expected that this Alternative will effect water quality (depletion), wetlands (destruction), and fish habitat (depletion). Further, construction activities will cause noise which will also cause wildlife disturbance (see Sections 7.4.3 and 7.4.8). This shorter route will likely be preferred by land users (as it will provide better access to the land).

2.5.3.3 Rationale for best Alternative selection

The selected alternative is undecided and will be confirmed in consultation with First Nations.

Economics: At the onset, the least expensive is Alternative 1, since it uses an existing road. Road construction is estimated at costing $76,017/km, representing a total of $98,822 for Alternative 2 (1.3 km of new road required). In addition, the Proponent estimates that it wil cost $1,200,000 to construct the stream crossings associated with this Alternative, for a total of $1,276,017.

Since the Proponent is committed to maintaining either bypass road Alternative bi-annually throughout the Project duration, the additional 16 km (approximately) of road under the North Road-Greenbush Alternative may results in a more costly Alternative in the long term. It is estimated that it will cost $5,515/km to maintain either bypass road. This represents a total annual maintenance cost of $176,480 for Alternative 1 and $14,339 for Alternative 2 (only considering those sections that are not identical to the two alternatives).

Environmental: Alternative 1 poses the least environmental issues for biophysical components, since it uses an existing road. However, it is expected that this longer route will deplete air quality due to longer travel times. Alternative 2 requires that 1.3 km of new route be constructed, which may destroy wetlands and deplete water quality. Under this Alternative, two streams will need to be crossed, thereby affecting water quality/fish habitat.

Logistics: The logistics of either bypass route involve the bi-annual maintenance to which the Proponent is commited. For this, the logistics of Alternative 2 (1.3 km) is smaller than Alternative 1 (16 km). However, the new road construction required under Alternative 2 poses large logisitcal constraints. Further, Alternative 2 requires that the Proponent arrange for the safe crossing of the DSO haul road by land users.

Aboriginal: The longer route presented in Alternative 1 may reduce the quality of land users access to the land. Further, longer travel times may increase the frequency of accidents.

2.5.4 Dump Locations

The Proponent analyses three alternative locations for waste dumps in this section. Figure 2-2 shows the locations of the three dump location alternatives considered. **The final Alternative is Alternative 2, because it has fewer adverse effects on the environment.**

2.5.4.1 Alternatives Considered

Alternative 1:

Alternative 1 has 3 waste dumps, located above and below the Howse haul road. The largest waste dump (furthest above the Howse pit) occupies a naturally sloped area. The waste piles under this Alternative have a footprint of 82 ha.

Alternative 2:

Alternative 2 has two waste dump locations, one above the Howse haul road and the other at the Howse In-Pit site (e.g. *within* the Howse Pit). Consequently, the out-of-pit footprint for this Alternative is 39 ha. This option is entirely removed from the Pinette Lake watershed.

Alternative 3:

This Alternative has dump components above and below the Howse haul road. Two of the three proposed sites are on the Pinette Lake watershed, with one dump site being within 300 m of Pinette Lake. The footprint for this Alternative is 71 ha.

2.5.4.2 Effects on VCs

Alternative 1:

This Alternative has the largest footprint. Therefore, this Alternative has the potential to destroy the most habitat, in particular because the largest dump location is surrounded by wetlands. Further, the 2nd-largest dump location is, for the most part, on wetlands.

This Alternative requires the longest travel routes for trucks to reach its topmost location (more than 2 km of road to travel from the Howse pit). Consequently, this Alternative implies a depletion of air quality and a potential for more road accidents. This location, however, is strategic in that it does not create a pile per se, but rather uses the natural landscape to depose of the waste. The aesthetic effect, therefore, is not as impactful as the other two Alternatives.

The location of parts of the waste dump below the Howse haul road is within the Pinette Lake watershed, and therefore could affect its water quality and associated fish habitat and ultimately, affect First Nation's land use at Pinette Lake.

Alternative 2:

This Alternative has a much smaller footprint than the others because the Proponent would use the mined part of the pit as a dump site. This Alternative also encroaches on wetlands, but to a slightly lesser extent as compared to the other two Alternatives.

Alternative 2 is completely removed from the Pinette Lake watershed.

Alternative 3:

Alternative 3 has a footprint of 71 ha, divided into three piles. Of these, two piles are on the Pinette Lake watershed, the closest being approximately 300 m from Pinette Lake.

2.5.4.3 Rationale for best Alternative selection

The selected Alternative is 2.

Economics: Aside for the longer travel routes incurred by Alternative 1 due to the location of the largest dump location, the costs of implementing all three Alternatives are comparable. The longer commute for Alternative 1 may be slightly more costly to the Proponent.

Environmental: The Alternatives with the largest footprint (habitat destruction, including wetlands) also have effects on Pinette Lake (adverse effects on water quality and fish habitat). The longer commute for Alternative 1 may result in more vehicle accidents and noise, which has been shown to affect wildlife (see Sections 7.4.3 and 7.4.8). As such, the logical Alternative from an environmental perspective is Alternative 2.

Logistics: The logistics incurred by Alternatives 1, 2 and 3 are similar.

Aboriginal: The fewer adverse environmental effects associated with Alternative 2 should be preferred by First Nations. Further, since Pinette Lake is frequently used by locals for recreational activities, the other Alternatives would be a cause for concerns for First Nations. The bypass road Alternatives considered by the Proponent also reach very close to Dump Location Alternative 3, which would not be appropriate.

2.5.5 Crushing and Screening Facility Location

The crushing and screening facility has a footprint of 1.5 ha. The Alternative to place the Howse crushing and screening facility at the DSO site (Alternative 2) poses no negative effects on economics, the environment (minimal, see below), logistics and/or First Nations, whereas Alternative 1 is more costly, it also creates additional environmental stress and requires additional loading/unloading and transportation of material.

Alternative 2 is therefore a logical way to proceed and clearly the preferred Alternative for the Howse Project.

2.5.5.1 Alternatives Considered

Figure 2-2 shows the proposed locations of the two Alternatives for the crushing and screening facility location.

Alternative 1:

The crushing pad will be placed near the Howse Pit (exact location to be determined).

Alternative 2:

Crushing pad will be placed near the rail loop.

2.5.5.2 Effects on VCs

Alternative 1:

If the Proponent were to place the crushing and screening facility near the Howse Project site, it would destroy an additional 1.5 ha of habitat, likely wetland, at the Howse site. Wetland destruction would necessarily correspondingly affect wildlife, through habitat destruction.

Alternative 2:

This Alternative places the crushing and screening facility in an area that is already heavily disturbed (no natural environment and air, noise and light emissions already created as a result of the activities at the DSO complex). As such, the placement of the facility near the rail loop is not expected to cause additional effects on VCs.

2.5.5.3 Rationale for best Alternative selection

The selected Alternative is 2 – the crushing and screening facility will be placed at the DSO site, near the rail loop.

Economics: Alternative 2 reduces the number of generators needed as it will use the DSO plant generator, which reduces costs.

Environmental: Although Alternative 2 requires that ore be shipped from the pit to the facility, it also places the facility in an already-disturbed area, thereby concentrating the disturbance in a single location, and avoiding the destruction/alteration of any additional habitat. Modelling confirms that noise will be reduced this way (Volume 2 Supporting Study E).

Logistics: Sharing of the facilities with other DSO projects renders the construction logistics of Alternative 2 simpler. Alternative 2 simplifies product manipulation by condensing all mineral processing facilities in two locations. Alternative 1 requires that the mineral be crushed at the Howse site, then manipulated once again at DSO3 facilities, thus necessitating repeated loading and unloading of product.

Aboriginal: No known effects.

2.5.6 Water Treatment

In this section, water treatment options with/without coagulant, are analyzed. Section 3.2.5 of the present document states that if any runoff water from the site exhibits water quality issues (other than suspended solids), treatment chemicals, such as a coagulant, could be added as a contingency measure to help destabilize the fine particles and help them co-precipitate out with the floc formed by the addition of a coagulant. Currently, since Howse operations are not ongoing on an annual basis, and the use of coagulant is not required under the GNL guidelines, and local information on water quality at adjacent project sites indicates that it is not inferior when it is untreated (i.e. no coagulant is applied), the use of coagulant is not expected for the Howse Project. Should it be required, the type of coagulant will be decided by the Proponent at a later date. Further, the Proponent is committed to conducting an economic and environmental feasibility study for each option.

The Proponent choses Alternative 1 (no water treatment) for the time being, but is committed to conduct ongoing water monitoring and implementing a coagulant if needed.

2.5.6.1 Alternatives Considered

Alternative 1:

No water treatment: Use of sedimentation ponds alone to allow sediment to settle for a known period of time prior to discharge.

Alternative 2:

Water treatment: Use of coagulant as water treatment could be added as a contingency measure at the entrance of sedimentation ponds with manual dosing pumps, and mixed naturally by the turbulence action of the incoming flow. The inorganic coagulant could be aluminum sulfate, iron salts or lime. The treatment chemicals will help destabilize the fine particles and help them co-precipitate out with the floc formed by the addition of a coagulant. Alternatively, an organic polyamide cationic flocculant could also be used to destabilize the fine iron oxide particles. An anionic flocculant could be added to enhance the settling rate of the coagulated particles if required.

2.5.6.2 Effects on VCs

Alternative 1:

This Alternative requires larger sedimentation ponds, and so increases the Howse footprint, thus potentially destroying sensitive habitat. However, the Howse Project will only build two new sedimentation ponds (HOWSEA, 1.9 ha and HOWSEB, 4.4 ha) and the third sedimentation pond is existing (Timmins 4 sedimentation pond 3, 3.4 ha). As such, Alternative 1 uses 3.1 ha of new footprint only, due to the larger sedimentation ponds. These values are based on the new sedimentation ponds being twice as large as those proposed under the present WMP (Volume 1 Appendix IV), as suggested in Section 3.2.5.

The new footprint could imprint on sensitive environmental areas. However, the current WMP plan, which includes two new sedimentation ponds that are planned without the use of coagulant, have been designed so that their imprint on wetlands is limited/minimized.

Alternative 2:

The Howse WMP (Section 3.2.5) estimates that ponds will be half the size presented under the current WMP. As such, under Alternative 2, the Howse footprint is smaller. However, depending on the Proponent's choice of coagulant, this treatment may need further management by the Proponent.

2.5.6.3 Rationale for best Alternative selection

The selected Alternative is 1

Economics: The cost of adding coagulant renders Alternative 2 more costly than Alternative 1.

Environmental: The addition of coagulant will decrease the Howse footprint: estimates indicate that sedimentation ponds will be half their size under Alternative 2. Local information on water quality at adjacent project sites indicates that it is not inferior when it is untreated (i.e. no coagulant is applied).

Logistics: Given that the addition of coagulant may not be necessary, the logistics of Alternative 1 are easier. Section 3.2.5 states that, based on the surface runoff water quality from the Timmins 4 site, a chemical treatment dosing system is not required.

Aboriginal: Other than the smaller footprint of the Project, this activity poses no known effects to local communities.

2.5.7 Explosives Transportation Route

The Proponent sees no Alternative but to use the existing DSO facilities for explosives storage. Trucks from explosives facility A will need to meet trucks with the detonators from explosives facility B, at which point the products will be mixed and trucked to the Howse Pit (see Figure 2-2 Depiction of project Alternatives). This is logically the safest, and preferred at all levels, for this activity. Rather, the Proponent assesses the different routes that trucks may take to transport explosives to the mine site. The safest and shortest route (Alternative 1) is chosen.

2.5.7.1 Alternatives Considered

Alternative 1:

Start at explosives location A and follow route E1 to meet a truck from explosives location B, and go to the Howse pit (see Figure 2-2).

Alternative 2:

Start at explosives location A and follow route E2, track back on E1 to meet a truck from explosives location B, and go to the Howse pit (see Figure 2-2).

2.5.7.2 Effects on VCs

Both Alternatives are very similar and will have very similar effects on VCs. However, Alternative 2 is slight longer (just under 1 km) and so may have more adverse effects on air quality.

2.5.7.3 Rationale for best Alternative selection

The selected Alternative is 1 because it is slightly less expensive, simpler, and safer.

Economics: Both Alternatives have the same economic costs. It can be assumed that the slightly longer route under Alternative 2 will render it slightly more expensive to the Proponent.

Environmental: It can be assumed that the slightly longer route under Alternative 2 may incur more adverse effects on air quality.

Logistics: Alternative 2 is more logistically complex at it will require that the truck containing the explosives track back onto route E1 to meet the detonator truck.

Aboriginal: Improved social acceptability resulting from the implementation of Alternative 1, as risk of accidents is reduced.

2.5.8 Winter (November-March) blasting

Based on the analysis below, the Proponent has chosen Alternative 1 (no winter blasting). However, the Proponent will blast infrequently in winter, and only if frozen ground or hard rock are encountered during winter overburden removal. HML is committed to implementing a seismograph for one year to assess vibration speed (peak particle velocity) during blasting. However, the blasting activity/schedule will be upgraded as needed, depending on the results. See Section 9.1.2 for more details.

2.5.8.1 Alternatives Considered

Alternative 1:

No winter blasting: Blasting will only occur between April and October if exceedances are detected.

Alternative 2:

Winter blasting: Blasting will occur all year.

2.5.8.2 Effects on VCs

Alternative 1:

This Alternative poses no negative effects on biophysical VCs.

Alternative 2:

This Alternative will create additional short-term noise between November and March, which may cause disturbances to wildlife (See Sections 7.4.3, 7.4.8, 8.6 and 8.7), as blasting creates avoidance behavior in caribou and avifauna. Further, this Alternative will deplete air quality between November and March (see Section 7.3.2). It is estimated that air quality will exceed allowable standards due to winter blasting 13 times in 5 years (Lalonde, personal communication).

2.5.8.3 Rationale for best Alternative selection

The selected Alternative is 1

Economics: Alternative 1 is more costly to the Proponent as it will slow down mining operations.

Environmental: Alternative 1 reduces the Howse environmental (noise and air quality) footprint during winter which will temporarily benefit wildlife and nearby people which may suffer from the estimated 13 times in 5 years that the air quality will exceed allowable standards due to winter blasting (Lalonde, personal communication). However, in delaying the Howse Project operations, Alternative 1 also delays the restoration process and thus delays the time for wildlife to return to the Howse site. As such, the relatively short-term and rare air quality exceedances may be acceptable to the Proponent. Winter blasting would avoid avifauna disturbance in summer, as there are very few birds in the Howse area in winter, and notably no species at risk. Further, winter blasting would not conflict with the migratory bird convention nor with breeding periods.

Logistics: The logistics incurred from either Alternative are equal.

Aboriginal: Aboriginal considerations will likely mirror the environmental ones, as air quality standards and wildlife health are both deemed important issues to Aboriginal communities.

2.5.9 Maintenance Site Location

The possible locations for the maintenance site are shown in Figure 2-2. The Proponent has chosen to use existing DSO3 Maintenance Site facilities. This will minimize environmental effects by reducing the project footprint and the need to build new structures at the Howse site.

2.5.9.1 Alternatives Considered

Alternative 1:

Build a new maintenance facility on the Howse Project Site.

Alternative 2:

Use existing DSO3 maintenance Site facilities.

2.5.9.2 Effects on VCs

Alternative 1:

Additional footprint will, depending on the exact location, create negative effects on sensitive landscapes (environmental or cultural sensitivity).

Alternative 2:

This Alternative poses no negative effect on biophysical VCs

2.5.9.3 Rationale for best Alternative selection

The selected Alternative is 2

Economics: Alternative 1 is more costly as it requires building new infrastructure.

Environmental: Alternative 2 is preferred as no extra footprint is needed. However, trucks will need to travel between 2-3 km to reach the existing DSO3 Maintenance Site (Alternative 2), thereby increasing the possibility of accidents (e.g. fuel spills) and emitting more GHGs.

Logistics: With Alternative 2, construction logistics would be facilitated, whereas Alternative 1 necessitates the construction of a new facility with installation of new water and power sources. Distance between existing DSO3 maintenance and Howse site is however minimal and should not pose any logistical problem.

Aboriginal: Reduced footprint will improve social acceptability from local communities.

2.5.10 Water Management Plan (WMP)

The selected WMP for the Howse Project is largely based on DFO and Aboriginal concerns over the integrity of Pinette Lake. Complete WMP for Alternatives 2 and 3 are provided in Volume 1, as Appendices V and VI.

2.5.10.1 Alternatives Considered

Alternative 1:

Part of the WMP infrastructures are within the Pinette Lake Watershed. Runoff from these infrastructures are pumped to Timmins 4 Pond 3. Runoff from all the other infrastructures will be discharged to Goodream Creek, including runoff from dewatering and runoff. No detailed plan is available for this alternative.

Alternative 2:

Part of the WMP infrastructures are within the Pinette Lake Watershed. Runoff on these infrastructure pumped to Timmins 4 Pond 3. Runoff on remaining infrastructures discharged to Goodream Creek, dewatering to Goodream Creek and pit runoff discharged in Burnetta Creek. (a copy of this plan is available in Volume 1 Appendix V).

Alternative 3:

Almost no infrastructures in Pinette Lake Watershed. Runoff of topsoil stockpile and in-pit dump to Burnetta Creek, Runoff on remaining infrastructures in Goodream Creek. Dewatering in Goodream Creek, Pit runoff in Goodream creek (2/3 in Timmins 4 Pond 3, 1/3 in HOWSEB). A copy of this plan is available in Volume 1 Appendix IV).

Table 2-6 Watershed Area variations

	GOODREAM CREEK	BURNETTA CREEK	PINETTE LAKE
Alternative 1	+100ha	-40ha	-61ha
Alternative 2	+22ha	+39ha	-61ha
Alternative 3	+46ha	-38ha	-9ha

2.5.10.2 Effects on VCs

Alternative 1:

This Alternative required significant watershed area changes, increasing the negative effects on aquatic fauna and water balance. Both DFO and Aboriginal groups expressed concerns over this plan.

Alternative 2:

This Alternative required large watershed area changes, but dewatering water flow allocation was better split between the Burnetta and Goodream watersheds.

Alternative 3:

This Alternative requires the smallest watershed area changes, particularly for Pinette Lake. The dewatering water flow allocation is better split between the Burnetta and Goodream watersheds, thereby minimizing effects on VCs.

2.5.10.3 Rationale for best Alternative selection

The selected Alternative is 3

Economics: There are no major cost differences between Alternatives.

Environmental: The footprint of the three Alternatives is similar; Alternative 3 minimizes the watershed area variation; Alternative 3 better divide dewatering and drainage water flows between Burnetta and Goodream creeks watersheds.

Logistics: All three Alternatives require comparable logistical efforts.

Aboriginal: Alternative 3 minimizes the biophysical effects on Pinette Lake, therefore increasing social acceptability to the project.

2.5.11 Summary of Project Alternatives

Table 2-7 presents a summary of the project alternatives considered for the Howse Project.

Table 2-7 Summary of Project Alternatives Considered

ACTIVITY CONSIDERED	ALTERNATIVE SELECTED	EFFECTS ON VC
1. Mine production schedule	The mine production rate for the Howse Project is 3.04 Mt per year (2018-2022) and 9.13 Mt per year (2023-2031) and 5.22 in 2032.	This design reduces effects on VCs by coordinating activities with adjacent mining operations.
2. Pit method	Mixed Conventional and In-Pit: A large portion of the waste material will be accumulated inside the mined portion of the Howse pit. The remainder will be accumulated in nearby waste piles.	Overall footprint of the Howse Project, traffic and overall disturbance effects will be mitigated.
3. Bypass road location	This Alternative is undecided	
4. Dump size and location	The Proponent has chosen the Alternative with the least adverse environmental effects	Habitat destruction.
5. Crushing and screening facility location	Use existing DSO3 infrastructure.	This Alternative poses no negative effect on biophysical VCs as compared to other Alternatives
6. Water treatment	The Alternative to not treat water is selected (use of sedimentation ponds alone)	This Alternative will result in larger sedimentation ponds under the WMP (habitat destruction)

ACTIVITY CONSIDERED	ALTERNATIVE SELECTED	EFFECTS ON VC
7. Explosives transportation route	The Proponent will use the shortest and safest route proposed.	This Alternative poses no negative effect on biophysical VCs as compared to other Alternatives
8. Winter blasting	No winter blasting: Blasting will only occur between April and October	This Alternative poses no negative effect on biophysical VCs as compared to other Alternatives
9. Maintenance site location	Use existing DSO3 infrastructure.	This Alternative creates a slight increase in traffic and a correspondingly slight depletion of air quality as compared to other Alternatives
10. Water management plan	Almost no infrastructures in Pinette Lake Watershed. Runoff of topsoil stockpile and in-pit dump to Burnetta Creek, Runoff on remaining infrastructures in Goodream Creek. Dewatering in Goodream Creek, Pit runoff in Goodream creek (2/3 in Timmins 4 Pond 3, 1/3 in H2)	This Alternative requires the smallest watershed area changes, particularly for Pinette Lake. The dewatering water flow allocation is better split between the Burnetta and Goodream watersheds, thereby minimizing effects on VCs.

3 PROJECT DESCRIPTION

3.1 PROJECT UPDATE

A preliminary Environmental Impact Statement for the Howse Project was submitted in February 2015 to CEAA. Following this submission, information requests were submitted to the Proponent, and which are adressed in the present document. This section outlines the improvements that were made to the Howse Project since February 2015, and since the project description submission. These improvements were made following regular meeting with federal experts and First Nations and primarily focused on, but not limited to, air quality, human health, permafrost and water quality.

The Howse Project footprint was improved overall, largely due to the Proponent's decision to conduct an in-pit mining technique (see Sections 2.5.2 and 3.2.1). This method reduces the out-of-pit waste rock dump footprint by approximately 27 ha, allows the Proponent to apply progressive restoration at the site while the mining operations are ongoing. This new project design was decided following consultations with First Nations. The Howse Project layout has also been adjusted to improve it's footprint characteristics; that is, the new footprint avoids wetlands and is entirely outside of the Pinette Lake watershed.

At the request of local First Nations Communities, the proponent has upgraded an existing IOCC road and therefore made available the Timmins-Kivivik bypass road. In addition to providing access to the land above the Howse Project site, the Timmins-Kivivik bypass road allows users to avoid the DSO haul road entirely, thus providing a safer alternative to access the land. With this mitigation measure, the proponent is also on the same breath providing will provide additional access to the Howells River and Pinette Lake via aa bypass road, as discussed in Section 2.5.3.

The WMP has been adjusted to minimize impact on the Pinette Lake watershed. Following discussions with the Department of Fisheries and Oceans and expressions of concern from First Nations, the watershed variation on Pinette Lake was reduced from 61 ha to 9 ha.

The Proponent will no longer need a low-grade stockpile. Rather, the remaining 20% low-grade ore will be mixed with higher-grade material to achieved desired grade, and shipped.

Numerous supporting studies were added to assist in the analysis of the environmental effects of the Howse Project, and are presented in Volume 2 of the present document. A focused study, including three field visits, on the common nighthawk confirmed its absence from the Howse Project site. A thorough literature review, field work and new data provided evidence for the absence of permafrost and field studies were able to confirm that the Project will not have adverse environmental effects on Pinette Lake. The results of a country food survey conducted in June 2015 were used to support a human health risk assessment and confirmed that the Howse Project poses no risk to human health, as it relates to country foods.

New field studies provided data on water levels and quality at Pinette Lake and Burnetta Creek, permafrost, hydrogeology and avifauna. In addition, monitoring equipment was installed to provide information on Pinette Lake and Burnetta Creek, light and soil quality. All of the new data acquired from field activities was cascaded into the effects assessment of all the components.

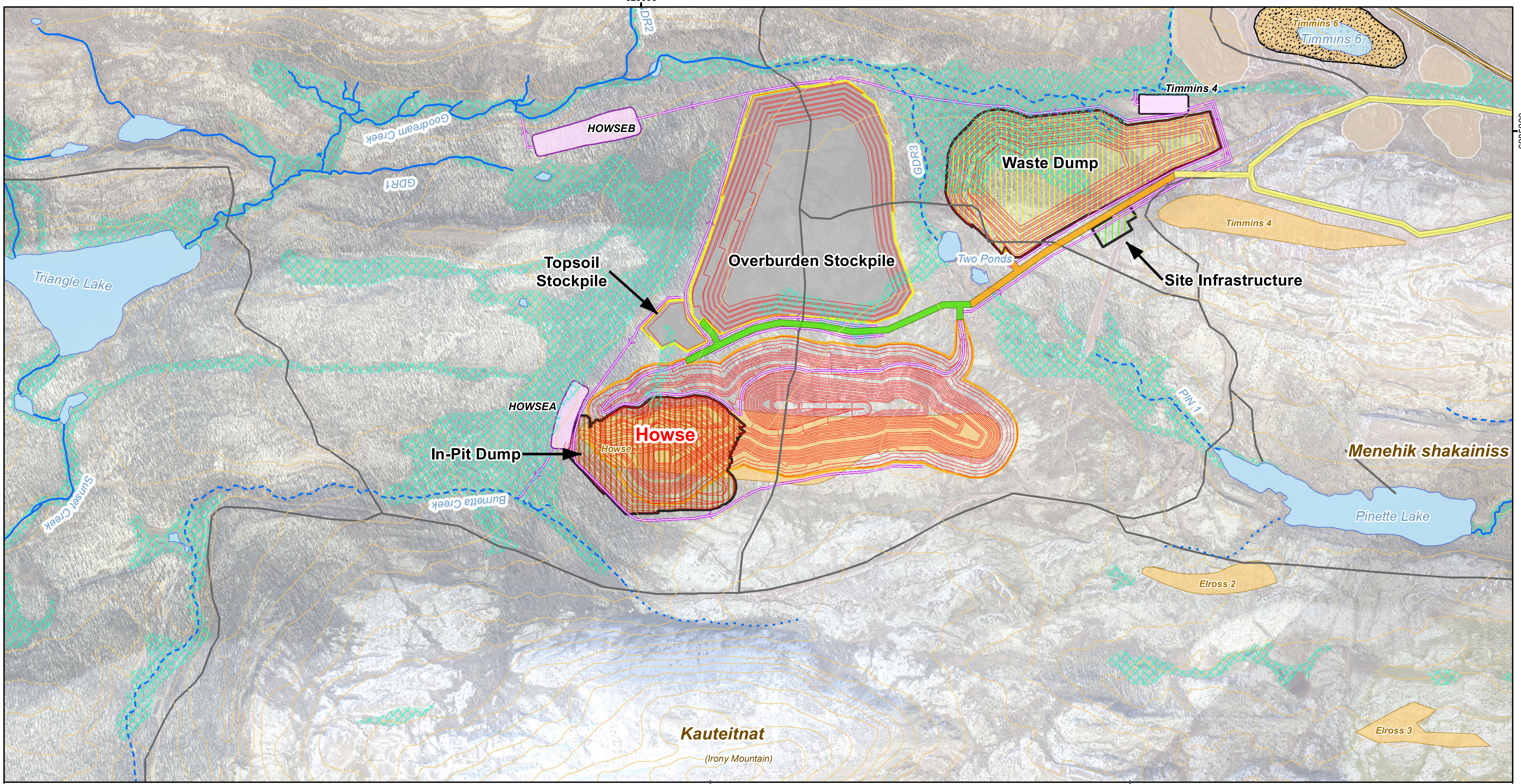
As of summer 2016, the electricity at the Workers' Camp is now supplied by the Main Plant GenSet which have a higher engine to generator efficiency than the diesel generators located at the Camp (95% vs 85%). The four diesel generators located at the Workers' Camp are still in place but only used for emergency situations (ex.: malfunction of the Main Plant GenSet or failure of the power line between the Main Plant and Workers' Camp). The Main Plant Generators loads and emission calculations presented in this report include the portion of electricity required at the Workers' Camp, since TSMC had already planned for this power switch; it just occurred faster than anticipated. The air modelling study was conducted assuming all generators were in operation and represent a theoretical worst-case scenario.

3.2 PROJECT COMPONENTS AND LAYOUT

Figure 3-1 shows the major physical features of the Project. The new physical works associated with the development of the Howse Property include:

- open pit;
- stockpiles (topsoil and overburden) and waste rock dumps;
- Howse haul road;
- bypass road;
- water management facilities and general site drainage works;
- diesel, light fuel oil and gasoline; and
- existing facilities.

Details of these Project components are provided in the following sections.



LEGEND

Infrastructure and Mining Components

- Proposed Howse Pit
- Proposed Topsoil/Overburden Stockpile
- Proposed Site Infrastructure
- Proposed In-Pit Dump
- Proposed Waste Dump
- Proposed Sedimentation Pond
- Proposed Infrastructure Contour Line (10m)
- Proposed Ditch and Outlet
- DSO Haul Road
- Existing Dump
- Existing Pit
- Deposit
- Existing Sedimentation Pond

Haul Roads

- Upgrade
- New Construction
- DSO Project Truck Road

Basemap

- Permanent Watercourse
- Intermittent Watercourse
- Storm Runoff
- Disappearing Stream
- Artesian Spring
- Water Body
- Contour Line (50 ft)
- Provincial Border
- Existing Road
- Main Access Road
- Wetland

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0572b , PR185-19-14, 2016-03-23, edickoum

N

0 200 400 600 800
Meters

UTM 19N NAD 83

SCALE: 1:15 000

SOURCES:
Basemap
Government of Canada, NTDB, 1:50,000, 1979 Government of NL and government of Quebec, Boundary used for claims
SNC Lavalin, Groupe Hémisphères, Hydrology update, 2013

Infrastructure and Mining Components
New Millennium Capital Corp., Mining sites and roads
Howse Minerals Limited/ MET-CHEM Howse Deposit Design for General Layout, 2015

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

HML Infrastructure and Layout

Howse Minerals Limited

GroupeHemispheres

5731, rue Saint-Louis,
Bureau 201, Lévis (QC)
Canada, G6V 4E2

1453, rue Beaubien est,
Bureau 301, Montréal (QC)
Canada, H2G 3C6

Figure 3-1

3.2.1 Open Pit

The Proponent will apply a Mixed Conventional and In-Pit technique to mining. This method will allow for the Proponent to accumulate a large portion of the waste material inside the mined portion of the Howse pit, resulting in an out-of-pit footprint of approximately 100 ha (namely a footprint of 39 ha for the waste rock). The remainder will be accumulated in nearby waste piles. Waste pile heights vary between 60-70 m in height.

The final dimensions for the proposed open pit are approximately 1,600 m long and 450 m wide at the top, with a maximum depth of 195 m. The anticipated footprint of the pit is approximately 78 ha projected surface area. Material from the pit will be drilled and blasted and subsequently extracted (Figure 3-2). Blasting at the Howse Property will occur approximately once per week during summer and infrequently during winter (the Proponent will blast infrequently in winter, and only if frozen ground or hard rock are encountered during winter overburden removal).

The optimal pit design for Howse is expected to contain 46 Mt of high-grade iron ore (@62.7% Fe), 50 Mt of overburden, 57 Mt of waste rock and 5 Mt of low-grade material. Depending on the final mine design and market value of the ore, the mine's service life is estimated at 15 years. The deposit has a strip ratio of 3.3:1 (calculated based on high-grade ore only).

The high-grade iron ore, which represent around 80% of the mineral resource, will be crushed and screened at the screening and crushing facility which will be located at the rail loop at a rate of 1.304 ROM Mt in 2018, 3.0 Mt per year between 2019 and 2022, 9.13 Mt per year between 2023 and 2031 and 5.55 in 2032. The finished product will be transported by haul trucks to the DSO product stockyard, where it will be loaded by loaders onto product reclaiming conveyors for subsequent loading onto rail cars. The remaining 20% low-grade ore will be mixed with higher-grade material to achieved desired grade, and shipped.

The mine design meets industry standards and complies with applicable provincial and federal legislation. For safety, environmental and economic reasons, the pit walls have been designed at a 35° slope throughout the overburden layer, at a 45° slope through the iron deposit above the water table and at a 40° slope through the iron deposit below the water table. As shown in Figure 3-2, overburden depth varies between 21 m and >50 m, with an average thickness of 25 m. For stability, 10-m high benches will be built through the iron deposit, with a minimum width of 6.5 m (Volume 2 Appendices A and B).

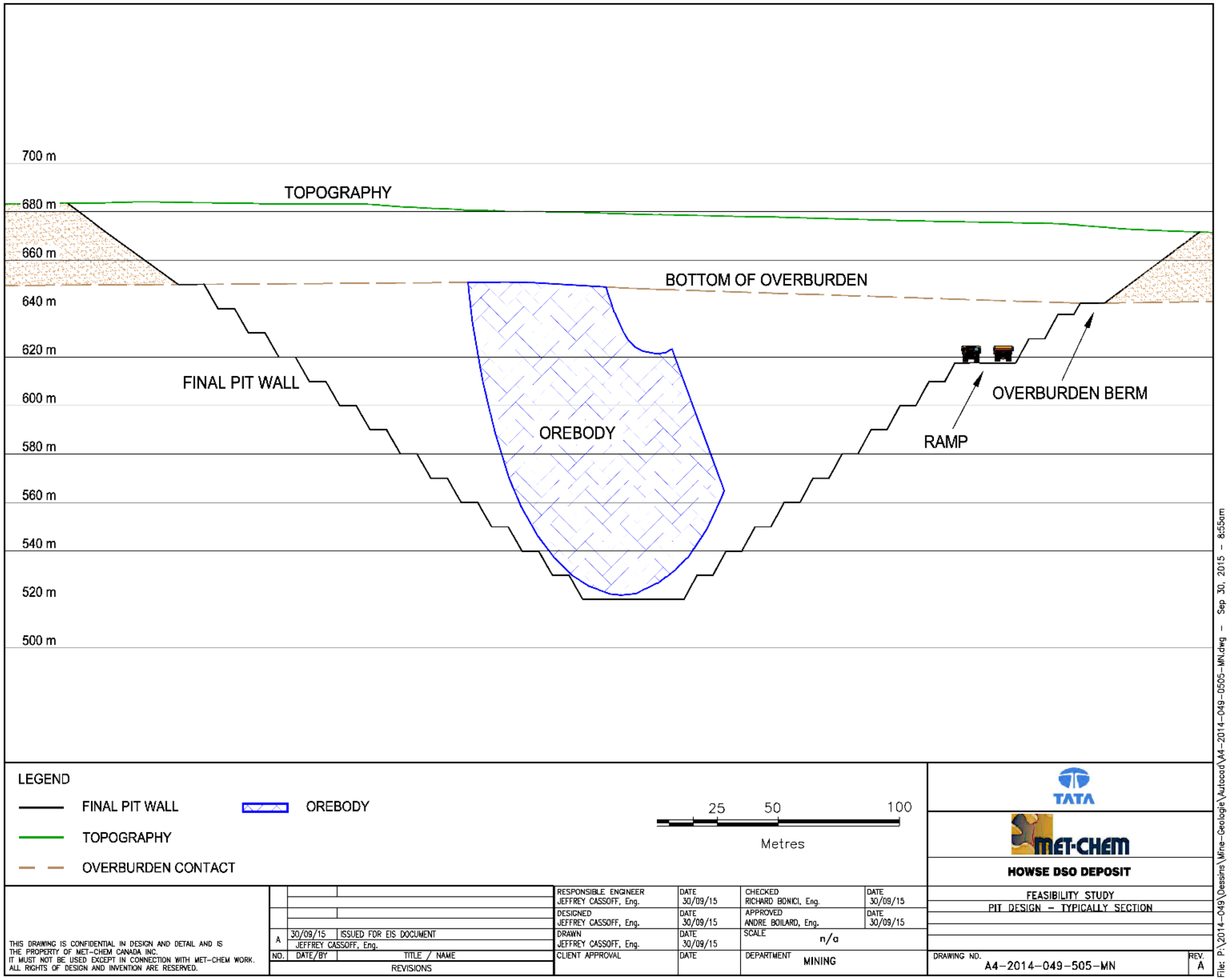


Figure 3-2 Typical Cross Section, Open Pit

3.2.2 Stockpiles and Waste Rock Dumps

As per mining regulations, organic material and topsoil from the pit and any disturbed area (waste rock dump, overburden stockpile, crushing and screening facility and roads) will be stripped and stockpiled for future site reclamation. This material will be stored in stockpiles around the property (see location in Figure 3-1). The overburden, consisting of surficial soil deposits and loose rock, will be piled in a single stockpile to ensure stability. The proposed location and footprint of the dump and stockpiles are shown in Figure 3-1.

All of the waste rock disposal area and stockpiles will have a perimeter ditch to capture water runoff that will be directed to sedimentation ponds. This drainage ditch network will be designed to direct the water for appropriate treatment before it is discharged into the environment (Section 3.1 for details). The dumps and stockpiles will be located within the claims, but outside of the ore boundary. As discussed in Section 7.3.5, acid rock drainage issues are not expected, but water quality monitoring will be done by HML to tests for PH changes. Further, regular testing will be done on the waste rock and waste stockpile to monitor for acid in rocks. If a potential risk is uncovered during monitoring, the material will be identified and specific monitoring will be implemented. As a result of this monitoring, HML will stockpile any problematic rock material separately.

Some of the waste rock and overburden materials will likely be salvaged for the bypass road upgrading and road maintenance, thereby proportionally reducing the corresponding dump/stockpile footprints. Measures will be taken to deter birds from nesting in piles of unattended soil (Section 7.4.8.3).

At the final stage, the maximum height of the dumps/stockpiles will be 60 m for the overburden, 70 m for the waste rock and 12 m for the topsoil.

The design parameters for the waste rock piles are as follows:

- face angle of 45º;
- bench height of 18 m;
- berm width of 15 m; and
- overall slope of 29°.

At the end of the fiscal year 2025, pile and dump volumes are predicted to be:

- Overburden: 15,816,000 m^3
- Waste dump: 8,326,000 m^3
- Top Soil: 192,000 m^3

At the end of the mine life, pile and dump volumes are predicted to be:

- Overburden: 18,308,000 m^3
- Waste dump: 14,768,000 m^3
- Top Soil: 234,000 m^3
- In-Pit: 12,923,000 m^3

3.2.3 Howse Haul Road

The Howse haul road configuration will take environmental, economic and safety factors into account. The amount of new road construction for the Howse haul road is 1.2 km and will be done on a disturbed area. In addition, 0.95 km of road will be upgraded to complete the road. These roads were built by the IOCC in the 1980s and so the Proponent assumes that ownership belongs to IOCC. The material used for the road construction will initially be tested for acid generating potential, as only materials showing no acid generating potential or metal leachate potential will be used. The Howse haul road location is presented in Figure 3-1.

Temporary ramps will be required in order to maintain accessible benches in the advancing wall. These ramps will either be cut with shovels or backfilled with waste rock. The ramps will be built with a maximum grade of 10%.

The road outside of the pit will have longitudinal ditches to collect the roadside surface water runoff and to convey the water affected by mining operations to a settling pond (Section 3.2.5 for more details).

Approximately 950 m of existing road from past IOCC mining operations will be upgraded and 1.2 km of new road will be built on disturbed land to connect the Howse deposit with the existing road near the Timmins 4 deposit, as shown in Figure 3-1. The road, which will be shared by mining trucks and light vehicles, will be designed for 64-tonne (CAT775) and 100-tonne (CAT777) haul trucks. For double lane traffic, HML has authorization to build the running surface width to two-times the width of the largest truck (rather than the standard three). The overall width of a 100-tonne haul truck is 6.2 m, resulting in a running surface of 12.4 m. The overall width of the haul road must account for safety berms and ditches.

The safety berm height will be a minimum of one half the height of the largest truck tire. The diameter of a 100-tonne haul truck's tires is 2.70 m. The safety berm slopes are 1.35 m high and 2.70 m wide with 45° angles (triangular shape). The maximum road grade will be 10% and the design will include a crown of 1% (minimum). The berms will be interrupted every 25 m in length to allow water to run into the ditches. Figure 3-3 shows a typical road section of 42 m including berms and ditches, which is wider than necessary but accounts for variations in topography.

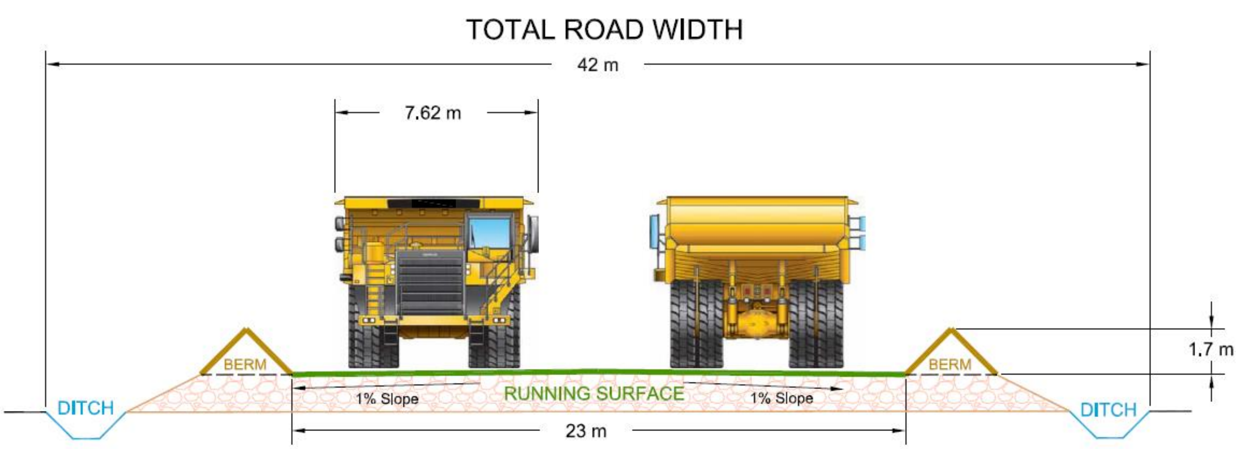


Figure 3-3 Typical Road Cross Section

3.2.4 Bypass Road

The proponent is committed to providing First Nations with access to the land throughout the Howse Project activities to compensate for the loss of a road as a result of the Howse Project location. Access will be provided via a new route to Pinette Lake and Kauteitnat. The exact specifications of the final route are currently being considered and full details are provided in section 2.5.3. In either case, the Proponent plans to conduct upgrades to existing roads and has no plans to build new roads.

Both bypass alternatives are located on Crown Land, were built by IOCC and have been used by First Nations for several decades. Neither TSMC nor HML assume ownership of the road upgrades. However, at the request of the community, the Proponent will maintain the chosen road twice per year during the project duration.

3.2.5 Water Management Facilities and General Site Drainage Works

The complete WMP is available in Volume 1 Appendix IV. A summary of the WMP is provided in the sections below. The WMP will use three sedimentation ponds, two of which will be built by the Proponent, and one which is existing (Timmins 4 sedimentation pond 3).

<u>Water use requirements</u>

The proponent plans to recycle water by pumping water from the sedimentation ponds if the quality satisfies the truck requirements. Potable water for office will come from the potable water treatment unit of the DSO camp.

3.2.5.1 Water Management Strategy

The Howse Property sits on three different watersheds leading to Pinette Lake, Burnetta Creek and Goodream Creek.

Figure 3-5 shows the general WMP layout. The water management strategy aims to manage surface runoff and pit dewatering water with as little effects as possible on these three watersheds. The WMP will avoid construction in sensitive areas like wetlands and will minimize flow variations in existing natural creeks. Further, existing infrastructure will be used, such as the Timmins 4 sedimentation pond 3. Water treatment will consist of removing suspended sediments by means of three (two new) sedimentation ponds.

In order to address the concerns of local stakeholders, no water will be discharged into Pinette Lake. All ditches will be protected against erosion with riprap to avoid any sediment production from the ditches themselves. The water management strategy is as follows:

- runoff from the west part of the in-pit waste rock dump, the topsoil stockpile and from the surrounding area on the south-west side of the site will be collected by a ditch leading to sedimentation pond HOWSEA and then discharged to Burnetta Creek;
- runoff on the waste rock dump, the site infrastructure (Figure 3-1) pad, and the overburden stockpile will be collected by ditches leading to sedimentation pond HOWSEB and then discharged to Goodream Creek;
- since underground water will seep into Howse pit as the pit depth reached the water table, pit dewatering will consist of pumping the water that accumulates into the pit and diverting it to a ditch on the north-east side of the pit, leading to sedimentation pond HOWSEB, and then discharged into Goodream Creek. The portion of the ditch receiving the dewatering water along the pit will be waterproofed to avoid infiltration of water directly back into the pit; and
- approximately 2/3 of the surface runoff from the Howse pit will be pumped into existing Timmins 4 sedimentation pond 3, to take advantage of its full sedimentation capacity, and then discharged into Goodream Creek. The remaining third, like the underground water, will be pumped to a ditch on the north-east site of the pit leading to sedimentation pond HOWSEB and then discharged into Goodream Creek.

The following schematic describes the WMP infrastructures and water fluxes between them (Figure 3-4).

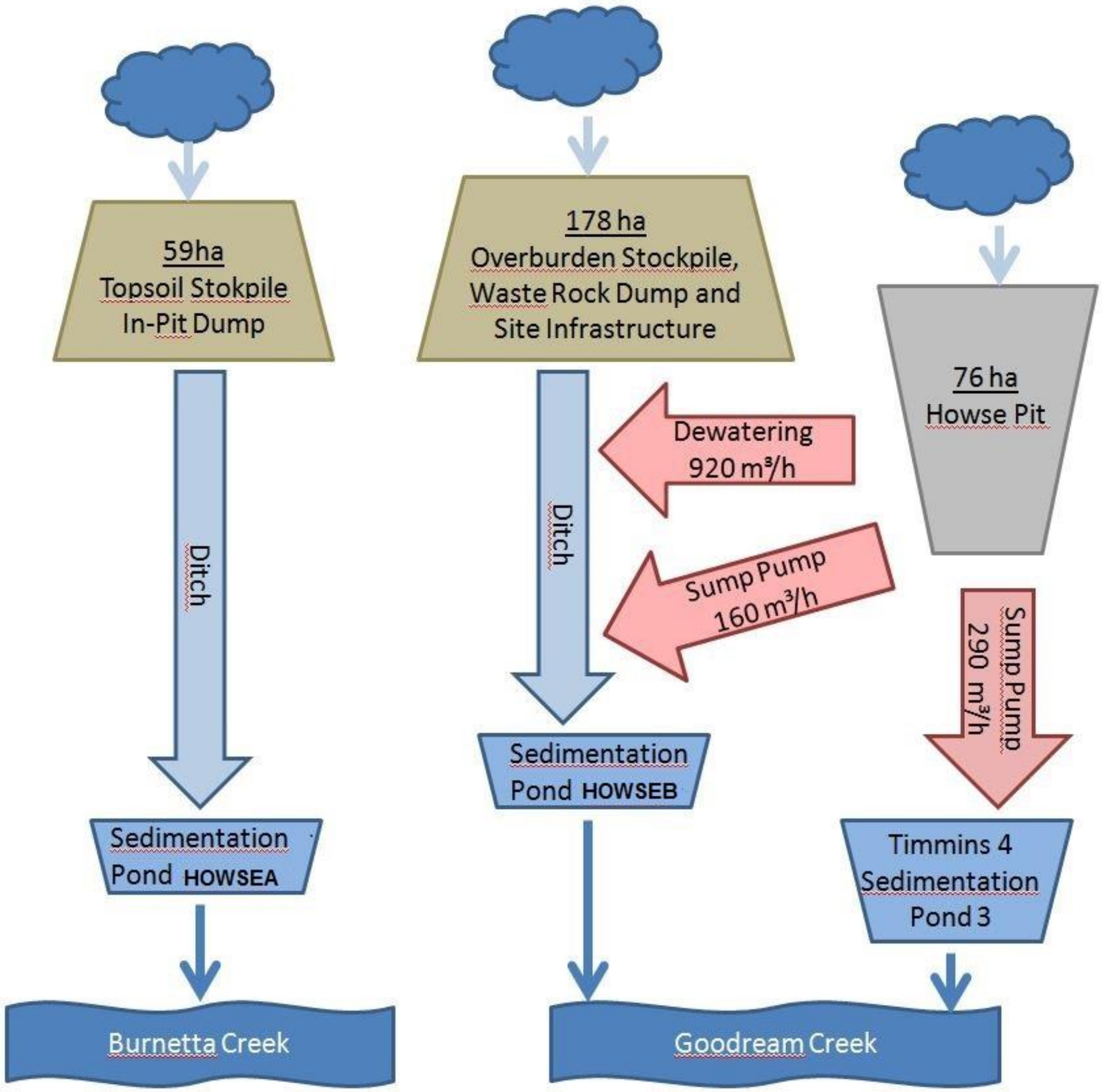


Figure 3-4 Water Management Plan Schematic

Table 3-1 Design Criteria of the Planned Water Management Infrastructure

TYPE OF CRITERIA	CRITERIA	VALUE	COMMENTS
Location criteria	Buffer zone between the infrastructure and Irony Mountain	500 m	--
	Buffer strip between the infrastructure and watercourses and wetlands	Minimum of 30 m	--

TYPE OF CRITERIA	CRITERIA	VALUE	COMMENTS
Environmental criteria	Alteration of Pinette Lake	No alteration in Pinette Lake water quality is accepted	No surface water from Howse mine site can be discharged into Pinette Lake, even after treatment through a sedimentation pond
	General location of the infrastructure	Avoid building infrastructures on wetlands, whenever possible	--
	Quality of runoff water and dewatering water	The only issue is assumed to be total suspended solids	See Water Quality and Treatment section for discussion on this issue.
	Pond and ditch waterproofing	No waterproofing	See Water Quality and Treatment section for discussion on this issue
Hydrological criteria	Source of meteorological data	Schefferville A meteorological station	
Ditch design criteria	Ditch longitudinal slopes	Minimum 0.5%	--
	Ditch transverse slopes	2H:1V	--
	Ditch excavation	Minimize volume of excavation	--
	Return period of design flow	100 years	--
Pond design criteria	Infiltration	No infiltration is taken into account	Pond bottom and sides assumed to be frozen during the spring freshet
	Dead storage for sediment	0.5 m	The frequency at which the sediments will need to be removed from the pond during the life of the mine will be evaluated in the next phase of the project. If sediment removal is required, it will be managed according to all applicable regulations
	Vertical distance between dike crest and spillway invert	1 m	--
	Pond outflow structure	Permeable rockfill dike	--
	Ice cover during design flood	0.5 m	The sedimentation ponds will naturally drain by gravity at the end of fall. Thus, there will be no significant build-up of ice cover during winter. Sedimentation pond HOWSEB receives water from pit dewatering operations. Thus, it is assumed that a 1-m ice cover will remain at the peak of the spring freshet.
	Return period of design flood for emergency spillway	100 years	Based on Canadian Dam Safety Guidelines for Significant Dam Class

TYPE OF CRITERIA	CRITERIA	VALUE	COMMENTS
	Return period of design flood for pond routing and sedimentation	25 years	--
	Design flood for pond routing and sedimentation	The worse of either: A summer-fall 24-hour 25-year return period rainfall; or Combinations of a 24-hour 25-year return period rainfall with the melting of a 25-year return period snowpack over 30 days	--
Sedimentation criteria	Design flow	Average 24-hour inflow during the peak of the design flood	--
	Specific gravity of particle to settle	2.7	--
	Design particle size to settle for sedimentation ponds	0.01 mm (10 microns)	Particle size selected according to assumed particle size analysis for overburden and waste rock. Pond designed to ensure minimum area requirement is met and a minimum residence time of approximately 5 h.
	Length to width ratio of the sedimentation ponds	Minimum 3 to 1	--

3.2.5.2 Dewatering

The conceptual dewatering rate for the Howse pit was estimated based on historical dewatering data from other similar mines in the area and using conservative assumptions.

An overview of historical mine dewatering at Knob Lake is given in Stubbins & Munro (1965). The Wishart, Gagnon, French and Ruth mines were studied. It was found that dewatering was significantly correlated with pit depth. Table 3-2 summarizes these results. The range of dewatering rates varied from approximately 16, 900 to 86, 500 m^3/d for those mines. This wide range of dewatering rates is due to several factors, such as pit dimensions, hydraulic conductivities of geological units, fault zones, proximity to water bodies, permafrost, and mining and dewatering operations, for which data is unavailable.

Results from measurements taken at the Timmins 3 and LabMag sites were used to create an estimate. Dewatering simulations were conducted for Timmins 3 and located about 5 km northeast from Howse deposit, and LabMag, located west of the Howse deposit. Dewatering rates (Table 3-2) for these two mines are similar to the ones measured at Wishart and Gagnon mines (between 13, 000 and 23, 000 m^3/d). Hydraulic conductivities for Howse iron ore units were estimated from pumping tests by Geofor in 2015 (Volume 2 Supporting Study B). Very similar results were obtained for Howse, Timmins 3 and LabMag deposits. Therefore, Howse dewatering rate is expected to be similar to Timmins 3 and LabMag dewatering rates.

Groundwater flow modelling results for the Howse deposit (Volume 1 Appendix V) further confirmed the similar dewatering rates between Howse, Timmins 3 and LabMag as a dewatering rate of approximately

14, 000 m^3/d was estimated for a base case scenario considering a safety factor of 1.5. However, this flow rate could reach higher values, ranging between 17, 700 to 31, 000 m^3/d, when considering slightly higher hydraulic conductivities values for the geological units surrounding the pit, and a slightly higher recharge rate. At the time of writing, field work is ongoing to obtain a more precise estimation of Howse dewatering rate.

Consequently, a dewatering rate of 22, 000 m^3/d was adopted for the present study. This value is relatively conservative and corresponds to an average value between 14, 000 and 31, 000 m^3/d.

The Howse deposit water table was found to be between 64 and 90 m deep (Volume 2 Appendices A and B). The dewatering rate is expected to be lower during the first years of mining operations as it will be limited to water from direct precipitation and infiltration through the unsaturated geological units. Later, when the pit depth reaches water table depth, dewatering rate will increase gradually, and reach a maximum value when the pit reaches its final depth. Dewatering will be ongoing all year long once the water table depth will be reached.

Table 3-2 Summary of Hydrogeological Data

TYPE OF DATA	MINE SITE	FLOOR DEPTH (M)	DEWATERING (M^3/D)	DATA REFERENCES
Historical DSO mine data	Wishart	69	16,874	Stubbins, J. B. and P. Munro. 1965. Historical information on mine dewatering of DSO (Knob Lake). The Canadian Institute of Mining and Metallurgy Bulletin, 58:814-822.
	Gagnon	83	20,412	
	French	116	84,370	
	Ruth	144	86,547	
Simulation results for new mines	Timmins 3	80	12,960	Groupe Hémisphères, March 2010. Hydrological and hydrogeological study: survey season 2009, DSOP. Final technical report.
	LabMag	150	22,262	SNC-Lavalin, in preparation. Hydrogeology and mine pit dewatering modelling - LabMag site. New Millenium Iron – TATA Steel
Assumption	Howse	160	22 000(*)	Geofor, personal communication, 2015
(*) Average value of the expected possible range.				

Water management infrastructures are designed based on the assumed dewatering flow rate of 22 000 m^3/d.

3.2.5.3 Water Quality and Treatment

Effluent Quality

Results from water quality analysis at the Timmins 4 mining operation were used to anticipate the water quality of the Howse Property based on their proximity to each other. The water quality results from sedimentation ponds B and C (samplings COA-SW11 and COA-SW12) were reviewed since they are the most representative of the effluent that is expected from the Howse Property.

Results from ponds B and C indicate good water quality that generally meets the requirements of the certificate of approval (GNL, 2012) for all parameters except for suspended solids, where the concentration in the water tested is slightly above 30 mg/L. The certificate of approval is based on the MMER, 2002 (Government of Canada, 2002). The concentration of total iron, which is not currently regulated by the MMER, was tested once and the result was high. This parameter will be closely monitored in the future, but it is assumed that iron is present in suspended solid form and should settle out in the sedimentation pond, thus lowering the concentration to acceptable limits. It is important to note that the MMER is currently under review and iron could be included in its next edition.

Consequently, for the purpose of this study, and assuming that any effluent collected on the Howse Property will have similar water quality as that observed at the Timmins 4 site, the main parameter of concern is assumed to be limited to suspended solids.

Types of Effluent

There are three types of effluent that will need to be managed on the Howse Property:

1) **Natural site runoff:** The main parameter of concern for natural site runoff will be suspended matter, specifically during heavy rainfall and snowmelt events. It is assumed that suspended solids will mainly consist of silt, sand and grit.

2) **Runoff from overburden and waste rock dump:** The overburden at the Howse Property is expected to be mainly composed of silt, sand and gravel. The waste rock is expected to be composed of fine rock particles. The waste rock is also expected to be non-acid generative. The main parameter of concern is assumed to be fine suspended matter.

3) **Pit dewatering:** The pit dewatering water will occur as a result of groundwater infiltration into the pit as well as surface runoff that flows into the pit:

    a. Groundwater: The groundwater is expected to be of similar quality to the natural site runoff. The groundwater pumped from the wells around the pit is expected to have very few suspended solids.

    b. Sump water: The main parameter of concern in the sump water from the pit is expected to be fine suspended matter. Total suspended solids in the sump water are expected to be high due to the mining activity in the pit.

    c. The sump water could also be contaminated with ammonia, nitrate, and diesel from unexploded explosive residues, and oil and hydrocarbon spills from machinery. In order to minimize the load of ammonia and nitrate that could migrate into the sump water, proper explosive management will be implemented, with the objective of limiting the leaching of ammonia and nitrate from the explosive into the water column. The explosive management could include the following:

        i. Proper selection of a water resistant based emulsion explosive.

        ii. Monitoring blasting performance based on explosive quantities, blast design and surface water quality.

        iii. Proper explosive handling in combination with proper spillage control in order to promptly remove explosive spills around the blast holes.

        iv. Proper blast design to minimize incomplete detonation of explosive.

To manage any oil and hydrocarbon spills from the machinery, once a spill is detected, it will be promptly contained and removed through the use of absorbing pads. Furthermore, to manage any diesel that could be present in the sump water, an oil/water separator system could be used to remove the diesel before the surface runoff is transferred to the sedimentation pond.

Two pumps will be used for mine dewatering, one in the north end and one in the south end. Godwin HL160M diesel powered centrifugal pumps were chosen based on the flow rates, heads and piping lengths. The pumps are 475 hp each.

Treatment Strategy

Sedimentation ponds will remove the suspended solids before the water is returned to the natural receiving streams. All the sedimentation ponds are sized to provide the required settling area to allow for the smallest design particle size to settle out in the pond.

The sedimentation ponds will not be lined with any impervious material to prevent or reduce water infiltration into the ground. Ammonia and nitrate residues are expected at very low concentrations in the effluent water, and are not expected to necessitate treatment. Regardless, effluent monitoring in accordance with the provincial and federal regulations will be conducted on a regular basis and specific treatment will be considered if ammonia and nitrate blasting residue concentrations are above the criteria. The only parameter of concern is suspended matter. Consequently, if some of the runoff water does infiltrate into the ground, it will not have a negative effects on the quality of the underlying groundwater.

An allowance of 0.5 m is provided at the bottom of the sedimentation pond for sediment storage. The frequency of sediment removal and management will be assessed in the next phase of the project and will follow all applicable regulations during the life of the mine.

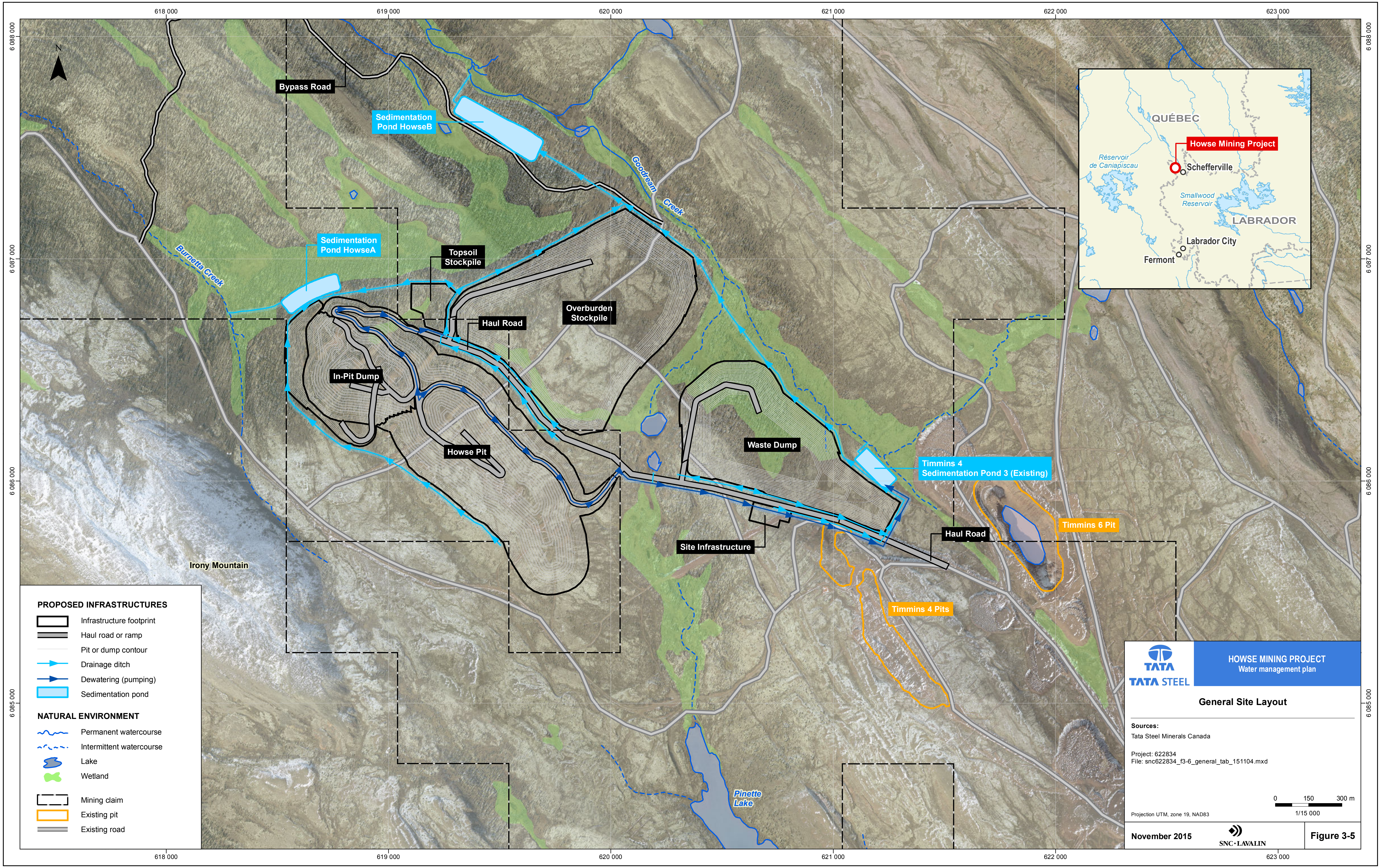
The sediments that are expected to settle out are silt, sand, gravel, grits and a small amount of hydroxide metals. As mentioned above, iron could be a source of contamination, but assuming the water quality will be similar to the one at Timmins 4 ponds B & C, it will be in negligible quantities. Dredging of the sediments may be required during mining operations if the sediment storage area fills up. Dredging involves excavating or pumping of the accumulated sediments out of the pond and transferring them for final disposal in the in-pit dump. However, based on the current information available from site, no dredging is anticipated since the quantity of sediments to be managed during the life of mine should fit in the sedimentation pond. At closure, the sedimentation pond will be covered to avoid any leaching of iron.

Based on the surface runoff water quality from the Timmins 4 site, a chemical treatment dosing system is not required. If runoff water from the overburden, waste rock dumps, or pit exhibits water quality issues (other than suspended solids), such as color issues due to the presence of fine iron oxide and hydroxide particles, treatment chemicals, such as a coagulant, could be added as a contingency measure at the entrance of sedimentation ponds with manual dosing pumps, and mixed naturally by the turbulence action of the incoming flow. The inorganic coagulant could be aluminum sulfate, iron salts or lime. The treatment chemicals will help destabilize the fine particles and help them co-precipitate out with the floc formed by the addition of a coagulant. Alternatively, an organic polyamide cationic flocculant could also be used to destabilize the fine iron oxide particles. An anionic flocculant could be added to enhance the settling rate of the coagulated particles if required.

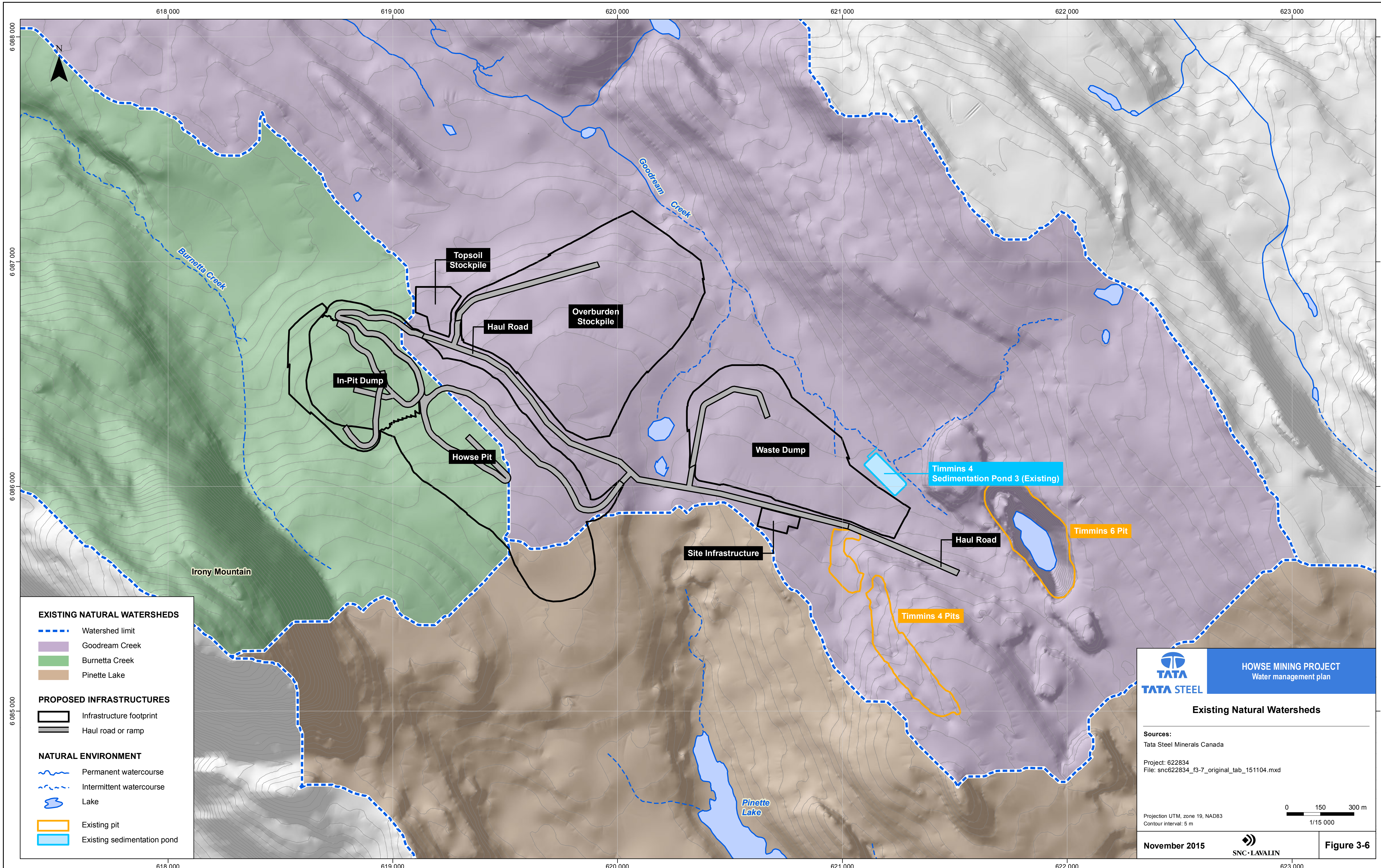
3.2.5.4 Water Management Infrastructure

The proposed site layout is shown in Figure 3-5. The layout was designed to minimize the effects on the natural watersheds in which the project will be constructed and to distribute the pit runoff and pit dewatering water in the most suitable watershed. Figure 3-6 shows the natural watersheds limits and Figure

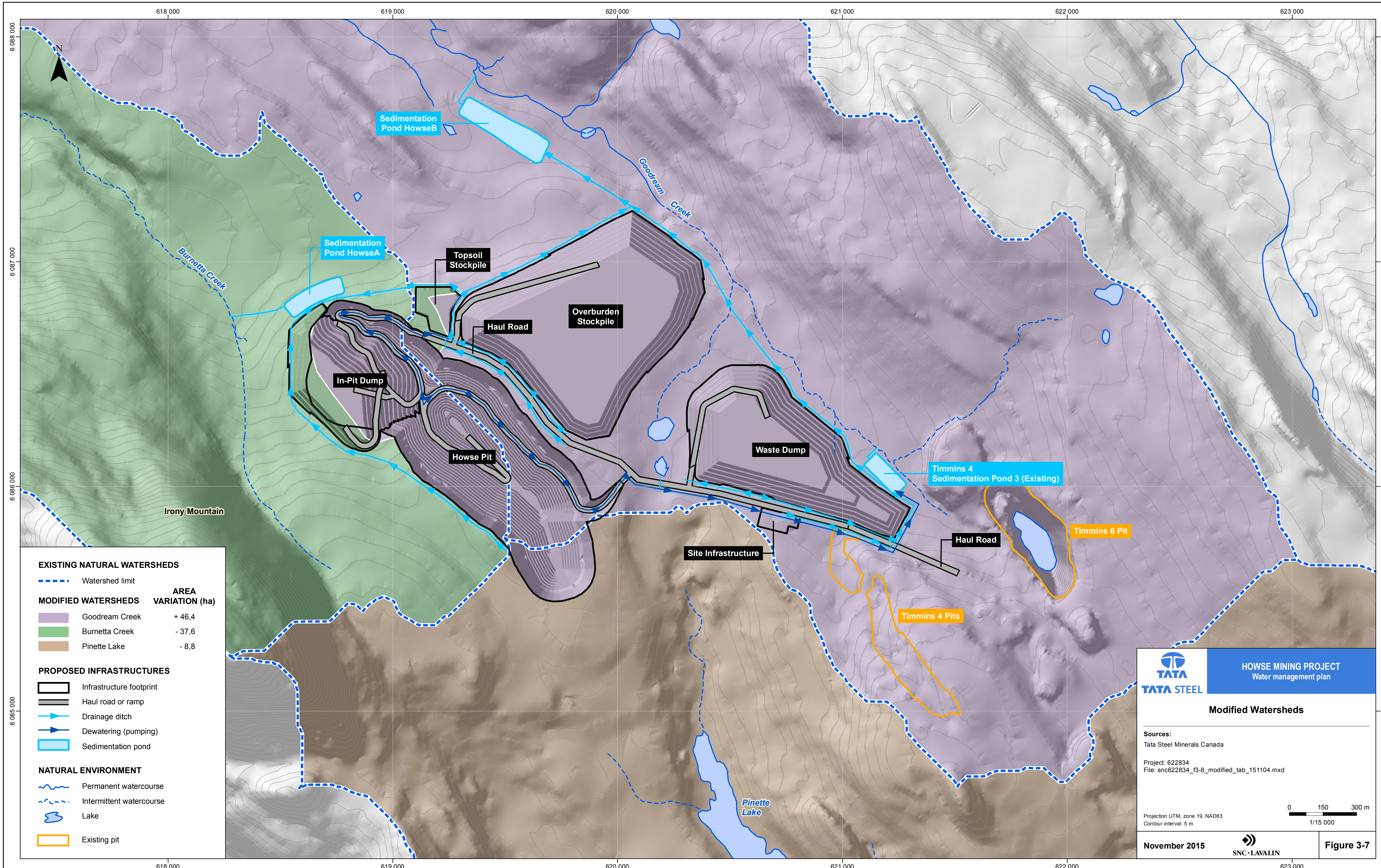
3-7 presents the modified watershed boundaries. The planned infrastructure and watershed areas are shown Figure 3-8 and Table 3-3.



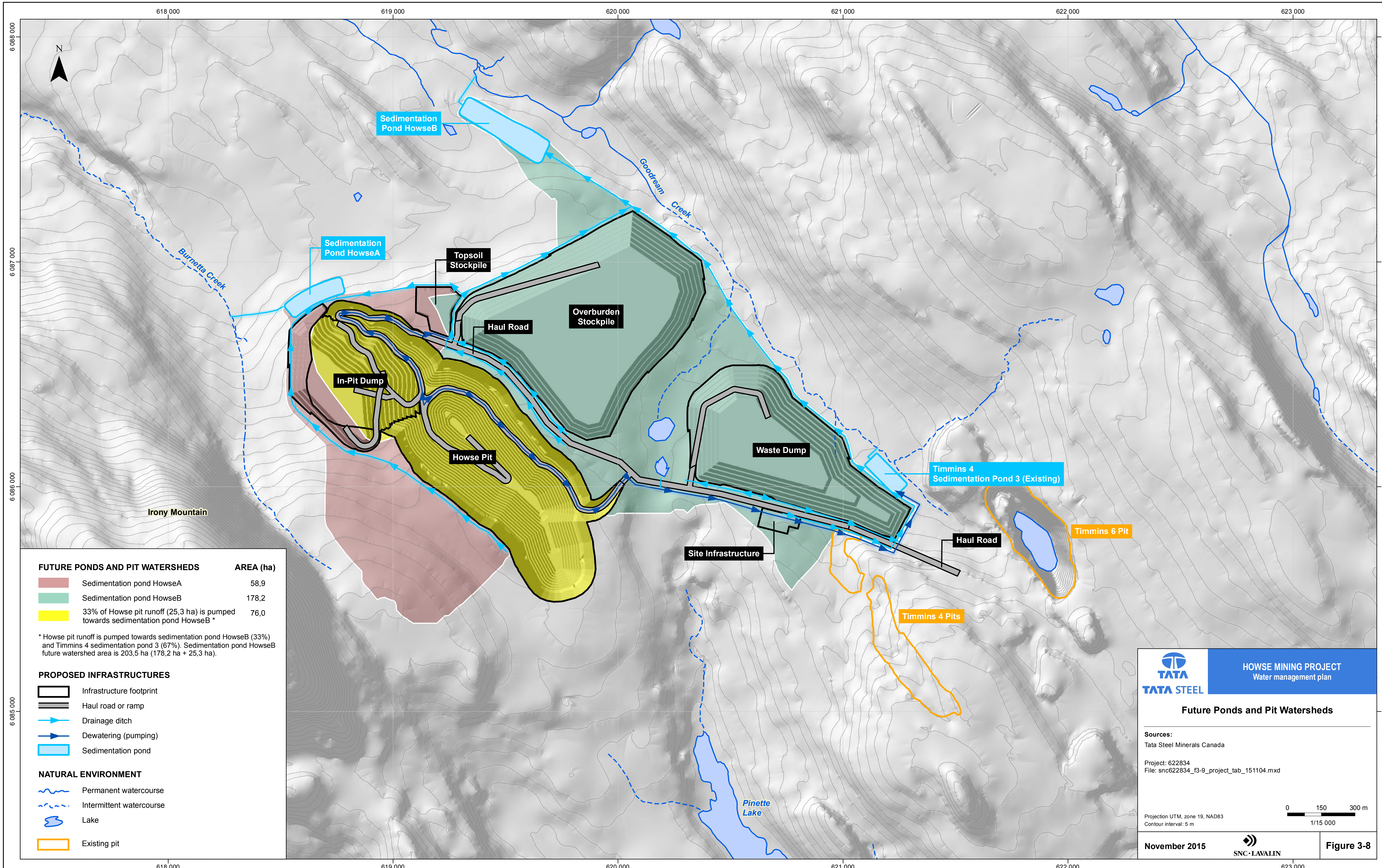
C:\Projets\622834 Howse\interne\diffusion\produit\etude_impact_2015\snc622834_f3-6_general_tab_151104.mxd



C:\Projets\622834 Howse\interne\diffusion\produit\etude_impact_2015\snc622834_f3-7_original_tab_151104.mxd



C:\Projets\622834 Howse\interne\diffusion\produit\etude_impact_2015\snc622834_f3-8_modified_tab_151104.mxd



618 000
619 000
620 000
621 000
622 000
623 000
6 088 000
6 087 000
6 086 000
6 085 000
N
Sedimentation Pond HowseB
Goodream Creek
Sedimentation Pond HowseA
Burnetta Creek
Topsoil Stockpile
Overburden Stockpile
Haul Road
In-Pit Dump
Howse Pit
Waste Dump
Timmins 4 Sedimentation Pond 3 (Existing)
Timmins 6 Pit
Haul Road
Site Infrastructure
Timmins 4 Pits
Irony Mountain
Pinette Lake
FUTURE PONDS AND PIT WATERSHEDS
AREA (ha)
Sedimentation pond HowseA 58,9
Sedimentation pond HowseB 178,2
33% of Howse pit runoff (25,3 ha) is pumped towards sedimentation pond HowseB * 76,0
* Howse pit runoff is pumped towards sedimentation pond HowseB (33%) and Timmins 4 sedimentation pond 3 (67%). Sedimentation pond HowseB future watershed area is 203,5 ha (178,2 ha + 25,3 ha).
PROPOSED INFRASTRUCTURES
Infrastructure footprint
Haul road or ramp
Drainage ditch
Dewatering (pumping)
Sedimentation pond
NATURAL ENVIRONMENT
Permanent watercourse
Intermittent watercourse
Lake
Existing pit
TATA
TATA STEEL
HOWSE MINING PROJECT
Water management plan
Future Ponds and Pit Watersheds
Sources:
Tata Steel Minerals Canada
Project: 622834
File: snc622834_f3-9_project_tab_151104.mxd
Projection UTM, zone 19, NAD83
Contour interval: 5 m
0 150 300 m
1/15 000
November 2015
SNC·LAVALIN
Figure 3-8

Table 3-3 Planned Infrastructure and Watershed Area (Mine End of Life)

INFRASTRUCTURE	WATERSHED AREA
Sedimentation pond HOWSEA	59 ha
Sedimentation pond HOWSEB	178 ha

Detailed information on infrastructure design is available in Volume 1 Appendix IV. A short description of the main water management infrastructure is provided in the following paragraphs.

Sedimentation Pond HOWSEA

Sedimentation pond HOWSEA is used to treat runoff water from the topsoil stockpile, part of the in-pit dump not flowing into the pit, and from the natural area located on the south-west side of Howse pit. This pond will be located on the west side of Howse pit and treated water will be discharged into Burnetta Creek. The pond will be located in a natural slope of about 5% and the downstream side of the pond will have to be confined with a dike. Runoff from the natural areas located on the south-west side of Howse pit will be collected and treated in HOWSEA to avoid the construction of any ditch and/or sedimentation basin outside of the claim limit, and to avoid having this water flow into the Pit, resulting into more pumping towards HOWSEB and increasing the release of water between different natural watersheds.

Sedimentation Pond HOWSEB

Sedimentation pond HOWSEB will receive runoff from the overburden stockpile, the waste rock dump, the site infrastructure (Figure 3-1) pad, water pumped from the peripheral wells used for Howse pit dewatering, and approximately 1/3 of the pit runoff. This pond will be located on the north-west side of the overburden stockpile, in a natural slope, and the downstream side of the pond will have to be confined with a dike. Treated water will be discharged into Goodream Creek.

Timmins 4 Sedimentation Pond 3 (Existing)

Timmins 4 sedimentation pond 3 is an existing sedimentation pond located on the east side of the Howse Project. It will be used to treat approximately 2/3 of the pit runoff water that will be pumped from the bottom of the pit.

Ditches

A network of collection ditches is used to collect contaminated runoff from the whole mine site, including the Howse haul road, the site infrastructure (Figure 3-1) pad, the topsoil stockpile, part of In-Pit waste dump, the waste dump, and the overburden stockpile. The collected contaminated water will be conveyed into sedimentation ponds HOWSEA and HOWSEB.

It was chosen to include the relatively small wetland area located between the overburden stockpile and waste dump in the area collected by the collection ditches and treated into sedimentation pond HOWSEB. This decision was based on the facts that:

- it will not be possible to avoid contamination of this area due to its close location between two stockpiles; and
- it would be technically difficult to cross the outlet of this area with the collection ditch necessary to collect runoff from the most eastern part of the mine site.

Inlet and Outlet Structures

The water inlet structures of sedimentation ponds HOWSEA and HOWSEB will be designed to promote an even distribution of the flow over the pond width. Ditches will be widened at the sedimentation pond entrance, and water will flow into the pond via an impervious ditch section with the use of a HDPE plastic membrane. This impervious section will avoid the formation of preferential channels at the pond entrance.

The outflow structure for all sedimentation ponds will be made of a permeable rockfill dike sized to avoid any spill over the emergency spillway during the sedimentation ponds design flood. The emergency spillway will be integrated within the rockfill in a way allowing for the passage of vehicles when the spillway is not in use.

The outlet structure of existing Timmins 4 sedimentation pond 3 will have to be modified into a permeable rockfill dike and an emergency spillway similar to those for sedimentation ponds HOWSEA and HOWSEB. This is necessary to ensure the good functioning of the pond with the additional pumped discharge from the pit, based on the same design criteria as the new ponds.

Downstream of the permeable rockfill dike, treated water from the sedimentation ponds will be collected and conveyed toward the receiving stream with ditches. These ditches will have a small longitudinal slope to ensure low flow velocities at the entrance of the receiving streams. If needed, energy dissipation measures could also be put in place before the junction with natural streams to avoid unwanted disturbance to the existing creeks.

Dike Construction Material

For this stage of the Project, it is assumed that the dikes on the downstream side of sedimentation ponds HOWSEA and HOWSEB will be built with compacted material, using overburden available on site (cut and fill). The suitability of this material for construction will be confirmed in the next phase of engineering, based on more detailed sieve analyses of the material and its percentage of fines. Permeable rockfill dikes and riprap will be built using non-acid-generating material.

3.2.5.5 Annual Water Balance

Water balance computations were made for an average year consisting of average hydrological conditions. Monthly average values for snowfall, rainfall, lake evaporation and evapotranspiration were used with the considered drainage areas to determine the corresponding monthly average volumes of water. The following assumptions were made:

- snow accumulates from October to April and melt completely during the month of May;
- pumping can only happen during the summer months. Therefore, runoff from October to May is pumped out of the Pit in May;
    - this condition will change when the pit depth reaches the water table, at which point pit dewatering will be conducted year-round.
- actual evapotranspiration could be limited by water availability in the ground during the summer months. For this reason, actual evapotranspiration is computed as being the minimum between net runoff and evapotranspiration;
- a runoff coefficient of 1.0 is assumed for the months of October to May, to take into account frozen or saturated ground conditions. A runoff coefficient of 0.4 is assumed for the months of June to September;
- drainage areas corresponding to a time period close to the mine end of life are considered; and
- pit dewatering occurs year long.

Water balance computations were made, for an average year, for the Howse mine pit (76 ha), sedimentation ponds HOWSEA (59 ha), HOWSEB (178 ha), and Timmins 4 sedimentation pond 3 (82 ha). Water balance Tables are available in the WMP Technical note in Volume 1 Appendix IV.

3.2.6 Diesel, Light Fuel Oil and Gasoline

Fuel for the crushing and screening facility generators and pumps will be stored at the DSO project complex facilities. The Proponent estimates the average amount to be approximately 13,500 L/day, excluding the generator for the plant, which will be part of the dome. Refueling will be done according to standard practice on the Howse Property Project site: by fuel trucks equipped with fuel spill kits. All of the mining equipment dedicated to the Howse operations (excavators, haul trucks, production drill, dozer and grader) will be diesel-powered. Heavy machinery in will be refueled on site, and light vehicles and trucks will be refueled at the DSO project, at the approved TSMC DSO project facility.

The EPP (Volume 1 Appendix Ia) provides guidelines on:

- petroleum products and waste oil – Section 3.2.4;
- fuel farm – Section 4.5;
- fueling trucks – Section 4.6;
- fuel reservoirs – Section 4.7; and
- spill management plan – Section 7.3.

3.2.7 Existing Facilities

The proponent will use the approved facilities at TSMC's DSO project plant complex for certain activities (NML and PFWA, 2009). DSO infrastructure is not considered in the scope of the Howse EIS as it was previously assessed under ELAIOM (Project 1a) by the GNL (Section 2.2). The DSO infrastructure that may be used by the Howse Project includes:

- processing plant. The ELAIOM processing complex comprises five main areas: the mineral sizing station, the fine crushing plant, the wash plant building, the dryer and the product storage area. The last three areas may be used to process the low-grade ore from Howse Project activities (20% of the mineral resource) during the end-stages of the Project;
- crushing and screening and drying facilities;
- rail loop loading system. Under the SF and SPF stockpiles, three belt feeders in a tunnel will reclaim the material for loading into rail cars. One product can be loaded at a time. The system is designed to load at a capacity of 4,000 tph. It takes approximately six hours to load a 240-car train;
- existing railway track;
- camp to accommodate the workers maximum capacity is 192. All sewage treatment is managed at the camp;
- administration building, housing office space for all departments, wash facilities, laboratory and a small cafeteria;
- warehouse;
- workshops;
- garages. The mine equipment maintenance garage building is included in the wash plant building. It includes a wash bay, four major equipment maintenance bays, a tire shop and service bay, a drill repair area and a small-vehicle service area;
- landfill. Solid waste is collected around the site in animal-resistant containers. A contractor disposes of the contents of the containers in a waste management site near Timmins 1. This site meets or exceeds relevant GNL regulatory standards.

Apart from the increase in vehicle traffic, the Howse Project is not likely to put any additional pressure on the management of DSO project plant complex activities. No tailings or process water will be generated during the processing of the high-grade product. The capacity of the workers' camp will never exceed its limit of 192 workers, and no increase in domestic waste is therefore expected from the Howse Project.

The ROM ore from the Howse Property pit will be hauled by truck to the DSO rail loop to produce a final product consisting of 15% lumps and 85% sinter fines (Figure 3-9). The Proponent anticipates using one primary jaw crusher and two secondary cone crushers (see Volume 1 Appendix II for crusher specification sheets). Because it will be located at the DSO rail loop, the water management for the crushing and screening facility will be under the DSO3 WMP. A peripheral ditch will be built around the mobile crushing and screening facility to collect runoff water. Power for the crushing and screening facility will be provided by diesel generators (power and emissions details available in Section 7.3.2), and will not create any increase in capacity, as the generators are already in continuous operation. Dryers are 4.3 m in diameter and 26 m long, and dryer burners are rated for a maximum capacity of 166 GJ/hour. A complete list of the equipment that the Proponent expects to use in the crushing plant is available in Volume 1 Appendix II.

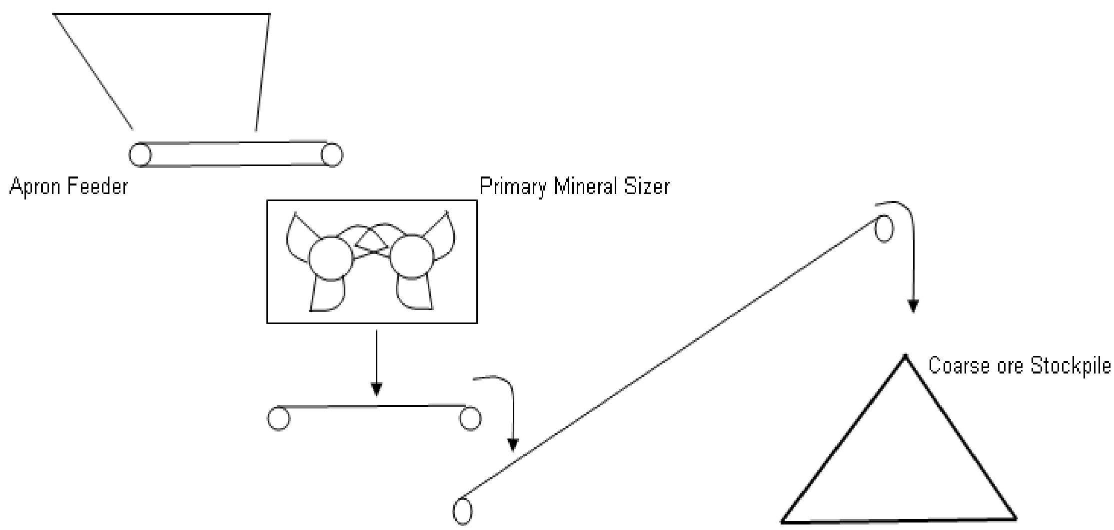
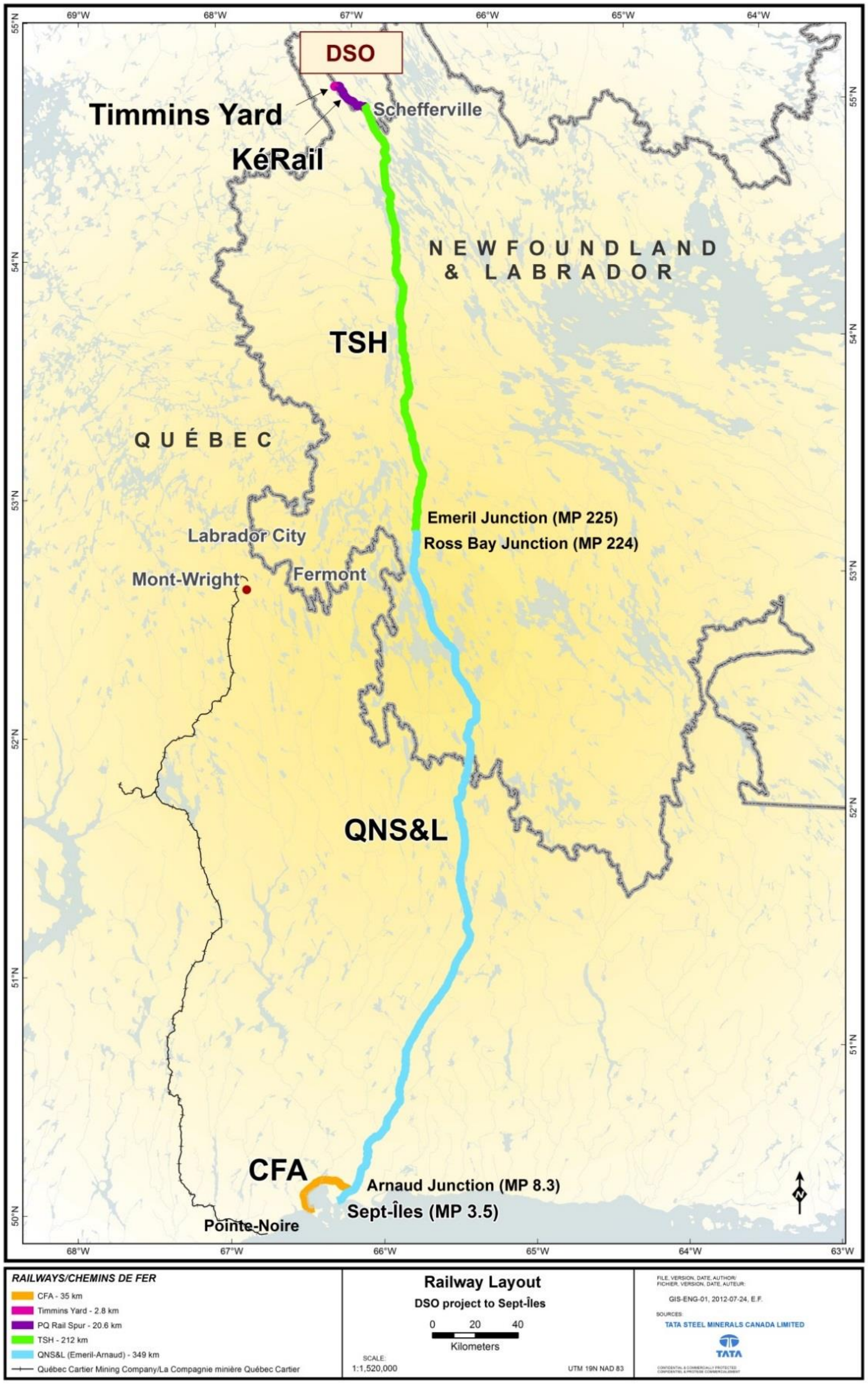


Figure 3-9 Crushing and Screening Facility Flowchart

Once at the rail loop loading area, the ore will then be transported by train to Sept-Îles and then by ship to markets in Europe, India and Asia. On average, two trains per day will depart from the TSMC loading facility from April to November, when iron ore is being mined simultaneously at the Howse Property and TSMC DSO projects. For the rest of the year, when iron ore is extracted only at DSO 3, one train every other day (three to four trains per week) will depart from the TSMC loading facility. There are five different companies operating the rail lines between the TSMC loading facility and Sept-Îles (Figure 3-10):

- KeRail: From the TSMC loading facility to French Mine (QC / NL border);
- WLR2013: From French Mine to TSH;
- TSH Rail: From TSH Junction to Emeril;
- QNSL Rail: From Emeril to Arnaud Junction; and
- CFA Rail: From Arnaud Junction to Pointe Noire (Port of Sept-Îles).



Source: Tata Steel Minerals Canada Ltd. (2014)

Figure 3-10 Train Companies Operating between DSO and Sept-Îles

Ore from the Howse Property would be unloaded at the Port of Sept-Îles and stockpiled at the Pointe Noire ore handling facilities and would then be reclaimed and conveyed to the multi-user dock and ship-loaded. It is expected that during the Howse Property Project operation phase (2017 to 2032), 10 to 15 more Capesize vessels will load per year at the multi-user dock. Tata Steel and its joint venture partner New Millennium Iron Corp. have jointly contributed $50 million for the construction of the new multi-user port, scheduled to be operational by summer 2015. The Québec Government is currently making installations at the site.

3.3 PROJECT ACTIVITIES

Activities are described in the sections below by project phase and associated sources of effects.

3.3.1 Site Preparation and Construction Phase

The construction phase involves the following activities:

- uupgrading/construction of the Howse haul road and upgrade of a bypass road;
- pit development; and
- transportation and traffic.

HML will ensure that all permits and authorizations from appropriate regulatory agencies are obtained prior to the start of construction in order to comply with laws and regulations from both governments. Mobile toilets will be installed at the work sites, and sewage will be transferred to the existing treatment unit at the worker's camp. All vehicle repairs and maintenance will be carried out at the DSO processing complex near Timmins 1.

In general, potential sources of effects associated with general site preparation and construction phase activities include:

- light emission from the Howse Property site lighting system;
- noise, vibration, emission of air contaminants and dust from heavy machinery use and light vehicle traffic; and
- stripping of vegetation, excavation and sediment runoff from construction activities.

3.3.1.1 Construction/upgrading of the Howse Haul Road and Bypass Road

Road upgrades will not occur during snowmelt. The stripping of vegetation will occur outside the migratory bird breeding season. In the event that a permanent watercourse crossing cannot be avoided, a properly sized culvert will be installed in such a way that connectivity, fish passage and fish habitat will be preserved. This will be achieved by installing an arched culvert anchored at the high watermark or a clear-span bridge on fish-bearing streams.

Potential sources of effects associated with road construction include:

- stripping of vegetation, excavation, sediment runoff; and
- noise, vibration, emission of air contaminants and dust from heavy machinery use and light vehicle traffic.

3.3.1.2 Pit Development

Pit development includes: vegetation clearing, stripping and grubbing of the open pit area, the creation of a waste rock dump, stockpile area and water management infrastructures (sedimentation and transfer ponds, drainage ditches). As required, equipment will be used to push the resulting debris into piles, the location of which will be determined at that time. All timber material will be piled and made available for removal in compliance with commercial cutting regulations. Erosion and sediment control measures will be applied and maintained as required for the duration of the Project to reduce the amount of sediment discharged into the water bodies. All of these standard mitigation measures and good practices are presented in the Water Quality effects assessment (Section 7.3.10) as well as in Volume 1 Appendix VI. One excavator and three 64-tonne haul trucks will be required during the pit development phase. Truck traffic during the construction phase is anticipated to be 3.2 one-way trips per hour. Including other vehicles, total traffic could reach four one-way trips per hour.

Part of the overburden and waste rock at the open pit area will be removed/blasted during pit development. A portion of this material (6,004,000 tonnes of overburden) will be used in the preparation of the Howse haul road and pad for the crushing and screening facility.

Potential sources of effects associated with pit development include stripping of vegetation, excavation, minimal use of explosives, sediment runoff, and emission of air contaminants, dust, noise, vibration and light.

3.3.1.3 Crushing and Screening and Dryer Facility

The crushing and screening facility will consist of two units and will be located at least 100 m away from any watercourse or water body. The electricity required to run the facility will be provided by generators located at the main plant.

Potential sources of effects associated with transportation and installation of facilities include stripping of vegetation, and noise, vibration, dust, suspended solids and exhaust gases from heavy machinery and other vehicles.

3.3.1.4 Transportation and Traffic

Workers will commute on a daily basis from the workers' camp near Timmins 1. The Howse haul road will be used to transport all equipment, fuel and personnel. An average of 70 trips will be made on a daily basis by trucks and other light vehicles, causing moderate levels of noise and atmospheric pollution.

Potential sources of effects associated with transportation and traffic include emission of air contaminants, dust, noise, vibration and light and handling of petroleum products.

3.3.1.5 Accidents and Failures

A complete assessment of possible accidents and failures associated with the Howse Project activities is provided in Section 6-6.

3.3.1.6 Standard Environmental Management Procedures

The proponent is familiar with the industry's Best Management Practices and Standard Environmental Management Procedures (Section 6.2). An EPP was prepared for DSO project activities (Volume 1 Appendix Ia).

Throughout the entire Project, compliance monitoring will be done to ensure that requirements stemming from applicable legislation, permits and/or approvals are met, and the EPP will be reviewed and updated on an ongoing basis.

HLM will adapt and apply the environmental management practices developed by TSMC for their other properties to the Howse Property Project. These practices cover any chemical spills that might occur during construction activities, including fuel spills. Other spills are related to the release of particles in water (suspended solids) and dust.

A specific health and safety program will be developed by HML for their subcontractors, which will include specific environmental management procedures relating to subcontractor activities. The current document is an initial version and is being introduced to staff and training sessions are being planned (See Draft Program in Volume 1 Appendix VII).

3.3.1.7 Approximate Total Construction Period and Proposed Start Date

Construction/upgrading of the Howse haul road is scheduled to begin in 2017, followed immediately by pit development and the start of overburden removal. The duration of the construction phase will be roughly seven to 10 months, based on 12-hour shifts.

3.3.2 Operation Phase

The operation phase involves the following activities:

- removal and storage of remaining overburden and topsoil;
- operation of waste rock dumps;
- blasting and ore extraction;
- mineral processing;
- dewatering;
- transportation of ore and other traffic;
- solid waste disposal;
- hazardous waste management;
- explosives waste management;
- treatment of sanitary wastewater; and
- ongoing site restoration.

Potential sources of effects associated with operation phase activities in general include:

- light emission from the Howse Property site lighting system;
- noise, vibration, and emission of air contaminants and dust from the usage of heavy machinery and generators for dewatering, drilling, crushing facility operation and light vehicle traffic;
- stripping of vegetation, excavation and sediment runoff from operation activities.

3.3.2.1 Removal and Storage of Remaining Overburden and Topsoil

The quantity of overburden to be stripped at the Howse Property is substantial. It will be placed in a separate pile from the waste rock and will be partially re-used when restoring the site (Figure 3-1).

During pit development, which is expected to be operational for 15 years, overburden and waste rock will be removed/blasted on an annual basis in order to maintain ore production throughout the mine's service life. An average of 3,123 Mt/yr of overburden and 3,583 Mt/yr of waste rock will be removed/blasted over 15 years, sporadically. These averages will vary each year according to pit operation requirements. This material will also be used for temporary road access and any other site work at the Howse Property or TSMC's DSO project complex.

Potential sources of effects associated with removal and storage of overburden and waste rock management include stripping of vegetation, excavation, emission of air contaminants, dust, noise, vibration, and light and sediment runoff. Water and soil contamination from pile runoff is also a potential source of effects.

3.3.2.2 Operation of Waste Rock Dumps

Waste rock that is mined will be placed in the dump to be located on the northeast side of the pit. The waste dump is designed to have a footprint of 67 ha and reach a maximum height of 70 m. Once complete, the waste rock dump will reach an elevation of 660 m. A ditch will be established at the base of the waste dump to capture all runoff water. This ditch will be connected to the main surface water network and directed to a sedimentation pond for treatment.

Potential sources of effects associated with the operation of waste rock dumps include sediment runoff and emission of air contaminants, dust, noise, vibration and light.

3.3.2.3 Blasting and Ore Extraction

Mining technique

Iron ore will be extracted by conventional and in-pit mining techniques:

- rotary, diesel-driven drills will drill 160-mm diameter holes for blasting;
- blasting will be done using a bulk emulsion;
- 64-tonne-capacity trucks will be loaded by hydraulic excavators fitted with a 6 m^3 bucket and will transport the iron ore to the crushing and screening facility; and
- one tracked bulldozer and one road grader will maintain the roads and assist each front-end loader.

Given the softness of the ore found at the Howse Property, it is estimated that only 50% of the material will require blasting. Explosive consumption is estimated at about 22,000 kg per week. It is proposed that the entire drilling and blasting operation be outsourced to an explosives supplier, and explosives manufacturing will occur outside the mining lease, at the ELAIOM DSO site.

Potential sources of effects associated with blasting and ore extraction include excavation, use of explosive, sediment runoff, and emission of air contaminants, dust, noise, vibration and light. Moreover, nitrate residue generated by blasting has the potential to contaminate the surface water and groundwater.

Currently, the Proponent has no plans to use Ironsorb for the Howse Project, but considerations on its use are detailed, below, for potential future use.

Mining sequence

A mine production schedule is presented in Figure 3-11. Because of the severe weather conditions in winter, ore cannot be transported by train to Pointe-Noire unless it is dried, since undried ore will freeze in the rail cars and will be impossible to unload.

During the pre-production period, which corresponds to the site preparation/construction phase, sufficient waste rock will be mined to build the ROM pad and for other general construction work, such as upgrading access roads. The ROM pad will be located near the ELAIOM primary sizer and will serve as a temporary ROM ore stockpile on the rare occasions when the primary sizer is out of operation for maintenance.

Generally, the deposit areas with the least waste rock will be mined first, as this will minimize the stripping ratio. However, some areas with a larger volume of waste rock may be mined in the early years to meet blending requirements, resulting in a higher stripping ratio. As a general rule, every effort will be made to maintain a constant stripping ratio.

MET-CHEM

PROJECT : Howse FS
CLIENT : TSMC
PROJECT No : 2014-049
DATE : November 2nd, 2015
REVISION : H

YEARLY PRODUCTION SCHEDULE →

MINE PRODUCTION SCHEDULE

Description	Units	PRE PROD	FY - 2018		FY - 2019		FY - 2020		FY - 2021		FY - 2022		FY 2023 - 25	FY 2026 - 28	FY 2029 - 31	FY 2032 - 33	Total
			Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter					
Target (Wet Tonnage)	kt	0	1,304	0	3,043	0	3,043	0	3,043	0	3,043	0	9,130	9,130	9,130	5,225	46,094
Ore to Dry Plant	kt	0	1,304	0	3,043	0	3,043	0	3,043	0	3,043	0	9,130	9,130	9,130	5,225	46,094
Fe	%	0.0	64.1	0.0	64.7	0.0	63.0	0.0	62.0	0.0	62.1	0.0	63.0	61.7	62.3	63.2	62.7
SiO_2	%	0.0	4.7	0.0	3.8	0.0	5.9	0.0	7.1	0.0	6.9	0.0	6.1	7.6	7.0	6.4	6.5
Al_2O_3	%	0.0	0.9	0.0	0.9	0.0	0.9	0.0	1.0	0.0	1.2	0.0	1.0	1.1	1.1	0.9	1.0
MnO	%	0.00	0.16	0.00	0.15	0.00	0.15	0.00	0.13	0.00	0.15	0.00	0.16	0.13	0.11	0.07	0.13
LOI	%	0.0	2.9	0.0	3.0	0.0	3.0	0.0	2.9	0.0	2.7	0.0	2.7	2.4	2.3	1.5	2.5
Total Waste	kt	6,004	146	4,629	776	5,725	2,990	0	2,504	0	1,760	5,625	27,050	28,341	14,605	7,141	107,296
Overburden	kt	6,004	0	4,629	0	5,725	0	0	0	0	0	5,625	16,219	11,773	0	0	49,975
Waste Rock	kt	0	146	0	776	0	2,990	0	2,504	0	1,760	0	10,831	16,569	14,605	7,141	57,322
Total Material Moved	kt	6,004	1,450	4,629	3,819	5,725	6,034	0	5,548	0	4,803	5,625	36,180	37,472	23,736	12,366	153,391
Daily Tonnage	t/d	32,896	6,776	30,657	17,848	37,912	28,195	0	25,925	0	22,446	37,254	33,041	34,221	36,971	33,660	
Stripping Ratio		n/a	0.1	n/a	0.3	n/a	1.0	n/a	0.8	n/a	0.6	n/a	3.0	3.1	1.6	1.4	2.3

Note: Run of mine tonnages are on a wet basis.

Figure 3-11 Detailed mine production schedule

3.3.2.4 Mineral Processing

Primary Treatment

In light of the high quality of the resource at the Howse Property, ROM ore will only go through a primary treatment, consisting of crushing and screening to produce a final product containing 15% lumps and 85% sinter fines. It is estimated that 5 to 20% of the ROM ore is lower-grade iron and will require mixing with higher-grade material to produce an acceptable grade, and shipped. HML will have to temporary stockpile (7-10 days of material) the lower-grade material on site until it can be processed.

The crusher and mobile equipment operators will be in cabins equipped with high-efficiency particulate absorption (HEPA) air filters in order to ensure that there is no exposure to airborne silica particles. Dust emissions will be controlled through the application of water mists/sprays at material transfer points. Stockpiles will be wetted down with water sprays as required. Employees working outside of equipment enclosures will be equipped with appropriate dust masks. There will be no brushing or cleaning of the ore.

Addition of Polymers

Due to the unique nature of the material on site and conditions in the area, measures must be taken by the Proponent in order to ship ore throughout the year in a cost-effective manner. The material being shipped must be below the transportable moisture limit (TML) prior to being shipped, as required by Transport Canada. The TML is 90% of the flow moisture point and can be determined by three recognized methods. In addition, because of the low temperatures encountered in the area, winter shipping is not possible, as the stockpile excavation rates are not sufficient.

Polymers have been known to increase the TML of iron ore by forming bonds with the free water within the ore, so that the material acts like lower moisture material, and the moisture is absorbed by the polymer when the material is subject to forces during shipping and transport, making it less likely to compress and liquefy. As a result of the bonds being formed with the free water, the material is more friable during freezing temperatures.

The polymer Ironsorb can absorb up to 240 times its weight in water, and treated material looks and handles as if it were much dryer. The material safety data sheet for Ironsorb is listed in Volume 1 Appendix VIII. Over the past two years, a variety of tests have been performed on DSO with polymers to determine their effectiveness in three areas:

- polymer utilization during the summer months to modify the TML of iron material;
- polymer utilization to replace or supplement the need for drying wet ore prior to screening; and
- polymer utilization during winter months as a freezing inhibitor.

Currently, large-scale modelling is ongoing for presentation to Transport Canada and the International Maritime Organisation for the use of polymers to modify the TML. The current plan is to use Ironsorb in a proportion of 0.5-1% of the ROM ore after crushing and screening of the ore.

Potential sources of effects associated with mineral processing include emission of air contaminants, dust, noise, vibration, and light and handling of petroleum products.

3.3.2.5 Dewatering

Dewatering will be carried out as required by means of diesel-powered pumps, as the Howse Property will not be supplied with electricity. Details on dewatering are provided in Section 3.2.5.2, within the Water Management Facilities and General Site Drainage Works (Section 3.1).

Before any pit dewatering occurs on the Howse Property, appropriate authorization/permits will be obtained from the Water Resources Management Division of the Department of Environment and Conservation of the GNL. Dewatering will eventually become continuous as the pit level goes under the water table level. However, dewatering will not affect migratory birds as water should never accumulate in the pit, and the only expected drawdown expected is in Pinette Lake, and it will be non-significant (see section 7.4.8)

Potential sources of effects associated with dewatering include noise, vibration, and emission of air contaminants from diesel generators. Water discharged into the environment will also increase the local flow of nearby streams. Water contamination by petroleum product is another potential source of effects.

3.3.2.6 Transportation of Ore and Other Traffic

The following is a list of major mobile mining equipment needed to mine the Howse deposit; the remaining support and service equipment required will be shared with DSO mining operation and will come from its existing fleet:

- 2 hydraulic excavators – 6 m^3 bucket (Komatsu PC1250 Class);
- 8 haul trucks – 64/100 tonne payload (CAT 775 / CAT 777 Class);
- 1 production drill – 160 mm diameter holes (CAT MD5125 Class);
- 1 track dozer – 250 kW (CAT D8 Class);
- 1 road grader – 200 kW (CAT 14M Class).

During the operation phase, truck movement is expected to be 12 one-way trips per hour and could reach a total of 16 one-way trips per hour when other vehicles are considered. The distance between the mine and the DSO complex is 3 km and average truck speed is 30 km/h.

Increased rail traffic along the five rail lines between TSMC's facilities and the Port of Sept-Îles is also expected at a rate of 0.42 trains per day, for a total of one train per day, including the DSO project.

Potential sources of effects associated with transportation include emission of air contaminants, dust, noise, vibration and light from loading/unloading of ore, ore transportation (haul truck, train and boat) and other traffic. Soil contamination from the handling of petroleum products is another possible effect.

3.3.2.7 Solid Waste Disposal

Domestic solid waste generated by mine operation will be disposed of at the TSMC approved landfill site. Although there are potential environmental effects associated with the production and management of this waste, these are likely to be minimal or non-existent because no new facilities are being built, staffing is not expected to increase, and the waste will be disposed of at the TSMC DSO project facilities, which have the planned and approved capacity to treat such waste. Section 4.1 of the EPP (Volume 1 Appendix Ia) refers to the camp area and related environmental protection measures, including solid waste disposal. A specific waste management plan is also available (TSMC, 2013b).

Potential sources of effects associated with solid waste disposal include emission of air contaminants, noise and vibration from trucks used to transport the solid waste. Air quality might also be affected by landfill fumes.

3.3.2.8 Hazardous Waste Management

Hazardous waste, including used oil, will be labelled and stored at TSMC's ELAIOM complex in an appropriate receptacle, with adequate separation where necessary, and will be disposed of as per TSMC's hazardous waste management program and policies. Although there are potential environmental effects associated with the production and management of these wastes, these are likely to be minimal or non-existent, since the waste will be disposed of at the TSMC ELAIOM facilities, which have the planned and approved capacity to treat such waste. Section 3.2 of the EPP (Volume 1 Appendix Ia) refers to hazardous material. A specific waste management plan is also available (TSMC, 2013b).

Potential sources of effects associated with hazardous waste management include emission of air contaminants, noise and vibration from hazardous waste transportation. Water and soil contamination is another possible effect.

3.3.2.9 Explosives Waste Management

The emulsion used for blasting, which is a solution consisting mainly of water, diesel fuel and ammonium nitrate, will be the only explosives waste found on site. The emulsion will be made by a third party off the TSMC property and delivered on site by truck to the explosives storage area on an as-needed basis. Residual waste such as boxes will be burned at TSMC's DSO project complex as per federal regulations. Section 5.13 of the EPP (Volume 1 Appendix Ia) refers to the safe blasting control plan. Environmental protection measures regarding blasting and drilling are also described in the EPP.

Potential sources of effects associated with explosives waste management include emission of air contaminants, noise and vibration from trucks used to transport the explosives waste, leaching of explosives waste and possible water and soil contamination.

3.3.2.10 Treatment of Sanitary Wastewater

Mobile toilets will be installed near the facility during the construction phase and will remain in place until the decommissioning and reclamation of the mine. Sewage will be transferred to the existing wastewater treatment unit at the TSMC work camp. Although there are potential environmental effects associated with the production and management of this waste, these are likely to be minimal or non-existent, since the waste will be disposed of at the TSMC workers' camp/dormitory facility, which has the planned and approved capacity to treat such waste. Section 4.1 of the EPP (Volume 1 Appendix Ia) refers to the camp area and related environmental protection measures, including wastewater and sewage disposal.

Potential sources of effects associated with treatment of sanitary wastewater include emission of air contaminants, noise and vibration from trucks used to transport the sanitary waste, leaching of sanitary waste and possible water and soil contamination.

3.3.2.11 Ongoing Site Restoration

TSMC is currently in talks with the Québec government on an international research program related to lichen as a proxy for air quality as well as with NRCAN on water management improvement (related to decommissioning). These two programs will be confirmed and defined and developed spring 2016. The progressive restoration of disturbed sites (piles, open pit and haul road) will be undertaken where possible. The overburden stockpile and waste rock dumps will be stabilized and revegetated as soon as their operation is completed. Topsoil stockpile will be used and its size will reduce as the restoration activities are progressing.

The ditch network will be minimal to avoid long-term maintenance. The goal will be to minimize slope erosion to prevent suspended particles from getting into the surface runoff and into the environment.

Any demolition debris and residues will be recycled or disposed of at TSMC's DSO project authorized landfill site.

Restoration will generate modest levels of noise and atmospheric pollution for a short period of time.

The restoration of work areas will be an ongoing process at the site. For example, if a road is upgraded to access a certain area of the Project for a limited amount of time, it will be restored as soon as the work is done in this area. Whenever possible, temporary work sites will be restored to pre-construction conditions. Compensation will be determined with the authorities and First Nation communities.

Potential sources of effects associated with ongoing site restoration include excavation, and emission of air contaminants, noise and vibration from heavy machinery and other vehicles. However, once completed, restoration will be beneficial for most biophysical components by contributing to soil decontamination, plantation, seeding, and habitat and ecosystem creation.

3.3.2.12 Accidents and Failures

A complete assessment of possible accidents and failures associated with the Howse Project activities is provided in Section 6-6.

During the operation and maintenance phase, the potential for accidents will stem from the transportation of fuel, explosives and overburden/waste rock/ore, the use of heavy equipment and explosives, blasting operations and mine wall stability issues. The implementation of the EPP (Volume 1 Appendix Ia) use of safety equipment and observation of safe working procedures will greatly reduce the risk of accidents with environmental effects.

A protocol for mining and blasting operations has been developed by TSMC for its other mining operations in Labrador and will also be adopted by HML for the Howse Property Project. This protocol will be followed at all times to reduce the risk of accidents.

Measures will be taken to mitigate the risk of accidents related to pit wall stability. Horizontal holes will be drilled to drain confined groundwater exerting pressure on the pit walls. In some circumstances, a berm could be built on every second bench to provide further stability.

Furthermore, the final pit wall slope will be designed according to the recommendations of an ongoing geotechnical study (Volume 2 Supporting Study A).

Lastly, the final pit wall will be independently drilled and blasted to carve out clean, precise pit edges. Once mining operations cease, the measures put in place to prevent access to the pit will render the risk of accidents occurring in the pit negligible.

Apart from the precautions described above, the stability of the pit walls will be monitored with instruments that accurately measure any wall movement.

Section 7.0 of the EPP (Volume 1 Appendix Ia) contains contingency plans as listed in Section 3.2.1.5. Sections 7.2 and 7.3 of the EPP refer to the Landfill Emergency Plan and to the Spill Management Plan respectively. An ERP is also available (Volume 1 Appendix Ib).

Potential sources of effects associated with accidents and failures include water, soil and air contamination.

3.3.2.13 Anticipated Size and Production Capacity

In the final stage, the area affected by the Project is estimated as follows (Table 3-4):

Table 3-4 Estimated Footprint of the Howse Property Project

INFRASTRUCTURE	FOOTPRINT FROM JANUARY 2015 EIS	FOOTPRINT FROM JANUARY 2016 EIS
	(ha)	(ha)
Open Pit	72	78
Overburden Stockpile	66	63.5
Waste Rock Dumps	66	39 (out of pit)
Topsoil Stockpile	4	3
Crushing and Screening Facility	3	1.5
Howse Haul Road	12	4.8
Sedimentation Ponds	4	9.25
Site Infrastructure (new)		1.35
Total	227	200.4

Once the mine is in operation, iron ore will be mined 24 hours a day, seven to eight months per year, depending on weather conditions, to produce 1.3 Mt of ROM ore during the first year and 3.0 Mt per year between 2019 and 2022. The maximum planned production is 9.13 Mt per year (25, 000 t/day), which will be reached in 2023, and will last until the end of the mine's service, in 2032. The incidental low-grade ore (approximately 5 Mt), generated by the excavation of high-grade ore will be temporarily stockpiled near the Howse deposit and will be mixed with higher-grade material, to produce the desired grade, and shipped.

In comparison, TSMC's DSO projects will produce a maximum of 11,667 tonnes/day throughout the year with the following estimated footprint at the final stage (Table 3-5).

Table 3-5 Estimated Footprint for TSMC's DSO Projects

PROJECT	1A (ELAIOM)	2A	2B	TOTAL
Infrastructure	**Footprint (ha)**	**Footprint (ha)**	**Footprint (ha)**	**Footprint (ha)**
Open Pit	33	43	31	107
Overburden Stockpile	10	15	12	38
Waste Rock Dumps	36	37	52	125
Topsoil Stockpile	2	2	2	6
Primary Sizer and Plant Site	2	0	0	2
Howse Haul Road		128		128
Low-grade Material	4	0	0	4

PROJECT	1A (ELAIOM)	2A	2B	TOTAL
Infrastructure	**Footprint (ha)**	**Footprint (ha)**	**Footprint (ha)**	**Footprint (ha)**
Camp Site	6	0	0	6
Sedimentation Ponds	11	3	NA	14
			Total	**430**

3.3.2.14 Standard Environmental Management Procedures

The applicable standard environmental management procedures for the operation and maintenance phase will include:

- storage, handling and transfer of fuel;
- storage, handling and transfer of hazardous materials;
- blasting and drilling;
- dewatering of work areas;
- solid waste disposal;
- dust control;
- noise control;
- pumps and generators;
- equipment and vehicle use and maintenance;
- vehicular traffic;
- road maintenance;
- quarrying and removal of aggregate;
- waste rock piles;
- laydown and storage areas;
- erosion protection;
- vegetation and wildlife control;
- protected species control;
- trenching; and
- excavation, embankments and grading.

Refer to the following sections of the EPP (Volume 1 Appendix Ia) for more details:

- Permits, approvals, and compliance monitoring – Section 3.0 of the EPP;
- Site-Specific Environmental Protection Measures – Section 4.0 of the EPP; and
- Environmental Control Plans – Section 5.0 of the EPP.

3.3.2.15 Operation Schedule

Commissioning of the mine is scheduled for 2017. Mining activities at the Howse Property are expected to be ongoing until 2032. The mine will be operational year-round; however, the ore will only be extracted, crushed, screened and shipped by train from April to mid-October or November, depending on the weather. For the remaining months, crews will work on restoring the overburden and waste rock stockpiles/dumps.

The mine is expected to be operational from 2017 to 2032, for a total of 15 years.

3.3.3 Decommissioning and Reclamation Phase

As per the GNL's *Mining Act*, 1999, and commitments undertaken under the IBAs, the proponent of a mining project will submit a rehabilitation and closure plan and provide financial assurance to cover the costs associated with completing the work set out in the plan.

The rehabilitation and closure plan will be developed to achieve the following objectives:

- provide a balanced and maintenance-free environment for existing fish and wildlife;
- create a landscape compatible with surrounding areas while taking into account the fact that previous disturbances caused by former IOCC mining operations occurred in the vicinity of the site prior to work by TSMC;
- keep potential sources of pollution, fire hazards and public liability at an acceptable level and develop mitigation measures, if required; and
- provide a safe environment for long-term public access.

The site will be progressively rehabilitated prior to mine closure

The decommissioning and reclamation phase involves the following activities:

- transportation and traffic;
- demobilization of Howse facilities and heavy machinery;
- final site restoration.

Potential sources of effects associated with the decommissioning and reclamation phase in general are:

- light emission from the Howse Property site lighting system;
- emission of air contaminants, dust, noise and vibration from heavy machinery use and light vehicle traffic.

3.3.3.1 Transportation and Traffic

As stated above, access to the pit will be limited, and no additional environmental effects is therefore anticipated. At the end of mining operations, only maintenance work, if any, will be performed on site.

The potential sources of effects associated with transportation and traffic are emission of air contaminants, dust, noise, vibration and light from heavy machinery and other vehicles. Soil contamination from the handling of petroleum products is also a possible effect.

3.3.3.2 Demobilization of Crushing and Screening Facility and Heavy Machinery

Once the mine ceases to operate, the crushing and screening facility will be relocated to another DSO project, as needed.

The potential sources of effects associated with equipment demobilization are emission of air contaminants, dust, noise, vibration and light from heavy machinery and transportation.

3.3.3.3 Final Site Restoration

Techniques applied during mining operations, such as the in-pit mining method, will facilitate the restoration process. The characterization of potentially contaminated sites in the vicinity of the complex will be undertaken when the mine closes. Old spills and other mining activities could require soil rehabilitation in some locations.

The proponent is committed to restoring the Howse area to its original form and that it be revegetated with suitable local indigenous plant species. As such, special consideration will be given to selecting species to avoid contamination from invasives. The sedimentation ponds will be in operation until water quality is within regulatory limits.

The closure plan will also include the vegetation and stabilization of disturbed areas. The top, horizontal benches and slopes of the waste rock dump will be revegetated. Access to the open pit by people and wildlife will be restricted via a barrier, and the access ramps and benches will be vegetated.

The potential sources of effects associated with site restoration are excavation and emission of air contaminants, dust, noise, vibration from heavy machinery and other vehicles. However, once completed, restoration will be beneficial for most biophysical components by contributing to soil decontamination, plantation, seeding, and habitat and ecosystem creation. Site restoration should be more significant during decommissioning and reclamation in terms of duration and area affected than during previous project phases.

3.3.3.4 Accidents and Failures

A complete assessment of possible accidents and failures associated with the Howse Project activities is provided in Section 6-6.

3.3.3.5 Decommissioning and Reclamation

The decommissioning and reclamation phase will begin before the closure of the mine (progressive reclamation) and is expected to last for five years following the end of the Operations phase. A preliminary reclamation and closure plan is described in Section 10.4.

4 ABORIGINAL ENGAGEMENT AND PUBLIC CONSULTATIONS

The reader is cautioned that the Air Quality data discussed in this chapter derives from the data presented in the federal report (Volume 2 Supporting Study E).

The Proponent has deployed considerable effort to develop positive and fruitful relationships with the various stakeholders, in particular with Aboriginal groups of Québec and Labrador. The Proponent has established ongoing consultation/discussion mechanisms in order to maintain these positive relationships and to respond to the requests of Aboriginal groups in a timely manner. The following chapter describes the relationships and discussions held with:

- Government departments and agencies;
- Aboriginal groups; and
- Other stakeholders and the public.

For each, a short report is presented on:

- the ongoing engagement mechanisms established by HML (TSMC) 1, in particular the IBAs signed with Aboriginal groups, through which consultation for the Howse Project took place;
- the consultation process prior to and leading to the EIS; and
- the EIS consultations process itself.

It is important to understand that the Howse Project is being inserted within a brownfield context, where mining activities (exploration and operations) are ongoing. Although HML is the Proponent, TSMC's personnel has been the Project face interacting with the various stakeholders. Accordingly, the local population associates the Project with TSMC (primarily), and thus, it is difficult to dissociate the Howse Project from the ongoing DSO Project. For its part, Labrador Iron Mines (LIM) obtained in April 2015 Court protection under the *Companies' Creditors Arrangement Act* (CCAA) and has not carried out mining operations since 2014.

4.1 GOVERNMENT DEPARTMENTS AND AGENCIES

HML has provided Project overview information to, and corresponded and met with, the provincial and federal governments on various occasions in the course of the EIS process (Table 4-1). Most of the meetings took place before March 2014, just before the submission of the Project Registration, and during the preparation of the Final EIS in summer and fall 2015. Ongoing discussions also occur with some government departments, especially those who act as regulators for the EIS.

Table 4-1 Meetings and Discussions with Government Agencies

GOVERNMENTS / AGENCIES	MEETING LOCATION AND DATE	MEETING FOCUS
TSMC Meetings		
Newfoundland and Labrador Department of Environment and Conservation	St-John's, January 22, 2014	Presentation of the Howse Property Project

[1] For the purposes of this specific chapter, while HML is the Proponent, TSMC is the company acting on behalf of HML for day-to-day operations and interactions with stakeholders. TSMC is also the company with which agreements have been signed with Aboriginal groups.

GOVERNMENTS / AGENCIES	MEETING LOCATION AND DATE	MEETING FOCUS
Newfoundland and Labrador Water Resource Management Division	St-John's, January 22, 2014	Presentation of the Howse Property Project
Newfoundland and Labrador Pollution Prevention Division	St-John's, January 22, 2014	Presentation of the Howse Property Project
Newfoundland and Labrador Intergovernmental and Aboriginal Affairs Secretariat	St-John's, January 22, 2014	Presentation of the Howse Property Project
Canadian Environmental Assessment Agency (CEAA)	Halifax, January 23, 2014	Presentation of the Howse Property Project
Québec Ministère des Ressources naturelles du Québec	Québec, January 15, 2014	Information meeting on: ○ Status of the DSO project including latest developments ○ Introduction to the Howse Property Project
Québec Ministère des finances et de l'économie	Québec, January 15, 2014	Information meeting on: ○ Status of the DSO project including latest developments ○ Introduction to the Howse Property Project
Québec Secrétariat of Développement Nordique	Québec, January 15, 2014	Information meeting on: ○ Status of the DSO project including latest developments ○ Introduction to the Howse Property Project
Newfoundland and Labrador Department of Natural Resources Assistant Deputy Minister	Toronto (PDAC), March 4, 2014	Discussions on the Howse Property Project

In addition, a draft copy of the Project Registration was sent out and a comment period of 30 days was provided to the following government departments and agencies:

- Canadian Environmental Assessment Agency (CEAA);
- Newfoundland and Labrador Pollution Prevention Division;
- Newfoundland and Labrador Water Resource Management Division;
- Newfoundland and Labrador Department of Environment and Conservation; and
- Newfoundland and Labrador Wildlife Division.

Comments received via the CEAA were included in the guidelines for the EIS by the CEAA. In addition, several discussions were held with the CEAA to address questions on the EIS process and expectations (June 30th and October 8th in Halifax, and November 12th 2014, as well as May 22nd and 26th, June 1st and 11th, July 24th and September 14th 2015 by phone) and a site visit on May 14-15 2015. Since the beginning of the EIS process, email correspondence with CEAA has been frequent, almost on a weekly basis, to ensure that all reviewers (Aboriginal groups and government agencies) obtain the information in a timely manner, and to ensure that the EIS duly responds to requirements. Questions from CEAA and three First Nations

(IN, NIMLJ and NNK) were received following the submission of the draft EIS, HML has provided answers to groups individually.

It is important to note that HML has established long term relationships with the federal, NL and Québec governments, and that discussions are held frequently with various departments, depending on the issue, more particularly with the Environmental Assessment Division of the NL Environment and Conservation Department. These meetings concern TSMC's operation generally, and the Howse Project has been referred to as a joint venture with LIM. Examples of recent meetings include:

- October 17, 2014, Minister of Transport, the Honorable Lisa Raitt;
- October 17, 2014, Minister of Infrastructure, Communities and Intergovernmental Affairs and Minister of the Economic Development Agency of Canada for the Regions of Québec, the Honorable Denis Lebel;
- October 27, Minister of Native Affairs (Québec), Mr. Geoffrey Kelly;
- November 3, 2014, Minister of Natural Resources, Mr. Pierre Arcand ;
- December 17, 2014, Minister of Mines (Québec), Mr. Luc Blanchette;
- January 8, 2015, Deputy Minister, Plan Nord Secretariat, Mr. Robert Sauvé; and
- January 12, 2015, Office of the Premier of Québec.

In the context of the EIS process, specific government organizations and elected officials of Québec and Labrador were consulted by letter in October, 2014, informing them of the ongoing EIS consultation process and asking whether they had concerns regarding the Howse Project or suggestions for mitigation measures (Table 4-2). The decision to contact them by letter was justified by the fact that the Project will maintain the jobs and contracts associated with TSMC's DSO project.

No responses to the letters sent had been received as of November 2015. An example of the letters sent can be found in Volume 1 Appendix IX.

Table 4-2 Elected Officials in Newfoundland and Labrador and Québec Consulted on the Howse Project - October 14 2014

FUNCTION / MINISTRY	NAME	COMMENTS RECEIVED
Member of Parliament, Labrador	Ms. Yvonne Jones	None
Member of the House of Assembly, Labrador West	Mr. Nick McGrath	None
Minister of Labrador and Aboriginal Affairs	The Honorable Keith Russell	None
Elected member of Parliament, Manicouagan, Québec,	M. Jonathan Genest-Jourdain	None
MNA for Duplessis, Québec	Ms. Lorraine Richard	None
Prefect, Caniapiscau MRC	Ms. Lise Pelletier	None
Prefect, Sept-Rivières MRC	Ms. Violaine Doyle	None

The Project will also eventually require a range of additional environmental permits and other authorizations. The post-EIS permitting process will provide the opportunity for relevant regulatory authorities to receive and review additional Project design information, and to establish specific terms and conditions to avoid or reduce environmental effects. The proponent and/or its contractors will identify, apply for and adhere to all required permits and other authorizations that are required for Project Construction and/or Operations.

In the case of benefits to the Province of NL, TSMC will be responsible for compliance with all applicable obligations under its Newfoundland and Labrador Benefits Plan (NLBP). For instance, 60% of the labour force will come from NL, as is currently the case for the DSO project.

In addition, the NLBP includes a Women's Employment Plan (WEP) (NML, 2010). This plan, which was prepared for TSMC'S DSO project (Volume 1 Appendix X), will also apply to the Howse Project. The WEP includes provisions relating to: "a communications strategy; targets for women's employment and access to business opportunities; an implementation plan; leadership and accountability mechanisms; a monitoring, reporting and implementation schedule; and periodic evaluations and amendments. It also contains important goals for education and training, as well as for the recruitment and retention of Aboriginal women" (NML, 2010). The WEP also includes an implementation plan, accountability mechanisms, and monitoring measures (NML, 2010).

4.2 ENGAGEMENT AND COMMUNICATIONS WITH ABORIGINAL GROUPS

The Proponent is committed to ensuring that Aboriginal communities and organizations are consulted appropriately on the proposed Project and to meaningfully accommodating their rights and interests as required by Section 35 of the *Canadian Constitution Act (1982)* and as per IBAs signed with them. What follows describes the Proponent's efforts to interact with the potentially affected Aboriginal groups so as to integrate their concerns into the planning process for the Howse Project. Table 4-3 provides a list of the Aboriginal groups consulted for the EIS.

Table 4-3 Aboriginal Groups Consulted for the EIS

ABORIGINAL GROUP	CONTACT INFORMATION
Nation Innu Matimekush-Lac John	Chief Réal Mackenzie C.P. 1390 Schefferville, QC G0G 2T0 (418) 585-2601
Naskapi Nation of Kawawachikamach	Chief Noah Swappie 1009 Naskapi Road Kawawachikamach Nuchimiyuschiiy, Québec P.O. Box 5111 G0G 2Z0 (418) 585-2686
Innu-takuaikan Uashat mak Mani-Utenam	Chief Mike Mackenzie 265 Boul. des Montagnais Uashat, QC G4R 5R2 (418) 962-0327
Innu Nation	Grand Chief Anastasia Qupee Innu Nation PO Box 119

ABORIGINAL GROUP	CONTACT INFORMATION
	Sheshatshiu, NL (709) 497-8398
NunatuKavut Community Council	President Todd Russell PO Box 460 Station C 370 Hamilton River Rd. Happy Valley-Goose Bay, NL A0P 1C0 (709) 896-0592

In the context of the EIS, actions were taken to ensure due participation of potentially affected Aboriginal groups, who are subjected to mining activities and their related effects on a daily basis. These groups have also signed IBAs with both TSMC and LIM, and it is in the LIM IBA that provisions for the Howse Project have initially been made.

The Proponent has been engaged in Project-related consultation activities with the aforementioned groups, through which it has provided information on the proposed Project in order to identify and discuss the nature of any associated interests, questions or concerns on the part of each group, for consideration as Project planning proceeds.

Based on TSMC's previous work with the concerned Aboriginal groups, HML has determined that the groups most impacted by the planned activities for the Howse Project are the NIMLJ, NNK and ITUM. Of these, members of the NNK and the NIMLJ actively use the land near the Howse Property (Irony Mountain / Kauteitnat and the Howells River valley).

ITUM is also informed on the Project, as two traplines pertaining to ITUM families will be affected by the mining activities of the Howse Project. Indeed, family trapline holders in the area around the Howse Project (Trapline #211 – Jean-Marie Mackenzie family; and Trapline #207 – Louis (Sylvestre) Mackenzie family) (Figure 4-1) are ITUM members, and the area near the Kauteitnat Mountain has been identified as sensitive.

In contrast, members of the Innu Nation (IN) and NCC are not known to currently use the land near the Howse Project. However, given the agreements signed with these groups (Section 7.5.1.1), both the IN and NCC were consulted within the EIS process. In particular, IN has, under the Tshash Petapen/New Dawn Agreement, a recognized *Economic and Hydroelectric Major Development Impacts and Benefits Area* in the area of Labrador where the Project is located, and the NCC have land claims of the same area. Given the distance of these populations from the Project site, as well as the information available regarding their actual use of this area (Section 6.9.9), these two groups were consulted early in the EIS process: in the context of the project guidelines via the CEAA, and by letter for the EIS. The IN has prepared an extensive list of questions relative to the draft EIS that the Proponent has duly answered (Section 4 below for a summary). A meeting was held with IN at the end of October 2015 to discuss the Howse Project and related IN concerns.

To ensure that the measures proposed were satisfying for the local population dealing with mining activities on a daily basis, a validation session was held with members of NIMLJ and NNK. The purpose was to ensure that they concurred with the proposed mitigation measures, and that they could be heard regarding other measures that they would find useful in alleviating the Project's potential effects. The results of these discussions are presented in Section 4.3 below.

Overall, in keeping with the spirit of the agreements signed, consultations were carried out with all five groups, but were more extensive with the three former groups (NIMLJ, NNK, ITUM), and this will be applicable to the proponent's longer term engagement activities.

4.2.1 Agreements with Aboriginal Groups

Integrating the environmental and human components of sustainable development in mining is important for HML. In keeping with the founding principles of Tata, HML is committed to working with and supporting Aboriginal communities impacted by its activities.

As a result of its past and ongoing presence and development activities in Labrador West and Québec, HML has established respectful and mutually beneficial relationships with Aboriginal communities and organizations in Labrador and Québec.

In relation to the Howse Project, the following agreements have been signed:

- LIM
    - IN: IBA dated July 17, 2008
    - NNK: IBA dated September 2, 2010
    - NIMLJ: IBA dated June 6, 2011
    - ITUM: IBA dated February 13, 2012
    - NCC: Economic Partnership Agreement, dated December 14, 2012
- HML
    - NNK: IBA dated June 10, 2010
    - NIMLJ: IBA dated June 6, 2011
    - IN: IBA dated November 11, 2011
    - ITUM: IBA dated February 9, 2012
    - NCC: Cooperation Agreement dated August 14, 2013.

Initially, the responsible development of the Howse Project was provided for in the LIM agreements. However, given the change in circumstances in April 2015 whereby HML acquired 100% of the Howse deposit and LIM obtained Court protection under the CCAA, it is the intention of HML to incorporate the Howse deposit into its agreements with Aboriginal groups. As such, the same commitments made as part of HML DSO Project will apply for the Howse Deposit. These agreements provide for mechanisms and measures for full and effective participation and involvement of said groups in the planning and implementation of the Howse Project so that they obtain socioeconomic benefits, their traditional activities and knowledge are respected, and environmental effects are minimized. These provisions include:

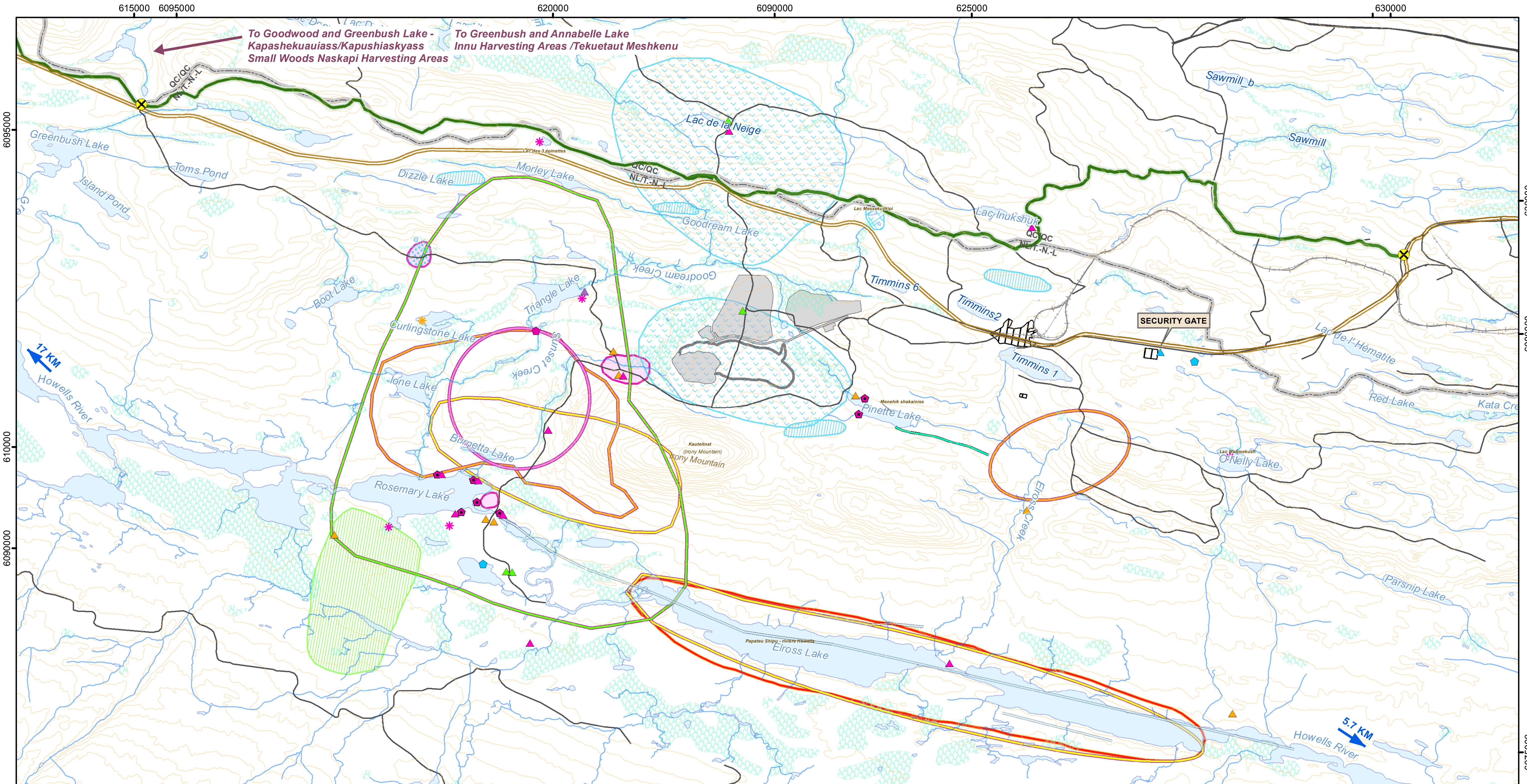
- Aboriginal employment targets and training measures during the Construction and Operation phases;
- Targets and processes that encourage and facilitate the participation of Aboriginal businesses in contracting opportunities;
- Program dollars for priority areas identified by communities, which vary from one agreement to the next but which generally include:
    - capacity-building;
    - economic development;
    - infrastructure;
    - support for traditional activities;
    - training;
    - education;
    - arts and music;

    - recreation.
- Revenue-sharing;
- Environmental monitoring; and
- Accommodations for culturally- and gender-specific needs.

HML is committed to fully respecting these confidential agreements.

Proper implementation is essential in meeting the objectives of these agreements, which is why timely and open communication, reporting, and support and involvement in the joint management of matters important to the communities through implementation committees and a Community Health, Safety and Environment committee are vital aspects of positive relationships. HML has already begun integrating these activities into its ongoing engagement activities for the DSO Project, and using them throughout the consultation process for the Howse Project EIS.

Support for local infrastructure, training, education, environmental protection, economic development, traditional activities, arts and music, and revenue sharing have been and will continue to be provided by HML. Furthermore, there are clear measures identified for safe, healthy, respectful and culturally cognizant work conditions and arrangements as these relate to counselling, transportation, rotation schedules, cultural leave, harvesting restrictions by workers staying at Camp and country food.



LEGEND

Camps/ Tents
- Naskapi
- Innu
- Unknown Owner
- Naskapi - Old
- Innu - Old

Innu Harvesting Locations
- Beaver Hunting
- Goose Hunting
- Fishing

Naskapi Harvesting Spot
- Fishing

Innu Harvesting Areas
- Hunting Area
- Goose Hunting
- Porcupine Hunting
- Firewood Cutting
- Camp Area

Naskapi Harvesting Area
- Goose Hunting

Harvesting Roads
- Winter Skidoo Trail
- ATV Road - Skidoo Trail

Old Innu Harvesting Site
- Caribou Killing Site

Old Innu Harvesting Areas
- Old Partridge Area
- Old Goose Hunting
- Old Berry Picking Area
- Old Camp Area

Old Naskapi Harvesting Area
- Old Camp Area

Access Roads
- Haul Road to DSO Area 4

Historic Roads
- Timmins - Kivivic Bypass Road
- Other Land Use Road
- Land User Crossing

Infrastructure and Mining Components
- Railroad
- Proposed Howse Pit
- Howse Infrastructure Footprint
- Existing DSO Project Infrastructure

Basemap
- Contour Line (50 ft)
- Provincial Border
- Watercourse
- Water Body
- Wetland

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0584 , PR185-19-14, 2016-03-21, edickoum

0 2 4
Kilometers

UTM 19N NAD 83 SCALE: 1:55 000

SOURCES:

Basemap and Land Use Components
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,

Mining Components
Howse Minerals Limited/
MET-CHEM Howse Deposit Design
for General Layout., 2015
Groupe Hémisphères, Hydrology and update, 2013

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Land Use and Traditional Aboriginal Knowledge

Howse Minerals Limited

GroupeHemispheres
5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 4-1

4.2.2 Ongoing Engagement and Consultation Mechanisms

HML, via TSMC, has engaged with the residents of the Schefferville region for over four years and has been involved in organizing or participating in events to support the community and to strengthen its relationships with the Aboriginal and non-Aboriginal population of the LSA.

These activities for the interest and benefit of the communities have included:

- the renovation and modernization of the MLJ arena – a significant front-end contribution forming part of the LIM and TSMC IBAs;
- elder's gatherings;
- school career fairs;
- site tours for students and Elders;
- cultural and spiritual gatherings;
- interactive workshops for students to strengthen ties with schools and to expose youths in school to the numerous and varied careers that can be pursued relating to the mining sector; and
  - various community celebrations, sporting events, and social causes.

HML has also established numerous engagement and participation mechanisms for its projects to maintain an open and transparent dialogue with the Aboriginal groups, and the Howse Project will be integrated into TSMC's ongoing activities. As indicated above, feedback on the Howse Project collected through these mechanisms was communicated for inclusion in the EIS. These mechanisms include:

- The Community Health, Safety and Environment (HSE) Committee, established in spring 2013, and represented by mandated officials of the NIMLJ, the NNK, ITUM, the Labrador Innu, the NCC and TSMC/HML. The Committee meets three to four times per year, and its general responsibilities include:
  - Serving as a formal mechanism for communication and cooperation between TSMC/HML and Aboriginal groups with respect to HSE-related matters pertaining to the Project;
  - Serving as a monitor and facilitating the implementation of TSMC/HML's HSE-related objectives or obligations under its respective IBAs, provincial and federal laws, and corporate policies with regard to HSE-related matters;
  - Reporting in a timely manner on the environmental effects and TSMC/HML's compliance with its HSE objectives and obligations;
  - Facilitating, integrating and coordinating the involvement of Aboriginal groups and appropriate and qualified organizations and businesses in the environmental monitoring and mitigation of environmental effects;
  - Reporting and making recommendations to TSMC/HML and the Aboriginal groups with respect to environmental monitoring and mitigation for the Project;
  - Serving as an accessible, public repository of environmental data, studies and reports relevant to the Project, subject to such confidentiality provisions as may apply;
  - Carry out such other functions as are referred to it jointly by TSMC/HML and Aboriginal groups.

HML considers this committee as a working group and the preferred forum for open discussions and addressing issues relating to health, safety and the environment. HML provides information transparently to HSE Committee members and encourages members to disseminate the information to their community. HML supports initiatives to assist in the communication flow between the HSE Committee and community members. All documents that relate to the HSE Committee meetings are saved on a shared drive to which all members have access. Many Howse Project documents are also available on this server: meeting minutes, maps, Howse Project Registration, DSO Project environmental studies, internal monthly environmental monitoring reports, pamphlets, environmental follow-up reports, etc. Given that DSO and Howse Projects involve the same stakeholders, HML has included the Howse Project within the work of the HSE Committee. Table 4-4 summarizes the proceedings of the HSE Committee.

Table 4-4 Meetings of the HSE Committee and Discussions on the Howse Project

MEETING LOCATION AND DATE	MEETING FOCUS , INCLUDING ANY QUESTIONS / ISSUES RAISED AND PROPONENT RESPONSE
Uashat, October 7, 2013 Present: Representatives of NIMLJ, NNK, ITUM, and IN.	▪ Provision of information on planned mining activities relating to the Howse Project, including details on the Exploration Plan; ▪ NIMLJ and ITUM representatives expressed concerns with the proximity to Irony Mountain ("Kauteitnat"), which has spiritual and historical significance to the Innu, as well as the Project's planned production timeframe; ▪ It was explained that a separation (buffer) zone will be established and maintained between Kauteitnat and Project activities; ▪ Aboriginal groups will be kept informed of exploration and development activities as they progress, and TSMC will support the groups in the dissemination of information to their membership.
Timmins Site, January 28, 2014 Present: Representatives of NIMLJ, ITUM, NNK and NCC.	▪ TSMC provided an update on the DSO project, and presented information including location, purpose, and nature of the partnership between HML and LIM and implications for IBA obligations, the environmental assessment process, environmental effects, and effects avoidance and reduction. Handouts were also provided, including maps and pamphlets in English and Naskapi or French and Innu. ▪ The in was invited but could not participate due to a schedule conflict. Information provided at meeting was forwarded electronically. No comments on Howse Project were received from the IN. ▪ No concerns were raised by NCC members. ▪ NIMLJ, NNK and ITUM had concerns with the cumulative effects of dust caused by mining activities in general. ▪ Although dust originates from multiple sources, it was agreed that HML and the communities will collaborate to take steps towards greater dust control in the Schefferville area, including the creation of a Steering Committee on air quality involving the Town of Schefferville and other mining companies active in the area, and which will require the support from the provincial and federal governments regarding investment in the local road system. ▪ The NIMLJ recommended hiring Innu environmental science graduates for environmental monitoring work. HML indicated that it has previously provided job shadowing opportunities for students interested in environmental studies though the TSMC DSO project, and is continuously seeking profiles of Aboriginal candidates for the position of Environmental Technician/Coordinator. The NIMLJ will forward résumés of Innus with the relevant education for consideration in future employment and work experience opportunities.
June 6, 2014, Schefferville, QC Present: Representatives of NIMLJ, NNK, ITUM, NCC. By phone: IN.	▪ Review of the Committee's mandate and responsibilities of members regarding transfer of information to respective leadership and community members ▪ The Howse Project deadline for comments from the public on federal government guidelines for EIS is July 3, 2014 Measures taken by TSMC to control dust: ▪ Hiring of a water truck to apply water between the Timmins site and the Schefferville landfill; ▪ Speed limit of 50km/hr established for TSMC employees and contractors; ▪ TSMC collaborating with the Town of Schefferville in the purchase and use of a wash bay that will be installed at the end of the Summer 2014. The principal users will be TSMC and its contractors, but all vehicles coming from the mines to town will be required to use the wash bay; ▪ Evaluation of product application options on the road; ▪ Internship opportunities were offered to the local schools but students were not identified or were not available.

MEETING LOCATION AND DATE	MEETING FOCUS , INCLUDING ANY QUESTIONS / ISSUES RAISED AND PROPONENT RESPONSE
November 26, 2014, Schefferville, QC Present: Representatives of NIMLJ, NNK, ITUM.	TSMC will be an active member of the Schefferville Region Emergency Measures Steering Committee, composed of the NNK, NIMLJ, Sureté du Québec, Town of Schefferville, and Tshiuetin Rail Transportation. A DSO Project update was also presented. Howse Project update : ▪ The reports on the socioeconomic and land use studies are being compiled. Light monitoring is taking place at Irony Mountain and Pinette Lake and in Schefferville and Kawawachikamach. ▪ The EIS review period will be at least one year. Aboriginal groups will be attributed a pre-review period, followed by general public consultations.
May 13th 2015 Present: Representatives of NIMLJ, NNK, ITUM.	▪ Update on the DSO Project, especially concerning Kivivic region. Construction of the DSO ore process plant is coming to an end. Pictures of the Dome were provided. ▪ Current challenges for the viability of the DSO Project in the context of low iron ore prices. ▪ Health and safety: two security agents were added 24/7 for escorts during the goose hunting season. Road safety needs to be enforced, and TSMC will install road signs on the main road and on the bypass road. ▪ Discussions on the Howse Project: comments received through CEAA. More data required on hydrology, permafrost, surface water, air quality, and wildlife. Field work will be required. ▪ Environmental monitoring: ○ Report on environmental incident, silica management, air quality, domestic waste management, recycling, water management, caribou (contribution to Caribou Ungava). ○ One member observed water changing color near Rosemary Lake – TSMC has agreed to analyze water quality in this location. ▪ Re: dust, TSMC in discussions with the Government of Quebéc on the pavement of roads in Schefferville and Matimekush. TSMC has also agreed to install air quality stations in Schefferville to analyze for silica. ▪ Goodwood and bypass road: will be ready at the end of July 2015. A map of the road will be prepared and distributed to community members.
October 20th 2015 Present: Representatives of NIMLJ, NNK, and NCC	▪ Update on the DSO Project, particularly re: Kivivic region. The construction of the DSO ore process plant is complete at 97%. Pictures of the Dome were provided. Plant is being tested and commissioned. ▪ Engagement: reopening of Schefferville arena, Aboriginal training, and softball team. ▪ Environmental monitoring: ○ Inspection of culverts along Goodwood road. ○ Airborne silica monitoring (no results to date, beginning of testing), ○ spill response ability improvement ○ sampling in Kivivic area, ○ increase in environmental staff, ○ endangered species protection, ○ Environmental authorizations for DSO3. ▪ Research programs: Vegetation research program cancelled (but looking for other options), water management research program (ongoing discussions), and bioevaluation of air quality (ongoing discussion) ▪ Health and safety: 1.5 million hours worked without lost time injury; proactive approach to health and safety; decrease in health station visits; road safety incident; fire hall completed and emergency practices sessions held. ▪ Update on Howse field studies and completion of EIS.

- Meetings between HML and leadership from each community on a regular basis. These meetings serve as a forum to discuss particular issues with HML executives and Aboriginal community leaders. Periodic meetings also occur with the family trapline holders to discuss any issues related to the Projects (DSO and Howse Project). In particular, TSMC's Community Affairs Manager and Senior Director, Government and Stakeholders Relations make themselves available to meet with community leadership at their convenience or when required;

- Regular Agreement Implementation Committee meetings held with each Aboriginal group separately to review the successes and challenges in the implementation of these agreements;
- Community Affairs department in place to address matters that relate to community needs, requests, and to ensure compliance within HML and its contractors. The Community Affairs Manager and the Senior Director, Government and Stakeholders Relations remain available to answer concerns raised by community members. The tasks of the Community Affairs department are to :
  - Contribute to maintaining positive relations with Aboriginal communities near the DSOP area and with Aboriginals working on site;
  - Work with TSMC and its contractors to achieve the employment and training objectives outlined in the IBAs;
  - Update and implement Aboriginal human resource development strategy and action plans;
  - Address Aboriginal worker and employer issues relating to employment, training, communication, performance, workplace policies, the environment, culture, and social matters;
  - Be engaged in community projects;
  - Assist in carrying out cultural orientation for all new employees and cultural awareness sessions;
  - Organize cultural training and language courses for all workers on-site;
  - Organize mentorship programs;
  - Prepare meeting minutes and employment reports;
  - Implement other measures conducive to an inclusive workplace;
  - providing information on projects such as the Howse Project and addressing concerns.
- TSMC uses the two local radio stations to provide project updates quarterly. Information on the Howse Project was disseminated by radio periodically in 2014 and 2015, and radio was used to announce the open-house activity in September of 2014. In addition, radio is used at least 48 hours prior to all blasting activities by TSMC.
- A radio announcement was broadcasted in January 2015, and included information relative to the Howse Project: "On the Howse Project, near Irony Mountain, TSMC, through Howse Minerals Limited, will submit to Aboriginal communities in early February a draft environmental impact study as required by the federal government. The document will be sent to the Naskapi Nation and to the Conseil de Matimekush-Lac John for comments. A final draft incorporating comments from Aboriginal communities will then be submitted and made public in March and accessible on the website of the Canadian Environmental Assessment Agency. The public and Aboriginals will then have 30 additional days to provide comments, after which point a final revised version of the environmental study for the Howse Project will be submitted to the Agency and the GNL for analysis." Radio announcements are broadcasted on an as-needed basis, several times per year to communicate company activities, responses to current issues, and general updates on benefits for the communities. For instance, TSMC informed the population in August 2015 of the end of the construction of the iron ore process plant (DSO Project), the possibility to access the Timmins-Kivivik bypass road, and positive socioeconomic effects including employment of Aboriginals, contracts and community initiatives funded by HML IBAs.
- Periodic bulletins are also sent to all post office boxes in the Schefferville region (Schefferville and Kawawachikamach) by HML to provide updates on mining activities, on the Howse Project planning process, and current issues (Volume 1 Appendix XI). For instance, the summer 2015 newsletter announced the completion of the Kérail railway, the advancements on the Goodwood road construction, and information on the percentage of jobs occupied by /

contracts awarded to Aboriginal peoples at the Timmins site. Events and actions organized in the communities were also communicated (renovations in the area and tree planting, for example).

HML also participates in three local partnerships that will bring positive changes in the Schefferville area:

- Agreement between the Sureté du Québec (SQ) and the Royal Newfoundland Constabulary (RNC): This agreement allows the SQ to intervene in Labrador, at the camp site for example, without having to request permission from the RNC. The agreement was signed on August 31, 2014. The SQ is now given full powers for interventions in Labrador in cases of emergency or for preliminary inquiries (Bouchard, Communication, and September 26, 2014). This facilitates the work of the SQ, as the officers are now protected by this agreement.
- Standing Joint Committee on Emergency Measures (SJCEM) for Kawawachikamach, Matimekush-Lac John and Schefferville. In June of 2014, a forest fire broke out not far from Kawawachikamach. TSMC and its contactors helped contain the forest fire but also arranged for food and accommodations for the evacuated people from the community. Chief Noah Swappie sent a letter thanking TSMC for their support. This event coincided with an initiative supported by AANDC and the Québec's Ministry of Public Safety to reunite several actors (social services, public safety, and businesses) working locally to collectively work together to improve public safety in Schefferville area. The terms of reference for this committee are in the process of being approved, and TSMC/HML has been invited to be a member of the committee.
- A Regional Steering Committee on Mining Issues was formed May 2015 as a result of concerns raised by residents of Schefferville and Matimekush. Composed of local organisations (Ville de Schefferville, Schefferville airport, local enterprises, First Nation representatives, land-users) and of TSMC representatives, the objectives of this Committee are to discuss and address concerns related to mining activities in the Schefferville area and potential measures that would improve the quality of life of residents. Issues have included dust, the capacity of local infrastructure, cleanliness of workers and their vehicles in public areas, access to Greenbush, Kivivik, and Goodwood areas, road safety, etc. Measures since been taken by TSMC in improve conditions for residents.

Finally, HML has an open communication policy in place by which all leaders or community members may communicate directly with the companies' representatives when they need to obtain specific information or to convene a meeting if needed.

4.3 HOWSE PROJECT EIS CONSULTATIONS

4.3.1 Consultations on Project Registration

A draft copy of the Project Registration was sent to all five Aboriginal organizations at the end of January 2014 for review and comments within a 30-day time frame.

NIMLJ, IN and NCC offered comments to inform the EIS requirements (guidelines). NNK provided questions and comments on the Project Registration itself. Although many questions were raised on technical aspects of the projects, general comments and important issues for NNK can be extracted from this document. ITUM submitted an email in support of the Howse Project dated July 5th 2014, indicating to the CEAA and the GNL that it had signed IBAs with both LIM and TSMC, and that ITUM "wishes to convey to both Canada and Newfoundland that ITUM will address its concerns with respect to the development of the Howse mine directly with the proponent".

Table 4-5 Consultations on Project Registration

ABORIGINAL GROUP(S), LOCATION, DATE	MEETING FOCUS , QUESTIONS / ISSUES RAISED	PROPONENT RESPONSE
NIMLJ, Montreal, June 3, 2013	Presentation of information on the Joint Venture and plans to mine the Howse deposit. No concerns were raised.	
IN, Montreal, July 18, 2013	Provision of a Project update, including information on the Joint Venture and plans to mine the Howse deposit. No comments were received.	
ITUM, Montreal, August 8, 2013	Provision of a Project update, including information on the Joint Venture and plans to mine the Howse deposit.	Indicated that further discussion on the mining of Howse will be required at a later time.
NIMLJ, NNK, ITUM and IN, Individual emails, October 15, 2013	Information regarding the 2014 permit application for the Howse deposit. No responses were received.	
NIMLJ Council, Site visit, Howse Property November 7, 2013	Potential disruptions to goose hunting activities on the opposite (west) side of Kauteitnat in May as a result of noise from the proposed mining activities.	▪ Adjusted the Project layout to minimize visual effects on Kauteitnat; ▪ Will ensure continuous access to Pinette Lake and Howells River Valley. ▪ To discuss with the NIMLJ how to avoid or reduce any potential disturbance through Project construction and operations planning.
ITUM delegation – site visit Site visit, Howse Property November 10, 2013	The Howse deposit is situated on the trapline of the Jean-Marie MacKenzie family (210) and the Louis Sylvestre MacKenzie family (207), presently residing in Uashat and Maliotenam. An ITUM delegation, including members of the MacKenzie family, to the Howse site to discuss the exploration work and its distance from Kauteitnat. Requested that TSMC establishes a sufficient buffer zone between Kauteitnat and the planned exploration and mining activities and efforts to minimize any visual effects.	Adjusted the Project layout to reduce waste pile height and thus the visual effects, and increased the distance between Irony Mountain and the Project.
NIMLJ, By email, January 24, 2014	Submission of the Draft Project Registration and request for review and comments within 30 days. No comments were received.	
ITUM, By email, January 24, 2014	Submission of the Draft Project Registration and request for review and comments within 30 days. No comments were received.	
NNK Council, Kawawachikamach, January 28, 2014	HML presented information on the Howse Project, including location and purpose, the environmental assessment process, environmental effects, effects avoidance and reduction, and maps. Handouts were also provided, including maps and a pamphlet in English and Naskapi. Questions: ▪ Access to harvesting grounds.	▪ The company will ensure that land users will continuously have access to harvesting grounds except for periods of blasting. ▪ LIM will be responsible for revenue-sharing payments2.

[2] As previously explained, the responsible development of the Howse Project was provided for in the LIM agreements. However, given the change in circumstances whereby HML acquired 100% of the Howse deposit and LIM obtained Court protection under the CCAA, it is the intention of HML to incorporate the Howse deposit into its agreements with Aboriginal groups.

ABORIGINAL GROUP(S), LOCATION, DATE	MEETING FOCUS , QUESTIONS / ISSUES RAISED	PROPONENT RESPONSE
	▪ Mechanics of the IBA were raised.	
IN, By email, January 29, 2014	Submission of the Draft Project Registration and request for review and comments within 30 days. No comments were received.	
NNK, By email, January 29, 2014	Submission of the Draft Project Registration and request for review and comments within 30 days. No comments were received.	
NCC, By email, January 29, 2014	Submission of the Draft Project Registration and request for review and comments within 30 days. NCC asked about the mechanics of the agreement obligations in relation to the joint venture between LIM and HML and the implications if LIM defaults on its revenue-sharing payments.	Should LIM default on payments relating to the Howse Project, HML will assume responsibility for said payments.
NNK Community-at-large Kawawachikamach, January 29, 2014	Information Centre held[3], publicized prior to the event via postings in public buildings and radio announcements. Approximately 10-15 community members attended. Information was presented on: location and purpose of Project; nature of the partnership between HML and LIM and implications for IBA obligations; potential environmental effects, assessment process, and mitigation measures. Question: ▪ Will Howells River be affected by the Project? ▪ Mining is destructive to the land and the people who use it and is occurring at an overly advanced pace. ▪ What is the restoration plan?	▪ The Howells River will not be affected because it is sufficiently removed from Project site and on the other side of Irony Mountain. ▪ Restoration will be progressive in nature and consist of laying topsoil that was set aside from preliminary mining works, planting vegetation, building safety barriers around pits, re-grading waste dumps to resemble the natural landscape, environmental monitoring for 10 years following pit closure.
Members of the Jean-Marie Mackenzie family and the Louis Sylvestre Mackenzie family (holders of Trapline Nos. 207 and 211) Uashat, January 30, 2014	HML provided an update on TSMC's DSO project. Information was presented on: location and purpose of Project; nature of the partnership between HML and LIM and implications for IBA obligations; potential environmental effects, assessment process, and mitigation measures. Questions raised: ▪ Why was this location chosen to mine and can the mine be farther away? ▪ Where will the process water be sent? ▪ Many birds nest on Kauteitnat. ▪ Recommendation for hiring Innu environmental science graduates for environmental monitoring work. ▪ Are there tests for mercury and other heavy metals in fish (apprehension that fish could contain heavy metals as a result of mining)? ▪ Concerns about possible dumping of wastewater into nearby lakes	▪ The Howse deposit has a very high iron ore content. ▪ Tailings process water is expected since the ore will be mined, crushed, screened and shipped without being processed at the plant. ▪ Clearing and stripping will be suspended during bird nesting. ▪ HML welcomes profiles of Aboriginal candidates for the position of Environmental Technician, and for job shadowing with the Environment Team. ▪ HML does not have a procedure for monitoring heavy metals in fish. ▪ Wastewater: HML does not have sufficient information on the matter to comment.

[3] Posters were made available, as well as handouts, including maps and pamphlets in English and Naskapi.

ABORIGINAL GROUP(S), LOCATION, DATE	MEETING FOCUS , QUESTIONS / ISSUES RAISED	PROPONENT RESPONSE
	▪ Is there a possibility that blasting activities could cause cracks in Kauteitnat. ▪ What is the schedule for workers?	▪ Such cracks would not occur given the measures taken to contain the blast to a very small area. ▪ Work schedules vary according to the employer/contractor, but are usually 12 hr/day, 14 days on, 14 days off for TSMC employees
ITUM Community-at-large, Uashat and Maliotenam, January 30, 2014	Pamphlets on the Howse Project in French and Innu were distributed in public places in Uashat and Maliotenam.	
NIMLJ and ITUM Councils, Matimekush, February 12, 2014	Meeting to discuss the Howse Project and other matters. ITUM asked about the mechanics of the IBA obligations in relation to the joint venture between LIM and HML and the implications if LIM defaults on its revenue-sharing payments.	Should LIM default on payments relating to the Howse Project, HML will assume responsibility for said payments.
NIMLJ Council, Matimekush, March 14, 2014	Information was presented on: location and purpose of Project; nature of the partnership between HML and LIM and implications for IBA obligations; potential environmental effects, assessment process, and mitigation measures. NIMLJ asked about ownership of Howse and IBA responsibilities in the hypothetical event that LIM enters into bankruptcy.	In this situation, HML would have the option to acquire the Howse Project.

As explained above, the development of the Howse Project was provided for in the LIM agreements. However, given the change in circumstances whereby HML acquired 100% of the Howse deposit and LIM obtained Court protection under the CCAA, it is the intention of HML to incorporate the Howse deposit into its agreements with Aboriginal groups.

In addition to these meetings, several comments were received in writing on the EIS Project Registration. These written comments and questions received from the NIMLJ, NNK, IN and NCC are found in Volume 1 Appendix XII. These comments were significant for HML as they provided guidance in the preparation of the preliminary EIS, and enabled an informed scoping of issues. In addition, they served as a basis for the proponent's subsequent consultation efforts, especially in terms of the involvement of local land-users. The main concerns expressed in writing during the spring of 2014 by Aboriginal groups are summarized as follows:

NIMLJ:

- an environmental assessment is required for the Project given its environmental effects on fish and their habitat, aquatic species and migratory birds, on the NIMLJ community and on its ancestral rights;
- potential sources of pollutants and emissions are and will be noise, vibrations, dust, suspended solids, exhaust gases and greenhouse gases from the heavy machinery and vehicle traffic, impacting the NIMLJ community and its rights;
- dust and poor air quality from mining-related activities is having major repercussions on community members;
- negative effects of the noise from vehicle and air traffic;

- work on the railway and blasting restrict access to ancestral lands for traditional activities. Paths used to access lands are completely inaccessible in the spring because of mud;
- concerned about the survival of caribou and protective and management measures required. Subsistence caribou hunting is a practice, custom and tradition that forms an integral part of MLJ Innu culture;
- environmental effects of mining have been driving migratory birds away and have affected their reproduction and the traditional practice of goose hunting, mostly on the Howells River; and
- concerned about the presence of heavy metals in any fish caught near the Project.

NNK:

- concerns regarding respect of the IBA as per the Joint Venture Agreement and whether the Howse Project will be included in an updated IBA;
- concern for passenger train service potentially affected by increased ore transportation;
- concern that the Proponent's agreement with the GNL regarding employment and business opportunities takes precedence over IBAs;
- attention must be paid to archaeological sites or artifact discovery throughout the life of the Project;
- the Proponent should propose compensation for the potential loss of traditional hunting and gathering grounds, known to be used by Naskapis;
- Naskapis need to be consulted on traditional knowledge;
- the effects on the caribou populations should be taken very seriously;
- potential effects of mining and dewatering on the aquatic fauna or its habitat, fish eggs and spawning grounds should be monitored and reported;
- the cumulative effects of trains on caribou are increasing with every new project, and need to be analyzed in depth;
- the NNK should be kept updated following the submission of the hydrogeological report, notably on effects of seepage from waste rock piles and of dewatering on the water table and water bodies; and
- sightings of wildlife (wolverine, caribou or lynx, etc.) should be reported to the NNK and the Government.

IN:

- There is a need for an Environmental Assessment of the Project given the potential adverse effects on fish and fish habitat, migratory birds, and the Innu of Labrador's health and socioeconomic conditions, heritage, exercise of their rights, and archaeological sites. Cumulative effects must also be addressed;
- Concerned that the project could have serious negative effects on the George River caribou herd - proposed mitigation measures will have to address the gravity of the situation;
- An up-to-date and comprehensive assessment of the Innu of Labrador's historic use in the area and proper archaeological assessments should be done with the involvement of the IN. Proper mitigation measures must be put in place to protect archaeological sites;
- The potential effects on the health and socioeconomic conditions of the IN needs to be fully understood;
- Concerned about the effects of dewatering on the watersheds and ecosystems, as well as about the effect of the numerous mining projects on water quality in the region;
- There should be a fully funded consultation plan with Canada to assess the effects of the proposed Project on Aboriginal rights;

NCC:

- Major concerns about the Project are the following: general adverse effects on wildlife caused by loss of habitat; effect of silica dust on air quality; adverse effects of tailings ponds; loss of habitat in the mine site area affects accessibility to other areas due to loss of trail routes; effects on affordable housing in the area; hiring;
- Cumulative effects must be considered: added noise, dust, water contamination, habitat loss for various species, population increase, NCC communities and the general area must be addressed in a substantial manner;
- Concerns regarding the effects on the George River Caribou Herd;
- Ongoing projects and exploration will add to the number of flights to the Schefferville and Wabush airports;
- The mines' power needs affect local communities in a region already strapped for available electrical power; and
- Clarify how the water table and groundwater in the region will be affected by the project.

4.3.2 Consultations on Environmental Impact Statement

Consultations for the EIS took place between September 2014 and November 2015. These included:

- Initial Community Consultations from September to November 2014. These consisted of in-person interviews held in Matimekush, Schefferville, Kawawachikamach and Uashat-Maliotenam, with community representatives and land users relating to potential effects, measures or concerns (Section 4.3.2.1). Consultations were also held with other stakeholders such as the Town of Schefferville and business partners (Section 4.3.2.1). A Project presentation (Volume 1 Appendix XIII) and a pamphlet (Volume 1 Appendix XIV) explaining the Howse Project were prepared to serve as visual support for these interviews;
- Aboriginal Consultations on Preliminary Draft between January and November 2015 (Section 4.3.2.2); and
- Feedback Received on Mitigation Measures from Local Aboriginal groups (Section 4.3.2.3).

4.3.2.1 Initial Community Consultations and Aboriginal Traditional Knowledge

NIMLJ and NNK Representatives and Community Members

Aboriginal communities included in the LSA are the NIMLJ and the NNK. Three types of interviews took place in Matimekush-Lac John and Kawawachikamach: interviews to obtain feedback and concerns on the Howse Project from community Councils and other representatives (for example, Council elected officials, community administrators, police officers, CLSC and public health, school directors, etc.), interviews with land-users, and interviews for the purpose of data collection, mostly to establish the baseline conditions.

Table 4-6 NIMLJ and NNK EIS Interviews

REPRESENTATIVES	DATE
NIMLJ	
Chief Real Mackenzie	September 23 and 24, 2014
Members of the NIMLJ Band Council (3 members)	September 23, 2014
Director General	October 28, 2014
Director, Public Works	September 23, 2014
Environment Officer	September 24, 2014

REPRESENTATIVES	DATE
Land-users (elders)	September 25, 2014
Land-users (youth)	October 28, 2014
Local dispensary (Health Canada)	September 26, 2014
School Director	September 24, 2014
Public Safety (SQ)	September 26, 2014
NNK	
Chief and Council	September 22, 2014
Environment Officer	September 22, 2014
Public Works Department	October 28, 2014
Naskapi Development Corporation	September 22, 2014
Local CLSC (3 members, including the physician for Schefferville area)	September 24 and 25, 2014
Jimmy Sandy Memorial School principal	September 25, 2014
Public Safety (NNK Police)	September 25, 2014
Land-users (elders)	September 26, 2014
Land-users (youth)	October 27, 2014

In addition to these meetings, an open-house event was held on September 23rd, 2014, at the NML/TSMC office in Schefferville. Concerns expressed by both local First Nations were mostly related to the effects of dust on air quality and the cumulative effects of the different mining projects in the region. Other comments and questions received included:

- the daily difficulties associated with an ongoing mining operation in the area;
- IBAs perceived as not being respected, lacked transparency and tangible commitments;
- questions of responsibility of LIM IBA commitments in context of HML partnership;
- economic development opportunities are welcome, though more benefits should flow to local First Nations, including training, filling of qualified positions, and overall benefits for community members;
- the need for better communication; and
- effects on water bodies and other resources.

Comments received during the Open House event confirmed issues that were raised by community members during previous consultations. Given that this was a public consultation, a registry of the participants was prepared, but HML indicated that the comments made would remain confidential to ensure that participants would feel free to ask their questions.

LOCAL ABORIGINAL TRADITIONAL KNOWLEDGE AND LAND-USE

Recognizing the importance of ATK and land-use practices, specific interviews for land-use and occupation were carried out in relation to the proposed Howse Project mine site, the detailed results of which are presented in Volume 2 Appendices C and D. It should be noted that an Innu researcher was hired to conduct a portion of the field work. The interviews allowed the Proponent to take stock of the many concerns in relation to the environment and wildlife, harvesting activities, and the transmission of ATK by the Innu of MLJ, the ITUM, and the Naskapi. While Elders indicated that they rarely frequent the area anymore, but suggested that younger land-users be interviewed. The younger harvesters pointed to the difficulties in reconciling land-use with full-time employment, and mining activities with safe access to land and resources.

It should be noted that a meeting was held with members of NIMLJ in August of 2015 to obtain their feedback on Figure 4-1.

As previously indicated, NIMLJ community members frequently use the land in the vicinity of the Howse Project, while certain ITUM members are the holders of family traplines. The Naskapi also use the land to harvest resources in the area of the Howse Project (Figure 4-1). Their respective concerns on land-use are further discussed in Section 7.5.2.1. Table 4-7 provides a summary of the concerns raised during discussions on land-use, using participatory mapping, with Aboriginal stakeholders, Elders, and by land-users and trapline holders.

A summary of responses/ mitigation measures and feedback received from the local First Nations is included in Table 4-11.

Table 4-7 Summary of Issues Raised by Aboriginal Stakeholders, Land-Users and Trapline Holders

THEME	COMMENTS MADE DURING COMMUNITY CONSULTATIONS (NIMLJ AND NNK)	COMMENTS MADE BY LAND-USERS (NIMLJ AND NNK) AND BY TRAPLINE HOLDERS (ITUM)
Access to Land (Section 0)	▪ Need for a bypass road. The Howse project is located on the road that leads to Kauteitnat and it will prevent land access. ▪ There is a security escort on the way in, but not on the way back, and users must pass around large trucks. ▪ Will the existing road near Pinette Lake be kept open to the public? What is the alternative? ▪ Ongoing work blocks road access in Goodwood and Greenbush	▪ Access to the land is a very important issue and a bypass road would better ensure this access. ▪ The gate and machinery are disturbing. Many do not want to pass through the security checkpoint and be escorted - it is too restrictive. ▪ Ski-doo access is not possible because of mining traffic on road, and trucks leave rocks behind. ▪ Access to Pinette Lake for fishing will become difficult. ▪ Mining activities are being practiced on the same routes used for hunting. ▪ It is important to the community that young Innu still have opportunity to travel to the Howells River in the future
Agreements (Section 7.5.1.1)	▪ IBAs are not transparent and are too complicated for people who are not familiar with their content. Little information is communicated on IBAs, and only Council is kept informed. ▪ People want tangible commitments, such as a training center. ▪ If LIM goes out of business, HML will theoretically go out of business too.	▪ Will there be compensation or royalties for loss of these resources? ▪ Some regret having signed the agreements and feel there is no respect from the mining companies.
Air quality and Cleanliness (Section 7.5.2.2)	▪ There was no air quality monitoring and the community was not tested. ▪ Air quality and dust are a problem especially in summer when it is dry. Dust can be seen on windows and in offices and it deposits on berries, plants, and in lakes. ▪ The town is dirtier than before due to mud and filthy vehicles ▪ There should be a security gate at the town limits to control traffic, as was done by IOC.	▪ Dust is considered as an important issue, and its effects on air quality, water quality and health are a concern. ▪ Dust from mining activities and from trucks is a concern.

THEME	COMMENTS MADE DURING COMMUNITY CONSULTATIONS (NIMLJ AND NNK)	COMMENTS MADE BY LAND-USERS (NIMLJ AND NNK) AND BY TRAPLINE HOLDERS (ITUM)
Caribou and other resources (Section 7.5.2.1)	▪ The caribou has been present in the region for centuries but hasn't been present for 10 years because of mining, and won't come back because of blasting. ▪ All works should be stopped when a caribou herd is present. ▪ People need to go further to harvest food and other resources, including caribou, grouse and berries.	▪ There is a concern that animals will move farther away because of new mining activities. ▪ People depend on hunting and fishing for food supply and they worry they will need to go further for hunting (food supply). ▪ There are costs to going farther. Costs for hunting and fishing can double. Also, food in the supermarket is expensive. ▪ The long-term use of land to practice traditional activities by young First Nations is important.
Communication (Section 0)	▪ Information from the HSE Committee does not come through, is not communicated to the community. ▪ The Liaison Officer is Naskapi, which creates a language barrier. Why not also have an Innu. ▪ People working for security are all English and don't speak French. This is intimidating for the Innu who don't speak English. ▪ The community does not know who to reach if there is a problem with TSMC. ▪ If there are effects on Lake Pinette, information about potential pollution should be communicated by the company. ▪ Information is often limited to hot topics, such as Health, Safety and Environment. The community would like to know more about social effects, which requires a different type of communication. ▪ There is a need for more consultation and explanations on the project, as well as more citizen participation. ▪ Many people do not know what the CEAA is. There are many ways to reach the population – radio, Facebook, etc.	▪ People wish to have more information on the project - they feel they know very little.
Economic benefits (Section 7.5.3.5)	▪ Because of the fly-in fly-out system, royalties go to Labrador and they collect income tax from workers. ▪ Innu do not have their share of benefits. ▪ Infrastructure and facilities in the community are not well maintained: some street lights are broken, and sidewalks and road need maintenance and major repairs. There is no financing. The Council would like support from TSMC. ▪ There is a feeling that TSMC takes more care of people in Labrador than of the Innu of Québec, even though effects are felt in Québec and Québec Innu are the ones that use the territory. ▪ Economic development is a positive effects of the project. ▪ NNK have small contracts with mining companies. It's hard for them to compete with bigger companies. They always have to bid, but don't always have the expertise. TSMC should give them the job instead of fighting fair game.	▪ More economic benefits are wanted - some feel only TSMC will profit from mining operations. ▪ There should be more partnerships with the Innu. ▪ Economic benefits need to be equitably distributed.

THEME	COMMENTS MADE DURING COMMUNITY CONSULTATIONS (NIMLJ AND NNK)	COMMENTS MADE BY LAND-USERS (NIMLJ AND NNK) AND BY TRAPLINE HOLDERS (ITUM)
	▪ Companies need to reinvest locally.	
Employment and Training (Section 7.5.3.2)	▪ TSMC does not respect agreements regarding employment and training. There are presently only 10 Innu working. ▪ Local people want jobs. In the end, there are few Natives employed. ▪ Cases of discrimination have occurred, employee abuse. People work too hard. There does not seem to be a clear complaint mechanism at the camp. ▪ In the first years, Innu / Naskapi workers were employed, but the number of employees decreases each year. Some are now in debt. ▪ Some training has been carried out, mainly heavy machinery operation. Mamu has contracts, but they employ white outsiders. Youth from the community do not have contracts. ▪ Trained persons are not employed by the mine. Some have been trained and were later dismissed. ▪ People see that many people in Labrador and Uashat are employed. Some of them do not have their competency cards. ▪ Job postings require potential employees to speak English, which is very limiting for the Innu. ▪ Some workers do not know their rights (e.g., CSST). There is no labour organization for Québec workers. Cross-border problems are significant. ▪ There is no targeted training for women, most of the work is for men. Women could be used, for example, for construction finishing stage. ▪ Employment makes people proud of themselves, brings personal growth and better living standards. However, it can lead a person to consume more alcohol. ▪ There are ongoing training programs – for example, heavy machinery. Would like to see the Naskapis in qualified positions, such as millwrights, mechanics, and boilers. ▪ There is a career fair in the community, organized by the academic councillors. Sometimes, mining companies participate. Exploration/mining people have come to explain about the types of jobs. A mining-oriented career fair might help. ▪ There is no facility for vocational training in the area. There is the new learning center, but it is small. A proper training facility should come soon.	▪ There is a desire for more qualified jobs for the Innu, and more specialized training. ▪ Some feel Innu are hired at the beginning of the Project and are then limited to unskilled jobs (cleaning). ▪ There is concern that jobs are not fairly distributed between Québec and Labrador and that the NIMLJ should have its fair share. ▪ Mining companies employ people from Labrador and the outside on a fly-in-fly out basis. There are no local jobs or benefits. ▪ Some locals think that if there is mining development, jobs should be given to the members of the family that use or occupy the land. ▪ Employment is a great concern and TSMC should respect the agreement and ensure jobs for the community. ▪ To avoid problems with racism between workers, there should also be local bosses. ▪ There are pressures between workers and workers do not complain because they are afraid of losing their jobs if they do. ▪ There should be better monitoring and communication on jobs and promotions. ▪ People are glad that there will be job opportunities again.

THEME	COMMENTS MADE DURING COMMUNITY CONSULTATIONS (NIMLJ AND NNK)	COMMENTS MADE BY LAND-USERS (NIMLJ AND NNK) AND BY TRAPLINE HOLDERS (ITUM)
Environment (Section 7.5.2.1)		▪ Respect for the environment is a concern. ▪ Would like feedback on environmental monitoring. ▪ Major concerns are for wildlife, trees, the environment and ecosystems. ▪ Disturbances to vegetation and trees by industrial activities are a concern. ▪ There are concerns on the monitoring of the environment by mining companies.
Health (Section 7.5.2.2)	▪ People with alcohol problems are often unemployed. Those who are able to maintain a job are sober. ▪ Many white construction workers have substance abuse problems. It is hard to know who supplies the camp, locals or whites.	▪ Health services are more burdened than before and some are concerned about access to health services. ▪ Concerns on the presence of outside workers bringing new viruses and affect Innu health. ▪ As with IOCC, there should be health exams and drug testing before workers are employed ▪ -The effect of dust on health is a concern.
Kauteitnat/Cultural Heritage (Section 7.5.2.1)	▪ The project being near Kauteitnat could be problematic. ▪ The issue of the discovery of a burial site was raised – people ask if the company would stop building in this area if there was one.	▪ The mountain is an important landmark used for orientation and to spot caribou, and is a feeding ground for ptarmigans and Canada geese. ▪ The site is appreciated and has a historical and sacred value. ▪ There is a will to protect the mountain. People are concerned the mountain will eventually be mined. ▪ Discovery of artifacts or any archaeological element should be well communicated. This should be the object of an agreement. ▪ Elders are very attached to Kauteitnat. ▪ Blasting near Kauteitnat should be avoided. ▪ The mountain is considered as a nice area that should become a park but protection has never been discussed. ▪ The site is used for blueberry picking and caribou sighting. ▪ Kauteitnat represents a lot of history, particularly geological history.
Noise (Section 7.3.3)	▪ Noise scares away animals. ▪ In May (2014), during goose-hunting season, machinery use was noisy. In the surroundings of Rosemary Lake, machinery could still be heard. However, the geese are still present. ▪ Some Innu can hear the railway from their cottage.	▪ The effects of vibration are a concern. ▪ Noise can be heard from far away and it drives the animals away. ▪ Effects on resources of noise from helicopters, planes, trucks and blasting are a concern.
Road safety (Section 0)	▪ The company does not listen and lacks respect for locals in terms of security and subsistence, by blocking the access to resources. ▪ Speeding on the road to Timmins is problematic. Trucks go very fast and it's dangerous.	▪ People are concerned that traffic constraints will become worse and that the Howse Project will be a problem for road safety. ▪ Safety is a concern; concerns that mining companies could try to save money by skimping on safety measures.

THEME	COMMENTS MADE DURING COMMUNITY CONSULTATIONS (NIMLJ AND NNK)	COMMENTS MADE BY LAND-USERS (NIMLJ AND NNK) AND BY TRAPLINE HOLDERS (ITUM)
	▪ Contractors do not follow the company's directives and the area is not in the SQ jurisdiction. ▪ Access to camp and Irony Mountain: when travelling on the road in the mine site people are escorted on the way in, but not on the way back. This is a safety issue because it is dangerous. ▪ There are some new roads, and some people felt they would get lost.	▪ The need to pass through mining activities on the road is a concern.
Rehabilitation (Section 10	▪ People are worried that there will be no money left for rehabilitation. It has been the case in the past and LIM is also going bankrupt. It could be the same for TSMC. ▪ Will rehabilitation recreate a live lake?	▪ Rehabilitation is important because the community feels open pits can be dangerous and remain a source of dust. ▪ Some insist that the company must agree to start site rehabilitation as early as 2018. ▪ Rehabilitation of the mining site and of stock piles is a concern. ▪ The pit should be filled with hard material and not water to avoid dust.
Water Quality (Section 7.3.10)	▪ Concerned by effects on water quality and on fish.	▪ Contamination of surface water and particularly of the Howells River via groundwater is a major concern. ▪ Want to be informed on the way water will be cleaned if there is contamination. ▪ Concern for contamination affecting wildlife and fish. ▪ Some are worried about accidental spills polluting lakes.

THEME	COMMENTS MADE DURING COMMUNITY CONSULTATIONS (NIMLJ AND NNK)	COMMENTS MADE BY LAND-USERS (NIMLJ AND NNK) AND BY TRAPLINE HOLDERS (ITUM)
CUMULATIVE EFFECTS		
Air quality (Section 8.9)	▪ Dust around mining sites is an issue. Dust from the roads is also an issue. ▪ Lakes in the region are affected by dust. Fishing activities are also disturbed. ▪ Since the opening of the mine in 2009, there is more dust and wind creates orange clouds. This could be a source of respiratory problems. ▪ There are dots on fish - dust may be the cause. ▪ Health issues are always a concern. Thyroid issues – could be because of mining activities. ▪ Effects on health are not visible yet, but iron dust may have an effect on health in the long term.	▪ Every mine creates dust, which creates contamination.
Caribou and wildlife resources (Section 8.10)	▪ The disappearance of caribou is a cumulative effect of mining activity. Cause for decline: mining activity and natural causes (mix of both). When IOCC shut down in 1982, caribou came back in the area, which means that mining activity had an effects. When the mining exploration began again, caribou left. More moose are now present in the area. ▪ Geese are less present because of helicopters and some contractors do not follow directives. ▪ Birds' nests near the TSMC camp are threatened. ▪ Mining activities are affecting livelihoods and food available to populations. ▪ The absence of caribou has an effect on culture. ▪ Berries and fish are used for subsistence. People here live off nature's resources. ▪ It's becoming harder to practice traditional medicine because of the effects of dust on berries and plants.	▪ Pinette Lake is overfished due to easy access. ▪ Effects on resources have changed hunting habits. Since there are no more caribou, people hunt more geese and moose. ▪ Areas around mining sites are avoided for berry harvesting because of dust.
Communication (Section 8.9)	▪ There is little information in the community about mining projects – what are the activities and how many workers? ▪ Mining companies do not integrate women and do not communicate with informal organizations. Relations with the community are limited to official organizations (elected officers), but both types should be used.	

THEME	COMMENTS MADE DURING COMMUNITY CONSULTATIONS (NIMLJ AND NNK)	COMMENTS MADE BY LAND-USERS (NIMLJ AND NNK) AND BY TRAPLINE HOLDERS (ITUM)
Economic Benefits and Employment (Section 8.9)	▪ Kids are quitting school and mining companies should help find ways to keep kids in school, with training, for example. ▪ Mining has had a positive effect on living standards, but money has also amplified existing social problems.	
Environmental effects (Chapter 7)	▪ All mining activities should be considered as a whole. Many companies are present and are breaking the land. ▪ There are already 18 mine pits, 9 in Québec and 9 in Labrador. These have a major effects and locals have to live with these holes. ▪ The main concerns of the Council are the environment, dust, pollution of lakes, pollution of groundwater, health of youth, and local employment. ▪ The environment is already damaged enough. Locals must live with that without benefiting from the projects. ▪ Long-term environmental effects are worrisome, especially for kids. ▪ The projects are in Labrador, but the effects are in Québec	▪ There is a feeling that there are so many mining companies that it's hard to isolate the effects of each one. ▪ Some believe that mining activities break up the land. ▪ Some think mining companies should only establish themselves on previously used site and not go any farther. ▪ There is a sense that there are so many mining companies that it's hard to isolate the effects of each one.
Roads and access to Land (Section 8.9)	▪ The Greenbush-Goodwood road is not accessible anymore because it is surrounded by mines. ▪ Roads have damaged the environment. They are very wide and people won't use them anymore because there is too much machinery. ▪ Passenger and freight transport is constrained due to increased ore traffic and priority is given to ore trains. Freight is a particular issue in the summer. The construction period is short, and it becomes more difficult to bring materials, groceries, all types of supplies (May-December). Sometimes (3-4 week period) waiting time, which causes losses – payments for carpenters, staff.	▪ There are concerns about access to Howells River, which is difficult to access because there is no road. ▪ It is important to the community that young Innu still have the opportunity to travel to the Howells River in the future
Waste	▪ There are concerns about waste and its effects, air quality and the use and disposal of dangerous products. ▪ TSMC does not control and monitor its contractors sufficiently, and exploration activities generate a lot of waste in the environment.	

THEME	COMMENTS MADE DURING COMMUNITY CONSULTATIONS (NIMLJ AND NNK)	COMMENTS MADE BY LAND-USERS (NIMLJ AND NNK) AND BY TRAPLINE HOLDERS (ITUM)
Water quality (Section 7.3.2)	▪ Mining activities affect lakes, and locals wonder if it also affects groundwater. ▪ Mining activities threaten potable water sources. ▪ Oil and fuel pollute water sources.	

ITUM

As indicated above, Uashat and Mani-Utenam are located far from the Project site (over 500 km), but some of their members have family traplines located on the Project site, and ITUM has signed IBAs with both TSMC and LIM. Table 4-8 presents the ITUM members that were met with or contacted during the consultation process. Table 4-9 presents a summary of the issues raised by the ITUM members.

Table 4-8 ITUM EIS Interviews

REPRESENTATIVES	DATE
ITUM	
Chief Mike Mackenzie	November 3, 2014
Bureau de la protection des droits et du territoire, Director	November 4, 2014
Bureau de la protection des droits et du territoire, Environment Advisor and Biologist	November 3, 2014
Tshiuetin Rail Transportation	November 3, 2014
Société de développement économique de Uashat mak Mani-Utenam	November 3, 2014
Louis (Ben) Sylvestre Mackenzie family, land-users (207)	November 4, 2014
Jean-Marie Mackenzie family (211)	November 4, 2014
Data collection discussions	
Public Works	November 4, 2014
Public Safety (SQ)	November 5, 2014
CSLC	November 5, 2014 (was unable to meet at the time, no answer to email)
Director, Education	By email, no answer

ITUM members expressed various concerns; the main issue was the desire for more spin-offs in employment and contracts. Other issues included: the need for a bypass road; the effects on water quality and the environment; the proximity of the site to Kauteitnat (Irony Mountain).

It should be mentioned that the ITUM leadership sent a letter to the federal government and the government of NL confirming that it supports the Howse Project and that it will address its concerns with respect to the development of the Howse mine directly with the Proponent.

Table 4-9 Summary of Issues Raised by ITUM Members

THEME	COMMENTS	EIS SECTION
Access to Land	An alternative bypass road for users is wanted.	6.9.7
Communication	An update of the 2013 site visit in 2015 is requested.	-
Economic benefits	▪ Financial compensation for sensitive areas should be provided. ▪ Uashat also has a minority of contracts. There are very few jobs for Uashat entrepreneurs.	6.9.9

THEME	COMMENTS	EIS SECTION
Employment	▪ Spin-offs in employment are significant. ▪ There is favoritism for the Naskapi and few jobs for people of Uashat. Uashat people are a minority. Jobs available are often with Sodexo.	6.9.8
Environment	▪ There is concern regarding the environmental compliance of the Howse Project in general.	EIS
Kauteitnat	▪ Kauteitnat is a sacred place. There is concern about proximity of the pit to this site (too close). ▪ Kauteitnat Mountain is an observation point. Caribou could be spotted from the top. ▪ Question whether archaeological investigations were properly carried out.	6.9.9
Water quality	There are concerns about water quality near the Project site.	6.7.10

<u>IN and NCC</u>

The IN of Labrador and the NCC were also consulted for the Howse EIS, but given their considerable distance from the Project site (close to 500 km), and given their participation in the HSE Committee and Implementation Committee, they were consulted by letter in mid-October 2014 (Volume 1 Appendix XV). The letters acknowledged the comments previously received from both groups during the Project Registration phase. No response was received from both groups, but IN provided comments on the EIS preliminary draft as discussed below (Section 4.3.2.2).

<u>Town of Schefferville Representatives and Residents</u>

A meeting was held in April 2014 with the Town of Schefferville Administrator to discuss the Project Registration of the Howse Project. The Town Administrator sent HML a letter dated April 21 2014, indicating that, given that the Howse Project will have no additional effects on Schefferville and the mitigation measures already put in place for environmental protection, the Town is supports the Howse Project. Table 4-10 lists the individuals met for the purposes of the EIS.

Table 4-10 Meetings with Schefferville Representatives and Residents

REPRESENTATIVES	DATE
Town Administrator	September 24, 2014
Non-Aboriginal land-users (2)	September 25, 2014
Business person	September 25, 2014
CLSC	September 27, 2014
Sûreté du Québec	September 26, 2014

Stakeholders consulted in Schefferville did not have concerns about the Howse Project, but rather about the cumulative effects of the mining industry's presence in the area, mostly regarding the town's inability to deal with a boom in the mining industry. They also relayed the difficulties experienced on a daily basis related to the Québec-Labrador border. In general, the Town would like to be adequately prepared for when the next mining boom, in which case, government participation is necessary (Joncas 2014, personal communication).

Table 4-11 Summary of Issues Raised by Schefferville Representatives

THEME	COMMENTS	EIS SECTION
Howse Project Effects		
Access to land	The gate and the escort on the road make travel difficult. Control at the gate is problematic and it's intimidating to say you work for another company.	6.9.7
Agreements	Mining companies are concerned about First Nations blocking projects and the governments' lack of intervention.	6.9.4
	People do not know their rights and get angry. Mining companies should be their partners.	6.9.4
	There is no agreement between TSMC and doctors, even if an attempt was made.	6.9.6
	There is no agreement between the mining companies and health services. An agreement or a protocol would make things easier for health care employees.	6.9.6
Communication	People on the Reserve are not informed. There is a lack of transparency from the Band Council.	-
Economic benefits	▪ Mines are in Labrador but there are many effects in Québec, particularly Schefferville. Investments must be made for the landfill and waste water system. ▪ Facilities were planned for 850 persons and are functioning at 100-130% of their capacity; the infrastructure is insufficient. ▪ In general, mining development is positive; housing development has started again.	6.9.7
Employment	▪ It is hard to find two suitable jobs for couples. Families in general do not want to move to the region. ▪ Jobs can have positive and negative effects on health.	-
Cumulative Effects		
Access to land	▪ The security checkpoint hampers traffic and the escort system is complicated. ▪ Since mining started, some areas have become inaccessible or less attractive.	6.9.7
Air quality	Dust in town is problematic. A wash bay at the city entrance is supposed be put in place.	6.7.2
Caribou and wildlife resources	Caribou hunting is no longer possible.	6.8.3
Health	▪ Many mine workers are not from Québec and must pay fees when treated for health issues in Schefferville. ▪ Health consultations in Schefferville for mine workers have increased. Many mine workers have poor health. ▪ CLSC workers wish there would be discussion to better coordinate healthcare between Québec and Labrador. ▪ Economic spin-offs can have positive and negative effects on health.	
Housing	▪ Housing is problematic. Outfitters now provide services to mining companies. ▪ The town cannot expand anymore. There are only 6 lots left for expansion in 2014 (125 in 2012).	6.9.6
Water quality	The contamination of lakes and its effects on fish are a concern. The proliferation of mining projects will make it more and more difficult to find good lakes to fish.	Chapter 7

Business Partners

Some comments were received from local business representatives, especially those who provide services to the Proponent (Table 4-12). Given that the Howse Project will secure the need for services for the duration of the Project, it is seen as positive by business partners. However, the purpose of the discussions was to provide business representatives with information on the Howse Project.

Table 4-12 HML Business Partners

ORGANIZATION	DATE OF COMMUNICATIONS
Air Inuit	By letter, November 27, 2014. No response received.
Tshiuetin Rail Transportation	November 3, 2014.
Wabush Airport	By letter, October 14, 2014. Response received November 5, 2014.

Wabush Airport provided an answer to the letter, indicating that Wabush's airport is owned by Transport Canada. As a Federal Authority under the CEAA, TC has provided comments on both the Project Description and the Environmental Impact Statement Guidelines. The letter indicated that TC has not identified any potential effects related to the Wabush Airport operations in reading the Project Description. TC will also have the opportunity to comment on the Environmental Impact Statement during the review process.

Tshieutin Rail Transportation (TSH) has no concerns regarding the Howse Project, as the volume can be handled with an upgraded maintenance plan. TSH is prepared to carry up to 5 million tonnes per year with its current maintenance plan, and up to 8 million tonnes per year when its railway maintenance plan is upgraded. In 2015, over two million tonnes of ore was transported on the railway. The passenger train is not affected by the freight train, because all pull-off lanes are open. The Howse Project will have little if any effect on the enhanced transportation capacity of TSH (Cordova 2014, *personal communication*).

Other Stakeholders from Labrador and Québec

The Proponent meets with various local stakeholders from the region and in Schefferville on a regular basis, and participates in numerous conferences through which the public can stay informed on current and planned mining projects operated by HML. Regular meetings are held with municipal councils, local authorities and the business community from the Québec-Labrador region (Labrador West, Happy Valley Goose Bay, and Sept-Îles).

Frequent discussions with the authorities of Sept-Îles have been held given the presence of TSMC in the area, more specifically for the use of the Port facilities. Where indicated, these discussions include the Howse Project on behalf of HML. Positive relations were established and are maintained with the City of Sept-Îles and with DESI in particular. The latest meeting held with DESI took place on December 1, 2015.

4.3.2.2 Comments from Aboriginal Groups on EIS Preliminary Draft

A draft version of the Howse Project EIS was submitted to the CEAA and relevant Aboriginal groups for comment. Between March and May 2015, HML received questions from NIMLJ, NNK, IN and the CEAA on this document.

The Final EIS was revised according to the comments and questions received from First Nations and the CEAA. The effects assessment and cumulative effects assessment methodology was thoroughly revised in close consultation with the CEAA. When relevant, answers to questions were integrated into the main body of the EIS. Additional supporting studies were carried out and are available in Volume 2 of the present document.

What follows is a summary of the main issues addressed through the comments and questions from First Nations on the preliminary EIS. Only a summary is presented below. HML appreciates the substantial level of comments made and questions asked, which were numerous: NIMLJ had 50 questions; NNK 103 questions; and the IN submitted 60 questions. These allowed for important improvements to the Final EIS.

Comments from NIMLJ Representatives

A first set of general comments were made, including request to detail the Project justification. Several questions concerned the involvement of NIMLJ in communications and consultations for the EIS, and a question was about the role and efficiency of the HSE Committee and communications during the Howse Project. One question was about how HML intended to communicate with its contractors to ensure that they will also apply the health, safety and environmental policies, as some NIMLJ had noted non-conformities by contractors. No less than 15 questions were about air quality in the area, and 8 questions concerned water quality and fish habitat. A question was raised in relation to work conditions at the mine site, in particular for the inclusion of women in the workforce.

Several questions pertained to access to land, traditional activities, and comments were appended to the main document submitted by NIMLJ regarding contemporary land-use of the Innu for inclusion in the EIS. The preservation of Kauteitnat was also raised as a concern, and a few questions were about the visual effects of the Project. Finally, several comments made regarded cumulative effects, and again, the importance of communications relative to cumulative effects was reiterated.

Comments from NNK Representatives

NNK questions dealt with a variety of issues, beginning with technical questions on the Project itself, on the mine site, stock piles, grade of material, and acid rock drainage. Several questions concerned air quality (9, including questions on climate), and over 15 questions pertained to water quality, and another five on fish and fish habitat.

An additional 16 questions dealt with wildlife, including caribou, avifauna, and small mammals. A few questions concerned traditional activities, access to land and road safety. Socioeconomic concerns was also of importance, as questions were asked regarding employment and contract opportunities, training, adaptation of work conditions for families, and initiatives for women, youths and cultural awareness. Finally, a few questions tackled IBAs, cumulative effects, monitoring and reporting, as well as site rehabilitation.

Comments from IN Representatives

Globally, most of the questions by the IN focused on methodological considerations of the effects assessment and cumulative effects assessment, as well as of the land-use study carried out in the context of the Howse Project. The IN document began with general comments on various issues, including the EIS methodology, air quality, traditional land-use and the George River Caribou Herd. These were complemented by sixty detailed questions on:

- The Howse Project undertaking;
- The EIS methodologies;
- Land-use and ATK, including on the land-use study carried out for the purpose of the Howse Project, and about First Nations concerns regarding land-use (approximately 10 questions);
- Agreements with First Nations.

Air quality was also a significant theme for which the IN requested clarifications (9 questions total, including a general comment, a question on GHG, and on the relation with human health). Other questions concerned noise, light, and wildlife. Another set of questions focused on socioeconomic issues, such as employment and work conditions. Finally, there were a few questions on reclamation and on the closure plan.

4.3.2.3 Feedback on Mitigation Measures by Local Aboriginal Groups

In the context of the environmental effect assessment for the Howse Project, a number of mitigation measures were proposed as normally required in EISs. Given that the Project's effects are mostly felt at the local level, discussions with NIMLJ and NNK representatives were held to validate the proposed measures.

Feedback Received from the NIMLJ

One meeting was held with NILMJ representatives in August 2015 to discuss the comments made in writing on the EIS draft. The representatives indicated that they were pleased regarding the availability of the Timmins-Kivivik bypass road, although they mentioned that it took a long time for HML to complete it. Many comments were made on the land-use map and these comments are integrated in this current version as previously indicated (Figure 4-1). The NIMLJ's feedback included corrections on areas of particular concern for waterfowl, wildlife hunting locations that seemed to be missing, and they also clarified their need to extend the bypass road network to maintain easy access to Rosemary Lake area.

Another discussion was held at the beginning of November 2015 to specifically discuss main concerns raised by community representatives and members, and HML's proposed mitigation measures. The feedback received from NIMLJ representatives on these mitigation measures was overall positive, except for certain suggestions for further improvements. HML reiterated during the meeting that it remains open to further suggestions, which can be discussed at future HSE Committee meetings, or at another time that is convenient, which was acknowledged and appreciated.

This feedback, which includes that of the NNK given the close similarities in issues and concerns raised, is presented in Table 4-13.

NNK Representatives

A discussion was held by teleconference at the beginning of November 2015 to specifically discuss main concerns raised by community representatives and members, and HML's proposed mitigation measures. HML's mitigation measures were generally well-received by the NNK representative, who was in agreement with the measures, without precluding the possibility to suggest other measures in due course. Suggestions made during the discussion for further improvements were noted. HML reiterated during the meeting that it remains open to further suggestions, which can be discussed at future HSE Committee meetings, or at another time that is convenient, which was acknowledged and appreciated.

Table 4-13 Summary of Main Issues Raised by Local First Nations, Measures by HML and Feedback Received (November 2015)

THEME	ANSWERS / MEASURES	FIRST NATIONS FEEDBACK RECEIVED
Access to the land	▪ Upgrades to the Timmins-Kivivik bypass road were completed in Summer 2015; and ▪ Access to active mining roads will continue to be controlled for safety reasons. Active mining roads should not be used by the land users since an alternative bypass road is available. If a land user requires access a specific area not accessible from the bypass road, HML/TSMC will provide a safety escort.	▪ Bypass road to Howells River is needed, via Pinette Lake; ▪ More signage on bypass road is required to guide drivers; ▪ TSMC should continue snow removal to the Rosemary Lake bridge during Goose Break in May to give road access to local hunters
Agreements	▪ IBAs signed with the local leadership contain a number of tangible commitments, are legally-binding and are	▪ Community members can consult agreements at Nation office;

THEME	ANSWERS / MEASURES	FIRST NATIONS FEEDBACK RECEIVED
	confidential. Specific questions on the IBAs should be taken up with local authorities; ▪ Given the change in circumstances whereby HML acquired 100% of the Howse deposit and LIM obtained Court protection under the CCAA, and the acquisition of 100% of the Howse deposit by TSMC, it is the intention of HML/TSMC to incorporate the Howse deposit into its IBAs with Aboriginal groups; and ▪ Periodic updates are provided by way of radio announcements and bulletins to community members on the progress of the DSO and Howse Projects, mining activities, and on the numerous benefits to the community.	▪ Ongoing discussions on transfer of Howse to TSMC IBA; ▪ Important to continue with communications, jointly with Nation representatives.
Air quality and Cleanliness	HML has /will : ▪ Install an air quality measurement unit in Schefferville once specifications advised by the Government of Québec are confirmed; ▪ Apply water, via its Innu contractor, Mamu Construction, to road between DSO Project Site and Schefferville during dry periods to avoid dust generation as much as possible; ▪ Begun reducing its workforce as the construction of the DSO Project nears completion, thus reducing traffic and dust generation; ▪ Since Summer 2015, begun transporting freight by train between Schefferville and the DSO site, which will help diminish dust in town; ▪ Since Summer 2015, coordinated an improved system for transportation of merchandise and workers by bus; ▪ Redesigned the Howse Project to further reduce the height of the waste rock piles and to return a portion of the waste rock to the Howse pit; ▪ A wash bay operated by TSMC at DSO site between May and October, which all vehicles must use; ▪ Been collaborating with the authorities responsible for local road infrastructure within the Government of Québec (Secrétariat au Plan Nord, Ministère des Affaires municipales et Occupation du territoire, Ministère des Transports) and the Town of Schefferville regarding paving of streets, including Chemin de la Gare, Knob Lake, Laurentide, Wishart and Atlantic. According to information obtained by the government, it is envisaged that the paving will take place in 2016, at same time as works on road to Kawawachikamach.	▪ To be more effective, TSMC wash bay should be moved to the DSO Timmins site exit/entry point ▪ NIMLJ would like to see the main road on the reserve paved as part of the paving project – will need to be coordinated with responsible parties
Caribou and other resources	▪ Since 2009, caribou sightings within the LSA have been rare. The GRCH has experienced unprecedented declines throughout its range, and in tandem with other caribou populations across North America, commencing in 2010. Causes for this decline are generally unknown but commonly attributed to habitat loss and/or climate factors. Local activities cannot be directly attributed as the cause of this continental trend; ▪ As discussed in the Howse EIS, some time prior to 2010, caribou calving areas migrated more than 230 km east from their original location near Schefferville and so there is negligible potential for the Howse Project to interact with this sensitive life stage;	▪ Local communities would like to be involved in the monitoring if caribou are found to be in the vicinity over the Howse/DSO Project. ▪ No other comments because no other projects operating in region.

THEME	ANSWERS / MEASURES	FIRST NATIONS FEEDBACK RECEIVED
	▪ The Proponent recognizes that the GRCH can, one day, return to its original grounds and includes, in its mitigation measures, a commitment to be aware of any caribou seen within a 100 km radius of Howse activities, conduct surveys if collared caribou are found within 20 km of Howse and cease all activities if caribou are known to be within 5 km of the active pit or the processing complex; ▪ HML/TSMC contributes to a compensation fund as specified in certain IBAs4, as per priorities identified, for subsistence activities. First Nation leadership determines how the funds are allocated and used. This fund contributes to alleviating the financial burden for families who count on subsistence harvesting for its economic and nutritive value, in an area where store-bought food is expensive, such as for a fuel allocation for all members; ▪ HML/TSMC, the biggest private contributor to the Caribou Ungava project, will pursue its financial participation in the program to advance research on caribou and on the effects of mining activities on the George River herd decline, and on other factors that may play a role in this decline. Researchers will involve the concerned Aboriginal communities by considering their views, their traditional indigenous knowledge in the studies and by involving them in the research activities held on their traditional territories; ▪ Sightings of caribou will be reported to the HSE Committee; ▪ HML will announce on the local radio stations blasting activities two days ahead of time; and ▪ In collaboration with the HSE Committee, and in some cases with local authorities, mining activities will be adapted if needed to minimize the effects on traditional activities.	
Communication	HML has /will : ▪ Support the work of the IBA Implementation Committees; ▪ Provide Project information via radio updates and newsletter; ▪ Work with the local Councils to improve communication to community members on a periodic basis; ▪ Include the Howse Project in TSMC's HSE Committee; ▪ Maximize the presence of Aboriginal personnel for all security shifts to facilitate communication in Innu with local lands users; ▪ Provide cultural awareness to all staff and language training to personnel who require it in their day-to-day tasks;	▪ Suggest to provide pictures to First Nation representatives that illustrate monitoring and mitigation measures to assist them in providing explanations to with community members

[4] Local leadership have determined in each of their respective IBAs their needs in regard to land-use. As such, said compensation funds vary according to the IBA. However, in all cases, HML provides funds but each local leadership is responsible for funds management and allocation.

THEME	ANSWERS / MEASURES	FIRST NATIONS FEEDBACK RECEIVED
	▪ Work with the local communities to hold a Security course for its members, so that there are additional Innu personnel at the security post; and HML contact information may be found in Band Councils. HSE Committee members may also provide contact information.	
Cumulative Effects	▪ HML will continue to address all HML/TSMC mining matters (Howse, Goodwood, DSO) under the aegis of the HSE Committee to monitor impacts and cumulative effects of mining operations; ▪ Continue to participate in the Regional Steering Committee on Mining Issues (Schefferville), and the Labrador West Regional Task Force, and collaborate with other mining companies operating in the region to assess, address and monitor cumulative effects relating to mining; ▪ Legislation requires financial guarantees from mining companies to ensure that all rehabilitation works are completed, while the Howse Rehabilitation and Closure Plan will require First Nation approval; ▪ Continue to adhere to the Joint Emergency Preparedness Plan and collaborate with communities and other mining companies in doing so; ▪ Continue to collaborate in the Ungava Caribou research program in order to assess cumulative effects of mining on the GRCH; ▪ Work with mining associations and government to discuss and address cumulative effects issues; and Work with governments and communities to prepare a map showing all mining projects (proposed and ongoing), and which will guide land-users in harvesting resources in safe locations. These maps will be posted in public places.	▪ Agree with measures – may suggest other measures in due course.
Cumulative Effects	▪ HML will continue to address all HML/TSMC mining matters (Howse, Goodwood, DSO) under the aegis of the HSE Committee to monitor impacts and cumulative effects of mining operations; ▪ Continue to participate in the Regional Steering Committee on Mining Issues (Schefferville), and the Labrador West Regional Task Force, and collaborate with other mining companies operating in the region to assess, address and monitor cumulative effects relating to mining; ▪ Legislation requires financial guarantees from mining companies to ensure that all rehabilitation works are completed, while the Howse Rehabilitation and Closure Plan will require First Nation approval; ▪ Continue to adhere to the Joint Emergency Preparedness Plan and collaborate with communities and other mining companies in doing so; ▪ Continue to collaborate in the Ungava Caribou research program in order to assess cumulative effects of mining on the GRCH; ▪ Work with mining associations and government to discuss and address cumulative effects issues; and Work with governments and communities to prepare a map showing all mining projects (proposed and ongoing), and which will guide land-users in harvesting resources in safe locations. These maps will be posted in public places.	▪ Agree with measures – may suggest other measures in due course.

THEME	ANSWERS / MEASURES	FIRST NATIONS FEEDBACK RECEIVED
Economic benefits	HML/TSMC has/will: ▪ In place IBAs that ensure that a share of the economic benefits remain in the Schefferville area, including priority hiring and contracting; ▪ Awarded hundreds of millions of dollars in contracts to local Aboriginal businesses since the beginning of the DSO Project; ▪ Continue to provide information on all employment and contracting opportunities; ▪ Continue to support the establishment of local businesses and capacity-building; ▪ Continue to adapt the bidding process to the size of some of the local businesses, where possible divide big contracts into smaller ones; ▪ Continue to collaborate with the responsible authorities for local road infrastructure within the Government of Québec (Secrétariat au Plan Nord, Ministère des Affaires municipales et Occupation du territoire, Ministère des Transports) and the Town of Schefferville regarding paving of streets, including chemin de la Gare, Knob Lake, Laurentide, Wishart and Atlantic. According to information obtained by the government, it is envisaged that the paving will take place in 2016, at same time as works on road to Kawawachikamach and ▪ Continue to meet with Aboriginal representatives to review IBA implementation. Significant benefits have flowed to Innu and Naskapi businesses since the beginning of the DSO Project, including to: Autobus Tshiuetin, Pétroles Naskinnuk, Construction Mamu, Innutel, TSH, Sodexo, Garage Montagnais, Nirinnu, Naskapi Heavy Machinery, Naskapi Imuun, and others.	▪ Agree with measures – may suggest other measures in due course.
Employment and Training	HML/TSMC has/will: ▪ Close to 150 Innu and Naskapi were working on the DSO Project (September 2015), representing close to 15% of the Project workforce. This rate is expected to increase once the construction period ends and there are less outside trades workers; ▪ HML/TSMC has a strict zero tolerance policy with regard to discrimination and harassment, which is presented to all workers during site orientation and which includes steps to take in the case of harassment; ▪ Maintain jobs through the Howse Project; ▪ Continue to train and promote Aboriginal workers in the workplace, and which will continue to be required of all contractors; ▪ Continue to support essential skills training and ensure its accessibility in the area; ▪ Continue to provide access to adequate technical training according to job needs as per IBA commitments; ▪ Provide mechanisms through which Aboriginal workers may access qualified positions and obtain promotions (in progress); ▪ Offer an alternating schedule to local workers when work schedules can allow it; ▪ Continue to provide training equitably for both male and female staff;	▪ Agree with measures – may suggest other measures in due course.

THEME	ANSWERS / MEASURES	FIRST NATIONS FEEDBACK RECEIVED
	▪ Continue to provide Cultural Awareness and Respectful Workplace training program for all its employees; ▪ Delivered a custom-designed training in Process Plant Operations to 3 Québec First Nations in spring 2015, which included English classes for Innu students. Many graduates have since been hired to work on the DSO Site; ▪ Employs women at a rate of over 10% of its Project Workforce and will continue to favour women who have the required skills and qualifications; ▪ Employs numerous Aboriginal women in non-traditional roles including heavy equipment operators, plant operators, security officers; ▪ Coordinate more training in collaboration w/ community in fields related to mining industry; ▪ Continue to support Innu staff in improving their English skills on-the-job, given that the worksite is in Labrador and primarily English-speaking; ▪ Deliver language training to personnel who require it in their day-to-day tasks; ▪ A clear complaint mechanism. In fact TSMC encourages workers who feel discriminated upon to speak out so that problems may be solved; and ▪ Continue to participate in local career fairs.	
Kauteitnat	▪ HML recognizes the historical and cultural significance of Kauteitnat, which is why it is considered a sensitive area by the Proponent; ▪ A buffer zone of 500 m will be maintained between the bottom of Irony Mtn and the Howse footprint. This distance was established based on the local of the iron deposit, an on-site meeting with trapline holder family representatives, and design criteria to set the maximum distance between the mountain and feasible mine activities, infrastructure and components; ▪ HML has optimized the Project design to minimize effects in the vicinity of Kauteitnat, including the visual impact, through reduced waste rock pile heights and progressive in-pit filling; ▪ As per discussions between TSMC and NML, it is envisaged that the mining claims covering Irony Mountain will be transferred to the local communities by the GNL and designated as a no-mining are; and Proper archaeological investigations have been carried out for both DSO and the Howse Project. After verification, there was no burial found on Kauteitnat.	▪ Agree in principle with measures, but will require further analysis
Rehabilitation	▪ LIM is subject to the Newfoundland and Labrador Mining Act with respect to rehabilitation of mining sites; ▪ All rehabilitation and closure works are fully covered as per the requirements of the Newfoundland and Labrador Mining Act; ▪ The rehabilitation and closure plan for the Howse Project will be completed to the satisfaction of the Aboriginal groups prior to HML applying for the release certificate from the GNL; ▪ HML will inform in advance local businesses of contracting opportunities for the decommissioning and reclamation phase; and	▪ Agree with measures – may suggest other measures in due course.

THEME	ANSWERS / MEASURES	FIRST NATIONS FEEDBACK RECEIVED
	▪ Rehabilitation works of DSO pits will begin in 2016 (Timmins 4).	
Road safety	HML has/will: ▪ Continue to participate in the Regional Steering Committee on Mining Issues (Schefferville) which has discussed this matter and identified solutions; ▪ Continue to maintain the multi-user road between the Schefferville landfill and the DSO site, including safety signage; ▪ Installed in 2015 road safety signage on the road between Schefferville and the DSO site, including for the new railway. Additional bilingual road safety signs, including speed limits, messages on safe driving, beacon lights, will be installed in spring 2016, in collaboration with the Town of Schefferville and the Sûreté du Québec. This will assist the SQ in enforcing driving laws; ▪ Speed limit will be maintained at 70 km/hour on the multi-user road north of the Schefferville landfill, and at 50 km/hour between the Schefferville landfill and the town of Schefferville. The speed limit will apply to all road users. Respect of applicable speed limits will be monitored by HML and by the Sûreté du Québec; ▪ Continue to raise awareness among workers on importance of safe driving. Measures are taken for detractors found disobeying traffic laws, and witnesses of road safety violations are asked to report details.	▪ Suggest increased enforcement by HML/TSMC security personnel on the multi-user road between the DSO Site and Schefferville
Water quality	▪ The water regime of Pinette Lake was analyzed in 2015. This work was undertaken to anticipate the change in water level resulting from a decrease of 4% in its watershed. Given the drainage form of the lake and a slight decrease in flow, the level of Pinette Lake is not expected to decrease by more than 2 mm, which would be in the spring. The water level in the Summer will continue to vary as before the Project; ▪ Since Pinette Lake will not receive any discharge water from the Howse mine (from drainage or treatment), the lake will not change colour and its water quality will remain the same. Regarding Rosemary Lake, which is at a much lower elevation and connected to the Howells River, the discharge water directed to Burnetta and Goodream creeks will flow into it. At its entry point, the discharge water will be highly diluted, however, i.e. 1/73, and the water will be clear at the lake exit point; ▪ Fish are not expected to be affected by the Howse Project. The Human Health Risk Assessment completed in October 2015 modelled the risk of fish consumption on human health, and concluded that the potential affect to human health was very low. During Howse operations, aquatic fauna (fish and benthic invertebrates) will be monitored in accordance with the Metal Mining Effluence Regulations; ▪ Regarding spills that are reasonably expected to occur, there are safeguards in place: a spill response plan on which HML workers are regularly trained; spill kits are readily available equipped in trucks for spills to be contained quickly and not reach water bodies; and ▪ As mentioned in the EIS, Section 7.3.10, the only risk of groundwater contamination relates to nitrate and	▪ Agree in principle with measures, but will require further analysis.

THEME	ANSWERS / MEASURES	FIRST NATIONS FEEDBACK RECEIVED
	nitrite. Since there are no drinking water wells near the Project, this was not considered an issue. Therefore, mitigation measures were not proposed for this possible contamination. However, numerous current measures have been written with a view to reducing the amount of residual ammonium in surface water following the use of explosives. Ammonium is a form of nitrogen that quickly turns to nitrate. These measures can be found in Section 7.3.10.3, regarding drilling and blasting.	

5 METHODOLOGY

5.1 GENERAL CONSIDERATIONS

This section presents and justifies the methodology used to describe the biophysical and socioeconomic components, identifies the environmental effects of the Project, describes mitigation measures, and assesses the significance of each effect that is identified. Where appropriate, a distinction was made between the effects generated during the Project Construction, Operations and Decommissioning and Reclamation phase.

The following steps were completed to ensure that a comprehensive effects assessment was accomplished for all physical, biological and socioeconomic components that might be affected by the Project:

COMPONENT DESCRIPTION	
1.	An LSA, RSA study area and a temporal boundary were defined for each component and valued component. Rationale is provided for the inclusion or rejection of a component as a VC;
2.	Each component and its associated baseline was described based on a literature review and traditional knowledge/land use studies, including those specific to the Howse Project. Data gaps were identified;
ENVIRONMENTAL EFFECTS OF THE PROJECT	
3.	An initial assessment of the effects of the Project on each VC was carried out by characterizing the relationship as having/not having an interaction;
4.	The effects associated with the VC that have an interaction with the Project are described;
MITIGATION MEASURES	
5.	Standard and specific mitigation measures were described and, where possible, measures are proposed by phase. For those interactions where a residual effect remains, a significance assessment was conducted;
SIGNIFICANCE ASSESSMENT	
6.	A residual effects significance assessment was conducted. The nature and direction of the effects were described and a quantitative evaluation of the effects of the project on the residual effects was completed based on six criteria;
7.	The likelihood of the environmental effect was determined, and for those where an effects is still likely, a cumulative effects assessment was conducted.
CUMULATIVE EFFECTS ASSESSMENT	
8.	Cumulative effects (i.e. combined residual effects of past, present and future projects) were assessed on those VC where mitigation measures were insufficient and an environmental effects remains. Cumulative assessment was completed using standard procedures: scoping, analysis, mitigation and significance assessment
MONITORING AND FOLLOW-UP	
9.	Recommended VC monitoring and follow-up procedures to evaluate the exactness of VC effect assessment and mitigation measures (site specific and cumulative assessments)

5.2 ENVIRONMENTAL COMPONENT DESCRIPTION

The following subsections describe each biophysical and socioeconomic components based on baseline data stemming from available literature. Technical term definitions can be found in the glossary. Where indicated, more detailed information concerning specific components has been appended to the main text of the EIS.

5.2.1 Selection of Valued Components

The identification of valued components was based on several criteria. First, VCs were identified by the CEAA under the Howse EIS guidelines. Second, we identified VCs based on their applicability (i.e. having an environmental effect) to the criteria described in Section 5 of CEAA act (see below,) and third, according to the criteria described in the Species at Risk Act. The provincial EPR guidelines submitted in December 2014 were also considered.

As required by Section 5 of the *Canadian Environmental Assessment Act* (2012), the term "environmental effects" shall mean:

(a) a change that may be caused to the following components of the environment that are within the legislative authority of Parliament:

(i) fish and fish habitat as defined in subsection 2(1) of the *Fisheries Act*,

(ii) aquatic species as defined in subsection 2(1) of the *Species at Risk Act*,

(iii) migratory birds as defined in subsection 2(1) of the *Migratory Birds Convention Act, 1994*, and

(iv) any other component of the environment that is set out in Schedule 2;

(b) a change that may be caused to the environment that would occur:

(i) on federal lands,

(ii) in a province other than the one in which the act or thing is done or where the physical activity, the designated project or the project is being carried out, or

(iii) outside Canada; and

(c) with respect to Aboriginal peoples, an effect occurring in Canada or any change that may be caused to the environment on:

(i) health and socioeconomic conditions,

(ii) physical and cultural heritage,

(iii) the current use of lands and resources for traditional purposes, or

(iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

The CEAA (2012) further defines "environment" as meaning the components of the Earth, including:

(i) land, water and air, including all layers of the atmosphere,

(ii) all organic and inorganic matter and living organisms, and

(iii) the interacting natural systems that include components referred to in paragraphs (a) and (b).

For the purpose of this EIS, VCs were divided into biophysical and socioeconomic VCs. In accordance with the CEAA, only biophysical and socioeconomic VCs that could potentially be affected by the Project, whether negatively or positively, were selected. For the Howse EIS, the term "VC" includes both biophysical and socioeconomic VCs. The following criteria were also considered in the determination of a VC:

1. The component is present in the LSA or RSA.
2. The Project could possibly interact with and have a harmful effect on the component.
3. The component is listed under section 5 of CEAA Act.
4. The component is particularly vulnerable to disturbance.
5. The component includes species with special status (as per Newfoundland and Labrador's Endangered Species Act, the federal SARA and/or the Committee on the Status of Endangered Wildlife in Canada).
6. The component was specifically highlighted as valued in the consultation process or in focus groups organized for the land-use and ATK study.
7. The component was defined as an important issue at the regional level (land use plans, municipality or MRC master plans), provincial level (provincial legislation and regulations, guidelines) and/or federal level (federal legislation and regulations, guidelines).
8. The component refers to Aboriginal benefits, including claimed or proven Aboriginal rights and/or treaty rights.

The following criteria is also used for the final selection of VCs (Environmental Assessment Office, 2013):

9. If the possible effects on the VC can be effectively considered within the assessment of another VC, they should be combined (no duplication of effects assessment).

5.2.2 Definition of Spatial and Temporal Boundaries

For each component and VC, the biophysical LSA was determined and defined as the area where the physical extent of the Project activities are felt by the component, whereas the biophysical RSA corresponds to the extent of the cumulative effects (residual effects of past, present and future activities combined) of the Project on the targeted component. The LSAs and RSAs are the same for all the socioeconomic components.

Temporal boundaries were defined based on the anticipated temporal extent of the effects of the project on the component. Biological and seasonal cycles have been considered for all biophysical components and/or socioeconomic cycles and are described.

5.2.3 Existing literature

A literature review was performed for each component.

5.2.3.1 Current Study

In an effort to acquire additional information for components with scarce data, and to comply with CEAA requests, HML has overseen the completion of several studies which support the guideline documents provided by CEAA and GNL. These new studies were carried out specifically for the Howse Project and have provided a significant source of new information which has eliminated some data gaps, and include:

Appendix A. Golder Associés (2014) *Howse Pit Conceptual Slope Design - Interim Report*. CONFIDENTIAL. Report Number: 014-13-1221-0104-4000 RA. Submitted to Labrador Iron Mines.

Appendix B. Geofor Environnement (2015) *Hydrogeology and MODFLOW Modelling – Howse Property*. Technical Memorandum prepared for Howse Minerals Limited, 22 p. and 6 Appendices.

Appendix C. Raphael Picard (2014) Study on Land and Resource use by the Innu and Naskapi – Howse Property Iron Ore Project. Prepared for Howse Minerals Limited, 36 p.

Appendix D. *Human Health Risk Assessment* and supporting documents.

Appendix E. AECOM (2015) *Air Dispersion Modelling Report*s

Appendix F. AECOM (2015) *DSO Howse Property Environmental Assessment – Noise and Vibration Technical Report*. Prepared for Howse Minerals Limited, 17 p. and 3 appendices.

Appendix G. AECOM (2015) *DSO Howse Property Environmental Assessment – Ambient Light Technical Report*. Prepared for Howse Minerals Limited, 16 p. and 2 appendices.

Appendix H. Activation Laboratories Ltd. (2014) *Acid-Base Accounting and Toxicity Characterization Leach Procedure Report*. HPP-RM-20141023. A14-08392. Prepared for Tata Steel.

Appendix I. Groupe Hémisphères (2014) 2013-2014 Hydrological Campaign for the Howse Property. Field Report for Howse Minerals Limited, 6 p. and 2 appendices.

Appendix J. Permafrost Condition at Howse and supporting documents

Appendix K. Groupe Hémisphères (2014) *Terrestrial ecosystem mapping, Howse pit study area*. Technical Report submitted to Howse Minerals Limited, 45 p. and 6 appendices.

Appendix L. Groupe Hémisphères (September 2015) *Pinette Lake Water Regime*. Technical Report submitted to Howse Minerals Limited., 13 pp. and 1 appendix

Appendix M. Groupe Hémisphères (2014) *Aquatic Survey - Howse Pit Study Area.* Technical Report Submitted to TSMC, 35 pages and 7 appendices.

Appendix N. Groupe Hémisphères (2015) *Common Nighthawk Survey* for Howse Mining Project, Labrador, Summer 2015. Technical Report submitted to Howse Minerals Ltd., 11 pp. and 3 appendices.

Appendix O. Gerald Penney Associates Limited (2014) *Goodwood-Timmins Haul Road and Howse Property Historic Resources Impact Assessment, near Schefferville, QC.* Archaeological Investigation Permits #14.42. DRAFT Submitted to Provincial Archaeology Office and Tata Steel Minirals Canada.

These studies are appended to this report in Volume 2. A summary is presented in the EIS core document, for all components. In addition, several studies we conducted for adjacent projects for TSMC and/or NML.

These are all referred to in the text. All wildlife studies produced by Groupe Hemisphères that are relevant to the Howse EIS are available in Volume 3, as well as the bird studies quoted in Section 7.4.8.

5.2.4 Data Gaps

Data gaps for each component were identified where the gaps could limit the effects assessment are listed in this section.

5.3 EFFECTS ASSESSMENT METHODOLOGY

5.3.1 Sources of Environmental Effects

Identifying and analyzing the interactions between components and Howse Project infrastructure, equipment, processes and activities is fundamental to a proper environmental effects assessment. Sources of biophysical effects associated with the Project are described in Section 3 (Project Description) and listed in Table 5-1

Table 5-1 List of Project Activities and Sources of Effects

PROJECT ACTIVITY AND RELATED PROJECT PHASE	SOURCES OF EFFECTS
Construction phase	
Upgrading/construction of the Howse haul road, upgrading of a bypass road and water management infrastructures (sedimentation and transfer ponds, drainage ditches)	Stripping of vegetation, excavation, sediment runoff, and emission of air contaminants, dust, noise, vibration, and light
Pit development	Stripping of vegetation, excavation, use of explosive, sediment runoff, and emission of air contaminants, dust, noise, vibration, and light
Transportation and traffic	Emission of air contaminants, dust, noise, vibration, and light, and handling of petroleum products
Mine construction*	Direct, indirect and induced employment, contracting opportunities (goods and services), fly-in fly-out work rotations, use of and pressure on public infrastructures and services, and changes to the visual environment
Operation phase	
Removal and storage of remaining overburden and topsoil	Stripping of vegetation, excavation, emission of air contaminants, dust, noise, vibration, and light, and sediment runoff
Blasting and ore extraction	Excavation, use of explosive, sediment runoff, and emission of air contaminants, dust, noise, vibration, and light
Mineral processing	Emission of air contaminants, dust, noise, vibration and light, and handling of petroleum products
Dewatering	Water diversion and management and handling of petroleum products
Operation of waste rock dumps	Sediment runoff and emission of air contaminants, dust, noise, vibration, and light
Transportation of ore and traffic	Emission of air contaminants, dust, noise, vibration, and light, and handling of petroleum products
Solid waste disposal	Transportation of solid waste, landfill fumes, and emission of air contaminants, noise, and vibration

PROJECT ACTIVITY AND RELATED PROJECT PHASE	SOURCES OF EFFECTS
Hazardous waste disposal	Transportation and storage of hazardous waste, and emission of air contaminants, noise, and vibration
Treatment of sanitary wastewater	Transportation of sanitary waste, leaching of sanitary waste, and emission of air contaminants, noise, and vibration
Explosives waste management	Transportation of explosives waste and leaching of explosives waste
Ongoing site restoration	Excavation, emission of air contaminants, noise, and vibration, soil decontamination, plantation, seeding, and habitat and ecosystem creation
Mine operation*	Direct, indirect and induced employment, contracting opportunities (goods and services), fly-in fly-out work rotations, and use of and pressure on public infrastructure and services
Decommissioning and reclamation phase	
Demobilization of Howse facilities and heavy machinery	Emission of air contaminants, dust, noise, vibration, and light
Transportation and traffic	Emission of air contaminants, dust, noise, vibration, and light, and handling of petroleum products
Final site restoration	Excavation, emission of air contaminants, dust, noise, and vibration, soil decontamination, plantation, seeding, and habitat and ecosystem creation
Mine decommissioning and reclamation*	Loss of direct, indirect and induced employment, loss of contracting opportunities (goods and services), and fly-in fly-out work rotations

*These activities refer to the overall project phase and are associated with sources of effects on the socioeconomic environment.

5.3.2 Interaction of the Project and Potential Effects

Sources of information were extracted from scientific literature, field studies, models built to assess the magnitude or extent of targeted effects and/or from Aboriginal/traditional knowledge sources. Available data extracted from the monitoring or the follow-up of similar mining projects also were also considered as valid sources of information to assess the effects of particular project activities.

For each of the previously-defined interactions, the potential environmental effects were described and quantified whenever possible. Effect determination was based on the available sources of information described in Section 5.3.6.

This section concludes with a statement on the nature and direction of the specific phase's activities on the component.

5.4 MITIGATION MEASURE SELECTION

The mitigation measures proposed for each component are often based on TSMC's EPP document (Volume 1 Appendix Ia), as measures have been developed over time by TSMC, based on past experiences. Section 6.2.1 provides information on the EPP in general, and how it will be adapted for the Howse Project.

To have the most beneficial effect on the biophysical and socioeconomic environments, mitigation measures were designed to meet the following criteria:

- Be technically and economically feasible to implement;

- Be concrete and demonstrably effective to reducing effect significance;
- Have a well-known significant positive effect on the targeted VC;
- Be aimed at counteracting a specific effect or series of effects;
- Have been suggested/accepted by local communities; and
- Have been suggested/accepted by the scientific community.

Mitigation measure description includes a clear statement of its efficiency in reducing the effect significance using, whenever possible, quantitative examples. Mitigation measures were presented by project phases.

5.4.1 Standard Mitigation Measures

TSMC, the assigned operator, has already developed a series of general mitigation measures for the ELAIOM and Project 2a EIS, and these will be amended to include general mitigation measures for the Howse Project. The full list of standard mitigation measures is presented in Volume 1 Appendix VI. From these, the relevant measures will be highlighted for each VC in the appropriate section and their effect on the VC will be described.

5.4.2 Specific Mitigation Measures

Specific mitigation measures were selected to reduce effect significance for a given VC. The mitigation measures must be described and documented, using a sufficient amount of detail to explain how they will effectively minimize the environmental effect. The full list of specific mitigation measures is presented in Volume 1 Appendix XVI.

5.5 RESIDUAL EFFECTS ASSESSMENT METHODOLOGY

Residual environmental effects are those that remain after the implementation of the standard and specific mitigation measures. They were assessed for each VC using the methodology described in the section below.

5.5.1 Residual Effects Significance Assessment

The following subsection presents the methodological approach used to assess the significance of the residual effects on the VCs, by Project phase. Emphasis was placed on VCs that undergo the most significant effects and the same methodological approach was adapted for each VC according to specific thresholds, standard governmental guidelines, laws and regulations.

Six criteria that were used to quantify the significance of the residual effects of the project on the VCs are described below. For each criteria, three levels of effects on the VC are described and an associated value is assigned (value of 1, 2 or 3), with the lowest value representing the least detrimental effect. These values were tabulated to assist with the numerical determination of VC effect significance.

This EIS follows the Operational Policy Statement published by the CEAA in November 2015. As such, the EIS assesses effects on VCs *within the present ecological context* CEAA, 2015b). The assessment of socioeconomic components was completed while consulting the CEAA'S *Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archeological, Paleontological or Architectural Significance under the* Canadian Environmental Assessment Act, 2012 (CEAA, 2015d).

The environmental setting of ELAIOM is significantly disturbed by past IOCC activities as well as by present TSMC/LIM exploration and operation activities. The Howse Project footprint adds relatively little disturbance to the area, except for the presence of an old access road and some exploration drill holes and related access.

5.5.1.1 Nature and Direction of an Effect

In order to further characterize the relationship between the project and the environment, the nature and direction of the effects were described. Effects may be direct or indirect in nature, or both. Direct effects are those that occur as a direct cause-effect consequence of a project activity (Sadar, 1996), such as the destruction of habitat due to the development of an iron ore mine pit. Indirect effects are those that are caused by another project effect, such as a reduction in the size of an animal population resulting from the destruction of habitat.

The direction of an effect could be either positive (Project interactions having positive effects on the biophysical or socioeconomic environments) or negative (Project interactions having negative effects on the biophysical or socioeconomical environments). The CEAA only considers negative effects in their review, as described in the Reference Guide: Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects (CEAA, 2015b). Like their nature, the direction of effects is not a criterion of significance.

The nature and direction of the socioeconomic effects are considered insofar as the Howse Project's effects on the environment affects the socioeconomic values of the Aboriginal people. One purpose of the consultation program described in Section 4.0 was to gain insights into how the groups and individuals consulted would define the direction of the effects of the Project.

5.5.1.2 Timing of the Effect

The timing of an effect of the Project on a valued component is considered. Seasonal effects, biorhythms and ecological cycles are considered.

5.5.1.3 Geographic Extent of an Effect

Geographic extent refers to the area or distance over which a given VC will be affected by the source of an effect. As the LSA and RSA are specific to each selected VC, these will be used to describe the geographic extent of the effects of the Howse Project on each VC.

5.5.1.4 Duration of an Effect

Duration refers to the period of time during which a VC will be affected by the source of an effect. Consideration is given to effects that are expected to be seasonal and/or extend beyond the lifespan of the Howse Project.

5.5.1.5 Reversibility of an Effect

Ecosystems, including their human components, are dynamic and have, to varying degrees, the capacity to return to a pre-existing state when a source of effects ceases. Reversibility assessment criteria is adapted for each VC.

5.5.1.6 Magnitude of an Effect

Magnitude refers to the degree to which a given VC is affected by the source of an effect Magnitude could be higher if an effect is cumulative (e.g., several different water contaminants reaching the same water source), delayed (e.g., a contaminant such as mercury bioaccumulates in a living structure and shows its toxicity long after the beginning of the exposure) or synergistic (e.g., several low-toxicity chemical substances interact to produce a highly-toxic by-product).

The criteria to assess the magnitude of an effect is adapted according to each VC's particular scientific, technical and socioeconomic contexts and so are presented in each VC's respective section.

5.5.1.7 Frequency of an Effect

Frequency refers to the number of times that a given source of effect is active. Criteria used to determine frequency is provided for each VC.

5.5.2 Determining the Significance of a Residual Effect

The matrix below presents the conceptual evaluation of the significance of the residual effects, based on six criteria. The matrix shows how these effects were quantified; each criteria was first categorized into three incremental value categories, where 1 is the smallest and 3 is the largest environmental effect. The final numbers are tabulated into values between 6 and 18, and from these, five levels of effects are defined, from very low to very high. From these five levels, 'very high' and 'high' effects are defined as significant. Figure 5-1 shows how the criteria of magnitude/ecological context, geographic extent, frequency and duration/reversibility were aggregated to yield a measure of an effect. Levels determined as high or very-high are considered as significant. Level determined as 'moderate', 'low' or 'very low' are not considered as significant.

When the residual effects remain significant, compensation measures were adopted. The summary of the logic used to define the significance for each inter-relation is presented at the end of each assessment section.

A concluding statement is provided at the end of this section on the significance of the residual effect.

			REVERSIBILITY																										
			Non-reversible									Partially reversible									Reversible								
			Duration									Duration									Duration								
			Long			Medium			Short			Long			Medium			Short			Long			Medium			Short		
Timing	**Magnitude**	**Spatial Extent** / **Frequency**	Continual	Intermittent	Once	Continual	Intermittent	Once	Continual	Intermittent	Once	Continual	Intermittent	Once	Continual	Intermittent	Once	Continual	Intermittent	Once	Continual	Intermittent	Once	Continual	Intermittent	Once	Continual	Intermittent	Once
Unfavorable	High	Regional	18	17	16	17	16	15	16	15	14	17	16	15	16	15	14	15	14	13	16	15	14	15	14	13	14	13	12
		Local	17	16	15	16	15	14	15	14	13	16	15	14	15	14	13	14	13	12	15	14	13	14	13	12	13	12	11
		Site Specific	16	15	14	15	14	13	14	13	12	15	14	13	14	13	12	13	12	11	14	13	12	13	12	11	12	11	10
	Moderate	Regional	17	16	15	16	15	14	15	14	13	16	15	14	15	14	13	14	13	12	15	14	13	14	13	12	13	12	11
		Local	16	15	14	15	14	13	14	13	12	15	15	14	14	13	12	13	12	11	14	13	12	13	12	11	12	11	10
		Site Specific	15	14	13	14	13	12	13	12	11	14	14	13	13	12	11	12	11	10	13	12	11	12	11	10	11	10	9
	Low	Regional	16	15	14	15	14	13	14	13	12	15	14	13	14	13	12	13	12	11	14	13	12	13	12	11	12	11	10
		Local	15	14	13	14	13	12	13	12	11	14	13	12	13	12	11	12	11	10	13	12	11	12	11	10	11	10	9
		Site Specific	14	13	12	13	12	11	12	11	10	13	12	11	12	11	10	11	10	9	12	11	10	11	10	9	10	9	8
Moderate timing	High	Regional	17	16	15	16	15	14	15	14	13	16	15	14	15	14	13	14	13	12	15	14	13	14	13	12	13	12	11
		Local	16	15	14	15	14	13	14	13	12	15	14	13	14	13	12	13	12	11	14	13	12	13	12	11	12	11	10
		Site Specific	15	14	13	14	13	12	13	12	11	14	13	12	13	12	11	12	11	10	13	12	11	12	11	10	11	10	9
	Moderate	Regional	16	15	14	15	14	13	14	13	12	15	14	13	14	13	12	13	12	11	14	13	12	13	12	11	12	11	10
		Local	15	14	13	14	13	12	13	12	11	14	13	12	13	12	11	12	11	10	13	12	11	12	11	10	11	10	9
		Site Specific	14	13	12	13	12	11	12	11	10	13	12	11	12	11	10	11	10	9	12	11	10	11	10	9	10	9	8
	Low	Regional	15	14	13	14	13	12	13	12	11	14	13	12	13	12	11	12	11	10	13	12	11	12	11	10	11	10	9
		Local	14	13	12	13	12	11	12	11	10	13	12	11	12	11	10	11	10	9	12	11	10	11	10	9	10	9	8
		Site Specific	13	12	11	12	11	10	11	10	9	12	11	10	11	10	9	10	9	8	11	10	9	10	9	8	9	8	7
Inconsequential timing	High	Regional	16	15	14	15	14	13	14	13	12	15	14	13	14	13	12	13	12	11	14	13	12	13	12	11	12	11	10
		Local	15	14	13	14	13	12	13	12	11	14	13	12	13	12	11	12	11	10	13	12	11	12	11	10	11	10	9
		Site Specific	14	13	12	13	12	11	12	11	10	13	12	11	12	11	10	11	10	9	12	11	10	11	10	9	10	9	8
	Moderate	Regional	15	14	13	14	13	12	13	12	11	14	13	12	13	12	11	12	11	10	13	12	11	12	11	10	11	10	9
		Local	14	13	12	13	12	11	12	11	10	13	12	11	12	11	10	11	10	9	12	11	10	11	10	9	10	9	8
		Site Specific	13	12	11	12	11	10	11	10	9	12	11	10	11	10	9	10	9	8	11	10	9	10	9	8	9	8	7
	Low	Regional	14	13	12	13	12	11	12	11	10	13	12	11	12	11	10	11	10	9	12	11	10	11	10	9	10	9	8
		Local	13	12	11	12	11	10	11	10	9	12	11	10	11	10	9	10	9	8	11	10	9	10	9	8	9	8	7
		Site Specific	12	11	10	11	10	9	10	9	8	11	10	9	10	9	8	9	8	7	10	9	8	9	8	7	8	7	6

16-17-18 Very High	14-15 High	11-12-13 Moderate	9-10 Low	6-7-8 Very low

Figure 5-1 Matrix used to Assess level of an Effect

5.5.3 Determining the likelihood of an Environmental Effect

When environmental effects are rated as significant, it is still necessary to determine the likelihood of the environmental effect occurring or not (CEAA, 2015b). Two main criteria allow the determination of the likelihood of an effect:

- Probability of Occurrence: according to CEAA (1994), "*If there is a high probability that the identified significant adverse environmental effects will occur, obviously they are likely. Conversely, if there is a low probability of occurrence, the significant adverse environmental effects are unlikely*".
- Scientific Uncertainty: according the CEAA (1994) "*if the confidence limits are high, there is a low degree of uncertainty that the conclusions are accurate and that the significant adverse environmental effects are likely or not. If the confidence limits are low, there is a high degree of uncertainty about the accuracy of the conclusion. In this case, it will be difficult to decide whether the significant adverse environmental effects are likely or not*". Data gaps were clearly identify in each VC component description and greatly help identifying scientific uncertainty.

An assessment should then be made to determine the risk that the VC will be negatively affected. The risk that the significant effect will generate adverse effects increases with the likelihood in Figure 5-2.

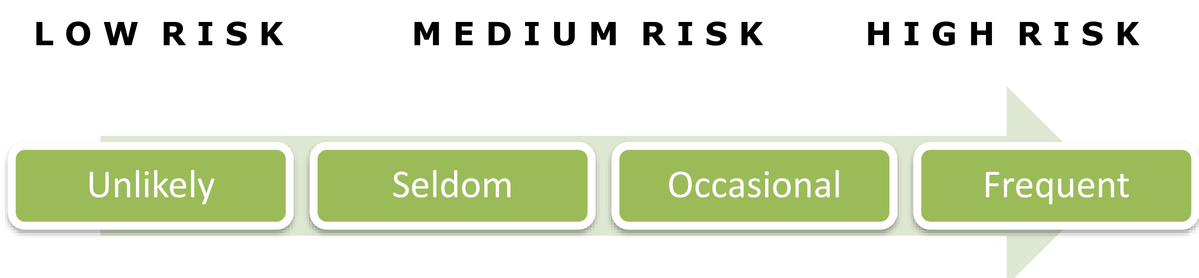


Figure 5-2 Risk assessment to determine the risk that the VC being significantly negatively affected

Evaluations of the probability of occurrence and scientific uncertainty for each VC are justified in the text in order to understand how the risk assessment was performed for the Howse EIS.

5.6 CUMULATIVE EFFECTS ASSESSMENT METHODOLOGY

Cumulative effects are defined as changes to the environment due to the project, combined with the existence of other past, present and reasonably foreseeable physical activities (CEAA, 2015c). Cumulative effects may result if:

- Implementation of the project being studied may cause direct residual adverse effects on the valued components, taking into account the application of technically and economically feasible mitigation measures; and
- The same valued components may be affected by other past, present or reasonably foreseeable physical activities.

According to Hegmann *et al.* (1999), the selection of future actions to consider in a cumulative environmental effects assessment should reflect "the most likely future scenario." Emphasis is given to projects with greater certainty of occurring; however, hypothetical projects might be discussed on a conceptual basis in some cases.

It should be noted that the cumulative effects assessment (Chapter 8) considered Schefferville-Sept-Îles rail traffic but that this source of effects was not assessed in the effects assessment (Chapter 7) because the infrastructure is already in place and owned by other entities. Furthermore, an assessment of the significance of the effects related to rail traffic for the Howse Project alone is not justified because of the large number of non-Howse related traffic on the rail line, but it is recognized that the significance increases when other physical activities are considered.

The document *Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012* (CEAA, 2015c) thoroughly describes the CEAA's cumulative effect assessment approach and it is being followed closely in this EIS. This section briefly summarizes this approach and describes how it was implemented for the Howse Property Project.

5.6.1 Step 1: Scoping

As mentioned in the technical guidance document (CEAA, 2015c), only those VCs that continue to be subjected to residual effects undergo the cumulative effect assessment process.

Complementary information to the effects assessment is presented at the beginning of the cumulative assessment section. Information from various sources is considered, including the public consultation processes (Aboriginal or non-Aboriginal), ATK, the scientific literature, government websites and monitoring information coming from other physical activities effect assessment processes. Scoping is needed to determine how the VC effects associated with Howse Project interact with other physical activities and if these interactions are strong enough to justify a comprehensive analysis (Step 2). Spatial and temporal boundaries are essential elements to perform the scoping.

Spatial boundaries are always associated with the component's RSA and are described at the beginning of the component description section. Sufficient level of details is presented to properly justify the RSA selection. Along with the temporal boundaries, the LSA and RSA definitions serve to provide focus for the cumulative assessment of a project's effects on a VC.

Temporal boundaries are considered around the RSA and are usually directly related with the duration of the past, present and future physical activities of the Howse Project, as described in Section 8. However, an adaptive approach was taken and temporal boundaries adjustments were made where necessary for a VC, in which case justifications will be provided. The recovery period of the VC was also be considered and identified as the period of time needed for the VC to return to its initial state or to a new ecological equilibrium.

The goal of Step 1 is to identify VCs that will be carried forward into the analysis step. Further, Step 1 will identify and characterize the past, present and future physical activities that are susceptible to interact with the VC. Projects that are likely to be associated with cumulative effects on the Howse VCs are presented in Section 8.2. The specific activities which are anticipated to interact with Howse VCs are also presented.

5.6.2 Step 2: Analysis

Cumulative assessment analysis was done using the best available information. Sources of information are numerous and sometimes available from adjacent projects (Section 8.2). In addition, for past IOCC projects, historical information is available from the McGill Research Center, from the IOCC historical documents as well as through data gathered by the various ATK processes done for ELAIOM and Howse Projects. For other activities, sources of information are extremely scarce and primarily available on the internet. The types of data and information gathered to assess each VC is presented and logic for their selection clearly introduced.

Standard analytical methods were applied to present quantifiable results to assess the cumulative effects of the Howse Project on VCs. Numerical models are used to assess the cumulative effects of the Howse project on air quality and human health. Dilution factors were used for air and water analyses to consider the effect of physical activities within the Schefferville region. Spatial analyses using geographical information system (GIS) were used to characterize the spatial interactions between the Project and the other physical activities. GIS was also used to evaluate the cumulative loss of wetlands and sensitive or unique ecosystems over the Schefferville region. Methodology used to assess cumulative effect are described in detail in their respective section and choice for their selection is also clearly introduced.

The cumulative effect assessment for socioeconomic VCs was primarily accomplished using data gathered through the consultation process, sources of ATK as well as with data available from Provincial and Federal authorities. Information on land use and subsistence and traditional activities by Aboriginal groups has been obtained from the land-use study conducted for the purpose of the Howse project and from previous studies conducted in the area.

5.6.3 Step 3: Mitigation

The mitigation measures presented in the effects assessment continue to be applicable for the cumulative effects assessment. However, cumulative effect mitigation also considers interactions with other physical activities, and longer-term effects. Further, new mitigation measures were proposed, where relevant, to target the effects of cumulative effects on the VC effect. Rationales for their selection are also clearly presented. Commitments made by the proponent are described.

5.6.4 Step 4: Significance Assessment

The same methodology used for VC effect assessment (Section 5.4) was used to assess the cumulative effects. In addition, the definitions for the six criteria (timing, geographic extent, duration, reversibility, frequency, magnitude) are used, and their definitions are modified accordingly.

5.6.5 Step 5: Follow-up

The methodology used to develop the monitoring and follow-up program to assess the effectiveness cumulative assessment mitigation measures is presented in Section 9, along with the methodology to develop the follow-up program for the Howse Project (Section 9 for further details). The section highlights which measures are specifically selected to follow the cumulative assessment of a specific VC.

5.6.6 Physical Activities Considered

An overview of active and foreseeable projects are located in the vicinity of the Howse Project and/or share infrastructure with the Project is presented in Section 8.2. A list of VCs identified for the cumulative effects assessment are presented in Section 8.1.

5.6.7 Monitoring and Follow-up Methodology

A short methodological approach to develop monitoring and follow-up program for each VC is presented in section 9. Both site specific and cumulative effect assessments monitoring and follow-up are presented in section 9.

6 EFFECTS ASSESSMENT – GENERAL CONSIDERATIONS

6.1 EFFECT AVOIDANCE STRATEGIES

The proponent has developed a comprehensive strategy to minimize the negative effects of the Project on the biophysical and socioeconomic environments and to maximize its positive effects. A significant part of this strategy consists of adapting the established mitigation measures for the DSO projects to the Howse Property Project phases. The following topics summarize the main elements of the proponent's strategy, which includes, in the opinion of HML, a meaningful accommodation of Aboriginal rights, interests and concerns through the Project design and through an on-going flow of communication and information with Aboriginal communities to mitigate effects:

- ecological constraints were studied (i.e. location of sensitive areas and species), highlighted and mapped, and the Project layout and activities were adjusted to minimize the negative effects on these constraints (i.e. reduction of footprint on wetlands, minimize effects on Pinette Lake);
- the proponent has been working in close collaboration with a team of mining engineers to develop an infrastructure layout that would minimize the Project's footprint and visual effects (Section 2.5 for details);
- the waste rock dump and other piles are located as close to the pit as possible—but outside areas of mineralization to reduce the length of haul—and are designed to minimize energy-consuming lifts;
- the footprint of the waste rock dump and overburden stockpiles will be reduced by using material from the Timmins 4 area to upgrade/build the future mining/access road. Further reduction of waste rock and overburden footprints will occur by selling sand and gravel from the glacio-fluvial deposit portion of the overburden to local communities as construction material (*potential* activity);
- the Project layout was designed to maximize the use of existing mining facilities (former IOCC infrastructure and DSO Project 1a) such as haul roads, right-of-way's, railways, waste dumps, camps, warehouses, landfills, and diesel, gas and explosives storage facilities;
- a dust control policy will be applied to reduce the release of fugitive dust and to eliminate runoff from rain and snow. All stockpiles will have a drainage system and water will be diverted to sedimentation ponds;
- instead of transporting pre-mixed explosives, these will be manufactured at the blast site, thereby eliminating the danger of an explosion during transportation;
- best-available technology will be used so as to reduce effects and pollution;
- many jobs and contracts during both the Construction and the Operation phases will be carried out by locally- and regionally-based firms and individuals, including Aboriginal and Labrador West workers and Aboriginal-owned and Labrador West businesses;
- benefits for affected Aboriginal groups and residents of Newfoundland and Labrador, with special consideration for the residents of Labrador West, will be optimized. These include major investment in local and regional infrastructure (Tshiuetin Railway, Port of Sept-Îles, Schefferville arena), which in turn create additional employment opportunities and capacity-building (literacy and essential skills training, donations of thousands of new books to school children);
- indirect economic spin-offs and future investment in the region led by government and First Nation organizations (e.g., fiber-optic communication from Emeril Junction to Schefferville; paving of local street and road network creates additional employment opportunities); and
- the workers' camp is located in the DSO3 project area so as to avoid the socioeconomic effects associated with lodging a large and predominantly male labour force in a small, primarily Aboriginal community, eliminate the cost of daily transportation, and optimize productivity.

A full list of standard mitigation measures is provided in Volume 1 Appendix VI. From this list, standard mitigation measures specific to each VC are presented in the appropriate section. The list of 153 measures fall into 12 categories:

- Tree removal and timber management;
- Erosion and sedimentation control;
- Watercourse crossing;
- Waste management;
- Hazardous materials management;
- Drilling and blasting;
- Construction equipment;
- Mining operations;
- Management of ore, rock piles, waste rock, tailings and overburden;
- Water management;
- Air quality control; and
- Rehabilitation.

To avoid repetition, the specific mitigation measures are integrated into the text where relevant and presented in Volume 1 Appendix XVI.

6.2 BEST MANAGEMENT PRACTICES

HML is directed by the environmental best practices of the Tata Group, Tata Steel and TSMC.

Throughout its long history, the Tata Group has been recognised as an organization committed to good corporate citizenship – long before the term was invented. This philosophy was encapsulated by its founder, Jamsetji Tata (1839-1904), who viewed the creation of wealth not as an end in itself, but as the means by which his company could make a positive contribution to the communities it served.

In the modern world, a good corporate citizen recognizes that it has important social and environmental, as well as financial, responsibilities. To help ensure a good quality of life for all, both now and for generations to come, we need to balance economic prosperity and social progress with care for our planet.

Tata Steel understands and recognizes that:

- responsible practices and procedures ensure that all aspects of Tata Steel's business are conducted with the utmost respect for the environment;
- every major business has an effects on the communities and societies in which it operates. In all its operations throughout the world, Tata Steel contributes to local and regional economic and social development in myriad ways;
- making sure that our employees and contractors return home from work safely each day is more important than anything else;
- ethical behaviour is intrinsic to the way we conduct our business and is part of our legacy from the founder of the Tata Group, Jamsetji Tata, who believed that business must operate in a way that respects the rights of all its stakeholders and creates an overall benefit for society; and
- regulatory compliance is part of the business.

TSMC is a member of the Canadian Institute of Mining, Metallurgy & Petroleum – Newfoundland and the Québec Mining Association, and adheres to the Equator Principles and follows the Environmental Guidelines for mining operations compiled by the United Nations Department of Economic and Social Affairs or by the Article 8j) of the United Convention on Biodiversity with respect to the protection of indigenous knowledge and lifestyle, including the CBD's Akwé: Kon voluntary guidelines for the conduct of cultural, environmental and social effects assessments regarding proposed development projects on indigenous lands and territories. Moreover, TSMC is an active player in a number of different environmental initiatives, including in wildlife protection (Ungava project).

6.2.1 HML Environmental Protection Plan

Overall, the EPP document applies to all its mining projects in the Schefferville region. However, HML is also committed to modify the EPP in order to render it specifically applicable to the Howse Project (see below). While the present version of the EPP applies to current operations only, the annual update of the document, planned to be released in spring 2016, will include provision for environmental monitoring at Howse. At the present time, it is expected that the spring 2017 version of the EPP will include Howse Operation activities.

The complete EPP is available in Volume 1 Appendix Ia.

General description of TSMC's EPP

The EPP serves as a tool in attaining TSMC's goals and objectives in terms of environmental management. At the corporate level, the EPP serves as a working document to ensure that compliance with environmental policies and legislation have been achieved. The EPP also serves as a reference document; a tool for documenting environmental concerns and proposed appropriate protection measures; a guidance document to provide employees and contractors with concise and clear instructions to follow for different work tasks; a tool to communicate program changes through the revision process; and as a reference to legislative, guideline and approval/permit requirements.

The EPP outlines the best protection measures to follow while performing the general activities required during the site operations (Sections 3.0 and 4.0). Detailed procedures are outlined for specific aspects of the project (Volume 1 Appendix Ia).

The EPP contains clear instructions to ensure that the personnel understands and implements environmental protection measures for both routine activities and unplanned events associated with Project activities. The style and format of the EPP is intended to be user friendly for everyone. The bulk content of the EPP is contained in the appendices.

The main body of the EPP outlines the general protection measures to be followed, activities associated with the construction, development and operation of the mining site, and the site-specific measures associated with each location during the operation phase of the DSO 3/ DSO 4 Project. The different sections of the EPP may be considered as stand-alone, separate documents outlining the general protection measures and separate contingency plans.

The **Preface** provides guidelines for making revisions to this document, as well as a source for document control records.

Section 1.0 is an introduction to the EPP, including the main purpose and its organization as well as outlining the responsible authorities and mechanisms for EPP development and implementation.

Section 2.0 provides a list of the permits and approvals required for the activities of the project. This section also outlines compliance monitoring requirements.

Section 3.0 is an introduction and overview of the general activities anticipated during the operation phase. The environmental protection measures associated with these activities are provided in Volume 1 Appendix Ia. Section 3.0 contains some general principles on environmental procedures, hazardous waste materials, petroleum product storage and transport and potential discovery of contaminated soil. These stand-alone documents outline the operational considerations and environmental concerns to justify the need for these procedures.

Section 4.0 describes the various work areas and site-specific environmental measures to apply to the operation phase of the DSO 3/DSO 4 Project, and provides a list of the applicable general standard operating procedures. This section provides a way for managers and workers to use the EPP as a guide to the most appropriate procedures applicable to each work site. This section also contains information about local environmental sensitivities and periods that may apply.

Sections 5 and 6 describe current environmental control plans and contingency plans.

EPP Update Procedure

The EPP and associated documents (environmental monitoring plan, contingency plan and Environmental emergency plan) is an evolving document. The document is updated annually based on the mining plan, the permit and legal obligation requirement as well corporate TSMC, Tata Steel Europe, Tata Steel and Tata group requirements and environmental objectives.

Since 2012, the Howse Project has evolved significantly and the EPP has been adapted to reflect these changes. A revision of this document is in process and is expected to be available in sping 2016 and will be submitted to governments of Newfoundland and Labrador and Québec as well as to all local community and First Nations for review; following the integration of all comments, the final version will be enforced and available to all employees and contractors in spring 2016.

Howse EPP

At the current exploration stage of the Howse Project, the EPP is not applicable, as the exploration stage is never included in the EPP. However, specific environmental information, environmental procedures and/or requirements are communicated to TSMC or to contractors.

As soon as all environmental measures, including government requirements and specific monitoring, will become available, these will be integrated into the EPP and communicated to all personnel. This updated EPP will be discussed with the communities during the Health, Safety, Security and environmental committee. The following Spring, the document will be submitted to authorities (governments of Newfoundland and Labrador and Québec) as agreed.

Due to the proximity of the DSO and Howse Projects, some elements of the Howse Project are already present in the DSO EPP, such as those pertaining to Pinette Lake and Goodream stream. As such, in this case, we are integrating specific Howse condition to the general EPP rather than conducting a full revision of the EPP. The major modifications will be in the following sections:

Section 1.5.3: Special training

In this section, all special training related to the Howse Project, such as archeology screening and restricted access will be listed and clearly defined.

Section 2: Project overview

The project overview is a description of each sector, including sensitive areas and restricted areas as well as a description of sensitive environmental components, such as Irony Mountain, Pinette Lake and Goodream stream, which are already listed on DSO3 project overview. Additional details will be added in the Howse Project overview, including Burnetta creek and Triangle Lake will be added in the section.

Section 3.3: Compliance monitoring

In this section, we describe all the water sampling, air quality description as well others monitoring; this will include Howse LSA water and air sampling locations as well as any other specific monitoring procedures (See Section 9 in the present document for a full description).

Section 4: Specific environmental protection measures

In this section, all specific information related to Irony Mountain, Pinette Lake, Burnetta creek, Triangle Lake and related protection measures like water discharge etc. will be described.

Section 5: Environmental control plans

6.3 CROSS-BORDER EFFECTS

The Project is adjacent to Labrador/Québec border. The closest projected Howse infrastructure is about 950 m from this border. Given the proximity of the Project, there is a potential for Air Quality (Section 7.3.2) and Noise and Vibration (Section 7.3.3) effects in Québec, as well as effects on mobile species (birds and mammals). In order to assess cross border effects, 17 sensitive receptors for air quality were located in Québec and 23 in Labrador. Most of the dust emissions will be the result of haul truck traffic and blasting. Air pollution from blasting and generators is discussed in Section 7.3.2. Noise and Vibration effects will likely be perceived in Québec, primarily due to blasting (Section 7.3.3). For noise, 14 sensitive receptors were located in Labrador and five in Québec. For a more complete review of the cross border effects related to Air and Noise, please see Volume 2, Appendices E and F, respectively.

An increase in rail traffic is expected between the two provinces. On average, one train per day will depart from the TSMC loading facility for a period of 10 months, when iron ore is extracted simultaneously at the Howse Property and the TSMC DSO project. During this period, traffic on the NL (WLR2013) and QC (KeRail, TSH, QNS&L and CFA) provincial railways will be higher.

No cross-border effect on ground and surface water quality and quantity is possible, since water flow direction is northwesterly (in the Howells River direction) in both cases (Section 3.1). Also, pit dewatering drawdown will not at any time reach Québec territory, since the drawdown radius will be below 1 km and the projected pit is more than 2 km from the border (Section 7.3.6).

Several species at risk designated by the SARA might be present in both Québec and Labrador. Every federally-designated species has the same designation in both provinces. As such, any of the federally-designated species in the present text have the same status in Québec. Mobile species (birds and mammals) might travel from Québec to the vicinity of the Project and consequently, could experience adverse effects from the Project. However, as presented in their respective sections (Chapters 7 and 8), these species are rather sensitive to human disturbance (notably, noise and light) and tend to avoid disturbed sites. These species will probably not frequent the Howse Project site and so the likelihood of adverse environmental effects of the Howse Project on federally-designated mobile species is unlikely.

Overall, no considerable cross-border effect is expected due to the Howse Project activities.

6.4 EFFECTS OF ACCIDENTS AND MALFUNCTIONS

This section describes the Proponent's readiness to manage unforeseen events. Accidents and malfunctions, and their associated effects on Project activities, can have adverse environmental effects on VCs. Events considered below include those caused by human error, exceptional natural events as well as the environmental effects on the project, that could cause adverse environmental effects on VCs.

The specific errors and/or events presented were identified by CEAA and communicated via the Howse Project Guidelines, and also by a roundtable of experts with knowledge of the Project and the environmental setting within which the Howse Project sits. Where possible, details of the effects are provided (e.g. estimate of contaminant leakage and extent of damage caused by the event). Estimates of the likelihood of the event and their consequence on VCs is provided. Figure 6-1 and Table 6-1 present the methodology used to assess the effect. For all potential accidents and malfunctions which have a sum total of ≤5 in the matrix table (which combines likelihood and consequence of an adverse environmental effect on a VC) the effect on VCs are qualified and quantified.

Although the Proponent makes an effort to provide the reader with phase-specific accidents, malfunctions and environmental concerns, the Proponent recognizes that most of the events described can occur at any stage of the Project's lifespan.

Figure 6-1 Effect Assessment Matrix

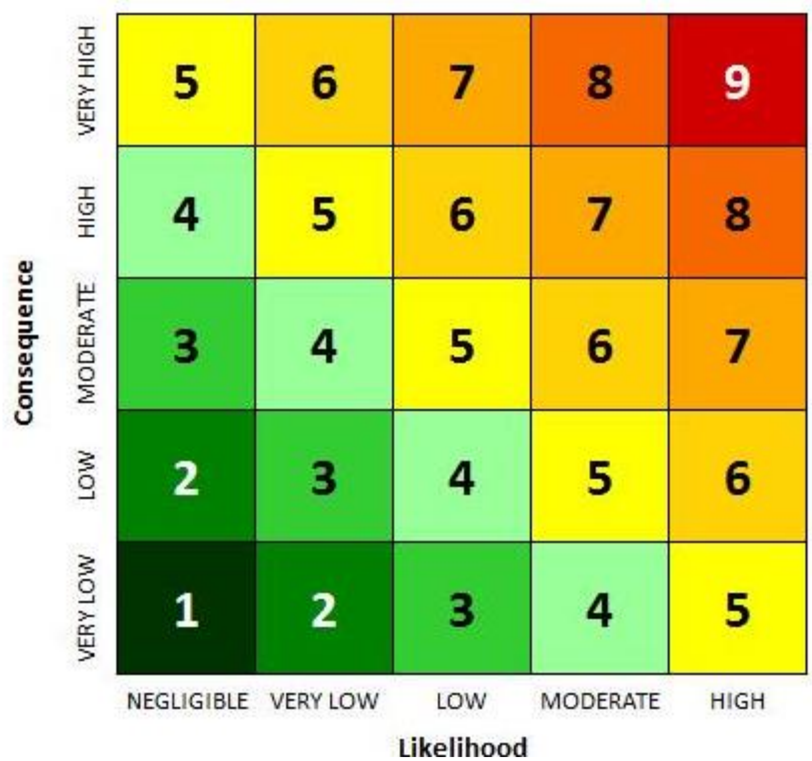


Table 6-1 Likelihood and Magnitude Definitions for the Effect Assessment Matrix

LIKELIHOOD	DEFINITION		CONSEQUENCE	DEFINITION
Negligible	Probably will never happen		Very low	Single VC temporarily affected, effect reversible
Very low	May happen once during mine life		Low	Multiple VCs temporarily affected, effect reversible
Low	May happen more than once		Moderate	Single VC temporarily affected, monitoring/restoration measures (i.e. cleanup) required
Moderate	Will probably happen during mine life		High	Multiple VCs temporarily affected, monitoring/restoration measures (i.e. cleanup) required
High	Will happen more than once during mine life		Very high	One or more VCs permanently affected

The Proponent is in the enviable position of having multiple years of experience with mining Projects in the Schefferville area and, as such, has the benefit of experience with respect to accidents and malfunctions, especially those related to the harsh local environment of the Schefferville area. Although overall details are provided below, the reader is often directed to an EPP (Volume 1 Appendix Ia) or an ERP (Volume 1 Appendix Ib), which includes details on safeguards and emergency measures that the Proponent has previously evaluated and considers effective, and is committed to follow in the event of the error/events listed below. Further, the Proponent's long-term experience with the area has allowed HML/TSMC to acquire significant amounts of information on the biophysical environment of the Howse Project area, and this knowledge will serve to inform decision-makers on how to most effectively conduct targeted responses to accidents, malfunctions, and environmental hazards (e.g. extreme weather events).

Federal and provincial standards will be used as mitigation tools in the design stage to prevent the environment from affecting the Project. For example, the National Building Code of Canada provides design criteria for dealing with wind, snow, waves, ice loading and drainage, which are important given the extreme environmental conditions the Project may face throughout its service life. The General Guidance for Practitioners prepared by the Agency (CEAA, 2003) has also been reviewed and taken into account in the design of mitigation measures for adverse effects on the public and the environment due to climate change. The design also considers the possibility of an increase in wind strength and frequency, extreme snow and ice events, extreme precipitation and sudden snow melt, and an overall increase in precipitation.

6.5 Accidents and Malfunctions Caused by Human Error

6.5.1 Spills

A spill is defined as the discharge of a hazardous product out of its containment and into the environment. Potential hazards to humans, vegetation, water resources, fish and wildlife vary in severity, depending on several factors including nature of the material, quantity spilled, location, and season (see Section 7.7 of TSMCs ERP– Wildlife protection procedures, in Volume 1 Appendix Ib). Diesel is the main product that may be spilled and therefore spill response procedures focus on this hazardous material. Other chemicals that may be spilled include sewage water, coagulant, glycol, small quantities of lubricants and oils, and releases of gaseous material. Note that spill response procedures will be different depending on the magnitude and nature of the release. A diesel spill of five liters can easily be contained and cleaned by one person, while a spill of a larger magnitude will be much more hazardous and require more personnel.

Spills are common at mining sites due to the number of liquids that are used daily. Diesel is the most common hazardous liquid that could spill, and chemical spills can include: glycol, sewage water and lubricants. These are categorized below into immiscible and miscible materials, based on their solvency with water. Lubricants and oils, because of their immiscibility with water, are treated as diesel spills.

Only very small quantities of sewage water will be present on site as sewage water treatment will take place at the Timmins Worker Camp under the ELAIOM Project. In this context, the effect of a sewage water spill is considered negligible and will not be further treated either. The Proponent's ERP has a plan for spills of miscible materials (Volume 1 Appendix Ib) on land and water, which is discussed below.

6.5.1.1 Fuel Spills

Vehicles, tanks, generators and other pieces of equipment throughout the site are to be fueled via a mobile fueling truck operated by an independent contractor. Fuel will arrive on-site by rail, and distributed to a 50,000 L vehicle fueling station where it will be then discharged to 18,000 L mobile fueling trucks for distribution to mobile equipment. As such, only 18,000 L fueling truck will be used on Howse Project study area to fuel heavy equipment. Spills could occur because of fueling carelessness during refueling of heavy machinery at the Howse site, or due to a road accident.

6.5.1.1.1 Worse-Case Scenario

A traffic accident resulting in a spill from the fueling truck (max 18,000 L spill) would be the worse-case scenario. Further, the most precarious location for a spill would be at the Two Ponds area (Figure 3-1). A large fuel spill at this location could reach a pond (small waterbody with no fish) connected to Goodream Creek and ultimately Triangle Lake. There is also a small isolated wetland on the other side of that road that could be affected. Considering the possible spill quantities and containment procedures, contamination of the Howells River is improbable.

The worse-case scenario would be that an uncontrolled large-scale spill reach a moving waterway. However, the Howse Project area was designed with no crossings and no routes are within 100 m of watercourses, therefore making a spill into a waterway unlikely.

6.5.1.1.2 Effects on VCs

Based on the definitions from Table 6-1 , the likelihood of a spill is low since it is not expected to happen, but could happen due to human error or environmental conditions. On the other hand, the **likelihood of it reaching a VC (water quality or wetlands) is negligible** since there are no crossings and all infrastructures are at least 30 m away from any water body or wetland. Therefore, due to the potential size of a spill (fuel truck), it is unlikely to reach any VC.

Assuming the unlikely event of a spill reaching a water body or a wetland, the **consequence would be high** since it could affect multiple VCs and would require monitoring and restoration measures.

When crossed in the effect assessment matrix (Figure 6-1), the result is **four (4)**, or below the effect assessment threshold and will not be further assessed here.

6.5.1.1.3 Safeguards in Place

All vehicles are equipped with spill kits for emergency response and a current Emergency Response Spill Contingency Plan, which identifies spill kit locations and response plans, will be respected. The spill kits will contain the appropriate type, size and quantity of equipment for the volume/type of product present in the storage location as well as the environment likely to be affected by a spill.

Heavy equipment will be refueled via a mobile fueling station (i.e. a fuel truck) at various locations throughout the mine site. All fuel trucks will be equipped with auto shut off valves and will be required to carry an appropriately sized spill kit. In addition, fuel trucks will follow the rules set out in the Federal 'Gasoline and Gasoline Dispensing Flow Rate Regulations' if applicable. A spill plan will be used when refueling to prevent a discharge in the event of a splashback or overfilled tank.

HML has the following safeguards in place to avoid spilling incidents:

- spill kits will be located in close proximity to areas of risk, including storage sites of hazardous materials, parking areas, and refueling locations;
- the Emergency Response Spill Contingency Plan will be given to Contractors before work begins. Contractors must make the manual available to employees and ensure they are aware of the emergency measures, their responsibility, and the importance of responding quickly when a spill occurs;
- contractors must have a sufficient number of Spill Response Kits with contents approved by the Environment Representative;
- machinery must be checked on a daily basis for leakage of lubricants or fuel, and must be in good working order with special attention given to machinery working near watercourses.
- workers awareness program, 2 drills per year;
- quarterly groundwater monitoring is required as a condition of the provincial Certificate of Approval; and
- safe driving practices.

The design of the project without any watercourse crossings is the single most important safeguard against fuel spill reaching water bodies.

6.5.1.1.4 Preliminary Response/Emergency Measures

TSMC's ERP includes a section on Spill Response Procedures (Volume 1 Appendix Ib). All site personnel are trained on the procedures to report a spill and initiate a spill response. In the event of a spill, the first person to notice it takes the following steps:

- contractors must contact The Environment Representative immediately in the event of an environmental incident and apply the procedures set forth in the Emergency Response Spill Contingency Plan without delay;
- immediately warn other personnel working near the spill area;
- evacuate the area if the health and safety of personnel is threatened;
- in the absence of danger, and before the spill response team arrives at the scene, take any safe and reasonable measure to stop, contain, and identify the nature of the spill; and
- remove any source of ignition in the immediate vicinity.

Fuel truck drivers will also be trained to initiate the ERP using the spill kit in the truck, in the event of a spill from a fuel truck. Large volumes of fuel should be diverted away from any waterbodies by trenching or building small dykes with the tools on hand (i.e., shovel, pick, nearby loader). If the spill kit is so equipped, placing booms on the ground or across small waterways may prevent further contamination until the Emergency Response Team can arrive. Emergency personnel may be required to boom the exit point of the river if containment is not possible at the spill site. If possible, the driver should maintain communication with the dispatcher and Emergency Response Team to update the situation.

6.5.1.1.4.1 On Land

Response to spills on land will include the general procedures previously detailed. If a large spill is suspected (>5 L) or there is a spill into water, immediately contact dispatch or the environment and permitting department by radio or telephone to initiate the Emergency Response Plan. For smaller spills that are contained and do not pose a threat to enter a water body, contact your supervisor and the environment and permitting department to report the spill and for instructions on cleanup. Note that depending on the magnitude of the spill, the steps outlined below may vary in order (e.g., if you knock over a 25 L fuel canister and there is no immediate danger, pick up the canister to stop the flow of fuel and place spill pads on the surface prior to contacting security). The following procedures outline response to a diesel fuel spill; however they can be applied to any low density (i.e., floating) liquid spill. Miscible liquids (mixes readily with water) will be covered separately.

Safety

Safety is of utmost importance. Immediately warn other personnel working in the area. Before approaching a spill, the immediate vicinity should be evaluated for any hazards or potential sources of fire. Sources of fire should be extinguished and/or removed from the area. When approaching a large spill, always approach from upslope or perpendicular to the slope in order to avoid contact with any free flowing material. Where possible, approach the spill from upwind to avoid any gases or the potential of a runaway fire if one were to occur. Do not approach the spill if it is not safe to do so or if proper PPE is not on hand. If possible, ensure that a fire extinguisher is nearby at all times. In case of fire, avoid being surrounded by fuel on all sides (i.e., always have an exit route).

Stop Free Flow of Product

When it is deemed safe to approach the spill, the first steps should involve reducing or stopping the flow of product whenever possible. As noted above, this could involve very simple actions such as turning off a pump, closing a valve, or sealing a puncture hole with almost anything handy (e.g., a rag, piece of wood, tape), raising a leaky or discharging hose to a level higher than the product level inside the tank, or transferring fuel from a leaking container or tank.

Reporting

After attempting to stop or reduce the flow of product, immediately contact security and/or your supervisor by radio or telephone. If possible, do not leave the location of the spill provided it is safe to do so. Have someone else call security if a radio or telephone is not available. Security will initiate the spill response team. Ensure to report your location to the dispatcher (e.g., north side of the crusher, km 10 north on the Goodwood Road.), report the nature of the spilled material (e.g., diesel fuel), the volume of spilled material (approximate), the direction of flow (e.g., towards a river, into a wetland) and whether fuel is still being discharged.

Containment

After source control and reporting, containment of the spill is the next priority. The main containment techniques involve the use of two types of barriers: dykes and trenches. Selecting the type of barrier depends on the ground surface and available materials. For example, a trench would not likely be dug when booms are available. Either type of barrier should slow the progression of the spill and serve as containment to allow recovery of the spilled product. Barriers should be placed downgradient (down-slope) from the source of the spill, and as close as possible to the source of the spill in order to minimize the affected area. If a spill cannot be rapidly or easily contained, it should initially be diverted away from any source of water.

Dykes

Depending on the volume spilled, the site of the spill, and available material at the site, a dyke may be built with soil, booms, lumber, snow, or other suitable items. A plastic liner should be placed at the foot of and over the dykes to protect the underlying soil or other material and to facilitate recovery of the spilled product. A plastic liner will also decrease the permeability of the dyke. Dykes should be constructed in a manner to accumulate a thick layer of free product in a single area (V-shaped or U- shaped with the spill on the open side of the V or U).

Trenches

Trenches are useful in the presence of permeable soil and when the spilled fuel is migrating below the ground surface. A plastic liner should be placed on the down-gradient edge of the trench to protect the underlying soil. Liners should not be placed at the bottom of the trench so water is allowed to continue flowing underneath the layer of floating oil (if applicable). Similar to dykes, trenches can be built in a V or U shape to accumulate the spilled material. Also related to trenches, a simple excavation can be made in an area of slightly lower elevation where spilled material will pool.

Recovery

Once the product has been contained, the next step is to recover and containerize the product. The use of large quantities of absorbent materials to recover higher volumes of spilled fluids should be avoided if possible. If ponding has occurred, large volumes of free-product should be recovered and containerized by using vacuums and pumps appropriate to the spilled material. Mixtures of water and fuel may be processed through an oil-water separator during or following recovery. Absorbent sheets should be used to soak up residual fuel on water, on the ground (soil and rock), and on vegetation. Dry absorbent material such as treated peat moss may also be sprinkled on vegetation to absorb films of petroleum products.

Smaller spills that have largely been absorbed into the top layer of soil can be excavated by hand using a spark resistant shovel or by using heavy equipment. Contaminated soil should be placed in a weatherproof container and disposed of properly.

Remediation

Subsequent to the initial response and recovery, Tata will remediate the affected area and confirmatory sampling will be conducted to ensure a thorough clean up. Excavated areas will be backfilled with uncontaminated soil following clean up.

6.5.1.1.4.2 On Waterbody

Response to spills near or into water include the general procedures previously detailed, including safety, stopping the free flow of product, and reporting. The containment procedures listed in above can serve to keep spilled material away from any water bodies and as a source control. Various containment, diversion, and recovery techniques for spills into water are discussed in the following sections. The following elements must be considered when conducting response operations:

- type of waterbody or water course (lake, stream, river, wetland);
- water depth and surface area;
- wind speed and direction;
- type of shoreline; and
- seasonal considerations (open-water, freeze-up, break-up, frozen).

Large Waterbody

Containment of a diesel fuel slick in a large waterbody requires the deployment of mobile floating booms to intercept, control, contain, and concentrate (i.e., increase thickness) the floating oil/fuel. One end of the boom is anchored to shore while the other is towed by a boat and used to circle the diesel fuel slick and return it close to shore for recovery using a skimmer. Reducing the surface area of the slick increases its thickness and thereby improves recovery. Mechanical recovery equipment (i.e., skimmers and oil/water separators) would be mobilized to site if required.

Small Waterbody

If diesel fuel is spilled in a small lake or pond it may not be possible to deploy booms using a boat. In this case, measures are taken to protect sensitive and accessible shorelines (spills resulting from traffic incidents). The diesel fuel slick can be monitored to determine the direction of migration. In the absence of strong winds the oil will likely flow towards the discharge of the lake. Measures are taken to block and concentrate the oil slick at the lake discharge using booms where it will subsequently be recovered using a portable skimmer, a vacuum, and/or sorbent materials.

Small Stream

In small slowly-flowing rivers, streams, channels, inlets, or ditches, inverted weirs (i.e., siphon dams) can be used to stop and concentrate moving diesel fuel for collection while allowing water to continue to flow unimpeded. In order to prevent fuel flowing over a barrier or check dam in an emergency situation (i.e., in a remote area), a rudimentary siphon dam can be made by simply inserting a pipe through the dam at its base. Care must be taken to ensure that the water level does not decrease enough to allow fuel to flow through the pipe. This can be attained by raising the exit end of the pipe to the height of the desired water level.

In the case of floating diesel fuel flowing towards a culvert (i.e., at a road crossing) a culvert block is used to stop and concentrate moving fuel for collection while allowing water to continue to flow unimpeded. In an emergency, a culvert block can be made by placing boards or a piece of plywood just above and below the surface of the water thereby stopping the uppermost level of water, or floating oil, from going through the culvert. In both cases diesel fuel will then be recovered using a portable skimmer or sorbent materials. In very slow flowing streams, fuel can be contained and recovered as noted above in the small waterbody section.

Large Stream

In the case of spills in larger rivers, with fast moving currents, diversion booming is used to direct the oil slick ashore for recovery. Single or multiple booms (i.e., cascading) may be used for diversion. Typically, the booms are anchored across the river at an angle. The angle will depend on the current velocity. Choosing a section of a river that is both wider and shallower makes boom deployment easier. Diversion booming may also be used to direct an oil slick away from a sensitive area to be protected. Once fuel has been diverted it can be recovered using a portable skimmer or sorbent materials.

6.5.1.1.4.3 Spills on Snow and Ice

Response to spills on snow or ice include the general procedures previously detailed, including safety, stopping the free flow of product, and reporting. In general, snow and ice will slow the movement of hydrocarbons. Snow and frozen ground also prevent hydrocarbons from migrating down into soil or at least slow the migration process and will often prevent seepage of fuel into water. The presence of snow may however hide the diesel fuel slick and make it more difficult to follow its progression. Snow is generally a good natural sorbent, as hydrocarbons have a tendency to be soaked up by snow through capillary action. However, the use of snow as absorbent material is to be limited as much as possible.

Following the snow melt, TSMC personnel will re-assess the spill area in order to confirm no soil penetration of spilt material for spills larger than 50 L.

Containment

When encountering a spill on snow and ice, most of the response procedures for spills on land may be used. The use of dykes (i.e., compacted snow berms lined with plastic sheeting) or trenches (dug in ice) slow the progression of the fuel and also serve as containment to allow recovery of the fuel.

Recovery

Free-product can be recovered by using a vacuum, a pump, or sorbent materials. Contaminated snow and ice can be scraped up manually or by using heavy equipment, depending on volumes of spilled material and the area covered. The contaminated snow and ice is placed in containers or within lined berms on land. Once enough snow has melted, the oily water is removed from the storage and processed through an oily water treatment system. Any under ice fuel can be recovered by auguring through the ice and using a vacuum pump.

6.5.1.1.4.4 On Wetland

Wetlands vary greatly in size and composition. They may be composed of mainly peat with very little surface water (i.e., bog) or may be mainly composed of emergent plants with large amounts of flowing or standing surface water (i.e., fen or marsh). Responses to spills in these environments will therefore generally be a combination of the above noted procedures of spills on land and into water (winter procedures would default to Spills on Snow and Ice). The response would include the general procedures previously detailed above, including safety, stopping the free flow of product, and reporting.

Spills into a relatively dry wetland (i.e., no standing water) would generally be contained using the methods outlined using berms and dykes. Any free product could be contained using vacuums or pumps while remaining peat could be excavated or skimmed off using heavy equipment.

Spills into wetlands with flowing water would require the use of booms. Spills into wetlands that have standing water may or may not require booms depending on the size of the water body and the magnitude of the spill. A large magnitude spill would likely benefit from booms strung out over both the land and water portions of the wetland. A smaller scale spill may be completely contained within the wetland. In either case recovery would entail pumping/skimming the spill from the water body and excavating the land based portion of the spill area.

6.5.1.2 Spills of miscible materials

Miscible materials are substances that will readily mix with water (i.e., will not float on the surface like oil). Miscible materials on site will be used in small quantities and include glycol (less than 100 L) and sewage (reservoir of 5, 000 L, although very little sewage water will be present on site as sewage water treatment will take place at the Timmins Worker Camp under the ELAIOM Project). Both glycol and sewage, when mixed with water, will readily disperse and mix with the water and thus contaminate the water body. Ensure proper PPE is used if working near a sewage spill as it is considered a biohazard. When working near a glycol spill, workers are instructed to ensure that there is plenty of ventilation and that personnel are not breathing vapors (i.e., work up-wind from a spill and ensure proper use of vapor purifying respirators). Glycol is mildly flammable, therefore ensure sources of ignition are removed.

Sewage, depending on the relative amount in comparison to the size of the water body, may create a very high biological oxygen demand (BOD) potentially removing all oxygen from the system and causing a fish kill. With prompt response, a barrier from the top to the bottom of the water column may contain and concentrate large amounts of spilled substance (mainly solids) for removal via pumps.

Glycol (ethylene glycol) dissipates rapidly in water and is a toxin. A concentration of 41,000 mg/L will kill 50% of trout within 96 hours (LC50). Glycol will generally break down in approximately 10 days.

6.5.1.2.1 Worse-Case Scenario

The worse-case will be an accident of the sewage truck on the road (e.g. a 10,000 L spill, as the maximum size of the small vacuum truck is less than 10,000 L); the associated environmental impact would be local and limited; or the incident could be related to overflow of the sewage tank.

Likewise, a glycol spill of 100 L will not have adverse effects on VCs as it is not expected reach a watercourse.

6.5.1.2.2 Effects on VCs

Based on the definitions from Table 6-1 , likelihood of a spill of glycol is low since it is not expected to happen, but could happen due to human error or environmental conditions. On the other hand, the **likelihood of it reaching a VC (water quality or wetlands) is negligible** since there are no crossings and all infrastructures are at least 30 m away from any water body or wetland. Therefore, due to the potential size of a spill, it is unlikely to reach any VC.

Assuming the unlikely event of a spill reaching a water body or a wetland, the **consequence would be high** since it could affect multiple VCs and would require monitoring and restoration measures.

When crossed in the effect assessment matrix (Figure 6-1), the result is **four (4)**, or below the effect assessment threshold and will not be further assessed here.

6.5.1.2.3 Safeguards in Place

The following safeguards are in place to prevent an accidental spill of glycol or sewage at the Howse site:

- glycol is not stored in howse project; it is used only to avoid freezing of pumps;
- transfer of sewage to the camp site every day;
- daily inspection and volume measure of the reservoir;
- A hazardous storage procedure is in place; and
- sewage management plan.

6.5.1.2.4 Preliminary Response/Emergency Measures

There is very little that can be done for cleanup of miscible materials, however, wildlife should be kept from entering the water body and any dead fish should be recovered to prevent the scent from attracting animals.

Spills of miscible materials on land can generally be contained similarly to diesel fuel, however, caution must be taken that these substances do not contaminate groundwater through seepage. Prompt removal of the top layer of soil and proper disposal would potentially avoid contamination.

6.5.2 Road Accidents

For the Howse Project, a haul road (1.95 km) will link the pit to the DSO3. This Howse haul road will be 21 m wide to accommodate large 180 tonne trucks and it will have a maximum gradient of 8% to accommodate for freezing and slippery conditions during winter. All site roads will undergo regular maintenance, including grading and ditching. Truck traffic during the construction phase is expected to be 3.2 one-way trips per hour between the pit and waste dump locations. Including other vehicles (heavy vehicles, maintenance, environment and safety), total traffic could reach 4 one-way trips per hour during the construction phase.

During the operations phase, the Howse haul road will be used to transport all equipment, fuel and personnel. An average of 70 trips will be made on a daily basis by trucks and other light vehicles. Trucks will not operate within 100 m of a watercourse or within 30 m of any water body or wetland and the likelihood of a road accident having an effect on those is therefore unlikely. Road design follows the NL standard practice and by following this procedure, the risk of accident is reduced to a minimum. All traffic on the mining road shall follow the principle develop for the Goodwood road mining Operations SOP from June 2015. Access to Howse mining area is also limited and road accidents could only involve light vehicles and/or hauling trucks. Light vehicles are expected to frequent the entire Howse site, whereas haul truck traffic will be limited to the Howse haul road.

6.5.2.1 Fuel Spill

Fuel spills resulting from a road accident are possible but such spills have been treated in the previous section and will not be discussed further here.

6.5.2.2 Wildlife Collision

A vehicle may collide with wildlife including caribou and/or avifauna which are VCs. The presence of large mammals in the area is however very rare.

6.5.2.2.1 Worse-Case Scenario

The environmental worse-case scenario with any vehicle accident would be the death of individuals of a species at risks.

6.5.2.2.2 Effects on VCs

The likelihood of collision with caribou is negligible since the presence of the species in the area is improbable. As for birds at risks, the heavy traffic on the road should be deterrent for them and collision should be infrequent (low likelihood). To be conservative, an overall **low likelihood** will be used.

The **consequence is very low** since it most probably will affect only a few individuals (if any) of species of birds at risk since no caribou are present in the area and, in any case, they avoid populated areas. Furthermore, not restoration or cleanup would be needed apart from carcasses removal.

When crossed in the effect assessment matrix (Figure 6-1), the result is **three (3)**, or below the effect assessment threshold and will not be further assessed here.

6.5.2.2.3 Safeguards in Place

Many safeguards are already in place to increase road safety:

- a water truck will spray the roads whenever necessary in order to keep dust down;
- the Howse haul road will have proper drainage and a 2% crown plus a berm on the sides;
- the speed limit will not exceed 50 km/hour;
- culverts along the roads will be inspected and maintained regularly to ensure that proper drainage is achieve;
- the Howse haul road (excluding the main access road) and the roads to the waste rock piles will not be open to the public during periods of active mining at the sites in question. To avoid any issue and prevent accident or incident a control gate is installed in the surface right boundary in each side of the main road;
- ATVs shall not be allowed on the site except where necessary to perform work. When necessary, the use of ATVs shall be restricted to designated trails and roadways, within and between work, marshaling, maintenance and storage areas, thus minimizing ground disturbance;

- ATV use shall comply with the Motorized Snow Vehicles and All-Terrain Vehicles Act, the NLDEC's Environmental Guidelines for Stream Crossings by All-Terrain Vehicles, and the DFO Fish Habitat and All-Terrain Vehicle Guidelines (DFO 2010ahttp://www.nfl.dfo-mpo.gc.ca/e0005494);
- all Project vehicles will be properly inspected and maintained in good working order, including all exhaust systems, mufflers and any other pollution control devices to meet emission standards;
- travel in areas outside designated work areas will not be permitted;
- site roads will be graded regularly and monitored for signs of erosion, and appropriate action will be taken to repair roads where necessary;
- vehicles and equipment shall follow established routes when travelling to or from the site;
- if issues arise related to noise attributed to Project or Operations related traffic, noise levels will be monitored during a typical day and, if necessary, changes will be made to reduce noise (e.g., rescheduling, modifying vehicles or adjusting speeds);
- trucks will operate only with registered allowable loads, unless oversize and overweight permits are obtained from the applicable regulatory agencies. All loads will be secured in accordance with the Load Security Regulations N.L.R 47/02 under the GNL Highway Traffic Act;
- all personal who drive in mining area should have a mining driving test; and
- Worker's awareness program, including daily and weekly safety talk.

Additionally, some measures are specifically aimed at dealing with wildlife encounter on site. As a protection measure, hunting, trapping or fishing by Project personnel is not permitted on or off site while under the direct or indirect employment of Tata Steel Minerals Canada (TSMC). The following safeguards will be followed on the Howse site with respect to wildlife:

- site and working areas shall be kept clean of food scraps and garbage;
- animal proof disposal containers shall be used and will be regularly emptied and transferred to an approved waste disposal site;
- the on-site landfill shall be regularly maintained, compacted, and covered in order to deter scavenging from wildlife (predominantly bears)
- no personal pets, domestic or wild, shall be allowed on the site
- all sightings of notable species should be immediately reported to the TSMC Environmental team in accordance with our wildlife control plan.

Sensitive Areas and Periods

Traffic including heavy equipment shall not be permitted to enter wetlands or any area that is not designated for traffic. If Site Road Access operations make encounters with migratory caribou unavoidable, the contingency plan detailed in Appendix B-2 of the EPP (Volume 1 Appendix Ia) will be followed. Appropriate measures will be taken to prevent any threat to Rusty Black Bird habitat due to Site Road Access operations.

6.5.2.2.4 Preliminary Response/Emergence Measures

In the case of any staff encountering wildlife on site, the following steps shall be followed;

- If a notable species, the Environment team shall be informed immediately and advised of best course of action;
- If not a notable species, the individual shall proceed with his/her work provided it does not interfere with their personal safety, or the animal in question;

- In the case of Bears, Wolves, Foxes, or Wolverines, should the animal present a risk to human safety contact shall be made to TSMC Security on TATA 1 to provide for escalating action if required;

If an animal is killed, contacting Environmental team for carcass disposal. Disposal of carcass will be managed by Environmental the team in cooperation with NL wildlife or others government departments including federal if required.

6.5.3 Fire

Forest fires are treated below in the *Effect of the environment on the project* section. This section covers fires on site (caused by human error) only. Fire on site can be divided in two categories:

- fire in the mining complex; or
- fire related to a spill.

6.5.3.1 Fire in the Mining Complex

Fires in the mining complex can go from small to very large and it is of the utmost importance to follow the *Dome Fire Emergency Response Plan* that is supplied to workers on site. The likelihood of a fire taking place in the mining complex is moderate as it will probably happen during the mine life. On the other hand, since the mining complex in in the middle of a large disturbed area with no surrounding vegetation or wildlife, no effect is expected from such a fire on the environment and it will not be further treated.

6.5.3.2 Spills Involving Fires

Collisions or traffic accidents resulting in fuel spills can be the source of fires. Although diesel fuel is not extremely flammable, fires are nevertheless a possibility and are included in the emergency response plan.

6.5.3.2.1 Worse-Case Scenario

A large spill from the fuel tank that would take fire would probably be the worse-case scenario as the quantity of fuel would render the site inaccessible and the proximity to the source of fuel would probably be inaccessible for the stopping of the spilling. It could event lead to an explosion, but that will be treated in the next section.

6.5.3.2.2 Effects on VCs

The likelihood of a spill from the fuel truck has already been assessed as low since it is not expected to happen, but could happen due to human error or environmental conditions. For it to catch fire would be event less probable. The **likelihood of such an event taking place is therefore assessed to be very low**.

The environmental **consequences should be moderate**. Indeed such a fire would prevent the diesel to penetrate in the soil and since such a spill is bound to happen on the road or other working areas, not wildlife habitat should be affected. Therefore, the main VC affected would be air quality and some cleanup would probably be required afterwards.

When crossed in the effect assessment matrix (Figure 6-1), the result is **four (4)**, or below the effect assessment threshold and will not be further assessed here.

6.5.3.2.3 Safeguards in Place

Firefighting equipment, including extinguishers, pumps, and hoses will be stationed at various work areas including fuel trucks, generators, and anywhere fuel or flammable material is regularly handled. Personnel will be evacuated from site if a fire cannot be immediately controlled or impacts necessities of life or personnel safety. Trained onsite personnel will respond to fires using onsite equipment. Regulatory authorities will be notified as needed. All on-site personnel will be trained in the use of fire extinguishers, and all Emergency Response Team personnel will be trained in the use of all firefighting equipment.

Should the fire be too large to handle with the portable fire extinguisher, security should be contacted and they will mobilize the fire brigade in the fire truck. The fire truck is equipped with 750 litres of water plus foam capabilities which should double the capacity of the truck. The fire truck is also equipped with 8 fire extinguishers.

6.5.3.2.4 Preliminary Response/Emergence Measures

Small fires that are away from the source of fuel can be extinguished relatively easily using an appropriately sized fire extinguisher, however larger fires or fires that are near the source of the spill (i.e., leaking tank) have a much greater potential danger associated with them. Unless personnel are trained in the use of fire extinguishing equipment and the fire is small and away from the source of fuel, the onsite fire crew should be notified immediately via radio and/or telephone (contact dispatch) and informed of the situation. Personnel should evacuate to a safe distance. Large fires may require the evacuation of all personnel from a large radius surrounding the immediate area.

In the case of a small fire, personnel may attempt to extinguish the fire with a fire extinguisher provided it is safe to do so and the employee is adequately trained and knowledgeable in the types of fire extinguishers for different types of fire. When approaching a fire, always approach from upwind or at a slight angle and away from the fuel source. Pull the pin on the fire extinguisher, aim the nozzle at the base of the flame, squeeze the handle/trigger, and sweep from side to side until the fire is extinguished. Once the fire is extinguished and it is deemed safe to do so, proceed to the spill response procedures outlined above.

6.5.4 Explosives

Explosives of the type proposed for use at the Project are very common and are used every day by mining and construction companies throughout Canada. If proper procedures are followed, the risks of accidents and malfunctions are extremely low. As per Federal regulations, two explosive magazines are required, one containing detonators and one containing primers. TSMC as part of DSO project already have 2 magazines which separate detonators from other explosives. This area has already been approved and permits in place. Furthermore, this area is secured with signage and locked access as well as locked magazines. Also, Site Mixed Explosives Technology (SME) SME is a technology that allows the components of an emulsion explosive to be mixed and sensitized just prior to entering the hose into the blast hole. This allows the elimination of an emulsion manufacturing facility and requires only proper storage facilities for each component. The two main components being fuel oil and ammonium nitrate liquor would be stored in tanks along with the other components of emulsion at the DSO project. As such, there are no explosion risks outside to the pit, since the emulation is not mixed beforehand.

During the Operations phase, blasting at the Howse Property will occur approximately once per week during summer and irregularly during winter. This infrequent schedule is due to the softness of the ore found at the Howse Property, where it is estimated that only 50% of the material will require blasting.

At this point in the blasting process, measures such as notification of the community would have been made up to 48 hours prior, and so safeguards would already be in place for this event. The frequency therefore, of an unplanned blasting event could not be more than once per week/month during the operations phase.

An uncontrolled explosion is defined as an unmanaged or uncontrolled detonation of explosives, or inadvertently combined emulsion constituents, or detonators associated with blasting of the open pit or quarry, or the detonation of explosives resulting in property damage from fly rock or higher-than standard-practice vibration levels. This scenario was not considered to be credible in consideration of normal industry practice and the design basis for the Project. Their analysis follows. While blasting will be a regular part of Project activities during Operation (and to a lesser extent during Construction), the risk of an uncontrolled explosion is greatly reduced by current technology and the legal requirement to follow strict operating procedures. Drilling will be conducted using track-mounted drill rigs. Explosives will be pumped into the boreholes using industry certified explosive delivery trucks, the holes stemmed, and the charges will be detonated in a sequential manner. All of this will be done by qualified and certified blasting personnel. Blasting during Operation will occur a few times a week according to strict clearance procedures. Explosives will be supplied by a distributer who is certified under Canadian regulations, and the method of supply is to not mix the constituent chemicals until they are pumped into the blast hole in the pit. The licensed explosives supplier will be responsible for the final mixing of the emulsion explosives prior upon delivery directly to the blast holes. An on-site explosives magazine will provide for storage of blasting accessories and explosives. This magazine will be in compliance with the Explosives Act and Regulations. Transporting explosives will be regulated by Explosives Regulations under the Explosives Act, Transportation of Dangerous Goods Regulations and the Canada Motor Vehicle Safety Standards.

A Blasting Plan will also be developed and followed and will specifically address health and safety. The new Explosives Regulations require a fire safety plan and key control plan to be in place before an application for a magazine licence is submitted and the applicant must include in the application a declaration that these plans have been prepared. Additionally, a security plan must be prepared for every magazine storing type E (blasting) explosives.

Therefore, the potential for an uncontrolled explosion would be limited to a malfunction or accident in relation to a planned blasting activity (i.e., an early detonation or unplanned detonation in the pit). As a licensed blasting contractor will handle all explosives who will be highly trained in the safe handling, storage, and use of explosives, this accident scenario is not likely.

Any leakage of the emulsion that might occur within a facility will be physically contained. The material will be recovered and if need be, transported to a blast site within a pit and detonated for disposal as described above. Leakage that might occur to ground outside a facility but not at a blast site will be contained. Any free product will be transported to a blast site and detonated if necessary for disposal. Any impacted soil at the spill site will be collected and moved to the secure area for disposal.

6.5.4.1 Worse-Case Scenario

The worse-case scenario for explosives is considered to be the detonation of a full Operation phase explosives magazine. It will be located in an isolated area, at distances from other facilities prescribed by federal regulations to ensure the safety of personnel and facilities in the extremely unlikely event of an accident or malfunction. In a worse-case scenario, the principal effects will be health and safety related.

6.5.4.2 Effects on VCs

We consider the adverse environmental effects of an unplanned explosion at the pit on VCs. An unplanned explosion is not expected to emit more elements into the air than a planned explosion. As such, it is expected to have the same adverse environmental effects as for a planned explosion, and those effects have already been treated in their respective section of the effect assessment chapter.

Section 7.4.9 also analyzes the possible adverse effects of vibrations on fish and fish egg mortality and concludes that the maximum charges predicted by the Howse activities will not affect either VC. As such, even an unplanned explosion is not expected to cause adverse effects on fish since it is not expected to occur outside of the pit.

The **likelihood of an unplanned explosion is negligible** since this activity is well supervised and a lot of safeguards are in place to prevent such events. Also, all personals affected to this activity are highly trained.

Since an eventual unplanned explosion is only expected to happen in the pit, the **magnitude is also very low** as it is not expected to affect the environment any more than a planned explosion.

When crossed in the effect assessment matrix (Figure 6-1), the result is **one (1)**, or below the effect assessment threshold and will not be further assessed here.

6.5.4.3 Safeguards in Place

Rigorous safeguards have been put in place to control risk associated to explosives on site, and they are categorised as follows:

6.5.4.3.1 Guidelines for Explosives

The loading, transportation, storage, preparing, fixing and firing of explosives shall be governed by regulations of the Explosives Act (Canada) and by applicable provincial regulations.

<u>Transportation of Explosives</u>

- all vehicles used to transport explosives shall conform to the Transportation of Dangerous Goods regulations and the Federal Explosives Act, and Transport Canada Regulations; and
- all drivers transporting explosives shall be trained and certified in the transportation of explosives.

<u>Explosive Magazines</u>

- explosives and detonators shall not be stored together in a magazine.
- magazines are to be properly identified, federally licensed, locked and located in a secure area;
- regulations regarding inventory of explosives and maintenance of magazines shall be strictly adhered to;
- any amount of stolen explosive product must be reported as required by the Explosive Regulation;
- disposal of damaged explosives shall be done as recommended by the manufacturers MSDS.

<u>Drilling Near Explosives</u>

- an extreme hazard may exist in any area where blasting has taken place during previous construction or where grade blasting precedes ditch blasting. This hazard may be in the form of lost or abandoned explosives or undetonated explosives located in rock rubble or lodged in bootlegs;
- all drillers shall be experienced and familiar with the work to be performed prior to commencing activities;
- all provincial regulations regarding drilling shall be strictly adhered to;
- no Driller shall drill a hole within the prohibited radius beside any loaded hole. These distances may change from Province to Province. The driller shall ensure he is aware of the required distance;
- drillers shall ensure that the work surface is bare and clean of debris before drilling.
- no attempt shall be made to remove or destroy any explosives or detonators that may be encountered. Work in the area shall cease immediately and supervision notified;

- dust control devices shall be kept in good working order;
- required PPE shall be worn by all drillers.

6.5.4.3.2 Guidelines for Blasting

General

A qualified contractor will comply with all Federal and Provincial legal requirements in connection with the use, storage and transportation of explosives, including the Canada Explosives Act and Transportation of Dangerous Goods Act.

Only employees thoroughly experienced in handling explosives shall be permitted to supervise, handle, haul or detonate explosives. The qualified contractor shall ensure that no person shall be allowed to conduct or direct a blasting operation unless that person is the holder of a valid Blasters Certificate where required by the authority having jurisdiction. In those jurisdictions, where the licensing of blasters is mandatory, the qualified contractor will provide the proof of the required certification for every person so required.

Any vehicle used to transport explosives from the magazine to the blast shall conform to the Transportation of Dangerous Goods regulations.

Qualification for Blasters

- blasting will be managed by a qualified contractor in compliance with all regulations; and
- a list of competent and/or certified blasters must be posted at the work location.

Blasting Restrictions

- controlled blasting (i.e., use of mats, blast design and adequate collar) shall be required when blasting is performed in the vicinity of overhead or underground facilities or structures, to preclude the possibility of damage due to fly-rock, air blast or vibrations;
- when the project is within the vicinity of an electrical transmission corridor a potential hazard exists whereby premature initiation of blasting could be triggered by stray current from the electrical field which may exist at these locations;
- all blasting operations shall be suspended and all men and equipment withdrawn immediately at the first indication of an approaching electrical storm;
- mobile radio transmitters shall be kept well away from areas of electrical blasting operations and signs shall be posted to have all transmitters near the site turned off;
- drilling and blasting operations shall be planned so that the last blast of the day shall normally occur one full hour prior to sunset;
- blast holes shall not be left loaded for extended periods during working hours or overnight, unless provisions have been made for guarding of the blast site. Where such a variance is approved the following restrictions shall apply as a minimum:
  - Tying in of blast holes shall be delayed until immediately prior to the resumption of the day's blasting activity or the start of the following day's activities;
  - The area loaded shall be marked with pink "Restricted Area" tape and shall be continuously patrolled to prevent unauthorized entry to the area.
- the following procedure shall be followed by a qualified contractor prior to the start of each drilling operation in any area where blasting has previously been conducted:
  - the bedrock surface area around the proposed holes shall be thoroughly cleaned of all debris down to bare rock;
  - a thorough examination shall be made of the bedrock to locate previous blast holes or remnants of holes that no missed holes or cut-offs are encountered;

- should any pre-drilled holes or remnants of holes be found these shall be circled with red/orange fluorescent paint and marked with a like-paint stake and shall be examined by a qualified blaster to determine that they are free from undetonated explosives;
- drilling shall not start until all hoes or hole remnants have been located, circled with paint, marked by a stake and determined to be free of undetonated explosives by a qualified blaster;
- should explosives or suspected explosives be encountered the area shall be clearly marked as being hazardous and entry restricted to authorized work personnel only;
- in any event, holes shall not be drilled within the prohibited radius adjacent to any loaded holes. These distances are specified in provincial regulations for the Province where the work is located.

Blasting Signals and Sirens

Warning signs detailing the Blasting Procedure shall be erected on all accesses to the blast area. All workers shall familiarize themselves with blast warning signs and obey them. Prior to initiating the blast warning system:

- the blaster shall complete his blast inspection;
- the blaster shall clear all personnel from the blast area;
- the blaster shall ensure all road and access road traffic is halted, if applicable;
- the blaster shall retreat to a safe firing distance while checking the controlled area and confirming that the guards are posted and the controlled area is secure.

Blast Siren Procedure

- once all guards are in place, the blast zone has been cleared and all workers are accounted for the blast warning siren procedure will commence;
- after a final check with all guards, the Blaster In Charge gives the O.K. to sound three short sirens indicating that blasting will commence in one minute;
- once these three sirens have gone, there is radio silence until a minute has passed and the Blaster In Charge does a final check with the guards;
- once the final check has been cleared with all guards the Blaster In Charge requests the "Blast Imminent" siren. This is a longer continuous siren which will be immediately be followed by the blast when finished;
- once the blast has been detonated all guards hold their position;
- the Blaster In Charge waits until all flyrock has landed and the dust has settled before checking the blast to make sure all explosives have detonated;
- once the Blaster has determined that all explosives have detonated and it is safe to return to work he requests the guards to sound the "All Clear", which is a continuous siren similar to the "Blast Imminent". Once this siren has sounded all guards are free to let traffic pass.

Loading Explosives

- When loading holes, only wooden or plastic tamping poles shall be used;
- Non-sparking tools are to be used when priming explosives;
- Artificial lighting shall be in place and used when required;
- Once holes are loaded, they must be guarded until initiated (fired);
- No loose or boxed explosives or detonators shall be left unattended;
- Loaded holes must not be driven over by mobile equipment;

- An appropriate blasting machine shall be used for the number of circuits/detonators to be fired;
- Precautions shall be taken to minimize fly rock;
- Secure the Blast Site:
  - Danger area clear of workers/equipment (minimum of 500m);
  - Guards have been assigned and instructed as to duties;
  - Warning signals have been posted.

Blast Detonation

- Only one person shall be in charge of initiating a blast sequence and blasting. This person shall be a duly qualified and, where required, a certified blaster. This person shall personally supervise and be responsible for all connections and detonating the blast. No change of responsibility shall take place;
- Prior to any blast a controlled area shall be established. All personnel not involved with the actual detonation must stand back at least the safe required distance as set by the Blaster In Charge;
- Workers involved with the detonation must stand back as required by the Blaster In Charge, from the time the "Blast Imminent" signal is given until the "All Clear" has been sounded;
- The blaster shall position himself at the maximum distance practical from the blast;
- Personnel shall vacate vehicles and take a position of safety that provides full body cover to protect against possible fly rock strike when a blast is about to take place. Each person shall take their individual cover when the "Blast" signal sounds (i.e. cover should not be shared). The Blaster shall, where practical, direct all personnel to take a position of safety at the back of a blast rather than in front of the face;
- Prior to any electrical blast and after mats have been placed, a continuity check shall be performed to ensure that the circuit is intact;
- Proper warning signals are sounded before firing the charge;
- After every blasting sequence the blasting foreman or blaster shall conduct a thorough post-blast inspection of the blast area for cut-offs or misfires and shall ensure that any undetonated explosives are properly destroyed by blasting prior to any other working proceeding.

After the Blast

- If a misfire occurs, the Blaster must wait 30 minutes for safety fuse and 10 minutes for electrical detonation, before inspecting the blast;
- Lead wires are to be shorted out immediately after firing;
- No other person enters the blast site until the blaster has examined for hazards (unstable slopes, loose rocks, trees, etc.);
- The Blaster must make a thorough check for misfired charges;
- No person is to enter the blast site until the blaster has given permission;
- All clear signal is sounded;
- Any hazards are corrected before workers are employed in that area (loose rocks, trees, misfires, etc.).

Misfire Procedures

- Only qualified workers involved with the blast are to be allowed in the blast area;
- Metallic equipment can only be used under controlled conditions with a spotter;

- Misfires must be detonated before any other work is to be done;
- Any drilling to re-fire the undetonated explosives is carried out under the direction of the blaster;
- No dynamite is to be removed from any misfired hole;
- Only ammonium nitrate products can be washed out with water;
- No person shall remove, relight, or disturb any fuse or any part of a misfired charge.

6.5.4.4 Preliminary Response/Emergence Measures

Very small amounts of 'prepared' explosives will be onsite at any given time. Explosive materials and their individual components (i.e., ammonium nitrate) will be housed offsite through an independent contracting company. In the event of any explosives related issues, an immediate evacuation of the surrounding area would occur and the Emergency Coordinator would deploy the Emergency Response Team.

In the event of a vehicular accident occurring while transporting explosives, the explosives contracting company and the Emergency Response Team would be notified immediately in order to evacuate the surrounding area and put in place the emergency response plan. On-site emergency medical services would be contacted to respond or put on standby, depending on the severity of the explosion. It is highly likely that in the case of an explosion, firefighting services would be required from the Emergency Response Team. After the risk to human life and property has passed, a qualified professional would be required to 'clear the area' (i.e., indicate that there is no longer a risk of explosion) prior to clean up. With fire crew on standby, the Emergency Response Team would commence with cleanup as appropriate for ammonium nitrate and/or fuel spilled on site.

6.5.5 Water Management Plan failure

The water management plan (WMP) includes a network of ditches and sedimentation ponds that are designed to control mine drainage. There are three types of mine drainage that are managed by the WMP at the Howse property:

- natural site runoff (main parameters of concern being suspended solids consisting of silt, sand and grit);
- runoff from overburden and waste rock dump (main parameters of concern being suspended solids consisting of silt, sand and grit); and
- pit dewatering (clean groundwater mixed with sump water charged with suspended solids and possibly nitrogen compounds).

Any diesel or oil that could be present in the sump water will be captured by an oil/water separator system before it reaches the surface runoff network of sedimentation pond.

Throughout the mine life, the three sedimentation ponds (sedimentation pond HOWSEA, sedimentation pond HOWSEB and existing Timmins 4 Sedimentation pond 3) will be increasingly filled with these contaminants.

Possible failures of the WMP include:

- Sedimentation pond leakage;
- Ditch failure; and
- Pump failure.

6.5.5.1 Worse-case scenario

Since the main water treatment of the Project is achieved through deposition in the sedimentation ponds, a sedimentation pond leakage would be the worse-case scenario. It would be even worse if it happened at the end of the mine life since the sedimentation ponds will be filled with contaminated sediments. The resulting increased flow could also increase erosion downstream. Ultimately that would equate to a contamination of receiving watercourses by suspended solids and possibly nitrogen compounds, potentially leading to effects on aquatic life.

6.5.5.2 Effects on VCs

Since some of the ditches are within a 100 m of watercourses but always at least at 30 m away, a ditch failure could result in an effect on water quality or fish and fish habitat. The **likelihood of such a failure is considered to be low** as it has chances of happening if fallen materials or ice block a ditch, but the distance from water bodies greatly reduces that risk as does the planned proper maintenance and inspection. In the event of a ditch failure causing a spill in a waterway, the **consequence would be low** since it would affect many VCs such as water quality and fish and fish habitat, but since only runoff travels through those ditches, only suspended solids would be discharged, limiting damages to the environment that will clean itself once the discharge ceases.

A pump failure on the other hand would simply imply less water flow through the WMP network and hence no effect is expected from such an event.

As stated in the worse-case scenario, a sedimentation pond failure could result in a more important effect. The **likelihood of a sedimentation pond failure is negligible** since the ponds will be constructed to withstand extreme environmental conditions and will be inspected regularly. On the other hand, if such an event was to happen, the **consequence of the effect could be high** since many VC could be affected (water quality, fish and fish habitat) and some restoration measures could be necessary to limit contamination of affected areas.

Overall, when crossed in the effect assessment matrix (Figure 6-1), the result for either ditch failure or sedimentation pond failure is **four (4)**, or below the effect assessment threshold and will not be further assessed here.

6.5.5.3 Safeguards in place

During the operation phase, it is important that particular attention is given to storm water management to ensure sediments and related contamination does not enter any nearby water bodies, and to limit erosion. The main safeguard against WMP failure is its design that is detailed in section (3.2.5.4. Water Management Infrastructure).

Apart from that, the Proponent has the following additional safeguards in place:

- at minimum, WMP ditch infrastructure will be inspected two times per year (Spring and Fall);
- environmental monitoring (previously-acquired data on surrounding water bodies will assist with monitoring);
- EPP Section 4.7.3 (Storm WMP): runoff captured in perimeter ditches, discharge monitored weekly, environmental long term effect program.
- EPP Section 5.1 (Groundwater Control Plan): dewatering water will be used for dust suppression or will infiltrate in the soil, installation of petroleum product reservoirs, designed containers for hazardous materials, use of berms, no dewatering into natural drainage system without treatment;

- EPP Section 5.2 (Surface water control plan): petroleum product reservoirs, no discharge of potentially contaminated water into the natural drainage system, use of designed containers for hazardous materials, use of berm for process, fuel-storage, re-fueling and wash-down areas, appropriate storage of fuels and chemicals.

6.5.5.4 Preliminary Response/Emergence Measures

Emergency measures to be applied here are the same as for spills (see section 6.5.1).

6.5.6 Slope Failures

Slope failure can happen anywhere a slope exists, but is more likely on manmade slopes such as the ones found on piles and in the pit. Slope failure can be of little impact if occurs in an already disturbed area, but could be more problematic if it occurred in a previously unaffected area.

6.5.6.1 Worse-Case Scenario

Although a failure of the pit wall would be highly dramatic for the workers present, it would not translate in an adverse environmental effect.

On the other hand, a slope failure of a pile into a peripheral ditch would divert the mine drainage into the environment before being treated in a sedimentation pond. In that case surface water contamination could occur. Effect would be similar to that expected from a WMP ditch failure. The only waterbody close enough to peripheral ditch subject to such an event is Goodream Creek and the ditch in question is only redirecting surface runoff from natural area and from waste dump and overburden stockpile. As such, the only contaminant expected to be transported is suspended solids.

6.5.6.2 Effects on VCs

Likelihood

Although unlikely (negligible), the **consequences of such an event could be high**, as multiple VCs like water quality and fish habitat could be temporarily affected but the discharged suspended solids. Prompt excavation of the ditch should greatly limit the adverse effects, but if high quantities of suspended solids are discharged into Goodream Creek, some fish habitat could be compromised and some cleanup measures might be required.

When crossed in the effect assessment matrix (Figure 6-1), the result is **4**, or below the effect assessment threshold and will not be further assessed here.

6.5.6.3 Safeguards in Place

TSMC’s approach to managing potential wall failures, either as a result of general instability or as a direct result of freeze-thaw cycle, is based on the following steps:

- Ground monitoring plan;
- Regular waste rock, and ditch inspection (2 times per year is the minimum);
- Identification; and
- Mitigation.

Prevention and identification are safeguards and will be detailed in this section, whereas mitigation will be treated in the next section.

<u>Prevention</u>

In 2014, geotechnical study "Howse Pit Conceptual Slope Design" was conducted by Golder Associates (Volume 2 Supporting Study A). This study, based on core samples, laboratory tests, and numerical modeling, provides slope recommendations throughout the depth of the pit. The Howse pit was designed to conform to these slope parameters

During operations, excavations will be closely monitored to ensure their adherence to the design of the pit. Daily surveys will ensure the excavation of the benches match the design of the pit, which ensures a degree of stability based on the initial geotechnical study.

Further geotechnical work will be conducted throughout the life of the operation as the slope study concludes that with further drilling there is potential for the slopes to be steepened and for waste rock movement to be reduced. While a timeframe for this work cannot be determined at this time and the nature of this work will be to seek additional geological data to confirm that the pit walls can be steepened, it will present opportunities to identify geological anomalies which may compromise the stability of the pit.

Strictly adhering to slope parameters recommended by external geotechnical experts is a key component to preventing wall failures.

Identification

Preventing wall failures involves identifying potential failure zones before they occur. TSMC will have a detailed field reporting system in order to allow operations and technical personnel to report any anomalies or changes to the pit walls as part of their regular duties in and around the pit. These may include bench degradations, water infiltration through the walls as a result of thawing, cracks propagating through the wall, or localized slope failures which may compromise the integrity of a bench or the pit wall. These reports will then be followed up with a field investigation by qualified personnel to identify the nature of the anomaly and evaluate whether it poses a risk to the wall stability of the excavation.

These field observations, while conducted daily, will be intensified during thaw periods as this is the timeframe where potential failure zones are most likely to appear.

TSMC will also conduct regular comprehensive surveys of the pit walls. Through the use of modelling software, pit walls can be regularly measured to ensure their slopes and benches are stable, and any movement can be identified to its specific area to be evaluated by qualified personnel.

Lastly, TSMC will evaluate the possibility of implementing a radar based slope stability system. These systems monitor pit walls on a real time basis and can report any movement within a pit wall in order to identify failure zones before they occur.

6.5.6.4 Preliminary Response/Emergence Measures

Once a potential failure zone is identified, an action plan is formed in order to address the situation. The action plan will depend on the severity and size of the potential failure zone.

For personnel safety, the first step will be to close off access to areas immediately above and below the potential failure zone, through signage and berms if necessary. If the potential failure zone is deemed large and severe enough that the integrity of the pit will be compromised, geotechnical directed drilling may be conducted in order to collect core samples and conduct a proper detailed analysis of the area in question, though this remains a very unlikely scenario.

In a scenario involving bench degradation or small localized slope failures, which typically occur at higher elevations where the rock may not be entirely consolidated, a pushback of the slope will typically be enough to ensure the stability of the area.

As the excavation deepens and the rock gets harder and more consolidated, action plans become increasingly dependent on the specific nature of the potential failure zone, thus it is difficult to generalize a response plan. Depending on the nature of the zone in question, responses to potential failure zones can include installing a dewatering well behind the wall, rock bolting, grouting, or scaling of the wall, and other options.

In extreme cases where the potential failure zone is deemed to be impossible to mitigate, a small localized blast may be initiated in an attempt to make the failure occur so re-sloping and clean-up work can proceed and operations can resume

The pit wall slope angles and bench heights are based on the most conservative, standard methods known.

6.5.7 Accidents and malfunctions caused by exceptional natural events and Effects of the environment on the Project

This section assesses how natural events could impact on the project activities (and possibly cause accidents and malfunctions) and in turn, how these altered activities can adversely affect VCs. Some exceptional natural events effects on the environment could be exacerbated by the presence of the project. This section focuses on assessment of those complications due to the presence of the mine.

Extreme weather conditions may occur in various seasons over the course of the Project duration. The Proponent's EPP document considers, and classifies extreme weather as follows: extreme wind events and white-out events, and extreme precipitation events, each with its respective procedures.

Section 6.4.4 presents climate change scenarios for the Howse Project area. Extreme precipitation events are predicted to increase in frequency for the summer months in the Howse Project area. The effects of the predicted temperature changes in the Howse area are not expected to alter site activities or operations.

6.5.7.1 High Winds and blizzard

High winds are frequent at the mine site, especially in winter, because it is in an alpine tundra area with a lot of fetch to the West, where the dominant winds come. However, high winds may increase the possibility of road accidents (especially in the event of a blizzard), due to poor visibility. Effects of road accidents are considered in Section 6-14. TSMC's EPP document considers an extreme wind event as gusts occur in excess of 110 km/h, or sustained wind speed of 90 km/h. A white-out event can be considered as any event in visibility descends to a point in which outside travel becomes difficult.

Other than the possibility of road accidents, no other effects on VCs are expected from high winds since, in the event of a high wind/blizzard event, TSMC will either limit/stop all outdoor work, limiting/stop the use of heavy equipment. The final decision on these procedures will be made by the mine superintendent.

6.5.7.1.1 Worst Case Scenario

Since only small infrastructures are planned for the Howse Project (most infrastructures belonging to the ELAIOM Project), they do not provide large areas on which wind can act. The worst situation would probably by associated with a blizzard that would reduce visibility such that further work or transport is impossible.

6.5.7.1.2 Effects on VCs

The effects of road accidents on VCs are discussed in Section 6-14 above.

6.5.7.1.3 Safeguards in Place

Data should be relayed from the TSMC Environmental staff regarding present and expected wind conditions utilizing Environment Canada forecasts and on-site weather equipment to the Mine superintendent.

The mine superintendent shall decide a course of action which will provide for worker safety, including but not limited to:

- limiting outdoor work;
- stopping all outdoor work;
- limiting heavy equipment;
- stopping all heavy equipment;
- issuing a no-travel notice, temporarily stopping travel between DSO3, DSO4, and Schefferville; and
- mandating maximum work periods.

6.5.7.2 Effects of climate change on water balance (flood/drought)

The effects of 100-year flood and drought events on the water balance at the Howse site are discussed in Section 6.4.4. In all cases (drought or flood), the implementation of the Howse Project has the effect of increasing flow into three watersheds (Goodream Creek, Burnetta Creek and Pinette Lake). As a result, the effect of a 100-year drought event on the Howse Project under natural conditions (no Project) would incur more drought (adverse effects) than under the Howse Project itself. As such, we consider the adverse effects of a 100-year flood on the water balance/Howse VCs.

Due to the sloped nature of the area, flooding is highly unlikely. Increase rain fall has already been taken into account for sedimentation pond design and not impact is expected there. The only area where flooding could occur would be in the pit itself in the event that precipitations surpasses sump pump capacities. In that event, operation would have to be halted until the pumps can clear the pit again. Pit flooding would therefore imply a cessation of operations until sump pumps are able to empty the pit again. Since this in unlikely to happen and would only last a few days, not significant impact on the Project, or VCs, is expected.

6.5.7.2.1 Effects on VCs

A 100-year flood event implies an 8% increase in flow, which is not expected to adversely affect fish or fish habitats more than the natural conditions would by itself in a wet year. As such, fish and fish habitat will not be adversely affected.

6.5.7.2.2 Safeguards in place

The WMP is designed to withstand high water flow events.

6.5.7.2.3 Preliminary response/emergence measures

Cease operations until pit is emptied again.

6.5.7.3 Forest Fire

Climate predictions for the Howse Project area include warmer summer nights, longer summers and more summer precipitation. When considering that precipitation is sometime accompanied by lightning events, the combined predicted changes to these variables imply more forest fire activity in the area.

TSMC’s EPP document considers forest fires that threaten operations as well as those that do not threaten operations. Given the tundra-like vegetation surrounding the Howse Project, as well as the wetlands in the vicinity, a forest fire event is unlikely to occur at the Howse site. The possibility of a forest fire on site is limited to a small area near Greenbush (outside of the Howse Project site) and from the limit of the propriety of the Howse Project and the Howells River valley.

6.5.7.3.1 Worse-case scenario

The worse case scenario would be that a forest fire reaches the Howse site, which could cause total destruction of the Howse infrastructures, and effectively destroy most of the VCs associated with the Project. This scenario, however, is very unlikely (negligible) given the landscape in which the Howse Project lies: the disturbed land from past IOCC activities coupled with the wetlands surrounding the site and the low-fuel vegetation beyond this makes the possibility of a forest fire resulting in effects on VCs at the Howse site negligible.

Rather, smoke from a fire in the Greenbush area or in the Howells River Valley could affect operations at the Howse Project site by affecting visibility. In the event that a forest fire occurs that does not threaten the Howse Project area, the Proponent will first consider precautionary measures owing to the potential for logistics disruption, and secondly, TSMC should assume the role of assisting agency given the resources at its disposal.

Consequently, low visibility can increase the possibility of traffic accidents.

6.5.7.3.2 Effects on VCs

The effects of road accidents on VCs are discussed in Section 6-14 above.

6.5.7.3.3 Preliminary Response/Emergence Measures

In any event, should a forest fire be initiated, the water bombers in Wabush or Goose Bay will be contacted to put out the fire. TSMC Safety personnel regularly attend the Standing Joint Committee for Emergency Measures, (SJCEM) compose of Schefferville, Matemikush-Lac John or Kawawa.

The following text is derived from TSMC's EPP (Volume 1 Appendix Ia), Appendix B-4 and pertains to TSMC's DSO operations. This document is updated annually and includes consideration of the upcoming operations. As such, it will be updated to reflect the Howse Project in spring 2016.

The Goodwood Haul road linking DSO4 deposits with the DSO Process plant, should be considered an area at high risk for forest fires due to the dense, continuous spruce (C-2 Fuel Type). In case of fire, the incident shall be reported to the appropriate authorities, SOPFEU if the fire is located in Quebec, and Department of Natural Resources if the fire is located in Newfoundland and Labrador. Further, the TSMC representative reporting the incident shall pass onto the appropriate government agency the following details;

- Fire location (GPS Coordinates);
- Fire description including; Approximate size, wind direction, wind speed, relative humidity, temperature, weather conditions over fire (clear, cloudy, lightening), flame length, smoke color, geographical features (hills, lakes, etc);
- Resources at risk. Clearly communicate which infrastructure (if any) is being imminently threatened by the fire (Roads, transmission lines, etc.) and which may be threatened as the fire develops;
- Resources available. Clearly state assets at TSMC's disposal which may be utilized in the direct or indirect suppression of wildfires including heavy equipment, water trucks, etc;
- Appoint an incident commander on behalf of TSMC, and mobilize the TSMC fire brigade as a precautionary measure to perform structural protection should it be necessary;
- In the event that the site may be threatened by forest fires, evacuation of the camp may not be necessary due to the lack of combustible material in the vicinity of the camp. Should the roads north or south of the camp be threatened, a no-travel order shall be placed, and the road closed with the assistance of the Surete de Quebec until such time that the fire shall no longer impede travel; and

- Should personnel be in the DSO4 area and a fire threaten the Goodwood road, a no-travel order should be issued for the Goodwood road, including stopping haulage operations, until the fire passes, the threat diminishes, or both.

6.5.7.4 Unlikely events

6.5.7.4.1 Ice jams

There are no large rivers are present in the vicinity of the Project and hence no ice jams are expected to occur or to affect the Howse Project activities, or their associated VCs. Also, the absence of crossings largely eliminates any risks of impacts from that source.

6.5.7.4.2 Landslides and avalanches

Landslides or snow slides could potentially block paths and delay operations slightly, although not enough to modify project global schedule. Rock slides from waste piles are discussed in the Slope Failures Section above.

6.5.7.4.3 Seismic events

There are no avalanches of earthquake risks in the vicinity of the project (see Section 7.3.5).

6.5.7.4.4 Erosion

Possible erosion effects are expected only downstream of the Project, and therefore, no effect on the Project itself are expected.

6.5.7.4.5 Subsidence

Since the mine does not include underground tunnels, this is not considered as an issue.

6.6 Climate Change

This section discusses the effects of climate change on the project. Predicted temperature and precipitation changes, including extreme events, are discussed, as well as their potential effects on the Howse Project.

Finnis (2013) describes the climate change projections (2038-2070) for 19 climate indices, based on seven regional climate models (RCMs). It is noted that the climate change predictions reported in this document are for years commencing approximately 5 years after the projected closure of the Howse Project (Operations are expected to cease in 2032), but, given that climate change predictions are not absolute, the environmental effects of climate change on the Howse Project are assessed below based on the values reported in Finnis (2013).

The results for the northern Labrador interior are discussed below, with reference to how these predicted climatic changes may affect the Howse Project. The current climate trends of the Schefferville region are described in Section 7.3.1.

Temperature

For the northern Labrador interior, winter temperature increases (3-4°C) are expected to be more pronounced than summer temperature increases (~1°C). In both cases (winter and summer) temperature increases will be more pronounced for minimum temperatures, indicating that nighttime conditions in winter will be warmer by the mid-century. Given the current severe winter temperatures in Labrador, these changes are not expected to pose any constraints on the Howse Project, nor require any mitigation. Currently, the freezing temperatures in winter cause the need to dry the ore before transportation and it is expected that the same drying process will be required as a result of continued freezing conditions in winter, despite the predicted warming, until the end of the Project.

However, the RCM's predicted warming during the spring and fall seasons may result in winters being on average 1-2 weeks shorter, which could result in some changes to the Howse Project region. In addition, to reducing the time period for when ore drying is necessary, the earlier onset of spring/later onset of winter may:

- cause vegetation to grow earlier in the region and provide suitable forage for wildlife, notably caribou;
    - Given that predictions are for more pronounced effects inland as compared to the coast due to the moderating effects of the ocean, and given that the George River Caribou Herd has its calving areas closer to the coast, it is speculated here that caribou may gradually show a preference for calving in inland habitats. This effect, should it occur, will be verified under the Ungava Program (Section 9.2.2).
- similarly, uncouple wildlife-forage relationships for other wildlife in the area;
- if coupled with lower precipitation, cause increase drought conditions which could be problematic for fish and plants;
- delay trout spawning in fall.

The effects of the predicted temperature changes in the Howse area are not expected to alter site activities or operations. Notably, the predicted nighttime temperature increases will not cause any changes to freezing/thawing, since the temperatures are expected to remain below freezing values, even with the changes expected. The changes to wildlife may be more pronounced as an earlier spring thaw could result in uncoupling between forage availability and wildlife.

Precipitation

Finnis (2013) predicts increases in the intensity of precipitation in the area, in particular during the summer months. This includes the 3/5/10 day precipitation events as well as the number of days with substantial precipitation (more than 10 mm). Similarly, Finnis (2013) predicts increases in extreme precipitation events. Increases in summer precipitation events such as those described above for the mid-century may result in a rise in flood events in the Howse area. The effects of floods and HML's preparedness for these events are discussed in 6.5.7.2.

The predicted increased precipitation will necessitate a corresponding need for pit dewatering. However, towards the end of the Howse project (when increased precipitation is predicted), this will occur in tandem with the predicted increased pit dewatering, when the pit depth reaches the water table. At this stage, HML expects to conduct pit dewatering activities continuously, and so the measures for the increased pit dewatering will already be in place to accommodate the predicted increased precipitation events predicted by Finnis (2013).

Water balance modelling was conducted for ground water and surface water for the Howse Project (ful reports available in Volume 1 Appendix XVII and XVIII, respectively). The hydrological year 1978-1979 was selected as typical wet year because it resulted in an annual runoff of 794 mm, which is more than the runoff corresponding to a 100 years wet year return period (776 mm). The hydrological year 1996-1997 was selected as typical dry year because it resulted in an annual runoff of 343 mm, which is less than the runoff corresponding to a 100 years dry year return period (350 mm).

Table 6.1. Monthly precipitation values used in water balance modelling

MONTH	RAINFALL (MM) WET/DRY	SNOWFALL (MM) WET/DRY	RUNOFF (MM) WET/DRY	LAKE EVAPORATION (MM) WET/DRY	EVAPOTRANSPIRATION (MM) WET/DRY
January	0.0	62.4/17.6	0.0	0.0	0.0
February	0.0	61.6/1.8	0.0	0.0	0.0
March	0.2/0.0	101.9/9.7	0.2/0.0	0.0	0.0
April	60.2/2.9	42.2/21.0	60.2/2.9	0.0	0.0
May	73.1/43.2	26.0/23.8	547.2/195.0	0.0	0.0
June	82.3/35.1	0.0	32.9/14.1	109.6/99.4	38.4/34.8

MONTH	RAINFALL (MM) WET/DRY	SNOWFALL (MM) WET/DRY	RUNOFF (MM) WET/DRY	LAKE EVAPORATION (MM) WET/DRY	EVAPOTRANSPIRATION (MM) WET/DRY
July	149.5/170.8	0.0	59.8/68.3	103.3/93.6	36.2/32.8
August	76.9/42.6	0.0	30.7/17.0	73.8/66.9	25.8/23.4
September	100.5/67.4	2.4/0.0	41.2/27.0	48.5/43.9	17.0/15.4
October	21.3/7.8	64.8/14.3	21.3/7.8	0.0	0.0
November	0.0/10.4	63.3/27.2	0.0/10.4	0.0	0.0
December	0.0	51.9/36.4	0.0	0.0	0.0
Year	**564.0/380.3**	**476.5/151.8**	**793.5/342.5**	**335.2/303.8**	**117.3/106.3**

Groundwater modelling conducted for the Howse Project indicates that for a dry year scenario with a recharge of 60 mm, the estimated dewatering rate is about 8, 500 m^3/day. By comparison, for a wet year scenario with a recharge of 250 mm and conductivity hydraulic multiplied by 2 for overburden and Sokoman units, the estimated dewatering rate is about 23, 200 m^3/day.

The following Tables (1.1, 1.2, 1.3 and 1.4) summarizes the monthly maximum flow differences with and without Howse deployment for all locations and for wet, average and dry years. Note that monthly maximum flow differences are the same for each scenario for Burnetta Creek and Pinette Lake (except in the case of a Q = 0) because only drainage areas differences are applied. Since all scenarios are have similar effects at those two outflow locations, they will not be further discussed here as the effect on VCs is already assessed in Section (Chapter 7). For Goodream Creek these differences are not constant because pit dewatering values change and pit dewatering is treated in priority in HOWSEB sedimentation pond. Also note that the variation observed when the Project is added to the model is based on wet, average and dry monthly maximums respectively (e.g. the variation compares two wet-year conditions: one with and one without Howse).

For example, Table 6.2 indicates that, with Howse, a 23% increase in flow is expected in May at the Timmins 4 sedimentation pond 3 outflow in a dry year scenario relatively to a dry year scenario without Howse (ΔQ/Q Without Howse - Dry). However, if we look at the actual water flow (Q with Howse = 283 L/s), the flow is still far below the Q without Howse for an average year in May (453 L/s). Therefore the increase in water flow with Howse, even though it is considerable, will have no additional adverse environmental effects due to erosion since the flow is still way below the stream bed containment capacity. In fact, the presence of the project will slightly increase water flow in low flow periods (June to September), thereby potentially increasing fish habitat availability.

The same rationales apply for the dry year scenario of HOWSEB sedimentation pond as shown in Table 6.3. Indeed, the large proportional increases as shown by the high percentages (ΔQ/Q Without Howse) are due to very low Q without Howse (sometimes Q = 0) rather than very large Q with Howse as is again shown by the Q with Howse from June to September as compared with the Q without Howse for May. Note that if Q without Howse equals zero, any increase in flow will result in an infinite (∞) ΔQ/Q since the water flow difference is divided by zero. Once again no erosion is expected to occur due to the project in dry years, and in this case, the substantial increase in flow should prevent it from drying up as it often does in summer, thereby increasing fish habitat availability.

For the wet scenario, the situation is different. Indeed, the effect of the Project in a wet year is proportionally smaller for the month of May (ΔQ/Q with Howse = 8% and 21% for Timmins 4 sedimentation pond 3 and HOWSEB respectively) since the natural flow of the receiving stream is already very high. Therefore the adverse effect of a wet year on water quality through erosion would be mainly due to the higher natural water levels in the stream (Q without Howse – May) rather than the Project itself. As for other months, the situation is similar at Timmins 4 sedimentation pond 3, with proportionally smaller increases in water flow with Howse in a wet year scenario. On the other hand, for HOWSEB, were most the dewatering is sent ΔQ/Q with Howse reaches very high values, but the situation is similar as with the dry year scenario; that is the Q with Howse for June to September, although proportionally a lot higher that the corresponding Q without Howse, are still all far below the Q without Howse for an average year in May, and hence, no adverse effect are expected on the environment in the form of erosion. Once again, increases in water flow will probably eliminate dry up events that the model still suggests happens in a wet years in June, thereby increasing fish habitat availability.

Table 6.2. Monthly Maximum Flow Variation for Wet, Average and Dry Scenario at Timmins 4 Sedimentation Pond 3 Outflow – With and Without Howse Project

Month	Q Without Howse (L/s)			Q With Howse (L/s)			ΔQ/Q With Howse (%)			ΔQ/Q Without Howse (%)		
	Wet	Average	Dry	Wet	Average	Dry	Wet	Average	Dry	Wet	Average	Dry
May	645	453	230	699	515	283	8%	12%	19%	8%	14%	23%
June	0	0	0	0	0	0	0%	0%	0%	0%	0%	0%
July	28	7	42	30	8	50	6%	11%	17%	7%	12%	20%
August	6	16	0	6	18	0	6%	11%	0%	7%	12%	0%
September	29	25	14	31	27	17	6%	11%	17%	7%	12%	20%

Q: Water flow

ΔQ : Difference in the water flow with and without Howse project

Table 6.3. Monthly Maximum Flow Variation for Wet, Average and Dry Scenario at HOWSEB Sedimentation Pond Outflow – With and Without Howse Project

Month	Q Without Howse (L/s)			Q With Howse (L/s)			ΔQ/Q With Howse (%)			ΔQ/Q Without Howse (%)		
	Wet	Average	Dry	Wet	Average	Dry	Wet	Average	Dry	Wet	Average	Dry
May	2182	1533	777	2641	1923	944	17%	20%	18%	21%	25%	21%
June	0	0	0	266	255	97	100%	100%	100%	∞	∞	∞
July	94	25	142	369	282	252	74%	91%	44%	291%	1037%	77%
August	20	56	0	288	315	97	93%	82%	100%	1366%	467%	∞
September	100	83	48	375	345	149	73%	76%	68%	276%	316%	213%

Q: Water flow

ΔQ : Difference in the water flow with and without Howse project

Table 6.4. Monthly Maximum Flow Variation for Wet, Average and Dry Scenario at HOWSEA Sedimentation Pond Outflow – With and Without Howse Project

Month	Q Without Howse (L/s)			Q With Howse (L/s)			ΔQ/Q With Howse (%)			ΔQ/Q Without Howse (%)		
	Wet	Average	Dry	Wet	Average	Dry	Wet	Average	Dry	Wet	Average	Dry

May	170	119	61	291	205	104	42%	42%	42%	72%	72%	72%
June	0	0	0	0	0	0	0%	0%	0%	0%	0%	0%
July	7	2	11	13	3	19	42%	42%	42%	72%	72%	72%
August	2	4	0	3	7	0	42%	42%	0%	72%	72%	0%
September	8	6	4	13	11	6	42%	42%	42%	72%	72%	72%

Q: Water flow

ΔQ : Difference in the water flow with and without Howse project

Table 6.5. Monthly Maximum Flow Variation for Wet, Average and Dry Scenario at Pinette Lake Outlet – With and Without Howse Project

Month	Q Without Howse (L/s)			Q With Howse (L/s)			ΔQ/Q With Howse (%)			ΔQ/Q Without Howse (%)		
	Wet	Average	Dry	Wet	Average	Dry	Wet	Average	Dry	Wet	Average	Dry
May	484	340	173	466	328	166	-4%	-4%	-4%	-4%	-4%	-4%
June	0	0	0	0	0	0	0%	0%	0%	0%	0%	0%
July	21	5	31	20	5	30	-4%	-4%	-4%	-4%	-4%	-4%
August	4	12	3	4	12	0	-4%	-4%	0%	-4%	-4%	0%
September	22	18	11	21	18	10	-4%	-4%	-4%	-4%	-4%	-4%

Q: Water flow

ΔQ : Difference in the water flow with and without Howse project

As such, the adverse effects of the Project during a wet or dry year on the water balance at the Howse site are not expected to differ significantly from an average scenario, at least not in a negative way. What is show with tables above is that the effect of the Project on the VCs will not be amplified by the occurrence of a dry or wet year. It is therefore not deemed necessary to complexity effect assessment of the VC with dry and wet year scenarios, since the effects will be basically the same. In any case, the average scenario still is the most probable to occur, and therefore the best premise on which to assess the effect of the project on the environment.

7 EFFECTS ASSESSMENT

7.1 STUDY AREAS

7.1.1 Biophysical

Table 7-1 describes the LSA, RSA and temporal boundaries for each biophysical component. It also presents summary justifications for the selection of those areas. A detailed justification for each study area is presented in the corresponding section describing the receiving environment. The maps illustrating spatial limits are presented in corresponding sections.

This document presents the results of the biophysical effects assessment in compliance with the federal and provincial guidelines. All results apply to both jurisdictions simultaneously, with the exception of the Air Quality component. The Air Quality data discussed in this chapter derives from the data presented in the federal report (Volume 2 Supporting Study E). A unique subsection (7.3.2.2.2) is provided which presents the Air Quality results in compliance with the EPR guidelines.

Table 7-1 Summary of the LSA and RSA for the Various Components of the Receiving Environment

COMPONENT	LSA	RSA	JUSTIFICATION
Greenhouse Gas Emissions	A 30 km radius centered on the Howse Project	The climate region of central Ungava	Local: Data availability, as this radius encompasses the Schefferville A climate station. Regional: Includes the entire Central Ungava climate region
Air Quality	Area of 340 km^2 centered on the Howse Project	Area of 520 km^2 centered on the Howse Project	Local: Modelling carried out for projects similar to ELAIOM confirmed that dust emissions, the most important effect on air quality, are most often limited to a 10-km radius. Regional: Include the towns of Schefferville and Kawawachikamach, and the Matimekush-Lac John community.
Noise	Mapping of the DSO3 and Howse Mine study area	5-km radius centered on the Howse Project	Local: Includes noise sensitive areas near the Howse Mine, Irony Mountain, and near Pinette, Rosemary, Elross, and Triangle Lakes Regional: Project noise is not expected to be above background levels at approximately 5 kilometres from the Howse Mine
Light	Area of 25 km^2 of the Howse Project	Area of 625 km^2 of the Howse Project	Local: distance at which artificial lighting from the project could be visible Regional: Includes the nearest towns where artificial lighting and permanent lighting is prevalent and also additional mining pits of the whole DSO project, where artificial lighting is almost non-existent
Geology	Howse sector	Labrador Trough	Local: Direct effect on geology is limited to the sector to be mined. Regional: The Labrador Trough was selected as the BRSA because several other mining projects are proposed there and the geology is similar.

COMPONENT	LSA	RSA	JUSTIFICATION
Hydrogeology	Elross/ Goodream/ Burnetta creek watersheds	Howells River watershed and Schefferville area	Local: Direct effects will be confined to watersheds within which the Project is located. Regional: Elross and Goodream streams flow into the Howells River, and a large quantity of data on similar subwatersheds of Howells River is available for comparison with the LSA.
Geomorphology	Elross/ Goodream/ Burnetta creek watersheds	Labrador Trough and Northeastern Québec-Labrador	Local: Potential direct effects on surficial deposits are restricted to the immediate footprints of ground disturbance, whereas potential indirect effects are farther-reaching Regional: The Howells River Valley has topography, surficial deposits and climate similar to the Howse Project and can be compared.
Permafrost	1-km radius centered on the Howse Project	Howells River watershed	Local: Direct effects will be confined to the Howse footprint. Regional: encompasses areas of previous and proposed mining-related disturbance (e.g., open pits, waste rock piles, etc.). The full extent of any cumulative effects is included within this region of historic mining operations.
Hydrology	Pinette/ Goodream/ Burnetta creek watersheds	Howells River watershed and regional area	Local: Direct effects will be confined to watersheds within which the Project is located. Regional: Pinette, Burnetta and Goodream creeks flow into the Howells River, and a large quantity of data on similar subwatersheds of Howells River is available for comparison with the LSA. It also includes regional hydrometric stations.
Water quality	Pinette/ Goodream/ Burnetta creek watersheds	Howells River watershed	Local: Direct effects will be confined to watersheds within which the Project is located. Regional: Pinette, Burnetta and Goodream creeks flow into the Howells River, and a large quantity of data on similar subwatersheds of Howells River is available for comparison with the LSA.
Anthropogenically altered landscapes	Elross/ Goodream/ Burnetta creek watersheds	TEM projects carried out regionally (DSO and Howse)	Local: Direct effects will be confined to watersheds within which the Project is located. Regional: Limits of the regional studies carried out in the Schefferville vicinity.
Terrestrial ecosystems	Elross/ Goodream/ Burnetta creek watersheds	TEM projects carried out regionally (DSO and Howse)	Local: Direct effects will be confined to watersheds within which the Project is located. Regional: Limits of the regional studies carried out in the Schefferville vicinity.

COMPONENT	LSA	RSA	JUSTIFICATION
Caribou - Migratory Tundra ecotype	15-km radius surrounding the Howse sector	Québec-Labrador Peninsula	Local: Corresponds to the limits of caribou perception Regional: Corresponds to the range of migratory caribou.
Boreal Forest ecotype	15-km radius surrounding the Howse sector	Eastern Québec and Labrador territory occupied by caribou of sedentary ecotype	Local: Corresponds to the limits of caribou perception Regional: Corresponds to the range of Boreal Forest caribou
Other large mammals	20-km radius surrounding the Howse sector	100-km radius surrounding the Howse sector	Local: Black bear can travel several km per day. Regional: A 100-km radius was deemed sufficient, since it corresponds to the limit of the Project's zone of influence on large mammals.
Furbearers	Howse Project footprint	5-km radius surrounding the Howse Project footprint	Local: Corresponds to sectors that will likely be directly affected by disturbances associated with Project activities. Regional: It is unlikely that the Project will affect furbearers living more than 5 km from the Howse Project.
Other small mammals	Howse Project footprint	5-km radius surrounding the Howse Project footprint	Local: Corresponds to sectors that will likely be directly affected by disturbances associated with Project activities. Regional: It is unlikely that the Project will affect small mammals living more than 5 km from the DSO3 and Silver Yards sectors (explanations in Section 5.4.3.3).
Micromammals	Howse Project footprint	n/a	Local: The ranges of micromammals are limited to between 0.5 and 2.0 ha, corresponding to the Howse Project footprint Regional: No need to define an RSA; micromammals do not move outside the mining operations sectors.
Chiroptera	Howse Project footprint	Howells River Valley	Local: Corresponds to sectors that will likely be directly affected by disturbances associated with Project activities. Regional: Corresponds to the only habitat located close by.
Herpetofauna	Howse wetlands and Elross/Goodream/Burnetta Creek watersheds	5-km radius surrounding the Howse sector	Local: Local effects will be confined to the watersheds within which the Project will take place. Regional: It is unlikely that the Project will affect herpetofauna living more than 5 km from DSO3/Silver Yards.
Avifauna	Elross/ Goodream/ Burnetta creek watersheds	30-km radius surrounding the Project area	Local: Corresponds to sectors potentially directly affected by disturbances associated with Project activities which is considered as being limited to the watersheds within which the Project takes places (e.g. Triangle Lake, Pinette Lake and Burnetta Creek watersheds). Regional: A 30-km radius takes into account recent avian studies and databases from the past 10 years and yields an accurate

COMPONENT	LSA	RSA	JUSTIFICATION
			representation of the regional avian communities
Aquatic Fauna	Pinette/ Goodream/ Burnetta creek watersheds	Howells River watershed and the Schefferville area	Local: Fish populations that may be directly affected by the Project are confined to the watersheds within which the Project takes place. Regional: Pinette, Burnetta and Goodream streams flow into the Howells River, and a large quantity of data on similar subwatersheds of Howells River is available for comparison with the LSA.

7.1.2 Socioeconomic

The LSA was defined to include the populations that are closer to the Howse Project. The nearest populations to the project site are found in the Schefferville area and Kawawachikamach. The Town of Schefferville and Matimekush-Lac John, an Innu community, are located approximately 25 km from the Howse Property, and 2 km from the Labrador border. The Naskapi community of Kawawachikamach is located about 15 km northeast of Schefferville.

The RSA was defined according to the region of influence of the Howse Project. This area includes:

- In Labrador, Labrador West (Labrador City and Wabush), as well as the IN and the NCC;
- In Québec, the City of Sept-Îles, and the Innu of Uashat and Mani-Utenam (ITUM). As discussed in Chapter 4, however, ITUM is considered within the LSA for land-use and harvesting activities.

7.2 VC SELECTION

In addition to following the CEAA guidelines and those criteria defined under Section 5 of CEAA (CEAA, 2012), the following table (Table 7-2) was used to guide the selection of the VCs. This table answers the question:

The component was specifically highlighted as valued in the consultation process or in focus groups organized for the land-use and ATK study.

Table 7-2 Summary of First Nation Concerns for Each Component Identified Under the Howse EIS

COMPONENT	HIGHLIGHTED AS VALUED	CONCERNS RAISED	STAKEHOLDER GROUP	DATES	NUMBER OF MENTIONS
Climate	No	▪ No concerns raised during the land-use and ATK study or in the comments on the preliminary EIA.			
Air quality	Yes	▪ Dust is considered as an important issue (from mine and roads) and its effects on air quality, water quality and health is a preoccupation ▪ Dust from the mining activities and from trucks is a preoccupation. ▪ Areas around mining sites are avoided for berry harvesting because of dust. ▪ Dust travels a long way. Travels on lakes. Could be better controlled. ▪ A lot of dust the summer (dry period). ▪ Absence of data on existing air quality in town. ▪ Cumulative effects of dust from mining operations is a concern ▪ Presence of dust in the lakes. ▪ Rehabilitation is important because community feels open pits can be dangerous and remain a source of dust. ▪ Dust in Schefferville from trucks. ▪ Human health problems related to dust.	NIMLJ NNK UASHAT IN of Labrador	Fall 2014	24
Noise	Yes	▪ Effects of noise made by helicopters, planes, train, trucks and blasting on resources, which leave the area was mentioned as an issue. ▪ The effects of vibrations are a preoccupation. ▪ Noise from machinery is a source of disturbance. ▪ Noise can be heard from far away and it drives the animals away.	NNK NIMLJ IN of Labrador	Fall 2015	6
Light	Yes	▪ Lights on top of trucks are unnecessary left open at night and disturb the community ▪ Effects of lights on the population and the wildlife	NNK NIMLJ IN of Labrador	Fall 2015	3
Geology	No	▪ No concerns raised during the land-use and ATK study or in the comments on the preliminary EIA.			

COMPONENT	HIGHLIGHTED AS VALUED	CONCERNS RAISED	STAKEHOLDER GROUP	DATES	NUMBER OF MENTIONS
Hydrogeology	Yes	▪ Contamination surface water and particularly of the Howells River via groundwater is a major concern. ▪ Surface water systems and groundwater systems being interlinked, effects on the Howells River is of special concerns	NIMLJ UASHAT	Fall 2014.	2
Geomorphology	No	▪ No concerns raised during the land-use and ATK study or in the comments on the preliminary EIA.			
Permafrost	Yes	▪ Permafrost is a major carbon store in the form of carbon dioxide and methane.	NNK		
Hydrography	No	▪ No concerns raised during the land-use and ATK study or in the comments on the preliminary EIA.			
Water quality	Yes	▪ Water pollution and the protection of fish is an important preoccupation. ▪ Some are worried of accidental spills polluting lakes or running off in water systems ▪ Dust is considered as an important issue and its effects on water quality and health is a preoccupation ▪ Contamination of lakes and watercourses is a preoccupation. ▪ Contamination of surface water and particularly of the Howells River via groundwater is a major concern. ▪ Water contamination would also affect the wildlife and fish populations. ▪ Some are preoccupied and want to be informed on the way water will be cleaned up if there is contamination. ▪ It is important to the community that young Innu still have the possibility to go down the Howells River in the future.	NNK NIMLJ UASHAT IN of Labrador	Fall 2014	10
Terrestrial ecosystems, wetlands, vegetation	Yes	▪ Major concerns are for wildlife, trees, the environment and ecosystems. ▪ Disturbances to vegetation and trees by industrial activities were mentioned as a preoccupation. ▪ There are concerns on the monitoring of the environment by mining companies ▪ Mining activities break up the land (cumulative effects is a concern) ▪ There is concern animals will move further away because of new mining activities	NNK NIMLJ UASHAT IN of Labrador	Fall 2014	7

COMPONENT	HIGHLIGHTED AS VALUED	CONCERNS RAISED	STAKEHOLDER GROUP	DATES	NUMBER OF MENTIONS
		▪ People depend on hunting and fishing for food supply and they apprehend they will need to go further for hunting (food supply). ▪ Respect of the environment is a preoccupation. ▪ Mining haul roads are too large and affect the environment			
Caribou	Yes	▪ Effects on fish, animals, and waterfowl are of concern because these resources are used for subsistence. ▪ Mining operations (including blasting) affect the caribou. The caribou was present before mining activities (cumulative effects is a concern). ▪ Any mining activities should be stopped in presence of caribou. ▪ Rehabilitation is a concern. Caribou may fall in open pits. ▪ Absence of caribou has an effects on culture, people have to go further away to find caribou. ▪ There is also concern about this contamination affecting wildlife.	NNK NIMLJ IN of Labrador	Fall 2014	15
Other large mammals	Yes	▪ Effects on fish, animals, and waterfowl are of concern because these resources are used for subsistence. ▪ There is also concern about this contamination affecting wildlife.	NIMLJ IN of Labrador	Fall 2014	3
Furbearers and small mammals	Yes	▪ Effects on fish, animals, and waterfowl are of concern because these resources are used for subsistence. ▪ There is also concern about this contamination affecting wildlife.	NIMLJ IN of Labrador	Fall 2014	3
Chiroptera	No	▪ No concerns raised during the land-use and ATK study or in the comments on the preliminary EIA.			
Herpetofauna	No	▪ No concerns raised during the land-use and ATK study or in the comments on the preliminary EIA.			
Avifauna	Yes	▪ Effects of helicopters on Canada Goose. ▪ Canada Goose don't frequent the mine sites. ▪ Nesting area are threatened ▪ Effects on fish, animals, and waterfowl are of concern because these resources are used for subsistence.	NIMLJ IN of Labrador	Fall 2014	7
Aquatic fauna	Yes	▪ There are concerns that access for fishing will become difficult. ▪ The mining activities being practiced on the same routes that are used for hunting/fishing, there are worries that they will lose access to these areas.	NNK NIMLJ IN of Labrador	Fall 2014	8

COMPONENT	HIGHLIGHTED AS VALUED	CONCERNS RAISED	STAKEHOLDER GROUP	DATES	NUMBER OF MENTIONS
		▪ Effects on fish, animals, and waterfowl are of concern because these resources are used for subsistence. ▪ Potential risk for the fish.			
Anthropogenically-altered landscapes	Yes	▪ Restoration of landscapes during mine rehabilitation and closure ▪ **Kauteitnat** ▪ Kauteitnat is an observation point and an important landmark in the region. ▪ The mountain is considered as a nice area that should become a park but protection has never been discussed, ▪ The site is used to sight caribou. ▪ Kauteitnat a lot of history, particularly geological history. ▪ There is a will to protect the mountain. People are concerned the mountain will eventually be exploited. ▪ There is a fear that the final objective is to eventually mine the Kauteitnat Mountain. ▪ Blasting near Kauteitnat should be avoided. ▪ Elders are very attached to Kauteitnat	NNK NIMLJ UASHAT IN of Labrador	Fall 2014	11

7.3 PHYSICAL ENVIRONMENT

7.3.1 Greenhouse Gas Emissions

The Proponent recognizes that the industrial activities associated with the Howse Project will emit substances in the air (Section 7.3.2) which can affect human health (Section 7.5.2.2). This section focuses on GHG emissions from the Howse Project by first describing the general climatic conditions of the Schefferville area (temperature, precipitation and climate change) and also providing an estimate of the GHG emissions resulting from the Howse Project activities. GHG are not considered a VC under the Howse Project EIS as their effects on climate are difficult to quantify, and they were not raised as an issue during public consultations.

7.3.1.1 Component Description

LSA, RSA and Temporal Boundaries

The LSA for climate/GHG includes a 30 km radius centered on the Howse Project which encompasses one government weather station at the Schefferville airport (Schefferville A, 522 m asl., No. 7117825, 1948-present).

The climate of central Ungava has been classified as humid micro-thermal under the Koppen-Gieger system (Pollard, 2005). This area is considered as the RSA for the present study.

The temporal effects of GHG emissions from the Howse Project could be far-reaching and the duration of their synergistic effects on the global climate are impossible to predict a priori. We therefore define the temporal boundary as that when the GHG are emitted from the Howse Project, or the Project duration.

Located at 54° north, the Howse project lies in the path of the dominant westerlies of the mid-latitudes. Long-term records indicate a mean annual air temperature of -5.3 °C at Schefferville, but tundra ridge areas have been documented as having a mean annual air temperature as low as -7 °C (Pollard, 2005). The seasonal pattern of air temperature is typically continental and is characterized by dramatic extremes, with minima as low as -50.6 °C and maxima above 34.3 °C. On average, the first day of frost is September 11 and the last is June 13, yielding 92 frost-free days per year (Cournoyer *et al.,* 2007). Mean annual precipitation is 791 mm, with a peak in summer. The Project area, like elsewhere along the western boundary, is among the driest in Labrador. A little more than half the precipitation falls as snow, the average maximum thickness of which is 71 cm in March. There are 216 days with precipitation in one form or another.

Variation in Snow Cover

Two recent surveys of the snow cover in the Howells River Valley reveal some variations that depend on the type of biotope (Gartner Lee Limited 2006; SNC-Lavalin, 2013a). Results indicate that snow depth is greater but less dense in forest and scrublands than in wetlands and tundra. On average (± standard deviation), the snow thickness was 50.1 (±31.4) cm in March 2012, the water equivalent was 11.0 (±9.1) cm and the density was 22.4 (±7.3).

Wind

Wind speed, with a mean value of 15.5 km/h, varies little from month to month. The wind direction is almost always northwest. Extreme statistics from data collected between 1953 and 2009 show a maximum gust speed of 153 km/h in December, while a sustained wind speed of 97 km/h was recorded for one hour in June.

Existing Literature

Results of air modelling for the Howse Project included an estimate of GHG emissions, which is provided below. Further, the Environment Canada climate station in Schefferville (1948-present, provide climate data to describe, analyze and monitor climate in the area (Figure 7-1).

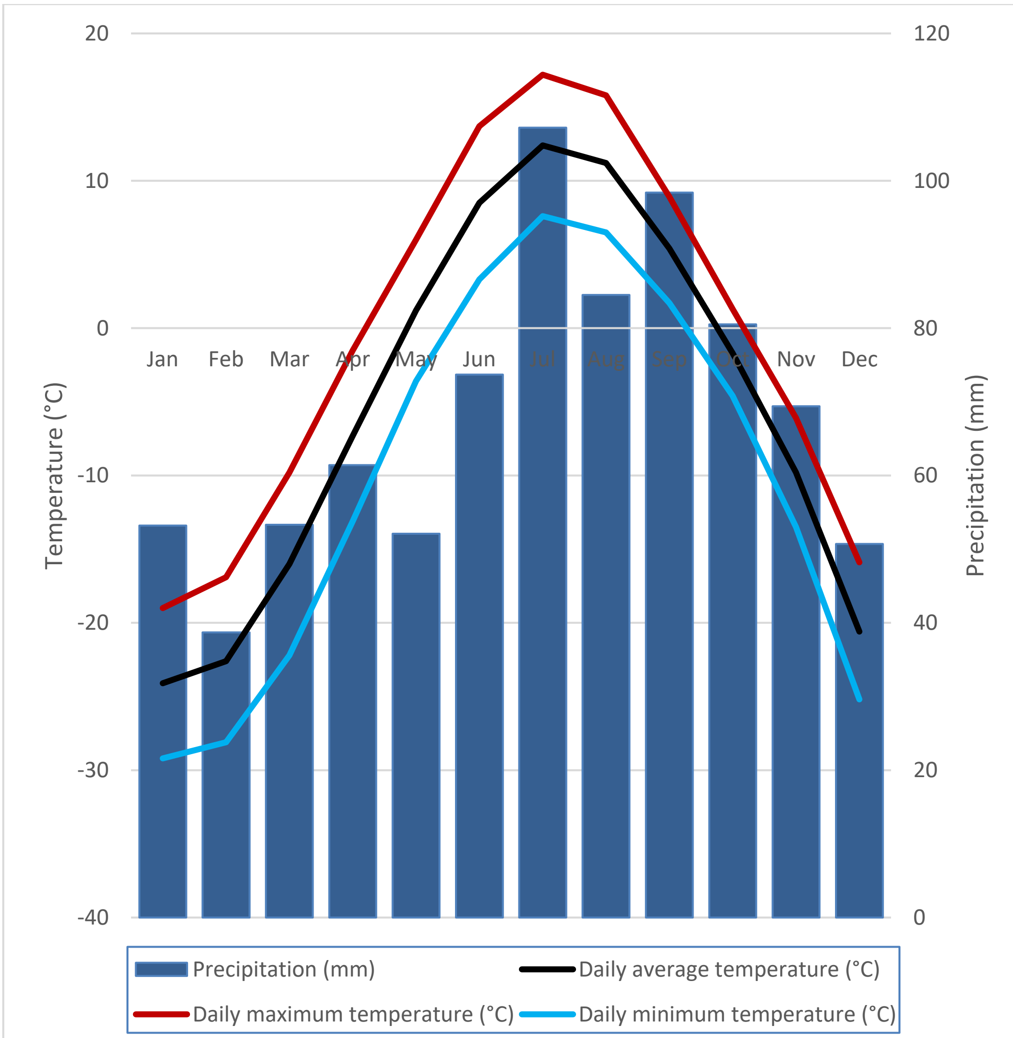


Figure 7-1 Climograph for Schefferville

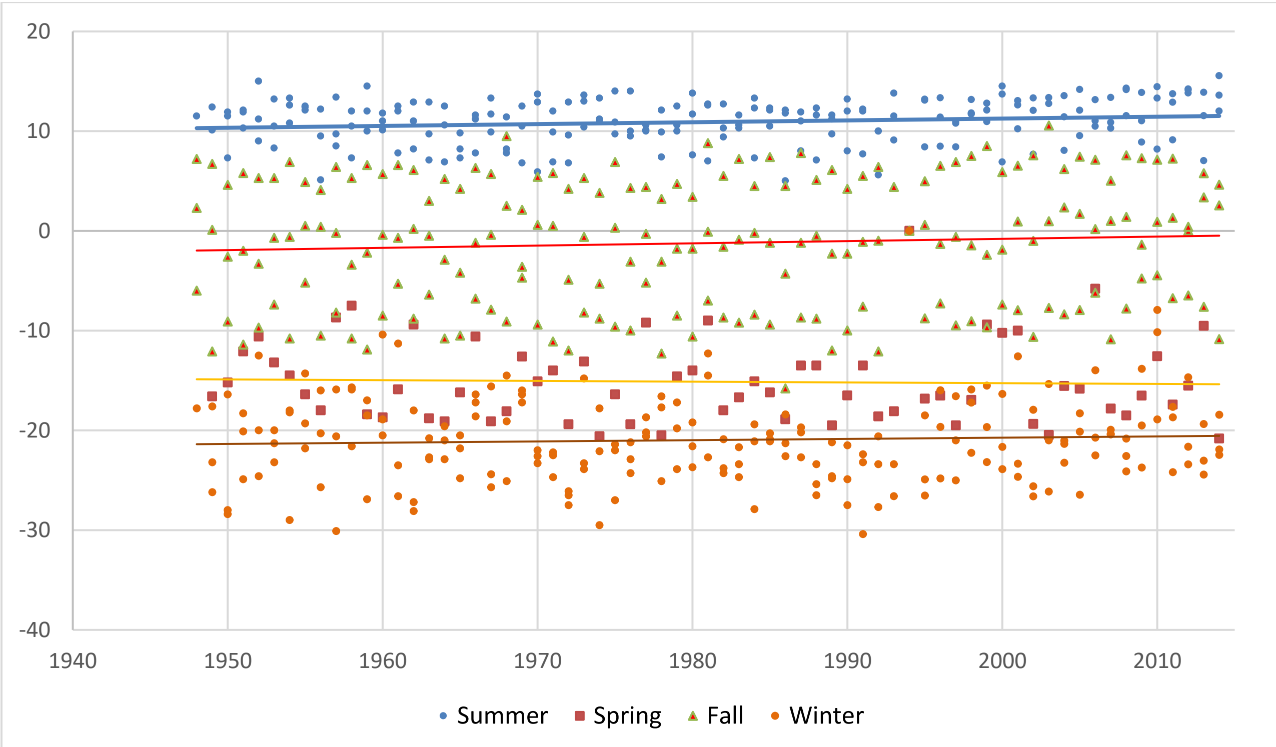


Figure 7-2 Seasonal mean monthly temperature values for Schefferville A station

Finnis (2013) draws the latest provincial climate change projection from an ensemble local-level projection (2038-2070) from seven scenarios from four global models. Results for Wabush Lake and Churchill Falls are considered representative of the LSA/RSA. Seasonally, mean daily minimum (nighttime) temperatures are expected to rise by 3.7 °C in winter (DJF) for Churchill Falls and 3.8 °C at Wabush, 2.4 °C in spring (MAM), 2.1 °C in summer (JJA) (Churchill Falls) and 2.3 °C in Wabush, and 2.5 °C in fall (SON). These changes in minimum daily temperatures are reflective of nighttime temperatures which are predicted to be warmer due to an enhanced greenhouse effect. In particular, with this predicted warming, current mean daily minimum temperatures in fall (-3.9 °C for Churchill Falls and -3.3 °C for Wabush) will approach the thawing mark, and could potentially change snow/ice cover to wet precipitation and increased thawing.

Main daily precipitation is expected to increase by 0.24 mm or 8.1% over the year. For extreme precipitation events, the increase grows with the length of the return period. For a 24-hour duration and a 100-year event, which is the maximum return period analyzed, the projected change is an increase of 8.9% in mean daily precipitation.

An analysis of the effects of climate change on the Project is available in Section 6.6.

Greenhouse Gases

GHG emissions from the Howse Project activities were calculated for all three phases as a whole, since the Construction and Decommissioning and Reclamation phases will be largely limited to road traffic, resulting in negligible emission (as compared to the operations phase). Emissions were estimated based on the amount of fuel burned and the emission factors of the National Inventory Report, 1990-2011 (Environment Canada, 2013a). According to this report, each litre of diesel fuel burned results in the emission of 2,663 g of CO_2, 0.13 g of CH_4 and 0.4 g of N_2O.

Carbon dioxide equivalents (CO2 eq) were determined by multiplying the amount of emissions of a particular gas by the global warming potential (GWP) of that gas. GHGs differ in their ability to absorb heat in the atmosphere due to their differing chemical properties and atmospheric lifetimes. For example, over a period of 100 years, methane's (CH4) potential to trap heat in the atmosphere is 25 times greater than carbon dioxide's potential, and thus it is considered to have a GWP of 25. The IPCC publishes the GWPs and atmospheric lifetimes for each GHG which can be found in Environment Canada (2013a).

Table 7-3 Estimated diesel consumption for the Howse Project

HOWSE MINI-PLANT*						
Description	**Unit**	**L/HR**			**HR/YR**	**L/YR**
2MW Diesel Generator - HOWSE Mini-Plant	1	397			5110	2,028,670
Diesel burner for ore dryer (125 MMBtu/hr)	1	3719			5110	9,502,624**
Diesel burner for ore dryer (125 MMBtu/hr)	1	3719			5110	9,502,624**
					Total	21033917
HOWSE HAULING TRUCKS ***						
Description	**Trips/yr**	**L/HR**	**Trip (km)**	**Time/trip (hr)**	**HR/YR**	**L/YR**
Hauling Trucks - Howse haul road to Howse O.B	211802.0	78.55	2	0.05	12102.97	950688.40
Hauling Trucks - Howse haul road to Howse Waste	124015.5	78.55	0.6	0.01	2125.98	166995.82
Hauling Trucks - Howse pit to Howse haul road and Portion of Howse Main road	124016 (Howse pit to waste) 211802 (Howse pit to O.B)	78.55	2.4	0.06	10805.33	848759.23
Howse haul Road (close to Howse Waste) to Main Plant	96153.84	78.55	2.8	0.08	7692.30	604230.76
Hauling Trucks - Main Plant to Rail loop	96153.84	78.55	0.8	0.02	2197.80	172637.36
Hauling Trucks - Rail loop to Howse Mini-Plant	192307.69	78.55	1.2	0.03	6593.40	517912.08
					Total	3,261,223.65
HOWSE PIT MINING EQUIPMENT GROUP ****						
Description	**Units**	**L/HR/Unit**			**HR/YR**	**L/YR**
HOWSE Pit Mining Activities (Truck+Excav+Excav+Loader+Drill)	5 units	26.28			8760	1151064

* Operation 24HR - 7 months per year.

** Assumes that 50% of the iron ore material requires drying

*** Speed 35 km/HR

**** Operation 24HR 12 months per year

The GHG emissions were calculated as CO_2 equivalent per year (CO_2eq/yr) using the following IPCC (2013) global warming potentials: 25 for CH_4 and 298 for N_2O. GHG emissions from the Howse Project are estimated to be 0.067 MtCO_2eq/yr. Newfoundland and Labrador total GHG emissions for the years 1990, 2005 and 2013 are 9.8, 10.3 and 8.6, respectively (Environment Canada, 2013a https://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=18F3BB9C-1). The Howse emissions represent roughly 0.7% of Newfoundland and Labrador total emissions (based on a mean GHG emissions value of 9.56 MT CO2 eq/YR).

Table 7-4 Estimate of Greenhouse Gases Emissions from the Howse Project

	L/YR	KG CO_2/YR	KG CH_4/YR (KG CO2 EQ)	KG N_2O/YR (KG CO2 EQ)	MT CO2 EQ / YR
Mini-plant	21,033,918	56,013,324	2734 (68,360)	8414 (2,507,243)	0.0586
Hauling trucks	3,261,223	8,684,639	424 (10,599)	1304 (388,738)	0.0091
Pit mining equipment	1,151,064	3,065,283	150 (3,741)	460 (137,207)	0.000013
Total	**25,446,206**	**67,763,247**	**3,308 (82,700)**	**10,178 (3,033,188)**	**0.067**

The Construction and Decommissioning and Reclamation phases are limited, in their GHG emissions, to truck traffic. Based on the table above, it is expected that GHG emissions for the Construction and Decommissioning and Abandonment phases (1 year each) will be 0.0091 MT CO2 eq/YR. This represents 0.09% of Newfoundland and Labrador total annual emissions (based on a mean GHG emissions value of 9.56 MT CO2 eq/YR).

HML expects to produce an action plan to reduce its GHG emissions in spring 2016. This plan will be based on real data (as opposed to theoretical data, as is the case presently) for while the plant is fully operational.

Aboriginal Traditional Knowledge

Climate change is affecting the ice-free period in the northern part of Nunavik but this is not the case around Schefferville, according to the Kawawachikamach Naskapi community (Tremblay *et al.*, 2006).

7.3.2 Air Quality

The Air Quality effects assessment in this chapter derives from the data presented in the federal report (Volume 2 Supporting Study E). Further to these federal guidelines, 20 new sensitive receptors were added to the Howse Project EIS in compliance with federal guidelines (Figure 7-3). A unique subsection (7.3.2.2.2) is provided which presents the Air Quality results in compliance with the EPR guidelines.

7.3.2.1 Component Description

Mining activities generate air emissions via vehicle travel on roads, diesel engines, power generation and ore mining and processing. The effects of air emissions are particularly apparent during summer, when there is no snow or ice cover on roads and stockpiles. When concentrations of some pollutants in ambient air exceed recognized standards, air quality can provoke complaints and potentially affect the health of ecosystems and humans. Air quality is an important component and clearly outlined in the CEAA guidelines for the preparation of an EIS.

Furthermore, air quality can affect other biophysical components, such as dust settling on water bodies, thereby affecting fish habitat, and human health. Dust effects on air quality was a concern raised 24 times during Aboriginal consultations in the fall of 2014. For all these reasons, air quality is selected as a VC.

LSA, RSA and Temporal Boundaries

The LSA is selected based on the requirements of the air dispersion modelling software used for effects assessments and on provincial regulatory requirements on dispersion modelling methodology. As such, the LSA covers an area of 340 km^2 centered at the UTM coordinates East – 623 000 m, North – 6 082 500 m, located at the center of DSO3, this area extends 17 km north to south and 20 km east to west (see Figure 7-3).

The RSA is a larger area extending east to include the towns of Schefferville and Kawawachikamach, and the Matimekush-Lac John community, located approximately 20 km towards the east of the project. The RSA covers an area of 520 km^2. Centered at the UTM coordinates East – 628 200 m, North – 6 082 130 m, located half way between DSO2 and DSO3, this area extends 17 km north to south and 40.5 km east to west (see Figure 7-3).

The LSA and RSA are characterized by rugged relief, with drops of up to 300 metres. It is covered in large part by coniferous forests and tundra. Sensitive receptors, defined as strategic locations within the RSA where human activities are common, were identified and are also shown in Figure 7-3.

An air quality modelling perimeter was established and air emissions from sources located within this perimeter were included in the air quality modelling study. This way, air emission sources from Howse and DSO3 activities were considered in the study, in addition to emissions due to ore hauling from the DSO4 mining areas (e.g., on the portion of the Goodwood Road located within the air quality modelling perimeter).

The highest air quality effects will be observed during the Operation phase of the Project due to the operation of the processing plants and full scale production (e.g. mining and ore hauling).

During all three project phases, air emissions from diesel powered engines, dust emissions from vehicles and blasting will occur, but rates of air emissions during the operation phase will be continuous and of a higher intensity. One important reason why the nature of the air contaminants remains the same during the three phases is the fact all power used at the site is generated by diesel equipment; the site is not connected to the power grid. Air emissions intensity during the Operation phase will be higher due to continuous intensive mining and processing at the Howse Mini-Plant. Consequently, the air quality effects study was conducted for the Operation phase only.

Mining activities at the Howse Property are expected to be ongoing until 2032, for a total of 15 years. Air emission release rates used in the air modelling study were calculated based on the maximum production year of the project. Similarly, other projects in the vicinity of Howse will also effects air quality, namely DSO3 and DSO4. These two projects, currently in start-up mode, were incorporated in the air modelling study (as baseline or pre-Howse conditions) and the maximum production year for each, were used in emission rates calculations. Therefore, the temporal boundaries for the Air Quality component covers the Operation phase of the project, using the maximum annual production rates available.

Existing Literature

Air emissions effects assessment is performed using an air dispersion modelling software predicting air quality at selected receptors in terms of pollutant concentrations in µg/m^3. Resulting concentrations can then be compared to ambient air quality standards promulgated by federal and provincial authorities (Canada, Québec and Newfoundland and Labrador, in this case).

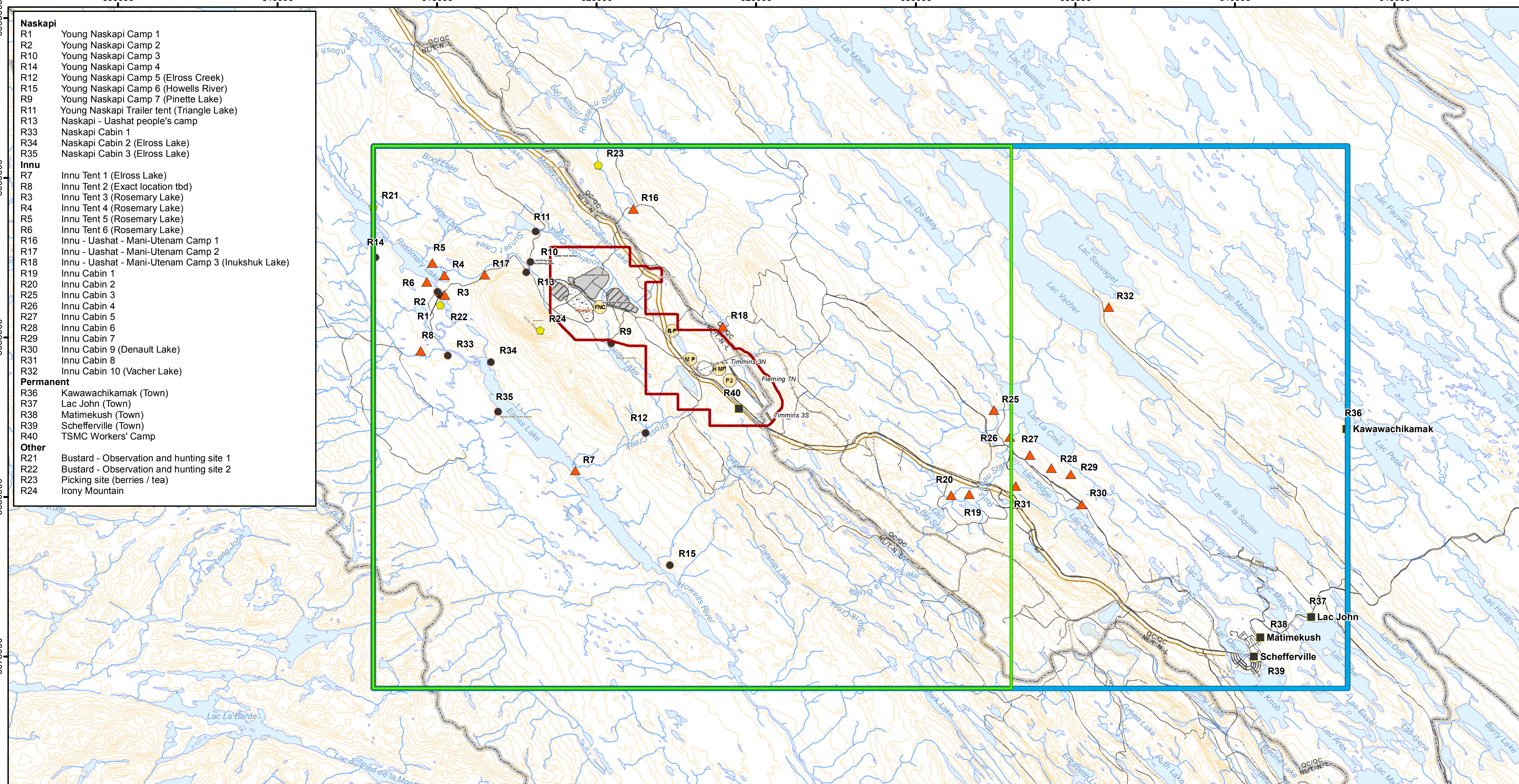
In the past, for different DSO phases, air dispersion modelling was conducted for compliance demonstration or EIS purposes. Examples of previous air dispersion modelling studies are:

- Environmental Impact Assessment (EIA) for the Elross Lake Area Iron Ore Mine (ELAIOM) submitted to the GNL in 2009 (NML and PFWA, 2009);
- EIA for the Direct-Shipping Ore Project 2A (Goodwood, Leroy1, Sunny1 and Kivivik 3S deposits) submitted to the Government of Québec in 2009 (NML and PFWA, 2010);
- Environmental license application for DSO3 mining and processing application (TSMC, 2014); and
- Environmental license application for Joan Lake Project - Kivivic 1c and 2, part of the DSO4 Area (TSMC, 2015).

Reports, data and methodologies from these previous air modelling efforts were incorporated in the current Howse project assessment. To ensure consistency, some key aspects and/or methodologies of previous studies were used for the Howse Project EIS and include the following:

- CALPUFF dispersion modelling software;
- meteorological data;
- topographical data;
- terrain usage; and
- methodologies to calculate emission factors for sources such as roads, vehicle engines, diesel generators, drills, mining activities, truck loading and unloading and ore processing activities.

To establish background air concentrations, which for this study would represent air concentrations prior to the start of DSO3/DSO4, a review of existing monitoring data and guidance information documents provided by provinces and applicable to the region was conducted. A memo summarizing this review is available in the Air Dispersion Modelling Report (Volume 2 Supporting Study E). Background air concentrations selected for the Howse EIS were based on the conclusions presented in the memo.



LEGEND

Sensitive Receptors
- Naskapi
- Innu
- Permanent
- Other

Study Areas
- Local Study Area (LSA)
- Regional Study Area (RSA)
- Air Quality Modelling Perimeter

Infrastructure and Mining Components
- P2 Plant 2
- MP Main processing Plant
- HMP Howse Mini-Plant
- BP Batch Plant
- FNC First Nations crusher/screener
- DSO Haul Road
- Existing Railroad
- Deposit
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Waste Dump/ In-Pit Dump
- Proposed Mine Haul Road

Basemap
- Existing road
- Contour Line (50 ft)
- Provincial Border
- Watercourse
- Water Body

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0672 , PR185-19-14, 2016-03-23, edickoum

N

0 2 4
Kilometers
SCALE: 1:120 000

UTM 19N NAD 83

SOURCES:

Basemap and Land Use Components
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,

Mining Components
Howse Minerals Limited/
MET-CHEM Howse Deposit Design
for General Layout., 2015
Groupe Hémisphères, Hydrology and update, 2013

AECOM

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Study Areas for Air Quality Modelling

Howse Minerals Limited

GroupeHemispheres

5731, rue Saint-Louis,
Bureau 201, Lévis (QC)
Canada, G6V 4E2

1453, rue Beaubien est,
Bureau 301, Montréal (QC)
Canada, H2G 3C6

Figure 7.3

Data Gaps

It is anticipated that during normal operation, blasting at the Howse Property will occur approximately once per week during summer and infrequently during winter. Blasting will also occur at the Fleming 7N pit, and since this pit is part of the DSO3 area and may have parallel operations with Howse, blasting events at both pits are included in the dispersion modelling study. Blasting events are short in duration and infrequent. The air dispersion software input requirements limits the representativeness of these blasting events, which leads to an overestimation of the resulting short-term effects on air quality. The methodology used to capture a wide variety of meteorological conditions in the air model, was to assume one blast per day at each pit would be conducted. At the Fleming 7N pit, the blast was assumed to occur between 11AM-12PM. At the Howse pit, the blast was assumed to occur between 1PM-2PM. Using this methodology, the number of blasting events entered in the model is 730 (365 blasts/yr/2 pits), while in reality approximately 60 blasting events are expected for the two pits (Fleming 7N and Howse). An additional data gap related to blasting events is the limited knowledge on actual emissions from blasts. Conservative emission factors from USEPA AP-42 were used in the calculations. These factors have a rating of "D" on a scale of A to E. One way to minimize to minimize the emission factors lack of representativeness would be to obtain more precise factors to depict emissions from explosive detonation during the blasts. Such factors were not available at the time of preparing this air quality assessment.

7.3.2.2 Effects Assessment

This section contains two subsections which present the results which comply with the Government of Newfoundland and Labrador Air Quality modelling requirements and the CEAA guidelines, respectively. We begin with the EPR requirements.

7.3.2.2.1 Effects Assessment on EPR guidelines

Modelling Results and Discussion

To optimize air dispersion modelling and computing time, project sources have been divided into several CALPUFF modelling input files. Concentration results obtained for each modelling have been compiled with CALSUM and then post processed with CALPOST. CALPUFF and CALPOST input files are referenced in Volume 2 Supporting Study E, but due to their number and volume, they are available electronically on request.

Volume 2 Supporting Study E explains how background concentrations and baseline concentrations due to other projects (e.g. DSO3 and DSO4) are incorporated in the results. Resulting concentrations are compared to the NL ambient air quality standards presented in Volume 2 Supporting Study E.

The results from the air dispersion modelling for all air pollutants assessed in this study are presented in this report in tabular format at the sensitive receptor locations, and also at grid receptors having the highest impacts.

Each table has a similar format and contains:

- Identification of averaging period and pollutants
- NL Ambient Air Quality Standards
- Background concentrations
- Separate resulting concentrations for each DSO Areas included in the air modelling study:
    - DSO3 and DSO4 only;
    - Howse Only;
    - Combined DSO3, DSO4 and Howse;
    - All: Background + DSO3, DSO4 and Howse.

- Selected Sensitive Receptors. Volume 2 Supporting Study E describes the 23 sensitive receptors located in NL and included in this study.
- Grid Receptors with highest impacts. The maximum modelled concentrations at grid receptors located on or outside the air quality modelling perimeter (e.g. typically referred to as “Off-Property Limits” concentrations). Maximum concentrations in NL are reported. These grid receptors are NOT sensitive receptors; they are just equally spaced geographical points entered in the Calpuff model as per air modelling guidelines.

Table 7-5 Summary Results – Annual Concentrations

	RESULTS - 1 Yr AVG.				
Pollutant	TPM	PM10	PM2.5	SO2	NO2
Averaging Period	1-yr	1-yr	1-yr	1-yr	1-yr
NL Ambient Air Quality Standard	**60**	--	**8.8**	**60**	**100**
Level or rank *	1st	1st	1st	1st	1st
BACKGROUND CONCENTRATIONS - PRE-DSO3	**15**	**10**	**5**	**5**	**3.8**

DSO3 + DSO4 ONLY

ID	Description	TPM, 1-yr	PM10, 1-yr	PM2.5, 1-yr	SO2, 1-yr	NO2, 1-yr
R1	Young Naskapi Camp 1	0.1	0.0	0.0	0.0	0.2
R2	Young Naskapi Camp 2	0.1	0.0	0.0	0.0	0.2
R3	Innu Tent 3 (Rosemary Lake)	0.1	0.0	0.0	0.0	0.2
R4	Innu Tent 4 (Rosemary Lake)	0.1	0.0	0.0	0.0	0.2
R5	Innu Tent 5 (Rosemary Lake)	0.1	0.0	0.0	0.0	0.2
R6	Innu Tent 6 (Rosemary Lake)	0.1	0.0	0.0	0.0	0.3
R7	Innu Tent 1 (Elross Lake)	0.1	0.0	0.0	0.0	0.3
R8	Innu Tent 2 (Exact location tbd)	0.1	0.0	0.0	0.0	0.3
R9	Young Naskapi Camp 7 (Pinette Lake)	0.4	0.2	0.1	0.0	1.5
R10	Young Naskapi Camp 3	0.3	0.1	0.0	0.0	0.6
R11	Young Naskapi Trailer tent (Triangle Lake)	0.2	0.1	0.0	0.0	0.6
R12	Young Naskapi Camp 5 (Elross Creek)	0.2	0.1	0.1	0.0	1.1
R13	Naskapi - Uashat people's camp	0.3	0.1	0.0	0.0	0.7
R14	Young Naskapi Camp 4	0.0	0.0	0.0	0.0	0.2
R15	Young Naskapi Camp 6 (Howells River)	0.1	0.0	0.0	0.0	0.4
R17	Innu - Uashat - Mani-Utenam Camp 2	0.1	0.0	0.0	0.0	0.3
R21	Bustard - Observation and hunting site 1	0.0	0.0	0.0	0.0	0.1
R22	Bustard - Observation and hunting site 2	0.1	0.0	0.0	0.0	0.3
R24	Irony Mountain	0.4	0.2	0.1	0.0	1.5
R33	Naskapi Cabin 1	0.1	0.0	0.0	0.0	0.3
R34	Naskapi Cabin 2 (Elross Lake)	0.1	0.0	0.0	0.0	0.3
R35	Naskapi Cabin 3 (Elross Lake)	0.1	0.0	0.0	0.0	0.4
R40	TSMC Workers' Camp	2.5	1.3	0.7	0.1	18.6
--	"Off-Property Limit" Maximum - Newfoundland/Labrador	9.8	3.6	0.9	0.0	13.8

HOWSE ONLY

ID	Name	TPM, 1-yr	PM10, 1-yr	PM2.5, 1-yr	SO2, 1-yr	NO2, 1-yr
R1	Young Naskapi Camp 1	0.1	0.0	0.0	0.0	0.1
R2	Young Naskapi Camp 2	0.1	0.0	0.0	0.0	0.1
R3	Innu Tent 3 (Rosemary Lake)	0.1	0.0	0.0	0.0	0.1
R4	Innu Tent 4 (Rosemary Lake)	0.1	0.0	0.0	0.0	0.1
R5	Innu Tent 5 (Rosemary Lake)	0.1	0.0	0.0	0.0	0.1
R6	Innu Tent 6 (Rosemary Lake)	0.1	0.0	0.0	0.0	0.1
R7	Innu Tent 1 (Elross Lake)	0.1	0.0	0.0	0.0	0.1
R8	Innu Tent 2 (Exact location tbd)	0.1	0.0	0.0	0.0	0.1
R9	Young Naskapi Camp 7 (Pinette Lake)	1.0	0.5	0.1	0.0	1.2
R10	Young Naskapi Camp 3	0.6	0.3	0.1	0.0	0.8
R11	Young Naskapi Trailer tent (Triangle Lake)	0.4	0.2	0.0	0.0	0.5
R12	Young Naskapi Camp 5 (Elross Creek)	0.2	0.1	0.0	0.0	0.3
R13	Naskapi - Uashat people's camp	0.6	0.3	0.1	0.0	1.0
R14	Young Naskapi Camp 4	0.0	0.0	0.0	0.0	0.1
R15	Young Naskapi Camp 6 (Howells River)	0.1	0.0	0.0	0.0	0.1
R17	Innu - Uashat - Mani-Utenam Camp 2	0.1	0.1	0.0	0.0	0.2
R21	Bustard - Observation and hunting site 1	0.0	0.0	0.0	0.0	0.0
R22	Bustard - Observation and hunting site 2	0.1	0.0	0.0	0.0	0.1
R24	Irony Mountain	0.8	0.4	0.1	0.0	1.2
R33	Naskapi Cabin 1	0.1	0.0	0.0	0.0	0.1
R34	Naskapi Cabin 2 (Elross Lake)	0.1	0.0	0.0	0.0	0.1
R35	Naskapi Cabin 3 (Elross Lake)	0.1	0.0	0.0	0.0	0.1
R40	TSMC Workers' Camp	1.7	0.7	0.2	0.0	2.1
--	"Off-Property Limit" Maximum - Newfoundland/Labrador	4.7	2.1	0.5	0.0	5.5

- all values in $\mu g/m^3$. Red cell, if any, indicates above criteria.
* n^{th} highest levels as per NL Guidance Document GD-PPD-009.4 (2012)

RESULTS - 1 Yr AVG. (cont'd)

	Pollutant	TPM	PM10	PM2.5	SO2	NO2
	Averaging Period	1-yr	1-yr	1-yr	1-yr	1-yr
	NL Ambient Air Quality Standard	**60**	**--**	**8.8**	**60**	**100**
	Level or rank *	1st	1st	1st	1st	1st
	BACKGROUND CONCENTRATIONS - PRE-DSO3	**15**	**10**	**5**	**5**	**3.8**

DSO3 + DSO4 + HOWSE

ID	Name	TPM, 1-yr	PM10, 1-	PM2.5, 1-	SO2, 1-yr	NO2, 1-yr
R1	Young Naskapi Camp 1	0.1	0.1	0.0	0.0	0.3
R2	Young Naskapi Camp 2	0.1	0.1	0.0	0.0	0.3
R3	Innu Tent 3 (Rosemary Lake)	0.1	0.1	0.0	0.0	0.3
R4	Innu Tent 4 (Rosemary Lake)	0.1	0.1	0.0	0.0	0.3
R5	Innu Tent 5 (Rosemary Lake)	0.1	0.1	0.0	0.0	0.3
R6	Innu Tent 6 (Rosemary Lake)	0.1	0.1	0.0	0.0	0.3
R7	Innu Tent 1 (Elross Lake)	0.1	0.1	0.0	0.0	0.4
R8	Innu Tent 2 (Exact location tbd)	0.1	0.1	0.0	0.0	0.4
R9	Young Naskapi Camp 7 (Pinette Lake)	1.4	0.7	0.2	0.0	2.7
R10	Young Naskapi Camp 3	0.8	0.4	0.1	0.0	1.4
R11	Young Naskapi Trailer tent (Triangle Lake)	0.6	0.3	0.1	0.0	1.1
R12	Young Naskapi Camp 5 (Elross Creek)	0.4	0.2	0.1	0.0	1.3
R13	Naskapi - Uashat people's camp	0.9	0.5	0.1	0.0	1.6
R14	Young Naskapi Camp 4	0.1	0.0	0.0	0.0	0.2
R15	Young Naskapi Camp 6 (Howells River)	0.1	0.1	0.0	0.0	0.5
R17	Innu - Uashat - Mani-Utenam Camp 2	0.2	0.1	0.0	0.0	0.5
R21	Bustard - Observation and hunting site 1	0.1	0.0	0.0	0.0	0.2
R22	Bustard - Observation and hunting site 2	0.1	0.1	0.0	0.0	0.4
R24	Irony Mountain	1.1	0.6	0.2	0.0	2.6
R33	Naskapi Cabin 1	0.1	0.1	0.0	0.0	0.4
R34	Naskapi Cabin 2 (Elross Lake)	0.1	0.1	0.0	0.0	0.4
R35	Naskapi Cabin 3 (Elross Lake)	0.1	0.1	0.0	0.0	0.5
R40	TSMC Workers' Camp	4.2	2.1	0.8	0.1	19.8
--	"Off-Property Limit" Maximum - Newfoundland/Labrador	12.8	4.9	1.1	0.0	16.4

ALL: Background + DSO3 + DSO4 + HOWSE

ID	Name	TPM, 1-yr	PM10, 1-yr	PM2.5, 1-yr	SO2, 1-yr	NO2, 1-yr
R1	Young Naskapi Camp 1	15.1	10.1	5.0	5.0	4.1
R2	Young Naskapi Camp 2	15.1	10.1	5.0	5.0	4.1
R3	Innu Tent 3 (Rosemary Lake)	15.1	10.1	5.0	5.0	4.1
R4	Innu Tent 4 (Rosemary Lake)	15.1	10.1	5.0	5.0	4.1
R5	Innu Tent 5 (Rosemary Lake)	15.1	10.1	5.0	5.0	4.1
R6	Innu Tent 6 (Rosemary Lake)	15.1	10.1	5.0	5.0	4.1
R7	Innu Tent 1 (Elross Lake)	15.1	10.1	5.0	5.0	4.2
R8	Innu Tent 2 (Exact location tbd)	15.1	10.1	5.0	5.0	4.2
R9	Young Naskapi Camp 7 (Pinette Lake)	16.4	10.7	5.2	5.0	6.5
R10	Young Naskapi Camp 3	15.8	10.4	5.1	5.0	5.2
R11	Young Naskapi Trailer tent (Triangle Lake)	15.6	10.3	5.1	5.0	4.9
R12	Young Naskapi Camp 5 (Elross Creek)	15.4	10.2	5.1	5.0	5.1
R13	Naskapi - Uashat people's camp	15.9	10.5	5.1	5.0	5.4
R14	Young Naskapi Camp 4	15.1	10.0	5.0	5.0	4.0
R15	Young Naskapi Camp 6 (Howells River)	15.1	10.1	5.0	5.0	4.3
R17	Innu - Uashat - Mani-Utenam Camp 2	15.2	10.1	5.0	5.0	4.3
R21	Bustard - Observation and hunting site 1	15.1	10.0	5.0	5.0	4.0
R22	Bustard - Observation and hunting site 2	15.1	10.1	5.0	5.0	4.2
R24	Irony Mountain	16.1	10.6	5.2	5.0	6.4
R33	Naskapi Cabin 1	15.1	10.1	5.0	5.0	4.2
R34	Naskapi Cabin 2 (Elross Lake)	15.1	10.1	5.0	5.0	4.2
R35	Naskapi Cabin 3 (Elross Lake)	15.1	10.1	5.0	5.0	4.3
R40	TSMC Workers' Camp	19.2	12.1	5.8	5.1	23.6
--	"Off-Property Limit" Maximum - Newfoundland/Labrador	27.8	14.9	6.1	5.0	20.2

- all values in µg/m3. Red cell, if any, indicates above criteria.
* nth highest levels as per NL Guidance Document GD-PPD-009.4 (2012)

Table 7-6 Summary Results – Daily (24-hr) Concentrations

			RESULTS - 24-Hr AVG.				
		Pollutant	TPM	PM10	PM2.5	SO2	NO2
		Averaging Period	24-hr	24-hr	24-hr	24-hr	24-hr
		NL Ambient Air Quality Standard	**120**	**50**	**25**	**300**	**200**
		Level or rank *	2nd	2nd	2nd	2nd	2nd
		BACKGROUND CONCENTRATIONS - PRE-DSO3	**15**	**10**	**5**	**5**	**3.8**
DSO3 + DSO4 ONLY	**ID**	**Description**	TPM, 24-hr	PM10, 24-hr	PM2.5, 24-hr	SO2, 24-hr	NO2, 24-hr
	R1	Young Naskapi Camp 1	0.8	0.4	0.3	0.0	5.8
	R2	Young Naskapi Camp 2	0.8	0.4	0.3	0.0	5.6
	R3	Innu Tent 3 (Rosemary Lake)	0.8	0.4	0.3	0.0	5.7
	R4	Innu Tent 4 (Rosemary Lake)	0.8	0.4	0.2	0.0	4.9
	R5	Innu Tent 5 (Rosemary Lake)	0.8	0.4	0.2	0.0	4.8
	R6	Innu Tent 6 (Rosemary Lake)	0.9	0.5	0.3	0.0	5.5
	R7	Innu Tent 1 (Elross Lake)	0.8	0.5	0.3	0.0	6.1
	R8	Innu Tent 2 (Exact location tbd)	0.9	0.6	0.4	0.0	10.3
	R9	Young Naskapi Camp 7 (Pinette Lake)	4.4	2.6	2.0	0.0	44.5
	R10	Young Naskapi Camp 3	2.6	1.0	0.7	0.0	17.1
	R11	Young Naskapi Trailer tent (Triangle Lake)	2.0	1.0	0.5	0.0	13.7
	R12	Young Naskapi Camp 5 (Elross Creek)	2.0	1.4	1.2	0.0	25.2
	R13	Naskapi - Uashat people's camp	3.1	1.2	0.6	0.0	14.9
	R14	Young Naskapi Camp 4	0.6	0.4	0.2	0.0	4.5
	R15	Young Naskapi Camp 6 (Howells River)	0.9	0.5	0.3	0.0	7.7
	R17	Innu - Uashat - Mani-Utenam Camp 2	1.1	0.6	0.3	0.0	6.7
	R21	Bustard - Observation and hunting site 1	0.6	0.3	0.1	0.0	2.3
	R22	Bustard - Observation and hunting site 2	0.9	0.5	0.4	0.0	7.0
	R24	Irony Mountain	4.5	2.4	1.3	0.0	34.3
	R33	Naskapi Cabin 1	1.0	0.7	0.5	0.0	10.8
	R34	Naskapi Cabin 2 (Elross Lake)	0.8	0.5	0.3	0.0	8.7
	R35	Naskapi Cabin 3 (Elross Lake)	0.9	0.6	0.4	0.0	7.5
	R40	TSMC Workers' Camp	16.1	7.9	5.6	0.5	203.7
	--	"Off-Property Limit" Maximum - Newfoundland/Labrador	85.9	31.1	6.2	0.1	139.6
HOWSE ONLY	**ID**	**Name**	TPM, 24-hr	PM10, 24-hr	PM2.5, 24-hr	SO2, 24-hr	NO2, 24-hr
	R1	Young Naskapi Camp 1	1.5	0.7	0.2	0.0	1.8
	R2	Young Naskapi Camp 2	1.5	0.7	0.2	0.0	1.8
	R3	Innu Tent 3 (Rosemary Lake)	1.5	0.7	0.2	0.0	1.8
	R4	Innu Tent 4 (Rosemary Lake)	1.8	0.9	0.2	0.0	2.0
	R5	Innu Tent 5 (Rosemary Lake)	1.9	0.9	0.2	0.0	2.3
	R6	Innu Tent 6 (Rosemary Lake)	1.6	0.8	0.2	0.0	1.8
	R7	Innu Tent 1 (Elross Lake)	1.1	0.5	0.1	0.0	1.4
	R8	Innu Tent 2 (Exact location tbd)	1.1	0.6	0.2	0.0	1.6
	R9	Young Naskapi Camp 7 (Pinette Lake)	9.1	4.0	1.0	0.0	10.2
	R10	Young Naskapi Camp 3	10.4	5.0	1.1	0.0	10.2
	R11	Young Naskapi Trailer tent (Triangle Lake)	5.6	2.5	0.5	0.0	6.5
	R12	Young Naskapi Camp 5 (Elross Creek)	2.3	1.1	0.3	0.0	2.4
	R13	Naskapi - Uashat people's camp	11.1	7.2	1.5	0.0	13.7
	R14	Young Naskapi Camp 4	0.9	0.4	0.1	0.0	1.4
	R15	Young Naskapi Camp 6 (Howells River)	0.8	0.4	0.1	0.0	1.3
	R17	Innu - Uashat - Mani-Utenam Camp 2	3.1	1.6	0.5	0.0	5.2
	R21	Bustard - Observation and hunting site 1	0.7	0.4	0.1	0.0	0.8
	R22	Bustard - Observation and hunting site 2	1.4	0.8	0.2	0.0	2.2
	R24	Irony Mountain	10.1	6.2	1.4	0.0	16.7
	R33	Naskapi Cabin 1	1.2	0.7	0.2	0.0	1.8
	R34	Naskapi Cabin 2 (Elross Lake)	1.5	0.7	0.1	0.0	1.5
	R35	Naskapi Cabin 3 (Elross Lake)	1.1	0.6	0.1	0.0	1.3
	R40	TSMC Workers' Camp	15.3	7.9	2.5	0.2	33.2
	--	"Off-Property Limit" Maximum - Newfoundland/Labrador	74.9	32.3	8.6	0.4	81.4

- all values in µg/m3. Red cell, if any, indicates above criteria.
*** nth highest levels as per NL Guidance Document GD-PPD-009.4 (2012)**

RESULTS - 24-Hr AVG. (cont'd)

			TPM	PM10	PM2.5	SO2	NO2
		Pollutant	TPM	PM10	PM2.5	SO2	NO2
		Averaging Period	24-hr	24-hr	24-hr	24-hr	24-hr
		NL Ambient Air Quality Standard	**120**	**50**	**25**	**300**	**200**
		Level or rank *	2nd	2nd	2nd	2nd	2nd
		BACKGROUND CONCENTRATIONS - PRE-DSO3	**15**	**10**	**5**	**5**	**3.8**
DSO3 + DSO4 + HOWSE	**ID**	**Name**	TPM, 24-hr	PM10, 24-hr	PM2.5, 24-hr	SO2, 24-hr	NO2, 24-hr
	R1	Young Naskapi Camp 1	2.1	1.0	0.4	0.0	7.4
	R2	Young Naskapi Camp 2	2.1	1.0	0.4	0.0	7.2
	R3	Innu Tent 3 (Rosemary Lake)	2.1	1.0	0.4	0.0	7.3
	R4	Innu Tent 4 (Rosemary Lake)	2.4	1.2	0.4	0.0	7.0
	R5	Innu Tent 5 (Rosemary Lake)	2.4	1.3	0.4	0.0	7.1
	R6	Innu Tent 6 (Rosemary Lake)	2.2	1.0	0.4	0.0	6.9
	R7	Innu Tent 1 (Elross Lake)	2.1	1.0	0.3	0.0	7.1
	R8	Innu Tent 2 (Exact location tbd)	1.6	1.1	0.5	0.0	11.7
	R9	Young Naskapi Camp 7 (Pinette Lake)	11.1	5.4	2.0	0.0	44.5
	R10	Young Naskapi Camp 3	12.0	5.8	1.4	0.0	27.3
	R11	Young Naskapi Trailer tent (Triangle Lake)	6.8	3.2	0.8	0.0	14.0
	R12	Young Naskapi Camp 5 (Elross Creek)	3.9	1.8	1.2	0.0	25.4
	R13	Naskapi - Uashat people's camp	15.8	8.0	1.7	0.0	20.1
	R14	Young Naskapi Camp 4	1.3	0.7	0.3	0.0	5.5
	R15	Young Naskapi Camp 6 (Howells River)	1.7	0.9	0.3	0.0	7.7
	R17	Innu - Uashat - Mani-Utenam Camp 2	4.1	2.0	0.7	0.0	12.1
	R21	Bustard - Observation and hunting site 1	1.4	0.7	0.1	0.0	3.1
	R22	Bustard - Observation and hunting site 2	2.0	1.2	0.5	0.0	8.9
	R24	Irony Mountain	14.3	8.6	1.9	0.1	37.1
	R33	Naskapi Cabin 1	1.8	1.1	0.6	0.0	12.0
	R34	Naskapi Cabin 2 (Elross Lake)	2.0	0.9	0.4	0.0	8.7
	R35	Naskapi Cabin 3 (Elross Lake)	1.8	1.0	0.4	0.0	7.6
	R40	TSMC Workers' Camp	29.3	14.6	5.6	0.5	204.3
	--	"Off-Property Limit" Maximum - Newfoundland/Labrador	99.2	37.1	8.8	0.4	139.6
ALL: Background + DSO3 + DSO4 + HOWSE	**ID**	**Name**	TPM, 24-hr	PM10, 24-hr	PM2.5, 24-hr	SO2, 24-hr	NO2, 24-hr
	R1	Young Naskapi Camp 1	17.1	11.0	5.4	5.0	11.2
	R2	Young Naskapi Camp 2	17.1	11.0	5.4	5.0	11.0
	R3	Innu Tent 3 (Rosemary Lake)	17.1	11.0	5.4	5.0	11.1
	R4	Innu Tent 4 (Rosemary Lake)	17.4	11.2	5.4	5.0	10.8
	R5	Innu Tent 5 (Rosemary Lake)	17.4	11.3	5.4	5.0	10.9
	R6	Innu Tent 6 (Rosemary Lake)	17.2	11.0	5.4	5.0	10.7
	R7	Innu Tent 1 (Elross Lake)	17.1	11.0	5.3	5.0	10.9
	R8	Innu Tent 2 (Exact location tbd)	16.6	11.1	5.5	5.0	15.5
	R9	Young Naskapi Camp 7 (Pinette Lake)	26.1	15.4	7.0	5.0	48.3
	R10	Young Naskapi Camp 3	27.0	15.8	6.4	5.0	31.1
	R11	Young Naskapi Trailer tent (Triangle Lake)	21.8	13.2	5.8	5.0	17.8
	R12	Young Naskapi Camp 5 (Elross Creek)	18.9	11.8	6.2	5.0	29.2
	R13	Naskapi - Uashat people's camp	30.8	18.0	6.7	5.0	23.9
	R14	Young Naskapi Camp 4	16.3	10.7	5.3	5.0	9.3
	R15	Young Naskapi Camp 6 (Howells River)	16.7	10.9	5.3	5.0	11.5
	R17	Innu - Uashat - Mani-Utenam Camp 2	19.1	12.0	5.7	5.0	15.9
	R21	Bustard - Observation and hunting site 1	16.4	10.7	5.1	5.0	6.9
	R22	Bustard - Observation and hunting site 2	17.0	11.2	5.5	5.0	12.7
	R24	Irony Mountain	29.3	18.6	6.9	5.1	40.9
	R33	Naskapi Cabin 1	16.8	11.1	5.6	5.0	15.8
	R34	Naskapi Cabin 2 (Elross Lake)	17.0	10.9	5.4	5.0	12.5
	R35	Naskapi Cabin 3 (Elross Lake)	16.8	11.0	5.4	5.0	11.4
	R40	TSMC Workers' Camp	44.3	24.6	10.6	5.5	208.1
	--	"Off-Property Limit" Maximum - Newfoundland/Labrador	114.2	47.1	13.8	5.4	143.4

- all values in µg/m3. Red cell, if any, indicates above criteria.
*** nth highest levels as per NL Guidance Document GD-PPD-009.4 (2012)**

Table 7-7 Summary Results – 1-Hr, 3-Hr, 8-Hr Concentrations

	RESULTS - 1-Hr, 3-Hr, 8-Hr Averages							
Pollutant	SO2	SO2	NO2	CO	CO	TPM	PM10	PM2.5
Averaging Period	3-hr	1-hr	1-hr	8-hr	1-hr	1-hr	1-hr	1-hr
NL Ambient Air Quality Standard	**600**	**900**	**400**	**15000**	**35000**	--	--	--
Level or rank *	6^{th}	9^{th}	9^{th}	3^{rd}	9^{th}	9^{th}	9^{th}	9^{th}
BACKGROUND CONCENTRATIONS - PRE-DSO3	**5**	**5**	**4**	**114**	**114**	**15**	**10**	**5**

DSO3 + DSO4 ONLY

ID	**Description**	SO2, 3-hr	SO2, 1-hr	NO2, 1-hr	CO, 8-hr	CO, 1-hr	TPM, 1-hr	PM10, 1-hr	PM2.5, 1-hr
R1	Young Naskapi Camp 1	0.0	0.0	19.2	1.6	2.6	2.7	1.6	1.0
R2	Young Naskapi Camp 2	0.0	0.0	20.3	1.6	2.6	2.7	1.7	1.0
R3	Innu Tent 3 (Rosemary Lake)	0.0	0.0	18.8	1.5	2.5	2.6	1.5	1.0
R4	Innu Tent 4 (Rosemary Lake)	0.0	0.0	17.3	1.4	2.5	2.3	1.3	0.8
R5	Innu Tent 5 (Rosemary Lake)	0.0	0.0	17.2	1.5	2.4	3.0	1.3	0.8
R6	Innu Tent 6 (Rosemary Lake)	0.0	0.0	23.1	1.6	2.7	3.0	1.8	1.0
R7	Innu Tent 1 (Elross Lake)	0.0	0.0	20.7	1.4	2.3	2.5	1.6	1.0
R8	Innu Tent 2 (Exact location tbd)	0.0	0.0	35.6	2.7	3.4	2.5	2.0	1.6
R9	Young Naskapi Camp 7 (Pinette Lake)	0.1	0.1	94.9	6.3	10.3	14.3	7.4	4.2
R1	Young Naskapi Camp 3	0.0	0.0	42.8	2.8	4.6	9.8	3.6	1.8
R1	Young Naskapi Trailer tent (Triangle Lake)	0.0	0.0	31.1	2.5	4.0	5.1	2.5	1.3
R1	Young Naskapi Camp 5 (Elross Creek)	0.0	0.1	57.5	2.9	4.3	4.8	3.0	2.5
R1	Naskapi - Uashat people's camp	0.0	0.0	42.9	3.4	4.8	12.4	4.4	1.8
R1	Young Naskapi Camp 4	0.0	0.0	18.1	1.1	1.9	2.2	1.2	0.8
R1	Young Naskapi Camp 6 (Howells River)	0.0	0.0	17.0	1.1	2.2	3.0	1.6	0.8
R1	Innu - Uashat - Mani-Utenam Camp 2	0.0	0.0	24.7	1.5	2.5	3.3	1.7	1.0
R2	Bustard - Observation and hunting site 1	0.0	0.0	8.4	0.7	1.1	1.8	0.8	0.3
R2	Bustard - Observation and hunting site 2	0.0	0.0	22.3	1.6	2.7	3.2	1.7	1.2
R2	Irony Mountain	0.1	0.1	110.2	7.4	12.0	14.5	7.9	4.3
R3	Naskapi Cabin 1	0.0	0.0	33.7	2.7	3.7	2.9	2.1	1.4
R3	Naskapi Cabin 2 (Elross Lake)	0.0	0.0	23.4	1.4	2.4	2.2	1.5	1.0
R3	Naskapi Cabin 3 (Elross Lake)	0.0	0.0	29.8	1.9	3.2	2.2	1.6	1.3
R4	TSMC Workers' Camp	0.7	0.7	382.8	62.7	100.3	67.9	33.6	11.2
--	"Off-Property Limit" Maximum - Newfoundland/Labrador	0.3	0.3	311.2	69.5	96.8	345.7	118.5	16.4

HOWSE ONLY

ID	**Name**	SO2, 3-hr	SO2, 1-hr	NO2, 1-hr	CO, 8-hr	CO, 1-hr	TPM, 1-hr	PM10, 1-hr	PM2.5, 1-hr
R1	Young Naskapi Camp 1	0.0	0.0	7.6	3.3	5.6	4.2	2.8	0.7
R2	Young Naskapi Camp 2	0.0	0.0	7.3	3.1	5.3	4.6	2.7	0.7
R3	Innu Tent 3 (Rosemary Lake)	0.0	0.0	7.3	3.2	5.4	4.1	2.6	0.7
R4	Innu Tent 4 (Rosemary Lake)	0.0	0.0	6.3	2.4	5.0	4.4	2.5	0.7
R5	Innu Tent 5 (Rosemary Lake)	0.0	0.0	6.4	2.6	4.8	5.6	3.0	0.7
R6	Innu Tent 6 (Rosemary Lake)	0.0	0.0	5.9	2.4	4.8	4.4	2.5	0.6
R7	Innu Tent 1 (Elross Lake)	0.0	0.0	3.7	1.7	2.8	3.1	1.6	0.4
R8	Innu Tent 2 (Exact location tbd)	0.0	0.0	5.3	2.1	4.3	3.4	2.1	0.6
R9	Young Naskapi Camp 7 (Pinette Lake)	0.0	0.1	43.9	20.4	39.7	27.0	16.7	4.6
R10	Young Naskapi Camp 3	0.0	0.0	48.8	21.4	43.2	39.7	19.6	5.3
R11	Young Naskapi Trailer tent (Triangle Lake)	0.0	0.0	25.6	11.0	25.8	14.5	7.8	2.9
R12	Young Naskapi Camp 5 (Elross Creek)	0.0	0.0	9.7	5.3	7.7	6.8	3.9	1.0
R13	Naskapi - Uashat people's camp	0.0	0.1	72.8	29.9	67.4	53.9	33.1	8.1
R14	Young Naskapi Camp 4	0.0	0.0	3.8	1.5	2.7	2.6	1.7	0.4
R15	Young Naskapi Camp 6 (Howells River)	0.0	0.0	3.4	1.3	2.4	3.0	1.7	0.4
R17	Innu - Uashat - Mani-Utenam Camp 2	0.0	0.0	21.9	10.4	22.8	8.8	5.4	2.4
R21	Bustard - Observation and hunting site 1	0.0	0.0	3.4	1.0	2.4	3.2	1.8	0.4
R22	Bustard - Observation and hunting site 2	0.0	0.0	8.5	3.0	6.5	4.4	2.9	0.8
R24	Irony Mountain	0.1	0.2	61.6	22.3	49.5	35.9	24.2	5.7
R33	Naskapi Cabin 1	0.0	0.0	5.7	2.8	5.1	3.5	2.3	0.6
R34	Naskapi Cabin 2 (Elross Lake)	0.0	0.0	5.4	2.1	4.2	3.4	2.0	0.5
R35	Naskapi Cabin 3 (Elross Lake)	0.0	0.0	4.7	2.0	4.6	3.3	2.2	0.6
R40	TSMC Workers' Camp	0.6	0.8	149.7	17.1	32.9	53.2	25.3	10.3
--	"Off-Property Limit" Maximum - Newfoundland/Labrador	0.9	1.2	225.6	149.7	210.4	312.4	154.7	29.0

- all values in μg/m3. Red cell, if any, indicates above criteria.
nth highest levels as per NL Guidance Document GD-PPD-009.4 (2012)

RESULTS - 1-Hr, 3-Hr, 8-Hr Averages (cont'd)

Pollutant	SO2	SO2	NO2	CO	CO	TPM	PM10	PM2.5
Averaging Period	3-hr	1-hr	1-hr	8-hr	1-hr	1-hr	1-hr	1-hr
NL Ambient Air Quality Standard	**600**	**900**	**400**	**15000**	**35000**	--	--	--
Level or rank *	6th	9th	9th	3rd	9th	9th	9th	9th
BACKGROUND CONCENTRATIONS - PRE-DSO3	**5**	**5**	**4**	**114**	**114**	**15**	**10**	**5**

DSO3 + DSO4 + HOWSE

ID	Name	SO2, 3-hr	SO2, 1-hr	NO2, 1-hr	CO, 8-hr	CO, 1-hr	TPM, 1-hr	PM10, 1-hr	PM2.5, 1-hr
R1	Young Naskapi Camp 1	0.0	0.0	22.5	4.1	6.9	5.6	3.6	1.3
R2	Young Naskapi Camp 2	0.0	0.0	23.0	4.2	6.7	5.7	3.5	1.2
R3	Innu Tent 3 (Rosemary Lake)	0.0	0.0	21.7	4.2	6.8	5.5	3.4	1.2
R4	Innu Tent 4 (Rosemary Lake)	0.0	0.0	20.1	3.1	6.4	5.6	3.3	1.0
R5	Innu Tent 5 (Rosemary Lake)	0.0	0.0	21.7	3.3	6.2	7.0	3.7	1.1
R6	Innu Tent 6 (Rosemary Lake)	0.0	0.0	27.1	3.9	6.4	6.5	3.5	1.3
R7	Innu Tent 1 (Elross Lake)	0.0	0.0	22.1	2.5	3.7	4.8	2.9	1.2
R8	Innu Tent 2 (Exact location tbd)	0.0	0.0	40.1	4.4	6.2	5.2	3.4	1.7
R9	Young Naskapi Camp 7 (Pinette Lake)	0.1	0.1	97.6	21.3	41.7	33.7	18.8	5.1
R10	Young Naskapi Camp 3	0.1	0.1	61.8	22.6	44.3	42.8	20.6	5.8
R11	Young Naskapi Trailer tent (Triangle Lake)	0.0	0.0	36.1	11.6	26.1	16.5	9.0	3.0
R12	Young Naskapi Camp 5 (Elross Creek)	0.0	0.1	57.7	5.5	9.1	9.8	5.2	2.6
R13	Naskapi - Uashat people's camp	0.0	0.1	77.2	30.6	69.4	57.2	34.0	8.8
R14	Young Naskapi Camp 4	0.0	0.0	20.5	2.3	4.2	4.0	2.3	1.0
R15	Young Naskapi Camp 6 (Howells River)	0.0	0.0	18.4	2.0	3.5	5.3	3.0	1.1
R17	Innu - Uashat - Mani-Utenam Camp 2	0.0	0.0	27.5	10.9	23.8	9.6	6.1	2.8
R21	Bustard - Observation and hunting site 1	0.0	0.0	10.9	1.5	3.1	4.4	2.4	0.6
R22	Bustard - Observation and hunting site 2	0.0	0.0	25.2	4.8	7.8	6.1	3.9	1.3
R24	Irony Mountain	0.2	0.3	123.7	28.2	51.2	46.4	26.7	6.3
R33	Naskapi Cabin 1	0.0	0.0	40.5	4.6	6.5	5.8	3.5	1.9
R34	Naskapi Cabin 2 (Elross Lake)	0.0	0.0	25.9	2.8	5.8	4.9	2.8	1.2
R35	Naskapi Cabin 3 (Elross Lake)	0.0	0.0	34.5	2.9	6.1	5.0	3.5	1.4
R40	TSMC Workers' Camp	0.9	1.1	384.7	62.9	100.4	108.3	55.4	12.1
--	"Off-Property Limit" Maximum - Newfoundland/Labrador	0.9	1.2	313.4	152.7	212.1	358.7	158.3	29.3

ALL: Background + DSO3 + DSO4 + HOWSE

ID	Name	SO2, 3-hr	SO2, 1-hr	NO2, 1-hr	CO, 8-hr	CO, 1-hr	TPM, 1-hr	PM10, 1-hr	PM2.5, 1-hr
R1	Young Naskapi Camp 1	5.0	5.0	26.3	118.1	120.9	20.6	13.6	6.3
R2	Young Naskapi Camp 2	5.0	5.0	26.8	118.2	120.7	20.7	13.5	6.2
R3	Innu Tent 3 (Rosemary Lake)	5.0	5.0	25.5	118.2	120.8	20.5	13.4	6.2
R4	Innu Tent 4 (Rosemary Lake)	5.0	5.0	23.9	117.1	120.4	20.6	13.3	6.0
R5	Innu Tent 5 (Rosemary Lake)	5.0	5.0	25.5	117.3	120.2	22.0	13.7	6.1
R6	Innu Tent 6 (Rosemary Lake)	5.0	5.0	30.9	117.9	120.4	21.5	13.5	6.3
R7	Innu Tent 1 (Elross Lake)	5.0	5.0	25.9	116.5	117.7	19.8	12.9	6.2
R8	Innu Tent 2 (Exact location tbd)	5.0	5.0	43.9	118.4	120.2	20.2	13.4	6.7
R9	Young Naskapi Camp 7 (Pinette Lake)	5.1	5.1	101.4	135.3	155.7	48.7	28.8	10.1
R10	Young Naskapi Camp 3	5.1	5.1	65.6	136.6	158.3	57.8	30.6	10.8
R11	Young Naskapi Trailer tent (Triangle Lake)	5.0	5.0	39.9	125.6	140.1	31.5	19.0	8.0
R12	Young Naskapi Camp 5 (Elross Creek)	5.0	5.1	61.5	119.5	123.1	24.8	15.2	7.6
R13	Naskapi - Uashat people's camp	5.0	5.1	81.0	144.6	183.4	72.2	44.0	13.8
R14	Young Naskapi Camp 4	5.0	5.0	24.3	116.3	118.2	19.0	12.3	6.0
R15	Young Naskapi Camp 6 (Howells River)	5.0	5.0	22.2	116.0	117.5	20.3	13.0	6.1
R17	Innu - Uashat - Mani-Utenam Camp 2	5.0	5.0	31.3	124.9	137.8	24.6	16.1	7.8
R21	Bustard - Observation and hunting site 1	5.0	5.0	14.7	115.5	117.1	19.4	12.4	5.6
R22	Bustard - Observation and hunting site 2	5.0	5.0	29.0	118.8	121.8	21.1	13.9	6.3
R24	Irony Mountain	5.2	5.3	127.5	142.2	165.2	61.4	36.7	11.3
R33	Naskapi Cabin 1	5.0	5.0	44.3	118.6	120.5	20.8	13.5	6.9
R34	Naskapi Cabin 2 (Elross Lake)	5.0	5.0	29.7	116.8	119.8	19.9	12.8	6.2
R35	Naskapi Cabin 3 (Elross Lake)	5.0	5.0	38.3	116.9	120.1	20.0	13.5	6.4
R40	TSMC Workers' Camp	5.9	6.1	388.5	176.9	214.4	123.3	65.4	17.1
--	"Off-Property Limit" Maximum - Newfoundland/Labrador	5.9	6.2	317.2	266.7	326.1	373.7	168.3	34.3

- all values in µg/m3. Red cell, if any, indicates above criteria.
nth highest levels as per NL Guidance Document GD-PPD-009.4 (2012)

Discussion of Results

All NL ambient air quality standards are met, except for the NO2 (24-hr) at the workers' camp (R40). This receptor is located within the air quality monitoring perimeter. As can be seen in Table 7-6, the maximum result at R40 when all cumulative sources are considered, NO_2 (24-hr) is 208.1 μg/m3, slightly above the NL standard of 200 μg/m3. Also shown in Table 7-9, the impact of the Howse project only at receptor R40 is 33.2 μg/m3 for NO_2 (24-hr), which is well below the 200 μg/m3.

The principal cause of predicted NO_2 (24 hours) exceedances the Workers' Camp (R40) are the four (4) diesel generators located right within the Camp area. As of summer 2016, the electricity at the Workers' Camp is now supplied by the Main Plant GenSet which have a higher engine to generator efficiency than the diesel generators located at the Camp (95% vs 85%). The four diesel generators located at the Workers' Camp are still in place but they will only be used for emergency situations (ex.: malfunction of the Main Plant GenSet or failure of the power line between the Main Plant and Workers' Camp). Considering this change and the fact that assumptions and calculations procedures used in this air modelling study were conservative (e.g. worst-case), the noted exceedance for the single parameter NO_2 (24-hr) is very highly unlikely to occur in reality.

7.3.2.2.2 Effects Assessment on CEAA guidelines

All three phases involve similar equipment and activities; however the operation phase has the highest effects on air quality due to the operation of the processing plants and full-scale production. Consequently, an air quality effects study was conducted for the operation phase; summary results and conclusions are presented in the section below, while a detailed report is available in the Air Dispersion Modelling Report (Volume 2 Supporting Study E).

Literature review and Current Studies Data Used to Assess the Potential Effect

The addition of the Howse Mine will result in the following operational changes, which will influence air quality:

- operation of the new Howse Mine site (typical mining and blasting operations);
- additional Crushing/Screening/Drying equipment, referred to as Howse Mini-Plant in the air quality study. The Howse Mini-Plant will be located to the East of the rail loop, as shown on Figure 3-1 ; and
- increased haul truck and train operations.

The proposed Howse Mine will be located in close proximity to the DSO3 project area. As such, the air quality in the vicinity of the proposed Howse Mine site will be directly influenced by DSO3 operations. Air emissions sources associated with DSO3 include excavation, drilling, blasting, grading, trucking activities, and ore processing such as crushing, screening, and drying at the main plant and Plant 2. Additionally, ore from mining area DSO4 (from pits such as Kivivik, Goodwood, Sunny, etc..) will be hauled towards the DSO3 processing complex and road dust/engine emissions resulting from this hauling activity may influence air quality levels in the vicinity of the proposed Howse Mine site.

Consequently, air emissions associated to the DSO3 and DSO4 projects as indicated above are included in the assessment of air quality effects of the Howse Project and can be summarized by the following equation:

(1) Background concentrations (pre-DSO3/DSO4 conditions)
\+ (2) Concentrations due to emissions from DSO3 operations
\+ (3) Concentrations due to emissions from ore hauling from the DSO4
\+ (4) Concentrations due to emissions from other Projects in the RSA

= Pre-Howse Air Quality Condition ("Baseline Condition")

\+ (5) Concentrations due to emissions from Howse operations

= Cumulative Air Quality Effect

The overall methodological approach to assess the environmental effects is presented in previous sections. However, in order to apply this methodology to the Air Quality VC, it is essential to consider assessment criteria applicable specifically to this VC.

The Howse Property and DSO3 complex mining areas are located in the Province of Newfoundland and Labrador, in close proximity to the Québec (QC) border. The Howse Project is located in the vicinity of the larger DSO complex operated by TSMC, which includes several mining and ore processing areas. From start-up to decommissioning and reclamation, the mining and operation schedules of each area vary in time and this was taken into account when establishing the air dispersion modelling approach. From an air quality effects perspective, Table 7-10 lists the key areas of the DSO and Howse projects and how they were integrated in this air quality assessment for the Howse Project, based on their respective schedule of operation and locations.

Criteria Air Contaminants (CAC) evaluated for the air quality assessment study are:

- total Particulate Matter (TPM);
- particulate Matter less than 10 microns (PM10);
- particulate Matter less than 2.5 microns (PM2.5);
- nitrogen Dioxide (NO2);
- sulfur Dioxide (SO2); and
- carbon Monoxide (CO).

Non-Criteria Air Contaminants (CAC) evaluated for the air quality assessment study are:

- dust deposition (Dustfall);
- metals (Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, Thallium, Vanadium, Zinc); and
- Volatile Organic Compounds or VOC (1,3-Butadiene, Acetaldehyde, Acrolein, Benzene and Formaldehyde).

Table 7-8 presents ambient air quality standards and objectives for the three jurisdictions (Canada, QC and NL) for the six Criteria Air Contaminants (CAC) evaluated in this study. Table 7-9 presents ambient air quality standards for the twenty non-Criteria Air Contaminants (non-CAC) evaluated in this study and the selected assessment criteria based on air quality standards from QC, NL and ON. In all cases, the most stringent air quality standards were selected as assessment criteria for this study. Note that each jurisdiction has its own procedure for comparing air modelling results to air quality standards. For example, compliance with the Canada $PM_{2.5}$ standard is based on the 98^{th} percentile ambient annual measurements, averaged over 3 consecutive years. Another example is in NL, compliance for modelled effects for any given year is to be based on the 2^{nd} highest level to the 9^{th} highest level depending on the averaging period of air quality standards. In this study, maximum modeled results are compared to the selected assessment criteria, regardless of their percentile or ranked levels.

Table 7-8 Air Quality Standards/Objectives and Selected Assessment Criteria – CAC

POLLUTANT	AVERAGING PERIOD	NL AIR QUALITY STANDARDS (1) (µG/M³)	QC AIR QUALITY STANDARDS (2) (µG/M³)	CANADA AIR QUALITY STANDARDS/OBJECTIVES(3) (µG/M³)	SELECTED ASSESSMENT CRITERIA (µG/M³)
TPM	1-yr	60	70	70	**60**
	24-hr	120	120	120	**120**
PM_{10}	24-hr	50	--	--	**50**
$PM_{2.5}$	1-yr	--	--	10 (8.8 after 2020)	**8.8**
	24-hr	25	30	28 (27 after 2020)	**25**
SO_2	1-yr	60	52	60	**52**
	24-hr	300	288	300	**288**
	3-hr	600	--	--	**600**
	1-hr	900	--	900	**900**
NO_2	1-yr	100	103	100	**100**
	24-hr	200	207	200	**200**
	1-hr	400	414	400	**400**
CO	8-hr	15 000	12 700	15 000	**12 700**
	1-hr	35 000	34 000	35 000	**34 000**

(1) Reference: Air Pollution Control Regulations, 2004 Newfoundland and Labrador Regulations 39/04, Schedule A – Table I: Ambient Air Quality Standards at Reference Conditions.
(2) Reference: Atmospheric quality standards, Sections 197 and 198 and Schedule K of the Clean Air Regulation, Q-2, r. 4.1.
(3) Federal $PM_{2.5}$ standards published on May 25, 2013: Sections 54 and 55 of the Canadian Environmental Protection Act, 1999. For other pollutants, in 2004, the federal government sets national ambient air quality objectives (NAAQOs) on the basis of recommendations from the Federal–Provincial Working Group on Air Quality Objectives and Guidelines consisting of representatives from both the health and environment departments. NAAQOs are structured in three-tiered: maximum desirable levels, maximum acceptable levels and maximum tolerable levels. Maximum acceptable levels are listed in the table.

Table 7-9 Air Quality Standards/Objectives and Selected Assessment Criteria – Non-CAC

POLLUTANT		AVERAGING PERIOD	NL AIR QUALITY STANDARDS [1] (µG/M³)	QC AIR QUALITY STANDARDS [2] (µG/M³)	ON AIR QUALITY STANDARDS [3] (µG/M³)	SELECTED ASSESSMENT CRITERIA (µG/M³)
Metals	Antimony (Sb)	1-yr	--	0.17	--	**0.17**
	Arsenic (As)	1-yr	--	0.003	--	**0.003**
		24-hr	0.3	--	0.3	**0.3**

POLLUTANT		AVERAGING PERIOD	NL AIR QUALITY STANDARDS [1] (µG/M³)	QC AIR QUALITY STANDARDS [2] (µG/M³)	ON AIR QUALITY STANDARDS [3] (µG/M³)	SELECTED ASSESSMENT CRITERIA (µG/M³)
	Barium (Ba)	1-yr	--	0.05	--	**0.05**
	Beryllium (Be)	1-yr	--	0.0004	--	**0.0004**
	Cadmium (Cd)	1-yr	--	0.0036	0.005	**0.0036**
		24-hr	2	--	0.025	**0.025**
	Chromium (Cr)	1-yr	--	0.004	--	**0.004**
	Copper (Cu)	24-hr	50	2.5	50	**2.5**
	Lead (Pb)	1-yr	--	0.1	--	**0.1**
		30 days	0.7	--	0.2	**0.2**
		24-hr	2	--	0.5	**0.5**
	Mercury (Hg)	1-yr	--	0.005	--	**0.005**
		24-hr	2	--	2	**2**
	Nickel (Ni)	24-hr	2	0.014	0.2	**0.014**
	Silver (Ag)	1-yr	--	0.23	--	**0.23**
	Thallium (Tl)	1-yr	--	0.25	--	**0.25**
	Vanadium (V)	1-yr	--	1	--	**1**
		24-hr	2	--	2	**2**
	Zinc	24-hr	120	2.5	120	**2.5**
Volatile Organic Compounds (VOC)	Benzene	24-hr	--	10	2.3	**2.3**
	1,3-Butadiene	1-yr	--	0.3	2	**0.3**
		24-hr	--	--	10	**10**
	Formaldehyde	24-hr	--	6.5	65	**6.5**
	Acetaldehyde	24-hr	--	--	500	**500**
	Acrolein	24-hr	--	--	0.4	**0.4**
Other	Dustfall	30 days	7.0 g/m² per 30 days	--	7.0 g/m² per 30 days	**7.0 g/m² per 30 days**
		1-yr	4.6 g/m² per 30 day avg.	--	4.6 g/m² per 30 day avg.	**4.6 g/m² per 30 day avg.**

(1) Air Pollution Control Regulations, 2004 Newfoundland and Labrador Regulations 39/04, Schedule A – Table I: Ambient Air Quality Standards at Reference Conditions.
(2) Atmospheric quality standards, Sections 197 and 198 and Schedule K of the Clean Air Regulation, Q-2, r. 4.1. When necessary, averaging time conversion was made.
(3) Ontario's Ambient Air Quality Criteria, Standards Development Branch Ontario Ministry of The Environment, April 2012

The Howse Project is located in the vicinity of the larger DSO complex operated by TSMC, which includes several mining and ore processing areas. From startup to decommissioning and reclamation, the mining and operation schedules of each area vary in time and this was taken into account when establishing the air dispersion modelling approach. From an air quality effects perspective Table 7-10 lists the key areas of the DSO and Howse projects and how they were integrated in this air quality assessment for the Howse Project, based on their respective schedule of operation and locations.

More specifically, this assessment evaluates the effects on air quality from activities related to these main sources:

- mining (drilling, blasting, excavation, loading, unloading, piles, etc.);
- power generation (diesel generators);
- transportation (emissions from vehicle engines and road dust);
- operation of the main processing plant (diesel generators, crushing, screening, ore drying, stockpiles, train loading, etc.);
- operation of Plant 2 (ore crushing, drying, screening, stockpiles); and
- operation of Howse Mini-Plant on the east side of the rail loop (ore crushing, drying, screening, stockpiles).

Detailed source descriptions and emissions can be found in the Air Dispersion Modelling Report (Volume 2 Supporting Study E). A project description with additional information on the DSO process and context of the project can be found in previous sections of this EIS. Emission rates calculations were performed in accordance with best practices and recent air modelling efforts for other areas of the TSMC DSO project. Most emission rates were calculated based on data and methodologies from USEPA (2014). When available site-specific emissions data provided by equipment suppliers were used instead of those from USEPA (2014). Table 7-11 and Table 7-12 show annual emissions from Howse and DSO3/DSO4 respectively.

Table 7-10 DSO and Howse Projects - Schedules and Inclusion in the Air Quality Study

PROJECT AREA	AIR EMISSION SOURCES	EXPECTED OPERATION SCHEDULE	INCLUSION IN THIS AIR QUALITY STUDY	MAXIMUM MINING RATE* USED IN AIR QUALITY STUDY
DSO3	Mining activities at Fleming 7N and Timmins 3N deposits Ore processing at the Main Processing Plant Ore processing at Plant 2 Road transportation and ore hauling Ore loading to rail cars Workers' Camp	DSO3 operations started in 2015 (currently in commissioning stages). DSO3 and Howse will operate simultaneously after Howse starts up in 2017.	The DSO3 complex is located within the Air Quality LSA. DSO3 air emission sources are included in this study and considered as part of the baseline (pre-Howse) condition.	3 383 MT/yr
DSO4	Mining activities at Kivivic and Goodwood/Sunny deposits Road transportation and ore hauling (on Goodwood Road)	DSO4 operations started in 2015 (currently in commissioning stages). DSO4 and Howse will operate simultaneously after Howse starts up in 2017.	The DSO4 deposits are located approximately 22 km from Howse, are outside the LSA and emissions associated to DSO4 mining activities are not included in air quality study. However, the ore mined at DSO4 will be hauled to the DSO3 Main processing plant. Air emissions from ore hauling on the 9.6 km portion of the Goodwood road located within the LSA are included in this air quality study and considered as part of the baseline (pre-Howse) condition.	7 384 MT/yr
HOWSE	Mining activities at Howse deposit Road transportation and ore hauling Ore processing at the Howse Mini-Plant FN crushing/Screening facility	2017-2032	Included in this air quality study.	13 823 MT/yr

*Mining rate includes: Activities related to ore mining and waste + overburden removal. Detailed mining plans are available in the Air Dispersion Modelling Report (Volume 2 Supporting Study E).

Table 7-11 Annual Emissions Inventory – Howse Project

PROJECT AREA	ANNUAL EMISSIONS INVENTORY (1)						
	TPM	PM_{10}	$PM_{2.5}$	NOX	CO	SO_2	HC (2)
HOWSE	231.4	121.9	64.2	283.2	146.3	2.2	13.1

(1) Based on maximum production year of the Project

(2) HC = Hydrocarbons. HC = VOC in this air quality study.

Table 7-12 Annual Emissions Inventory – DSO3 and DSO4 Areas

PROJECT AREA	ANNUAL EMISSIONS INVENTORY (1)						
	TPM	PM_{10}	$PM_{2.5}$	NOX	CO	SO_2	HC (3)
DSO3	301.9	99.1	22.8	1550.7	200.1	3.2	41.9
DSO4 (2)	259.2	73.9	8.4	124.6	68.7	0.1	7.8

(1) Based on maximum production year of each project area

(2) Includes a 9.6 km section of the Goodwood Road where Hauling trucks transport ore from the DSO4 area. DSO4 mining activities not included.

(3) HC = Hydrocarbons. HC = VOC in this air quality study.

Description of the dispersion model and meteorological data used for the air quality study

The CALPUFF model is the atmospheric pollution dispersion model recommended in the NLDEC's *Guideline for Plume Dispersion Modelling* (2012).

CALPUFF is a Lagrangian puff modelling system for the simulation of variable spatial and temporal conditions. Atmospheric emissions are modeled as a series of puffs which disperse according to wind direction over a given period. These puffs disperse vertically and horizontally in the atmosphere. They are influenced by the topography. Thus, a change in wind direction will influence the results of the modelling. The CALPUFF model adapts to various modelling situations. The flexibility of the model allows for the various characteristics associated with the local context to be taken into account. CALPUFF is especially useful in situations in which particulate matter is transported over long distances, with light and calm wind conditions (speed less than 0.5 m/s), wind inversions such as land breezes and sea breezes, and complex wind configurations associated with very rugged terrains. In addition, parameters such as dry deposition, wet deposition and particulate matter sizing have been incorporated into the CALPUFF input files as described in the *Guideline for Plume Dispersion Modelling*.

The system is made up of three programs: CALMET, CALPUFF and CALPOST. CALMET allows for the processing of meteorological data and the obtaining of hourly tridimensional meteorological data specific to the study area. Once processed, the meteorological data obtained with CALMET are used by CALPUFF, the atmospheric dispersion modelling program. Lastly, CALPOST allows for the processing and analysis of the modelling results. The V6.334, V6.42 and V6.292 versions of CALMET, CALPUFF and CALPOST were used within the framework of this study.

The CALMET program was used to generate meteorological data files. The program used meteorological data obtained by a non-hydrostatic mesoscale assessment technique using Mesoscale Model (MM 5) (operated by the Canadian company Lakes Environmental) for years 2004 to 2008 as baseline data. Meteorological data from years 2004 to 2008 were used in the Howse evaluation because they were used for all previous air modelling studies for other TSMC DSO projects. Data from this timeframe were considered representative of current conditions and met the objectives of the air modelling study. The data grid provided by Lakes Environmental had a resolution of 14 km and covered a surface area of 40 km by 40 km. The UTM coordinates of the central point were: East – 628 000 m, North – 6 081 000 m.

More information about the CALPUFF model and meteorological data can be found in the Air Dispersion Modelling Report (Volume 2 Supporting Study E).

Sensitive receptors used in the air quality study

A list of 40 discrete sensitive receptors was determined and used for the air dispersion modelling study (Table 7-13). The location of these receptors can be seen in Figure 7-3.

Table 7-13 Sensitive Receptors

ID	FINAL DESCRIPTION	PROVINCE	X EASTING (KM)	Y NORTHING (KM)	Z ELEVATION (M)	DISTANCE AND DIRECTION RELATIVE TO HOWSE DEPOSIT
R1	Young Naskapi Camp 1	NL	615.0828	6086.3313	498	4.21 km, W
R2	Young Naskapi Camp 2	NL	615.0068	6086.4258	498	4.29 km, W
R3	Innu Tent 3 (Rosemary Lake)	NL	615.2457	6086.3324	499	4.05 km, W
R4	Innu Tent 4 (Rosemary Lake)	NL	615.2376	6086.9500	499	4.11 km, W
R5	Innu Tent 5 (Rosemary Lake)	NL	614.8537	6087.3314	500	4.56 km, WNW
R6	Innu Tent 6 (Rosemary Lake)	NL	614.6857	6086.7490	498	4.63 km, W
R7	Innu Tent 1 (Elross Lake)	NL	619.3356	6080.8277	500	5.44 km, S
R8	Innu Tent 2 (Exact location tbd)	NL	614.4960	6084.5808	505	5.08 km, WSW
R9	Young Naskapi Camp 7 (Pinette Lake)	NL	620.4557	6084.8152	636	1.86 km, SE
R10	Young Naskapi Camp 3	NL	617.9290	6087.3644	606	1.75 km, NW
R11	Young Naskapi Trailer tent (Triangle Lake)	NL	618.0872	6088.3173	580	2.38 km, NNW
R12	Young Naskapi Camp 5 (Elross Creek)	NL	621.5380	6082.0124	579	4.81 km, SSE
R13	Naskapi - Uashat people's camp	NL	617.7971	6087.0367	619	1.68 km, WNW
R14	Young Naskapi Camp 4	NL	613.0674	6087.5092	514	6.35 km, WNW
R15	Young Naskapi Camp 6 (Howells River)	NL	622.2957	6077.8614	515	8.92 km, SSE
R16	Innu - Uashat - Mani-Utenam Camp 1	QC	621.1566	6089.0311	624	3.34 km, NE
R17	Innu - Uashat - Mani-Utenam Camp 2	NL	616.4962	6086.9704	556	2.88 km, WNW

ID	FINAL DESCRIPTION	PROVINCE	X EASTING (KM)	Y NORTHING (KM)	Z ELEVATION (M)	DISTANCE AND DIRECTION RELATIVE TO HOWSE DEPOSIT
R18	Innu - Uashat - Mani-Utenam Camp 3 (Inukshuk Lake)	QC	623.9650	6085.3445	718	4.76 km, E
R19	Innu Cabin 1	QC	631.6822	6080.0850	551	13.85 km, ESE
R20	Innu Cabin 2	QC	631.1136	6080.0592	558	13.35 km, ESE
R21	Bustard - Observation and hunting site 1	NL	612.9988	6089.0819	521	6.89 km, WNW
R22	Bustard - Observation and hunting site 2	NL	615.1038	6086.0116	514	4.19 km, W
R23	Picking site (berries / tea)	QC	620.0463	6090.4069	606	4.21 km, N
R24	Irony Mountain	NL	618.2357	6085.2228	835	1.48 km, SW
R25	Innu Cabin 3	QC	632.4583	6082.717	496	13.64 km, ESE
R26	Innu Cabin 4	QC	632.9582	6081.877	491	14.35 km, ESE
R27	Innu Cabin 5	QC	633.5804	6081.318	502	15.12 km, ESE
R28	Innu Cabin 6	QC	634.2557	6080.909	487	15.89 km, ESE
R29	Innu Cabin 7	QC	634.862	6080.707	493	16.53 km, ESE
R30	Innu Cabin 9 (Denault Lake)	QC	635.213	6079.776	504	17.19 km, ESE
R31	Innu Cabin 8	QC	633.1337	6080.34	539	15.06 km, ESE
R32	Innu Cabin 10 (Vacher Lake)	QC	636.0547	6085.953	492	16.77 km, E
R33	Naskapi Cabin 1	NL	615.3395	6084.424	502	4.36 km, WSW
R34	Naskapi Cabin 2 (Elross Lake)	NL	616.6907	6084.223	502	3.3 km, SW
R35	Naskapi Cabin 3 (Elross Lake)	NL	616.9098	6082.671	498	4.31 km, SSW
R36	Kawawachikamak (Town)	QC	643.5	6082.132	474	24.56 km, E
R37	Lac John (Town)	QC	642.39	6076.24	505	25.18 km, ESE
R38	Matimekush (Town)	QC	640.8	6075.6	516	24.01 km, ESE
R39	Schefferville (Town)	QC	640.6	6075	511	24.1 km, ESE
R40	TSMC Workers' Camp	NL	624.465	6082.765	742	6.25 km, SE

General grid receptors used in the air quality study

To meet the requirements of the *Guideline for Plume Dispersion Modelling* of the Department of Environment and Conservation of the GNL (GNL 2002), two Cartesian grids of receptors as well as discrete receptors were defined. The terrain elevation data used in the grids was obtained from a digital database having a precision of ± 5m.

The larger Cartesian grid covers a surface area of 340 km^2. It covers the DSO2 and DSO3 sites and is centered by Main Plant. The North-west corner start close to Howells Rover and the South-eastern corner extends close to Stork Lake. This grid resolution is 500 m by 500 m.

The second Cartesian grid covers a surface area of 16 km^2. It extends along the DSO3 facilities for a distance of 4 km and covers a strip of land of 4 km in width. Its resolution is 200 m by 200 m. It was not necessary to use a grid of 50 m resolution (as required in the *Guideline for Plume Dispersion Modelling*) because the zone for which such a grid is required falls within the boundaries of the air quality perimeter.

The receptors were positioned at ground level. General grid receptors located within the air quality modelling perimeter were removed from the modelling file in order to evaluate the ambient concentrations outside this boundary. General grid receptors located at less than 100 m from roads were also removed.

This removal process only excludes grid receptors, which are not specifically designated as sensitive receptors where humans live, hunt or do other activities. None of the sensitive receptors discussed in the next paragraph were removed from the model.

<u>Air Modelling Results and Conclusions</u>

The Air Dispersion Modelling Report (Volume 2 Supporting Study E) contains the detailed discussion, results and figures (such as isoconcentration plots). All results presented in this study are maximum concentrations outputted by the model; no statistical treatment was performed on the data, such as determining the 98% percentile average or removing highest outliers. Due to the limitations in modelling blasting events, air modelling results are presented for two scenarios: "With Blasts" and "No Blasts".

Air modelling results indicate that no exceedances of assessment criteria are predicted for dustfall, metals and VOCs reviewed in this EIS.

The results show that for annual averaging periods, for both the "With Blasts" and "No Blasts" scenarios, no exceedances of assessment criteria are predicted for all CAC and for all receptors types (e.g. Sensitive and Grid). Table 7-14 summarizes results for annual averaging periods and shows the contribution of Howse and DSO3/DSO4 separately. Due to the large amount of results (for both the "With Blasts" and "Without Blasts" scenarios) and the number of sensitive and grid receptors, the tables of results include a list of 13 selected sensitive receptors reflecting highest effects or cluster of representative receptors; results for the remaining 27 sensitive receptors not shown in the tables, all meet air quality assessment criteria. Complete tables of results with all 40 sensitive receptors are available in the Air Dispersion Modelling Report (Volume 2 Supporting Study E). Table 7-15 and Table 7-16 summarize CAC air modelling results for daily and short-term averaging periods (e.g. 24-hr, 8-hr, 3-hr, and 1-hr), respectively.

Sensitive receptors R36 to R39 are located at the nearest towns (Kawawachikamak, Lac John, Matimekush and Schefferville). The effects of the modelled Howse Project activities on these four receptors' air quality is minimal and meet the air quality assessment criteria. For example, the NO_2 1-hr concentration in Schefferville and due to the Howse project is 20.0 $\mu g/m^3$ vs an assessment criteria of 400 $\mu g/m^3$. In considering the cumulative effects of all mining activities included in the air quality study (e.g. DSO3 + DSO4 + Howse + Background), the cumulative NO_2 1-hr concentration in Schefferville is 74.3 $\mu g/m^3$ vs an assessment criteria of 400 $\mu g/m^3$. The effects at sensitive receptors R36, R37 and, R38 is lower than at Schefferville.

The results show that for CAC for short-term averaging periods (24-hr, 8-hr, 3-hr, and 1-hr), results sometimes exceed the project's air quality assessment criteria for both scenarios ("With Blasts" and "No Blasts"). Table 7-17 shows at which sensitive receptors exceedances may occur and also shows the frequency count of these exceedances. A similar frequency analysis table has also been generated for non-sensitive "Off-Property Limits" grid receptors and is presented in Table 7-18.

CAC Results - Short-Term Averaging Periods – at Sensitive Receptors

Based on the results presented herein, the following observations can be made:

- For TPM (24-hr), no exceedances are predicted under the "No Blasts" scenario, while 2 exceedances are predicted to occur under the "With Blasts" scenario at Receptor R40 (Workers' Camp), over the 5 years of meteorological data studied. These 2 exceedances are equivalent to 0.11% of the time during which a maximum of 137.1 µg/m3 (vs criteria of 120 µg/m3) is predicted to occur.
- For PM10 (24-hr), no exceedances are predicted under the "No Blasts" scenario, while under the "With Blasts" scenario, 1 exceedance (0.05% of the time) is predicted to occur at Receptor R13 (Naskapi - Uashat people's camp) and 6 exceedances (0.33% of the time) at Receptor R40 (Workers' Camp), over the 5 years of meteorological data studied.
- For NO2 (24-hr), 7 exceedances (0.38% of the time) are predicted to occur under both "With Blasts" and "No Blasts" at 315.8 µg/m3 and 315.0 µg/m3, respectively. The occurrence of the same number of exceedances under both scenarios indicates that the cause of higher NOx during that time period and specific meteorological conditions is not due to blasting events. In addition, for Receptor R40, for Howse only (No Blasts) the predicted contribution is 43.2 µg/m3, which in itself does not exceed the criterion. In the same table, the contribution of DSO3 + DSO4 at R40 is 285.0 µg/m3. This explains that the Howse Project itself does not create the exceedance, but the cumulative effect of all projects combined causes the exceedance.
- For NO2 (1-hr), exceedances are predicted at 8 sensitive receptors (R9, R10, R11, R13, R16, R17 and R24) in the "With Blasts" scenario, while no exceedances would occur at these same receptors in the "No Blasts" scenario. Note that the 8 receptors are located in the vicinity of the Howse deposit. The maximum number of exceedances is 13 (0.71% of the time) at R9 – Young Naskapi Camp 7 (Pinette Lake). A more detailed review indicated that all exceedances at these 8 receptors occur during winter (November to March period) and are due to blasting events at the Howse pit. By minimizing blasting at the Howse pit during the winter period (which the Proponent will do), exceedances would also be minimized.
- For NO2 (1-hr), 9 exceedances (0.49% of the time) are predicted at sensitive receptor R18 - Innu - Uashat - Mani-Utenam Camp 3 (Inukshuk Lake) in the "With Blasts" scenario, while no exceedances would occur in the "No Blasts" scenario.
- For NO2 (1-hr), exceedances at Receptor R40 (Workers' Camp) occur less than 1% of the time for both "With Blasts" and "No Blasts" scenarios. Looking at the "No Blasts" scenario in Table 7-17 for Receptor R40, for Howse only, No Blasts, the predicted contribution is 199.5 µg/m3, which in itself does not exceed the criterion. In the same table, the contribution of DSO3 + DSO4 at R40 is 423.0 µg/m3. This explains that the Howse Project itself does not create the exceedance, but the cumulative effect of all projects is above the assessment criteria at this receptor. Furthermore, it was determined that the principal cause of the 99 exceedances at the Workers' Camp is the continuous operation of diesel generators located on the premises of the camp to produce electricity used at the camp.

As of summer 2016, the electricity at the Workers' Camp is now supplied by the Main Plant GenSet which have a higher engine to generator efficiency than the diesel generators located at the Camp (95% vs 85%). The four diesel generators located at the Workers' Camp are still in place but only used for emergency situations (ex.: malfunction of the Main Plant GenSet or failure of the power line between the Main Plant and Workers' Camp). The Main Plant Generators loads and emission calculations presented in this report include the portion of electricity required at the Workers' Camp, since TSMC had already planned for this power switch; it just occurred faster than anticipated. The air modelling study was conducted assuming all generators were in operation 5 and represent a theoretical worst-case scenario. Note that for all diesel generators, except the Main Plan GenSet (5 x 2825 kW units), pollutants emissions were calculated by multiplying respective emission factors in units of g/kW by the generators power ratings in units of kWe instead of the engine power inputs in units of kW. This procedure may have underestimated emissions of these sources by approximately 15%. Considering the high-level of conservativeness used in all other *calculations and assumptions coupled to the fact that the Workers' Camp generators emissions are overly exaggerated since they will only be used for emergency purposes, it is evaluated that changes to the calculations procedure are not warranted.*

CAC Results - Short-Term Averaging Periods – at "Off-Property Limit" Grid Receptors

Based on the results, the following observations can be made:

- For the "No Blasts" scenario results, exceedances are predicted for the following averaging periods and pollutants: 24-hr (TPM, PM10, PM2.5, and NO2), 1-hr (NO2). The maximum number of predicted exceedances is 15 (0.82% of the time) for PM10 (24-hr) at "Off-Property Limit" grid receptor UTM coordinates 622.2434, 6085.7298 in NL. Figure 3.17 of the Air Dispersion Modelling Report shows the points at which maximum concentrations are predicted to occur; these points are located on the edge of the air quality modelling perimeter.
- For the "With Blasts" scenario results, exceedances are predicted for the following averaging periods and pollutants: 24-hr (TPM, PM10, PM2.5, and NO2), 1-hr (NO2, SO2, CO). The maximum number of predicted exceedances is 2.85% of the time for PM10 (24-hr) at "Off-Property Limit" grid receptor UTM coordinate 625.6801, 6083.313 in QC. Figure 3.16 of the Air Dispersion Modelling Report shows the points at which maximum concentrations are predicted to occur; these points are located on the edge of the air quality modelling perimeter.
- Zones of air quality effects exceeding assessment criteria on "Off-Property Limit" grid receptors are:
  - restricted to small areas along perimeter limits;
  - pollutants concentrations drop-off quickly by distance; and
  - zones where no people live, not sensitive receptors.

Table 7-14 Summary Results – CAC – Maximum Annual Concentrations – With Blasts and No Blasts

			WITH BLASTS					NO BLASTS				
		Pollutant	TPM	PM10	PM2.5	SO2	NO2	TPM	PM10	PM2.5	SO2	NO2
		Averaging Period	1-yr	1-yr	1-yr	1-yr	1-yr	1-yr	1-yr	1-yr	1-yr	1-yr
		Selected Air Quality Assessement Criteria for Howse	**60**	**--**	**8.8**	**52**	**100**	**60**	**--**	**8.8**	**52**	**100**
		BACKGROUND CONCENTRATIONS - PRE-DSO3	**8**	**4**	**3**	**2**	**10**	**8**	**4**	**3**	**2**	**10**
DSO3 + DSO4 ONLY	**ID**	**Description**	TPM	PM10	PM2.5	SO2	NO2	TPM	PM10	PM2.5	SO2	NO2
	R5	Innu Tent 5 (Rosemary Lake)	0.1	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.2
	R7	Innu Tent 1 (Elross Lake)	0.1	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.3
	R9	Young Naskapi Camp 7 (Pinette Lake)	0.4	0.2	0.1	0.0	1.5	0.4	0.2	0.1	0.0	1.5
	R10	Young Naskapi Camp 3	0.3	0.1	0.0	0.0	0.7	0.3	0.1	0.0	0.0	0.6
	R11	Young Naskapi Trailer tent (Triangle Lake)	0.2	0.1	0.0	0.0	0.6	0.2	0.1	0.0	0.0	0.6
	R13	Naskapi - Uashat people's camp	0.3	0.1	0.0	0.0	0.7	0.3	0.1	0.0	0.0	0.7
	R16	Innu - Uashat - Mani-Utenam Camp 1	0.9	0.4	0.1	0.0	1.7	0.9	0.4	0.1	0.0	1.6
	R17	Innu - Uashat - Mani-Utenam Camp 2	0.1	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.3
	R18	Innu - Uashat - Mani-Utenam Camp 3 (Inukshuk Lake)	1.7	1.1	0.4	0.1	8.8	1.5	0.9	0.4	0.0	8.5
	R20	Innu Cabin 2	0.1	0.1	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.3
	R24	Irony Mountain	0.4	0.2	0.1	0.0	1.5	0.4	0.2	0.1	0.0	1.5
	R39	Schefferville (Town)	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.1
	R40	TSMC Workers' Camp	3.7	2.1	0.7	0.4	19.3	2.5	1.3	0.7	0.1	18.5
	--	"Off-Property Limit" Maximum - Quebec	11.0	6.4	1.1	2.3	21.3	8.4	3.1	0.8	0.0	11.0
	--	"Off-Property Limit" Maximum - Newfoundland/Labrador	9.8	3.6	0.9	0.3	14.2	9.8	3.6	0.9	0.0	13.8
HOWSE ONLY	**ID**	**Name**	TPM	PM10	PM2.5	SO2	NO2	TPM	PM10	PM2.5	SO2	NO2
	R5	Innu Tent 5 (Rosemary Lake)	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1
	R7	Innu Tent 1 (Elross Lake)	0.1	0.1	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.1
	R9	Young Naskapi Camp 7 (Pinette Lake)	1.4	0.8	0.1	0.2	2.2	1.0	0.5	0.1	0.0	1.2
	R10	Young Naskapi Camp 3	0.9	0.5	0.1	0.1	1.5	0.6	0.3	0.1	0.0	0.8
	R11	Young Naskapi Trailer tent (Triangle Lake)	0.7	0.4	0.1	0.1	1.2	0.4	0.2	0.0	0.0	0.5
	R13	Naskapi - Uashat people's camp	0.8	0.5	0.1	0.1	1.6	0.6	0.3	0.1	0.0	1.0
	R16	Innu - Uashat - Mani-Utenam Camp 1	0.5	0.3	0.1	0.1	0.9	0.4	0.2	0.0	0.0	0.5
	R17	Innu - Uashat - Mani-Utenam Camp 2	0.2	0.1	0.0	0.0	0.4	0.1	0.1	0.0	0.0	0.2
	R18	Innu - Uashat - Mani-Utenam Camp 3 (Inukshuk Lake)	1.4	0.7	0.2	0.0	2.2	1.3	0.6	0.2	0.0	2.0
	R20	Innu Cabin 2	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1
	R24	Irony Mountain	1.0	0.6	0.1	0.1	1.8	0.8	0.4	0.1	0.0	1.2
	R39	Schefferville (Town)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	R40	TSMC Workers' Camp	1.7	0.8	0.2	0.0	2.3	1.7	0.7	0.2	0.0	2.1
	--	"Off-Property Limit" Maximum - Quebec	3.3	1.5	0.3	0.1	4.3	3.2	1.4	0.3	0.0	4.0
	--	"Off-Property Limit" Maximum - Newfoundland/Labrador	5.3	2.8	0.5	0.7	7.6	4.7	2.1	0.5	0.0	5.4
ALL: Background + DSO3 + DSO4 + HOWSE	**ID**	**Name**	TPM	PM10	PM2.5	SO2	NO2	TPM	PM10	PM2.5	SO2	NO2
	R5	Innu Tent 5 (Rosemary Lake)	8.1	4.1	3.0	2.0	10.4	8.1	4.1	3.0	2.0	10.3
	R7	Innu Tent 1 (Elross Lake)	8.2	4.1	3.0	2.0	10.5	8.1	4.1	3.0	2.0	10.4
	R9	Young Naskapi Camp 7 (Pinette Lake)	9.8	5.0	3.2	2.2	13.7	9.4	4.7	3.2	2.0	12.7
	R10	Young Naskapi Camp 3	9.1	4.6	3.1	2.1	12.2	8.8	4.4	3.1	2.0	11.4
	R11	Young Naskapi Trailer tent (Triangle Lake)	9.0	4.5	3.1	2.1	11.8	8.6	4.3	3.1	2.0	11.1
	R13	Naskapi - Uashat people's camp	9.1	4.6	3.1	2.1	12.3	8.9	4.5	3.1	2.0	11.6
	R16	Innu - Uashat - Mani-Utenam Camp 1	9.5	4.7	3.1	2.1	12.5	9.3	4.6	3.1	2.0	12.1
	R17	Innu - Uashat - Mani-Utenam Camp 2	8.3	4.2	3.0	2.0	10.7	8.2	4.1	3.0	2.0	10.5
	R18	Innu - Uashat - Mani-Utenam Camp 3 (Inukshuk Lake)	11.1	5.7	3.6	2.1	20.9	10.8	5.5	3.6	2.0	20.5
	R20	Innu Cabin 2	8.2	4.1	3.0	2.0	10.5	8.1	4.1	3.0	2.0	10.4
	R24	Irony Mountain	9.3	4.8	3.2	2.1	13.2	9.1	4.6	3.2	2.0	12.6
	R39	Schefferville (Town)	8.0	4.0	3.0	2.0	10.2	8.0	4.0	3.0	2.0	10.2
	R40	TSMC Workers' Camp	13.1	6.7	3.8	2.4	30.7	12.2	6.1	3.8	2.1	29.7
	--	"Off-Property Limit" Maximum - Quebec	19.5	10.6	4.2	4.3	32.1	17.6	7.7	3.9	2.0	23.3
	--	"Off-Property Limit" Maximum - Newfoundland/Labrador	21.0	9.1	4.1	2.7	27.2	20.8	8.9	4.1	2.0	26.4

- all values in µg/m^3. Red cell indicates above criteria.

Table 7-15 Summary Results – CAC – Maximum Daily Concentrations – With Blasts and No Blasts

	WITH BLASTS					NO BLASTS				
Pollutant	TPM	PM10	PM2.5	SO2	NO2	TPM	PM10	PM2.5	SO2	NO2
Averaging Period	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr
Selected Air Quality Assessement Criteria for Howse	**120**	**50**	**25**	**288**	**200**	**120**	**50**	**25**	**288**	**200**
BACKGROUND CONCENTRATIONS - PRE-DSO3	**40**	**20**	**15**	**10**	**30**	**40**	**20**	**15**	**10**	**30**

DSO3 + DSO4 ONLY

ID	Description	TPM	PM10	PM2.5	SO2	NO2	TPM	PM10	PM2.5	SO2	NO2
R5	Innu Tent 5 (Rosemary Lake)	1.5	0.5	0.3	0.1	7.9	1.5	0.5	0.3	0.0	7.7
R7	Innu Tent 1 (Elross Lake)	1.4	0.9	0.5	0.3	10.6	1.0	0.6	0.5	0.0	10.6
R9	Young Naskapi Camp 7 (Pinette Lake)	6.2	4.1	2.6	1.7	63.2	6.2	3.1	2.6	0.1	59.6
R10	Young Naskapi Camp 3	3.6	1.4	0.9	0.6	20.0	3.6	1.3	0.9	0.0	19.9
R11	Young Naskapi Trailer tent (Triangle Lake)	2.5	1.6	0.9	0.7	20.0	2.5	1.3	0.9	0.0	19.4
R13	Naskapi - Uashat people's camp	5.1	1.9	0.8	0.5	19.8	5.1	1.9	0.8	0.0	19.7
R16	Innu - Uashat - Mani-Utenam Camp 1	7.1	2.6	1.1	0.6	24.5	7.1	2.6	1.1	0.0	24.5
R17	Innu - Uashat - Mani-Utenam Camp 2	1.4	1.0	0.3	0.4	7.2	1.4	0.6	0.3	0.0	6.9
R18	Innu - Uashat - Mani-Utenam Camp 3 (Inukshuk Lake)	36.6	26.3	5.5	11.6	119.0	11.7	7.3	5.5	0.1	119.0
R20	Innu Cabin 2	1.8	1.5	0.4	0.6	9.9	1.1	0.6	0.3	0.0	9.3
R24	Irony Mountain	4.7	2.6	1.5	0.7	39.5	4.7	2.6	1.4	0.0	35.8
R39	Schefferville (Town)	0.6	0.4	0.2	0.1	4.6	0.5	0.3	0.2	0.0	4.5
R40	TSMC Workers' Camp	97.1	70.6	7.7	31.3	283.3	20.2	10.7	7.7	0.6	283.3
--	"Off-Property Limit" Maximum - Quebec	211.3	137.1	14.2	58.1	333.7	82.1	35.2	10.0	0.2	171.5
--	"Off-Property Limit" Maximum - Newfoundland/Labrador	105.8	44.9	8.2	19.5	175.9	105.8	35.8	8.2	0.2	175.9

HOWSE ONLY

ID	Name	TPM	PM10	PM2.5	SO2	NO2	TPM	PM10	PM2.5	SO2	NO2
R5	Innu Tent 5 (Rosemary Lake)	3.6	3.3	0.2	1.4	11.1	1.9	1.0	0.2	0.0	3.2
R7	Innu Tent 1 (Elross Lake)	2.6	2.4	0.2	1.0	8.4	1.2	0.6	0.1	0.0	1.5
R9	Young Naskapi Camp 7 (Pinette Lake)	41.0	29.2	1.9	13.1	90.7	9.2	4.4	1.3	0.0	11.9
R10	Young Naskapi Camp 3	33.4	25.9	1.8	11.2	72.2	10.7	5.1	1.2	0.0	12.9
R11	Young Naskapi Trailer tent (Triangle Lake)	17.7	14.2	1.0	6.2	44.1	5.9	2.7	0.8	0.0	9.5
R13	Naskapi - Uashat people's camp	45.6	36.1	2.6	15.5	101.3	14.9	7.5	1.8	0.0	18.2
R16	Innu - Uashat - Mani-Utenam Camp 1	14.7	10.3	0.6	4.6	35.5	4.3	2.0	0.5	0.0	5.7
R17	Innu - Uashat - Mani-Utenam Camp 2	13.8	12.1	0.8	5.2	37.6	3.4	1.6	0.6	0.0	5.9
R18	Innu - Uashat - Mani-Utenam Camp 3 (Inukshuk Lake)	12.1	10.5	3.4	4.4	52.2	11.8	6.5	3.4	0.2	52.2
R20	Innu Cabin 2	1.7	1.0	0.2	0.4	3.3	1.7	1.0	0.2	0.0	2.0
R24	Irony Mountain	33.8	20.3	1.8	8.9	56.6	12.5	7.8	1.7	0.0	18.0
R39	Schefferville (Town)	0.6	0.4	0.1	0.1	1.2	0.6	0.4	0.1	0.0	0.9
R40	TSMC Workers' Camp	17.9	8.4	2.7	3.3	43.2	17.7	8.3	2.7	0.2	43.2
--	"Off-Property Limit" Maximum - Quebec	54.8	27.0	5.8	10.4	83.8	54.5	26.8	5.8	0.4	80.1
--	"Off-Property Limit" Maximum - Newfoundland/Labrador	123.6	83.4	10.7	37.0	196.3	82.7	42.7	10.6	0.4	89.6

ALL: Background + DSO3 + DSO4 + HOWSE

ID	Name	TPM	PM10	PM2.5	SO2	NO2	TPM	PM10	PM2.5	SO2	NO2
R5	Innu Tent 5 (Rosemary Lake)	44.1	23.8	15.5	11.5	43.6	42.5	21.3	15.5	10.0	40.9
R7	Innu Tent 1 (Elross Lake)	42.6	22.4	15.5	11.0	40.6	42.1	21.0	15.5	10.0	40.6
R9	Young Naskapi Camp 7 (Pinette Lake)	81.0	49.2	17.6	23.1	121.0	52.4	25.7	17.6	10.1	89.6
R10	Young Naskapi Camp 3	74.8	47.2	16.9	21.7	107.6	52.2	25.8	16.7	10.0	61.8
R11	Young Naskapi Trailer tent (Triangle Lake)	58.2	34.6	16.2	16.3	78.3	47.5	23.5	16.2	10.0	53.5
R13	Naskapi - Uashat people's camp	87.3	57.5	17.8	26.0	136.9	56.2	28.1	16.9	10.0	57.6
R16	Innu - Uashat - Mani-Utenam Camp 1	54.8	30.4	16.1	14.6	69.6	48.9	23.6	16.1	10.0	54.5
R17	Innu - Uashat - Mani-Utenam Camp 2	54.8	33.1	15.9	15.6	71.2	44.1	22.1	15.7	10.0	42.6
R18	Innu - Uashat - Mani-Utenam Camp 3 (Inukshuk Lake)	76.8	46.5	20.5	21.6	149.1	62.2	33.8	20.5	10.2	149.1
R20	Innu Cabin 2	43.0	22.0	15.4	10.8	40.0	42.7	21.6	15.4	10.0	39.3
R24	Irony Mountain	73.8	40.4	17.6	18.9	87.4	56.3	29.7	17.5	10.1	75.8
R39	Schefferville (Town)	41.2	20.7	15.2	10.2	34.7	41.1	20.7	15.2	10.0	34.6
R40	TSMC Workers' Camp	137.1	90.6	22.7	41.3	315.8	73.9	36.3	22.7	10.7	315.0
--	"Off-Property Limit" Maximum - Quebec	251.4	157.2	29.2	68.2	364.2	127.8	64.5	25.0	10.4	201.5
--	"Off-Property Limit" Maximum - Newfoundland/Labrador	184.9	103.7	26.0	47.0	232.1	184.1	77.1	25.8	10.4	205.9

- all values in μg/m^3. Red cell indicates above criteria.

Table 7-16 Summary Results – CAC – Maximum 1-hr, 3-hr and 8-hr Concentrations – With Blasts and No Blasts

		WITH BLASTS					NO BLASTS				
	Pollutant	SO2	SO2	NO2	CO	CO	SO2	SO2	NO2	CO	CO
	Averaging Period	3-hr	1-hr	1-hr	8-hr	1-hr	3-hr	1-hr	1-hr	8-hr	1-hr
	Selected Air Quality Assessement Criteria for Howse	**600**	**900**	**400**	**12700**	**34000**	**600**	**900**	**400**	**12700**	**34000**
	BACKGROUND CONCENTRATIONS - PRE-DSO3	**18**	**24**	**50**	**400**	**600**	**18**	**24**	**50**	**400**	**600**
DSO3 + DSO4 ONLY											
ID	**Description**	SO2	SO2	NO2	CO	CO	SO2	SO2	NO2	CO	CO
R5	Innu Tent 5 (Rosemary Lake)	1.1	1.8	31.8	33.3	138.7	0.0	0.0	31.8	1.9	4.2
R7	Innu Tent 1 (Elross Lake)	2.3	6.0	56.0	43.6	259.6	0.0	0.1	56.0	1.8	5.0
R9	Young Naskapi Camp 7 (Pinette Lake)	12.8	28.5	191.9	207.7	1138.9	0.1	0.2	180.3	8.7	13.4
R10	Young Naskapi Camp 3	4.6	7.9	61.4	72.0	350.1	0.0	0.1	49.0	4.1	5.7
R11	Young Naskapi Trailer tent (Triangle Lake)	5.2	9.9	74.8	83.7	517.7	0.0	0.0	39.4	3.1	9.5
R13	Naskapi - Uashat people's camp	4.1	8.2	64.1	74.6	364.9	0.0	0.1	50.1	3.9	6.4
R16	Innu - Uashat - Mani-Utenam Camp 1	3.9	8.2	83.7	81.0	293.2	0.1	0.1	83.7	6.2	11.3
R17	Innu - Uashat - Mani-Utenam Camp 2	3.0	6.0	46.8	62.6	285.4	0.0	0.0	34.4	1.8	3.7
R18	Innu - Uashat - Mani-Utenam Camp 3 (Inukshuk Lake)	68.3	205.0	1428.5	1260.4	7378.7	0.2	0.3	269.2	31.9	54.9
R20	Innu Cabin 2	4.2	11.6	86.8	76.9	457.4	0.0	0.0	25.8	2.1	3.7
R24	Irony Mountain	5.1	9.4	183.6	88.9	413.3	0.1	0.2	183.6	10.5	16.9
R39	Schefferville (Town)	1.1	2.6	22.0	28.7	112.8	0.0	0.0	9.4	0.7	1.6
R40	TSMC Workers' Camp	202.9	608.5	2961.1	3422.5	21957.0	0.8	0.8	423.0	78.8	120.8
--	"Off-Property Limit" Maximum - Quebec	402.0	1206.0	5339.8	6291.5	42341.0	0.3	0.4	327.3	193.7	319.0
--	"Off-Property Limit" Maximum - Newfoundland/Labrador	139.1	417.1	2161.0	2101.6	14721.0	0.4	0.5	373.8	82.0	104.7
HOWSE ONLY											
ID	**Name**	SO2	SO2	NO2	CO	CO	SO2	SO2	NO2	CO	CO
R5	Innu Tent 5 (Rosemary Lake)	10.6	30.4	240.1	182.8	1335.4	0.0	0.0	11.3	3.3	8.7
R7	Innu Tent 1 (Elross Lake)	7.5	21.9	173.6	161.1	990.7	0.0	0.0	9.4	2.4	4.5
R9	Young Naskapi Camp 7 (Pinette Lake)	104.4	237.4	1586.9	1419.2	8569.9	0.1	0.2	67.7	35.5	63.0
R10	Young Naskapi Camp 3	89.7	197.1	1293.3	1285.2	7386.2	0.0	0.1	75.1	27.7	77.2
R11	Young Naskapi Trailer tent (Triangle Lake)	49.5	81.8	608.4	713.4	3139.3	0.0	0.0	47.2	22.4	48.0
R13	Naskapi - Uashat people's camp	124.0	247.6	1523.6	1774.0	9409.3	0.1	0.1	93.7	48.5	92.0
R16	Innu - Uashat - Mani-Utenam Camp 1	36.5	82.6	635.8	496.9	3000.1	0.1	0.1	35.2	13.9	32.4
R17	Innu - Uashat - Mani-Utenam Camp 2	41.6	87.5	625.6	631.1	3539.2	0.0	0.0	26.8	13.4	27.5
R18	Innu - Uashat - Mani-Utenam Camp 3 (Inukshuk Lake)	35.3	78.7	609.2	522.6	3092.7	0.7	0.9	160.2	20.2	38.2
R20	Innu Cabin 2	3.0	7.9	63.6	59.2	323.9	0.0	0.0	7.7	2.1	4.5
R24	Irony Mountain	71.4	188.1	1181.2	939.4	6599.8	0.2	0.3	91.8	37.7	78.2
R39	Schefferville (Town)	0.8	2.5	20.0	14.9	94.6	0.0	0.0	3.0	0.9	1.8
R40	TSMC Workers' Camp	26.3	52.6	413.9	388.4	2068.5	1.0	1.1	199.5	20.1	41.1
--	"Off-Property Limit" Maximum - Quebec	83.2	191.9	1459.8	1135.8	6955.0	1.7	1.8	269.6	37.0	67.0
--	"Off-Property Limit" Maximum - Newfoundland/Labrador	295.5	769.4	3525.5	3975.8	27484.0	1.7	1.8	269.6	162.7	227.9
ALL: Background + DSO3 + DSO4 + HOWSE											
ID	**Name**	SO2	SO2	NO2	CO	CO	SO2	SO2	NO2	CO	CO
R5	Innu Tent 5 (Rosemary Lake)	29.6	56.2	303.5	616.2	2074.1	17.9	24.4	84.5	405.1	610.4
R7	Innu Tent 1 (Elross Lake)	25.4	46.2	224.0	561.5	1591.9	17.9	24.4	106.3	403.4	606.8
R9	Young Naskapi Camp 7 (Pinette Lake)	122.3	261.7	1636.9	1819.2	9169.9	18.1	24.6	231.7	437.3	667.7
R10	Young Naskapi Camp 3	111.6	227.4	1391.3	1756.9	8300.6	18.0	24.4	131.9	428.4	678.9
R11	Young Naskapi Trailer tent (Triangle Lake)	68.2	107.2	658.7	1130.1	3791.8	18.0	24.4	98.6	423.1	648.8
R13	Naskapi - Uashat people's camp	146.0	280.1	1637.7	2248.6	10374.2	18.0	24.4	146.1	449.4	693.8
R16	Innu - Uashat - Mani-Utenam Camp 1	54.4	107.0	687.9	899.4	3601.4	18.0	24.5	136.2	416.2	633.0
R17	Innu - Uashat - Mani-Utenam Camp 2	62.5	113.9	693.9	1093.7	4293.1	17.9	24.4	93.5	414.8	630.5
R18	Innu - Uashat - Mani-Utenam Camp 3 (Inukshuk Lake)	86.2	229.4	1478.5	1660.4	7978.7	18.6	25.2	329.3	432.2	654.9
R20	Innu Cabin 2	22.3	35.9	137.5	515.4	1058.0	17.9	24.4	77.7	404.0	607.2
R24	Irony Mountain	89.3	212.4	1232.0	1340.0	7200.3	18.2	24.7	234.3	438.8	680.2
R39	Schefferville (Town)	19.0	26.9	74.3	431.3	713.0	17.9	24.4	61.5	401.5	603.4
R40	TSMC Workers' Camp	220.8	632.9	3011.1	3822.5	22557.0	19.1	25.6	487.3	479.1	721.0
--	"Off-Property Limit" Maximum - Quebec	419.9	1230.3	5391.0	6696.3	42942.0	19.6	26.1	388.3	593.7	926.8
--	"Off-Property Limit" Maximum - Newfoundland/Labrador	313.4	793.8	3577.3	4376.7	28085.0	19.6	26.1	431.9	565.0	830.1

- all values in µg/m^3. Red cell indicates above criteria.

Table 7-17 Frequency of Exceedances at Sensitive Receptors

POLLUTANT	AVERAGING PERIOD	ASSESSMENT CRITERIA (µG/M³)	RECEPTORS WITH PREDICTED EXCEEDANCE		MAXIMUM CONCENTRATION* (EXCEEDANCE COUNT / % OF TIME)**			
			ID	NAME	WITH BLASTS		NO BLASTS	
TPM	24-hr	120	R40	TSMC Workers' Camp	**137.1**		**Meets Criteria**	
					2	0.11%	--	--
PM_{10}	24-hr	50	R13	Naskapi - Uashat people's camp	**57.5**		**Meets Criteria**	
					1	0.05%	--	--
			R40	TSMC Workers' Camp	**90.6**		**Meets Criteria**	
					6	0.33%	--	--
NO_2	24-hr	200	R40	TSMC Workers' Camp	**315.8**		**315.0**	
					7	0.38%	7	0.38%
NO_2	1-hr	400	R9	Young Naskapi Camp 7 (Pinette Lake)	**1636.9**		**Meets Criteria**	
					13	0.71%	--	--
			R10	Young Naskapi Camp 3	**1391.3**		**Meets Criteria**	
					10	0.55%	--	--
			R11	Young Naskapi Trailer tent (Triangle Lake)	**658.7**		**Meets Criteria**	
					8	0.44%	--	--
			R13	Naskapi - Uashat people's camp	**1637.7**		**Meets Criteria**	
					8	0.44%	--	--
			R16	Innu - Uashat - Mani-Utenam Camp 1	**687.9**		**Meets Criteria**	
					6	0.33%	--	--
			R17	Innu - Uashat - Mani-Utenam Camp 2	**693.9**		**Meets Criteria**	
					1	0.05%	--	--
			R18	Innu - Uashat - Mani-Utenam Camp 3 (Inukshuk Lake)	**1478.5**		**Meets Criteria**	
					9	0.49%	--	--
			R24	Irony Mountain	**1232.0**		**Meets Criteria**	
					6	0.33%	--	--
			R40	TSMC Workers' Camp	**3011.1**		**487.3**	
					128	0.93%	99	0.23%

* Maximum modelled concentration over 5 year's meteorological data.

** Exceedance count = Number of times concentration above the standard in the 5 year period. The exceedance count is for the cumulative air quality effect e.g. Background + DSO3 + DSO4 + HOWSE.

% of time = Count ÷ Number of averaging period in 5 years. For hourly averaging period With Blasts, a day corresponds to the averaging period, due to the way blasting is modelled. At the R40 receptor, for the "With Blasts" scenario the % of time exceedance was calculated based on the number hours in 5 years (5 yrs x 8760 hrs/yr = 43 800 hrs/5 yrs) and the 29 exceedances due to blasting, while the "No Blasts" % of time exceedance was calculated based on the number of hours in 5 years (5 yrs x 8760 hrs/yr = 43 800 hrs/5 yrs).

Table 7-18 Frequency of Exceedances at Maximum "Off-Property" Grid Receptors

POLLUTANT	AVERAGING PERIOD	ASSESSMENT CRITERIA	RECEPTORS WITH PREDICTED EXCEEDANCE	MAXIMUM CONCENTRATION* (EXCEEDANCE COUNT / % OF TIME)**

		(µG/M^3)	PROV.	NAME	WITH BLASTS		NO BLASTS	
TPM	24-hr	120	QC	"Off-Property Limit" Maximum - QC	**251.4**		**127.8**	
					26	1.42%	4	0.22%
			NL	"Off-Property Limit" Maximum - NL	**184.9**		**184.1**	
					8	0.44%	8	0.44%
PM_{10}	24-hr	50	QC	"Off-Property Limit" Maximum - QC	**157.2**		**64.5**	
					52	2.85%	7	0.38%
			NL	"Off-Property Limit" Maximum - NL	**103.7**		**77.1**	
					17	0.93%	15	0.82%
$PM_{2.5}$	24-hr	25	QC	"Off-Property Limit" Maximum - QC	**29.2**		**Meets Criteria**	
					5	0.27%	--	--
			NL	"Off-Property Limit" Maximum - NL	**26.0**		**25.8**	
					1	0.05%	1	0.05%
NO_2	24-hr	200	QC	"Off-Property Limit" Maximum - QC	**364.2**		**201.5**	
					9	0.49%	1	0.05%
			NL	"Off-Property Limit" Maximum - NL	**232.1**		**205.9**	
					3	0.16%	1	0.05%
NO_2	1-hr	400	QC	"Off-Property Limit" Maximum - QC	**5391.0**		**Meets Criteria**	
					358	< 1.19%	--	--
			NL	"Off-Property Limit" Maximum - NL	**3577.3**		**431.9**	
					46	2.52%	3	0.00002%
SO_2	1-hr	900	QC	"Off-Property Limit" Maximum - QC	**1230.3**		**Meets Criteria**	
					6	< 1.19%	--	--
			NL	"Off-Property Limit" Maximum - NL	**Meets Criteria**		**Meets Criteria**	
					--	--	--	--
CO	1-hr	34 000	QC	"Off-Property Limit" Maximum - QC	**42942**		**Meets Criteria**	
					4	< 1.19%	--	--
			NL	"Off-Property Limit" Maximum - NL	**Meets Criteria**		**Meets Criteria**	
					--	--	--	--

* Maximum modelled concentration over 5 year's meteorological data.

** Exceedance count = Number of times with concentration above the standard during the 5 year modelling period. The exceedance count is for the cumulative air quality effect e.g. Background + DSO3 + DSO4 + HOWSE.

% of time = Count ÷ Number of averaging period in 5 years. For NO2 1-hr, SO2 1-hr and CO 1-hr averaging periods, the No Blasts result is "Meets Criteria", which means that results for the With Blast scenario are all caused by blasting events. Blasting events will occur once per week at most. Conservatively assuming that each blast at Howse and Fleming 7N causes a 1-hr air quality exceedance, this would translate to: 52 blasts/yr x 2 pits x 5 years = 520 blasts per 5 year. There are 5 yrs x 8760 hrs/yr = 43 800 hrs/5 yrs. Resulting in 520 ÷ 43 800 x 100 = 1.19% of time exceedance. In reality, the annual number of blasts per year is expected to be less at 30 and 33 for Fleming 7N and Howse, respectively.

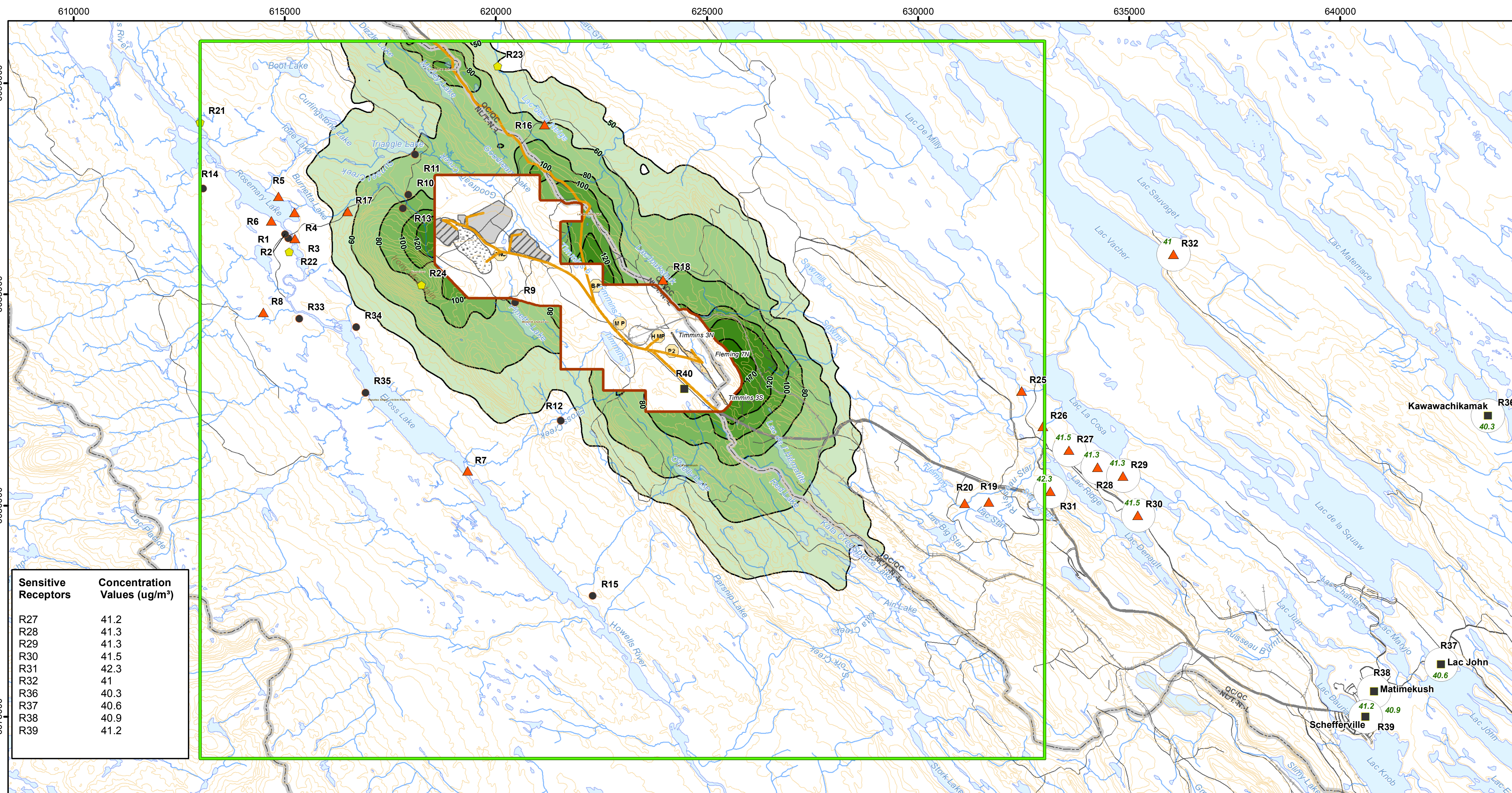
*** Figures 3.16 and 3.17 of the Air Dispersion Modelling Report show the locations of grid receptors with maximum predicted concentration for the "With Blasts" and "No Blasts" scenarios respectively.

Isoconcentration Contour Plots and Figures

In this section, for air pollutants having predicted maximum concentrations that exceed the applicable Project Air Quality Assessment Criteria, concentrations are presented in graphical format, eg.

isoconcentrations contour plots. It is important to note that the maximum predicted concentrations shown on the contour plots represent the single highest concentration predicted to occur at each location, at any time during the 5-year assessment period, and include background concentrations. Therefore, the contours shown do not represent a snapshot in time as these maxima may occur on different days, under different meteorological conditions. It should also be emphasized that the model results are based on the conservative emissions scenario described in Volume 2, Supporting Study E, which assumes that all sites within the LSA (DSO3, DSO4 and Howse) operate at their maximum capacities over the entire 5 year meteorological assessment period. Therefore, the results presented below are expected to be lower than those predicted by the model.

Results are also shown for 10 sensitive receptors which are outside of the study area, and so have no contour plots but have otherwise been included in the modelling process. Their values are shown and represented in a manner that corresponds with the corresponding Figure legend.



Sensitive Receptors	Concentration Values (ug/m³)
R27	41.2
R28	41.3
R29	41.3
R30	41.5
R31	42.3
R32	41
R36	40.3
R37	40.6
R38	40.9
R39	41.2

LEGEND

Sensitive Receptors
- Naskapi
- Innu
- Permanent
- Other

Study Areas
- Local Study Area (LSA)
- Air Quality Modelling Perimeter
- Road Included in the Model
- Road Not-included in the Model

TPM (24-hour) - With Blasts
- Isocontour

Concentration Range (ug/m³)
- 0-50
- 50-60
- 60-80
- 80-100
- 100-120
- 120-170
- 170-252

Infrastructure and Mining Components
- Plant 2
- Main processing Plant
- Howse Mini-Plant
- Batch Plant
- First Nations crusher/screener
- Existing Railroad
- Deposit
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Waste Dump/ In-Pit Dump
- Proposed Mine Haul Road

Basemap
- Existing road
- Contour Line (50 ft)
- Provincial Border
- Watercourse
- Water Body

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0678 , PR185-19-14, 2016-04-14, edickoum

N

0 2 4
Kilometers

UTM 19N NAD 83
SCALE: 1:90 000

SOURCES:

Basemap and Land Use Components
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,

Mining Components
Howse Minerals Limited/
MET-CHEM Howse Deposit Design
for General Layout., 2015
Groupe Hémisphères, Hydrology and update, 2013

AECOM

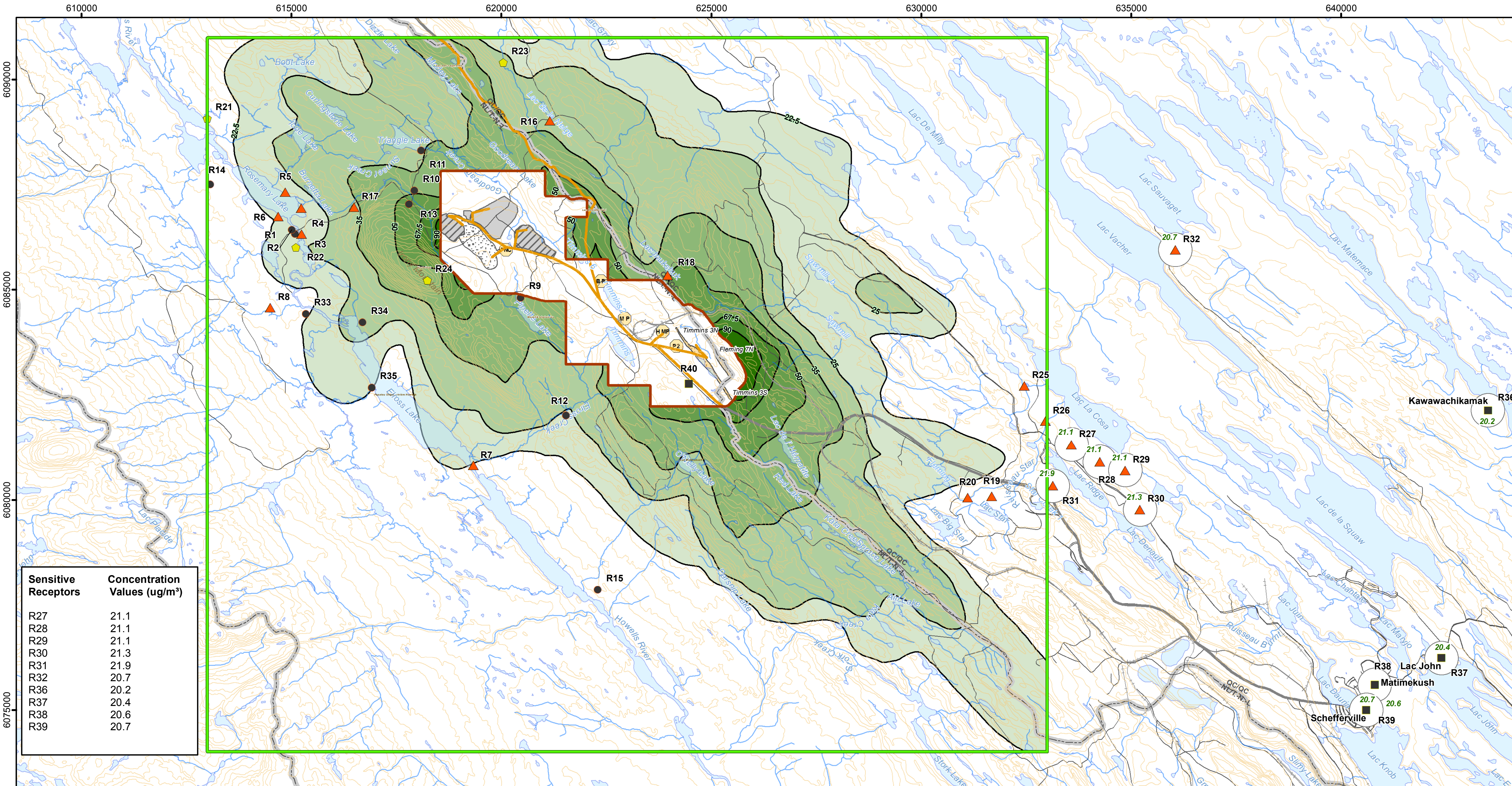
ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Maximum Concentrations - TPM (24-hour) - With Blasts

Howse Minerals Limited

GroupeHemispheres
5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 7.4



Sensitive Receptors	Concentration Values (ug/m³)
R27	21.1
R28	21.1
R29	21.1
R30	21.3
R31	21.9
R32	20.7
R36	20.2
R37	20.4
R38	20.6
R39	20.7

LEGEND

Sensitive Receptors
- Naskapi
- Innu
- Permanent
- Other

Study Areas
- Local Study Area (LSA)
- Air Quality Modelling Perimeter
- Road Included in the Model
- Road Not-included in the Model

PM10 (24-hour) - With Blasts
- Isocontour

Concentration Range (ug/m³)
- 0-22.5
- 22.5-25
- 25-35
- 35-50
- 50-67.5
- 67.5-90
- 90-158

Infrastructure and Mining Components
- P2 Plant 2
- MP Main processing Plant
- HMP Howse Mini-Plant
- BP Batch Plant
- FNC First Nations crusher/screener
- Existing Railroad
- Deposit
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Waste Dump/ In-Pit Dump
- Proposed Mine Haul Road

Basemap
- Existing road
- Contour Line (50 ft)
- Provincial Border
- Watercourse
- Water Body

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0678 , PR185-19-14, 2016-04-14, edickoum

N

0 2 4
Kilometers

UTM 19N NAD 83

SCALE: 1:90 000

SOURCES:

Basemap and Land Use Components
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,

Mining Components
Howse Minerals Limited/
MET-CHEM Howse Deposit Design
for General Layout., 2015
Groupe Hémisphères, Hydrology and update, 2013

AECOM

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Maximum Concentrations - PM10 (24-hour) - With Blasts

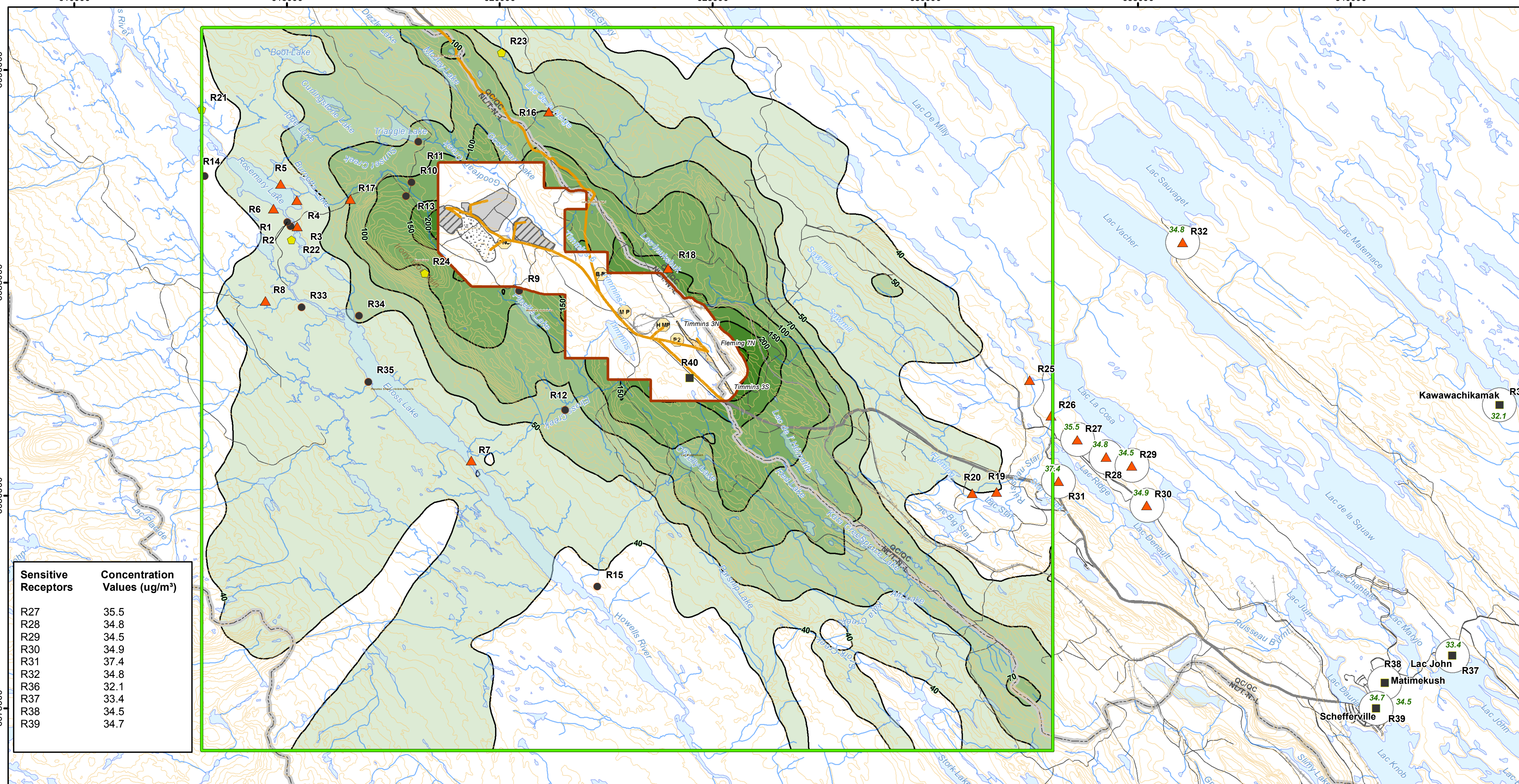
Howse Minerals Limited

GroupeHemispheres

5731, rue Saint-Louis,
Bureau 201, Lévis (QC)
Canada, G6V 4E2

1453, rue Beaubien est,
Bureau 301, Montréal (QC)
Canada, H2G 3C6

Figure 7.5



Sensitive Receptors	Concentration Values (ug/m³)
R27	35.5
R28	34.8
R29	34.5
R30	34.9
R31	37.4
R32	34.8
R36	32.1
R37	33.4
R38	34.5
R39	34.7

LEGEND

Sensitive Receptors
- Naskapi
- Innu
- Permanent
- Other

Study Areas
- Local Study Area (LSA)
- Air Quality Modelling Perimeter
- Road Included in the Model
- Road Not-included in the Model

NO2 (24-hour) - With Blasts
- Isocontour

Concentration Range (ug/m³)
- 0-40
- 40-50
- 50-70
- 70-100
- 100-150
- 150-200
- 200-290
- 290-365

Infrastructure and Mining Components
- P2 Plant 2
- MP Main processing Plant
- HMP Howse Mini-Plant
- BP Batch Plant
- FNC First Nations crusher/screener
- Existing Railroad
- Deposit
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Waste Dump/ In-Pit Dump
- Proposed Mine Haul Road

Basemap
- Existing road
- Contour Line (50 ft)
- Provincial Border
- Watercourse
- Water Body

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0678 , PR185-19-14, 2016-04-14, edickoum

N

0 2 4
Kilometers
UTM 19N NAD 83 SCALE: 1:90 000

SOURCES:

Basemap and Land Use Components
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,

Mining Components
Howse Minerals Limited/
MET-CHEM Howse Deposit Design
for General Layout., 2015
Groupe Hémisphères, Hydrology and update, 2013

AECOM

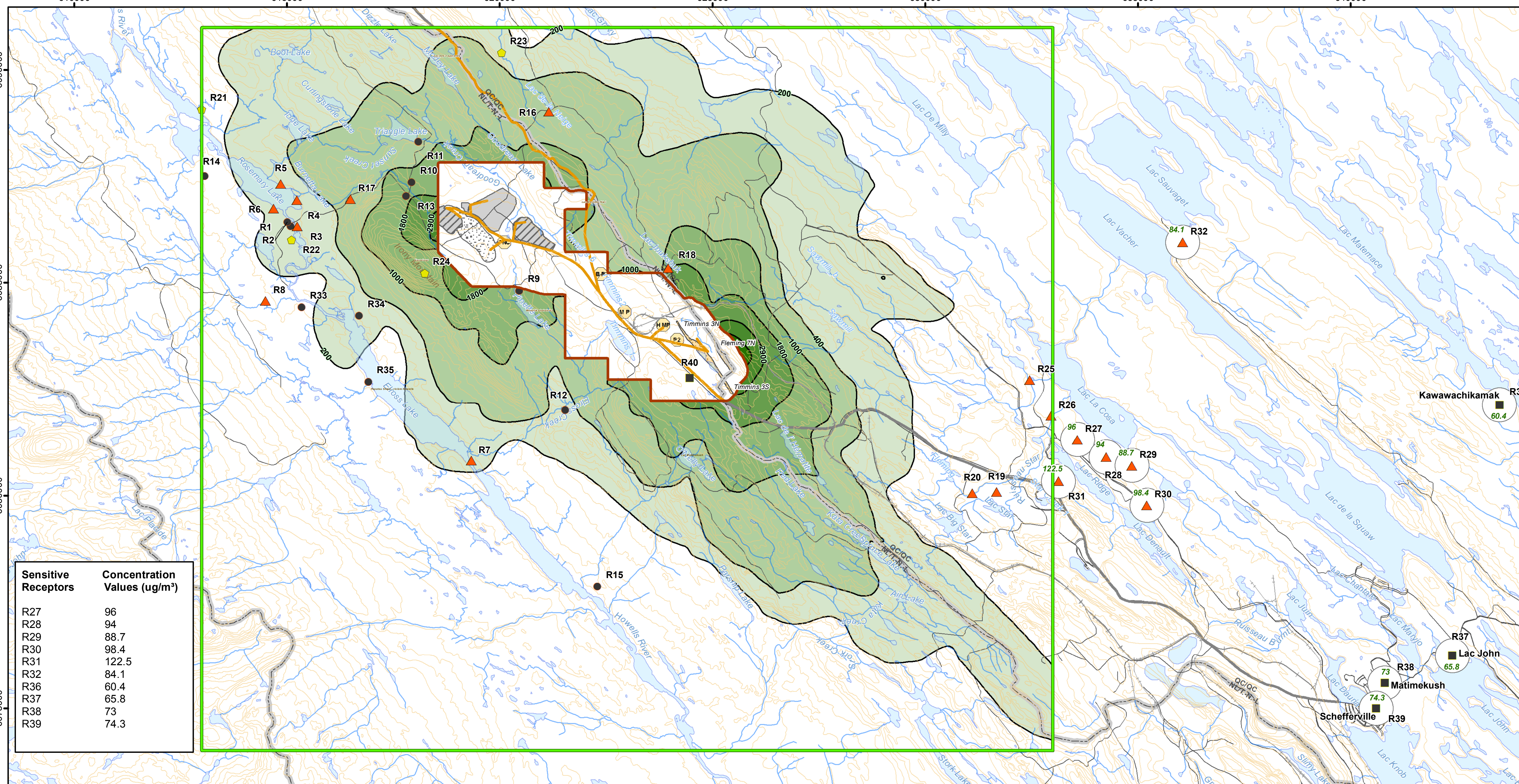
ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Maximum Concentrations - NO2 (24-hour) - With Blasts

Howse Minerals Limited

GroupeHemispheres
5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 7.6



Sensitive Receptors	Concentration Values (ug/m³)
R27	96
R28	94
R29	88.7
R30	98.4
R31	122.5
R32	84.1
R36	60.4
R37	65.8
R38	73
R39	74.3

LEGEND

Sensitive Receptors
- Naskapi
- Innu
- Permanent
- Other

Study Areas
- Local Study Area (LSA)
- Air Quality Modelling Perimeter
- Road Included in the Model
- Road Not-included in the Model

NO2 (1-hour) - With Blasts
- Isocontour

Concentration Range (ug/m³)
- 0-200
- 200-400
- 400-1000
- 1000-1800
- 1800-2900
- 2900-4000
- 4000-5391

Infrastructure and Mining Components
- P2 Plant 2
- MP Main processing Plant
- HMP Howse Mini-Plant
- BP Batch Plant
- FNC First Nations crusher/screener
- Existing Railroad
- Deposit
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Waste Dump/ In-Pit Dump
- Proposed Mine Haul Road

Basemap
- Existing road
- Contour Line (50 ft)
- Provincial Border
- Watercourse
- Water Body

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0678 , PR185-19-14, 2016-04-14, edickoum

N

0 2 4
Kilometers

UTM 19N NAD 83

SCALE: 1:90 000

SOURCES:

Basemap and Land Use Components
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,

Mining Components
Howse Minerals Limited/
MET-CHEM Howse Deposit Design
for General Layout., 2015
Groupe Hémisphères, Hydrology and update, 2013

AECOM

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Maximum Concentrations - NO2 (1-hour) - With Blasts

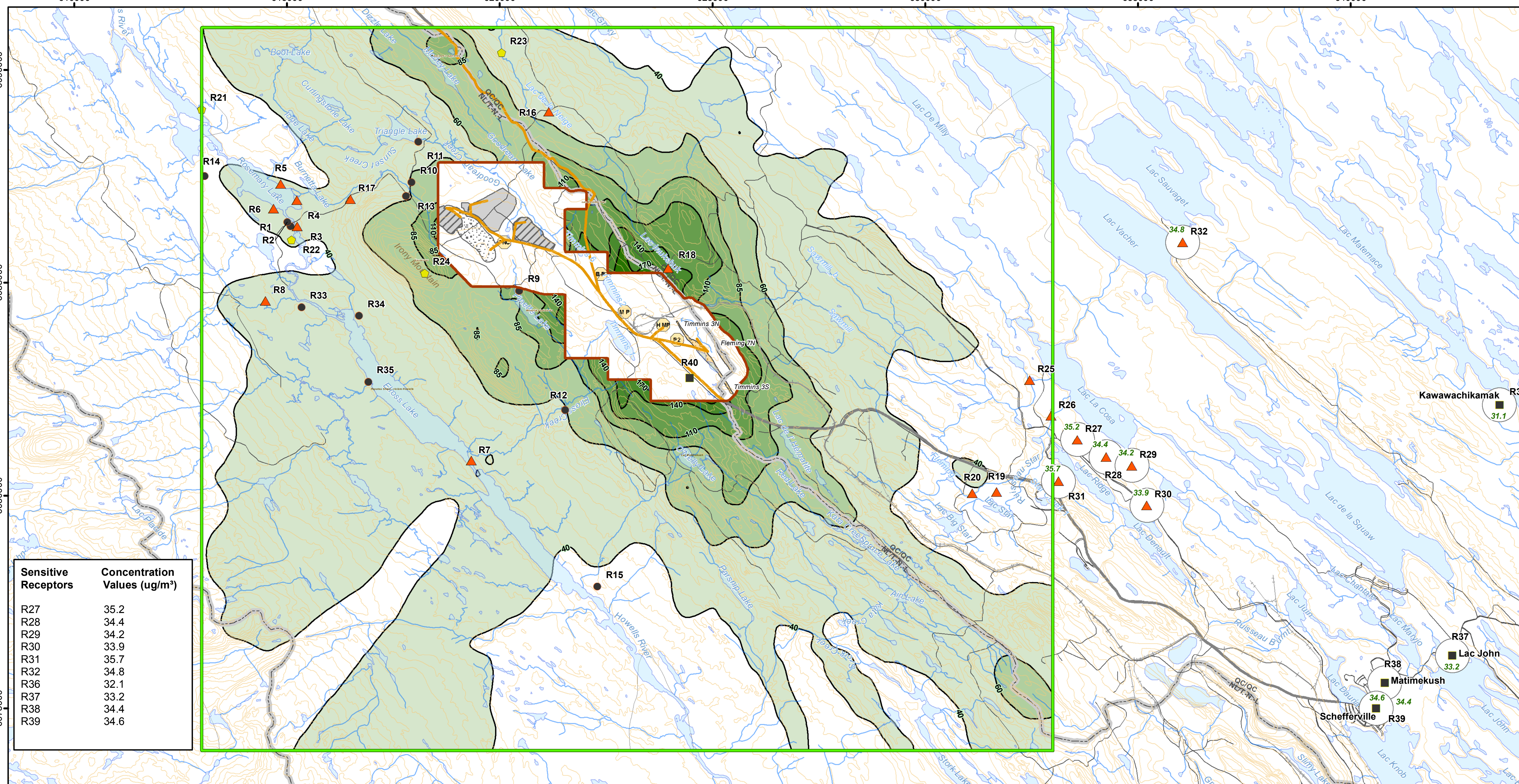
Howse Minerals Limited

GroupeHemispheres

5731, rue Saint-Louis,
Bureau 201, Lévis (QC)
Canada, G6V 4E2

1453, rue Beaubien est,
Bureau 301, Montréal (QC)
Canada, H2G 3C6

Figure 7-7



Sensitive Receptors	Concentration Values (ug/m³)
R27	35.2
R28	34.4
R29	34.2
R30	33.9
R31	35.7
R32	34.8
R36	32.1
R37	33.2
R38	34.4
R39	34.6

LEGEND

Sensitive Receptors
- Naskapi
- Innu
- Permanent
- Other

Study Areas
- Local Study Area (LSA)
- Air Quality Modelling Perimeter
- Road Included in the Model
- Road Not-included in the Model

NO2 (24-hour) - No Blasts
- Isocontour

Concentration Range (ug/m³)
- 0-40
- 40-60
- 60-85
- 85-110
- 110-140
- 140-170
- 170-316

Infrastructure and Mining Components
- P2 Plant 2
- MP Main processing Plant
- HMP Howse Mini-Plant
- BP Batch Plant
- FNC First Nations crusher/screener
- Existing Railroad
- Deposit
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Waste Dump/ In-Pit Dump
- Proposed Mine Haul Road

Basemap
- Existing road
- Contour Line (50 ft)
- Provincial Border
- Watercourse
- Water Body

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0678 , PR185-19-14, 2016-04-14, edickoum

N

0 2 4
Kilometers

UTM 19N NAD 83

SCALE: 1:90 000

SOURCES:

Basemap and Land Use Components
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,

Mining Components
Howse Minerals Limited/
MET-CHEM Howse Deposit Design
for General Layout., 2015
Groupe Hémisphères, Hydrology and update, 2013

AECOM

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Maximum Concentrations - NO2 (24-hour) - No Blasts

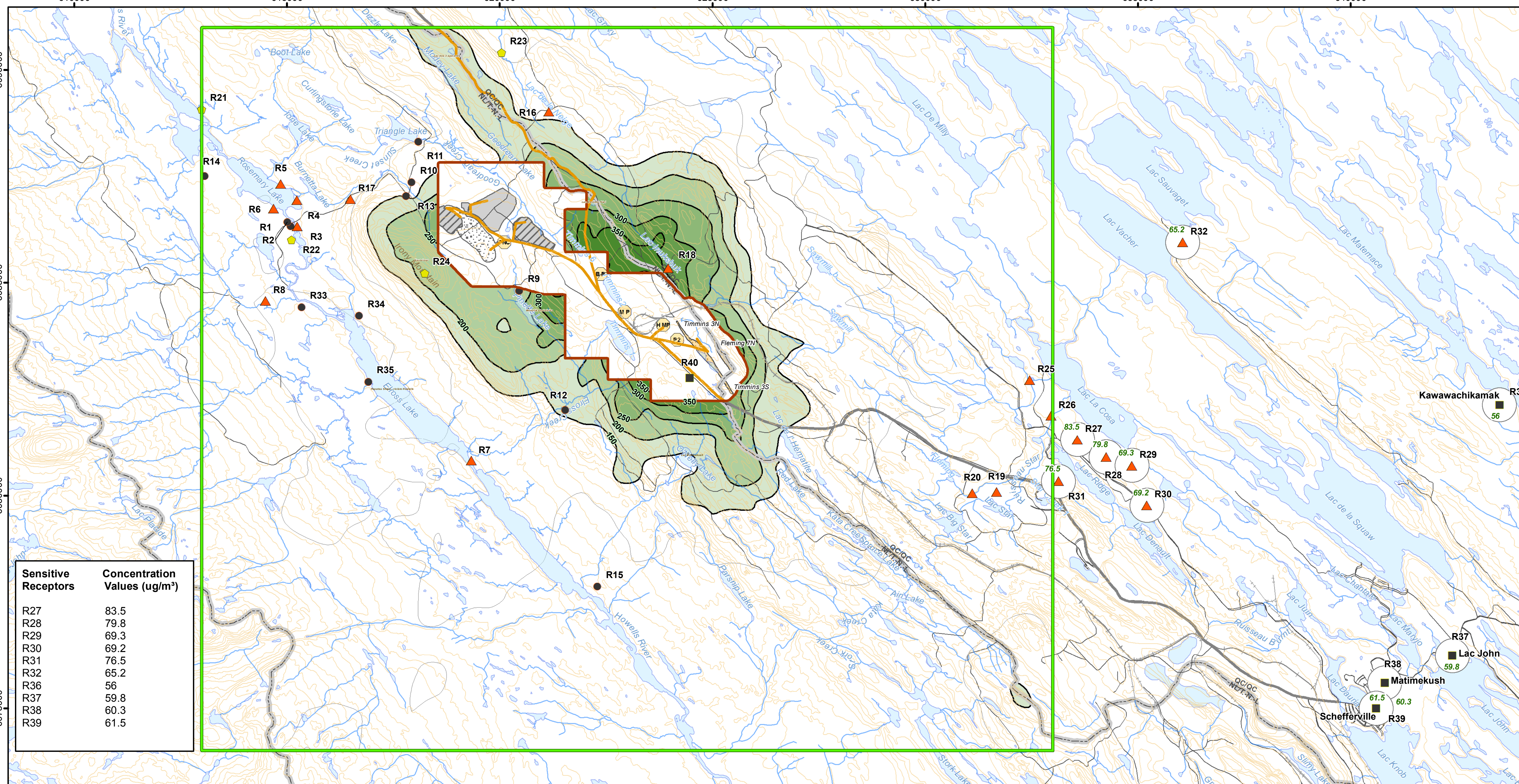
Howse Minerals Limited

GroupeHemispheres

5731, rue Saint-Louis,
Bureau 201, Lévis (QC)
Canada, G6V 4E2

1453, rue Beaubien est,
Bureau 301, Montréal (QC)
Canada, H2G 3C6

Figure 7.8



Sensitive Receptors	Concentration Values (ug/m³)
R27	83.5
R28	79.8
R29	69.3
R30	69.2
R31	76.5
R32	65.2
R36	56
R37	59.8
R38	60.3
R39	61.5

LEGEND

Sensitive Receptors
- Naskapi
- Innu
- Permanent
- Other

Study Areas
- Local Study Area (LSA)
- Air Quality Modelling Perimeter
- Road Included in the Model
- Road Not-included in the Model

NO2 (1-hour) - No Blasts
- Isocontour

Concentration Range (ug/m³)
- 0-150
- 150-200
- 200-250
- 250-300
- 300-350
- 350-400
- 400- 488

Infrastructure and Mining Components
- P2 Plant 2
- MP Main processing Plant
- HMP Howse Mini-Plant
- BP Batch Plant
- FNC First Nations crusher/screener
- Existing Railroad
- Deposit
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Waste Dump/ In-Pit Dump
- Proposed Mine Haul Road

Basemap
- Existing road
- Contour Line (50 ft)
- Provincial Border
- Watercourse
- Water Body

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0678 , PR185-19-14, 2016-04-14, edickoum

N

0 2 4
Kilometers

UTM 19N NAD 83
SCALE: 1:90 000

SOURCES:

Basemap and Land Use Components
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,

Mining Components
Howse Minerals Limited/
MET-CHEM Howse Deposit Design
for General Layout., 2015
Groupe Hémisphères, Hydrology and update, 2013

AECOM

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Maximum Concentrations - NO2 (1-hour) - No Blasts

Howse Minerals Limited

GroupeHemispheres
5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 7.9

Interaction of the Project with Air Quality and Potential Effects

Site Preparation and Construction Phase

During the site preparation and construction phase, all project activities will have potential interaction with air quality.

Potential interaction

- upgrading/construction of the Howse haul road, upgrading of the bypass road and water management infrastructures;
- pit development;
- installation of the Howse ore processing plant near the rail loop (e.g. Howse Mini-Plant);
- transportation and traffic;

➔ The effect associated with the above potential interactions is a **decrease in air quality**.

The nature of the effect is direct and the effect is adverse.

As indicated in the LSA, RSA and Temporal Boundaries section for the air quality component, the types of air contaminants and the areas from which air emissions will occur during the *Site Preparation and Construction* and *Decommissioning and Reclamation* phase will be similar to those encountered during the Operation phase. During all three phases, air emissions from diesel powered engines, dust emissions due to vehicle movements and blasting will occur, but rates of air emissions during the Operation phase will be continuous and of a higher intensity. One important reason why the nature of the air contaminants remains the same during the three phases is the fact all power used at the site is generated by diesel equipment; the site is not connected to the power grid. Consequently, the air quality effects study was conducted for the Operation phase only. Therefore, the effect assessment, mitigation measures, specific mitigation measures and methodological approach used to assess the air quality component are covered in the Operation phase section below and are applicable to all phases of the project.

Operation Phase

No potential interaction

During the operation phase, the following activities will have no interaction with air quality:

- hazardous waste disposal;
- explosives waste management; and
- treatment of sanitary wastewater.

Potential interaction

- removal and storage of remaining overburden and topsoil;
- blasting and ore-extraction;
- mineral processing;
- operation of waste rock dumps;
- dewatering;
- transportation of ore and traffic;

- solid waste disposal; and
- ongoing site restoration.

➔ The effect associated with the above potential interactions is a **decrease in air quality**.

The nature of the effect is direct and the effect is adverse.

Decommissioning and Reclamation Phase

No potential interaction

During the decommissioning and reclamation phase, all project activities will have potential interaction with air quality.

Potential interaction

- Demobilization of Howse facilities and heavy machinery;
- Transportation and traffic;
- Final site restoration.

➔ The effect associated with the above potential interactions is a **decrease in air quality**.

The nature of the effect is direct and the effect is adverse.

For the reasons indicated previously, the air quality effect assessment was conducted for the Operation phase only.

7.3.2.3 Mitigation Measures

Standard Mitigation Measures

The following standard mitigation measures will be applied during all project phases (Table 7-19).

Table 7-19 Standard Mitigation Measures for Air Quality

CODE	MEASURE	MITIGATION EFFECT
Tree removal and timber management (TM)		
TM10	Ensure that cleared areas that are left bare and exposed to the elements are kept to a strict minimum.	Minimizing bare areas will reduce potential for airborne dust generation by wind erosion during dry periods
Erosion and Sedimentation Control (ES)		
ES15	Avoid storing excavated material on steep slopes and ensure they are properly compacted. To ensure better compaction of fill more than 60 cm thick, it is preferable to deposit several thin layers rather than a single layer. In zones with no transversal slope, the height and depth of the fill must be limited to three metres.	Airborne dust from wind erosion of excavated material piles will be transported on shorter distances if their height is limited
Waste Management (WM)		
WM2	Emphasize, in the following order, reduction at source re-use, recycling and conversion of	

CODE	MEASURE	MITIGATION EFFECT
	waste. Replace hazardous products with less harmful ones if possible. The quantity of waste can be reduced at source by using up products completely, buying in bulk and accurately estimating required amounts.	Waste reduction will minimize potential air emissions due to landfilling of organic wastes and transport to the landfill site
WM7	Comply with applicable regulations that prohibit the burning of waste.	
Drilling and Blasting (DB)		
DB3	Only properly qualified and trained personnel may handle and detonate explosives as per the manufacturer's instructions and applicable laws and regulations.	Best practices used for drilling and blasting will minimize short-term air emissions associated with these activities. Combine these standard measures to the specific measure for management of NOx from Blasts.
DB4	The manufacturer's instructions must be followed to ensure that blasting procedures are safe both for humans and the environment.	
DB21	Take the necessary precautions to control dust emissions from drilling.	
DB22	Fill borehole necks with clean crushed rock to eliminate dust and gas emissions during blasting.	
Construction Equipment (CE)		
CE4	Construction equipment must be delivered to the site in good working order, without leaks and equipped with all emissions filters required to comply with emissions regulations and reduce noise disturbance. The equipment must be regularly inspected to detect any leaks or mechanical defects that could lead to fuel, lubricant or hazardous material spills.	Well maintained engines will keep air emissions in-line with regulations
CE8	Install appropriate road signs and follow speed limits in order to minimize accidents and disturbance to the environment.	Road dust emissions are minimized at lower speed.
CE14	Use low sulfur content fuels.	There is a direct relationship between SO_2 emissions and fuel sulfur content. Low fuel sulfur content, means low SO_2 emissions. Fuel sulfur content is limited to 15 ppm, as per Canadian regulations
CE15	The dust-control liquid used must comply with GNL regulations.	Application of a dust control agent will reduce road dust emissions
Mining Operations (M)		
M3	Reports required by governments must be submitted by the stipulated deadlines.	n/a
Management of Ore, Rock Piles, Waste Rock, Tailings and Overburden (MO)		
MO1	Take the necessary steps to prevent wind erosion of stored tailings and avoid slippage around the mine tailing storage sites.	Reduce dust emissions by minimizing tailings disturbances Minimizing tailings volumes reduces dust emissions caused by erosion
MO4	Prepare scenarios for using tailings, particularly waste rock. For example, tailings could be used to build roads and railways.	
MO5	The physico-chemical parameters of the ore and tailings must be characterized.	

CODE	MEASURE	MITIGATION EFFECT
MO6	Control dust emissions from tailing storage and handling.	
Air Quality Control (AQ)		
AQ1	Dust extractors with filter bags will be used to control dust emissions at the Howse Mini-Plant dryers.	Well maintained fabric filter dust emission control reduces dust emissions by >95%
AQ2	Dust recovered from the dust extractor must be disposed of in a manner that prevents dust emissions.	Good practices in dust handling minimizes punctual releases in the environment
AQ3	Use a water-spraying system at conveyor transfer and drop points.	Water spraying is efficient in reducing dust releases
AQ4	Mix the ore with water in the drum scrubber.	Water mixing is efficient in controlling dust from being released at the source
AQ5	A dust extractor will be used to limit dust emissions from drills.	The dust extractor limits the area in which wind gusts could blow dust away from the drill
AQ6	Roads will be sprayed to reduce dust emissions during dry periods.	Application of a dust control agent will reduce road dust emissions
Rehabilitation (R)		
R1	Follow good practices presented in the rehabilitation plan.	Dust emissions from wind erosion will be minimized by considering it as a specific issue in the rehabilitation plan
R2	Draw up a rehabilitation plan	
R3	Produce post-mining and post-rehabilitation monitoring reports.	

Specific Mitigation Measures

The following specific mitigation measures will be applied to limit effects on air quality by the Project activities (Table 7-20).

Table 7-20 Specific Mitigation Measures for Air Quality

SPECIFIC MITIGATION MEASURES FOR AIR QUALITY	
Measure	**Mitigation Effect**
TSMC will develop a plan for the prevention and management of blast generated NOx. This plan will be based on the Code of Good Practice prepared by the Australian Explosives Industry and Safety Group Inc. (2011). A draft version of the Plan is available in Volume 1 Appendix XIX.	The plan will provide information and recommended guidelines to assist in the prevention and management of blast generated NOx gases from blasting operations and will be specific to NOx.
SPECIFIC MITIGATION MEASURES FOR AIR QUALITY	
Measure	**Mitigation Effect**
TSMC will develop a plan for the prevention and management of blast generated NOx (Volume 1 Appendix XIX). This plan will be based on the Code of Good Practice prepared by the Australian Explosives Industry and Safety Group Inc. (2011).	The plan will provide information and recommended guidelines to assist in the prevention and management of blast generated NOx gases from blasting operations and will be specific to NOx.

7.3.2.4 Residual Effects Significance Assessment

The overall methodological approach to assess the environmental effects is presented in Section 5. However, in order to apply this methodology to the air quality VC, it is essential to consider assessment criteria applicable specifically to this VC (Table 7-21). The project's air quality assessment criteria are based on air quality standards promulgated by environmental authorities. These air quality standards were developed to protect human health. From an ecological perspective, short-term exceedances of air quality assessment criteria as identified in this EIS have limited effects. Air quality resilience to disturbance is largely good after the completion of the project. After completion of the project, major active sources of air emissions (ore mining, transport and processing) will stop. Inactive sources of air emissions (piles) may continue to be affected by wind erosion.

Table 7-21 Assessment Criteria Applicable to Air Quality

TIMING		
Inconsequential timing	**Moderate timing**	**Unfavorable timing**
Timing of predicted Howse air emissions has no consequences on air quality	Timing of predicted Howse air emissions may have consequences on air quality	Timing of predicted Howse air emissions has consequences on air quality
SPATIAL EXTENT		
Site specific	**Local**	**Regional**
Effects are limited to the footprint of the project.	Effects extend beyond the footprint, but do not extend outside the LSA.	The effect of the Howse Project will affect air quality in substantial part or the entire RSA.
DURATION		
Short	**Medium**	**Long**
>1 hour Air quality standards for 1-hour periods are applicable. Effects of blasts are modelled as one hour events.	>24 hours Air quality standards for 24-hour periods are applicable. Maximum activities can occur on a continuous basis over several periods of 24 hours	>1 year Air quality standards for 1-year periods are applicable. Project activities will be conducted at varying intensities all year long
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Air quality returns to pre-project levels	Air quality degradation persist after source of effect ceases, but its magnitude is significantly lower	Air quality degradation persist after source of effect ceases
MAGNITUDE		
Low	**Moderate**	**High**
Air quality at sensitive receptors within the RSA is barely or not affected by the Howse Project (all parameters meet Project's air quality assessment criteria)	Air quality at sensitive receptors in the RSA is moderately affected by the Howse Project because air modelling results do not meet the Project's air quality assessment criteria.	Air quality at sensitive receptors in the RSA is severely affected by the Howse Project because air modelling results persistently do not meet the Project's air quality assessment criteria.
FREQUENCY		
Once	**Intermittent**	**Continual**

Air quality standards will be exceeded once	Air quality standards will be exceeded occasionally, such as during blasting events.	Air quality standards will be exceeded year round.

Timing

Howse Project activities will occur throughout the year. The air quality modelling study included hourly meteorological conditions over a 5 year period. Maximum predicted results for several pollutants were compared were compared to project specific assessment criteria, regardless of season and timing. Logically, dust emissions from the project are expected to be higher and more visible during the summer. Additionally, withstanding modelling limitations, blasting events at the Howse pit are predicted to create short-term air quality exceedances, and so the effect is high (Value of 3).

Spatial Extent

The air dispersion modelling study predicts that short-term air quality assessment criteria may be exceeded at certain sensitive receptors and at geographical grid receptors mostly due to the methodology used to input blasting events in the air modelling software. These short-term exceedances are limited to the LSA. No exceedances of air quality assessment criteria are predicted outside the LSA. As such, the geographic effect of the Howse Project is expected to extend beyond the footprint, but does not extend outside the LSA (Value of 2).

Duration

Air quality will be negatively impacted from the beginning of the construction phase up to the end of the Howse Project, and even after. Air emissions will be generated during all phases of the project. The nature of the air pollutants will be similar throughout all phases of the project, but the highest air emissions effects will occur during the Operation phase, due to the intensity of mining, transportation and processing activities. Air modelling results predicted that all long term (e.g. 1-yr averaging period) project air quality assessment criteria are met, but nonetheless the duration of the effect will last throughout the life of the mine. For this reason, the duration is considered to be long (Value of 3).

Reversibility

After the high intensity operation phase stops, air quality will mostly return to pre-project conditions. Airborne dust due to wind erosion from piles may still occur after the Project but with the proposed mitigation measures and pit design, if dust from piles becomes airborne, its effects will be limited to the project footprint. As such, the air quality effect of the Howse Project is considered reversible (Value of 1).

Magnitude

When considering the Howse Project only and sensitive receptors, the single air quality assessment criterion for which exceedances are predicted is NO_2 (1-hr) under the “With Blasts” scenario only, see Table 7-16. The exceedances frequency at the 9 sensitive receptors identified in Table 7-16 (R9, R10, R11, R13, R16, R17, R18, R24, and R40) is less than 1% of the time. Predicted exceedances correspond to the worse meteorological condition during a blasting event that will generate the highest concentration at a receptor. When blasting events are excluded from the model, the Howse Project in itself does not create exceedances of air quality assessment criteria at any receptor (neither sensitive nor non-sensitive). Finally, at non-sensitive receptors (e.g. geographical grid receptors) located on or in close proximity to the air quality modelling perimetre, the model predicts limited exceedances of air quality assessment criteria when the worse-case scenario (e.g. “With Blasts”). For these reasons, the magnitude is considered to be moderate (Value of 3).

Frequency

The frequency is intermittent, since even though activities of the Howse Project will occur on a continuous basis for at least 7 months per year, exceedances of air quality standards are predicted to occur infrequently. (Value of 2).

7.3.2.4.1 Significance

The residual effects of the Howse Project on air quality are expected to be significant (value of 14). This is representative of the magnitude of the effects of the Project as well as the expected reversibility of the effects on air quality. The primary disturbance caused to air quality at sensitive receptors by the Howse Project is due to intermittent blasting events at the pit.

Likelihood

The likelihood of Howse having an effect on air quality is **high**, since air emissions will be generated throughout the duration of the project and air dispersion modelling is showing non-negligible air quality impacts from the Howse project.

7.3.3 Noise

Noise and vibration can provoke complaints and negatively affect quality of life when levels exceed a pre-existing background level or attain a certain absolute level. The negative effects may include sleep disturbance, annoyance, stress, and potential hearing damage (at high noise levels). Vibration also has the potential to damage structures. For those reasons, noise and vibration is identified as a VC. As mentioned previously, typical daily operations (without blasting) were assessed separately from blasting.

All three project phases consist of similar equipment and activities; however, the operation phase has the highest noise effects, due to the processing plant operation and full-scale production. Consequently, a noise effects study was conducted for the operation phase; summary results and conclusions are presented in the section below, while a detailed report is available in Volume 2 Supporting Study F.

Noise and/or vibration were mentioned six times during Aboriginal consultations in 2015. Concerns raised were:

- effects of noise made by helicopters, planes, train, trucks and blasting on resources, which leave the area was mentioned as an issue;
- the impacts of vibrations are a preoccupation;
- noise from machinery is a source of disturbance; and
- noise can be heard from far away and it drives the animals away.

The effect of noise on caribou and avifauna are described in Sections 7.4.3 and Section 7.4.8 below, respectively, and further in the cumulative effects sections of these components in Sections 8.6 and 8.7, respectively.

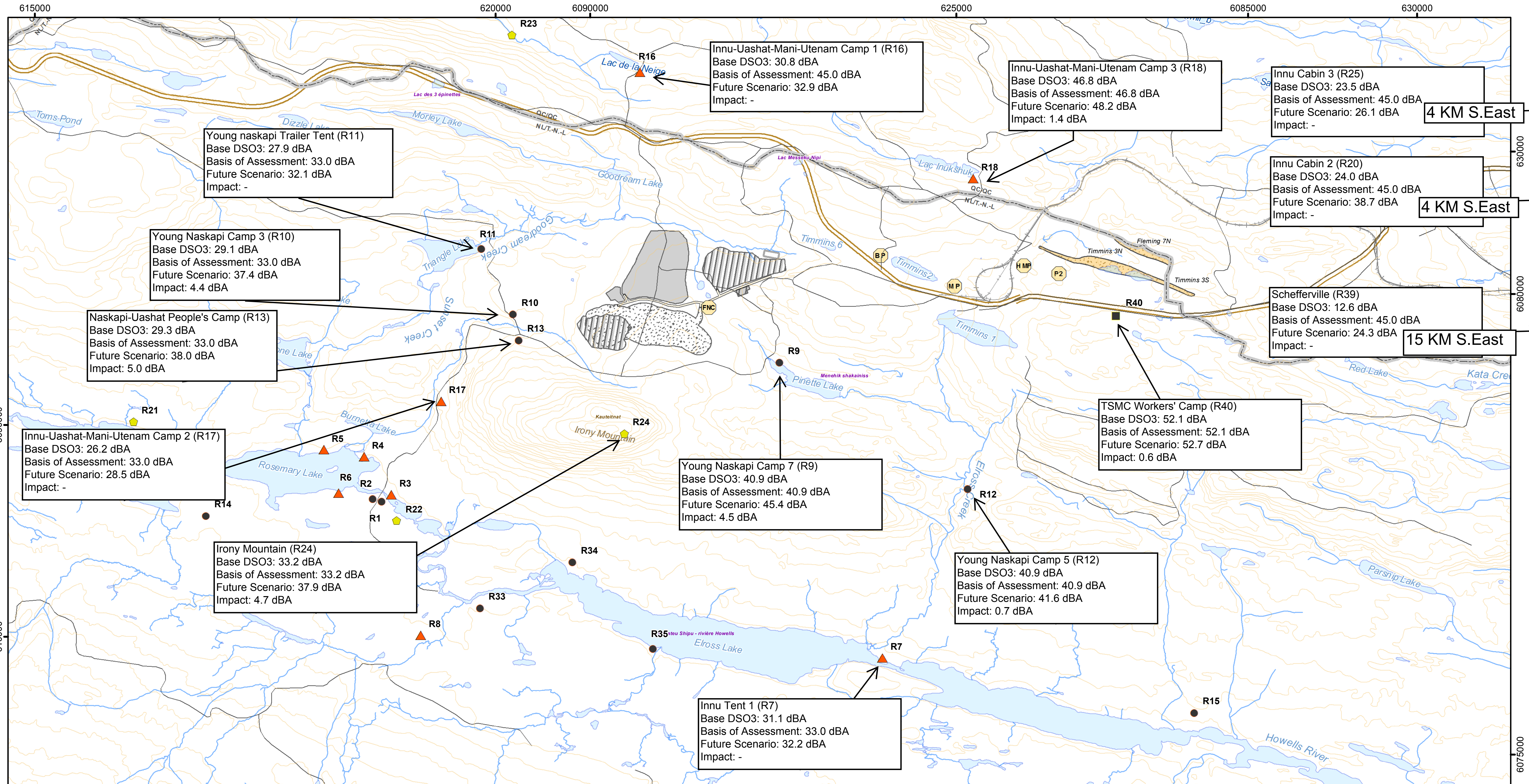
7.3.3.1 Component Description

LSA, RSA and Temporal Boundaries

The LSA is limited to within mapping of the DSO3 and Howse Mine study area (see Figure 7-10). This includes noise-sensitive areas near the Howse Mine, Irony Mountain, and Pinette, Rosemary, Elross, and Triangle Lakes. The Town of Schefferville was also assessed, as it is the closest town to the Howse Mine. The assessed areas are representative of the worse-case locations for each noise sensitive area. Areas further from mining operations will receive lower noise and vibration impacts.

The RSA includes areas outside mapping. As project noise is not expected to be above background levels at approximately 5 kilometers from the Howse Mine (within the LSA), project-related noise and vibration were not assessed in the RSA.

Mining activities at the Howse Property are expected to be ongoing until 2032, for a total of 15 years. Technical data used in the noise modelling study was obtained for equipment and activities in use at the project. Similarly, other projects in the vicinity of Howse will also impact noise levels, namely DSO3 and DSO4. Noise data for equipment and activities, within the LSA, at these two projects that are currently in startup mode, were incorporated in the noise modelling study. Therefore, the temporal boundaries for the Noise/Vibration component study covers the Operation phase of the project.



LEGEND

Sensitive Receptors

- Naskapi
- Innu
- Permanent
- Other

Infrastructure and Mining Components

- P2 Plant 2
- MP Main processing Plant
- HMP Howse Mini-Plant
- BP Batch Plant
- FNC First Nations crusher/screener
- Road to DSO Area 4
- Existing Railroad
- Deposit
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Site Infrastructure
- Proposed Waste Dump/ In-Pit Dump
- Proposed Sedimentation Pond
- Proposed Mine Haul Road

Basemap

- Existing road
- Contour Line (50 ft)
- Provincial Border
- Watercourse
- Water Body

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0674 , PR185-19-14, 2015-10-15, edickoum

N

0 2 4
Kilometers

UTM 19N NAD 83 SCALE: 1:50 000

SOURCES:

Basemap and Land Use Components
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,

Mining Components
TATA Steel Minerals Canada Limited/
MET-CHEM Howse Deposit Design
for General Layout., 2013
Groupe Hémisphères, Hydrology and update, 2013

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Noise and Vibration Receiver Location and Impact Results

Howse Minerals Limited

GroupeHemispheres
5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 7.10

Existing Literature

The ambient background noise level measurements taken by Tecsult in 2006 (Groupe Hémisphères, 2014a) are used to describe ambient noise levels prior to the start of mining. The ambient noise in the area is controlled by the natural environment (and not by human activity) and which can be considered fairly uniform. As such, two of the measurement sites can be considered as representative of the LSA.

Noise measurements taken by Tecsult were measured using a Type-2 sound level meter (TES-1358), as prescribed in Publication 651 Electroacoustics – Sound Level Meters (1979) of the International Electrotechnical Commission. Tecsult operated the sound level meter in slow mode with a frequency weighting in A-weighted decibels (dBA). The noise measurements were performed outdoors away from human activity. The microphone was placed at a height of 1.2 meters above ground level, away from obstacles and traffic.

Table 7-22 presents the relevant results of the ambient noise level measurements obtained at the two representative measurement locations, during day and night-time periods. The Tecsult report defined the ambient background as the L_{95} measurement. The L_{95} value is the noise level that matched or exceeded 95% of the measurement period which typically is representative of the base background noise level, without short duration effects (e.g. without plane flybys). Background noises (L_{95}) fluctuated between 33 and 36 dBA. Noise levels are considered controlled by natural and not man-made sounds, as the measured background night time levels are higher than the day time background noise.

Table 7-22 Results of Ambient Noise Measurements (Tecsult, 2006)

LOCATION		PERIOD	AMBIENT NOISE (DBA)	OBSERVATIONS AT TIME OF NOISE MEASUREMENTS
ID	COORDINATES (DECIMAL DEGREES)		L95	
Station 1	-67.21595 54.89924	Day 10:26-11:26 10/02/2006	33	Light wind Presence of birds Passing of an airplane Passing of two trucks
		Night 0:38-1:36 10/03-2006	36	Light wind Passing of a truck
Station 2	-67.23445 54.89814	Day 14:12-15:12 10/02/2006	34	Light wind Presence of birds Passing of a helicopter
		Night 4:17-4:59 10/03/2006	35	Light wind Presence of birds Passing of an airplane Passing of one truck

Data Gaps

Insufficient detail on topographical and soil conditions was available for blasting vibration and overpressure assessment. As such, prediction adjustments to suit site-specific conditions could not be completed. Therefore, blast vibration and overpressure predictions are based on generic conservative environmental and topographical conditions.

7.3.3.2 Effects Assessment

Literature review and Current Studies Data Used to Assess the Potential Effect

Current Study

A review of Newfoundland and Labrador Department of Environment and Conservation information has revealed that there are no available noise and vibration guidelines. A review of CEAA sources has also revealed no specific guidelines or limits. In addition, Health Canada states: "Health Canada does not have noise guidelines or enforceable noise thresholds or standards" (Health Canada, 2010).

However, Health Canada does recommend a change in highly annoyed percentage (%HA_n) as a measure for determining health impacts of noise generated by wind turbine, road traffic, and industrial noise sources. Health Canada has recommended that noise mitigation be investigated when a project related increase in %HA_n is greater than 6.5%. Detailed explanations of criteria can be found in Volume 2 Supporting Study F.

Receivers in Newfoundland and Labrador were assessed with respect to the anticipated community response to changes in noise level due to the Project. Guidance on this relationship is provided in ISO/R 1996, *Assessment of Noise with Respect to Community Response*. Similar to traffic noise impact assessments and other projects with criteria based on noise level difference, a 5dB exceedance of criteria was adopted as the threshold for noise mitigation investigation for Newfoundland and Labrador receivers. Receivers in Quebec were assessed against the Quebec Guidelines for stationary sources (MDDEFP, 2006). Detailed explanations of criteria can be found in Volume 2 Supporting Study F.

Noise levels for the base and future scenarios were modeled with the ISO 9613 noise prediction algorithm implemented in the CadnaA modelling package. Noise levels for the train were modeled using the railroad Federal Transit Association (FTA) methodology, also implemented in CadnaA (USDT, 2006b). Only the worse-case (closest) receptors were modelled. Receptors further removed will have lower noise impacts. A total of 40 receptors were identified (towns consisting of many houses were counted as a single receptor). The 14 modelled receptors are representative of the worse-case locations.

Project Related Noise and Potential Effects During Typical Daily Operations

Noise modelling for two scenarios was required for the typical daily operations assessment: Base DSO3, and future case. The base DSO3 case was modeled with noise sources at the following areas:

- Main Processing Plant;
- Production Plant 2 (currently operating east of the Main Processing Plant);
- Timmins 3,4,7 Mining Sites;
- Fleming 7 Mining Site;
- roads connecting the production plants and the Timmins and Fleming mining sites;
- road connecting DSO3 to Kivivic mine site (e.g. DSO4).

Trains are not currently in daily operation during the Base DSO3 operations, and therefore were excluded from the base DSO3 noise modelling. The future worse-case scenario with the highest amount of mine production contains noise sources at the same areas listed above, (with the exceptions of Timmins mine sites which will no longer be active during the worse-case scenario), in addition to the following:

- Howse mining site;
- roads connecting plants and the Howse mining site;
- daily train operations east of Plant 1;
- Howse mini-plant (processing plant for Howse ore) located near the rail loop;
- First Nations crushing site (located next to the Howse Mine Site, on the east side)[5].

Equipment noise data was gathered from manufacturer data, previous equipment measurements, BSI British Standards (BSI, 2008), and Roadway Construction Noise Model (RCNM) data (USDT, 2006a). Train data was provided by Howse Minerals Limited. Detailed sound power levels and source data can be found in Volume 2 Supporting Study F.

Equipment types included in the noise modelling is listed below. A full detailed equipment list (including make, model number, serial number [as applicable], negligible sources, and number at each location) for all locations are provided in Volume 2 Supporting Study F.

- vibrating screen;
- apron feeder;
- feed hopper;
- hydraulic rock breaker;
- primary sizer;
- secondary sizer;
- roof fans;
- wall fans;
- ventilation fans;
- HVAC ventilation unit;
- 2MW generators;
- generator rad fans;
- hydraulic excavators;
- production drill;
- track dozer;
- road grader;
- haul trucks;
- train (idling and traveling); and

[5] Although a First Nations Quarry was in the initial planning stages under the Howse Project (see section 2.5 for a description of all Project Alternatives), this activity is currently no longer considered, and that for the foreseeable future. However, the First Nations Quarry was included as a noise source in the Noise and Vibration Modelling Report (Volume 2 Supporting Study F) and consequently in the results presented herein. We propose that this scenario is a 'worse-case' scenario and will continue to be evaluated for its effects on the present component.

- diesel-fired burners;
- induced draft fans; and
- Drill noise was modeled using RCNM noise data, and will require mitigation if noise reaches predicted levels. However, RCNM data is conservative. This data does not account for localized conditions and additional factors (drill speed, drilling time, equipment used). Mitigation for drilling may not be required if noise levels are lower than predicted.

A number of areas around the mining operations were identified as noise and vibration sensitive. The areas were located in the provinces of Quebec, and Newfoundland and Labrador. These locations included:

- Innu camps;
- Uashat-Mani-Utenam Camps;
- Naskapi camps;
- workers' camp; and
- towns (Schefferville, Kawawachikamach, Lac John and Matimekush[6]).

Predicted day-time and night-time noise level impacts at each nearby Newfoundland and Labrador receptor are presented in Table 7-23 and Table 7-24. Each receptor is representative of noise sensitive areas surrounding the two production plants and each mining site.

Table 7-23 Day-Time Base and Future Scenario Noise Levels - Newfoundland and Labrador

RECEPTOR	RECEPTOR ID	BASE DSO3 NOISE LEVEL (DBA)	BASIS OF ASSESSMENT (DBA)[1]	FUTURE SCENARIO NOISE LEVEL (DBA)	IMPACT (DBA)
TSMC Workers' Camp	R40	52.1	52.1	52.7	0.6
Innu Tent 1 (Elross Lake)	R7	31.1	33.0	32.2	-
Young Naskapi Camp 7 (Pinette Lake)	R9	40.9	40.9	45.4	4.5
Young Naskapi Camp 3	R10	29.1	33.0	37.4	4.4
Young Naskapi Trailer Tent (Triangle Lake)	R11	27.9	33.0	32.1	-
Young Naskapi Camp 5 (Elross Creek)	R12	40.9	40.9	41.6	0.7
Naskapi – Uashat People's Camp	R13	29.3	33.0	38.0	5.0
Innu - Uashat - Mani-Utenam Camp 2	R17	26.2	33.0	28.5	-
Irony Mountain	R24	33.2	33.2	37.9	4.7

1: Ambient background measurements indicate an existing noise level without mining of 33-35 dBA.

[6] Schefferville was assessed instead of Kawawachikamach, Lac John and Matimekush as Schefferville is in closer proximity to the mining operations.

Table 7-24 Night-Time Base and Future Scenario Noise Levels - Newfoundland and Labrador

RECEPTOR	RECEPTOR ID	BASE DSO3 NOISE LEVEL (DBA)	BASIS OF ASSESSMENT (DBA)	FUTURE SCENARIO NOISE LEVEL (DBA)	IMPACT (DBA)
TSMC Workers' Camp	R40	52.1	52.1	52.7	0.6
Innu Tent 1 (Elross Lake)	R7	31.1	34.9	32.1	-
Young Naskapi Camp 7 (Pinette Lake)	R9	40.9	40.9	45.4	4.5
Young Naskapi Camp 3	R10	29.1	34.9	37.4	2.5
Young Naskapi Trailer Tent (Triangle Lake)	R11	27.9	34.9	32.1	-
Young Naskapi Camp 5 (Elross Creek)	R12	40.9	40.9	41.6	0.7
Naskapi – Uashat People's Camp	R13	29.3	34.9	38.0	3.1
Innu - Uashat - Mani-Utenam Camp 2	R17	26.2	34.9	28.4	-
Irony Mountain	R24	33.2	34.9	37.7	2.8

1: Ambient background measurements indicate an existing noise level without mining of 33-35 dBA.

The predicted noise impact (≥ 5dB) at the Naskapi – Uashat People's Camp (R13) camp site (west of Howse Mine) triggers mitigation investigation. The noise sources creating the greatest noise impact on the camp site are predicted to be the drill operating at the Howse mining site (for the blast charges), and the First Nations crusher operation near Howse mine (note: FN crusher is no longer considered, see Footnote 5). Sporadic noise complaints are expected if no mitigation is implemented. Noise impact at Irony Mountain is close to but does not exceed criteria. Moving the First Nations crusher further north behind an existing berm or overburden pile may reduce likelihood of noise complaints (note: FN crusher is no longer considered, see Footnote 5 in previous page).

Predicted day-time and night-time noise level impacts at each nearby Quebec receptor are presented in Table 7-25 and Table 7-26. For receptors in Quebec, sound levels were assessed against the greater of predicted base level ambient noise or maximum L_{eq} levels set for Zone I areas.

Table 7-25 Day-Time Base and Future Scenario Sound Levels - Quebec

RECEPTOR	RECEPTOR ID	BASE DSO3 NOISE LEVEL (DBA)	BASIS OF ASSESSMENT (DBA)	FUTURE SCENARIO NOISE LEVEL (DBA)	Impact (dBA)
Innu Cabin 3	R25	23.5	45.0	26.1	-
Innu - Uashat - Mani-Utenam Camp 1	R16	30.8	45.0	32.9	-
Innu - Uashat - Mani-Utenam Camp 3	R18	46.8	46.8	48.2	1.4
Innu Cabin 2	R20	24.0	45.0	38.7	-
Schefferville (town)	R39	12.6	45.0	24.3	-

Table 7-26 Night-Time Base and Future Scenario Sound Levels - Quebec

RECEPTOR	RECEPTOR ID	BASE DSO3 NOISE LEVEL (DBA)	BASIS OF ASSESSMENT (DBA)	FUTURE SCENARIO NOISE LEVEL (DBA)	IMPACT (DBA)
Innu Cabin 3	R25	23.5	40.0	24.3	-
Innu - Uashat - Mani-Utenam Camp 1	R16	30.8	40.0	32.8	-
Innu - Uashat - Mani-Utenam Camp 3	R18	46.8	46.8	48.2	1.4
Innu Cabin 2	R20	24.0	40.0	24.5	-
Schefferville (town)	R39	12.6	40.0	13.1	-

There were no predicted noise impact exceedances for any receptors in Quebec. Table 7-27 presents the Day-Night noise levels and change in Highly Annoyed percentage for each receptor.

Table 7-27 Day-Night Noise Levels and Change in Highly Annoyed Percentage

RECEPTOR NAME AND ID	RECEPTOR ID	BASE DSO3 DAY-NIGHT LEVEL (DBA)	FUTURE SCENARIO DAY-NIGHT (DBA)	BASE DSO3 HIGHLY ANNOYED PERCENTAGE (%)	BASE DSO3 HIGHLY ANNOYED PERCENTAGE (%)	CHANGE IN HIGHLY ANNOYED PERCENTAGE (%)
Innu Tent 1	R7	37.5	38.5	0.43	0.49	0.06
Young Naskapi Camp 7	R9	47.3	51.8	1.54	2.76	1.22
Young Naskapi Camp 3	R10	35.5	43.8	0.33	0.98	0.65
Young Naskapi Trailer Tent	R11	34.3	38.5	0.28	0.49	0.21
Young Naskapi Camp 5	R12	47.4	48.0	1.56	1.69	0.13
Naskapi – Uashat People's Camp	R13	35.7	44.4	0.34	1.06	0.72
Innu - Uashat - Mani-Utenam Camp 1	R16	37.2	39.3	0.41	0.54	0.13
Innu - Uashat - Mani-Utenam Camp 2	R17	32.6	34.8	0.22	0.30	0.08
Innu - Uashat - Mani-Utenam Camp 3	R18	53.2	54.6	3.30	3.94	0.64
Innu Cabin 2	R20	30.4	37.6	0.17	0.43	0.27
Irony mountain	R24	39.6	44.2	0.56	1.03	0.47
Innu Cabin 3	R25	29.9	31.0	0.16	0.18	0.02
Schefferville (town)	R39	19.0	23.9	0.04	0.07	0.03
TSMC Worker's Camp	R40	58.5	59.1	6.43	6.92	0.49

No receptors have a Highly Annoyed percentage change of 6.5% or greater. Therefore, Highly Annoyed percentage will not trigger mitigation per Health Canada criteria at any receptors. However, the Naskapi-Uashat People's Camp receptor (R13) will still undergo mitigation investigation due to the ≥5dB noise impact at that location.

Project Related Vibration and Potential Effects of Blasting Operations

There are two main effects from blasting: ground vibration and overpressure. When explosives detonate in a borehole, shock waves (energy from the detonation) radiate outward and crush the material adjacent to the borehole. Energy not used in the fracturing and displacement of bedrock dissipates in the form of ground vibration and air overpressure.

A review of Newfoundland and Labrador Department of Environment and Conservation information and federal sources has revealed that there are no available noise and vibration guidelines. Therefore, the ground vibration and overpressure from blasting operations are assessed per Quebec's "DIRECTIVE 019-SUR L'INDUSTRIE MINIÈRE, MARS 2012", and Ontario's Ministry of the Environment (MOE) NPC-119 Guideline. The MOE criteria are similar to Quebec's criteria, but are slightly more conservative. Therefore, MOE criteria were adopted for this assessment.

Since the blasting plan is still in development, vibration and overpressure levels from the blasting were predicted using MOE 1985 "Guidelines on Information Required for Assessment of Blasting Noise and Vibration" models. As no blast vibration and overpressure data is available for the site, conservative generic empirical formulae (which do not take local ground conditions into consideration) were used to estimate the impact of blast vibration and overpressure at the closest point of reception.

The closest sensitive receiver (Receptor ID#13) is approximately 900 m from the site perimeter. The maximum allowable charge per delay (using generic conditions) for the closest receiver is summarized in Table 7-28.

Table 7-28 Generic Maximum Allowable Charge per Delay for the Closest Point of Reception Located 900 Meters from the Site

CHARGE PER DELAY (KG)	CRITERIA
3,128	Blast Vibration Limit – 12.5 mm/sec
1,092	Blast Overpressure Limit – 128 dBL

The impact is dominated by the overpressure limit, so the charge per delay should be restricted to below 1,092 kg. However, blasting vibration and overpressure is complex in nature, and variability in ground type and meteorological conditions makes it difficult to accurately predict ground vibration and overpressure without site specific measurement data. Test blasting using a lower charge should first be conducted. Although meeting overpressure criteria may satisfy regulatory requirements, the short duration, high noise level may be a source of complaints.

Interaction of the Project with Noise and Potential Effects

<u>Site Preparation and Construction Phase</u>

No potential interaction

During the site preparation and construction phase, all project activities will have potential interaction with noise/vibration levels.

Potential interaction

- upgrading/construction of the Howse haul road and upgrading of the bypass road;
- pit development;

- installation of the ore processing plant (Howse Mini-Plant) in close proximity to the rail loop;
- transportation and traffic; and
- heavy machinery use and light vehicle traffic

➔ The effect associated with the above potential interactions is an **increase in noise and vibration levels**.

The nature of the effect is direct and the effect is adverse.

The nature of noise and vibrations and the areas where they will occur during the *Site Preparation and Construction* and *Decommissioning and Reclamation* phase will be similar to those encountered during the Operation phase. During all three phases, noise and/or vibrations from diesel powered engines, vehicle movements and blasting will occur, but intensity during the Operation phase will be continuous and of a higher level. One important reason why the nature of the noise/vibration remains the same during the three phases is the fact all power used at the site is generated by diesel equipment; the site is not connected to the power grid. Consequently, the noise and vibration effects study was conducted for the Operation phase only. Therefore, the effect assessment, mitigation measures, specific mitigation measures and methodological approach used to assess the noise and vibration component are covered for the Operation phase section below and are applicable to all phases of the project.

<u>Operation Phase</u>

No potential interaction

During the operation phase, all project activities will have potential interaction with noise/vibration levels.

Potential interaction

- removal and storage of remaining overburden and topsoil;
- blasting and ore extraction;
- mineral processing;
- dewatering;
- operation of waste rock dumps;
- transportation of ore and traffic;
- solid waste disposal;
- hazardous waste disposal;
- treatment of sanitary wastewater;
- explosives waste management; and
- ongoing site restoration.

➔ The effect associated with the above potential interactions is an increase in the ambient noise level and vibration.

The nature of the effect is direct and the effect is adverse.

Decommissioning and Reclamation Phase

No potential interaction during the decommissioning and reclamation phase, all project activities will have potential interaction with noise/vibration levels.

Potential interaction

- demobilization of Howse facilities and heavy machinery;
- transportation and traffic; and
- final site restoration.

➔ The effect associated with the above potential interactions is an **increase in the ambient noise level**.

The nature of the effect is direct and the effect is adverse.

7.3.3.3 Mitigation Measures

Standard Mitigation Measures

The following standard mitigation measures will be applied during all project phases (Table 7-29).

Table 7-29 Standard Mitigation Measures for Noise

CODE	MEASURE	MITIGATION EFFECT
Drilling and Blasting (DB)		
DB2	All explosives must be used in accordance with applicable laws, orders and regulations.	Using best practices will ensure efficient blasting is achieved. Efficient blasting procedures lead to a reduction of explosives use and consequently of noise and vibration due to these blasting events.
DB3	Only properly qualified and trained personnel may handle and detonate explosives as per the manufacturer's instructions and applicable laws and regulations.	
DB4	The manufacturer's instructions must be followed to ensure that blasting procedures are safe both for humans and the environment.	
DB16	Use multiple detonators in bore holes as per the manufacturer's recommendations and optimize the arrangement of blasting holes to minimize misfires.	
DB18	Prevent misfires by establishing time delay blasting cycles as per the explosives manufacturer's recommendations.	
DB19	Use reliable triggering systems that allow for precise firing of the explosives.	
DB20	Use blasting mats, if necessary, to prevent excessive scatter of rock.	For safety and nuisance reduction
DB24	Keep blasting data for two years, including the following: vibration speed, vibration frequency on the ground, air pressure and blasting patterns. Respect maximum vibration speeds.	Keeping complete historical records helps troubleshooting, if necessary.
DB25	Blasting must be carried out in such a way that air pressure at the receptors (camps) is less than 128 db.	Minimize nuisance due to blasting
Construction Equipment (CE)		

CODE	MEASURE	MITIGATION EFFECT
CE4	Construction equipment must be delivered to the site in good working order, without leaks and equipped with all emissions filters required to comply with emissions regulations and reduce noise disturbance. The equipment must be regularly inspected to detect any leaks or mechanical defects that could lead to fuel, lubricant or hazardous material spills.	Well maintained engines will keep noise levels in-line with regulations
CE16	When making the final choice of equipment, ensure that their noise levels are equal or less than those described in the environmental impact study.	Noise assessment for this EIS is based on a series of noise data for equipment and shows compliance with standards
Mining Operations (M)		
M2	The noise level of mining operations must be no higher than 40 dba at night and 45 dba during the day at each receiver (Quebec Guidelines for Stationary Noise Sources for Type I Zoning Area).	Meets Quebec regulations
M3	Reports required by governments must be submitted by the stipulated deadlines.	n/a

Specific Mitigation Measures

The following specific mitigation measures will be applied to limit impacts of noise by the Project activities:

SPECIFIC MITIGATION MEASURES FOR NOISE	
Measure	**Mitigation Effect**
Should noise complaints occur, prepare a mitigation plan for drilling to be implemented. Example methods of reducing drill noise include: ▪ Reducing drilling speed; ▪ Reducing drilling time; ▪ Using a noise shroud around the drill; and ▪ Use of a mobile noise screen.	Adaptive Management
A blast monitoring specialist will monitor a minimum of an initial four blasts to obtain site-specific data. It is recommended that the four initial test blasts be conducted with a charge of less than 700 kg per delay.	The site-specific data is needed to develop attenuation formulae, confirm the applicability of the initial guideline parameters, and assist in developing future blast designs. Vibration and overpressure will be monitored to provide an update to the prediction model parameters.
Blast designs shall be continually reviewed with respect to ground vibration and overpressure. Blast designs shall be modified as required to ensure compliance with applicable guidelines and regulations. Decking, reduced hole diameters, and sequential blasting techniques will be used to ensure minimal explosives per initiated delay period.	Adaptive Management
Maintain blast records. Records will include information such as: Location, date and time of the blast; Dimensional sketch including photographs, if necessary, of the location of the blasting operation, and the nearest point of reception; Type of material being blasted; Prevailing meteorological conditions including wind speed in m/s, wind direction, air temperature in °C; Number of drill holes; Pattern and pitch of drill holes; Size of holes; Weight of charge per delay; Number and time of delays. MOE (1985) will be consulted to determine an applicable list of records.	Documentation provides information for adaptive management measures

7.3.3.4 Residual Effects Significance Assessment

The noise/vibration residual effects significance assessment is to be reviewed in parallel with the ecological contexts of the Caribou (Section 7.4.3) and the Avifauna (Section 7.4.8) both of which are valued components.

The Howse Project is located in an area that has historically been continuously and significantly altered by human activities. Within this context of a pre-established mining complex, the Howse footprint is not expected to cause significant detrimental additions to this unfavorable ecological context. The fauna has experienced fluctuations over the last several decades but is known to be resilient to disturbances caused by mining infrastructures and has shown plasticity in their adaptability to anthropogenically-altered landscaped. Noise and vibration are short-term effects that cease immediately when activities cease.

Table 7-30 Assessment Criteria Applicable to Noise

TIMING		
Inconsequential timing	**Moderate timing**	**Unfavorable timing**
Timing of predicted Howse activities are not expected to affect any human activities or sensitive activities in wildlife life cycles.	Timing of predicted Howse activities may affect some human activities or wildlife activities, i.e.: during migrating seasons.	Timing of predicted Howse activities may affect some human activities or key wildlife activities, i.e.: the calving/breeding periods.
SPATIAL EXTENT		
Site specific	**Local**	**Regional**
Effects are limited to the footprint of the project.	Effects extend beyond the footprint, but do not extend outside the LSA.	The effect of the Howse Project will affect air quality in substantial part or the entire RSA.
DURATION		
Short	**Medium**	**Long**
Less than 12 months. Limited to the construction and/or decommissioning and abandonment phase.	12-24 months. Extends beyond the preparation/construction phase, but shorter than the lifespan of the Project.	More than 24 months Or as long as the Project duration
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Ambient noise expected to return to its pre-Howse level	Altered ambient noise levels persists after the decommissioning and abandonment phase	Ambient noise permanently altered by the Howse Project.
MAGNITUDE		
Low	**Moderate**	**High**
Affects <5% of the population in the LSA or 5% of the activity in question and few or no people in the RSA.	Affects 5%-15% of the population in the LSA or of the activity in question and a few people in the RSA.	Affects >15% of the population in the LSA or of the activity in question and more than a few people in the RSA.
FREQUENCY		
Once	**Intermittent**	**Continual**
One time	Occasional or intermittent	Year round

Timing

Howse Project activities will occur throughout the year, with the potential exception of winter blasting (which is expected to be infrequent). Since some of the noise produced by the Howse Project activities will be generated continuously after daylight hours, the timing of the disturbance may occur during periods of human/wildlife in the LSA, and so the effect is high (Value of 3).

Spatial Extent

The noise modelling study predicts that noise assessment criteria are met at all sensitive receptors in the LSA and RSA. A noise impact of 5 dBA was predicted at Receptor R13 (Naskapi - Uashat people's camp, located in NL, approximately 1.68 km from the center of the Howse Project). A cause of this impact is the inclusion of the projected First Nations crushing site (note: FN crusher is no longer considered, see footnote 1 in previous page) and the Howse Mine Site track drill used to drill blasting holes. By making a provision for a mobile screen, the spatial effect of the Howse Project remains within the Project's footprint (Value of 1).

Duration

Ambient noise levels will be negatively impacted from the beginning of the construction phase up to the end of the Howse Project. Project's noise will stop after the Decommissioning and Abandonment Phase is completed. Noise and vibration will be generated during all phases of the project. The nature of the Noise and vibration will be similar throughout all phases of the project, but the highest effects will occur during the Operation phase, due to the intensity of mining, transportation and processing activities. For this reason, the duration is considered to be long (Value of 3).

Reversibility

Project's noise and vibration will stop after the Decommissioning and Abandonment Phase is completed. As such, the noise effect of the Howse Project is considered reversible (Value of 1).

Magnitude

A noise impact of 5 dBA was predicted at Receptor R13 (Naskapi - Uashat people's camp, located in NL, approximately 1.68 km from the center of the Howse Project). A cause of this impact is the inclusion of the projected First Nations crushing site (note: FN crusher is no longer considered, see footnote 1 in previous page). Noise and vibration impacts at all other sensitive receptors are below the assessment criteria. For that reason, the magnitude is considered to be low (Value of 1).

Frequency

The noise frequency is continual, since activities of the Howse Project will occur on a continuous basis for at least 7 months per year. The associated value is 3.

Blasting events are planned to be conducted on a weekly basis during warmer months. Winter months blasting will be conducted at a reduced frequency (if at all) of approximately once per month. Blasting events are intermittent by nature and the associated value is 2, but this value is not retained for effect assessment, since the noise frequency has a higher value.

7.3.3.4.1 Significance

The residual effects of the Howse Project on noise are evaluated at non-significant (value of 12-13). This is representative of the moderate magnitude of the effects of the Project as well as the reversibility of the effects on ambient noise levels.

Likelihood

The likelihood of Howse having an effect on ambient noise levels and vibration is **high**, since noise and blasting events will occur throughout the duration of the project.

7.3.4 Light

7.3.4.1 Component Description

Night-time illumination level is an important component and it is highlighted in the CEAA EIS Guidelines. Ambient light assessment is primarily an assessment of the effects of the Howse Project's lighting on sensitive receptors within a zone of influence. Light pollution is an issue that has gained prominence within the context of environmental assessment because:

- it is recognized that the esthetic components of the environment have value; in particular, daytime vistas (viewsheds) and night-time skies are valued social components; and
- light pollution is associated with nuisance-related effects of stray light, physiological changes in humans (similar to those experienced by shift workers), and disorientation of migrating wildlife.

Outdoor lighting is essential at industrial development projects to provide safe work conditions during night-time hours and to provide security for the workers and the facility. Light in itself is not a pollutant. However, inappropriately designed lighting or excessive lighting can cause effects that can range from a minor nuisance to a disruptive effect. This assessment considers the potential effect that the Howse Project lighting could have on the existing ambient light levels surrounding the Project.

Light pollution was mentioned three times during Aboriginal consultations in the fall of 2014. The concerns raised were:

- lights on top of trucks are unnecessary left open at night and disturb the community; and
- effects of lights on the population and the wildlife.

The effect of lights on caribou and avifauna are described in Sections 7.4.3 and 7.4.8 below, respectively, and further in the cumulative effects sections of these components in Sections 8.6 and 8.7, respectively.

Consequently, in and of itself, night-time illumination is not considered as a VC for the physical environment assessment. However, an effects assessment for light is present here in order to support the cumulative effects assessment for caribou and avifauna.

LSA, RSA and Temporal Boundaries

The spatial boundaries for effects assessment of ambient light are described as follows:

The LSA is the area within 25 km^2 of the Howse Project. This area is estimated as the distance at which artificial lighting from the project could be visible.

The RSA is the area within 625 km^2 of the Howse Project. This area includes the towns of Schefferville and Kawawachikamach, both of which are located approximately 23 km southwest of the Howse Mining Project. The RSA also includes the future mining pits of DSO4 (i.e., Goodwood and Sunny). This RSA was selected to include the nearest towns where artificial and permanent lighting is prevalent and also additional mining pits of the whole TSMC DSO project, where artificial lighting is almost non-existent. Figure 7-11 presents the LSA and the RSA for ambient light.

The ambient light study covers different seasons and weather conditions, as required in the Project's EIS preparation guidelines.

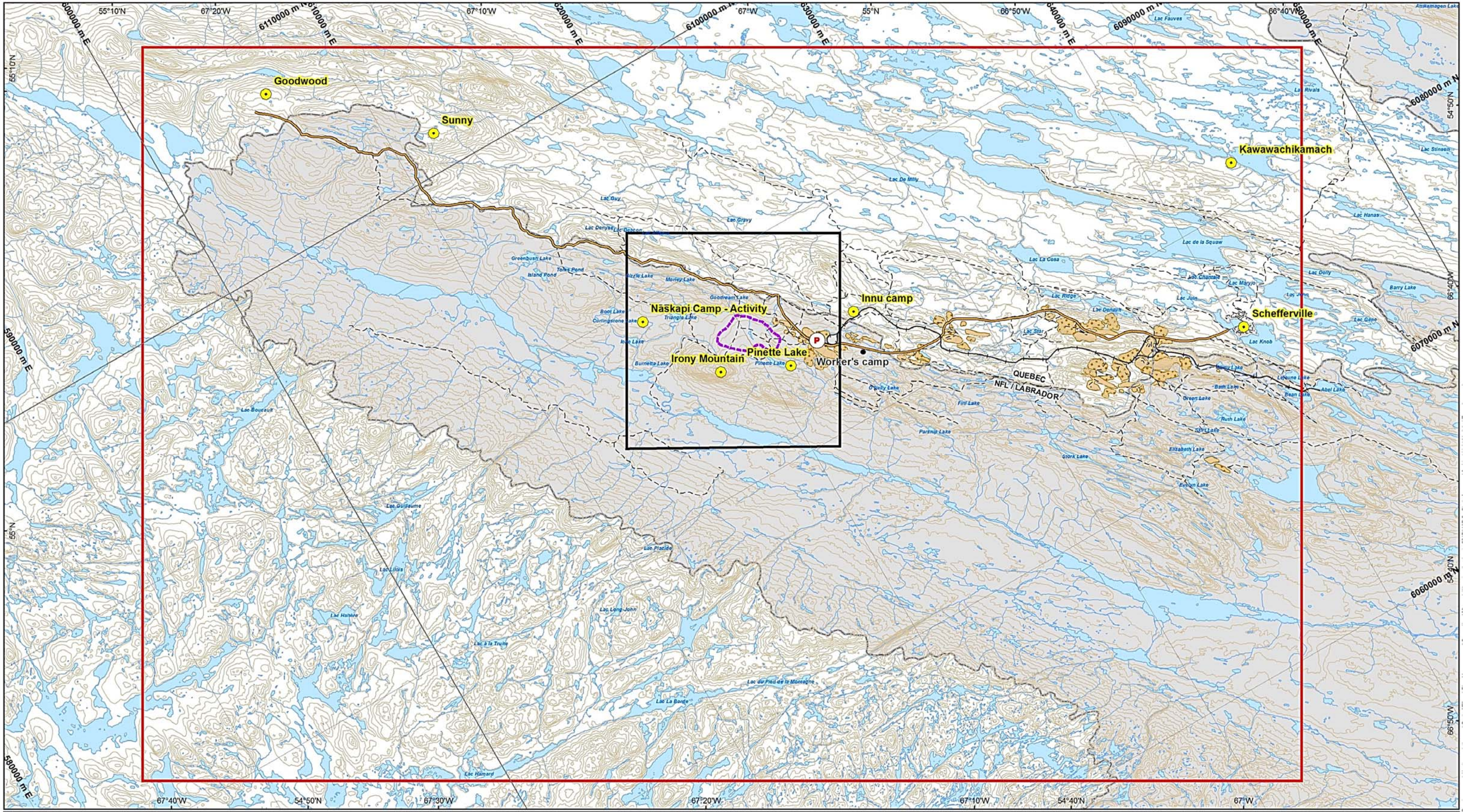
Existing Literature

Assessment of a project's effects on night-time light levels is an issue that has recently gained prominence in the context of environmental assessments. Consequently, knowledge and examples of previous effects assessments in this domain are limited to non-existent. An internet-based search for regulations or policies in northern parts of Canada of the amount of obtrusive light emitted from industrial facilities revealed that no information is available.

There are no legal requirements in place (e.g., regulations, guidelines, or policies) in Québec or Newfoundland and Labrador that regulate the amount of obtrusive light being emitted from facilities. However, the *Commission Internationale de l'Éclairage* (CIE), also known as the International Commission on Illumination, has developed maximum values for light spill and glare that should not be exceeded (CIE, 2003). These guidelines have been adopted in Great Britain and form the basis of a number of recommendations in the Leadership in Energy and Environmental Design (LEED) Green Building Council Certification Program of Canada (LEED, 2004). Such guidelines have also been adopted for other industrial projects in Canada. However, the CIE guidelines are considered to be more applicable to industrial or institutional installations with permanent lighting systems (e.g., electricity to power the lights is readily available from the grid), which is not the case for the Howse Project.

Ambient night-time light levels is a relatively recent component included in CEAA Guidelines for the Preparation of Environmental Impact Statements. In general, CEAA EIS guidelines documents for industrial projects from 2013 on, now include requirements for describing ambient night-time light levels; prior to 2013, only specific projects included this type of requirement. However, few EIS reports with ambient light evaluation requirements are currently available. Table 7-31 presents a review of several CEAA projects for which an ambient light assessment is (or was) required, and includes a comment describing the applicability to the Howse Project.

Based on a review of the ambient light evaluation requirements for the 10 projects presented in Table 7-31, in our opinion there are no comparable projects that provide a description of night-time light levels in different weather conditions and seasons, as required by the CEAA for the Howse Project.



Legend

- Sky Radiance Receptors used in modelling
- Regional Study Area
- Local Study Area
- Border

Infrastructure and Mining Components

- Existing Mined-out Pit
- Existing Waste Dump
- Main Access Road
- Road
- Howse Mining Area (approximative)
- Main Processing Plant Area
- Railway

Quebec
New Foundland and Labrador

1:170 000

0 2 4 km

UTM 19N NAD 83

SOURCES:
NTDB, 1:50,000, edition 3.1
Gov. of NL and Gov. of Qc, Border
NML, Mining sites and roads
GH, Hydrology update, 2008

DSO Howse Project EIS

Study Areas and Ambiant Light Modeled Receptors

January 2015

MAP 2

Figure 7-11

AECOM

Table 7-31 Select CEAA Projects Reviewed for Night-time Light Assessment (as of January, 2015)

CEAA #[2]	NAME	EIS GUIDELINES DATE REFERENCE TO AMBIENT LIGHT?	EIS SUBMITTED?	COMMENT IN RELATION TO THE HOWSE PROJECT
80066	Highway 947 Extension Project **Alberta Transportation** **Edson, Alberta**	July 2014 Ambient light requirement? Yes, the same requirements as for Howse[1]	Not yet [3]	Not applicable
80068	Hardrock Deposit Project **Premier Gold Mines Hardrock Inc.** **Geraldton, Ontario**	August 5, 2014 Ambient light requirement? Yes, the same requirements as for Howse[1]	Not yet [3]	Not applicable
47632	Canpotex Potash Terminal Project **Prince Rupert, British Columbia**	November 22, 2011 Ambient light requirement? Yes	Dec. 13, 2011	Contains ambient light assessment, mostly focused on the terminal. Typical good practices and mitigation measures listed. Different weather conditions and seasons not assessed.
80032	Pacific Northwest LNG Project **Port Edward, British Columbia**	June 7, 2013 Ambient light requirement? Yes, the same requirements as for Howse[1]	Feb. 28, 2014	Contains an ambient light assessment, mostly focused on communities close to project. Typical good practices and mitigation measures listed. Different weather conditions and seasons not assessed.
64575	Kami Iron Ore Project Alderon Iron Ore Corp. Labrador, NFLD **Pointe-Noire, Québec**	February 6, 2012 By CEAA and NFLD DEC Ambient light requirement? Yes, but limited.	Oct. 1, 2102	The EIS report contains baseline ambient light measurements at three sites in Northern Québec (Kami terminal, a cabin and Baie de Sept-Îles). These light measurements were taken on one day from three to seven minutes per site. This data is not representative of the Howse Project or the Schefferville region and cannot be used to describe illumination levels during different weather conditions and seasons.
80036	Côté Gold Mine Project IAMGOLD Corporation **Gogama, Ontario**	July 9, 2013 Ambient light requirement? Yes, the same requirements as for Howse[1]	May 21, 2014	No light assessment submitted
80017	Blackwater Gold Project New Gold Inc.	February 19, 2013 Ambient light requirement? Yes, the same requirements as for Howse[1]	Not yet [3]	Not applicable

CEAA #[2]	NAME	EIS GUIDELINES DATE REFERENCE TO AMBIENT LIGHT?	EIS SUBMITTED?	COMMENT IN RELATION TO THE HOWSE PROJECT
	Vanderhoof (British Columbia)			
80021	Whabouchi Mining Project Nemaska Lithium inc. **Nemiscau and west-north-north of Chibougamau, Québec**	March 18, 2013 Ambient light requirement? Yes, the same requirements as for Howse[1]	May 17, 2013	Ambient light assessed as non-significant. Limited information on mitigation measures and good practices Different weather conditions and seasons not assessed.
80015	Joyce Lake Direct Shipping Iron Ore Project Labec Century Iron Ore **Labrador (approximately 20 km northeast of Schefferville, QC), Newfoundland and Labrador**	March 5, 2013 Ambient light requirement? Yes, the same requirements as for Howse[1]	Not yet [3]	Not applicable
80008	Hopes Advance Iron Mining Project Oceanic Iron Ore Corporation **Aupaluk, Québec**	December 10, 2012 Ambient light requirement? Yes, the same requirements as for Howse[1]	Not yet [3]	Not applicable

[1] The general requirement in the CEAA Howse EIS Guidelines is: Describe existing ambient night-time light levels at the project site and at any other areas where project activities could have an effect on light levels. The EIS will describe night-time illumination levels during different weather conditions and seasons.

[2] For detailed information on each project, enter the CEAA # from the table on this website http://www.ceaa-acee.gc.ca/050/index-eng.cfm

[3] No document submitted as of January, 2015

Definition of Types of Lighting Effects

Table 7-32 presents a summary of the definitions of types of lighting effects. Sky glow is the predominant type of lighting effect that could be expected from the Howse Project. No legal requirements pertaining to sky glow could be found.

Table 7-32 Definitions of Types of Lighting Effects

TYPE OF LIGHTING EFFECT	DEFINITION
Light Spill	Refers to the spilling of light from fixtures within a facility to the environment and receptors outside the facility. The unit of measure for light spill is a lux. A lux is equal to 1 lumen per square metre (lumen/m^2). For example, problematic light spill would occur when lights located on the outside of an industrial facility shine in through the windows of nearby residential homes. In the middle of the night, light spill at residential properties should not exceed 1 lux (CIE, 2003). An example of this effect is the excess light that may shine into a sleeping space and disrupt the ability of the residents to achieve a good night's sleep.
Glare	Refers to intense, harsh, or contrasting lighting conditions that reduce the ability of humans, birds, and other organisms to see. The most common example is oncoming high-beam headlights that provide lots of light but paradoxically make it difficult to see. The unit of measure for glare, sometimes referred to as luminance, is lumens per steradian, which equals a candela (cd).
Sky glow	Refers to the illumination of the clouds by light sources on the surface of the earth, such as street lighting, and haze in the atmosphere that replaces the natural night-time sky with a translucent to opaque lighted dome. The sky appears washed out or brownish-purple and may be devoid of visible stars in the extreme. Sky glow is the cumulative effect of all of the lights at the surface either emitting upward or being reflected upward by the surface. The unit of measure for sky glow is mag/$arcsec^2$. Values for sky glow range from approximately 22 mag/$arcsec^2$ in a rural environment where stars are abundant to approximately 18 mag/$arcsec^2$ in an urban environment where stars are barely visible.

Data Gaps

As previously noted, assessment of a project effects on night-time illumination levels is a developing environmental issue, and knowledge in this domain and its application to the Howse Project is limited to non-existent. No applicable "sky quality" standards could be found for comparable projects.

Tools and/or models for interpreting sky brightness measurements are varied and typically custom-made. For the Howse Mining project EIS, the Illumina model was selected as the most adequate to provide representative results for the study area. The Illumina model was developed by Professor Martin Aubé, an international expert who has been involved in studies to reduce light pollution at the Dark-Sky Reserve of Mont-Mégantic in the province of Québec (Astrolab, 2014).

7.3.4.2 Effects Assessment

Literature review and Current Studies Data Used to Assess the Potential Effect

Current Study

The proposed Howse mining site is located in Newfoundland and Labrador, approximately 23 kilometres northwest of Schefferville, Québec, near the provincial border of Newfoundland and Labrador, and Québec. The site will be located in close proximity to the DSO3 project. DSO3 consists of Timmins 3, Timmins 4, Timmins 7, and Fleming 7 mining sites, in addition to a processing plant complex. The ore from the Howse mining area will be transported to DSO3 loading facility and shipped by rail.

The Howse Mining Project will have limited effects on ambient light levels since:

- no power lines will be constructed to bring electricity to the Howse Mining site due to its relatively remote location, consequently no permanent light fixtures will be installed at the mine site;
- most activities at the site will be during the day time; and
- limited mining activities will occur during the winter months, when the nights are longer and there is snow on the ground which reflects light (artificial or natural).

Light pollution is an issue that has gained prominence within the context of environmental assessment. However, standardized quantification methods, procedures and standards are limited to non-existent, particularly in a remote location such as the region of Schefferville where artificial light is minimal and the sky and air are clear (compared to more densely populated areas).

Taking the above project specificities into consideration, TSMC decided to use an innovative baseline assessment methodology that combines on-site ambient light measurements, a radiative transfer model and the most recent available satellite images in order to characterize ambient light on a set of identified sensitive receptors in the vicinity of the Howse/DSO project region. Detailed results of the baseline assessment study are presented in the Ambient Light Technical Report for the Howse Project (Volume 2 Supporting Study G). Summary methodology and results are presented below.

Recent Portrait of Night-time Illumination Levels within the RSA

The use of Sky Quality Meters (SQM) manufactured by Unihedron inc. for measuring night-time illumination levels (e.g., sky glow) is prevalent in the literature. A simple portable photometer device, the SQM was designed for the purpose of measuring the subtle light of the rural night sky with high enough sensitivity, and it is used widely for light pollution monitoring. The SQM is a handheld device and collects the light from a relatively large solid angle (1.5 steradians, approximately a cone with a 20-degree half angle). The device displays the average luminance of this solid angle in astronomical units: magnitude per square arcsecond (mag/arcsec^2). SQM is temperature-calibrated and gives the luminance with the precision of 0.1 mag/arcsec^2, which is equivalent to 10 percent in linear luminance (cd/m^2) units. This type of SQM was used for measuring current sky glow levels in the vicinity of the Howse Project.

In November 2014, an *in-situ* night-time illumination measurement program was conducted by TSMC within the RSA. A SQM (Model SQM-LU-DL by Unihedron) was used to measure sky brightness at seven sites located in the vicinity of the Howse project site. A figure showing measurement locations is available in the Ambient Light Technical Report (Volume 2 Supporting Study G). Table 7-33 presents the measurement results. The SQM provides measurements in units of mag/arcsec^2**,** which are commonly used in astronomy to measure sky brightness. As indicated in Table 7-34, the higher the number, the more the sky is dominated by the natural background. In order to be representative and useable for modelling purposes, measurements were conducted under strict night sky conditions. Based on best practices found in the literature review, strict night sky conditions can be described as follows:

- moonless night;
- no clouds or fog;
- the sun is at least 18 degrees below the horizon (astronomical twilight); and
- no direct light from artificial sources reaches the detector of the device.

The SQM measurements were then used to calibrate the radiative transfer model (Illumina). Using the Illumina model, it was possible to conduct an assessment of ambient light in the Project region for the winter season (with snow cover and clear skies) and the summer season (without snow on the ground, with clean air or during sporadic air pollution events caused by forest fires). The Illumina model outputs were used to generate maps and tables of the sky radiance for different seasons and air quality levels at eight sensitive receptors.

Table 7-33 In Situ Night-Time Illumination Results, November 26 to 28, 2014

SITE ID	DESCRIPTION	DATE AND TIME OF MEASUREMENT	AVG. SQM READING MAG/ARCSEC^2
Irony Mountain / Howse	Important site for First Nations and project site, ≈1.5 km west of Howse	27-Nov-14 00:37 to 00:43	20.52
Pinette Lake	Innu camp, hunting site and potential migratory birds area. ≈2 km southeast of Howse	26-Nov-14 23:14 to 23:20	20.50
Kawawachikamach-1	Town center ≈26 km east to southeast of Howse	26-Nov-14 20:40 to 20:46	19.95
Kawawachikamach-2	On the road out of town	26-Nov-14 21:05 to 21:11	21.16
Schefferville-1	Town center ≈24 km east-southeast of Howse	26-Nov-14 21:30 to 21:36	19.13
Schefferville-2	On the road out of town	26-Nov-14 21:49 to 21:54	20.50
Dark point	Old Goodwood Rd, on the way to Kivivik. ≈13 km from Howse.	27-Nov-14 to 28-Nov-14 21:14 to 05:09	21.74*

* Maximum reading over the period of unattended sampling

Table 7-34 Reference Night Sky Brightness Scale as Defined by Berry in 1976

SKY GLOW (MAG/ARCSEC^2)	NAKED-EYE APPEARANCE OF THE SKY (M.W. = MILKY WAY)
21.7	The sky is crowded with stars, extending to the horizon in all directions. In the absence of haze the M.W. can be seen to the horizon. Clouds appear as black silhouettes against the sky. Stars look large and close.
21.6	Essentially as above, but a glow in the direction of one or more cities is seen on the horizon. Clouds are bright near the city glow.
21.1	The M.W. is brilliant overhead but cannot be seen near the horizon. Clouds have a greyish glow at the zenith and appear bright in the direction of one or more prominent city glows.
20.4	To a city dweller the M.W. is magnificent, but contrast is markedly reduced, and delicate detail is lost. Limiting magnitude is noticeably reduced. Clouds are bright against the zenith sky. Stars no longer appear large and near.

SKY GLOW (MAG/ARCSEC^2)	NAKED-EYE APPEARANCE OF THE SKY (M.W. = MILKY WAY)
19.5	M.W. is marginally visible, and only near the zenith. Sky is bright and discoloured near the horizon in the direction of cities. The sky looks dull grey.
18.5	Stars are weak and washed out, and reduced to a few hundred. The sky is bright and discoloured everywhere.

Table 7-35 presents the ratio of artificial sky radiance to natural sky radiance, and Table 7-36 presents modeled winter sky brightness and the artificial light origin in percent. A full night-time illumination level technical report with more detailed explanations is available in Volume 2 Supporting Study G.

Table 7-35 Artificial Sky Radiance to Natural Sky Radiance Ratio

RECEPTOR ID	LONGITUDE	LATITUDE	WINTER[1]	SUMMER1[2]	SUMMER2[3]
			%	%	%
Goodwood ≈25 km NNE of Howse	55° 6'2.87"N	67°20'12.05"W	0.2	0.1	0.0
Sunny ≈17 km NNE of Howse	55° 2'59.99"N	67°14'47.30"W	0.5	0.2	0.0
Naskapi camp/activity ≈4 km NNE of Howse	54°56'06.48"N	67°11'19.19"W	3.5	0.9	0.5
Irony Mountain ≈1.5 km ESE of Howse	54°54'3.71"N	67° 9'29.59"W	8.9	1.9	2.0
Innu camp ≈6 km WSW of Howse	54°53'37.10"N	67° 3'9.10"W	37.5	6.3	13.6
Pinette Lake ≈3 km SSE of Howse	54°53'16.91"N	67° 6'43.63"W	66.1	9.1	19.6
Kawawachikamach ≈25 km ESE of Howse	54°51'49.03"N	66°45'39.00"W	404.3	39.5	120.0
Schefferville ≈24 km SE of Howse	54°48'7.09"N	66°48'57.18"W	492.8	53.0	149.6

1. Winter: covers the period with a snow cover.
2. Summer1: Covers the majority bare soil periods. Such a situation occurs most of the time in late spring, summer and early fall.
3. Summer2: Covers sporadic air pollution events caused by forest fires. This case typically occurs in summer and early fall.

Table 7-36 Modeled Winter Sky Brightness and Origin

RECEPTOR ID	MODELED WINTER SKY BRIGHTNESS	RATIO OF ARTIFICIAL TO NATURAL[1]	ORIGIN OF ARTIFICIAL SKY RADIANCE (%)	
	mag/arcsec^2		Towns	Existing activities
Goodwood ≈25 km NNE of Howse	21.29	0.2	46.1	53.9
Sunny ≈17 km NNE of Howse	21.29	0.5	37.9	62.1
Naskapi camp/activity ≈4 km NNE of Howse	21.26	3.5	17.6	82.4
Irony Mountain ≈1.5 km ESE of Howse	21.20	8.9	10.4	89.6
Innu camp ≈6 km WSW of Howse	20.95	37.5	4.8	95.2
Pinette Lake ≈3 km SSE of Howse	20.75	66.1	2.2	97.8
Kawawachikamach ≈25 km ESE of Howse	19.54	404.3	99.8	0.2
Schefferville ≈24 km SE of Howse	19.36	492.8	99.8	0.2

1: The lower the ratio, the smaller the contribution of artificial light.

Table 7-35 indicates that, as expected, sky radiance is higher during winter due to light reflection on the snow.

The results of Table 7-36 indicate that artificial lighting from activities outside of Kawawachikamach and Schefferville has a negligible effects (<0.2%) on sky brightness in these towns. Light pollution comes from the towns themselves. In contrast, artificial lighting originating from Kawawachikamach and Schefferville have a very small effects (<10%) on receptors close to the Howse pit, such as Irony Mountain and Pinette Lake, for example. Sky brightness due to artificial lighting at these receptors is due to existing activities (such as construction of the main processing plant for DSO3). It is reasonable to assume that any lighting used for the Howse Project would add to the sky brightness.

Interaction of the Project and Potential Effects

Several factors have to be taken into account for each phase of the Project:

- During the site preparation and construction phase, all lighting at the Howse pit will not be permanent due to its remote location.
- It is anticipated that the majority of the site preparation and construction phase will occur during the warmer months, between April and October. Given that the proposed Howse Mine site is located close to the 55th parallel, summer days are considered to be long in terms of daylight hours. Consequently, night-time operation and subsequent sky illumination by artificial lights is expected to be limited.

- During the operation phase, the Project will have limited effects on ambient light levels since:
  - No power lines will be constructed to bring electricity to the Howse Mining site due to its relatively remote location, and consequently no permanent light fixtures will be installed at the mine site;
  - Most activities at the site will be during the day-time;
  - Limited mining activities will occur during the winter months, when the nights are longer and there is snow on the ground which reflects light (artificial or natural).
  - The Howse ore processing activities will be conducted at the Howse Mini-Plant located close to the rail loop in the DSO3 area for a period of 7 months. Lighting from the Howse Mini-Plant will be intertwined with that of DSO3.
- The effect is reversible, because natural light will be restored to its original pre-Project state once all work areas are fully rehabilitated at the end of the Project.

Light concerns are related to the whole DSO area and not solely to the Howse Project. The "lights on top of trucks" concern will be addressed by specific mitigation measures (see list below). As shown in Table 7-36, the towns (Schefferville and Kawawachikamach) own lighting system currently accounts for 99.8% of the night time sky radiance; due to the distance between the Project and the towns, the effects of the Project's lighting on the population will not be perceptible.

The nature of the effect is direct and the effect is adverse.

7.3.4.3 Mitigation Measures

Standard Mitigation Measures

No standard mitigation measures apply to ambient light, however, specific mitigation measures are listed below.

Specific Mitigation Measures

Even if night-time illumination is not considered a VC, the following specific mitigation measures will be applied during the construction, operation and decommissioning and reclamation phase of the Project to ensure that the night-time illumination level remains close to the pre-Project level (Table 7-37).

Table 7-37 Specific Mitigation Measures for Light

MEASURE	MITIGATION EFFECT
Shield your outdoor lighting [1]	When personnel safety is not jeopardized, the Measures will minimize effects of the Project on ambient light. It is anticipated that light fixtures for the Howse Project will be portable and diesel powered; limiting the use of these lights will enable savings on diesel fuel usage, while limiting night-time illumination levels.
Only use the light when you need it [1]	
Shut off the lights when you can [1]	
Use only enough light to get the job done [1]	
Use long wavelength light with a red or yellow tint to minimize effects [1]	
Staff will be informed to turn off lights on top of trucks at night, when not necessary,	Minimize nuisance
The minimum amount of pilot warning and obstruction avoidance lighting should be used on tall structures.	Minimize risk of attraction of migratory birds

MEASURE	MITIGATION EFFECT
Lighting for the safety of employees should be shielded to shine down and only to where it is needed, without compromising safety.	Minimize nuisance and radiance towards the sky
When possible, LED lights will be used	LED light fixtures are less prone to light trespass

(1): Measures proposed by the International Dark-Sky Association in the document Light Pollution and Wildlife (IDA, 2008)

7.3.4.4 Residual Effect Significance Assessment

The overall methodological approach to assess the environmental effects is presented in Section 5. Even if night-time illumination is not considered a VC and does not have an ecological context in and of itself, an assessment of the residual effects significance is presented in Table 7-38 The night-time illumination residual effects significance assessment is to be reviewed in parallel with the ecological contexts of the Caribou (Section 7.4.3) and the Avifauna (Section 7.4.8) both of which are VCs.

Table 7-38 Assessment Criteria Applicable to Night-time Illumination

TIMING		
Inconsequential timing	**Moderate timing**	**Unfavorable timing**
Timing of predicted Howse activities are not expected to affect any sensitive activities in wildlife life cycles.	Timing of predicted Howse activities may affect some wildlife activities, i.e.: during migrating seasons.	Timing of predicted Howse activities may affect some key wildlife activities, i.e.: the calving/breeding periods.
Site specific	**Local**	**Regional**
The effect of the Howse Project lights will be visible in the LSA.	The effect of the Howse Project lights will be visible in the LSA.	The effect of the Howse Project will be predominant in the LSA.
DURATION		
Short	**Medium**	**Long**
Less than 12 months. Limited to the construction and/or decommissioning and reclamation phase.	12-24 months. Extends beyond the preparation/construction phase, but shorter than the lifespan of the Project.	More than 24 months Or long as the Project duration
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
The nighttime illumination is expected to return to its pre-Howse level	The nighttime illumination will persist after the decommissioning and reclamation phase	The nighttime illumination will be permanently altered by the Howse Project.
MAGNITUDE		
Low	**Moderate**	**High**
Howse Project will likely have no effects on night sky brightness, relative to the closest light sources	Howse Project will have little effects on night sky brightness, relative to the closest light source	Howse Project will have an important effect on nighttime illumination levels and significantly deteriorate night sky brightness
FREQUENCY		

Once	Intermittent	Continual
The disturbance will occur once	The disturbance will be occasional	The disturbance will be year round.

Timing

Howse Project activities will occur throughout the year, with the potential exception of winter blasting (which will be infrequent). Since the light produced by the Howse Project activities will be generated continuously after daylight hours, the timing of the disturbance may occur during periods of human/wildlife in the LSA, and so the effect is high (Value of 3).

Spatial Extent

The Howse Project lighting is expected to extend beyond the LSA, but will not be the predominant source of illumination due to the presence of the DSO3 processing plant nearby (Value of 2).

Duration

For safety reasons, lighting at the Howse project will last as long as the project duration (Value of 3).

Reversibility

After decommissioning, all light sources from the Howse project will be removed and the illumination levels will return to pre-Howse levels (Value of 1).

Magnitude

Lights will be used at the Howse project, but the absence of permanent power lines reduces the potential for over-lighting due to the high cost of generating power with portable diesel engines. The main source of light in the LSA will be the DSO3 processing plant nearby. As such the effect is low (Value of 1).

Frequency

The frequency of light generation is expected to be continuous, although artificial light disturbance will only occur at night. (Value of 3).

7.3.4.4.1 Significance

The residual effects of the Howse Project on light (night sky brightness) are expected to be non-significant (value of 13). This value is representative of the low magnitude of the effects of the Project as well as the full reversibility of the effect.

Likelihood

The likelihood of Howse having an effect on night sky illumination is **likely** because the presence of any artificial lights in a region relatively free of artificial lights will have an effect.

Night-time illumination in and of itself is not a VC, therefore an assessment of light cumulative effects has been integrated in the caribou and avifauna sections.

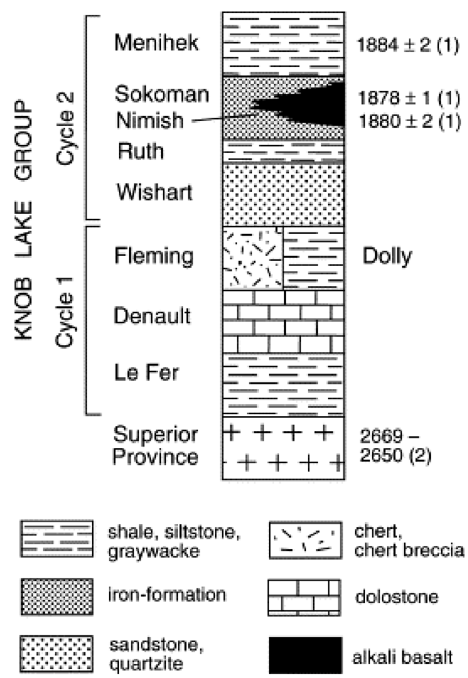
7.3.5 Geology

7.3.5.1 Component Description

The geology of the site will not be affected by the Project. Geology is thus not retained as a VC.

The Labrador-Québec Trough, 1,200 km long and up to 100 km in width, is a complexly folded and faulted geosyncline bearing sedimentary, volcanic and intrusive rocks. The Trough is divided into North (Ungava Bay Region), Central (Schefferville Region), and South (The Grenville). Sedimentary and meta-sedimentary rocks overlie unconformably the Archaen basement granodioritic and granitic gneisses. The 100-km wide belt (central part) tapers considerably towards the north and south. The DSO style of mineralization is mostly concentrated in the central part of the Trough, and historically dominantly mined in the Schefferville region. Several processes have been put forward by different schools of thought on the genetic model of the DSO; however, the leaching process is generally adopted for this region. Another style of mineralization also present in this region is Taconites, a fine-grained, weakly metamorphosed iron formation with magnetite as the primary iron oxide mineral and secondary hematite, with smaller amounts of iron carbonates and iron silicates.

The Knob Lake group is believed to have been deposited in two cycles, and the Sokoman Formation, which is the principal host of the iron mineralization, was deposited during the second cycle (Williams and Schmidt, 2004). This group of rocks is generally considered as a chemical precipitate of sedimentary origin. Below is a summary description of the different Knob Lake group formations in the Schefferville area (Figure 7-12). Some of the formations that have been intersected only locally are not shown. For example, the Purdy dolomite formation overlies the Sokoman formation locally.



Source: Williams and Schmidt, 2004

Figure 7-12 Stratigraphy of the Knob Lake Group

Menihek Formation (MS)

A dark, fine-grained, thin to medium bedded graphitic shale, the formation commonly contains chert laminations and pyrite layers or nodules, and its color is almost always black or greenish-grey. The thickness of this upper shale or slate (US), if weakly metamorphosed, is unknown.

Sokoman Formation

The Sokoman formation is the main iron formation host throughout the Labrador-Québec Trough, and its thicknesses vary between 120 and 240 metres. The essential minerals are chert, iron oxides, iron hydroxides and iron silicates with minor carbonates. The principal ore mineralogy in the DSO category is hematite, martite, and goethite, generally distributed into red, blue and yellow ores. Mineralization of the Sokoman formation can be widely classified across the Trough as follows: Upper iron formation (UIF), Middle iron formation (MIF) and Lower iron formation (LIF), which are in turn further divided into several subclasses.

Upper Iron Formation (UIF)

This formation encompasses three main subclasses. Grey Upper Iron Formation (GUIF) is a unit that is somewhat similar to PGC, although the overall iron content is usually significantly less. The unit shows disseminated iron oxides in a grey cherty matrix mixed with carbonates, and seldom makes DSO grade Blue ore because of its low primary iron content. The GUIF has also been identified as the Jasper Upper Iron Formation (JUIF) with increasing Jasper content, and produces DSO-grade Red Ore upon leaching.

Lean Chert (LC), overlaid by MS and grades to JUIF, is an oxide facies almost void of primary iron oxides. The chert displays a variety of colors but is generally green to greenish-grey and the unit rarely grades into ore.

The lower limit of the UIF is Green Chert, usually 1.2 to 9.4 m in thickness.

Middle Iron Formation (MIF)

This formation encompasses four main units:

Lower Red Green Cherty (LRGC) is the lower contact with the LIF. This unit, which is not always present, is chert, magnetite, silicates and carbonate bearing, with minor hematite.

Lower Red Cherty (LRC) is an oxide facies rich in hematite, martite and minor magnetite occurring in bands alternating with jasper, and when leached results in DSO-grade Blue ore.

Pink Grey Cherty (PGC) is a thick unit, rich in hematite, with minor magnetite, sometimes bearing considerable iron carbonates. Upon leaching, the unit produces Blue ore with some Yellow ore characterize by goethite. The PGC occasionally bears bands rich in iron silicates, carbonates and iron oxides resembling SCIF. When present, these units are identified as yellow MIF (YMIF) and produces Yellow ore upon leaching.

Upper Red Cherty (URC) is often not well developed and is thus challenging to distinguish from PGC. It is an oxide-rich facies bearing jasper lenses and laminae, and produces DSO-grade Blue ore upon leaching.

Lower Iron Formation (LIF)

This is the lowest member in the Sokoman formation stratigraphy column in contact with the Wishart formation. Based on field observation, it can be described as laminated to bedded. The LIF consists of two units: silicate carbonate iron formation (SCIF) and Ruth Shale (RS). The SCIF is the main unit, consisting of chert interbedded with iron silicate minerals, iron oxides and carbonates, and produces DSO-grade Yellow Ore when leached. Green chert and higher magnetite is a key for this submember. The Ruth Shale unit, previously considered as a separate formation, occasionally contains black shale bearing trace pyrite and also magnetite, hematite or quartz at the upper contact.

The LIF also bears discontinuous oxide-rich layers that produce DSO-grade Blue and Red ores upon leaching.

Ruth Formation

The Ruth formation consists of laminated to micro-bedded black, grey-green or maroon chert-carbonate ferruginous slate 3 to 36 metres thick, bearing minor pyrite. Lenses of black chert and various amounts of iron oxides are also present. This unit produces Red ore upon leaching. When present, the jaspilite produces Blue ore upon leaching. Much of the slate contains more than 20% iron.

Wishart Formation

This formation consists of quartzite and arkose and is a persistent unit in the Kaniapiskau Supergroup. Thick beds of massive quartzite bear well-rounded intraclasts of glassy quartz and 10-30% rounded clasts of pink and grey feldspar, with a cement of silica and minor amounts of hematite and other iron oxides. Thicknesses of 10-75 m have been intersected.

Fleming Formation

This formation commonly ascribes as chert breccias (CB) consisting of rectangular fragments of chert and quartz within a matrix of chert grading to dolomitic downwards. It has a maximum thickness of about 100 metres.

Denault Formation

This dolomite and calcite formation is 20-60 m thick, bearing cherty bands and pebbles of black chert, and exhibits buff-grey to brown hummocky alteration and/or weathering. The formation grades upwards into the chert breccia and or quartzite.

Attikamagen Formation: (thickness >300 m)

This formation is commonly exposed in folded and faulted segments of the stratigraphic succession and varies in thickness from 30 m to over 300 m. The lower part of the formation has not been observed. It consists of laminated to micro-bedded argillaceous material (2-3 mm), fine-grained (0.02 to 0.05 mm), grayish-green, dark grey to black or reddish-grey. Calcareous or arenaceous lenses up to 30 cm thick occur locally inter-bedded with the argillite and slate, and lenses of chert are common. The formation grades upwards into Denault dolomite, or into Wishart quartzite in areas where dolomite is absent. Other prominent structures are drag-folds, and well developed cleavages parallel with axial planes, perpendicular to axial lines of folds and parallel with bedding planes.

LSA, RSA and Temporal Boundaries

The Howse deposit is classified under the DSO3 area. The deposit stratigraphy of this area is dominated by iron formation, quartzite and lower shale with occasional Fleming chert breccias and Denault dolomite. The beds are generally interpreted to be dipping at 65º ENE, though variations are also noted locally. Faults are easily recognized by the rapid change and intersected points of lithology, as well as a hiatus of successive formations between the juxtaposed areas.

The Howse deposit is classified as the Lake Superior type of mineralization, a style of mineralization that is strongly structurally controlled. Complex structures have been recorded in the DSO project area, including faults and folds. The folds in this area are closely spaced and strike in a northwesterly direction. The major axis of the folds plunges NW or SE. Faults are high angle reverse or cross faults with dips greater than 60º.

The Howse deposit is buried in unconsolidated overburden (OB) with thicknesses of 12 to 52 m. This OB comprises sand, gravel and silt material deposited by glacial melting.

The 2014 drilling indicate three DSO-grade ore types: Blue, Red, and Yellow. The Blue and Red ores are dominant, with only narrow intervals of Yellow ore intersected so far. The ore is dominantly friable, porous and soft, with locally alternating layers of high-grade iron ore and hard, partly altered/leached zones of iron formation.

Table 7-39 presents a summary of the formations intersected during hydrogeology and geotechnical drilling at Howse.

Table 7-39 Formations Intersected During Hydrogeology and Geotechnical Drilling at Howse

DDH	FROM	TO	TITLE	DESCRIPTION
HW-GT13-01	0	43	Overburden	No core
	43	201.5	Chert	Pink leached chert, alternating hard leached chert and soft clayey leach chert, fractures infilled with talc. Soft leached chert contain slightly more hematite than the harder sections.
HW-GT13-02	0	33.6	Overburden	OB
	33.6	61.3	Iron Ore Formation	Blue ore, pronounced limonite alteration @ upper contact, shale @42.0m, locally bedded @ 50deg to Core Axis(CA), core lost @50.0m & 55.0m, the ore grades into Red (30cm thick) @ 53.0m. Blue hem bearing disseminated jasper and localized strong limonitisation @59.4m, fracture zone @45deg. CA at the distinct lower contact.
	61.3	70.7	Iron Formation	Clay zones up to 1.5m thick intercalated with red hematite zone @ 35 deg. CA @68.6m. Core lost @68.8m & 70.7m. Distinct Lower contact with Wishart Quartzite.
	70.7	87	Wishart Fm (WQTZ)	Wishart Quartzite; 20cm fractures // to CA at 77.0m. There are some carbonate blebs associated with this unit. The fractures are varying between 45.
	87	120.9	Wishart Fm (WQTZ)	This section is red in color associated with clay and carbonate. The core is fractured along the CA at 86m, filled with calcite and also limonitisation. There is some bedding @40 degree CA at 87.5 m, becoming parallel to CA at 93m. There are 35 degree veins filled by calcite cutting across the bedding at 95.3m.
	120.9	146	Wishart Fm (WQTZ)	This section is constituted of shale associated with green chert. Presence of disseminated sulfur (pyrite). There is some bedding associated with hematite. The core is fractured along the CA at 122.2m. There is some micro faulting at 123.9m. There is 45 degree bedding at 128.6m. Fracture at 137.9m filled with hematite.
	146	200.8	Wishart Fm (WQTZ)	This section bears more shale. The texture is layered. There is more bedding @30 degree to CA at 145.6m. Presence of limonite alteration at 149m. Presence of hydraulic fracture at 155.5m filled by hematite. 40 degree fracture at 155.8 filled by hematite. From 169.5 to 172.5 m there is a fault zone associated with graphite and brecciated. Bedding became parallel to CA at 170.5m. From 174 to 121m the core is badly broken and redder in color. 45 degree fracture at 188.2 m bearing limonite alteration.
HW-RC13-02	0	36	Overburden	Large blue chert fragments, significant magnetite, decreases in grain size with depth. Dull blue chert with minor magnetite and brown coating. Mostly sandy with grain size decreasing down hole.
				36-39: Transition between overburden and MIF. Fine-grained sand, hard to distinguish, rounded quartz and dark grey chert. Minor hematite and trace coarse-grained magnetite.

DDH	FROM	TO	TITLE	DESCRIPTION
	36	39	Iron Formation	Chert fragments and hematite with dark coating.
	39	105	Iron Ore Formation	Dominantly Blue, and locally Red, fine-grained and strongly leached, dominantly high-grade (>60% Fe) DSO, averaging ~65% Fe; dominantly hematite and locally very weakly magnetic depicting the presence of martite. Gangues include locally red clay and chert. Mineralization is dominantly Blue and high-grade from the upper contact, and grades into Red and low-medium-grade towards the lower contact.
	105	108	Iron Ore Formation	Red hematite, red iron clay coating. White chert fragments, clay pockets.
	108	114	Iron Formation	Blue hematite with dark brown clay coating, mostly white with minor blue chert.
	114	129	Iron Formation	Blue hematite with dark brown clay coating. White/blue chert fragments.
	129	162	Wishart Fm (WQTZ)	Very fine-grained sand with large- to medium-grained quartz sand and medium-grained goethite and hematite.
HW-RC14-WE01R	0	44.15	Overburden	Light to dark brown, predominantly very-fine-grained to coarse-grained sand with abundant, subrounded to rounded, pebble-sized clasts up to a few cm in diameter; consisting of chert, quartz and other rock fragments.
	44.15	59.4	Iron Ore Formation	Dark brown, fine- to coarse-grained hematite ore with locally minor clay component. Dominantly sandy size fraction with minor gravel. Ore type is Blue at the upper contact grading into dominantly Red from 68m down to the lower contact.
	126.5	164	Wishart Fm (WQTZ)	Quartz-rich sand that characterizes an intensely altered Wishart formation. EOH
HW-RC14-WE02R	0	25.8	Overburden	From 0m to 13.6m the rock chips are medium reddish-brown in color with minor clay component. Grain size ranges from fine-grained sand to pebble sized clasts up to 1-1.5cm; From 13.6m to 19.7m color changes to a light-medium brown and grain size measures from fine-grained sand particles to pebbles sized material up to 0.5cm. Deep reddish brown regolith from 19.7m-22.75m -with minor clay intercalations and particles that measure up to 1-2cm. gradational transition from OB to ore in interval 22.75m-25.8m. Overall, the particles are rounded to subrounded and consist of chert and other rock fragments.
	25.8	60.3	Iron Ore Formation	Blue/red to red/brown gravel ore with abundant sand-sized particles composed mostly of quartz and chert with minor martite. Color becomes more reddish-brown downhole with the presence of minor clay as gangue.
	60.3	109.1	Iron Ore Formation	Reddish-brown gravel ore with an abundant fine-grained sandy component of quartz, chert, martite and possibly trace carbonate?
				Rock chips become more medium reddish-brown downhole; Grains are rounded to subrounded and sometimes angular; Rare yellow limonitic alteration visible on some grains from interval 90.8m to 93.85m; Unit becomes more sandy downhole
	109.1	182.3	Iron Ore Formation	Predominantly medium reddish-brown in color, very sandy intervals of quartz, chert and locally minor martite; rare carbonate grains visible in most interval along with some visible limonitic alteration; minor gravel ore component in intervals 124.35m-127.40m; 133.5m-145.7m; and from 151.8m - 164.0m

DDH	FROM	TO	TITLE	DESCRIPTION
HW-RC14-WE03R	0	22.8	Overburden	Brown gravel with a mix of sand. Gravel ranges in size from 1mm to 2cm and is mostly well-rounded with some angular pieces. Mostly chert, with some minor magnetite.
	22.8	35	Iron Ore Formation	Red gravel mixed with a minor amount of sand. The gravel is very hard and doesn't leave much of a streak.
	35	47.2	Iron Ore Formation	Mostly reddish-blue hematite that is largely gravel mixed with sand.
	47.2	108.2	Iron Formation	Red, TRX that is mostly gravel with lesser sand. Mostly chert with minor hematite. Water seen from 88m to 106m. Short interval of possibly carbonate-rich rock between 71.60m-74.65m.
	108.2	180.25	Wishart Fm (WQTZ)	Quartz-rich sand that characterizes the Wishart formation.
HW-RC15-WE05R	0.0	54.86	Overburden	Grey to Brown gravel with a mix of sand. Gravel ranges in size from 1mm to 2cm and is mostly well-rounded with some angular pieces.
	54.86	70.10	Wishart Fm (WQTZ)	Weathered white chips with a muddy light red-brown clay coating. Silica grains in white chips show matrix leaching.
	70.10	182.88	Attikamagen Fm (LS)	Over all color is typical greenish-grey of the Attikamagen. Most of recovered material is sand size with some rounded chips. Chips show some bedding coloured from mauve, green, grey and white.
HW-RC15-WE07R	0.0	18.29	Overburden	Grey sand with a mixed with bands of gravel. Gravel ranges in size from 1mm to 2cm and is mostly well-rounded with some angular pieces
	18.29	39.62	Sokoman Fm (BIF)	Reddish-brown coating on 2-10 mm chips of leached IF. Black non-magnatic chips common. White leached chips with yellow limonite staining 20-30%
	39.62	67.06	Sokoman Fm (BIF)	Greyish-brown coating on 2-10 mm chips. Common non-magnetic black chips with minor red band/spots. Some leached white chert and minor yellow limonite staining. Mostly reddish-blue hematite that is largely gravel mixed with sand.
	67.06	97.54	Sokoman Fm (PGC)	Most chips over 10 mm. Chips show PGC weathering with rust/black mineral in the weathered carbonate blebs. Weak magnetics. Red and black colour to the chips. Quartz-rich sand that characterizes the Wishart formation.

Existing Literature

The earliest major reported and recorded work on the Howse Property and deposit was by IOCC from 1950 to 1980. During this period, IOCC completed approximately 110 holes and several trenches, and reported a mineral resource estimate. Between 2005 and 2012, LIM completed ground geophysics survey, and drilled eight holes from 2008 to 2009. IOCC and LIM reported thick overburden of up to 40 m over the deposit. No production has taken place on Howse Property till date.

Structurally, the deposit occurs in a broad syncline with tight second order folds in the hinge area. The hinge area of the first order syncline is faulted by a major reverse fault dipping steeply to the northeast. A major northeast-southwest striking cross fault separates the deposit into two parts. In the southern part, the ore zone has a surface width of about 76 m and the southwest limb of the first order syncline is faulted against lower slate to the northeast. In the northern part, the ore zone has a width averaging about 152 m and both limbs of the syncline in iron formation are preserved.

The 1983 IOCC Inventory of Resources lists the Howse resource at 28,800,000 tonnes at 58% Fe and 5% SiO_2.

Overburden

Some information presented in this section is based on information provided in Section 7.3.7. Depositional evidence of meltwater activity, rare in the region, occurs within the area encompassed by the Howse Property itself. In this area, a relatively uniform cover of till overlies buried glaciofluvial sand and gravel. The landform is interpreted to be a buried kame, more or less centered on the deposit, overridden by a late glacial advance. The kame (dome shape) is deduced on aerial photographs by a distinct, radial drainage pattern centered on the thickest portion of sand and gravel that encompass the Howse Property area. Drilling has shown that the overburden covering the Howse Property varies in thickness from 12 to 52 m in the explored part of the deposit, as shown for some boreholes in Figure 7-13. Silty sand is the most widespread surficial material in the vicinity of the Project. The till is generally moderately-well to well drained, supporting sandy soils. In depressions where the groundwater table is perched on an impervious layer, the till may be imperfectly to poorly drained. The 2013-2014 drilling results (Volume 2 Supporting Study C) indicate that the glaciofluvial material intercepted was mainly a mixture of sand and gravel, with occasional clay content.

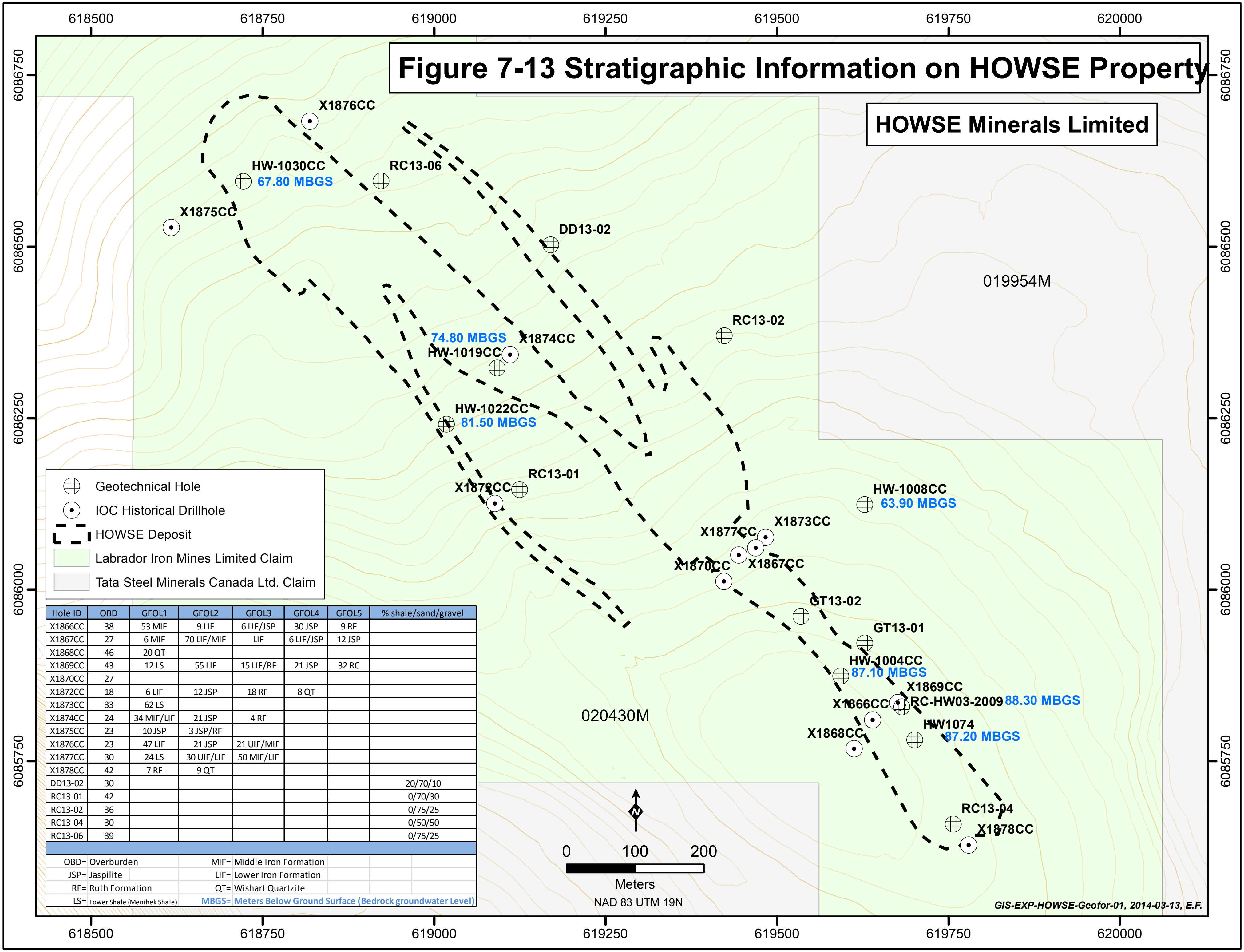
Figure 7-13 shows the observed percentage of clay, sand and gravel in the overburden section of some boreholes.

The Howse area is dominated by Irony Mountain, which is a prominent bedrock knob resistant to glacial erosion. Meltwater channels incised through till are seen on the western flank of the mountain.

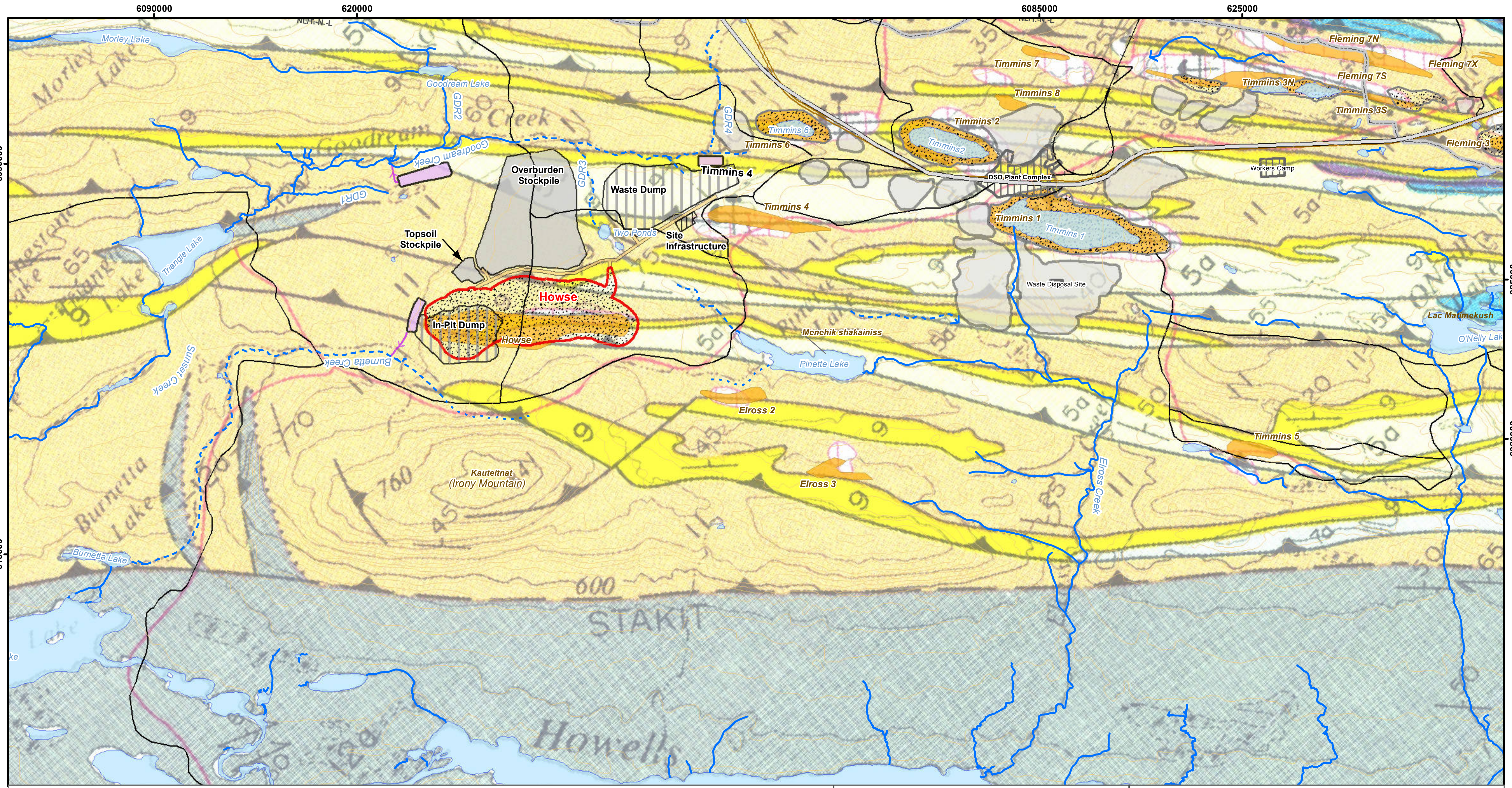
Bedrock

The bedrock at Figure 7-13 shows the general geology of the spatially close Timmins and Howse deposits. It can be observed that the geological context is very similar for the Howse and Timmins deposits considering the geological trend and bedrock lithological continuity. Exploration work, including drilling conducted by IOCC on the Howse Property, generated stratigraphic sections of the deposit showing a narrow correlation with the Timmins deposits as illustrated by Figure 7-13. The general pattern is the same for both the Timmins and Howse areas, with the obvious exception of some minor local variations. The formations containing the economic iron ore are highlighted in blue. Some stratigraphic sequences established from drilling by IOCC on the Howse Property are shown in Figure 7-13. A surface ore plan produced by IOCC shows that the Howse Property lies in a faulted geological environment.

Figure 7-13 Stratigraphic Information on HOWSE Property



Hole ID	OBD	GEOL1	GEOL2	GEOL3	GEOL4	GEOL5	% shale/sand/gravel
X1866CC	38	53 MIF	9 LIF	6 LIF/JSP	30 JSP	9 RF	
X1867CC	27	6 MIF	70 LIF/MIF	LIF	6 LIF/JSP	12 JSP	
X1868CC	46	20 QT					
X1869CC	43	12 LS	55 LIF	15 LIF/RF	21 JSP	32 RC	
X1870CC	27						
X1872CC	18	6 LIF	12 JSP	18 RF	8 QT		
X1873CC	33	62 LS					
X1874CC	24	34 MIF/LIF	21 JSP	4 RF			
X1875CC	23	10 JSP	3 JSP/RF				
X1876CC	23	47 LIF	21 JSP	21 UIF/MIF			
X1877CC	30	24 LS	30 UIF/LIF	50 MIF/LIF			
X1878CC	42	7 RF	9 QT				
DD13-02	30						20/70/10
RC13-01	42						0/70/30
RC13-02	36						0/75/25
RC13-04	30						0/50/50
RC13-06	39						0/75/25
OBD=	Overburden		MIF=	Middle Iron Formation			
JSP=	Jaspilite		LIF=	Lower Iron Formation			
RF=	Ruth Formation		QT=	Wishart Quartzite			
LS=	Lower Shale (Menihek Shale)		MBGS=	Meters Below Ground Surface (Bedrock groundwater Level)			



LEGEND

Geological Components

- 5a : Grey Shale, Siltstone And Graywacke
- 6a : Dolomite
- 8 : Brecciated Chert
- 9 : Orthoquartzite, Quartzite And Siltstone
- 11 : Cherty Iron Formation
- : Mining Area

Infrastructure and Mining Components

- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Site Infrastructure
- Proposed Waste Dump/ In-Pit Dump
- Proposed and Existing Sedimentation Pond
- Proposed Ditch
- DSO Haul Road
- Proposed Mine Haul Road
- Existing Railroad
- Elross Lake Area Iron Ore Mine (ELAIOM) Plant Infrastructure footprint
- Existing Pit
- Existing Dump
- Deposit

Basemap

- Permanent Watercourse
- Intermittent Watercourse
- Storm Runoff
- Disappearing Stream
- Artesian Spring
- Water Body
- Contour Line (50 ft)
- Provincial Border
- Existing Road
- Main Access Road

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0615 , PR185-19-14, 2016-01-26, jtremblay

N

0 500 1 000
Meters

UTM 19N NAD 83

SCALE: 1:30 000

SOURCES:

Basemap
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec, Boundary used for claims
SNC Lavalin, Groupe Hémisphères, Hydrology update, 2013

Infrastructure and Mining Components
New Millennium Capital Corp., Mining sites and roads
Howse Minerals Limited/
MET-CHEM Howse Deposit Design for General Layout., 2015

Geology layer
Wardle RJ, Geology of the south-central Labrador Trough, scale 1:100,000.

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Geology

Howse Minerals Limited

GroupeHemispheres
5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 7-14

Acid Rock Drainage Potential

Comparison data used to understand the Howse Property is mainly from the Timmins area, as the two are physically close and geologically similar. Samples were collected from drill holes in various parts of the Timmins deposits to cover the widest range of volume, extent and relative proportions of ore/waste in relation to the exploration hole. Waste samples around the deposit were also included as part of this program in order to better understand the various formations that will be encountered during mining.

The process of sample selection was based on the following rationale:

- consider the local and regional geological and hydrogeological conditions which could be affected during this process;
- cover all geological formations to be encountered during the service life of the mine;
- cover ore and waste in a proportional way; and
- cover any visible changes in the proportions of minerals in the ore and waste log data.

The Timmins area was well analyzed with respect to the ARD potential because of the mining activity. In addition, several orthodox tests such as Acid Base Accounting (ABA), which includes Total Sulfur (S) and Raw Neutralizing Potential (NP), Acid Potential (AP), Net Neutralization Potential (NNP) and Neutralization Potential Ratio (NPR or NP/AP) tests were conducted. Moreover, a Leaching Potential test, including the Toxicity Characteristic Leaching Procedure (TCLP), was conducted on the samples. Analyses of the resulting sample leachates were performed for concentrations of mercury, arsenic, barium, boron, cadmium, chromium, lead, selenium, uranium, fluoride, nitrates and nitrites. The primary goal for these tests was to monitor the drainage chemistry and acid generating potential of the geological formations of the Timmins area. Some results are shown in Table 7-40 for reference.

Based on the above ARD results and geological similarity between the Timmins area and the Howse Property, it can be assumed that the geological formations that will be encountered in and around the Howse Property do not have acid generating potential. The TSMC geological team will also send samples from all Howse geological formations at various levels to confirm this assumption in the coming months. From the first ABA analysis done for Howse, the maximum acid potential result was 2 kg $CaCO_3$/t, indicating that the samples are not acid generating (Volume 2 Supporting Study H).

Table 7-40 Toxic Element Concentration and Acid Rock Potential of the Timmins Area

ORE/ WASTE	LITHO-LOGY	SULFUR (%)	AS	CR	PB	SE	CD	AP	NP	NNP	F	NO_3	NO_2	LEACHATE PH
Ore	MIF	0.02	<0.004	<0.007	<0.01	<0.005	<0.002	0.6	12	11.4	1	<0.2	<0.2	4.94
		0.01	<0.004	<0.007	<0.01	<0.005	<0.002	0.6	12	11.4	<1	<0.2	<0.2	4.93
Ore	MIF	<.01	<0.004	0.083	<0.01	<0.005	<0.002	0.3	12	11.8	<1	<0.2	<0.2	4.94
Waste	MIF	<.01	<0.004	0.023	<0.01	<0.005	<0.002	0.3	12	11.7	<1	<0.2	<0.2	4.94
Waste	MIF	0.02	<0.004	0.007	<0.01	<0.005	<0.002	0.6	12	11.4	<1	<0.2	<0.2	4.94
Ore	MIF	0.02	<0.004	<0.007	<0.01	<0.005	<0.002	0.3	12	11.7	<1	<0.2	<0.2	4.93
Waste	MIF	<.01	<0.004	<0.007	<0.01	<0.005	<0.002	<0.3	12	12	<1	<0.2	<0.2	4.94
Waste	MIF	0.01	<0.004	<0.007	<0.01	<0.005	<0.002	0.3	12	11.7	<1	<0.2	<0.2	4.91
Ore	MIF	0.01	<0.004	<0.007	<0.01	<0.005	<0.002	0.3	12	11.7	<1	<0.2	<0.2	4.94
		0.01	<0.004	<0.007	<0.01	<0.005	<0.002	0.3	12	11.7	<1	<0.2	<0.2	4.94

ORE/ WASTE	LITHO-LOGY	SULFUR (%)	AS	CR	PB	SE	CD	AP	NP	NNP	F	NO_3	NO_2	LEACHATE PH
Ore	MIF	0.01	<0.004	<0.007	<0.01	<0.005	<0.002	0.3	12	11.7	<1	<0.2	<0.2	4.91
Ore	MIF	0.01	<0.004	<0.007	<0.01	<0.005	<0.002	0.3	12	11.7	<1	<0.2	<0.2	4.91
Waste	MIF	0.01	<0.004	<0.007	<0.01	<0.005	<0.002	0.3	12	11.7	<1	<0.2	<0.2	4.90
Waste	MIF	0.02	<0.004	<0.007	<0.01	<0.005	<0.002	0.6	12	11.4	<1	<0.2	<0.2	4.90
Ore	MIF	0.01	<0.004	0.008	<0.01	<0.005	<0.002	0.3	25	24.7	<1	<0.2	<0.2	4.94
Waste	MIF	0.01	<0.004	<0.007	<0.01	<0.005	<0.002	0.3	13	12.7	<1	<0.2	<0.2	4.94
Ore	MIF	0.01	<0.004	<0.007	<0.01	<0.005	<0.002	0.3	12	11.7	<1	<0.2	<0.2	4.94
Ore	MIF	0.02	<0.004	<0.007	<0.01	<0.005	<0.002	0.6	12	11.4	<1	<0.2	<0.2	4.94
Waste	MIF	0.02	<0.004	0.091	<0.01	<0.005	<0.002	0.6	12	11.4	<1	<0.2	<0.2	4.94

Seismicity

The Schefferville station of the Federation of Digital Seismograph Networks (FDSN) is located within the Eastern Background seismic zone, in which low-level but occasionally noteworthy seismicity may occur. The region is seismically quiet in all directions from the station for more than 300 km (FDSN, no date). Blasts from the mines near Labrador City are recorded several times weekly. They normally range from 2 < MN < 3.

Current Study

The concurrent exploration, geotechnical, and hydrogeology work on Howse Deposit comprises both reverse circulation and diamond drilling. In addition to drilling, reconnaissance mapping was done on both licenses (021314M and 021315M).

Some geotechnical and hydrogeological investigations were also completed on the Howse deposit during the same period.

The objective of the exploration program was to validate reported historical resources and carry out further drilling to bring this information to at least the Indicated resource category.

The objective of the geotechnical study was to provide information to an acceptable level for pit-wall design in different strata to ensure stability.

Data Gaps

The geology of the Howse area is well known and there are no data gaps.

7.3.6 Hydrogeology

The Howse hydrogeological field study was initiated by Golder Associates (Golder) in winter 2013 and completed by Geofor Environnement (Geofor) in falls 2014 and 2015. A part of the data collected by Golder Associates was incorporated in the Geofor's hydrogeological report, which is found in Volume 2 Supporting Study C, along with Golder's technical memorandum. The wells drilled under supervision of Geofor in 2015 are presented in Figure 7-15 along with the Golders' boreholes referred in the Geofor's report.

Golder Associates supervised the drilling of five boreholes into bedrock (HW-RC13-001, HW-RC13-002, HW-RC13-003, HW-GT13-001 and HW-GT-13-002), and one into overburden only (HW-BH-13-01). HW-GT13-001 and HW-GT13-002 were submitted to packer tests. HW-GT13-0001 was fitted with a thermistors array distributed along the borehole to check the eventual presence of permafrost. Temperatures were recorded automatically twice a day.

Geofor's hydrogeological program of fall 2014 consisted of the drilling of three wells into the overburden to the rock interface and three wells into the rock at an initially planned depth of 180 m below ground surface. Two wells into rock were submitted to pumping tests. One well was drilled at each extremity of the long axis of the deposit and the third one, which caved in at the end of the drilling, in the middle of it. The field work was completed in September and October 2014.

Five new wells sequentially numbered from HW-RC15-WE05R to HW-RC15-WE09R, were drilled in September 2015. Except for HW-RC15-WE06, which is in the middle of the long axis of the deposit, all wells are outside the deposit. HW-RC15-WE05R, HW-RC15-WE06R, HW-RC15-WE08R and HW-RC15-WE09R are located along the long axis of the iron formation containing the deposit. This axis corresponds to the dominant structural and geological northwest-southeast trend of the Labrador Through. Well HW-RC15-WE07R was drilled in order to obtain information on groundwater on the northeast side of the deposit.

HW-RC15-06R, HW-RC15-07 and HW-RC15-08R were submitted to pumping tests. Well HW-RC14-WE02R, which has caved in in 2014, was cleaned to a certain depth with the drill and equipped as a piezometer to be used as observation well during the pumping of HW-RC15-WE06R.

The 2014 available hydrogeological data was gathered in order to establish a hydrogeological model and to simulate impacts of mine dewatering on groundwater and surface water. The modelling part was subcontracted to SNC-Lavalin which was asked to update the model in 2015 with new data. SNC-Lavalin's report is included in Volume 2 Supporting Study C.

All previous studies concerning the DSO projects were consulted. This section presents the compilation of previous knowledge and findings of the 2013 to 2015 Howse hydrogeological programs. The results of dewatering simulations are also discussed.

7.3.6.1 Component Description

LSA, RSA and Temporal Boundaries

The local study area (LSA) is considered to be limited to the watersheds within which the Project takes place. This corresponds to the Goodream Creek, Pinette Lake and Burnetta Creek watersheds, including Triangle Lake. The LSA is limited to these watersheds because they will be the only ones directly affected by the Project. The Elross Creek watershed is not included in the LSA, since it will not be directly affected by the Project, and since the effects generated by the processing of ore at the DSO plant are discussed in the ELAIOM EIS. The regional study area (RSA) is considered to be the upper portion of the Howells River. The three watersheds included in the LSA drain into Howells River, and other projects in the area also ultimately discharge into the Howells River watershed.

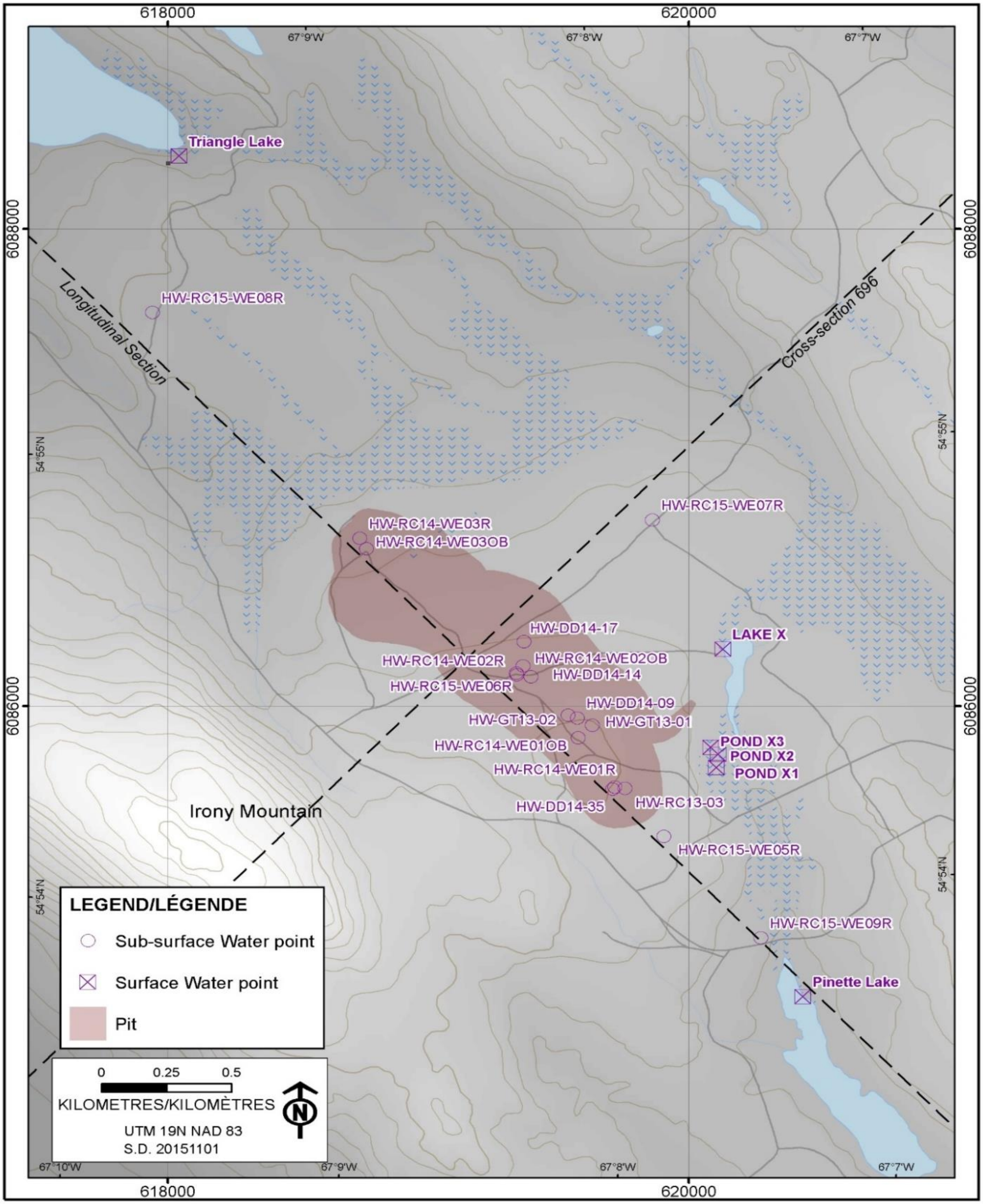


Figure 7-15 Location of Wells, Piezometers and Boreholes in the Howse Project area

Existing Literature

Regional Groundwater Flow

There is no specific literature concerning the hydrogeology of the Howse deposit except the studies carried out by TSMC since 2013. No documentation about the field works done by IOCC on Howse hydrogeology was found. FracFlow (2006) and SNC in collaboration with Geofor (unpublished and confidential report) have conducted some hydrogeological works on Labmag and Kémag taconite deposits. Labmag project is located northwest of Howse just on the other side of Howells River.

Other mining projects in the area were conducted by different companies. A section on hydrogeology in the NI43-101 Joyce Lake DSO deposit Report for Century can be downloaded from the Sedar site. Other information can be available in assessment report of others companies having operated in the region. For example, Labrador Iron Mine which has mined the James Deposit, few kilometers from Schefferville, has done extensive hydrogeological study. Century's Full Moon Taconite and Adriana Otelnuk Taconite NI43-101 studies also likely have some hydrogeology studies related to their specific deposit.

Some articles about hydrogeology of the large area of Schefferville can also be found in the official literature. J.J. Drake, L. Nichols, J.P. Stubbins, P. Monro and F.H. Nicholson are the best known of these authors.

Groundwater Basins

The analysis of the data collected during the mining of a large number of DSO deposits located between the Gagnon pits near Schefferville and the Triangle Lake and information gathered from exploration campaigns by TSMC and former companies allowed defining two main groundwater basins. The groundwater flow in both basins is primarily controlled by the Hudsonian northwest-southeast main fracturing system and to a lesser extent by perpendicular secondary fractures.

The Fleming 7 deposit is located on a groundwater divide which corresponds also to the Québec-Labrador border. To the south-east of Fleming 7, the groundwater is flowing entirely on the Québec side from Fleming 7 area toward the Big Star Lake area (Fleming Basin on the Figure 7-16) which is a sector of discharge for a large part of groundwater of this basin

On the northwest side of Fleming 7, the partial delimitation of the Goodream Basin on Figure 7-16, which is entirely in Labrador, is based on groundwater elevations collected by TSMC during previous and recent hydrogeological studies (Groupe Hémisphères 2010, Groupe Hémisphères and Geofor 2011, 2012a, 2012b, Geofor 2015a, Geofor 2015b). Much information is available in the sector of TSMC/DSO3 which is the mining area circling the TSMC's processing plant and including the Timmins and Fleming deposits (see Figure 7-17). Elsewhere, the information is mainly obtained from water elevations measured in the Howse deposit area from 2013 to 2015. The northwest and a part of the southwest limit of the basin cannot be defined or ascertained without supplementary hydrogeological data.

Groundwater Flow in the Goodream Basin

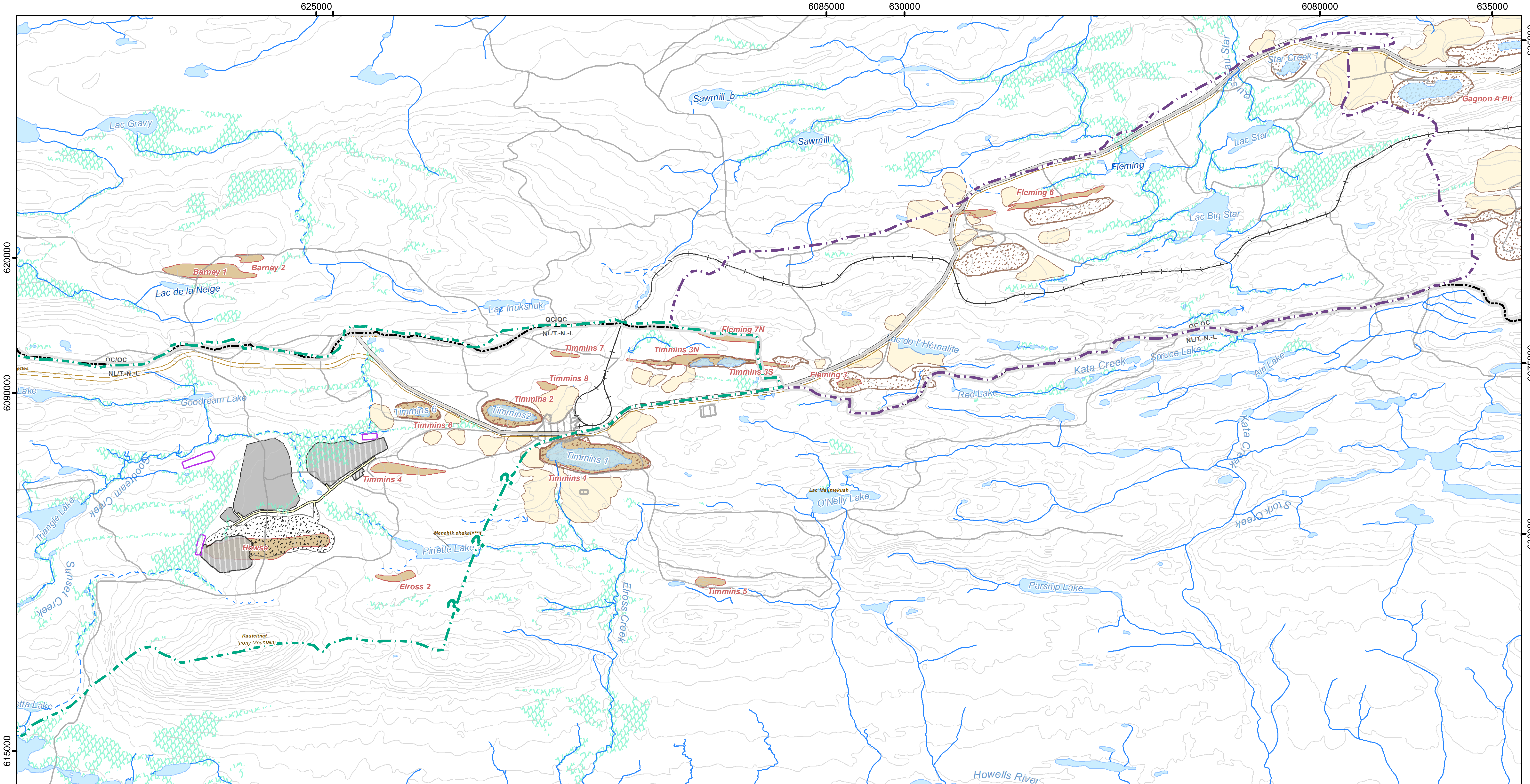
As part of the modelling, SNC-Lavalin has drawn the piezometric map presented in Figure 7-18 from all available groundwater elevations measured in Howse and TSMC/DSO3 areas. Table 7-41 summarizes the main specifications of wells or piezometer used. A map, showing the geology of the Howse area is presented in Figure 7-19. The piezometric maps (Figure 7-18) shows the groundwater flow pattern in the Goodream basin. The groundwater recharge is occurring in the Fleming 7 deposit area where the highest groundwater elevations are found and from the high elevation terrains along the Québec-Labrador boundary for the northeast of the basin and from the groundwater divide on the Irony Mountain on the southwest side of the basin. Groundwater flows in a northwest direction more or less parallel to the geological and structural main trend with a mean gradient of about 0.15 m/m. At the level of Timmins 4, a part of groundwater flow begins to focus toward an area located southwest of the Triangle Lake. The gradient is minimal in the vicinity of the well HW-RC15-WE08R with a value of 0.005 m/m (see Figure 7-18).

No obvious groundwater resurgence was observed in the area surrounding the Howse deposit. This is coherent with the deep water table observed in the large area around the Howse deposit. Without presuming of all mechanisms of discharge of groundwater to the surface network, it can be assumed that the Burnetta Lake area is one of the points of discharge of groundwater in the sector of Howse deposit.

Henry Simpson, an experienced geologist involved in the mapping of the Schefferville area, outlines that the creeks often follows the surficial layout of thrust faults which are zones of soft and erodible material. He also believes that the Burnetta Creek layout can also be controlled by such a structure based on his mapping experience of this sector (personal communication). As can be seen in Figure 7-18, the Burnetta Creek flows, from its origin, along the surficial layout of a thrust fault to a certain point downgradient where it makes a sudden 90 degree turn to flow southwest toward the Burnetta Lake following very likely another thrust fault perpendicular to the structural main trend. The creek finally flows into the Burnetta Lake that discharges into the Howells River.

The area between the Burnetta Lake and the irony mountain is very disturbed from the geological and structural point of view. Two thrust faults oriented northeast-southwest and delimiting a northeast geological Menihek unit are noted on each side of the Burnetta Creek upstream of the Burnetta Lake. In this area, this orientation is unusual for a thrust fault and a geological unit as can be seen on the Figure 7-19. Although incompletely mapped in the northeast direction, it can be supposed that the faults are continuous along the northeast section of the Burnetta Creek and intercept at some point the main northwest-southeast structural faults conveying the groundwater that will then be channelled toward the Burnetta Lake area where it will discharge.

As support to this hypothesis, Groupe Hémisphères has observed a clear increase of the flow of the Burnetta creek close to its discharge into the Howells River (Groupe Hémisphères, 2014). For example, for the same day in August 2013, the specific runoff at the upstream was 4.1 L/s/km^2 while the downstream station near the mouth recorded 147 L/s/km^2. They concluded that the downstream section of the creek was probably largely fed by groundwater.



LEGEND

Hydrogeologic watershed
- Goodream
- Fleming

Infrastructure and Mining Component
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Site Infrastructure
- Proposed In-Pit Dump/ Waste Dump
- Proposed Sedimentation Pond
- DSO Haul Road
- Existing Railroad
- Existing Dump
- Existing Pit
- Deposit
- Elross Lake Area Iron Ore Mine (ELAIOM) Plant Infrastructure Footprint
- Proposed Mine Haul Road

Basemap
- Permanent Watercourse
- Intermittent Watercourse
- Storm Runoff
- Disappearing Stream
- Artesian Spring
- Water Body
- Wetland
- Contour Line (50 ft)
- Provincial Border
- Existing Road
- Main Access Road

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0597 , PR185-19-15, 2016-03-22, edickoum

0 500 1 000 1 500 2 000
Meters

UTM 19N NAD 83

SCALE: 1:50 000

SOURCES:
Basemap
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and Government of Quebec,
Boundary used for claims
SLE, AMEC and GHI (October 2012). LabMag and Kémag Iron Ore Projects 2012 Mine Site Aquatic Program Field Report.
Groupe Hémisphères, Hydrology, Wetland, 2013.

Infrastructure and Mining Components
New Millennium Capital Corp., Mining sites and roads
Howse Minerals Limited/
MET-CHEM, Howse Deposit Design for General Layout, 2015

geofor environnement

ENVIRONNEMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Location of the Goodream and Fleming Groundwater Basins

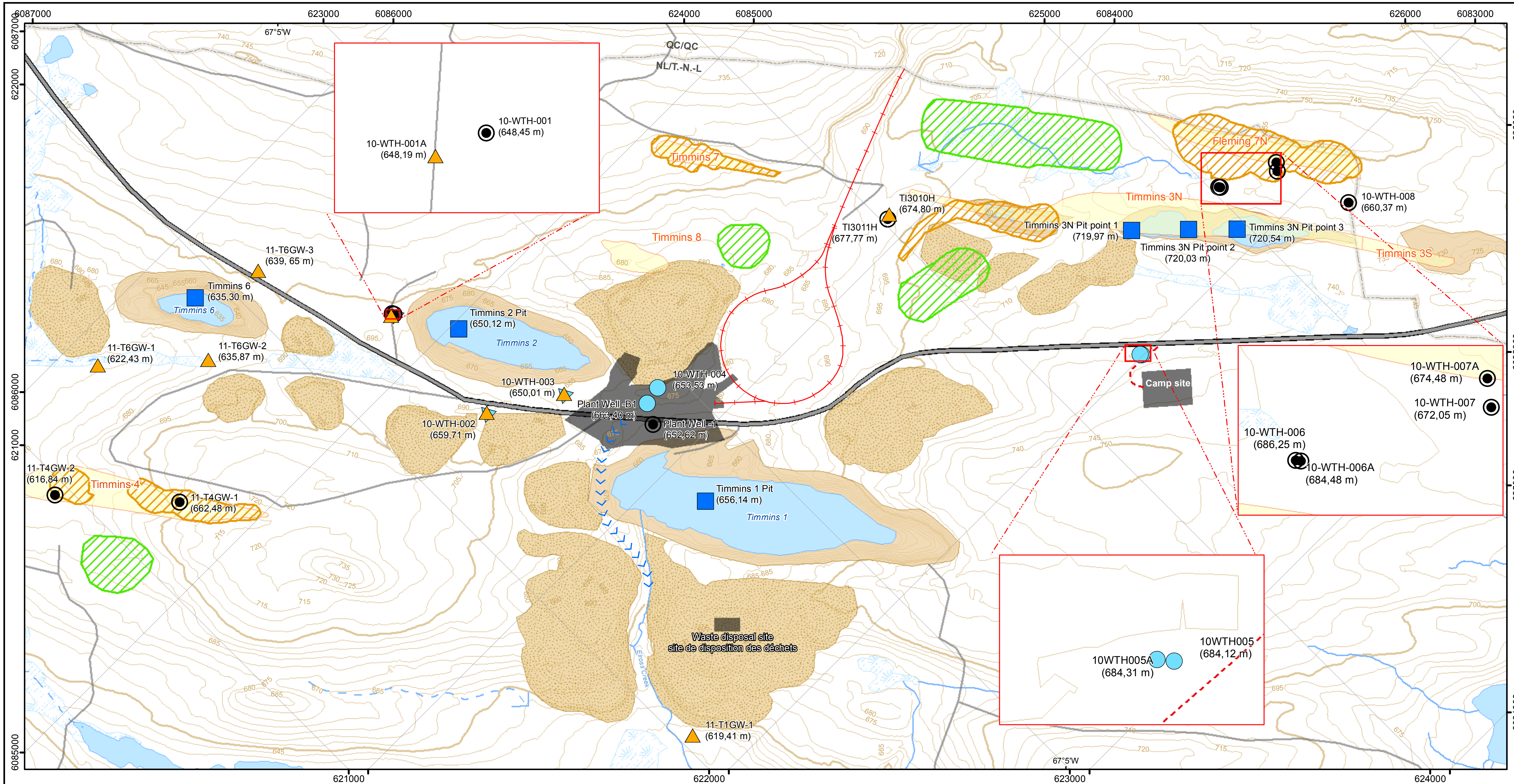
Howse Minerals Limited

GroupeHemispheres

5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2

1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 7-16



LEGEND

Surveys

- Environmental monitoring well
- Piezometer
- Unconfined water in relation with watertable
- Water supply well
- (649,4 m) Static water elevation asl

Infrastructure and Mining Component

- Deposit
- Proposed road
- Proposed pit
- Proposed waste dump
- Elross Lake Area Iron Ore Mine (ELAIOM) Plant Infrastructure Footprint
- Proposed yard track

Basemap

- Provincial border
- Main access road
- Road/route
- Waterbody
- Disappearing pond
- Wetland
- Watercourse
- Intermittent watercourse
- Disappearing watercourse
- Existing large ditch
- Existing mined-out pit
- Existing waste dump
- Contour interval

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0223 , PR84h, 2016-01-27, jtremblay

0 200 400 600 800 1 000 1 200
Meters

UTM 19N NAD 83

SCALE: 1:15 000

SOURCES:
Basemap
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and Government of Quebec,
Boundary used for claims
Geofor and GHI (April 2012). Hydrogeological Drilling Report, Fleming 7N Area - DSOP, Project 1a.
Groupe Hémisphères, Hydrology, Wetland, 2013.
Infrastructure and Mining Components
New Millennium Capital Corp., Mining sites and roads

ENVIRONNEMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

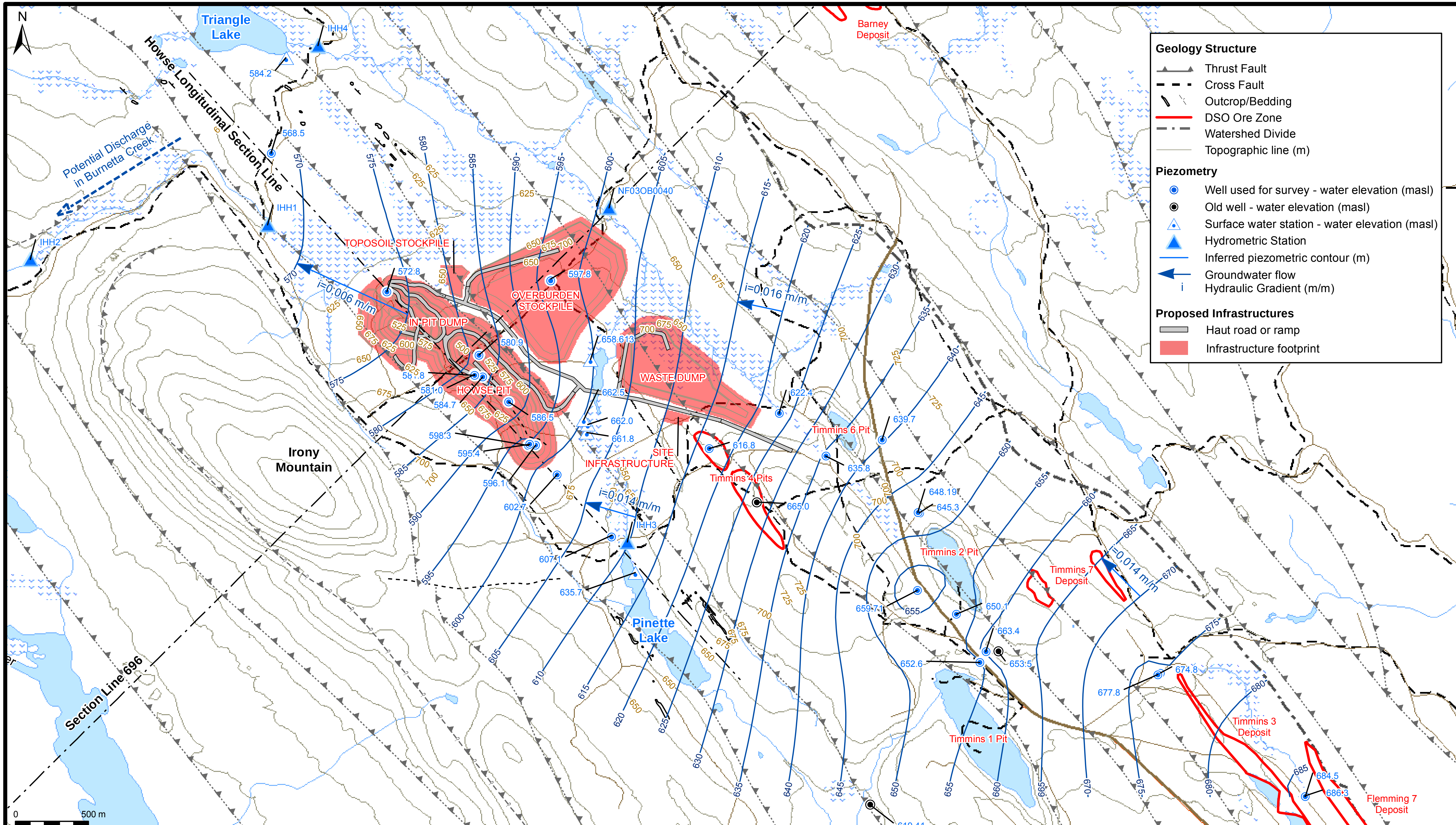
Wells Location in the TSMC/DSO3 Area

Howse Minerals Limited

geofor environnement

GroupeHemispheres
5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 7-17



NO.	DATE	DESCRIPTION	DRAWN	VERIFIED
0	9 nov. 2015	Pour consultation	E. Cazeneuve	A. M. Benlahcen

TITRE

Figure 7-18
Piezometric Map
of the Goodream
Groundwater Basin

PROJET

Hydrogeology Modeling - Howse project

CLIENT

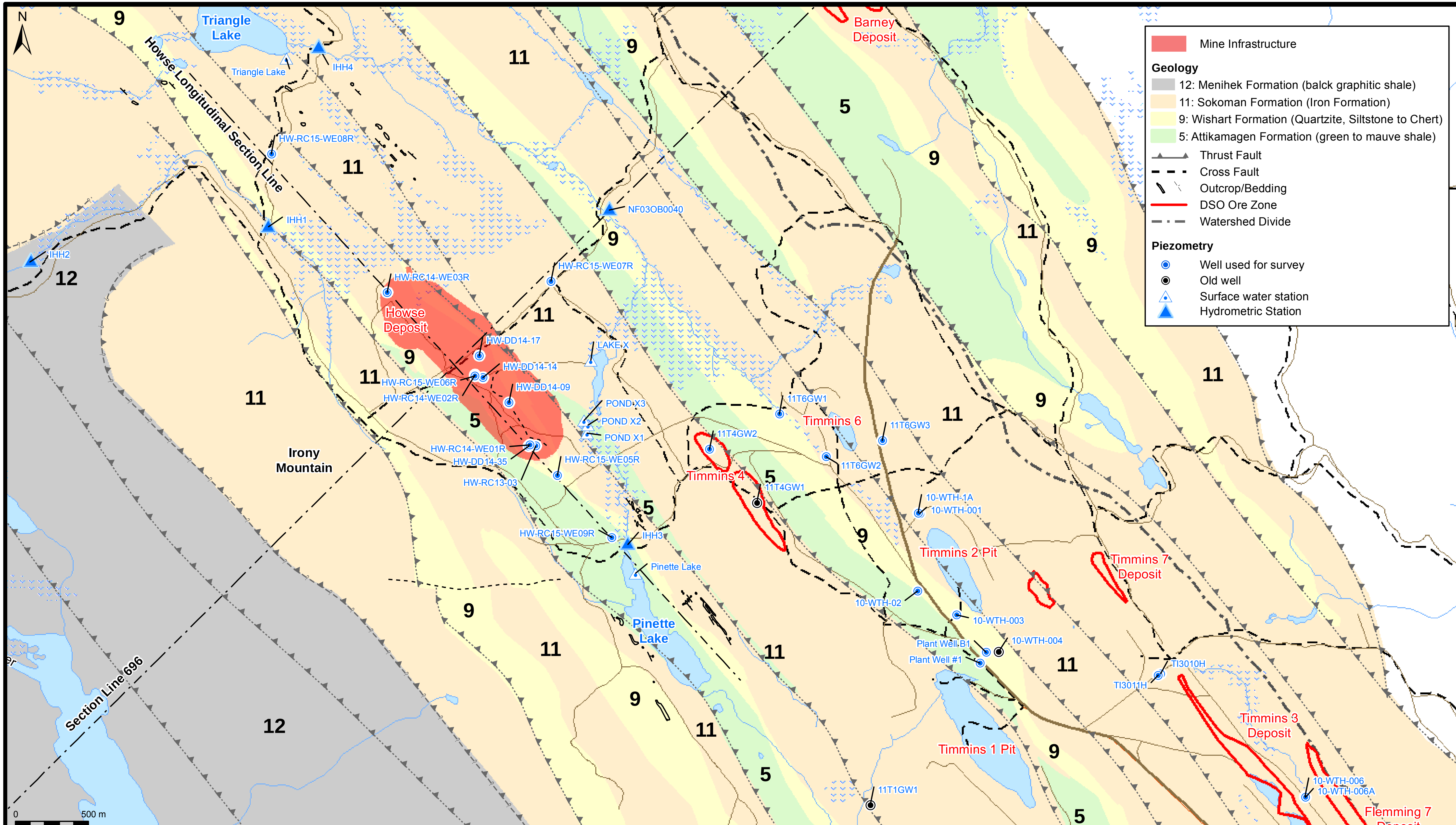
Geofor Environnement

CONSULTANT

SNC·LAVALIN

ÉCHELLE	NUMÉRO	RÉV.
1:25 000	623419-000-1005-2-6	0

\\Envir01\public\Proj\623418_Modelisation_projet Howse\4.0_Réalisation\4.5_SIG\ArcGIS\1MXD\Report\623418_Howse_Fig2-6_PiezoMap_V4.mxd



NO.	DATE	DESCRIPTION	DRAWN	VERIFIED
0	5 nov. 2015	Pour consultation	E. Cazeneuve	A. M. Benlahcen

TITRE

Figure 7-19
Surface Geology
of the Howse Area

PROJET

Hydrogeology Modeling - Howse project

CLIENT

Geofor Environnement

CONSULTANT

SNC·LAVALIN

ÉCHELLE	NUMÉRO	RÉV.
1:25 000	623419-000-1005-2-3	0

Document Path: \\Envir01\public\Proj\623418_Modelisation_projet Howse\4.0_Réalisation\4.5_SIG\ArcGIS\1MXD\Report\623418_Howse_Fig2-3_GeologyWell_V2.mxd

Envir01: \\Envir01\public\Proj\623418_Modelisation_projet Howse\4.0_Réalisation\4.5_SIG\ArcGIS\1MXD\Report\623418_Howse_Fig2-3_GeologyWell_V2.mxd

Table 7-41 Wells, Piezometers and Boreholes in the Howse and TSMC/DSO3 Areas

HOLE ID.		Well Ø (mm)	Easting (mE) zone 19	Northing (mN) zone 19	Elevation (TOC) (m)	final depth (m)	water depth (toc) Nov. 4, 2015 (m)	Groundwater Elevation (m)	Final diameter mm	Construction End Date (m)
WELLS AND PIEZOMETERS OF THE HOWSE AREA										
HW-RC14-WE01R	Geofor, 2014	152	619715	6085660	684.173	164.00	88.76	595.41	152	2014-09-13
HW-RC14-WE02R	Geofor, 2014	203	619338	6086138	671.032	182.00	90.05	580.98	178	2014-09-24
HW-RC14-WE03R	Geofor, 2014	152	618737	6086703	640.145	180.00	67.32	572.83	152	2014-10-19
HW-RC15-WE05R	Geofor, 2015	152	619903	6085454	679.07	181.4	76.35	602.72	152	2015-08-28
HW-RC15-WE06R	Geofor, 2015	305	619339	6086132	672.30	168.2	90.48	581.82	305	2015-09-02
HW-RC15-WE07R	Geofor, 2015	203	619859	6086780	656.21	97.6	58.37	597.84	203	2015-09-11
HW-RC15-WE08R	Geofor, 2015	184	617942	6087650	613.07	73.2	44.53	568.54	203	2015-09-10
HW-RC15-WE09R	Geofor, 2015	184	620275	6085028	646.46	97.6	39.39	607.07	203	2105-09-08
HW-RC14-WE01OB	Geofor, 2014	203	619575	6085867	684.368	40	38.89	645.48	203	2014-09-03
HW-RC14-WE02OB	Geofor, 2014	203	619363	6086168	671.051	28.5	dry	dry	203	2014-09-01
HW-RC14-WE03OB	Geofor, 2014	203	618762	6086659	644.937	35	dry	dry	203	2014-08-29
HW-DD14-09	TSMC, 2014	123	619571	6085950	681.599	150.00	95.08	586.52	83	2014-08-20
HW-DD14-14	TSMC, 2014	123	619393	6086123	674.179	102.00	89.5	584.68	83	2014-08-27
HW-DD14-17	TSMC, 2014	123	619367	6086270	665.707	101.00	84.84	580.87	83	2014-08-27
HW-DD14-35	TSMC, 2014	123	619706	6085652	684.722	94.50	86.41	598.31	83	2014-10-09
HW-RC13-03	Golder, 2013	123	619755	6085655	683.449	180.00	87.37	596.08	83	2013-12-07
HW-GT13-01	Golder, 2014	123	619628	6085922		184.40			83	2013-12-03
HW-GT13-02	Golder, 2015	123	619535	6085961		183.90			83	2013-12-12
WELLS AND PIEZOMETERS OF THE TIMMINS AREA										
11T6GW-01	TSMC, 2011	152	621425	6085872	665.130	92.40		622.43	152	2011-10-09
11T6GW-02	TSMC, 2011	152	621746	6085581	684.600	103.70		635.82	152	2011-10-08
11T6GW-03	TSMC, 2011	152	622131	6085690	704.150	103.70		639.65	152	2011-10-06
11T4GW-02	TSMC, 2011	152	620945	6085630	677.97	97.6		616.84	152	2011-10-11
Plant Well #1	TSMC, 2011	152	622800	6084167	680.55	103.7		652.63	152	2011-10-14
Plant Well B1	TSMC, 2011	152	622843	6084242	681.78	97.6		663.40	152	2011-10-30
10-WTH-02	TSMC, 2010	152	622372	6084662	693.04	140.2		659.71	152	2010-10-05
10-WTH-01A	TSMC, 2010	152	622376	6085195	699.29	79.25		648.19	152	2010-10-29
10-WTH-01	TSMC, 2010	152	622387	6085191	699.05	73.15		645.25	152	2010-10-06
10-WTH-03	TSMC, 2010	152	622639	6084499	682.81	94.5		650.10	152	2010-10-07
TI3010H	TSMC, 2009	152	624039	6084096	694.13	74		674.80	152	2009-10-27
TI3011H	TSMC, 2009	152	624021	6084085	694.46	110		677.77	152	2009-10-31
10-WTH-06	TSMC, 2010	152	625028	6083256	739.14	134.1		686.25	152	2010-11-05
10-WTH-06A	TSMC, 2010	152	625032	6083251	739.23	140.2		684.48	152	2010-11-12
SURFACE WATER IN THE HOWSE AREA										
LAKE X			6086239	620132				658.61		
POND X1			6085741	620106				661.82		
POND X2			6085797	620114				661.96		
POND X3			6085827	620085				662.46		
Pinette Lake			6084782	620439				635.73		
Triangle Lake			6088305	618045				584.2		

The Table 7-42 compares the temperatures for Burnetta and Pinette Lakes. The drilling of well HW-RC15-WE08R in 2015 in the vicinity of Pinette Lake shows that the groundwater level is 24 m below the bottom of the lake suggesting that the lake is fed by surface water of its watershed and not by groundwater. The Table 7-42 compares the temperature of both lakes. The lower temperatures of Burnetta Lake suggest that a part of the water is provided by cold groundwater resurgences.

Table 7-42 Lakes Temperatures

	BURNETTA L.	PINETTE L.
Date	ºC	ºC
June 2014		8.2
July 2014		13.0
July 2015	6.6	12.5
August 2015	6.9	
Sept. 2015	5.0	7.6

Groundwater Flow under the Howse Deposit

The Figure 7-20 shows the cross-section drawn from the knowledge of the geology of the area and the drilling done along the northwest southeast Iron Formation passing through the deposit. The section illustrates the profile of the deposit and of the planned pit with the geology intercepted by the wells and the position of the main fractured zones. The water table is also represented.

The profile covers 3.5 km between the 2 extreme wells. It shows that the overburden thickness varies from a minimum of 20 m at the northwest limit of the deposit to a maximum of over 50 m at the southeast limit. The groundwater has a constant downward slope passing from an elevation of 607 m at HW-RC15-WE09R to 569 m at HW-RC15-WE08R. The groundwater flow is then from the southeast to the northwest with a mean slope of 0.01 m/m. Under the deposit the depth of the water table is minimum at HW-RC15-WE03R with a value of 67 m below ground surface and maximum of 90 m at HW-RC15-WE06R. The groundwater in the section of the deposit is recharged in the high elevation of the groundwater divide of the Irony Mountain. The groundwater would discharge into the Burnetta Lake area as explained in the previous section.

Based on the depth of the bottom of Pinette Lake above the groundwater elevation, it is not excluded, although unlikely, that Pinette Lake feeds the groundwater flowing toward the deposit. The lake is sitting on the Attikamagen shale which is a more or less impervious geological unit. The bottoms of the lakes of the area are generally naturally lined by impervious sediments. The only possible contact with groundwater would be a thrust fault whose location has been extrapolated to the southwest shore of the lake.

Groundwater Recharge Calculation

The climatic data for the Schefferville area is based on the 1981–2010 monthly climate normals from the Schefferville A weather station (No. 7117825) and evaporation data from Churchill Falls weather station (No. 8501132). A gap in the temperature data was filled using the Fermont station (No. 704BC70).

Schefferville monthly temperature is above freezing point during the months of May to September. July is the warmest month with an average temperature of 12.7 ºC and the coldest month is January with an average temperature of -23.3ºC.

Table 7-43 summarizes the water budget. The mean total precipitation is 790.8 mm per year, of which 373.5 mm represents snowfall expressed as rainfall equivalent. The water budget uses the evapotranspiration value calculated for a contiguous area by Fracflow (2006) using the Thornwaites equation. Fracflow evaluated the total evapotranspiration value taking place from May to November at 188.4 mm per year.

The sublimation of snow is estimated at 15 % of the total snowfall based on extensive studies conducted in the Wolf Creek Research Basin, Yukon (Pomeroy *et al.*, 1998). The actual study area is at similar latitude and experiences equivalent average temperatures throughout the year. The sublimation will therefore represent 56.2 mm, expressed as rainfall equivalent. As shown on water budget of Table 7-43, a total of 109 mm of water is available for groundwater recharge, representing 20 % of the water depth after evapotranspiration and sublimation. The runoff value of 80 % of the total precipitation has been taken from the waste management plan section of SNC-Lavalin.

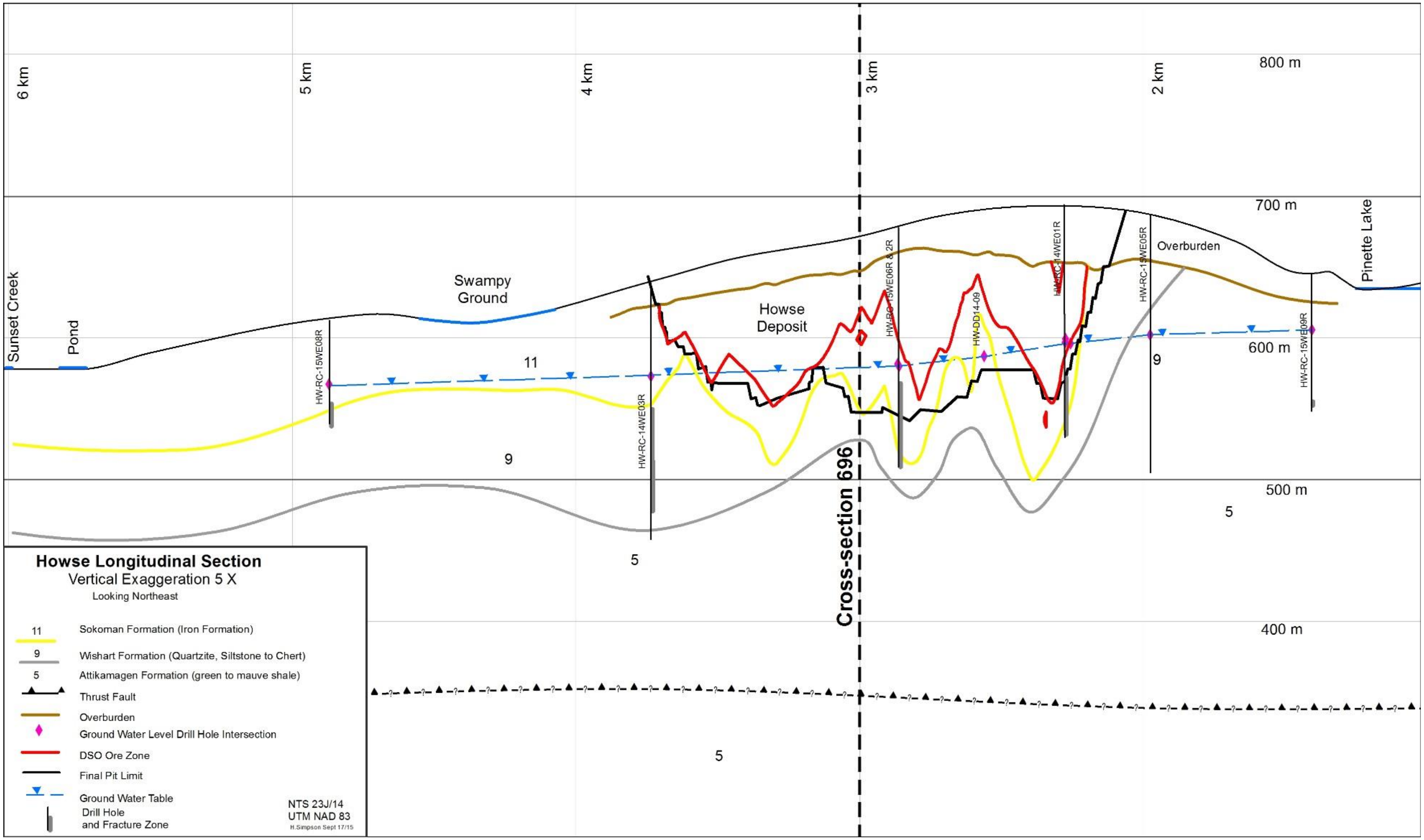


Figure 7-20 Howse Geological Frost Section 696 with the Profile of the Planed Pit

Table 7-43 Annual Water Budget

COMPONENT	DEPTH (MM)
Precipitation	790.8
Evapotranspiration (-)	188.4
Sublimation (-)	56.2
Net Water Depth	**546.2**
Surface flow (80% of Net Water Depth)	437
Infiltration (20% of Net Water Depth)	109

A well supplying the workers camp, a few kilometers from Howse deposit, was equipped by Geofor with a level logger to monitor the variation of the groundwater level along the year. This is actually the only monitoring of the groundwater level covering a one year period. The behavior of the phreatic level of an aquifer varies from a location to another depending, amongst others, of the dimension and nature of the recharge area. This example illustrates the behavior of a specific aquifer of the area.

The graph of Figure 7-21 shows the variation of the phreatic level during the period of observation. A first recharge of the aquifers happens at the snowmelt in spring. At this location, the groundwater rose 14 meters from the end of April to mid-June. The water level stabilized and slightly decreased by few meters in the period from mid-June to around September 20th. From there, a recharge of groundwater begins with the large rainfalls of this season and continues till the end of October, for a total rise of 10 m in groundwater level. With the freezing of the ground and the arrival of solid precipitation, the curve shows that the drawdown of the aquifer is continuous until spring, with the groundwater level reaching 74 m below the surface, with a total drawdown of 25 m at the observed location.

A Groundwater level logger was installed at the end of June 2015 in each of the wells HW-RC13-03 and HW-RC14-WE03R of the Howse deposit. The curve of the water table variation for both loggers shown at Figure 7-22 with the corresponding pluviometry for a part of the observed period is presented for information since it is only covering a short period of the year. For the equivalent period, the behavior of the two Howse monitoring loggers is very different in shape and amplitude compared to the logger at the camp site.

The curves of both loggers (Figure 7-22) at Howse are showing an inverted behavior. HW-RC13-03 has experienced a continuous drawdown of the phreatic level of 1.7 m since the installation of the logger in June 2015 to the last readings available at the beginning of October 2015. For the same period, HW-RC14-WE03R is showing a groundwater level rise of 1.7 m. In our opinion, the drawdown in summer until the beginning of the heavy rains of October is a normal tendency. This pattern was confirmed by periodic manual readings at HW-RC-14-WE01R, HW-DD14-09 and HW-DD14-35 plotted on the Figure 7-22. There are no other wells in the sector to validate the possibly odd but real behavior of HW-RC14-WE03R that can be explained by heterogeneity of the terrain at the location of the well.

The relative stability of water table indicates a good equilibrium between the discharge and the recharge. The level loggers in the wells are still currently recording and the data will be analyzed after a year of recording in order to confirm and explain the behavior of both wells and have a better image of the seasonal variations of the water table.

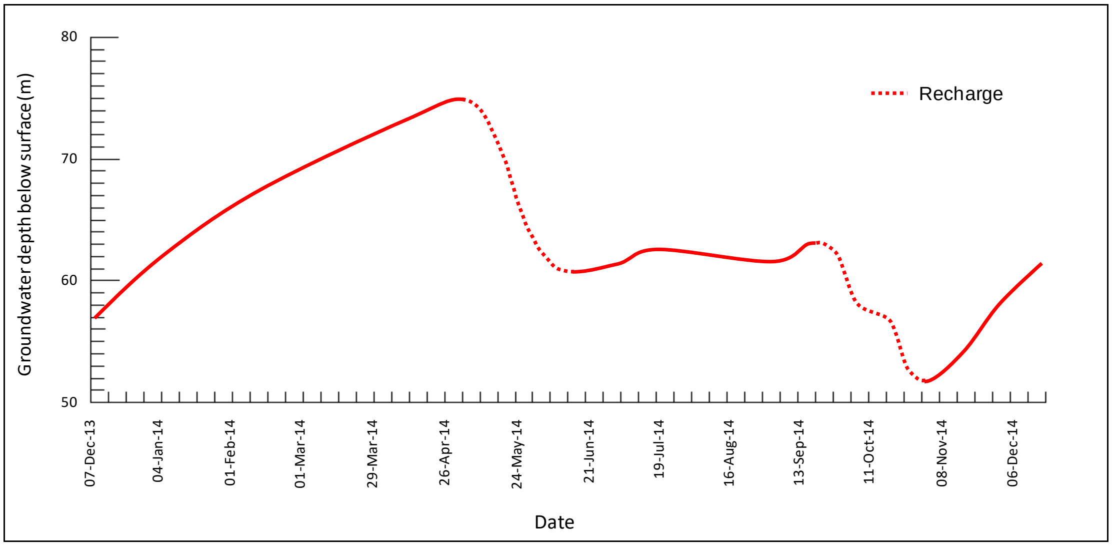


Figure 7-21 Seasonal Variation of the Water Table at Timmins Workers camp

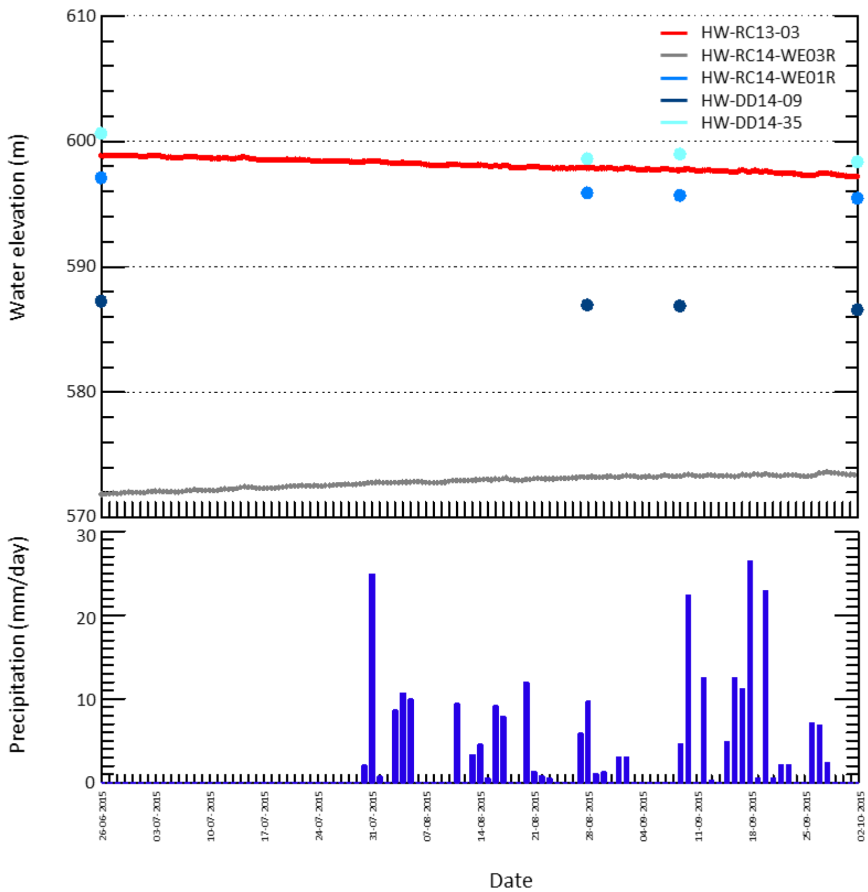


Figure 7-22 Seasonal Variation of the Groundwater Level under the Howse Deposit

Groundwater Flow in an Area of Discontinuous Permafrost

The Howse deposit and its large area are affected by discontinuous permafrost. In this region characterized by series of elongated ridges flanking parallel valleys, permafrost is found at the highest elevations, on tundra sites poorly protected against the wind (IOC, 1974).

Figure 7-22 illustrates the conceptual model of groundwater flow in an area of discontinuous permafrost. Totally and permanently frost-free areas occur within a permafrost zone. Those areas, called taliks, are found principally under some lakes and components of the surface water drainage network. Groundwater flows over the permafrost in the unfrozen superficial layer called the active layer. The groundwater infiltrates into the regional aquifer when the water flowing through active layer reaches a talik. As illustrated in Figure 7-23 a deep mining pit can also feed the groundwater with surface water if it is dug under the regional groundwater level.

A study carried out by Journeaux Ass. (2015) about eventual presence of permafrost in the Howse deposit area has shown that discontinuous permafrost, if any, should occur in erratic and isolated small lenses or pockets but not in any extensive identifiable layers. Based on this study the Howse area will be considered permafrost free.

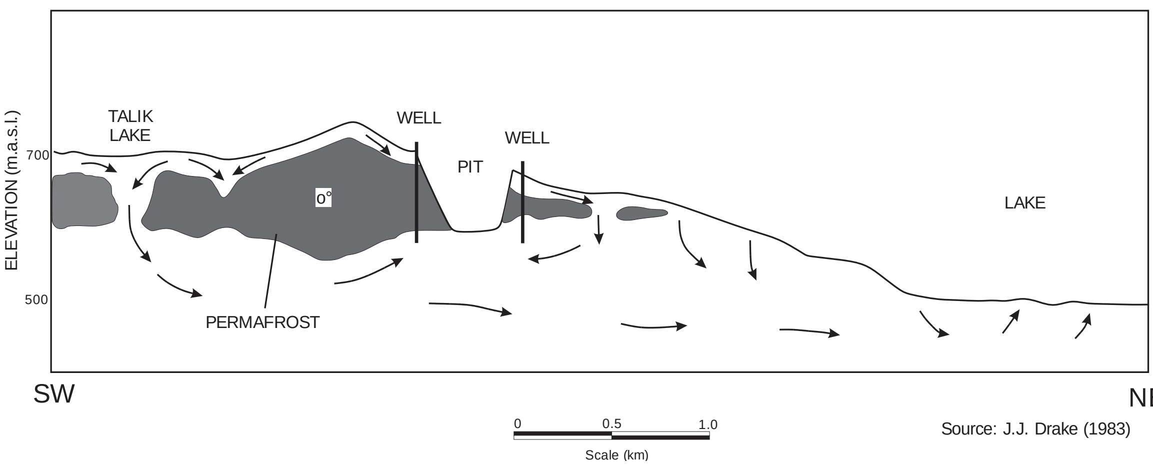


Figure 7-23 Groundwater Flow in a Region of Discontinuous Permafrost

Howse Overburden Aquifer

The 2013-2014 drilling for the assessment of the deposit was done with minimal drilling water for some overburden wells. The majority of the samples collected were dry. Two of the three holes listed in Table 7-41 and located in Figure 7-15, specifically drilled in the overburden during the hydrogeological study, were dry. A small flow rate of about 12 L/min was observed in well HW-RC14-WE01OB at about 38 m below the surface.

Based on all the available observations and on the 2013 to 2015 programs, it appears that the overburden is generally dry except for the presence of a few perched aquifers of limited extension. This can be explained by the infiltration of the surface water in the overburden and its fast evacuation along the slope of the terrain in permeable layers horizons in the overburden or of at rock interface. A part of the water can also migrate rapidly through the rock fractures.

Howse Rock Aquifer

RC15-WE06R, HW-RC15-WE08R and HW-RC15-WE09R are distributed along the northwest-southeast dominant geological and structural axis of the large area of the Howse deposit. The longitudinal section presented in Figure 7-20 was drawn from the geological knowledge of the area and from the results of the drilling along the northwest-southeast axis.

The section of Figure 7-20 shows the position of the water bearing fractured zones met by the drill in relation to the geology. Water bearing fractures were met deeply below the surface. The ground was dry till the interception of water bearing fractured zones. The observed Groundwater table shown in Figure 7-20 is everywhere over the water bearing fractures indicating a confined aquifer in artesian condition.

All wells, except the HW-RC-15-05R and HW-RC-15-09R, have intercepted the Sokoman Formation (Iron Formation). For all wells into the Iron Formation, the most productive of the fractures shown on the cross-section were met close to or at the interface of the Sokoman and the Wishart Formations. This is the case for HW-RC15-WE07R and also for HW-RC14-WE03R where other productive factures were also met deeper in the Wishart Formation. Well HW-RC15-WE06R was entirely drilled in the Sokoman and was ended not far from the Wishart Formation. An important water bearing zones was met toward the end of the hole probably not far from the Wishart Formation. Productive fractured zones for HW-RC15-WE07R which was drilled into another Iron Formation were met into the Sokoman between 60 and 98 m below ground surface. Any noticeable water bearing fractures were observed at wells HW-RC15-WE05. A small water bearing fracture was intersected at HW-RC15-WE09 toward the end of the hole. HW-RC15-WE05R and HW-RC15-WE09, drilled in the Attikamagen shale and HW-RC15-WE01 in a very muddy section of the Iron Formation show relatively low yield varying between 3 and 60 L/min. The yield of aquifer for all other wells varies from 200 to 800 L/min, the maximum occurring at HW-RC15-WE06R.

Those observations tend to show that the interface between the Sokoman and the Wishart is sometime a fractured sector providing important quantities of water. The Wishart Formation can also convey important quantities of water. The Attikamagen shales will supply minor quantities of groundwater. An important portion of the mining can be done without dewatering due to the deep location of the water table below the ground surface.

Hydraulic Parameters of the Rock Aquifer

Generally, the recent results of hydraulic conductivity testing showed in Table 7-44 indicate that the hydraulic conductivity of the Sokoman Formation, which is the main formation in the area, was relatively higher, and ranging from 1.6E-6 m/s to 1.9E-5 m/s with an average of 9.4E-6 m/s. The shale of Attikamagen have the lowest permeability values with an average of 5E-8 m/s while the Wishart and fault zone recorded an intermediate conductivity values with an average of 1E-7 m/s. The fault zones tested by Golder were coated with mixed and less permeable materials according to borehole logs. This can explain their lower hydraulic conductivities values in comparison to the Sokoman.

The step-drawdown tests conducted by Geofor in 2015 at the three pumping wells (HW-RC15-WEO6R, HW-RC15-WEO7R and HW-RC15-WEO8R) showed a slight decrease in specific capacity of the wells with flow rate increase.

The well HW-RC15-WEO6R located within the proposed open pit was pumped to a maximum of 1.1 m^3/min (291 usgpm) resulting in a 12.4 m final drawdown, and a specific capacity decreasing from 0.2 to 0.1 m3/min per meter.

The wells HW-RC15-WEO7R and HW-RC15-WEO8R located outside the proposed open pit were pumped to a maximum of 0.26 m^3/min (75-85 usgpm) resulting in a 13.6 m final drawdown, and a specific capacity decreasing slightly from 0.04 to 0.02 m^3/min per meter.

Table 7-44 Summary of Calculated Hydraulic Conductivity Results

REFERENCE	TEST	WELL TESTED	K (M/S)	K AVERAGE (M/S)	FORMATION
Golder, 2014	Packer test	HW-GT13-002	2E-07 - 6E-07	4.00E-07	Wishart
			4E-08 - 6E-08	5.00E-08	Attikamagen Shale
		HW-GT13-001	4E-08 - 5E-08		
			1E-07	1.3E-07	Chert/Shale/fault zone
			1E-07		Chert/Shale/fault zone
			2E-07		Shale/fault zone
Geofor, 2014	Pump test	HW-RC14-WE01*	2.13E-06	9.40E-06	Sokoman (Iron ore)/Wishart
		HW-RC14-WE03*	3.34E-05		
Geofor, 2015	Pump test	HW-RC15-WEO6R*	1.1E-05 - 2.4E-05		Sokoman
		HW-RC14-WEO2R**	1.2E-05 - 1.9E-05		
		HW-RC15-WEO7R*	1.6E-06 - 1.1E-05		
		HW-RC15-WEO8R*	1.10E-05		

*Pumping well; ** Observation well

Groundwater Uses and Quality

Actually, groundwater has no specific uses in the Howse area. In the TSMC/DSO3 area groundwater is used for dust control and for some other non-drinking applications. The process plant is taking water from old Timmins 2 pit, which is in fact a mixture of groundwater and surface water. The workers camp, which is about 1 kilometer southeast of the TSMC plant, is supplied by 3 wells which provide drinking water that do not need treatment.

The results of chemical analysis for the wells of Howse submitted to pumping test and, for information, other results from TSMC/DSO3 and TSMC/DSO4 are shown in Table 6. TSMC/DSO4 is another DSO mining sector about 30 km northwest of TSMC/DSO3. Wells K1C009, 11KI2007 and 11TSMC-LBM19 pertains to TSMC/DO4 sector.

Table 7-45 shows the result of the physical property measured in the field in 2015. These parameters indicate that the water is slightly acidic for all wells except for HW-RC14-WE03R which is close to the neutrality. In all cases, the water is very weakly mineralized, as indicated by the electrical conductivity and cold with values around 2 ^oC.

The results of analysis of water of the wells of Howse area, presented in Table 7-46, show that, for all wells, except HW-RC14-WE01R, the analysed chemical parameters of this very soft water are generally under the detection limits of the laboratory method or, if not, well below the maximum acceptable concentration of the more stringent regulations, if appropriate. The maximum acceptable concentrations from Canadian *Metal Mining Effluent Regulations* (MMER) are shown the corresponding column of Table 7-46 for the deleterious elements concerned.

In contrast to all other wells drilled in the Howse sector, the physical properties of the water at HW-RC14-WE01R show values of total suspended solids exceeding the authorized limit of 30 mg/L of the MMER and high values of total dissolved solids and turbidity. The turbidity of all other wells is below 2 NTU with a real color below 4 UCV. Some water bearing muddy sections where met during the drilling of HW-RC14-WE01R. The muddy sections were releasing suspended solids in the pumped water causing an increase of the turbidity. The concentration of total suspended solids, as well as the turbidity and coloration, decreased significantly between the two sampling sessions indicating a cleaning of the water bearing structures with time. This decrease may continue in time but it has not been proven that it will go under the MMER limit. The suspended solids must therefore be taken into account in the dewatering process. The classical solution consists to settle the pumped water in ponds before releasing it in the drainage surface network. The Wells can also be designed with gravel pack around a pumping column in order to filter the groundwater at the pumping stage. Finally, the location of the wells can also be carefully chosen by drilling exploration holes prior to drill the dewatering wells.

The wells of the TSMC-DSO3 and TSMC/DSO4 show characteristics close to Howse area as can be seen in Table 7-46. The groundwater is showing low mineral content. Well 10WTH005 has shown concentration of 250 ug/ml that is higher than the very low values of other wells. The water of shows sometimes relatively high concentration of suspended solids associated to turbidity values. This can be explained by the simple construction design of those well which were mainly drilled for hydrogeological exploration purposes.

Table 7-45 Physical Parameters Measured in the Field

WELL	HW-RC14-WE01R			HW-RC14-WE03R			RC15-WE07R	RC15-WE08R
Time from the pump start	24 hours	36 hours	72 hours	24 hours	48 hours	72 hours	24 hours	72 hours
pH	6.05	6.2	6.04	6.9	6.7	6.2	5.92	5.84
Electrical Conductivity (µσ)	11	12.3	14.5	21.2	20.7	21	21.9	22.9
Sp. Electrical Conductivity (µσ)	20	22	26.1	37.5	36.5	37.1	38.6	39.0
Temperature (°C)	2.1	1.8	1.8	2.3	2.3	2.3	2.1	2.0

Table 7-46 Results of Physical and Chemical Analysis Measured in the Laboratory

		HOWSE DEPOSIT							TSMC/DSO3 and TSMC/DSO4								
	Units	**HW-RC14 WE01R (24HRS)**	**HW-RC14 W01R (72H)**	**HW-RC14 WE03R (24HRS)**	**HW-RC14 WE03R (72HRS)**	**HW-RC15 WE06R**	**HW-RC15 WE07R**	**HW-RC15 WE08R**	**TI3011H**	**10WTH005**	**10WTH004**	**10WTH06A**	**11T6GW1**	**11T4GW2**	**KI1C009A**	**KI2007**	**TSMC-LBM-19**
METALS																	
Mercury (Hg)	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001									
METALS																	
P2O5		-	-	-	-	-	0.0	0.0									
Total phosphorous	mg/L	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01									
METALS ICP-MS																	
Aluminum (Al)	ug/L	<30	<30	53	49	<10	<10	<10		<1.0	<0.03	<30	2100	19	<10	<10	<0.03
Antimony (Sb)	ug/L	<3.0	<3.0	<3.0	<3.0	<1.0	<1.0	<1.0		<1.0	<30	<6	<1.0	<1.0	<1.0	<1.0	<0.006
Arsenic (As)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	< 2	<1.0	<0.3	<2	<1.0	<1.0	<1.0	<1.0	<0.002
Barium (Ba)	ug/L	<20	<20	<20	<20	2.6	2.7	<2.0		<2.0	<2	<30	5.9	2.6	<2.0	<2.0	<0.03
Silver (Ag)	ug/L	<0.3	<0.3	0.36	<0.3	<0.10	<0.10	<0.10		<0.10	<6	<0.3	0.18	0.21	<0.10	<0.10	<0.0003
Boron (B)	ug/L	<50	<50	<50	<50	<20	<20	<20		<5.0	12	<50	9.6	<5.0	<5.0	<5.0	<0.05
Cadmium (Cd)	ug/L	<1.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20		<0.20	<30		<0.20	<0.20	<0.20	<0.20	<0.001
Beryllium (Be)	ug/L	<2.0	<2.0	<2.0	<2.0	<0.40	<0.40	<0.40				<2	<0.50	<0.50	<0.50	<0.50	<0.002
Bismuth (Bi)	ug/L	<50	<50	<50	<50	<0.25	<0.25	<0.25					<0.25	<0.25	<0.25	<0.25	<0.05
Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	<5.0	<0.50	<0.50	<0.50		<0.50	<1	<30	<0.50	<0.50	<0.50	<0.50	<0.03
Calcium (Ca)	ug/L	1 400	1 600	2 400	2 400	1000	2300	<300	9900	3000	<10	1000	<1000	<1000	2000	<1000	<1000
Cobalt (Co)	ug/L	<20	<20	<20	<20	<0.50	<0.50	<0.50		1.1	<30	<30	<0.50	<0.50	<0.50	<0.50	<0.03
Copper (Cu)	ug/L	<3.0	<3.0	<3.0	<3.0	7.1	<0.50	<0.50	5	<0.50	<30	8	0.81	0.75	<0.50	<0.50	<0.003
Total Hardness (CaCO3)	ug/L	9 900	1100	1500	1500	7200	14000	1600	5800	2800	<1	3000	<1	<1	10	<1	<1
Tin (Sn)	ug/L	<50	<50	<50	<50	<1.0	<1.0	<1.0					<1.0	<1.0	<1.0	<1.0	<0.05
Iron (Fe)	ug/L	<100	<100	<100	<100	<100	<100	<100	< 100	32	<30	<100	1100	100	<100	<100	<0.1
Magnesium (Mg)	ug/L	1 600	1 700	2 200	2 200	1100	2000	220	6600	5000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Manganese (Mn)	ug/L	<3.0	<3.0	<3.0	<3.0	3.5	9.8	<0.40		250	<3	<3	4.2	7.4	0.51	1.6	0.003
Molybdenum (Mo)	ug/L	<10	<10	<10	<10	<0.50	<0.50	<0.50				<30	<0.50	<0.50	<0.50	<0.50	<0.03
Nickel (Ni)	ug/L	<10	<10	<10	<10	<10	<1.0	<1.0	< 10	<1.0	<3	<10	3.4	<1.0	<1.0	<1.0	<0.01
Lead (Pb)	ug/L	<1.0	<1.0	<1.0	<1.0	0.53	0.31	<0.10	< 1	0.97	<1	<1	0.33	0.22	<0.10	<0.10	<0.001
Potassium (K)	ug/L	290	210	340	360	200	360	<100	500	470	<100	300	1000	140	230	<100	<0.2
Selenium (Se)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	100	<1	<1.0	<1.0	<1.0	<1.0	<0.001
Sodium (Na)	ug/L	2 100	1 900	1 700	1 700	1700	920	<100	920	1800	<10	1100	520	340	410	290	0.5
Strontium (Sr)	ug/L	<50	<50	<50	<50	3.1	5.4	<2.0					3.3	2.4	3.4	4.5	<0.05
Thallium (Tl)	ug/L	<10	<10	<10	<10	<2.0	<2.0	<2.0					<2.0	<2.0	<2.0	<2.0	<0.01
Titanium (Ti)	ug/L	<50	<50	<50	<50	<10	<10	<10					15	<10	<10	<10	<0.05
Uranium (U)	ug/L	<2.0	<2.0	<2.0	<2.0	<1.0	<1.0	<1.0					<0.02	<0.02	<0.02	<0.02	<0.02
Vanadium (V)	ug/L	<10	<10	<10	<10	<2.0	<2.0	<2.0				<10	<2.0	<2.0	<2.0	<2.0	<0.01
Zinc (Zn)	ug/L	30	31	27	19	5.7	<5.0	<5.0	35	6.2	590	19	5.7	<5.0	<5.0	<5.0	0.007
Mercury (Hg)	ug/L	-	-	-	-	1.5	<0.10	-		0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

		HOWSE DEPOSIT							TSMC/DSO3 and TSMC/DSO4								
	Units	HW-RC14 WE01R (24HRS)	HW-RC14 W01R (72H)	HW-RC14 WE03R (24HRS)	HW-RC14 WE03R (72HRS)	HW-RC15 WE06R	HW-RC15 WE07R	HW-RC15 WE08R	TI3011H	.0WTH00!	10WTH004	10WTH06A	11T6GW1	11T4GW2	KI1C009A	KI2007	TSMC-LBM-19
CONVENTIONALS																	
Conductivity	mS/cm	0.029	0.028	0.037	0.038	0.022	0.034	0.041		0.073	0.011		0.012	0.008	0.023	0.010	0.011
Inorganic phosphorous	mg/L	0.04	0.03	<0.02	<0.02	-	-	-					<0.03	<0.03	<0.03	<0.03	<0.03
Nitrogen ammonia (N-NH3)	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02		<0.02	<0.02		0.03	<0.02	<0.02	<0.02	0.04
Orthophosphate (P)	mg/L	0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.05	<0.05		0.02	0.02	<0.01	<0.01	<0.01
Phenols-4AAP	mg/L	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002					0.002	0.003	<0.002	<0.002	0.002
Reactive silica (SiO2)	mg/L	9.8	11	7.0	7.1	10	6.2	6.7					6.7	4.4	5.5	3.6	6.1
Real Color	UCV	15	4	4	3	<2	<2	<2		<2	4		3	<2	<2	<2	<2
Sulfides (S2-)	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02	<0.02		<0.02	<0.02	<0.02	<0.02	<0.02
Total Cyanide (CN)	mg/L	<0.01	<0.01	<0.01	<0.01	-	-	-	< 0.01	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Turbidity	NTU	180	99	1.9	1.6	1.8	1.4	0.2		0.5	7.5		51	86	0.6	27	3.7
Absorbance at 254nm	/cm	0.29	0.15	0.008	0.009	-	-	-					0.18	0.072	<0.005	0.023	0.006
Alkalinity Total (as CaCO3)	mg/L	15	15	17	20	21	11	17									
Bromide (Br-)	mg/L	<0.1	<0.1	<0.1	<0.1	-	-	-			<0.1		<0.1	<0.1	<0.1	<0.1	<0.1
Bicarbonates (HCO3 as Ca(	mg/L	15	15	17	20	21	11	17	44	13	2	12					
Carbonate (CO3 as CaCO3	mg/L	<1	<1	<1	<1	<1	<1	<1		<1							
Chloride (Cl)	mg/L	0.14	0.15	0.12	0.12	0.11	1.7	0.14	0.87	0.16	8.1	0.07	0.27	0.17	0.11	0.28	0.21
Nitrites (N-NO2-)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02		<0.02	<0.02		<0.02	<0.02	<0.02	<0.02	<0.02
Nitrates (N-NO3-)	mg/L	0.06	0.10	0.11	0.11	0.08	0.76	0.09		0.05	0.33		0.58	0.56	0.09	0.09	1.2
Sulfates (SO4)	mg/L	0.9	0.9	1.0	1.1	<0.5	1.0	0.8	0.9	18	12	0.2	0.6	<0.5	1.3	1.2	<0.5
Total Dissolved Solids	mg/L	37	37	45	39	15	20	28		47	<10		77	<10	14	12	17
Total suspended solids (TS(	mg/L	210	180	2	<2	-	-	-	6				15	120	<0.2	110	12
Dissolved organic carbon	mg/L	1.2	0.8	-	-	0.5	0.3	0.3		0.3	0.4						
Total Organic Carbon	mg/L	-	-	<0.2	<0.2	-	-	-		0.4	0.3		0.2	<0.2			
Dissolved oxygen	mg/L	-	-	-	-	12	11	11									
pH	pH	-	-	-	-	7.11	7.00	7.38									
Nitrate (N) and Nitrite(N)	mg/L	-	-	-	-	0.08	0.76	0.09		0.05	0.47		0.58	0.56	0.09	0.09	1.2

Dewatering Simulations

The technical memorandum, describing the methodology, the model and the results of the simulations are provided in Volume 1 Appendix IV.

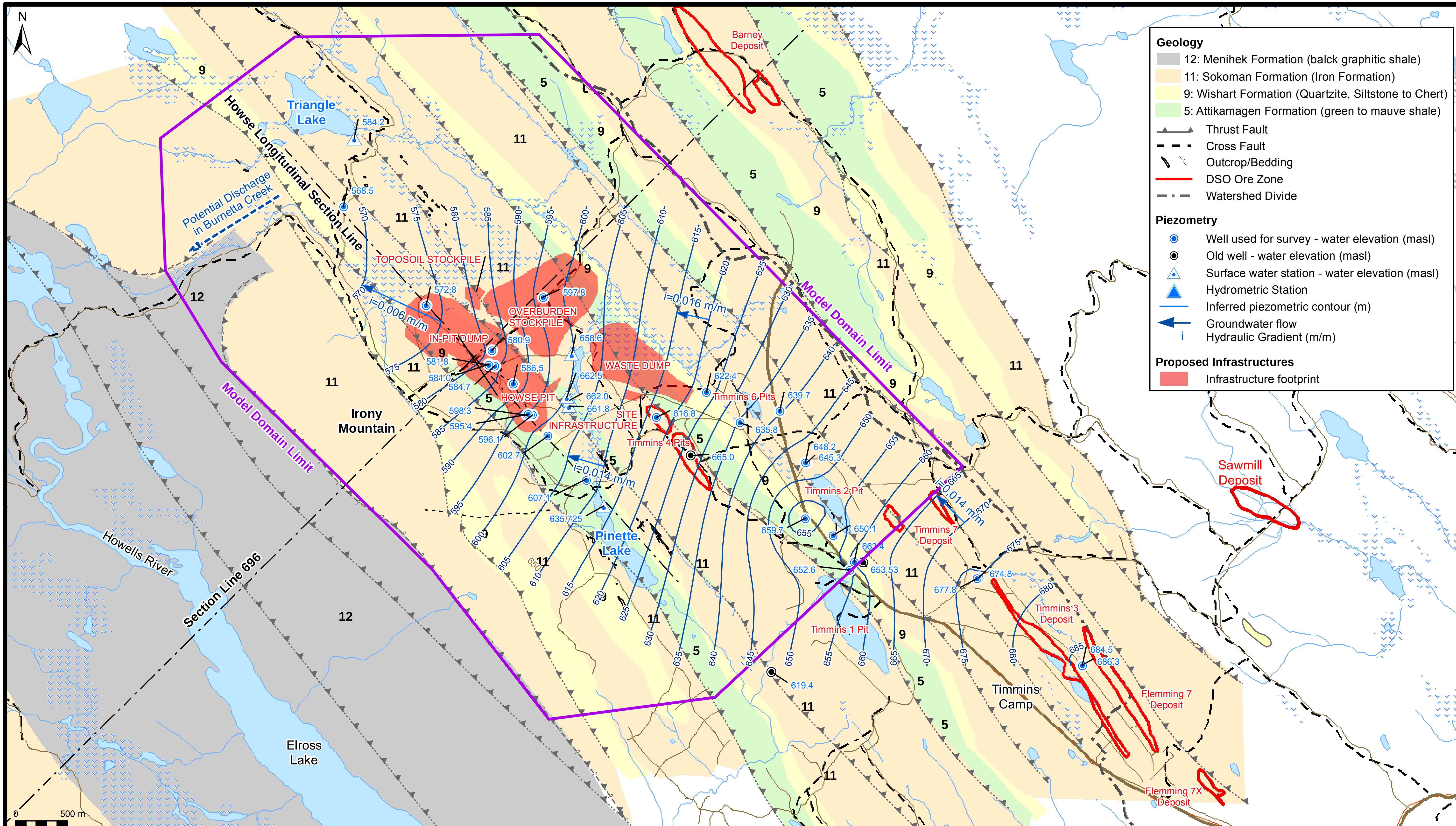
In order to estimate the flow rate resulting from the dewatering of the Howse deposit, a conceptual model of the aquifer flowing through the deposit was built and transposed into a numerical model. The model of the natural groundwater flow of the aquifer was calibrated with hydrogeological parameters determined from field data collected at the site during actual and past campaigns. After the calibration of the natural groundwater flow model, the open pit was introduced into the model to simulate the dewatering of the future mine pit at its final maximum depth of 160 m. The model considers a rectangular domain of about 5 km by 8 km as shown on Figure 7-24.

The model incorporates the basic assumptions of the groundwater flow developed in this report. Simulations were carried out in steady state flow regime with the objective of evaluating the flow rates and extent of the influence of the dewatering activities at the final depth of the pit only. Direct precipitation over the area of the pit was not considered in the model since this water will be collected by sump pumps. The runoff water is considered to be deviated from the pit.

In addition to the base case of the calibrated model, three sensitivity analyses were completed by increasing the hydraulic conductivities of hydrostratigraphic units to emphasize the flow along bedding planes and increasing the recharge rate for one of the scenarios.

A total pumping rate of 9 400 m^3/day was obtained from the simulations for the base case dewatering scenario updated with the supplementary data of 2015. The details of the modelling with all parameters used are shown in Volume 1 Appendix IV.

The base case flow rate may reach higher values ranging from 12,000 to 19,000 m^3/day with slightly higher hydraulic conductivities and increased recharge values. Table 7-47 summarizes the flow rate results taking into account these non-negligible factors, and shows the influence of permeability and recharge rate increase possibly due to the heterogeneity of the formations and geological structures within the study area.



NO.	DATE	DESCRIPTION	DRAWN	VERIFIED
0	9 nov. 2015	Pour consultation	E. Cazeneuve	A. M. Benlahcen

TITRE

Figure 7-24
Model Domain
of the Howse Deposit Area

PROJET

Hydrogeology Modeling - Howse project

CLIENT

Geofor Environnement

CONSULTANT

SNC·LAVALIN

ÉCHELLE	NUMÉRO	RÉV.
1:35 000	623419-000-1005-3-1	0

\\Envir01\public\Proj\623418_Modelisation_projet Howse\4.0_Réalisation\4.5_SIG\ArcGIS\1MXD\Report\623418_Howse_Fig3-1_ModelDomain_v3.mxd

Table 7-47 Dewatering simulation results including sensitivity analysis

SCENARIO	FLOW RATES (M^3/DAY)		ASSUMPTIONS	PUMPING RATE INCREASE
	MODEL	SAFETY FACTOR OF 1.25		
Base case: Calibrated model	9393	11741	Kx, Ky, Kz; Recharge : 100 mm/y	
Sensitivity analysis Case 1	17382	21728	Kx, Ky and Kz multiplied by 2 for OB and Sokoman, Recharge increased to 200 mm/y	1,9
Sensitivity analysis Case 2	18752	23440	Kx, Ky and Kz multiplied by 2 for all five units (OB, Sokoman, Whishart, Shale and Fault zones), Recharge increased to 200 mm/y	2,0
Sensitivity analysis Case 3	11754	14693	Kx, Ky, Kz; Recharge increased to 200 mm/y	1,3

The sensitivity analyses results indicate that the hydraulic conductivity is the more influent parameter in the model. Indeed when the recharge is doubled (case 3) the pumping rate increases by a factor of 1.3 while doubling the hydraulic conductivity and recharge results by a pumping rate increase by a factor of 2.

Groundwater dewatering simulation results are presented in terms of piezometry and drawdown in the Figure 7-25 and Figure 7-26 respectively.

It can be seen in Figure 7-26 that larger drawdowns are observed in the vicinity of the pit. The regional drawdown resulting from the pumping activities is expected to be about 10 m towards the north-west limit of the domain (downgradient of the study area near the Triangle Lake). This result implies that Burnetta Creek and a wetland complex located at the southwest of the Triangle Lake may be affected by the drawdown. In fact, Burnetta Creek is supposed to be a groundwater discharge zone according to the field observations and the structural geology (likely existence of a fault) along Burnetta Creek.

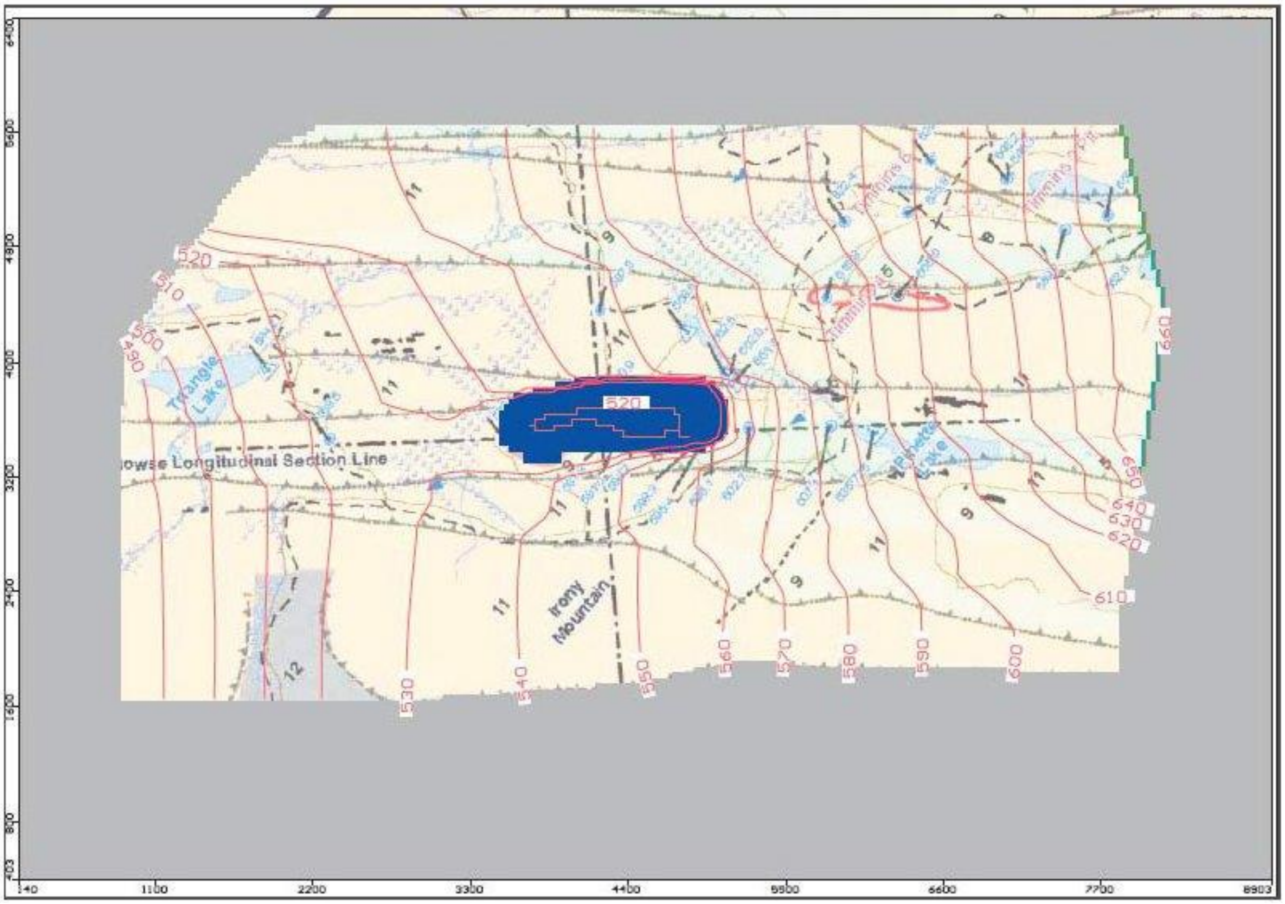


Figure 7-25 Piezometric Map during Dewatering (final depth)

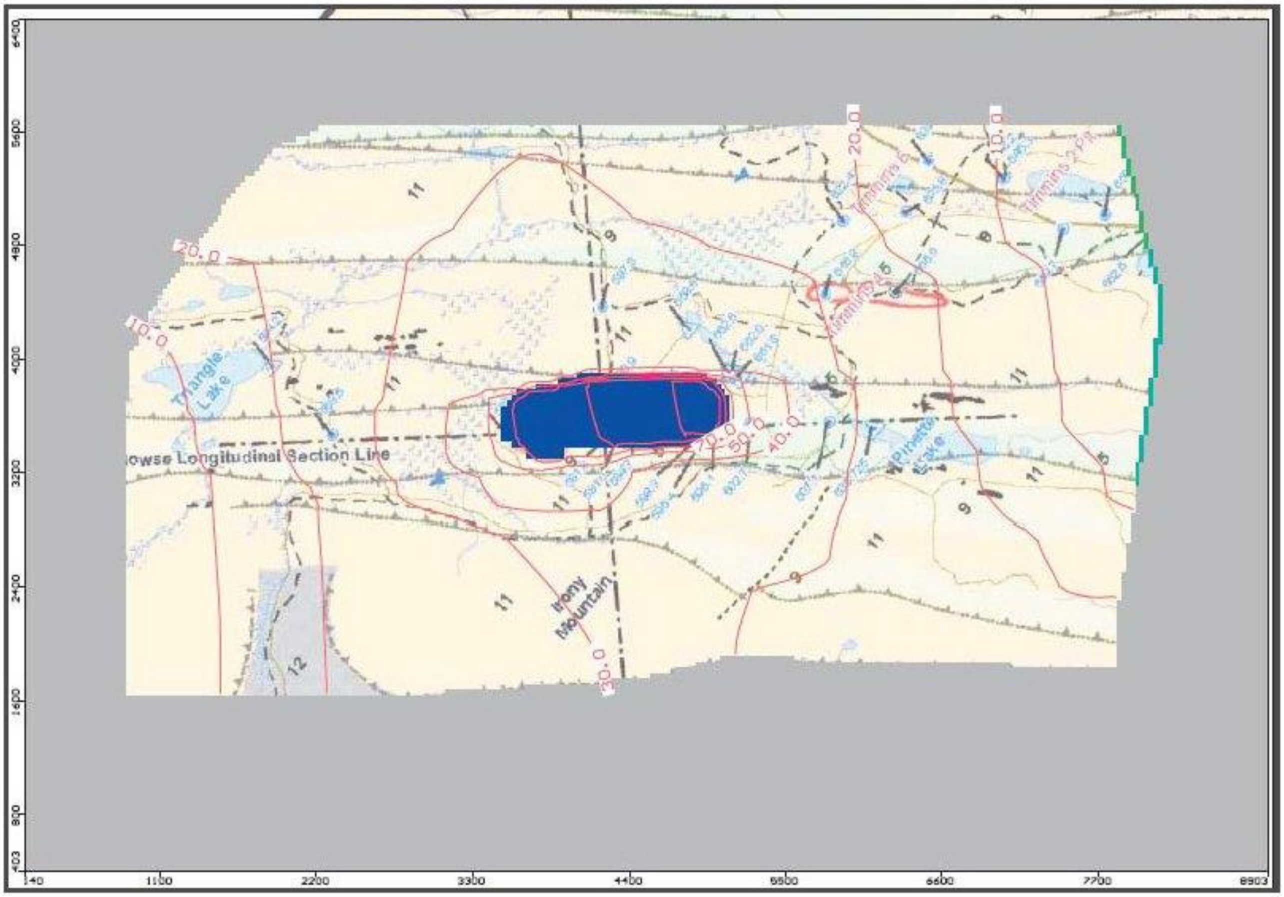


Figure 7-26 Groundwater Drawdown during Pit Dewatering (final depth)

Data Gaps

The groundwater flow model was developed based on up-to-date (2015) hydrogeologic information. The predicted dewatering rates derived from the model have allowed for the completion and sizing the WMP components. The actual results of the modelling give an estimate of the global dewatering rate sufficient for the sizing of the WMP components. Further, the detailed dewatering plan will be adjusted based on the local drilling results, which will be acquired prior to dewatering. The model will then be fine-tuned following new information.

Local monitoring of the groundwater flow of Burnetta Creek is in progress and should be maintained in order to obtain historical data and to assess the impact of dewatering during mining.

7.3.7 Geomorphology

VC Assessment

Site-scale geomorphology will be modified through excavation of the open pit and localized earth works associated with site preparation for stockpiling, waste rock placement and local road upgrading. This could have minor water balance effects in the immediate vicinity. Potential effects would be limited to surficial materials and landforms that are regionally widespread. Furthermore, reclamation of all surface disturbance areas will restore conditions necessary to support re-establishment of terrestrial ecosystems. Geomorphology is thus not retained as a VC.

7.3.7.1 Component Description

Geomorphology refers to the surficial materials and landforms within an area. Its consideration in the Howse Project proposal is relevant because of its role in supporting terrestrial ecosystems and its influence on project layout and site reclamation.

LSA, RSA and Temporal Boundaries

The LSA for geomorphology encompasses the watersheds of Burnetta, Elross and Goodream (western portion) creeks. Potential direct effects on surficial deposits are restricted to the immediate footprints of ground disturbance, whereas potential indirect effects are farther-reaching. A watershed-based definition of the LSA acknowledges that earth works and localized changes in surface drainage patterns could affect site-scale waters balance. Such potential effects on surficial deposits, in turn, could affect local ecosystem function. Geomorphological (terrain) mapping has been completed within the LSA to ensure the distribution and characteristics of surficial materials, and their sensitivities to mine development, are understood.

The RSA for geomorphology encompasses the Labrador Trough of Labrador and northeastern Québec, which exhibits low-relief, valley-and-hill morphology. The distribution of different surficial materials and landforms, overall, is relatively homogeneous within this region. All surficial materials and landforms encountered within the LSA similarly occur within the RSA, providing an important geographic context. Furthermore, this RSA definition encompasses areas of previous and proposed mining-related disturbance (e.g., open pits, waste rock piles, etc.). The full extent of any cumulative effects is included within this region of historic mining operations.

The temporal boundaries for geomorphology include the expected lifespan of the mine (i.e., approximately 10 years) plus an allowance for a period of natural stabilization and restoration following localized disturbance (i.e., another 30 years). A 40-year timeframe is conservative, given that surface instabilities associated with historic mining operations have stabilized since their cessation several decades ago, and that deliberate reclamation will expedite site recovery and vegetation colonization.

Existing Literature

A good understanding of geomorphology in the vicinity of the Howse Project has been gained from government-, university- and industry-led research on the distribution and characteristics of surficial materials and landforms within western Labrador and northeastern Québec. Surficial geology maps to support drift prospecting and permafrost studies in the region provide confidence that the conditions within the Howse Project LSA are generally representative of conditions in the broader RSA. Several publications describing the glacial history and landscape evolution also provide important background information. Studies involving interpretation of large-scale aerial photography and examination of soils at hundreds of locations within the region have been completed by Groupe Hémisphères and its project partners since 2006 in support of mineral exploration projects.

Table 7-48 summarizes key publications that are directly relevant to the characterization of geomorphological conditions within the Howse Project LSA and RSA, and to an effects assessment.

Table 7-48 Summary of Pertinent Information on Geomorphology within the Howse Project Area

TITLE	AUTHOR/YEAR	DESCRIPTION	RELEVANCE
LabMag Iron Ore Project Labrador Study Area Terrestrial Ecosystem Mapping	Gartner Lee Limited and Groupe Hémisphères (2007)	Detailed report with accompanying surficial geology mapping describing terrain units within the Howse Project RSA	Provides local-scale characterization of geomorphology, including distribution of terrain units similar to those in the Howse Project LSA
Surficial Geology of Western Labrador, Schefferville (NTS 23J)	Klassen and Paradis (1998)	1:250,000-scale surficial geology map with polygon, line and point features within the Howse Project RSA	Provides distribution and characteristics of geomorphology at a scale of relevance to regional effects assessment
Glacial landforms and deposits, Labrador, Newfoundland and eastern Québec	Klassen et al. (1992)	1:1,000,000-scale surficial geology map with polygon, line and point features within the Howse Project RSA	Provides a basis for characterizing the regional-scale distribution and characteristics of different surficial materials and landforms
Surficial geology of the Schefferville area (Labrador parts of NTS 23J/10 and 23J/15)	Liverman and Vatcher (1992)	Publication describing local-scale glacial and meltwater processes responsible for the geomorphology within the Schefferville region	Provides photographs and descriptions of different landforms, which also occur within the Howse Project RSA
Ice flow history and glacial dispersal in the Labrador Trough	Klassen and Thompson (1987)	Publication summarizing the glacial history specifically within the Labrador Trough portion of the Howse Project RSA	Provides an understanding of the nature and distribution of landforms within the region
Quaternary correlations in Arctic Canada	Andrews et al. (1986)	Publication outlining the glacial (ice-flow) history across northern regions of Canada, including across the Howse Project RSA	Provides chronology and trajectories of ice flows and deglaciation in the region, which is important for understanding post-glacial landscape evolution
Evolution of the landscape of the Schefferville area	Nicholson (1971)	Overview of the bedrock, glacial and post-glacial processes responsible for the geomorphology present in the Howse Project RSA today	Provides regional context and an integrated understanding of the geomorphological processes that most influence different elements of the landscape

Glacial History and Geomorphology within the RSA

The main landscape elements of the Howse Project RSA, including ridges, valleys and the pattern of the major drainage network, are the result of deformation and erosion of Precambrian (up to 3 billion years old) bedrock. Continental glaciations during the Quaternary Period (<2 million years) have modified areas of the landscape to varying degrees through the erosion of bedrock and the deposition of surficial materials. During the Quaternary Period, continental glaciations repeatedly covered most of Canada, including the Howse Project RSA. The Laurentide Ice Sheet, which extended across mainland Canada from the foothills of the Rocky Mountains to Newfoundland and Labrador, is believed to have had several centers, or ice divides, from which ice flowed outward. One of those ice divides, the Labrador Divide, appears to have been centered just a few tens of kilometres northwest of Schefferville during the most recent, Late Wisconsin glacial advance, which culminated locally about 8,000 years ago (Andrews *et al*., 1986).

Till deposited beneath actively flowing glaciers and through passive let-down by melting ice covers most of the ground surface. Its continuity and thickness are, however, highly variable. Only a thin, discontinuous veneer overlies the bedrock west of the Howells River, whereas comparatively thick (up to several metres) ground moraine blankets the uplands to the east. The till is bouldery, with a silty sand matrix. Large erratics are scattered across the rolling plains. Deglaciation appears to have occurred through gradual concentric retreat of the ice sheet from the margin toward the center, with isolated areas of *in situ* downwasting of ice. Kettles and low-relief, hummocky moraine are typical features of stagnant ice. Sandy to gravelly kames, such as that overlying the Howse Deposit, are scattered throughout the region with various sizes. Meltwater spillways and esker complexes radiate outward from the LSA in regional-scale surficial geology mapping (Klassen *et al*., 1992). Boulder fields in some valley bottoms are probably the result of meltwater erosion of fine-grained sediments. According to radiocarbon dating of peat, the LSA was not ice-free until 5,000 to 6,000 years ago (Nicholson 1971).

Early in the post-glacial period, particularly before vegetation had become established, a variety of processes modified the regional landscape. Periglacial activity was concentrated along windswept ridges and plateaux at high elevations, where snow depth during the long winter was minimal. As a result of glacial debuttressing and weathering, cliffs were particularly susceptible to frost shatter and mass movements. Colluvium accumulated along the bases of prominent hills and knobs. Streams eroded channels through glacial drift and formed small fans and deltas where they flowed into broad valley bottoms and lakes. Strong winds deflated till-covered ridges, leaving behind a gravelly surface lag and redistributing fine sediments into sheltered, low-lying areas. In valley bottoms and depressions within rolling to undulating plains, vegetation began to colonize. Wetlands formed in the most poorly-drained areas, such as along bedrock fractures and at the confluence of headwater streams and shallow subsurface drainage pathways, where high groundwater tables slowed the decomposition of organic material. Permafrost is sporadic (discontinuous) within the region (Heginbottom, 1995), occurring mostly within high-elevation, windswept hills (Journeaux Assoc, 2015), but it is sufficiently deep that it has little to no effect on ground stability or terrestrial ecosystems.

Surficial Materials and Landforms within the LSA

The surficial geology in the vicinity of the Project is based on aerial photograph interpretation (Volume 2 Supporting Study K), field observation reviews and previous terrain mapping for the Taconite Project (Gartner Lee and Groupe Hémisphères, 2007) and for the DSO Project (Groupe Hémisphères, 2011a). Terrestrial ecosystem descriptions highlighted for each type of surficial deposit can be consulted in Section 7.4.2. Terrain in the vicinity of the Project is shown in Figure 7-27. Soils are described in Section 7.4.2 in association with other ecosystem characteristics.

The distribution and characteristics of landforms in Howse Project LSA reflect a combination of ridges and valleys formed by folded, iron-rich, Precambrian metamorphic bedrock; glacial erosion and deposition from a generally northwestward flowing portion of the Laurentide Ice Sheet; deglacial meltwater processes; and post-glacial stream erosion and accumulation of organic matter. Irony Mountain, which is relatively resistant to glacial erosion, projects above the surrounding landscape as a prominent bedrock knob at the western edge of the LSA. Its thin, silty sand soils are well to rapidly drained and support Ecotypes TSS02 and TSS03, and TSS04 to a lesser extent (Section 7.4.2 for details on the ecosystems). Bedrock is also exposed along the crests of lower ridges and in some narrow valleys where meltwater has eroded surficial materials, supporting Ecotype TSS02. Its weathered surface is a patchwork of angular blocks where frost heave has been most severe.

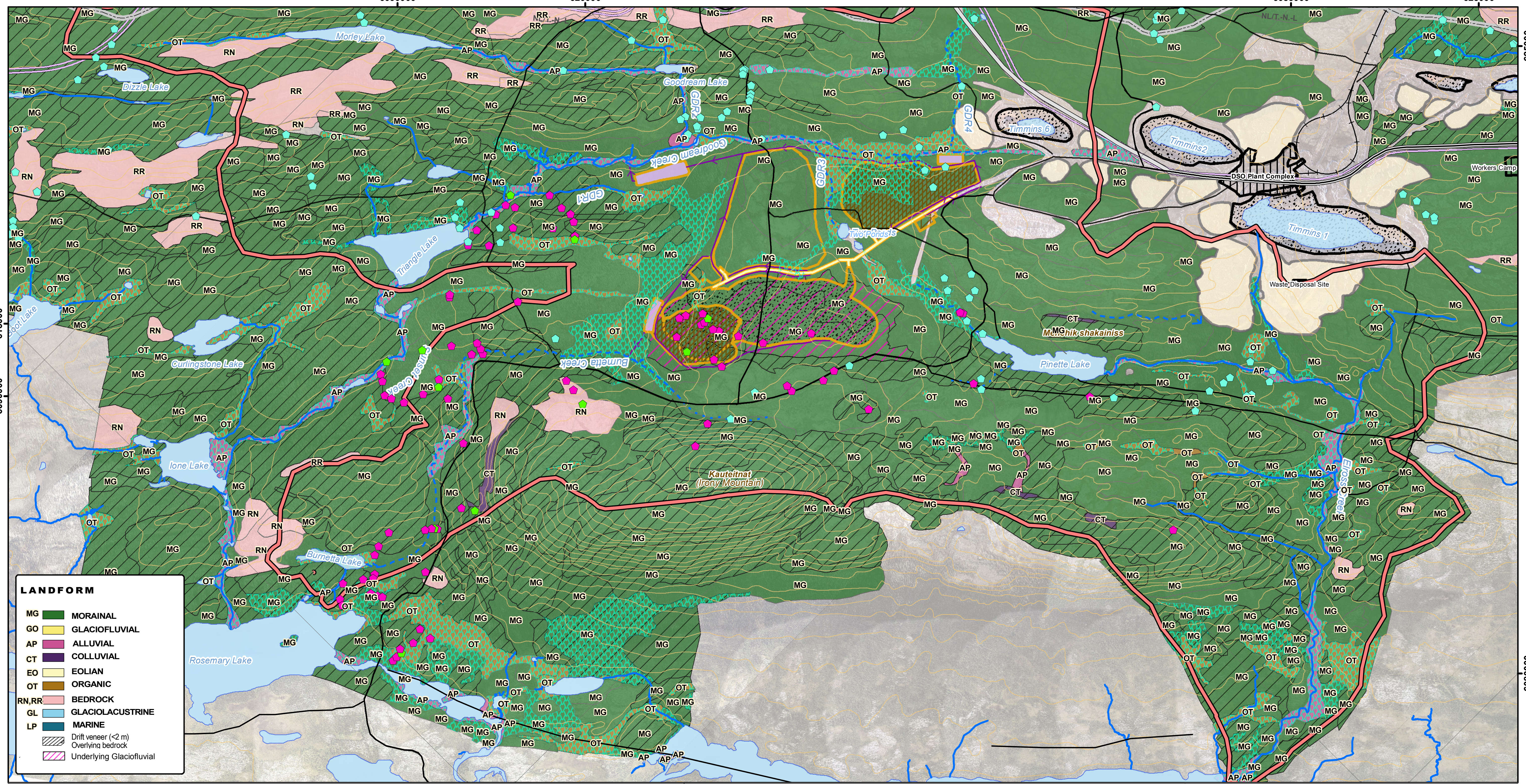
Silty sand till is the most widespread surficial material in the vicinity of the Project. Its thickness ranges from less than one metre in discontinuous veneers to a few metres in blankets and infilled hollows, which were more sheltered from glacial erosion. The till is generally moderately well to well drained, supporting sandy soils and Ecotypes FSM05 and FSM01. In depressions, where the groundwater table is perched on underlying bedrock, the till may be imperfectly to poorly drained. Ecotype FSM08 is more common in such areas.

Conspicuous meltwater channels wrapping around the western flank of Irony Mountain and incised through till provide clear evidence of deglacial meltwater pathways. Depositional evidence of meltwater activity is less common in the region. One noteworthy exception occurs northeast of Irony Mountain, in the vicinity of the Howse Deposit itself. Here, trenching and drilling records indicate that a relatively uniform cover of till overlies an average of 28 m of buried glaciofluvial sand and gravel (Thiagarajan (BK) Balakrishnan, *pers. comm*.). Its presence can only be inferred in aerial photography based on a distinct, radial drainage pattern interpreted to be centered on the thickest portion of sand and gravel. The landform is interpreted to be a buried kame overridden by a late glacial advance. The till cap is sufficiently thick and continuous that soil moisture and nutrient regime are relatively unaffected by the underlying glaciofluvial deposit. As in other areas of well drained till, Ecotypes FSM05 and FSM01 predominate.

Since the deglaciation of the region, organic material has accumulated in poorly to very poorly drained depressions and in areas of groundwater discharge. Organic mesic and fibric soils support Ecotypes FSM10, FSM12 and FSM14. In areas of greater regional slope, contemporary streams have eroded and redistributed glacially derived sediments in alluvial plains. The floodplains, comprising sand and silt, are typically imperfectly drained. Riparian ecosystems in such areas include Ecotypes FSM07 and FSM15. In the LSA, permafrost is restricted to high-elevation, windswept hills above about 660 m (Journeaux Assoc, 2015), at sufficient depth that it has little to no effect on ground stability or terrestrial ecosystems.

Data Gaps

Previous government- and university-led surficial geology projects have produced regional- and local-scale mapping and descriptions of geomorphology within the Howse Project RSA and LSA. Information gained from these original publications has been supplemented by observations made during recent field investigations and aerial photograph-based geomorphological mapping in support of mineral exploration in the area. No significant data gaps are known to exist for geomorphology, and diligent observations during site preparation and mining will further supplement the existing data set.



LEGEND

Data Validation
- 2008/2009 Survey
- 2013 Survey
  - Ground
  - Visual
- Local Study Area

Infrastructure and Mining Components
- DSO Haul Road
- Existing Railroad
- Elross Lake Area Iron Ore Mine (ELAIOM) Plant Infrastructure footprint
- Existing Pit
- Existing Dump
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Site Infrastructure
- Proposed In-Pit Dump/ Waste Dump
- Existing and Proposed Sedimentation Pond
- Proposed Ditch
- Proposed Mine Haul Road

Basemap
- Permanent Watercourse
- Intermittent Watercourse
- Storm Runoff
- Disappearing Stream
- Artesian Spring
- Water Body
- Contour Line (50 ft)
- Existing Road
- Main Access Road
- Wetland

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0575 , PR185-19-14, 2015-11-10, edickoum

N

0 500 1 000 1 500
Meters

UTM 19N NAD 83

SCALE: 1:30 000

SOURCES:
Basemap
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,
Boundary used for claims
SLE, AMEC and GHI (October 2012). LabMag and Kémag Iron Ore Projects 2012 Mine Site Aquatic Program Field Report.
Groupe Hémisphères, Hydrology, Wetland, 2013.

Infrastructure and Mining Components
New Millennium Capital Corp., Mining sites and roads
Howse Minerals Limited/
MET-CHEM, Howse Deposit Design for General Layout, 2015

SURVEY:
Groupe Hémisphères (2011) Terrestrial Ecosytems and Terrain : Iron Ore Project Direct Shipping.
Technical Report for New Millennium Capital Corp, 2008-2010.

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Terrain

Howse Minerals Limited

GroupeHemispheres

5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2

1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 7-27

7.3.8 Permafrost

7.3.8.1 Component Description

The demonstrated absence or isolated presence of permafrost in the Howse Project LSA makes negligible any potential effects of permafrost on the project, or of the project on permafrost. Assuming a continued trend of climatic warming, permafrost is not expected to aggrade into stockpiles or waste rock piles, and any isolated bodies of permafrost at depth within bedrock will continue to thaw undetected, with no measurable effect on groundwater. In the unlikely event small bodies of frozen ground are encountered during pit excavation, site-specific adjustments or mitigations will address any potential effects. Finally, no comments were raised concerning permafrost during the Howse consultation process. For these particular reasons, permafrost is not retained as a VC.

Permafrost is ground that remains at or below 0°C for more than one year. Its consideration in the Howse Project proposal is relevant because of the potential for permafrost, where present, to influence ground conditions, approaches to project design and support ecosystem function.

LSA, RSA and Temporal Boundaries

The LSA for permafrost is defined by a 500 m buffer around the Howse Project footprint. This is considered to be the maximum potential area of effect for proposed project activities, such as excavations (open pit) and stockpiles. Potential direct effects of ground alteration from the project are localized (typically metres to tens of metres), whereas potential indirect effects through alteration to surface drainage patterns can have farther-reaching effects (in the order of a few hundred metres). A 500 m buffer intentionally excludes Irony Mountain, which has no potential for effects.

The RSA for permafrost is defined by the upper Howells River watershed and its immediate surroundings within the Labrador Trough. This area is entirely within the zone of sporadic discontinuous permafrost; it exhibits relatively uniform valley-and-hill morphology; and it encompasses areas of previous and proposed mining-related disturbance (e.g., open pits, waste rock piles, etc.). The full extent of any cumulative effects is included within this region of historic mining operations.

The temporal boundaries for permafrost include the expected lifespan of the mine (i.e., approximately 15 years) plus an allowance for a period of re-equilibration and restoration of any detectable changes in permafrost and related ground conditions (i.e., another 30 years). A 46-year timeframe is conservative, given that surface expressions of localized changes in permafrost associated with historic mining operations have stabilized since their cessation several decades ago. This timeframe is also based on EBA Engineering Consultants Ltd.'s (2004) experience in permafrost regions of northwestern Canada, where natural processes can reclaim a mine cut in permafrost in four to ten years, depending on site conditions, and "succession toward a closed-canopy spruce forest is well underway about 40 years after disturbance" (p.22).

Existing Literature

A uniquely good understanding of permafrost conditions and distribution in the vicinity of the Howse Project has been gained from a history of Iron Ore Company of Canada (IOCC) mining operations in the area, starting in 1954, through which numerous deep (up to ~100 m) exploration boreholes were instrumented with thermocables. Decades of permafrost-related research ensued, following establishment by the McGill Subarctic Research Station of a permafrost research site in 1967 at the Timmins 4 Deposit, just 2 km southeast of the Howse Deposit (Granberg et al., 1984). Studies involving interpretation of large-scale aerial photography and examination of soils at hundreds of locations within the region have been completed by Groupe Hémisphères and its project partners since 2006 in support of mineral exploration projects. More recent field investigations and desktop analyses, specifically in support of planning for the Howse Project, have supplemented and updated key observations and measurements from the extensive historical data set.

Table 7-49 summarizes key publications, including those containing historical and recent data sets, which are directly relevant to the characterization of permafrost conditions within the Howse Project LSA and to an effects assessment.

Table 7-49 Summary of Pertinent Information on Permafrost Conditions within the Howse Project Area

TITLE	AUTHOR/YEAR	DESCRIPTION	RELEVANCE
Permafrost Condition at TSMC Howse Deposit, Schefferville, Québec	Journeaux Assoc (2015)	Includes new analyses of historical ground temperature and permafrost data from the Howse Project RSA, and reports the results of newly collected ground temperature, air temperature and permafrost data from the Howse Project LSA	Facilitates comparison between historical and current permafrost conditions, and allows updates to be made with respect to expectations for mining
Hydrogeology and MODFLOW Modelling – Howse Property	Geofor Environment (2015)	Reports the results of recent borehole drilling and groundwater monitoring in the Howse Project LSA	Facilitates inference of unfrozen conditions in areas of rapidly responding groundwater levels
Permafrost Map of Canada	Heginbottom, 1995	Provides nation-wide delineation of permafrost continuity, ice content, landforms and temperatures	Establishes regional context for permafrost conditions and limits of discontinuous permafrost
Schefferville Permafrost Research Volume I: Parts 1a and 1b, Summary, Review and Recommendations and Catalogue of Available Materials	Granberg et al. (1984)	Reports results of extensive permafrost research conducted in the Howse Project RSA, including ground temperature records, material properties and ground ice observations, and includes bibliography of related references	Provides comprehensive baseline foundation for characterizing historical permafrost conditions within the Howse RSA
Annotation, Error Analysis and Addenda to Schefferville Permafrost Data File, Vol I, Summary & Index	Granberg et al. (1984)	Provides overview of errors and erratic results from thermocable data in the Howse Project RSA	Provides opportunity to update interpretations of original ground temperature data
Annotation, Error Analysis and Addenda to Schefferville Permafrost Data File, Vol XIII, Graphic Representation of Thermocable Data (b) Howse to Timmins 4 Cable 14E	Granberg et al. (1984)	Identifies errors and erratic results from thermocable data in the Howse Project RSA	Provides opportunity to update interpretations of original ground temperature data
Annotation, Error Analysis and Addenda to Schefferville Permafrost Data File, Vol XV,	Granberg et al. (1984)	Includes comments of erratic readings, sometimes with cause, and permafrost presence	Provides opportunity to better understand where and how groundwater is impacting

TITLE	AUTHOR/YEAR	DESCRIPTION	RELEVANCE
Annotations of Thermocable Data Plots and Permafrost Prediction Maps; Data Corrections		and condition, based on thermocable readings in the Howse Project RSA	ground temperature measurements
Permafrost spatial and temporal variations near Schefferville, Nouveau-Québec	Nicholson (1979)	Provides synthesis and analysis of data from history of IOCC/McGill permafrost research in mine areas within Howse Project RSA, including permafrost distribution (three-dimensionally) and thermal regime	Provides valuable regional summary of historical permafrost data set, to which more modern observations and measurements can be compared
Indirect mapping of the snow cover for permafrost prediction at Schefferville, Québec	Granberg (1973)	Assess the relationship between topography (elevation and surface roughness) on snow accumulation, and relates this to permafrost distribution within the Howse Project RSA	Emphasizes the important role that snow cover and wind exposure have on the occurrence of permafrost and reports particular snow depth thresholds of regional relevance

Distribution

The Howse Project is located within the zone of sporadic discontinuous permafrost, within which permafrost generally underlies 10-50% of the landscape (Heginbottom, 1995). Regionally (i.e., within the RSA), permafrost is more extensive to the north, where tundra dominates the landscape, and less extensive to the south, where woodlands predominate. At a local scale (i.e., within the LSA), the distribution of permafrost relates to elevation, topographic characteristics, vegetation, snow cover, substrates and groundwater movement.

Research centered around the Timmins 4 Deposit determined that "the winter snow cover is the most important single factor affecting the distribution of ground temperatures [and, therefore, permafrost distribution] in the Schefferville area" (p. 148, Granberg et al., 1984). Snow acts as an effective insulator, reducing heat loss from the ground during winter. The average annual snowfall of about 350 cm and 7 to 8 months of snow cover inhibit permafrost development in much of the area (Nicholson, 1979). In order to understand the distribution of permafrost in the vicinity of the Howse Project, local patterns in winter snow cover and spring snow melt must be considered. Through indirect mapping of snow cover for permafrost prediction, Granberg (1973) found that the distribution of snow relates strongly to the dynamics of winter winds and the snow it carries. Minimal snow accumulates in exposed areas, such as high-relief, rocky hill crests, where the absence of trees allows redistribution by wind. Permafrost is common in such areas. Thicker snow cover in sheltered areas, such as forested slopes, valleys and in the lee of hills, promotes the deposition, accumulation and springtime persistence of snow. Permafrost is commonly absent in such areas. Typical woodland snowpacks of 1.5 m are sufficient to prevent the development of permafrost (Nicholson, 1979). Based solely on site exposure and vegetation, permafrost is more likely to underlie Irony Mountain, immediately west of the Howse Deposit, than it is to underlie the Howse Project LSA, which is lower, relatively sheltered and partly forested.

Journeaux Assoc (2015) demonstrated that elevation is a particularly reliable predictor of permafrost distribution within the Howse Project RSA, based on spatial comparisons it made of historical observations and ground temperature data available in Granberg et al.'s (1984) summaries of permafrost research in the area. Journeaux Assoc's (2015) Table 4-1 summarizes occurrences of frozen ground reported by personnel working in the former and existing mining pits in the region. Frozen ground conditions were only reported in pits above 660 m (i.e., based on observations from 11 pits from 660 m at Leroy 1 to 800 m at Sunny 1). Unfrozen conditions were documented at pits from 540 m in elevation (i.e., Ferriman) to 775 m in elevation (i.e., Kivivic 4). The unfrozen conditions at higher elevations are partly attributed to substrate and ore characteristics (e.g., porosity).

Based solely on elevation, permafrost has a low likelihood of occurrence within the Howse Deposit itself, which slopes from a maximum of about 680 m at its southern limit down to almost 580 m at its northern limit. Most of the broader Howse Project LSA is similarly below the 660 m regional low threshold of frozen ground occurrences. Only two small areas within the LSA exceed the 660 m elevation: a gentle slope between the western edge of the Howse Deposit and the base of Irony Mountain, and the crest of a small hill southeast of the southern waste rock dump (Figure 7-28). No mine-related infrastructure is proposed within either of these areas.

Substrate composition also has an important role on permafrost distribution within the Howse Project LSA, seemingly counteracting the effects of elevation and exposure in the upper portion of the Howse Deposit itself, where may otherwise occur. An average of 28 m of highly permeable sands and gravels overlies the Howse Deposit (Granberg et al., 1984), in contrast to the comparatively thin mantle of till prevalent elsewhere. The landform with which these sands and gravels are associated is likely a kame, deposited by glacial meltwater in contact with glacial ice. Much of the kame is unfrozen based on information derived from thermocables installed in boreholes within the deposit (Granberg et al., 1984). Granberg et al. (1984) postulate that the permeable sands and gravels allow "a heat gain by warm water infiltration during summer that outweighs the effects of shallow snow accumulation in winter" (p. 23). Nicholson (1979) also documented a strong dependence of permafrost presence/absence on the proximity to, and catchment areas of, subsurface drainage pathways. Areas with subsurface water flow inhibit permafrost development and, over time, can thaw any relict permafrost that may be present. These statements are corroborated by the recent observations and interpretations of Journeaux Assoc (2015), which found that groundwater levels within the deposit are deep (i.e., approximately 70 to 90 m below ground surface, based on wells drilled recently by Geofor Environment), yet respond notably to major rainstorms. Each year, relatively warm rainwater efficiently infiltrates the granular deposits and porous iron formation, transferring heat and thawing any relict permafrost.

During field reconnaissance in the Schefferville mining region, Journeaux Assoc (2015) attributed observations of shallow, irregular depressions along high-elevation haul roads to localized permafrost degradation. No surface expressions diagnostic of permafrost or thawing frozen ground were observed in the Howse Project area.

Thermal Conditions and Trends in Ground Temperature

The general thermal regime of the permafrost in the Howse Project RSA is well understood from the significant amount of thermocable data and related research. Mean permafrost temperature, regionally, is usually between 0 and -1°C; temperatures lower than -2°C are almost always restricted to the uppermost 20 m (Nicholson, 1979). Nicholson (1979) reports seasonal fluctuations of permafrost temperature of up to 0.1°C are common to depths of 25 m, which is consistent with more recent measurements described below. The magnitude of the temperature variation decreases with depth, and there is a lag time before maximum and minimum temperatures are reached at depth (Granberg et al., 1984). Steep horizontal temperature gradients of up to 1°C per 15 m lateral distance are not exceptional in the region (Nicholson, 1979).

Journeaux Assoc (2015) compiled and reviewed ground temperature records from four sources: 1979 McGill temperature graphs from thermistors installed in the Howse area; Golder Associates' temperature records beginning in December 2013 in a borehole near the southeast limit of the Howse Deposit; New Millennium temperature records from installations in the nearby LabMag and KéMag deposits; and measurements by Nicholson (1979) at Timmins 3 and 4. With the exception of an occasional "erratic reading" (documented as such), Granberg et al. (1984) reported ground temperatures encompassing the Howse Deposit, below the depth of seasonal frost penetration, above 0°C (i.e., 0.5 to 2°C) down to 120 m depth below ground surface. Nicholson (1979) presented a cross-section that showed ground temperatures for an area around the Timmins 4 deposit, just 2 km away from the Howse Deposit, with temperatures above 0°C for terrain lower than 670 m in elevation. Given that the Howse Deposit is lower than 680 m, Nicholson's findings are consistent with the measurements reported by Granberg et al. (1984).

Golder Associates installed a thermistor string in December 2013 to a 40 m depth on the southeast end of the Howse Deposit (elevation approx. 680 m). The temperature profile from December 2013 to August 2014 reveals ground temperatures below the depth of seasonal frost penetration (approx. 5 m) are consistently above freezing. The temperatures decrease from about 3°C at 666 m (14 m below ground surface (bgs)) to about 1.5°C at about 644 m (38 m bgs). The temperature profile from August 2014 to February 2015 reveals a similar frost penetration depth of about 5 m, and deeper ground temperatures transitioning from 2.5°C down to a 24 m depth, to 1°C by about 38 m depth (64 m bgs). In conjunction with the thermistor installation, Golder Associates installed two water temperature recorders at the same location, one at 89.5 m depth and another at 180 m depth. The readings indicate a temperature of 0.5°C at the groundwater table and 1°C at the 180 m depth. Based on this information, Journeaux Assoc. (2015) concludes that ground temperature probably decreases slowly from 1°C at the 38 m depth noted above, to about 0.5°C at the water table (80 m bgs).

These recent temperature records confirm unfrozen conditions and the absence of permafrost within this part of the Howse Deposit (Journeaux Assoc, 2015). Of note in the temperature profile is an anomalous rise in ground temperature at 7 m depth during a period when gradual cooling is expected. The infiltration of relatively warm precipitation during a rainstorm likely explains this temporary warming, and is a testament to the warming effect that can occur to greater depth over centuries in such granular deposits as exist at the Howse Deposit (Journeaux Assoc, 2015). Geofor Environment's recent monitoring of groundwater levels in the Howse Deposit confirmed unfrozen conditions with groundwater levels about 70 to 90 m below ground surface, with a gentle 2% slope toward the northwest (as reported by Journeaux Assoc, 2015). Groundwater flow is noted to be mainly controlled by bedding planes, fractures and faults, with no indication of permafrost control.

Thermistors installed by New Millennium in 2012 in the LabMag and KéMag deposits provide another opportunity to assess and compare recent ground temperatures in the area. The two thermistors installed in the LabMag deposit, just a few kilometres west in forested areas at an elevation of 513 and 565 m, exhibit temperature profiles similar to those recorded at the Howse Deposit (Journeaux Assoc, 2015). Temperatures below the 3-5 m thick annual surface freezing layer decreased from about 5°C at 5 m depth to about 3°C at 10 m depth. Much farther north, in exposed areas of bedrock at an elevation of 705 m, the KéMag thermistor intercepts the permafrost table at about 8 to 10 m depth, with permafrost temperatures fluctuating between about 0 and -2°C.

In order to assess the potential for changes in climate to affect permafrost, especially since most of the data were collected by IOCC and McGill researchers, Journeaux Assoc (2015) compiled weather data from Schefferville since the mid-1900s. The tabular and graphical representation of freezing and thawing indices (i.e., the yearly sum of the differences between 0°C and the daily mean temperature of the days with means below and above 0°C, respectively) indicate a slight warming trend in an air temperature metric that relates to permafrost condition. This warming trend is likely reflected in ground temperatures as well.

Summary of Permafrost Conditions and Implications for Mining

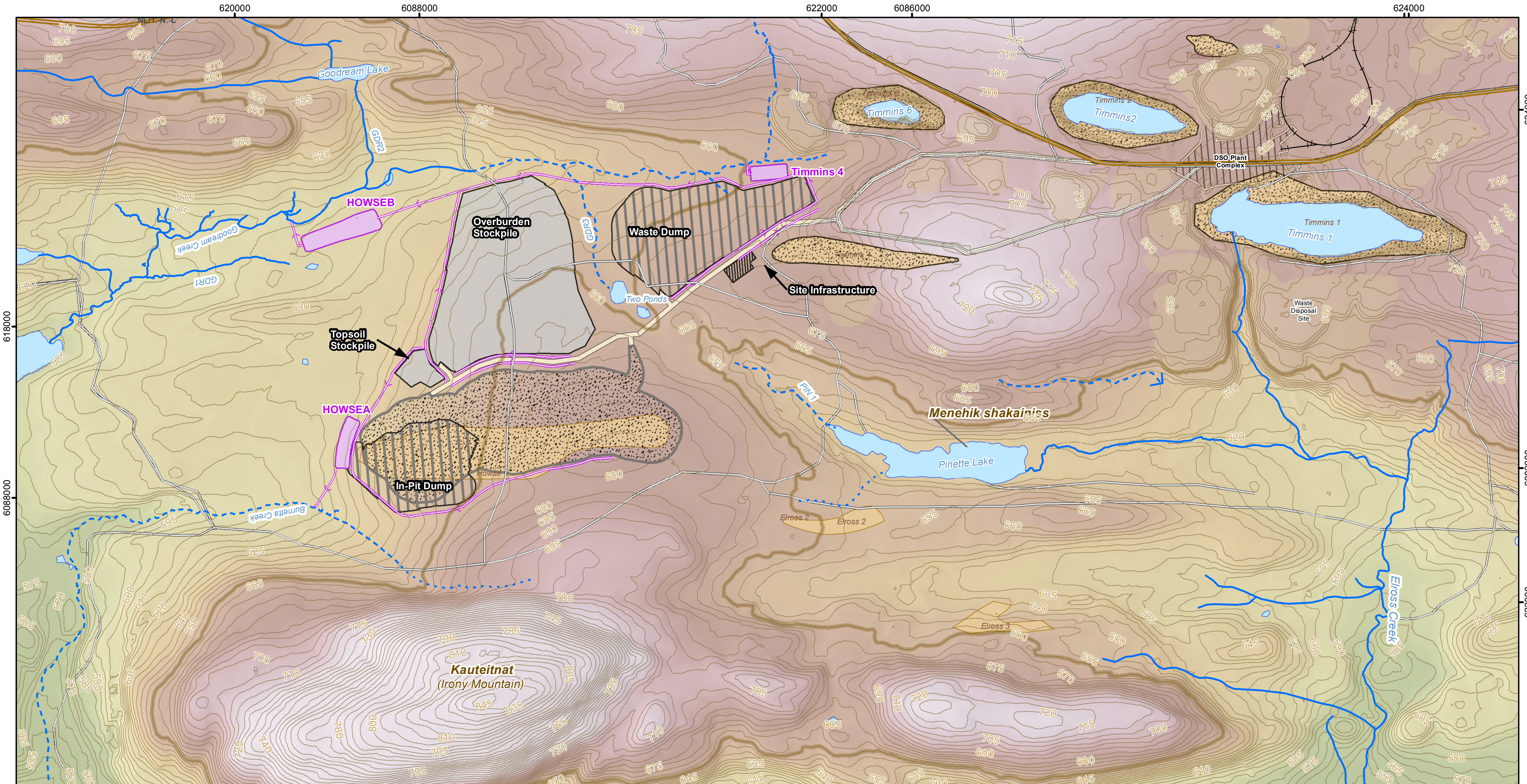
Journeaux Assoc's (2015) recent field investigation and desktop analysis conclude that any notable permafrost historically present in the Howse Project LSA below 660 m in elevation has since thawed and disappeared based on several lines of evidence:

- Thermistor readings reported in and around the Howse Deposit by McGill researchers (Granberg et al., 1984) and by Golder Associates, and in the nearby LabMag Deposit by New Millennium;
- Recent confirmation by Geofor Environment of deep groundwater levels in permeable granular deposits overlying the Howse deposit;
- Absence of any indication of permafrost below an elevation of 660 m in notes from personnel working in old and existing pits in the region; and
- Extrapolation of Nicholson's (1979) ground temperature observations from the nearby Timmins 4 area (i.e., unfrozen ground below 680 m).

Any isolated bodies of permafrost that do exist within the Howse Project LSA are likely restricted to the two higher elevation areas to the west and southeast of the Howse Deposit, where no mine-related infrastructure is proposed. Other areas below the 660 m lower regional limit of permafrost (Journeaux Assoc, 2015) are less exposed and at least partly forested. Even if small remnants of permafrost exist within the area, they would occur deep within the bedrock and have low ice contents. Nicholson's (1979) observation that ice contents in the area are low (commonly around 15% by volume) supports his statement, with application to proposed mine development, that "there is usually no change of rock volume on thawing" (p. 267). With low ice contents, any remnant permafrost exposed in bedrock during pit excavation would have little effect on overall pit stability and could be addressed through site-specific adjustments and mitigations as needed. As noted by Journeaux Assoc (2015), direct detection or modelling of possible remnant patches of permafrost within the Howse Project LSA would be difficult and of limited value.

Data Gaps

Few regions of Canada have such an extensive historical data set on ground temperature and permafrost conditions as is available for the Howse Project LSA and RSA. Recent field investigations, including borehole drilling, thermistor installations and groundwater monitoring, have enabled updates and comparisons to be made of permafrost conditions. These have been supplemented by desktop analyses and interpretations. No significant data gaps are known to exist for permafrost, and diligent observations during site preparation and mining will further supplement the existing data set.



LEGEND

Elevation (m asl)
847
551
660 m asl

Infrastructure and Mining Components
- DSO Haul Road
- Existing Railroad
- Elross Lake Area Iron Ore Mine (ELAIOM) Plant Infrastructure footprint
- Existing Dump
- Other Pit
- Deposit
- Proposed Ditch
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Site Infrastructure
- Proposed In-Pit Dump /Waste Dump
- Proposed and Existing Sedimentation Pond
- Proposed Mine Haul Road

Basemap
- Permanent Watercourse
- Intermittent Watercourse
- Storm Runoff
- Disappearing Stream
- Artesian Spring
- Water Body
- Contour Line (16 ft)
- Provincial Border
- Existing Road
- Main Access Road

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0577 , PR185-19-14, 2016-03-22, edickoum

N

0 500 1 000
Meters

UTM 19N NAD 83 SCALE: 1:20 000

SOURCES:
Basemap
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and Government of Quebec,
Boundary used for claims
Groupe Hémisphères, Hydrology, 2013.

Infrastructure and Mining Components
New Millennium Capital Corp., Mining sites and roads
TATA Steel Minerals Canada Limited/ MET-CHEM,
Howse Deposit Design for General Layout, 2013

Permafrost
Schefferville Permafrost Research, summary review and recommendations and catalogue of available materials for IOC Permafrost data, 1983.

ENVIRONNEMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Permafrost Potential within the LSA

Howse Minerals Limited

GroupeHemispheres

5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2

1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 7-28

7.3.9 Hydrography and Hydrology

7.3.9.1 Component Description

Hydrology is considered a VC insofar as it concerns the water budget, which is linked with the available amount of water for fish habitat. Further, the amount and speed of water flowing into creeks can lead to more or less erosion of the natural habitat, thus affecting water quality, which is also a component of fish habitat. As such, due to its effect on water quality and fish habitat, in interest for first nations, water budget is selected as VC.

LSA, RSA and Temporal Boundaries

The LSA is considered to be limited to the watersheds within which the Project takes place and that could potentially be affected by the Project: Triangle Lake, Pinette Lake and Burnetta Lake watersheds. This area includes some watercourses, the largest being Goodream Creek. This LSA also encompasses all sections that could dry out from the operation of the Howse mining activities (Figure 7-29).

In an effort to capture as much data as possible, we include data from well-documented large watersheds as far as 600 km away. Closer stations are used to better understand the local hydrography; the Howells River station at the bridge and others along Elross Creek are among these, but with much shorter time-series, in the order of a few years or less. The RSA also includes the Elross Lake watershed (Figure 7-29).

The temporal boundaries for the hydrology component includes up to 5 years after the end of the Howse Project Decommissioning and Reclamation phase, as based on observations of past IOCC iron ore sites throughout the ELAIOM project. Seasonal variations are also considered: During spring thaw, water flow is at its maximum and more mine water is expected to be discharged according to the WMP (Section 3.2.5), whereas in late summer and winter, streams are at their lowest flow, and sometimes even dry up because of the permeable nature of the surficial deposits and bedrock. In Labrador, dry ups are frequent in winter because of the very long cold period with persistent snow (Rollings, 1997).

Existing Literature

Hydrography

Knowledge of the surface flow pattern in the area was updated through field observations and interpretation of 2008 aerial photographs taken at a 1:10,000 scale. This hydrographic update was described in NML and PFWA (2009) and shows that the National Topographic Data Base (NTDB) was relatively outdated and imprecise. It also indicates that IOCC's mining operations dried out sections of watercourses farther east and thus reduced drainage density. Nevertheless, the most recent LSA update conducted by Groupe Hémisphères (Volume 2 Supporting Study K) currently reveals a terrain that is slightly disturbed by geological exploration paths, but with a drainage density that is still lower than anticipated, i.e., slightly more than 1 km of watercourse per km². With a cumulative length of 36 km in the LSA, the flow is achieved through three main watercourses, namely Goodream Creek to the north, Burnetta Creek (newly recommended hydronym) to the west and PIN1 (Pinette Lake Inflow to the southeast). Ultimately, all the creeks end at Howells River. For Goodream Creek, which ends at Triangle Lake, water is discharged toward two more lakes and then Howells River via Sunset Creek. For Pinette Lake Inflow, water is discharged via Elross Creek.

Combined, the LSA's lakes and ponds cover a total surface area of 50 ha. Triangle Lake is by far the largest water body, followed by Pinette Lake. Small ponds, part of wetlands (labelled as Two Ponds on the maps), are located northeast of the deposit, while other unnamed small lakes and ponds can be found within the LSA.

Hydrology

Brace Centre for Water Resources Management (BCWRM, 2005) conducted the initial hydrology investigation in 2005 with flow measurements at the Howells River Bridge. This station, with a drainage area of 250 km² and named HBL, was recommissioned in 2010 by Groupe Hémisphères (2013a), and provides the first year-round hydrogram in the vicinity of the LSA. Analysis suggests that HBL has hydrological responses that are similar to those of large-scale government hydrometric stations. Also, the transposition method for estimating extreme events seems effective only for the largest stations situated down the valley. High elevation watercourses were found to have a really large freshet, proportionally speaking. In contrast, some watercourses fed by large wetlands may show a particularly regular water regime, where freshets are inconspicuous, as was the case in the RSA (Groupe Hémisphères, 2010).

Reference Hydrometric Stations

Long-term streamflow data in central-west Labrador are sparse, whereas data in Québec are more abundant. Rollings (1997) identified 39 reference stations useful for modelling hydrology in Labrador. McFadyen (near the mouth), Pekan River and Swampy Bay are hydrometric stations that are now out of operation but are close to the study area and meet basic requirements, notably that of the number of years of operation. Baseline information and statistics can be found in Table 7-50.

Table 7-50 Reference Hydrometric Stations

NAME	FEDERAL NO.	COOR-DINATES (NAD83)	DRAINAGE AREA (KM²)	OPERA-TIONAL DATE	MEAN MONTHLY DISCHARGE (M³/S)	LOWER QUARTILE (M³/S)	UPPER Quartile (m³/s)
McFadyen (near the mouth)	03OA003	54°5'52" N 66°33'32" O	3,610	1972–1982	89.1	73.3	109
Pekan River	02UC003	52°11'20" N 66°53'29" O	3,390	1965–1982	75.7	69.7	81.6
Swampy Bay	03LD004	56°38'34" N 68°33'50" O	8,990	1972–1993	165	155	178

Local Hydrometric Stations

Numerous hydrometric stations already exist in the LSA. There are three types of measurements: instantaneous (single or discontinuous records), recording (continuously recording but not transmitting data using a satellite transmitter), and near real-time (continuously recording and transmitting data using a satellite transmitter). As previously discussed, 20 stations were installed in the Howells River Valley for the Taconite Project (SNC-Lavalin, 2013a). Of these, four monitor the water quantity coming from the Howse Project drainage area (Table 7-51). Roughly 20% of the recording stations, left for over a year, recorded that watercourses were completely dry by the end of the winter, when the low flow period occurred. Those were streams with a total drainage area of less than 9 km². Groupe Hémisphères (2013a) reported similar results at the nearby DSO 2a project site.

Two upstream stations were built by TSMC to monitor the TSMC's ELAIOM Project and are now part of the Real Time Streamflow program maintained jointly by Environment Canada – Water Survey of Canada and the Water Resources Management Division, NL Department of Environment and Conservation of Newfoundland and Labrador. Station NF03OB0039 records data on Elross Creek below the Pinette Lake inflow, while station NF03OB0040 records data on Goodream Creek, 2 km northwest of Timmins 6 pit. At the moment, gauging is not fully completed and only water level (or stage) is presented over the Internet (WRE, 2014).

For the current Project, four instantaneous stations were recently installed to collect flow data near the Project footprint, as shown in Figure 7-29. In addition to the location, Table 7-51 shows basic morphometric data and flow rates collected since 2013.

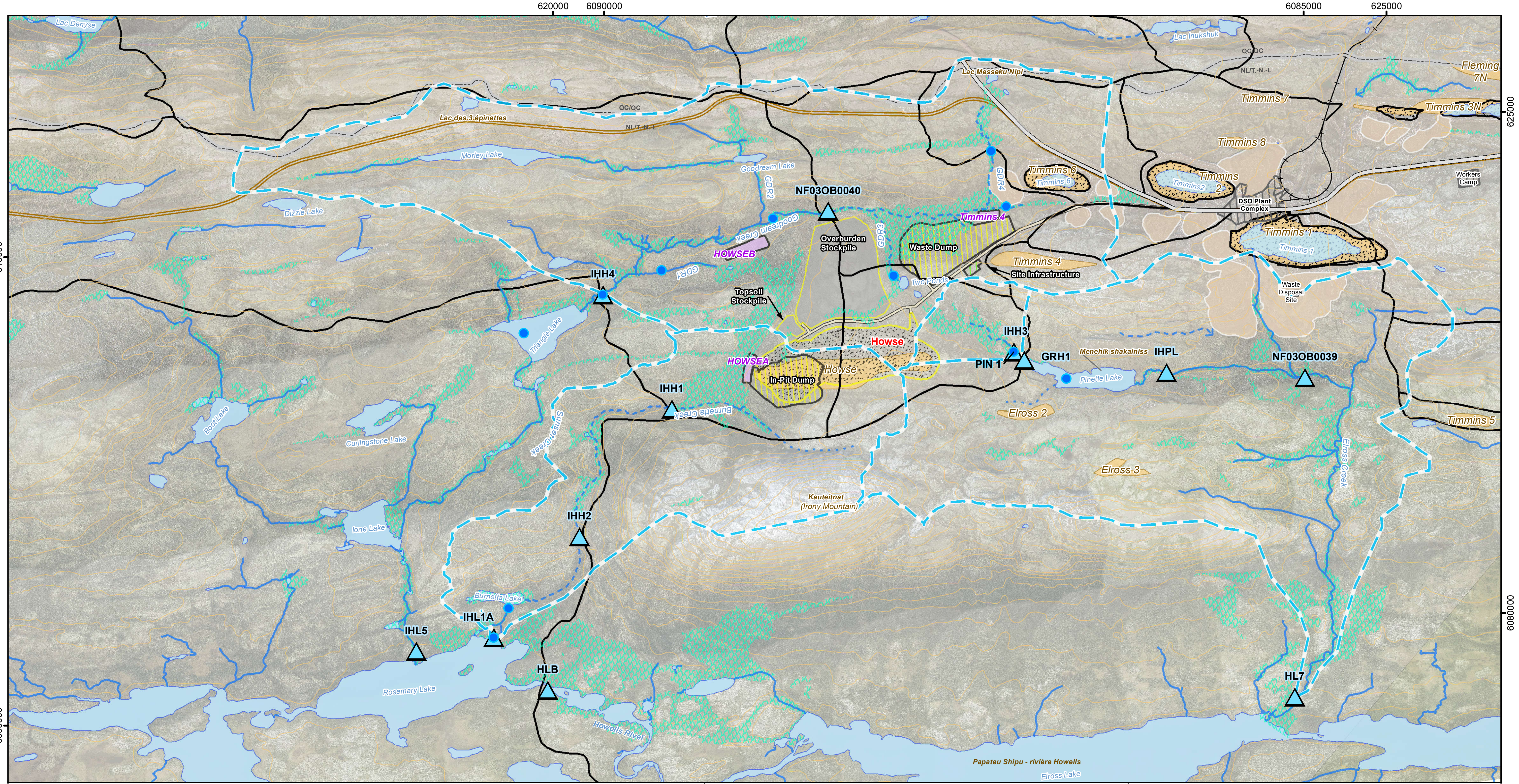
Compared to larger watercourses like Howells River, smaller watercourses like Burnetta Creek or PIN1 dry up in winter or summer.

Table 7-51 Local Hydrometric Stations and Stream Dimensions

STATION (WATER BODY)	TYPE (OPERATIONAL DATE)	COORDINATES (NAD83)		DRAINAGE AREA	WETTED WIDTH*	MEAN WATER DEPTH*	FLOW RATE (M^3/S)**	
		LATITUDE	LONGITUDE	(KM^2)	(M)	(M)	MIN.	MAX.
Current Project (Volume 2 Supporting Study I)								
IHH1 (Burnetta Creek Upstream)	Instantaneous (2013-2014)	54.91743	-67.16064	2.72	2.00	0.097	0	0.011
IHH2 (Burnetta Creek Midcourse)	Instantaneous (2013-2014)	54.91797	-67.17927	4.65	0.97	0.056	0	0.001
IHH3 (Pinette Lake Inflow)	Instantaneous (2013-2014)	54.89796	-67.12312	0.66	0.35	0.031	0	0.003
IHH4 (Goodream Creek)	Instantaneous (2013-2014)	54.92791	-67.15383	13.65	3.13	0.236	0.397	0.703
ELAIOM Project (WRE, 2013)								
NF03OB0039 (Elross Creek)	Near real-time (>2011)	54.87750	-67.09972	n.d.	n.d.	n.d.	Stage	Stage
NF03OB0040 (Goodream Creek)	Near real-time (>2011)	54.91750	-67.12389	n.d.	n.d.	n.d.	Stage	Stage
Taconite Project (SNC-Lavalin, 2013)								
HLB (Howells River bridge)	Recording (2010-2011)	54.91089	-67.20390	250.0	14.50	0.776	1.42	22.5
HL7 (Elross Creek near Mouth)	Recording (2010-2011)	54.86150	-67.13702	16.15	2.75	0.287	0.12	0.26
IHL1A (Burnetta Creek near mouth)	Instantaneous (2011-2014)	54.91717	-67.20282	5.81	9.00	0.158	0.26	0.86
IHL5 (Sunset Creek near mouth)	Instantaneous (2011)	54.92154	-67.21140	28.80	6.20	0.228	1.58	1.69

*: As measured at the higher observed stage when gauging

**: Minimum or maximum flow rate can be instantaneous or mean daily records



LEGEND

Survey

- Hydrometric Station
- Water Quality Station

Infrastructure and Mining Component

- Proposed Howse Pit
- Proposed Topsoil/Overburden Stockpile
- Proposed Site Infrastructure
- Proposed In-Pit Dump/ Waste Dump
- Proposed and existing Sedimentation Pond
- DSO Haul Road
- Mine Haul Road
- Existing Railroad
- Existing Dump
- Existing Pit
- Deposit
- Elross Lake Area Iron Ore Mine (ELAIOM) Plant Infrastructure Footprint

Basemap

- Permanent Watercourse
- Intermittent Watercourse
- Storm Runoff
- Disappearing Stream
- Artesian Spring
- Water Body
- Wetland
- Watershed Boundary
- Contour Line (50 ft)
- Provincial Border
- Existing Road
- Main Access Road

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0576 , PR185-19-14, 2016-03-22, edickoum

0 500 1 000 1 500 2 000
Meters

UTM 19N NAD 83

SCALE: 1:35 000

SOURCES:
Basemap
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and Government of Quebec,
Boundary used for claims
SLE, AMEC and GHI (October 2012). LabMag and Kémag Iron Ore Projects 2012 Mine Site Aquatic Program Field Report.
Groupe Hémisphères, Hydrology, Wetland, 2013.

Infrastructure and Mining Components
New Millennium Capital Corp., Mining sites and roads
Howse Minerals Limited/
MET-CHEM, Howse Deposit Design for General Layout, 2015

Surveys
SNC-Lavalin (May 2013) Taconite Project LabMag Mine Site 2012 Hydrology Field Report. Final Report done in collaboration with Groupe Hémisphères and AMEC for New Millennium Iron/TATA Steel, 25 pages and 5 appendices.

ENVIRONNEMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Hydrography and Hydrology Water Quality

Howse Minerals Limited

GroupeHemispheres
5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 7-29

Table 7-52 Goodream Creek Natural Inflow at Junction with Timmins 4 Sedimentation Pond 3 Outflow (316 ha)

MONTH	SNOWFALL [M³]	RAINFALL [M³]	INFILTRATION [M³]	NET RUNOFF [M³]	EVAPO-TRANSPIRATION [M³]	INFLOW [M³]	INFLOW [L/S]
Jan	141,337	0	0	0	0	0	0.0
Feb	116,175	330	0	330	0	330	0.1
Mar	140,404	1,219	0	1,219	0	1,219	0.5
Apr	143,454	15,101	0	15,101	0	15,101	5.8
May	74,514	88,527	0	1,213,971	0	1,213,971	453.2
Jun	11,399	219,038	138,262	92,175	92,175	0	0.0
Jul	0	319,818	191,891	127,927	108,319	19,608	7.3
Aug	1,739	301,660	182,040	121,360	77,371	43,989	16.4
Sep	30,733	255,297	171,618	114,412	50,844	63,568	24.5
Oct	148,195	89,629	0	89,629	0	89,629	33.5
Nov	205,982	8,337	0	8,337	0	8,337	3.2
Dec	155,384	520	0	520	0	520	0.2
Year	**1,169,316**	**1,299,476**	**683,811**	**1,784,981**	**328,709**	**1,456,273**	**46.2**

Table 7-53 Goodream Creek Natural Inflow at Junction with HOWSEB Outflow (1,068 ha)

MONTH	SNOWFALL [M³]	RAINFALL [M³]	INFILTRATION [M³]	NET Runoff [m³]	EVAPO-TRANSPIRATION [M³]	INFLOW [M³]	INFLOW [L/S]
Jan	477,942	0	0	0	0	0	0.0
Feb	392,854	1,117	0	1,117	0	1,117	0.5
Mar	474,787	4,124	0	4,124	0	4,124	1.5
Apr	485,101	51,064	0	51,064	0	51,064	19.7
May	251,973	299,359	0	4,105,130	0	4,105,130	1,532.7
Jun	38,546	740,691	467,542	311,695	311,695	0	0.0
Jul	0	1,081,488	648,893	432,595	366,290	66,305	24.8
Aug	5,882	1,020,086	615,581	410,387	261,636	148,752	55.5
Sep	103,925	863,306	580,339	386,893	171,932	214,961	82.9
Oct	501,130	303,085	0	303,085	0	303,085	113.2
Nov	696,542	28,193	0	28,193	0	28,193	10.9
Dec	525,441	1,758	0	1,758	0	1,758	0.7
Year	**3,954,124**	**4,394,271**	**2,312,354**	**6,036,040**	**1,111,552**	**4,924,488**	**156.2**

Table 7-54 Burnetta Creek Natural Inflow at Junction with HOWSEA Outflow (83 ha)

MONTH	SNOWFALL [M³]	RAINFALL [M³]	INFILTRATION [M³]	NET RUNOFF [M³]	EVAPO-TRANSPIRATION [M³]	INFLOW [M³]	INFLOW [L/S]
Jan	37,192	0	0	0	0	0	0.0
Feb	30,570	87	0	87	0	87	0.0
Mar	36,946	321	0	321	0	321	0.1
Apr	37,749	3,974	0	3,974	0	3,974	1.5
May	19,608	23,295	0	319,446	0	319,446	119.3
Jun	2,999	57,638	36,382	24,255	24,255	0	0.0
Jul	0	84,157	50,494	33,663	28,503	5,160	1.9
Aug	458	79,379	47,902	31,935	20,360	11,575	4.3
Sep	8,087	67,179	45,160	30,107	13,379	16,727	6.5
Oct	38,996	23,585	0	23,585	0	23,585	8.8
Nov	54,202	2,194	0	2,194	0	2,194	0.8
Dec	40,888	137	0	137	0	137	0.1
Year	**307,695**	**341,946**	**179,939**	**469,702**	**86,497**	**383,205**	**12.2**

Table 7-55 Pinette Lake Outlet Natural Inflow (237 ha)

MONTH	SNOWFALL [M³]	RAINFALL [M³]	INFILTRATION [M³]	NET RUNOFF [M³]	EVAPO-TRANSPIRATION [M³]	INFLOW [M³]	INFLOW [L/S]
Jan	106,070	0	0	0	0	0	0.0
Feb	87,186	248	0	248	0	248	0.1
Mar	105,370	915	0	915	0	915	0.3
Apr	107,659	11,333	0	11,333	0	11,333	4.4
May	55,921	66,437	0	911,055	0	911,055	340.1
Jun	8,554	164,382	103,762	69,175	69,175	0	0.0
Jul	0	240,016	144,009	96,006	81,291	14,715	5.5
Aug	1,305	226,389	136,616	91,078	58,065	33,013	12.3
Sep	23,064	191,594	128,795	85,863	38,157	47,706	18.4
Oct	111,216	67,264	0	67,264	0	67,264	25.1
Nov	154,584	6,257	0	6,257	0	6,257	2.4
Dec	116,612	390	0	390	0	390	0.1
Year	**877,542**	**975,225**	**513,183**	**1,339,584**	**246,688**	**1,092,896**	**34.7**

The following tables show the water balance results, after the construction of water management infrastructure, at a time near the end of the mine life.

Table 7-56 Goodream Creek Modified Inflow at Junction with Timmins 4 Sedimentation Pond 3 Outflow (304 ha)

MONTH	SNOWFALL [M³]	RAINFALL [M³]	INFILTRATION [M³]	NET RUNOFF [M³]	EVAPO-TRANSPIRATION [M³]	PUMPING FROM PIT [M³]	INFLOW [M³]	INFLOW [L/S]
Jan	135,118	0	0	0	0	0	0	0.0
Feb	111,063	316	0	316	0	0	316	0.1
Mar	134,226	1,166	0	1,166	0	0	1,166	0.4
Apr	137,142	14,436	0	14,436	0	0	14,436	5.6
May	71,235	84,631	0	1,160,551	0	210,000	1,370,551	511.7
Jun	10,897	209,399	132,178	88,118	88,118	0	0	0.0
Jul	0	305,745	183,447	122,298	103,553	3,098	21,843	8.2
Aug	1,663	288,386	174,029	116,019	73,966	6,950	49,003	18.3
Sep	29,380	244,063	164,066	109,377	48,606	10,044	70,815	27.3
Oct	141,673	85,685	0	85,685	0	0	85,685	32.0
Nov	196,918	7,970	0	7,970	0	0	7,970	3.1
Dec	148,546	497	0	497	0	0	497	0.2
Year	**1,117,861**	**1,242,294**	**653,720**	**1,706,433**	**314,243**	**230,092**	**1,622,282**	**607**

Table 7-57 Creek Modified Inflow at Junction with HOWSEB Outflow (1162 ha)

MONTH	SNOWFALL [M³]	RAINFALL [M³]	INFILTRATION [M³]	NET RUNOFF [M³]	EVAPO-TRANSPIRATION [M³]	PIT DEWATERING [M³]	INFLOW [M³]	INFLOW [L/S]
Jan	519,251	0	0	0	0	682,000	682,000	254.6
Feb	426,809	1,214	0	1,214	0	616,000	617,214	255.1
Mar	515,824	4,480	0	4,480	0	682,000	686,480	256.3
Apr	527,029	55,478	0	55,478	0	660,000	715,478	276.0
May	273,752	325,233	0	4,459,942	0	682,000	5,141,942	1 919.8
Jun	41,877	804,710	507,953	338,635	338,635	660,000	660,000	254.6
Jul	0	1,174,962	704,977	469,985	397,949	682,000	754,036	281.5
Aug	6,390	1,108,253	668,786	445,857	284,249	682,000	843,608	315.0
Sep	112,908	937,923	630,498	420,332	186,792	660,000	893,540	344.7
Oct	544,444	329,281	0	329,281	0	682,000	1,011,281	377.6
Nov	756,745	30,629	0	30,629	0	660,000	690,629	266.4
Dec	570,856	1,910	0	1,910	0	682,000	683,910	255.3
Year	**4,295,885**	**4,774,073**	**2,512,214**	**6,557,743**	**1,207,625**	**8,030,000**	**13,380,118**	**3,137**

Table 7-58 Burnetta Creek Modified Inflow at Junction with HOWSEA Outflow (143 ha)

MONTH	SNOWFALL [M³]	RAINFALL [M³]	INFILTRATION [M³]	NET RUNOFF [M³]	EVAPO-TRANSPIRATION [M³]	INFLOW [M³]	INFLOW [L/S]
Jan	64,448	0	0	0	0	0	0.0
Feb	52,974	151	0	151	0	151	0.1
Mar	64,022	556	0	556	0	556	0.2
Apr	65,413	6,886	0	6,886	0	6,886	2.7
May	33,977	40,367	0	553,552	0	553,552	206.7
Jun	5,198	99,878	63,045	42,030	42,030	0	0.0
Jul	0	145,832	87,499	58,333	49,392	8,941	3.3
Aug	793	137,553	83,007	55,338	35,280	20,058	7.5
Sep	14,014	116,412	78,255	52,170	23,184	28,986	11.2
Oct	67,574	40,869	0	40,869	0	40,869	15.3
Nov	93,925	3,802	0	3,802	0	3,802	1.5
Dec	70,853	237	0	237	0	237	0.1
Year							

Table 7-59 Pinette Lake Outlet Modified Inflow (228 ha)

MONTH	SNOWFALL [M³]	RAINFALL [M³]	INFILTRATION [M³]	NET RUNOFF [M³]	EVAPO-TRANSPIRATION [M³]	INFLOW [M³]	INFLOW [L/S]
Jan	102,266	0	0	0	0	0	0.0
Feb	84,059	239	0	239	0	239	0.1
Mar	101,591	882	0	882	0	882	0.3
Apr	103,798	10,926	0	10,926	0	10,926	4.2
May	53,915	64,054	0	878,380	0	878,380	327.9
Jun	8,248	158,487	100,041	66,694	66,694	0	0.0
Jul	0	231,407	138,844	92,563	78,376	14,187	5.3
Aug	1,259	218,269	131,717	87,811	55,983	31,829	11.9
Sep	22,237	184,723	124,176	82,784	36,789	45,995	17.7
Oct	107,228	64,852	0	64,852	0	64,852	24.2
Nov	149,040	6,032	0	6,032	0	6,032	2.3
Dec	112,429	376	0	376	0	376	0.1
Year	846,069	940,248	494,778	1,291,540	237,840	1,053,699	33.4

Dilution factor over the LSA and RSA

Solely based on increasing of drainage area, the effluent is rapidly diluted when progressing downstream. This hydrological phenomena is used to evaluate the effect of the mining effluent on other components such water quality and fish habitat. Table 7-60 show the dilution factor for the effluents for Construction and Operation phases, when the water leaves the LSA or the RSA.

Table 7-60 Dilution factor of the pond effluents over the LSA and RSA

WATERSHED	CONSTRUCTION PHASE	OPERATION PHASE
Burnetta Lake Outlet (LSA)	1 in 8.4	1 in 6.8
Triangle Lake Outlet (LSA)	1 in 8.4	1 in 4.8
Elross Lake (RSA)	1 in 124.7	1 in 96.9

Data Gaps

Water balance computations are based on climatological data from Environment Canada Schefferville A climate station (ID 7117823, 520.90 m asl, 2005-present).

7.3.9.2 Effects Assessment

Project Interaction with Water Budget and Potential Effects

Site Construction Phase

No potential interaction

During the site Construction phase, the following activities have no interaction with water budget:

- transportation and traffic;

At the beginning of mine construction, as the water table is deep, there will be no dewatering, so no effect on water budget is expected.

Potential interaction

- upgrading/construction of the Howse haul road and upgrading of the bypass road;
- pit development.

During the construction of infrastructure such as roads and pit development, some surficial modification might change the runoff path but the general topography will not be changed and the water budget should stay largely unchanged. On the other hand, removal of part of the overburden will likely intercept some runoff and lead to slight modifications of the water balance.

➔ The effect associated with the above potential interaction is the modification of the water budget reporting to specific locations along the creeks and water bodies surrounding the Howse Project.

The nature of the effect is direct and the effect is adverse.

Operation Phase

No potential interaction

The following activities do not have potential interaction with the water budget:

- blasting and ore extraction;
- mineral processing;
- transportation of ore and traffic;
- solid waste disposal;
- hazardous waste disposal;
- treatment of sanitary wastewater; and
- explosives management.

Potential interaction

- removal and storage of remaining overburden and topsoil;
- operation of waste rock dumps;
- pit development;
- dewatering; and
- ongoing site reclamation.

The removal and storage of the remaining overburden and topsoil, as well as the operation of waste rock dumps, have an effect on the water budget because the presence of those big stacks will modify natural site runoff. This will result in a modification of the water budget of the natural creeks and water bodies downstream from the mine site.

Dewatering has an effect on water budget because groundwater is discharged at the surface of the site, adding an important quantity of water to the natural watercourses (Section 3.1). The dewatering water will be discharged at a single point, adding a great amount of water at Burnetta Creek and Goodream Creek. The water budget downstream from this point will be modified through increased flows. On the other hand, the deepening and dewatering the pit will cause drying of the periphery of the pit; the source of creeks or wetlands can be altered by this interaction. The magnitude of this effect can be visualized in the hydrogeological component description (Section 7.3.9). The result is a change of the hydrography, by a reduction in the density of the watercourses. The only potential risk to level changes could have been Pinette Lake, but a water regime analysis reveals a non-significant change in stage over the years of operation, as, based on surface flow changes, the drawdown does not exceed 2 mm. The complete study is available in Volume 2 Supporting Study I). The addition of dewatering water may regulate the water regime of the receiving creek by reducing the magnitude of high and low flows during the year.

Ongoing site reclamation could reverse most of the effect on water budget if the drainage of the restored area can be diverted towards its original drainage path.

➔ The effect associated with the above potential interaction is the modification of the water budget reporting to specific locations along the creeks and water bodies surrounding the Howse project.

The nature of the effect is direct and the effect is adverse.

<u>Decommissioning and Reclamation Phase</u>

No potential interaction

The following activities do not have potential interaction with the water budget:

- demobilization of Howse facilities and heavy machinery;
- transportation and traffic.

Potential interaction

- final site reclamation.

With the final site reclamation, dewatering will be stopped. The final site reclamation will then largely reverse the effects on the water budget, which will tend to approach its original state. However, the water budget will never be exactly the same as it was before the Howse Project.

➔ The effect associated with the above potential interaction is the modification of the water budget reporting to specific locations along the creeks and waterbodies to approach its natural state.

The nature of the effect is direct and the effect is adverse.

7.3.9.3 Mitigation Measures

Standard mitigation measure

Table 7-61 presents the standard mitigation measures that will be applied for all phases. Even if water crossing were completely avoided in the footprint, standard mitigation measures are provide in case of necessity, like a possible bypass road.

Table 7-61 Standard Mitigation Measures for the Water Budget

CODE	MEASURE	MITIGATION EFFECT
Erosion and Sedimentation Control (ES)		
ES2	To follow the site's natural topography and prevent erosion, keep stripping, clearing, excavation, backfilling, and grading operations to a strict minimum on the work sites.	Limiting disturbance of the natural land will limit the effect on the natural water creeks, lakes and river
ES14	Along steep slopes bordering rights-of-way, use sediment barriers at the foot of the embankment or install protective material (straw, wood chips or mats) directly on the slope to reduce the volume of sediments that are transported.	This measure will limit erosion and sediment transportation. Furthermore, it will promote infiltration.
Watercourse Crossings (WC)		
WC1	Check whether a permit or authorization is needed for building watercourse crossings.	Proper permitting planification will allow for the regulation to be respected and deadline to be met.
WC6	Accurately assess the watercourse's peak flow in order to choose the appropriate diametre of pipe.	Avoiding overflow reduce the possibility that road material reaches waterbody and reduce erosion in the upstream portion of the culvert.
WC17	Install a culvert at least 45 cm in diameter.	This measure will prevent blockage with miscellaneous debris and flooding of the creek or ditch
WC18	Maximum flow depth must not exceed 85% of the culvert's vertical clearance.	Proper design of the culvert will allow for optimal flow and prevent flooding and erosion in the creek or ditch

CODE	MEASURE	MITIGATION EFFECT
WC21	Do not block the flow of water and respect the slope, natural drainage of the soil and direction of the watercourse when installing a culvert.	Proper installation of culvert will limit disturbance of the natural flow
WC27	Monitor culverts and bridges periodically, especially in the spring or after heavy rains. Pay particular attention to signs of erosion, poor plant regrowth, obstacles blocking water flow and structural integrity.	Good monitoring will prevent damage of the infrastructure and erosion in the ditch or creek
Waste Management (WM)		
WM3	Do not dump any waste into aquatic environments, including waste from cutting vegetation or stripping the soil. All waste accidentally introduced into aquatic environments must be removed as quickly as possible.	In addition to degrading the quality of the water, waste can cause jams in the flow of water, and erosion. This measure will prevent all of these negative environmental effect.
Drilling and Blasting (DB)		
DB4	The manufacturer's instructions must be followed to ensure that blasting procedures are safe both for humans and the environment.	These measures will preserve the water quality from any deleterious forms of nitrogen contamination in surface or groundwater
DB9	No explosive must be used in or near water.	This measure preserve global water quality of the LSA natural water bodies
DB16	Use multiple detonators in bore holes as per the manufacturer's recommendations and optimize the arrangement of blasting holes to minimize misfires.	This measure preserves quality of the water for direct or indirect contamination from deleterious form of nitrogen
DB19	Use reliable triggering systems that allow for precise firing of the explosives.	These measures increase blasting efficiency and therefore reduce the explosive residues concentration in sump water
Construction Equipment (CE)		
CE6	No machinery must circulate in the riparian strip unless regulations permit it.	As long as the littoral of the crossing remains intact, erosion cannot begin. Furthermore, it will ensure infiltration of possible run off.
Water Management (H2OM)		
H_2OM2	Re-use of waste water from mining operations will be encouraged.	This measure will limit the use of fresh water and limit the variation of the natural water balance of the LSA.
H_2OM6	At the end of restoration work, implement the surface water and groundwater monitoring programme.	If water quality does not improve after mining operations, find the source of the problem and correct the situation
Rehabilitation (R)		
R1	Follow good practices presented in the rehabilitation plan.	Most of the good practice are already proven methods that help reducing modification of natural water balance
R2	Draw up a rehabilitation plan	A rehabilitation plan will ensure that the final situation is brought back the most possible to initial condition

Specific Mitigation Measures

Table 7-62 presents the specific mitigation measures to which the Proponent is committed and will be applied to reduce the significance of the effects on water budget.

Table 7-62 Specific Mitigation Measures for Water Budget

SPECIFIC MITIGATION MEASURES FOR WATER QUALITY	
Measure	**Mitigation Effect**
Riprap will be installed on both sides of Burnetta Creek from the discharge point to 600 m downstream	Riprap will be installed within Burnetta Creek littoral and lower shore up to where water flow increase is expected to stay below 20%, thereby nearly eliminating erosion risks in that stream (see the next section Methodological Approach used to Assess this Component for more details).

7.3.9.4 Residual Effects Significance Assessment

The overall methodological approach to assess the environmental effects is presented in Section 5. However, in order to apply this methodology to the water budget VC, it is essential to consider assessment criteria applicable specifically to this VC (Table 7-63).

In order to understand the context in which this component is affected, it is important to describe its ecological context and resilience. Ecologically, most of the water bodies potentially affected by water regime changes are of low ecological importance. Indeed, water regime changes will mainly affect adjacent watercourses (Burnetta and Goodream Creeks) Therefore, since Burnetta Creek dose not shelter fish, only Goodream Creek is ecologically sensitive to those water regime changes. Moreover, the scale of water regime changes significantly reduces with increasing distance from the project and insignificant effects are expected once we reach downstream lakes.

Table 7-63 Assessment Criteria Applicable for Water Budget

TIMING		
Inconsequential timing	**Moderate timing**	**Unfavorable timing**
Timing of discharge makes it so that there are insignificant environmental effects	Timing of discharge makes it so that there are low significant environmental effects	Timing of discharge makes it so that there are large significant environmental effects
GEOGRAPHIC EXTENT		
Site specific	**Local**	**Regional**
Howse project footprint	LSA delineated in Section 7.3.9.1	Higher portion of the Howells River potentially disturbed by the Howse Project
DURATION		
Short	**Medium**	**Long**
Less than 12 months. Limited to the Construction and/or Decommissioning and Reclamation phase.	12-24 months. Extends beyond the Construction phase, but shorter than the lifespan of the Project.	More than 24 months Or long as the Project duration
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**

Full restoration of pre-development situation likely.	Partial restoration of pre-development situation likely.	Little/no restoration of pre-development situation likely.
MAGNITUDE		
Low	**Moderate**	**High**
The spring monthly maximum flow will increase less than 20% (Stephens, 2002). The hydrography will not change significantly, only the intermittent character of watercourses will be accentuated	The spring monthly maximum flow will increase more than 20% but less than 50% (Stephens, 2002). The hydrography will change significantly: upstream of watercourses will drying-out but waterbody will remains permanent.	The spring monthly maximum flow will increase more than 50% (Stephens, 2002). The hydrography will change dramatically: upstream of watercourse and waterbody will all dry up.
FREQUENCY		
Once	**Intermittent**	**Continual**
One time	Occasional or intermittent	Year round

Site Construction Phase

Timing

There are two scales to consider for timing. First, there is the annual timing. Discharge will mainly take place in the spring, at snow melt. Therefore, most of the flow increase will occur when the river banks are still frozen, which will considerably reduce erosion stress. Secondly, there is the long time scale in which the dewatering of the pit will occur only throughout the last years of the project as the groundwater table will not be reached before a few years. Since, significant effect on water regime are not expected in the first years, timing is considered **inconsequential** for this phase (Value of 1).

Geographic extent

The water budget modification will be restricted to the creeks and water bodies located directly downstream from the infrastructure construction site (**local**). Farther than that, the difference in water budget will become insignificant. (Value of 2)

Duration of the effect

The area excavated prior to pit development will not be filled, at least for the entire duration of the project (**long**). (Value of 3)

Reversibility of the effect

At the end of construction activities, natural water balance of the streams will not have returned to its original state (**partly reversible**). (Value of 2)

Frequency

Runoff only during the spring and summer period, and no runoff during winter (**intermittent**). (Value of 2)

Magnitude

Changes in water budget during the Construction phase will be limited. There will be no dewatering at this phase, limiting the effect on water budget. During the Construction phase, perceptible effects are not expected on environmental integrity, component quality or human use related to water budget (**low**). (Value of 1)

7.3.9.4.1 Significance

Based on this assessment, the effects of the Howse Project on the Hydrography and Hydrology are expected to be non-significant.

Operation Phase

Timing

Significant effect on water regime are expected as the pit gets deeper. Although ice cover in the spring will lower erosion impact on steam banks, lowering importance of the effects. Also, higher effects are expected in Burnetta Creek, but it is of lower ecological value as it does not shelter fish. Therefore, it is expected that there will be low but significant effect over the course of the project or **moderate timing** (Value of 2).

Geographic extent

The geographic extent of the effect is **local**, since the water budget modification will be restricted to the creeks and water bodies located directly downstream from the mine site. (Value of 2)

Duration of the effect

The duration of the effect is **long**, corresponding to the duration of the Howse project. (Value of 3)

Frequency

The frequency of the effect is **continual**, because the dewatering will be ongoing all year long once the water table depth is reached. As the water table is very deep, there will be intermittent dewatering until the pit reaches a certain depth. Continuous dewatering might start only a few years after the beginning of the operation. (Value of 3)

Reversibility of the effect

The reversibility of the effect is **partial**, because at the end of the operation of the Howse project, diches and sedimentation ponds will remain in place modifying slightly the natural flow path of the water in the footprint of the project. (Value of 2)

Magnitude

The magnitude of the effect is **moderate**, because the WMP will cause an increase of the spring monthly maximum flow more than 50% for Burnetta but less for other water bodies. Specific mitigation measures are planned for Burnetta that can lower down erosion to almost zero. Concerning hydrography, only the upstream watercourses have the possibility to know longer dry up period. (Value of 2)

Based on this assessment, the effects of the Howse Project on the Hydrography and Hydrology are expected to be significant, although the magnitude could be much lower as all scenarios were calculated as worse-case scenarios.

Decommissioning and Reclamation Phase

Timing

Throughout decommissioning, only natural water inputs will flow through the mine site and impact of the modified watersheds is expected only at freshet, but will be negligible. Timing is considered to be **inconsequential** for this phase (value of 1).

Geographic Extent

The geographic extent of the effect is **local**, since the water budget modification will be restricted to the creeks and water bodies located directly downstream from the infrastructure construction site. Farther than that, the difference in water budget will become insignificant. (Value of 2)

Duration of the effect

The duration of the effect is **long**, since the modification occurring during project restoration will be permanent. (Value of 3)

Frequency

The frequency of the effect is **once**, because once the site is rehabilitated, no other modification will affect the site over time. (Value of 1)

Reversibility of the effect

The reversibility of the effect is **partial**, because even after rehabilitation, the stockpiles and ditches will stay in place, continuing to modify slightly the original drainage layout of the site. (Value of 2)

Magnitude

The magnitude of the effect of stopping dewatering will be **low** when compared with the pre-operation state, as the water budget will tend to return to its original state, and there will be no perceptible effect on environmental integrity anymore. (Value of 1)

Based on this assessment, the effects of the Howse Project on the Hydrography and Hydrology are expected to be significant Significance of the Residual Effect

Residual effects are presented for the three watersheds affected by the construction of the Howse project. The water budget modifications represents either a flow increase and possible erosion or a reduction in flow. Erosion is estimated based on the spring monthly maximum flow, considering that an increase of 20% of the spring monthly maximum flow causes a significant hydrological change (Stephens, 2002).

Goodream Creek

The drainage area difference, between the existing (1068 ha) and the modified (1162 ha) Goodream Creek watershed, at the junction with HOWSEB outflow, is 94 ha. This represents an increase of approximately 9 % of the existing drainage area at this point, resulting in additional runoff downstream from sedimentation pond HOWSEB.

Pit dewatering will be treated in sedimentation pond HOWSEB, adding a constant discharge into Goodream Creek downstream from sedimentation pond HOWSEB as well. At this location, Goodream Creek is considered a permanent watercourse with fish habitat (HML, 2014c). The ditch planned on the southeast part of the Howse Project will intercept natural drainage flowing towards Goodream Creek. However, the release of approximately two third of Howse pit runoff into Timmins 4 sedimentation 3 will ensure that some water will be kept in this section of the creek.

Howse deposit water table was found to be between 64 and 90 m deep (Geofor, 2015 and Golder, 2014). Dewatering rate is expected to be lower during the first years of mining operations as, during this time, dewatering will be limited to water from direct precipitation and infiltration through the unsaturated geological units. Later, when pit depth reaches the water table depth, dewatering rate will increase gradually, and reach a maximum value when the pit reaches its final depth. Therefore, there will be no dewatering until the pit reaches a certain depth. Dewatering will be ongoing all year long once the water table depth will be reached. Goodream Creek spring monthly maximum flow, at the junction with sedimentation pond HOWSEB outflow, will increase by approximately 25%, corresponding to a low magnitude effect on erosion. However, Goodream Creek is surrounded by wetlands, which will have a buffering effect on flow. Also, Goodream Creek has a braided system of streams and canals where the water will spread.

Figure 3-7 shows a comparison of Goodream Creek watershed area at the outlet of Triangle Lake with Howse Project (1706 ha) and without Howse Project (1659 ha). There is a 3% (47 ha) increase of Triangle Lake drainage area with Howse. This is a small increase that will not generate any noticeable water level variation for Triangle Lake. Similarly, the average flow increase in Goodream Creek, due to Howse mine pit dewatering, will not effects noticeably Triangle Lake water level as this flow increase is small in comparison with existing natural flow variations during floods.

Burnetta Creek

The drainage area difference, between the existing (83 ha) and the modified (143 ha) Burnetta Creek watershed at the junction with HOWSEA outflow, is 60 ha. This represents an increase in the existing drainage area at this point, resulting in additional runoff downstream from the junction with sedimentation pond HOWSEA outflow.

Burnetta Creek does not host any fish habitat upstream from Burnetta Lake, which is located considerably downstream (>4 km) from this water release point. It is an intermittent creek with a relatively small natural flow. The bed is mainly made up of boulders but downstream, the last reach of 1.2 km before the lake, a proper channel could not even be found in some areas and the water flow is believed to be subterranean (Volume 2 Supporting Study I).

After the construction of sedimentation pond HOWSEA, a relatively large area of the Burnetta Creek watershed will be diverted. Rather than flowing naturally into Burnetta Creek some distance downstream from the junction with HOWSEA outflow, runoff from the diverted area will be collected then released sporadically. Consequently, spring monthly maximum flow will increase by approximately 72%, corresponding to a high effect on erosion.

However, the effects of the Howse project construction on Burnetta Creek is decreasing when the distance downstream from junction with HOWSEA outflow is increasing. When a point located approximately 600 m downstream from the junction with HOWSEA outflow is considered, the drainage area difference between actual and future conditions is only 36 ha. At this point, spring monthly maximum flow will increase by approximately 18 %, which corresponds to a low magnitude effects. Therefore, to keep the effects magnitude of Howse construction on Burnetta Creek low, this creek will be protected against erosion by a riprap on a distance of approximately 600 m downstream from junction with HOWSEA outflow as a specific mitigation measure.

Pinette Lake

Pinette Lake watershed will be reduced by 9 ha following Howse Project construction. This difference represents 4 % of the existing Pinette Lake watershed (237 ha) at the lake outlet.

The decrease in Pinette Lake inflow is very low. An inflow decrease is beneficial from an ecosystemic perspective, because an oligotrophic lake like Pinette Lake could benefit from a longer water renewal time. Concerning the water level change, a dedicated study was realized to simulate the difference in water regime between the natural and modified one. Because the weir at the outlet is very wide, the lake level varies little during a year. At the spring freshet, a drawdown of only 2 mm is expected while in summer and autumn no more than 1 mm is expected (Volume 2 Suppporting Study L).

7.3.10 Water Quality

It is important to the community that young Innu continue to have access the Howells River in the future. Furthermore, water quality - primarily water color - is a sensitive issue for local communities, who will avoid water bodies affected by changes in water quality or color, a statement that was clear during the public consultations, by both elders and younger users of the area. Further, water bodies provide habitat for aquatic life. For these reasons, this component was selected as a VC. Local and regional water quality data are available to properly assess the effects of the Howse Project on water quality, and federal and provincial criteria exists to quantify water quality.

Three lakes and two ponds are located within the LSA. Water quality is a concern for first nations people, namely in relation to overall water quality and fish habitat. This component was raised as an issue by first nations groups 10 times during consultations in the fall of 2014.

7.3.10.1 Component Description

LSA, RSA and Temporal Boundaries

The LSA is limited to the subwatersheds directly in contact with the Howse Project. The limits are the same as for the hydrology component and are shown in Figure 7-29. The LSA is limited to these watersheds because dilution factors are large enough within these limits to ensure the integrity of the surrounding receiving environment, since lakes act as decanters (Section 7.3.9). The Elross Creek watershed is not included in the LSA, since all efforts have been made to have zero effect on Pinette Lake, a tributary to Elross Creek. Therefore, it will not be directly affected by the Project. Further, the effects generated by the processing of ore at the DSO plant, which potentially effects Elross Creek, are covered in the ELAIOM EIS.

The RSA is composed of the larger surrounding watersheds, which encompasses the subwatersheds of the LSA until Elross Lake. This large watershed (335 km²) includes the entire Elross Creek watershed and the Ione Lake watershed, including Sunset and Goodream Creeks. The RSA includes all drainages coming from other projects in the area which could potentially interact and create cumulative effects.

The temporal boundaries for the water quality component includes up to 1 year after the end of the Howse Project Decommissioning and Abandonment phase, as based on observations from Dubreuil (1979) showing that water quality returned to normal after a few months of cessation of pumping at Fleming 3 (a close-by mine site). Additionally, capturing seasonal variations is fundamental to properly assess this component. During spring thaw, water flow is at its maximum and more mine water is expected to be discharged according to the WMP (Section 3.2.5), whereas in late summer and winter, streams are at their lowest flow, and sometimes even dry up because of the permeable nature of the surficial deposits and bedrock. In Labrador, dry ups mainly happen in winter because of the very long cold period with persistent snow (Rollings, 1997).

Existing Literature

Table 7-64 summarizes summertime water quality for 11 water bodies close to Schefferville approximately 25 years after the start of mining in the area. Burnt Lake and Hematite Lake were both receiving water pumped from mines at the time of sampling. Burnt Lake was so severely disrupted by mining that it had virtually no natural catchment, and the stream above it was actively eroding mine wastes that were encroaching on its banks (Drake, 1983). Lake-water concentrations of Ca and Mg ions were similar in each of the water bodies sampled and are consistent with what is expected for lakes with drainage basins associated with the mineral-rich rocks of the Labrador Trough (Penn, 1971). Dissolved oxygen in the lakes surrounding Schefferville ranges from 8 mg/L to 13 mg/L, and lakes are usually near oxygen saturation during the open-water period, even at maximum depth (Penn, 1971). Combined with the transparency that always exceed 5 m, it can be said that all lakes of the RSA are oligotrophic (cold water bodies with low nutrients and trout).

Table 7-64 Water Chemistry in the RSA or Nearby, Means (and SD), 1975-2003

WATER BODY	LOCATION	SAMPLING DATE	TEMPE-RATURE (°C)	PH	CA (mg/L)	MG (mg/L)	HCO_3 (mg/L)	SIO_2 (mg/L)
Knob Lake	Nearby	1975–1978	13.7 (3.7)	6.9 (0.3)	6.6 (0.5)	4.1 (0.8)	24.4 (4.4)	2.1 (0.9)
Burnt Lake*	Nearby	1975–1978	11.6 (1.7)	7.7 (0.3)	14.7 (4.4)	9.4 (0.9)	90.9 (15.5)	5.5 (1.8)
Hematite Lake*	Nearby	1975–1978	13.1 (2.0)	5.1 (0.1)	1.2 (-)	0.7 (-)	1.9 (1.7)	0.6 (0.1)
Hope Lake	Nearby	1975–1978	13.0	5.7	9.8	6.9	59.9	-
Gemini Lake	Nearby	1975–1978	15.6 (2.9)	8.2 (0.7)	11.5 (2.4)	7.3 (2.3)	75.4 (16.3)	4.3 (1.4)
Pinette Lake	LSA	1975–1978	14.0 (3.6)	5.8 (0.4)	1.2 (0.6)	0.7 (0.4)	5.1 (2.6)	2.0 (1.7)
Elross Lake	RSA	1975–1978	15.3 (2.8)	7.0 (0.5)	6.0 (1.6)	2.4 (0.4)	29.8 (8.7)	3.0 (1.1)
Ione	RSA	2003	12.8	7.49	3.65	2.20	-	-
Rosemary	RSA	2003	13.2	7.68	8.37	3.00	-	-
Fleming*	RSA	2003	11.9	7.75	8.34	2.89	-	-
Contact	RSA	2003	-	-	9.03	3.06	-	-

* Downstream of a mining effluent

In 2006, a survey of the Howells River basin was carried out by AMEC Earth & Environmental (2012). Surface water samples were collected from roughly 30 locations along the Howells River Valley, all included in the RSA. Results show that surface temperatures on lakes and ponds in early September ranged from 8.1 to 13.9 °C, pH level between 8.1 and 8.6, conductivity between 43 and 84 µmho/cm and dissolved oxygen 8.34 to 11.38 mg/L. The water was universally non-turbid (<1 NTU) and soft (hardness 20-60 mg/L; alkalinity 10-60 mg/L). Scruton (1984) reports that the dissolved minerals of water bodies on the Lakes Plateau (East of Schefferville area) has a mean value of 6.1 mg/L, placing these freshwater bodies among the purest in the world. Conductivity in Menihek Lake was measured as 31 µS/cm by Duthie and Ostrofsky (1974).

Recent Portrait of Water Bodies within the LSA

More recently, *in situ* surface water quality measurements were taken within the LSA in July and September 2008 for the ELAIOM project (AMEC, 2009). The Project's launch also required the installation of two near Real-Time Water Quality (RTWQ) monitoring stations which are now part of a provincial network partnership between the Water Resources Management Division (from Department of Environment and Conservation of NL Government), Environment Canada and various industries. Data from the RTWQ monitoring station NF03OB0040 extend back to 2012 and consist of around 3000 measurements annually. A 2014 aquatic survey technical report was completed to collect essential complementary water quality data to assess the effects of the Howse Project is presented in Volume 2 Supporting Study M. Also note that TSMC has ongoing monitoring of Goodream Creek and Pinette Lake. Up to date data from those recent studies are summarized in Table 7-65 and Table 7-66 and sampling stations can be located at Figure 7-29.

Table 7-65 Recent *In Situ* Surface Water Quality Measurements from the LSA, Minimum and Maximum Values

REACH/ SITE	WATERBODY LOCATION	DATE	TEMPER-ATURE	CONDUC-TIVITY	PH	TURBIDITY	DISSOLVED OXYGEN
			(°C)	(µS/CM)		(NTU)	(MG/L)
Goodream Creek	Close to Triangle Lake	2013	3.8 – 5.2	41 – 43	5.69 – 7.0	0.21	13.12
Burnetta Creek	At the road crossing	2013	6.4	6	5.39	0.45	10.59
Burnetta Lake	Burnetta Lake outflow	2015	-	50	7.0	0.20	-
GDR1	At the confluence with Goodream Creek	2013	3.8	41	5.7	-	13.12
GDR2	Close to Goodream Lake	2012	12.8	11	6.7	0.65	-
GDR3	Two Ponds outlet	2008*	9.3 – 14.1	1 – 14	5.7 – 7.2	13.10	-
GDR4	Middle of the reach	2009	9.7 – 14.4	0 – 13	5.3 – 5.4	0.19 – 0.36	-
Goodream Creek	Upstream from GDR4	2009	16.5	0 – 13	7.8 – 8.0	0.91 – 9.37	–
IHH4	Goodream Creek before Triangle Lake	2013	3.8	41	5.7	-	13.12
IHH1	Upstream from Burnetta Creek	2013	6.8	6	4.9	-	9.70
IHL1A	Downstream from Burnetta Creek	2013	6.0	5	5.9	0.45	11.50
NF03OB0040	Goodream Creek 2 km NW of Timmins 6	2012-2015	1.1 – 21.5	2 – 20	4.3 – 6.5	0 – 2,779***	5.14 – 13.30
PIN1/IHH3	Pinette Lake inflow	2008* to 2013	8.8 – 16.7	6 – 7	4.7 – 5.9	0.31 – 0.62	6.90 – 10.38
Pinette Lake	Pinette Lake center	2013	12.7	4	6.8	-	10.38
Triangle Lake	Triangle Lake center (RSA)	2013	8.8	34	6.3	-	12.46

*: Two samplings, one in July and one in September
**: Over 3,000 readings
***: values over 1,000 are attributed to biofouling
Source: Volume 2, Appendices I and M; AMEC, 2009, Groupe Hémisphères 2013a, September 2013b and 2009b, RTWQ

Most of the *in situ* parameters measured (including dissolved oxygen, temperature, and conductivity) were consistent with good water quality. Conductivity was exceptionally low; the virtual absence of nutrients, salts or impurities in the water showed no correlation between the location of the sampling sites downstream or upstream from old mining activities. All of the water bodies within the ELAIOM project study area were acidic at one time or another during the sampling periods. The pH was quite low at the RTWQ station along Goodream Creek, as well as in the Pinette Lake inflow (PIN1) and the upstream portion of Burnetta Creek, two small watercourses close to the Howse deposit. The acidic value is likely due to the wetlands which partially cover their drainage area, since acidic forest and fen are the most extensive type of wetland, occupying about 12% of the LSA, as discussed in Section 7.4.2.

According to the RTWQ reports (NLDEC, 2012b; 2013b; 2014d) large turbidity spikes coincide with significant rainfall events and the subsequent rapid flow increases and values surpassing 1000 NTU are attributable to biofouling. Indeed, values reached over 2,700 NTU in 2012 and since 2013, whereas, it never exceeded 131 NTU. Other values are within relatively normal range.

Laboratory surface-water physico-chemical quality results are shown in Table 7-66. Surface water data for Goodream Creek is available from three recent field surveys (Groupe Hémisphères, 2013a; 2013b, and Volume 2 Supporting Study I). Combined, they provide a comprehensive overview of surface water quality in the LSA, and indicate that some parameters exceed CCME guidelines. Aluminium exceedances were detected for all watersheds, for iron in the Goodream and Pinette watersheds and for copper upstream of Goodream Creek. For aluminium, this phenomenon was observed by AMEC (2009) in about half the stations visited for the ELAIOM project, indicating that background values are naturally high for that parameter. However, it is noteworthy that values shown are for total concentration, meaning that water samples are not filtered before analysis. As such, the particulates affect the concentration values, and if the soil is particularly rich in metal, this will transpose to the water quality. The overall quality of the natural water for metals and conventional parameters is considered good. The water was soft (hardness 20-60 mg/L; alkalinity 10-60 mg/L) for most of the sites sampled, but particularly in Burnetta Creek, where the water is less alkaline.

Nevertheless, some RDLs were too high to confirm that the CCME guidelines were not exceeded by any of the parameters. However, if we consider the Metal Mining Effluent Regulation (MMER) guidelines, which are most likely to apply to this Project, the RDLs would be within acceptable limits. The first environmental effect monitoring cycle is currently being carried out (summer 2015) for the ELAIOM project and its report will provide information to improve the predictions of the expected environmental effects.

Table 7-66 Laboratory Surface Water Quality Results for the LSA

SURFACE WATER			CCME	RESULTS						
PARAMETER	UNIT	RDL[1]	GUIDELINES[2] AQUATIC LIFE	GOODREAM CREEK 2011-2014 (N=8)	GDR2 08-08-2012	PIN1/IHH3 2008-2014 (N=8)	BURNETTA CREEK 03-09-2013	GDR3 (TWO PONDS OUTLET) 10-09-2008	TRIANGLE LAKE 02-09-2013	BURNETTA LAKE 16-07-2015
Conventional										
Acidity ($CaCO_3$)	mg/L	10	—	-	41	41	<10	<10	10	-
Ammoniacal Nitrogen ($N-NH_3$)	mg/L	0.02	2.22[3]	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02
Bicarbonates (HCO_3 as $CaCO_3$)	mg/L	1	—	-	5	5	2	7	15	25
Chlorides (Cl)	mg/L	0.05	120	0.41	0.06	0.06	0.11	0.42	0.22	0.13
Fluorides (F)	mg/L	0.1	0.12	-	<0.1	<0.1	<0.1	<0.1	<0.1	-
Nitrate(NO_3^-) and Nitrite(NO_2^-)	mg/L	0.02	—	0.29	<0.02	<0.02	<0.02	0.28	0.11	<0.02
Sulfates (SO_4)	mg/L	0.5	—	1	1.7	1.7	<0.5	2.5	2.2	2.6
Suspended Solids (TSS)	mg/L	2	Narrative[4]	0.3	<2	<2	5	19	3	<2
Total Alkalinity ($CaCO_3$) at pH 4.5	mg/L	1	—	11	5	5	2	7	15	25
Total Hardness ($CaCO_3$)	mg/L	1	—	12	11	11	1.2	14	1.6	22
Total Phosphorus (P)	mg/L	0.003/0.01	oligotrophic 0.004-0.01	<0.003	<0.01	<0.01	-	<0.01	-	<0.01
True Color (sampled on 06-07-2014)	UCV	2	—	6	-	-	27	3	3	3
Metal (total)										
Aluminum (Al)	µg/L	10/30	100	<10-120	70	12-118	130	57	18	<10
Arsenic (As)	µg/L	1/2	5	<1	<2	-	<1	<1	<1	<1
Cadmium (Cd)	µg/L	0.02/1	$10^{(0.86(\log [CaCO_3])-3.2)}$	<0.2	<1	<0.02-0.129	<0.2	0.129	<0.2	<0.2
Calcium (Ca)	µg/L	300/500	—	300-2,300	1,900	300-569	<500	685	2,700	4,000
Copper (Cu)	µg/L	0.5/3	2	<0.5-1	<3.0	<0.5-1.9	<1.0	4	<1.0	<1.0
Iron (Fe)	µg/L	60/100	300	<60-310	100	60-1,080	220	1,640	75	<60

SURFACE WATER			CCME		RESULTS					
PARAMETER	UNIT	RDL[1]	GUIDELINES[2] AQUATIC LIFE	GOODREAM CREEK 2011-2014 (N=8)	GDR2 08-08-2012	PIN1/IHH3 2008-2014 (N=8)	BURNETTA CREEK 03-09-2013	GDR3 (TWO PONDS OUTLET) 10-09-2008	TRIANGLE LAKE 02-09-2013	BURNETTA LAKE 16-07-2015
Lead (Pb)	µg/L	0.1/1	1	<0.1	<1.0	<0.1	<0.50	<1.0	<0.50	<0.50
Magnesium (Mg)	µg/L	100/200	—	2.0-1300	1,400	180-291	290	195	2,300	3,000
Manganese (Mn)	µg/L	0.4/3	—	1-33	12	2.3-104	23	64	6.5	2.6
Mercury (Hg)	µg/L	0.02/0.1	0.026	<0.001-<0.1	<0.1	<0.01-<0.1	<0.10	<0.02	<0.10	<0.10
Molybdenum (Mo)	µg/L	0.05/30	73	<0.5-1	<30	<0.05-<2	<1.0	<2	<1.0	<1.0
Nickel (Ni)	µg/L	1/10	25	<1-<3.5	<10	<1-<2	<2.0	<1	<2.0	<2.0
Potassium (K)	µg/L	100/500	—	<100-330	<200	56-<100	<500	20	<500	<500
Radium (RA 226)	Becquerel/L	0.002	—	0.002	-	-	-	-	-	-
Selenium (Se)	µg/L	1/3	1	<1-<3	<1	<1-<3	<3.0	<1	<3.0	<3.0
Sodium (Na)	µg/L	100/500	—	610-820	300	390-820	<500	<500	580	740
Uranium (U)	µg/L	1/20	15	<1-<20	<20	<1-24	<1.0	<1.0	<1.0	<1.0
Zinc (Zn)	µg/L	5/7	30	<5-25	<5	<5	<7.0	8	<7.0	<7.0

[1] RDL, Reported Detection Limit; (RDL for Goodream/RDL for other stations when different)

[2] CCME (2007), Surface Water Quality Guidelines for the Protection of Aquatic Life

[3] The criteria for total ammoniacal nitrogen varies with temperature and pH; the most conservative value from the parameters measured in the field was used

[4] Clear flow: Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d)

Aboriginal Traditional Knowledge

As identified in the summary of first nation concerns (Table 7-2), contamination of lakes and watercourses is a real preoccupation.

For local peoples, the red color of the water is associated with water bodies affected by the mining activities and that have a bad quality. Peoples will avoid exploiting the aquatic habitat were this phenomena occurs. It as to be said here that the red color in the RSA is mainly a consequence of the colloidal TSS, and not a dissolved substance that affect the true color of the water. Therefore, it has to be understood that assessment of the effect of TSS and associated mitigation measures are one and the same that would be applied to alleviate the red color problematic highlighted by first nations.

Data Gap

The extensive literature on water quality on the local and regional scale along with the detailed water quality information collected in the recent years provide a good portrait of the physico-chemical characteristics of the surface water of the LSA, and no significant data gap is believed to exist for this component.

7.3.10.2 Effects Assessment

Literature review and Current Studies Data Used to Assess the Potential Effect

The following water quality standards were used to assess environmental effect on water quality:

- CCME (2014)
- MMER (2002)

In addition to data collected in 2013 and 2014 (Table 7-65) for the Howse Project, the MMER environmental effect monitoring and the Newfoundland and Labrador monitoring, as per the certificate of approval for the ELAIOM project, provides information on the dynamics between water quality and mining operations. The Water Management Strategy (Section 3.2.5) also provides useful information on effluent quality and types of effluent treatments developed for the Howse Project. The ELAIOM project is adjacent to the LSA and composed of a similar iron deposit and was extracted by TSMC in the same manner as the Howse Project. Effluent quality measurements from ELAIOM are therefore very useful to assess the effect of Howse Project on water quality.

At a national scale, Environment Canada performed an assessment of the environmental effects monitoring data coming from all metal mines subjected to the MMER (Environment Canada, 2012). This metadata study summarized essential effluent and water quality data for the iron ore sector. A complementary metadata study was performed by Hatch for the Mine Environment Neutral Drainage (MEND) Program (Pouw *et al.*, 2014) This study identify best available technologies economically achievable (BATEA) to manage and control effluent from various types of metal mines in Canada, including for iron ore.

These standards, data and studies were selected because they are commonly used by the scientific community to assess the effects of metal mining projects on water quality and because they are recognised as reliable to protect the ecological and human health across Canada.

Project Interaction with Water Quality and Potential Effects Assessment

Site Construction Phase

During the site Construction phase, all project activities will have potential interaction with water quality.

Potential interaction

- upgrading/construction of the Howse haul road, bypass road and water management infrastructures;
- pit development; and
- transportation and traffic.

Construction will begin by setting up facilities dedicated to the management of drainage water as described previously in the WMP (Section 3.2.5). These water management facilities will intercept and treat runoff water from the entire Howse footprint. Further, basin dimensioning will allow particles as fine as 0.01 mm to settle for a design flood return period of 25 years.

Land clearing will induce runoff and has the potential to contaminate the nearby water bodies of all three watersheds of the LSA with TSS.

Potential water contamination may also occur at watercourse crossings during the excavation and installation of culverts and other structures. The road network will be upgraded according to rigorous design criteria which minimize the effects on watercourse crossings and manage suspended solids. These criteria are specified by DFO and are related to the sizing and position of the culvert.

Transportation and traffic will create dust that may reach nearby water bodies (Section 7.3.2), and hence increase the TSS concentrations in the water. However, the roads are at least 100 m from the closest watercourse, lowering contamination risks from this source. Furthermore, no lakes are included in the Air Quality Modelling Perimeter, where TPM (24 hours) may exceeds air quality standards. Outside this perimeter, neither TPM nor other parameters will exceeds quality standards in NL. It is, however, anticipated that the roads will be sprayed in dry weather to reduce dust. In evaluating the emission rates of particulates, it was estimated that spraying the roads regularly would reduce the production of dust emissions by 75% (Section 7.3.2).

Accidents and malfunctions can also potentially have an effect on water quality and it is treated in Section 6.4.

➔ The effect associated with the above potential interaction are due to water contamination by total suspended solids and accidental spills.

The nature of the effect is direct and the effect is adverse.

<u>Operation Phase</u>

No potential interaction

During the operation phase, all project activities will have potential interaction with water quality.

Potential interaction

- removal and storage of remaining overburden and topsoil;
- blasting and ore extraction;
- mineral processing;
- dewatering;

- operation of waste rock dumps;
- transportation of ore and other traffic;
- solid waste disposal;
- hazardous waste management;
- explosives waste management;
- sanitary waste management; and
- ongoing site restoration.

Although water bodies are located near the overburden stockpile and waste rock dumps (minimum distance being 60 m), the ditches of the WMP will intercept the runoff before reaching them. Further, the erodibility of waste rock from iron ore mines in Québec/Labrador is in the order of 30 t soil/ha per year (Ripley *et al.* 1996), as compared to more than 400 t soil/ha per year for most other kinds of waste rock generated by Canadian mines, thus reducing the risk of contamination by suspended solids and other contaminants (blasting residues, fuel/oil). The available geological knowledge (Section 7.3.5) indicates that the ore and waste rock generated by the Howse Project are already naturally leached and should therefore not leach further in the local environment. As discussed in Section 7.3.5.1, acid rock drainage issues are not expected, but water quality monitoring will be done by HML to tests for PH changes. Further, regular testing will be done on the waste rock and waste stockpile to monitor for acid in rocks. As a result of this monitoring (full details provided in Sections 9.1.3-9.1.5), HML will stockpile any problematic rock material separately. Moreover, according to Pouw *et al.* (2014), the Labrador Trough iron ore mine operations are non-acid generating and non-metal leaching, which is in accordance with a focused study completed for the Howse Project (Volume 2 Supporting Study H). Risks associated with acid rock drainage issues are therefore considered to be non-existent.

Hydrological changes caused by Howse operations will affect water quality as such: increase flow induces erosion and hence cause more TSS contamination. It is expected that the spring monthly maximum flow at Burnetta Creek will increase by 72% (Section 7.3.9.2). As for Goodream Creek, increases are more modest: 12% at the Timmins 4 Sedimentation Pond 3 discharge and 25% at Sedimentation Pond HOWSEB (Section 7.3.9.2). All sump and dewatering water will be discharged into Sedimentation Pond HOWSEB and ultimately into Goodream Creek. Fortunately, the water quality from peripheral wells at the Howse site is expected to be of very good quality (Volume 2 Supporting Study B), mixing with sump water before it is discharged in the environment.

Pouw *et al.* (2014) reviewed effluent quality control metadata (MMER data) coming from different iron ore mines operation and concluded that "the sole contaminant that is considered to be typical for iron ore operations based on the information reviewed is total suspended solids". Based on 10 years of data accumulated on iron ore mines through MMER, concentrations of TSS after settling treatment is always lower than 62 mg/L. The operation of the Howse Project is similar to the iron ore mining operation described in the Pouw *et al.* (2014) study. Additionally, it does not include the use of a concentrator, minimizing the risk of generating a large amount of colloidal TSS that could be problematic to remove using settling alone. Indeed, the water quality survey of the ELAIOM mining operation meets legislative requirements based on MMER (2002), except for TSS, which will therefore be the main parameter of concern as demonstrated in Section 3.2.5. The ELAIOM effluent TSS concentration in the water tested was above MMER criteria at spring freshets since 2013, although ongoing work in the sedimentation ponds might be to blame.

A study of the IOCC Fleming 3 mining area has shown that water pumped from mine pits is red and muddy, which affects sump water quality. Concentration of TSS in water pumped from the bottom of the pit varied from 8 to 2,100 mg/L (Mansikkaniemi, 1980). However, at approximately 5 m from the mouth of the water pipe, the mean grain size of bottom material was found to be 0.27 mm. From the foregoing that include the bottom of Red Lake, the deposits are medium and fine silt. The establishment of a WMP for the Howse Project comprising a large network of ditches and three sedimentation ponds will treat water for suspended sediments. However, TSS smaller than 0.01 mm are not expected to settle in sedimentation ponds and are still expected to flow in the receiving environment. The fact that Howse project effluent does not include processed water charged with very fine suspended solids coming from a concentrator (see above for more details), as it is the case for many other iron ore operations in the Labrador Trough Region, greatly reduces the risk of finding an important portion of TSS smaller than 0.01 mm.

Due to the type of erodible surficial deposits present within the Howse Project footprint, road runoff will be another source of water contamination to the water bodies during rain events and snow melt. However, the WMP is designed to intercept all this runoff.

The use of emulsion for explosives and machinery during ore extraction will leave nitrogen compounds (blasting residue), fine particulates and fuel/oil in the open pit. Once mixed with the sump water, these contaminants will be pumped to the surface. However, since the beginning of ELAIOM project, neither nitrates, nitrites nor hydrocarbons exceed CCME and MMER criteria. Therefore, no exceedance is expected for those parameters.

The Howse operations will generate dust that could reach nearby water bodies and increase TSS concentrations. Because dust concentration will be concentrated around pit and road (Section 7.3.2), and that the WMP will capture all runoff, the effects are expected to be negligible compared to other TSS sources (runoff and sump water).

All types of dangerous and domestic wastes will be transported to the DSO complex facilities, where they will be treated as described in Section 3.3.2.

Finally, ongoing restoration will have a positive effect by reducing runoff on waste dump and overburden stockpile.

➔ The effect associated with the above potential interaction derives from water contamination by total suspended solids and accidental spills.

The nature of the effect is direct and the effect is adverse.

<u>Decommissioning and Reclamation Phase</u>

No potential interaction

During the decommissioning and reclamation phase, all project activities will have potential interaction with water quality.

Potential interaction

- demobilization of Howse facilities and heavy machinery;
- transportation and traffic;
- final site restoration.

Runoff will continue to be generated throughout this phase, but effect will decrease substantially after cessation of pumping and will further decrease with revegetation of Howse footprint. Water quality has been shown to return to normal after a few months of cessation of pumping at Fleming 3 mine site in old IOCC Schefferville operations (Dubreuil, 1979).

Facility demobilization, transportation and traffic will continue to generate dust in the same way as presented in the operation phase subsection.

As stated in Section 7.3.9.2, water regime should nearly return to previous levels and erosion associated with spring flow will decrease accordingly.

➔ The effect associated with the above potential interaction derives from water quality contamination by total suspended solids and accidental spills, although improved water quality is expected following final site restoration.

The nature of the effect is direct and the effect is adverse.

7.3.10.3 Mitigation Measures

Standard Mitigation Measures

Table 7-67 presents the standard mitigation measures that will be applied during all project phases. Please note that no water crossings are planned in the Howse project selected alternative, but that standard mitigation measures for water crossings are included in Table 7-67, in case of a unpredictable change.

Table 7-67 Standard Mitigation Measures for Water Quality

CODE	MEASURE	MITIGATION EFFECT
Watercourse Crossings (WC)		
WC2	Arched culverts must be installed at all watercourse crossings where potential or confirmed fish habitat is present.	This will prevent erosion as the littoral of the crossing will remain intact.
WC3	Keep the scale and duration of work in the water to a minimum and confine the work to minimum-flow or low-water periods.	This measure will limit the amount of erosion generated during water crossing construction activities.
WC5	Build bridges and install culverts on narrow, straight sections without reducing the width of the watercourse, choosing ground with adequate load-bearing capacity and gentle slopes. Build them as far as possible from watercourse mouths or confluences.	Reducing imprint on shoreline maintains a natural protection from erosion.
WC6	Accurately assess the watercourse's peak flow in order to choose the appropriate diameter of pipe.	Avoiding overflow reduce the possibility that road material reaches waterbody and reduce erosion in the upstream portion of the culvert.
WC9	Build crossings perpendicular to the watercourse.	Reducing imprint on shoreline maintains a natural protection from erosion.
WC10	Use existing road crossings, cleared strips or paths as far as possible to avoid disturbing riparian vegetation.	
WC12	Preserve plant cover and stumps in road rights-of-way.	
WC14	Before starting work, confine the work area with a silt or filter fence	This measure avoid sediment transport into water and ensure that work methods and materials used do not generate excessive turbidity.
WC16	When building a bridge or installing a culvert in an area without fish habitat, do not reduce the width of the watercourse more than 20% (measured from the natural high-water mark).	These measures will prevent road material from reaching the river.

CODE	MEASURE	MITIGATION EFFECT
WC19	Ensure the stability of soil, shorelines, banks, fill and structures during the construction of watercourse crossings (geotextile liner, rip-rap on embankments and watercourse bed, etc.)	
WC21	Do not block the flow of water and respect the slope, natural drainage of the soil and direction of the watercourse when installing a culvert.	These measures will ensure that erosion will not occur downstream the culvert.
WC22	Backfill around the culvert and stabilize the fill. The end of the culvert must extend at least 30 cm beyond the base of the fill.	
WC23	The base of the culvert must be buried beneath the natural bed of the watercourse to a depth equivalent to 10% of the culvert's height. Maximum burial depth must not exceed 30 cm, however, or a bottomless arched culvert must be used.	
WC25	All temporary structures must be stabilized upstream and downstream and demolished when the work is finished.	These measures will reduce sediment transport into water and ensure that erosion not begin downstream of working zones.
WC26	Once work is finished, restore the bed of the watercourse to its natural profile, stabilize the banks and revegetate as needed with native species.	
WC27	Monitor culverts and bridges periodically, especially in the spring or after heavy rains. Pay particular attention to signs of erosion, poor plant regrowth, obstacles blocking water flow and structural integrity.	This measure made sure to prevent the road material from reaching the river.
Waste Management (WM)		
WM3	Do not dump any waste into aquatic environments, including waste from cutting vegetation or stripping the soil. All waste accidentally introduced into aquatic environments must be removed as quickly as possible.	In addition to degrading the quality of the water, waste can cause jams in the flow of water, and erosion. This measure will prevent all of these negative environmental effects.
Hazardous Materials Management (HM)		
HM1	Implement a hazardous waste management plan in the event that fuel or other hazardous substances are spilled.	These measures will preserve water quality from direct or indirect hydrocarbons or other hazardous substances contamination.
HM3	Spill kits for recovering oil products and hazardous materials must be present on the worksite at all times.	
HM4	Each vehicle and piece of machinery on the site must contain enough absorbent materials to intervene rapidly in the event of a spill. A list of materials and intervention methods to be used in the event of a spill must be approved by the supervisor.	
HM5	All accidental spills must be reported immediately to the person in charge of the emergency response plan, which will have been drawn up and approved before work start-up.	These measures will ensure that swift action done by trained individuals is taken in case of accidental spills.
HM6	If harmful substances are spilled, the responsible authority must be contacted.	
HM9	If hazardous materials are spilled, the contaminated areas must be marked and the surface layer removed for disposal in accordance with regulations in effect in order to limit contamination of waterbodies by runoff. Contaminated areas must be backfilled and stabilized to permit revegetation.	These measures will preserve water quality from direct or indirect hydrocarbons or other hazardous substances contamination.

CODE	MEASURE	MITIGATION EFFECT
HM12	When a site is closed, ensure that all tires have been removed and properly disposed of.	
Drilling and Blasting (DB)		
DB1	An explosives management plan must be drawn up to minimize the amount of ammonia and nitrates released into the natural environment.	These measures will preserve the water quality from any deleterious forms of nitrogen contamination in surface or groundwater.
DB4	The manufacturer's instructions must be followed to ensure that blasting procedures are safe both for humans and the environment.	
DB9	No explosive must be used in or near water.	This measure preserve the global water quality of the LSA natural water bodies.
DB13	Water left after drilling must be blown out using compressed air before the pneumatic loading of the ANFO.	These measures increase blasting efficiency and therefore reduce the explosive residues concentration in sump water.
DB14	Depending on blasting conditions, the explosives used can greatly affect the overall quantity of explosives waste, so it is important to choose the appropriate type of explosive.	
DB15	Explosives waste must be recovered and disposed of in an appropriate manner after each blast.	This measure preserve the quality of the water for direct or indirect from deleterious form of nitrogen.
DB16	Use multiple detonators in bore holes as per the manufacturer's recommendations and optimize the arrangement of blasting holes to minimize misfires.	These measures increase blasting efficiency and therefore reduce the explosive residues concentration in sump water.
DB17	To minimize explosives waste, minimum distances between collars and charges must be determined for all underground blasting charges, based on geological conditions and the application.	
DB18	Prevent misfires by establishing time delay blasting cycles as per the explosives manufacturer's recommendations.	
DB19	Use reliable triggering systems that allow for precise firing of the explosives.	
Construction Equipment (CE)		
CE1	Store all equipment and machinery in areas specifically designed for this purpose, particularly parking, washing and maintenance areas. These zones must be located 60 m or more from watercourses and waterbodies.	These measures will preserve water quality from direct or indirect hydrocarbons contamination.
CE2	Washing of equipment in aquatic environments is prohibited.	This measure preserve the global water quality for all LSA natural water bodies.
CE4	Construction equipment must be delivered to the site in good working order, without leaks and equipped with all emissions filters required to comply with emissions regulations and reduce noise disturbance. The equipment must be regularly inspected to detect any leaks or mechanical defects that could lead to fuel, lubricant or hazardous material spills.	These measures will preserve water quality from direct or indirect hydrocarbons contamination.
CE5	Fuel-related operations (storage, transportation and handling) must comply with the relevant standards and guidelines. All equipment must be refuelled more than 15 m from a waterbody.	

CODE	MEASURE	MITIGATION EFFECT
CE6	No machinery must circulate in the riparian strip unless regulations permit it.	As the littoral of the crossing remains intact, erosion cannot begin.
CE9	All pumps and generators near waterbodies must be equipped with a drip pan.	These measures will preserve water quality from direct or indirect hydrocarbons contamination.
CE10	Inspect equipment at each use to detect leaks and drips. Any leaks must be repaired and reported immediately to the field supervisor.	
CE15	The dust-control liquid used must comply with GNL regulations.	This measure preserve the global quality of the water for natural water body.
Water Management (H_2OM)		
H_2OM5	Once mining operations are finished, but before restoration work begins, establish a surface water and groundwater monitoring programme approved by the competent authority and proceed with required sampling.	This method will ensure that if water quality does not improve after mining operations, the source and solution to the problem will be identified quickly.
H_2OM6	At the end of restoration work, implement the surface water and groundwater monitoring programme.	If water quality do not improve after mining operations, find the source of the problem and correct the situation
Rehabilitation (R)		
R1	Follow good practices presented in the rehabilitation plan.	Most of the good practices are already proven methods that help reducing water contamination
R2	Draw up a rehabilitation plan	
R3	Produce post-mining and post-rehabilitation monitoring reports.	This method will ensure that if water quality does not improve after mining operations, the source and solution to the problem will be identified quickly.

Specific Mitigation Measures

Table 7-68 present all specific mitigation measures applied to reduce the effects on water quality.

Table 7-68 Specific Mitigation Measures for Water Quality

SPECIFIC MITIGATION MEASURES FOR WATER QUALITY	
Measure	**Mitigation Effect**
Riprap will be installed on both sides of Burnetta Creek from the discharge point to 600 m downstream	Riprap will be installed within Burnetta Creek littoral and lower shore up to where water flow increase is expected to stay below 20%, thereby nearly eliminating erosion risks in that stream (Section 3.2.5 of the WMP for more details).
Divert sedimentation pond HOWSEA into the pit	This will avoid contamination of Burnetta Creek surface water from TSS generated by the peripheral ditches.

Note that at this stage, most of the design included in the WMP (Section 3.1.6) are also practices and measures carefully adapted to mitigate the environment concerns. This plan essentially target TSS to settle out before reaching the environment. Since smaller particles do not settle out fast enough, there will probably be some suspended solids discharged into the environment, but the Proponent has committed to applying chemical treatment if necessary. The complete description of this optional treatment is in the WMP (Section 3.1.5).

7.3.10.4 Significance of the Residual Effects

In order to assess the effects properly, a little ecological context is necessary. Hardness is extremely low in all water bodies of the LSA as shown in the component description, increasing bioavailability of contaminants for aquatic fauna. Buffer capacity is also low based on low alkalinity values in the water bodies of the area. However, water bodies are very far from their carrying capacity since they are all oligotrophic as indicated by very low nutrient concentrations and low primary productivity. Also, several other components depend on the integrity of the water quality such as aquatic fauna and herpetofauna. Based on limited knowledge of the effect of neighboring mining operations on water quality, the Howse Project is likely to increase TSS in the water bodies of the LSA. On the other hand, the water quality of the surface water in contact or flowing from IOCC past mining sites is largely good. Analysis of differences in metal concentration between sites upstream and downstream from the former IOCC DSO mine sites show no significant difference (NML and PFWA, 2009). All other parameters analyzed comply with the applicable requirements of the CCME.

Table 7-69 Assessment Criteria Applicable for Water Quality

TIMING		
Inconsequential timing	**Moderate timing**	**Unfavorable timing**
Timing of discharge makes it so that there are insignificant environmental effects	Timing of discharge makes it so that there are low significant environmental effects	Timing of discharge makes it so that there are large significant environmental effects
SPATIAL EXTENT		
Site specific	**Local**	**Regional**
Howse project footprint	LSA delineated in Section 7.3.10.1	RSA delineated in Section 7.3.10.1
DURATION		
Short	**Medium**	**Long**
Less than 12 months. Limited to the Construction and/or decommissioning and reclamation phase	12-24 months. Extends beyond Construction phase, but shorter than the lifespan of the Project	More than 24 months As long as the Project duration or even longer
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Water quality returns to pre-project levels	Surface water contamination persist after source of effect ceases, but its magnitude is significantly lower	Surface water contamination persist after source of effect ceases
MAGNITUDE		
Low	**Moderate**	**High**
Water quality in water bodies located within the LSA is barely or not affected by the Howse Project (all parameter below CCME guidelines)	Water quality in water bodies located within the LSA is affected by the Howse Project because results are sometimes above MMER authorized concentrations in the effluent but below CCME guidelines in the receiving environment	Water quality in water bodies located within the LSA is severely affected by the Howse Project because results are often above MMER authorized concentrations and sometimes above CCME guidelines in the environment

FREQUENCY		
Once	**Intermittent**	**Continual**
One time	Occasional or intermittent	Year round

Timing

There are two scales to take into account when considering timing. First, there is the annual timing. Discharge will mainly take place in the spring, at snow melt. Therefore, most of the discharge will occur while background water quality is at its worse due to natural erosion deriving from the extreme flow increase. Secondly, there is the long time scale in which the dewatering of the pit will occur only throughout the last years of the project, when the groundwater table will be reached. Since the main contaminant is TSS and it is expected to be naturally high in the spring, the importance of this impact is lowered. As for the long term timing, even if more mine water is discharged, the contaminant charge will stay the same and will therefore be more diluted.

As such, timing of the effect on water quality is considered to have a **moderate** effect on water quality (Value of 2).

Spatial Extent

TSS should sometime exceed the MMER criteria at the outfall of the sedimentation ponds (Section 3.2.5), and dilution will lower concentration under CCME criteria before exiting into the LSA. Using only the proportion of watersheds, dilution reach 1 in 8 at Burnetta Lake while it approach 1 in 5 at Triangle Lake (Section Hydrology 7.3.9). When further considering deposition and filtration by substrate and vegetation along the watercourses, no notifiable effects of the project on surface water quality is expected outside the LSA.

As such, the spatial extend of the Howse Project on water quality is not expected to extend to the RSA, and is therefore considered to be **local** (Value of 2).

Duration

Water quality will be negatively impacted from the beginning of the Construction phase up to the end of the Howse Project, and even after. TSS will be generated during construction and site preparation and are likely to reach WMP infrastructures. The effluent will flow periodically during the operation and decommissioning and reclamation phases. It will also flow after the Project ends but will eventually not be charged anymore with TSS. For this reason, the duration is considered to be **long** (Value of 3).

Reversibility

Water quality has been shown to return to normal after a few months of cessation of pumping at the Fleming 3 mine site in old IOCC Schefferville operations (Dubreuil, 1979), a similar mine site close to the LSA. Surface water quality contamination is therefore considered **reversible** (Value of 1).

Magnitude

Water quality in water bodies located within the LSA has high probability to be impacted by the Howse Project because similar conditions encountered for ELAIOM give effluent quality results above MMER criteria's for TSS. As discussed above, the TSS is a water quality parameter know to be difficult to control. However, the presence of wetlands in Goodream Creek will act as a filter, reducing the water contamination risk in Triangle Lake located downstream of the wetland complex. Burnetta Creek does not host a wetland complex, but most of the TSS reaching it will have time to settle before reaching Burnetta Lake located more than 4 km downstream. Water infiltration is also expected along watercourses, which represents the best water treatment for TSS in the absence of other contaminants.

Based on the maximum value of 62 mg/L after treatment providing by Pouw et al. (2014) and only considering dilution, maximum concentrations are not expected to exceed 7.4 mg/L in Burnetta Lake, well below MMER authorized monthly mean concentration (15 mg/L) and, most of the time, respecting the 5 mg/L increase allowed by CCME guidelines. Indeed, background levels of TSS are <2 mg/L in Burnetta Lake (Section WQ), but the value used for this calculation is the maximum concentration observed and will actually probably be lower. Additionally, the filtrating action of substrate and aquatic vegetation along the 4 km of intermittent streams will most certainly further reduce TSS content and make TSS exceedance sporadic or non-existent in Burnetta Lake.

Sump water will probably be heavily charged with TSS and some effects on fish and fish habitat are possible in that stream as well as in Triangle Lake. Indeed, using the same rationale as above, TSS concentrations in Triangle Lake are not expected to be above 12,9 mg/L, still under the MMER's authorized monthly mean concentration (15 mg/L), but sometimes above the CCME guidelines, when considering a natural TSS concentration of 3 mg/L. Nevertheless, concentrations should generally be lower than CCME guidelines. Then again, concentrations in Goodream Creek will often be higher than the MMER and CCME guidelines when there is an effluent flow (during spring freshet or heavy rain events).

For that reasons, the magnitude is considered to be **moderate** (Value of 2).

<u>Frequency</u>

The frequency is **intermittent**, since no contamination will occur during the winter months, as deep freeze prevents water runoff. Moreover, the effluent flows only during spring or during heavy rain events. The associated value is 2.

7.3.10.4.1 Significance

The great majority of the above assessment criteria's are of moderate order (most of the values are of 1 or 2, except for duration). When using the aggregation matrix presented in the methodology**, the overall effect of the Howse Project on water quality is expected to be non-significant (value of 12)**. The ELAIOM Project effluent TSS is known to be above MMER criteria for a short period of time in spring. No other ELAIOM Project MMER effluent parameters are above the criteria. Similar effluent quality should be expected for the Howse Project as the WMP uses similar water treatment techniques. As the dilution factor is very high when the effluent reach the Howells River (>1 in 50), the effect of the Howse Project on water quality is limited to the LSA. When comparing with Elross creek that has been a receiving environment for more than 40 years due to past IOCC and present ELAIOM Projects, the effect of the Howse Project effluent is not likely to cause the demise of the actual aquatic life in Goodream or Burnetta Creeks. For all these reasons, the effect of the Howse Project on water quality is considered **non-significant**.

<u>Likelihood</u>

Likelihood determination is not needed as the effect was determined non-significant.

7.4 BIOLOGICAL ENVIRONMENT

7.4.1 Anthropogenically Altered Landscapes

7.4.1.1 Component Description

Anthropogenically altered landscapes are not considered a VC. It is not a natural ecosystem and it does not support a high biological diversity. Anthropogenically altered landscapes are perceived negatively by the local communities. They are concerned that future mining activities will lead to the same altered landscapes that those already present throughout the LSA.

Some anthropogenically altered landscapes could be affected by operations at the Howse site, but the effect can't be considered harmful since it is already disturbed. Restoration of the site after the mining exploitation will be beneficial, and so the implementation of the Howse Project and its associated responsibilities, including a rehabilitation program, can be seen as a positive effects on anthropogenically-altered landscapes.

LSA, RSA and Temporal Boundaries

The LSA consists of the Burnetta, Goodream (western portion of the watershed) and Elross Creek watershed limits. The water balance will not be affected by the Howse Project outside these watersheds, confining any potential effects to terrestrial ecosystems within that area. The RSA represents the mapped area, which covers 280 km^2 in the vicinity of Howse Project. Temporal boundaries for the anthropogenically altered landscapes component encompasses all the phases of the Howse Project and will probably extend afterward based on observation of past IOCC iron ore sites throughout the ELAIOM project.

Existing Literature

A portion of the study area has been disturbed by previous mining activity that ended in 1982, in some cases to such an extent that the original condition of the landscape is no longer recognizable. Mining-related alterations to the landscape include numerous test pits and trenches, survey cut-lines, access roads and yards, and abandoned camps, infrastructure and equipment. In anthropogenically altered areas that have not been disturbed for several decades, pioneer species of vegetation have begun to colonize the surface. The rate of colonization has been slow, though, most likely due to the harsh climate, rocky soils and lack of organic matter. The following pioneer plant species were usually found on those sites: rough alder, bearberry willow, flatleaf willow and dwarf birch, as well as several grass species (Groupe Hémisphères, 2011a).

In the LSA, the proportion of anthropogenically altered landscapes represents 136 ha, or less than 4%. In the RSA, anthropogenically-altered landscapes concentrated close to the LSA and represents less than 1% of the RSA.

Aboriginal Traditional Knowledge

Aside from land use patterns (discussed in Section 7.5.2.1), no specific information concerning anthropogenically altered landscapes is available.

Data Gaps

Detailed mapping of terrestrial ecosystems combined with surveys was carried out within the LSA and in a larger zone, i.e., the RSA. The location of all anthropogenically altered landscapes is well known.

7.4.2 Terrestrial Ecosystem, Wetlands and Vegetation

7.4.2.1 Component Description

With the exception of wetlands, which are not common in the LSA, the ecosystems present are common within both the LSA and the RSA. Surveys revealed no floristic species at risk, and none are potentially present in the area. Some plants are used by the First Nations. They are all, however, common throughout the LSA and the RSA.

Wetlands are the ecosystems that have the highest ecological value, since the majority of wildlife habitats in the LSA are associated with them. Furthermore, wetlands have a diversified flora, and species that occur in them usually cannot colonize other types of ecosystems. Wetlands and riparian environments occupy a small part of the LSA, but they support a high percentage of wildlife and floristic species there. Consequently, they must be given priority in the assessment of environmental effects.

Finally, the importance of conserving and protecting wetlands is the subject of consensus within the scientific community, and wetlands are protected by the *Water Resources Act*.

Within the terrestrial ecosystem component, only **wetlands** are therefore considered as a VC. The main reason for this selection is that wetlands are recognized by the scientific community and First Nations as habitats to be protected and conserved. They are extensively used by the members of First Nations for berry picking, hunting and trapping.

LSA, RSA and Temporal Boundaries

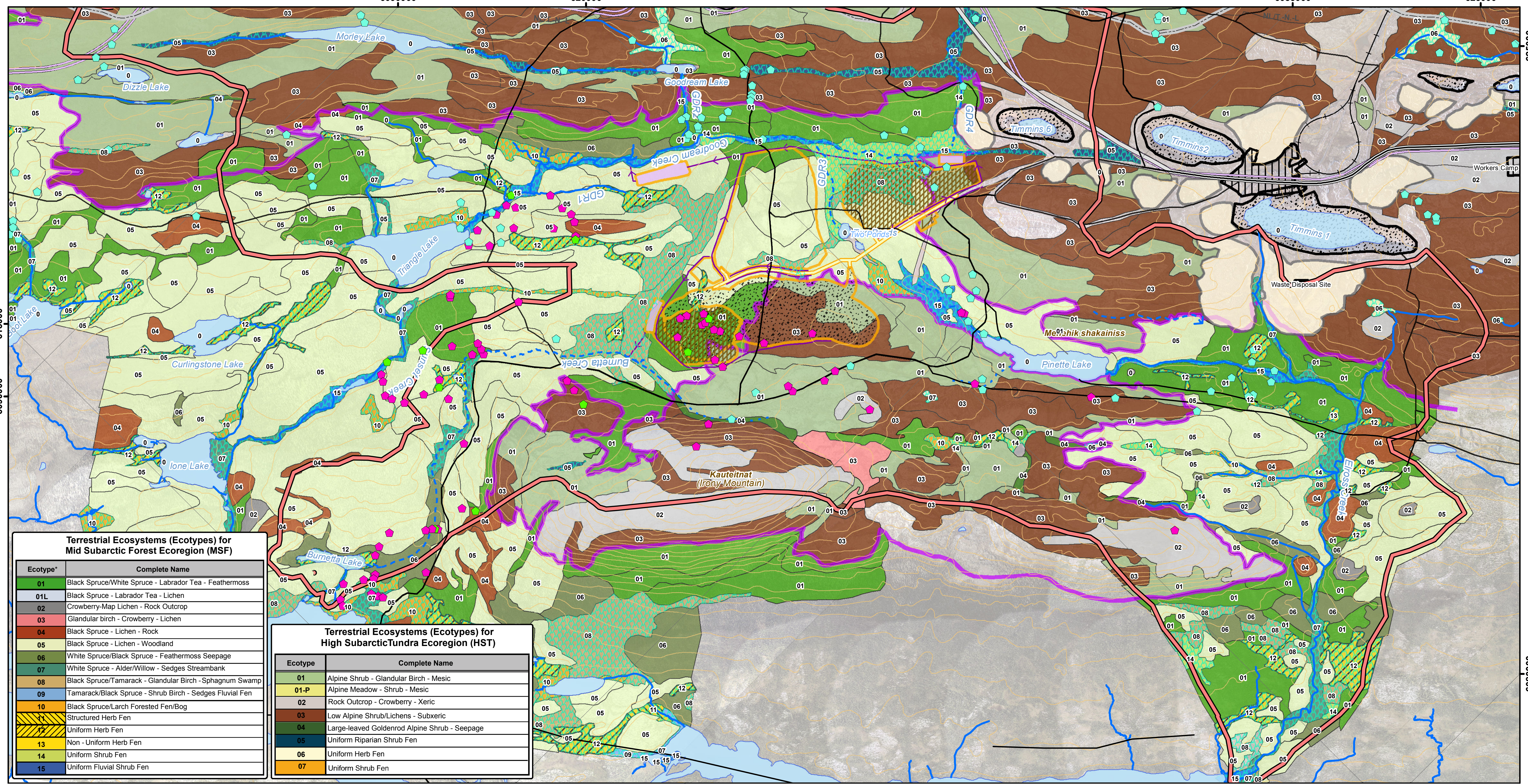
The LSA consists of the Burnetta Creek, western part of Goodream Creek and Elross Creek watershed limits. The effect of the project should not be felt outside the limit of these watersheds. The RSA represents all terrestrial ecosystem mapping (TEM) done in the same regional area, which represents 280 km^2 in the vicinity of Howse Project (including DSO and Howse Projects). This RSA roughly correspond to natural large watersheds present in the Howse Project vicinity (head of Goodwood and Howells River watersheds). Temporal boundaries for the component encompasses all the phases of the Howse Project and will probably extend afterward based on observation of past IOCC iron ore sites.

Existing Literature

Terrestrial Ecosystems

TEM makes it possible to classify and map the various terrestrial ecosystems present in a given territory. TEM includes forest ecosystems, the tundra, riparian ecosystems and wetlands. The approach used for the TEM included a description of the physical characteristics of the terrestrial ecosystems, such as landforms, drainage, surface geology and soil types. It also included certain biological characteristics of the terrestrial ecosystems, specifically the composition of the plant communities and forest stands. TEM was previously carried out in the vicinity of the Howse Property for the LabMag Iron Ore Project (Gartner Lee and Groupe Hémisphères, 2007), for the TSMC's DSO Project 1a (Groupe Hémisphères, 2011a) and for the KéMag Iron Ore Project (SNC-Lavalin, 2013b). Finally, the TEM was extended to cover the Project study area (Volume 2 Supporting Study K).

The Project is located within two ecoregions which are briefly described in the following sections. Figure 7-30 shows the terrestrial ecosystems mapped in the LSA.



Terrestrial Ecosystems (Ecotypes) for Mid Subarctic Forest Ecoregion (MSF)

Ecotype*	Complete Name
01	Black Spruce/White Spruce - Labrador Tea - Feathermoss
01L	Black Spruce - Labrador Tea - Lichen
02	Crowberry-Map Lichen - Rock Outcrop
03	Glandular birch - Crowberry - Lichen
04	Black Spruce - Lichen - Rock
05	Black Spruce - Lichen - Woodland
06	White Spruce/Black Spruce - Feathermoss Seepage
07	White Spruce - Alder/Willow - Sedges Streambank
08	Black Spruce/Tamarack - Glandular Birch - Sphagnum Swamp
09	Tamarack/Black Spruce - Shrub Birch - Sedges Fluvial Fen
10	Black Spruce/Larch Forested Fen/Bog
11	Structured Herb Fen
12	Uniform Herb Fen
13	Non - Uniform Herb Fen
14	Uniform Shrub Fen
15	Uniform Fluvial Shrub Fen

Terrestrial Ecosystems (Ecotypes) for High SubarcticTundra Ecoregion (HST)

Ecotype	Complete Name
01	Alpine Shrub - Glandular Birch - Mesic
01-P	Alpine Meadow - Shrub - Mesic
02	Rock Outcrop - Crowberry - Xeric
03	Low Alpine Shrub/Lichens - Subxeric
04	Large-leaved Goldenrod Alpine Shrub - Seepage
05	Uniform Riparian Shrub Fen
06	Uniform Herb Fen
07	Uniform Shrub Fen

LEGEND

Data Validation
- 2008/2009 Survey
- 2013 Survey
  - Ground
  - Visual
- Local Study Area
- Ecoregion Boundary

Infrastructure and Mining Components
- DSO Haul Road
- Existing Railroad
- Elross Lake Area Iron Ore Mine (ELAIOM) Plant Infrastructure footprint
- Existing Pit
- Existing Dump
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Site Infrastructure
- Proposed In-Pit Dump/ Waste Dump
- Existing and Proposed Sedimentation Pond
- Proposed Ditch
- Proposed Mine Haul Road

Basemap
- Permanent Watercourse
- Intermittent Watercourse
- Storm Runoff
- Disappearing Stream
- Artesian Spring
- Water Body
- Contour Line (50 ft)
- Existing Road
- Main Access Road
- Wetland

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0575 , PR185-19-14, 2015-11-10, edickoum

0 500 1 000 1 500
Meters

UTM 19N NAD 83

SCALE: 1:30 000

SOURCES:
Basemap
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,
Boundary used for claims
SLE, AMEC and GHI (October 2012). LabMag and Kémag Iron Ore Projects 2012 Mine Site Aquatic Program Field Report.
Groupe Hémisphères, Hydrology, Wetland, 2013.

Infrastructure and Mining Components
New Millennium Capital Corp., Mining sites and roads
Howse Minerals Limited/
MET-CHEM, Howse Deposit Design for General Layout, 2015

SURVEY:
Groupe Hémisphères (2011) Terrestrial Ecosytems and Terrain : Iron Ore Project Direct Shipping.
Technical Report for New Millennium Capital Corp, 2008-2010.

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Terrestrial Ecosystems

Howse Minerals Limited

GroupeHemispheres
5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 7-30

Mid Subarctic Forest (MSF) Ecoregion

Mean annual temperature is between -5 and -2.5 °C, and mean annual precipitation is around 800 mm, with an average 300 mm falling as snow. Summers are cool and four to five months long, and winters are cold and snowy (Meades, 1990). The mean daily minimum temperature of the coldest month is -28.9 °C, and the lowest recorded temperature is around -50 °C. These are similar to the climate normal recorded at the Schefferville weather station (Section 7.3.1 on climate).

The severe climate inhibits continuous tree cover on upland sites, so forest cover is generally discontinuous, a transition between the relatively productive closed boreal forests to the south and the treeless subarctic tundra to the north. Closed-canopy forests occur only on moist sites with seepage, and there are very few deciduous trees (scattered and isolated stands of white birch do occur on some post-fire sites near the southern boundary with the Balsam Spruce Moss Ecoregion). To the north, balsam fir almost disappears from the main forest canopy, leaving only black spruce, white spruce and tamarack as the dominant tree species. Black spruce-lichen woodland stands are common on dry sites, and low-productivity, open stands of black spruce, mixed with white spruce and tamarack, occur on well-drained sites on deep morainal landforms. Forest fires are common and typically cover large areas, so many stands are in early successional stages. Extensive wetland complexes are common and are characterized by patterned or ribbed fens, interspersed with forested fens.

Figure 7-31 shows the late seral-ecotypes present in the MSF Ecoregion. Ecotypes highlighted in blue are not present within the LSA, but are common elsewhere within the MSF Ecoregion. The MSF Ecoregion edatopic grid, showing how the ecosystems are displayed by their moisture level and the nutrient level, is also presented in Figure 7-31. A detailed description of MSF ecotypes is included in the TEM report (Volume 2 Supporting Study K).

Table 7-70 Late-Seral Ecotypes in the MSF Ecoregion

LATE-SERAL ECOTYPE			DESCRIPTION
CODE	COMPLETE NAME	COMMON NAME	
MSF01	Black Spruce / White Spruce - Labrador Tea-Feathermoss (Forested Ecosystem)	Mesic / Zonal Spruce Feathermoss	Black spruce and moss-lichen stand; thin-thick deposits; medium soil texture; well drained
MSF02	Crowberry-Map Lichen Rock Outcrop (Non-Forested Ecosystem)	Rock Outcrop	Rock outcrop with low ericaceous species; no or little surficial deposits; variable soil texture; very rapidly drained
MSF03	Glandular Birch - Crowberry-Lichen Very Thin Till Over Rock (Non-Forested Ecosystem)	Birch-Crowberry-Lichen	Low shrub communities on thin soils in crest positions; variable soil texture; rapidly drained
MSF04	Black Spruce-Lichen Rock (Forested Ecosystem)	Black Spruce Lichen Rock	Rock-dominated sites with scattered, stunted black spruce; very thin veneers; variable soil texture; rapidly drained
MSF05	Black Spruce - Lichen Woodland (Forested Ecosystem)	Black Spruce Lichen	Black spruce lichen stand; thin-thick deposits; coarse soil texture; well to rapidly drained

LATE-SERAL ECOTYPE			DESCRIPTION
CODE	**COMPLETE NAME**	**COMMON NAME**	
MSF06	White Spruce/Black Spruce - Feathermoss Seepage (Forested Ecosystem)	White Spruce/Black Spruce Seepage	Black spruce feathermoss-ericaceous stand; thin-thick deposits; fine soil texture; imperfectly drained with seepage
MSF07	White Spruce-Alder / Willow-Sedges Streambank (Forested Riparian Ecosystem)	Fluvial White Spruce / Sedge	White spruce-moss stand; thin-thick deposits; fine soil texture; riparian; flooded sites imperfectly to poorly drained
MSF08	Black Spruce / Tamarack-Glandular Birch-Sphagnum Swamp (Forested Wetland Ecosystem)	Black Spruce/ Tamarack Forested Swamp	Forested swamp; denser stand than Ecotype MSF10; organic deposits; Sphagnum-dominated; poorly drained
MSF09	Tamarack / Black Spruce-Shrub Birch-Sedges Fluvial Fen (Forested Wetland Ecosystem)	Black Spruce/ Tamarack Fluvial Spruce Fen	Forested fen; fluvial or organic deposits; sedge-dominated; poorly drained
MSF10	Black Spruce Forested Bog (Forested Wetland Ecosystem)	Black Spruce Bog	Uniform forested bog; organic deposits; forest floor dominated by sedge and grass; poorly drained
MSF11	Structured Herb Fen (or patterned/ribbed fens) (Non-Forested Wetland Ecosystem)	Structured Herb Fen	Structured non-forested herb fen; organic deposits; vegetation dominated by sedge and grass; very poorly drained
MSF12	Uniform Herb Fen (Non-Forested Wetland Ecosystem)	Uniform Herb Fen	Uniform non-forested herb fen; organic deposits; vegetation cover dominated by sedge and grass; poorly drained
MSF13	Non-Uniform Herb Fen (Non-Forested Wetland Ecosystem)	Non-Uniform Herb Fen	Random non-forested herb fen; organic deposits; vegetation cover dominated by sedge and grass; poorly drained
MSF14	Uniform Shrub Fen (Non-Forested Wetland Ecosystem)	Uniform Shrub Fen	Uniform non-forested shrub fen; organic deposits; vegetation cover dominated by sedge and grass; poorly drained
MSF15	Uniform Fluvial Shrub Fen (Non-Forested Riparian Ecosystem)	Uniform Fluvial Shrub Fen	Uniform non-forested shrub fen; fluvial or rich organic deposits; vegetation cover dominated by sedge and grass; soil richer and more diverse plant community than Ecotype MSF14; imperfectly to very poorly drained

Marginally represented within the LSA

Absent from the LSA

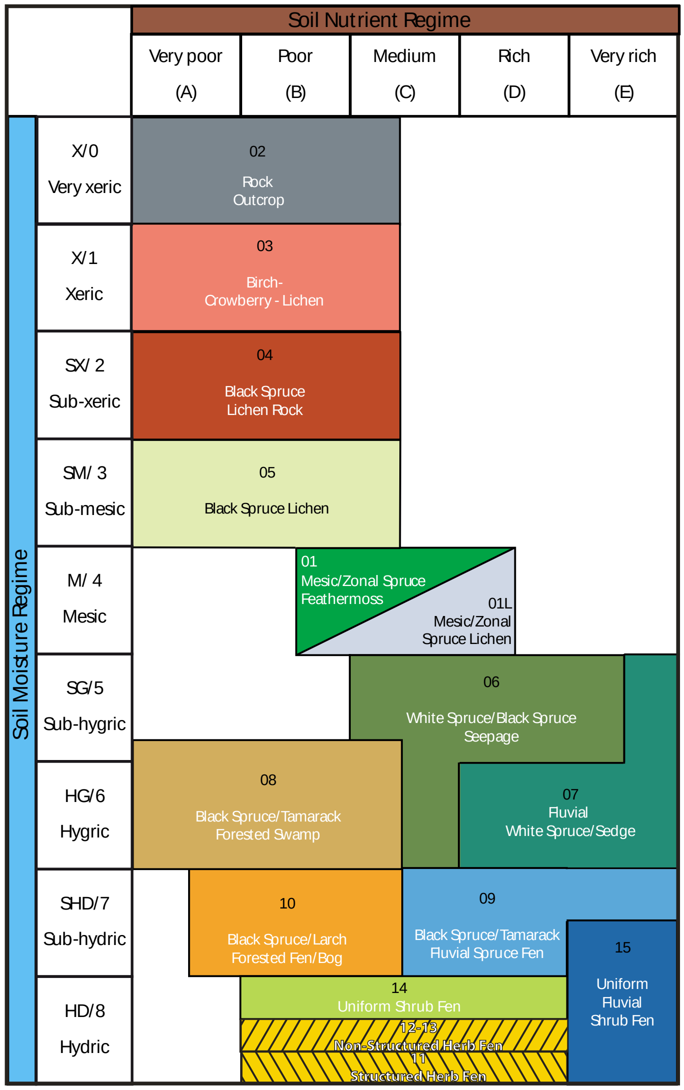


Figure 7-31 Edatopic Grid for the MSF Ecoregion

High Subarctic Tundra (HST) Ecoregion

The climate of the HST Ecoregion is characterized by short, cool summers and long, windy winters. The growth period lasts only 80 to 100 days, and annual precipitation varies from 700 to 1,000 mm. Within the Project LSA, the various ecotypes of the HST Ecoregion are found in the vast majority of cases at elevations higher than 650 m. The ecotypes found inside the HST Ecoregion are all treeless and are similar to the alpine tundra that is described by Meades (1990), who mentions that more than 50% of the upland plateaus characteristic of the HST Ecoregion support vegetation dominated by shrubs, low shrubs and graminoids. The HST Ecoregion contains discontinuous permafrost and small areas of wetlands with thin organic soils, mostly located in depressions and around lakes.

Table 7-71 shows the late-seral ecotypes present in the MSF Ecoregion. Ecotypes highlighted in blue are not present within the LSA but are common elsewhere within the HST Ecoregion. The edatopic grid for this ecoregion is also presented in Figure 7-32. A detailed description of HST ecotypes is included in the TEM report (Volume 2 Supporting Study K).

Table 7-71 Late-Seral Ecotypes in the HST Ecoregion

LATE-SERAL ECOTYPE			DESCRIPTION
CODE	COMPLETE NAME	COMMON NAME	
HST01	Alpine Shrub – Glandular Birch – Mesic	Mesic Arctic Alpine Shrub	Mesic ecosystem dominated by herbs and shrubs; thick till; silty texture; well to moderately well drained
HST01-P	Alpine Meadow – Shrub – Mesic	Shrubby Alpine Meadow	Moist soil ecosystem dominated by shrubs and herbs; thick till deposits; rich soil with silty texture; good to moderate drainage
HST02	Rock Outcrop – Crowberry – Xeric	Rock Outcrop	Dry ecosystem dominated by lichen-covered rock outcrops; thin or no soil; medium texture; very rapid drainage
HST03	Low Alpine Shrub/Lichens – Subxeric	Dry Arctic Alpine Shrub	Subxeric ecosystem dominated by Ericaceae and lichen species; thin till on bedrock; medium to coarse texture; good to rapid drainage
HST04	Large-leaved Goldenrod Alpine Shrub – Seepage	Moist Arctic Alpine Shrub	Ecosystem with soils enriched by seepage and dominated by tall shrubs and a dense and diverse ground cover; thick till deposits; medium or fine texture; moderate to imperfect drainage
HST05	Uniform Riparian Shrub Fen	Riparian Artic Alpine Shrub	Riparian fen; fluvial or organic deposits; ground cover dominated by sedge and grass; imperfect to poor drainage
HST06	Uniform Herb Fen	Uniform Sedge Fen	Uniform herb fen; organic deposits; ground cover dominated by sedge and grass; poor to very poor drainage
HST07	Uniform Shrub Fen	Uniform Shrub Fen	Uniform shrub fen; dominated by diverse shrub species of the Ericaceae family; ground cover dominated by sedge and grass; poor drainage

Marginally represented within the LSA

Absent from the LSA

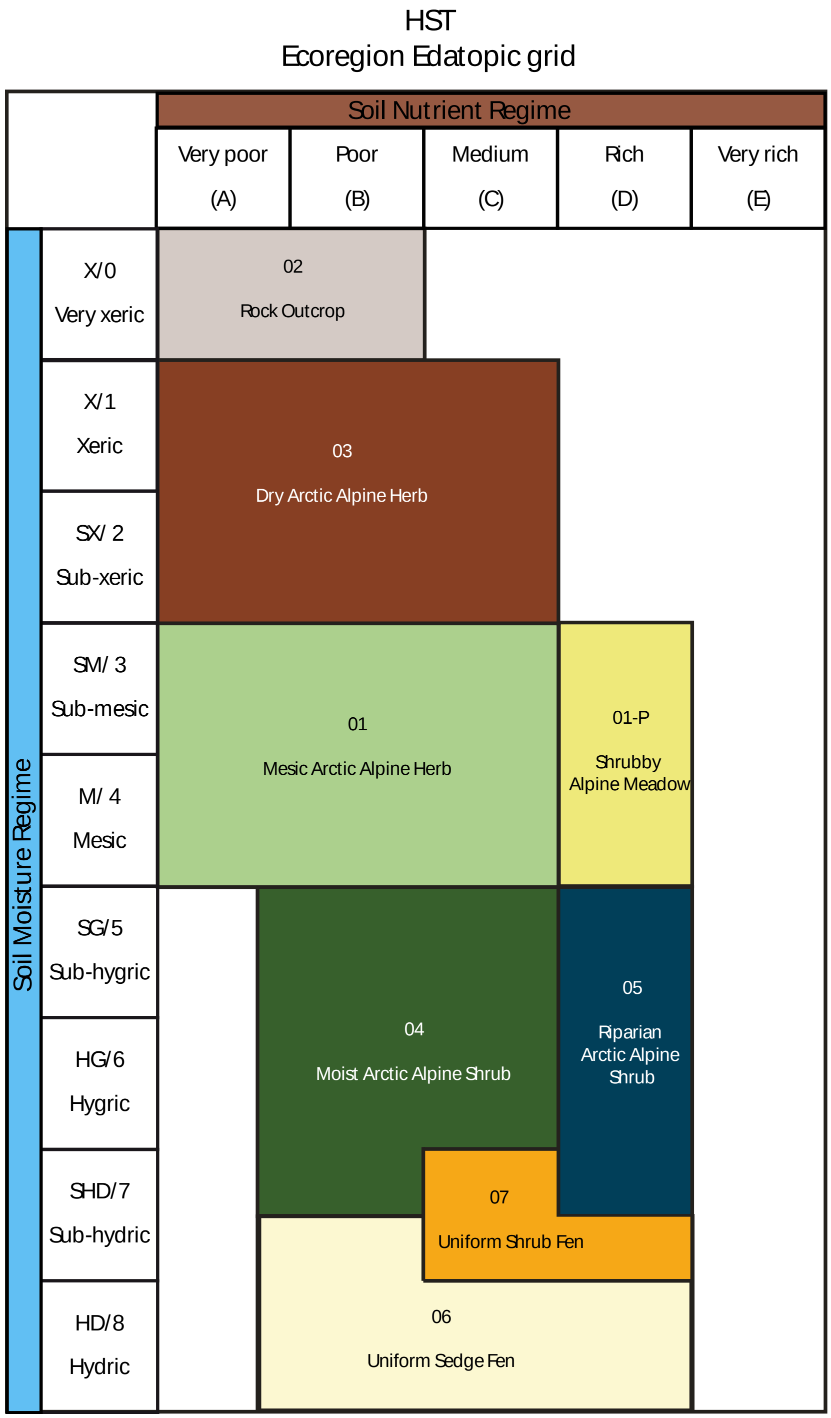


Figure 7-32 Edatopic Grid for the HST Ecoregion

Ecotypes Present Within the LSA

Table 7-72 presents the ecotypes that are located in the LSA. Wetland ecotypes are highlighted in light grey in the table. The proportions in the RSA are also presented. A detailed description of MSF and HST wetland ecotypes is included in the TEM report (Volume 2 Supporting Study K). The most common ecotypes are briefly described in the following paragraphs. A list of flora species observed in the LSA is presented in Volume 1 Appendix XX.

Dry Arctic Alpine Shrub (HST03) represents 22% of the LSA. The shrub layer is dominated by glandular birch, crowberry and alpine bilberry. The herbaceous layer is not very developed and the bryophyte layer is dominated by lichens.

Mesic Arctic Alpine Shrub (HST01) represents about 18% of the LSA. Like HST03, the shrub layer is dominated glandular birch, crowberry and alpine bilberry. The herbaceous layer is diverse and important.

Black Spruce Lichen Woodland (MSF05) covers more than 20% of the LSA. Ecotype MSF05 is typified by a low cover (15 to 25%) of slowly growing black spruce, scattered shrubs and herbs and commonly continuous cover of reindeer lichens. AECOM (2010) also reported that it was the most common plant community, which they called open black spruce woodland. Stassinu Stantec Limited Partnership (2010) classified this ecotype as Black Spruce/Lichen Woodland.

The Mesic / Zonal Spruce Feathermoss Ecotype (MSF01) occupies 13% of the LSA. Compared to Ecotype MSF05, Ecotype MSF01 has a more closed canopy of black and white spruce and a higher shrub cover, consisting mostly of Labrador tea. Feathermosses are more abundant than reindeer lichens in the moss layer.

Table 7-72 Ecotypes Within the LSA

ECOTYPE	COMMON NAME	SURFICIAL AREA (HA)	PROPORTION WITHIN LSA (%)	PROPORTION WITHIN RSA (%)
Mid Subarctic Forest				
MSF01	Mesic / Zonal Spruce Feathermoss	463.11	13.15	12.15
MSF04	Black Spruce Lichen Rock	68.25	1.94	0.48
MSF05	Black Spruce Lichen	752.70	21.38	13.53
MSF06	Seepage White Spruce	85.49	2.43	3.99
MSF07	Fluvial White Spruce / Sedge	41.50	1.18	1.02
MSF08	Forested Swamp	119.30	3.39	2.22
MSF10	Black Spruce Bog	41.20	1.17	1.03
MSF12	Uniform Herb Fen	83.77	2.39	1.81
MSF14	Uniform Shrub Fen	31.80	0.90	1.17
MSF15	Uniform Fluvial Shrub Fen	33.55	0.95	0.73
High Subarctic Tundra				
HST01	Alpine Shrub Mesic	613.11	17.42	17.56
HST02	Rock Outcrop	116.07	3.30	6.32
HST03	Alpine Shrub Subxeric	782.12	22.21	26.36

ECOTYPE	COMMON NAME	SURFICIAL AREA (HA)	PROPORTION WITHIN LSA (%)	PROPORTION WITHIN RSA (%)
HST05	Uniform Riparian Shrub Fen	22.06	0.63	1.04
Marginally represented non-humid ecotypes (MS02, MSF03, HST04)		58.33	0.41	1.75
Marginally represented wetland ecotypes (MSF09, MSF11, MSF14, HST06, HST07)		14.38	1.66	0.51
Anthropogenic Altered landscape		136.03	1.64	2.13
Waterbody		57.84	3.87	6.20
TOTAL		3,520.74	100	100

Highlighted: Wetland Ecotypes

Wetlands

Wetlands represent around 12% of the LSA (Table 7-72), a proportion comparable but slightly superior to the RSA (9.54%). Wetlands are common in the northeastern portion of the LSA (Figure 7-30) since the watercourse network mainly flows in that direction before reaching Howells River due west. The Howells River Valley also supports large and diverse wetland complexes.

The Forested Swamp (MSF08) is the most common ecotype in the LSA (3.39% of the LSA). This ecosystem is generally forested, with abundant herb, shrub and moss species. Although black spruce is the dominant tree, tamarack occurs more frequently in this ecotype than in any other.

Uniform Herb Fen (MSF12, covering 1.81% of the LSA) are sedge-dominated ecosystems with scattered shrubs and other wetland herbs. Their surfaces range from flat to depressed, with a continuous vegetation cover. Black spruce and tamarack occur as scattered, stunted individuals on raised microsites.

Uniform Shrub Fen (MSF14, covering 1.17% of the LSA) support shrub species dominated by several shrubby willow species that tolerate poor drainage. Bushy tamaracks are also dispersed on higher microsites.

Wetland Classification

A wetland classification was done based on the Canadian wetland classification (CWC) (NWWG, 1997). Table 7-73 presents the types of wetlands that are found within each ecotypes.

Table 7-73 Wetland Classification According to the CWC

CWC	DESCRIPTION	ECOTYPE	AREA (HA)
Swamp			
Discharge Swamp	Topographically flat; developed on sites of groundwater discharge located adjacent and above the swamp	MSF08	57.48
Flat Swamp	Developed in topographically defined basins, kettle holes or bedrock where the water is derived by surface runoff, groundwater or precipitation	MSF08	24.85

CWC	DESCRIPTION	ECOTYPE	AREA (HA)
Riparian Swamp	Located along rivers, streams and lakes, and are directly influenced by the water in the river, stream or lake	MSF07	49.07
		MSF08	15.81
Slope Swamp	Have surfaces that slope downward with the lowest end positioned lower than the upslope side	MSF08	14.99
Bog			
Basin Bog	Situated in basins with a flat surface across the entire peatland	MSF10	2.83
Flat Bog	Occur in broad, poorly defined lowland areas.	MSF10	6.78
Riparian Bog	Formed on edges of ponds, lakeshores or banks of slow-flowing streams and rivers	MSF10	10.26
Veneer Bog	Occur on gentle slopes that are underlain by discontinuous permafrost. Although drainage is predominantly below the bog surface, surface flow may occur in poorly defined drainageways during peak runoff	MSF10	12.51
Fen			
Basin Fen	Topographically confined to basins that may be entirely isolated and closed to both surface inflow or outflow feeder streams, or they may lack only inflowing streams but will have a surface outflow	MSF12	32.52
		MSF14	5.85
		HST06	0.58
		HST07	0.53
Channel Fen	Occupies well-defined channels which at present do not contain an actively flowing stream. They are developed in abandoned glacial meltwater channels, glacial spillways, old river and stream channels or any other channel features which have either lost their source of water and dried up or contain a very much smaller remnant stream continuing to flow in the channel	MSF12	15.40
		MSF13	0.81
		HST05	1.02
		HST06	7.35
Horizontal Fen	Occupies broad, ill-defined depressions. They occur on gentle slopes and are characterized by featureless surfaces	HST06	1.48
Riparian Fen	Developed adjacent to lakes, ponds and streams	MSF12	6.02
		MSF14	31.81
		MSF15	39.19
		HST05	33.49
Spring Fen	Nourished by a continuous discharge of groundwater	MSF12	15.96
Total			**390.88**

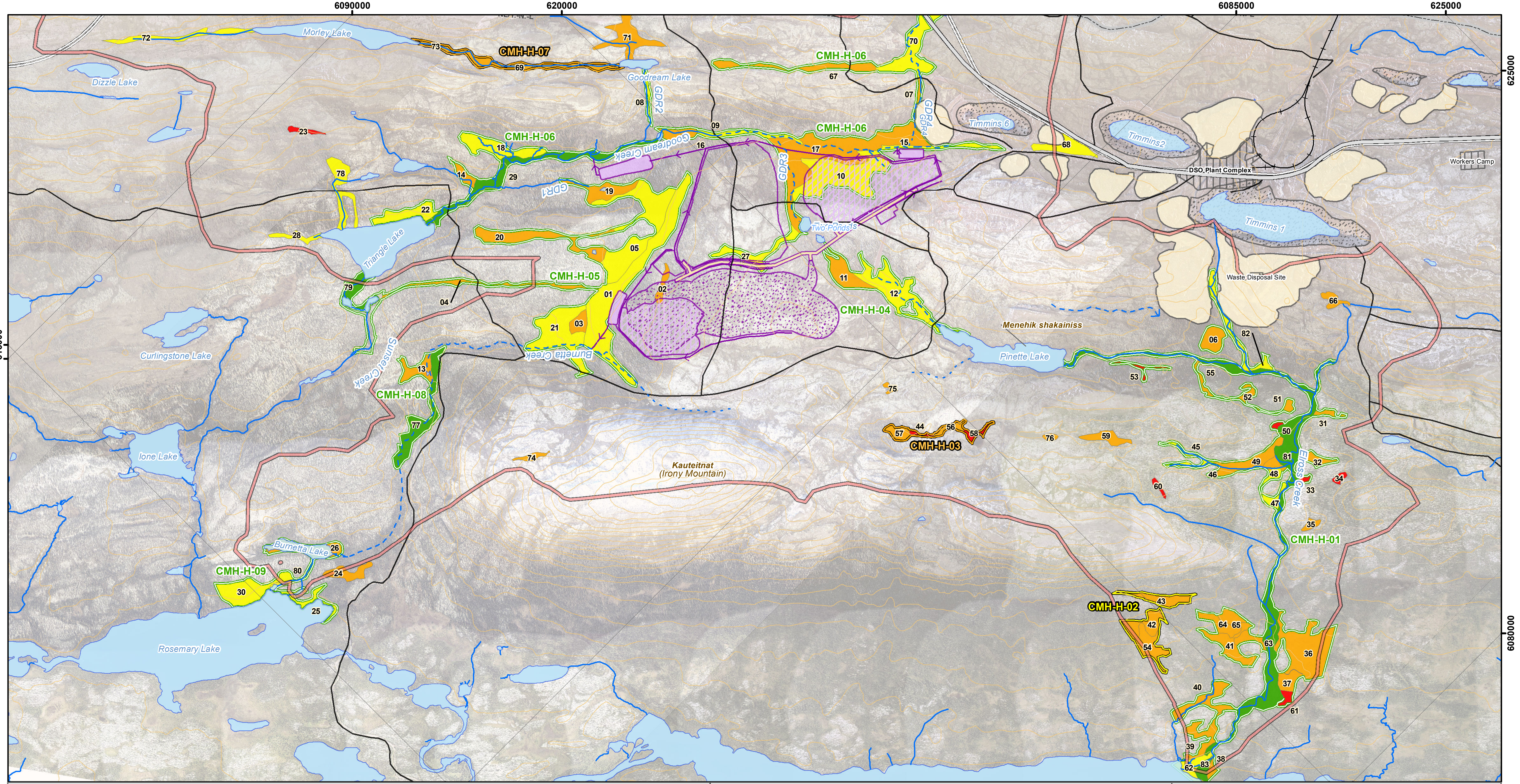
<u>Wetland Functions and Ecological Value Assessment</u>

An assessment of wetland functions was realized using a watershed approach based on the methodology presented in Hansen *et al*. (2008) and Tiner (2003, 2011). Wetlands functions are based on the position in the watershed, the water flow path and the dominant vegetation type (trees, shrubs or herbs). Functions were chosen based on knowledge of the RSA and a literature review (Hanson *et al*., 2008; Tiner; 2003; OWES, 2013). The methodology for wetland functions assessment and the results are presented in Volume 1 Appendix XXI.

Wetland functions were then used in the wetland ecological value assessment. Other criteria used are wetland area, connectivity, representativeness, complexity and fragmentation. The ecological value assessment was carried out for individual wetlands. Ecological value assessment was also carried out for wetland complex and is presented separately. Table 7-74 presents a summary of the ecological value assessment, and the results are shown in Figure 7-33.

Table 7-74 Wetland Ecological Value in the LSA

ECOTYPE	COMMON NAME	ECOLOGICAL VALUE (SURFICIAL AREA IN HA)			
		LOW	MEDIUM	HIGH	VERY HIGH
Mid Subarctic Forest					
MSF07	Fluvial White Spruce / Sedge	-	-	11.43	37.63
MSF08	Forested Swamp	-	26.98	86.14	-
MSF10	Black Spruce Bog	-	15.35	17.04	-
MSF12	Uniform Herb Fen	4.02	65.89		-
MSF13	Non-Uniform Herb Fen	-	0.81	-	-
MSF14	Uniform Shrub Fen	3.32	38.63		-
MSF15	Uniform Fluvial Shrub Fen	-	-	27.63	11.56
High Subarctic Tundra					
HST05	Uniform Riparian Shrub Fen	-	14.39	20.12	-
HST06	Uniform Herb Fen	-	9.41	-	-
HST07	Uniform Shrub Fen	-	0.53	-	-



LEGEND

Wetland Label
00 H-MH-00

Wetland Value
- Low
- Medium
- High
- Very High

Complex Wetland Value
- Medium
- High
- Very High

Infrastructure and Mining Components
- DSO Haul Road
- Existing Railroad
- Elross Lake Area Iron Ore Mine (ELAIOM) Plant Infrastructure footprint
- Existing Pit
- Existing Dump
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Site Infrastructure
- Proposed Waste Dump/ In-Pit Dump
- Proposed Sedimentation Pond
- Proposed Ditch
- Proposed Mine Haul Road

Basemap
- Permanent Watercourse
- Intermittent Watercourse
- Storm Runoff
- Disappearing Stream
- Artesian Spring
- Water Body
- Contour Line (50 ft)
- Existing Road
- Main Access Road
- Local Study Area

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0619 , PR185-19-14, 2015-11-10, edickoum

0 500 1 000 1 500
Meters

UTM 19N NAD 83

SCALE: 1:30 000

SOURCES:
Basemap
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec, Boundary used for claims
SLE, AMEC and GHI (October 2012). LabMag and Kémag Iron Ore Projects 2012 Mine Site Aquatic Program Field Report.
Groupe Hémisphères, Hydrology, Wetland, 2013.

Infrastructure and Mining Components
New Millennium Capital Corp., Mining sites and roads
Howse Minerals Limited/
MET-CHEM, Howse Deposit Design for General Layout, 2015

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Wetland Ecological Value
Howse Minerals Limited

GroupeHemispheres
5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 7-33

Flora Species at Risk

No flora species at risk were observed during the surveys of terrestrial ecosystems (Groupe Hémisphères, 2011a and (Volume 2 Supporting Study K)). An analysis of species designated by the federal government in NFL and Quebec territory (SARA, 2014; COSEWIC, 2014) and the provincial government (NLDEC, 2014a) revealed that no species at risk, plant, lichen or moss, might be found in the vicinity of the Project.

Aboriginal Traditional Knowledge

Some plant harvesting is carried out by the Naskapi and the Innu in the vicinity of the Project (Weiler, 2009; Clément, 2009; (Volume 2 Supporting Study D)). Different varieties of berries, including blueberry, bilberry, cranberry, cloudberry and crowberry, are harvested, especially in wetlands. Plants harvested for medicinal purposes include Labrador tea and tamarack bark. White spruce, black spruce and tamarack are harvested for firewood. Some harvesters refrain from picking berries or harvesting plants in locations where mines are active. Given its proximity to the other DSO projects (Volume 2 Supporting Study D), berry picking is limited near the Howse proposed site.

Data Gaps

Detailed mapping of terrestrial ecosystems combined with surveys was carried out within the LSA and in a larger zone, i.e., the RSA. Ecological mapping was also carried out in an adjacent sector, the Howells River Valley. It is therefore possible to assert that all ecosystems present in the region have been recorded and described in detail.

7.4.2.2 Effects Assessment

Literature review and Current Studies Data Used to Assess the Potential Effect

Wetland's location and type are known throughout the LSA and RSA based on several studies that were carried out in the vicinity of the Project. Wetland's functions and ecological value were assessed based on a literature review and were adapted for the context of the Project.

Interaction of the Project with Wetlands and Potential Effects

Site Construction Phase

No potential interaction

- transportation and traffic;

Potential interaction

A potential interaction can be anticipated between wetlands and the following activities:

- upgrading/construction of the Howse haul road, bypass road and water management infrastructures; and
- pit development.

➔ The potential effect associated with the project activities during the site preparation and construction phase is **loss of wetlands and localized drying-out**.

The nature of the effect is direct and the effect is adverse.

Those activities will require the stripping of vegetation where they will occur. According to the preliminary plans, about 2.8 ha of wetlands will be directly affected by these activities. Table 7-75 presents the wetlands that will be affected by the Project during the site Construction phase.

Proper drainage (ditches) along roads and working areas could also potentially alter wetland hydrology for the poorly drained forested soils (Skaggs et al., 2011). Soil deformation by heavy machinery can reduce water infiltration rates and reduce groundwater flow, accelerating erosion during periods of rain (Schack-Kirchner et al., 2007).

The WMP might also lead to wetland drying-out. Some ditches and ponds will be developed in or close to wetlands. Localized drying-out is evaluated in details for the operation phase, since further pit development and dewatering will have a more important effect on wetland than the WMP.

Table 7-75 Wetlands Loss during the Construction Phase

ECOTYPE	WETLAND NUMBER	AREA AFFECTED (HA)			% OF THE WETLAND	ECOLOGICAL VALUE
		MINE HAUL ROAD	PIT DEVELOPMENT	WMP		
MSF08	H-MH-01			0.62	2.72	High
	H-MH-10			0.15	0.91	High
MSF10	H-MH-11	0.03			0.55	Medium
	H-MH-27	0.28		0.18	8.85	High
MSF12	H-MH-02		0.9		58.89	Medium
MSF14	H-MH-17			0.54	2.01	Medium
MSF12	H-MH-15			0.03	2.23	High
	H-MH-29			0.02	0.15	Very High
HST05	H-MH-68	0.09			1.46	High
Total		0.39	0.90	1.54		
		2.83				

Operation Phase

No potential interaction

- blasting and ore extraction;
- mineral processing; and
- transportation of ore and traffic.

None of these activities takes place close to wetlands and, consequently, none can have an effect on them.

The following activities will take place at existing DSO3 facilities that have been in operation since 2015:

- solid waste disposal;
- hazardous waste disposal;
- treatment of sanitary wastewater; and
- explosives waste management.

No additional loss of wetlands is therefore expected.

Potential interaction

A potential interaction can be anticipated between wetlands and the following activities:

- pit development;
- removal and storage of remaining overburden and topsoil;
- dewatering;
- operation of waste rock dumps; and
- ongoing site restoration.

➔ The potential effects associated with the project activities during the operation phase is **loss of wetlands and localized drying-out**.

The nature of the effect is both direct (loss of wetland) and indirect (localized drying-out) and the effect is adverse.

Loss of wetlands

About 20 ha of wetland will be affected by the waste rock dumps and the overburden and topsoil piles. For these, the encroachment in wetlands will be progressive and carried throughout the Project operation. Table 7-76 presents the wetlands that will be partially or totally destroyed by the Project during the operation phase.

Table 7-76 Wetlands Loss Area by the Operation Phase

ECOTYPE	WETLAND NUMBER	AREA AFFECTED (HA)			% OF THE WETLAND	ECOLOGICAL VALUE
		OVERBURDEN STOCKPILE	WASTEROCK DUMP	TOPSOIL STOCKPILE		
MSF08	H-MH-10		13.90		84.04	High
MSF10	H-MH-27	3.35			65.09	High
MSF12	H-MH-02			0.27	17.86	Medium
MSF14	H-MH-17		1.68		6.28	Medium
Total		3.35	15.59	0.27		
		19.21				

Table 7-77 presents the expected loss of wetland (Operation and Construction phases) compared to those wetland types in the LSA and RSA. The wetland ecotypes affected are not unique and represent the most common wetland type in the LSA and RSA.

Table 7-77 Wetland Loss Area Compared to the Study Areas

ECOTYPE	AREA AFFECTED (HA)	LSA [1]		RSA	
		AREA (HA)	PROPORTION (%)	AREA (HA)	PROPORTION (%)
FSM08	14.68	119.30	12.30	623.71	2.35
FSM10	3.81	41.20	9.24	288.68	1.32
FSM12	1.17	83.77	1.40	506.74	0.23
FSM14	2.22	31.80	6.99	326.92	0.68
FSM15	0.04	33.55	0.13	205.49	0.02
TSS05	0.09	22.06	0.40	291.69	0.03
Total	22.01	331.68	6.64	2243.23	0.98

1. Area represents the surficial area in ha in the LSA; proportion represents the loss of wetland due to the Project footprint compared to the area of the LSA

Localized drying-out of wetlands

Dewatering will also potentially affect wetlands by modifying the hydrography and hydrology (Section 7.3.9.2). As the plants and wildlife the wetland supports depends on its size and its hydrological features, changes in the timing and quantity of water entering wetlands may influence the ecological integrity of the ecosystem (Mitsch and Gosselink, 2000).

Localized drying-out was evaluated based on the type of wetland, its water supply and the type of soil. These characteristics might lower the potential effect of dewatering. The drawdown presented in Section 7.3.6 was also used to determine the wetlands that might be affected by the pit dewatering. Also, as mentioned in Section 7.3.6, the Howse deposit water table was found to be between 64 and 90 m deep (Geofor, 2015 and Golder, 2014) and the dewatering rate is expected to be minimal during the first years of mining operations, as compared to the final years of pit operations.

During the first years of mining operations, dewatering will be limited to water from direct precipitations and infiltration through the unsaturated geological units. There will still be a circulation of water throughout wetlands. Dewatering will be more important when the operation will reach the pit's maximum depth. Wetlands situated at an elevation between the top of the pit and the edge of the predicted drawdown cone might be affected by dewatering. However, riparian wetlands located downstream from the sedimentation's ponds outflow will still receive water. The ones along Goodream Creek are a good example. The effect on wetlands will be limited during this period of operation.

Since the water table is actually located at a minimum of 50 m depth (See section 7.3.6), a majority of wetlands are not in relation with this water resource. They have a low permeability bed and are supplied by surface runoff and precipitation. Most of the wetlands located in the LSA will still be feed by water from the upper parts of the watersheds. Also, small isolated wetlands and TSS ecotype wetlands will not be affected by drawdown since they are considered impervious.

It is expected that only the wetlands close to the pit will be affected by dewatering.

The complex of wetlands located north of the pit is the one that might be the most affected by the pit dewatering. It rests close to the pit and in lower elevation, so their principal intake of water, the runoff, will be less available. The remnant of H-MH-02, a small isolated wetland that will be affected by the pit development will dry-out since it is close to the pit. Also, H-MH-27, which is close to the pit, might dry-out since it is close to the pit. For the location of the wetlands, refer to Figure 7-33.

Decommissioning and Reclamation Phase

No potential interaction

- demobilization of Howse facilities and heavy machinery;
- transportation and traffic.

Potential interaction

A potential interaction can be anticipated between wetlands and the following activity:

- final site restoration

Restoration will aim to recreate ecosystems that are within the LSA. Wetlands might be recreated in man-made depressions.

7.4.2.3 Mitigation Measure

Standard Mitigation Measures

Table 7-78 presents the standard mitigation that will be applied for the wetlands.

Table 7-78 Specific Mitigation Measures for Wetlands

CODE	MEASURE	MITIGATION EFFECT
Tree removal and timber management (TM)		
TM3	Do no clearing in the riparian strip along watercourses or in wetlands without authorization.	It will ensure that the impacted areas will be limited to those that were identified.
TM5	Be particularly careful in wetlands and protected areas.	
TM6	Before removing any trees, clearly mark work sites (right-of-way, storage area, etc.) and required clearing to be done around the work sites (branches to be trimmed) so that they can be readily inspected at any time during the work.	
TM7	For marking use strong, weather- and tear-resistant material of a colour that is visible at a distance. If possible, use short lengths of biodegradable tape.	
TM8	Remove trees in a way that does not damage vegetation bordering the work sites. Prevent trees from falling outside the work site or into watercourses. If this does occur, remove the trees carefully to avoid any unnecessary disturbance to the area. Do not remove or uproot trees with machinery near the edges of a work site.	It will help to maintain vegetation near worksite and ensure a faster recolonization by vegetation.
TM9	Maintain a transition zone around work site in which trees are removed, but stumps are left intact to preserve the shrub stratum.	

CODE	MEASURE	MITIGATION EFFECT
TM15	Do not pile organic matter from topsoil stripping or logging and commercial wood waste less than 20 m from a lake or watercourse, in a wetland or in the water.	It will ensure that no sediment contamination will occur in wetlands.
Erosion and Sedimentation Control (ES)		
ES1	Identify erosion-sensitive zones using surface deposit and slope class maps, and avoid working in these areas if possible.	These measures will prevent the migration and deposition of sediments in the riparian wetlands and it will limit the loss of superficies.
ES2	To follow the site's natural topography and prevent erosion, keep stripping, clearing, excavation, backfilling, and grading operations to a strict minimum on the work sites.	
ES3	Excavation and reshaping must be done from the top of the embankment and closely monitored in order to detect any possibility of slippage and to modify work methods if necessary.	
ES4	Respect the area's natural drainage and take all appropriate measures to permit the normal flow of water.	This measure will maintain the natural flow to wetlands and ensure that wetland will not drying-out.
ES5	Comply with instructions on plans and specifications with respect to the area and location of the work as well as the volume of material excavated.	It will ensure that the impacted areas will be limited to those that were identified.
ES8	Avoid removing vegetation from slopes bordering roads or near watercourses. When building or improving a road that crosses a watercourse, preserve a 20 m strip of shrub vegetation on either side, hereafter called the "riparian strip."	
ES9	No ditches must be dug in the riparian strip on either side of a watercourse. Within the riparian strip, ditch water must be diverted toward a vegetated area, ideally a wetland. If necessary, build a settling pond outside the riparian strip to receive runoff and sediments. Pond dimensions will depend on the inflow and outflow volume.	It will prevent the migration and deposition of sediments in the riparian wetlands and it will limit the loss of superficies.
ES11	In sloped areas, use techniques such as the installation of trenches, retaining banks or diversion ditches perpendicular to the slope.	These measures will prevent the migration and deposition of sediments in the riparian wetlands and it will limit the loss of superficies.
ES14	Along steep slopes bordering rights-of-way, use sediment barriers at the foot of the embankment or install protective material (straw, wood chips or mats) directly on the slope to reduce the volume of sediments that are transported.	
ES23	Do not put the topsoil in a water-saturated area. Ideally, it should be used within 12 months of piling.	It will ensure that no sediment contamination will occur in wetlands.
Watercourse Crossings (WC)		
WC21	Do not block the flow of water and respect the slope, natural drainage of the soil and	This measure will maintain the natural flow to wetlands and ensure that wetland will not drying-out.

CODE	MEASURE	MITIGATION EFFECT
	direction of the watercourse when installing a culvert.	
Waste Management (WM)		
WM3	Do not dump any waste into aquatic environments, including waste from cutting vegetation or stripping the soil. All waste accidentally introduced into aquatic environments must be removed as quickly as possible.	This measure will prevent the contamination and the backfilling of wetlands.
WM5	If quantities are minimal, dry materials (concrete, asphalt, etc.) can be used as fill buried directly behind the protective work. Wood and plant debris can be buried in the bank directly above the protective work.	This measure will prevent the contamination and the backfilling of wetlands.
Hazardous Materials Management (HM)		
HM1	Implement a hazardous waste management plan in the event that fuel or other hazardous substances are spilled.	These measures will prevent the contamination of wetlands and water by hazardous substance. In case of an accidental spill, measures will prevent the spread of the contaminant in the environment and the restoration of the site.
HM3	Spill kits for recovering oil products and hazardous materials must be present on the worksite at all times.	
HM5	All accidental spills must be reported immediately to the person in charge of the emergency response plan, which will have been drawn up and approved before work start-up.	
HM6	If harmful substances are spilled, the responsible authority must be contacted.	
HM7	It is prohibited for any employee to dump any hazardous material in the environment or wastewater treatment system. This includes scrap and volatile materials, particularly mineral spirits and oil or paint thinners.	
HM9	If hazardous materials are spilled, the contaminated areas must be marked and the surface layer removed for disposal in accordance with regulations in effect in order to limit contamination of waterbodies by runoff. Contaminated areas must be backfilled and stabilized to permit revegetation.	
HM12	When a site is closed, ensure that all tires have been removed and properly disposed of.	
Drilling and Blasting (DB)		
DB9	No explosive must be used in or near water.	It will prevent the contamination of wetlands and water by hazardous substance.
Construction Equipment (CE)		
CE1	Store all equipment and machinery in areas specifically designed for this purpose, particularly parking, washing and maintenance areas. These zones must be located 60 m or more from watercourses and waterbodies.	These measures will prevent the contamination of wetlands and water by hazardous substance.

CODE	MEASURE	MITIGATION EFFECT
CE2	Washing of equipment in aquatic environments is prohibited.	
CE4	Construction equipment must be delivered to the site in good working order, without leaks and equipped with all emissions filters required to comply with emissions regulations and reduce noise disturbance. The equipment must be regularly inspected to detect any leaks or mechanical defects that could lead to fuel, lubricant or hazardous material spills.	
Rehabilitation (R)		
R1	Follow good practices presented in the rehabilitation plan.	These measures will enable the elaboration of a rehabilitation plan. If possible, wetland creation or restoration will be considered.
R2	Draw up a rehabilitation plan	
R3	Produce post-mining and post-rehabilitation monitoring reports.	

Specific Mitigation Measures

Table 7-79 presents the specific mitigation measures will be applied to limit loss of wetlands due to the Project activities.

Table 7-79 Specific Mitigation Measures for Wetlands

SPECIFIC MITIGATION MEASURES FOR WETLANDS	
Measure	**Mitigation Effect**
Stripping the entire area all at once rather than progressively whenever possible (e.g., during site preparation).	This measure will limit stress on the wetland. Also by stripping a given area all at once, it will limit further encroachment in wetlands than those that were anticipated. This measure will also reduce thr overall surface area of wetland destruction as a result of the Howse Project by promoting their development elsewhere. This measure can be assessed by measuring the surface area of the wetland that is successfully transplanted.
The top layer of the stripped organic matter (the 40-50 cm layer that includes the roots) should be preserved. To the extent possible, the organic matter will be excavated in blocks, without disturbing the various horizons. It will then be deposited in, for example, a disturbed area. The area selected will be an isolated depression (far from any watercourse, so as to avoid increasing suspended matter), which will promote revegetation and, eventually, the regeneration of a wetland.	This measure might recreate wetlands in areas outside Howse footprint. It will not mitigate the direct effect on wetlands, but rather compensate for the loss of wetlands caused by the Project. This measure will also reduce thr overall surface area of wetland destruction as a result of the Howse Project by promoting their development elsewhere. This measure can be assessed by measuring the surface area of the wetland that is successfully transplanted.
During the work on Burnetta Creek to limit erosion (riprap), specific measures will be taken to limit the effects on the adjacent wetland. If a road has to be built, it is recommended to do it during the winter season. In the event that no road is built and only a temporary access is necessary, a temporary protection mat will be used where machinery will operate.	It will limit its effect on the wetland. Working during winter will also ensure that the soil is stable. This measure will protect those portions of wetlands that are not directly affect (destroyed) by the Project footprint, but rather that may be disturbed by activities. This measure can be assessed by comparing the surface area of wetlands that will be destroyed VS the measuring the surface area of the wetland that is actually destroyed.

7.4.2.4 Residual Effects Significance Assessment

The overall methodological approach to assess the environmental effects is presented in Section 5. However, in order to apply this methodology to the wetland VC, it is essential to consider assessment criteria applicable specifically to this VC (Table 7-80).

The Howse Project is located in an area that has historically been continuously and significantly altered by human activities. Roads are already present in the area and mining exploration has already affected ecosystems within the footprint and its immediate area. However, wetlands in the vicinity of Howse Project showed few disturbance. Some wetlands will be affected by the roads system and the WMP that will be implemented. Local hydrology will also be modified and might effects on wetland but wetland's function will not be affected in totality. A drying-out does not mean the loss of the wetland, it means an ecosystem shift toward type characterized by soil less moisture regime. For many of them, the ecosystem types will remain a wetland one.

Wetland resilience to alteration is moderate considering the natural conditions that prevail in northern Canada. Vegetation growth is slow and modification in the hydrology might favour plant communities that are more adaptable and that can colonize more easily disturbed habitat.

Table 7-80 Assessment Criteria Applicable for Wetlands

TIMING		
Inconsequential timing	**Moderate timing**	**Unfavorable timing**
Timing of Howse activities are not expected to alter any essential wetlands functions.	Timing of Howse activities may alter some wetland functions, but will not have an adverse effect on other components, i.e. water quality, birds.	Timing of Howse activities may alter some key wetlands functions, i.e. hydrological (flood control, surface water detention) and ecological (breeding of bird species, fish habitat protection).
SPATIAL EXTENT		
Site specific	**Local**	**Regional**
Howse project footprint	LSA delineated in Section 6.7.10.1	Higher portion of the Howells River potentially disturbed by the Howse Project
DURATION		
Short	**Medium**	**Long**
Less than 12 months. Limited to the Construction and/or Decommissioning and Reclamation phase.	12-24 months. Extends beyond the Construction phase, but shorter than the lifespan of the Project.	More than 24 months Or long as the Project duration
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Applicable for temporary work sites or temporary stream disturbance	It persist after source of effect ceases, but its magnitude is significantly lower.	Persist after source of effect ceases. Applicable for activities generating long term or permanent effects such as wetland destruction/alteration, waste dump operation or pit operation.
MAGNITUDE		

Low	Moderate	High
The effects will occur only on the wetland or wetland's complex.	The effects will be felt on the wetlands located on the same stream and downstream.	The effects will be felt on the wetlands located in the watershed.
FREQUENCY		
Once	**Intermittent**	**Continual**
One time	Occasional or intermittent	Year round

Timing

Howse Project activities will occur throughout the year, but the stripping will mostly be carried out in winter. This timing will have a minimal effect on wetlands functions since it will not alter directly hydrological or ecological functions (Value of 2).

Spatial Extent

The effect of the Project on wetlands will be limited to the footprint with regard to the destruction. No wetland outside the footprint will be lost due to the project (value of 1). However, wetlands in the LSA might be affected by drying-out (Value of 2).

Duration

The loss of wetlands and the drying-out will last beyond the duration of the Project. Restoration during decommissioning might recreate wetland but they might not have the same ecological value than those that were lost due to the Project. However, there are similar wetlands locally and regionally and no unique type of wetland will be lost due to the Project (Value of 3).

Reversibility

The loss of wetlands is considered not reversible. As mentioned above, decommissioning might create new wetlands but they might not have the same ecological value (Value of 3).

Hydrological alteration is considered reversible. During decommissioning and reclamation phase, if the hydrology is restored to its pre-operation regime, wetlands that might have dry-out will be restored (Value of 1).

Magnitude

The magnitude is considered low for the loss of wetlands and localized drying-out. Its effect will only be felt on the wetlands or wetland complexes that will be directly affected (Value of 1).

Frequency

The frequency of loss of wetlands is intermittent since the site preparation will alter all the wetlands that will be affected by the Project and then will occur occasionally when the wasterock dump will be expanded (Value of 2). Dying-out is considered continual, since dewatering will occur throughout the year (Value of 3).

7.4.2.4.1 Significance

The overall residuals effect of the Howse Project on wetlands is expected to be non-significant, as calculated using the matrix presented in Figure 5-1. This value is representative of the low magnitude of the effects of the Project and the site-specific spatial extent. The primary threat to wetlands comes from the fact that the effect is non-reversible and the moderate sensitivity of the wetlands regarding the effect of the Project.

Likelihood

Likelihood determination is not needed as the effect was determined non-significant.

7.4.3 Caribou

Given the cultural importance of caribou for Aboriginal groups and its precarious status, this entire section is devoted to the species, and addresses both the migratory tundra and boreal forest ecotypes. To eliminate confusion, only the ecotype names used in Hummel and Ray (2008) will be used in this document. Those are the migratory tundra and the boreal forest ecotype. The migratory tundra ecotype is equivalent to other ecotype names such as tundra, migratory or barren-ground caribou. The boreal forest ecotype is equivalent to other ecotype names such as woodland, forest-dwelling or sedentary caribou.

Migratory Tundra

All migratory tundra caribou found in the vicinity of the Howse Project belong to the George River Caribou Herd (GRCH). The most recent census of this population was carried out in 2014, at which time the herd was estimated at 14,200 animals (GNL, 2014b), down from 27,600 in 2012 and 74,000 in 2010 (CARMA, 2013). In 2001, the size of the herd was estimated at 440,000 individuals (Couturier *et al.*, 2004), representing a 97% decline in one decade. Investigations into this rapid decline focus on the causes behind the high adult mortality rate and the low number of caribou surviving beyond six months of age. Currently, herd recovery is hampered in part by low recruitment: calves represent 7% of the population, whereas 15% is needed for herd recovery. Calving areas for the GRCH have recently (2010) been found to have migrated more than 230 km to the northeast from their original locations, which were located east of Schefferville. The provinces of Newfoundland and Labrador and Québec have initiated discussions on the development of a joint management plan in collaboration with all resource users, including Aboriginal authorities and organizations (GNL, 2014b).

The historical presence of the GRCH is confirmed in the LSA. Even if there were no caribou sightings in the LSA during the last five years, the Innu and Naskapi expect the caribou to return to the LSA after the actual decline in population and fear that the Project will modify caribou migrating routes (Volume 2 Supporting Study C). Moreover, migratory tundra caribou is an ecotype known to be sensitive to human disturbances such as mines (Weir *et al.* 2007; Boulanger *et al*., 2012), and habitat fragmentation. The Project activities can therefore be expected to disturb it. Census results, along with biological health indicators, population modelling projections and consultation with stakeholders, have prompted the Government of Newfoundland and Labrador to initiate a five-year caribou hunting ban for the herd (to 2016) (NLDEC, 2013a). The Québec government has also prohibited sport hunting of the animals starting in 2012, and for an indeterminate period (MFFP, 2014). For all those reasons, the migratory tundra caribou is selected as a VC.

Boreal Forest Ecotype

The population density of boreal forest caribou is low throughout its range (one to three individuals per 100 km^2). These animals occupy environments that are poorly suited to other cervids, probably to isolate themselves from these cervids and their predators (Courtois, 2003). They avoid environments that have been disturbed, either naturally (e.g., by fire) or anthropogenically. Population trends of the three ranges found in Labrador (Lac Joseph, Red Wine Mountain and Mealy Mountain) are decreasing (Environment Canada, 2012a). Consequently, the boreal forest caribou is designated as: Threatened under the SARA - Schedule 1 (NFL and Quebec); Threatened by the COSEWIC (NFL and Quebec); Threatened under the Endangered Species Act by the Province of Newfoundland and Labrador; Vulnerable under the Loi sur les espèces menacées ou vulnérables by the Province of Québec. Also, it was specifically highlighted as valued in the consultation process or in focus groups organized for the land-use and ATK study 15 times.

Even though boreal forest caribou is also of great interest, especially as it is legally protected at the provincial and federal levels, its presence in or close to the LSA seems highly improbable according to recent studies done over the last decade. The component boreal forest caribou will thus not be further assessed at the project level, but rather it will be assessed under the cumulative effects section below, as the railway and the proximity of old IOCC pits and dump sites may effect it. Most of the mitigation measures presented below will benefit to both caribou ecotypes.

7.4.3.1 Component Description

LSA, RSA and Temporal Boundaries

Migratory Tundra Ecotype

The GRCH undertake a large spring migration to reach traditional calving grounds[7] (Taillon, 2013). The first fall route starts at the George River and heads southeast toward Schefferville and Fermont. The second fall route comes from Caniapiscau, goes northeast and crosses the Howells River. Studies show that migratory tundra caribou can avoid mining infrastructure up to 14 km (Nellemann and Cameron, 1998; Wolfe *et al*., 2000; Cameron et *al*., 2005; Boulanger *et al*., 2012) and that their perceptive abilities reach 15 km (Mayor et al., 2009). Therefore, a 15 km radius zone surrounding the Howse Project area footprint is defined as the LSA for the migratory tundra ecotype.

Calving grounds, defined as the areas where females give birth, are usually occupied between late May and early July. Calving grounds are semi-permanent; they exist in the same general areas for centuries (Noltz *et al*., 2013). Generally, female of the GRCH foal in the high tundra plateau found in the eastern part of the Québec-Labrador peninsula (Taillon, 2013). Traditional and annual (2006-2010) calving grounds for the GRCH are located several hundred kilometres outside the LSA (Figure 7-34).

Much less clearly defined than the calving areas, caribou wintering grounds are thought to have shifted toward eastern Labrador early in the 2000s (Schmelzer and Otto, 2003). The caribou’s preferred migration routes are high ridges and open black spruce-lichen forests. They have adapted to the former mining area by using old mining roads when they happen to head in the same direction as the migration route (Brown, 2005).

Nearly three quarters (71%) of the LSA is suitable caribou habitat (see Table 7-81). However, these habitats are also ubiquitous throughout Labrador and therefore are not limiting to caribou.

---

[7] Traditional calving grounds refer to cumulative area used for calving by the herd

Table 7-81 Composition of suitable caribou habitat within the LSA

		AREA (KM^2)	PERCENTAGE	SUM (%)
Bryoids	Bryoids	10.57	14.95	14.95
Shrubs	Shrub tall	0.75	1.06	29.36
	Shrub low	19.92	28.18	
	Wetland-shrub	0.08	0.12	
Trees	Wetland-herb	0.42	0.6	26.83
	Wetland-treed	0.03	0.05	
	Coniferous-dense	1.94	2.74	
	Coniferous-sparse	16.57	23.44	

In order to encompass all past, present and future effects of the Howse Project and associated activities on the GRCH, we define the RSA as the entire herd range; that is, the northeastern part of Labrador and Québec. This area will encompass all possible effects of the Howse Project on the GRCH, from the individual, to the herd-scale.

Caribou will continue to maintain their distance from anthropogenically-altered landscapes for the duration of the disturbance. As such, the temporal boundary for this component is the duration of the project. In addition, it is noted that given the sensitive nature of the calving season, the period May-June is of particular importance.

Boreal Forest Ecotype

Woodland caribou have been shown to react to all stages of mine development by exhibiting avoidance behavior for 4 km from a mine during all seasons (Weir et al., 2007). Although caribou can cover up to 80 km annually, values around 10 and 40 km are more common (Edwards and Ritcey, 1959; Fuller and Keith, 1981; Paré and Huot, 1985; Cummings and Beange, 1987; Edmonds, 1988; Seip, 1992; Cichowski, 1993; Paré and Brassard, 1994; Environment Canada, 2012a). A radius of 15 km centered on Howse Project is chosen as the LSA for boreal forest caribou, an ecotype sensitive to human activities (St-Laurent *et al.*, 2012).

LEGEND

Migratory Tundra Ecotype

George River Caribou Herd
- George River Herd
- Traditional Calving Grounds
- Annual Calving Grounds (2006-2010)

Leaf River Caribou Herd
- Traditional Calving Grounds
- Annual Calving Grounds (2006-2010)

Boreal Forest Ecotype
- Lac Joseph Caribou Herd
- Red Wine Caribou Herd
- Quebec Caribou Herd

Caribou Movement
- Fall
- Spring

- Local Study Area

Basemap
- Town
- Howse Deposit
- Railway
- Watercourse
- Water Body
- Boundary

FILE, PROJECT, DATE, AUTHOR:
GH-0573 , PR185-19-14, 2016-01-27, jtremblay

N

0 50 100 150 200 250
Kilometers

UTM 19N NAD 83

SCALE: 1:6 000 000

SOURCES:

Basemap
Atlas of North America, 1:7,500,000

Woodland Caribou
Taillon (2012), Figure 6
Environment canada (2012), Figure 2
Clément (2009) Figures 10-11

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Woodland Caribou

Howse Minerals Limited

GroupeHemispheres
5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 7-34

Existing Literature

Woodland Caribou Surveys in the Project LSA

The component description is based on a scientific literature review, ATK, and four spring surveys of caribou conducted in 2009, 2010, 2011 and 2012 in the region of Schefferville. These studies are emphatic that no caribou is present in the LSA.

The Howse Project caribou LSA (for both Boreal forest and Migratory tundra ecotypes) is located within an area surveyed by NML and LIM between 2009 and 2012. During these years, aerial spring surveys (one pilot and three observers) covered a 50-km radius centered on Schefferville (D'Astous and Trimper, 2009), while during the subsequent years a 20-km radius was flown (D'Astous and Trimper, 2010a; Groupe Hémisphères, 2011b and 2012a). In 2009, three sightings of caribou (total seven individuals) were sighted and no sightings in 2010, 2011 or 2012.

The 2009 body measurements indicated that the two caribou observed in the LSA probably belonged to the migratory tundra ecotype (D'Astous and Trimper, 2009). Moreover, the only caribou captured and collared in 2009 had joined the GRCH (D'Astous and Trimper, 2010a). Based on the absence of caribou sightings in 2012, and based on the 2009 (D'Astous and Trimper, 2009), 2010 (D'Astous and Trimper, 2010b), 2011 (Groupe Hémisphères, 2011b) and 2012 (Groupe Hémisphères, 2012a) data compiled to date, there is no evidence that the LSA has been used by Boreal forest ecotype caribou during the pre-calving period in recent years.

D'Astous and Trimper (2009) collected caribou tissue samples for genetic analysis. Samples of ear dermis were collected from the adult female collared by the field team and an adult female recently killed by a wolf. The samples could not be assigned to any of the ecotypes or herds in the reference collection. The caribou sampled were genetically similar, suggesting that they belonged to the same ecotype. As a result of the extensive variability observed in the genetic testing, attributable to gene flow between the different migratory herds of caribou in the Québec–Labrador Peninsula, a clear assignment of the sampled individuals to a known reference herd based solely on genetics was not possible at that time (D'Astous and Trimper, 2011).

While conducting a bird survey in July 2009, AECOM observed recent caribou scat on a service road in the northern part of the Howse Property (AECOM, 2009).

According to the director of Caribou Ungava (Côté 2014, *personal communication*), no radio-collared individual of the GRCH are present in the LSA.

In Labrador, none of the three currently-recognized herds has a range that encompasses any part of the Project's LSA (Schmelzer *et al.*, 2004). The closest herd, the Lac Joseph herd, has a range of 66,000 km^2 was recorded about 50 km southeast of Schefferville in the 1980s (Schmelzer *et al.*, 2004). The herd spans from south of the Trans-Labrador Highway between Winokapau Lake in the east and Wabush to the west, south to the Québec/Labrador border (Noltz *et al*., 2013). A population estimate based on a large-scale aerial census conducted in 2009 concluded that the Lac Joseph herd consisted of 1,047 individuals (Schmelzer, 2011). According to Environment Canada (2012), none of the boreal forest caribou ranges overlap the Project's LSA. The Government of Québec (ERCFQ, 2013) also shows this caribou's distribution to be clearly outside the Project's LSA.

According to RRCLS (1994), the McFadyen River herd had a range that encompassed the Project's LSA. There is, however, no direct evidence suggesting that the caribou associated with the McFadyen River form a distinct population, and some have suggested that they belong to the Lac Joseph herd (Schmelzer *et al*., 2004). According to Environment Canada (2008), the McFadyen River population was associated with the Lac Joseph population but no longer exists.

Further to their absence, the Project's LSA does not have high potential for boreal forest caribou. A high proportion of the area is covered by subarctic tundra, and part of it has been disturbed by old and ongoing mining operations, including a road used by local residents (Volume 2 Supporting Study C) and TSMC's ELAIOM project facilities and operations. Boreal forest caribou are highly sensitive to anthropogenic disturbance. They avoid roads and areas used by humans (St-Laurent *et al*., 2012; Dyer *et al*., 2001). One important factor limiting their presence in the study area would therefore be past and present disturbances, including mining activities and snowmobile use in winter. Food availability would be of secondary importance for their presence in the LSA, since food is generally abundant throughout the herd's range (Courtois, 2003).

Aboriginal Traditional Knowledge and Subsistence Hunting

Caribou harvesting is important for the Naskapi and the Innu in the LSA. The location of the hunting ground depends on caribou movements. A 2006 survey of Naskapi land and resource use in the Howells River Valley showed extensive caribou hunting. The densest concentration of caribou hunting was recorded along the Ridge between the Howells River Valley and the Swampy Bay River basin, between the DSO2 and DSO4 areas, mainly throughout the historic mining road network, which encompass the Project's LSA. A secondary area of concentration is the Howells River basin between Kivivic and Stakit lakes (Weiler, 2009). Caribou were found in both areas during their fall migration. Most of the hunting activity during that period occurs along the Ridge, as harvesting is most effective when caribou appear in large numbers along the fairly barren hilltops, where they can be easily spotted. More recent information (2006-2009) indicated that caribou are now extremely rare in the region, if not absent (Clément, 2009; Weiler, 2009).

The ATK survey conducted in fall 2014 confirmed that caribou has not been seen in the region by the Innu and the Naskapi in the last five years (Volume 2 Supporting Study C). Prior to this, however, caribou coming from the southwest used to stop near Kauteitnat (Irony Mountain) during their migration. This prominent land feature was also used as an observatory point for caribou hunting.

The GNL initiated a five-year ban in 2013 on all caribou hunting in Labrador. A public notice addressed to the IN dated November 5, 2014, asked members to lower hunting pressure on the GRCH (Volume 1 Appendix XXII).

The Ungava Peninsula Caribou Aboriginal Round Table was created by Aboriginal governments and Nations of Québec and Labrador to preserve caribou and the deep relationship that Aboriginal people have long held with it. The Round Table has also been created to respond to the decline of the migratory caribou and will strive to develop a conservation and management system in a way that respects all cultures and traditions.

Caribou Ungava is a research program led by Université Laval to advance research on caribou and on the effects of mining activities on the George River herd decline, and on other factors that may play a role in this decline or in the change of migratory paths, for example. Within the framework of the program, researchers will involve the concerned Aboriginal communities in its research initiatives by considering their views, their traditional indigenous knowledge in the studies and by involving them in the research activities held on their traditional territories. TSMC is the largest private contributor to this program.

Data Gaps

Largely as a result of the declining populations and local harvesting practices, the distribution and population dynamics of both caribou ecotypes are well understood and monitored in Labrador and Québec.

7.4.3.2 Effects Assessment

Literature review and Current Studies Data Used to Assess the Potential Effect

Studies of caribou responses to all types of anthropogenic disturbances are exhaustive across North America (for example, Nelleman and Cameron, 1998; Dyer *et al*., 2001; 2002; Mahoney and Schaefer, 2002; Courtois *et al*., 2007; Vistnes and Nellemann, 2008). Studies of habitat destruction (complete loss or fragmentation) or alteration (loss or fragmentation) include effects of mines, noise, light on adults and calves alike.

Noise and light effects on wildlife are a common concern but they are difficult to confirm in the wild, much less quantify. Noise can effectively cause a disturbance, which is a form of harassment. This harassment effect can range from being threatening to an animal to a habituation.

Interaction of the Project with Caribou and Potential Effects

Site Construction Phase

The Howse Project activities during the site Construction phase will cover a limited area and will be carried out over a short period of time (10 months). Physical habitat loss will occur due to vegetation stripping, road work and pit development. In addition, roads may cause habitat fragmentation. However, the Howse Project is expected to generate only 1.2 km of new road, and that on disturbed soil. In total, it is expected that up to 1.2 km^2 of feeding habitats will be destroyed during the site Construction phase. Despite this physical loss of habitat, caribou food availability is not compromised, as caribou populations are small and forage is plentiful in surrounding areas. We therefore expect that caribou behavior, rather than health or survival directly, will be impacted by the Construction phase of the Howse Project as a result of habitat alteration.

Caribou are sensitive to anthropogenic disturbances (Nelleman and Cameron, 1998; Dyer *et al*., 2001; 2002; Mahoney and Schaefer, 2002; Courtois *et al*., 2007; Vistnes and Nellemann, 2008). Noise and light emission can result in behavioral and physiological responses, such as avoidance of an area, even if it is appropriate for foraging. Pollution such as de-icing salt, dust and construction debris also represents a potential effect on area frequentation, but little is known on this matter (Environment Canada, 2012a).The disturbance generated by noise could result in the modification of the migration route of the GRCH. A study of the effects of a gold mine in insular Newfoundland showed that caribou numbers and group size decreased within a 6-km radius of the mine (Weir *et al.* 2007). Even though the study addressed boreal forest caribou, it illustrates caribou avoidance of activities. The potential effects of noise disturbance on the seasonal movements and distribution of migratory tundra caribou are difficult to quantify and/or predict. Their movements and distribution (i.e. migration patterns) tend to vary in accordance with the size of the population (Bergerud *et al.* 1984) and its use of wintering areas (Schmelzer and Otto, 2003). Such behavioral reactions to nuisances (noise, vibration, light) may eventually increase caribou travel time by modifying the usual migration route (avoidance), thus, in extreme cases reducing feeding and breeding time (Environment Canada 2012a). The general health of individuals will in turn be affected, increasing vulnerability to predation. This may negatively affect the caribou population due to higher mortality rates and lower recruitment (St-Laurent *et al*., 2012). Mortality could also occur through collisions with vehicles. However, road mortality is not seen as a likely threat (Environment Canada, 2012a).

- ➔ The potential effects associated with the project activities during the site Construction phase is anthropogenic disturbance and alteration of habitat (physical and functional).

The nature of the effect is indirect and the effect is adverse.

Operation Phase

The following activities will take place at existing DSO3 facilities that will be in operation in 2016 and are not expected to interact with caribou:

- solid waste disposal;
- hazardous waste management;
- explosives waste management; and
- treatment of sanitary wastewater.

No additional loss of habitat or disturbance is therefore expected at the DSO3 complex. However, increased traffic due to additional waste generated by the Howse Project is considered under the "Transportation of ore and traffic" activity.

Potential interaction

- removal and storage of remaining overburden and topsoil;
- blasting and ore extraction;
- mineral processing;
- dewatering;
- operation of waste rock dumps;
- transportation of ore and traffic;
- ongoing site restoration; and
- Lighting of facilities to permit nighttime work.

In total, up to 1.2 km^2 of caribou feeding habitat will be destroyed or severely disturbed during the operation phase. Such habitats are common, both locally and regionally. Ongoing site restoration should allow the recovery of some habitat loss. The habitat loss will not affect caribou during the Project life since the entire LSA will be avoided due to the overall project disturbance. More specifically, noise and vibration disturbance will be generated by:

- diesel generators used continually for pit dewatering and mineral processing;
- blasting and ore extraction;
- Mineral processing (crusher will generate light and noise);
- transportation of ore and traffic.

The same effects assessed for the site Construction phase will also occur during the operation phase, but for a longer period of time, i.e. 12 years. The magnitude of the disturbance is also expected to be greater as periodic blasting (once every 7 days) will be required for ore extraction.

➔ The potential effects associated with the Project activities during the operation phase is anthropogenic disturbance and loss of habitat (physical and functional).

The nature of the effect is indirect and adverse.

<u>Decommissioning and Reclamation Phase</u>

All project activities have an interaction with caribou during the decommissioning and reclamation phase.

Potential interaction

- demobilization of Howse facilities and heavy machinery;

- transportation and traffic;
- final site-restoration.

The demobilization of the Howse facilities may result in less disturbance caused by mining activities, but other important mining activities will nonetheless occur nearby at DSO3 and DSO4. The Howse haul road will not be decommissioned, but the waste rock dumps will be stabilized and revegetated. The potential caribou habitat that will thus be created will have a limited area and will be common both locally and regionally.

➔ The potential effects associated with the project activities during the decommissioning and reclamation phase is anthropogenic disturbance.

The nature of the effect is indirect and adverse.

7.4.3.3 Mitigation Measures

Standard Mitigation Measures

Table 7-82 presents the standard mitigation measures that will be applied during all project phases for caribou.

Table 7-82 Standard Mitigation Measures for Caribou

CODE	MEASURE	MITIGATION EFFECT
Tree removal and timber management (TM)		
TM1	Comply with the Forest Act and all related regulations, particularly the Regulation respecting standards of forest management for forests in the domain of the State and the Forest Protection Regulation. Take the necessary measures to ensure that tree removal complies with the stipulated requirements.	Respectful timber management will minimize damage to caribou habitat and facilitate the restoration process. In turn, this will allow more effective restoration of caribou habitat.
Drilling and Blasting (DB)		
DB10	Blasting must be suspended in certain circumstances to avoid excessive disturbance of wildlife.	Limited blasting will diminish caribou perception of the disturbance in the same proportion as the blasting is reduced.
Construction Equipment (CE)		
CE7	Equipment and vehicles must yield to passing animals.	Given the very small population size of the GRCH and the lack of any caribou sightings in the last 5 years in the vicinity of the LSA, the mitigation effects of safe driving practices will effectively reduce the risk of collision to virtually non-existent. Further, the natural sensitivity of this species to noise will assist in reducing the potential encounters with equipment.
CE8	Install appropriate road signs and follow speed limits in order to minimize accidents and disturbance to the environment.	
CE13	Respect speed limits and all traffic regulations. Install signs warning drivers of the presence of animals along project roads and railways.	
Rehabilitation (R)		
R2	Draw up a rehabilitation plan	This will assist in caribou behavior returning to pre-Howse conditions following a rehabilitation plan. Studies show that caribou behavior may

CODE	MEASURE	MITIGATION EFFECT
		display a lag of up to 2 years to return to their usual activities following a mine closure, but if appropriate foraging habitat exists, caribou will use it.

The standard mitigation measures will ensure that, during normal work activities, disturbance is reduced to a minimum, land clearing will be restricted to the necessary work areas, and wildlife harassment is avoided. Specific mitigation measures will be adopted to further reduce anthropogenic disturbance in case of caribou encounters.

Further, the Howse Mining Project will have limited effect on ambient light levels since it will not include the construction of new power lines (I.e. Howse will not have permanent light fixtures), most (operations) activities at the site will be during the day time and limited mining activities will occur during the winter months, when the nights are longer and there is snow on the ground which reflects light (artificial or natural).

Specific Mitigation Measures

Table 7-83 present all specific mitigation measures applied to reduce the significance of the effects on caribou.

Table 7-83 Specific Mitigation Measures for Caribou

SPECIFIC MITIGATION MEASURES FOR CARIBOU	
Measure	**Mitigation Effect**
Where possible, operation activities will avoid areas of wildlife concentration, as traffic would disturb wildlife during critical periods.	This specific measure will have a minor mitigation effect on caribou, as they are not expected to frequent the Howse footprint for the duration of the project, and have not been observed in the area in over 5 years. As such, areas of high wildlife concentrations are not identified. It is noted, however, that critical periods include the spring season when animals need to forage to replenish calories lost during winter and during the fall rut, when calories are accumulated in preparation for winter.
Under an agreement with the Ungava project and CARMA, TSMC's Environmental Specialist / Permit Manager will be notified when migratory tundra caribou, which are monitored via satellite collars, come within 100 km of the Howse Project. Upon receipt of such a notice, operations will continue with caution. If data from the radio collars indicate that some of the caribou have moved to within 20 km of the Howse Project, TSMC will institute surveys within that radius to monitor their movements in greater detail.	This measure will allow HML to practice adaptive management of the caribou resource. Since several hundred GRCH animals are currently collared, this data source will provide HML with accurate tools to protect caribou from the Howse Project site.
Activities will cease if caribou are seen within 5 km of an active pit or the processing complex.	This distance is in accordance with the range of disturbance affecting caribou that is presented for the site Construction phase. This measure will therefore minimize any project disturbance during all project phases. Scientific references and useful details on caribou disturbance are presented above in the effect assessment section.
Whenever activity ceases pursuant to the foregoing, TSMC will contact the Wildlife Division of the NLDEC to discuss any further steps to be taken.	This measure will allow the proponent to coordinate its caribou conservation activities with the government. It will also allow the NLDEC to warn other resource

SPECIFIC MITIGATION MEASURES FOR CARIBOU	
	extracting companies working in the same area to adopt a similar mitigation strategy.
Work activities will be re-scheduled where necessary to avoid wildlife encounters.	This will minimize disturbance of caribou.
Equipment and vehicles will yield the right-of-way to wildlife.	
Firearms are prohibited in the workers' camp, except for two that may be used by security personnel in the case of an emergency. These measures will prevent caribou hunting by workers	This measure will minimize caribou mortality.

7.4.3.4 Residual Effects Significance Assessment

The overall methodological approach to assess the environmental effects is presented in Section 5. However, in order to apply this methodology to the caribou VC, it is essential to consider assessment criteria applicable specifically to this VC (Table 7-84).

The Howse Project is located in an area that has historically been continuously and significantly altered by human activities. Within this context of a pre-established mining complex, the Howse footprint is not expected to cause significant detrimental additions to this unfavorable ecological context. The GRCH has experienced significant declines over the last several decades, thereby producing a precarious ecological context for the GRCH. However, caribou are known to be resilient to disturbances caused by mining infrastructures (i.e. Weir et al., 2007), and have shown plasticity in their adaptability to anthropogenically altered landscapes. It is expected that following a site restauration program, the ecological context of the GRCH will not be altered by the Howse Project.

Table 7-84 Assessment Criteria Applicable to the GRCH

TIMING		
Inconsequential timing	**Moderate timing**	**Unfavorable timing**
Timing of predicted Howse activities are not expected to affect any sensitive activities in the caribou life cycle.	Timing of predicted Howse activities may affect some caribou activities, i.e.: winter forage availability migration routes.	Timing of predicted Howse activities may affect some key caribou activities, i.e.: the calving period.
SPATIAL EXTENT		
Site specific	**Local**	**Regional**
Effects are limited to the footprint of the project.	Effects extend beyond the footprint, but do not extend outside the LSA. Further, a subsection of caribou habitat will be altered.	The effect of the Howse Project will affect caribou in substantial part or the entire RSA.
DURATION		
Short	**Medium**	**Long**
The effect of the Howse Project on the GRCH will last less than 12 months and will not cause changes to the GRCH	The effect of the Howse Project on the GRCH will last between 12 or 24 months corresponding to one (maximum of two) caribou annual migration Extends beyond the Construction phase, but shorter than the lifespan of the Project.	Longer than 24 months, possibly as long as the project duration. The Howse Project will likely cause long-term demographic changes to the GRCH.

REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
The GRCH is expected to return to their pre-Howse population status and distribution	Effect on caribou will persist after the decommissioning and reclamation phase but the GRCH is expected to largely return to their pre-Howse status.	GRCH will be permanently altered by the Howse Project.
MAGNITUDE		
Low	**Moderate**	**High**
Effect will be at the individual level	Effects will be felt on a subsection of the GRCH	Effects will be on the entire GRCH
FREQUENCY		
Once	**Intermittent**	**Continual**
The disturbance will occur once	The disturbance will be occasional, such as blasting event.	The disturbance will be year round.

Timing

Howse Project activities will occur throughout the year, but rarely in winter. In particular, caribou will exhibit deterrence behavior related to noise and light from the Project. Since the noise and light produced by the Howse Project activities will be produced continuously, the timing of the disturbance may occur during the calving period, and so the effect is high (Value of 3).

Spatial Extent

Caribou will likely alter their behavior as a direct result of the Howse Project to the extent of the LSA, as the radius for this zone (15 km) has been shown to be the limit of caribou perception (Mayor et al., 2009). This effect will likely not effect forage availability as the surrounding favorable ecosystems are numerous, undisturbed, and appropriate for foraging. Calving areas that exist beyond the LSA (but within the RSA) fall outside the area of caribou perception and so it is not expected that these will be impacted directly by Howse activities. Further, the display of plasticity in the annual location of calving areas prohibits the ability to predict these changes. As such, the spatial effect of the Howse Project is expected to extend beyond the footprint, but do not extend outside the LSA (Value of 2).

Duration

The GRCH is expected to interact with the Howse Project for the entire duration of the project, and maybe for a few years following the mine closure (Weir et al., 2007). However, the Howse Project in itself is not expected to cause long-term demographic changes to the herd because to date, this region has not been appropriate caribou habitat for several caribou generations and is expected to last one more generation. None the less, we expect that the effect of the Howse Project on the GRCH will be at least as long as there are human activities in the Howse Project vicinity (Value of 3).

Reversibility

Studies have shown that although caribou may alter their behavior in the vicinity of a mine project for the duration of the project (and sometimes continue for up to two years following the end of the project), the effect is fully reversible (Mahoney and Schaefer, 2002) (Value of 1).

Magnitude

Possible interactions between the Howse Project and caribou can cause behavioral changes and site avoidance, which can in turn lead to delayed effects, such as changes to predator-prey interactions, leading to population-wide effects. These effects are impossible to predict, much less quantify. We therefore expect that the effect of the Howse Project on caribou will be at the individual level. (Value of 1).

Frequency

The frequency of noise and light disturbance on caribou is expected to be continuous, although artificial light disturbance will only occur at night. (Value of 3).

7.4.3.4.1 Significance

The residual effects of the Howse Project on caribou is expected to be non-significant (value of 13). This value is representative of the low magnitude of the effects of the Project as well as the expected reversibility of the effects on caribou. The primary threat to caribou following mitigation measures is habitat alteration, specifically related to the duration and frequency of noise and light disturbance, which can be perceived by caribou and result in behavioral reactions.

Likelihood

The likelihood of Howse having an effect on the GRCH herd is **unlikely** because no caribou have been seen in the vicinity of the Howse Project in the last 5 years and calving grounds have shifted away from the Howse Project area.

7.4.4 Other Large Mammals

7.4.4.1 Component Description

Moose (*Alces alces*)

Moose are generally found in mixed coniferous and deciduous forests, where they seek shelter and food in closed-canopy and conifer-dominated areas, particularly in stands of balsam fir, white and yellow birch. Most of the Project area has a low potential for moose habitat because of the high proportion of open spaces; nearly 60% of the LSA consists of arctic tundra and open-forest habitats (Volume 2 Supporting Study K). However, some of the lower elevation ecosystems, namely the riparian fen (MSF15) along Goodream Creek and herb fen (MSF12), show good potential for moose feeding habitats, and they have been known to travel as far north as the Schefferville region in spring and summer (Brown, 2005).

There is no moose management by the GNL within >200 km of the Howse Project, perhaps indicating that this species is not significant in the Howse Project area. In addition to the suboptimal moose habitat in the Howse Project region, moose also exhibit difficulty in traveling in snow depths of >60 cm (Dodds, 1974; Dussault et al., 2005; Newbury et al., 2007) which is problematic given the nearly 400 cm of annual snowfall reported in the Schefferville area.

The component "Other Large Mammals" was mentioned three times during consultations with Aboriginal groups in the fall of 2014. Concerns raised included availability for consumption and contamination. However, the concerns were raised in tandem with discussions on fish and more commonly-hunted species such as waterfowl. Given that moose is uncommon in the region, that it is not a species at risk and that it is not likely to frequent the area due to lack of appropriate habitat, moose are not retained as a VC.

Black Bears (*Ursus americanus*)

In Labrador, black bears average 200-300 lbs (males) and 110-180 lbs (females) (NLDEC, 2015) and use a variety of habitats that are known to be present in the vicinity of the Project. Bear movement patterns are plastic and adaptable to disturbance, including anthropogenic disturbance. As such, in environments with high human activity such as in the vicinity of the Howse Project, black bears are more active at night and during crepuscular time periods (Lewis and Rachlow, 2011). Their adaptability to habitat disturbance renders the effects of the Project less detrimental to their population. As such, they are labelled here as a resilient species.

Black bears are present in the vicinity of the Howse Project and the Howells River Valley (more than 20km from the Howse Project site) is thought to support a fairly dense population of black bears. In fact, it is in that area that black bears are hunted by the Naskapis. Given their prolific nature throughout the Schefferville area, the known lack of hunting in the vicinity of the Howse Project, the fact that they are not an at-risk species, black bears are not considered as a VC. However, a bear management control plan, as presented in the DSO EPP (Volume 1 Appendix Ia), will be applied for the Howse Project.

LSA, RSA and Temporal Boundaries

Neither species is particularly sensitive to anthropogenic disturbance. We therefore define the LSA for other large mammals as the Howse Project footprint.

Black bear home ranges average up to 850 km^2 (males) and 250 km^2 (females) (NLDEC, 2015) representing circular regions with a radius if 16 km and 9 km, respectively. By contrast, moose home ranges are up to 13 km^2 within Gros Morne National Park on the island of Newfoundland. Although Labrador home ranges are likely much larger due to the lower density of optimal habitat, it is accepted here that moose home ranges are considerable smaller than bear's. The RSA consists of a 20 km radius zone surrounding the Howse Project footprint, to include the home ranges of both species.

The temporal boundary for the potential effects of the Howse Project on other large mammals is defined as the duration of the three phases of the project.

Existing Literature

The component description is based on a literature review, ATK, and four spring surveys of caribou and other wildlife, conducted between 2009 and 2012 in the region of Schefferville.

<u>Moose</u>

Several moose sightings were recorded during the caribou surveys carried out from 2009 to 2012. In 2009, one adult male was seen east of Menihek Lakes and four tracks were recorded southeast of Menihek Lakes (D'Astous and Trimper, 2009). In 2010, one adult female moose and the tracks of two other moose were identified (D'Astous and Trimper, 2010b). They were not located close to the Project LSA. There were no moose or moose track sightings in 2011 (Groupe Hémisphères, 2011b) or 2012 (Groupe Hémisphères, 2012a).

<u>Black bear</u>

Black Bears were recorded during the caribou surveys carried out from 2009 to 2012. Several Black Bears were sighted in 2009, none in 2010, one south of the study area in 2011, and none in 2012 (D'Astous and Trimper, 2009; D'Astous and Trimper, 2010b; Groupe Hémisphères, 2011b; Groupe Hémisphères, 2012a). Several bears are also seen daily at the TSMC DSO site (camp, complex area and landfill) (TSMC 2015, pers. comm).

Data Gaps

Since data on species in Labrador is primarily collected to provide information on populations that are harvested, and harvest rates are comparatively low in the Howse Project area (there is no moose management areas within the RSA), very little literature exists specific to these species in western Labrador.

There are two black bear management areas in Labrador and the study area falls within the George River Management Zone. Rather, habitat and population density values exist for more southern eastern regions in Labrador. The density of large mammals in the LSA is not well known. However, their preferred habitats are well documented in the literature, and potentially-suitable habitats are scarce in the LSA. Effects Assessment

Aboriginal Traditional Knowledge and Subsistence Hunting

Black bears and moose are harvested by the Naskapi, chiefly along the Howells River Valley for black bears and east of the valley for moose (Weiler, 2009). Between 1989 and 1993, only one moose was killed by Naskapi hunters (Tecsult Foresterie Inc., 2000), not necessarily in the vicinity of the Project. The Innu are familiar with the black bear, but say that although black bears abound near the Schefferville landfill, they are not harvested because of their eating habits. The Innu are also not keen on hunting moose (Clément, 2009; Volume 2 Supporting Study C).

7.4.5 Furbearers, Small Mammals and Micromammals

No new studies were performed on furbearers, small mammals and micromammals for this EIS. The component description is based solely on a literature review and ATK. However, several studies were done for this group of species in the context of other mining projects located in the vicinity of the Howse Project footprint. Some of these studies covered the Howse Project LSA.

7.4.5.1 Component Description

Furbearers and Small Mammals

Generally, the likelihood of finding furbearers and small mammal species in the LSA is low, since the habitats are not suitable. Several of those species are associated with wetlands or riparian habitats, which are rare within the LSA.

The mitigation measures presented for wetlands will ensure that the species do not decline locally. Also, hunting and trapping does not seem to be an important activity in the LSA. Furbearers and small mammals are not considered as a VC.

Species at Risk

A single species at risk, the Wolverine, may be present in the area; it is designated as: Endangered under the SARA - Schedule 1 (NFL and Quebec); Endangered under the Endangered Species Act by the Province of Newfoundland and Labrador; threatened under the Loi sur les espèces menacées ou vulnérables by the Province of Quebec. However, it may have completely disappeared. Its primary source of food, caribou, has been evaluated and specific measures will be implemented to ensure its protection.

A conversation between the proponent and the GNL in June 2015 as well conversations between CEAA and the proponent concurred with the findings that the wolverine is most likely non-existent in the area and would not necessitate further assessment for the Howse Project EIS.

Micromammals

Micromammals are not considered as a VC. Surveys carried out nearby showed that the population density is low. Few species are present in the LSA, and no species at risk were found in the LSA or its vicinity. Furthermore, this is not a significant species group for the First Nations.

The term micromammal refers to terrestrial mammals of a very small size. These animals play an important ecological role, being one of the first links in the food chain of carnivorous mammals and birds of prey.

Micromammals include several taxonomic groups, such as rodents (mice and voles) and insectivores (shrews and moles) (Desrosiers *et al*., 2002). In general, they are active night and day, all year long. In winter, they rarely come out into the open, moving through tunnels that they dig under the snow to protect themselves from predators.

LSA, RSA and Temporal Boundaries

Furbearers and Small Mammals

The LSA for furbearers and small mammals consists of the Howse Project footprint. It corresponds to the area that will likely be directly affected by disturbances associated with Project activities. The RSA consists of a 5-km radius zone surrounding the Howse Project footprint, as it is unlikely that the Project will affect furbearers living more than 5 km from the Howse Project.

Micromammals

The LSA for micromammals consists of the Howse Project footprint. It corresponds to areas that will likely be directly affected by disturbances associated with Project activities. There is no need to define a RSA, as micromammals have a home range of less than 5 ha (Desrosiers *et al*., 2002).

Existing Literature

Furbearers and small mammals

The species of furbearers and small mammals observed by Brown (2005) along the Howells River from May to October during the 1983–2002 period are listed in Table 7-85 along with other species potentially present in the area. Species recorded at the DSO installations are also noted in Table 7-85 (TSMC 2015, pers. comm.).

Table 7-85 Furbearer and Small Mammal Species Potentially Present or Observed in the Howells River Valley

SPECIES		OBSERVED	HABITAT DESCRIPTION
ENGLISH NAME	LATIN NAME		
American Beaver	*Castor canadensis*	X	Wetlands and riparian environments
American Marten	*Martes americana*		Large coniferous forests
American Mink	*Mustela vison*	X	Forests and the shrub-covered banks of watercourses and lakes
Arctic Fox	*Alopex lagopus*	√	Various habitats where they can find their prey (north of the tree line) Observed during winter at DSO installations
Arctic Hare	*Lepus arcticus*		Tundra and rocky slopes
Canada Lynx	*Lynx canadensis*		Boreal forest, swampy areas, and brush, where hares (its main prey) are abundant
Ermine	*Mustela erminea*	X	Wide variety of habitats, feeding essentially on hares, small mammals and birds
Grey Wolf	*Canis lupus*	X √	The availability of prey is more important than the types of habitat present Observed during winter at DSO installations

SPECIES		OBSERVED	HABITAT DESCRIPTION
ENGLISH NAME	LATIN NAME		
Common Muskrat	*Ondatra zibethicus*	X	Bogs, ponds, rivers, streams and lakes
Least Weasel	*Mustela nivlalis*		Dry uplands and/or riparian zones
North American Porcupine	*Erethizon dorsatum*		Mature forests, stands of conifers, rocky slopes and talus deposits
Northern Flying Squirrel	*Glaucomys sabrinus*		Coniferous and mixed forests, often nesting close to watercourses
Northern River Otter	*Lontra canadensis*	X	Otters are entirely dependent on aquatic habitats and fish
Red Fox	*Vulpes vulpes*	X √	Wide variety of habitats; cannot be associated with a specific terrestrial ecosystem Observed mostly during winter at DSO installations
Red Squirrel	*Tamiasciurus hudsonicus*	X	Coniferous and mixed forests
Snowshoe Hare	*Lepus americanus*	X	Wherever young conifers grow: regeneration areas, copses, brush, along watercourses and all locations that offer protection and food
Wolverine [P, F]	*Gulo gulo*		Wherever there is prey availability; not linked to specific habitats
Woodchuck	*Marmota monax*		Pastures, boulder-covered rugged terrain, open forests and well-drained rocky slopes

X: recorded by Brown (2005); √: Observed at DSO installations (TSMC 2015, pers. comm.)

[Species at risk pursuant to provincial (P) or federal (F) legislation]

Sources: Novak *et al.*, 1987; Clément, 2009; Groupe Hémisphères, 2011a; Weiler, 2009; Tecsult Foresterie Inc., 2000; Brunet *et al.*, 2008; Moisan, 1996.

Micromammals

A review of observations, by Brunet and Duhamel (2005a) and Brunet *et al*. (2008), is provided in Table 7-86.

Table 7-86 Micromammal Species Potentially Present or Observed in the Schefferville Region Along with Habitat Description

SPECIES		OBSERVED	HABITAT DESCRIPTION
ENGLISH NAME	LATIN NAME		
Cinereus Shrew	Sorex cinereus	X	Mature deciduous or coniferous forests, bogs, fens and brush Corresponding terrestrial ecosystems: MSF01, MSF06, MSF07 MSF08, MSF11, MSF12.
Pygmy Shrew	*Microsorex hoyi*	X	Various habitats close to watercourses (forests, groves, fens, etc.) Corresponding terrestrial ecosystems: MSF07, MSF11, MSF12, MSF13, MSF15.

SPECIES		OBSERVED	HABITAT DESCRIPTION
ENGLISH NAME	**LATIN NAME**		
Water Shrew	*Sorex palustris*		Mature coniferous or mixed forests close to watercourses. Corresponding terrestrial ecosystems: MSF07, MSF11, MSF12, MSF13, MSF15
Star-nosed Mole	*Condylura cristata*		Forests and fields, but prefers riparian and wetland environments. Corresponding terrestrial ecosystems: MSF07, MSF15.
Meadow Jumping Mouse	*Zapus hudsonius*	X	Wet meadows, brush, grassy banks of watercourses as well as alder and willow groves. Fringes of coniferous and deciduous forests (where vegetation is dense). Corresponding terrestrial ecosystems: MSF07, MSF11, MSF12, MSF15.
Woodland Jumping Mouse	*Napaeozapus insignis*	X	Deciduous and coniferous forests close to watercourses. Corresponding terrestrial ecosystems: MSF06, MSF07.
Meadow Vole	*Microtus pennsylvanicus*	X	Wet and brush areas close to ponds, lakes and watercourses. Corresponding terrestrial ecosystems: MSF11, MSF12, MSF15.
Northern Bog Lemming	*Synaptomys borealis*	X	Sphagnum fens, wet coniferous forests, wet subalpine grasslands and tundra. Corresponding terrestrial ecosystems: MSF06, MSF08 MSF11, MSF12, HST01, HST03, HST04, HST05, HST06.
Rock Vole	*Microtus chrotorrhinus*	X	Wet taluses, between moss-covered rocks, at the base of cliffs, on rocky outcrops in mixed or coniferous forests. Corresponding terrestrial ecosystems: HST02, HST03, HST05.
Southern Red-backed Vole	*Clethrionomys gapperi*	X	Mature forests (coniferous, mixed or deciduous) and brush close to a source of water. Corresponding terrestrial ecosystems: MSF06, MSF07, MSF08, MSF15.
Ungava Collared Lemming	*Dicrostonyx hudsonius*		Mature forests (coniferous, mixed or deciduous) and brush close to a source of water. Corresponding terrestrial ecosystems: MSF06, MSF07, MSF08, MSF15.
Western Heather Vole	*Phenacomys intermedius*	X	Various habitats close to water. Bushes near wooded areas, wet meadows with moss. Summits of mountains. Corresponding terrestrial ecosystems: MSF06, MSF07 MSF13, MSF15 HST01, HST02, HST03.

Species highlighted in light blue were observed in the LSA

During the 2005 micromammal survey, the Southern Red-backed Vole was the most abundant micromammal, and the Western Heather Vole was the second most abundant. One of the Brunet and Duhamel (2005b) study sites included part of the LSA around Triangle Lake.

Brunet and Duhamel (2005b) indicated that they measured relatively low population densities, but noted that inter-annual variations in micromammal population size are particularly great in northern latitudes. They speculated that such fluctuations might explain the absence of Ungava Lemmings in 2005. Low population densities were also recorded by SNC-Lavalin (2012a) during a survey for the KéMag project located around 30 km north of the Howse Project site.

The Southern Bog Lemming was recorded in riverine and bog habitats southwest of Schefferville, between the 52^{nd} and 53^{rd} parallels (Fortin *et al.*, 2004). According to Girard (2003), small mammals such as Ungava Lemmings and Meadow Voles are also present in the Howells River Valley.

The Innu of Matimekush–Lac John are familiar with the Star-nosed Mole and confirmed its presence in the Schefferville region (Clément, 2009).

Species at Risk

The wolverine, listed both federally and provincially as endangered, is the only at-risk species of this group potentially present in the region. It is typically found wherever prey is available, and has not been linked to specific habitats. A study in the Howells River basin that endeavored to establish the presence of wolverines by means of baited posts failed to locate any wolverines in the area (Brunet *et al*., 2008). In 1978, an Innu gave an Indian and Northern Affairs Canada representative a pelt from a wolverine that was reportedly harvested north of Schefferville (Moisan, 1996). The site of the capture was not confirmed; nonetheless, based on knowledge of the territory used by the Matimekush–Lac John Innu, it seems unlikely that the harvest would have occurred farther than ± 150 km north of Schefferville. Prior to 1978, the most recent wolverine sightings in the Schefferville region were those made by the Innu of Matimekush–Lac John in the 1950s (Clément, 2009). The wolverine is probably extremely rare in Québec and Labrador or, according to COSEWIC (2003), may have disappeared entirely.

Aboriginal Traditional Knowledge

The Innu of MLJ have observed wolves in the LSA (Clément, 2009). Wolves are said to visit landfills occasionally, but are mostly associated with migratory caribou, which they generally follow.

According to most of the Innu interviewed, the region's beaver population has been stable for the last 10 years (Clément, 2009). Beaver meat is valued and is a common meal for the Innu. However, only one mention of beaver trapping was made during the 2014 interviews (Volume 2 Supporting Study C).

The Innu of MLJ are very familiar with otters (Clément, 2009); there have been otter sightings in the region, but none in the LSA.

The presence of the American Mink was confirmed by all of the Innu interviewed by Clément (2009). This species is trapped by the Innu and Naskapi in the LSA (Volume 2 Supporting Study C).

Ermine are said to be plentiful in the Schefferville area and are trapped by the Naskapi (Weiler, 2009). The Innu believe that the ermine population in the LSA is stable (Clément, 2009).

According to the Innu, Red Foxes are found throughout the Schefferville region. The Red Fox population is thought to have increased in recent years (Clément, 2009). Foxes are also said to be plentiful by the Naskapi, who harvest them in considerable numbers (Weiler, 2009). However, no mention of fox harvesting was made during the 2014 interviews (Volume 2 Supporting Study C).

According to Innu sources (Clément, 2009), Red Squirrels are found everywhere in the LSA.

The muskrat is mainly observed in the Howells River area, according to the Innu of MLJ (Clément, 2009).

All of the Innu interviewed by Clément (2009) reported the presence of hare in large numbers in the LSA. Hare are trapped by the Innu in the LSA (Volume 2 Supporting Study C).

The Naskapi trap martens in the Howells River region (Weiler, 2009; Volume 2 Supporting Study C). Martens are also trapped by Innu in the LSA (Volume 2 Supporting Study C).

Porcupines are a valued resource, particularly for the Innu (Volume 2 Supporting Study C). According to the Innu of MLJ, porcupines are plentiful along the roads in the region (Clément, 2009).

The Innu of MLJ reported sightings of Northern Flying Squirrels close to the Howells River (Clément, 2009).

According to the Innu of MLJ, woodchucks are present in the LSA (Clément, 2009).

The Innu of MLJ consider the Canada Lynx to be scarce in the region, and several of those interviewed had never seen one (Clément, 2009). A recent survey confirmed that the species was hard to trap (Volume 2 Supporting Study C).

The Arctic Fox and Arctic Hare are also hunted by the Naskapi. The Project's LSA is located at the southern limit of their ranges (Novak *et al*., 1987). Both species can be found in the LSA, but Weiler (2009) did not record their presence in interviews with Naskapi hunters about the area between the Howells River Valley and Menihek. According to the Innu of MLJ, Arctic Foxes are mostly found in the tundra, but there was only one sighting in the village of Matimekush–Lac John, on January 12, 2009 (Clément, 2009). Foxes are trapped by Innu in the LSA (Volume 2 Supporting Study C).

There is little traditional knowledge on micromammals, as they are not an important component of Aboriginal subsistence.

Data Gaps

The population densities of furbearers and small mammals are not well known, but this lack is partially offset by data on furbearer harvesting by local communities. All micromammal species potentially present in the LSA are common, and no significant data gaps exist.

7.4.6 Chiroptera

No new studies were performed on Chiroptera for the Howse Project. The component description is based solely on a literature review. However, a Chiroptera study done for the Taconite Project (Brunet and Duhamel, 2005b; Brunet et *al.*, 2008) covered the Howse Project LSA.

7.4.6.1 Component Description

Chiroptera are not considered as a VC. Even though the scientific community considers this group of animals as important, surveys carried out indicated that the population density is very low and that only one species is present in the region. In addition, no resting or hibernation sites were found in or close to the LSA, which supports the view that the use of the territory by Chiroptera is not intensive.

LSA, RSA and Temporal Boundaries

The LSA for Chiroptera consists of the Howse Project footprint, and corresponds to the area that will likely be directly affected by disturbances associated with Project activities. The RSA consists of the Howells River Valley, and corresponds to the only potential Chiroptera habitat located nearby.

Existing Literature

There are 20 species of bats found in Canada (Williams *et al.,* 2002). In Newfoundland and Labrador, there are four species of bats (Wild Species Canada, 2010), all of which can be found on the island of Newfoundland, but only one species, the Little Brown Bat (*Myotis lucifugus*), has been confirmed in Labrador

(NLDEC, 2009). It must be noted, however, that the distribution of many bats in Canada is still unknown (Wild Species Canada, 2010).

Species Presence

No species were formally identified in the surveys carried out in 2005 and 2006 (Brunet and Duhamel, 2005b; Brunet et *al.*, 2008). Calls were recorded, but their low intensity made it impossible to attribute them to a particular species. However, no calls were recorded in a study area located northeast of Irony Mountain; all the calls were recorded in the Howells River Valley sites.

NLDEC (2014b) notes that the Little Brown Bat is the only species known to live in Labrador, and the probability that it was the recorded species is therefore high. It is a medium-sized species, and the most widespread bat species in Canada. It uses a variety of habitats (Williams *et al.*, 2002), from arid grasslands to humid coastal forests. In summer it roosts in buildings and other man-made structures when it can, or in tree cavities, rock crevices, caves, and under the bark of trees. In summer, females will congregate in nursery colonies that may contain hundreds to thousands of individuals (Broders and Forbes, 2004). The Little Brown Bat emerges at dusk to feed on a variety of insect prey and will often feed over water (Furlonger *et al*., 1987). This species typically hibernates in caves and abandoned mines (Nagorsen and Brigham, 1993).

Local and Regional Habitat Distribution

Bat density was estimated to be very low by Brunet *et al*. (2008). Furthermore, even after several surveys in the area, no bat species were identified. There is a very low likelihood that the Little Brown Bat might be found around the LSA. In 2005 and 2006, surveys conducted to identify roosting and hibernacula throughout the Taconite and ELAIOM project LSA found no evidence of bats (Brunet and Duhamel, 2005b; Brunet *et al*., 2008).

Species at Risk

The Little Brown Bat is designated as: Endangered under the SARA - Schedule 1 (NFL and Quebec); Endangered by the COSEWIC.

Aboriginal Traditional Knowledge

There is little traditional knowledge on Chiroptera, as they are not an important component of Aboriginal subsistence.

Data Gaps

Despite the scarcity of data available, there are no major data gaps.

7.4.6.2 Effects Assessment

VC Assessment

Because the Little Brown Bat is designated as endangered, the following specific mitigation measures will be adopted without further effects assessment (SAR Public Registry, 2014):

- Avoid accessing caves or inactive mines, especially during winter months (potential bat hibernation site);
- If a cave or old mine needs to be accessed, use decontamination practices known to be effective in destroying spores of the fungus which cause White-nose syndrome.

7.4.7 Herpetofauna

No new studies were performed on Herpetofauna for the Howse Project. The component description is based solely on a literature review and ATK. However, several herpetofauna studies done for the Taconite project (Brunet and Duhamel, 2005a and b; Brunet *et al*., 2008; Genivar, 2011; SNC-Lavalin, 2012a) partly covered the Howse Project LSA.

7.4.7.1 Component Description

Herpetofauna is not considered a VC. The Project site coincides with the northern limit of the range of most amphibian and reptile species. Four species were found during the surveys carried out, and four others may be present. Most of these species are common. No species at risk were found or are potentially present in the LSA and the adjacent RSA. The population density is also very low, and the presence of only a few individuals of each species was recorded.

LSA, RSA and Temporal Boundaries

The LSA for herpetofauna consists of the Howse wetlands and the Goodream Creek, Pinette Lake and Burnetta Creek watersheds, including Triangle Lake, as the local effects will be confined to the watersheds within which the Project will take place. The RSA consists of a 5-km radius zone surrounding the Howse Project footprint, as it is unlikely that the Project will affect herpetofauna living more than 5 km from the Howse area.

Species Presence

Table 7-87 lists the species of herpetofauna present or likely to be present in the Schefferville region, including the LSA, based on species distribution and survey results. The generally low abundance of the species present is noteworthy.

Existing Literature

There is a total of eight species of herpetofauna potentially present in the Schefferville region. Five species were found during recent surveys (Brunet and Duhamel, 2005a; Brunet and Duhamel, 2005b; Brunet *et al*., 2008; Genivar, 2011; SNC-Lavalin, 2012a): the American Toad, the Mink Frog, the Northern Green Frog, the Northern Spring Peeper and the Wood Frog. The three species potentially present according to the literature (the Northern Dusky Salamander, the Northern Two-lined Salamander and the Blue-spotted Salamander) were sought, but none were found.

Table 7-87 Herpetofauna Potentially Present or Observed in the Schefferville Region

SPECIES		OBSERVED
ENGLISH NAME	LATIN NAME	
American Toad	*Bufo americanus*	X
Blue-spotted Salamander	*Ambystoma laterale*	
Mink Frog	*Lithobates septentrionalis*	X
Northern Green Frog	*Lithobates clamitans melanota*	X
Northern Spring Peeper	*Pseudacris crucifer crucifer*	X
Northern Two-lined Salamander	*Eurycea bislineata*	

SPECIES		OBSERVED
ENGLISH NAME	LATIN NAME	
Wood Frog	*Lithobates sylvatica*	X
Northern Dusky Salamander	*Desmognathus fuscus*	

Species highlighted in light blue were observed in the LSA

Sources: Brunet and Duhamel, July 2005a; Brunet and Duhamel, December 2005b; Brunet *et al.*, 2008; Desroches and Rodrigue, 2004; Conant, 1975; Genivar, 2011; SNC-Lavalin, 2012

Local and Regional Distribution

The Wood Frog and the Northern Spring Peeper were recorded in the LSA. The Northern Spring Peeper outnumbered the Wood Frog everywhere. The American Toad was only found on the western side of Howells River (Brunet and Duhamel, 2005b; Brunet *et al.*, 2008), quite far from the LSA. Brown (2005) also recorded the American Toad in the Howells River Valley, and he was informed that it belonged to the *copei* subspecies.

No salamanders or snakes were recorded north of the 54th parallel during recent surveys (Brunet and Duhamel, 2005a; Brunet and Duhamel, 2005b; Brunet et *al.*, 2008; Genivar, 2011; SNC-Lavalin, 2012a).

Fortin (no date) recorded the Northern Two-lined Salamander close to the 54th parallel, some distance west of Schefferville, and mentioned others recorded south and southeast of Schefferville.

Brunet and Duhamel (2005a) noted that few herpetofauna surveys have been conducted in northern regions, and the understanding of the northern limit of herpetofauna distribution is therefore limited.

Species at Risk

No amphibians or reptiles found in the literature review are protected under the legislation of Canada or Newfoundland and Labrador. No other species at risk are expected to be found in the LSA.

Aboriginal Traditional Knowledge

There is little traditional knowledge of amphibians and reptiles among the Schefferville Innu, as these are not an important component of their subsistence and are considered to be pests (Clément, 2009). The American Toad and the Mink Frog are the only species of amphibians and reptiles apparently known to the Innu. No salamanders or snakes are known to them (Clément, 2009). No mention of amphibians or reptiles was made during the 2014 land-use study.

Data Gaps

The current understanding of the herpetofauna potentially found in the Howse Project LSA comes from studies conducted for the Taconite project, not from studies carried out at the Howse mine site itself. Nevertheless, the two projects are near each other and some surveys were done within the Howse Project LSA, and there is therefore no significant data gap.

7.4.8 Avifauna

Volume 3 of the present document offers all avifauna studies discussed below that have been conducted in the vicinity of the Howse EIS.

7.4.8.1 Component Description

Four different biological studies, two ATK studies and two databases (Québec Breeding Bird Atlas and ebird) confirmed the presence of bird species within the LSA and 112 bird species within the RSA. The Project will interact with all the species found in the LSA and has a high risk of having an effect on avifauna. Avifauna were noted as VCs by the CEAA and mentioned seven times as a concern during Aboriginal consultations in the fall of 2014. Primary concerns expressed by the NIMLJ and the IN included effects with helicopters. However, HML helicopters activity will be limited to emergency situations or environmental monitoring. Since the environmental monitoring for the Howse Project will be largely done by truck or foot, it is therefore expected that helicopter flying will constitute a maximum of 7 cumulative days per year. Most of the species found in the LSA are protected by the Migratory Bird Convention and breeding species are particularly at risk. Avifauna are considered as a VC.

The Red-necked Phalarope (*Phalaropus lobatus*) Bank Swallow (*Riparia riparia*), the Gray-cheeked Thrush (*Catharus minimums*) and the Rusty Blackbird (*Euphagus carolinensis*) are protected by the *Species at Risk Act* and are considered as VCs.

In addition, Rock Ptarmigan (*Lagopus mutus*), Willow Ptarmigan (*Lagopus lagopus*) and Spruce Grouse (*Falcipennis Canadensis*) can be found in the LSA but are not protected by the Migratory Bird Convention or the *Species at Risk Act*. However, "partridges", as they are called by locals, represent an important socioeconomic component for First Nations and will be discussed in Section 7.5. The potential effects on this group of species, the "partridges", will be considered in terms of the potential effect of the Project on their use of the affected area. The partridges are considered as a VC.

LSA, RSA and Temporal Boundaries

The LSA is considered as being limited to the watersheds within which the Project takes place (e.g., Triangle Lake, Pinette Lake and Burnetta Lake watersheds). It includes areas that will be affected by habitat loss, as well as lakes and streams that are part of the watershed affected by the Project, as changes in water quality could affect food distribution for aquatics birds. Figure 7-35 shows the boundaries of the LSA. The LSA is limited to the above-mentioned watersheds since habitat integrity and food distribution for birds rely heavily of the proximity of water bodies.

In order to take into consideration the cumulative effects on bird populations such as habitat fragmentation and changes in behavior traits, both of which could lead to population-wide effects, the RSA has conservatively been designated as the area within a 30-km radius of the Howse Project. Notably, this area will includes every any species that spend a part of their life cycle regionally and on which the Howse project could be effected. The 30-km radius is arbitrary but deemed sufficient to encompass all potential past, present and foreseeable future effects of the Howse Project on avifauna. Bird populations will continue to interact with the landscapes for the duration of the Project and beyond for some species, and so we set the avifauna temporal boundaries at the operations phase and decommissioning and abandonment phases. Bird avoidance due to disturbances will be mostly restricted to the operation phase while breeding birds will avoid nesting in unsuitable (altered) habitats and will not recolonize until previous habitats are restored. It is noted that given the sensitive nature of the breeding season, the period between June and mid-August is of particular importance.

Existing Literature

Table 7-88 summarizes the literature consulted. A regional species list was completed using data from the Québec Breeding Bird Atlas (AONQ, 2014) and ebird (Ebird, 2014). The LSA also encompasses data surveys from the ELAIOM project properties, which include the Howse Property (AECOM, 2009; Groupe Hémisphères, 2009a). Waterfowl surveys from Taconite project also include data for Triangle Lake, which lies within the LSA (Groupe Hémisphères, 2012b; 2012c), which represents six extensive avian studies that took place between 2009 and 2015, two studies on ATK and two avian databases. Additional information was obtained during summer 2015 (Groupe Hémisphères, 2015) in particular, to verify the presence or absence of Common Nighthawk (*Chordeiles minor*), which is considered as "threatened" by the *Species at Risk Act*.

Table 7-88 Summary of literature used to study the effects on Avifauna.

REFERENCE	PERTINENT DATA
AECOM, 2009	Conduct point counts for breeding birds in the Howse Project area (LSA).
	Conduct points counts during the breeding season in the RSA.
Clément, 2009	Provides information based on traditional Innu knowledge on waterfowl, raptors, game birds (ptarmigans and grouses) and aquatic birds.
Groupe Hémisphères, 2009a	Conduct point counts for breeding birds in the Howse Project area (LSA).
Weiler, 2009	Provides information based on traditional Innu knowledge on waterfowl, and game birds (ptarmigans and grouses).
Groupe Hémisphères, 2012b	Provides information on migrating birds, waterfowl and species at risk in the RSA. Surveys were conducted by helicopter.
Groupe Hémisphères, 2012c	Provides information on migrating birds, waterfowl and species at risk in the RSA. Surveys were conducted by helicopter.
Groupe Hémisphères, 2012d	Conduct points counts during the breeding season in the RSA.
Migratory Birds Convention Act, 1994.	Details on the Migratory Birds Convention Act and the legal aspects ensuring the protection of migratory birds, their eggs and their nests.
AONQ, 2014	Québec Breeding Bird Atlas map the presence and, increasingly, the relative abundance of birds occurring within a set area. This provides information on breeding birds in the RSA.
Ebird, 2014	eBird is a global project revolving around sharing bird data with science, conservation and bird watchers. This includes valuable information submitted by volunteers in the RSA.
Groupe Hémisphères, 2015b	A survey protocol for Common Nighthawk was conducted in summer 2015. Even if no nighthawk was found, complementary information on breeding birds in the LSA was obtained

Avifauna data on the Howse Project Property were primarily obtained from a breeding bird survey conducted on LIM properties (AECOM, 2009). This survey used the point-count method consistent with methods used by the Canadian Wildlife Service (CWS). Point counts were five minutes in duration and consisted of an unlimited radius. Thirteen point counts were completed within the LSA. Three more point counts (20 minutes in duration) from the ELAIOM project (Groupe Hémisphères, 2009b) were part of LSA and were used to build a complete portrayal of the local avian diversity. For the ELAIOM project, a total of 83 point counts were done in 2008-2009 for a total of 830 minutes (Groupe Hémisphères, 2009a). A breeding bird survey was also carried out on the Kémag property, in which 51 point counts were done for a total of 584 minutes (Groupe Hémisphères, 2012d). These studies were used to estimate breeding bird densities and the number of pairs/ha that might be affected by the Howse Project. For the ELAIOM Project, the earliest point count (15 minutes duration) that was part of the Howse LSA started at 5h47 while the latest started at 6h27. No starting time was provided by AECOM for the bird survey conducted on LIM properties. Complementary data were gathered during the Common Nighthawk survey (Groupe Hémisphères, 2015b), as every species seen or heard in the LSA during travelling were carefully written down.

Finally, overland helicopter flights targeting waterfowl were done for the Project and data were obtained both in spring and fall in the LSA wetlands and lakes in 2011 (Groupe Hémisphères, 2012b; 2012c).

Bird Species Present in the Schefferville Region

A complete list of avifauna recorded in the Schefferville area between June 2008 and July 2015 (including the LSA), based on survey results and on ATK is available in Volume 1 Appendix XXIII.

A total of 114 bird species are present within the RSA. During recent surveys, 106 of these species were found in the region (AECOM, 2009; Groupe Hémisphères, 2009b; 2012b; 2012c; 2012d; AONQ, 2014; Ebird, 2014). Eight other species were added to the list based on ATK (Clément, 2009; Weiler, 2009): the Snow Goose (*Chaen caerulescens*), Red-throated Loon (*Gavia stellate*), Double-crested Cormorant (*Phalacrocorax auritus*), Rock Ptarmigan, Ruffed Grouse (*Bonasellla umbellus*), Great Horned Owl (*Bubo virginianus*), Snowy Owl (*Bubo scandiacus*) and Boreal Owl (*Aegolius funereus*).

Locally, 46 species were recorded in the Howse area LSA during recent avian surveys. This shows a rather low avian biodiversity component compared to the RSA. This might be explained by the rather common habitat that dominates the LSA, as tundra and altered habitats are not known to support high avian diversity. Most species were inventoried at lower elevations, within the Howells River Valley.

Local and Regional Distribution

<u>Breeding Bird Survey</u>

In order to address CEAA concerns, an in-depth survey of the Common Nighthawk was conducted on the Howse Property during summer 2015. Eight point counts were conducted at dusk (between 20h06 and 22h01) with playback specifically for this species but the presence of any other bird species was noted. No Common Nighthawk were found during this survey but 35 species were tallied including 10 species of aquatics birds and 25 terrestrial birds, all within the LSA. This bird survey covered all types of biotopes: open coniferous forests, shrub land, tundra, rocky outcrop/bare ground and lakes. Full survey report is available in Volume 2 Supporting Study N.

AECOM (2009) recorded 16 species on the Howse pit property, as did Groupe Hemisphères (2009b) between July 15 and 22, 2009. Both recorded the White-crowned Sparrow (*Zonotrichia leucophrys*), which prefers spruce and open habitats, as the most abundant in the Howse Project region. The American Tree Sparrow (*Spizella arborea*), which prefers taiga and open habitats, was also frequently observed, as were the Common Redpoll (*Acanthis flammea*) and American Robin (*Turdus migratorius*). This bird survey covered all types of biotope in this landscape of ridges and valleys. In coniferous forests, Fox Sparrows (*Passerella illiaca*) and Dark-eyed Juncos (*Junco hyemalis*) were the most plentiful species. The boundaries of the Groupe Hemisphères (2009a) bird survey area are shown in Figure 7-35. A total of 52 species were identified during the breeding bird survey carried out in DSO2/DSO3 areas, including four birds of prey, 13 aquatic birds and 35 terrestrial birds (Groupe Hémisphères, 2009a). Of these 52 species, 41 are considered migrating species under the Migratory Bird Convention (Migratory Bird Convention Act, 1994). The complete list of birds surveyed during this study is presented in Volume 1 Appendix XXIII.

Bird Migration

In 2011, surveys were conducted on the LabMag and KéMag properties during the spring and fall migrations (Groupe Hémisphères, 2012b; 2012c). The LabMag project study area covered the Howse LSA (Figure 7-35). Waterfowl, shorebirds and passerines were surveyed, and raptors sightings were also noted.

As highlighted in the LabMag Project migrating birds survey technical report (Groupe Hémisphères, 2012c), the dominant staging areas for waterfowl and shorebirds were located at the bottom of the Howells River Valley (510 m elev.), at a lower elevation than the Project footprint (average altitude: 660-680 m). Most of the waterfowl and shorebirds observed during the 2011 May and September migrations were located within the Howells River boundaries, more than 3 km from the Howse Project footprint, in large, flat, open wetlands or in forested valley-floor biotopes.

However, waterfowl were also observed at Triangle Lake during the spring migration. Four Lesser Scaups (*Aythia affinis*) and two Common Goldeneyes (*Bucephala clangula*) were sighted during this period (Groupe Hémisphères, 2012b). No waterfowl were observed in Triangle Lake during the fall migration. Triangle Lake is located at a higher elevation than the Howells River Valley. According to Clément (2009), the only goose-hunting site located in the Howse Project footprint is Pinette Lake. No ducks or geese were sighted in Pinette Lake during the spring and fall migrations (Groupe Hémisphères, 2012c).

With regard to passerines identified during the migration period in May, the most common species were also frequently sighted during the breeding bird survey in June and July (Groupe Hémisphères, 2012c). The Common Redpoll and White-crowned Sparrow were the most common species in coniferous forests and shrub land, while the White-crowned Sparrow and American Robin were the most common species in the tundra. There were also several sightings of Rusty Blackbird and Gray-cheeked Thrush, both migratory birds, during the two migration periods.

Species at Risk

Six species at risk have been reported in the RSA (see Table 7-89). Four species were sighted in the LSA: the Bank Swallow, the Red-necked Phalarope, the Rusty Blackbird and the Gray-cheeked Thrush. Figure 7-35 shows the locations of these sightings, as well as locations of Harlequin Duck (*Histrionicus histrionicus*) and Short-eared Owl (*Asio flammeus*) sightings in the RSA.

In response to concerns from the GNL and the CEAA over the potential presence of the Common Nighthawk, the Proponent mandated the completion of a Common Nighthawk survey, which was conducted during summer 2015, using playback at dusk with stops spaced 800m apart (Groupe Hémisphères, 2015b). Two visits were conducted for this species, one on June 23rd and another on July 14th. Despite this effort, this species was not observed during this survey or any other bird surveys that were carried out in the Schefferville area. Considering that there are no previous historical records on the Schefferville region (Groupe Hémisphères, 2008; 2009; 2012; AECOM, 2009; Ebird, 2014), and that its distribution in Labrador is located in the southern portion, Wabush/Labrador City being the limit of its range (NLDEC, 2014a), it was not unexpected that the species would not be found on the Howse property. In particular, local weather conditions are suboptimal for a nocturnal insectivorous bird. Records at the Schefferville weather station (Environment Canada, 2015) show that in June 2015, 20 days out of 30 had a minimum nightly temperature below 7°C while in July of the same year, there were 15 days out of 31 with the same conditions. Temperatures below 7°C are considered critical for nighthawk foraging due to low insect activity rates (Saskatchewan Ministry of Environment, 2015). Therefore, it appears unlikely that breeding could occur under such severe conditions. Furthermore, the Howse area is approximately 100 metres higher in elevation than the Schefferville weather station and even colder temperatures are expected to occur.

Table 7-89 Species at Risk Present in the RSA

ENGLISH NAME	HABITAT TYPE	STATUS		
		NEWFOUNDLAND / LABRADOR	SARA*	COSEWIC*
Harlequin Duck	Aquatic	Vulnerable	Special concern, Schedule 1	Special concern
Red-necked Phalarope	Aquatic	-	Special concern, no schedule	-
Short-eared Owl	Terrestrial	Vulnerable	Special concern, Schedule 1	Special concern
Bank Swallow	Terrestrial	--	Threatened, no schedule	-
Gray-cheeked Thrush	Terrestrial	Vulnerable	-	-
Rusty Blackbird	Terrestrial	--	Special concern, Schedule 1	Special concern

* SARA and COSEWIC status are the same for NFL and Quebec

The following paragraphs summarize data on bird species at risk potentially present in the RSA (or the LSA). Common Nighthawk and Olive-sided Flycatcher (*Contopus cooperi*) have never been detected in the LSA or the RSA, but potential effects were assessed even if probability of their presence is very low.

Harlequin Duck

The Harlequin Duck nests along watercourses characterized by rapids (Smith, 1998). Its distribution in northeastern Québec and Labrador is poorly understood. A pair of ducks was sighted in an apparent breeding habitat along the Howells River in May 2011 in the RSA but there is a lack of suitable rivers for nesting in the LSA (Groupe Hémisphères, 2012b). The species is named Nutshipaushtikushish, which means "the little one who runs in the rapids" in Innu. It is seldom seen by natives in the region (Clément, 2009).

Red-necked Phalarope

The Red-necked Phalarope has declined worldwide over the last 40 years; however, overall population trends in Canada during the last three generations are unknown. The species faces potential threats on its breeding grounds, in the Low Arctic and Subarctic regions, including habitat degradation associated with climate change. It is also susceptible to pollutants and oil exposure during winter migration. This is because birds gather in large numbers on the ocean, especially where currents concentrate pollutants (COSEWIC, 2014). The species breeds across the Low Arctic and Subarctic in tundra or tundra forest transition vegetation near freshwater lakes, pools, bogs, and marshes and amid or near small streams (Rubega et al, 2000).

An agitated adult male Red-necked Phalarope was observed in proper breeding habitat in July 2015 on a small pond with abundant aquatic vegetation. The pond was part of Burnetta Creek, as part of the LSA (Groupe Hémisphères, 2015b). The species was also reported in Lake Harris during summer 2011 nearby as part of the RSA (Groupe Hémisphères. 2012b).

Short-eared Owl

During the breeding season, the Short-eared Owl inhabits a variety of wide open spaces, such as dunes, peatlands, swamps, wet prairies, pastures and arctic tundra (Holt and Leasure, 1993). The abundance of the species is closely linked to the presence of voles, and fluctuates greatly. The Short-eared Owl can even be absent in some years if the vole population is low. In May 2011, the Short-eared Owl was reported in the vicinity of Harris Lake, in a suitable breeding habitat (Groupe Hémisphères, 2012b). Bird and Junda (2012) carried out a survey to locate Short-Eared Owl in the vicinity of the Kémag property but none were located. The Innu were not familiar with the Short-eared Owl (Clément, 2009), so it is probably not common around Schefferville. It is unlikely to breed in the LSA considering the lack of large fen and tundra habitats in the Howse sector.

Bank Swallow

The Bank Swallow is well known for nesting in the streamside (riparian) banks and bluffs of rivers and streams. This species is a highly social land-bird with a Holarctic breeding distribution. It nests in colonies ranging from 10 to almost 2,000 active nests (Garrison, 1999). This widespread species has shown a severe long-term decline amounting to a loss of 98% of its Canadian population over the last 40 years and is considered as “threatened” (COSEWIC, 2014). In 2015, a small colony (approximatively 10 nests) was found in Timmins 4 south (DSO Mines), directly on an artificial vertical bank in the mining pit within the LSA (Groupe Hémisphères, 2015b).

Gray-cheeked Thrush

During the breeding season, the Gray-cheeked Thrush is found primarily in coniferous stands of the boreal forest region, but also in tall shrubby enclaves of the taiga or above tree lines, and in mature coniferous stands (Ouellet, 1993). In 2008, the species was observed in the LSA during the DSO2/DSO3 survey (Groupe Hémisphères, 2009b) and during the breeding bird survey conducted on LIM properties (Volume 3 Avifauna Study a). It should be noted that the Gray-cheeked Thrush (*Catharus minimums aliciae*), which breeds in inland Labrador and the Gray-cheeked Thrush (*Catharus minimum minimus*), which breeds on the island of Newfoundland and along the coast of the strait of Belle-Isle region in Labrador, are from two different subspecies. It has been proposed in 2015 that the status of *Catharus minimus minimus* be “Threatened” while *Catharus minimums aliciae* (the one found in the Howse area) status be “Not at Risk” (NLDEC, 2010). The COSEWIC status report is pending acceptance.

Rusty Blackbird

During the breeding season, the Rusty Blackbird lives close to water; it inhabits peatlands, marshes, swamps adjacent to forests, humid woodlands and thickets of large shrubs where pools persist. It is also found in the partially-flooded areas surrounding lakes and beaver ponds (Nadeau, 1995). A pair of adult birds, one carrying food in its beak, was recorded in the LSA at one point count station in the Howse sector (Volume 3 Avifauna Study a).

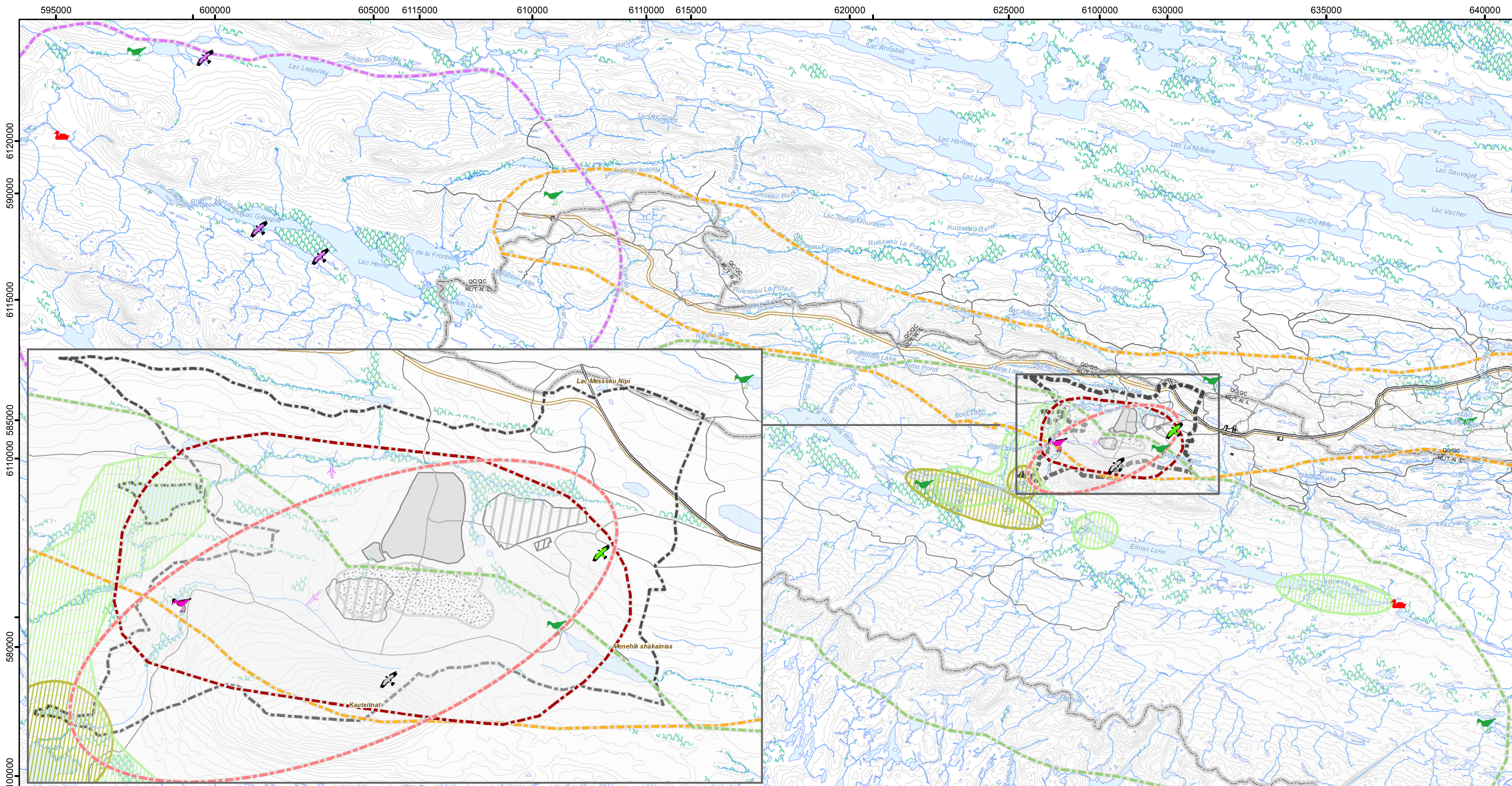
In the RSA, Rusty Blackbirds were sighted in a swamp bordering Ione Lake (Girard, 2003). A Rusty Blackbird was also observed on July 18, 2008, near Inukshuk Lake (DSO4) during a fisheries survey (Groupe Hémisphères, 2008). In 2009, two adults and a juvenile were also observed near Lake Big Star (in Québec, south of the 55th parallel), thereby confirming regional breeding (Groupe Hémisphères, 2009b). This species reaches relatively high densities in the Schefferville region, and can generally be expected to breed in any reasonably-sized wetland in the LSA.

Common Nighthawk

Common Nighthawk nesting habitat includes logged or slashburned areas of forest, woodland clearings, forests, rock outcrops, and flat gravel rooftops (Brigham et al, 2011). No nighthawk has been sighted in the Schefferville region despite extensive searches in 2015 (Groupe Hémisphères, 2015b). However, habitats may be created (or re-created as the case may be) during site reclamation, but weather conditions might be suboptimal to support the ecological needs of this species.

Olive-sided Flycatcher

The Olive-sided Flycatcher is most often associated with forest openings, forest edges near natural openings or human-made openings (e.g., harvest units), or open to semi-open forest stands. Presence in early successional forest appears dependent on availability of snags or residual live trees for foraging and singing perches (Atlman and Sallabanks, 2012). Despite several breeding surveys in the area, this species has never been recorded in the LSA or the RSA. Therefore, it is unlikely that it will be impacted by the Project. However, openings made at the edge of the Project could potentially benefit this species by creating proper habitat.



LEGEND

Bird Species at Risk
- Harlequin Duck
- Rusty Blackbird
- Short-eared Owl
- Gray-cheeked Thrush
- Bank Swallow Colony
- Red-necked Phalarope

Breeding Bird Surveys
- Survey Area - DSO 2008-2009
- Survey Area - AECOM 2008-2009
- Survey Area - Howse 2015

Migratory Bird Surveys
- Survey Area KeMag 2011
- Survey Area LabMag 2011
- High Concentration Area for Aquatic Birds Fall - LabMag 2011
- High Concentration Area for Aquatic Birds Spring - LabMag 2011

Infrastructure and Mining Components
- Main access road
- DSO Haul Road
- Existing Railroad
- Proposed Howse Pit
- Proposed Topsoil/Overburden Stockpile
- Proposed Site Infrastructure
- Proposed Waste Dump/In-Pit Dump
- Proposed Ditch

Basemap
- Existing Road
- Contour Line (50 ft)
- Provincial Border
- Watercourse
- Water Body
- Wetland
- Local Study Area

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0568 , PR185-19-14, 2016-03-23, edickoum

0 5 10
Kilometers

UTM 19N NAD 83

SCALE: 1:145 000

SOURCES:

Basemap and Bird Surveys Components
Government of Canada, NTDB, 1:50,000, 1979; Government of NL and government of Quebec,
DSO 2009 - Groupe Hémisphères (2009); Groupe Hémisphères (2012c)
AECOM (2009)
Howse - Groupe Hémisphères (2015) in progress

Mining Components
TATA Steel Minerals Canada Limited/ MET-CHEM Howse Deposit Design for General Layout., 2013
Groupe Hémisphères, Hydrology and wetland update, 2013

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Species at Risk and Bird Surveys

Howse Minerals Limited

GroupeHemispheres

5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2

1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 7-35

Aboriginal Traditional Knowledge

Although many species were observed in the vicinity of TSMC's DSO Project 1a by the local First Nations groups, this section only covers species of socioeconomic importance and raptors. A complete list of bird species observed by the Innu of MLJ is found in Clément (2009). The only species at risk mentioned by First Nations is the Harlequin Duck, mentioned above.

Species of Socioeconomic Importance

The group of birds most important to the livelihood of the Innu are the *Missipat*, or "water game" (Clément, 2009). The wetlands around Kivivic, Boundary and Harris lakes are a refuge for waterfowl, serving as staging and nesting areas during spring and early summer (Clément, 2009). Two species of loons are clearly distinguished by the Innu (Clément, 2009). The Common Loon (*Gavia immer)* is very common along Howells River, and the Red-throated Loon is common around Rosemary Lake, although it was not sighted in the LSA.

The Long-tailed Duck (*Clangula hyemalis*) is common in the spring, and many sightings of this species have been reported (Clément, 2009), including in the eastern and western portions of the Howells River Valley, between Fleming Lake and Stakit Lake.

The Innu group various dabbling duck species (American Black Duck (*Anas rubripes*), Northern Pintail, (*Anas acuta*) Green-winged Teal (*Anas crecca*)) into a single category (Clément, 2009). These species appear to be quite common and widespread, with sightings between Lac John and Squaw Lake, north of Elross Lake, and along Howells River and Star Lake.

The Innu and Naskapi eat gull eggs regularly (Clément, 2009; Weiler, 2006). Herring Gulls and Iceland Gulls are believed to be present in the LSA and are commonly observed at the Schefferville landfill.

Another group of considerable importance for the Innu is the Tetraonidae family, which are prized for their meat. Three species are commonly found in the region: the Spruce Grouse, the Willow Ptarmigan and the Rock Ptarmigan (Clément, 2009). According to First Nations, these three species can be found in the LSA. The Ruffed Grouse is less common, but can also be observed in the region. The Spruce Grouse is the most common species and is found in both summer and winter around the Howells River. The Willow Ptarmigan is also common around Howells River in winter. The Rock Ptarmigan can be observed in the spring and fall and is found in mountainous regions near old IOCC sites. The Ruffed Grouse has been reported historically in the region, but seems to be present in extremely low densities, and is far north of its usual breeding range.

Raptors

Interestingly, some species of raptors expected to be found in the region were never reported by biologists during environmental studies, yet are well-known to the Innu. The presence of the Great Horned Owl was reported by many Innu sources, especially along the Howells River. The Snowy Owl was also observed west of the Howells River by locals, and is characterized as "present but rare" (Clément, 2009). The Boreal Owl was observed at La Miltière Lake, north of Star Lake and at Vacher Lake. The Northern Goshawk (*Accipter gentilis*) is widely reported by First Nations in the study area but was rarely seen during bird surveys. It is closely associated with the partridge, its main source of food.

Subsistence

Naskapi

Waterfowl are an important resource in spring, as they provide relatively large amounts of high-quality food when other resources are scarce (fishing is difficult in spring due to unsafe ice conditions, caribou are less mobile and have generally retreated from the area, and hunters' movements are restricted by difficult snow and ice conditions, making small-game hunting less attractive). Moreover, waterfowl hunting is carried out in a relatively stationary manner and can yield high returns for relatively low investments of time, effort and transportation (Weiler, 2009). Suitable locations are *ashkui*, sites of early open water in water bodies that are otherwise ice-covered during the spring waterfowl migration.

Waterfowl are harvested to a lesser degree during the fall migration, when they tend to stop to rest on suitable water bodies or feed on hilltops and ridges offering berries or other food. Breeding populations are occasionally hunted locally (Weiler, 2009).

None of the waterfowl hunting areas reported by the Naskapi for the 1954-1982 period are located in the LSA. The key areas identified in the wider Schefferville region were Attikamagen Lake, part of the upper Swampy Bay/Ferrum river basins near Annabel, Gillard and Roullois lakes, and the Harris Lake area (Weiler, 2009).

The only area where the Naskapi reported harvesting waterfowl in the RSA during the 1983-1993 period is a system of interconnected water bodies in the Swampy Bay River basin, which contains Vacher, Gunshot, La Miltière and De Milley lakes. Such hunting occurred primarily during the spring migration.

The Naskapi use the Howells River Valley and the Swampy Bay River basin, as well as the ridge between them, for waterfowl hunting. Attikamagen Lake is probably the most heavily-used site and produces substantial yields in spring.

Geese and ducks are harvested in the Howells River Valley during the spring migration.

The many *ashkui* found along the Howells River and the associated string of lakes are attractive sites for migrating waterfowl, inducing them to land, rest and feed. Consequently, these constitute the most productive waterfowl hunting spots (Weiler, 2009). During a 2006 survey, the Naskapi most frequently identified Stakit Lake in the southern part of the valley and Kivivic and Rosemary lakes in the northern part as waterfowl hunting areas. In summer, the valley is home to a significant breeding population of geese and ducks, nesting mostly in the wetlands along the western shore of the Howells River, particularly on the western side of Kivivic Lake. Some Naskapi hunt these resident populations during the moulting period in June or later in summer (Weiler, January 2009). The hilltops along the ridge offer staging areas for flocks of geese during the fall migration. Geese rest and feed on the northern half of the ridge, attracted by the berries. Geese hunters are thus also attracted to that area in fall (Weiler, 2009).

Waterfowl are also harvested in the Swampy Bay River basin, mainly in spring, in Annabel, Hameau, Mollie and La Tesserie lakes (Weiler, 2009).

Pursuant to Section 15 of the NEQA, members of the NNK have the following annual guaranteed levels of harvesting for migratory birds: 2,246 Canada Geese, 2 Snow Geese, 303 ducks and 10 loons.

Grouse is hunted by Naskapis mainly during fall while ptarmigan is hunted during winter (Volume 2 Supporting Study C).

Matimekush-Lac John Innu

The Innu of MJL harvest Canada Geese in the LSA and beyond for food and clothing. They hunt Canada Geese and waterfowl in spring and fall. They also collect their eggs (Clément, 2009).

Three of the Innu sources each took between 20 and 25 Canada Geese in the general vicinity of the LSA in 2008, while two harvested 10 ducks and one took 30 ducks.

Other species of waterfowl frequently harvested for subsistence are the Common Goldeneye, White-winged Scoter (*Melanitta fusca*), American Black Duck, Long-tailed Duck, Common Merganser (*Mergus merganser*) and Common Loon (Volume 3 Appendix D).

Innu sources took from 20-30 to 50 Spruce Grouse in 2008, and from 2-3 to 200 Willow Ptarmigan.

Three sites are used by Innu for Canada Geese and waterfowl hunting: Rosemary Lake, Triangle Lake and Pinette Lake (Volume 2 Supporting Study D-2 and Supporting Study D-3).

Data Gaps

The current understanding of the avifauna potentially found in the Howse area is based on extensive studies conducted for various projects in the region, including two avian studies carried out at mine sites. There is therefore no significant data gap.

7.4.8.2 Effects Assessment

Literature review and Current Studies Data Used to Assess the Potential Effect

Numerous avian studies were completed between 2008 and 2015 for migrating and breeding birds in the Howse project area and so the local avian portrait can be considered as complete (see Table 7-88). The potential effects of mining projects on migratory birds, and in particular, avian species at risk were adressed according to Mining Project Baseline Desktop Assessment and Survey Requirements (Environment Canada, 2014b).

Data on breeding bird densities are available by habitat (biotope) by using point counts data (Groupe Hémisphères; 2009b, 2012d) while playback and adapted visits were often used for species at risk. Finally, the amount and type of habitat affected; the change in diversity, abundance, and density of species that utilise the various habitat types were all measured.

Interaction of the Project with Avifauna and Potential Effects

Site Construction Phase

All project activities have a potential interaction with birds during the site Construction phase.

- ➔ The potential effects associated with the Project activities during the site Construction phase is loss of habitat and anthropogenic disturbances (noise and light).

The nature of the effect is both direct (loss of habitat) and indirect (anthropogenic disturbance) and its effect is adverse.

These activities will cover a limited area and will be carried out over short periods of time. However, the disturbance associated with those activities will be felt throughout the LSA.

Loss of habitat

Road upgrade and pit development will alter some bird habitats. Four major biotopes have been identified for birds: coniferous forest, shrubland, open wetland and rock outcrop. According to data from the ELAIOM and Taconite projects (Groupe Hémisphères, 2009b; 2012d), open wetland is the habitat with the highest density (5.16 pairs/ha), followed by coniferous forest (2.36 pairs/ha), shrubland (2.27pairs/ha) and rock outcrop (1.98 pairs/ha).

Thirty-nine species of birds were found within the LSA, which could all be considered as potentially breeding species (except Rock Ptarmigan). Most of them are protected under the Migratory Bird Convention.

Densities of breeding pairs per hectare were calculated in the five different biotopes using point counts data from the Taconite and ELAIOM projects (Groupe Hémisphères, 2009b; 2012d) (Table 7-90).

Table 7-90 Estimated Number of Breeding Pairs of Birds Affected by Habitat Loss

BIOTOPE	AREA AFFECTED BY THE PROJECT (HA)	TOTAL NUMBER OF BREEDING PAIRS AFFECTED
Coniferous forest	157.9	372
Open wetland	1.3	7
Shrubland	48.9	111
Rock outcrop/Herb	27.6	55
Total	**235.8**	**545**

The component includes four species at risk, either under the Newfoundland and Labrador *Endangered Species Act*, the federal SARA and/or the Committee on the Status of Endangered Wildlife in Canada, that exist within the LSA: the Gray-cheeked Thrush, the Rusty Blackbird, the Bank Swallow and the Red-necked Phalarope.

The Gray-cheeked Thursh and the Rusty Blackbird usually build their nest in spruce trees, which are far from unique to the LSA. Building roads on disturbed ground (i.e. 1.2 km of new road for the Howse haul road) does not seem to directly threaten nests or eggs. According to Québec Breeding Bird Atlas (AONQ, 2014), the calendar of nesting chronology, from egg laying to brood-rearing, extends from early June to mid-August for the Gray-cheeked Thrush and from May to mid-July for the Rusty Blackbird. For both species, the number of pairs likely to be affected in the Howse area was evaluated according to densities by biotope from the Taconite project (Groupe Hémisphères, 2012d), based on point count data. The Rusty Blackbird density was evaluated at 0.02 pairs per hectare of coniferous forest and 0.69 pairs per hectare of open wetland. By extrapolating these densities to suitable habitats that will be affected in Howse area, up to 4.0 pairs of this species could be affected by the Project. Regionally, by extrapolating these densities to suitable habitat in a 20-km radius surrounding the LSA, up to 1,094 pairs of Rusty Blackbird could be breeding in the area. Therefore, the number of pairs of Rusty Blackbird that could be affected by the Howse Project appears negligible from a conservation point of view. The Gray-cheeked Thrush density was evaluated at 0.15 pairs per hectare of coniferous forest; accordingly, up to 23.7 pairs of this species could be affected by habitat loss in the Howse area. Regionally, by extrapolating these densities to suitable habitat in a 20-km radius surrounding the LSA, up to 6,254 pairs of Gray-cheeked Thrush could be breeding in the area. Therefore, the number of pairs of Gray-cheeked Thrush likely to be affected by the Howse Project appears negligible from a conservation point of view.

Unlike Gray-cheeked Thrush and Rusty Blackbird, the Bank Swallow is expected to find new breeding habitats during the Construction phase as new vertical banks will be created in the future mining pit. Mitigation measures will be needed to avoid destroying their nests (Section 7.4.8.3).

Finally, Red-necked Phalarope is likely to use small lakes and ponds for breeding. It was confirmed on Burnetta creek and could potentially use Triangle Lake as well. Water quality is expected to change in Burnetta Creek with an increase in suspended solids and color change (Section 7.3.10.2). No studies exist on the effect of these changes on Red-necked Phalarope. However, decreased visibility, potentially lowering prey detection (Gardner, 1981; Berg, 1982; Sweka and Hartman, 2001), reduction in numbers of benthic organisms (Sorenson *et al.*, 1977), and a reduction in light penetration and hence photosynthetic activity, primary production and oxygen production (Sorenson *et al*., 1977; Davies-Colley and Smith, 2000) could be encountered. As the Red-necked Phalarope is a visual forager, pecking small aquatic invertebrates from water, it could be expected that the species could choose to avoid breeding again on Burnetta Creek with water quality change.

Spruce Grouse and Willow Ptarmigan are expected to breed in the LSA on a regular basis. Spruce Grouse is a conifer specialist, feeding on spruce needles much of the year (Boag and Schroeder, 1992), while Willow Ptarmigan is found primarily in subarctic zones with shrubby habitats, especially where willow or dwarf birch are abundant (Hannon *et al*, 1998). Both of these habitats are common in the region, and habitat loss effects on these species should be low. Even if Willow Ptarmigan occasionally breeds in the LSA, it is considered as a much more common winter visitor. However, Rock Ptarmigan is only winter visitor in the LSA, where it does not breed. Therefore, disturbance and habitat loss will have a low effect on these species and their survival or reproduction should not be threatened as mining activities are slowed down during the cold season.

There is little research on Willow Ptarmigan densities in Newfoundland and Labrador. However, Bergerud (1970) estimated 0.5–1.6 pairs/km^2 or 0.005-0.016 pairs/ha for the region. By extrapolating these data to affected Willow Ptarmigan breeding habitats in the LSA, only 1.2 pairs of Willow Ptarmigan could potentially lose their habitat. The number of Spruce Grouse pairs per hectare cannot be evaluated based on the literature and available data. However, Spruce Grouse individual home ranges averages 24 ha (Boag and Schroeder, 1992). Considering the coniferous forested area that will be affected by the Project, 6.1 individual Spruce Grouse could potentially be affected by the Project. These numbers are very low compared to the annual harvest by local hunters.

Birds that use the Howse area only as a stopover during migration without breeding will be much less affected by the Project than breeding birds. Considering that most of the RSA can be used by migratory birds, habitat loss effects on migrating birds during spring and fall should be negligible.

Ecological light pollution on birds

Birds can experience increased orientation or disorientation from additional illumination and are either attracted or repulsed by glare, which can affect foraging, reproduction, communication and other critical behavior (Longcore and Rich, 2004).

Artificial light disrupts interspecific interactions evolving in naturel patterns of light and dark. For example, diurnal predators such as Peregrine Falcon can use artificial lights to hunt at night when they forage in urban areas. They can even take advantage of songbirds disoriented by artificial light (DeCandido and Allen, 2006). In addition to foraging, artificial illumination may induce other behaviors, such as territorial singing in birds.

Birds can be disoriented and entrapped by artificial lights at night (Ogden, 1996). Once a bird is within a lighted zone at night, it may become “trapped” and will not leave the lighted area. Large numbers of nocturnal migrating birds are vulnerable to this phenomena when meteorological conditions cause them to steer near lights. Within the sphere of lights, birds may collide with each other or with a structure, become exhausted, or be caught by predators. Other than absolute illumination levels, a sudden change in illumination may also be disruptive for some species (DeCandido and Allen, 2006).

Noise disturbance

Waterfowl respond both to loud noises and rapid movements. Large flocks of waterfowl are more susceptible to disturbance than small flocks. The effect is more important during brood-rearing season but it can also cause flushing, displacement or abandonment of key area during migration (Korschgen and Dahlgren, 1992). However, Triangle Lake, Pinette Lake and Burnetta Creek are not important staging areas for waterfowl (including Canada Goose, a species of concern for the IN). During waterfowl surveys by helicopter in spring and fall 2011, the numbers of ducks observed on these lakes were very low (Groupe Hémisphères, 2012c), and ducks are likely to use more suitable habitats in the RSA if disturbed during migration.

Concerns were expressed by the NIMLJ and the IN on effects with helicopters but use of helicopters is limited to emergency situations or environmental monitoring and will not exceed 7 cumulative days per year.

For songbirds, noise disturbance can also have a negative effects on breeding success by creating acoustic interference when birds are protecting their territories and attracting partners (Slabbekoorn and Ripmeester, 2008).

The nature of the effect is indirect and its direction is negative. Loss of habitat and disturbance associated with the project activities will mostly affect the LSA, and effects in the RSA will be negligible or nonexistent. Disturbance in the LSA might result in bird avoidance of the LSA.

<u>Operation Phase</u>

No potential interaction

The following activities will take place at existing DSO3 facilities:

- solid waste disposal;
- hazardous waste management;
- explosives waste management;
- treatment of sanitary wastewater.

No additional loss of avian habitat is therefore expected. Increased traffic due to the additional wastes generated by the Howse Project is considered under the “Transportation of ore and traffic” activity.

Potential interaction

A potential interaction can be anticipated between avifauna and the following activities:

- removal and storage of remaining overburden and topsoil;
- dewatering;
- management of waste rock dumps;
- transportation of ore and traffic;
- ongoing site restoration.

➔ The potential effect associated with Project activities during operation phase is anthropogenic disturbance (noise and light) and loss of habitat.

The nature of the effect is both direct (loss of habitat) and indirect (anthropogenic disturbance) and its effect is adverse.

Removal of overburden and stockpiling of waste rock and other wastes will result in some loss of habitat, including some loss of wetlands that are important for certain at-risk migratory birds. Wetlands will be inspected in this area at least annually to ensure that the loss of wetland habitat does not exceed what was predicted. The Proponent is committed to ensure all contractors are aware of Migratory Bird Regulations and use of biodegradable alternatives for fueling and servicing equipment.

In total, 260.8 ha of breeding bird habitats will be destroyed or severely disturbed during the operation phase. This represent a habitat loss for 4.5 pairs of Rusty Blackbirds and 21.6 pairs of Gray-cheeked Thrush, two species at risk. However, those habitats are common both locally and regionally. Site restoration will have a positive effects on habitat recovery in the long term.

Noise and vibration disturbance will be generated by:

- blasting and ore extraction;
- transportation of ore and traffic.

Concerns were raised that no waterfowl should be nesting during dewatering. As dewatering will eventually become continuous once the pit level is below the water table level, this will not affect migratory birds as water should never accumulate in the pit, and the only drawdown expected is in Pinette Lake, and it will be non-significant. The summer 2015 study on Pinette Lake confirmed this hypothesis, as a simulation of the water regime for Pinette Lake predicted slight changes in water level of only 2 mm (Groupe Hémisphères, 2015a) which should not, in any case, affect breeding success in waterfowl.

<u>Decommissioning and Reclamation Phase</u>

All project activities have an interaction with birds during the decommissioning and reclamation phase.

➔ The potential effects associated with the Project activities during the decommissioning and reclamation phase is anthropogenic disturbance.

The nature of the effect is direct and its effect is adverse.

The demobilization of the Howse facilities may result in less disturbance than that caused by mining activities, but other important mining activities will nonetheless occur locally and regionally. The Howse haul road will not be decommissioned, but the waste rock dumps will be revegetated. The potential bird habitat that will thus be created will have a limited area and will be common both locally and regionally. It will also be unsuitable for several generations of birds, since the vegetation will take time to grow.

7.4.8.3 Mitigation Measures

<u>Standard Mitigation Measures</u>

Table 7-91 presents the standard mitigation measures that will be applied for avifauna.

Table 7-91 Standard mitigation measures to be applied to Avifauna

CODE	MEASURE	MITIGATION EFFECT
Tree removal and timber management (TM)		
TM1	Comply with the *Forest Act* and all related regulations, particularly the *Regulation respecting standards of forest management for forests in the domain of the State* and the *Forest Protection Regulation*. Take the necessary measures to ensure that tree removal complies with the stipulated requirements.	By complying with the Forest Act, a buffer strip 20 m wide along the banks of a peat bog with a pond, of a swamp, of a marsh, of a lake or of a permanent watercourse will be preserved ensuring habitat for most several migrating birds including species at risk, Rusty Blackbird.
TM3	Do no clearing in the riparian strip along watercourses or in wetlands without authorization.	This measure will preserve breeding and foraging habitats for several migrating birds including species at risk, Rusty Blackbird.
TM8	Remove trees in a way that does not damage vegetation bordering the work sites. Prevent trees from falling outside the	By preventing trees from damaging vegetation bordering the work sites, residual habitats for

CODE	MEASURE	MITIGATION EFFECT
	work site or into watercourses. If this does occur, remove the trees carefully to avoid any unnecessary disturbance to the area. Do not remove or uproot trees with machinery near the edges of a work site.	species breeding in the open, such as White-crowned Sparrow, are preserved.
TM9	Maintain a transition zone around work site in which trees are removed, but stumps are left intact to preserve the shrub stratum.	Shrub stratum can be both used for foraging and breeding by species under the Migratory Bird Convention (Blackpoll Warbler, American Tree Sparrow).
TM10	Ensure that cleared areas that are left bare and exposed to the elements are kept to a strict minimum.	By keeping bare and exposed habitats to a minimum, more usable habitats for breeding and foraging will be preserved
TM13	When line cutting and surveying, clear a maximum width of one metre.	By limiting to one metre the maximum width, more trees will be available to birds for breeding and foraging
Drilling and Blasting (DB)		
DB24	Keep blasting data for two years, including the following: vibration speed, vibration frequency on the ground, air pressure and blasting patterns. Respect maximum vibration speeds.	These data will be available for future uses to evaluate the effects on migrating birds, especially waterfowl
DB25	Blasting must be carried out in such a way that air pressure at the receptors is less than 128 db.	By limiting the number of decibels during blasting, the effects radius of disturbance on birds will be considerably reduced
Mining Operations (M)		
M2	The noise level of mining operations must be no higher than 40 dba at night and 45 dba during the day at each receiver (Québec Guidelines for Stationary Noise Sources for Type I Zoning Area).	In environments with high noise disturbances, birds are forced to sing with higher amplitudes and have to bear the increased costs of singing (Brumm, 2004). By limiting, the noise level of mining operation, songbirds will be able to spend more time on their physiological needs and on their breeding activities.

<u>Specific Mitigation Measures</u>

Specific Mitigation Measures concerning the Migratory Bird Convention

Article 12 of the Migratory Bird Convention forbids that "nests may be damaged, destroyed, removed or disturbed". To avoid destroying nests, vegetation clearing will generally be avoided during the breeding season. Given the calendar of nesting chronology of all the species that are known to occur in the LSA (AONQ, 2014), this period would extend from May 1st to the first quarter of August (approximately August 7th). The critical period for breeding in the region occurs after snowmelt in June and July. Before and after the breeding period, the effects of vegetation clearing on migratory birds should be much more limited and in compliance with the law. Construction activities will take place during the breeding season but only in already cleared areas. If nests are found incidentally or through dedicated searches outside the breeding season, they will be protected with a buffer zone determined by a setback distance appropriate to the species, the level of the disturbance and the landscape context, until the young have permanently left the vicinity of the nest. Setback distance suggested by Environment Canada vary from 1-5 meters for songbirds to 100 meters and more for larger birds (Environment Canada, 2015). However, very few species are expected to be found breeding outside the proposed calendar.

Deforestation is the primary activity under the Howse Project with the potential to disturb or destroy nests and eggs. Subsection 6a of the *Migratory Birds Regulations*, which addresses incidental take, prohibits disturbing, destroying or taking nests or eggs of all species of migratory birds. As such, according to the calendar of nesting chronology for birds found in the LSA, deforestation should not occur between May 1st and August 7th. HML's commitment to the pre-emptive removal of vegetation outside the breeding where operation phase activities are planned will avoid creating an ecological trap where some species of birds would build nests that would be later damaged.

The CEAA raised concerns for ground-nesting migratory birds in the Avifauna Management Plan. The Spotted Sandpiper and Semipalmated Plover would be likely to breed directly on altered soil as they sometimes prefer to lay their eggs in a simple scrape on bare grown modified by man. Disturbance by machinery, especially in June, during nest selection should be enough to prevent these two species selecting prepared ground as potential breeding site. In the unlikely possibility that one of the two species would still choose this anthropogenic habitat to build their nest, distraction display behaviour should be performed by adult birds which should help locating nests that are completely unprotected. If a nest is located, a small fence with wooden stakes and galvanized metal T-posts with colored nylon rope along the posts will be installed to identify it and prevent the machinery destroying the eggs.

Finally, the CEAA's concern that the removal of overburden and stockpiling of waste rock and other waste will result in some loss of habitat, including some loss of wetlands that are important for certain migratory birds. The Proponent is committed to inspecting wetlands in this area at least annually to ensure that the loss of wetland habitat does not exceed what was predicted. During breeding season from mid-May to mid-August, traffic including heavy equipment shall not be permitted to enter wetlands or any area that is not designated for traffic.

Specific Mitigation Measures concerning the Bird Species at Risk

For the Rusty Blackbird and Gray-cheeked Thrush, application of the first measure (i.e. not conducting disturbance activities between May 1 and August 7) concerning the Migratory Bird Convention would be sufficient on its own. If, however, the first measure cannot be implemented and the riparian strip or the aquatic habitat must itself be damaged or destroyed, the following mitigation measure makes it possible to minimize the effects on Rusty Blackbird breeding success, since the individuals will choose sites that are suitable for nesting when they arrive in spring and will avoid sites that have been disturbed in their absence.

The Proponent is committed to applying the TSMC/NML Plan for the Protection of the Rusty Blackbird (Groupe Hémisphères, 2011c), the protection of a riparian strip at least 75 m wide adjacent to riparian and non-riparian wetlands for the protection of the Rusty blackbird and, to a lesser extent, the Gray-cheeked Thrush. Numerous studies support the view that a 30-m riparian strip is required to preserve the biodiversity of the invertebrates and amphibians on which the Rusty Blackbird feeds (Newbold *et al.,* 1980; Gregory *et al.,* 1987; Rudolph and Dickson, 1990; Castelle *et al.,* 1992; Parkyn, 2004;) as well as a variety of forest types and geomorphological formations from short-term effects (Parkyn, 2004). Another study shows that the Rusty Blackbird prefers to nest within 30 m of wetlands and suggests an unlogged buffer of 75 m around nests to minimize predation pressure (Powell *et al*., 2010). Because the nests are very close to water, and often above water (Gauthier et Aubry, 1995), and because the wetland delineation for the Project includes the totality of the aquatic ecosystem such as the marginal spruce swamp, a 75-m protection buffer strip drawn around the wetlands should protect both the nesting and the feeding sites for these species as well as reduce predation risk, as it has been shown that predation rates are highest within 50 m of wood edges (Paton, 1994).

During the breeding season it is important that nests not be disturbed by erosion prevention and control measures or by excavation and construction activities. For the Bank Swallow, the period when nests are considered to be active includes not only when birds are incubating eggs and taking care of flightless chicks, but also the roosting period after chicks have learned to fly and nests continue to be used (Environment Canada, 2015). At northern latitudes, this period could go from mid-June to mid-August.

The Proponent is committed to surveying the Howse Pit area in early and mid-summer every year that the mine is in the operations phase (where vertical walls exist). Should the swallow be detected, then deterrence methods or measures should be taken to render the site inhospitable (noise, plastic covering of pit walls, etc.) for nesting. Any nest found will be protected with a buffer zone determined by a setback distance appropriate to the species, the level of the disturbance and the landscape context, until the young have permanently left the vicinity of the nest. Setback distance suggested by Environment Canada (Environment Canada, 2015) is up to 50m or more for swallow colonies.

Regular blasting should naturally deter the swallow to use the pit as a breeding site. If not, additional measures will be taken to cover the banks during the breeding season to deter the birds from using the large piles of unattended/unvegetated soil or the vertical banks in the mining pits if none of the previous mitigation measures can be provided. Swallows can be excluded from potential nest sites with barriers made from plastic sheeting, or fine-mesh wire. Nets or other barriers must be installed before swallows arrive on their breeding ground. Bank Swallow are late migrants and are expected to arrive in the Howse area at the beginning of June and will not start digging their nest as long as the soil is frozen.

The Red-necked Phalarope was only found in a sedge stream bank along Burnetta Creek where no habitat loss will occur. It could also reasonably occur on Triangle Lake where habitat disturbance will be negligible. Therefore, no specific mitigation measure is planned as the effects will already be low.

Specific Mitigation Measures Related to Light Pollution

Several specific mitigation measures proposed in the section on light (see Section 7.3.4.3) will also benefit birds. These measures will ensure that night-time illumination will be minimal. It will benefit the nocturnal migrants.

Lighting of the mine will be reduced by half when weather forecasts are extreme (thick fog and snowstorms). This measure will be considered during the migration period (in May and from August to October) where migrating birds are more vulnerable to being entrapped by artificial lighting during harsh weather conditions.

7.4.8.4 Residual Effects Significance Assessment

The Howse Project is located in an area that has historically been continuously and significantly altered by human activities. Within this context of a pre-established mining complex, the Howse footprint is not expected to cause significant detrimental additions to this ecological context. Birds breeding in boreal ecosystems where frequent small and large scale natural disturbances have occurred historically may be more resilient to human-induced to habitat changes. The subarctic forest itself, is heavily and naturally fragmented, with strong edaphic and elevational gradients at the local and regional scales which have forced birds to adapt to patchy habitats. Further, the Howse area does not include any unique habitats. As such, it is expected that avifauna will find alternate breeding grounds nearby and thus is generally considered as being resilient to such disturbance.

Birds breeding in boreal ecosystems where frequent small and large scale natural disturbance have occurred historically may be more resilient to human-induced to habitat changes. The subarctic forest is heavily fragmented, with strong edaphic and elevational gradients at the local and regional scales which have forced birds to adapt to patchy habitats. Further, the Howse area does not include any unique habitats. As such, it is expected that avifauna will find alternate breeding grounds nearby and thus is generally considered as being resilient to such disturbance.

The overall methodological approach to assess the environmental effects is presented in Section 5. However, in order to apply this methodology to the avifauna VC, it is essential to consider assessment criteria applicable specifically to this VC (Table 7-92).

Table 7-92 Assessment Criteria Applicable for Avifauna

TIMING		
Inconsequential timing	**Moderate timing**	**Unfavorable timing**
Timing of predicted Howse activities are not expected to affect any sensitive activities in the birds' life cycle.	Timing of predicted Howse activities may affect some birds' activities, i.e.: migration, late rearing, moulting.	Timing of predicted Howse activities may affect some critical birds' activities, i.e.: breeding and brooding or during migration in an important staging area.
SPATIAL EXTENT		
Site specific	**Local**	**Regional**
The Project effects are limited to the Howse project footprint	The effect is limited to the LSA	The Project effects extend beyond the LSA and affects avifauna at the RSA level.
DURATION		
Short	**Medium**	**Long**
Less than 12 months. Limited to the Construction and/or Decommissioning and Reclamation phase.	12-24 months. Extends beyond the Construction phase, but shorter than the lifespan of the Project.	More than 24 months or long as the Project duration
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Full restoration of pre-Howse Project avifauna numbers and condition is likely.	Partial restoration of pre-Howse Project avifauna numbers and condition is likely. Partial restauration of pre-development avifauna.	Restoration of pre-Howse Project avifauna numbers and condition is unlikely.
MAGNITUDE		
Low	**Moderate**	**High**
Howse Project will likely have no or little effects on a few birds.	Howse Project will likely have effects on groups of birds.	Howse Project will likely have effects on bird populations.
FREQUENCY		
Once	**Intermittent**	**Continual**
One time	Occasional or intermittent	Year round

<u>Timing</u>

Howse Project activities will occur throughout the year, with limited winter blasting. Birds might exhibit deterrence behavior related to noise and light from the Project since noise and light produced by the Howse Project activities will be produced continuously. There will be no vegetation clearing during summer, when critical bird activities occurs. As there is no important staging area in the Howse area during spring and fall migration, the timing is thus evaluated as moderate (Value of 2).

<u>Spatial Extent</u>

Avifauna will modify their breeding behaviour as a direct result of the Howse Project. For grouses, ptarmigans and most of the species protected under the Migratory Birds Act, the effects will be mostly limited to the footprint. For species at risk Red-necked Phalarope, Bank Swallow, Rusty Blackbird and Gray-cheeked Thrush, the effect will extend to the LSA which include_lakes and streams that are part of the watershed affected by the Project, as changes in water quality could affect food distribution for these sensitive species. The Bank Swallow may benefit from the Howse Project as new breeding habitats will be created by the pit. Common Nighthawk and Olive-sided Flycatcher are not expected to be found in the LSA but if so, they could benefit in the long run with human-made opening within the coniferous biome. Spatial extent is thus evaluated as follows:

Table 7-93 Spatial Extent Evaluation for Avifauna Group or Species

AVIFAUNA GROUP OR SPECIES	SPATIAL EXTENT
Grouses and ptarmigans ("partridges")	Value of 1
Migrating birds protected by the Migratory Bird Convention	Value of 2
Rusty Blackbird (species at risk)	Value of 2
Gray-cheeked Thrush (species at risk)	Value of 2
Red-necked Phalarope (species at risk)	Value of 2
Bank Swallow (species at risk)	Value of 1
Common Nighthawk (species at risk)	Value of 1
Olive-sided Flycatcher (species at risk)	Value of 1

Duration

Avifauna is expected to interact with the Howse Project for the entire duration of the Project, and as long as the mining site will not be restored. However, the Howse project itself is not expected to cause long term demographic changes to any species of birds found in the LSA considering that no rare or critical habitats are found locally (Value of 3).

Reversibility

Birds that will avoid breeding on the mining footprint are expected to be absent for the duration of the Project and as long as their former habitat is not restored. However, no species of bird is considered at risk of being extirpated at a local scale as plenty of proper breeding habitats are found nearby (Value of 1).

Magnitude

As no habitats in the LSA are unique or critical for the survival of any bird species, the magnitude due to habitat loss is expected to be low or moderate, depending on the avifauna group or species. For migrating songbirds, an estimated 545 pairs will lose their breeding habitats. For species at risk, 4.5 pairs of Rusty Blackbird, 21.6 pairs of Gray-cheeked Thrush are expected to lose their breeding ground while an estimate of many thousands breed in a 20-km radius. One or two pairs of Red-necked Phalarope may be breeding in the LSA and they could be displaced by the Project. No Bank Swallow are expected to lose any habitat because of the Project. Finally, 1.2 pairs of Willow Ptarmigan and up to 6 Spruce Grouses could lose their home range due to the mining activities. As probability of finding Common Nighthawk or Olive-sided Flycatcher in the LSA is close to zero, the magnitude for these species would be very low. Magnitude is thus evaluated as follows:

Table 7-94 Magnitude Evaluation for Avifauna Group or Species

AVIFAUNA GROUP OR SPECIES	MAGNITUDE
Grouses and ptarmigans ("partridges")	Value of 1
Migrating birds protected by the Migratory Bird Convention	Value of 2
Rusty Blackbird (species at risk)	Value of 2
Gray-cheeked Thrush (species at risk)	Value of 2
Red-necked Phalarope (species at risk)	Value of 1
Bank Swallow (species at risk)	Value of 1
Common Nighthawk (species at risk)	Value of 1
Olive-sided Flycatcher (species at risk)	Value of 1

Frequency

As most species found in the LSA are migrating birds and as birds are more vulnerable during the breeding season, the critical period for disturbances will be mostly between May and August which represents 25% of the year (Value of 2).

7.4.8.4.1 Significance

Effect significance is evaluated is presented in Table 7-95 for the different avifauna group or species. **The overall effect of the Howse Project on avifauna in non-significant.** For grouses, ptarmigans, and the following species at risk (Bank Swallow, Common Nighthawk and Olive-sided Flycatcher), the overall effect value is expected to be low (Value of 9). The primary threat to avifauna in general following mitigation measures is habitat alteration and anthropogenic disturbance specifically related to the duration and frequency of noise and light disturbance, which can result in behavioral reactions.

Table 7-95 Effect Assessment Evaluation for Avifauna Group or Species

AVIFAUNA GROUP OR SPECIES	EFFECT VALUE	EFFECT ASSESSMENT	LIKELIHOOD
Grouses and ptarmigans ("partridges")	10	Non-significant	Likely
Migrating birds protected by the Migratory Bird Convention	11	Non-significant	Likely
Rusty Blackbird	11	Non-significant	Likely
Gray-cheeked Thrush	11	Non-significant	Likely
Red-necked Phalarope	11	Non-significant	Likely
Bank Swallow	10	Non-significant	Likely
Common Nighthawk	10	Non-significant	Unlikely
Olive-sided Flycatcher	10	Non-significant	Unlikely

Likelihood

The likelihood of Howse having an effect on grouses, ptarmigans, migrating birds and on species at risk such as Rusty Blackbird, Gray-cheeked Thrush, Red-necked Phalarope and Bank Swallow is **likely** because all of these species were observed in the vicinity of the Howse Project in the last 5 years, including in 2015. As no Common Nighthawk nor Olive-sided Flycatcher have been seen in the vicinity of the Howse Project, the probability of Howse having an effect on these components is **very unlikely**.

7.4.9 Aquatic Fauna

Aquatic fauna is directly linked with water quality and quantity and is clearly highlighted as such in the CEAA Guidelines. Furthermore, aquatic fauna and their habitat is are valued by local communities (Volume 2 Supporting Study D), who sometime use the water bodies of the LSA for recreational fishing. This point was made clear during the public consultations held in fall 2014 Schefferville by both elders and younger users of the area, who mentioned the importance of fish 8 times. For those reasons, aquatic fauna, with a focus on fish and fish habitat, is selected as a VC. Benthic invertebrates, which are good bio-indicators of water quality, are also considered as part of the fish habitat and are covered in this section.

7.4.9.1 Component Description

LSA, RSA and Temporal Boundaries

The LSA is strategically chosen to be the same as for water quality and hydrography and hydrology since, apart from direct mortality from blasting, all effects on these components are linked. Therefore, the LSA for this component is limited to the subwatersheds directly in contact with the Howse Project: Triangle Lake, Pinette Lake and Burnetta Lake watersheds. The limits of the LSA is the same as those for the hydrology and water quality components and are shown in Figure 7-36. The Elross Creek watershed is not included in the LSA, since it will not be directly affected by the Project, and since the effects generated by the processing of ore at the DSO plant are considered in the ELAIOM EIS.

As for water quality, the RSA is composed of the larger watersheds which encompasses the subwatersheds of the LSA until Elross Lake, a body of water on the Howells River. This large watershed of 335 km² includes the entire Elross Creek watershed and the Ione Lake watershed, including Sunset and Goodream Creeks. The RSA includes all drainages coming from other potential projects in the area and ultimately draining towards the Howells River.

Temporal boundaries will extend a few years longer than it takes for the water quality to return to normal, which is a few months after cessation of pumping mine water according to Dubreuil (December 1979) based on data from Fleming 3 pit in the ELAIOM sector. Therefore temporal boundaries will extend 3 years past decommissioning allowing a few spring high flow events to clean the substrates of the affected watercourses and bring aquatic habitats close to their pre-mining quality.

Existing Literature

There is extensive literature on the fish and fish habitat of the RSA (Scruton, 1984; Brown, 2005; Gartner Lee Limited, 2006; Weiler, 2009). Moreover, because of the many mining projects in the vicinity of Schefferville, many more studies have been conducted on fish and fish habitat (AMEC, 2009; Groupe Hémisphères and Groupe Synergis, 2010; 2011; SNC-Lavalin, 2012b) and for road design projects (Groupe Hémisphères, 2009b; 2013c; 2014b). Other baseline fish and fish habitat surveys were also carried out for the Canadian government's ELAIOM first cycle environmental effects monitoring (EEM) study design (Groupe Hémisphères, 2013b; 2014c).

Fish Species Present in the RSA

Thirty native freshwater fish species are present in Newfoundland and Labrador's waterways, in addition to two exotic species. While 18 species are found on the island of Newfoundland, 26 are found in Labrador (NLDEC, 2014c). Table 7-96 lists the 12 species of fish observed in the Schefferville region and the Howells River watershed, or the RSA. However, according to Groupe Hémisphères (Volume 2 Supporting Study M), only five species are present in the LSA; these records are highlighted in pale blue in Table 7-96. In any case, none of the species listed in Table 7-96 are at risk.

Table 7-96 Fish Species Present in the RSA or LSA

SPECIES*	
ENGLISH NAME	**LATIN NAME**
Brook Trout	*Salvelinus fontinalis*
Burbot	*Lota lota*
Lake Chub	*Couesius plumbeus*
Lake Trout	*Salvelinus namaycush*
Lake Whitefish	*Coregonus clupeaformis*
Landlocked Atlantic Salmon (Ouananiche)	*Salmo salar*
Longnose Sucker	*Catostomus catostomus*
Mottled Sculpin	*Cottus bairdii*
Northern Pike	*Esox lucius*
Round Whitefish	*Prosopium cylindraceum*
Slimy Sculpin	*Cottus cognatus*
White Sucker	*Catostomus commersoni*

*Species highlighted in pale blue were observed in the LSA

Common Species

Other than the species sampled in the 2013-14 Groupe Hemisphères' surveys (Volume 2 Supporting Study M), it is believed that no other species are present in the LSA. Table 7-97 summarizes the presence of fish and fish habitat within the LSA. It is unlikely that other species from the Howells River Valley (Howells River and mouth of tributaries) would swim upstream into the LSA, because there are steep slope gradients to overcome, and many streams are intermittent. Nevertheless, the following is a brief overview of the species usually found in similar habitats of the region.

The White Sucker, Longnose Sucker and Lake Trout usually dominate the fish biomass in the larger lakes of the region, where more than 50% of the biomass is usually composed of Suckers and Lake Trout (Scruton, 1984; Groupe Hémisphères and Groupe Synergis, 2010; 2011; SNC-Lavalin, 2012b). Brook Trout is the dominant species in the smaller lakes and often the only species occupying streams. Individuals of that species were observed in all types of aquatic habitat encountered during surveys in the Howells River Valley (Lee, 2006; Groupe Hémisphères and Groupe Synergis, 2010; 2011; SNC-Lavalin, 2012b). According to Lee's visual estimates of stream habitats, the age of Brook Trout ranged from young-of-the-year (0+) to five-year-old (5+) individuals. Young-of-the-year and 1+ were usually encountered in upwelling areas, stream margins and small side channels. Older Brook Trout (5+) were generally present in pools, deeper sections and pond margins (Lee, 2006). A 1982 Fisheries and Oceans Canada (DFO) gill-net survey of western Labrador lakes showed that Lake Trout accounted for 37% of the biomass of the salmonid catch (Scruton, 1984).

Benthos

Recent benthos sampling has also been conducted in the region (AMEC Earth & Environmental, 2009; Groupe Hémisphères and Groupe Synergis, 2010; 2011; SNC-Lavalin, December 2012; Groupe Hémisphères, 2013b; 2014c and Volume 2 Supporting Study M). The species found were generally the same all over the region, with greater diversity in streams than in lakes, which had really low diversity. The higher density found in streams indicates that streams provide better feeding grounds for benthivorous fish species like Brook Trout. It should also be noted that a high proportion of taxa (mainly of the *Ephemeroptera*, *Plecoptera* and *Trichoptera* orders) that are intolerant to pollution were caught within the LSA. This is indicative of generally good water quality, since these species are the first to disappear when water quality degrades. This data thus provides good background information that will allow the rapid monitoring of water-quality-related environmental effects on aquatic biota.

Local Fish Habitat Distribution and Description

Table 7-97 summarizes the presence of fish and fish habitat within the LSA. Figure 7-36 shows all the sampled habitats investigated within the LSA. Multiple sampling points were surveyed in each water body.

The number of sampling points in the watercourses varied depending on the length and complexity of the site. Two classification systems were used: that of Beak (1980), as suggested in Sooley *et al* (1998); and a new system soon to be adopted by the DFO in Newfoundland and Labrador (DFO, 2012 Draft) (the "New System"). The Beak classification system is based on the life stages of salmonids and habitat quality, which is particularly relevant to this study since the only species of interest are salmonids. Beak habitat type results are also shown in Figure 7-36.The classification system used for lakes was that of Bradbury *et al*. (2001).

Table 7-97 Habitat Type and Fish Presence Summary

SITE ID	YEAR OF SAMPLING	BEAK HABITAT TYPE	NEW SYSTEM	SPECIES PRESENT
		IN DECREASING ORDER OF IMPORTANCE		
Watercourses				
Burnetta Creek	2013	Not a fish habitat	Flat[b]/Riffle	None
Goodream Creek	2013	II/IV	Riffle/Run/Flat[b]/Rapid	Brook Trout
GDR1	2013	Not a fish habitat	Riffle[b]/Flat[b]	None
GDR2	2012	III	Rapid/Riffle	Brook Trout
GDR3 (DSO3-14)	2008	Not a fish habitat	Flat	None
PIN1 (DSO3-13)	2008-2013	IV*	Flat[b]/Riffle/Run	Lake Chub Brook Trout
GDR4 (DSO3-11)	2008	Not a fish habitat	Run/Riffle	None
Water Bodies				
Pinette Lake	2013	Max depth 5.2 m		Brook Trout

SITE ID	YEAR OF SAMPLING	BEAK HABITAT TYPE	NEW SYSTEM	SPECIES PRESENT
		IN DECREASING ORDER OF IMPORTANCE		
				Lake Chub
Triangle Lake	2013	Max depth 12 m		Burbot Lake Trout Round Whitefish
Two ponds	2014	Max depth ~2 m		None

[b]: At least some segments presenting this type of habitat were braided
* All fish were caught at the mouth of the stream, in the first downstream segment
Source: AMEC, 2009; Groupe Hémisphères, 2013b, 2014c and Volume 2 Supporting Study M.

For simplicity, only streams and lakes considered to be fish habitats within the LSA will be further described and analyzed/quantified. For more details on non-fish habitat water bodies, please refer to Volume 2 Supporting Study L or Section 7.3.10 on water quality. Fish habitats were further analyzed in order to quantify potentially impacted fish habitat areas. Table 7-98 shows the results of this analysis; examples of the calculations can be found in Volume 2 Supporting Study M. Quantification of streams was performed based on the two classification systems. The results are given in area (m^2) per type of habitat for the Beak system or in habitat equivalent units (HEU) for the New System. Stream HEUs were only calculated for Brook Trout. For lakes, the quantification results are also given in HEU. HEU were only calculated for salmonids, i.e., for Brook Trout in Pinette Lake and for Lake Trout in Triangle Lake.

Table 7-98 Fish Habitat Quantification Results

SITE ID	BEAK		NEW SYSTEM
	TYPE	AREA	HEU
Watercourses		**m^2**	**m^2**
Goodream Creek	II IV	9,376 16,058	**11,412**
GDR2	III	1,218	**1,218**
PIN1	IV	185	**185**
Water Bodies			**ha**
Pinette Lake	n.a.	n.a.	**9.3**
Triangle Lake	n.a.	n.a.	**12.6**
Burnetta Lake	n.a.	n.a.	**n.d.**

n.a. = not applicable, n.d. = non disposible

Goodream Creek

Goodream Creek is about 4.5 km in length and has a permanent water flow for about half of its length, with the upstream 2 km showing intermittent water flow (upstream from the access road crossing the stream between GDR2 and GDR3 junctions). Only the first 3.3 km downstream are considered fish habitats, based on previous aquatic surveys (AMEC, 2009; Groupe Hémisphères, 2009b, and Volume 2 Supporting Study M), and are further described below. Starting downstream, **the first 560 m are considered Type II habitats**, and consist mostly of rapids, with some running sections and a little flat section at the mouth of the stream. The substrate is dominated by medium-sized substrates with some boulders in the rapids. Vegetation cover is low. **The next 240 m are considered Type IV habitats.** This section is heavily braided and is considered a seasonal obstacle to fish passage. It is mostly flat with a few riffles, and its substrate is dominated by silt, with some boulders and rubble. It flows in a wetland area, with the riparian vegetation covering about 40% of the watercourse. **The next 1,300 m are considered Type II habitats**, and consist mainly of riffles and runs with medium to coarse substrate containing a considerable amount of organic matter originating from the riparian wetland. Riparian vegetation covers 10 to 20% of the watercourse in this section. **The next 590 m are considered Type IV habitats**, and consist of a flat, sluggish area created by the presence of beaver dams at its downstream end. This section is wide for the first 300 m and narrows to about 1.5 m wide in its upstream end. The substrate is a mix of sand and silt with variable amounts of medium-sized substrate. **The next 220 m are considered Type II habitats**. The wetted width is about 2.5 m and the substrate is dominated by cobbles and rubble. Riparian vegetation covers about 10% of the watercourse in this section. After this section, the stream crosses an access road and is considered intermittent farther upstream (Volume 2 Supporting Study M). **The last 390 m of fish habitat are considered Type II habitats** even though the flow is intermittent, since fish were caught here. This section mainly consists of shallow riffles with a mean wetted width of 2.1 m and a substrate dominated by coarse particles like boulders, rubble and cobbles. Riparian vegetation covers about 25% of the stream bed in this section (Groupe Hémisphères, 2013b). Brook Trout was caught both upstream and downstream from this watercourse segment.

GDR2

This approximately 600-m long stream is the outflow of Goodream Lake and flows into Goodream Creek. **It is considered a Type III habitat over its entire length**, and consists mainly of rapids with a few riffles, and shows a permanent flow. Since fish were caught in its upstream segment, it is considered to be a fish habitat over its entire length. Goodream Lake is also considered a fish habitat, since no obstacles to fish passage exist between the stream and the lake (Groupe Hémisphères, 2013b), but it is outside of the LSA, being upstream from the effects area.

PIN1

PIN1 is the only Pinette Lake tributary that is not a torrent and has an intermittent water flow. It is about 550 m long, is mostly flat in its downstream section (first 130 m), and alternates between riffles and runs in its upstream section before completely disappearing underground. Its channel is around 0.5 m wide except for a pool that is about 20 m wide. **The first 185 m is considered a Type IV habitat** according to Beak (1980), but **the intermittent upstream section, higher than the access road, is not considered a fish habitat**, since it is usually dry over time, completely choked with vegetation and no fish were caught in it. The substrate is a mix of sand, gravel, cobbles and rubble at the stream’s mouth, but muck and silt dominate the substrate in the intermittent section. There is substantial riparian vegetation cover and some aquatic plants in the pool. The downstream segment is braided and could constitute an obstacle to fish passage in dryer periods. The stream also completely disappears in a wetland about 220 m from Pinette Lake, representing a permanent obstacle to fish passage (Volume 2 Supporting Study M).

Pinette Lake

Pinette Lake, also known as Meneikshakikawiss by First Nations, is a natural lake with one identified tributary (PIN1) and an emissary named ELR1, which joins Elross Creek downstream. The lake has a total area of 15 ha with a maximum water depth of 5.2 m. The substrate composition consists mainly of silt with variable amounts of cobbles, rubble and boulders in the littoral zone. There is a dense aquatic plant population on the northeastern end of the lake, corresponding with the mouth of PIN1. Both Lake Chub and Brook Trout have been caught with gill nets and minnow traps deployed in the lake (Volume 2 Supporting Study M).

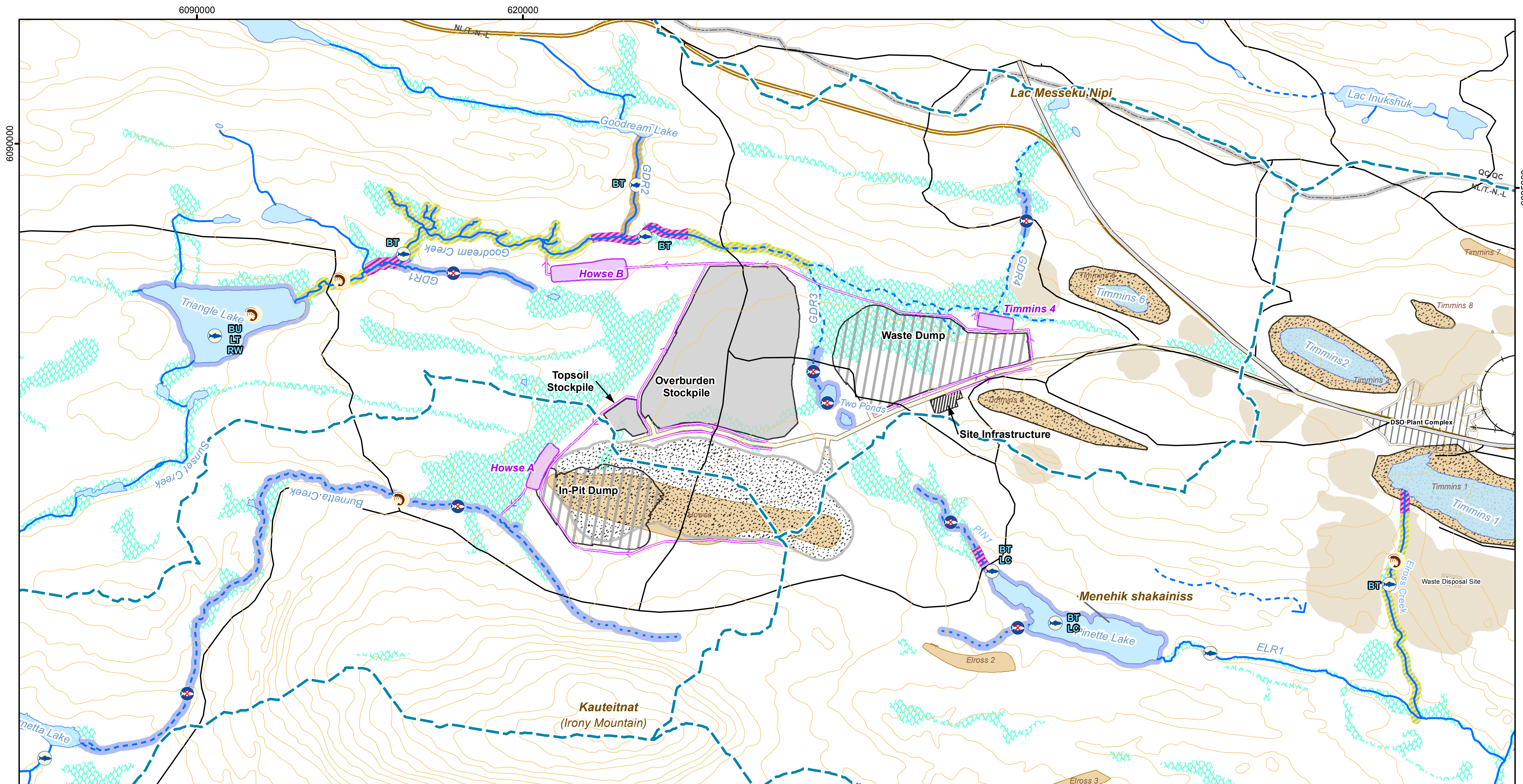
Triangle Lake

This lake has an area of about 21 ha and a maximum depth of about 12.0 m. Its substrate is dominated by silt with a few boulders, although cobbles and rubble cover more than half of the littoral zone at a depth of zero to one metre. There are patches of aquatic plants dispersed all over the littoral zone. Lake Trout, Round Whitefish and Burbot have been caught with the gill nets and minnow traps deployed in the lake (Volume 2 Supporting Study M).

Burnetta Lake

This lake has an area of about 5 ha. It has not yet been surveyed and no other details are known about its aquatic fauna. Still, some surface water samples have been taken in that water body (see Section 7.3.10).

Although speculative, knowledge of fish populations in nearby lakes would suggest that a fish community mainly composed of Lake Trout, White Fish, Sucker and Burbot occupies Burnetta Lake habitats. Note that a fall higher than 1 m exist between this lake and the Howells River below.



LEGEND

Surveys
- Fish
- No Fish
- Benthos

Fish Species
- BT : Brook Trout
- LT : Lake Trout
- RW : Round Whitefish
- BU : Burbot
- LC : Lake Chub

- Lake and Stream Segments Surveyed

Habitat
- Type II
- Type III
- Type IV

Infrastructure and Mining Components
- DSO Haul Road
- Existing Railroad
- Elross Lake Area Iron Ore Mine (ELAIOM) Plant Infrastructure footprint
- Existing Dump
- Deposit
- Proposed Ditch
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Site Infrastructure
- Proposed In-Pit Dump /Waste Dump
- Proposed and Existing Sedimentation Pond
- Proposed Mine Haul Road

Basemap
- Permanent Watercourse
- Intermittent Watercourse
- Storm Runoff
- Disappearing Stream
- Artesian Spring
- Water Body
- Wetland
- Contour Line (50 ft)
- Main Access Road
- Existing Road
- Provincial Border
- Watershed Boundary

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0569 , PR185-19-14, 2016-03-23, edickoum

N

0 500 1 000
Meters

UTM 19N NAD 83

SCALE: 1:21 000

SOURCES:

Basemap
Government of Canada, NTDB, 1:50,000, 1979;
Government of NL and government of Quebec,
Boundary used for claims,
Groupe Hémisphères, Hydrology and Wetland update, 2013

Infrastructure and Mining Components
New Millennium Capital Corp., Mining sites and roads
Howse Minerals Limited/ MET-CHEM,
Howse Deposit Design for General Layout, 2015

Surveys
AMEC Earth and Environmental. (2009).
Fish and Fish Habitat Investigation for the Direct-Shipping Ore Project,
New Millennium Capital Corp. Report TF8165902.
Prepared for Groupe Hémisphères, 39 pages and 3 appendices

Groupe Hémisphères (2013) Baseline Aquatic Fauna Characterization:
Elross Lake Area Iron Ore Mine (ELAIOM) Environmental Effects
Monitoring (EEM).
Field Report Submitted to TSMC, 12 pages and 2 appendices.

Groupe Hémisphères (2014) Howse Pit Aquatic Survey.
Technical report submitted to TSMC.

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Fish Habitat

Howse Minerals Limited

GroupeHemispheres
5731, rue Sainte-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 7-36

Species at Risk

No fish species at risk, either in NFL or in Quebec are present regionally.

Aboriginal Traditional Knowledge and Subsistence Hunting

Pinette Lake and Triangle Lake are sometimes used for recreational and fishing by the local people, who have thorough knowledge of the fish species present in the region. This section describes the species observed by the Innu and the Naskapi in the Schefferville area and discusses the likelihood of finding these species in the LSA.

The Naskapi are known to use Elross Lake, Kivivic Lake and Fleming Lake in the Howells River basin, but not the small lakes in the LSA (Weiler, 2009).

The Innu recognize several types of Brook Trout. According to the Innu, Brook Trout is abundant throughout rivers, streams and lakes. They are known to be found in John Lake, Howells River, Elross Lake, Island Pond, Boot Lake and Squaw Lake. The Innu have also reported the presence of a spawning ground at Star Lake. According to several sources, the population of Brook Trout has increased in a number of the commonly-fished water bodies (Clément, 2009).

Lake Trout is a species that frequents large, deep cold-water lakes (Scott and Crossman, 1974). According to the Innu, it is found in Howells River. This species is already identified as present in the LSA (Volume 2 Supporting Study M).

Lake Chub are identified as present in the LSA (Volume 2 Supporting Study M). Populations are considered stable by the Innu (Clément, 2009).

Burbot has already been recorded as being present in the LSA (Volume 2 Supporting Study M). Populations are considered stable by the Innu (Clément, 2009).

It is not impossible that Longnose Sucker and White Sucker are present within the LSA, as their presence was confirmed in the Elross Creek catchment area and in small streams and lakes (Clément, 2009). However, as these species are usually readily caught in nets during surveys and none were caught in 2013 (Volume 2 Supporting Study M), they are not believed to be present in the LSA.

A recent survey confirmed that Lake Trout, Northern Pike, Lake Whitefish and Ouananiche were caught by Innu and Naskapi fisherman in an area including Rosemary Lake, which is part of the Howells River and thus the RSA (Volume 2 Supporting Study D). Lake Trout presence has been confirmed in the LSA and Lake Whitefish could be present, but it is unlikely that Ouananiche of Northern Pike is present according to all fish surveys conducted in the waterbodies upstream of the Howells River waterbodies (including Rosemary and Elross Lake).

Data Gaps

All the watercourses and water bodies potentially affected by this Project were directly surveyed for fish and fish habitat, with the exception of Burnetta Lake. The risk of an effect on aquatic fauna this far from the mine site is unlikely but nonetheless possible and an aquatic survey should be conducted in that lake in the summer of 2016 to complete the portrait.

7.4.9.2 Effects Assessment

Given that fish and their habitat includes benthic microinvertebrates, aquatic fauna will be considered as fish only from now on. Also, since trout species have the highest socioeconomic relevance by far in the LSA, focus is put on Brook Trout and Lake Trout.

Literature review and Current Studies Data Used to Assess the Potential Effect

The natural environment knows few exceedances for arsenic, copper, zinc, aluminium and iron, but sporadic and are usually associated with TSS (Pouw, *et al.*, 2014), suggesting that those contaminants are not available to aquatic life since they are bonded to suspended solids. As explained in Section 7.3.10 and Section 3.2.5, and in studies on metal mines under MMER, typical exceedances for iron ore mines are found in TSS only (Environment Canada, 2011; Pouw *et al.*, 2014) and so it is the only contaminant that will be discussed here.

Few data exist on the effect of iron ore on fish and fish habitat, but the *Second National Assessment of Environmental Effect Monitoring Data from Metal Mines Subjected to the Metal Mining Effluent Regulations* (Environment Canada, 2012b) presents an overview of the existing results. Resource Consultants and Endeavour Scientific (2015) reanalysed the same dataset to determine the likelihood of false positives of the former study and elements of the rationales presented will be considered. Finally, since trout species are essentially the only species of interest according to traditional knowledge, a literature review on the effects of turbidity and suspended solids on salmonids made by Bash *et al.* (2001), along with more specific studies on the subject (Berg, 1982; Berg and Northcote, 1985; Cederholm and Salo, 1979; Davies-Colley and Smith, 2000; Gardner, 1981; Gregory and Northcote, 1993; Redding *et al.*, 1987; Sedell *et al.*, 1990; Servizi and Martens 1987;, Sorenson *et al.*, 1977; Spence *et al.*, 1996; Sweka and Hartman, 2001; USFWS, 1998) were used to investigate sources of effects of the Howse mine on fish and its habitat.

Another source of effects will come from hydrography, hydrology and hydrogeology through changes in water regimes and is based on data from Sections 7.3.9 and 7.3.6, respectively.

Finally, blasting could potentially provoke fish mortality and effect is discussed based on the guidelines prepared by Wright and Hopky (1998) and on the appended report on noise and vibration Volume 2 Supporting Study F.

Project Interaction with Aquatic Fauna and Potential Effects

Site Construction Phase

During the site Construction phase, all project activities will have potential interaction with Aquatic Fauna, since they were all shown to potentially interact either with water quality (Section 7.3.10) of Hydrography and Hydrology (Section 7.3.9). Although, since none of these activities physically overlap with any of the fish-bearing water bodies, all interactions are deemed indirect through water quality or regime changes for this phase. Since Burnetta Creek does not shelter fish, it is not directly considered for this VC unless when Burnetta Lake is concerned.

Most interactions would come from surface runoff and indirectly through water quality changes, which are explained in Section 7.3.10. Ultimately, potential contamination will come from land clearing, watercourse crossing and dust from transportation. Since there will be no water pumping at this stage, the modified drainage due to peripheral ditches only represents a 9% increase in water volume discharged in Goodream Creek, based on modified watershed areas only (WMP, Section 3.2.5). Therefore, the long residence time in the sedimentation ponds designed to support the larger inflow of pumped water (operation phase) in addition to the dilution obtained in Goodream Creek, should keep concentrations below CCME guidelines in the environment of the LSA. Moreover, discharge is bound to be sporadic at this phase and no effluent is expected for most of the year. Contamination will therefore be minimal during this phase and effect on aquatic fauna is unlikely. Nonetheless, some limited sedimentation might occur in the stream following spring thaw and exceptionally large rain events, potentially reducing quality of some Brook Trout spawning grounds or benthic invertebrate habitats. That can be translated in limited Brook Trout habitat degradation over a total of 25,434 m² of habitat or 11,412 m² of HEU. The dilution obtained in Triangle Lake (1 in 4.8) is considered sufficient to keep effect on aquatic fauna negligible in this water body for this phase, although some light TSS contamination could be visible in the spring.

The expected watershed drainage area increase for Burnetta Creek (not a fish habitat) is considerable (73%). Since those sedimentation ponds are not designed to support pumped water inputs, a discharge into Burnetta Creek will be inevitable, at least at spring thaw. Nonetheless, the settling in the sedimentation ponds, the dilution in Burnetta Creek and the filtering action of the substrate and abundant aquatic vegetation of this 4 km of intermittent stream should bring TSS concentrations below CCME guidelines before reaching any fish habitats (Burnetta Lake), where a dilution of 1 in 8.4 will further reduce concentrations. No effect on aquatic fauna is expected in the Burnetta Creek watershed for this phase.

Finaly, since no runoff will reach PIN 1, the Pinette Lake watershed will not be affected by runoff, and the negligible 4% decrease in watershed size will not modify water levels in the water bodies, therefore, no effect on aquatic fauna is expected in this watershed.

Accidental spills are also a risk for water quality, but mine roads being all more than 100 m from any water body, the risk is therefore very low. Accidents and malfunctions are treated in Section 6.4. No effect on aquatic fauna is expected from this source.

➔ The effects associated with the above potential interactions are:
  - sublethal effects of water contamination by TSS on fish and fish habitat;
  - degradation of habitat quality by sedimentation.

The nature of the effect is indirect and the effect is adverse.

Operation Phase

During the operation phase, all Project activities will have potential interaction with aquatic fauna through water quality or quantity changes and or from blasting. The effect of the Project on water quality is discussed in WMP (Section 3.2.5) and Section Water Quality (Section 7.3.10) and will not be repeated here, other than that the only contaminants that will reach aquatic habitat in significant quantities is TSS. The effect of the Project on water quality is discussed in WMP (Section 3.2.5) and Section Water Quality (Section 7.3.10) and will not be repeated here, other than that the only contaminants that will reach aquatic habitat in significant quantities is TSS.

With a focus on salmonids, TSS can have three different types of interaction with fish and fish habitat: physiological, behavioral and habitat related (Bash *et al.*, 2001). Potential physiological effects include gill trauma (Berg, 1982; Berg and Northcote, 1985), increased levels of blood glucose, plasma glucose, plasma cortisol, and osmoregulatory ability due to stress (Redding *et al.*, 1987; Servizi and Martens, 1987; USFWS, 1998), and clogging of redds affecting the quantity and quality of fish produced (Spence *et al*., 1996). Poor health could also favor parasitism, further decreasing fitness. Secondly, there are behavioral effects, including avoidance (Sedell *et al*., 1990), decreased visibility, potentially lowering prey detection (Berg, 1982; Gardner, 1981; Sweka and Hartman, 2001) or lowering of predation risks (Gregory and Northcote, 1993), a reduction in numbers of benthic organisms (Sorenson *et al*., 1977), and a reduction in light penetration and hence photosynthetic activity, primary production and oxygen production (Davies-Colley and Smith, 2000; Sorenson *et al*., 1977). Finally, there are habitat-related effects including increased embeddedness, reducing oxygenation and removal of waste in the interstitial spaces (Cederholm and Salo, 1979), and reduction of habitat complexity and abundance (USFWS, 1998).

When focusing more on iron ore mine data from the last 10 years of studies done under the MMER, some negative effects are indeed observed on fish and benthos (Environment Canada, 2012b). The same documents indicate adverse effects on weight at age, age of fish and on density of benthos (Phase I only). However, when critical effects sizes are used, as recommended in the latest version of the metal mining environmental effect monitoring guidance document (Environment Canada, 2012c), effect considered indicative of a higher risk to the environment are considerably reduced (Resource Consultants and Endeavour Scientific, 2015). Following this procedure, the analysed data rater indicates either no effect (Phase I) or mitigated effects (Phases 3 and 4), with slight increase in general condition of fish and slight decreases in gonad size. It is noteworthy that most of the data comes from iron ore mine sites including a concentrator that generates considerably smaller sized suspended solids difficult to settle and that no such facility is planned on Howse footprint since concentration will occur in ELAIOM footprint where water is discharged in Timmins 2 pit, an old IOCC mined out pit with no connectivity with surface water.

Therefore, in light of existing data on effects of iron ore mine effluents on fish, important effects could be expected on fish. On the other hand, the lack of transformation on site (no concentration) considerably reduces the probabilities of having an important effect representing a high risk to the environment.

Runoff from the natural ground, the topsoil stockpile and the in-pit dump will be diverted with ditches to Sedimentation Pond HOWSEA and ultimately discharged in Burnetta Creek (Section 3.2.5.4 for details). The discharge in Burnetta Creek is not considered important for this VC since the stream does not shelter fish upstream of Burnetta Lake. According to analysis presented in the Water Quality (Section 7.3.10), TSS concentrations in Burnetta Lake should seldom surpass the CCME guidelines for the protection of aquatic life, and no effect on fish is expected in that watershed.

On the other hand, part of the sump water will be pumped to Timmins Sedimentation Pond 3 while the rest will be pumped, along with dewatering, towards Sedimentation Pond HOWSEB where it will mix with runoff from overburden stockpile, waste rock dump and the site infrastructure pad; both sedimentation ponds ultimately discharging into Goodream Creek (Section 3.2.5 for details). Even though it will be highly diluted in pristine groundwater coming from peripheral wells, sump water will be heavily charged with suspended solids and TSS concentrations will probably sometime surpass the CCME guidelines in Triangle Lake, and often, in Goodream Creek (Section 7.3.10). Based on those assumptions, effects are expected on fish and fish habitat in this watershed and could be larger than the critical effect sizes, especially in Goodream Creek, where concentrations are expected to be the highest. On the other hand, effluent might only be discharged in the spring for part of the project life (with limited dewatering), resulting in substantially decreased effects throughout those year. Potential habitat degradation could affect up to 25,434 m² of habitat or 11,412 m² of HEU in Goodream Creek and, with less probability, 12.6 ha of HEU in Triangle Lake.

Regardless, Brook Trout were frequently captured in Elross Creek (AMEC Earth & Environmental, 2009; Groupe Hémisphères, 2013b and 2014c), a stream with red water and regular runoff contamination from old waste dumps piles on both sides of it, without diverting ditches or sedimentation pond, and fed by the overflow of an old pit. This suggests that the contaminants generated by the local material do not destroy Brook Trout habitat, even after more than 40 years of contamination. Nevertheless, a rigorous EEM study will ensure that any adverse effects will be identified quickly.

Dewatering could technically interact with aquatic fauna by modifying the hydrography and hydrology (Section 7.3.9.2). On the other hand, mine water discharge will largely compensate for any water table drawdown effect in receiving streams (Goodream and Burnetta Creek). However, this is not the case for PIN1 (not a fish habitat) and Pinette Lake. Technically a drawdown of the water table could lower the water level of the lake if a connectivity existed between the lake and le groundwater table. Fortunately, this does not seem to be the case as the groundwater table is reached between 67 and 92 m below the surface (Section Hydrogeology). Therefore, the water bodies seem to be linked to a perched water table rather than the groundwater table (Section Hydrology). Therefore, dewatering is not expected to dry-up water bodies. Precisely concerning Pinette Lake, its expected water level change is linked to the 4% of watershed reduction. A Hydrological study dedicated to this stake reveals that in the worse situation, which is at the spring freshet, the lowering of the lake will be of 2 mm compared to the actual regime (Volume 2 Supporting Study L). In that case, no fish habitat nor fish passage is expected to be loss.

Also, all pumped dewatering water will be discharged into Goodream Creek and its water level will therefore increase just above the threshold level of 20% for a slight effects (13% increase downstream of Timmins 3 Sedimentation Pond 3 and 25% increase downstream of sedimentation pond HOWSEB at spring maximum flow, which is the worse-case scenario). This should regulate flow in the intermittent part of the stream downstream of the Timmins 4 Sedimentation Pond 3 and could have a positive effect by increasing availability of habitat for fish. Downstream of sedimentation pond HOWSEB, the stream is already permanent and the level will rise. Still, the discharge point is in a large wetland area and some of the increase in water level should be buffered, regulating the flow further downstream. Therefore, flow increase downstream of Goodream Creek is not expected to reach 25% at normal flood (Section 7.3.9)

The use of explosives close to water bodies may injure or kill fish from all life stages (Wright and Hopky, 1998). Given that the Howse Property is close to some water bodies considered fish habitats, fish mortality may occur as a result of blasting, depending on the size of the charge used.

➔ The effects associated with the above potential interactions are:
- sublethal effect of water contamination by TSS on fish and fish habitat;
- degradation of habitat quality by sedimentation;
- changes to habitat availability through hydrographic and hydrologic changes; and
- lethal effect of blasting.

The nature of the effect is both direct (blasting) and indirect through water quality degradation (water contamination) and hydrologic modifications and the effect is adverse.

Decommissioning and Reclamation Phase

During the decommissioning and reclamation phase, all project activities will have potential interactions with aquatic fauna.

The waste rock dumps and other work areas will continue to generate runoff, potentially contaminating water with TSS, but site restoration will reduce contamination risks and frequency and dewatering discharge will cease, bringing most water levels back to normal.

➔ The effects associated with the above potential interactions are:
- sublethal effect of water contamination by TSS on fish and fish habitat;
- degradation of habitat quality by sedimentation; and

The nature of the effect is indirect through water quality degradation and effect is adverse.

7.4.9.3 Mitigation Measures

Standard Mitigation Measures

Since many of the interactions with the aquatic fauna are indirect through water quality or hydrography and hydrology, the mitigation measures proposed in those respective sections often apply to aquatic fauna and most of the standard mitigation measures enumerated here are the same (Table 7-99).

Even though it is not a mitigation measure in the sense that it is considered as part of the projet, the WMP developed to minimize the effects of the Project and described in detail in Section 3.1.5 mitigates many of the effects expected on aquatic fauna through water contamination. Here are the highlights of the mitigation of effects on aquatic fauna derived from this WMP. First, a peripheral ditch network will intercept all runoff before it reaches the water bodies. The runoff will be redirected to sedimentation ponds where most of the

TSS will settle before reaching the environment. Moreover, the sedimentation ponds will reduce the frequency of effluent discharge, as suggested by data from DSO3 showing that effluent discharge usually only occurs for a few weeks in May (spring thaw) and that the water either infiltrate or evaporates in the sedimentation pond the rest of the year. This will greatly lowering the potential effect of TSS on fish, since only extreme weather events and high dewatering periods will produce enough water for the sedimentation ponds to overflow, lowering the probability of effects on aquatic fauna. Indeed, it has been shown that TSS concentration alone is a relatively poor indicator of TSS effects (r^2 = 0.14), while the product of concentration and duration of exposure is a better indicator (r^2 = 0.64) (Newcombe and Macdonald, 1991). Also, an effort was made to divide effluent discharges between Burnetta and Goodream Creek in a way that minimizes flow modifications in fish habitats (maximum of 25% increase of the natural flood in Goodream Creek).

Table 7-99 Standard mitigation measures for aquatic fauna

CODE	MEASURE	MITIGATION EFFECT
Watercourse Crossings (WC)		
WC2	Arched culverts must be installed at all watercourse crossings where potential or confirmed fish habitat is present.	Prevents fish habitat loss and ensures fish passage
WC3	Keep the scale and duration of work in the water to a minimum and confine the work to minimum-flow or low-water periods.	Limit fish disturbance and habitat degradation through sedimentation
WC4	Ensure that fish can move freely at all times and avoid critical periods for fish (spawning, incubation, nursing, etc.).	Minimizes effects on fish life cycle
WC5	Build bridges and install culverts on narrow, straight sections without reducing the width of the watercourse, choosing ground with adequate load-bearing capacity and gentle slopes. Build them as far as possible from watercourse mouths or confluences.	Limit fish habitat degradation through sedimentation
WC6	Accurately assess the watercourse's peak flow in order to choose the appropriate diameter of pipe.	Ensures fish passage and reduces habitat degradation through sedimentation
WC7	Choose the type of culvert (arched, round, elliptical, etc.) based on the characteristics of the site and the fish habitat.	Prevents fish habitat loss and ensures fish passage
WC9	Build crossings perpendicular to the watercourse.	Limit fish habitat degradation through sedimentation
WC10	Use existing crossings on roads, cleared strips or paths as far as possible to avoid disturbing riparian vegetation.	
WC12	Preserve plant cover and stumps in road rights-of-way.	
WC14	Before starting work, confine the work area to avoid sediment transport into water and ensure that work methods and materials used do not generate excessive turbidity.	
WC19	Ensure the stability of soil, shorelines, banks, fill and structures during the construction of watercourse crossings (geotextile liner, rip-rap on embankments and watercourse bed, etc.)	

CODE	MEASURE	MITIGATION EFFECT
WC21	Do not block the flow of water and respect the slope, natural drainage of the soil and direction of the watercourse when installing a culvert.	Ensure fish passage
WC22	Backfill around the culvert and stabilize the fill. The end of the culvert must extend at least 30 cm beyond the base of the fill.	Limit fish habitat degradation through sedimentation
WC25	All temporary structures must be stabilized upstream and downstream and demolished when the work is finished.	Limit fish passage obstacles and fish habitat degradation through sedimentation
WC26	Once work is finished, restore the bed of the watercourse to its natural profile, stabilize the banks and revegetate as needed with native species.	Restore degraded fish habitat and limit further degradation through sedimentation
WC27	Monitor culverts and bridges periodically, especially in the spring or after heavy rains. Pay particular attention to signs of erosion, poor plant regrowth, obstacles blocking water flow and structural integrity.	Ensure fish passage and limit habitat degradation through sedimentation
WC28	If necessary, spread the work out over time to take into account the life cycles of the species found in the area.	Minimizes effects on fish life cycle
Waste Management (WM)		
WM3	Do not dump any waste into aquatic environments, including waste from cutting vegetation or stripping the soil. All waste accidentally introduced into aquatic environments must be removed as quickly as possible.	Avoid fish contamination of fish habitat degradation through contamination or by blocking fish passage
Hazardous Materials Management (HM)		
HM1	Implement a hazardous waste management plan in the event that fuel or other hazardous substances are spilled.	Prevent fish contamination of fish habitat degradation through contamination
HM3	Spill kits for recovering oil products and hazardous materials must be present on the worksite at all times.	
HM4	Each vehicle and piece of machinery on the site must contain enough absorbent materials to intervene rapidly in the event of a spill. A list of materials and intervention methods to be used in the event of a spill must be approved by the supervisor.	
HM5	All accidental spills must be reported immediately to the person in charge of the emergency response plan, which will have been drawn up and approved before work start-up.	Limit contamination of fish and degradation of habitat in case of a spill
HM6	If harmful substances are spilled, the responsible authority must be contacted.	
HM7	It is prohibited for any employee to dump any hazardous material in the environment or wastewater treatment system. This includes scrap and volatile materials, particularly mineral spirits and oil or paint thinners.	Prevent fish contamination of fish habitat degradation through contamination

CODE	MEASURE	MITIGATION EFFECT
HM9	If hazardous materials are spilled, the contaminated areas must be marked and the surface layer removed for disposal in accordance with regulations in effect in order to limit contamination of waterbodies by runoff. Contaminated areas must be backfilled and stabilized to permit revegetation.	Limit contamination of fish and degradation of habitat in case of a spill
HM12	When a site is closed, ensure that all tires have been removed and properly disposed of.	Prevent fish contamination of fish habitat degradation through contamination
Drilling and Blasting (DB)		
DB1	An explosives management plan must be drawn up to minimize the amount of ammonia and nitrates released into the natural environment.	Limit effect on fish health
DB4	The manufacturer's instructions must be followed to ensure that blasting procedures are safe both for humans and the environment.	
DB5	Fisheries and Oceans Canada *Guidelines for the Use of Explosives in or near Canadian Fisheries Waters* must be followed when blasting on land.	Prevent fish mortality
DB6	No explosive is to be detonated in or near fish habitat that produces an instantaneous pressure change greater than 100 kPa in the swimbladder of a fish.	
DB7	No explosive is to be detonated that produces, or is likely to produce, a peak particle velocity greater than 13mm s^{-1} in the spawning bed during the period of egg incubation.	
DB9	No explosive must be used in or near water.	
DB13	Water left after drilling must be blown out using compressed air before the pneumatic loading of the ANFO.	Limit effect on fish health
DB14	Depending on blasting conditions, the explosives used can greatly affect the overall quantity of explosives waste, so it is important to choose the appropriate type of explosive.	
DB15	Explosives waste must be recovered and disposed of in an appropriate manner after each blast.	
DB16	Use multiple detonators in bore holes as per the manufacturer's recommendations and optimize the arrangement of blasting holes to minimize misfires.	
DB17	To minimize explosives waste, minimum distances between collars and charges must be determined for all underground blasting charges, based on geological conditions and the application.	
DB18	Prevent misfires by establishing time delay blasting cycles as per the explosives manufacturer's recommendations.	

CODE	MEASURE	MITIGATION EFFECT
DB19	Use reliable triggering systems that allow for precise firing of the explosives.	
Construction Equipment (CE)		
CE1	Store all equipment and machinery in areas specifically designed for this purpose, particularly parking, washing and maintenance areas. These zones must be located 60 m or more from watercourses and waterbodies.	Reduced risk of fish habitat degradation through contamination
CE2	Washing of equipment in aquatic environments is prohibited.	Prevents fish habitat degradation through contamination
CE4	Construction equipment must be delivered to the site in good working order, without leaks and equipped with all emissions filters required to comply with emissions regulations and reduce noise disturbance. The equipment must be regularly inspected to detect any leaks or mechanical defects that could lead to fuel, lubricant or hazardous material spills.	Reduced risk of fish habitat degradation through contamination
CE5	Fuel-related operations (storage, transportation and handling) must comply with the relevant standards and guidelines. All equipment must be refuelled more than 15 m from a waterbody.	
CE6	No machinery must circulate in the riparian strip unless regulations permit it.	
CE9	All pumps and generators near waterbodies must be equipped with a drip pan.	
CE10	Inspect equipment at each use to detect leaks and drips. Any leaks must be repaired and reported immediately to the field supervisor.	
CE15	The dust-control liquid used must comply with GNL regulations.	
Mining Operations (M)		
M3	Reports required by governments must be submitted by the stipulated deadlines.	Ensure any effect on aquatic fauna is detected and that proper mitigation measures are deployed, if need be
Management of Ore, Rock Piles, Waste Rock, Tailings and Overburden (MO)		
MO1	Take the necessary steps to prevent wind erosion of stored tailings and avoid slippage around the mine tailing storage sites.	Limit fish habitat degradation through sedimentation
MO2	Locate the storage area more than 60 m from the high water mark.	Water quality / Hydrography and hydrology
MO3	Only mine tailings shall be deposited in the storage areas.	Prevent fish habitat degradation through contamination
MO5	The physico-chemical parameters of the ore and tailings must be characterized.	
Water Management (H_2OM)		
H_2OM5	Once mining operations are finished, but before restoration work begins, establish a surface water and groundwater monitoring	Monitor fish habitat quality

CODE	MEASURE	MITIGATION EFFECT
	programme approved by the competent authority and proceed with required sampling.	
H_2OM6	At the end of restoration work, implement the surface water and groundwater monitoring programme.	
Rehabilitation (R)		
R1	Follow good practices presented in the rehabilitation plan.	Reduce effect of the mine on fish and fish habitat through sedimentation, contamination of hydrological changes
R2	Draw up a rehabilitation plan	
R3	Produce post-mining and post-rehabilitation monitoring reports.	

Specific Mitigation Measure

Table 7-100 presents the specific mitigation measures that will be applied to limit the effects of the Project on aquatic biota.

Table 7-100 Specific mitigation measures for aquatic fauna

SPECIFIC MITIGATION MEASURES FOR AQUATIC FAUNA	
Measure	**Mitigation Effect**
Limit the maximum charges of explosives to be used so that the blast vibration and overpressure limits respect the NPC-119 guidelines (MOE, 1985). The smallest distance between the pit and a water body (Pinette Lake) is 900 m, which limits the charges to 3,128 kg per delay to protect fish eggs from vibration and to 1,092 kg to protect the fish from overpressure (Volume 2 Supporting Study F).	Respect of those limits will ensure not fish and fish egg mortality in the adjacent water bodies.

The application of standard mitigation measures will lower the risk of water contamination by TSS and other contaminants through the use of proper work techniques and by limiting the source of contamination. Also, all mitigation measures suggested for water quality (Section 7.3.10) and hydrography and hydrology (Section 7.3.9) will be beneficial to aquatic fauna. In order not to be redundant, only the mitigation measures specific to fish and fish habitat are further discussed here.

Concerning the use of explosives, based on the guidelines prepared by Wright and Hopky (1998), the maximum charges to be used in order to protect adult fish and fish eggs in nearby water bodies have been calculated and are shown in

Table 7-101. Maximum charge for adult fish is calculated in order to keep blast over pressure under 100 kPa and, for fish egg, to keep blast vibration under 13 mm/s.

Table 7-101 Maximum Charges of Explosives to Be Used to Prevent Fish Mortality

POTENTIALLY AFFECTED WATER BODY	DISTANCE FROM DEPOSIT* (M)	MAX. CHARGES (KG)	
		Adult Fish	Fish Egg
Pinette Lake	862	29,368	3,261
Triangle Lake	1,661	109,044	12,106
Goodream Creek	1,045	43,162	4,792

*Distances from deposits are the shortest distances between two points respectively in the proposed pit and the water bodies

Since the criteria used to calculate the generic maximum allowable charge per delay for the closest human point of reception located at 900 m from the site are lower than the ones for fish (Volume 3 Hemis Study f), respecting those limits will ensure no fish or fish egg mortality. Lethal effect of blasting will therefore not be further considered for the evaluation of the significance of the residual effects.

7.4.9.4 Residual Effects Significance Assessment

Since the specific mitigation measure concerning explosives eliminates the effect expected from this source, the 3 phases of the project have the same types of effect on aquatic fauna and will be further discussed jointly.

The regional fish communities are really homogeneous. Indeed, many fish surveys done in le LSA and the RSA show the same fish communities. As explained earlier fish communities of big lakes are composed of Lake Trout, Whitefish, Sucker and burbot while smaller lakes are populate by Brook Trout and Lake Chub. Streams of the region are practically only occupied by Brook Trout. Therefore, effect on the LSA's fish communities do not represent a regional menace as both species and habitats are omnipresent.

Therefore, resilience of the regional population is good since the LSA could easily be repopulated after cessation of disturbances. In any case, data from other iron ore mines show that Brook Trout still use habitats in which effluents are discharged and that those fish do not show apparent negative effects to their health (Resource Consultants and Endeavour Scientific, 2015; Environment Canada, 2012b; AMEC Earth & Environmental, 2009; Groupe Hémisphères, 2013b; 2014c).

The overall methodological approach to assess the environmental effects is presented in Section 5. However, in order to apply this methodology to the aquatic fauna VC, it is essential to consider assessment criteria applicable specifically to this VC (Table 7-102).

Table 7-102 Assessment Criteria Applicable for Aquatic Fauna

TIMING		
Inconsequential timing	**Moderate** timing	**Unfavorable timing**
Effects expected mostly outside of critical periods (spawning and incubating), with little to not residual effects throughout critical periods	Effects expected mostly outside of critical periods (spawning and incubating), with some residual effects throughout critical periods	Effects expected throughout critical periods (spawning and incubating)
SPATIAL EXTENT		
Site specific	**Local**	**Regional**

Howse project footprint	LSA	RSA or more
DURATION		
Short	**Medium**	**Long**
Less than 12 months Limited to the Construction and/or Decommissioning and Reclamation phase.	12-24 months Extends beyond the Construction phase, but shorter than the lifespan of the Project.	More than 24 months Or as long or longer than the Project duration
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Applicable for temporary work sites or temporary stream disturbance	It persist after source of effect ceases, but its magnitude is significantly lower. An example of this is water crossing. The water crossing remains, but its negative effect on the environment its much lower when shorelines and stream substrate are stabilised and when fish habitat is stable over time.	Persist after source of effect ceases. Applicable for activities generating long term or permanent effects such as stream destruction/alteration, waste dump operation or pit operation.
MAGNITUDE		
Low	**Moderate**	**High**
No significant changes in fish health endpoints and fish densities in receiving environment	Significant changes in fish health endpoints but below critical effect size.	Significant changes in fish health endpoints above critical effect size.
FREQUENCY		
Once	**Intermittent**	**Continual**
One time	Occasional or intermittent	Year round

Timing

Most of the effects will be derived from mine drainage discharges in the environment, which will happen mostly at snowmelt. Indeed, low to no discharge are expected the rest of the year, and if any, water quality will be substantially better than in the spring because of the long residence time in the sedimentation ponds designed for a 24h retention at highest flow (spring). Since trout species are the more valuable in term of sport and subsistence fishing in the affected water bodies, and since those species spawn in late summer/fall, timing of effect is rater good (in the spring or outside of the spawning and incubating period). Nevertheless, there will most probably be residual effects between discharge events in the form of sedimentation of the waterbed. (Value of 2)**.**

Spatial Extent

The spatial extent of the combined sources of effect is local since the effect will not reach beyond the LSA (Value of 2).

Duration

The duration of the effect is long since potential effect on fish and fish habitats will extend at least for the lifetime of the mine, and probably a few years afterwards (Value of 3).

Reversibility

The potential effect is considered partially reversible since water quality has been shown to return to normal a few months after cessations of pumping mine water (Dubreuil, December 1979) based on data from Fleming 3 pit in DSO3, and water contamination is the main treat to fish health, but changes to the hydrology and hydrography will be permanent (Value of 2).

Magnitude

The magnitude is low since data from other iron ore mines show either no or mitigated effects on fish in the receiving environment of iron ore mines with concentrators across Canada (Resource Consultants and Endeavour Scientific, 2015; Environment Canada, 2012b), whereas Howse does not include a concentrator, suggesting lower effect on the fish community (Value of 1).

Frequency

The frequency is continual even though water contamination will be intermittent since habitat degradation from sedimentation or changes in water regime will be continuous (Value of 3).

7.4.9.4.1 Significance

The residual effects significance assessment of the Howse Project on aquatic fauna is non-significant (value of 13). Indeed, re-examination of MMER data over ten years of metal mining activities across Canada shows that observed effect on aquatic fauna, if any, are often below the critical effect size (Resource Consultants and Endeavour Scientific, 2015), a threshold below which an effect may be indicative of a lower risk to the environment (Environment Canada, 2012c).

Likelihood

Likelihood determination is not needed as the effect was determined non-significant.

7.5 SOCIOECONOMIC ENVIRONMENT

This document presents the results of the biophysical effects assessment in compliance with the federal and provincial guidelines. All results apply to both jurisdictions simultaneously, with the exception of the Air Quality component. For this, unless otherwise noted, the results presented/discussed refer to the federal guidelines. A unique subsection (7.3.2.2.2) is provided which presents the Air Quality results in compliance with the EPR guidelines.

7.5.1 Regional and Historical Context

The nearest populations to the Project site are found in the Schefferville and Kawawachikamach areas. The Town of Schefferville and Matimekush-Lac John, an Innu community, are located approximately 25 km from the Howse Property, and 2 km from the Labrador border. The Naskapi community of Kawawachikamach is located about 15 km northeast of Schefferville, by road. In Labrador, the closest cities, Labrador City and Wabush, are located approximately 260 kilometres from the Schefferville area (Figure 7-37).

The RSA for all socioeconomic components includes:

- Labrador West (Labrador City and Wabush); and
- the City of Sept-Îles, and Uashat and Mani-Utenam. As discussed in Chapter 4, however, Uashat and Mani-Utenam are considered within the LSA for land-use and harvesting activities (Section 7.5.2.1).

The IN and NCC are also considered to be within the RSA, in particular due to their population and their Aboriginal rights and land-claims, of which an overview is presented.

The section below describes in broad terms the socioeconomic and historic context of the region in which the Howse Project will be inserted.

<u>Northwestern Labrador</u>

With a population density of 0.1 inhabitant per km^2, Labrador has the particularity of having a small population spread over a large territory (Statistics Canada, 2011)[8]. While there are 32 recognized communities in Labrador, the most populated town, Happy Valley-Goose Bay (HVGB), has less than 8,000 inhabitants. The 2011 population of Newfoundland and Labrador was 514,526 inhabitants. Of this total, 26,728 reside in Labrador and more than 9,000 live in Labrador West (Statistics Canada, 2011). Thirty-five percent of the total population of Labrador has Aboriginal origins (Statistics Canada, 2011). Labrador is home to three Aboriginal groups: the IN, the Inuit of Labrador, and the Labrador Inuit Métis, under the NCC.

Ms. Yvonne Jones was elected federal Member of Parliament for Labrador (Newfoundland and Labrador)in May 2013 (Radio-Canada, 2013a) and re-elected in October 19th 2015.

The economy of the province of Newfoundland and Labrador relies in large part on the oil extraction industry: in 2012, this sector represented 28.2% of NL's GDP and the construction sector, accounting for

[8] The most recent census of the Canadian population was conducted in 2011, with data released in 2012. The government of Canada eliminated the mandatory long census form in the 2011 Census and this has resulted in data limitations and data discontinuity. Thus 2011 census information is limited to population and private dwelling data. Other data, previously available in the census, can be obtained through the National Household Survey (NHS). However, the NHS is not mandatory and some data are unavailable, statistically unsound or suppressed due to the small number of responses. In these cases, 2006 census data or other information was used.

9.2% of NL's GDP. In 2013, NL's GDP grew by 5.9%, largely stimulated by capital investments for the Muskrat Falls, Hebron and Vale nickel projects in Labrador, when capital investments reached $12.3 billion.

Labrador West is formed by the twin towns of Labrador City and Wabush, with populations of 7,367 and 1,861, respectively. Each of these municipalities has its own organizational structure, a mayor and a city council. These municipalities are accessible by paved and gravel roads that connect to Québec and central and eastern Labrador.

Labrador City's municipal council is composed of four permanent councillors (excluding the mayor and the deputy mayor). The current mayor of Labrador City is Ms. Karen Oldford. Labrador City is part of the Labrador West district (provincial elections) and the Labrador electoral districts (federal elections).

LEGEND

- Town/Community
- Howse Deposit Layout

Transportation infrastructure
- Road
- Railroad
- Airport

Basemap
- Watercourse
- Water Body
- Municipalité Régional de Comté (MRC)
- Provincial Boundary

FILE, PROJECT, DATE, AUTHOR:
GH-0618 , PR185-19-14, 2016-01-27, jtremblay

N

0 50 100 150 200 250
Kilometers

UTM 19N NAD 83

SCALE:
1:5 500 000

SOURCES:
Basemap
Atlas of North America, 1:7,500,000
Government of Quebec, BDGA, 1:1,000,000
Government of Quebec, MERN, MRC

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Regional Context
and
Transportation Infrastructure

Howse Minerals Limited

GroupeHemispheres

Figure 7-37

Wabush's municipal council is composed of four permanent councillors (excluding the mayor and the deputy mayor). The current mayor of Wabush is Mr. Colin Vardy. Wabush adopted a budget of $7.6 million in 2013. It is part of the same electoral districts as Labrador City.

The towns have similar histories as both were developed in the 1960s to support two local mining operations: IOCC and Wabush Mines respectively (IOCC, 2013). Wabush and Labrador City began as a mining camp in the early 1960s. The QNS&L railway built by the IOCC in the 1950s provided opportunity for mining development projects. In turn, the development of the mining industry required energy, which could be provided by the Churchill Falls hydroelectric dam. In the 1960s, Wabush and Labrador City were built to serve as workers' camps for mining companies. The region developed into mining towns (Labrador West, 2014). Labrador City was founded in 1961, and in less than a decade, became a small town housing a few families.

The Trans-Labrador Highway (TLH) ensures the connection between cities in Labrador, from Wabush and Labrador City to Churchill Falls and Happy Valley-Goose Bay and to Cartwright, located on the eastern coast of Labrador, and provides access to the port located on Lake Melville. The TLH is also connected to Route 389 on the Québec side, via Fermont. Route 389 leads to Baie-Comeau, located on the north shore of the St. Lawrence River (Figure 7-37). In addition, the QNS&L railway connects Labrador West to Schefferville in the north and to Sept-Îles in the south. Air transportation companies (Air Inuit and Provincial Airlines, among others) provide passenger and freight services in the area, using Wabush airport and connecting with many towns in Labrador and in Newfoundland. Frequent connections are also available between Wabush and Schefferville.

The portion of Labrador that is adjacent to the Howse Project and the Québec border has historically been occupied by Aboriginal peoples and First Nations. This land is included in the New Dawn Agreement (2011) signed by the IN, the GNL and the Canadian government and is claimed by the NCC, the Naskapis, and the Innu of NIMLJ and ITUM. More details on agreements with Native communities are available in Chapter 4.

Innu Nation

Aboriginal peoples have long used the area along what they called the "Grand River", now known as the Churchill River, and around the Lake Melville area (Mailhot, 1993; Armitage and Stopp, 2003; NL Tourism, 2013). Human occupation in Hamilton Inlet's region goes back 6000 years (Mailhot, 1993). The Innu have used the Labrador territory since time immemorial, and their first recorded contacts with Europeans – especially with the Dutch explorers - dates from 1718 (Mailhot, 1993). A trading post was built in North West River (NWR) in 1743 by Louis Fornel and it became a gathering and service location for many Innu. It is only in 1837 that this post was acquired by the Hudson Bay Company (HBC). Historical records show that the name "Sheshashit" has been used for more than 300 years (Mailhot, 1993).

At that time, religious organizations and trading companies administered Labrador, and the government had little if any contacts with the Innu population. Catholic missionaries, notably the Jesuits, started sending priests in the region in 1769, and the Oblates took over the religious mission as of 1844. Both Jesuits and Oblates periodically visited the region from their base in Québec's Côte-Nord region (Mailhot, 1993). Although the Christianization of the Innu started at the end of the 1700s, permanent Oblate missions only arrived in Sheshatshiu in 1949 (Mailhot, 1993).

When the province of NL joined Canada in 1949, the federal government did not include the NL Aboriginal people under the *Indian Act*, as was the case in other Canadian provinces. Instead, the federal government provided funds to the GNL that would serve to provide services to Aboriginal populations, including healthcare and education. The GNL then sought to ensure children's education and forced Innu children to attend school by preventing families from receiving welfare if they left the community. This government requirement obliged families to remain in the communities for the greater part of the year, drastically affecting their way of life, as it forced the adoption of a sedentary lifestyle (Innu Nation, 2014). Despite these changes, however, the Innu continued to hunt, fish and trap, and some Innu continued to leave the community for long periods of time (Newfoundland and Labrador Heritage, 2014).

The 1950s and 1960s was also a period that brought other challenges to Innu traditions and practices. Many industrial development projects took place, such as the Upper Churchill Falls hydroelectric project, which flooded a great part of Innu lands. At that time, the Innu were not consulted by the GNL (Innu Nation, 2014).

In 1973, the Innu joined the Native Association of Newfoundland and Labrador, along with the Inuit and the Mik'maq in order to protect their land and culture. Three years later, the Innu joined the Naskapi Montagnais Innu Association, which became the IN in 1990 (Innu Nation, 2014). A series of agreements were signed with the Canadian government, the GNL and mining companies, the latest one being the 2011 Agreement-In-Principle (AIP) that recognizes territorial rights and self-government, as described in Section 7.5.1.1.

The IN was known as the Naskapi-Montagnais-Innu Association until 1990. Currently, the IN, who's Grand Chief is Ms. Anastasia Qupee, represents two Innu bands: the Sheshatshiu Innu First Nation and the Mushuau Innu First Nation, both recognized under the *Indian Act* in 2002. The IN is a not-for-profit corporation and works on behalf of these two First Nations and their members. It oversees industrial developments on their territory, and ensures that these are carried out in a way that respects the Aboriginal rights of the Innu of Labrador. Further, the IN is also involved in negotiations regarding land claims and self-governance in the aftermath of the signing of the AIP in 2011, in view of reaching a Final Agreement. In addition, the IN represents its members at the regional level for matters that affect their Aboriginal rights, including for IBA negotiations, for example. While the Sheshatshiu Innu First Nation and the Mushuau Innu First Nation represent their members on matters that affect their respective reserves, their Band Council chiefs sit on the IN's board of directors.

The IN elects a president and a board of directors. Its mandate is to "provide a unified political voice to protect the Innu people's interests against outside threats, as well as to pursue land claim negotiations and help deliver education, healthcare, and other social services to its membership" (Innu Nation, 2014). This organization gave the Innu a voice in many respects, and allowed them to protest against low-level military flights and to be consulted in other projects, such as the Lower Churchill Fall Hydroelectric Project and the Voisey's Bay Mine (Innu Nation, 2014). The IN works with both federal and provincial governments to improve the quality of life in the communities through programs and policies that concern housing, education, and healthcare (Newfoundland and Labrador Heritage, 2014).

NunatuKavut Community Council (NCC)

The NCC is a not-for-profit organization representing the Labrador southern Inuit Métis. The NCC was formed in 1981 and was incorporated under federal law in 1985. Labrador's Métis (or southern Inuit population) are descendants of the resident Inuit and the Europeans who traveled to Labrador in the 1700-1800s (NCC, 2014). The Labrador Métis Nation changed its name to NunatuKavut – "our ancient land" – Community Council in April 2010 to better reflect its Inuit heritage (CBC news, 2012). Mr. Todd Russell was elected President of the NCC in 2012, following a previous term from 1994 to 2005.

The NCC's mandate primarily concerns the recognition of the Métis people's rights and the achievement of self-government. The NCC also aims to preserve its members' culture and harvesting practices, to promote economic development, to improve the well-being of its members, and to define its traditional territory. Economic development is managed by NUNACOR, the NCC's corporation (NCC, 2011).

The NCC adopted a Strategic Plan for 2011-2014 (NCC, 2011). The plan identifies five critical priorities for the group: community economic development; cultural preservation; health and social programs; labour market programs; and negotiations for self-government. In addition, several proposed goals and objectives related to reaching partnership agreements, moving forward in seeking a land claims agreement based on the Treaty of 1765, negotiating IBAs with companies in the mining and forestry sectors, and defining a communication strategy to inform and engage with NCC members (NCC, 2011).

The NCC has just over 6000 members (NCC, 2014). While many NCC members live in HVGB, where the head office of the NCC is located, the Labrador Métis are spread throughout various communities of Labrador, including North West River, Mud Lake, Cartwright, and many others. The NCC has service points in Cartwright, Charlottetown, Port Hope Simpson, and St-Lewis.

Québec's Côte-Nord

The Côte-Nord, located northeast of Québec represents the second most extensive administrative region in Québec. Its territory occupies ¼ of the geographic area of the province (236, 502 km^{2}) and stretches over 1, 280 km, from the village of Tadoussac up the coast to the Gulf of St. Lawrence, where it meets the Labrador border. It is bordered by the St. Lawrence River to the south, and reaches Schefferville and the 55th parallel. The population is spread out over 52 municipalities. It covers a vast territory of 236, 502 km^2, with only 8.3% composed of municipal territory (ISQ, 2014).

In 2013, the population of the Côte-Nord region was 95, 552 inhabitants (1.3% of the population of Québec), mainly residing along the St. Lawrence River and the Gulf (ISQ, 2013). With a population density of 0.4 inhabitants per km^2, much of the Côte-Nord region remains uninhabited (CRECN, 2014). The two most populated urban poles of the region are Baie-Comeau and Sept-Îles, which make up nearly 50% of the region's population. Over 85% of the Côte-Nord's municipalities are populated by fewer than 2, 000 inhabitants (CRECN, 2014).

The Côte-Nord region is made up of six MRCs[9]: Haute-Côte-Nord, Manicouagan, Caniapiscau, Sept-Rivières, Minganie and Golfe-du-Saint-Laurent (CRECN, 2014) (Figure 7-37). The Howse Project affects the Caniapiscau MRC, where Schefferville is located, as well as the Sept-Rivières MRC, where the storage and shipping facilities are located (Sept-Îles). The QNS&L railway also runs through this MRC.

Seven Innu reserves, an Innu settlement and a Naskapi reserve are also scattered across the territory. These nine Aboriginal communities are: Essipit, Pessamit, Uashat, Mani-Utenam, Mingan, Nataskuan, La Romaine, Pakuashipi, Matikemush-Lac John, and Kawawachikamach. Québec's Innu population has reached 16, 000, with approximately 12, 000 living on the Côte-Nord region (SAA, 2014). The Innu inhabitants represent roughly 12% of the Côte-Nord's total population.

The Côte-Nord region is equipped with various types of transportation infrastructure: international-capacity airports (Baie-Comeau, Sept-Îles), high-volume port installations, extensive road network, railways, etc. A number of ferry boats ensure connections with the south shore of the St. Lawrence River. Starting in the 1950s, a network of 1,190 km of railway was developed for the mining extraction industry, which remains its principal usage today (CRECN, 2014). Route 138 is the backbone of the Côte-Nord's road network: it

[9] MRCs are administrative entities that were created in 1979 with the mandate to oversee land-use planning issues. Their specific roles are defined in the *Loi sur l'aménagement et l'urbanisme (L.R.Q., c. A-19.1) (LAU).* MRCs allow the representatives of municipalities to come together and to plan, in a concerted manner, matters related to the regional territory and its development. The responsibilities of the various MRCs were enlarged over time to cover issues that concern and affect all municipalities on their respective territories (MRC de Sept-Rivières website, July 2012). Their mandate was broadened in 1988, and since then they provide support and services to municipalities.

links the municipalities between Tadoussac and Natashquan, as well as the province's other regions along the north shore of the St. Lawrence River.

The Côte-Nord's economy is predominantly based on natural resource extraction. The region provides 30% of Québec's aluminum, 33% of its mineral production, 20% of the forestry exploitation volumes, 27% of the provincial electricity production, and 28% of Québec's fisheries production (CRECN, 2013). However, most municipalities have yet to diversify their economies, and depend rather on a single type of natural extraction. The Côte-Nord region has one of the lowest rates of industrial diversity in Québec (0.143), ranked 14 out of 17 regions (CRECN, 2013).

Caniapiscau MRC

The Caniapiscau MRC, where Schefferville is located, administers four non-organized territories[10]. It is the second largest MRC in Québec, with 81, 000 km^2, and its urbanized territory only accounts for 5% of its total surface. According to the ISQ, 4, 215 people inhabit the Caniapiscau MRC (ISQ, 2014).

Mr. Martin St-Laurent, mayor of Fermont, acts as the reeve for the MRC. The MRC's Council is composed of Schefferville's administrator, Mr. Ghislain Lévesque, and of one representative of the town of Fermont, Mr. Marco Ouellet. The MRC also employs five staff, including a secretary-treasurer and an urban planner.

Sept-Rivières MRC and Sept-Îles

The mineral extracted from the Howse Project will be transported to the port facilities in Sept-Îles in the Sept-Rivières MRC, where it will be shipped for export, as is currently the case for the mineral extracted from the DSO project, as well as other iron ore mining projects in the area (Section 8.2). The Sept-Rivières MRC is composed of two non-organized territories (Lac-Walker – including Lac Daigle's sector – and Rivière-Nipissis) and of two municipal agglomerations, Sept-Îles and Port-Cartier. With its 39,500 inhabitants in 2011, the Sept-Rivières MRC accounts for 42% of the overall population of the Côte-Nord region (MRC de Sept-Rivières, 2014). It is also home to the Innu communities of Uashat and Mani-Utenam.

The first Europeans known to frequent the Sept-Îles area were Basque fisherman who came annually for cod and whale fishing. In 1535, Jacques Cartier sailed by the islands and first recorded the existence of the archipelago he designated as the *Ysles Rondes* ("Round Islands"). Early European economic activity in Sept-Îles was based on fishing and on fur trade. Louis Joliet established trading posts by 1679. In 1842, the Hudson's Bay Company founded another post in Sept-îles, which was incorporated as a municipality in 1885. Lacking road access in the late 19th century, the town built its first pier in 1908. In 1951, on the 300th anniversary of the first Catholic mass held in the village, the City of Sept-Îles was incorporated. At that time, the population in Sept-Îles was roughly of 1,900 people, including about 700 Aboriginals (Ville de Sept-Îles, 2014).

Modern Sept-Îles was built rapidly during the construction of the QNS&L railway. Iron ore mined in Schefferville and later near Wabush, Labrador, was transported on this railway and shipped from the Iron Ore Company Port of Sept-Îles. Shipment of this important new commodity resulted in investments that turned Sept-Îles into a major port, second in Canada only to Vancouver in terms of yearly tonnage. The port's development led to a major increase in population, and housing was quickly built to accommodate the influx. The town grew from 2, 000 inhabitants in 1951 to 14, 000 in 1961, and 31, 000 in 1981. However, the decline in iron ore prices in the 1980s caused employment and population numbers to decrease.

[10] Lac-Vacher, Rivière-Mouchalagane, Lac-Juillet, Caniapiscau (MAMROT, 2014)

In the 1980s and 1990s, efforts were made to diversify the Sept-Îles economy. For example, the aluminum industry started up in the region at the beginning of the 1990s. The Plan Nord announced in 2008 and the ensuing boom in the mining sector triggered a rapid economic development in Sept-Îles, followed by a decline as of 2013.

With the Laurentian Highlands to the north, Gallix to the west and Moisie to the east, Sept-Îles' territory covers 2, 182 km^2. The city also borders a 45-km^2 bay with an entrance protected by a natural barrier composed of the seven islands that gave the city its name.[11]

The current urban configuration of Sept-Îles dates from 2003 following the merger of different agglomerations:

- Clarke City, annexed in 1970;
- Gallix, with a population of 671 in 2001, annexed in 2002; and
- Moisie, with a population of 930 in 2001, annexed in 2002.

The municipal council is composed of nine permanent councillors (excluding the mayor). The current mayor of Sept-Îles is Mr. Réjean Porlier, who was elected in November 2013. Sept-Îles is part of the Duplessis electoral district.

For the year 2013, the budget of the City of Sept-Îles was established at $6.16 million, an increase of 10.6% compared to 2012 (Le Nord-Est, 2012a). Due to the economic boom in the area, the city ended 2012 with a surplus of about $6.8 million (Radio-Canada, 2012a).

Uashat and Mani-Utenam

The Uashat reserve covers an area of 2.15 km^2 and is located in the northwest part of the City of Sept-Îles. The Mani-Utenam reserve is about 16 km east of the city limits and covers an area of 5.27 km^2 (AANDC, 2014). Together these reserves form the Innu First Nation of Uashat mak Mani-Utenam. They are considered as two settlements within one Indian reserve and they are administered jointly by the Innu Takuaikan Uashat Mak Mani-Utenam (ITUM) (AANDC, 2014).

The current ITUM Band Council is led by Chief Mike McKenzie. Nine councillors also form the Band Council – for a total of 10 elected members who manage and oversee the day-to-day affairs of ITUM. Elections are held every three years, the last one being on April 27, 2013 (Radio-Canada, 2013b).

Uashat mak Mani-Utenam is one of the five groups that form the Mamuitun Tribal Council (MTC, with Essipit, Mashteuiash, Pessamit and Matimekush-Lac John). Created in 1991, Mamuitun manages activities related to administration, financial management, community planning, economic development and technical services (Conseil Tribal Mamuitun 2014).

History

The Innu of Uashat mak Mani-Utenam are closely related to the Innu of Matimekush-Lac John and share a similar prehistory and history (Volume 2 Supporting Study D). The Innu people were composed of various bands living on the nowadays Côte-Nord and Labrador territory.

Historically, the population of Uashat mak Mani-Utenam stems from two Innu groups: those who lived near the Sainte-Marguerite River, who have progressively established themselves in Uashat, and those who exploited the Moisie River, and who, with time, sedentarized on the Mani-Utenam site (Castonguay,

[11] Grande Basque, Petite Basque, Corossol, Petite Boule, Grosse Boule, Manowin and Îlets De Quen (Ville de Sept-Iles, 2014).

Dandenault and Ass., 2006). These Innu groups faced similar challenges related to sedentarization, wage economy, and the establishment of towns by non-Aboriginal people as the Innu of MLJ.

The Uashat Reserve was founded in 1906 to protect the summer gathering site of the Innu who had camped there since the 17th century on their way from the Sainte-Marguerite and Moisie rivers. In 1949, the federal government created a second reserve, the Mani-Utenam Reserve, in an effort to allow for the City of Sept-Îles expansion plans. Though some individuals moved to the new reserve, approximately 50 families refused to abandon their traditional gathering site and resisted the forced relocation by the federal government with the support of religious authorities (Clément, 2009a). The conflict was resolved 17 years later in 1966, when the Uashat Reserve was finally integrated into the Sept-Îles development plan (AANDC, 2014).

Local Historical and Organizational Context

The LSA is where the Howse Project effects will be directly felt. It includes the following communities, located in the province of Québec:

- Naskapi Nation of Kawawachikamach (NNK);
- Nation Innu Matimekush – Lac John (NIMLJ); and
- Town of Schefferville.

However, for the land-use component, ITUM is also considered as part of the LSA.

Naskapi Nation of Kawawachikamach (NNK)

Kawawachikamach is located 15 km northeast of Schefferville, and about 5 km from the border with Labrador. The reserve covers 41.9 km^2 of land, which is for the exclusive use of the Naskapi as stipulated in the Northeastern Québec Agreement (NEQA, 1978). The NEQA recognizes a series of rights of the Naskapi (Chapter 4).

History

The term "Naskapi" was first seen in historical records of 1643 in the *Relations des Jésuites* (Mailhot, 1993). It is believed that the term referred to a subgroup of Montagnais people who were particularly dependant on caribou resources, and who lived more inland (Cooke, 1976; Mailhot, 1993; Clément, 2012; Newfoundland and Labrador Heritage, 2014). Up until the mid-1900s, the Naskapi lived from the resources harvested on the land that they exchanged at trading posts such as Fort McKenzie. They moved to the Schefferville area at the beginning of the 1950s where they found work at the Iron Ore Company of Canada. This is the period when the Naskapis entered the wage economy, which affected their nomadic way-of-life.

Between 1956 and 1983, the Naskapi and the Innu cohabited, first in Lac John (until 1972) and then in Matimekush (Weiler, 2009a; Genivar, 2006). It is only in 1983 that the Naskapi relocated to Kawawachikamach, after having signed the NEQA in 1978.

The signature of the NEQA was a historical milestone for the Naskapis (Chapter 4). Through this agreement, they obtained a series of rights, including territorial rights, and financial compensation in exchange for their consent to "cede, release, surrender and convey all their native claims, rights, titles and interests, whatever they may be, in and to land in the Territory and in Québec, and Québec and Canada accept such surrender" (NEQA, Sc. 2.1).

The closing of the IOCC mine in 1982 greatly affected the Naskapi. Many lost their employment, and opportunities for economic activities became very limited in the Schefferville area thereafter. The revival of the mining industry after 2000 brought new employment and business opportunities in the region.

Organization

Kawawachikamach is the only Naskapi community in Québec and in Canada. The current name of the band, the Naskapi Nation of Kawawachikamach (NNK), was authorized in 1996 by the Band Council itself.

The Naskapis of Kawawachikamach elect a chief, a deputy chief and four councillors every three years. The last election took place in September of 2012, and the current chief in office is Chief Noah Swappie. Under the Cree-Naskapi (of Québec) Act, the Council has the mandate to act as a local government that oversees and manages the land and its resources on category 1A-N land (i.e., the village), the use of the community's infrastructure, and the Nation's finances. In addition, the Council promotes the community's development and charitable works while preserving Naskapi culture and traditions. Moreover, the Band Council provides municipal services on Category 1B-N lands (Figure 7-38) (NNK, 2014). The Band Council is supported by two committees, the Elder's Advisory Council and the Emergency Preparedness Committee (NNK, 2012).

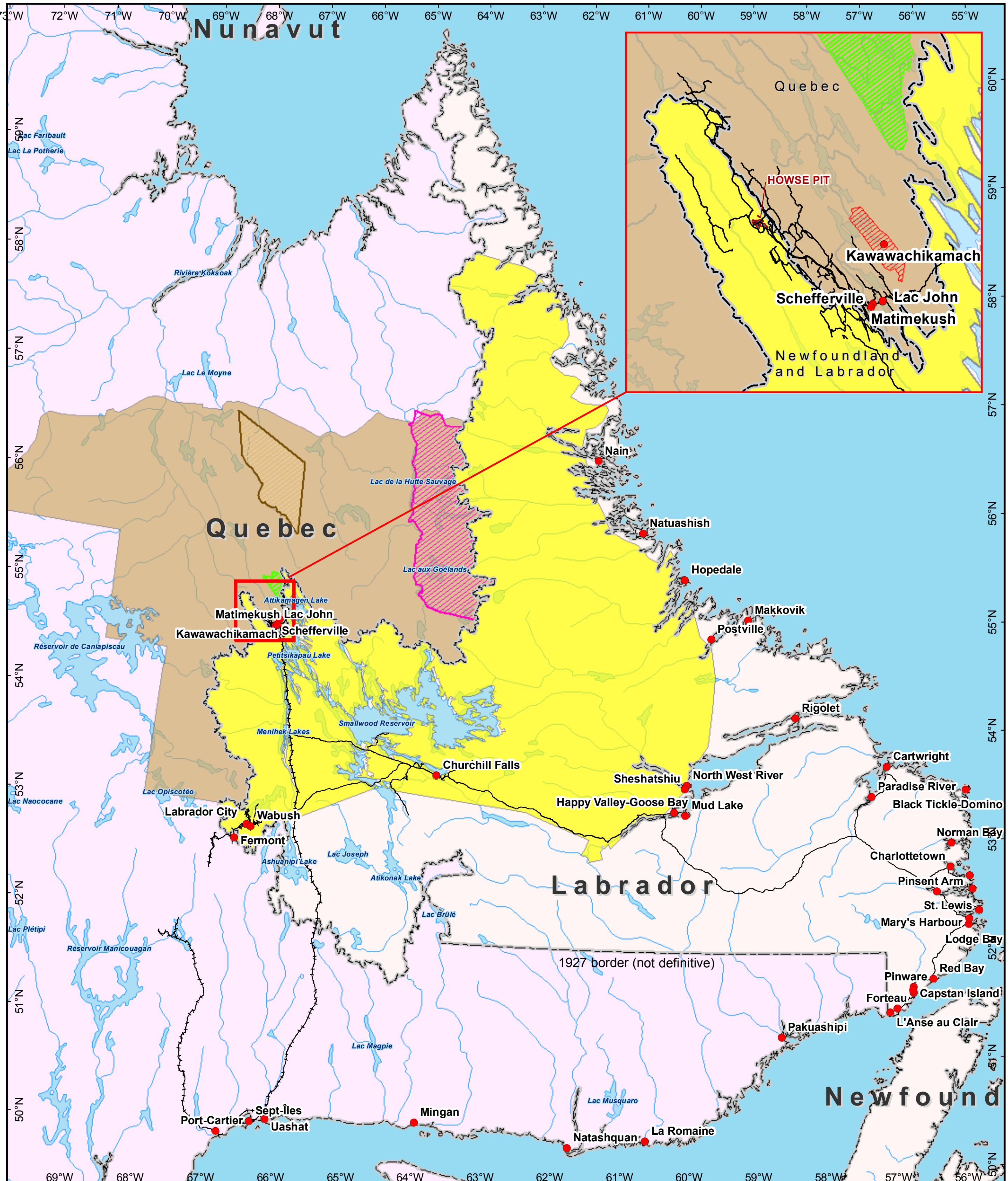
Band council revenues come from multiple sources: AANDC transfers, Health Canada, Canada Mortgage and Housing Corporation, MRNF, SAAQ, housing leases, and services contracts. Additional revenues also come from the NEQA and are managed by the Naskapi Development Corporation (NDC).

Nation Innu Matimekush – Lac John (NIMLJ)

The NIMLJ is comprised of two communities: Matimekush and Lac John. Matimekush is located within Schefferville on the shore of Lac Pearce and has an area of 0.68 km^2. The Lac John community covers an area of 0.23 km^2 and is located 3.5 km from Matimekush and from the center of Schefferville, on the road to Kawawachikamach (Nametau Innu, 2014).

<u>History</u>

The Innu were the "Montagnais" identified in historical records by Samuel de Champlain, a term that referred to the nomadic Native people that generally lived on the north shore of the St. Lawrence River and inland in the provinces of Québec and Labrador. They were divided into several bands, some of which lived inland and others along watercourses, notably the St. Lawrence River (Québec) and the Lake Melville area (Labrador) (Mailhot, 1993). With time, and depending on harvesting success, the Innu reorganized their bands according to the active trading posts, and some of them established around Fort McKenzie (Figure 7-39) at the beginning of the 20th century, given the importance of the fur trade.



LEGEND

- Schedule 4 Northeastern Quebec Agreement 1978
- Outstanding Land Claim - Labrador

Land Category
- Category IA-N Land
- Category IB-N Land
- Category II-N Land
- Area of Common Interest for the Inuit and the Naskapis

Basemap
- Road
- Railroad
- Watercourse
- Water Body
- Provincial Boundary

FILE, PROJECT, DATE, AUTHOR:
GH-0617 , PR185-19-14, 2016-01-27, jtremblay

N

0 50 100 150 200
Kilometers

UTM 19N NAD 83

SCALE:
1:5 500 000

SOURCES:
Basemap
Atlas of North America, 1:7,500,000
Government of Quebec, BDGA, 1:1,000,000
Aboriginal datas
Adapted from Alderon Iron Ore Corp (2012)

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Naskapi Nation of Kawawachikamach Lands in Quebec and Outstanding Land Claim in Labrador

Howse Minerals Limited

GroupeHemispheres

Figure 7-38

The Innu of MLJ, also known as the Schefferville Innu or Montagnais,[12] are in fact a subgroup of the Sept-Îles Innu, who have had hunting territories in the region since time immemorial, and who, at the beginning of the 1900s, stayed in the Schefferville region and formed the group of "those who go deep inland" (Clément, 2009a). As a result, most of the Innu living in MLJ are related by kinship and still remain in contact with their families in the Sept-Îles area.

The declining economic context at the end of the 1940s and beginning of the 1950s caused many inland trading posts to close. This in turn forced some Innu who needed other sources of income to settle around Lac John, where the IOCC mining company was beginning its operation.

At the time, in 1945, some Innu were employed to work on the construction of the railway, and settled on the shore of Knob Lake (NIMLJ, 2014). This is the period when the Innu entered the wage economy, which affected their nomadic way of life. In 1955, some of those who had worked on the construction of the railway settled near Lac John. By 1957, around 500 Innu lived in Schefferville, but they were not recognized as status Indians (Clément, 2009a).

Although the government of Canada requested that the Innu return to their original reserves on the Côte-Nord, over 300 Innu chose to stay near Schefferville. The Lac John reserve, which was shared with the Naskapi, was established in 1960 to accommodate the Aboriginal population. The Matimekush reserve was subsequently created in 1968 (Clément, 2009a; NIMLJ, 2014). The NIMLJ has been recognized as a band under the *Indian Act* since 1973. Before that, the Canadian government considered the Innu of the Schefferville region to be part of the Sept-Îles band (Conseil Tribal Mamuitun, 2014).

The closing of the IOCC was a difficult experience for the Innu, the Naskapis and the non-Aboriginal population of Schefferville. Many houses and facilities were destroyed, except for the arena that the local population managed to save by forming a human chain around the building, preventing the bulldozers from reaching it (Radio-Canada, 2012b). For the Aboriginal and non-Aboriginal populations who remained in the region, the period that followed the closing of the IOCC was characterized by profound economic difficulties.

Since 1982, the NIMLJ have focused on negotiating their rights and continuing to develop their community without the presence of the mining industry. Economic activities that have developed since included crafts, retail commerce, services and construction (NIMLJ, 2014).

Organization

Currently, the two reserves are jointly administered by one chief and four councillors elected for three-year terms in accordance with the Indian Act (AANDC, 2014). The current chief, Chief Real McKenzie, has been in office since 2007 and was re-elected in July 2013. The Band Council is subject to the Indian Act.[13]

[12] It is only in the 1980s that the Innu indicated their preference for the word "Innu" as opposed to Montagnais. Innu means people in the Innu language (Newfoundland and Labrador, 2014).

[13] Generally, band councils oversee the administration and organization of each Aboriginal reserve, as stipulated in the Indian Act (L.R.C. 1985, Sections I-5). They can proceed with elections according to provisions of the Indian Act or to their customary Aboriginal traditions (Conseil Tribal Mamuitun, 2012). The Band Council is free to put in place a number of committees or organizations to help in the daily administration of the reserve. Their mandate is to provide a number of services to their populations: housing, infrastructure, safety, education, health care, social services, and economic development. Band councils may also set up corporations or companies to promote the economic development of the community. Revenues of the band council come from multiple sources: AANDC transfers, Health Canada, Canada Mortgage and Housing Corporation, MRNF, SAAQ, housing leases, and service contracts.

The NIMLJ Band Council has been affiliated since 1991 with the *Conseil Tribal Mamuitun*, which provides support to Innu band councils in administration, economic development, technical services and community planning (NIMLJ, 2014).

Schefferville

The Town of Schefferville is home to the non-Aboriginal population of the LSA but also to a few Native families. It is located at 54°48’ N and 66° 48’ W, 25 km southeast of the proposed mine site. Schefferville is located about 2 km from the border with Labrador.

<u>History</u>

Mining exploration activities around Schefferville started in the early 1800s, but construction and operation of the first mine only began in 1945. The operation of the IOCC required the establishment of various types of infrastructure, such as landing strips, electricity, and workers’ camps, and most importantly, the QNS&L railway to carry the ore to the Port of Sept-Îles. The railway was completed in 1954. Schefferville officially became a city in 1955, and workers accompanied by their families came to live there on a permanent basis (Clément, 2009a).

Between 1954 and 1982, Schefferville grew as a mining town. During the course of mining operations, Schefferville’s population reached almost 2,000 people in 1971, peaked at 3,429 in 1976, and 3,271 in 1981 (NML, 2014). The town counted with two banks, a cinema, two hotels, restaurants, metalwork, gas stations and other stores. A town hall, including a police station and the fire department, and a federal post office were also available to the population, as well as recreational and sport facilities (arena, cultural center and a gym).

The economic recession of the beginning of the 1980s forced the IOCC to close Schefferville’s mine. In 1984, the city had no more budget for daily operations, and found itself in a position where it could not pay its employees. In 1985, the Government of Québec officially terminated the legal existence of the municipality. The government encouraged every resident to leave Schefferville by offering compensation. The IOCC proceeded to the demolition of Schefferville’s infrastructure, at the cost of $2 million (Radio-Canada, 2012c; 2012d).

However, in 1990, the IOCC, the governments of Québec and Canada agreed to save what was left of the municipality. About 60 houses were then transferred to the NIMLJ (Radio-Canada, 2013c). Except for a few people who provided services to the Aboriginal communities of Kawawachikamach and MLJ, the town was mostly abandoned by its non-native population. The city population continued to decline, downsizing to 280 people in 1996, and to 202 people in 2006.

More recently, between 2008 and 2015, Schefferville underwent an economic boom, which caused a rapid increase in the cost of life, and a shortage of accommodation for professionals. The Government announced a program for the municipality worth $25 million to update the city infrastructure and to provide housing and accommodations to its residents and visiting consultants (Radio-Canada, 2012c; 2012d). These projects however, were not all completed and the town’s administrator has indicated that Scheferville’s infrastructure is not ready for another boom (Joncas, 2014, *personal communication*).

<u>Organization</u>

Schefferville’s territory is about 39 km^2. The town’s first territorial development plan was prepared by the technical service of the IOCC, with the support of the former Ministry of Mines of Québec that existed between 1942 and 1960 (MRN, 2013). Under this plan, the town center had room for expansion and for possible construction of new infrastructure. Historically, the town’s residential area had about 670 permanent family homes.

Today, according to the Schefferville's zoning regulations, the town has very little room to grow, since it is surrounded by Matimekush, Pearce Lake, and land belonging to Transport Canada for the airport. In addition, some of the land that could be used for expansion was formerly used by the IOCC for operations and is likely contaminated. Schefferville could only expand east of the current town center (NML and PFWA, 2009; Joncas, 2014, *personal communicatio*n).

The town, which is part of the Caniapiscau MRC, is governed by the Cities and Towns Act (R.S.Q., Chapter C-19). Since 1990, the municipality has been managed by the Government of Québec, and the *Loi concernant la Ville de Schefferville* includes provisions concerning municipal services. A Town Administrator manages Schefferville's municipal affairs. Schefferville is part of the Duplessis electoral district.

Schefferville's revenues come from property taxes, payment for municipal services, and government transfers.

7.5.1.1 Aboriginal Rights: Treaties, Agreements, Land Claims and IBAs

Treaty Rights

The treaty rights of the NNK are included in the NEQA signed in 1978. The Howse Project, being located in Labrador, will not affect Naskapi lands located in the province of Québec, access to healthcare or education, or the rights that are inscribed in the NEQA. The only right that may be affected is related to caribou hunting, yet this right has already been affected by the drastic decrease in the caribou population, which is addressed in Section 7.5.2.1. This subcomponent will not be considered as a VC.

Agreement-in-Principle

The IN has signed an AIP with the GNL and the Canadian government. The main modalities of this AIP are described below. In particular, this AIP includes an Economic and Hydroelectric Major Development Impacts and Benefits Areas, which overlaps with the Howse Project site location. This gives the IN the right to negotiate an IBA, which it has done with both HML and LIM. As previously indicated, the proponent is committed to applying HML's IBA commitment to the Howse Project and will oversee that the provisions of this IBA, a confidential agreement, are implemented. Accordingly, this subcomponent is not retained as a VC.

Land Claims

The land claims of the NIMLJ and ITUM on their Nitassinan are not currently under negotiation with the province of Québec or the federal government. There are no indications that land claim negotiations with NIMLJ and ITUM could resume in the near future. In any case, both Innu groups have signed IBAs with LIM that include the Howse Project.

The Québec Innu's claim also concerns a part of Labrador, but the GNL did not accept this claim for negotiation, which is also the case for the NNK land claim on part of Labrador's territory.

The NCC submitted their land claim to the GNL in 1991 and is still waiting to begin an official negotiation process. They represent the last Inuit group in Canada with an outstanding land claim (NCC press release, 2014). The NCC has won two court cases in which the courts recognized the strength and credibility of their land claim: one in 2007 and one in 2014 (NCC Press Release, 2014). However, there are no indications that the GNL or the Canadian government will soon undertake a negotiation process. However, should such a process begin, the Howse Project should not interfere for three main reasons:

- the land-use activities of the NCC members seem to be concentrated in south and central Labrador, around Wabush and Labrador City, and HVGB, on the TLH axis (NCC, 2010; Mitchell and Coombs, 2012; Mitchell and Carroll, 2014);

- LIM has signed an Economic Partnership Agreement with NCC, which includes the Howse Project; and
- HML has signed a Cooperation Agreement with NCC for the purpose of the DSO project.

For the above-mentioned reasons, and in the absence of a negotiation process, an IBA or an agreement signed for the Howse Project, the Howse Project should have little if no effect on the respective land claims of the NIMLJ, ITUM, NNK and NCC. This subcomponent is thus not retained as a VC.

IBA Implementation

IBAs are confidential agreements, and it is therefore nearly impossible to accurately assess their effects on the local populations. In the case of the Howse Project, IBAs were originally signed with LIM. However, given that HML now owns the Howse Project, its IBA will be extended to include the Howse Project. There are some concerns among the population regarding the implementation of the IBA signed for the Howse Project, given the creation of HML, an unincorporated joint venture between HML and LIM. HML remains largely unknown by the population, and a trust relation with this entity remains to be established. At the moment, the population associates HML with HML, as explained in Chapter 4. LIM has also made its difficult financial situation public, which does not reassure the Aboriginal leadership and populations in terms of receiving the benefits they were promised. Expectations of Aboriginal groups in terms of the full respect of the IBA are high considering the sensitivity of the area and the presence of Kauteitnat.

However, as previously indicated, the Howse Project must be considered as being inserted into a brownfield context, more precisely as an extension of the DSO project by HML. Although the subcomponent IBA Implementation cannot be considered as a VC as it exceeds the purpose of the EIS, HML is aware of the stakeholders' concerns regarding IBA implementation, and measures will be taken to open a dialogue on this issue.

7.5.1.1.1 Component Description

LSA, RSA and Temporal Boundaries

The LSA includes the NNK and the NIMLJ, located in the province of Québec. The RSA includes Aboriginal Groups that live further from the Project and who are not directly affected by the Project, but that have recognized Aboriginal rights and have signed agreements on the Howse Project:

- In Québec, ITUM; and
- In Labrador, the IN and the NCC.

The temporal boundary for this component includes up until the end of the decommissioning and reclamation phase of the Project, as this is when the Agreements signed for the Howse Project will expire.

Aboriginal Rights: Treaties, Agreements, Land Claims and IBAs

The section below describes Aboriginal rights for each Aboriginal group located in the LSA or RSA. Of the five Aboriginal groups concerned by the Project, only the Naskapi Nation of Kawawachikamach has signed a modern-day treaty.

Aboriginal groups have signed agreements with HML in the particular case of the DSO project and with LIM for the Howse project. IBA provisions for the Howse Project were originally included in LIM's agreements. However, given the change in circumstances when LIM obtained court protection from creditors, and the acquisition of 100% of the Howse deposit by HML, it is the intention of HML to incorporate the Howse deposit into its IBAs with Aboriginal groups. As such, the same commitments made as part of HML's DSO Project will apply for the Howse Deposit.

LSA

NNK

The Naskapis are pioneers in terms of establishing new types of relationships with governments and in creating and maintaining their own self-government. They have signed the following agreements:

- the James Bay and Northern Québec Agreement (JBNQA, 1975);
- the Northeastern Québec Agreement (NEQA, 1978);
- the Agreement Respecting the Implementation of the Northeastern Québec Agreement (1980);
- the Cree-Naskapi (of Québec) Act (CNQA, 1984); and
- the Partnership Agreement on Economic and Community Development between Naskapis and Québec (2009).

The JBNQA (1975) establishes which lands are exclusively for the use of the Cree and Inuit peoples and which lands remain under the provincial and federal jurisdiction. The JBNQA served as a model for the negotiations leading to the NEQA (which began in 1966), and established territorial and land-use rights and the environmental and social protection regime (Chapter 14 of the NEQA). The JBNQA chapter on harvesting rights (Section 24) was amended in the NEQA to include the Naskapi in the regulating committees.

The Naskapi lands include the following (Figure 7-38):

Category 1-N lands: Category 1 lands are reserved for the exclusive use of Naskapis (Figure 7-38).

- these lands "cannot be taken away by Québec. In those circumstances […] where the right to expropriate by Québec is exercised, the land must be replaced or compensation paid at the option of the Naskapis of Québec except if otherwise provided herein (NEQA, s.5.1.2, p.5-3)";
    - 1A-N lands correspond to the reserve on which the community is located, and were under the administration of the Canadian government (NEQA, s.5.1.2, p.5-2), until the signature of the Cree-Naskapi Act in 1994, which transferred responsibilities to the Band Council.
    - 1B-N lands are under provincial government jurisdiction, but are located on lands that are under the JBNQA and administered by the Kativik Regional Government (KRG). For this reason, the Chief of the NNK sits on the KRG Council (KRG, 2014). In essence, "Category IB-N lands comprise the lands to be granted for the Naskapis of Québec to a private landholding corporation established in virtue of the laws of Québec or by a special law thereof, and the members of which must be Naskapis of Québec" (NEQA, s.5.1.2, p.5-3).
- on category II-N lands, the Naskapis have "exclusive right of hunting, fishing and trapping and also the rights established in their favor under the Hunting, Fishing and Trapping Regime referred to in paragraph 15.2.1" (NEQA, s.1, p.1-2). Category II-N lands comprise, 65,086 km2 south of the 55th parallel, and the James Bay Cree share the exclusive right of hunting, fishing and trapping. In addition, the Inuit of Kuujjuaq have the right to harvest resources on 598 km2 of Category II lands. Other than hunting, fishing and trapping rights, provincial jurisdiction generally applies on these land;
- the Naskapi do not have exclusive harvesting rights on Category III lands, as these lands are under provincial jurisdiction (JBNQA, s.5-3). However, they may use these lands for harvesting activities without having to obtain hunting, trapping or fishing permits.

Aside from the Naskapi lands, the NEQA, which is a comprehensive agreement in terms of the themes that are addressed (healthcare, education, housing, governance, environmental regime, etc.), established a series of other protected rights, including the following:

- harvesting rights: "the right to hunt, fish and trap […] in accordance with the provisions of the Hunting, Fishing and Trapping Regime […] in the Naskapi area of primary interest […] subject to the principle of conservation." (NEQA s.15.3);
- the establishment of the Hunting, Fishing and Trapping Coordinating Committee, which oversees the management of traditional activities and makes recommendations to Québec and Canada. The Coordinating Committee is divided into subcommittees which deal with more specific issues (NEQA, s.19) ;
- the Hunter Support Program provides income and benefits to the community members who practice traditional activities for subsistence. The funds are provided by the MRN (NNK, 2012).
- governance: the establishment and legitimacy of the Band Council to act as local government on category 1A-N lands and as a municipality on 1B-N lands (NEQA, s.7 and 8).
- health services: "Upon the Naskapis of Québec establishing their permanent residence on Category 1A-N lands, Québec shall undertake, […] to assume and to deliver to the Naskapis of Québec the full range of health and social services […]. (NEQA, Ss.10.11).
- education: "Education services for the Naskapis of Québec shall be assured by the establishment of a school […]. The general administration of the Naskapi School shall be carried out by la Commission scolaire régionale Eastern Québec (NEQA, s.11).

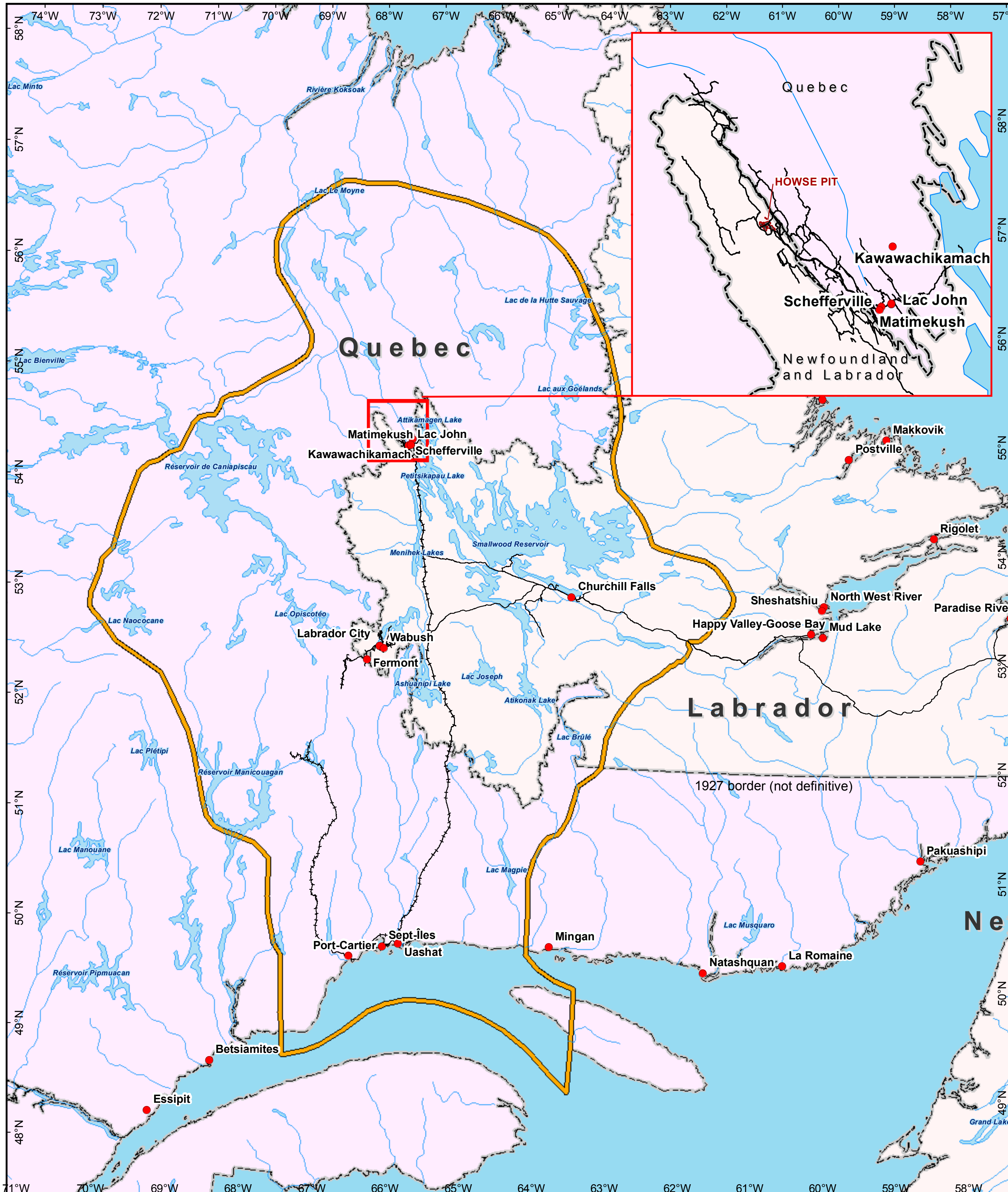
In 1980, the *Agreement Respecting the Implementation of the Northeastern Québec Agreement* was signed by the IOCC, but was only implemented in 1990. This Agreement "established the model for funding capital and operations and maintenance expenditures over five-year periods" (NNK, 2014). This agreement also provides a conflict resolution mechanism to solve disputes related to the implementation of the NEQA.

The Cree-Naskapi Act of 1984 confers a self-government status to the Band Council and establishes the current land management system into categories 1A-N and 1B-N, transferring responsibilities from the federal government to the Band Council. The Cree-Naskapi Commission is responsible for the implementation of the Act (Cree-Naskapi Commission, 2014).

In 2009, the Naskapis entered into the Naskapi-Québec Partnership Agreement (NQPA, 2009). The purpose of this agreement is to "establish a new nation-to-nation relationship and to put forward a common vision of the economic and community development of Naskapis" (NQPA, 2009). The parties agreed to promote development projects in the energy and mining sectors on Naskapi lands (as defined in the NEQA), and on sharing mechanisms for the benefits and economic opportunities of these development projects. This partnership agreement provides a framework for concluding agreements with mining companies, and "provides for revenue-sharing for certain types of energy projects, creates a mechanism to address a list of issues important to the Naskapis, including education and the Hunter Support Program, and targets solutions to problem areas relating to outfitting and culture" (NNK, 2014).

NNK Land Claims in Labrador

At the time of the impact assessment for the Lower Churchill Hydroelectric Project, former NNK Chief Louis Einish addressed a letter to the co-chairs of the Joint Review Panel, who had determined that the consultation with the Naskapi was not necessary in the context of the project. In his letter, Chief Einish explained that "the Nation asserts a claim to parts of Labrador" and that the Naskapi "still practice many aspects of [their] traditional way of life and culture, and rely on subsistence hunting, fishing and trapping in Labrador for a large part of [their] food supply and for many raw materials" (Chief Louis Einish, 2010, in CEAA 2012; Figure 7-38). The NNK has confirmed having submitted an official land claim to the federal and provincial governments, but that has not yet been accepted.



LEGEND

Ancestral Territory of the innu of Uashat mak Mani-Utenam and Matimekush-Lac John

Basemap
- Road
- Railroad
- Watercourse
- Water Body
- Provincial Boundary

FILE, PROJECT, DATE, AUTHOR:
GH-0617 , PR185-19-14, 2016-01-27, jtremblay

N

0 50 100 150 200
Kilometers

UTM 19N NAD 83

SCALE:
1:5 500 000

SOURCES:
Basemap
Atlas of North America, 1:7,500,000
Government of Quebec, BDGA, 1:1,000,000
Aboriginal datas
Adapted from Alderon Iron Ore Corp (2012)

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

NIMLJ and ITUM Nitassinan
Howse Minerals Limited

GroupeHemispheres

Figure 7-39

Impact and Benefit Agreements

The NNK has signed Impact and Benefit Agreements with the following mining companies:

- HML for the DSO project (2010); and
- Labrador Iron Mines for the Howse Project (2011).

The NNK also signed a Participation Agreement for the LabMag Project in 2004 with NML. The NNK owns 20% of this project, which is currently at the feasibility stage.

Negotiations to amend the agreement with LIM had begun but are presently at a standstill. LIM has not yet been successful in sustaining profitable operations in the region and has not been operating in 2014-2015.

<u>NIMLJ</u>

Unlike the NNK, the NIMLJ has not signed agreements or treaties with provincial or federal governments regarding land or self-government. However, NIMLJ has ongoing land claims and has participated in several rounds of negotiations over the years that failed to reach agreement. Compared to the Naskapi, Cree and Inuit, NIMLJ claims on their *Nitassinan* – which means "our land" – are particular in that they concern territories that are used and inhabited by non-Aboriginal people.

The negotiation process began in 1975, when the *Conseil des Atikamekw et des Montagnais* (CAM) was mandated to lead the Innu (Montagnais) and Atikamekw land claim negotiations with the governments. In 1979, CAM presented a claim for a Nitassinan that encompassed parts of Québec and Labrador territories. The GNL responded by stating it would first address the claims filed by its own Aboriginal inhabitants. The governments of Québec and Canada agreed to discuss the land claim filed by CAM, and signed a framework agreement in 1988 to that affect in order to plan further negotiations. In 1994, the Government of Québec made an offer to the Innu and Atikamekw that was rejected (NIMLJ, 2011). The divergence of opinions among CAM members led to its dissolution in 1994 (NIMLJ, 2011).

In 2004, the Mamuitun Tribal Council and Natashkuan, representing Mashteuitsh, Essipit, and Pessamit, signed an AIP with the governments of Canada and Québec.[14] Land claims in Labrador were not included in this AIP (NIMLJ, 2011). After the signing of this agreement, territorial negotiations with the government seem to have been relegated on a community by community basis, as each Innu community has its own demands and conditions.

The communities of Uashat mak Mani-Utenam and of Matimekush-Lac John, represented by the Ashuanipi Corporation, took part in a new round of negotiations as of 2005 concerning their Nitassinan, which covers part of the territory under the JBNQA (1975), of the province of Québec and of Labrador (Figure 7-39) (SAA, 2014). Meetings were held on a monthly basis between 2006 and 2008 to discuss a framework agreement. These negotiations were suspended in 2008. The Ashuanipi Corporation ceased its activities in 2009 when Ottawa ceased to finance the corporation, which employed 17 people.[15]

The *Alliance stratégique Innue* (ASI) was formed in 2008 by four Innu community (Ekuanitshit, Matimekush-Lac John, Pessamit and Uashat Mak Mani-Utenam), and was later joined by a fifth member,

[14] Agreement-in-Principle of General Nature between the First Nations of Mamuitun and Nutashkuan and the governments of Québec and Canada (2004).

[15] According to the government, the corporation had not respected its engagement in preparing territorial negotiations as well as discussions on the self-governance of both NIMLJ and ITUM. This point of view is currently contested by the Innu of both communities. Recently, the Ashuanipi Corporation appealed the Supreme Court decision that forced the corporation to repay $232,300 to Canada's Attorney General (Radio-Canada, 2012e).

Unamen Shipu. Its purpose is to ensure the respect of the rights and interests of these communities, as well as to lead the negotiation concerning the Nitassinan. The ASI represented about 12,000 Innu people, which corresponds to about 70% of the Québec Innu population (ASI, 2012). The ASI ceased its activities in 2011.

As mentioned above, the Innu Nitassinan claimed by the Innu of ITUM and of MLJ covers a portion of Labrador, and several administrative divisions of Québec, at least partially. These include:

- Saguenay-Lac St-Jean administrative region;
- Manicouagan MRC;
- Haute Côte-Nord MRC;
- Caniapiscau MRC (southern part);
- Minganie MRC (eastern part); and
- JBNQA territory, north of the 55th parallel.

According to Québec's *Secrétariat aux affaires autochtones du Québec* (SAAQ), a territorial agreement with the Innu of Matimekush and Uashat mak Mani-Utenam would remain subject to current legislation under which these territories are managed, but a number of provisions would most likely concern the following:

- traditional activities carried out by the Innu (hunting, fishing and trapping) would be in line with activities of Quebeckers;
- the Innu would be involved in the management of the land and natural resources. The mechanism of this participation remains to be determined;
- the Innu could also participate in development projects that could affect them. In case of conflict, the Innu could receive a financial compensation;
- the Innu would be entitled to a share of the royalties collected by Québec on the exploitation of natural resources; and
- the agreement would provide special protection to some Innu heritage sites and wildlife reserves (SAA, 2014).

To this day, the NIMLJ and ITUM have not reached agreement concerning the Nitassinan that they claim. They nonetheless have recognized ancestral rights under Section 35 of the 1982 constitution, and have harvesting rights recognized under the JBNQA (Section 24.3.22).

The Québec Innu, including MLJ, are challenging in court the Agreement-in-Principle (AIP) signed by the Labrador Innu, the GNL and the Canadian government in 2011, which is seen by Québec Innu as "extinguishing" Québec Innu claims on their Nitassinan. However, the Québec Innu does respect this agreement, although they deplore not having been consulted during the negotiation process that preceded the signature of the AIP. At the moment, the GNL tolerates the presence of Québec Innu on its territory for harvesting purposes but remains firm in its refusal to negotiate Québec Innu land claims on its territory (NIMLJ, 2011; Radio-Canada, 2012e).

The Innu communities of Québec have recently entered into discussions to reaffirm their common history, language, and shared culture and identity. In a *Declaration of Strengthened Unity of the Innu Nation* published in December of 2013, the chiefs of nine Innu communities, including MLJ, confirmed their will to work as one Nation "to develop Innu governance in order to achieve the recognition and autonomy of the members of the IN", notably by protecting Innu Aboriginal title and rights (Québec Innu Nation, 2013).

RSA

ITUM

ITUM shares a similar history with the NIMLJ in terms of land-claim negotiations (Section 4.2). The Innu negotiations started back in 1979, after the *Conseil des Atikamekw et des Montagnais* (CAM) was established in 1975.

As indicated in Section 4.2, the NIMLJ and ITUM have not reached an agreement concerning the Nitassinan. For its part, ITUM recently established the *Bureau de la protection des droits et du territoire* to pursue the protection of Innu rights under the Canadian constitution, as well as the protection of territory, including the environment and way of life. A large part of the bureau's work is connected to different governments, organizations and promoters wishing to develop on traditional territories. Territorial planning is developed in collaboration with the Innu Patrimonial Research sector, and eventually, with a consultative committee to be put in place.

The Nitassinan claimed by ITUM and NIMLJ is shown in Figure 7-39. The Innu still maintain the hope of negotiating their claim on the Nitassinan, as well as their wish to become one nation. An Innu Summit was held on the question in September 2012 (Radio-Canada, 2012f).

Since 2008, ITUM has signed four IBAs with mining companies (IBA Research Network, 2014):

- Cliffs Natural Resources (2008);
- HML, for the DSO project (2011);
- Labrador Iron Mines (2012); and
- ArcelorMittal (2012).

These agreements contain several provisions concerning employment and contract opportunities for the communities, as well as for the development of Uashat and Mani-Utenam. ITUM was the first community to negotiate royalties on the extracted tons of minerals. At least 90 jobs are guaranteed by the three most recent IBAs signed by ITUM. ITUM would even like to have a pellet plant on its territory (Industrie Québec, 2012). In order to ensure that the commitments ensuing from these agreements are respected, the Group Aishkat was created to increase the participation of the Innu in significant development projects (Industrie Québec, 2012).

Innu Nation

In September 2008, the GNL and the IN announced the signing of the *Tshash Petapen* ("New Dawn") *Agreement*, which resolved key issues relating to matters between the GNL and the IN surrounding the Innu land claim, as well as impacts and benefits related to past and proposed hydroelectric development projects in western and central Labrador. Since that time, the provincial and federal governments and the IN have completed detailed agreements on these matters, including a tripartite *Labrador Innu Land Rights Agreement-in-Principle* (AIP), which was ratified by the Innu on June 30, 2011 and signed by the three parties on November 18, 2011. The following describes the agreements signed by the IN.

Voisey's Bay Memorandum of Agreement (MoA)

A Memorandum of Agreement was signed in 2002 between the GNL and the IN in view of mitigating the effects that would be caused by the Voisey's Bay Project[16] on Innu lands. This MoA was signed in a context where land disputes were still undergoing between the GNL and the IN. This MoA provided the framework

[16] The Voisey's Bay Mine is located about 30km east of Natuashish.

for negotiation in view of signing an IBA with Vale Inco, the Voisey's Bay project proponent. The MoA established the revenues that would be paid to the IN, as well as harvesting modalities on the Voisey's Bay project area during the operation of the mine. For example, the Innu could continue to harvest on the site under certain conditions and had to be consulted at the moment of imposing any restrictions on land-use activities. In exchange, the "activities may be restricted or limited by legislation of the Province only to the extent necessary to provide for public health, safety, or conservation" (Voisey's Bay MoA, 2002).

Tshash Petapen Agreement/New Dawn Agreement

The New Dawn Agreement is a bilateral agreement between the IN and the GNL, as well as the Energy Corporation of Newfoundland and Labrador (Nalcor Energy), which took part in the negotiations. It was signed in September 2008, and its purpose was to settle disputes that would later facilitate the signing of an AIP. These issues included:

- Disputes between the GNL and the IN with regard to Innu land claims, and which included specifications on land categories, and on economic development areas.
- Redress for the Upper Churchill hydroelectric project, which may be considered as an IBA signed "after the fact", to compensate the Innu for loss of their lands.
- The Lower Churchill IBA, defining the payments that IN would receive; in exchange, the IN "shall provide a comprehensive release to ECNL related to any adverse effects of the project upon the rights and interests of the Innu of Labrador, including Aboriginal rights" (New Dawn Agreement, 2008:6).

Innu Nation Agreement-in-Principle (AIP)

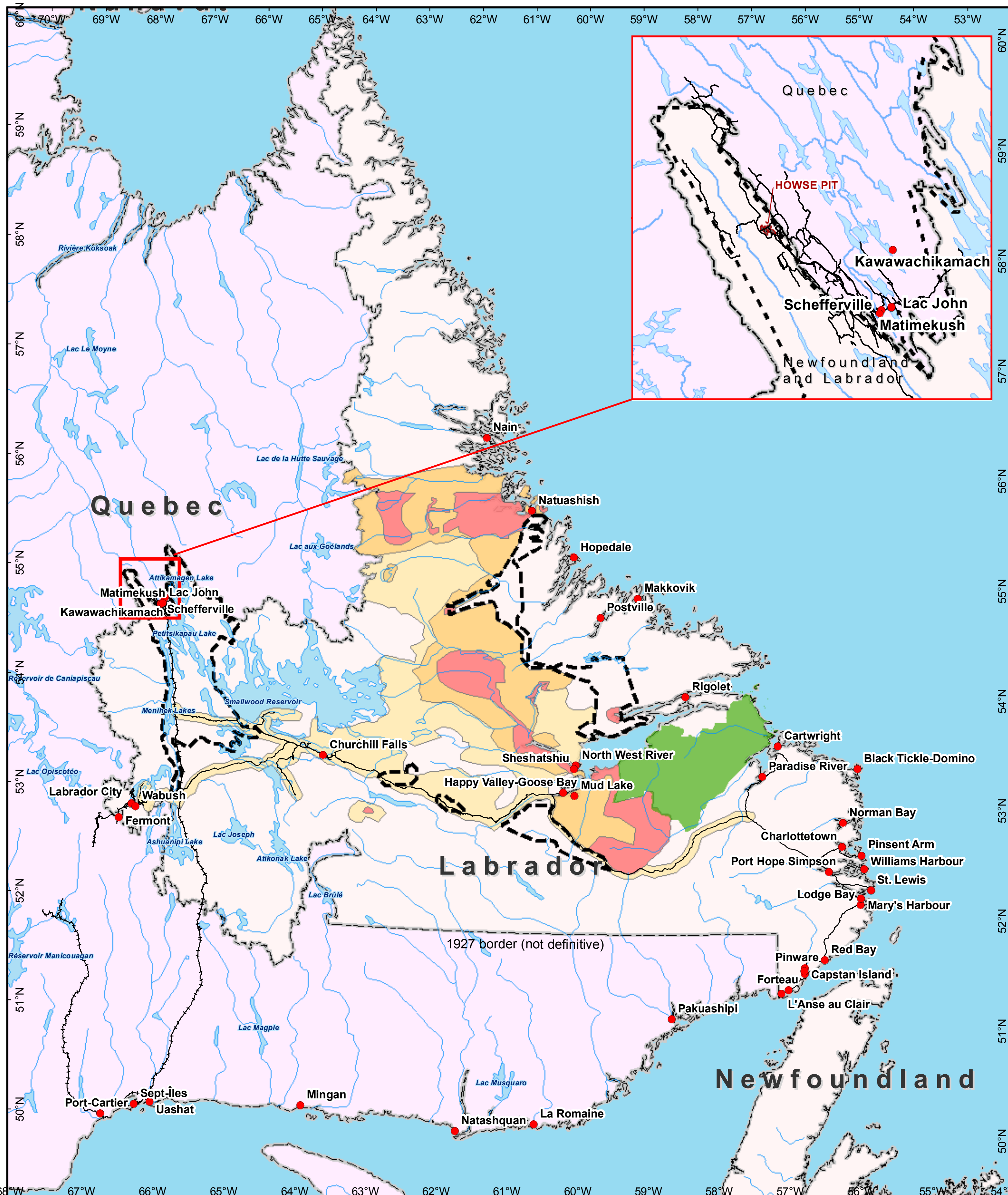
The IN submitted its first land claim in 1977. The claim, which focused on central Labrador, did not contain enough information, and the GNL agreed to fund further research. Another land claim was submitted in 1990, and a framework agreement was signed in 1996.

Negotiations to reach an AIP between the IN, the GNL and the Canadian government started in 2008 in the wake of the New Dawn Agreement. As part of its land claim talk, the IN also began negotiating self-government arrangements with the provincial and federal governments in 2006. The AIP was signed in November 2011, after three years of negotiations.

The AIP "sets out jurisdictions, rights, benefits and limitations for the Labrador Innu in a variety of subject areas. These include the harvesting of forest resources and plants; fish; migratory birds; and wildlife. All rights and benefits are directly tied to specific geographically defined lands (AANDC, 2014). The AIP is not yet legally binding, but will be once it becomes a treaty. Negotiations towards a final land claim agreement (eventually a treaty) and self-government agreement are still ongoing between the IN, the GNL and the Canadian government.

The AIP defines four categories of lands (Figure 7-40):

- The Labrador Innu Lands (12,950 km^2), which is administered by the Labrador Innu authority or government (IN);
- The Labrador Innu Settlement Area (LISA) (14,000 km^2), which includes Labrador Innu lands. The Innu have rights to harvest resources on the LISA (though not for commercial use), and will be involved in decisions that relate to land management.
- The Permit-Free Hunting Area (33,670 km^2), where the Innu have harvesting rights without the prior obtainment of a permit.
- The Economic and Hydroelectric Major Development Impacts and Benefits Areas, on which the Innu have the right to negotiate IBAs.



LEGEND

- Labrador Innu Lands (LIL) Category I
- Labrador Innu Settlement Area (LISA) Category II
- Labrador Innu Settlement Area (LISA) Category III
- Mealy Mountain National Park Reserve
- Economic and Hydroelectric Major Development Impacts and Benefits Areas

Basemap
- Road
- Railroad
- Watercourse
- Water Body
- Provincial Boundary

FILE, PROJECT, DATE, AUTHOR:
GH-0617 , PR185-19-14, 2016-01-27, jtremblay

N

0 50 100 150 200
Kilometers

UTM 19N NAD 83

SCALE:
1:5 500 000

SOURCES:
Basemap
Atlas of North America, 1:7,500,000
Government of Quebec, BDGA, 1:1,000,000
Aboriginal datas
Adapted from Alderon Iron Ore Corp (2012)

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Labrador Innu Land Claims
AIP Area

Howse Minerals Limited

GroupeHemispheres

Figure 7-40

In total, these lands cover approximately 70% of Labrador (GNL, 2014a). None of these land categories infringe on the territory of the province of Québec.

As illustrated in Figure 7-40, the proposed Project does not overlap or otherwise interact with land areas that have been designated as Labrador Innu Lands (LIL) (Category 1), Labrador Innu Settlement Area (LISA) (Category 2) or Permit-Free Hunting Areas (Category 3) under the current Labrador Innu Land Claims AIP. The proposed Project site is approximately 120 km away from the closest area of Category 3 lands in western Labrador, and is well over 200 km from any designated Category 1 or 2 lands. It is also located approximately 480 km from Sheshatshiu and 410 km from Natuashish.

However, the proposed Project site is located within the Western Labrador Economic Major Development Impacts and Benefits Agreement Area (Figure 7-40), which under an eventual Final Land Claims Agreement would see the Innu having the right to IBAs for "Major Developments", as defined specifically in the Agreement.

IBAs

The IN has signed IBAs with three mining companies (Chapter 4.2):

- HML;
- LIM (which covered the Howse Project before the acquisition of the project by HML)17; and
- Vale Inco.

<u>NCC</u>

The NCC has submitted a land claim that covers much of central and southeastern Labrador, including the area of western Labrador in which the proposed Project site is located. However, this land claim has not been accepted for negotiation by the federal or provincial governments.

Land Claims

In 1991, the NCC submitted a first land claim to the federal and provincial governments. However, to date, the Canadian government has not yet communicated its decision to reject or accept the NCC claim (Figure 7-41). In 2010, in the context of the Lower Churchill hydroelectric project, the NCC submitted a document to the CEAA entitled *Unveiling NunatuKavut: Describing the Lands and People of South/Central Labrador* (NCC, 2010a). The purpose of the document was to summarize the research carried out on Aboriginal ancestors and ancestral lands, but also to serve as "a foundation treatise to the Federal Department of Justice and Indian and Northern Affairs Canada, in an effort to illustrate present day rights and titles held by the Inuit descent people of South/Central Labrador" (NCC, 2010a).

The available information indicates that the traditional trapping areas of this group extended through southeastern Labrador to the Churchill River and included traplines up to the "Height of Land" in Western Labrador (LIM, 2009). NCC members continue to rely upon the resources of the land, the water and the sea (NCC, 2013), and are known to undertake land use and harvesting activities throughout Labrador. These include hunting for large and small game, fishing and harvesting vegetation for food, traditional medicines, firewood and other purposes (Martin, 2009; LIM, 2009; NCC, 2010a; 2010b).

[17] The existing IBA of HML, signed in the context of the DSO project, will include the Howse project.

LEGEND

NunatuKavut Land Claim within Labrador

Basemap
- Road
- Railroad
- Watercourse
- Water Body
- Provincial Boundary

FILE, PROJECT, DATE, AUTHOR:
GH-0617 , PR185-19-14, 2016-01-27, jtremblay

N

0 50 100 150 200
Kilometers

UTM 19N NAD 83

SCALE:
1:5 500 000

SOURCES:
Basemap
Atlas of North America, 1:7,500,000
Government of Quebec, BDGA, 1:1,000,000
Aboriginal datas
Adapted from Alderon Iron Ore Corp (2012)

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

NunatuKavut Community Council Land Claim within Labrador

Howse Minerals Limited

GroupeHemispheres

Figure 7-41

An NCC 2012 Land Use Study in the area of current and potential future iron ore mining in Western Labrador indicated that NCC members residing in Western Labrador undertake a variety of land and resource use activities in the region, including hunting, fishing, berry picking, camping and associated travel across the land. That study did not record any indication of current land, water or resource use by NCC members in or near the proposed Project area.

HML signed a cooperation agreement with the NCC for the DSO project in 2013. The NCC also signed an Economic Partnership Agreement with LIM in 2012. To our knowledge, the NCC has not signed IBAs with other mining companies (IBA Research Network, 2014).

Existing Literature

The component description is based on the assessment of existing treaties, agreements, land claims and IBAs.

Data Gaps

The existing data provides a recent and exhaustive overview of the component. However, Some IBAs are confidential agreements and their content or quality can hardly be assessed or compared. The effect assessment on this component is thus based on information publically available on existing treaties, agreements, land claims and IBAs.

Recommended Measures for Improvement

Current efforts by HML to communicate with stakeholders will continue. However, the EIS consultation has demonstrated that some concerns specific to IBA implementation should be addressed promptly.

To this end, information will continue to flow to interested parties and communities at large, as has been done for the DSO Project, and improvements will be made as required, including:

- reinforce and accelerate the current work of the IBA Implementation Committees;
- include the Howse Project in HML's HSE Committee;
- provide radio updates on Project progress and discussions held in the HSE Committee.
- issue a newsletter on Project activities, including information on IBA implementation; and
- work with Band Councils to prepare a joint communication plan on IBA implementation to ensure that up-to-date, accurate information reaches community members periodically.

7.5.1.2 Paleontological, Historical and Heritage Sites

The main concerns raised during the public consultations (Table 7-2) were:

- Ensure that the required archaeological research is carried out.

Given the absence of archaeological or historical sites on the Howse Property or on the haul road proposed trajectory, this component was not retained as a VC.

However, it is important to note that some stakeholders consulted have raised concerns regarding the archaeological potential of the area, especially with regard to Kauteitnat. Is this regard, it is important for HML to respect its engagement to limit operations to the proposed areas, as defined in the EPP (Volume 1 Appendix Ia).

7.5.1.2.1 Component Description

LSA, RSA and Temporal Boundaries

The LSA includes the area located near the Howse Project, including Kauteitnat.

- The RSA has not been considered for this component as Project effects will be felt locally.

The temporal boundary for this component includes up until the end of the operation phase of the Project, as this is when the Howse Project will no longer have potential effects on heritage sites.

Archaeological Research

Archaeological work was carried out in the vicinity of the Howse Project and resulted in the discovery of some prehistoric sites, as well as numerous Aboriginal sites from the contemporary period. An extensive assessment of archaeological potential (McCaffrey *et al.,* 2006) conducted in a pipeline assessment corridor—between Harris Lake, northwest of Schefferville, and Pointe-Noire in Sept-Îles (LabMag Iron Ore Project)—and followed by inventory survey, revealed some forty recent (post-1940s) sites in the northern section of the study corridor (Figure 7-42).

An assessment of archaeological potential and archaeological field work (supervision and survey) were later conducted in 2007 (Arkéos Inc., 2008a) in the Harris Lake area, and more specifically in the upper reaches of Goodwood River. Two test pits revealed the GgDu-1 and GgDu-2 sites, where three lithic tool fragments and altered stones were discovered, suggesting the presence of an ancient fireplace. The GgDu-2 site also contained seven contemporary Aboriginal camps. In July 2013, an inventory was conducted at these two sites and no additional lithic artefacts were discovered (Artefactuel, 2013). An analysis of the three relics discovered in 2007 did not find them to be noteworthy and the Borden codes were cancelled. A survey conducted in 2011 along the Goodwood–Timmins road yielded a prehistoric site (GfDs-3) where an endscraper and a scraper, both carved in stone, were discovered on a plateau overlooking the valley of Morley Lake in Labrador (Arkéos Inc., 2012). The site is located about 3.5 km east of the Project site. During the survey, several relics from recent camps (all connected to the existing road) were also recorded. Interestingly, an archaeological survey (Schwartz, 2006) was also conducted west of Howells River to determine if 58 chert outcrops recorded by LabMag geologists had served as sources of prehistoric lithic raw materials. The research did not show traces of human alterations associated with quarrying or any other human activities.

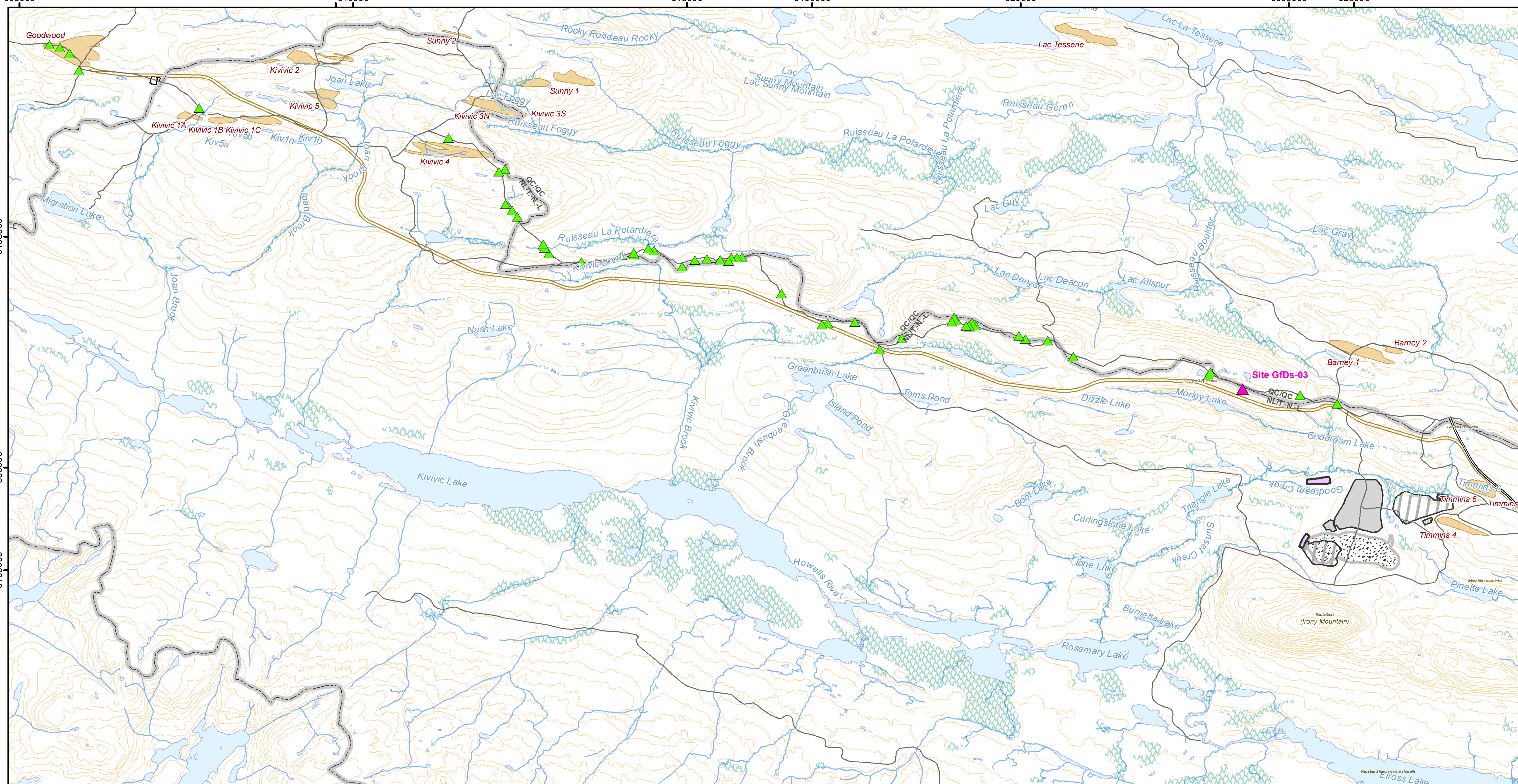
Another archaeological survey was carried out in 2008 (Arkéos Inc., 2008b) on properties affected by TSMC's DSO project, but it did not reveal any new archaeological sites. Lastly, it bears mentioning that a Stage 1 Historic Resources Assessment was conducted in 2008 on behalf of LIM for a number of iron ore deposits, including the Howse Property, and that no archaeological sites were identified (Stantec, 2009).

Archaeological Potential

All of the available data related to the paleogeography and geography of the Project footprint (glacial retreat, proglacial lake, climate, accessibility, surface characterization, resource availability and abundance, position in relation to travel routes, etc.), as well as the existing archaeological and ethnohistorical data, was used to determine the prehistoric potential.

The presence of ice on the territory until about 6500–6000 BP establishes a maximum age for human colonization of the area. However, the favorable climate that followed deglaciation and the sector's rapid colonization by vegetation after the glaciers melted and proglacial lakes retreated made human inhabitation possible thereafter. It is therefore plausible that there may have been a human presence in the region as early as 6000 BP.

The studied area spans 3.5 km in a northwest–southeast direction and 2 km in a northeast–southwest direction, and its landscape varies in altitude between 600 and 700 m. Its surface materials consist primarily of moraine deposits, i.e., coarse components mixed with sand, silt and clay deposited on the bedrock, which is exposed in some areas. The area features a few low-lying areas filled with organic matter with poor drainage, if any. In the southwest section, a small nameless lake flows through a series of small creeks and lakes before reaching Rosemary Lake, a northern constituent of Howells River. To reach this river, approximately 8 km of non-navigable streams must be crossed. A nameless stream is found alongside the west flank of the study area and runs through a sloping section that is not suitable for setting up camps. Goodream Creek flows into a relatively flat valley, but its surface areas are practically non-existent due to poorly drained surface materials. In short, given the environmental features, the area does not lend itself well to the establishment of human settlements. Archaeological inventories conducted in Québec’s subarctic have revealed a general tendency for Aboriginals to settle in areas characterized by fine, well-drained surficial deposits situated near watercourses or water bodies that are linked to a drainage basin.



LEGEND

Archaelogical Components

- GfDs-03 Site
- Contemporary Site

Infrastructure and Mining Components

- Proposed Howse Pit
- Proposed Topsoil/Overburden Stockpile
- Proposed Site Infrastructure
- Proposed Waste Dump/In-Pit Dump
- Proposed and Existing Sedimentation Pond
- DSO Haul Road
- Existing Railroad

Basemap

- Main Access Road
- Existing Road
- Contour Line (50 ft)
- Provincial Border
- Watercourse
- Water Body
- Wetland

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0616 , PR185-19-14, 2016-03-23, edickoum

0 2 4 6
Kilometers

UTM 19N NAD 83

SCALE: 1:70 000

SOURCES:

Basemap
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,
Boundary used for claims,

Mining Components
Howse Minerals Limited/ MET-CHEM Howse Deposit Design for General Layout, 2015
Groupe Hémisphères, Hydrology and wetland update, 2013

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Archaelogical Sites

Howse Minerals Limited

GroupeHemispheres
5731, rue Saint-Louis,
Bureau 201, Lévis (QC)
Canada, G6V 4E2
1453, rue Beaubien est,
Bureau 301, Montréal (QC)
Canada, H2G 3C6

Figure 7-42

Some documented archaeological sites in Québec–Labrador, however, show that the Aboriginals used chert from the Labrador Trough to prepare certain tools as early as 3500 BP, and around that same time, this resource began to be used in the dealings within a vast social network (McCaffrey, 1989). Still, among other things, the studied area contains fine chert that could have been utilized. Access to the studied area is nevertheless difficult, as it is situated away from main paths and water bodies. As such, it appears unlikely that Aboriginals would have invested time and energy to reach this relatively remote area given the presence of much more accessible chert outcrops along watercourses or water bodies (McCaffrey et Denton, 1987). Furthermore, a visual inspection of the studied area was conducted in 2008 and no archaeological relics were recorded at that time.

Recent Archaeological Investigation on Howse Project Area

For the specific needs of the Howse Project, a Historic Resources Impact Assessment was conducted in September 2014 (Volume 2 Supporting Study O). This survey was conducted on the proposed location for the 30 km Goodwood-Timmins haul road, and the 9 km² Howse Property deposit. The survey identified no pre-contact historic resources, but recent (20th century) historic resources were identified, though typically recent and within close proximity to an existing access road. Such findings included signs of past caribou presence in the form of several sets of antlers and a skeleton, and several surface-level chert fragments. A few test pits were dug during this survey, but with no findings.

While the surveys did not lead to the discovery of historic sites, the presence of a wide range of features was identified, including recent fire pits, a teepee, and mining-related debris. All are contemporary or near-contemporary, and are for the most part located near access roads.

During the fall of 2014, an elder reported that a burial would have been found on Kauteitnat, information that could not be confirmed by the Provincial Archaeology division of the GNL's Business, Tourism, Culture and Rural Development Department. However, if such a discovery was eventually confirmed, there would be no interference with the Howse Project, as HML has stated that there are no plans to extend the Howse Property boundaries any closer to Kauteitnat. Furthermore, TSMC's EPP (Volume 1 Appendix Ia) provides for Cultural Heritage protection in section 5.15 (Cultural Heritage Control Plan).

Existing Literature

The component description is based on the archeological researches that have been conducted in the region through time and that have been cited where appropriate in the text.

The EPP's Cultural Heritage Control Plan protects any cultural heritage resources that could be affected by construction activities. In this sense, should a discovery be made during Project construction, operation or decommissioning and reclamation, the proper means will be taken to protect such resources.

Data Gaps

The existing data provides a recent and sufficient understanding of the component.

7.5.2 Land Use Practices

7.5.2.1 Land-use and Aboriginal Traditional Knowledge

What follows summarizes the land-use study carried out for the purpose of the Howse Project (Volume 2 Supporting Study D). Previous studies indicated a rather intensive use of this area by local land-users (Clément, 2009; Weiler 2009), and TSMC found it necessary to obtain more precise information regarding harvesting practices specific to the proposed Howse Project location (Figure 4-1). Accordingly, the Howse Project study's purpose was to identify the current land-use and harvesting practices that are carried out in the vicinity of the Howse Project proposed site (Figure 4-1). Participants in the study were Innu from

NIMLJ and ITUM, and the NNK. The participatory mapping approach and methodology are described in Volume 2 Supporting Study D, as well as the historical land occupation of both the Innu and the Naskapi.

It should be mentioned that the land-use and ATK discussion focuses on the Québec Innu (NIMLJ and ITUM) and the Naskapi, as they represent the harvesters who occupy and intensively use the area.

Subcomponents are the following:

- Subsistence and traditional caribou hunting;
- Subsistence and traditional activities (hunting, fishing, trapping and berry/medicinal plant harvesting);
- Preservation of and access to Kauteitnat;
- Outfitting businesses;
- Access to land.

Schefferville used to be an area where outfitting businesses operated. However, since the ban on the caribou hunt, most outfitting businesses in the area have ceased their activities, or have maintained marginal activities in terms of the revenues they generate. Given this context, outfitting businesses, whether they belong to Aboriginal or non-Aboriginal owners, will not be retained as a VC.

Access to land is discussed in Section 7.5.3.4 under the subcomponent "Access to the local road network, access to lands, and road safety", and several measures are proposed to alleviate the issues related to access to land, which is key in the pursuit of harvesting activities.

It is important to note that the VC assessment below primarily concerns local Aboriginal groups, namely the NIMLJ and NNK, as they represent the most active land-users, or those who may carry out subsistence harvesting practices in the vicinity of the Howse Project site. However, ITUM and the family trapline holders are also included in assessing these VCs.

<u>Subsistence and traditional caribou hunting</u>

Both the Innu and Naskapi of Schefferville have historically relied on caribou for food, clothing and materials. Subsistence and traditional caribou hunting is thus of high cultural value, and there is a rich knowledge associated with caribou hunting. During the Howse Project consultations, concerns regarding the presence or absence of caribou in the region were expressed by many, including the IN and NCC, in the letters they submitted in the context of Project Registration (Chapter 4). This is why this subcomponent is considered as a VC.

<u>Subsistence and traditional activities</u>

Subsistence and traditional activities remain important for the Innu, Naskapi and non-Aboriginal population living in Schefferville area, but the Howse Project area itself is mostly used to reach other harvesting grounds (Volume 2 Supporting Study C and Supporting Study D). A fair amount of opportunistic harvesting activities are still carried out in the area, especially taking into account that it is easily accessible by road. However, the presence of the Howse Project and of other mining activities forces users to go farther inland to find resources, which translate into increased financial costs for the families. Therefore, this subcomponent is considered as a VC.

<u>Preservation of and access to Kauteitnat</u>

The cultural value of Kauteitnat for both Innu and Naskapi has been explained above. Many if not all participants in the consultations raised concerns regarding the proximity of Kauteitnat to the proposed mine site. Its historic and contemporary use as a landmark and its role as an observation point for caribou hunting are recognized and valued by Innu and Naskapi alike. Therefore, the preservation of and access to Kauteitnat is considered as a VC.

7.5.2.1.1 Component Description

LSA, RSA and Temporal Boundaries

The LSA includes the following communities, located in the province of Québec:

- Naskapi Nation of Kawawachikamach (NNK);
- Nation Innu Matimekush – Lac John (NIMLJ);
- Land-users from the Town of Schefferville.

In addition, ITUM is considered within the LSA for this component as some families are trapline holders in the vicinity of the Howse Project. The RSA has not been considered for this component as Project effects will be felt locally.

The temporal boundary for this component includes up until the end of the decommissioning and reclamation phase of the Project, as this is when the Howse Project will no longer have an influence on the LSA as the sources of effects will not be operative.

LSA

NIMLJ and ITUM

The current land use and Innu-Aitun in the study area reflect the changes in the way of life that were triggered by the beginning of mining operations by the IOCC, the development of Schefferville, and the closure and recent start-up of mining activities (Figure 4-1). Way of life has been greatly affected by the disappearance of caribou in the region, a vital resource in the exercise of Innu-Aitun, which influenced Innu subsistence hunting.

The Schefferville area is an easily accessible location for the practice of Innu Aitun and harvesting activities. As people from MLJ are close and have easy access to the study area, they are the most frequent users. Young MLJ Innu users are very active in the study area and use the land during short stays for resource harvesting activities, depending on the season. On the other hand, elders have reduced their activities in the study area, and now go farther for extended stays, using the study area mostly as a transit area.

Innu from Uashat and Mani-Utenam live farther away, and they travel less frequently to the area. Most often, they come for temporary visits to traplines (Figure 7-44). The fact remains that Uashat and Mani Utenam trapline holders near the study area have a special attachment to this territory, even though they are not continuously present and do not regularly practice harvesting activities in the area.

The roads built by IOCC in the study area are used by Innu for their traditional activities. The road that goes from Kauteitnat to Howells River is used frequently. Pick-up trucks are the most used mean of transportation, while ATVs, ski-doos and canoes are also complementary vehicles. The settling of long-term camps in the study area is random because most users now travel for short-term specific resource harvesting, and access by road allows them to come and go in a day by their own means. Most permanent camps are farther away and most of the existing camps in the study area are now used for day or short-term hunting and fishing trips.

Although the NIMLJ and ITUM Innus often pass through the area, some activities still take place. Depending on the season, the main activities practiced by Innu are caribou hunting, waterfowl hunting, trapping, fishing, small game hunting and plant harvesting. Irony Mountain or Kauteitnat is also an important landmark, having cultural and spiritual significance to the Innu. Table 7-103 presents the annual cycle of activities practiced in the study area, which are then described one by one.

Table 7-103 Annual Cycle of Activities Practiced by the Innu in the Study Area

SEASON	ACTIVITIES
Fall	- Waterfowl and small game hunting - Fishing - Beginning of trapping for some species - Alpine Cranberry harvesting - Caribou hunting if sightings (outside study area)
Winter	- Small game hunting - Fishing - Trapping
Spring	- Waterfowl hunting (mainly Canada geese) - Other activities in standby until geese move away
Summer	- Fishing - Waterfowl hunting - Wild berry harvesting

Caribou Hunting

The Innu of Labrador and Québec used to hunt caribou from the George River herd. This was the main activity exercised by the Innus of Matimekush-Lac John and Uashat Mani-Utenam in the fall, when the herd passed through the region during its migration to the north. During the last five years approximately, the herd has gradually disappeared from the region and is largely decimated. Caribou hunting is no longer practiced, which greatly affects the Nation’s food supply and traditions. Hunters must go farther away to find caribou, which is expensive. The local population is also prevented from passing on the cultural knowledge that is associated to the caribou.

Waterfowl Hunting

Canada Goose is the most hunted waterfowl. Goose hunting is mainly practiced in the spring by family-related groups who wait for geese flocks around water bodies. Three sites in the study area are largely used: Rosemary Lake, Triangle Lake and Pinette Lake. Howells River is also a preferred location. Besides the Canada Goose, the Loon, Black Duck and Long-Tailed Duck are also present and harvested in the area.

Trapping

Beaver trapping is practiced in late fall, whereas mink, fox and marten are mostly trapped in the winter. Lynx is present but is harder to catch. Beaver meat is very prized among the Innu. Trapping takes place around Matimekush-Lac John. However, according to elders, trapping is not practiced as much as before because it requires a lot of time investment, and the fur market is complex. The absence of caribou would incite trappers to go outside the study area, towards Greenbush and its surroundings, where there are permanent camps for long-term stays.

Fishing

Fishing is practiced with nets and fishing rods in summer and fall, at various sites in the study area, mostly Rosemary Lake, Triangle Lake and Pinette Lake. The main species fished are various trout species, char, cisco, Lake Trout and Landlocked Salmon. Ice fishing for Brook Trout is also practiced.

Small Game Hunting

Ptarmigan, hare and porcupine are harvested during spring, fall and winter. Small game is very appreciated by the Innu and is present in the study area. Small game hunting is mostly practiced opportunistically, while carrying out other harvesting activities.

Plant Harvesting

Blueberries and cloudberries, found in bogs, are the fruits most harvested during summer. Raspberries can also be found. Alpine cranberries are popular in the fall. Harvesting is mostly practiced by women, who are assisted by men to reach the harvesting sites. Harvesting is carried out in the study area, mainly in the Rosemary Lake area. Many people now refrain from harvesting berries or plants in the study area because of the presence of mining activities.

Irony Mountain or Kauteitnat

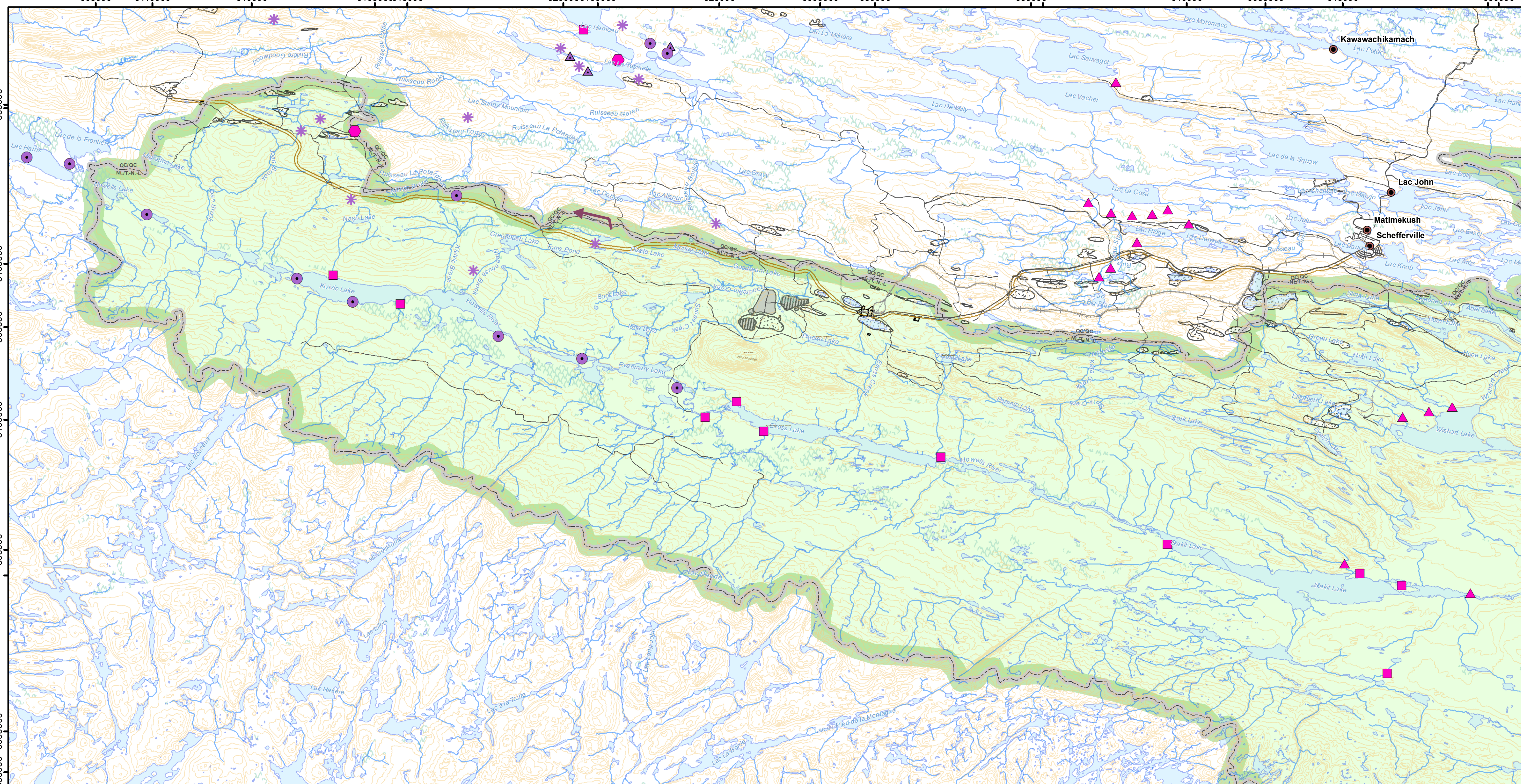
This mountain is an important topographic landmark for Innus of Matimekush-Lac John and Uashat-Mani-Utenam. The mountain has always been an important observation hill for locating caribou and other species. The mountain's intricate ties with resources and Innu-Aitun confer a sacred aspect to the site for the Innu. It is an important symbol in Innu culture.

NNK

The Naskapi use of the territory is quite similar to that of the Innu described above. However, many political and socioeconomic factors are specific to each Nation. The study area is mostly used for opportunistic harvesting and as a passing-through zone to reach the Greenbush or Goodwood area. Much of the Naskapi's harvesting activities are carried out in the vicinity of Lake Attikamagen and Swampy Bay, as well as the Kauteitnat, Goodwood and Greenbush areas. The territory is shared informally between the two nations, based on good will, and relations are generally positive.

The Naskapi use the existing roads to access different water bodies and sites in the study area. Chemin de la Montagne (Teketaut Meshkenu) is used to access the northeast, Goodwood and Greenbush. Like the Innu, the Naskapis us pick-up trucks most often for transportation, with ATVs, ski-doos and canoes used as complementary vehicles. There are few or no permanent camps in the study area, the zone being mostly used to travel to camps to the north, near Attikamagen and Swampy Bay lakes. Temporary camps are located along the Greenbush/Goodwood roads, outside the study area, and on the eastern side of Kauteitnat, as well as around Rosemary Lake (Figure 4-1).

Irony Mountain or Kauteitnat is also an important landmark for the Naskapi, and they practice more or less the same harvesting activities as the Innu on the territory: caribou hunting, waterfowl hunting, trapping, fishing, small game hunting, and plant harvesting. The specifics of each land use activity are described below, and Table 7-104 presents an overview of their annual cycle.



LEGEND

Recreational Land Use

- Town
- Innu Cabin
- Naskapi Cabin
- Other Cabin
- Bustard Observation And Hunting Site
- Beaver Lodge And Observation Site
- Picking Site (Cloudberry, Lingonberry, Bog bilberry, Blueberry, Labrador tea)
- Labrador Small Game/Fur zone
- Labrador Black Bear Management Area

*Hydronyms are oriented along the direction of water flow

Infrastructure and Mining Components

- DSO Haul Road
- Existing Railroad
- Deposit
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Site Infrastructure
- Proposed Waste Dump/ In-Pit Dump
- Proposed Sedimentation Pond
- Elross Lake Area Iron Ore Mine Plant Infrastructure Footprint

Basemap

- Existing Road
- Contour Line (50 ft)
- Provincial Border
- Watercourse
- Water Body
- Wetland

FILE, PROJECT, DATE, AUTHOR:
GH-0584b , PR185-19-14, 2016-03-23, edickoum

N

0 2 4 6
Kilometers

UTM 19N NAD 83

SCALE: 1:150 000

SOURCES:

Basemap and Land Use Components
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec, Land Use Atlas, 2009
Daniel Clement, 2009.

Mining Components
TATA Steel Minerals Canada Limited/ MET-CHEM Howse Deposit Design for General Layout., 2013
Groupe Hémisphères, Hydrology and update, 2013

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Known Harvesting Locations Schefferville Area

Howse Minerals Limited

GroupeHemispheres
5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 7-43

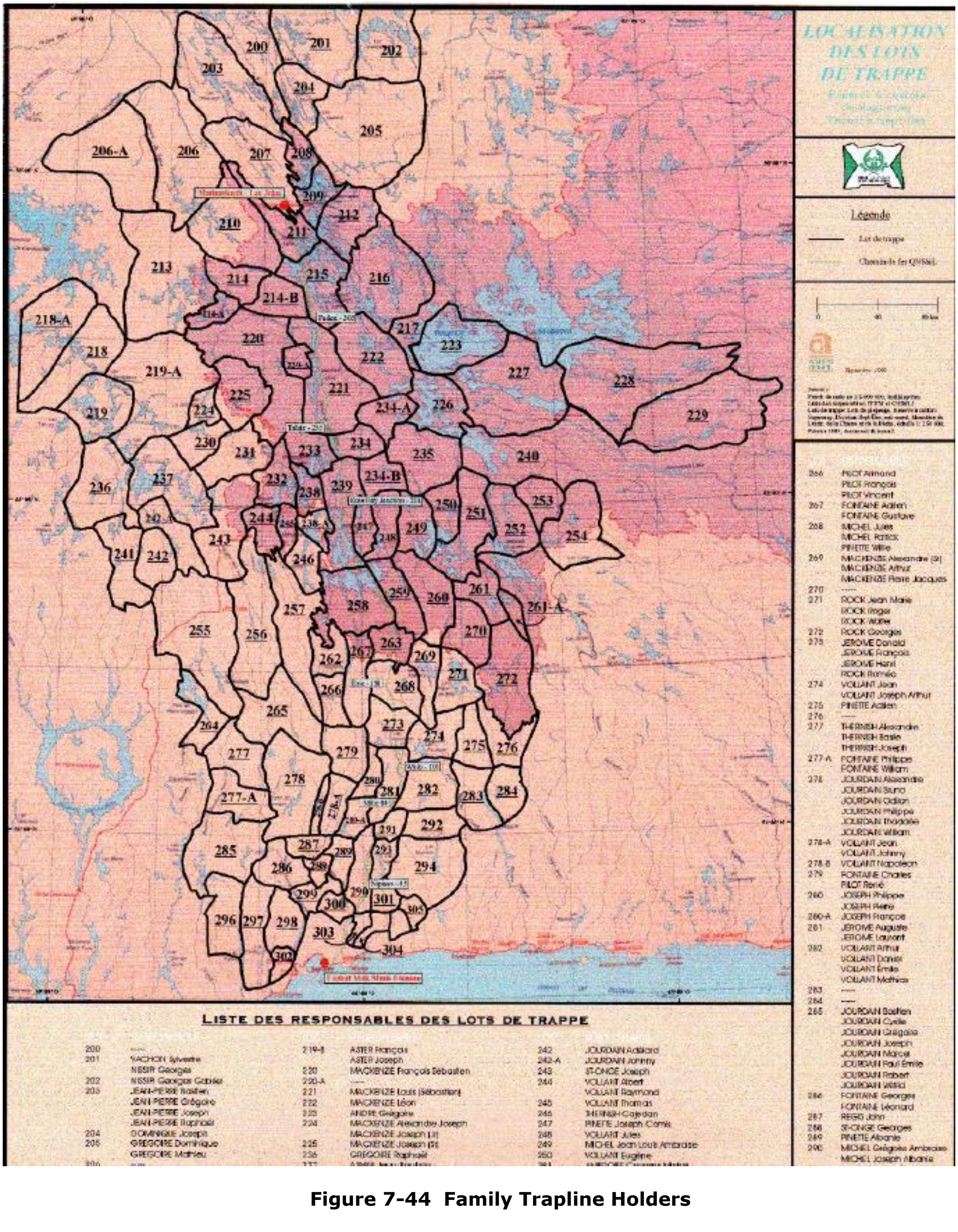


Figure 7-44 Family Trapline Holders

Table 7-104 Annual Cycle of Harvesting Activities Practiced by the Naskapi

SEASON	ACTIVITIES
Fall	- Waterfowl hunting (Canada geese and grouse) - Fishing - Alpine Cranberry harvesting - In the past, caribou hunting, now some Naskapi go to the Kuujjuaq region
Winter	- Waterfowl hunting (ptarmigan) - Trapping - Ice Fishing
Spring	- Waterfowl hunting (mainly Canada geese)
Summer	- Fishing - Waterfowl hunting - Wild berry harvesting

Caribou Hunting

Naskapi used to hunt the George River caribou herd in groups on the western side of Kauteitnat. There is now a ban on George River caribou hunting. The Naskapi may hunt the Rivière aux Feuilles herd occasionally. The recent scarcity of the species has had an effect on the Naskapis' lifestyle and they now have to go north to hunt caribou, which is more costly. The local population is also prevented from passing on the cultural knowledge that is associated to the caribou.

Waterfowl Hunting

Canada Goose hunting is a very important activity in the spring, when large flocks arrive. It is mostly practiced outside the study area, although some Naskapi hunt along the Papateu Shipu basin. Loon, Black Duck, Long-Tailed Duck and Black Scoter are also preferred waterfowl species that are hunted on some lakes in the study area.

Small Game Hunting

Grouse is a highly sought-after species in the fall, whereas ptarmigan is hunted more in winter. Grouse is hunted along roads and ptarmigan can be found on small plateaus in the study area.

Trapping

Naskapi trapping activities are rare in the study area. Some Naskapi will trap marten or mink while passing through the area for other activities.

Fishing

Naskapi come to the study area to fish Trout, Lake Trout and Landlocked Salmon in the Lake Curlington, Lake Rosemary and the Papateu Shipu areas. In winter, ice fishing for Brook Trout is practiced. Outside the study area, the Goodwood, Lake Attikamagen and Swampy Bay areas are also used for fishing.

Plant Harvesting

Blueberries, bog bilberries and raspberries are gathered by the Naskapi outside the study area, at the edge of Kauteitnat, mainly in the summer. Black crowberries and cloudberries are harvested in bogs. Alpine cranberries are the main harvest in fall, on Kauteitnat Mountain. Many now refrain from harvesting in the study area or part of it, because of the dust generated by mining operations.

Irony Mountain or Kauteitnat

For the Naskapi, Kauteitnat is a site for caribou hunting, and is unique for its use, and for the concentration of species that feed, rest or breed there. It is a landmark that played an important role in caribou hunting, as it is an accessible observation point from which to see the caribou coming and a place that helped harvesters orient themselves on the land from afar. However, the mountain does not have the same symbolic or sacred significance for the Naskapi as it has for Innu.

General observations on land-use in the vicinity of the Howse Project

Subsistence and traditional remain important for the Innu (NIMLJ and ITUM), Naskapi and non-Aboriginal population living in Schefferville area. The land-use study conducted for the purpose of the Howse Project (Volume 2 Supporting Study C) concluded that land-users mostly circulate through the Howse Project area to travel to other harvesting zones, towards the Greenbush/Goodwood areas, or towards Rosemary Lake. The hunting and trapping activities in the area are mostly opportunistic, in the sense that users will harvest resources that they see on the road, rather than purposely harvesting on the Howse Project proposed site. The exception if Rosemary Lake area (Figure 4-1). Fishing, however, occurs on the Project area mostly on day trips. Several users indicated that they refrain from harvesting berries in this zone because of the dust generated by mining activities and traffic.

The study also highlighted the importance and cultural significance of Kauteitnat for the local Aboriginal population and ITUM trapline holders, and confirmed that the presence of caribou in the area has been rare for at least the five past years.

The following observations were made:

- Subsistence fishing: According to the informants who took part in the Howse Project land-use study (Volume 2 Supporting Study D), fishing activities still occur in the study area, even close to the Howse Project proposed site, in Pinette Lake and Triangle Lake in particular. The WMP that will be put in place will avoid effects on the fish and fish habitat in Pinette Lake and minimize those effects in Triangle Lake.
- Subsistence trapping: Trapping, as an activity, requires time, efforts and funds. Very few land-users trap on a permanent basis. Trapping does occur, however, on an ad hoc basis, like while fishing, for example. Few trapping areas were identified during the land-use study in the vicinity of the Howse Project. Given the low occurrence of trapping activities generally, and specifically in the study area, effects on trapping per se will be limited.
- Subsistence gathering of berries and medicinal plants: Given the dust generated by both the road and the mining activities in the vicinity of the Howse Project proposed site, land-users have indicated that they refrain from harvesting berries in the study area (see Figure 4-1).
- Subsistence hunting: Some species, such as ptarmigan, waterfowl, and grouse, are harvested in the area. However, many harvesters now prefer to go elsewhere or farther towards the Rosemary Lake / Goodwood areas to avoid the mining activities.

In the context of the HHRA, a country food survey was undertaken in the Howse Project land-use area (Figure 4-1). Fourteen households that potentially collect country food in this area were met to obtain information on their harvesting habits in that specific area. The respondents were Innu families as the Naskapis have indicated not using this area for their harvesting activities. Nine families out of fourteen had used the study area in the past year, and the survey clearly demonstrated that the location that was most used by Innu families, within the study area, was the surrounding of Rosemary Lake. The survey also confirmed that daily trips were the most popular, as opposed to staying at the camps: longer stays are occasional and occur mostly in the fall. The area is not as used in the winter time due to a more difficult access by snowmobile. Generally, hunting activities are limited in the winter time in this particular area, and the most hunted specie is ptarmigan. Results confirm that country food harvested in the study area does not represent a significant source of food intake when considering the general diet of the respondents, as demonstrated in Table 7-105 below.

Table 7-105 Average consumption of country food from the land-use study area among surveyed households in the past 12 months

COUNTRY FOOD	MEALS / MONTH
Small mammals	0.3
Waterfowl	1.8
Fish	1.7
Berries	1.7 cups

Source: Country Food Survey (Volume 2 Supporting Study D)

Existing Literature

The component description is based on literature review of previous studies carried out in the context of the DSO Project (Clément 2009a,b; Weiler 2009a,b) and information provided by the land users for the purpose of the land-use assessment (Volume 2 Supporting Study C) and country food survey (Volume 2 Supporting Study D) carried out specifically for the Howse Project.

Data Gaps

The existing data provides a recent and exhaustive overview of the component.

7.5.2.1.2 Effects Assessment

VC Assessment

SUBSISTENCE AND TRADITIONAL CARIBOU HUNTING

The state of the herd is a constant concern for the Innu and Naskapi, and has deep effects on the cultural value attributed to the caribou, and on knowledge transmission, as indicated above. The main concerns raised during the public consultations (Chapter 4) were:

- The main concern is that the caribou will not come back to the area because of mining activities.
- People are well aware of the decrease in caribou population, which they partly attribute to climate change, mining activities, and other natural causes.
- People would like to be sure that mining activities will stop if caribou is spotted in the area.

Interaction of the Project with Caribou Subsistence and Traditional Caribou Hunting and Potential Effects

Site Construction Phase

All project activities have an interaction with caribou during the site Construction phase.

Potential interaction

- construction/upgrading of the Howse haul road and bypass road;
- pit development;
- transportation and traffic.

These activities will cover a limited area and will be carried out over short periods of time. As indicated in Section 7.4.3, the site Construction phase activities will cause disturbances that may cause caribou avoidance of the area. However, no caribou sightings were reported in the area during the last five years.

➔ The potential effects associated with the Project activities during the site preparation and construction phase is the prolonged absence of caribou in the area caused by anthropogenic disturbances.

The nature of the effect is indirect and the effect is adverse.

Operation Phase

No potential interaction

- solid waste disposal;
- hazardous waste management;
- explosives waste management; and
- treatment of sanitary wastewater.

No additional loss of habitat is expected, aside from the mine pit itself. However, caribou feeding habitats are common locally and regionally and so the Howse Project is not expected to limit caribou occupancy of the area. Increased traffic related to the vehicles for the disposal of additional wastes generated by the Howse Project is considered under the "Transportation of ore and traffic" activity.

Potential interaction

- removal and storage of remaining overburden and topsoil;
- blasting and ore extraction;
- mineral processing;
- dewatering;
- operation of waste rock dumps;
- transportation of ore and traffic; and
- ongoing site restoration.

More specifically, noise and vibration disturbance will be generated by:

- diesel generators used continually for pit dewatering and mineral processing;
- blasting; and
- transportation of ore and traffic.

The IN of Québec published a *Note to the Nation* on November 5, 2014, asking its members to reduce their hunting activities as much as possible. The note indicated that caribou hunting should be restricted to community hunts and for the purpose of traditional knowledge transmission. The *Note* also recommends that Innu members not practice hunting activities on Cree or Inuit lands until a protocol between Nations has been signed (Nation Innue, November 5, 2014). However, some do continue to hunt caribou, and go farther inland. The cost of such subsistence activities may be significant for these families.

Several lines of thought are to be considered in the assessment of the effect on this component:

- Subsistence and traditional caribou hunting is of high cultural value for both the Innu and the Naskapi, as there is rich knowledge associated with caribou hunting. In these terms, the absence of caribou affects the Innu and Naskapi cultures and their transmission.
- Informants have stated that the caribou does not come into the area of the mining projects anymore (north west of Schefferville), or near the Howse Project proposed site, and that they have not harvested caribou in the area for the past five years;
- The Nation Innue du Québec and NNK are active members of the Ungava Peninsula Caribou Aboriginal Round Table (UPCART), which includes the Nunavik Inuit, the Nunatsiavut Inuit, the NCC, the Grand Council of the Crees, and IN.

- According to specialists, it would take several decades for the George River herd to recover to a healthy number of animals: natural decline has occurred in the past, and the species has always recovered, but it took time (Fortin 2014, personal communication). This time, researchers are wondering how the herd could recover given the many anthropogenic disturbances and climate change effects: there is no unanimity among the scientific community on the question. In all cases, it is very unlikely that the population would recover to 2001 levels – up to 385,000 animals - in the time span of the Project (12-13 years). Should the caribou return, it may be located east of Schefferville, and there would be other locations to find and harvest the caribou.
- There are costs for harvesters who wish to go farther inland, as this requires expenses for helicopters or planes, for example.

These points suggest that, despite the high cultural value of subsistence and traditional caribou hunting for the Innu and Naskapi, subsistence caribou hunting is not likely to be an activity that will be pursued intensively by the Innu or the Naskapi during the life time of the Howse Project in the study area, even in the absence of the Howse Project. Given that there is hardly any caribou in the Howse Project area currently, and given the surrounding mining exploration and exploitation activities, the Project in itself will probably not exacerbate the situation, at least from a subsistence point of view.

➔ The potential effects associated with the project activities during the Operation phase is the prolonged absence of caribou in the area caused by anthropogenic disturbances.

The nature of the effect is indirect and the effect is adverse.

Decommissioning and Reclamation Phase

No potential interaction

All project activities have an interaction with caribou during the Decommissioning and Reclamation phase.

Potential interaction

- demobilization of Howse facilities and heavy machinery;
- transportation and traffic; and
- final site-restoration.

The demobilization of the Howse facilities may result in fewer disturbances. The Howse haul road will not be decommissioned, but the waste rock dumps will be revegetated. The main road leading to the Howse Project site will continue to be used for other projects. Once the Project is over, restoration should allow the recovery of some habitat loss.

➔ The potential effects associated with the Project activities during the Decommissioning and Reclamation phase is the prolonged absence of caribou in the area caused by anthropogenic disturbances.

The nature of the effect is indirect and the effect is adverse.

SUBSISTENCE AND TRADITIONAL ACTIVITIES (HUNTING, FISHING, TRAPPING AND BERRY/PLANT HARVESTING)

The main concerns raised during the public consultations (Chapter 4) were:

- local people are conscious that they will need to go elsewhere, which means increased cost for subsistence. Concerns that resources will be affected by dust and that wildlife will move away. Dust is considered as an important issue and its effects on air quality, water quality and health is a concern;
- concerns regarding access to land for subsistence activities;

- effects on fish, animals, and waterfowl are of concern because these resources are used for subsistence; and
- sightings of wildlife (wolverine, caribou or lynx, etc.) should be reported to the Nation and the government.

Interaction of the Project with Subsistence and Traditional Activities (hunting, fishing, trapping and berry/medicinal plant harvesting) and Potential Effects

Site Construction Phase

Potential interaction

- construction/upgrading of the Howse haul road and bypass road;
- pit development; and
- transportation and traffic.

The activities associated with the Construction phase will cause disturbances (noise, loss of habitat, pollution, light emissions, vibrations) that may disturb wildlife resources. Fish and fish habitat will probably be affected during the Construction phase but fish will remain fit for consumption. Plants and berries may be affected by dust, but will remain fit for consumption if given a thorough wash. The perception of the environmental disturbances by the local population may affect their confidence in the quality of the resources harvested in the vicinity of the Project site. Hence, as it is already the case for a few land-users, the population will likely refrain from harvesting resources near mining sites.

➔ The potential effects associated with the Project activities during the site preparation and construction phase is **a decrease in accessible subsistence and traditional activities and increased costs for family subsistence**

The nature of the effect is indirect and the effect is adverse.

Operation Phase

No potential interaction

- solid waste disposal;
- hazardous waste management;
- explosives waste management; and
- treatment of sanitary wastewater.

Those activities will take place at existing DSO facilities that will be in operation in 2015. Increased traffic due to the additional wastes generated from the Howse Project is considered under the "Transportation of ore and traffic" activity.

Potential interaction

- removal and storage of remaining overburden and topsoil;
- blasting and ore extraction;
- mineral processing;
- dewatering;
- operation of waste rock dumps;
- transportation of ore and traffic; and
- ongoing site restoration.

It was estimated that a 215 ha of vegetated area will be destroyed or severely disturbed during the Howse Project, and operations will also affect lakes and streams (Goodream Creek and Burnetta Creek in particular) through the mine effluent. During the operation phase, the fish and fish habitat of the Goodream Creek will be affected, but the fish will stay fit for consumption. In addition, the presence of wildlife will be affected by noise, vibration, light, and dust.

➔ The potential effects associated with the Project activities during the operation phase is **a decrease in accessible subsistence and traditional activities and increased costs for family subsistence**

The nature of the effect is indirect and the effect is adverse.

The opportunistic harvesting that may occur in the Howse Project proposed area will likely decrease because of avoidance of disturbances, perceived contamination of the vicinity of the Project and safety measures taken around the mine site. The presence of the Timmins-Kivivik bypass road and eventual additional bypass road (Section 2.5.3) however, will allow users to easily reach their harvesting grounds, though this may be more time consuming and costly.

This means that families may incur greater costs to fulfill their subsistence needs, as going farther on the land implies a certain number of expenses (fuel, temporary camps). In addition, there is a risk that impediments to accessing harvest resources affects the health of some people in the LSA: families who have limited means may prefer to buy less nutritious foods at the store rather than finding the necessary funds to go farther on the land to find suitable resources. However, land-users in Schefferville also have the possibility of going elsewhere in the vicinity of the community, and they already take advantage of this possibility. There might be constraints related to family hunting territories and to increasing number of land-users in a given area, which could put additional pressure on resources.

It is also important to keep in mind that ATK is site-specific. Hence, there is a possibility that knowledge related to the lands located in the vicinity of the Howse Project would be lost.

Decommissioning and Reclamation Phase

All project activities have an interaction with subsistence and traditional activities during the decommissioning and reclamation phase.

Potential interaction

- demobilization of Howse facilities and heavy machinery;
- transportation and traffic;
- final site restoration.

The demobilization of the Howse facilities may result in less disturbances caused by mining activities. The Howse haul road will not be decommissioned, but the waste rock dumps will be revegetated. Site restoration should allow the recovery of some habitat loss, but it may take time for animals to come back due to the overall Project disturbance. Some wildlife species may come back to the area faster than others.

➔ The potential effects associated with the project activities during the decommissioning and reclamation phase is an **increase in accessibility of subsistence and traditional activities**

The nature of the effect is indirect and the effect is adverse.

Once the Decommissioning and Reclamation phase begins, land-users will continue to refrain from harvesting resources in the Project area due to fear of contamination, as well as due to other mining activities in the area (see Section 8.2). The Project area will continue to be negatively perceived by the locals for at least a few years after the Project ends.

PRESERVATION OF AND ACCESS TO KAUTEITNAT

Concerns raised during the public consultations (Chapter 4) were:

- Kauteitnat is a sacred place. There is concern about the proximity of the pit to this site (too close);
- Kauteitnat Mountain is an observation point. Caribou could be spotted from the top. Elders are very attached to Kauteitnat;
- There is a fear that the final objective is to eventually mine the Kauteitnat Mountain;
- Concerns that blasting activities may affect Kauteitnat;
- Kauteitnat has a lot of history, particularly geological history; and
- The mountain is considered as a nice area that should become a park but protection has never been discussed.

Interaction of the Project with the Preservation of and Access to Kauteitnat and Potential Effects

<u>Site Preparation and Construction Phase</u>

Potential interaction

- construction/upgrading of the Howse haul road and bypass road;
- pit development; and
- transportation and traffic.

Site Construction phase activities will cause changes to the access road to Kauteitnat, but should not affect the mountain itself given the distance to the mine pit (500 m from the foot of the mountain). The presence of such activities will certainly alter the landscape around Kauteitnat.

➔ The potential effects associated with the Project activities during the site preparation and construction phase **will be the destruction of the access road to Kauteitnat, and the alteration of the landscape around Kauteitnat.**

➔ In turn, these effects will also affect the **cultural symbol that is Kauteitnat, especially for the Innu**.

The nature of the effect is indirect and the effect is adverse.

<u>Operation Phase</u>

No potential interaction

- solid waste disposal;
- hazardous waste management;
- explosives waste management;
- treatment of sanitary wastewater;
- mineral processing;
- dewatering; and
- operation of waste rock dumps.

Potential interaction

- removal and storage of remaining overburden and topsoil;
- blasting and ore extraction;
- transportation of ore and traffic; and
- ongoing site restoration.

The landscape surrounding Kauteitnat will permanently change with the mining of the open pit, located less than 1 km from the foot of the mountain. However, Kauteitnat as a landmark will remain the same, as the mountain itself will not be affected by the Project (Figure 4-1), but the cultural symbol that is Kauteitnat will be affected. There was no mention during the consultations of spiritual activities or rituals taking place on Kauteitnat. Camping and harvesting activities take place around Kauteitnat, especially towards Rosemary Lake. Few activities take place *on* Kauteitnat, except perhaps for occasional berry or plant harvesting, or occasional hiking.

The potential effects associated with the Project activities during the operation phase for access to Kauteitnat will be the destruction of the access road to Kauteitnat, and the alteration of the landscape around Kauteitnat.

In turn, these effects will also affect the cultural symbol that is Kauteitnat.

The nature of the effect is indirect and the effect is adverse.

Decommissioning and Reclamation Phase

All Project activities have an interaction with Kauteitnat during the decommissioning and reclamation phase.

Potential interaction

- demobilization of Howse facilities and heavy machinery;
- transportation and traffic;
- final site restoration.

The demobilization of the Howse facilities may result in less disturbances caused by mining activities. The road leading to Kauteitnat will not be rehabilitated. Although disturbances from mining activities generated by the Howse Project should cease once the Project is decommissioned, the traces left in the landscape will be permanent. Site restoration, however, should help improve the landscape and regain a natural visual aspect.

➔ The potential effects associated with the Project activities during the decommissioning and reclamation phase for access to Kauteitnat will be the destruction of the access road to Kauteitnat, and the alteration of the landscape around Kauteitnat.

➔ In turn, these effects will also affect the cultural symbol that is Kauteitnat, especially for the Innu.

The nature of the effect is indirect and the effect is adverse.

7.5.2.1.3 Mitigation Measure

SUBSISTENCE AND TRADITIONAL CARIBOU HUNTING

The mitigation measures that will be applied to limit negative effects on caribou are listed and discussed in Section 7.4.3.3. In terms of subsistence and traditional caribou hunting, some measures are particularly relevant and are worth mentioning here.

Standard Mitigation Measures

- EPP includes a Noise Control Plan to prevent excessive noise emissions from site operations and construction activities. This plan identifies measures to control the potential effects of noise released by a variety of sources and activities. For example, heavy equipment will be equipped with properly operating noise abatement systems and all materials handling will be carried out in such a way as to avoid unnecessary generation of noise.

Specific Mitigation Measures

- HML will continue to contribute to a fund as specified in certain IBAs18 for traditional activities. The Aboriginal leadership determines how the funds are allocated and used. First Nation leadership determines how the funds are allocated and used. This fund contributes to alleviating the financial burden for families who count on subsistence harvesting for its economic and nutritive value, in an area where store-bought food is expensive, such as for a fuel allocation for all members.
- HML/TSMC will pursue its financial participation in Caribou Ungava to advance research on caribou and on the effects of mining activities on the George River herd decline, and on other factors that may play a role in this decline or in the change of migratory paths, for example. Within the framework of the program, researchers will involve the concerned Aboriginal communities in its research initiatives by considering their views, their traditional indigenous knowledge in the studies and by involving them in the research activities held on their traditional territories;
- Sightings of caribou will be reported to the HSE Committee. Blasting activities are announced on the radio two days ahead of time. Measures to be taken when there are caribou sightings are explained in Section 7.4.3.3.
- The Proponent recognizes that the GRCH can, one day, return to its original grounds and includes, in its mitigation measures, a commitment to be aware of any caribou seen within a 100 km radius of Howse activities, conduct surveys if collared caribou are found within 20 km of Howse and cease all activities if caribou are known to be within 5 km of the active pit or the processing complex.

SUBSISTENCE AND TRADITIONAL ACTIVITIES (HUNTING, FISHING, TRAPPING AND BERRY/PLANT HARVESTING)

The mitigation measures to be applied to limit negative effects on wildlife and fish resources are discussed in Section 7.4.9.3. In terms of subsistence and traditional hunting, mitigation measures focus on ensuring access to resources, taking into account the costs incurred by families.

Standard Mitigation Measures

- The Timmins-Kivivik bypass road was completed and will allow harvesters to go farther on the land to access resources without experiencing security issues (the road was built in collaboration with Aboriginal groups);

Specific Mitigation Measures

- The mandate of the HSE Committee, which acts as an environmental monitoring committee and collaborates with TSMC to oversee and assess the effectiveness of the relevant mitigation measures (dust control, vegetation, for example), will include the Howse Project once the construction begins (already planned by HML). For instance, in collaboration with the HSE Committee, and in some cases with local authorities, mining activities will be adapted if needed to minimize the effects on traditional activities.
- Continue to contribute to a compensation fund as specified in certain IBAs to assist with costs for harvesters to access other areas for subsistence and traditional activities, in accordance with local land use and inter-family agreements. First Nation leadership determines how the funds are allocated. This fund contributes to alleviating the financial burden for families who count on subsistence harvesting for its economic and nutritive value, in an area where store-bought food is expensive (Section 7.5.3.5) and to maintaining other traditional activities.
- Sightings of wildlife (Wolverine, Caribou or Lynx, etc.) will be reported to the HSE Committee. Furthermore, monthly TSMC Environmental reports are made available to the HSE Committee members on the shared drive.

[18] Local leadership have determined in each of their respective IBAs their needs in regard to land-use. As such, said compensation funds vary according to the IBA. However, in all cases, HML provides the funds but each local leadership is responsible for funds management and allocation.

- Even during the decommissioning and reclamation phase, HML will maintain ongoing communication on activities with the local population through radio programs and bulletins, and via the HSE Committee, including environmental updates and reports.
- With respect to vegetation stripping, any usable wood will be made accessible to the local communities in a secure location near the site.
- Maximize the presence of Aboriginal personnel for all security shifts to facilitate communication in Innu with local lands users. Work with the local communities to hold a Security course for its members, so that there are additional Innu personnel at the security post.

PRESERVATION OF AND ACCESS TO KAUTEITNAT

Standard Measures

Except for the measures that were already taken within the Project design (locating the open pit farther from the foot of Kauteitnat, limiting the height of waste rock piles, and partial in-pit dump, for example), no other mitigation measures can be taken to avoid the changes to the landscape around Kauteitnat, or to preserve the road to Kauteitnat. However, the Timmins-Kivivik bypass road that was recently built should partly solve the issue of maintaining access to Kauteitnat, as an access will be provided on the western side of the mountain (Section 2.5.3). The 500-m buffer zone between the mine site and the foot of Kauteitnat will be strictly respected.

TSMC has already committed through its IBA with communities to not undertake any development activities, including exploration work, on Kauteitnat. As per discussions between TSMC and NML, it is envisaged that the mining claims covering Irony Mountain will be transferred to the local communities by the GNL and designated as a no-mining area.

Specific Measures

Progressive restoration should give the decommissioned mine pit a natural look once it is over, as there will be water at the bottom of the pit, and its surroundings will be revegetated (Chapter 10).

Some ITUM members plan to create a protected area that would include Kauteitnat and its surroundings. HML, through its Canadian JV Partner NML, considers to continue to play a role in facilitating or supporting this process, which would have to be discussed with NL authorities.

7.5.2.1.4 Residual Effects Significance Assessment

SUBSISTENCE AND TRADITIONAL CARIBOU HUNTING

Table 7-106 presents the criteria applicable for subsistence and traditional caribou hunting for the assessment of the residual effect significance.

The mitigation measures presented in Section 7.4.3.3 will reduce the effects on caribou in general, but will likely not change the significance of the residual effects on subsistence and traditional caribou hunting, as the caribou will nonetheless continue to avoid the area for reasons that are beyond the control of the proponent.

Table 7-106 Assessment Criteria Applicable for Subsistence and Traditional Caribou Hunting

TIMING		
Inconsequential	**Moderate**	**Considerable**
Will not have an effect	Will have a moderate effect at times	Will have an effect at all times during all phases of the Project.
GEOGRAPHIC EXTENT		
Site specific	**Local**	**Regional**

Effects are limited to the footprint of the Project.	Effects extend beyond the footprint, but do not extend outside the LSA.	The effect of the Howse Project will affect a large geographic area and a significant portion of the VC within the RSA.
DURATION		
Short	**Medium**	**Long**
During all or part of preparation/construction phase, the start-up period, a single season	Preparation/construction phase and first 24 months of operation phase.	Throughout preparation/construction/operation phases and beyond.
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Full restoration of pre-development situation likely.	Partial restoration of pre-development situation likely.	Little/no restoration of pre-development situation likely.
MAGNITUDE		
Low	**Moderate**	**High**
Affects <5% of the population in the LSA or 5% of the activity in question and few or no people in the RSA.	Affects 5%-15% of the population in the LSA or of the activity in question and a few people in the RSA.	Affects >15% of the population in the LSA or of the activity in question and more than a few people in the RSA.
FREQUENCY		
Once	**Intermittent**	**Continual**
~once per year	Occasional/intermittent	Year-round (continual)

Timing

Subsistence activities and traditional hunting of caribou in the LSA has been declining for the past 10 years, to a point where activities are restricted to a minimum due to the caribou population decline. In this context, the caribou is not available to be hunted in the LSA, it is unlikely that it will be disturbed by the project activities at any time during project activities. Timing is thus considered as inconsequential. (Value of 1).

Geographic Extent

The geographic extent is local since potential disturbance will be restricted to the LSA. (Value of 2).

Duration

The duration of the effect will be short for the site preparation and construction phase (Value of 1), long for the operation phase (Value of 3) and short for decommissioning and reclamation phase (Value of 1).

Reversibility

The effect (negative) will be fully reversible considering that the caribou is expected to return to their pre-Howse population status and distribution and that it is likely that similar subsistence and traditional caribou hunting conditions will be encountered after the project. (Value of 1).

Magnitude

The magnitude of the residual effect will be low for all phases of the project. (Value of 1).

Frequency

The frequency of the effect is considered intermittent for all phases of the project. The land users access the LSA seasonally (during the caribou hunting season if any presence of the animal). (Value of 2)

7.5.2.1.4.1 Significance

Based on the assessment, the residual effect of the Howse Project on subsistence and traditional caribou hunting will be non-significant for all three phases of the Project (values of 8, 10 and 8 for the site preparation and construction, operation and decommissioning and reclamation phase, respectively).

Likelihood

The likelihood of Howse having an effect on caribou hunting is low, considering that the caribou is already absent from the study area at the moment.

SUBSISTENCE AND TRADITIONAL ACTIVITIES (HUNTING, FISHING, TRAPPING AND BERRY/PLANT HARVESTING)

Table 7-107 presents the criteria applicable for subsistence and traditional activities for the assessment of the residual effect significance.

Table 7-107 Assessment Criteria Applicable for Subsistence and Traditional Activities (hunting, fishing, trapping and berry/plant harvesting)

TIMING		
Inconsequential	**Moderate**	**Considerable**
Will not have an effect	Will have a moderate effect at times	Will have an effect at all times during all phases of the Project.
SPATIAL EXTENT		
Site specific	**Local**	**Regional**
Effects are limited to the footprint of the Project.	Effects extend beyond the footprint, but do not extend outside the LSA.	The effect of the Howse Project will affect a large geographic area and a significant portion of the VC within the RSA.
DURATION		
Short	**Medium**	**Long**
During all or part of preparation/construction phase, the start-up period, a single season	Preparation/construction phase and first 24 months of operation phase.	Throughout the site preparation/construction/operation phases and beyond.
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Full restoration of pre-development situation likely.	Partial restoration of pre-development situation likely.	Little/no restoration of pre-development situation likely.
MAGNITUDE		
Low	**Moderate**	**High**
Affects <5% of the population in the LSA or 5% of the activity in question and few or no people in the RSA.	Affects 5%-15% of the population in the LSA or of the activity in question and a few people in the RSA.	Affects >15% of the population in the LSA or of the activity in question and more than a few people in the RSA.
FREQUENCY		
Once	**Intermittent**	**Continual**
~once per year	Occasional/intermittent	Year-round (continual)

Timing

The extent of timing as a factor will be dependent on the resource being sought. For example, the timing of blasting activities during Goose Hunting Season in May will be a considerable factor, because harvesters frequent areas at the NW edge of Irony Mountain during this time, while for fishing, harvesters tend to frequent areas farther from the LSA. So timing is considered moderate (Value of 2).

Spatial Extent

The spatial extent is local since potential disturbance will be restricted to the LSA. (Value of 2).

Duration

The duration of the effect will be short for site preparation and construction phase (Value of 1), long for the operation phase (Value of 3) and short for the decommissioning and reclamation phase (Value of 1).

Reversibility

The effect will be fully reversible considering that a partial restoration of pre-development situation is likely and that disturbances will cease once the Project is over. (Value of 1).

Magnitude

The magnitude of the residual effect will be low for all phases of the project, as access to the land remains available and as most activities are carried out in an area of the LSA where the overall magnitude of the effects will be low. (Value of 1)

Frequency

The land users usually use the LSA intermittently and seasonally (for example during hunting seasons or on the week-end for recreational purpose) and for a short periods of time (round trips in a single day). The frequency of the effect has nevertheless been considered continual as activities could be carried on a continuous basis in the vicinity of the Project, and as various resources are present in the vicinity of the Project throughout the year. (Value of 3).

Effect Significance

Based on the assessment, the residual effect significance will be **low** for site preparation and construction phase and the decommissioning and reclamation phase (Value of 10). For the operation phase, the effect will be **moderate** (Value of 12).

Likelihood

The likelihood of Howse having an effect on traditional activities is low, considering that a few families use the Howse Project vicinity, with the exception of Rosemary Lake area, where effects will be negligible. Land-users who pass through the Howse Project area to reach other locations will be able to use the bypass road.

PRESERVATION OF AND ACCESS TO KAUTEITNAT

Mitigation measures, for the most part, have been embedded within the Project design, and the final restoration of the site will also help in visually giving a natural look to the decommissioned site (magnitude will decrease from moderate to low). No other measures can alleviate alterations to the landscape in this particular case. In terms of access to Kauteitnat, the Timmins-Kivivik bypass road facilitates access and another option is being assessed (Section 2.5.3).

Table 7-108 presents the criteria applicable for subsistence and traditional caribou hunting for the assessment of the residual effect significance.

Table 7-108 Assessment Criteria Applicable for Preservation of and Access to Kauteitnat

TIMING		
Inconsequential	**Moderate**	**Considerable**
Will not have an effect	Will have a moderate effect at times	Will have an effect at all times during all phases of the Project.
SPATIAL EXTENT		
Site specific	**Local**	**Regional**
Effects are limited to the footprint of the project.	Effects extend beyond the footprint, but do not extend outside the LSA.	The effect of the Howse Project will affect a large geographic area and a significant portion of the VC within the RSA.
DURATION		
Short	**Medium**	**Long**
During all or part of preparation/construction phase, the start-up period, a single season	Preparation/construction phase and first 24 months of operation phase.	Throughout preparation/construction/operation phases and beyond.
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Full restoration of pre-development situation likely.	Partial restoration of pre-development situation likely.	Little/no restoration of pre-development situation likely.
MAGNITUDE		
Low	**Moderate**	**High**
Affects <5% of the population in the LSA or 5% of the activity in question and few or no people in the RSA.	Affects 5%-15% of the population in the LSA or of the activity in question and a few people in the RSA.	Affects >15% of the population in the LSA or of the activity in question and more than a few people in the RSA.
FREQUENCY		
Once	**Intermittent**	**Continual**
~once per year	Occasional/intermittent	Year-round (continual)

Timing

Kauteitnat will not be directly affected by the Project but the landscape in its vicinity (N-E of Kauteitnat) will be partly disturbed by the Project in the long-term. Timing will not be a factor (Value of 1).

Spatial Extent

The spatial extent will be site-specific for the three phases of the project because the effect will occur within or near the Project footprint. (Value of 1).

Duration

The duration is short for the site preparation and construction (Value of 1). Starting from the beginning of the operational phase, the duration is considered long and will remain as such, given that the alterations to landscape will exceed the length of the project, beyond the decommissioning and reclamation phase (Value of 3).

Reversibility

The effect will be partially reversible as Kauteitnat itself will be affected but not compromised. The main effect on the landscape will gradually appear during the operation of the project. Although the site will be restored, it is likely that long-term effects will remain visible in the landscape near and from

Kauteitnat. In terms of access to Kauteitnat, the Timmins-Kivivik bypass road facilitates access and another option is being assessed (Section 2.5.3) (Value of 2).

Magnitude

The residual magnitude will remain moderate, given that a) the integrity of Kauteitnat is affected but not compromised and b) damage to the landscape and possibility to the perception of the culturally valued site will persist beyond the end of the decommissioning and reclamation period. (Value of 2).

Frequency

The frequency is continual because the effect will occur year-round. (Value of 3).

Effect Significance

The residual effect significance will be **low** for the site preparation and construction phase (Value of 10) and **moderate** for both the operation and decommissioning phases (Value of 12) because of the importance of Kauteitnat for the Aboriginal population and given that the alterations to landscape will exceed the length of the decommissioning and reclamation phase.

Likelihood

The likelihood of Howse having an effect on the preservation of and access to Kauteitnat will be moderate given that the mountain itself will be preserved, but that effects on landscape will nonetheless be visible. Access to Kauteitnat will be maintained through the by-pass road and will also continue to be accessible via the main mining road on which a safety escort service will be provided.

Following this effect assessment, three components were considered in the cumulative effect assessment:

- Socioeconomic conditions, to reflect the importance of employment and contracting opportunities, especially for the local Aboriginal groups;
- Subsistence and Traditional Activities: taking into consideration the significance of land-use activities for the local Aboriginal populations, as well as access to land, and of Kauteitnat;
- Human health: given the concerns expressed by the local population with regards to the potential effects of mining projects on their health and on wildlife resources.

7.5.2.2 Human Health

A human health risk assessment for the effects of the Howse Project on the local land users is presented in this section, in addition to Volume 2 Supporting Study D in compliance with federal guidelines. The air quality data discussed in this chapter derives from the data presented in the federal report (Volume 2 Suppporting Study E).

Under section 5 of CEAA (2012), the changes to the environment which are expected to effect changes to health conditions are to be assessed as VCs. In addition, through Aboriginal Consultation, physical health of local residents was identified as a VC within the context of potential changes to environmental chemistry that might arise from the Project. Specifically, perceived effects of dust generated by mining projects on resource quality, the environment, and health were concerns raised by local stakeholders of MLJ, NNK and Schefferville. Given the importance of these concerns and the potential effects of environmental disturbances on the health of the local population, human health is considered as a VC.

Although the Howse mine site is located approximately 25 km from the nearest populations of Schefferville (24.1 km) and MLJ (24.6 km), and Kawawachikamach (24.5 km), the consultation and the land-use study demonstrated that some harvesters travel through this area, and that some camps, lakes and rivers in the vicinity of the Howse Project are used (Volume 2 Supporting Study D). Accordingly, the health of these harvesters could potentially be affected through breathing air, drinking water or by consuming country food.

7.5.2.2.1 Component Description

LSA, RSA and Temporal Boundaries

The potential health effects (risks) of the project were assessed within the vicinity of the Howse Project Property which represents areas with operable exposure pathway and the receptors. The following study areas have been defined for the HHRA and are defined spatially in Figure 7-45, which reflects the LSA/RSA of the air dispersion component of the EA (Section 7.3.2). The nature of air dispersion affords the largest potential footprint of interest and is highly relevant to this VC. The RSA is considered to be the Howells River watershed and the Schefferville region, including:

- in Labrador, Labrador West (Labrador City and Wabush), as well as the IN; and
- in Québec, the Ville de Sept-Îles, and the Innu of Uashat and Mani-Utenam (ITUM), who although located outside of the RSA have trap lines within the Project area and have a presence based on land-use and harvesting activities.

Temporal boundaries for the human health VC were established in the following manner:

- temporal window of 16 years for the combined Construction (1yr) and Operation (15yrs) phases during which project-related air emission would occur and conceivably influence human health during the event of active exposure; and
- temporal window of human lifetime was considered for potential health effects related to cancer.

Existing Literature

Supporting literature and input data used for the HHRA were acquired and/or derived from technical support studies of other biophysical disciplines within the present document, and by applying the data within the context and framework of the Health Canada (2010) guidance on Detailed Quantitative Health Risk Assessment (DQHRA). Air quality data were obtained from the Air Quality component of the present document (7.3.2 and 8.3) which modelled future emissions and air dispersion at selected receptors in terms of pollutant concentrations in µg/m^3, and particulate deposition to ground (mg/m^2/year).

To establish background air concentrations, which for this study would represent air concentrations prior to the start of DSO3/DSO4, a review of existing monitoring data and guidance information documents provided by provinces and applicable to the region was conducted (and reported) within the air quality component of the present document. Background (baseline) air concentrations selected for the Howse EIS were also based on the conclusions presented in the air dispersion component. Table 7-109 lists various documents from which information and data were obtained relevant to the LSA and RSA in the development of the HHRA.

Table 7-109 Supporting Documents Used to Inform HHRA

REPORT	DATA PROVIDED
Schefferville Iron Ore EIS (Jacques Whitford 2009)	RSA soil and surface water
Air Dispersion Modelling Report (Volume 2 Supporting Study E)	LSA Air Quality
Hydrology and MODFLOW Modelling Howse Property (GEOFOR 2015)	LSA Groundwater quality
Aquatic Survey – Howse Pit Study Area Technical Report (Volume 2 Supporting Study M)	LSA Water quality and Sediment quality
Hydrological Campaign DSO3 and DSO4 (Groupe Hémisphères 2011)	LSA Water quality

REPORT	DATA PROVIDED
Fish and Fish Habitat Investigation for the Direct-Shipping Ore Project (AMEC 2009)	LSA Water quality
Groupe Hemisphères Field Report – 2013 Baseline Aquatic Fauna Characterization: Elross Lake Area Iron Ore Mine (ELAIOM) Environmental Effects Monitoring (EEM)	LSA Water quality
KAMI Concentrate Storage and Load-out Facility, Québec (Stantec 2012)	RSA water quality
Air Quality Monitoring Baseline Study (Stantec 2012)	RSA air quality
Howse Property Country Food Survey (Volume 2 Supporting Study D-2)	Socioeconomic

Ingestion rates of country foods were estimated using literature-derived dietary patterns as well as from a dietary survey conducted for the LSA (Volume 2 Supporting Study D). Literature-derived ingestion patterns indicate that Caribou represents a significant portion of the total ingestion of country foods. It was therefore necessary to quantify the associated dose resulting from caribou ingestion as part of the multimedia risk assessment. A literature review was conducted to establish baseline tissue quality and its contribution to baseline dietary exposure to substances of interest that the aboriginal community may consume. Detailed discussion of this topic is provided in the HHRA technical support document (Volume 2 Supporting Study D).

Current Study

Volume 2 Supporting Study D provides additional insights from the literature and includes a Country Food Survey (Volume 2 Supporting Study D-2). In brief, quantitative risk estimation was conducted for scenarios where receptors, operable exposure pathways and substantive changes in environmental quality were considered plausible. A detailed description of the risk exposure scenario is available in the HHRA technical support document. The exposure scenario addressed related to the following key questions:

- HH1: What effect will project releases have on water and subsequently human health?
- HH2: What effect will project releases have on air quality and subsequently human health?
- HH3: What effect will project releases have on soil quality and subsequently human health?
- HH4: What effect will project releases have on food quality and subsequently human health?
- HH5: What will be the collective effect of changes to water, air, soil and food on human health?

A broad screening was used to identify substances of interest (SOI, also known as *potential contaminants of concern* or PCOCs) to be evaluated in the baseline and future scenarios (see HHRA technical support document; Volume 2 Supporting Study D). The screening included a wide array of metals and, at the request of CEAA, organic compounds from air emissions were also added. The screening framework evaluated substances against available federal and provincial guidelines for metals and hydrocarbons, site-specific background concentrations, or additional regulatory sources. In the final analysis the key substances of interest (potential contaminants of concern) were:

- Arsenic
- Barium
- Beryllium
- Iron
- Lead
- Manganese
- Mercury
- Molybdenum
- Selenium

- Chromium

Receptor and Exposure Pathways included aboriginal adult and young children (toddlers) that could be present in the LSA/RSA during prolonged traditional land use excursions. The following exposure pathways were considered relevant:

- Ingestion
  - Contaminated soil that is incidentally ingested (as soil or non-respirable dust) during outdoor activities such as camping, hunting etc. will result in an ingestion exposure.
  - Contaminants in drinking water will be retained by the body and result in an ingestion dose.
  - Contaminated produce/vegetation that is ingested will result in an ingestion dose.
  - Ingestion of contaminated fish or game will result in an ingestion dose.
- Inhalation
  - Airborne contaminants (either as vapour or respirable particulates as PM10) at the receptors location will be inhaled and retained within the body resulting in an inhalation exposure.
  - Frequency of exceedance of PM10 criteria at the off property maximum locations (assuming 1 day per week of blasting) results in PM10 concentrations in exceedance of regulatory guidelines <1% of the time.
- Dermal Absorption
  - Dermal contact with contaminated soil will adhere to skin surfaces and result in a dermal exposure.

Conceptual Exposure Model (CEM): A qualitative CEM provides the context for the quantitative risk assessment. The CEM (Figure 7-45) is a conceptual representation of the multimedia exposure pathways, and illustrates all contaminant sources, release mechanisms, transport pathways, and routes of exposure for the human health assessment at the mine site. The subsequent quantitative risk assessment and numerical risk estimates are based on the basic structure of this CEM.

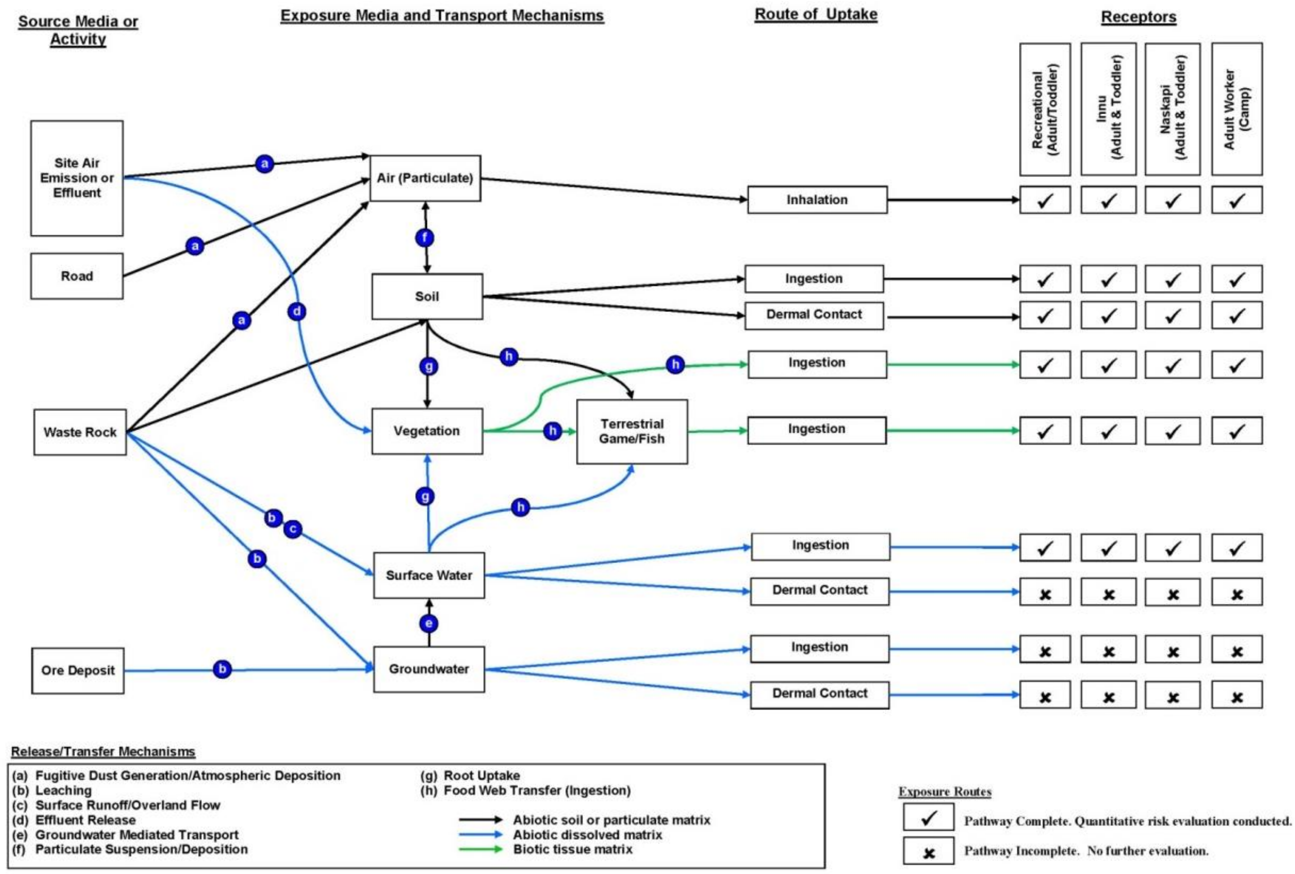


Figure 7-45 Conceptual Exposure Model for Human Receptors at the Howse Mine Site

Aboriginal Traditional Knowledge

ATK was gleaned from Aboriginal consultations to understand locations and timing for traditional activities such as fishing and hunting camps. This information was noted and compared to results of air quality modelling to associate exposure point concentrations during the estimation of potential exposure and health risk.

Similarly, knowledge was gleaned from a Country Food Survey and interviews to better understand the scope and frequency of traditional food types derived from hunting. Typically the final risk assessment assumptions employed for risk estimation were more conservative than the data inferred from the Country Food Survey; this was applied to allow for the possibility of individuals that may consume certain foods such as wild game, berries or medicinal plants at a higher frequency than recorded by the survey. This information is reported in Volume 2 Suppporting Study D.

Data Gaps

The HHRA component relied centrally on the air quality dispersion modelling, field sampling data (soil, berries, water, and fish tissue) and literature derived data. Key data gaps relate primarily to the air quality modelling and select small mammal baseline tissue quality which had to be predicted in the present assessment.

For air quality, it is anticipated that during normal operation, blasting at the Howse Property will occur approximately once per week during summer and infrequently during winter. Blasting will also occur at the Fleming 7N pit, and since this pit is part of the DSO3 area and may have parallel operations with Howse, blasting events at both pits are included in the air dispersion modelling study. Blasting events are short in duration and infrequent. The air dispersion software input requirements limits the representativeness of these blasting events, which leads to an overestimation of the resulting short-term impacts on air quality. One way to minimize this inaccuracy would be to obtain more precise factors to depict emissions from explosive detonation during the blasts. Such factors were not available at the time of preparing the air quality study and the HHRA.

The quantitative dose estimates based on the conceptual exposure model presented above were calculated using standard Health Canada exposure models (see HHRA support document) and a set of exposure scenarios and broad assumptions (Table 7-110) that describe the strategy for use of statistical metrics where data were available, and assumptions or derivations where data gaps existed.

Table 7-110 Overarching exposure assumptions for Baseline, Project and Cumulative impact scenarios

PARAMETER	BASELINE SCENARIO	PROJECT SCENARIO	CUMULATIVE SCENARIO
Abiotic Site Media			
Soil	Site specific 95% Upper Confidence Limit of the Mean (UCLM95) soil samples collected within the LSA during 2015.	Calculated as sum of baseline soil concentration and Project Incremental Soil Concentration (ISC) as a result of particulate deposition.	Calculated as sum of baseline soil concentration and Cumulative Incremental Soil Concentration (ISC) as a result of particulate deposition.
Surface Water	Site specific maximum measured concentration from Pinette or Triangle Lake.	No change from baseline	No change from baseline
Particulate	Calculated assuming baseline PM_{10} concentration of 4 $\mu g/m^3$ and chemical composition of baseline soils.	Calculated as 10.1 ($\mu g/m^3$) using 90th percentile predicted maximum PM_{10} concentrations for the project activities. Chemical composition of particulates assumed to be equal to the 95%UCLM of the ore dataset.	Calculated as 31.5 ($\mu g/m^3$) using 90th percentile predicted maximum PM_{10} concentrations for the cumulative activities. Chemical composition of particulates assumed to be equal to the 95%UCLM of the rock dataset. Note: In addition inhalation risks were assessed following probabilistic risk assessment principals. Details of the probabilistic risk assessment are presented in Section 3.3.4.
Biological Tissues			
Berries	The 90th percentile for unwashed partridge berry samples collected from the LSA. Barium, Iron and Manganese were the only elements that exceeded analytical detection limits. Elements not detected in berry samples were modelled from soil concentrations using literature derived transfer factors.	Modeled based on predicted soil chemistry and literature derived soil to berry transfer	Modeled based on predicted soil chemistry and literature derived soil to berry transfer factors

PARAMETER	BASELINE SCENARIO	PROJECT SCENARIO	CUMULATIVE SCENARIO
Labrador Tea	The 90th percentile for unwashed Labrador tea samples collected from the LSA. Barium, Iron and Manganese were the only elements that exceeded analytical detection limits. Elements not detected in berry samples were modelled from soil concentrations using literature derived transfer factors,	Modeled based on predicted soil chemistry and literature derived soil to vegetation transfer	Modeled based on predicted soil chemistry and literature derived soil to vegetation transfer factors
Fish	Maximum measured concentrations in fish collected from Triangle Lake or Pinette Lake. Beryllium, chromium and molybdenum modelled from surface water using literature derived transfer factors.	No change from baseline	No change from baseline
Game Bird	Site specific maximum measured concentrations from game bird (Spruce Grouse) collected from the LSA.	Modeled based on receptor characteristics, predicted chemistry and literature derived transfer factors.	Modeled based on receptor characteristics, predicted chemistry and literature derived transfer factors.
Human Health Risk	Literature derived maximum concentrations measured in muscle tissue.	No change from baseline	No change from baseline
Hare	Modeled based on receptor characteristics, abiotic chemistry and literature derived transfer factors.	Modeled based on receptor characteristics, predicted chemistry and literature derived transfer factors.	Modeled based on receptor characteristics, predicted chemistry and literature derived transfer factors.

7.5.2.2.2 Effects Assessment

Literature review and Current Studies Data Used to Assess the Potential Effect

When concentrations of some pollutants in various media collectively contribute a total dose that exceeds a toxicological safe dose, a human health *risk* is recognized. Whether this predicted risk translates to a future effect on the VC *human health* is uncertain, however it is prudent to manage the risk to avoid a health effect. To this end, a HHRA considers a multitude of possible health effects which are broadly grouped as either *non-carcinogenic* or *carcinogenic* effects.

For non-carcinogenic substances, a hazard quotient (HQ) is the measurement endpoint and is calculated as the ratio of the estimated daily exposure (dose) to the safe dose for each contaminant. These contaminants are threshold acting stressors, in that no health risks are predicted provided a threshold of safe exposure is not exceeded. The hazard quotient is a numerical metric of how a receptor's daily dose compares to what is toxicologically considered to be the safe dose, over a prolonged (chronic) period.

For substances with a non-threshold dose response (i.e., carcinogens) the risk estimate is a calculation of the Incremental Lifetime Cancer Risk (ILCR). ILCR is the predicted risk of an individual in a population of a given size developing cancer over a lifetime. The ILCR is expressed as the one additional person per "n" people that would develop cancer, where the magnitude of n reflects the risks (i.e., probability) to that population. For example, in Canada the lifetime probability of developing cancer is ~0.4 (40%), or 40 out of 100 people. An increase in the incremental lifetime cancer risk of 1E-5, would result in a probability of 0.40001, a 0.0025% increase relative to background cancer incidence. Due to the estimation nature of the prediction of ILCR, Health Canada recommends that ILCRs only be calculated for adult exposures.

To provide interpretive insight on the risk (effect) levels and conservative assumptions employed to offset various sources of uncertainty normally encountered in health risk assessment, the following categories were used to describe the risk magnitudes for non-carcinogenic compounds:

- Negligible: $HQ<1.0$ (consistent with Health Canada (2010a,b) guidance for a comprehensive multi-media exposure and has become accepted common practice)
- Low and likely to be negligible: $1.0>HQ\leq10$ (acknowledges in this case that considerable conservatism is employed by the risk assessor and that over estimation of risk is likely)
- Potentially elevated: $HQ>10$ (acknowledges in this case that considerable conservatism is employed by the risk assessor and that over estimation of risk is likely)

In cases where an estimated HQ may exceed any of the above categories by a change of <10% from the Baseline case, the Baseline is noted as the risk driver, and the incremental contribution from the Project is considered separately for interpretation of significance.

For carcinogenic compounds, the magnitude of the cancer risk was rated as follows with similar interpretation as note above for hazard quotients:

- Negligible: $ILCR \leq 1x10^{-5}$
- Low and likely to be negligible: $1x10^{-5} < ILCR \leq 1x10^{-4}$
- Potentially elevated: $ILCR>1x10^{-4}$

The potential effects of the Project on human health were assessed by comparing predicted contaminant exposure rates to Toxicity Reference Values (TRVs); TRVs were used as benchmarks of safe exposure levels and are prescribed by a variety of national and international agencies for the purpose of characterizing risks associated with exposure to environmental contaminants. Toxicity reference values used in the HHRA are tabulated in Volume 2 Supporting Study D and provide an understanding of the potency and type of health effect for which the TRV provide a health safety margin. Sources for TRVs in order of preference were:

- Health Canada, Toxicological Reference Values and Chemical-Specific Factors, Version 2.0
- US EPA Integrated Risk Information System

The reader should also refer to Table 7-109 "HHRA Supporting Documents Used to Inform HHRA".

Interaction of the Project with Human Health Risk and Potential Effects

<u>Site Construction Phase</u>

During the site Construction phase, virtually all project activities will have potential interaction with the biophysical environment including water and air quality.

Potential activities and that may interact with the environment potentially affecting human health include

- upgrading/construction of the Howse haul road and upgrade of the bypass road;
- pit development;
- installation of the ore processing plant (Howse Mini-Plant) in close proximity to the rail loop;
- transportation and traffic; and
- heavy machinery use and light vehicle traffic

➔ The general effect to physical environment associated with the above potential interactions is a potential decrease in (i) water quality of select receiving water bodies and (ii) air quality and associated particulate deposition to soil, which might affect human health.

- The effects to surface water quality and consequence effect to human health at the construction phase are considered negligible because settling pond design effluent criteria are intended to meet regulatory discharge standards.
    - The WMP (Volume 1 Appendix IV) establishes that settling pond effluent will comply with all relevant and applicable quality standards. Water quality from existing local settling ponds (Timmins operation) and effluent support this position. Although rare events of minor settling pond discharge with elevated TSS have been documented in existing settling ponds (Volume 1 Appendix IV), the magnitude and occurrence are not anticipated to change the quality of the aquatic receiving environment
- The effects to air quality and potential to affect human health during the Construction phase were not assessed directly because air quality was modelled only for the operation phase. However, the types of air emissions and associated air contaminants that will occur during the Construction phase will be similar to those during the Operation phase. During the Construction phase, air emissions from diesel powered engines, dust emissions due to vehicle movements and blasting will occur, but rates of air emissions during the construction phase will be less than those of operation phase, which will be continuous and of a higher intensity. One important reason why the nature of the air contaminants remains the same during the three phases is the fact all power used at the site is generated by diesel equipment; the site is not connected to the power grid. Consequently, the air quality impact study was conducted for the Operation phase only, and effects to air quality at the construction phase are inferred to be less than that assessed for the operation phase.
- ***The effect of the Construction phase to human health is therefore considered to be negligible.***

<u>Operation Phase</u>

During the Operation phase, various activities will have potential interaction with the biophysical environment which might contribute human health risks.

Activities unlikely to cause interactions with the biophysical environment and human health include the following:

- hazardous waste disposal;
- explosives waste management;
- treatment of sanitary wastewater; and
- treatment of waste rock run-off water in settling ponds.

Potential interactions influencing the environment and potentially affecting human health include:

- removal and storage of remaining overburden and topsoil;
- blasting and ore-extraction;
- mineral processing;
- operation of waste rock dumps;
- dewatering;
- transportation of ore and traffic;
- solid waste disposal; and
- ongoing site restoration.

The effects associated with the above potential interactions is a potential decrease in air quality and a possible negative effect towards human health. For continuity with the conceptual exposure model, the project interaction was associated with the key questions of the HHRA and the exposure pathways within the CEM.

1. Activities potentially affecting Air Quality (considered operable and assessed in the HHRA):
   - emissions from power generators and truck fleet
   - fugitive dust emissions from blasting, crushing and hauling
2. Activities potentially affecting Soil Quality (considered operable and assessed in the HHRA):
   - accumulation of ore-based chemical constituents from particulate air deposition
3. Activities potentially affecting Traditional Food Quality (considered operable and assessed in the HHRA):
   - accumulation of ore-based chemical constituents in vegetation (e.g., berries, plants) from soil after prolonged particulate air deposition
   - accumulation of ore-based chemical constituents in small local game (e.g., game birds, hare) from soil after prolonged particulate air deposition
4. Activities potentially affecting Surface Water and Fish Tissue Quality (considered operable but not assessed in the HHRA due to negligible alteration of aquatic environment):
   - The water management plan (Volume 1 Appendix IV) establishes that settling pond effluent will comply with all relevant and applicable quality standards. Water quality from existing local settling ponds (Timmins operation) and effluent support this position. Although rare events of minor settling pond discharge with elevated TSS have been documented in existing settling ponds (Volume 1 Appendix IV), the magnitude and occurrence are not anticipated to change the quality of the aquatic receiving environment

➔ The general effect of the operations to physical environment associated with the above potential interactions is a potential decrease in air quality and associated particulate deposition to soil, which might affect human health. Potential effects from remaining multi-media exposure pathways were assessed for aboriginal adults or toddlers present at the discrete receptor locations modelled in the air dispersion technical support document. The estimated effects to human health are:

  ➔ The predicted non-carcinogenic effects to adults and toddlers are provided below in Table 7-111 and Table 7-112 as hazard quotients (HQs). *The low magnitude of the numerical risk estimates (effects to human health) and the previously defined risk categories indicate the incremental operational risks to human health are negligible.*

  ➔ The predicted carcinogenic effects to adults (not tabulated but available from the HHRA technical support document) *and the previously defined risk categories indicate the incremental lifetime cancer risk (ILCR) from operational interactions to human health are negligible*.

Table 7-111 Predicted incremental hazard quotients for Adult receptors for the Project scenario assessment

	POTENTIAL CONTAMINANT OF CONCERN	ROUTE OF EXPOSURE					TOTAL
		Soil Ingestion	Particulate Inhalation	Soil Dermal Contact	Surface Water Ingestion	Country Food Ingestion	
PROJECT INCREMENT	Arsenic	1.0E-05	6.5E-05	2.7E-06	0.0E+00	3.3E-03	3.4E-03
	Barium	1.2E-08	3.2E-07	1.4E-07	0.0E+00	0.0E+00	4.8E-07
	Beryllium	6.0E-11	6.1E-08	7.3E-08	0.0E+00	7.3E-08	2.1E-07
	Chromium	1.2E-07	3.1E-05	7.8E-06	0.0E+00	1.3E-04	1.6E-04
	Iron	5.1E-05	3.9E-03	4.4E-05	0.0E+00	0.0E+00	4.0E-03

	POTENTIAL CONTAMINANT OF CONCERN	ROUTE OF EXPOSURE					TOTAL
		Soil Ingestion	Particulate Inhalation	Soil Dermal Contact	Surface Water Ingestion	Country Food Ingestion	
	Lead	4.8E-06	2.3E-05	4.1E-05	0.0E+00	1.7E-04	2.4E-04
	Manganese	2.8E-08	2.8E-06	6.0E-06	0.0E+00	0.0E+00	8.8E-06
	Mercury	1.5E-08	7.2E-05	1.3E-07	0.0E+00	8.2E-06	8.0E-05
	Molybdenum	9.9E-12	5.5E-11	8.5E-13	0.0E+00	4.4E-09	4.4E-09
	Selenium	9.1E-12	2.7E-11	7.8E-13	0.0E+00	3.4E-10	3.7E-10

Table 7-112 Predicted incremental hazard quotients for Toddler receptors for the Project scenario assessment

	POTENTIAL CONTAMINANT OF CONCERN	ROUTE OF EXPOSURE					TOTAL
		Soil Ingestion	Particulate Inhalation	Soil Dermal Contact	Surface Water Ingestion	Country Food Ingestion	
PROJECT INCREMENT	Arsenic	1.8E-04	2.8E-04	4.6E-06	0.0E+00	7.5E-03	8.0E-03
	Barium	2.0E-07	1.4E-06	2.4E-07	0.0E+00	0.0E+00	1.8E-06
	Beryllium	1.0E-09	2.6E-07	1.3E-07	0.0E+00	1.5E-07	5.4E-07
	Chromium	2.0E-06	1.3E-04	1.3E-05	0.0E+00	3.6E-04	5.1E-04
	Iron	8.8E-04	1.7E-02	7.6E-05	0.0E+00	0.0E+00	1.8E-02
	Lead	8.3E-05	9.8E-05	7.1E-05	0.0E+00	4.1E-04	6.7E-04
	Manganese	5.5E-07	1.4E-05	1.2E-05	0.0E+00	0.0E+00	2.6E-05
	Mercury	2.6E-07	3.1E-04	2.2E-07	0.0E+00	2.0E-05	3.3E-04
	Molybdenum	2.1E-10	2.9E-10	1.8E-12	0.0E+00	1.9E-08	1.9E-08
	Selenium	1.4E-10	1.1E-10	1.2E-12	0.0E+00	8.8E-10	1.1E-09

Decommissioning and Reclamation Phase

During the Decommissioning and Reclamation phase, all project activities will have some potential interaction with air quality, and therefore potential interaction with human exposure.

Potential interaction includes:

- demobilization of Howse facilities and heavy machinery;
- transportation and traffic; and
- final site restoration.

The effect associated with the above potential interactions is a time limited potential decrease in air quality which may affect human health.

- The general effect to physical environment associated with the above potential interactions is a potential decrease in air quality and associated particulate deposition to soil, which might affect human health.
- The effects to surface water quality and consequence effect to human health at the decommissioning phase are considered *negligible* because settling pond management and decommissioning are intended to meet regulatory discharge standards.
- The effects to air quality and consequent potential to affect human health at the decommissioning phase were not assessed directly because air quality was modelled only for the operation phase. However, the types of air emissions and associated air contaminants that will occur during the site decommissioning will be fewer, less intense and of shorter duration than those of the operation phase.
- Final site restoration will further improve fugitive dust emissions and air quality (revegetation of waste dumps and overburden stockpiles) thus reducing dust exposure via inhalation.
- *The effect (impact) of the decommissioning phase to human health is therefore inferred from that described in the previous section for the operation phase, and is considered to be negligible.*

7.5.2.2.3 Mitigation Measures

Standard Mitigation Measures

The following standard mitigation measures will be applied as previously cited in the Air Quality Section (7.3.2.3); these are designed to optimize air quality and are most relevant to mitigating human health. These are reproduced below for convenience in Table 7-113.

Table 7-113 Standard Mitigation Measures for Human Health Risk

CODE	MEASURE	MITIGATION EFFECT
Tree removal and timber management (TM)		
TM10	Ensure that cleared areas that are left bare and exposed to the elements are kept to a strict minimum.	Minimizing bare areas will reduce potential for airborne dust generation by wind erosion during dry periods
Erosion and Sedimentation Control (ES)		
ES15	Avoid storing excavated material on steep slopes and ensure they are properly compacted. To ensure better compaction of fill more than 60 cm thick, it is preferable to deposit several thin layers rather than a single layer. In zones with no transversal slope, the height and depth of the fill must be limited to three metres.	Airborne dust from wind erosion of excavated material piles will be transported on shorter distances if their height is limited
Waste Management (WM)		
WM2	Emphasize, in the following order, reduction at source re-use, recycling and conversion of waste. Replace hazardous products with less harmful ones if possible. The quantity of waste can be reduced at source by using up products completely, buying in bulk and accurately estimating required amounts.	Waste reduction will minimize potential air emissions due to landfilling of organic wastes and transport to the landfill site
WM7	Comply with applicable regulations that prohibit the burning of waste.	
Drilling and Blasting (DB)		

CODE	MEASURE	MITIGATION EFFECT
DB3	Only properly qualified and trained personnel may handle and detonate explosives as per the manufacturer's instructions and applicable laws and regulations.	Best practices used for drilling and blasting will minimize short-term air emissions associated with these activities. Combine these standard measures to the specific measure for management of NOx from Blasts.
DB4	The manufacturer's instructions must be followed to ensure that blasting procedures are safe both for humans and the environment.	
DB21	Take the necessary precautions to control dust emissions from drilling.	
DB22	Fill borehole necks with clean crushed rock to eliminate dust and gas emissions during blasting.	
Construction Equipment (CE)		
CE4	Construction equipment must be delivered to the site in good working order, without leaks and equipped with all emissions filters required to comply with emissions regulations and reduce noise disturbance. The equipment must be regularly inspected to detect any leaks or mechanical defects that could lead to fuel, lubricant or hazardous material spills.	Well maintained engines will keep air emissions in-line with regulations
CE8	Install appropriate road signs and follow speed limits in order to minimize accidents and disturbance to the environment.	Road dust emissions are minimized at lower speed.
CE14	Use low sulphur content fuels.	There is a direct relationship between SO_2 emissions and fuel sulfur content. Low fuel sulfur content, means low SO_2 emissions. Fuel sulfur content is limited to 15 ppm, as per Canadian regulations
CE15	The dust-control liquid used must comply with GNL regulations.	Application of a dust control agent will reduce road dust emissions
Mining Operations (M)		
M3	Reports required by governments must be submitted by the stipulated deadlines.	n/a
Management of Ore, Rock Piles, Waste Rock, Tailings and Overburden (MO)		
MO1	Take the necessary steps to prevent wind erosion of stored tailings and avoid slippage around the mine tailing storage sites.	Reduce dust emissions by minimizing tailings disturbances Minimizing tailings volumes reduces dust emissions caused by erosion
MO4	Prepare scenarios for using tailings, particularly waste rock. For example, tailings could be used to build roads and railways.	
MO5	The physico-chemical parameters of the ore and tailings must be characterized.	
MO6	Control dust emissions from tailing storage and handling.	
Air Quality Control (AQ)		
AQ1	Dust extractors with filter bags will be used to control dust emissions at the Howse Mini-Plant dryers.	Well maintained fabric filter dust emission control reduces dust emissions by >95%
AQ2	Dust recovered from the dust extractor must be disposed of in a manner that prevents dust emissions.	Good practices in dust handling minimizes punctual releases in the environment
AQ3	Use a water-spraying system at conveyor transfer and drop points.	Water spraying is efficient in reducing dust releases

CODE	MEASURE	MITIGATION EFFECT
AQ4	Mix the ore with water in the drum scrubber.	Water mixing is efficient in controlling dust from being released at the source
AQ5	A dust extractor will be used to limit dust emissions from drills.	The dust extractor limits the area in which wind gusts could blow dust away from the drill
AQ6	Roads will be sprayed to reduce dust emissions during dry periods.	Application of a dust control agent will reduce road dust emissions
Rehabilitation (R)		
R1	Follow good practices presented in the rehabilitation plan.	Dust emissions from wind erosion will be minimized by considering it as a specific issue in the rehabilitation plan
R2	Draw up a rehabilitation plan	
R3	Produce post-mining and post-rehabilitation monitoring reports.	

Specific Mitigation Measures

Based on the finding of negligible incremental health risks quantified for the project activity scenarios, no specific mitigation measures are identified for human health.

7.5.2.2.4 Residual Effects Significance Assessment

The ecological context for human health impact relates to the association of health impact as a result of human receptor relationships to traditional ecological food quality – such as berries, medicinal plants, game and fish meat. The multimedia exposure and risk assessment indicates the food component under the future conservative project only and cumulative scenarios yields negligible risk to human health. Therefore the ecological context is that traditional foods are found to be a negligible risk factor to human health risk under future project scenarios.

The human health context of the residual effect significance relates to the association of six criteria that may characterize the significance of health effects: timing (as it relates to project activities or receptor behaviours), spatial extent (LSA versus RSA extent of an effect), duration (duration of a predicted effect), reversibility of a predicted effect, magnitude (measure as the hazard quotient or incremental lifetime cancer risk), and frequency of the effect. The criteria and the rationale for how they have been assigned to the residual effects are further defined in Table 7-114.

Table 7-114 Assessment Criteria Applicable to Human Health Risk

TIMING		
Inconsequential timing	**Moderate timing**	**Unfavorable timing**
Timing and seasonality of predicted Howse activities or human receptor activities has no significant effect on Human Health.	Timing and seasonality of predicted Howse activities or human receptors activities may affect Human Health.	Timing and seasonality of predicted Howse activities or receptors activities will significantly affect Human Health.
SPATIAL EXTENT		
Site specific	**Local**	**Regional**
Effects are limited to the footprint of the project.	Effects extend beyond the footprint, but do not extend outside the LSA. Further, a subsection of Human Health Risk habitat will be altered.	The effect of the Howse Project will affect Human Health Risk in substantial part or the entire RSA.
DURATION		

Short	Medium	Long
The effect of the Howse Project will last less than 12 months.	The effect of the Howse Project will last between 12 or 24 months (Extends beyond the preparation/construction phase, but shorter than the lifespan of the Project).	Health effects will last longer than 24 months, possibly as long as the project duration.
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Health Effects expected to return to their pre-Howse levels.	Health Effects can be reversed but only in certain locations and not others; or certain health effects may be reversible but others may not be reversible.	Health Effects are not reversible (e.g. cancer)
MAGNITUDE		
Low	**Moderate**	**High**
Hazard Quotients ≤1.0 and Incremental Cancer Risks ≤ 10^{-5} -or- Change in Risk relative to Baseline Case is <10%	1.0< Hazard Quotients ≤10 or 10^{-5} < Incremental Cancer Risks ≤10^{-4}	Hazard Quotients >10 or Incremental Cancer Risks >10^{-4}
FREQUENCY		
Once	**Intermittent**	**Continual**
When no health effect occurs.	N/A	When health effects occur it is considered continuous.

Timing

The criterion *timing* in the present context relates to how the timing of project activities or human receptor activities could exacerbate or ameliorate exposure and health risk. Air quality and the presence/absence of human receptors are the most relevant factors. Other factors such as dietary exposure are extended over long time-lines (e.g. year-round consumption of frozen traditional foods tends to dampen a seasonal exposure). Noteworthy in this risk assessment, is the adoptions of exposure scenarios with worse-case exposure concentration and the assumption of receptors being present and exposed – notwithstanding the seasonality of hunting camps and summertime recreation. The multimedia exposure predicted total and pathway-specific exposure to yield negligible risk. Given this risk estimate is predicated on worse-case assumptions (e.g., conservatively high dietary consumption, high concentrations of air quality parameters), the influence of timing on the residual effect, although plausible, is considered inconsequential because the risk worse-case risk is negligible, and therefore *timing* is assigned a value of 1. Additional context for timing and seasonal air quality exposure is provided below.

For NO_2 (1-hr), air quality exceedances were predicted at 8 sensitive receptors (R9, R10, R11, R13, R16, R17 and R24) in the "With Blasts" scenario, while no exceedances would occur at these same receptors in the "No Blasts" scenario. Note that the 8 receptors are located in the vicinity of the Howse deposit. The maximum number of exceedances is 13 (0.71% of the time) at R9 – Young Naskapi Camp 7 (Pinette Lake). A more detailed review indicated that all exceedances at these 8 receptors occur during winter (November to March period) and are due to blasting events at the Howse pit. By minimizing blasting at the Howse pit during the winter period (which the Proponent will do), exceedances will also be minimized.

Spatial Extent

The concept of variable exposure concentrations beyond the project footprint is plausible. In rare cases (i.e., rare frequency), brief occurrences of an elevated air parameter were predicted (see paragraph on winter NO2, above), however these infrequent occurrences do not translate to a spatially expanded zone of health effects. Because the health effects under the conservative assumptions are predicted to be negligible, the criterion of spatial extent is assigned a value of 1.

Duration

The residual effect criterion *duration* is considered in the context of duration of a significant health effect; the duration ranging from <12months to >24mo, the latter which may also encompass a significant risk of lifetime cancer. In the present instance, all conservatively assessed exposure pathways yielded negligible risk, as characterized by acceptable risk level defined by Health Canada. Accordingly, the criterion of duration of residual effect is assigned a value of 1.

Reversibility

The residual effect criterion *reversibility* is considered in the context of whether a significant health effect, if it was to occur, would be reversible within the timeframe of the project and/or physiologically reversible (e.g., cancer health effect). In the present instance, all conservatively assessed exposure pathways yielded negligible risk, as characterized by acceptable risk level defined by Health Canada. Accordingly, the criterion of reversibility does not strictly apply, and is assigned a value of 1.

Magnitude

The residual effect criterion *magnitude* is considered in the context of risk magnitude previously defined for ranges of hazard quotients (for non-cancer endpoints) and incremental lifetime cancer risk (ILCR). The categories were developed with consideration for Health Canada policy on acceptable health risk and conservative assumptions employed in the risk assessment. In the present instance, all conservatively assessed exposure pathways yielded negligible risk, as characterized by acceptable risk level defined by Health Canada. Accordingly, the residual effect criterion magnitude is assigned a value of 1.

Frequency

The residual effect criterion *frequency* is considered in the simplified context of whether a significant health effect is predicted to occur or not occur. It has not been considered in the context of number of people, as generally Health Canada policy for HHRA is to consider significance of health risk to an individual, rather than frequency within a population. In the present instance, all conservatively assessed exposure pathways yielded negligible risk, as characterized by acceptable risk level defined by Health Canada. Accordingly, the residual effect criterion frequency is assigned a value of 1.

7.5.2.2.4.1 Significance

The overall effect of the Howse Project on human health is non-significant (value of 6). This conclusion is based on conservative exposure assumptions that err on the side of over – rather than under-estimating human exposure scenarios.

Likelihood

The likelihood of the Howse project having an effect on human health is considered very low, because the multimedia exposure assessment has employed numerous conservative assumptions, with consideration to traditional foods, Aboriginal traditional activities, and a comprehensive evaluation of the interaction of mine activities, air emissions and meteorological conditions that will influence air quality. Notwithstanding the conservative assumptions, the magnitude of health risk was found to be negligible for all exposure pathways, both individually and additively.

7.5.2.3 Visual Environment

No particular concerns were raised during consultations with local Aboriginal groups in terms of visual effects, except in relation to Kauteitnat, which is discussed in Chapter 4. Accordingly, the visual environment component is not considered as a VC, except in its relation to Kauteitnat.

7.5.2.3.1 Component Description

LSA, RSA and Temporal Boundaries

The LSA includes the area located near the Howse Project, including Kauteitnat. The RSA has not been considered for this component as Project effects will be felt locally.

The temporal boundary for this component includes up until the end of the decommissioning and reclamation phase of the Project, as this is when the Howse Project will no cause changes in the visual environment. However, it is also understood that some alterations to the landscape caused by the Howse Project will be permanently visible.

Visual Environment

The Howse Project is located in an area where the landscape has been altered by mining exploration and operation over for the past decades. Mining operations in the Labrador Trough are characterized by the exploitation of open pits, which leave a significant footprint in the landscape. As discussed in Chapter 4, mining-related alterations to the landscape also include numerous test pits and trenches, stock piles, survey cut-lines, access roads and yards, and abandoned camps, infrastructure and equipment. There would be 18 open pits in Schefferville area, and some participants in the consultations have indicated that they "are the ones who live with the holes in the environment" (NIMLJ Council 2014, *personal communication*). These pits are of various sizes, some several hundred metres across and perhaps more than a hundred metres deep, and they certainly represent the most important alteration to the landscape in the vicinity of the Howse Project (NML and PWFA, 2009). Even if some of these pits have been abandoned or decommissioned, very little vegetation has grown on their perimeter or within them. The Howse Project will be inserted in an environment where mining operations have altered and continue to alter the visual environment.

No populations live near the Project site, Schefferville and MLJ being the closest communities, located 25 km from the site. In this sense, alterations to the landscape caused by the Project will not be seen on a continuous basis by the population of the LSA. However, as discussed in detail in Section 7.5.2.1, Innu and Naskapi continue to transit in this area to access their harvesting lands.

HML is aware that the presence of Kauteitnat is a particularly sensitive issue to Aboriginal Groups, as was presented in Section 7.5.2.1 and in Chapter 4. As discussed, the Project will alter the environment on the southeast of Kauteitnat, without, however, affecting the mountain itself. HML has made efforts to adjust the Project layout in order to minimize visual effects on Kauteitnat: the stockpiles will not exceed 50 metres, so that Kauteitnat will continue to be the main landmark in the area; and the limit of the Project infrastructure was located as far as possible from the foot of the mountain (see also Section 7.5.2.1). The visual aspect of the Howse Project has been included in the discussion on Kauteitnat because it is part of the cultural value of the mountain. In a sense, the visual effects cannot be dissociated with the cultural symbol that is Kauteitnat.

It should be mentioned that the progressive restoration plan will also play a part in giving a natural aspect to the site, which should be particularly visible once the site is decommissioned. This progressive restoration consists in laying topsoil that was set aside from preliminary mining work and planting vegetation, building safety barriers around the pits, and re-grading waste dumps to fit into the natural landscape.

Existing Literature

The visual environment has been described from existing topographical data and maps (land use, vegetation, and geomorphology).

Data Gaps

The existing data provides a recent and exhaustive overview of the component, taking into consideration that a discussion on visual effects is included in Section 7.5.2.1 on Kauteitnat.

7.5.2.4 Land Use Practices Summary

As per Section 6.3.4 of the final EIS Guidelines for the Preparation of an Environmental Impact Statement, we describe below how changes to the environment caused by the Howse Project affect aboriginal people, with a focus on socioeconomic conditions, namely:

- the use of navigable waters;
- forestry and logging operations;
- commercial fishing, hunting, trapping and gathering activities;
- commercial outfitters; and
- recreational use.

In the present context, we consider the latter three points.

The Howse Project will occur within a large mining complex which is heavily disturbed by historical mining operations, which have resulted in avoidance of the area for several years. Consequently, recreational land use activities are scant in the immediate area. This was confirmed by a country food assessment and survey conducted by HML for the Howse Project (Volume 2 Supporting Study D). Although it is acknowledged that dust settling on vegetation may deter some local land users from traditional activities (namely collecting medicinal plants and berries), a Human Health Risk Assessment (Volume 2 Supporting Study D) confirms that the risk of contamination to country foods associated with the Howse activities is also very low. As such, the effect of the Howse Project on any of the few recreational land use activities that occur in the Howse Project area will be negligible.

Land use in closest proximity to the Project (i.e. Pinette and Triangle Lakes) will persist during the entire mine life because the Proponent is committed to providing access to these locations via a bypass road (both Alternatives provide access to these locations, as well as the Howells River valley).

The physical environmental effects (cumulative and not) of the Howse Project are limited to air quality, noise, light and water. The residual effects on these components have been evaluated as significant for air quality only, albeit only temporarily. The effects of noise, light and water quality could have the potential to affect wildlife habitat and/or behavior under normal circumstances but, given the historical ecological setting in which the Howse Project lies, wildlife species are currently relatively rare in the area and expected to remain so (i.e. the Howse Project is not expected to reduce their numbers further). Consequently, there are no known commercial fishing, hunting, trapping and gathering activities in the Howse Project area.

The residual biological environmental effects (cumulative and not) of the Howse Project on caribou, avifauna and aquatic fauna have been evaluated as non-significant. As such, while it is recognized that the Howse Project activities could affect these biological components, their rarity in the area (caribou and avifauna) and the Project's avoidance of sensitive areas (fish habitat) and associated WMP, and focused mitigation measures (avifauna) and monitoring commitments (for all components) and adaptive management commitments (avifauna and caribou) have mitigated these residual effects to the point where they are not expected to change the current low number of wildlife species in the area. Further, since caribou have not been seen in the vicinity of the Howse site recently, no effects on outfitting are expected.

The distance between the Project and known waterfowl hunting sites should prevent any adverse effects on goose hunting in that area. There is a slight chance that geese might be scared away from Pinette Lake, but since they still use it with the ongoing DSO project, no significant change in resource availability is expected. Other waterfowls is also harvested in the study area and their situation should be similar. The Proponent is committed to surveying waterfowl habitat every 5 years and the plan to restore the site at the end of its mining operations will assist in the potential return of some species, notably caribou, to the area.

Consequently, the effects of the Howse Project on Aboriginal people is expected to be limited. The lack of wildlife in the area coupled with the relatively small effects of the Howse Project activities on the biophysical environment minimizes the changes to the availability of resources (from hunting, fishing, collecting of medicinal plants and berries). The Proponent's commitment to working with First Nations to provide continued access to the land by upgrading existing roads rather than building new ones, thereby also limiting habitat destruction/fragmentation effects. These roads will ensure that locals continue to have access to Kauteitnat.

7.5.3 Population and Community

7.5.3.1 Population: Demography and Household Characteristics

The population and demography component includes two subcomponents:

- Demography and maintenance of local populations; and
- Household characteristics

No particular concerns were raised during the consultations with regard to this component.

Demography and Maintenance of Local Populations

In the LSA, both Innu and Naskapi living in MLJ and Kawawachikamach have demonstrated very little population fluctuations in the past (NML and PFWA, 2009). Very few people leave their communities for southern cities to go to school or for jobs; community members tend to remain close to their families. Although there are examples where the presence of workers' camps has caused increased mobility of the local populations (Costa, 2007), there is no indication at the moment that this could be the case in the LSA, as HML's camp is located . 25 km from Schefferville. Workers who will be mobilized for the Howse Project will be accommodated at the Timmins camp for all of the site Construction, Operation and Decommissioning and Reclamation phase. Aboriginal workers from the LSA will stay in their villages and will commute to work.

The presence of mining operations in the Schefferville area could affect the local populations positively by providing employment and contracts in an area of Québec and Labrador where work opportunities may be rare. With the Howse Project, current employment levels of HML's DSO project will be maintained at the local or regional levels. Newfoundland and Labrador benefits, in terms of employment, should also remain at their current level (Chapter 4).

Therefore, the subcomponent "Demography and maintenance of local populations" was not retained as a VC.

Household Characteristics

In the LSA, NIMLJ and NNK have young populations which have respectively 1.6 and 2.1 children per family. The Howse Project will not affect this family and population structure, unless a greater proportion of women from the local communities are employed. Considering that household characteristics and family cohesion did not change significantly in recent decades, even with the presence of the mining activities, and considering the importance of the family for the NIMLJ and NNK communities, there is a low probability that this could delay the moment at which they have children and the number of children they wish to have.

Aboriginal workers from the LSA will commute to work on a daily basis. The effects on mine workers' families will not be significantly different that on families that have members working elsewhere in the community, except perhaps due to the longer working hours (10 to 12-hour shifts).

The situation may be different for ITUM, IN and NCC members or for non-Aboriginals who may take a job at the site on a rotational basis through the fly-in fly-out mechanisms. While the Howse Project will prolong their possibility for employment at the mine site and economic gains, it will also mean the prolonged absence of workers from their families. The effects of fly-in fly-out on workers' families and spouse are well documented and may include difficulties for family members of coping with the absence of a spouse or a parent, the need to redefine family members' roles and disruption of routines, the reliance on social and family networks, fidelity issues, spouse loneliness, etc. (Costa, 2007; McLean, 2003; WIN, 2010; CIAFT, 2011; MABC *et al.,* 2011). However, given that employees come from various areas of Labrador, Newfoundland and Quebec, the effects of rotational work on family cohesion in the RSA is impossible to predict. Accordingly, this will not be considered as a VC.

7.5.3.1.1 Component Description

What follows provides a description of the demographic situation of the populations located in the LSA and the RSA, as well as a brief portrait of their respective household characteristics.

LSA, RSA and Temporal Boundaries

The LSA includes the following communities, located in the province of Québec:

- Naskapi Nation of Kawawachikamach (NNK);
- Nation Innu Matimekush – Lac John (NIMLJ); and
- Town of Schefferville.

For this component, the RSA includes:

- Labrador West (Labrador City and Wabush), as well as the IN and the NCC; and
- Sept-Îles, and the Innu of Uashat and Mani-Utenam (ITUM).

The temporal boundary for this component includes up until the end of the decommissioning and reclamation phase of the Project, as this is when the Howse Project will no longer have an influence on the LSA as the sources of effects (employment or contract opportunities, traffic, etc.) will no longer be operative.

NNK

The Naskapi population has more than doubled since 1986, reaching 1,261 people as of September 2014, of which 884 live on the reserve and 373 live off-reserve (MSSS, 2014; NNK, 2013). This represents an increase of almost 4% in the number of members living on Category IA-N land compared to 2013 (851) (Table 7-115).

Table 7-115 Population Characteristics in the LSA, 2011-2014[19]

	REGISTERED POPULATION 2014[1]	POPULATION 2011[2]	POPULATION 2006[2]	VARIATION[3] (%)	LAND AREA[4] (KM^2)	POPULATION DENSITY PER KM^2
Kawawachikamach (2014)	884	586	569	3.0	30.83	79.0

[19] The most recent demographic information comes from the 2011 Population Census carried out by Statistics Canada. However, it seems that the participation rate of Aboriginal peoples was quite low, which resulted in underestimated population counts (Statistics Canada 2012, *personal communication*). More reliable sources of information on Aboriginal populations are the Indian Registry of AANDC and the *Ministère de la santé et des services sociaux du Québec* (MSSSQ) for Québec's Aboriginal peoples who have signed treaties. However, given that most statistics presented in this socioeconomic portrait comes from Statistics Canada, the 2011 population counts were also included.

Matimekush-Lac-John (2014)	782	540	528	2.3	0.74	734.1
Schefferville (2011)	-	213	202	-5.2	25.11	8.5

Sources:

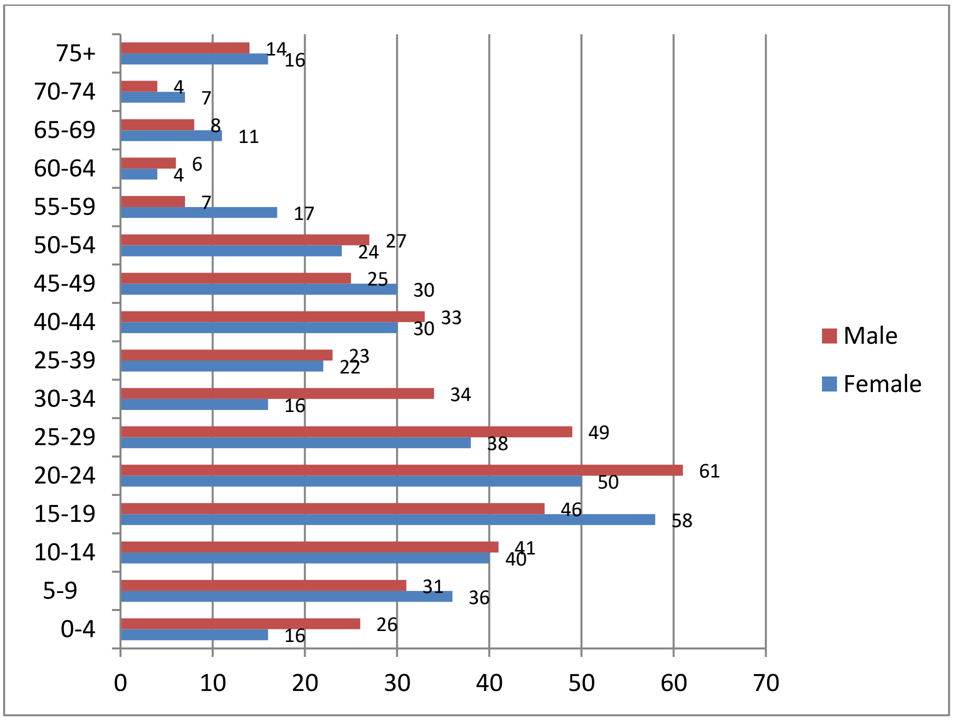
1 Registered ***on-reserve*** population. For NNK, Registre des Naskapis, 2014; For NIMLJ, AANDC, Indian register, 2014. There are 951 NIMLJ members, but 782 live in Matimekush-Lac John.

2 Statistics Canada, 2011.

3 Population variation calculated based on information provided by Statistics Canada.

4 For MLJ, land area and population density are only known for Matimekush, and exclude Lac John.

In 2013, 48.8% of the Naskapi population living in Kawawachikamach was made up of women (NNK, 2013). The age data represented in Figure 7-46 indicates a predominance of very young individuals in the community. The population of Kawawachikamach is composed of 22.3% individuals below 15 years of age, and 57.5% below 30 years of age. The median age of the NNK's population is 23 years old, whereas the median age in Québec is 41.9 years old (Statistics Canada, 2011).



Source: Statistics Canada, 2011.

Figure 7-46 Age of the Naskapi Population in Kawawachikamach, 2011

At the same time, the number of elders within the NNK population has doubled since the relocation of the community in 1983, a phenomenon that may be attributed "in part to the improved infrastructure, facilities and services available" (NNK, 2013). Nonetheless, as of March 2013, Naskapis aged 65 years and older formed 7.1% of the Kawawachikamach population, which is much less than the average for this age group within the province of Québec (16%) (NNK, 2013; Statistics Canada, 2011).

In 2011, Kawawachikamach counted 169 private dwellings. The average number of people per household is 3.9, and there is an average of 2.1 children per family. Eighty-nine percent of the total couple families are with children, and 36% of the census families are single-parent families (Table 7-116) (Statistics Canada, 2011).

Table 7-116 Household Characteristics in the LSA, 2011

	KAWAWACHIKAMACH	MLJ	SCHEFFERVILLE
Total private dwellings, 2011	169	200	178
Average number of persons in private households	3.9	3.3	-
Total population 15 years and over by marital status	410	360	-
Average number of children at home per census family	2.1	1.6	-

Source: Statistics Canada, 2011.

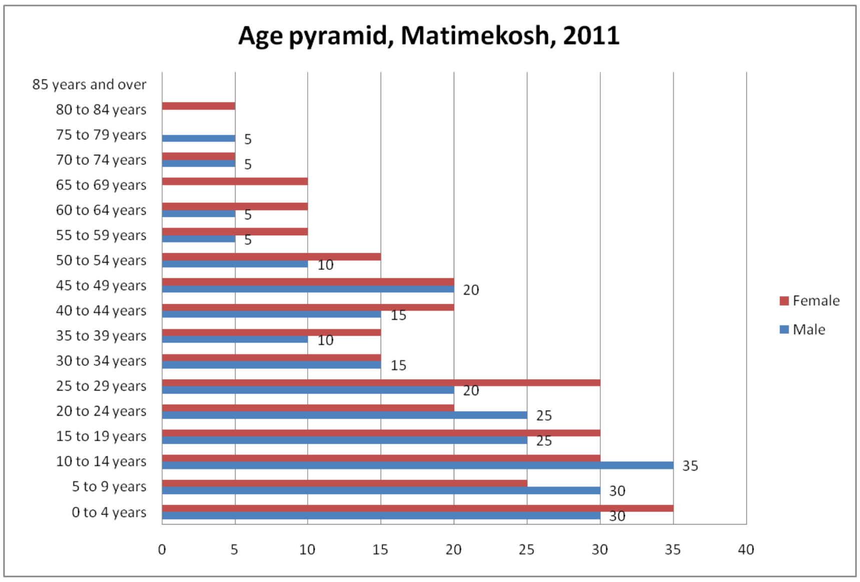
NIMLJ

According to the Indian Register, the population of NIMLJ is 951 people, with 782 living in MLJ (AANDC, 2014) (Table 7-115).

The population of MLJ underwent a rapid increase of 2.3% between 2006 and 2011 (Statistics Canada, 2011) (Table 7-115). It was suggested that the MLJ population has roughly tripled since 1957 (Clément, 2009a). According to Statistics Canada (2011), NIMLJ's population is young: population under 15 years old accounts for 34%, and the population under 30 years old represents 61% (Figure 7-47). The median age of NIMLJ is 24.8 years old, compared to 41.9 in Québec.

In Matimekush-Lac-John, 54% of the population is composed of women, and 46% are men (

Table 7-117).



Source: Statistics Canada, 2011.

Figure 7-47 Age of Innu Population of Matimekush-Lac John, 2011

Table 7-117 Age Characteristics of the Populations of NNK and NIMLJ, 2011

	KAWAWACHIKAMACH			MLJ		
	TOTAL (%)	M (%)	F (%)	TOTAL (%)	M (%)	F (%)
Median age of the population	23.0	22.0	24.4	24.8	23.2	25.8
% of the population aged 15 and over	70.2	70.7	68.4	67.2	66.4	70.3

Source: Statistics Canada, 2011.

There are 200 private dwellings in MLJ. The average number of people per household is 3.3, and there is an average of 1.6 children per family. Eighty-three percent of the total couple families are with children, and 40% of the census families are lone-parent families (Table 7-116) (Statistics Canada 2011).

Schefferville

Schefferville has 213 permanent residents (Statistics Canada, 2011), of which about 30% are of Aboriginal origin (MRC Caniapiscau, 2014) (Table 7-115).

Statistics Canada has not released information regarding the age characteristics or gender ratio of Schefferville's population for the 2011 census. However, the 2006 age and gender information indicates a different social composition of Schefferville's population compared to other typical cities in the province of Québec (NML and PFWA, 2009). For example, 55% of Schefferville's population is composed of men, compared to 45% for women. The population aged between 30 and 60 years old was also found in a high proportion of 55%. Schefferville's population thus consists mostly of middle-aged people. This structure is attributed largely to the fact that experienced, middle-aged professionals move to Schefferville to provide services to the Aboriginal communities that neighbor the municipality, as well as to provide labour to the mining industry (NML and PFWA, 2009).

Schefferville's resident population counts do not take into account the town's non-permanent residents. The revival of mining activities brought an increasing number of professionals who came to work in Schefferville. No statistics are available concerning non-permanent residents of Schefferville. However, the number of dwellings occupied by non-residents provides an idea of their number. Of the 178 private dwellings in Schefferville, 52% were occupied by non-residents in 2006.[20]

Schefferville households differ from neighboring Aboriginal households as there are far more households composed of one person (37%), and more households without children (21%) when compared to NNK and NIMLJ (Statistics Canada, 2006).

RSA

Labrador West

The towns of Labrador City and Wabush, referred to as Labrador West, are in close proximity to one another and generally function as one large community. Due to mining industry cycles, the population

[20] Information not available for 2011.

of Labrador West decreased between 2001 and 2006 and increased between 2006 and 2011, though not enough to compensate for the previous decline (Table 7-118).

Table 7-118 Population Characteristics in Labrador City and Wabush, 2011

	POPULATION 2011	POPULATION 2006	VARIATION %	LAND AREA IN KM^2	POPULATION DENSITY PER KM^2
Labrador City	7,367	7,240	1.8	38.8	189.7
Wabush	1,861	1,739	7.0	46.2	40.2

Source: Statistics Canada, 2011.

In Labrador City, average household size is 2.6, and 53% of couples live with children (Table 7-119). The proportion of couples with children is slightly higher than the provincial average (30% in NL).

Table 7-119 Household Characteristics in the RSA Labrador, 2011

	LABRADOR CITY	WABUSH
Total private dwellings, 2011	2,976	775
Average number of persons in private households	2.6	2.5
Total population 15 years and over by marital status	6,010	1,520
Average number of children at home per census family	0.9	0.8

Source: Statistics Canada, 2011.

* Numbers and percentages may not add up due to rounding. Includes married and common-law couples.

Innu Nation

The Innu of Labrador currently number about 2,500 and reside primarily in Sheshatshiu in Central Labrador and Natuashish on the Labrador North Coast (AANDC, 2014). The Sheshatshiu Innu and the Mushuau Innu of Natuashish are separate bands. In 2011, the registered Indian population for the Sheshatshiu Innu totaled 1,399 individuals, with 1,263 living on reserve and on Crown land, compared to 819 and 761 respectively for the Mushuau Innu (Table 7-120).

Table 7-120 Registered Labrador Innu Population, 2014

	POPULATION 2014
Sheshatshiu Innu First Nation	1,508
Mushuau Innu First Nation (Natuashish)	939
Total	**2,447**

Source : AANDC, 2014

NunatuKavut Community Council

The NCC has approximately 6,000 members that live in various cities of Labrador (NCC, 2014).

Uashat mak Mani-Utenam

As of January 2014, the Indian Registry recorded Uashat mak Mani-Utenam's Innu population at 4,304, with 976 members living off-reserve.[21] According to Statistics Canada (2011), the population increase between 2006 and 2011 reached 21.1% for Uashat mak Mani-Utenam (24.8% in Uashat and 17.2% in Mani-Utenam) (Table 7-121). Population density within the reserves, particularly Uashat, has increased significantly to reach 438.547/ km^2 in 2011, which is 27 times higher than in Sept-Iles.

Table 7-121 Population Characteristics, Sept-Îles and Uashat and Mani-Utenam, 2011

	REGISTERED POPULATION[1] 2014	POPULATION[2] 2011	POPULATION[2] 2006	VARIATION[3] (%)	LAND AREA[4] (KM^2)	POPULATION DENSITY PER KM^2
Uashat	4,424	1,485	1,190	21.1	6.387	438.547
Mak Mani-Utenam		1,316	1,123			
Sept-îles (including Moisie, Matamec and Galix)	-	28,487	27,827	2.4	1,770.52	16.1

Sources:
1 AANDC: Registered population for 2014.
2 Statistics Canada, 2011
3 Population variation calculated based on information provided by Statistics Canada, 2011.
4 Statistics Canada, 2011

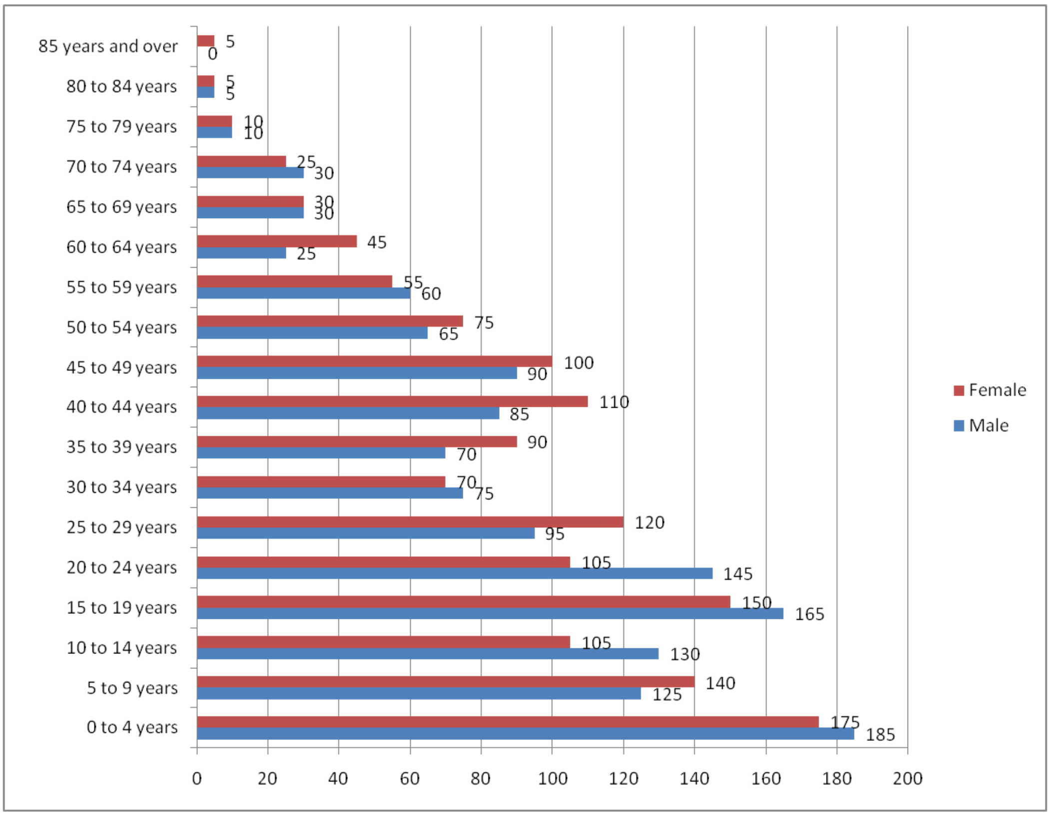
The median age of the Uashat and Mani-Utenam population in 2011 was 23.7 years old. Accordingly, the proportion of the population aged 15 and over is lower compared to the provincial proportion: 69.6% in Uashat, 68.7% in Mani-Utenam, and 84.1% in Québec (Table 7-122). Figure 7-48 below illustrates the breakdown of age categories. The highest concentration of population is within the 0 to 4 years age range. The proportion of elders aged 60 and over is much lower than in Québec generally (Statistics Canada, 2011).

Table 7-122 Household Characteristics, Sept-Îles 2011

	SEPT-ÎLES	UASHAT	MANI-UTENAM
Total private dwellings, 2011	12,912	438	445
Average number of persons in private households	2.3	3.5	3.1
Total population 15 years and over by marital status	23,265	1,035	905
Average number of children at home per census family	1.0	1.8	1.7

* Numbers and percentages may not add up due to rounding. Includes married and common-law couples.
Source: Statistics Canada, 2011.

[21] This is a significant change from the 2011 National Census, which recorded the population as being 2,801 (1,485 for Uashat and 1,316 for Mani-Utenam) (Statistics Canada, 2011).



Source: Statistics Canada, 2011.

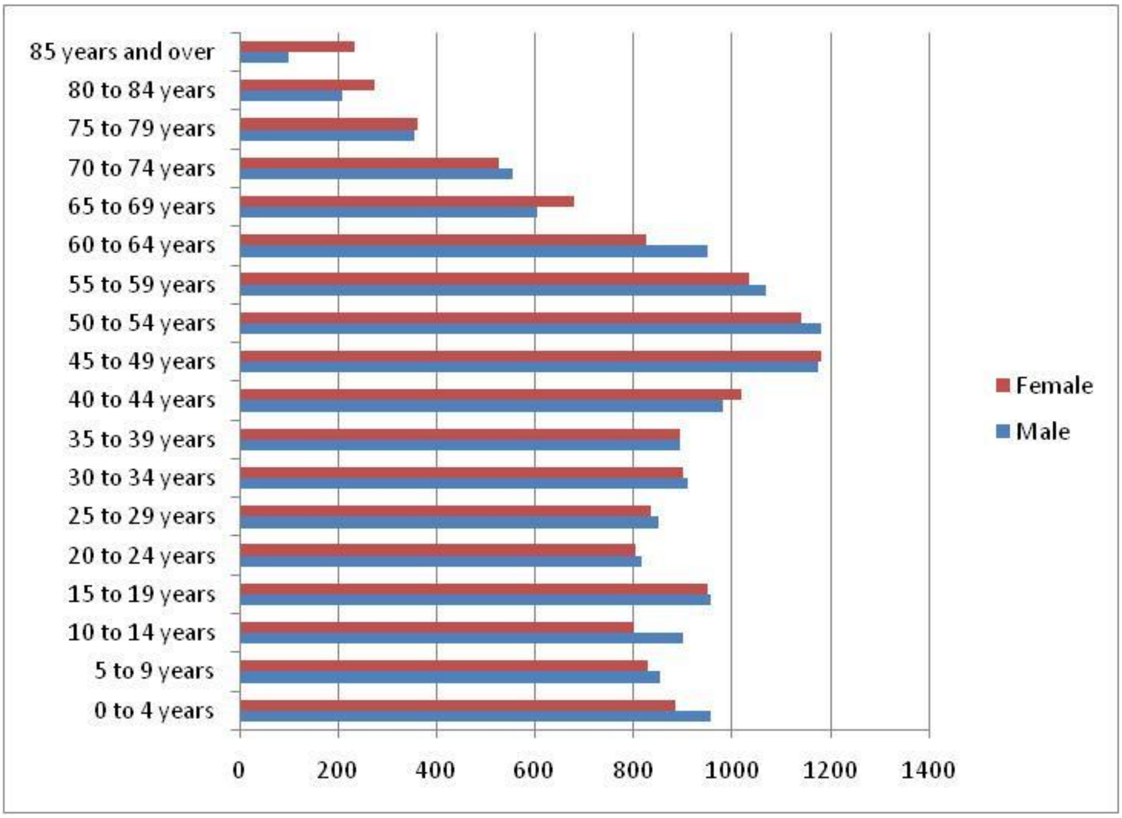
Figure 7-48 Age Characteristics, Uashat and Mani-Utenam, 2011

As of 2011, there are 438 private dwellings in Uashat, and 445 in Mani-Utenam. The average household size is 3.5 in Uashat, and 3.1 in Mani-Utenam. Over 70% of households in both Uashat (72%) and Mani-Utenam (76%) include children, with a combined average of 1.75 children per household (Statistics Canada, 2011).

Sept-Îles

According to the 2011 census, the population of Sept-Îles agglomeration is 28,487 inhabitants, which represents a 2.4% increase compared to 2006. The gender ratio is Sept-Îles is equal: 50% men, and 50% women.

In 2011, the median age in the communities of Sept-Îles was 40.5, which is slightly younger than Québec's 2011 median age of 41.9 (Table 7-121). Figure 7-49 clearly shows that the highest concentration of population is between 45 and 55 years old. Similarly, 83% of the population is over the age of 15 in Sept-Îles, compared to 84.1% for the province as a whole (Statistics Canada, 2011). Generally, the population in Sept-Îles is aging in similar ways as in the province of Québec.



Source: Statistics Canada, 2011.

Figure 7-49 Age Characteristics, Sept-Îles, 2011

The total number of private dwellings in Sept-Îles is 12,912, and the average household size is 2.3 people. Forty-eight percent of households include children, and there is an average of 1 child per household.

Existing Literature

The component description is based on literature review and official reports and statistics providing mainly from Statistics Canada, which were cited throughout the text where appropriate. Recent AANDC data on Aboriginal Registered population, NNK and Indian Registers have also been used.

Data Gaps

The existing data provides a recent and exhaustive overview of the component.

Recommended Measures for Improvement

In order to provide greater support to employees working on rotational schedules, HML will put in place an Employee Assistance Program once DSO/Howse are in full operation, for workers and their spouse in case of difficulties.

7.5.3.2 Education

For the education component, the subcomponents are *educational attainment* and *labour force training*. Labour force training goes hand-in-hand with employment, and was raised as an issue several times during the consultations. Accordingly, this subcomponent will be addressed in Section 7.5.3.5.

In terms of concerns raised during the public consultations (Chapter 4):

- no concerns were raised with regard to educational attainment in particular; and

- concerns raised regarding training are addressed in Section 7.5.3.5.

Educational attainment in the Aboriginal communities of the LSA is lower than the average education attainment for the provinces of Québec and NL (Section 7.5.3.2). This is due to several socioeconomic factors that have an effect on student success rates, be they family violence, absenteeism, lack of parental support, disconnect between training or the local job market (NIMLJ and NNK 2014, *personal communications*; Aerial Consulting 2014). Although NNK and NIMLJ primary and secondary schools provide complete facilities, there are no or few permanent facilities for vocational training, save for the recent learning center in Kawawachikamach.

The proponent has no control over the education system or the programs offered to increase the numbers of graduates from primary and secondary schools in the LSA. Nevertheless, the mining industry can positively influence the youth by demonstrating the employment opportunities that could be available to them once they graduate. The proponent has already participated in initiatives organized by NNK in this regard (Chapter 4).

Although education levels are a concern in terms of the future labour force, it is difficult to predict whether the possibility of getting jobs in the mining industry in the vicinity of the LSA communities could perhaps influence the success rates of the students, as many factors affecting it are beyond the proponent's control (quality of the education provided, parental involvement, teaching professionals, etc.). However, harmonizing training and job opportunities should have a positive influence (Aerial Consulting, 2014), and this would, in turn, increase the number of Aboriginal employees from the LSA, especially when taking into account the population increase and the young age of the Aboriginal populations (Section 7.5.3). To this end, a discussion on improving the possibilities for vocational training is included in Section 7.5.3.5.

The proponent also has no influence over the education systems Québec in the RSA, where the job markets are more diversified than in the LSA, opportunities for technical and professional training are varied, and educational attainment is higher when compared to the LSA. Most employees come from the province of Labrador, and a few come from the province of Québec.

Accordingly, education attainment cannot be considered as a VC.

7.5.3.2.1 Component Description

LSA, RSA and Temporal Boundaries

The LSA includes the NNK, the NIMLJ and the town of Schefferville, all located in the province of Québec. The RSA includes Labrador West (Labrador City and Wabush) and, in Québec, the City of Sept-Îles, and Uashat and Mani-Utenam (ITUM). The temporal boundary for the education component includes up until the end of the decommissioning and reclamation phase of the Project, as this is when the Howse Project will no longer have an influence on the LSA as the sources of effects (i.e. employment or contract opportunities) will no longer be operative.

LSA

<u>NNK</u>

Québec's education system has been offered to the Naskapis since the beginning of the 1970s. At the end of the first decade, less than half of the Naskapi people had completed high school, but the number had doubled by the beginning of the 1990s (NML and PWFA 2009).

The children are taught in Naskapi from pre-school to Grade 2 (95% in Naskapi). Introduction courses to oral English take place in Grade 1 and 2, but the need for these courses in Grade 1 is being questioned, as many kids are already good in English (TV and video games are all in English). For the past six years, Grade 3 has been split into a two-year program for the kids to gain a stronger foundational knowledge of English. At the moment, the school is developing tests to verify the skills of some of the Grade 3 students to see which ones could bypass this extra year.

In June 2014, 17 students completed Grade 6, and six students graduated from Secondary V, which represents an average year in terms of graduation (Tootoosis 2014, *personal communication*). It was noted that students who have an English-speaking parent have a better chance of success. The high school graduation rate is 31%. In fact, children who complete Secondary 3 and Secondary 4 have higher chances of success: 80% of them will go on to Secondary 5. Three years ago, the school tried a pilot program to promote the return to school for 20 dropouts. The success rate of this group was 50% (10 out of 20 graduated) which was considered significant. At the moment, the group in Secondary 2 is quite strong, giving the school principal good reason to hope that the graduation rate will increase in the years to come.

As the number of children is growing in the community, a budget was approved in 2009 for the school's expansion (NNK, 2010). The school expansion began in May 2011 (NNK, 2012) and negotiations are ongoing for expansion of the gymnasium (NNK, 2014).

Vocational and On-the-job Training

In accordance with Section 18 of the NEQA, training programs were made available to the Naskapi people during the late 1970s, over a seven-year period. Available training included small business management, outfitting, operation of heavy equipment, radio operation, and firefighting. The Naskapis have had access to various training programs:

- during the IOCC operations, the Naskapis often worked as general laborers, and rarely as specialized workers. When the mine closed in 1982, 17 Naskapis were permanent employees. At that time, some Naskapis also worked as fishing and hunting guides, and about 18 people were employed for the construction of the La Grande Complex, mostly for slashing trees (NML and PWFA, 2009);
- the building of the community itself at the beginning of the 1980s was an occasion to train Naskapi workers. Once the construction of Kawawachikamach was over, the NNK became the most important employer of the Naskapi people. It was estimated that approximately 375 Naskapis participated to related training programs (NML and PWFA, 2009). It was only in 1992 that training opportunities were made available to the community again, mainly to upgrade the skills of the NNK employees. These training programs included crafting, carpentry, construction and more recently, heavy equipment operations, truck driving (Class 1 and Class 3), health and safety officers, crusher operator, waste management specialist, welding, telecommunications and mineral prospecting;
- in 2001, training activities resumed, and in 2004, four Naskapis took part in a training to become geological technicians. In 2005-2006, 17 young Naskapis were involved in post-secondary programs (NML and PFWA, 2009);
- In 2010, the NNK Band Council obtained funding from several organizations to offer a one-year training program in mining exploration services for 12 young Naskapis. The training was provided between April 2010 and March 2011 (NNK, 2010);
- in 2011, funding was granted by the Human Resources and Skill Development Canada to provide a three-year training program in the mining sector to Naskapis, and a total of 113 Naskapis registered. A 66% success rate was reached for the training programs already completed (NNK, 2014); and
- every summer the Nation also provides a six to eight week summer career program.

The Naskapi Local Management Board (NLMB) "is mandated by Council to prioritize the employment and training needs of Naskapis and non-Naskapi Natives residing on Category 1N-A land, and to develop employment and training programs". It administers the funds for employment and training allocated to the First Nations Human Resources Development Commission of Québec (NNK, 2013). During the 2011-2012 fiscal year, the NLMB funded 23 training programs, whereas 24 programs were funded in 2012-2013 and in 2013-2014. In 2011-2012, a 32-week mining exploration training program was offered in which 12 people participated. Other training programs from 2011 to 2014 included Microsoft Office Training, High School Upgrading, Construction, Early Childhood Education, Carpentry, Painting Work Initiative and Sound and Music Recording. In addition, the NNK manages a yearly Summer Career

Program in which approximately 30 young people participate in six to eight week work placements within various community organizations (NNK, 2013; 2014; 2015).

The academic councillors organize a career fair in the community every year, in which mining companies sometimes participate (Tootoosis 2014, *personal communication*). Overall, there are few technician hands-on programs ("blue" programs) in the community. It was noted that there were more vocational programs during the first two or three years of the DSO project, and that any training offered in the community has to be rotational (not the same every year) because there is not enough clientele (Tootoosis 2014, *personal communication*).

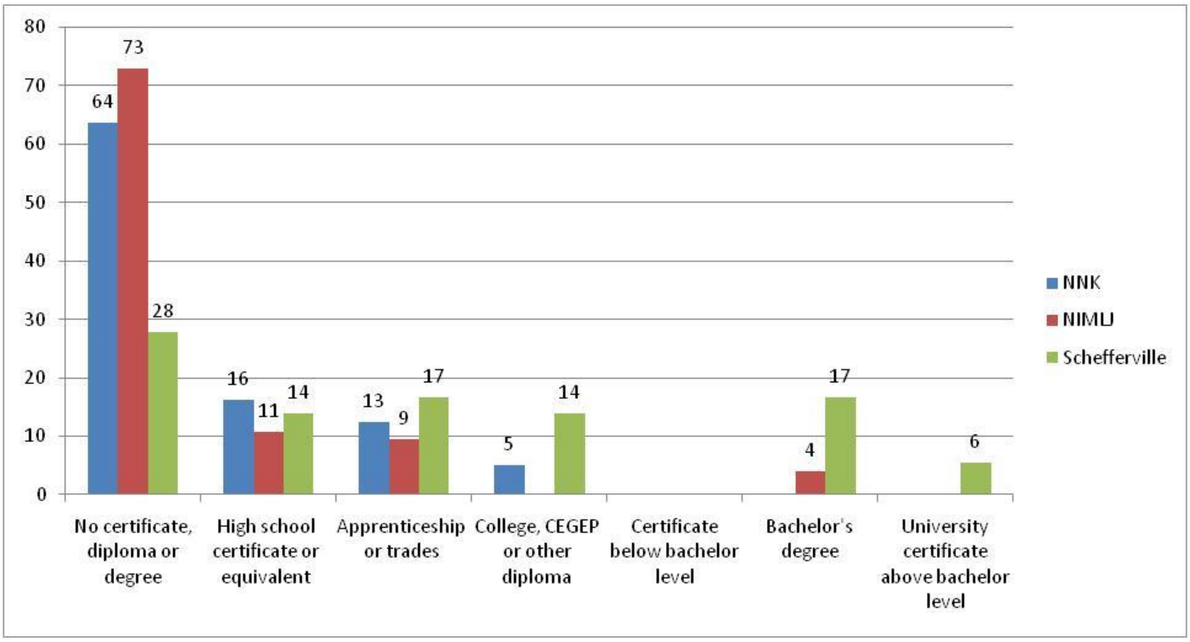
There is no facility for vocational training in the Schefferville area, but there is the new James Chescappio Memorial Learning Centre (Tootoosis 2014, *personal communication*), where the Workplace Essential Skills Program has been provided since 2011. One hundred and fourteen Naskapis have participated in the program since its introduction, and 30 students have been able to find a job (NNK, 2014).

The Jimmy Sandy Memorial School is collaborating with this learning center for older students who are not doing well in the regular setting (school) or because of family issues. The learning center provides more flexibility for these students, who also get paid $11 an hour when they pursue adult education. The learning center is mainly intended for young adults (21 years old and older) who cannot attend the school anymore.

HML has supported several training programs relating to the mining industry that were recently held in Schefferville area and in Kawawachikamach. For example, 50 participants from both communities obtained their DEP in heavy equipment operation and truck driving. HML is also contributing to the Essential Skills training in Kawawachikamach, and an introductory course in Process Plant Operations has been organized in the spring of 2015 for members of NIMLJ, NNK and ITUM.

Educational Attainment

Figure 7-50 below shows that NNK has a high percentage of people who have not completed their high school degree: 64% in Kawawachikamach compared to 22% in the province in general. Less than 1% of NNK population has obtained a university degree.



Source: Statistics Canada, 2011.

Figure 7-50 Educational Attainment of the Population Aged 15 Years and Over in the LSA, 2011

Gender differences in education are shown in Table 7-123. For 16% of population with high school certificates, 54% are men and 46% are women. In Québec, this proportion is reversed: 54% of women have a high school certificate, compared to 46% of men. However, 70% of men have apprenticeship or trade certificates, compared to 30% of women. Statistics do not show if the holders of a bachelor degree (less than 1 percent, or about 10 Naskapi people) are men or women.

High school graduates often leave for Ontario, to attend Algonquin College or go to North Bay, where courses are given in English (Tootoosis 2014, *personal communication*). They sometimes go to Québec or Sept-Îles, but very few go to Montréal. Some study social sciences while others study arts. A few have tried culinary or restaurant management.

Table 7-123 Educational Attainment by Gender of the Population Aged 15 Years and Over in the LSA, 2011

	KAWAWACHIKAMACH			NIMLJ			SCHEFFERVILLE			QUÉBEC (PROVINCE)		
	TOTAL (%)	M (%)	F (%)	TOTAL (%)	M (%)	F (%)	TOTAL (%)	M (%)	F (%)	TOTAL (%)	M (%)	F (%)
Population, 15 years old and over	100	53	48	100	46	54	100	53	47	100	49	51
No certificate, diploma or degree	64	50	50	73	46	52	28	40	50	22	50	50
High school diploma or equivalent	16	54	46	11	38	62	14	40	60	22	46	54
Apprenticeship or trade certificate or diploma	13	70	30	9	57	43	17	83	16	16	61	39
College, CEGEP or other non-university certificate or diploma	5	50	50	0	0	0	14	40	60	17	44	56
University certificate or diploma below bachelor level	0	0	0	0	0	0	0	0	0	5	41	59
Bachelor degree	0,25	0	0	4	33	67	17	50	50	12	45	55
University certificate, diploma or degree above bachelor level	0	0	0	0	0	0	6	0	0	7	52	48

Source: Statistics Canada, 2011.

Note: Numbers may not add up due to rounding/missing data. E.g. for 'No certificate, diploma or degree' for NIMLJ, the total value was 270 individuals, 125 men and 140 women (total 165 individuals).

<u>NIMLJ</u>

The Uatikuss childcare center of MLJ has a capacity of 44 children (Ministère de la famille, 2015), and it employs five educators and two support staff (NIMLJ, 2015; LIM, 2009). The daycare charges $7,30 per day to the parents. The waiting list contains approximately 20 names and the waiting time may vary between 6 months to a year, depending on the age of the children (Einish 2015, pers. comm.)

Schefferville residents may use the MLJ childcare facility.

In MLJ, the Kanatamat Tahitipetitamunu School is located on the MLJ Reserve and offers classes from kindergarten to Secondary V. The school, originally administered by Schefferville, was transferred to MLJ in 1998. Children are taught in Innu aimun and French. Native and non-Native children share the Kanatamat Tshitipetitamunu School. However, Schefferville's English-speaking children can attend the school in Kawawachikamach.

For the current school year (2014-2015), the school offers elementary programs to 58 children and high school programs to 38 students, for a total of 96 students (Jean-Pierre 2014, *personal communication*). The school currently employs 18 teachers, with 11 at the elementary level and 7 at the secondary level (Jean-Pierre 2014, *personal communication*). Specialist staff includes teachers in English, Innu, physical education, and arts, as well as a speech therapist and a psychoeducator.

The children are taught in Innu in pre-school (4-5 years old). Education is provided in French starting in Grade 1, but two Innu courses are taught over a seven-day cycle during the entire elementary school (Grade 1 to 6).

In June 2014, four students completed Grade 6 and three graduated from high school (Jean-Pierre 2014, *personal communication*). Between 35% and 40% of students drop out of school before finishing Secondary V. Absenteeism remains a major barrier to school success, although the situation has improved in the last two to three years. There is no special initiative in place to prevent school dropout, but students receive $30/month when their attendance rate is over 95%, and $20/month when it is between 80% and 95%.

Vocational Training

In 2008, one student was enrolled in vocational training in heavy machinery operations, 11 students had undertaken college level programs, and six students were attending university courses outside the community. Innu with higher education degrees tend to leave the region to seek employment opportunities (NML and PFWA, 2009).

Some NIMLJ members have been trained in the following sectors: carpentry, electricity, heavy machinery operation and construction (NML and PFWA, 2009).

Training programs have been delivered in disciplines relevant to current and future mining activities. Courses included heavy equipment operations and truck driver Class 1 and Class 3. On-the-job training has been provided by HML in health and safety, security, heavy equipment operation, food preparation, housekeeping, mining exploration and sampling (Howse Project Registration, March 2014). There is no adult training center in MLJ.

The members of NIMLJ participated in the truck driving and heavy equipment operation training programs described above. In addition, HML has been supporting adult education for several years. However, of the dozen or more people who registered at the beginning of term, only a few participants complete the courses from one year to the next.

Educational Attainment

In MLJ, the proportion of high school graduates is 11%. MLJ has a high percentage of people who have not completed their high school degree: 73% compared to 22% in the province in general. Four percent of the MLJ population has obtained a university degree, two-thirds of whom are women (Figure 7-50).

The total population of high school graduates is composed of a majority of women: 62% compared to 38% of men. Vocational training has been completed by 9% of the population, 57% of which are men compared to 43% women.

RSA

<u>Labrador West</u>

- Labrador City and Wabush are home to several education institutions, from pre-school to a university campus of the College of the North Atlantic.
- The First Steps Family Resource Centre Inc offers services to support families in the development of their children under seven through play, programming, education, and

family networking (Labrador West, 2014). There are also two preschools in the area: The Wee College Child Care Centre and The After School Zone (GNL, 2014c).

There are three primary/high schools (see Table 7-125) located in Labrador City, which are managed by the Labrador School Board, with the exception of the French school. The *Centre éducatif l'Envol* is managed by the *Conseil scolaire Francophone Provincial de Terre-Neuve-et-Labrador* (Labrador West, 2014).

The schools managed by the Labrador School Board offer different grades, so each student has to go through each of the schools to complete an elementary and high school education. This is not the case for the *Centre éducatif l'Envol*, where all the grades are offered under one roof.

From 1990 to 2000, four schools closed their doors: three in Labrador City (McManus Primary School, Labrador City Collegiate and Notre Dame Academy) and one in Wabush (Community Accounts, 2014). During this time period, student enrollment fell from 3,634 to 1,482 students (NL Community Accounts, 2014). However, since 2001, total student enrollment has started to rise again, increasing by 8.9% between 2001 and 2008 (LIM, 2009). Despite this increase in enrollment, all schools still have the capacity to accommodate a greater number of students. However, recruitment and retention of teachers has become difficult for the School Board and Conseil francophone (LIM, 2009; Conseil scolaire francophone provincial de Terre-Neuve-et-Labrador, 2014).

There is one school in Wabush, the J.R. Smallwood Middle School, which has a capacity to accommodate 1,000 students (Table 7-124). This school is also managed by the Labrador School Board. However, once students reach grade 8, they have to attend the Menihek High School located in Labrador City.

Labrador City is home to one of the 17 campuses of the College of the North Atlantic (CNA) in NL. The CNA offers post-secondary training in a variety of trades and continuing education. Approximately 300 full-time students attend courses per semester, while 30 students are registered part-time (CNA, 2014).

Table 7-124 Schools in Labrador West, 2012

SCHOOL NAME	LOCATION	GRADES	ENROLLMENT 2014/2015	SCHOOL CAPACITY*
A.P. Low Primary	Labrador City	Kindergarten to 3	424	600
J.R. Smallwood Middle School	Wabush	4-7	420	1,000
Menihek High School	Labrador City	8-12	617	800
Centre éducatif l'ENVOL	Labrador City	Kindergarten to 12	36	N/A

Source: GNL Department of Education and Early Childhood Development, 2014.
*Source: LIM. 2009

The Continuing Education evening courses attracted more than 1,000 students in 2012, and offer the following programs periodically:

- construction/Industrial Electrician (One year Program-Red Seal Certification)22;
- engineering Technology (First Year);
- industrial Mechanic (Millwright) - Red Seal Certification;
- mining Technician (two-year program);

[22] The Interprovincial Standards Red Seal Program (also known as the Red Seal Program) was established more than 50 years ago to provide greater mobility across Canada for skilled workers. Today, it represents a standard of excellence for industry. Through the program, tradespersons are able to obtain a Red Seal endorsement on their provincial/territorial certificates by successfully completing an interprovincial Red Seal examination. The Interprovincial Standards Red Seal Labour Force Qualification Program acknowledges their competence and ensures recognition of their certification throughout Canada without further examination (Red Seal Program, 2014)

- office Administration; and
- welding (one-year program).

The CNA in Labrador City is an important training facility for the mining industry. The Labrador West CNA campus is the only campus in NL to offer a two-year Mining Technician program, and has been designated as a Mining Centre of Excellence (LIM, 2009). The Provincial Mining Technology Centre, located at the campus, had 150 students registered for full-time studies in 2010-2011 (IOCC, 2013).

There are no post-secondary education facilities in Wabush. However, students may attend the CNA in Labrador City.

Educational Attainment

The proportion of people with no post-secondary certificate is much lower in Labrador City (16%) compared to NL (28%). The number of people in Labrador City with high school diplomas is similar to the provincial ratio, but more people in Labrador City have apprenticeship of trade certificates (22% compared to 13%) and college degrees (27% compared to 20%). The population of Labrador City has a similar level of university education as the NL population in general.

Gender differences in education are shown in Table 7-125. Similar numbers of men and women have no high school certificate or have obtained a high school certificate in Labrador City. The difference in men and women's education is the following: within the 22% of people with apprenticeship or trade certificate, 74% are men and 26% are women. In contrast, more women have obtained college degrees (56% compared to 44% of men), and 71% of the 7% of people with bachelor degrees are women. However, more men have obtained graduate degrees, in a proportion of 65% compared to 35% for women.

Table 7-125 Educational Attainment – Labrador City, 2011

	LABRADOR CITY			NL (PROVINCE)		
	TOTAL (%)	M (%)	F (%)	TOTAL (%)	M (%)	F (%)
Population, 15 years old and over	100	53	47	100	48	52
No certificate, diploma or degree	16	48	52	28	49	51
High school certificate or equivalent	22	51	48	23	46	54
Apprenticeship or trades certificate or diploma	22	74	26	13	66	34
College, CEGEP or other non-university certificate or diploma	27	44	56	20	43	57
University certificate or diploma below the bachelor level	3	49	49	3	42	58
Bachelor's degree	7	29	71	9	42	58
University certificate, diploma or degree above bachelor level	3	65	35	5	49	51

Source: Statistics Canada, 2011.

No information relative to educational attainment for Wabush in 2011 was released by Statistics Canada. However, the 2006 data shows that the proportion of people with no post-secondary certificate in Wabush was 19%. Twenty-eight percent of the population had obtained high school certificate, and 16% had an apprenticeship or trade certificate. Up to 25% had college degrees, and 9% of the Wabush population had a bachelor's degree. It is likely that 2001 education statistics for Wabush are similar to those of Labrador City.

Uashat mak Mani-Utenam

The following educational institutions are available to ITUM members:

- there is one childcare center in Mani-Utenam, the Auasis Center, with a capacity of 58 children. In Uashat, the CPE Kanitautshinaushiht can accommodate 44 children (RCPECN, 2013). There is currently one elementary school and one high school in Uashat: École Tshishteshinu (preschool and elementary) and École secondaire Manikanetish (high school). At least 169 children attended the primary school in 2012-2013, and 209 attended high school (Institut Tshakapesh 2014). The Manikanetish School employs five support staff (including the director), 24 teachers and two specialists. The school offers several optional programs, such as crafts, arts, sewing, sports, wood carving and hockey.
- in Mani-Utenam, there is one elementary school, named École primaire Johnny Pilot, where 224 children were taught in 2012-2013. Teenagers must travel to Uashat to attend high school. These schools are operated by the Institut Tshakapesh (Institut Tshakapesh, 2014).
- the Tshakapesh Institutes integrates traditional culture and language into the educational programs (Institut Tshakapesh, 2014). The Institute's objectives are also to offer the Innu population up-to-standard school programs for its children, and to promote the success of its primary and secondary students.
- according to a study conducted in 2001, barely 30% of people aged 15 and older finished their secondary V (Grade 11) studies. At the elementary school level, the education crisis was even more pronounced, with only 42% to 45% of students passing Grade 6. From 2000 to 2005, major investments were made by ITUM to improve schooling and education in the community. The graduation rate in Secondary V rose from 56% in 2000-2001 to 83% in 2003-2004 (GPS, 2006).
- compared to other Innu communities, Uashat and Mani-Utenam are located near Sept-Îles, where there are various possibilities in terms of post-secondary education. This means that young people do not need to leave the community to pursue their education. As indicated above, approximately 125 Innu are involved in various post-secondary programs at the Cégep de Sept-Îles (Industrie Québec, 2012). ITUM is hoping to build a post-secondary institution that would be specifically dedicated to meeting the needs of Innu communities.

Educational Attainment

Uashat mak Mani-Utenam education attainment compares to that of NNK and NIMLJ, and is significantly lower than in the neighboring City of Sept-Îles. Sixty-six percent of the population of Uashat and 62% of Mani-Utenam's population do not have post-secondary education certificates (Table 7-126), which are double the rates in Sept-Îles. The percentage of people with trades is 12% in both communities, and the number of people with college degrees was approximately half that of Sept-Îles (8% in Uashat, 10% in Mani-Utenam, compared to 17% in Sept-Îles) (Table 7-126). Only 2% of the population in both locations have a bachelor's degree, compared to 8% in Sept-Îles.

A greater proportion of the population with high school diplomas is composed of women. In Uashat, among the 10% of the population that completed high school, 57% are women, and this proportion reaches 67% in Mani-Utenam. However, many more men have completed apprenticeships or trade certificates: over 65% in Uashat, and over 80% in Mani-Utenam. The situation between both communities is different when it comes to the population with college degrees. In Uashat, equal numbers of men and women have obtained college certificates, but in Mani-Utenam, 61% of the population with college degrees are women, and 33% are men. Greater numbers of women have pursued high education: women represent 80% of Uashat's population with certificates below the bachelor's level, and 67% of Mani-Utenam's population. Generally, more women in both communities have obtained bachelor's degrees and graduate degrees.

Six percent of the population chose to study architecture, engineering and related technologies, while 3% chose business and management and education, and another 3% studies personal, protective and transportation services.

Sept-Îles

Several educational services are available in Sept-îles:

- Like in the province of Québec in general, government subsidized childcare centers, or Centre de la petite enfance (CPE), cost $7.30/day per child. Childcare in Sept-Îles is at capacity, and many childcare centers have long waiting lists. The lack of childcare services is partly due to new regulations that require childcare providers to be certified through a recognized course. To improve the situation, the Cégep de Sept-Îles offers childcare certificate courses for potential childcare providers to complete the program in less time (Cégep de Sept-îles, 2014). Additionally, the municipality offers a drop-in childhood education center for children aged two to five. The center offers activities aimed at the holistic development of children (Ville de Sept-Îles, 2014).
- The Commission scolaire du Fer operates seven French primary schools in Sept-Iles, and two secondary schools. A new primary school was opened in Sept-Îles in the fall of 2013.
- The Québec English School Board Association (QESBA) operates three Anglophone schools in Sept-Îles (QESBA, 2014): the Fleming Elementary School (Elementary, Sept-Iles); the Queen Elizabeth High School (Secondary, Sept-Iles); and the Northern Lights Adult Education and Vocational Centre.
- Sept-Îles has two post-secondary institutions: the Cégep de Sept-Îles and a branch of Université du Québec à Chicoutimi (UQAC). In addition, the Commission scolaire du Fer also offers continuing education programs, distance learning and high school completion for adults through the Centre de formation professionnelle et générale A.W. Gagné (Commission scolaire du fer, 2014).
- Courses at A.W. Gagné Sept-Îles are offered in partnership with the Commission scolaire du fer and other distance-learning institutions. Distance education courses are offered for those who wish to earn their high school certificate. A.W. Gagné also offers professional development programs adapted to the needs of the job market on the North Shore (Commission scolaire du fer, 2014).
- The Cégep de Sept-Îles offers eight technical diploma programs and four pre-university programs. Seven diploma programs are aligned with Université Laval and UQAC for those continuing onto a bachelor's degree. There are also partnerships that allow a bachelor's degree to be completed in two years instead of three. This applies to the nursing science program (UQAC), accounting and management (Université Laval), and information technology (UQAC and Université Laval) (Cégep de Sept-îles, 2014).

In May 2010, ArcelorMittal announced a CAN $800,000 donation to the Cégep de Sept-Îles to construct a pavilion for programs related to mining, including mineralogy training and industrial maintenance technology. The pavilion was inaugurated in August 2011 and now bears the name of *Institut de technologie minérale ArcelorMittal.* The Cégep also completed the construction of new residences in August 2012. For the 2011-2012 academic year, the college added a mineral technology (*Technologie minérale*) diploma program. The program prepares students to be technicians in mineral resource management. It is structured as an alternating work-study program with a paid internship semester. The program was first offered in the summer of 2012 in collaboration with mining companies in the region (Cégep de Sept-îles, 2014).

A new building has been added to the Cégep de Sept-Îles, representing an investment of $4.7 million. The building is dedicated to the industrial maintenance program. Courses were scheduled to start in the new building in the winter of 2014 (Radio-Canada, 2013d).

In addition, the Cégep is partnering with the Innu communities to offer training that matches the present and future labour force needs, especially in a context where ITUM has signed agreements with mining companies that guarantee them a certain number of jobs. At the moment, approximately 125 young Innu are studying at the Cégep de Sept-Îles, which corresponds to 13% of its total number of students (approximately 900 on a yearly basis). For example, a training program on train wagon operation is offered, though not exclusively to Aboriginal people. The Cégep hopes to support ITUM in the eventual creation of an Innu training center (Industrie Québec, 2012).

There is an UQAC branch in Sept-Îles with full-fledged undergraduate and masters programs.

Educational Attainment

Education attainment in Sept-Îles is, overall, similar to education attainment rates in Québec more generally. The proportion of people without post-secondary certificates in Sept-Îles is 30% compared to 22% in the province of Québec, and the proportion of people with high school certificates is almost the same, at 20%. The percentages of the population with apprenticeship or trade certificates and college degrees in Sept-Îles are 18% and 17%, respectively, which is very similar to provincial rates. The Sept-Îles population includes a high percentage of people with bachelor’s degrees, i.e., 8% (Table 7-126).

Gender differences in education are reflected in Table 7-126, and the general education trends are in line with those observed at the provincial level. Similar numbers of men and women have obtained high school certificates, yet more men have obtained apprenticeships or trades certificates (62% of men compared to 38% of women). In contrast, more women have obtained college degrees (54% of women compared to 46% of men) or bachelor degrees (60% of women compared to 40% of men) and a slightly higher percentage of women have completed graduate degrees (53% of women compared to 47% of men).

Table 7-126 Educational Attainment of Population Aged 15 Years and Over in Sept-Îles, Uashat and Mani-Utenam, 2011

	SEPT-ÎLES			UASHAT			MANI-UTENAM			QUÉBEC		
	TOTAL (%)	M (%)	W (%)	TOTAL (%)	M (%)	W (%)	TOTAL (%)	M (%)	W (%)	TOTAL (%)	M (%)	W (%)
Population, 15 years old and over	100	50	50	100	49	51	100	50	50	100	49	51
No certificate, diploma or degree	30	48	52	100	48	52	62	50	50	22	50	50
High school certificate or equivalent	20	50	49	66	43	57	10	39	67	22	46	54
Apprenticeship or trades certificate or diploma	18	62	38	10	67	29	12	82	18	16	61	39
College, CEGEP or other non-university certificate or diploma	17	46	54	12	50	50	10	33	61	17	44	56
University certificate or diploma below the bachelor level	3	44	55	8	40	80	2	0	67	5	41	59
Bachelor's degree	8	40	60	2	50	50	2	50	75	12	45	55
University certificate, diploma or degree above bachelor level	3	47	53	2	0	0	1	0	100	7	52	48

Source: Statistics Canada, 2011.

Existing Literature

The component description is based on a data collection on Statistics Canada website, and on a literature review of recent reports provided in particular by NNK, and on information provided by HML. Data sources were cited where applicable. This information has been completed through personal communication with key informants of the education sector in the LSA.

Data Gaps

The existing data provides a recent and exhaustive overview of the component.

Recommended Measures for Improvement

It is recommended that the proponent continue to collaborate with the communities of the LSA on initiatives to encourage youths to graduate and continue on to vocational training and/or post-secondary education levels and to increase opportunities for Aboriginal employment. Some measures are suggested in Section 7.5.3.5.

7.5.3.3 Health Conditions and Services

The following subcomponents are considered:

- continued availability of healthcare services for local residents;
- workers' health and safety;

Given the location of the mine site, potential effects on these subcomponents will mostly be felt in the LSA, except for the effects on workers' health and safety, as most of the workers are from the RSA or from other parts of Labrador or in Newfoundland. It is important to note that potential effects of dust on human health was one of the most recurring concerns raised during consultations.

The main concerns raised during the public consultations (Chapter 4) were:

- air quality and dusts and air quality monitoring;
- effects on health;
- effects on Pinette Lake and on fish and fish habitat;
- information made available about potential health issues; and
- an agreement or a protocol would make things easier for healthcare employees.

Issues concerning potential effects on human health are presented in Section 7.5.2.2).

Continued Availability of Healthcare Services for Local Residents

The Howse Project worker's camp features a well-equipped nursing station, and a nurse is present on site 24 hours per day. In 2014, HML recorded 18 medical aids by the camp nursing station. Although there is no formal protocol for medical intervention, effective collaboration has been established between the HML nurse and the nurses working at the Schefferville CLSC. It does happen that for confidentiality or proximity reasons, workers accommodated in Schefferville go to the local CLSC instead of the camp dispensary. The Schefferville CLSC nurse has indicated that they have the capacity to help out when needed, without interfering with Schefferville's residents' services (Porlier 2014, *personal communication*). In addition, workers in need of radiography would have to go to Kawawachikamach, where the local physician goes once a week to read the X-rays. In case of serious emergencies, workers would be flown to Sept-Îles, even if they come from Labrador. In general, the presence of workers and their potential need for care affect the Schefferville CLSC in a limited way (Porlier, J. *personal communication*, 2014), may have a potential effect on Kawawachikamach's X-ray facility, and does not affect the NIMLK facility.

Availability of services was not raised as a concern. Further, there are no indications so far that the presence of workers imposed a burden on local health services or has prevented resident from accessing services, the continued availability of healthcare services for local residents is not considered as a VC.

Workers' Health and Safety

Occupational hygiene testing was conducted in 2012 and 2013 (Pinchin LeBlanc Environmental Limited, 2012; 2013), focusing on breathable crystalline silica and particulates, and a respiratory hazard assessment was conducted in 2014 (Davis Industrial Hygiene Consulting, 2014). The report lists a series of measures that are in place to deal with occupational safety, and breathable silica in particular. Such measures, which would apply to the Howse Project, have already been or will soon be taken by HML:

- all heavy equipment cabs were thoroughly cleaned and inspected for leaks around the seals;
- a wash bay was built at the mine site and a schedule was put in place to ensure regular cleaning of vehicles when temperature is above 0o C, between May and October;
- a maintenance program was implemented to ensure the heavy equipment cabs are kept clean and free of dust. Training was provided to the operators to ensure that they understood the importance of this;
- manometers were installed in all relevant heavy equipment to ensure positive pressure is maintained;
- a policy was implemented so that all heavy equipment windows would be kept closed during operation;
- two water trucks were commissioned to water the roads around site to reduce dust. One covers the road to Schefferville and one covers the worksite area;
- boot cleaners were added to the cafeteria entrance to reduce dust brought into the mud room;
- mud rooms were added to the entrances of all dorms so that workers could leave dirty boots and work clothes in them;
- a respiratory protection program was implemented; and
- the use of HEPA-equipped vacuums for cleaning was implemented.

Nonetheless, analysis showed that some worker samples are above the ACGIH exposure limits, and in some cases, above the "action level", defined as one-half of the ACGIH established exposure limit (0.50 * TLV). Only one sample was above the exposure limit, and four above the action level (Davis Industrial Hygiene Consulting, 2014). Therefore, the 2014 report made the following recommendations:

- Continue to use all existing controls as previously listed in Section 3.4 of this report.
- Implement the use of water trucks to suppress dust from plants 1 and 2, parking lots, and stockpiles.
- Implement personal hygiene practices for protecting workers from exposure to crystalline silica. Workers should wash their hands and faces before eating, drinking, or smoking.
- Workers should not eat, drink, or use tobacco products in dusty areas.
- Workers should receive training that includes the following:
  - Information about the potential adverse health effects of crystalline silica exposure
  - Discussion about the importance of engineering controls, personal hygiene, and work practices in reducing silica exposure
  - Instruction about the use and care of appropriate protective equipment (including protective clothing and respiratory protection).

In addition, HML has a draft Health and Safety Program (Volume 1 Appendix VII) and an Emergency Response Plan, and several measures to mitigate risks are included into the EPP (Volume 1 Appendix Ia). Other measures that ensure a safe working environment include the zero tolerance policy for alcohol and drugs. In cases where an employee is caught with or under the effects of drugs or alcohol, the employee is invited to deal with his issues, and the possibility of returning to work is re-evaluated afterwards.

Worker's health and safety is a rigorously regulated sector: it is assured through provincial and federal legislations, and companies have to observe the legislation in order to operate. Worker's health and Safety has been discussed here to reassure the workers, their families and the communities that HML is complying with all laws and legislations in this sector. To this end, generally Worker Health and Safety is not considered as a VC. Volume 1 Appendix VII presents HML's draft Health and Safety Program that will be operational throughout the Howse Project.

7.5.3.3.1 Component Description

LSA, RSA and Temporal Boundaries

The LSA includes NNK, NIMLJ and the town of Schefferville, located in the province of Québec. The RSA includes Labrador West (Labrador City and Wabush) and, in Québec, the City of Sept-Îles, and Uashat and Mani-Utenam (ITUM).

The temporal boundary for this component includes up until the end of the Decommissioning and Reclamation phase of the Project, as this is when the sources of effects will be operative.

LSA

<u>NNK</u>

Health Services

Health and social services are provided in Kawawachikamach at the Local Community Service Center (CLSC), which is managed by a board of directors composed of a majority of Naskapi, and is administratively linked to the CSSS de l'Hématite in Fermont.[23] The local CLSC was inaugurated in 2001 (NNK, 2014).

The Naskapi CLSC offers a range of health and social services to NNK's population. Three doctors and six nurses work on a rotating schedule (AANDC, 2014). The center deals with minor medical issues and psycho-social consultations, while patients in need of long-term care are transferred to Sept-Îles. The CLSC is equipped to offer the following services: X-rays, dentistry, ophthalmology, psychology, occupational health, pharmacy and laboratory. Specialized services are available on a monthly basis (Nalcor Energy, 2011; LIM, 2009). A dentist is shared between the Naskapi CLSC, Schefferville and MLJ (NML and PFWA, 2009). In addition to emergency or curative services, the CLSC also works on health prevention. Medication is available onsite. It should be noted that X-rays are only available at NNK CLSC for the region of Schefferville.

The CLSC is functioning at full capacity, and has been accumulating a yearly deficit since 2007. The services offered will eventually need to be adapted to the population increase that is anticipated in the next coming years, and also to the changing age pyramid and growing number of elders (LIM, 2009). As an indication, the CLSC provided over 1,000 psycho-social consultations in 2007-2008, and 300 under the Aboriginal Diabetes Initiative (NML and PWFA, 2009). The construction of a new CLSC was approved at the beginning of 2013. Construction should be completed in 2016 (NNK, 2014).

A series of health programs are offered, as well as numerous workshops on youth suicide, addiction, domestic violence, alcoholism, elder care, etc. Examples of programs include: the Fetal Alcohol Spectrum Disorders Program, the Prenatal Nutrition Program, the Home and Community Care Program and the National Native Alcohol and Drug Addictions Program (NNADAP) – to help those who deal with drug, solvent abuse, and alcohol addictions (NNK, 2014).

Other health-related activities held in the community include:

- Spiritual Week;
- National Aboriginal Addictions Awareness Week;
- Elder's Christmas Feast;
- International Women's Day;
- Brighter Futures Program;
- Maternal and Child Health Program;
- Indian Residential School Resolution Health Support Program;
- Head Start Program;

[23] For most Aboriginal reserves, health services are managed by Health Canada. However, this responsibility was transferred to Québec in the NEQA (1978).

- Aboriginal Diabetes Initiative;
- First Nation and Inuit Childcare Services Initiative;
- Family Violence Program;
- Québec en Forme (NNK, 2014).

The National Aboriginal Youth Suicide Prevention Strategy, funded by Health Canada, is also active in the community and supports several activities, notably the Applied Suicide Intervention Skills Training and the Dialogue for Life Conference (NNK, 2014).

The Naskapi CLSC is working in a way that integrates Naskapi culture while respecting the obligations established by Québec health and social services and those related to the NEQA. The Naskapi CLSC faces several challenges, in particular the recruitment and retention of non-Native employees (NNK, 2012).

Health and Safety Conditions

Because of the confidential nature of the files, it is very difficult to obtain information or statistics on the health conditions of community members. However, the 10 community health priorities that were identified by the CLSC Naskapi Board of Director and the Nations' Health Committee provide an idea of the most pressing issues with which community members are dealing:

- Diabetes;
- Addiction;
- Mental Health;
- Health Education in Naskapi;
- Maternal and Child Health;
- Physical and Mental Disabilities;
- Chronic Diseases;
- Elder Services;
- Promotion of Health Living Conditions; and
- Health and Human Resource Development (NNK, 2014).

In 2009, the two major health problems in the community were diabetes and drug and alcohol abuse (NML and PWFA, 2009). This was also the case in 2014, as confirmed during the consultations (various participants). The number of diabetes cases in NNK, NIMLJ and Schefferville has exploded in the last 30 years, being seven times higher than in the Canadian population. An increase in breathing problems is also noticeable among the Native population (Gaudreault 2014, *personal communication*), and may be attributed to promiscuity, second hand smoke, and mold and dust in homes (Cloutier 2014, *personal communication*).

Several children have dermatitis that varies in severity. These skin problems may be related to a poor diet, quality of life, or home and personal hygiene (Gaudreault 2014, *personal communication*).

In 2013-2014, the Naskapi Police received a total of 813 calls, an increase of 58% compared to 2012-2013, and by 426% compared to 2010-2011. In 2013, there was a marked increase in the number of calls for conjugal violence (a total of 81, and an increase of 58% compared to the previous year), and in the number of alcohol-related calls (a total of 368, and an increase of 63% compared to the previous year). Alcohol-related calls are the most frequent and account for 45% of the total calls. In comparison, drug-related calls are far less frequent and account to 5% of the total number of calls. The number of attempted suicides seems to vary from one year to the next, yet there were 16 calls in 2013-2014, which represented the highest number in five years. Sixty percent of the calls concern men (NNK, 2014).

It is hard to explain why there was such an increase in the number of calls in the recent years. The Chief of the Naskapi Police Force has noted that violence is often related to alcohol abuse, as well as the mischief committed in the community (e.g., breaking windows). He also observed that the alcohol-related calls may concern a few individuals who have addiction issues and are known by the Naskapi Police Force. The Naskapi Police Force does approve of the zero tolerance policy that was adopted by HML at their work camp (Martin 2014, *personal communication*).

<u>NIMLJ</u>

Health Services

The dispensary of Matimekush, funded by Health Canada, provides a wide range of health and social services to NIMLJ's population. The services offered compare to those offered by the CLSCs of Schefferville and Kawawachikamach. The staff is composed of three nurses, a nutritionist, psychologists, a liaison officer, and doctors, in addition to administrative support staff. The mission of the dispensary is to adequately address the needs of its population through emergency services, general medical services, prevention and medical and social emergency intervention (NIMLJ, 2014).

The dispensary, which is relatively new, shares the doctor's services with the Schefferville and NNK CLSCs. It is equipped with two observation beds, and specialists come on a rotation basis to provide services to the population (ORL, ophthalmologist, dentist, physicians and optometrist) (NIMLJ, 2014).

Social services are also available to NILMJ members. The dispensary offers programs for people with specific needs, particularly those who went to boarding schools, who suffer from addictions, for suicide prevention, and for elder care. Youth protection services – in case of family violence and/or child abuse – are available, as well as care for those who suffer mental health issues. Social services in MLJ focus on six objectives that are largely family-oriented:

- promote and reinforce early intervention for children and their parents;
- promote and reinforce less disruptive measures and prevention services for families;
- promote child development in their family of origin;
- prevent and reduce the number of crisis situations;
- prevent and reduce the number of child abuse cases and youth protection interventions; and
- reduce the number and duration of child placements outside their families and community of origin (NIMLJ, 2014).

There is also a women shelter that provides care for women who are undergoing family violence (physical and psychological).

Health and Safety Conditions

As was the case for NNK, it is difficult to obtain precise information on the health conditions of the MLJ population.

The most frequent health problems in MLJ include inadequate nutrition, diabetes and smoking (NML and PWFA, 2009). In 2008, the doctors and nurses of the MLJ dispensary have seen 525 patients, and another 50 people visited the clinic for issues such as addiction and to seek psychological help. Addictions and social problems have been identified as the major cause of school drop-outs (NML and PWFA, 2009). At the moment, the main health problems encountered at the dispensary of Matimekush can be attributed to promiscuity (houses are overcrowded), smoking and second-hand smoke, as well as dirt and mold in homes (Jean-Hairet 2014, *personal communication*). An increase in breathing problems has been noticed since 2009, yet given the conditions in homes and smoking habits, it is difficult to draw a clear association with the dust generated by the mining activities, and no studies have ever been conducted on this issue.

Violence among the youth has also been identified as an important problem in the community. According to the local CLSC sociologist, youths are violent in part because they cannot self-identify with either the traditional culture or with the modern culture of the majority. Many young people suffer from low self-esteem problems (Radio-Canada, 2012g). Alcoholism is frequent and has an effects on health and social life (Jean-Hairet 2014, *personal communication*).

At the moment, the main safety issue in the community is alcohol consumption (Bouchard 2014, *personal communication*). Most calls come from intoxicated community members for disturbing the peace, assault, or threats. Arrivals of drugs for consumption are monitored as closely as possible in the community. Recently, the police found 825 pills of speed on the Schefferville train (Bouchard 2014, *personal communication*).

<u>Schefferville</u>

Health Services

Schefferville is home to the CSSS de l'Hématite, and is administratively linked to Fermont's facility. In 2007-2008, the center had 225 patients and performed 946 interventions (LIM, 2009). Most of its clients are the non-Aboriginal population of Schefferville.

The CSSS offers the services of a nurse and a doctor on a permanent basis. The doctor shares his time between the CSSS de l'Hématite, the Matimekush dispensary and the Naskapi CLSC. In case of emergency, patients are treated at the CSSS de l'Hématite, where three nurses work on eight-week rotations (Porlier 2014, *personal communication*). Outside the clinic's working hours, the attending nurse remains on call 24/7, and can be reached by the doctor if necessary (Porlier 2014, *personal communication*).

Several services are offered by the CSSS de l'Hématite, including:

- observation beds;
- full-time ambulance service;
- pharmacy (via Fermont's drugstore);
- pharmaceutical patient follow-up;
- emergency/medical evacuation;
- vaccination;
- blood tests; and
- obstetric follow-up (NML and PWFA 2009).

A new building is currently being built for Schefferville's CLSC. For years, the CLSC was located in a renovated two-story house, which was inadequate for patients' care. However, the Schefferville's CLSC nurse indicated that better choices could have been made in terms of the equipment that will be available in the new facility. Patients will now be able to stay for more than 24 hours if required, yet there will not be more staff to respond to demands. A new residence for doctors was also built in 2011.

Health and Safety Conditions

In 2010, the *Agence de la santé et des services sociaux de la Côte-Nord (*ASSSCN) gave the firm Léger Marketing the mandate to conduct health surveys in Côte-Nord, including one in the Caniapiscau MRC. The survey excluded the Aboriginal communities of Matimekush-Lac John and Kawawachikamach, but included the Aboriginal population living off-reserve and Schefferville's population. The data for the survey was collected in 2011.[24]

The survey revealed that 95% of the Caniapiscau MRC population is in good physical health, and 97% in good mental health. Almost everyone (97%) was satisfied of their overall life conditions, and 41% stated that their life was not stressful.

Although 46% of the population exercises at least 30 minutes each week, one of the major health problem identified was excess weight, which affects 62% of the population of the Caniapiscau MRC. Another issue identified was the drinking habits of the residents: 78% drink alcoholic beverages regularly, compared to 70% in the rest of Côte-Nord. In addition, 31% of the residents smoke cigarettes on a regular basis.

Chronic diseases affect one person out of three, which is less than in Côte-Nord region more generally (41%). Thirteen percent of the population suffers from hypertension, 6% from asthma, and 5% from diabetes. However, 97% of the diabetics and 90% of those suffering from asthma have found treatment or adequate information to control their diseases.

At least 27% of Caniapiscau MRC residents have indicated their concerns regarding industrial pollution, compared to 34% of Côte-Nord residents. However, 32% of residents cited second-hand cigarette smoke as causing the most harm to their quality of life (ASSSCN, 2010).

Although quality of life is perceived as excellent by Caniapiscau MRC residents, little is known regarding the health of Schefferville's residents in particular. There have recently been concerns due to the increasing respiratory problems related to the quantity of dust in the air caused by the mining industry (Radio-Canada, 2012d). However, this could not be confirmed at the Schefferville CLSC.

As discussed above, safety issues in Schefferville are often related to alcohol consumption, and include mischief and petty crimes (Bouchard 2014, *personal communication*). Schefferville and MLJ share the same police force (Sûreté du Québec), and joint statistics are kept. It is thus impossible to obtain information that concern Schefferville residents only.

Existing Literature

The component description is based on a review of official reports and of statistics providing mainly from Statistics Canada. All data sources were cited throughout the text where applicable. The information available has been completed through personal communications with key informants of the health sector in the LSA.

Data Gaps

The existing data provides a recent and exhaustive overview of the component.

Recommended Measures for Improvement

Several measures could be put in place to improve services, save time and ease the work of the treating nurses and physicians, and to ensure that services remain available for residents in the future. These measures would also play a preventive and protection role for the workers:

- all workers should have the prescription medications that they need with them for their rotation period;
- all workers should submit a list of the medication they take to the camp's nurse in case of emergency or medical treatment;

[24] The survey was carried out by phone, but the methodology does not specify how many survey participants were from Schefferville. However, the survey results are based on the 346 interviews in the Caniapiscau MRC, and the margin of error is estimated at 5.27% (ASSSCN, 2010)

- all workers should have their vaccination record with them, and should automatically receive tetanus vaccine and flu shots;
- workers from Québec should have their medicare cards with them at all times;
- the camp nurse should have a copy of all worker medical files, which should be translated into French in case of emergency, given that patients could be transferred to Sept-Îles;
- workers should have receive certain information prior to accepting a job at the site:
  - availability of medical staff: patients are not used to dealing with nurses;
  - dentistry services are not available for workers;
  - what happens in case of medication evacuation, with patients sent to Sept-Îles;
  - Schefferville nurses do not speak English fluently, and it might be difficult to obtain health services in English in the case of a transfer to Sept-Îles.

Language is an issue for local healthcare services in two major ways. Labrador workers who do not speak French may have to interact with Schefferville CLSCs, where the nurses might not speak English. Additionally, in case of emergency or severe injury, all workers are automatically transferred to the Sept-Îles hospital, to which Schefferville's CLSC is administratively related. In such a case, Anglophones from Labrador end up in the francophone Sept-Îles hospital, which is equipped with a translation service. Having a medical file in French would then help, but the problem runs deeper given that their relatives may also only speak English. It would perhaps be relevant for HML to develop a protocol in which workers from Labrador could be sent to Labrador City instead of Sept-Îles. The quality of the health infrastructure would allow for such transfers (Section 7.5.3.3). This would also accommodate workers from the IN or NCC.

Finally, there was a period in the summer of 2014 when there was no nurse available at camp. This situation has temporarily put an additional burden on Schefferville CLSC staff. HML, which is responsible of the Timmins camp, has indicated that this situation should not occur again in the future.

Taking into account the concerns raised during the consultation, HML will continue to observe effects on worker's health in order to improve the measures in place and keep exposure levels below the action level in June 2015. Sampling intervals were increased in 2015, and exceeded the minimum sampling frequency in the case of silica sampling. HML will continue to monitor the health of workers ensure that all precautionary measures are in place to maximize worker protection by the time the mine is in full operation. The HSE Committee will be made aware of the sampling results, and be given the opportunity to propose additional measures to HML. Results and measures will also be communicated to workers in the LSA and RSA to alleviate the concerns of the workers' families.

A Training Control Plan is defined in EPP in order to ensure that any training requirement arising as a result of the PEMP is adequately managed. Hence, contractors are required to train their personnel in environmental, health and safety matters. This should be enforced by HML.

7.5.3.4 Infrastructure and Services

The section that follows describes the infrastructure and the services that are available to the communities in the LSA and RSA.

For the infrastructure component, the subcomponents are the following:

- availability of public services and infrastructure for residents;
- housing in the LSA;
- maintenance of social stability; and
- access to the local transportation network, access to land, and road safety.

These subcomponents are unique to the LSA given that the overall DSO project will not increase, for instance, the traffic on the railways or the level of activities in Sept-Îles area.

The main concerns raised during the public consultations (Chapter 4) were:

- there is a need for a bypass road for access and safety reasons, such as:
  - speed;
  - one-way escorts; and
  - presence of machinery;
- issue of housing in Schefferville and in Aboriginal communities;
- difficulties relative to the expansion of Schefferville and concerns regarding the capacity of the Schefferville infrastructure;
- the city cannot expand anymore. There are only six lots left for expansion in 2014 (there were 125 in 2012);
- infrastructure and facilities in the community are not well maintained: some street lights are broken, sidewalks and road need maintenance and major repairs. There is no financing. The Council would like support from HML;
- railway traffic and priority is given to to ore trains on the railway. Passenger and freight transport is less possible. Freight is a particular issue in the summer. The construction period is short, and it becomes more difficult to bring in materials, groceries, all types of supplies (May-December). Sometimes (3-4 week period) waiting time, which causes lost–payments for carpenters, staff. This situation is worse because of increased traffic;
- vehicles drive too fast, which creates more dust;
- access to the territory is a very important issue and the bypass road would better ensure this access (access via the Timmins-Kivivik road was made available starting in the Summer of 2015); and
- ski-doo access is not possible because of new traffic on the road, and trucks leave rocks behind.

Availability of Local Services and Infrastructure for the Residents

Given that the workers who will be employed for the Howse Project Construction and Operation phases will be based at HML's Timmins camp, there is very little chance that workers will use the public and recreational services and infrastructure in the Schefferville area. The exception would be health services, which were discussed in Section 7.5.3.3, although there is a first-aid facility, and a nurse on duty 24 hours per day, seven days a week at the camp. Only local First Nation workers or workers from Schefferville will have the opportunity to commute to their homes by bus before and after their 12-hour shifts.

Given that the Howse Project will rely on HML's Timmins camp to accommodate its workers, all sanitary installations (land-fill, water, sewage, etc.) will remain the same and will not need to be upgraded. Electricity supplies will continue to come from the Menihek Generating Station surplus and will be sufficient to meet the needs of the Howse Project. The rest of the needs will be filled by diesel generators. Accordingly, the energy needs of the Howse Project will have no negative effects on Schefferville, MLJ and Kawawachikamach electricity supply (NML and PFWA, 2009).

Some of Schefferville's infrastructure is currently being used for HML's DSO project, and its use should remain stable with the construction and operation of the Howse Project, as it will maintain rather than increase the production level of HML's DSO project.

For instance:

- workers are flown in and out to/from the Schefferville airport. The number of workers who transit via the airport will not increase once the Howse Project is in construction or operation;
- workers will be accommodated at Timmins camp site; and
- however, the workers who transit via the airport also use the local road network to and from airport. Pick-up trucks do generate dusts and come into the city with dirt from the

mine site. A wash bay has been built at the mine site to minimize the effects of dust coming from the mine site into the communities. It operates between May and October, and can be used by all vehicles. In addition, during dry periods, a water truck will be used to minimize the dust generated by the vehicles.

Infrastructure in Kawawachikamach will not be affected as it is located further from the mine site. Only Naskapi workers will return to their homes after work.

This also applies to the community recreational infrastructure. Aside from special events held in collaboration with HML, such as hockey tournaments, workers housed at the Timmins camp will not be using the recreational infrastructure located in MLJ, Schefferville, or Kawawachikamach.

Accordingly, the Howse Project should not have negative effects on the availability of local services and recreational infrastructure for the residents. The same observation is valid for the facilities of the RSA (Wabush and Sept-Îles airports for example). This subcomponent is thus not retained as a VC.

Housing in the LSA

Schefferville has a limited capacity for housing, which is also the case for MLJ and Kawawachikamach. When the mining industry was booming in 2011 and 2012, finding temporary or long-term accommodation in Schefferville was difficult. The Howse Project should not have an effect on housing in Schefferville, given that all workers will be accommodated at the Timmins camp. In cases of the camp being temporarily overbooked, HML also has its own accommodations in Schefferville. HML has also booked a number of rooms at the recently built Innutel, which is a positive economic benefit for MLJ.

The Howse Project will have little if any effect on housing in the LSA, and housing is thus not considered as a VC. Given that there will be no need for an additional workforce in Sept-Îles, there will be no effect on housing in the RSA either.

Maintenance of Social Stability

"Social stability can be threatened when a transient labour force, especially one composed primarily of highly paid and predominantly single men, takes up residence in or near a small community, especially an Aboriginal one. The danger of such tensions is especially great when the transient workers have more disposable income than local residents" (NML and PFWA, 2009). This is especially true when workers are accommodated within communities, and these interaction need to be thoroughly assessed (IFC and EBRD, 2009).

In the particular case of the Howse Project, the Timmins camp is located in Labrador, 25 km from Schefferville and Matimekush, and has been in place for the past three years. During this time, very few relational incidents have disrupted social stability in Schefferville, MLJ or Kawawachikamach. Disturbances have been associated with the traffic and dust generated by the current mining projects in the area. The fact that the workers for the Howse Project will live at camp, and will work 12-hour shifts reduces the risks of social disturbances. Workers who transit between Schefferville and the camp are transported by bus, along with the workers from MLJ and Kawawachikamach. A zero tolerance policy for alcohol and drugs at the camp has also been established and enforced for safety reasons.

Interviews with the SQ officer in Schefferville and with the NNK Police force confirmed that most of their interventions in Schefferville, MLJ and Kawawachikamach are not related to the presence of workers, but more to alcohol abuse, family violence or mischief (Martin 2014, *personal communication*); Bouchard 2014, *personal communication*). Incidents at the camp are rare, but nonetheless, an agreement was recently signed between the Québec and Labrador police forces, giving full powers to Québec's SQ officers to intervene in Labrador when necessary. This agreement was signed on August 31, 2014. Both officers interviewed indicated that a long-term collaboration with HML has been established. An example of this collaboration is the adoption of a Joint Committee on Emergency Measures in which HML will be involved (Chapter 4).

Given the current limited effects on social stability and the measures in place to contain and minimize these effects, the maintenance of social stability is not considered as a VC.

Access to the Local Transportation Network, Access to Land, and Road Safety

As described in above, the local transportation network located northwest of Schefferville is currently used by HML and the local population. Several concerns were raised regarding the road network and its safety in relation to the conflicting types of uses – industrial versus recreational/subsistence activities – and these roads provide access to harvesting lands for both the Innu and the Naskapi (Figure 4-1: Rosemary Lake area, Goodwood area, Greenbush, for example). Accordingly, this subcomponent is considered as a VC and includes a set of issues that are intrinsically linked: the road network has become important in the practice of harvesting activities, especially in a context where land-users have less time to dedicate to these activities. In turn, given the multiple uses of this road, safety issues are becoming a concern, especially for harvesters. At the request of local First Nations Communities, the proponent has upgraded existing IOCC roads and therefore made available the Timmins-Kivivik bypass road since August 2015, which helps in reducing safety issues that relate to the multiple uses of the main road.

7.5.3.4.1 Component Description

LSA, RSA and Temporal Boundaries

The LSA includes the NNK, NIMLJ and the town of Schefferville, located in the province of Québec. The RSA is where the anticipated project effects are expected to be indirect and to have low levels of influence on the component. For this component, this area includes Labrador West (Labrador City and Wabush), Sept-Îles, and Uashat and Mani-Utenam (ITUM).

The temporal boundary for this component includes up until the end of the Decommissioning and Reclamation phase of the Project, as this is when the Howse Project will no longer have an influence on the LSA as the sources of effects will not be operative.

LSA

<u>NNK</u>

Housing

In 2011-2012, Kawawachikamach had 167 housing units (NNK, 2014), where an average of 3.9 people lived (Statistics Canada, 2011). According to APNWL, a total of 162 units existed in 2014, with an average household size of 5.3 persons per unit. Houses are owned by the NNK Band Council. Since the building of the community at the beginning of the 1980s, an average of three to four houses have been constructed every year (NNK, 2014). Beneficiaries of the Social Assistance Program pay a rent of $100/month, while other tenants pay $40/week, an amount that has remained unchanged since 1983.

Kawawachikamach is undergoing a shortage of housing, and new houses are allocated on a first-come, first-served basis, according to a list held by the Band Council. At the end of the 2013-2014 fiscal year, the list contained 130 requests for houses, and the oldest request dated from 1997. According to APNQL, in 2014, needs for new dwellings were estimated at 200. Some of the applicants currently live outside the community (NNK, 2013). Each year, 10 to 15 houses are renovated, and two new houses are built (Corbeil 2014, *personal communication*).

Transportation

Kawawachikamach is located approximately 25 km from Schefferville, to which it is connected by road. This road link provides Kawawachikamach with access to the QNS&L railway and the Schefferville's airport infrastructure. NNK is responsible for the maintenance of the road that connects Schefferville to the Reserve.

Community Services

Generally, the Department of Public Works (DPW) is responsible for the maintenance of the community infrastructure, shown in Table 7-127.

Table 7-127 NNK-owned Buildings, 2014

NNK BUILDINGS	COMMENTS
Municipal Garage	Built in 1981; renovated in 1999
Water Pumping Station	Built in 1982; Renovated in 2006
Sewage Pumping Station	Built in 1982
Building for Sewage Lagoons	Equipment upgraded in 1992-1993
Nation Office	Built in 1986; renovated in 2001-2002
Filling Station	Built in 1989
Radio Station	Built in 1993
Police Station	Built in 1995; rebuilt in 2001-2002
Ice Rink Changing Room	Built in 1996
Sachidun Childcare Center	Converted into childcare center in 1997; renovated in 2001
Dolly Ridge Tower and Equipment Shed Fire Station	Purchased in 1998
Jonathan Shecanapich Memorial Fire Station	Built in 1999
Recreation Facility	Completed in 2001
Community Center	Built in 2002-2003
Air Schefferville Hangar	Purchased in 2007-2008
Naskapi Miiywaayimuun Miichiwaahp	Purchased in 2008-2009; located in Sept-Îles
CLSC Personnel Residence	Built in 2009-2010
New Municipal Garage	Built in 2011-2012
Wastewater Technician Building	Built in 2012-2013
Habitaflex II – Two (2) Units	2 modular units purchased and erected in Schefferville

Source: NNK, 2014

Kawawachikamach has its own police force according to an agreement between the Cree Regional Authority (CRA) and the governments of Québec and Canada (AANDC, 2014). The Kawawachikamach police force is composed of five constables and one auxiliary helper (Martin 2014, *personal communication*). In 2013-2014, eight people were employed by the Naskapi Police Force (NNK, 2014). The police are equipped with five vehicles, including a snowmobile, an all-terrain vehicle, two pick-up trucks and one four-wheeler (NNK, 2014).

The NNK has a Volunteer Fire Department Service that is run by a Fire Chief, an Assistant Fire Chief, a Director, and a total of total of 20 Naskapis volunteer firefighters. The fire station is equipped with one truck and regular firefighting equipment. Six fires/accidents were recorded in the last fiscal year (NNK, 2014). Kawawachikamach, MLJ, and Schefferville have now completed the development of a joint emergency preparedness plan to make collaboration easier for all types of emergencies; HML is a participating member (see Chapter 4).

Kawawachikamach has a recreational centre that includes an outdoor ice rink, a swimming pool, a gymnasium, a workout room and a baseball field (NML and PWFA 2009). The center employs six people permanently (NNK, 2014). The pool was closed during the 2013-2014 fiscal year, and repairs took place in late summer 2014 (NNK, 2014). Construction of a new arena has begun.

The Naskapi Community Center offers a range of activities for young Naskapis, including Girl Guides, family reunions, community feasts and gatherings, and festivities of all sorts. It employs a manager, and assistant manager, a janitor and youth animators, and it is equipped with a multi-purpose room, a small library, and is home to the Youth Center. The Youth Center is a place for young people to "hang out", and is equipped with a pool table, several games, and computers with internet connection (NNK, 2014).

A summer day camp for kids and teenagers aged 5 to 14 years old takes place during the warm season. Approximately 80 children attended the camp in 2013, and 19 staff prepared and supervised the activities. Other recreational activities for youth included the summer and winter circus camps, and the winter carnival (NNK, 2013).

<u>NIMLJ</u>

Housing

According to Statistics Canada, there were 200 housing units in MLJ in 2011. On the other hand, statistics from the APNQL for 2014 state that there are 188 units in MLJ, with an average size of household of 3.9 person/unit, and a need for 112 new dwellings. The housing backlog in MLJ is an important issue for the community (APNQL, 2014).

The Hotel Innutel Rodeway, built in 2013, provides temporary lodging in Matimekush. It has 30 rooms.

Transportation

Matimekush is located within the limits of Schefferville, and therefore shares its road, rail and air connections. Lac John is connected by road to Schefferville and Matimekush, as it is located on the road to Kawawachikamach.

Tshiuetin Rail Transportation (TSH) belongs to the NNK, NIMLJ and ITUM. Since 2005, TSH has managed the portion of the QNS&L railway located between Emeril Junction (Labrador West) and Schefferville, a distance of 200 km (TSH, 2014). The train station in Schefferville employs five people on a permanent basis (TSH, 2014). It is equipped with a maintenance garage (built in 2007). The service is available for both passengers and freight. The passenger train stops at every station along the way (Cordova 2014, *personal communication*).

Freight transportation is the most important business for TSH. It is expected that over 9 Mt of iron ore will be transported yearly by 2015, which should create and maintain approximately 15 permanent jobs and 40 seasonal positions and generate substantial revenues for TSH shareholders. In order to be up to the task, TSH hopes to invest $75 million in the next 10 years to rehabilitate its rails. Funds would come from the mining industry and from the provincial and federal governments (Industrie Québec, 2012). HML and LIM have jointly invested over $21 million for improvements to the railway operated by TSH.

TSH also provides passenger and freight rail service between Schefferville and Sept-Îles. TSH currently transports less than 1 Mt of freight annually but can carry up to 8 Mt every year (Cordova 2014, *personal communication*). Between 120 and 164 freight cars are currently used for each trip. The passenger train has priority over the freight train, the latter using the sidings to allow the passenger train to pass on the main line. The passenger train makes about 104 round trips every year, carrying between 15,000 and 17,000 passengers per year (Cordova 2014, *personal communication*).

Community Services

Some community services in MLJ are shared with Schefferville (sewage, waste disposal, roads, water, etc.). The *Sûreté du Québec* (SQ) based in Schefferville currently provides police services to the NIMLJ community (NML and PWFA, 2009).[25] Fire protection services are provided by the municipality of Schefferville (Nametau Innu, 2014), as are sewage services (NML and PFWA, 2009).

MLJ is equipped with a community center, a community radio, a church, an arena, a library and a gymnasium. The arena was recently renovated. The Youth Center provides a space where youth can meet up, hang out, and benefit from the cultural and recreational activities that are periodically organized. The Youth Center offers the Ushu summer camp, which proposes outdoor activities to demonstrate the value of traditional activities and Innu culture to the young people of the community. The camp is offered to kids aged between 5 and 17 years old.

Schefferville

Housing

After the closing of the IOCC, many houses in Schefferville were destroyed. In 2011, there were 178 private dwellings in Schefferville (Statistics Canada, 2011). The municipality experienced an economic boom in 2011-2012 due to mining activities, which caused a shortage of housing, both for long-term and short-term accommodation. At the moment, the city cannot expand its territory further for the construction of new houses, as all of the lots have been bought.

Three hotels provide short-term accommodation in Schefferville:

- Hotel/Motel Royal;
- WedgeHills Lodge; and
- Hotel Auberge Guest House.

Hotel occupancy data for hotels in the region are unavailable.

Transportation

Schefferville's road network is not connected to any provincial roads. Locally, Schefferville has an 8-km "network of all-weather" gravel roads that were built back in the 1950s. This network reaches Kawawachikamach and was extended to include Matimekush at the end of the 1990s. The municipality maintains and upgrades the road network, which is connected to the Schefferville airport and train station. HML has entered into discussions with the Québec Government to support an initiative for the pavement and rehabilitation of the local municipal roads. According to information received from the Québec Government, it is possible that road pavement work could begin in the summer of 2016.

Another set of roads covering approximately 200 km were built during the IOCC mining operations and have been left unmaintained since 1982, except for those located within the municipality. These "historic roads" are nonetheless still used by the residents of Schefferville, MLJ and Kawawachikamach. They may be used by pick-up trucks and ATVs in the summer, or snowmobiles in the winter. Some of these roads are also located within the Howse Property LSA (see Figure 7-37).

Schefferville is equipped with an airport that belongs to Transport Canada (TC) but is managed by the Schefferville Airport Corporation, jointly owned by the NNK and NIMLJ. The terminal was built in 1971, and there is a paved runway, a fire hall and a garage (NML and PWFA, 2009). Air Inuit is the main user of the Schefferville Airport, and operates flights between Sept-Îles and Schefferville on a daily basis, and two flights a week between Schefferville and Québec and Montréal. Provincial Airlines also offers regular flights, with one commercial flight between Wabush and Schefferville three days a week. Air Inuit, and Max Aviation provide charter flights as required. Nolinor also provides services, mostly for HML.

[25] The costs of the SQ services in Aboriginal communities have increased by 60% over the last 10 years (Radio-Canada, 2012h)

Community Services

Police services are provided by the SQ, with six police officers: the director and five patrolmen (Bouchard 2014, *personal communication*). Two full-time officers are on call 24 hours/day, seven days/week, in addition to their official daily work hours five days a week. If interventions are needed outside these hours, a dispatch service located in Baie-Comeau will call the officers on duty. The SQ also provides services for Matimekush and may occasionally provide support to the Naskapi police force (NML and PFWA, 2009). As of August 31, 2014, SQ officers are also sworn special constable of Labrador, which gives them the authority to intervene in emergencies and preliminary investigations in Labrador without having to ask the permission of Labrador City police officers.

Firefighting services in Schefferville also extend to Matimekush, which shares the costs of the services. Recruitment of volunteer firefighters is a significant challenge, as is supporting the costs related to upgrading equipment to government standards and training new volunteers (NML and PFWA, 2009).

The Schefferville waste disposal site is also used by the NNK and NIMLJ. The site was expected to last 21 years, but in the absence of a waste management plan, its lifespan is decreasing, as some of the waste is not appropriate for this kind of disposal. Another waste disposal site is reserved for old vehicles.

Schefferville's drinking water directly comes from Knob Lake (MDDELCC, 2014). The water gravitates to the pumping and chlorination station, and the water is distributed to both Schefferville and Matimekush. A new wastewater treatment system was built in 1999. The current water and sewage system dates back to 1955.

RSA

<u>Labrador West</u>

Transportation

The communities of Labrador West and Sept-Îles are far from the proposed Howse Property, but workers, materials and equipment for the Project will likely move through Labrador City and Wabush. This section discusses regional services that may be relevant to the population and industry of the Schefferville area. Current operations in the Sept-Îles area will not change if the Project is approved.

The Labrador West transportation infrastructure includes a road / highway network. The Trans Labrador Highway (Route 500) extends from Happy Valley/Goose Bay to the Québec border west of Labrador City. This highway does not connect to the Schefferville area.

The QNS&L connects Labrador West and Québec but not the Canadian rail network. The QNS&L transports iron ore products, goods and freight for other enterprises in Labrador West (IOCC, no date). QNS&L is a common rail carrier and each company that uses the system manages its own rail cars. Again, passenger rail service is available from Schefferville to Sept-Îles on TSH's rail service and is provided by TSH.

Wabush Airport is operated by Transport Canada, with commercial flights offered by: Air Canada, Air Canada Jazz, Provincial Airlines, Air Inuit, Pascan Aviation and Air Liaison. Private charters also use the Wabush Airport (TC, 2013). The airport provides connections to points within Newfoundland and Labrador and Québec (Figure 7-37).

Aircraft and passenger traffic have both increased at Wabush Airport due largely to strong mining industry and construction activity (Table 7-128). Passenger movements increased by 82% between 2004 and 2010 (TC, 2010; 2013). The total number of passenger movements exceeded 200,000 in 2012 (Dooley, 2013).

Table 7-128 Wabush Airport Passenger Movements (2004-2010)

YEAR	2004	2005	2006	2007	2008	2009	2010
Passenger Movements	54,756	57,993	67,180	71,344	86,416	78,078	99,579

Source: TC, 2010

Aircraft movements at Wabush Airport reached 25,910 in 2012 (tripled since 2009) (TC, 2013a). Aircraft movements increased most noticeably from May to October (Table 7-129). Transport Canada has developed a plan for improvements to Wabush Airport. Note that since the closure of Wabush Mines in December 2015, this traffic may be altered.

Table 7-129 Wabush Airport Aircraft Movements (2010-2011)

MONTH	2010	2011	CHANGE (%)
January	741	959	29
February	789	1,060	34
March	868	1,260	45
April	795	1,098	38
May	856	1,325	55
June	1,004	1,659	65
July	850	2,064	143
August	1,134	2,182	92
September	1,228	2,183	78
October	1,244	1,904	53
November	1,227	1,642	34
December	927	1,388	50
Total	11,663	18,724	61

Source: TC, 2013

Community Services

Labrador West is served by the Royal Newfoundland Constabulary (RNC) through a detachment in Labrador City. Firefighting services are provided by combined professional and volunteer municipal fire departments. Emergency response teams are available at each of the mining sites (LIM 2009). Beverly Lake and Ouananiche Lake respectively provide the municipal water supply to Labrador City and Wabush. As indicated in Chapter 4, an inter-provincial agreement now allows the Québec SQ to intervene in the Schefferville area when the reason for intervention is located in Labrador. These interventions, however, have to be reported.

Solid waste is sent to an incinerator. A study was commissioned to determine whether Labrador should develop one super-site to accommodate all of the garbage from Labrador West and East. In the meantime, the Labrador West regional waste management committee is considering setting up a temporary landfill at an old dump site (LIM, 2009).

Electricity is provided to Labrador West by NALCOR. Industrial sites and communities are connected to technologies and telecommunications with advanced fiber optic cables (Labrador West, 2014).

Uashat mak Mani-Utenam

In 2011, the national census showed a slight increase in housing units, with 438 in Uashat (13 additional units built in the last two years) and 445 in Mani-Utenam (11 additional units built in the last two years). According to the APNQL, total housing units reached 942 in Uashat mak Main-Utenam in 2014.

As in many Aboriginal communities, several housing units are occupied by up to three generations (parents, children and grandchildren). New dwellings needed in Uashat and Mani-Utenam were in the order of 540 units as of 2006 and 463 in 2014. Renovation needs are also acute, with 41 dwellings needing major renovations. There are also serious concerns in terms of dwelling decontamination needs, specifically involving mold and vermiculite. In 2013-2014, six single family houses were built in Uashat and six in Mani-Utenam. Eight others were planned to be built in Uashat but were postponed (ITUM, 2014). Eleven units were approved in the Individual Section, which covers individual loans for housing, of which three were built in Uashat and four were built in Mani-Utenam. The four other approved projects were postponed until 2014-2015. Finally, the program for access to property financed one housing unit in Uashat. The community also finances a project for major renovations, with a $60,000 budget in 2013-2014 and a vermiculite decontamination program, which will start in the spring (ITUM, 2014).

Uashat and Mani-Utenam are both located in the vicinity of Sept-Îles and benefit from the same transportation infrastructure as described in Section 7.5.1. Both reserves are connected via Route 138. The QNS&L railway is particularly important to those who travel inland to carry out traditional activities. Snowmobiles and ATVs are also heavily used by ITUM members along the railway and electricity transmission lines.

Police services are provided by *Sécurité publique de Uashat mak Mani-Utenam* (SPUM). Fifteen police officers and three civilians compose the police force, including the director (Malec 2014, *personal communication*). The Band Council administers the budget for the police force. In addition, there is good collaboration with the SQ and the City of Sept-Îles.

Sept-Îles

Housing

Sept-Îles is faced with a growing population and, as a result, with a lack of housing and accommodation. According to the *Front d'action populaire en réaménagement urbain* (FRAPRU), no social housing projects have taken place in the Côte-Nord region since 1994. This lack of housing caused prices to increase, and some families living in Sept-Îles now spend more than half of their income on housing (Radio-Canada, 2013e). The vacancy rate in 2012 was 0.2%, which means that available housing is extremely rare considering that a balanced housing market has a vacancy rate of about 3% (CMHC, 2012; Le Nord-Côtier, 2013b).

As conditions for housing and accommodations tighten, prices also increase, making it more difficult for people with low incomes or newly arrived to find reasonably priced accommodation. The cost of housing has increased steadily since 2005. House prices have doubled in six years, from an average of $113,000 in 2006, to an average of $231,653 in 2012. Many reasons may explain this increase in prices: full employment, the arrival of new workers, and the scarcity of housing itself (La Presse, 2012).

The combination of the increasing cost of housing and rental accommodations and prosperous mining activity in the region is limiting the availability of housing for the needed labour force. While the municipality is supporting new housing developments, including a condominium development, the anticipated growth from expansion projects will continue to strain the housing market. Since the 2006 census, the CMHC reports that Sept-Îles has constructed over 225 new single family homes, 15 condos and three rental suites (CMHC, 2011). Between April 2013 and 2014, there was a 4.5% increase in rent and the vacancy rate increased from 0.9% to 1.1% (Desjardins, 2014).

Homelessness has emerged as a problem, yet there is only one shelter that welcomes homeless people in Sept-Îles. The Transit Sept-Îles facility receives 1,000 requests each year for housing, and houses between 250 and 300 people. Even though Sept-Îles is undergoing an economic boom, poverty remains an issue (Le Nord-Côtier, 2013c).

Transportation

Sept-Îles acts as a service center for the MRC de Sept-Rivières and the Côte-Nord region more generally, which makes it a strategic location for the economic development of the Côte-Nord region (Le Nord-Côtier, 2012a). It is equipped with a range of transportation infrastructure that includes the international airport, the Port of Sept-Îles, and Route 138, which connects Sept-Îles to Port-Cartier and to all villages of the Côte-Nord region, located on the north shore of the St. Lawrence River, as well as to Québec and Montréal. Pointe-Noire is connected by road to Route 138 and the Sept-Îles area road network.

The Sept-Îles international airport occupies a territory of 922 ha that belongs to Transport Canada. In addition to the terminal of 10,560 m^2, there are two landing strips, one control tower, fuel tanks, and a maintenance building. Several companies offer services to and from Sept-Îles: Air Canada Jazz, Air Inuit, Air Labrador, Aéro services Sept-Îles, Exact Air, and Provincial Airlines, as well as Hélicoptères Canadiens, Héli-Nord and Héli Rive-Nord (TC, 2012).

The Port of Sept-Îles dealt with 27.9 Mt of iron ore in 2012, which is a record. The port has undergone renovations to increase its capacity, the cost of which is shared by HML, New Millennium, Alderon, Labrador Iron Mines, and Champion, who all pledged to finance the installations up to $110 million. The federal government also promised a contribution of $55 million (Le Nord-Est, 2013).

The multi-user port facility is connected to the QNS&L railway. It was estimated that about 30 Mt per year of mineral travels on the railway to the port of Sept-Îles (CRECN, 2013).

Sept-Îles residents receive their water from several locations. For a majority of residences, potable water comes from Lac des Rapides, located some 15 km north of Pointe-Noire. The water pumped from Lac des Rapides serves about 25,000 people in Sept-Îles (MDDELCC, 2014). The populations of Gallix and Moisie get their potable water from underground water.

It should also be mentioned that Sept-îles has a lively network of social organizations, as well as environmental groups.[26] Centraide Duplessis is active and collects donations that are later distributed to the city's organizations. There is a homeless shelter and a women's shelter. However, shelters and kitchens lack adequate funds. For example, Transit Sept-Îles welcomed 266 people during the 2012-2013 financial year, and 7,122 meals were served. However, funds were insufficient to meet demand (Le Nord-Côtier, 2013d).

Existing Literature

The component description is based on a literature review that included recent official reports and statistics, from competent organizations and from NNK and NIMLJ annual reports, as well as press releases. Data sources have been cited where applicable throughout the text.

Data Gaps

The existing data provides a recent and exhaustive overview of the component.

7.5.3.4.2 Effects Assessment

Recommended Measures for Improvement

[26] Conseil régional de l'environnement de la Côte-Nord; Comité Zip Côte-Nord du Golfe; Corporation de protection de l'environnement de Sept-Îles; Comité de défense de l'air et de l'eau de Sept-Îles

Taking into consideration the "brownfield context" of the Howse Project, additional measures could be put in place as a proactive approach to favor social stability. Consultations confirmed that there are internal divisions within the NIMLJ and NNK with regard to mining projects. While some look forward to the economic benefits and find the presence of the mining industry stimulating and hopeful, others see it as highly disruptive environmentally and socially, and do not see the economic benefit (Chapter 4). Some community members show various degrees of disappointment with promises made and not yet fulfilled, or that took time to be accomplished (ex. the Timmins-Kivivik bypass road which was made available to First Nations since August of 2015).

In the particular case of the Howse Project, its proximity to Kauteitnat, which is culturally valued and considered as sensitive by the local population, adds another layer of complexity in terms of social and environmental disruption.

HML certainly does not have control over the community's internal issues and divisions, but does have control over how Project-related issues and activities are communicated, and how agreements are implemented, which positively contribute to social stability and the acceptability of mining projects. To this end, HML has signed IBAs with all potentially affected groups and has established mechanisms through which community members can make their concerns known (Chapter 4).

The HSE Committee, which has been put in place by HML to collaboratively oversee and assess the effectiveness and relevance of the environmental mitigation measures for the DSO Project, will also cover the Howse Project. This Committee's purpose is to provide information to the NIMLJ and the NNK on a regular basis of the economic benefits, mitigation measures, and health and safety issues.

In addition, a Regional Steering Committee on Mining issues was established as of May 2015 to oversee issues relation to mining activities in Schefferville area. This Committee meets three to four times a year and is composed of local stakeholders (Ville de Schefferville, Schefferville Airport, NIMLJ, NNK and local land-users from both communities), and of mining companies working in the area.

Some complementary initiatives to these mechanisms could further consolidate the positive relationship with HML and thus favor social stability, such as:

- employing a local Innu liaison agent;
- ensuring that the cultural training recently started for all workers, Aboriginals and non-Aboriginals continues and is repeated periodically; and
- when required, referring individuals to Aboriginal counselling services available in the local communities.

ACCESS TO THE LOCAL TRANSPORTATION NETWORK, ACCESS TO LAND, AND ROAD SAFETY

In 2014, HML recorded 27 road incidents (ranging mostly from slipping off the road to collisions). As of November 17 2015, there were 47 incidents involving vehicles and heavy equipment for 2015. The vast majority involved vehicles backing into objects or other vehicles in parking lots, and this number includes TSMC activities and contractors. Although none of these accidents caused major injuries or fatalities, they are a reminder that prevention and safety measures are required. However, these incidents represent a low proportion compared to the quantity of road traffic registered at the security point (gate): 722 locals were counted between May 2014 and April of 2015 (Table 7-130), and a total of 30 000 gate-crossings were counted in April 2015 (Figure 7-51). The total number of individuals passing the gate reached a peak of 35,000 in May of 2025, and has since stabilised at around 30 000 (until September of 2015).

Table 7-130 Number of land-users counted at HML's security point, excluding mining-related traffic between May 2014 and April 2015

MONTH / YEAR	TO/FROM GREENBUSH	TO/FROM IRONY MOUNTAIN	TOTAL
May 2014	4	57	61
June 2014	7	17	24
July 2014	29	81	107
August 2014	56	33	89
September 2014	105	91	196
October 2014	49	24	73
November 2014	13	22	35
December 2014	8	2	10
January 2015	7	6	13
February 2015	0	0	0
March 2015	7	0	7
April 2015	0	104	104
Total	285	437	722

Source: HML, personal comm.

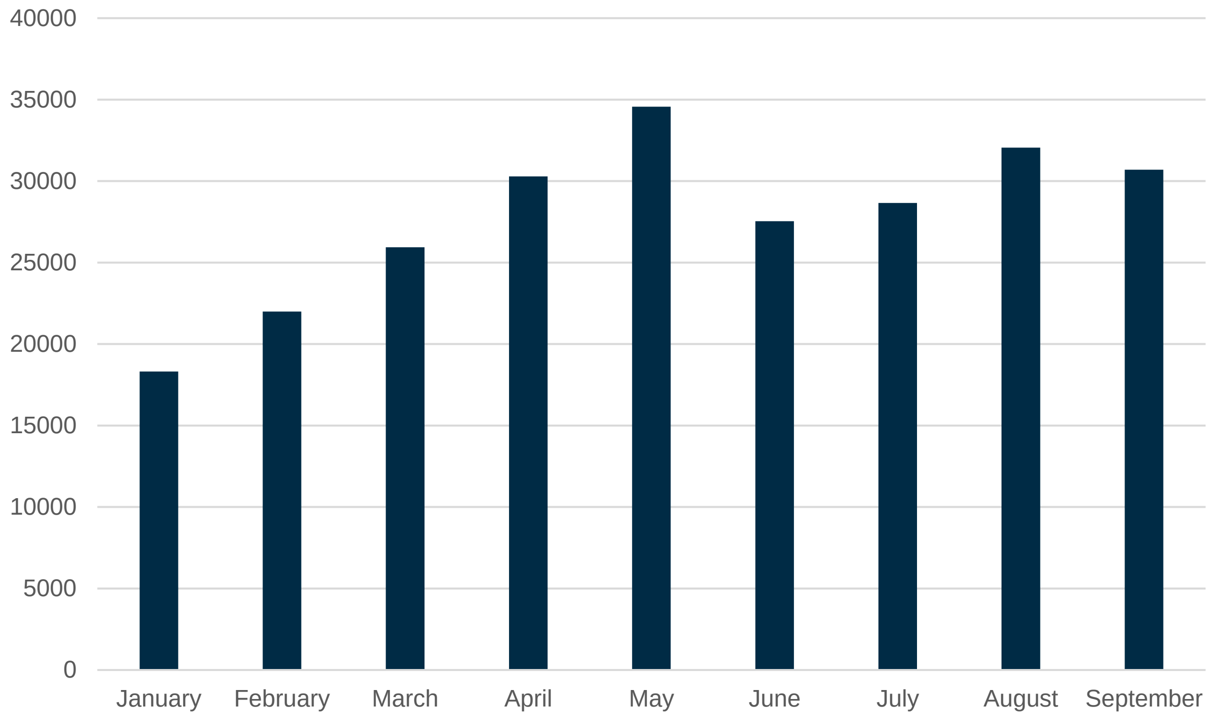


Figure 7-51 Numbers of individuals passing through the gate between January 2015 and September 2015

Several measures were put in place to facilitate access to land and to reduce risks related to mixed usage of the main road:

- the Timmins-Kivivik bypass road was upgraded in 2015 to improve access to land, at the request of First Nations. This now allows locals to avoid using the DSO Haul road and improves land access northwest of Schefferville. This road was upgraded in consultation with Aboriginal groups. As is the case with old mining roads, it will not be plowed in the winter, and the Proponent does not assume ownership of the road. However, the Timmins-Kivivik bypass road requires more time to access to some part of the territory (Rosemary Lake for example) which also involves an additional cost in fuel for the land-users;
- despite the possibility of using the Timmins-Kivivik bypass road, land-users still have the ability to use the DSO Haul road. However, for security reasons, land-users have to go through the HML security gate located at the entrance of the Timmins camp. From there, land-users who wish to continue on are escorted by security guards. While recognizing the needs for such an escort from a safety perspective, this measure is not appreciated by local land-users, who feel like they have to ask permission to circulate on their own land (Section 7.5.2.1). Users have also pointed out that the escort is sometimes not available when they need it, which causes delays. Also, there is sometimes no escort on their way back, as no mechanism has been put in place to communicate with security guards from afar; and
- the DSO Haul road is now open in the winter, which was not the case before. Aboriginal and non-Aboriginal residents now have road access to land year-round, and can access harvesting grounds without ski-doo or ATVs.

Currently, the speed limit is 70km/hour on the road leading to the Timmins camp. HML made a test by temporarily requesting its employees and contractors to reduce the speed limit to 50km per hour between Schefferville and the Timmins camp during summer, in order to reduce dust emissions and increase safety. After assessing the results of this measure, it was decided that the speed limit will be maintained at 70 km/hour on the main mining road north of the Schefferville landfill, and at 50 km/hour between the Schefferville landfill and the town of Schefferville. The speed limit will apply to all road users. Respect of applicable speed limits will be monitored by HML and by the Sûreté du Québec. Measures will be taken for detractors who are caught disobeying traffic laws.

Despite these measures, the local population continues to be concerned about the maintenance of their access to the local road network, as well as their safety while traveling on these roads. To this end, the Timmins-Kivivik bypass road was made availale starting in August 2015, as explained above. It begins just south of the Knob Lake-Timmins Railway crossing and extends to the Kivivic/Goodwood area, providing access to the Kivivic, Goodwood, Greenbush, Rosemary Lake and Howells River areas. This bypass had a positive effect for the population, particularly for land-users, since vehicle interactions with mining operations are now avoided, and since their displacements do not need to be controlled on the road anymore.

Interaction of the Project with Access to the Local Transportation Network and Land and Road Safety and Potential Effects

<u>Site Preparation and Construction Phase</u>

No potential interaction

- pit development.

Potential interaction

- upgrading/construction of the Howse haul road and upgrading of the bypass road;
- transportation and traffic.

The existing road network was built by the IOCC for the most part, and has been upgraded, in some locations, by recent mining operations. These roads were and continue to be used by the local Aboriginal and non-Aboriginal population for subsistence activities and recreation. However, prior to the arrival of mining companies in the mid-2000s, these roads were not maintained and could only be used in summer. The traffic on these roads used to be very limited (NML and PFWA 2009), but the situation changed with the increase of mining-related traffic (NIMLJ Council, NNK Council, *personal communication*, 2014). In particular, vehicle traffic increased during DSO Project construction activities, and road safety concerns were raised by the population using the area (Chapter 4).

➔ The potential effects associated with Project activities during the site preparation and construction phase are due to conflicting types of usage that **limit road access and access to the land for the local population and cause safety issues**.

The nature of the effect is indirect and the effect is adverse.

<u>Operation Phase</u>

No potential interaction

- solid waste disposal;
- hazardous waste management;
- explosives waste management;
- treatment of sanitary wastewater;
- blasting and ore extraction;
- mineral processing;
- dewatering.

These activities do not require transportation by road.

Potential interaction

- removal and storage of remaining overburden and topsoil;
- operation of waste rock dumps;
- transportation of ore and traffic;
- ongoing site restoration.

These activities will take place throughout the operation phase and require transportation of materials by road.

➔ The potential effects associated with the Project activities during the operation phase is due to conflicting types of usage that will **limit road access and access to the land for the local population and cause safety issues**.

The nature of the effect during the Operation phase is direct and its direction is negative from the perspective of land-users.

As explained above, HML recorded 27 road incidents in 2014 (ranging mostly from slipping off the road to collisions). Although none of these accidents caused major injuries or fatalities, they are a reminder that prevention and safety measures are required. Access to the land will be limited in a similar way as described during the site preparation and construction phase. Land-users will use the DSO Haul road when possible, or go through HML's security gate and be escorted for safety. But access to the land northwest of Schefferville will remain available.

The availability of the passenger train in summer was raised by some residents consulted. However, TSH has indicated that passenger service is not affected by freight, as all waiting lanes are opened (Cordova, *personal communication*, 2014).

<u>Decommissioning and Reclamation Phase</u>

No potential interaction

All Project activities during the Decommissioning and Reclamation phase have an interaction with transportation and road safety.

Potential interaction

- demobilization of Howse facilities and heavy machinery;
- transportation and traffic;
- final site restoration.

Demobilization of the Howse facilities may result in fewer disturbances caused by mining activities, but other significant mining activities will nonetheless occur nearby. The Howse access road will not be decommissioned, but the waste rock dumps will be revegetated. Locals will be able to use this road in the future.

➔ The potential effects associated with the Project activities during the Decommissioning and Reclamation phase is the progressive rehabilitation of **access to roads and land for the local population and a decrease in safety issues.**

The nature of the effect is direct and its direction is positive.

7.5.3.4.3 Mitigation Measures

Standard Mitigation Measures

The EPP contains road maintenance measures: it provides for the access road to the workers' camp to be 12 m wide, and all other site roads to be 21 m wide to accommodate large 180-tonne trucks. All roads will have a maximum gradient of 8% to prevent for freezing and slippery conditions during winter. All site roads will require regular maintenance, including grading and ditching. Regular road maintenance should limit negative effects associated with road transportation (e.g., erosion, dust). These measures will also be applied to the northern bypass road which is now in operation.

The EPP also establishes procedures for ATVs, cars, trucks and heavy equipment required for operations activities. Notably, the plan specifies that appropriate speed limits and road signage will be established and enforced to minimize environmental disturbance and accidents, and that travel in areas outside designated work areas will not be permitted.

In addition, the Timmins-Kivivik bypass road was upgraded in collaboration with Aboriginal groups and will be maintained once or twice a year. However, the road will not be plowed in the winter.

Other measures that limit road traffic were cited above and include:

- The use of the Know Lake-Timmins Railway;
- The use of a bus for local workers transportation;
- Presence of safety point (gate) and availability of safety escorts on the main mining road when needed.

Measures specific to the Construction Phase

Several measures were put in place in order to limit the traffic for the construction phase:

- Workers living in Schefferville, MLJ or Kawawachikamach are transported to and from the camp by bus.
- Once the construction of the DSO facilities has been completed, a very limited number of workers will be accommodated in Schefferville (less than current number) which will considerably limit the number of pick-up trucks on the road between Schefferville and the workers' camp. Workers mobilized for the construction of the Howse Project will be accommodated at the Timmins camp.

- The construction of the Kerail (end of 2014) has limited the number of haul trucks on the road between Schefferville and TSMC's Dome. These trucks will be used between the Howse Project and the Dome only once the Project is in operation.

Specific Mitigation Measures

To ensure land-users access and safety, a series of other measures will be put in place from the outset of the site preparation and construction phase through to the end of the decommissioning and reclamation phase:

- blasting announcements will be made on the radio 48 hours in advance of blast periods, and band councils will also be notified. Prior to any blasting, security vehicles will be present on the bypass road to protect the local population. These methods mirror those currently in place for DSO project;
- access to the mine road network will continue to be controlled for safety reasons. The DSO Haul road should not be used by the land users since a bypass road is available. If a land user needs to use the mine road network to access a specific area not accessible with the Timmins-Kivivik bypass road, HML will provide a safety escort to the land users;
- speed limit will be maintained at 70 km/hour on the main mining road north of the Schefferville landfill, and at 50 km/hour between the Schefferville landfill and the town of Schefferville. The speed limit will apply to all road users. Respect of applicable speed limits will be monitored by HML and by the Sûreté du Québec;
- HML will raise awareness among workers on the importance of safe driving. Measures are taken for detractors who are caught disobeying traffic laws and witnesses of road safety violations are asked to report details of observations;
- additional road safety signs will be installed in the spring of 2016. HML and the Town of Schefferville will install speed limit and safe driving road signs between Schefferville and Timmins work site to reinforce driving laws. The signs will clearly indicate the speed limits, and will remind users of the necessity to drive carefully, to turn off safety lights when in town;
- the Timmins-Kivivik bypass road for land-users was completed by HML in 2015, which provides access to lands to the northwest of the DSO and Howse sites. While more travel time is required, using the bypass road to access certain areas of the territory (Rosemary Lake and Pinette Lake, for example). HML is assessing a way to improve access to this part of the land; and
- collaborate with responsible authorities for local road infrastructure within the Government of Québec (Secrétariat au Plan Nord, Ministère des Affaires municipales et Occupation du territoire, Ministère des Transports) and the Town of Schefferville regarding paving of streets, including chemin de la Gare.

Information on road access and safety measures will be included in HML's radio announcements and newsletter as required (Chapter 4).

7.5.3.4.4 Residual Effect Significance Assessment

The Timmins-Kivivik bypass road was completed in August 2015 and resolved most of the issues related to conflicting usage of the mining road. The road plays an important part in ensuring the road safety of the users, as well as the other measures proposed above. However, the northern bypass road will not be maintained during winter time.

With the implementation of these measures, the magnitude of the effect on access to the local road network, access to land and road safety will be reduced during all project phases of the Howse project, since users will be avoiding industrial traffic.

The Howse Project is located in an area that has been used for mining activities since the 1950s. The road network that was built by the IOCC continues to be used by the local Aboriginal and non-Aboriginal population for subsistence activities and recreation. Importantly, the Howse Project will be inserted in a context already disturbed by mining activities. The socioeconomic context is one where the LSA will be little or not disturbed: a) the Howse Project uses a mining road located in between two mining operations and b) a bypass road exists and is used by the local population to access the land on the northwest side of the Project, and another possibility for a bypass road is being assessed.

Table 7-131 Assessment Criteria Applicable for Local Transportation Network, Access to Land and Road Safety

TIMING		
Inconsequential	**Moderate**	**Considerable**
Will not have an effect	Will have a moderate effect at times	Will have an effect at all times during all phases of the Project
GEOGRAPHIC EXTENT		
Site specific	**Local**	**Regional**
Effects are limited to the footprint of the Project.	Effects extend beyond the footprint, but do not extend outside the LSA.	Will affect a large geographic area and a significant portion of the VC within the RSA.
DURATION		
Short	**Medium**	**Long**
During all or part of Construction phase, the start-up period, a single season	Construction phase and first 24 months of Operation phase.	Throughout Construction and Operation phases and beyond.
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Full restoration of pre-development situation likely.	Partial restoration of pre-development situation likely.	Little/no restoration of pre-development situation likely.
MAGNITUDE		
Low	**Moderate**	**High**
Affects few or no people in the RSA.	Affects 5%-15% of the population in the LSA or of the activity in question and a few people in the RSA.	Affects >15% of the population in the LSA or of the activity in question and more than a few people in the RSA.
FREQUENCY		
Once	**Intermittent**	**Continual**
~Once per year	Occasional/intermittent	Year-round (continual)

Timing

With the exception of brief moments whereby traffic will be blocked during periods of blasting (1-2 hours per week), timing of land access and road safety will be inconsequential because of the existence of the Timmins-Kivivik bypass road and the proponent’s commitment to provide free access to Pinette Lake and the Howells River. (Value of 1).

Geographic Extent

The geographic extent will be local for the three phases of the project because it affects a limited portion of the VC in the LSA. (Value of 2).

Duration

The duration will be short for site preparation and construction phase, long for the operation phase and long for decommissioning and reclamation phase, as the road will remain in place for the users long after the project ends. Value of 1 for site preparation and construction; Value of 3 for operation (negative) and of 3 for decommissioning (positive).

Reversibility

The local population has been using the road network to access the territory during and after the different mining projects in the area. The negative effect is fully reversible considering the road network will remain available for the local population at the end of the project. The road network will also have been extended and made safer in some places. (Value of 1)

Magnitude

With the mitigation measures in place, the magnitude will be low (negative) for the site preparation and construction and for the operation phases given the presence of the Timmins-Kivivik bypass road. The magnitude will be moderate during and after the decommissioning phase as more locals may use the road to reach harvesting grounds. (Value of 1 for site preparation and construction and for operation (negative); Value of 2 for decommissioning (positive).

Frequency

The frequency is considered intermittent for all phases of the project. The land users access the territory seasonally (for example during the hunting season or on the week-end for recreational purpose) and usually for a short period of time (round trip in a single day). (Value of 2).

7.5.3.4.4.1 Significance

Based on the assessment, **the residual effects of the Howse Projet on Local Transportation Network, Access to Land and Road Safety will be non-significant** (value of 8, 10, and 11 for the site preparation and construction, operation and the decommissioning and reclamation phase, respectively). Further, the residual effects will be largely positive, considering that an access to roads and land for the local population will remain available and a decrease in safety issues will be noticed after the decommissioning and reclamation phase.

Likelihood

The likelihood of Howse having an effect on access to the Local Transportation Network, Access to Land, and Road Safety is low considering that the Timmins-Kivivik bypass road provides constant access to the land, and that safety escorts are available when needed on the main mining road. With the application of all measures, the likelihood of road safety incidents should be low.

7.5.3.5 Economy: Employment, Businesses and Labour Force Characteristics

Economic benefits, generally, represent the positive aspect of mining activities for affected communities. There are four subcomponents:

- availability of labour force;
- Newfoundland and Labrador benefits;
- local employment and training; and
- local contracting.

Availability of labour force

The *availability of labour force* is not retained as a VC given that most of the Howse Project labour needs will be filled by flying workers in from other regions of Québec, Labrador, and potentially other Canadian provinces. According to its NLBP, HML must to employ 60% of workers from NL. Workers already employed for the DSO will be mobilized for the Howse Project. All workers will be based at the Timmins camp.

Newfoundland and Labrador Benefits

Newfoundland and Labrador Benefits are covered under the NLBP signed with LIM, and this agreement will be updated for the Howse Project, as requested in the NL EPR guidelines. Therefore, *Newfoundland and Labrador Benefits* will not be considered as a VC.

It should be noted that the IN and NCC have their own IBA or economic partnership agreements with both LIM and TSMC, and they may join the labour force through the fly-in fly-out mode of operation.

Both *Local employment and training* and *Local contracting* are considered as VCs for the reasons explained below.

Local Employment and Training

Local employment and training is one of the most important benefits that the local population derives from mining projects, especially when taking into account the few employment opportunities available in remote areas such as Schefferville. It was one of the most important discussion themes that came up during the Howse Project consultations. Accordingly, the local employment and training subcomponent is considered as a VC.

Local Contracting

Local contracting is another way for the local population to benefit from mining projects, especially in areas where opportunities may be rare. Accordingly, the local contracting subcomponent is considered as a VC.

7.5.3.5.1 Component Description

LSA, RSA and Temporal Boundaries

The LSA includes the following communities, located in the province of Québec:

- Naskapi Nation of Kawawachikamach (NNK);
- Nation Innu Matimekush – Lac John (NIMLJ);
- Town of Schefferville.

For this component, the RSA includes:

- Labrador West (Labrador City and Wabush);
- In Québec, the City of Sept-Îles, and Uashat and Mani-Utenam (ITUM).

The temporal boundary for this component includes up until the end of the Decommissioning and Reclamation phase of the Project, as this is when the Howse Project will no longer have an influence on the LSA as the sources of effects will not be operative.

LSA

Since HML has been in operation, it has been economically involved in Schefferville area through job creation, contract opportunities, and other large and small financial contributions or donations (arena renovation, elders' gatherings, sport events, health initiatives, etc.). According to HML, stakeholder benefits to Aboriginal groups, local businesses, and communities, have reached $250 million in the past three years (Section 2.1.3). For instance, $21 million was provided to TSH for the rehabilitation of the railway, thereby creating a spinoff of approximately 60 seasonal jobs. Part of this Aboriginal workforce was later retained by HML for the construction by Innu RailCantech of the Kerail spurlines (10 seasonal jobs). HML, for its DSO project, created 700 jobs during the site construction peak, with roughly 100 of these jobs filled by employees from the LSA on a yearly basis. Table 7-132 shows the number of people employed by HML and its contractors for the month of August 2015.

Table 7-132 Number of Workers (TSMC and TSMC contractors) on the DSO Project, August 2015

	MEN	WOMEN	TOTAL
NL non-Aboriginal / Aboriginal residents	588	37	625
Québec Aboriginal residents (NNK, NIMLJ, ITUM)	103	58	161
All other	396	36	432
HML total employment (August 2015)			1218

Source: HML, 2015.

In August of 2015, 1111 positions were based at the mine site. Women represented 11% of the total labour force (130 positions) (HML, September 2015).

The local Aboriginal workers from the LSA represent 13% of the total labour force (161 positions). When including the Aboriginal from NL (38 positions), this figure reaches 16%. Aboriginal women (from all Aboriginal groups of Québec) count for 55% of the local Aboriginal workforce.

If the Howse Project does not move forward, the current 161 jobs will be lost at the local level, as well as the jobs held workers from NL and from other locations.

Members from NNK, NIMLJ and ITUM occupied several types of jobs, as can be seen in Table 7-133. Very few occupy management positions, but 53% (86 positions) occupy technical positions. Of this number, 83% are men (73 positions). Hence, 47% of the Aboriginal workers occupy non-qualified jobs. Forty-six percent of these jobs are filled by women. The most important employer in the LSA is Sodexo, a company that offers services such as catering and cleaning. Other contractors include Mamu Construction, Naskapi Heavy Machinery, ASC Innu, Nirinnu, and Distribution Pétrolière Naskinnu. Most jobs are provided by contractors. HML works with over a dozen Aboriginal contractors (members of NNK, ITUM, NIMLJ, IN, NCC and with the Inuit of Québec). Most of these enterprises are joint ventures and business partnerships between Aboriginal and non-Aboriginal businesses.

Table 7-133 Aboriginal Employees in the LSA by Job Category, August 2015

OCCUPATION	NOCC [1]	MEN	WOMEN	TOTAL
Labrador – Menihek Area				
Cleaner (Light Duty/Housekeeping)	6731	1	1	2
Coordinator - Materials/Warehouse	0731	1	0	1
Labourer/Plant Helper	7611	8	0	8
Operator (Plant)	9411	3	0	3
Sampler	7611	5	2	7
Security Officer	6541	3	0	3
Supervisor	711	1	0	1
Driver	7511	1	0	1
Crane rigger	7611	6	0	6
Loader operator	7521	2	0	2
Laborer	7611	1	0	1
Fuel delivery person	7511	5	1	6
Supervisor	7305	2	0	2

OCCUPATION	NOCC [1]	MEN	WOMEN	TOTAL
Truck Driver	7511	2	1	3
Laborer	7611	1	0	1
Cleaner	6731	2	1	3
Dishwasher	6711	4	2	5
2nd Cook	6322	0	1	1
Housekeeping	6731	0	6	7
Truck operator	7511	3	3	6
Loader/grader operator	7521	5	1	5
Manual worker	7611	5	0	5
Excavator operator	7521	1	0	1
Carpenter	7271	2	0	2
Heavy Equip Op	7521	10	4	14
H&S	2263	2	0	2
Laborer rigger	7622	1	0	1
Clerk	1211	0	1	1
Driver	7512	0	2	2
GH HSKP	4412	4	11	15
GH Kitchen	6711	13	13	27
Bus driver	7512	1	0	1
Director	16	1	0	1
Québec – Menihek Area				
Admin	1241	0	1	1
Light Duty Cleaner	6713	0	6	6
Maintenance	6663	1	0	1
Senior Director - Govt & Stakeholder Rels	0414	1	0	1
Operator	7421	1	0	1
Laborer	7611	1	0	1
Foreman	7217	3	0	3
Operator Sept-Iles	7511	1	0	1
Total		**103**	**58**	**161**

[1] NOCC (National Occupation Classification Codes) can be found at http://www5.hrsdc.gc.ca/NOC/English/NOC/2011/IndexOfTitles.aspx

When discussing the economy of the LSA, statistics on employment are a core indicator, but in this particular area, the cost of life is very high compared to other regions of Québec (Duhaime and Grenier, 2012). The analysis compared the prices of a total of 197 products, and the results show that prices in Sept-Îles and the city of Québec are similar, but that they are higher in Schefferville in the following proportions:

- food products are 64% higher;
- personal hygiene products are 84% higher; and
- domestic cleaning products are 106% higher.

These prices may partly be explained by the costs of transportation, as there is no road that connects Schefferville to the rest of the region. In fact, the costs of consumer goods in Schefferville were found to be similar to those in Nunavik, or to prices in other regions that are not connected by road to the rest of the province, such as Iles-de-la-Madeleine. Table 7-134 summarizes the prices of a selection of food items in both Sept-Îles and Schefferville.

Table 7-134 Average Prices for Selected Food Products, Schefferville - Sept-Îles, 2012

PRODUCT CATEGORY	SEPT-ÎLES ($)	SCHEFFERVILLE ($)	DIFFERENCE ($)	DIFFERENCE (%)
Fresh meat	10.79	15.31	4.52	60.9%
Dairy and eggs	3.40	4.81	1.41	40.6%
Fresh fruits	1.83	3.56	1.87	103.3%
Fresh vegetables	2.96	3.66	0.70	30.4%
Pasta	1.95	3.58	1.63	80.8%
Cereals and other products	6.81	12.92	6.10	88%
Fruit juice	1.22	2.60	1.54	130.2%
Baby food	30.00	49.91	19.91	68.2%

Source: Duhaime and Grenier, 2012:46.

NNK

Labour Force Characteristics

In 2011, Kawawachikamach's labour force (i.e., population over 15 years of age) was 405 people, 48% of which were women. The participation rate was 58%, which is similar to the participation rate in the province of Québec (64.9%). However, the unemployment rate was 29.8%, which is much higher than the provincial unemployment rate of 7.2%. The unemployment rate of Naskapi women was 40%, six times higher than the provincial unemployment rate for women (6.5%) (Table 7-135).

The Naskapi average individual income is roughly one third less than the provincial average income ($24,152 compared to $36,352). However, Naskapi women earn, on average, about $4,000 more per year than their male counterparts. Naskapi men's income is composed of their wages (81.5%) and government transfers (18.1%). The proportion of government transfers is higher in women's income (32.4%) given the transfers they receive for childcare (Table 7-135).

The main industry in which the Naskapi are involved is public administration: 63% of Naskapi men, and 35% of Naskapi women. Smaller numbers of Naskapi men are also involved in mining and oil and gas, as well as in transportation and warehousing services (9% for each category). Naskapi women are also involved in healthcare and social assistance (25%), educational services (20%), and retail trade (10%) (Figure 7-52).

Table 7-135 Labour Force Characteristics in the LSA, 2011

	KAWAWACHIKAMACH			MLJ			SCHEFFERVILLE			QUÉBEC (PROVINCE)		
	TOTAL	M	F	TOTAL	M	F	TOTAL	M	F	TOTAL	M	F
Total population aged 15 years and over by labour force status	405	210	195	375	170	205	175	95	85	6,474,590	3,170,640	3,303,950
In the labour force	235	125	105	250	120	125	155	80	70	4,183,445	2,188,555	1,994,885
Employed	165	75	85	185	90	95	140	75	65	3,880,425	2,014,810	1,865,610
Unemployed	70	50	20	65	35	30	15	10	0	303,020	173,745	129,275
Participation rate (%)	58.0	59.5	53.8	66.7	70.6	61.0	88.6	84.2	82.4	64.6	69.0	60.4
Employment rate (%)	40.7	35.7	43.6	49.3	52.9	46.3	80.0	78.9	76.5	59.9	63.5	56.5
Unemployment rate (%)	29.8	40.0	19.0	26.0	29.2	24.0	9.7	12.5	0.0	7.2	7.9	6.5
Median income ($)	17,108	16,129	19,190	19,745	17,274	19,824	-	-	-	28,099	33,148	23,598
Average income ($)	24,152	22,054	26,553	24,972	24,020	25,750	-	-	-	36,352	42,343	30,523
Total Income Composition of Population 15 Years and Over (%) in 2010												
Wages and salaries (%)	73.2	81.5	68.3	71.2	82.0	65.4	-	-	-	66.8	69.2	63.6
Self-employment income (%)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	4.9	5.5	4.1
Government transfer payments (%)	25.1	18.1	32.4	24.4	13.1	31.6	-	-	-	15.0	11.1	20.3

Source: Statistics Canada, 2011.

Note: Numbers may not add up due to rounding.

Public Sector

The Band Council employed 26 people in 2012. Of this number, 61% are women (NNK, 2013). The Department of Public Works (DPW) is also an important employer in the community. In 2012-2013, it employed 35 people in the winter, and this number increased to 110 in the summer with the construction and maintenance of community buildings (NNK, 2013). A certain number of employment opportunities are reserved for students, and 19 of them participated in the Summer Employee Program in 2012-2013 (Table 7-136).

Seasonal employment in the summer can be offered to clean up lakes, to carry out mineral inventories, to accommodate companies for impact assessments and field surveys (for mining companies, for example) and to offer internships to students (NNK, 2010).

Table 7-136 NNK Major Public Administration Employers

NAME OF EMPLOYER	NUMBER OF NASKAPI EMPLOYEES (Permanent and Seasonal)
Nation Office	27
DPW	110
CLSC*	7
NDC*	76
Jimmy Sandy Memorial School (JSMS)	50
Tshiuetin Rail Transportation Inc. (TSH)	6
Naskapi Heavy Machinery L.P.	76
Sachidun Childcare Centre	17
Kawawachikamach Energy Services Inc.(KESI)	22
Total	322

Source: * NNK, 2012; TSH; 2014; NNK, 2014.

Businesses

There is a diversified range of economic activities in Kawawachikamach. The Naskapi Development Corporation (NDC) is administered by a board composed of Naskapi beneficiaries and directors and manages the compensation funds ensuing from the NEQA. The NDC's objectives are to improve the living conditions of the Naskapi, to encourage the development of Kawawachikamach, and to encourage the education of the Naskapi people, among others (NNK, 2014). For example, the NDC provided a $25,000 grant to the local school for cultural, recreational and educational activities (NNK, 2014). In addition, the NDC currently owns the following businesses:

- Tuktu Hunting and Fishing Club;
- Naskapi Management Services Inc;
- Manikin Centre (General Store);
- Naskapi Northern Wind Radio Station
- Naskapi Adoschaouna Services (Project Management Services) (NNK, 2014).

Kawawachikamach is also home to the businesses figuring in Table 7-137.

Table 7-137 Businesses Owned in Whole or in Part by the NNK

NAME	SERVICES PROVIDED
Béton Naskinnu LP	Fresh concrete supply. Pre-fabricated concrete structures
Innu Namesu Ltd.	Drilling and blasting
Kawawachikamach Energy Services Inc.	Electrical line installation and maintenance
Naskapi Adoschaouna Services	Freight transportation and general construction contractor
Naskapi Catering Inc.	Catering and housekeeping services
Naskapi Heavy Machinery LP	Rock crushing. Civil works, landscaping. Road construction and maintenance. Mining (clearing, stripping, haulage, stockpiling, etc.)
Naskapi Imuun Inc.	Internet, telephone, radio and cellular services. Telecommunications infrastructure design and installation
Naskapi Waste Management	Collection and disposal of hazardous waste. Contaminated soil remediation. Distribution of safety products and gases (Linde)
Pimi Naskinnuk LP	Fuel supply and distribution. Construction and operation of tank farms
Tshiuetin Rail Transportation Inc.	Rail transportation (passenger, freight and ore)
X-Pijiit	Expediting and logistics services

Source: Coggan (2013)

In addition, Naskapi Miiwaayimuun Miichiwaahp is a registered company that looks after the community's elders. Elders are escorted to the Sept-Îles hospital for medical care, where they can stay at a specialized residence. During its fifth year of operation, in 2012-2013, this company provided services to approximately 527 patients (NNK, 2014).

The Naskapi Landholding Corporation "was created to own and manage the Category 1B-N land and to discharge certain other responsibilities identified in the Northeastern Québec Agreement". The NLC held one meetings in 2013-2014 (NNK, 2014).

The Community Economic Development Organization (CEDO) "is mandated by Council to prioritize the business development needs of Naskapis and Naskapi organizations. CEDO administers funds allocated to the Nation by Aboriginal Affairs and Northern Development Canada under the auspices of the CEDO Program" (NNK, 2014). In 2013-2014, CEDO supported Ecolure, Naskapi Imuun Inc. – fiber optic link and the Naskapi Waste Management Inc. equipment expenses.

A number of businesses owned by the Naskapi Nation provide employment related to mining activity (Table 7-137), yet it is difficult to assess how many Naskapis work in the mining sector. NNK also has several mining companies on or near its territory, and has developed partnerships or signed IBAs with some of them. The NNK set up a Mining Work Group in 2012 which has the mandate to identify economic opportunities, to liaise with mining companies (NML/TSMC and LIM, mostly), to prepare and implement business plans and to propose solutions to issues related to mining, among other tasks. In 2012-2013, the Mining Work Group met once and made recommendations to the council on economic opportunities prioritization, but is seems that this group is no longer active (NNK, 2014). In addition, there is a Field Training and Liaison Officer whose responsibility is to oversee the integration of Naskapi workers into mining activities (NNK, 2014).

NML and NNK started working together in the context of the LabMag Iron Ore Project (LIOP) in 2006, and NNK owns 20% of the project (LabMag Limited Partnership). Naskapi people and businesses are hired on a priority basis by NML, and a 30-year budget has been negotiated for training and contractual commitments with the Naskapis. NNK will also receive royalties on pellet production (0.3333%) (NNK, 2010). Work on the LIOP was suspended in late 2007 for political reasons, and resumed in 2011.

In 2010, NNK signed an IBA with TSMC. This IBA establishes terms for the sharing of benefits in terms of employment and business opportunities, among other things (NML, 2012). The IBA was amended in 2012 following the decision by TSMC to acquire an 80% interest in the DSO project (NNK, 2012). The Nation is benefiting from a growing number of performance-based contracts and employment opportunities with TSMC (NNK, 2014). NNK also signed an IBA with LIM in 2010 (Section 7.5.1.1).

NIMLJ

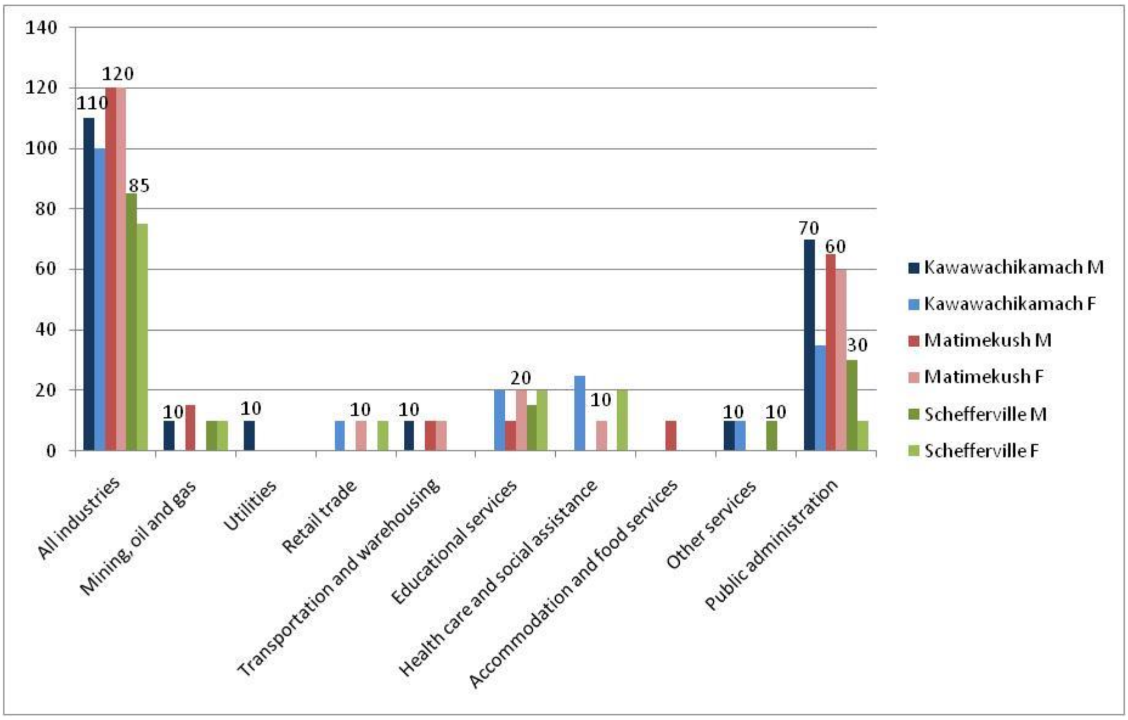
Labour Force Characteristics

The labour force in MLJ included 375 people in 2011, and 250 were "in" the labour force. This labour force is composed of almost equal percentages of men and women. The participation rate is 66.7%.

In MLJ, both men and women have a high unemployment rates: 29.2% for men and 24% for women (Table 7-135). This is higher than the average provincial unemployment rate, which is 7.9% for men and 6.5% for women for 2011.

The average individual income in MLJ is roughly one third less than the provincial average income ($24,972 compared to $36,352). Women earn slightly more than men, $25,750 compared to $24,020. Men's income is composed of their wages (82.0%) and government transfers (13.1%). The proportion of government transfers is higher in women's income (31.6%) given the transfers they receive for childcare (Table 7-135).

The main industry in which the Innu of MLJ are involved is public administration: 54% of Naskapi men, and 50% of Naskapi women. Smaller numbers of Naskapi men are also involved in mining, oil and gas (12.5%), as well as in transportation and warehousing services (8%), and educational services (8%). Naskapi women are also involved in educational services (16%), healthcare and social assistance (8%), and retail trade (8%) (Figure 7-52).



Source: Statistics Canada, 2011.

Figure 7-52 Workforce Characteristics by Industry Sector and by Gender in the LSA, 2011

Public Sector

The Band Council is the major employer of the Innu living in Matimekush-Lac John, with 80 employees from MLJ, and 60 non-Aboriginal employees, for a total of 140. Experienced labour is also hired for the health and education services provided in the community, as well as in the construction sector.

The *Corporation de Développement Économique Matimekush-Lac John* oversees the local economic development and offers programs to help create employment in the community, mostly in the public works sector.

Businesses

Businesses on the reserve include a convenience store, a pharmacy, a heavy equipment contractor, auto mechanics, camping equipment and supplies, plumbing, a gas station, outfitters, and video rental (NIMLJ, 2014).

Since 2005, NIMLJ, jointly with ITUM and NNK, manages a portion of the railway between Emeril Junction and Schefferville via TSH (TSH, 2009; Chapter 4). NIMLJ is also involved in the *Société aéroportuaire de Schefferville* for the operation and maintenance of the Schefferville Airport (NML and PFWA, 2009).

Other businesses owned or owned in part by the NIMLJ are shown in Table 7-138.

Table 7-138 Businesses Owned in Whole or in Part by the NIMLJ

NAME	SERVICES PROVIDED
Tshiuetin Rail Transportation Inc.	Freight and passenger service between Emeril and Schefferville
Société de gestion Innu	Heavy machinery rental, construction and renovation, public works
Artisanat Innu	Innu craft sales
Dépanneur MLJ	Food and convenience store
Restaurant Chez Rita	Restaurant
Transport Montagnais	Trucking and passenger service (operations suspended)
Schefferville Airport Corporation	Airport operation and maintenance
Hotel Innutel	Accommodation services

Source: Based on NML and PFWA (2009)

NIMLJ has signed two IBAs with mining companies: one with LIM (2010) and one with TSMC's DSO project (Section 7.5.1.1). It is difficult to accurately assess how many NIMLJ members are currently employed by the mining industry.

Schefferville

Labour Force Characteristics

The participation rate for Schefferville is higher compared to neighboring Aboriginal communities, as well as to the provincial rate: 88.6% of the population over 15 years old is involved in the labour force (Statistics Canada, 2006). This reflects the fact that Schefferville's residents live there for employment purposes. The unemployment rate in Schefferville was 9.7% in 2011 (Table 7-135). There are no statistics available regarding the income of Schefferville's residents due to its small population.

Schefferville's population is generally involved in the service sector. Women work in education and health services (27% for each), as well as in mining, oil and gas, retail trade, and public administration (8% each). Men living in Schefferville are involved in public administration (35%), the education sector (18%), mining, oil and gas (12.5%) and other services (12.5%) (Figure 7-52).

Public Sector

Since mining activities ended in 1982, Schefferville's resident population has dramatically decreased, and those who stayed became service providers to the Innu and Naskapi people, or found employment in outfitting businesses and mining exploration. Consequently, the public sector does not provide many job opportunities. However, Transport Canada, the municipality of Schefferville, and the CLSC provide a limited number of jobs, to provide healthcare, transportation and other services to the communities in the area. During the last five years, mining activity has helped to diversify the economy, which includes occupations in business, management, transportation and equipment services (Table 7-139). In parallel, the decline in the caribou population has lead a decrease in the employment created by outfitters, most of which have closed or have temporarily ceased their activities.

Table 7-139 Schefferville Labour Force by Sector, 2011

OCCUPATION / SECTOR (SELECT)	EMPLOYED (#)
Health	10
Education, Law and Social, Community and Government Services	45
Manufacturing and Utilities	0
Sales and Services	30
Management	15
Business, Finance and Administration	10
Natural and Applied Sciences and Related Occupations	0
Art, Culture, Recreation and Sport	0
Trades, Transport and Equipment Operators and related	25
Natural Resources, Agriculture and Related Production	0
All Occupations	135

Source: Statistics Canada, 2011

Businesses

Employers in Schefferville include, among others:

- The Northern Store;
- Corner stores (2);
- The Hotel Royal (hotel/restaurant);
- The Guest House;
- A gas station;
- The Société de Gestion Porlier;
- The Société Fortier inc.;
- Duberco inc. (plumbing and distribution of petroleum products);
- Location Pelletier (car rental);

- Théo Mazerolle (heavy equipment rental).

Aside from the companies that are currently operating in the area (Chapter 7), several mining companies are involved in exploration activities in the Schefferville area. However, it is difficult to know how many people from the Schefferville area are employed by some of these companies, which include the following:

- Century Iron Ore Mines Inc.;
- Labrador Iron Mines Ltd.;
- Adriana Resources Inc.; and
- CapEx Ventures.

RSA

<u>Labrador West</u>

At least 50% of the DSO project employees were from Labrador in November 2014 (Table 7-132), and the vast majority of all workers were based at the camp site or in the Schefferville area (85.6%).

Labour Force Characteristics

In Labrador City, the labour force is composed of 43.7% of women according to NHS (2011). The unemployment rate is 5.2%, almost three times lower than the provincial rate in 2011 (14.6%). The unemployment rate is, however, much lower for men (2.1%) compared to women (9.1%). On the other hand, women's unemployment rate in Labrador City is lower compared to the provincial rate of unemployment for women, which is 12.4%. The participation rate is 77.5%, compared to 59.4% for NL more generally (Table 7-140).

In Wabush, the 2006 data indicates that 48.6% of the labour force was composed of women. The unemployment rate was 8.6%, almost three times lower than the provincial rate, which was, at the time, 18.6%. The unemployment rate was, however, lower for men (3.9%) compared to women (14.8%). The participation rate was 71.6% (Table 7-140).

The median individual income in Labrador City is almost twice the median individual income for the province: $45,060 compared to $25,279. Men's average salaries in Labrador City are more than twice women's average salaries ($77,196 compared to $36,410). However, this discrepancy between men's and women's salaries is also seen at the provincial level. Men's income is mainly composed of their wages (87.4%) and government transfers (3.3%). The proportion of government transfers is higher in women's income (11.6%) given the transfers they receive for childcare (Table 7-140).

The median individual income in Wabush was $36,091, with an important discrepancy between the average individual salaries for men and women: $70,784 for men compared to $14,027 for women.

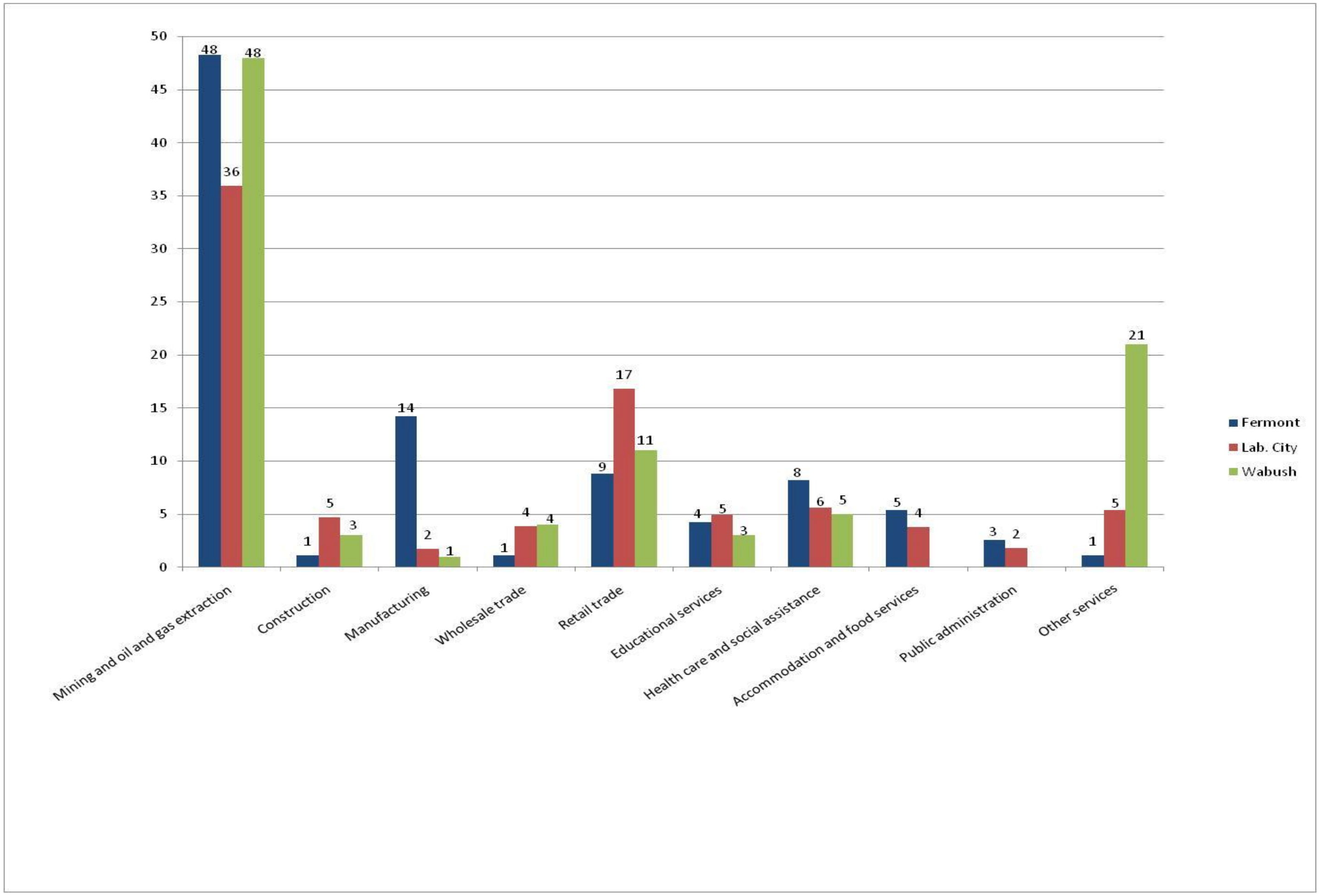
The main industry generating employment in Labrador City is by far mining and oil and gas extraction, which employed up to 36% of the population in 2011 (Figure 7-53). Retail trade is also important in Labrador City, as it occupies 17% of the workforce (Statistics Canada, 2006). The rest of the workforce is involved in similar proportions (5-6%) in the following sectors: construction, wholesale trade, education, healthcare, accommodation and food services, and other services.

The mining and oil and gas extraction is also the main employment sector in Wabush, which employed up to 48% of the population in 2006 (Figure 7-53). Other services (21%) and retail trade (11%) were also important in Wabush (Statistics Canada, 2006). The rest of the workforce was involved in similar proportions (5-6%) in the following sectors: construction, wholesale trade, education, and healthcare and social assistance.

Table 7-140 Labour Force Characteristics, Labrador City and Wabush, 2011

	LABRADOR CITY			WABUSH* (2006 DATA)			NL (PROVINCE)		
	TOTAL	M	F	TOTAL	M	F	TOTAL	M	F
Total population aged 15 years and over by labour force status	5,990	3,150	2,840	1,460	750	710	431,050	208,500	222,545
In the labour force	4,645	2,615	2,030	1,045	635	405	255,890	133,200	122,690
Employed	4,410	2,560	1,845	955	610	345	218,630	111,175	107,455
Unemployed	240	55	185	90	25	60	37,265	22,025	15,235
Participation rate (%)	77.5	83.0	71.5	71.6	84.7	57.0	59.4	63.9	55.1
Employment rate (%)	73.6	81.3	65.0	65.4	81.3	48.6	50.7	53.3	48.3
Unemployment rate (%)	5.2	2.1	9.1	8.6	3.9	14.8	14.6	16.5	12.4
Median income ($)	45,060	75,360	28,142	36,091	70,784	14,027	25,279	32,136	20,503
Average income ($)	58,041	77,196	36,410	44,467	64,675	20,958	35,089	42,479	28,062
Composition of total income in 2010 of population 15 years and over (%)									
Wages and salaries (%)	84.8	87.4	79.1	88.9	-	-	68.3	70.4	65.2
Self-employment income (%)	1.7	2.2	0.7	-	-	-	2.9	3.5	2.0
Government transfer payments (%)	5.8	3.3	11.6	4.7	-	-	19.3	16.2	23.8

Source: Statistics Canada, 2011.



Source: Statistics Canada, 2011

Figure 7-53 Workforce Characteristics by Industry, Labrador West, 2011 (2006 for Wabush)

Public Sector

The economy of the Québec-Labrador border region is dependent on a geological area known as the Labrador Trough. Interest in mining in this area continues to increase as a result of the global demand for mineral resources, but varies according to the cyclical prices of the iron ore resource.

HML and NML are currently investing in a number of projects in the Howells River area and the former IOCC site near Schefferville. As per the Benefits Plan Agreement signed with the GNL, residents from this province will continue to make up a majority of the workforce, and Newfoundland and Labrador businesses and particularly Labrador West businesses will continue to supply goods and services to support the mining industry in the region (HML 2013a). As an example, HML has spent over $800 million during the past three years, thereby generating revenues on which governments can collect various taxes, and the proponent should generate, $200 million/year from the Howse Project at a steady rate, from which governments will be able to collect various tax revenues. In addition, HML has created 700 direct and indirect jobs for the DSO project alone, and 60% of HML's employees are from NL.

However, the mining sector has boom and bust cycles, and the recent downsizing of operations at Cliffs' installations is an example. The mining sector, however, remains the most important employer in Labrador West (Table 7-141). The reader is cautioned that the Wabush Mines Project ceased activities in December 2015.

Table 7-141 Employment in Mining Companies Operating in Labrador West

COMPANY	LOCATION	NUMBER OF EMPLOYEES
Rio Tinto IOCC – Carol Lake	Labrador City	1,100
Cliffs Natural Resources – Scully Mine	Wabush	37

Source: Labrador West, 2014

The business community of Labrador City and Wabush includes approximately 491 companies, most of which operate in the following sectors:

- Construction (14);
- General contracting (11);
- Wholesale trade and distribution (5);
- Engineering (3);
- Transportation (10);
- Health (5);
- Food services (20);
- Public services (31); and
- Banks/financial services (Labrador West, 2014).

Uashat mak Mani-Utenam

Labour Force Characteristics

Both communities have much higher unemployment rates compared to the provincial average (7.2%) (Table 7-142). The unemployment rate is 21.4% in Uashat and 24% in Mani-Utenam. In Uashat, there are virtually no differences in the unemployment rates of men and women, but in Mani-Utenam, the discrepancy between men and women is wider: the male unemployment rate is 32.1%, whereas the female unemployment rate is 17.4%. It should be mentioned that the unemployment rates in both communities have dropped since 2006, when it reached almost 40%, and was 41.5% for men in Mani-Utenam. These numbers show that the employment situation has greatly improved since 2006, and that it is possible to find labour force in ITUM (Statistics Canada, 2011).

In 2006, women in Uashat and Mani-Utenam earned slightly higher incomes than men (Statistics Canada, 2006). However, this situation had changed in 2011: in Uashat, men's average income was $24,566, and women earned an average of $19,316. In Mani-Utenam, men earned an average of $34,405, and women $21,656. This is perhaps due to the fact that men have taken on positions as qualified labour force, in the construction sector for example, whereas women continue to be involved in more traditional positions, in public administration or health and social services, for example, or in non-qualified jobs.

In Uashat and Mani-Utenam, both men and women are mostly employed in the public administration sector: 35% of women and 32% of men in Uashat, and 34% of women and 25% of men in Mani-Utenam. Women are also involved in healthcare and social assistance (18% in Uashat, 21% in Mani-Utenam), and in education services (6% in each community). In contrast, men are also mostly involved in construction (11% in Uashat, 15% in Mani-Utenam) and manufacturing (10% in each community).

Table 7-142 Labour Force Characteristics, 2011

	SEPT-ÎLES			UASHAT			MANI-UTENAM			QUÉBEC (PROVINCE)		
	TOTAL	M	F	TOTAL	M	F	TOTAL	M	F	TOTAL	M	F
Total population aged 15 years and over by labour force status	22,865	11,455	11,410	1,020	500	525	900	450	455	6,474,590	3,170,640	3,303,950
In the labour force	14,930	8,035	6,890	490	265	225	500	265	230	4,183,445	2,188,555	1,994,885
Employed	13,865	7,375	6,485	380	205	180	380	185	190	3,880,425	2,014,810	1,865,610
Unemployed	1,070	660	405	105	60	50	120	85	40	303,020	173,745	129,275
Participation rate (%)	65.3	70.1	60.4	48.0	53.0	42.9	55.6	58.9	50.5	64.6	69.0	60.4
Employment rate (%)	60.6	64.4	56.8	37.3	41.0	34.3	42.2	41.1	41.8	59.9	63.5	56.5
Unemployment rate (%)	7.2	8.2	5.9	21.4	22.6	22.2	24.0	32.1	17.4	7.2	7.9	6.5
Median income (individuals)	28,416	34,870	23,763	15,097	15,334	14,814	17,094	17,387	17,037	28,099	33,148	23,598
Average income ($)	33,499	39,929	26,790	21,889	24,566	19,316	27,945	34,405	21,656	36,352	42,343	30,523
Composition of total income in 2010 of population 15 years and over (%)												
Wages and salaries (%)	72.7	76.7	66.0	70.2	81.1	56.3	73.1	83.5	58.0	66.8	69.2	63.6
Self-employment income (%)	3.7	3.5	4.1	0.0	0.0	0.0	0.4	0.0	0.0	4.9	5.5	4.1
Government transfer payments (%)	13.9	9.6	21.3	28.2	16.3	42.8	24.1	13.5	40.7	15.0	11.1	20.3

Source: Statistics Canada, 2011

Public Sector

The Band Council oversees most economic activities, and is the most important employer in the ITUM, with approximately 400 employees (Castonguay, Dandenault and Ass., 2006). Of this number, 160 employees work in health and social services, and 87 in education.

Trapping, hunting, fishing and gathering activities are also important to the community's economy. Depending on the extent to which they are carried out, these activities may constitute significant sources of income for families (Castonguay, Dandenault and Ass., 2006).

Other public organizations that provide employment for ITUM members include the Innu culture museum, the *Musée Shaputuan*, which was founded in 1998, and the *Institut Culturel et Éducatif Montagnais* (AANDC, 2014),

Businesses

The economy in Uashat mak Mani-Utenam is mainly dependent on fishing, logging, trapping, construction, transportation, outfitting and arts and crafts. There are approximately 50 businesses (about 200 jobs) spread across Uashat and Mani-Utenam which provide goods and services in the following sectors: food industry, nutrition, tailoring, management services, landscaping, heavy equipment operation, beauty care, electrical, translation services, campground services, retail, canoe-making, commercial fishing and marine food processing, and arts and crafts.

Commercial fishing creates between 20 and 30 seasonal jobs. ITUM has a fishing fleet which is utilized in the crab, lobster, shrimp and demersal fisheries.

In December 2005, in collaboration with the Matimekush-Lac John and Kawawachikamach communities, the Uashat mak Mani-Utenam Band created Tshiuetin Rail Transportation Inc. in order to provide safe, reliable transportation services for individuals living in these Aboriginal communities (Section 7.5.2.2 for more details). The 217 km of railway connects Emeril Junction in Labrador to Schefferville in Québec (TSH, 2009). TSH employs 55 permanent and 35 seasonal staff (Cordova 2014, *personal communication*). Seasonal staff works from April to October on railway maintenance. TSH prioritizes the employment of Innu, as approximately 80% of employees are Innu. Five to six train drivers are trained every year in Sept-Îles.

Other projects are proposed by ITUM are a small-size hydropower dam, windmills, the construction of a bowling alley, a hotel, ecotourism businesses, and the renovations of Innu-owned shopping center Galeries Montagnaises. The development of tourism and recreational activities was identified as one of the most promising economic sectors. It should also be noted that ITUM has the option to develop the forestry sector given that following an agreement with the provincial government, they have 44,400 m^3 of forest that they could exploit (Castonguay, Dandenault et Ass., 2006).

<u>Sept-Îles</u>

As of November 2014, approximately seven individuals worked for TSMC for the port operations in Sept-Îles.

Labour Force Characteristics

Labour force participation in Sept-Îles is 65.3%, which is similar to that of the province of Québec (66.6%) (Table 7-142). When looking at the disaggregated data, the male participation rate is higher than for women (70.1% compared to 60.4%), but the women's unemployment rate is lower than the men's (5.9% vs 8.2%). This perhaps means that women represent a more mobile labour force that can easily find work. However, the difference between male and female average individual earnings is considerable: $39,929 for men, compared to $26,790 for women. These numbers indicate that women probably occupy non-qualified positions, while men are employed as a professional or technical labour force in high-paying industries.

Men's income is mostly composed of their wages (76.7%) and government transfers (9.6%). The proportion of government transfers is higher in women's income (21.3%) given the transfers they receive for childcare (Table 7-140).

The Sept-Îles workforce is spread across several types of industries, which may be typical of regional service centres. The most predominant industries in Sept-Îles are retail trade and healthcare and social assistance, in a proportion of 13% each. Other important sectors are manufacturing (11%), public administration (9%), and educational services (7%). The mining and gas industry, construction, and accommodation and food services sectors all employ 6% of the workforce each.

Public Sector

Public and community organizations are numerous in Sept-Îles given that it acts as a regional center for several more remote localities of the Côte-Nord. The CSSS is a major employer, as well as the Cegep de Sept-Îles and the Ville de Sept-Îles itself (Table 7-143).

Table 7-143 Top Public Sector Employers, Sept-Îles

COMPANY	NUMBER OF EMPLOYEES
Centre de Santé et Services Sociaux Sept-Iles:	
CLSC	100 - 199
Hospital and administration	500 - 999
Other services	100 - 199
Cégep de Sept-Îles	200 - 499
Centre de santé Uahsat	100 - 199
Ville de Sept-Îles	200 - 499
Hydro-Québec Trans-Énergie Manicougan Est (Sept-Îles-1925)	200 - 499

Source: Emploi-Québec, 2015

The *Centre local d'emploi* (CLE) included 1,370 enterprises employing 14,736 people in Sept-Îles in 2009. A survey carried out in 2010 involving 374 enterprises showed that 79.3% of employers were private companies, and 21% were public administrations or non-profit organizations. About 64.7% of the companies surveyed employed fewer than 19 people, and employed a total of 21.1% of the workforce. In contrast, 12.6% employed 50 or more people, yet employed 56.8% of the workforce (Emploi-Québec,[27] 2010).

[27] Emploi-Québec conducted a workforce survey in 2009 in which 374 enterprises participated.

Businesses

The most important employment sectors were commerce (27.3%), education and health (18.7%) and the tourist and cultural accommodations and activities (17.1%). The mining and forestry sectors respectively employed 5% and 3% of the labour force. At the time, 42.8% of respondents reported difficulties recruiting personnel. This was explained by two factors: the lack of competent (42.2%) or experienced (36.6%) candidates. In addition, the location of the working station (far away or isolated) mattered and was cited as 32.4% of the causes associated with difficulties in recruitment. Sixty-eight percent of the companies offered training for most job positions to deal with the lack of a competent/experienced workforce. Difficulties in recruitment mostly concerned positions related to 1) retail services; 2) operation of heavy machinery and transportation vehicles, and 3) healthcare (Emploi-Québec, 2010).

Sept-Îles has a large number of manufacturing businesses to respond to different clientele needs. Many of these companies work abroad, offering their expertise in countries such as Mexico, USA, Brazil and Russia. These companies specialize in technology, products and services aimed at the mining sector (Ville de Sept-Îles, 2014) (Table 7-144).

Table 7-144 Top Private Sector Employers in Sept-Îles, 2014

COMPANY	NUMBER OF EMPLOYEES
Aluminerie Alouette	1,000 and over
Compagnie minière IOCC inc. / Chemin de Fer QNS&L	500 to 999
Cliffs Natural Resources Division	200 to 499
Pavage du Golfe Inc.	200 to 499
Groupe de Sécurité Garda inc.	200 to 499

Source: Emploi-Québec, 2015.

The types of businesses available in Sept-Îles are listed in Table 7-144. With 54.1% of employment, aluminum fabrication and fusion businesses comprise the majority of small and medium businesses in Sept-Îles. Other important sectors include factory workshops, fish processing and metal embossing (Ville de Sept-Îles, 2014). It should be noted that TSMC invested $50 million in the multi-user dock, which translated in 1,000 jobs during its construction. With the upcoming mining projects and other projects under planning in Sept-Îles, it is expected that between 150 to 200 jobs will be created in the near future.

Existing Literature

The component description is based on literature review including recent official reports and statistics. Data sources were cited throughout the text where appropriate.

Data Gaps

The existing data provides a recent and exhaustive overview of the component.

7.5.3.5.2 Effects Assessment

VC Assessment

LOCAL EMPLOYMENT AND TRAINING

The main concerns raised during public consultations (Chapter 4) were:

- employment is desired by local people. Some participants stated that TSMC does not respect agreements regarding employment and training. There are presently only 10 Innu working. In the end, there are few Natives involved. People who have jobs are proud and generally stay out of trouble;
- there is a perception that not enough local people are employed, and that the trained employees are not necessarily hired. Local people want jobs. In the first years, Innu workers were employed, but the number of employees decreases each year;
- project is seen as an opportunity for employment of the youth;
- more training opportunities would be appreciated. Some training has been carried out, mainly heavy machinery operation. Mamu has contracts, but they employ white outsiders. Young people from the community are not contacted;
- jobs and contracts have positive effects in the communities. Job postings require potential employees to speak English, which is very limiting for Innus;
- people who work on construction site come back at night. Some have left their jobs for racism issues. There does not seem to be clear complaint mechanism at the camp;
- some workers do not know their rights (e.g., CSST). There is no labour organization for Québec workers. Cross border problems are significant;
- there is no targeted training for women, most of the work is for men. Women could be used, for example, for construction finishing stage;
- many jobs go to external people; economic development – not many Naskapis have jobs;
- many mining companies are presently active (2014): Tata, LIM, NML – but yet not many Natives are working now;
- employment makes people proud of themselves, brings personal growth and better living standards. However, can lead a person to consume more alcohol;
- people that work normally stay out of trouble or will have isolated incidents;
- those that were trained did not get the jobs and there is little on-the-job training;
- better to have more people trained and working and to have contracts – positive effects;
- there are ongoing training programs – for example, heavy machinery. Would like to see the Naskapi in qualified positions, such as millwrights, mechanics and boilers;
- there is no facility for vocational training in the area. There is the new learning center, but it is small. A proper training facility may be built in the future. There were more vocational programs during the 2-3 first years of the mine. Training has to be rotational, not the same every year – not enough clientele; and
- to avoid some problems with racism between workers, there should also be local bosses.

For the Howse Project specifically, preliminary estimates of required manpower indicate that:

- About 20 jobs will be created for a period of one to two months during the construction period; and
- About 138 new direct full-time jobs will be created during the operation phase (Table 7-145). This represents a 15% increase compared to the current number of jobs for the DSO project.

All manpower is expected to be on contract, especially for the short construction phase. The proportion of apprentices should not exceed 30% in any trade. The contractor for both the mining and processing operations will be advised to include the local population. HML and its contractors will continue to strive to employ a maximum number of Aboriginals on its Project workforce. The same targets established in HML's IBAs with the First Nations will apply to the Howse Project. If current proportions of Aboriginal employment are maintained (approximately 15%), this means that 21 additional job could be created locally during the operation phase. Table 7-145 shows that Aboriginal employees are already employed in similar positions (when compared to Table 7-133).

Table 7-145 Estimated Number of Full-Time Employees per Job Categories, Operation Phase, Howse Project

JOB CATEGORIES	NATIONAL OCCUPATION CODES (NOC)	ESTIMATED NUMBER OF EMPLOYEES
Excavator Operators	7521	8
Truck Operators	8411	40
Drill Operators	8231	4
Dozer Operator	7521	4
Grader Operator	7521	4
Water Truck Driver	7511	4
Other Operators	8411 / 7521 / 7371	24
Heavy Equipment Supervisors	7302	6
Process Plant - Operation	9211	24
Process Plant - Maintenance	9211	12
Plant Supervisors	8221	4
Others		4
Sub-total		**138**

Source: HML, personal comm.

It should be reiterated that HML is an equal opportunity employer. The WEP (Volume 1 Appendix X) signed between HML and the GNL will apply to the Howse Project. As mentioned above, over 10% of the current DSO Project workforce are women, including Aboriginal women. They are employed in both traditional and non-traditional occupations including heavy equipment operations, truck driving, surveying, metallurgy, accounting, catering and housekeeping, human resources, plant operations

In addition, bursaries from HML IBA funds are awarded to high school graduates. HML also participates at career fairs and makes in-class presentations to high school students. Furthermore, youths are also encouraged to stay in school by virtue of the fact that numerous jobs require post-secondary education and trades certification. Also, HML has in place a Cultural Awareness and Respectful Workplace training program for all its employees.

Interaction of the Project with Local Employment and Training and Potential Effects

Site Preparation and Construction Phase

All project activities have an interaction with local employment and training during the site preparation and construction phase, as all activities require a qualified labour force.

Potential interaction

- construction/upgrading of the Howse haul road and bypass road;
- pit development;
- transportation and traffic; and
- mine construction.

Considering the scale of the project and its duration, the required manpower during construction will be limited to about 20 jobs for a period of one to two months. It is expected that qualified Aboriginal and local manpower will be available to account for over 15% of the needs for the construction period.

➔ The potential effects associated with the Project activities during the site preparation and construction phase is the **maintenance of current levels of local Aboriginal employment in the LSA.**

For the site preparation and construction phase, the nature of the effect is direct and its direction is positive.

<u>Operation Phase</u>

All project phases have potential interactions with local employment and training.

Potential interaction

- solid waste disposal;
- hazardous waste management;
- explosives waste management;
- treatment of sanitary wastewater;
- blasting and ore extraction;
- mineral processing;
- dewatering;
- removal and storage of remaining overburden and topsoil;
- operation of waste rock dumps;
- transportation of ore and traffic; and
- ongoing site restoration.

As previously discussed, qualified labour in MLJ, NNK, and Schefferville is limited. The total population in the LSA is about 1,800 people, and the population aged 15 years old and above is 955 individuals (Statistics Canada, 2011; see Table 7-135). In August 2015, 160 Aboriginal people (from NNK, NILMJ and ITUM) were employed by HML or by contractors hired for the DSO project. However, there are challenges for Aboriginal employment: acquisition of essential skills, access to technical training, and recruitment and retention of Aboriginal workers (long working hours, zero tolerance policy, etc.). HML estimates that there will be a need for approximately 138 additional employees for the Howse Project operation, which means that about 20 jobs could be created locally if the current proportion of Aboriginal employment is maintained (15%). This proportion could reach up to 40% local Aboriginal employment, which would mean 55 additional local jobs.

The Aboriginal communities of the LSA are undergoing a demographic boom, and the populations of both Kawawachikamach and MLJ are young. Accordingly, there is a potential for the eventual recruitment of an Aboriginal labour force. However, care needs to be taken to ensure that young people complete their educational curriculum prior to being recruited and trained by mining companies (NML and PFWA 2009). Aboriginal women have a similar unemployment rate to Aboriginal men, and may be a promising labour pool provided that training is offered. At the moment, Aboriginal women account for 56% of TSMC's local Aboriginal labour force, and 4% of the total labour force.

Training is a key issue in terms of Aboriginal employment. Opportunities for vocational training are sporadic in the Schefferville area, and trainees often lack essential skills before enrolling in technical training. There have been initiatives to train Aboriginal workers, yet acquiring competency cards, for example, might be difficult due to jurisdictional issues between the provinces.

Although the local population welcomes the possibilities for employment, many find that the promises made with regard to training and employment were not entirely fulfilled by companies (Chapter 4). However, HML and contractors are ultimately responsible for their hiring policy and objectives and are bound to comply with the IBA provisions pertaining to hiring local Aboriginals as much as possible.

➔ Overall, the Howse Project represents an opportunity for employment in the LSA, and the potential effects associated with the Project activities during the operation phase is the **maintenance, and potential increase, of current levels of local Aboriginal employment in the LSA.**

For the operation phase, the nature of the effect is direct and its direction is positive.

It is important to note that if the Howse Project does not go ahead, current jobs may be compromised, as well as the numerous positions at the regional level.

<u>Decommissioning and Reclamation Phase</u>

No potential interaction

All Project activities have an interaction with local employment and training during the decommissioning and reclamation phase.

Potential interaction

- demobilization of Howse facilities and heavy machinery;
- transportation and traffic; and
- final site restoration.

For the decommissioning and reclamation phase, **employment will decrease**. However, in the case of the Howse Project, it is possible that most employees may be redirected to other potential mining projects including TSMC projects. This possibility, however, is theoretical and difficult to predict. Nonetheless, fewer workers will be required for the decommissioning and reclamation phase.

➔ The potential effects associated with the project activities during the decommissioning and reclamation phase is a **decrease in local employment.**

For the decommissioning and reclamation phase, the nature of the effect will be direct and its direction will be negative.

<u>LOCAL CONTRACTING</u>

The main concerns raised during public consultations (Chapter 4) were:

- economic development is a positive effects of the project. The construction sector is active again, through housing;
- mining has had a positive effect on living standards, but money has also amplified existing social problems;
- companies are investing locally but there is a perception that they could do more; and
- local people feel that most of the benefits are spent in Labrador, whereas the effects are felt in Québec.

Interaction of the Project with Local Contracting and Potential Effects

<u>Site Preparation and Construction Phase</u>

No potential interaction

All project activities have an interaction with local contracting during the site preparation and construction phase, as all sources of effects require qualified labour force.

Potential interaction

- construction/upgrading of Howse haul road and bypass road;
- pit development;
- transportation and traffic;
- mine construction.

As explained above, the labour force needs for the Howse Project site preparation and construction phase will be limited. The positive effects of the beginning of the Howse Project for contractors will mostly lie in the overall continuation of the DSO project.

➔ The potential effects associated with the Project activities during the site preparation and construction phase is the maintenance and potential increase of current levels of contracts for local businesses.

For the site preparation and construction phase, the nature of the effect is direct and its direction is positive.

<u>Operation Phase</u>

No potential interaction

All Project phases have potential interactions with local employment.

Potential interaction

- solid waste disposal;
- hazardous waste management;
- explosives waste management;
- treatment of sanitary wastewater;
- blasting and ore extraction;
- mineral processing;
- dewatering;
- removal and storage of remaining overburden and topsoil;

- operation of waste rock dumps;
- transportation of ore and traffic; and
- ongoing site restoration.

Several concerns were raised by NIMLJ, NNK and ITUM regarding contracting opportunities on the Project. One concern is that they are not prepared when competition is high, and do not always possess the required equipment. They have mentioned that local businesses should benefit from the support of mining companies in terms of acquiring the skills and equipment to be prepared and to provide adequate services. Some have mentioned that Aboriginal companies, especially the small ones or the ones that are beginning, should forego the bidding process and be prioritized over external companies.

As it was expressed for employment, there is a widespread feeling in the LSA that local companies are not receiving their share of the contracting opportunities. More precisely, there is disappointment related to the observation that local Aboriginal groups receive "small" contracts compared to other contractors from Labrador. They would like to see more capacity building for the local contractors so that they may obtain these contracts eventually.

As explained above, the contracting opportunities for the Howse Project operation phase will be key in maintaining the overall number of contracts that are given out by TSMC for the DSO project. Again, if the Howse Project does not go ahead, the current contracts awarded by TSMC for its DSO project construction and operation may not be maintained.

➔ The potential effects associated with the Project activities during the operation phase is the **maintenance, and potential increase, of current levels of contracts for the local businesses.**

For the operation phase, the nature of the effect is direct and its direction is positive.

<u>Decommissioning and Reclamation Phase</u>

No potential interaction

All project activities have an interaction with local contracting during the decommissioning and reclamation phase.

Potential interaction

- demobilization of Howse facilities and heavy machinery;
- transportation and traffic;
- final site restoration.

A **lower number of contracts** will be given out for the decommissioning and reclamation phase as activities will generally be decreasing. In addition, decommissioning and reclamation work often calls for specialized types of firms and equipment that may not be available locally.

➔ The potential effects associated with the Project activities during the decommissioning and reclamation phase is a **decrease in the number of contracts for local businesses.**

For the decommissioning and reclamation phase, the nature of the effect is direct and its direction is negative.

7.5.3.5.3 Mitigation Measures

<u>LOCAL EMPLOYMENT AND TRAINING</u>

Standard Measures

The agreements in force between HML and the GNL and with Aboriginal groups for the DSO Project provide for the maximization of employment and contracts for NL residents/NL suppliers and members/businesses of the NIMLJ, NNK, ITUM, IN, and NCC. Local Aboriginal residents (members of the NIMLJ and the NNK) with the qualifications and competencies required are given priority in employment opportunities by virtue of their proximity to the project, while NL residents and members of the three other Aboriginal groups (ITUM, IN, NCC), with the qualifications and competencies required are given subsequent priority in employment. Similarly, NL and Aboriginal businesses are given the same priority, provided that they are technically competent and commercially competitive. The same hiring and contracting priorities will apply to the Howse Project, as well as the reporting requirements. To this effect, HML will update the existing Direct Shipping Ore Project NLBP and the WEP, and its IBAs and Cooperation Agreement to include the Howse Project, for which approval by the responsible authorities will be obtained prior to the beginning of the construction. In addition, HML provides training and internship opportunities, and many opportunities for on-the-job training of all workers on-site, including Aboriginal people and women.

Specific Mitigation Measures

Although local employment has a positive effects, the significance of this effects will be increased with the following specific measures:

- continue to support the essential skills training and other technical training according to job needs, via on-the-job training and institutional training, as per IBA and government funding available;
- provide mechanisms through which Aboriginal workers may access qualified positions and obtain promotions (in progress);
- work with communities to support the delivery of early training in areas that will be required. When the construction and operation phases begin, these workers will be fully prepared and trained;
- offer an alternate schedule to local workers when operational schedules allow it;
- continue to provide on-the-job training equitably for both male and female staff;
- continue to address issues relating to project construction and operation, including employment, training and contracting, via each individual community IBA Implementation Committee;
- continue to provide Cultural Awareness and Respectful Workplace training program for workers;
- HML will ensure that all new employees have their beginner’s handbook and appropriate health and safety training;
- deliver a custom-designed training in Process Plant Operations to three Québec First Nations in spring 2015, which included English classes for Innu students. Many graduates have since been hired to work on the DSO Site;
- continue to employ women at a rate of over 10% of its Project Workforce and continue to favour women who have the required skills and qualifications;
- continue to employ Aboriginal women in non-traditional roles including heavy equipment operators, plant operators, security officers;
- continue to support Innu staff in improving their English skills on-the-job, given that the worksite is in Labrador and primarily English-speaking. English language courses will be offered on-site (to come);
- continue to prioritize Aboriginal and local contractors as much as possible;

- continue to adapt the bidding process to the size of some of the local businesses, where possible divide big contracts into smaller ones; and
- continue to provide support the creation of local businesses.

The work schedule (10 to 12 hours a day, 14 days on, 14 days off) may be difficult to deal with, especially for parents with young children. Certain employers, such as HML, may be able to offer a certain degree of flexibility in scheduling depending on, within reason, the needs of the employee and the needs of the specific department. Other options such as time-sharing between two First Nation employees are also possible. However, such arrangements must be coordinated with the relevant supervisor and according to transportation schedules, and must be discussed on a case-by-case basis.

The perception that HML is not respecting the IBA in terms of employment is shared by many in the NIMLJ, ITUM and NNK (Chapter 4). This perception could be mitigated by increasing the information that is communicated regarding the employment situation (employment opportunities and current number of employees) of NIMLJ, NNK and ITUM members. HML newsletter and radio announcements should continue to be used, and the frequency of communications could be increased.

A decommissioning and closure plan will be prepared at least five years before the end of the Project to relocate workers where possible. This plan will be an opportunity to fund other types of businesses in the area. The plan could include initiatives to diversify the economy and to establish other opportunities for employment at the local level. The employment needs for the decommissioning and reclamation phase will certainly be lower, if not nil, once the site is decommissioned and restored. The only measure that would avoid the loss of jobs at the local level would be to redirect the workers to other mining projects.

LOCAL CONTRACTS

Standard Measures

As explained above, HML will respect all agreements in force. The effect of local contracting is positive, and HML has already put in place a range of measures to help Aboriginal businesses benefit from these contracts:

- Prioritize Aboriginal and local contractors as much as possible (in place);
- Adapt the bidding process to the size of some of the local businesses, where possible divide big contracts into smaller ones (in place);
- Support the creation of local businesses (in place, on an ad hoc basis);
- Provide start-up training for new business (in place, on an ad hoc basis);
- Provide cultural training for new enterprises (provided to all contractors hired by TSMC).

Specific Mitigation Measures

The measures cited above will be continued for the purpose of the Howse Project.

- Continue to prioritize Aboriginal and local contractors as much as possible;
- Continue to adapt the bidding process to the size of some of the local businesses, where possible divide big contracts into smaller ones;
- Continue to provide support the creation of local businesses;
- Continue to provide start-up training for new business (in place, on an ad hoc basis);
- Continue to provide cultural training for new enterprises (provided to all contractors hired by HML).

Consultations for the Howse Project EIS has brought to light the perception that HML is not respecting its commitments in terms of contracting (Chapter 4). However, given the numerous Aboriginal businesses that have had contracts with HML, amounting to hundreds of millions of dollars, it seems that this perception could be mitigated by circulating enhanced information on the contracting situation. HML has included information on the matter in its newsletter, and this practice will be continued.

For the decommissioning and reclamation phase, measures already presented for local employment and training also apply: support for planning of economic diversification of the LSA, in partnership with the local leadership, would secure a future for the local businesses. In addition, local businesses will be informed in advance of the type of work and equipment that will be required for the decommissioning and reclamation phase.

7.5.3.5.4 Residual Effects Significance Assessment

LOCAL EMPLOYMENT AND TRAINING

Table 7-146 presents the criteria applicable for local employment and training for the assessment of the residual effect significance.

The suggested measures will ensure that local employment of the Aboriginal population is prioritized when possible. However, the success of the mitigation measures will be highly dependent on the efforts made to provide adequate training, support, and access to meaningful employment. Considering that training will be provided in a timely manner and measures will be taken to increase trainee success, the magnitude of the effect would positively increase, given that more local and Aboriginal workers would be employed.

This situation differs for the decommissioning and reclamation phase. The measures would help decrease the magnitude of employment loss, as a plan would be put in place to diversify the economy so that employees would have other opportunities for employment.

Table 7-146 Assessment Criteria Applicable for Local Employment and Training

TIMING		
Inconsequential	**Moderate**	**Considerable**
Will not have an effect	Will have a moderate effect at times	Will have an effect at all times during all phases of the Project.
GEOGRAPHIC EXTENT		
Site specific	**Local**	**Regional**
Affects only populations within or near the Project footprint (LSA).	Affects a limited portion of the populations within the RSA.	Affects a large geographic area and a significant portion of the populations within the RSA.
DURATION		
Short	**Medium**	**Long**
During all or part of preparation/construction phase, the start-up period, a single season	Preparation/construction phase and first 24 months of operation phase.	Throughout preparation/construction/operation phases and beyond.
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Majority of jobs created will be lost	Half of the jobs created will be preserved.	Majority of jobs created will be preserved.
MAGNITUDE		

Low	Moderate	High
Affects <5% of the population in the LSA in question and few or no people in the RSA.	Affects 5%-15% of the population in the LSA and a few people in the RSA.	Affects >15% of the population in the LSA and more than a few people in the RSA.
FREQUENCY		
Once	**Intermittent**	**Continual**
~once per year	Occasional/intermittent	Year-round (continual)

Timing

The timing for local employment and training will be considerably affected (but positively) in the LSA as there will be numerous employment and training opportunities throughout construction and operations, though reduced during the decommissioning and reclamation phase, at a time when few if any jobs in the mining industry can be found locally. (Value of 1).

Geographic Extent

The geographic extent will be local for the three phases of the project because it affects a limited portion of the VC in the RSA. (Value of 2).

Duration

The duration will be short for the site preparation and construction phase (Value of 1), long for the operation phase (Value of 2) and short for the decommissioning and reclamation phase (Value of 1).

Reversibility

The positive effect on the local employment and training is reversible as jobs created will be lost when the Project comes to an end. (Value of 1)

Magnitude

The effect will be low for the site preparation and construction phase (Value of 1 - positive) and moderate for the operation phase (Value of 2 - positive). For the decommissioning and reclamation phase the effect is considered low and negative because of employment loss (Value of 1).

Frequency

The frequency will be continual for the site preparation and construction and operation phases (Value of 3) and intermittent for the decommissioning and reclamation, given that lay-offs should occur gradually (Value of 2).

7.5.3.5.4.1 Significance

Based on the assessment, the residual effect significance will be **low** (value of 9 and sometimes positive) for the construction phase, **moderate** (value of 11, and sometimes positive) during the operations phase and **very low** (value of 8) for the decommissioning and abandonment phase.

Likelihood

The likelihood of Howse having an effect on Local Employment and Training is high considering the manpower needs for the different phases of the project.

LOCAL CONTRACTING

Table 7-147 presents the criteria applicable for local contracting for the assessment of the residual effect significance.

The measures in place will secure contracts for the local population, both Aboriginal and non-Aboriginal. However, the success of the mitigation measures will be highly dependent on the efforts made to give priority to local enterprises when they are competitive and capable of meeting the requirements for a contract. HML has already taken appropriate means to favor local entrepreneurs, and will offer a continued support during the life cycle of the project.

Table 7-147 Assessment Criteria Applicable for Local Contracting

TIMING		
Inconsequential	**Moderate**	**Considerable**
Will not have an effect	Will have a moderate effect at times	Will have an effect at all times during all phases of the Project.
GEOGRAPHIC EXTENT		
Site specific	**Local**	**Regional**
Affects a limited portion of the populations and local enterprises within the LSA.	Affects a limited portion of the populations and local enterprises within the RSA.	Affects a large geographic area and a significant portion of the populations and enterprises within the RSA.
DURATION		
Short	**Medium**	**Long**
During all or part of preparation/construction phase, the start-up period, a single season	Preparation/construction phase and first 24 months of operation phase.	Throughout preparation/construction/operation phases and beyond.
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Majority of the local contracts will be closed	Half of the local contracts will be preserved.	Majority the local contracts will be preserved
MAGNITUDE		
Low	**Moderate**	**High**
Affects <5% of the population in the LSA in question and few businesses.	Affects 5%-15% of the population and some businesses in the LSA.	Affects >15% of the population in the LSA and the majority of local businesses.
FREQUENCY		
Once	**Intermittent**	**Continual**
~once per year	Occasional/intermittent	Year-round (continual)

Timing

The timing of the Project's activities will affect local contracting (positively) in the LSA as there will be important contracting opportunities for local businesses throughout construction and operations, and the decommissioning and reclamation phases, at a time when few if any contracts in the mining industry can be found locally. (Value of 3, positive).

Geographic Extent

The geographic extent will be local for the three phases of the project because it affects a limited portion of the VC in the RSA (Value of 2).

Duration

The duration will be short for the site preparation and construction phase (Value of 1), long for the operation phase (Value of 3) and short for decommissioning and reclamation phase (Value of 1).

Reversibility

The effect on the local contracting will be reversible because the business opportunities will be very limited, or inexistent, when the Project comes to an end. (Value of 1)

Magnitude

The effect will be low for the site preparation and construction phase (Value of 1, positive) and moderate for the operation phase (Value of 2, positive). For the decommissioning and reclamation phase the effect is considered low because there needs in terms of local contracting will decrease (Value of 1).

Frequency

The frequency will by continual for the site preparation and construction and operation phases (Value of 3) and intermittent for the decommissioning and reclamation, given that the number of contract will decrease at this time (Value of 2).

Effect Significance

Based on the assessment, the residual effect significance will be **moderate** (Value of 11) during site preparation and construction phase and **high** during the operation phase (Value of 14). For the decommissioning and reclamation phase, the residual effect will be **low** (Value of 10).

In all cases, the effects of the Howse Project on local contracting are positive.

Likelihood

The likelihood of Howse having an effect on local contracting is high considering the needs for the different phases of the project and that TSMC has already put in place local procurements procedure for its current activities.

7.6 POTENTIAL RESOURCE CONFLICTS

Resource conflicts can arise when multiple users are present in the same area or if the exploitation of a resource in an area affects the quantity or quality of resources in another area. According to traditional knowledge of land-use, depending on the season, the main activities practiced by the Innu are caribou hunting, waterfowl hunting, trapping, fishing, small game hunting and plant harvesting. Irony Mountain or Kauteitnat is also an important landmark, having cultural and spiritual significance for the Innu. Few other groups and no other companies currently use the resources of the study area. Table 7-148 presents the resources available in the Project area and the potential conflicts among users.

Most of the camps in the area are now abandoned or are very small since the access roads left after IOCC operations and by exploration campaigns allows people to easily access the area and return to town in one day.

Table 7-148 Potential Conflicts over Resources Present in the Study Area

RESOURCE	POTENTIAL CONFLICTS
Surface Water	The surface water of the Project area is mainly used for recreational fishing, which is further discussed in this table under "Aquatic Fauna". Since surface water is not yet utilized by anyone for other uses, no resource conflict is expected.
Groundwater	The groundwater of the Project area is not yet utilized by anyone and no resource conflict is expected.
Caribou	Noise disturbance and loss of habitat may create a resource conflict for caribou hunting (Section 7.4.3.2). The Project and its surrounding area will be less suitable for the caribou and in the worse-case scenario, they might not use it anymore. The most direct consequence would be for migratory caribou to avoid the Project and decrease the hunting success of Aboriginals in this sector. Although it has to be noted that presence of caribou in the sector has been very low for the past five years, most probably due to the plummeting numbers of the George River herd due to as-yet unknown reasons.
Waterfowl	Goose hunting is mainly performed at the bottom of the Howells valley (around Rosemary Lake) and at Pinette Lake (Figure 4-1). The distance between the Project footprint and Rosemary Lake should prevent any adverse effects on goose hunting in that area. There is a slight chance that geese might be scared away from Pinette Lake, but since they still use it with the ongoing DSO project, no significant change in resource availability is expected. Other waterfowls are also harvested in the study area and their situation should be similar.
Trapped Animals	Not much trapping is carried out in the study area (Section 7.5.3.5) and resource conflicts are not expected for this resource.
Fish	The aquatic fauna potentially affected by the Project is not substantial enough to create important resource conflicts with other biophysical or socioeconomic components. Fish species found within the Project area are only sparsely used by locals for recreational fishing and are not subject to commercial fishing. Moreover, special efforts were made to virtually eliminate effects on Pinette Lake so as to preserve its quality and fauna. Still, some effects on the fish community of Triangle Lake are possible (Section 7.4.9.2), but resource conflicts should be minimal as fishing is more important in Rosemary Lake, which is removed from Project effects.
Small Game	Small game hunting is mostly practiced opportunistically while carrying out other activities (Section 7.5.3.5). Since other activities are conducted in the study area, some small game hunting is likely to occasionally occur at the Project site. However, small game populations in the study area are small (Section 7.4.5) and, apart from the footprint of the Project and its immediate surroundings, no significant changes to the community are expected and resource conflicts should be negligible, although the roads through the projected footprint are currently used as partridge harvesting roads (Figure 4-1) and some conflicts regarding passage might occur.
Plant and Fruit	Fruits like blueberries, cloudberries and alpine cranberries are the plants most harvested by the locals. They used to be harvested in the Project area but locals already avoid the area because of proximity of mining activities. Activities are now concentrated closer to Rosemary Lake (Figure 4-1). Some resource conflict has therefore already occurred, but it should not intensify as few environmental effects are expected in the Rosemary Lake area.

RESOURCE	POTENTIAL CONFLICTS
Irony Mountain or Kauteitnat	Since the mountain is considered sacred by the Innus and is used to locate caribou and other hunted species from afar, free access to the site will be maintained and the informal agreement that it should be by non-locals only for scientific purposes will be respected. Therefore, no conflict is expected for this resource.

7.7 SUMMARY OF THE EFFECTS ASSESSMENT

The effects assessment on the valued components is summarized in Table 7-149. For a full list of the specific mitigation measures listed in this table, please refer to the respective sections of Chapter 7 or to Volume 1 Appendix XVI. Details concerning the areas of federal jurisdiction are presented in Volume 1 Appendix III.

Table 7-149 Summary of the Effects Assessment

VALUED COMPONENT AFFECTED	PROJECT ACTIVITY	POTENTIAL EFFECT AND DIRECTION OF EFFECT (+/-)	PROPOSED SPECIFIC MITIGATION MEASURE	TIMING	SPATIAL EXTENT	DURATION	REVERSIBILITY	MAGNITUDE	FREQUENCY	EFFECT SIGNIFICANCE	LIKELIHOOD
				Construction Operation Decommissioning and Reclamation							
Physical											
Air Quality	Upgrading/construction of the Howse haul road and upgrade of the bypass road Pit development Removal and storage of remaining overburden and topsoil Blasting and ore extraction Mineral processing Operation of waste rock dumps Transportation of ore and other traffic Solid waste disposal Ongoing site restoration	Decrease in air quality (-)	Develop a prevention plan to manage blasts generating NOx based on the Code of Good Practice prepared by the Australian Explosives Industry and Safety Group Inc. (Volume 1 Appendix XIX)	UNFAVORABLE TIMING	LOCAL	LONG	REVERSIBLE	MODERATE	INTERMITTENT	HIGH	HIGH
Noise	All activities (without blasting)	Increase in the ambient noise level (-)	Construct a berm west of the Howse crusher area Conduct four initial test blasts by a specialist in blast monitoring Review blast design continually to ensure compliance with regulations Maintain detailed blast records Implement a noise complaint process	UNFAVORABLE TIMING	SITE SPECIFIC	LONG	REVERSIBLE	LOW	CONTINUAL	MODERATE	HIGH
Noise	Blasting	Ground vibration and overpressure	Monitor a minimum of an initial four blasts with a charge per delay restricted to below 700 kg per delay	UNFAVORABLE	SITE SPECIFIC	LONG	REVERSIBLE	LOW	INTERMITTEN T	MODERATE	HIGH

VALUED COMPONENT AFFECTED	PROJECT ACTIVITY	POTENTIAL EFFECT AND DIRECTION OF EFFECT (+/-)	PROPOSED SPECIFIC MITIGATION MEASURE	TIMING	SPATIAL EXTENT	DURATION	REVERSIBILITY	MAGNITUDE	FREQUENCY	EFFECT SIGNIFICANCE	LIKELIHOOD
				Construction Operation Decommissioning and Reclamation							
Hydrography and Hydrology: Water Budget	Upgrading/construction of the Howse haul road and upgrade of the bypass road Pit development Removal and storage of remaining overburden and topsoil Dewatering Operation of waste rock dumps Ongoing site restoration Final site restoration	Modification of water budget (-)	Riprap will be installed on both sides of Burnetta Creek from the discharge point to 600 m downstream	INCONSEQUENTIAL	LOCAL	LONG	PARTIAL	LOW	INTERMITTENT	MODERATE	-
Water Quality	All activities	Water contamination by SS, color, blasting residues and fuel/oil (-)	Riprap will be installed on both sides of Burnetta Creek from the discharge point to 600 m downstream. Divert road ditch to an infiltration pond in the surrounding ecosystems	MODERATE	LOCAL	LONG	REVERSIBLE	MODERATE	INTERMITTENT	MODERATE	-
Biological											
Terrestrial Ecosystem, Wetlands and Vegetation: Wetlands	Upgrading/construction of the Howse haul road and upgrade of the bypass road Pit development Removal and storage of remaining overburden and topsoil Dewatering Operation of waste rock dumps Ongoing site restoration Final site restoration	Loss of wetlands (-)	Carry out stripping all at once instead of progressively Preserve stripped organic matter for restoration Use temporary protection mats or limit activities to winter for the work needed on Burnetta Creek	MODERATE	LOCAL	LONG	NOT REVERSIBLE	LOW	CONTINUAL	MODERATE	-

VALUED COMPONENT AFFECTED	PROJECT ACTIVITY	POTENTIAL EFFECT AND DIRECTION OF EFFECT (+/-)	PROPOSED SPECIFIC MITIGATION MEASURE	TIMING	SPATIAL EXTENT	DURATION	REVERSIBILITY	MAGNITUDE	FREQUENCY	EFFECT SIGNIFICANCE	LIKELIHOOD
				Construction Operation Decommissioning and Reclamation							
Migratory Tundra Caribou	Upgrading/construction of the Howse haul road and upgrade of the bypass road Pit development Transportation and traffic Removal and storage of remaining overburden and topsoil Blasting and ore extraction Mineral processing Dewatering Operation of waste rock dumps Transportation of ore and other traffic Ongoing site restoration Demobilization of the Howse facilities and heavy machinery Final site restoration	Anthropogenic disturbance (-) Loss of habitat (-)	Avoid areas of wildlife concentrations Monitor satellite-collared caribou around the Howse Project, and cease activities if caribou are present within 20 km of the active pit or processing complex and contact the NLDEC Wildlife Division for further instructions Reschedule work activities to avoid wildlife encounters if necessary Yield the right-of-way to wildlife	UNFAVORABLE	LOCAL	LONG	REVERSIBLE	LOW	CONTINUAL	MODERATE	-
Avifauna	Upgrading/construction of the Howse haul road and upgrade of the bypass road Pit development Transportation and traffic Removal and storage of remaining overburden and topsoil Blasting and ore extraction Mineral processing Dewatering Operation of waste rock dumps Transportation of ore and other traffic Ongoing site restoration Demobilization of the Howse facilities and heavy machinery Final site restoration	Anthropogenic disturbance (-) Loss of habitat (-)	Avoid nesting period as much as possible during the construction phase Do all vegetation stripping for areas where activities are planned in a specific year before the month of May of that year so that birds will not breed in those area Respect the Rusty Blackbird mitigation plan developed for the DSO project Reduce light intensity when weather forecasts are extreme during migration periods to minimize light attraction	MODERATE	SITE SPECIFIC TO LOCAL DEPENDING ON SPECIES	LONG	REVERSIBLE	LOW TO MODERATE DEPENDING ON SPECIES	INTERMITTENT	LOW TO MODERATE DEPENDING ON SPECIES	-

VALUED COMPONENT AFFECTED	PROJECT ACTIVITY	POTENTIAL EFFECT AND DIRECTION OF EFFECT (+/-)	PROPOSED SPECIFIC MITIGATION MEASURE	TIMING	SPATIAL EXTENT	DURATION	REVERSIBILITY	MAGNITUDE	FREQUENCY	EFFECT SIGNIFICANCE	LIKELIHOOD
				Construction Operation Decommissioning and Reclamation							
Aquatic Fauna: Fish	All activities	Sublethal and lethal effect of water contamination (-) Degradation of habitat quality by sedimentation (-) Sublethal and lethal effect of blasting (-)	Limit maximum charges of explosives to 4,500 kg between August and January and to 29,000 kg for the rest of the year	MODERATE	LOCAL	LONG	PARTIAL	LOW	CONTINUAL	MODERATE	-
Socioeconomic											
Human Health	All activities	Negative effects on human health through contamination of water, air, soil, and traditional food if consumed or inhaled (-)	None	INCONSEQUENTIAL	SITE SPECIFIC	SHORT	REVERSIBLE	LOW	ONCE	VERY LOW	-
Infrastructure and Services: Access to the Local Transportation Network, Access to Land, and Road Safety	Upgrading/construction of the Howse haul road and upgrade of the bypass road Removal and storage of remaining overburden and topsoil Operation of waste rock dumps Transportation of ore and other traffic Ongoing site restoration Demobilization of the Howse facilities and heavy machinery Final site restoration	Limitation to road access, land access and safety issues (-)	Complete the alternative road in collaboration with Aboriginal groups In the meantime, find a way for land users to have an escort for return travel, or install a traffic management system Reduce speed limits to 50 km/h between the Timmins camp and Schefferville Increase the numbers and visibility of road signs	INCONSEQUENTIAL	LOCAL	SHORT LONG LONG	REVERSIBLE	LOW LOW MODERATE	INTERMITTENT	VERY LOW LOW MODERATE	-

VALUED COMPONENT AFFECTED	PROJECT ACTIVITY	POTENTIAL EFFECT AND DIRECTION OF EFFECT (+/-)	PROPOSED SPECIFIC MITIGATION MEASURE	TIMING	SPATIAL EXTENT	DURATION	REVERSIBILITY	MAGNITUDE	FREQUENCY	EFFECT SIGNIFICANCE	LIKELIHOOD
				Construction Operation Decommissioning and Reclamation							
Economy: Local Employment and Training	All activities	Maintenance or increase in current levels of local Aboriginal employment in the LSA (+) Decrease in local Aboriginal employment after decommissioning and reclamation (-)	Continue supporting training initiatives, especially for future planned activities Offer English language instruction for Innus Continue inter-cultural training Ensure that all new employees have their beginner's handbook and appropriate health and safety training Disseminate more information on the employment opportunities available Prepare a decommissioning and reclamation plan to relocate workers when possible	INCONSEQUENTIAL	LOCAL	SHORT MEDIUM SHORT	REVERSIBLE	LOW MODERATE LOW	CONTINUAL CONTINUAL INTERMITTENT	LOW (+) MODERATE (+) VERY LOW (+)	-
Economy: Local Contracting	All activities	Maintenance of current levels of contracts for the local businesses (+) Decrease in the number of contracts for local businesses after decommissioning and reclamation (-)	Continue to give priority to Aboriginal and local contractors Adapt the bidding process to the size of local businesses Support the creation of local businesses Provide training for new businesses and cultural training for contractors hired by TSMC Support economic diversification to secure a future for local businesses	CONSIDERABLE	LOCAL	SHORT LONG SHORT	REVERSIBLE	LOW MODERATE LOW	CONTINUAL CONTINUAL INTERMITTENT	MODERATE (+) HIGH (+) LOW (+)	HIGH

VALUED COMPONENT AFFECTED	PROJECT ACTIVITY	POTENTIAL EFFECT AND DIRECTION OF EFFECT (+/-)	PROPOSED SPECIFIC MITIGATION MEASURE	TIMING	SPATIAL EXTENT	DURATION	REVERSIBILITY	MAGNITUDE	FREQUENCY	EFFECT SIGNIFICANCE	LIKELIHOOD
				Construction Operation Decommissioning and Reclamation							
Land-use and ATK: Subsistence and Traditional Caribou Hunting	Upgrading/construction of the Howse haul road and upgrade of the bypass road Pit development Removal and storage of remaining overburden and topsoil Blasting and ore extraction Mineral processing Dewatering Operation of waste rock dumps Transportation of ore and other traffic Ongoing site restoration Demobilization of the Howse facilities and heavy machinery Final site restoration	Reduction in the availability of caribou for subsistence hunting (-)	TSMC contributes to a specific compensation fund for subsistence activities through certain IBAs. HML/TSMC will pursue its financial participation in the Université Laval Caribou Research Initiative for advance research on caribou Report sighting to the HSE Committee and cease activity if caribou is nearby (details in the section on the caribou VC)	INCONSEQUENTIAL	LOCAL	SHORT LONG SHORT	REVERSIBLE	LOW	INTERMITTENT	VERY LOW LOW VERY LOW	-
Land-use and ATK: Subsistence and Traditional Activities	Upgrading/construction of the Howse haul road and upgrade of the bypass road Pit development Removal and storage of remaining overburden and topsoil Blasting and ore extraction Mineral processing Dewatering Operation of waste rock dumps Transportation of ore and other traffic Ongoing site restoration Demobilization of the Howse facilities and heavy machinery Final site restoration	Decrease in accessible subsistence activities and traditional pursuits (-) Increased costs for families' subsistence (-)	Timmins-Kivivik bypass road completed Mandate the HSE Committee to do environmental monitoring and oversee and assess the effectiveness of the relevant mitigation measures Report sightings of wildlife to the HSE Committee TSMC contributes to a specific compensation fund for subsistence activities through certain IBAs.	MODERATE	LOCAL	SHORT LONG SHORT	REVERSIBLE	LOW	CONTINUAL	LOW MODERATE LOW	-

VALUED COMPONENT AFFECTED	PROJECT ACTIVITY	POTENTIAL EFFECT AND DIRECTION OF EFFECT (+/-)	PROPOSED SPECIFIC MITIGATION MEASURE	TIMING	SPATIAL EXTENT	DURATION	REVERSIBILITY	MAGNITUDE	FREQUENCY	EFFECT SIGNIFICANCE	LIKELIHOOD
				Construction Operation Decommissioning and Reclamation							
Land-use and ATK: Preservation of and Access to Kauteitnat	Upgrading/construction of the Howse haul road and upgrade of the bypass road Pit development Removal and storage of remaining overburden and topsoil Blasting and ore extraction Transportation of ore and other traffic Ongoing site restoration Demobilization of the Howse facilities and heavy machinery Final site restoration	Destruction of the access road to Kauteitnat (-) Alteration of the landscape around Kauteitnat (-) Kauteitnat cultural symbol affected (-)	Facilitate and support the creation of a protected area for Kauteitnat	INCONSEQUENTIAL	SITE SPECIFIC	SHORT LONG LONG	PARTIAL	MODERATE	CONTINUAL	LOW MODERATE MODERATE	-

8 CUMULATIVE EFFECTS ASSESSMENT

The air quality data discussed in this chapter derives from the data presented in the federal report (Volume 2 Supporting Study E). A unique subsection (7.3.2.2.2) is provided which presents the Air Quality results in compliance with the EPR guidelines.

8.1 VC SELECTION

The following VCs were identified for the cumulative effects assessment:

The selection criteria, spatial and temporal boundaries and indicators for each VC are listed in Table 8-1. Cumulative effects are described in the respective subsections below.

Table 8-1 Selection Criteria, Spatial and Temporal Boundaries and Indicators

HOWSE VCS ASSESSED UNDER THE CUMULATIVE EFFECTS ASSESSMENT	
Air Quality	
Selection criteria	Importance for First Nations Standard provincial and federal regulatory requirement for this type of project
Spatial boundaries	520 km^2 surrounding the project
Temporal boundaries	Howse Project life (2016-2032)
Indicators	Ambient Air Quality Concentrations for criteria and non-criteria air pollutants
Water and Aquatic Fauna	
Selection criteria	Importance for First Nations (health and fishing activities); Several DSO and Taconite mining projects are concentrated in the Schefferville region, increasing the probability of cumulative effects on fish habitat and water quality.
Spatial boundaries	Howells River watershed
Temporal boundaries	1954-2024
Indicators	Water quality criteria, fish populations
Wetlands	
Selection criteria	Sensitive habitat
Spatial boundaries	Howells River watershed
Temporal boundaries	1954-2024
Indicators	Habitat integrity
Caribou	
Selection criteria	Species of cultural importance for First Nations; At-risk species; Moderate effect of the project on migratory tundra caribou; Migrating species with a wide range, likely to cross several large-project RSAs.
Spatial boundaries	Entire herd ranges
Temporal boundaries	1950s – 2024
Indicators	Individual presence/absence

Avifauna	
Selection criteria	88 species are protected by the Migratory Bird Convention or the *Species at Risk Act;* Breeding ranges of most of the bird species found in the Howse LSA also fell within the RSAs of select projects.
Spatial boundaries	RSA (30-km radius around the Howse Project)
Temporal boundaries	2016-2024
Indicators	Pairs of birds
Human Health	
Selection criteria	Importance for First Nations (health and fishing activities); Federal CEAA Guidance
Spatial boundaries	520 km2 surrounding the project (in alignment with Air Quality RSA)
Temporal boundaries	Howse Project life (2016-2032) (in alignment with Air Quality RSA)
Indicators	Chemistry (Soil, berries/vegetation, game meat, fish, air); exposure rates; hazard quotients (based on chronic exposure limits), incremental lifetime cancer risk.
Subsistence and Traditional Activities of Aboriginal Groups	
Selection criteria	Importance for Aboriginal groups (Chapter 4); Concerns regarding potential effects on harvested resources and access to land
Spatial boundaries	30-km radius around the Howse Project
Temporal boundaries	1954-2024
Indicators	Increased costs for subsistence activities; impaired access to land; absence of quality resources in the RSA
Health and Socioeconomic Conditions of Aboriginal Peoples	
Selection criteria	Importance for Aboriginal groups; Concerns regarding the potential effects on human health; Positive effects of economic benefits; Concerns regarding the maximization of economic benefits.
Spatial boundaries	30-km radius around the Howse Project
Temporal boundaries	1954-2024
Indicators	A sense that the health of the population is being safeguarded by mining companies; maintain socioeconomic benefits and ensure their maximization for the local populations and Aboriginal groups

8.2 PROJECTS AND ACTIVITIES CONSIDERED FOR THE CUMULATIVE EFFECTS ASSESSMENT

The unprecedented recent drop in iron ore prices has led to many rapid changes to the numerous iron mining projects in western Labrador. This volatile situation resulted in rapid changes to the scope of the activities and makes it difficult to confirm the current and future activities which should be included in the cumulative effects assessment. As such, several projects described below are under a temporary stoppage, with an uncertain future. In an effort to establish a realistic a baseline from which to conduct the cumulative effects assessment, we consider here all anticipated activities, even those that are currently uncertain. In this manner, we consider the worse-case scenario for the cumulative effects assessment for the Howse Project valued components.

This section presents an overview of probable projects that are located in the vicinity of the Howse Project and/or share infrastructure with the Project

8.2.1 Schefferville Area

DSO Projects – TSMC and Past IOCC Operations

Aside from Howse, other DSO projects are currently active or are planned for the near future (Table 8-2 and Figure 8-1). The site was mined by the IOCC up until 1982, and hosts 10 deposits mined by open pit (Figure 8-2). Ore is trucked to a plant for crushing, screening and washing to produce lump ore and sinter fine ores. From the plant, the ore is transported via rail to Sept-Îles, Québec, for shipment to customers. To the extent possible, the Project will use existing infrastructure or renovate/re-build infrastructure abandoned or decommissioned by other mining companies. A new multi-user deep-sea port located in Pointe-Noire was built in 2014 to accommodate the iron ore shipping needs of TSMC/LIM and other users.

Taconite – New Millenium Iron - Currently on hold.

The Taconite project consists of two deposits: the LabMag deposit located in the province of Newfoundland and Labrador and the KéMag deposit located in the province of Québec (NML, 2015). The concentrate will be transported from the mine to Sept-Îles via a ferroduct. In March 2011, NML and TSMC signed a binding heads-of-agreement regarding project development. TSMC has an option to develop one or both properties. If TSMC decides to develop only one deposit, NML will be free to develop the other deposit on its own or with some other partner. The parties jointly undertook a feasibility study that was completed in early 2014.

Recently, NML announced a new strategy to develop properties called NEWTAC.

Block 103 – Cap-Ex

Block 103 covers an area of 73 km^2 located 30 km northwest of the mining Town of Schefferville, Québec (Cap-Ex Iron Ore Ltd., 2014). The preliminary economic assessment was released in June 2013.

Joyce Lake – Century Iron Mines

The Attikamagen property, which includes both Joyce Lake and Hayot Lake, is located approximately 20 km northeast of Schefferville (Century Iron Mines, 2014). An EIS and a bankable feasibility study are underway, and production is expected to start in 2017. Labec Century Iron Ore Inc., a subsidiary of Century, has a 100% registered interest in the Attikamagen property. Century has signed a joint venture agreement with WISCO pursuant to which WISCO has earned 40% joint venture interest in Century's interest in the Attikamagen property.

Lac Otelnuk – Adriana Resources Inc.

The Lac Otelnuk iron project is located 170 km north of the Town of Schefferville, Québec (Adriana Resources Inc., 2015). The property was first explored in the early 1950s, when a significant magnetite iron formation was mapped over a strike length of approximately 25 km. Subsequent diamond drilling and surface sampling in the 1970s, which was largely limited to the upper iron formation unit, resulted in historic mineral resource estimates for two adjacent zones, the North and South zones. The results of the 2010 drill program confirmed a large, flat-lying iron formation covering an approximate area of 22.5 km^2.

Menihek Generating Station

The dam and powerhouse are located in Newfoundland and Labrador, 40 km south of Schefferville, Québec (Nalcor Energy, 2014). Nalcor took over ownership of the 18.7 MW Menihek generating station from the

IOCC in 2007. The company has entered into a 40-year power purchase agreement with Hydro-Québec to supply electricity from this facility to Hydro-Québec for its customers in the Schefferville region.

Tshiuetin Rail Transportation Inc.

Tshiuetin Rail Transportation Inc. owns 213 km of railway connecting Emeril (Labrador) and Schefferville (TSH, 2009). The owners are the three following First Nations:

- Innu Takuaikan Uashat mak Mani-Utenam
- Naskapi Nation of Kawawachikamach
- IN of Matimekush–Lac John

The company began its operations on December 1, 2005, and presently employs 40 people.

8.2.2 Labrador West and Fermont Area

QNS&L

QNS&L railway is a federally regulated common carrier operating freight services between Sept-Îles, Labrador City and Emeril Junction, which is the interconnection point for traffic transiting to and from Schefferville with the connecting carrier, Tshiuetin Rail Transportation (QNS&L, 2015). QNS&L is a wholly-owned subsidiary of IOCC. QNS&L offers bulk, through-freight and way-freight type rail services on its line.

Labrador Operations – IOCC

The IOCC mined iron ore in the Schefferville area from 1954 to 1982. The IOCC has been operating the Carol project in Labrador City since the 1960s (IOCC, 2013). The Labrador City operation produces concentrated iron ore and pellets (further processed), and transports these by train to the Port of Sept-Îles on the Gulf of St. Lawrence, and from there to global customers.

This project currently consists of:

- four operating open pit mines (Humphrey Main, Humphrey South, Sherwood Pond and Luce);
- two dormant pits (Lorraine and Spooks);
- one mined-out pit (Smallwood); and
- two new deposits (Wabush 3 (**currently on hold**) and Wabush 6), which are in the planning stages for future development.

Mont Wright Mine – ArcelorMittal

The Mont Wright open pit mine lies 16 km southwest of Fermont, covers an area of over 24 km^2, and has reserves and resources of one billion tonnes of crude ore with an iron content of approximately 30% (ArcelorMittal, 2014a). The concentrate is processed through filter tables to remove the water, and routed to the loading silo to be put on trains bound for Port-Cartier via the Cartier railway/ArcelorMittal Mines Canada railway.

Fire Lake – ArcelorMittal

The open pit mine at Fire Lake is located 55 km south of the Mont-Wright mining complex (ArcelorMittal, 2014b). The mine operates solely between May and October, when the ground is thawed. Products are sent to Port-Cartier via the Cartier railway/ArcelorMittal Mines Canada railway.

Fire Lake North – Champion Iron Mines Limited

The Consolidated Fire Lake North (CFLN) property is located in eastern Québec, immediately north of ArcelorMittal's Fire Lake Mine and 60 km south of Cliffs Natural Resources' Bloom Lake mine (Champion Iron Mines Limited, 2014).

Lac Knife – Focus Graphite

Focus Graphite Inc. own 100% of the Lac Knife crystalline flake graphite deposit, located in the Côte Nord region of Québec (Focus Graphite, 2015). Situated in the Grenville geological province of northeastern Québec about 27 km south of Fermont, the company's flagship property consists of a total of 57 mineral claims covering 299 km^2. At approximately 15% graphitic carbon, Lac Knife is one of the highest-grade flake graphite deposits in the world. The project is located between the Cartier railway/ArcelorMittal Mines Canada railway and the QNS&L railway.

Wabush, Scully and Bloom Lake Mines

Soon after IOCC started operations in the Wabush area near Labrador City, Wabush Mines opened its own workings in the same area. In 1963, it opened the Wabush Railway, a short railway connecting the mine workings with the QNS&L railway. Under an agreement with IOCC, QNS&L would carry Wabush Mines ore to the port of Sept-Îles. In December 2015, Wabush Mines ceased operations.

Cliffs Natural Resources announced the definitive closure of its Scully mines near Wabush in October 2014 and closed the Bloom Lake mine in January 2015 (Cliffs Natural Resources, 2015).

Kami – Alderon Iron Ore Corp

The Kami property is strategically located next to the mining towns of Wabush, Labrador City and Fermont (Alderon Iron Ore Corp, 2014). The property includes 305 claims in Labrador for a total of 76 km^2. Kami is within close proximity to a road (~2.5 km), a common railway carrier (~15 km) and a hydro power station (~15.5 km). The QNS&L railway will transport the material to the new deep sea port constructed in 2014 that will provide year-round access to the global market. Alderon has secured port access to ship up to 8 million tonnes of iron ore annually via the Pointe-Noire multi-user port.

Roy's Knob – Shabogamo Mining

Quartzite mining at Roy's Knob, with estimated reserves of 5-6 million tonnes, commenced in October 1999 (Labrador West, 2014). Quartzite is washed and screened at a plant in Wabush and shipped by rail to Sept Îles, Québec.

Champion Railway

In October 2014, Champion, the Government of Québec and Lac Otelnuk Mining Ltd. (a joint venture between Adriana Resources and WISCO International Resources Development & Investment Limited) announced a government-industry partnership to advance the feasibility study for a new rail line in the Labrador Trough. The partnership is called "La Société ferroviaire du Nord québécois" (SFNQ). All mining companies are free to become SFNQ partners.

8.2.3 Infrastructure and Other Projects at the Port of Sept-Îles

Some activities currently taking place in the Sept-Îles area need to be considered in addition to the Howse Project's train unloading/boat loading activities. In this context, a new multi-user deep sea port was constructed in 2014 at Pointe-Noire. Current major activities include the Arnaud railway, the ArcelorMittal pelletizing plant and the Alouette aluminium smelter. The Arnaud mining project, an apatite mine, should be developed in 2016-2018.

Table 8-2 Projects/Activities Considered in the Cumulative Effects Assessment

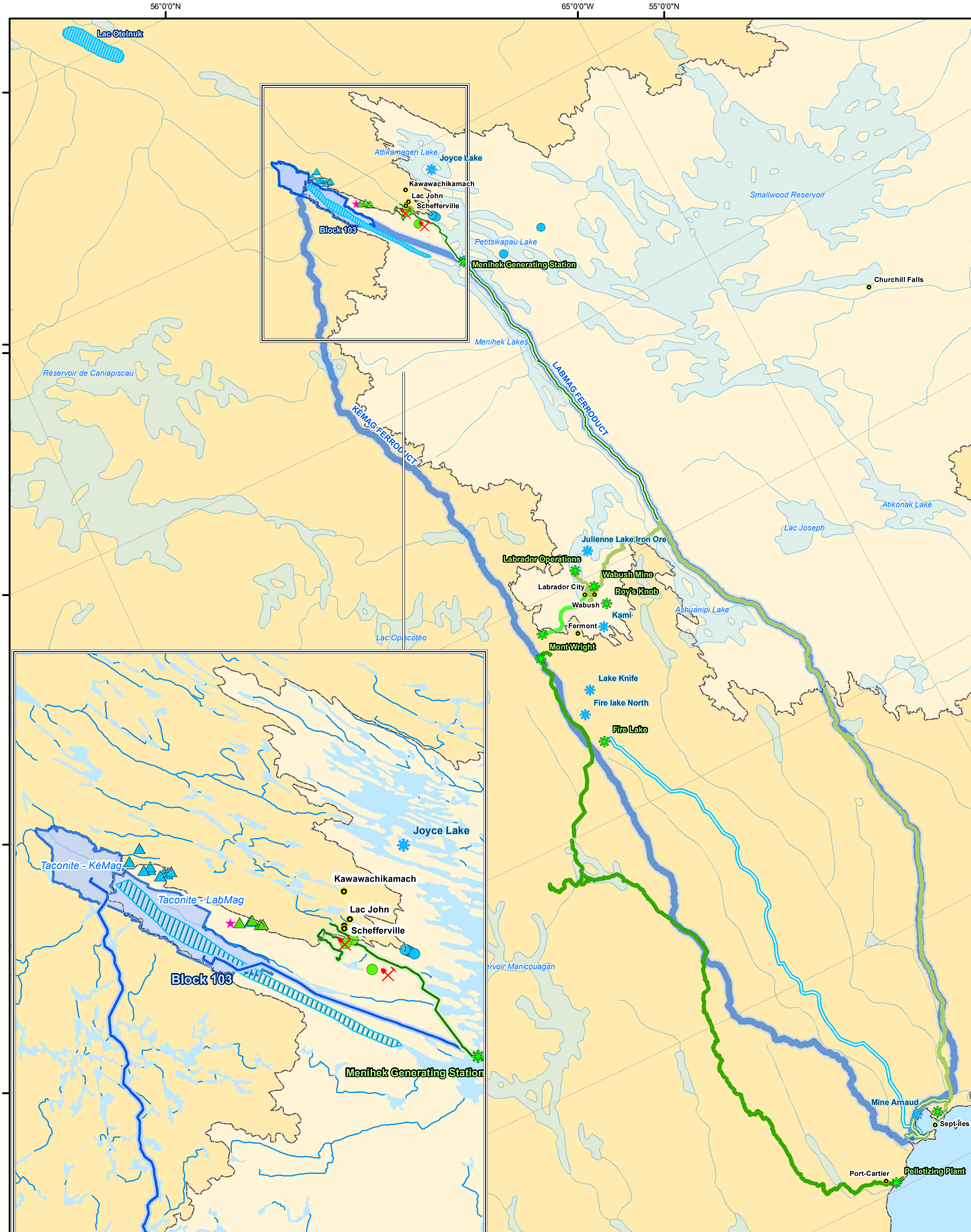
PROJECT / ACTIVITIES	OWNER	LOCATION	DURATION / SCHEDULE	ANTICIPATED SOURCES OF EFFECT*	INTERACTION WITH THE HOWSE PROJECT
Past Activities					
Labrador Operations – Schefferville Area	IOC	Schefferville area	1954-1982	Soil contamination by abandoned tailings; strongly anthropogenically disturbed landscape; unsecured old pits (no systematic fencing), erosion …	Possible cumulative effects with the Howse mine components
Existing Projects					
DSO 3 (Project 1a or ELAIOM)	TSMC	Schefferville area	The plant will run for the next 20 years and schedule could change	Emission of air pollution, dust, noise, vibration and light, pits, waste rock piles, QNS&L and Tshiuetin rail traffic, employment, contracting opportunities	Possible cumulative effects with the Howse mine components
Schefferville Area Stage 1 project	LIM (Currently under bankruptcy protection)	Schefferville area	James mine in operation since 2011 – suspended operation since 2014 LIM operations are on hold until future notice	Emission of air pollution, dust, noise, vibration and light, pits, waste rock piles, QNS&L and Tshiuetin rail traffic, employment, contracting opportunities	None
Menihek Generating Station	Nalcor	Schefferville area	In operation	Employment, contracting opportunities	Possible cumulative effects with the Howse mine components
Tshiuetin Rail Transportation	ITUM, NIMLJ, NNK	Schefferville – Emeril Junction	In operation since 2005 (was in operation prior under QNS&L)	Rail traffic, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles
QNS&L	IOCC	Emeril Junction – Sept-Îles	In operation	Rail traffic, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles
Wabush Mine		Labrador West and Fermont area	Not in operation	QNS&L rail traffic, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles

PROJECT / ACTIVITIES	OWNER	LOCATION	DURATION / SCHEDULE	ANTICIPATED SOURCES OF EFFECT*	INTERACTION WITH THE HOWSE PROJECT
Roy's Knob	Shabogamo Mining	Labrador West and Fermont area	In operation since 1999	QNS&L rail traffic, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles
Labrador Operations – Humphrey Main, Humphrey South, Sherwood Pond and Luce	IOCC	Labrador West and Fermont area	In operation	QNS&L rail traffic, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles
Mont Wright	ArcelorMittal	Labrador West and Fermont area	In operation	Cartier rail traffic, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles
Fire Lake	ArcelorMittal	Labrador West and Fermont area	In operation	QNS&L rail traffic, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles
Arnaud Railway	Arnaud Railway Company	Sept-Îles	In operation	Emission of air pollution, dust, noise, vibration and light, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles harbor
Pelletizing Plant	ArcelorMittal	Port-Cartier	In operation	Emission of air pollution, dust, noise, vibration and light, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles harbor
Aluminium Smelter	Alouette	Sept-Îles	In operation since 1992	Emission of air pollution, dust, noise, vibration and light, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles harbor
Future Projects					
DSO 4 (Project 2a)	TSMC	Schefferville area	In production from 2018 to 2024	Stripping of vegetation, emission of air pollution, dust, noise, vibration and light, pits, waste rock piles, QNS&L and Tshiuetin rail traffic, employment, contracting opportunities	Possible cumulative effects with the Howse mine components
DSO 4 (Project 2b)	TSMC	Schefferville area	In production from 2015 to 2020	Stripping of vegetation, emission of air pollution, dust, noise, vibration and light, pits, waste rock piles, QNS&L and Tshiuetin rail traffic, employment, contracting opportunities	Possible cumulative effects with the Howse mine components

PROJECT / ACTIVITIES	OWNER	LOCATION	DURATION / SCHEDULE	ANTICIPATED SOURCES OF EFFECT*	INTERACTION WITH THE HOWSE PROJECT
Block 103 covers an area of 73 km^2 30 km northwest of Schefferville, Québec (Cap-Ex Iron Ore Ltd., 2014). The preliminary economic assessment was released in June 2013.	Cap-Ex Iron Ore Ltd.	Schefferville area	Production targeted for 2018	Stripping of vegetation, emission of air pollution, dust, noise, vibration and light, pits, waste rock piles, QNS&L and Tshiuetin rail traffic, employment, contracting opportunities	Possible cumulative effects with the Howse mine components
Schefferville Area Stage 2 and Stage 4 & 5 projects	LIM (Currently under bankruptcy protection)	Schefferville area	LIM operations are on hold until future notice	Stripping of vegetation, emission of air pollution, dust, noise, vibration and light, pits, waste rock piles, QNS&L and Tshiuetin rail traffic, employment, contracting opportunities	
Joyce Lake	Century Iron Mines / WISCO	Schefferville area	In EIS process, production planned for 2017	Stripping of vegetation, emission of air pollution, dust, noise, vibration and light, pits, waste rock piles, QNS&L and Tshiuetin rail traffic, employment, contracting opportunities	Possible cumulative effects with the Howse mine components
Lac Otelnuk	Adriana Resources Inc.	North of the Schefferville area	Feasibility stage	Construction of new railway – Champion rail traffic; stripping of vegetation, habitat fragmentation, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles
Labrador Operations – Wabush 3 and 6	IOCC	Labrador West and Fermont area	EIS submitted in 2014	QNS&L rail traffic, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles
Lac Knife	Focus Graphite	Labrador West and Fermont area	In EIS process	Cartier or QNS&L rail traffic, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles
Kami	Alderon Iron Ore Corp	Labrador West and Fermont area	In EIS process	QNS&L rail traffic, Pointe-Noire multi-user port unloading activities, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles

PROJECT / ACTIVITIES	OWNER	LOCATION	DURATION / SCHEDULE	ANTICIPATED SOURCES OF EFFECT*	INTERACTION WITH THE HOWSE PROJECT
Fire Lake North	Champion Iron Mine Limited	Labrador West and Fermont area	Preliminary feasibility study published in 2013	Construction of new railway – Champion rail traffic: stripping of vegetation, habitat fragmentation, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles
Julienne Lake	Altius Minerals/JL Alliance	Labrador West and Fermont area	Final stage negotiations with NL government for award of mineral rights	QNS&L rail traffic, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles
Arnaud Mining Project	Investissement Québec and Yara International ASA	Sept-Îles	Construction 2016-2018	Stripping of vegetation, emission of air pollution, dust, noise, vibration and light, employment, employment, contracting opportunities	Possible cumulative effects with the Howse iron ore transportation to Sept-Îles harbor

*In the vicinity of the Howse Mine Project infrastructure, including the shared QNS&L railway line and Sept-Îles multi-user dock.



LEGEND

Mining Projects

Past Project/Activity

- Labrador Operations - Schefferville Area

Existing Project/Activities

- Shefferville Iron Ore Mine Stage 1
- DSO 3 - Project 1a (ELAIOM)
- Other Project
- Arnaud Railway
- Bloom Lake Rail Spur
- Cartier Railway
- QNS&L
- Tshiuetin Rail Transportation

Future Project

- Shefferville Iron Ore Mine Stage 2, 4, 5
- DSO 4 - project 2a, 2b
- Other Project
- Champion Railway
- Other Future Project
- Taconite - KéMag/LabMag
- KéMag/LabMag Ferroduct

Basemap

- Town
- Howse Deposit
- Watercourse
- Water Body
- Provincial Boundary

FILE, PROJECT, DATE, AUTHOR:
GH-0608 , PR185-19-14, 2016-03-23, edickoum

N

0 50 100
Kilometers

UTM 19N NAD 83

SCALE: 1:1 800 000

SOURCES:
Basemap
Atlas of North America, 1:7,500,000
Government of Quebec, BDGA, 1:1,000,000

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Other Projects Considered for Cumulative Effects Assessment

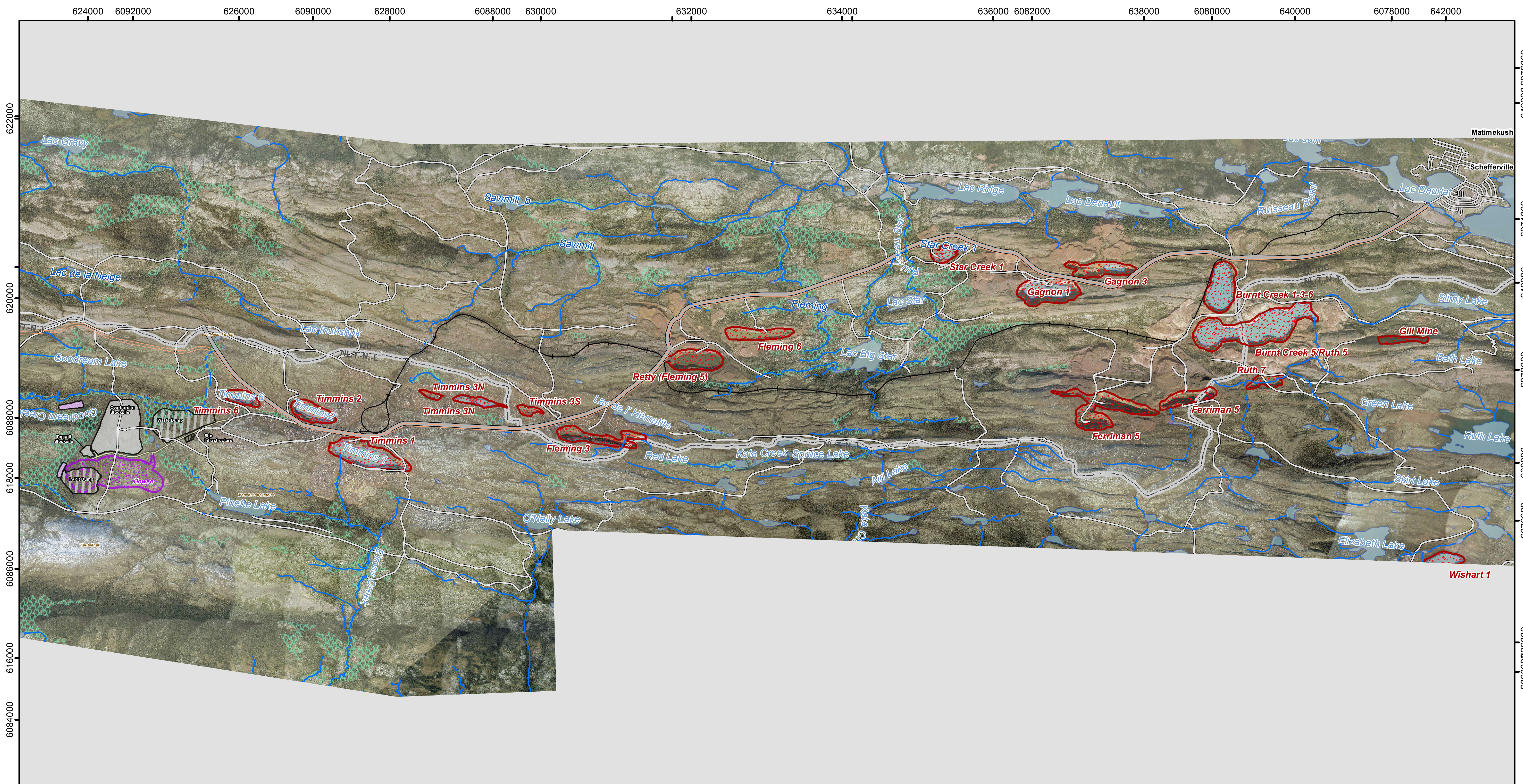
Howse Minerals Limited

GroupeHemispheres

5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2

1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 8-1



LEGEND

Infrastructure and Mining Components

- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Site Infrastructure
- Proposed Waste Dump/ In-Pit Dump
- Proposed and Existing Sedimentation Pond
- DSO Haul Road
- Existing Railroad
- Existing Pit
- Proposed Mine Haul Road

Basemap

- Permanent Watercourse
- Intermittent Watercourse
- Storm Runoff
- Disappearing Stream
- Artesian Spring
- Water Body
- Provincial Border
- Existing Road
- Main Access Road
- Wetland

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0613 , PR185-19-14, 2016-03-23, edickoum

N

0 1 2 3 4
Kilomètres

UTM 19N NAD 83

SCALE: 1:65 000

SOURCES:
Basemap
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and Government of Quebec,
Boundary used for claims
Groupe Hémisphères, Hydrology, 2013.

Infrastructure and Mining Components
New Millennium Capital Corp., Mining sites and roads
Howsel Minerals Limited/ MET-CHEM,
Howse Deposit Design for General Layout, 2015

ENVIRONNEMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Old and Active Pits in the Howse Project Area

Howse Minerals Limited

GroupeHemispheres

5731, rue Saint-Louis,
Bureau 201, Lévis (QC)
Canada, G6V 4E2

1453, rue Beaubien est,
Bureau 301, Montréal (QC)
Canada, H2G 3C6

Figure 8-2

8.3 AIR QUALITY CUMULATIVE EFFECTS ASSESSMENT

8.3.1 Scoping

The effects of air emissions from the Howse Project and nearby projects (e.g. DSO3 and DSO4) on air quality are considered in this cumulative effect assessment. The study area considered for cumulative assessment encompasses sensitive receptors of interest in the RSA and mining / processing/ hauling activities associated with Howse, DSO3 and DSO4 located within the LSA. The air dispersion modelling report (Volume 2 Supporting Study E) provides explanations on how air emissions sources from the three projects were incorporated in the calculations. The Howse, DSO3 and DSO4 projects are interconnected and their operation schedules will coincide at one point. This interconnection necessitated a global approach to the air modelling study. Analysis

Table 7-14 and Table 7-16 summarize the air modelling results for each area of the global projects e.g. DSO3/DSO4 only, Howse only and, All (DSO3/DSO4 + Howse + background). In reviewing these three tables together with the frequency of exceedances in Table 7-17 and Table 7-18, the following analysis can be made:

- For annual averages, the project's ambient air quality assessment criteria are all met. The contribution of the Howse Project to the overall predicted ambient air concentrations is generally less than 20% of the total.
- For daily averages (24-hr), under the "No Blasts" modelling scenario, the cumulative maximum predicted concentrations exceed the Project's ambient air quality assessment criteria at sensitive receptor R40 (Workers' camp) less than 0.82% of the time (see Table 7-17) shows the modelling result from DSO3/DSO4 projects only is 283.3 μg/m^3 at R40, which demonstrates they are the principal contributors to the exceedances at this receptor. The Howse Project does have an effect at R40, but the modelling result for Howse only is 43.2 μg/m^3 at R40 which in itself is less than the 200 μg/m^3 assessment criteria (see Table 7-15).
- For daily averages (24-hr), under the "No Blasts" modelling scenario, the maximum predicted concentrations for the Howse Project in itself do not exceed the Project's ambient air quality assessment criteria. Under the "With Blasts" modelling scenario for PM_{10} 24-hr, the cumulative effect at sensitive receptor R13 (Naskapi – Uashat people's camp) is 57.5 μg/m^3 vs a criteria of 50 μg/m^3. The Howse Project contributes the majority of this effect with 36.1 μg/m^3 because receptor R13 is located close to the Howse deposit. However, as shown in Table 7-17, this exceedance is predicted to occur only once in 5 years.
- For short-term averaging periods (24-hr, 8-hr, 3-hr, 1-hr), under the "No Blasts" modelling scenario, the maximum predicted concentration for the Howse Project in itself do not exceed the project's ambient air quality assessment criteria. Under the "With Blasts" modelling scenario, exceedances are predicted at nine sensitive receptors. The Howse Project is the main contributor at seven of these nine receptors, the exceptions being R18 (Inukshuk Lake) and R40 (Workers' camp). As can be seen in Table 7-17, the frequency of exceedances at all these sensitive receptors is less than 1%.
- For the "With Blasts" scenario results, exceedances are predicted for the following averaging periods and pollutants: 24-hr (TPM, PM_{10}, $PM_{2.5}$, and NO2), 1-hr (NO_2, SO_2, CO). The maximum number of predicted exceedances is 2.85% of the time for PM_{10} (24-hr) at "Off-Property Limit" grid receptor UTM coordinate 625.6801, 6083.313 in QC. Figure 3.16 of the Air Dispersion Modelling Report shows the points at which maximum concentrations are predicted to occur; these points are located on the edge of the air quality modelling perimeter. The cause of the predicted exceedances is: the DSO3 Fleming 7N pit is located in close proximity to the Québec border and the air quality modelling perimeter. Combining this short distance and the conservativeness of blasting events by the air model, leads to exceedances predictions.

8.3.2 Mitigation

Since the other projects considered in the air quality cumulative effects assessment are under TSMC's control, the previously-mentioned standard and specific mitigation measures for air quality will be applied by TSMC. In addition, proponent will practice adaptive management of the air quality in the vicinity of the Howse Project and in DSO areas as a whole. Adaptive management will be based on the air quality monitoring plan (AQMP) currently under review by the NL, QC and Kativik authorities (see below under Follow up and Monitoring Programs).

8.3.3 Residual Effects Significance Assessment

The project's air quality assessment criteria are based on air quality standards promulgated by environmental authorities. These air quality standards were developed to protect human health. From an ecological perspective, short-term exceedances of air quality assessment criteria as identified in this EIS have limited effect. After completion of the project, major active sources of air emissions (ore mining, transport and processing) will stop. Inactive sources of air emissions (piles) may continue to be affected by wind erosion. Table 8-3 presents assessment criteria applicable specifically to air quality.

Table 8-3 Assessment Criteria Applicable for the cumulative effects on Air Quality

TIMING		
Inconsequential timing	**Moderate timing**	**Unfavorable timing**
Timing of predicted Howse and surrounding projects air emissions has no consequences on air quality	Timing of predicted Howse and surrounding projects air emissions may have consequences on air quality	Timing of predicted Howse and surrounding projects air emissions has consequences on air quality
SPATIAL EXTENT		
Site specific	**Local**	**Regional**
Effects are limited to the footprint of the project.	Effects extend beyond the footprint, but do not extend outside the LSA.	Effects will affect air quality in substantial part or the entire RSA.
DURATION		
Short	**Medium**	**Long**
>1 hour Air quality standards for 1-hour periods are applicable. Effects of blasts are modelled as one hour events.	>24 hours Air quality standards for 24-hour periods are applicable. Maximum activities can occur on a continuous basis over several periods of 24 hours	>1 year Air quality standards for 1-year periods are applicable. Project activities will be conducted at varying intensities all year long
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Air quality returns to pre-project levels	Air quality degradation persist after source of effect ceases, but its magnitude is significantly lower	Air quality degradation persist after source of effect ceases
MAGNITUDE		
Low	**Moderate**	**High**
Air quality at sensitive receptors within the RSA is barely or not affected by the Howse and surrounding projects (all parameters meet Project's air quality assessment criteria)	Air quality at sensitive receptors in the RSA is moderately affected by the Howse and surrounding projects because air modelling results do not meet the Project's air quality assessment criteria.	Air quality at sensitive receptors in the RSA is severely affected by the Howse and surrounding projects because air modelling results persistently do not meet the Project's air quality assessment criteria.

FREQUENCY		
Once	**Intermittent**	**Continual**
Air quality standards will be exceeded once	Air quality standards will be exceeded occasionally, such as during blasting events.	Air quality standards will be exceeded year round.

Timing

Howse Project and surrounding projects activities will occur throughout the year. The air dispersion modelling study included hourly meteorological conditions over a 5 year period. Maximum predicted results for several pollutants were compared were compared to project specific assessment criteria, regardless of season and timing. Logically, dust emissions from the project are expected to be higher and more visible during the summer. Additionally, withstanding modelling limitations, blasting events at the Howse and DSO3 pits are predicted to create short-term air quality exceedances, and so the effect is high (Value of 3).

Spatial extent

The air dispersion modelling study predicts that short-term air quality assessment criteria may be exceeded at certain sensitive receptors and at geographical grid receptors mostly due to the methodology used to input blasting events in the air modelling software. These short-term exceedances are limited to the LSA. No exceedances of air quality assessment criteria are predicted outside the LSA. As such, the spatial effect of the projects in the RSA (Howse, DSO3 and DSO4) is predicted to extend beyond the footprint, but does not extend outside the LSA (Value of 2).

Duration

Air quality will be negatively impacted from the beginning of the construction phase of a project up to the end of the projects, and even after. Air emissions will be generated during all phases of the project. The nature of the air pollutants will be similar throughout all phases of a project, but the highest air emissions effects will occur during the Operation phase, due to the intensity of mining, transportation and processing activities. Air modelling results predicted that all long term (e.g. 1-yr averaging period) project air quality assessment criteria are met, but nonetheless the duration of the effect will last throughout the life of the mine. For this reason, the duration is considered to be long (Value of 3).

Reversibility

After the high intensity operation phase stops, air quality will mostly return to pre-project conditions. Airborne dust due to wind erosion from tailing piles may still occur after all projects are stopped, but with the proposed mitigation measures and pit design, if dust from piles becomes airborne, its effect will be limited to the project footprint. As such, the air quality effect of the projects is considered reversible (Value of 1).

Magnitude

When considering the cumulative effects of Howse, DSO3 and DSO4 projects at sensitive receptors, some air quality exceedances are predicted for short-term averaging periods. Exceedances at sensitive receptors are predicted to occur less than 1% of the time under the worse-case modelling scenario "With Blasts". The exceedance frequency falls to less than 0.38% of the time, when the normal modelling scenario "No Blasts" is considered. Finally, under the "With Blasts" modelling scenario, at non-sensitive receptors (e.g. geographical grid receptors) located on or in close proximity to the air quality modelling perimeter, the model predicts a frequency of exceedances of less than 2.85% for PM_{10} (24-hr). This percentage is less for other pollutants and averaging periods. The exceedance frequency falls to less than 0.82% of the time, when the normal modelling scenario "No Blasts" is considered. As mentioned previously, no humans live at non-sensitive receptors. For these reasons, the magnitude is considered to be moderate (Value of 2).

Frequency

The frequency is intermittent, since even though activities of the Howse Project will occur on a continuous basis for at least 7 months per year and year round for the other projects, exceedances of air quality standards are predicted to occur infrequently. The associated value is 2 (Value of 2).

8.3.3.1 Significance

Combined, the effects from all emission sources of the surrounding projects and Howse on air quality is significant (Value of 14). The primary disturbance caused to air quality at sensitive receptors by the projects is due to blasting events at the pit and the presence of diesel generators for electricity production to be used at the Workers' camp. (*Note that, as of summer 2016, the electricity at the Workers' Camp is now supplied by the Main Plant GenSet which have a higher engine to generator efficiency than the diesel generators located at the Camp (95% vs 85%). The four diesel generators located at the Workers' Camp are still in place but only used for emergency situations (ex.: malfunction of the Main Plant GenSet or failure of the power line between the Main Plant and Workers' Camp*)).

Likelihood

The likelihood of Howse having an effect on air quality is high, since air emissions will be generated throughout the duration of the project.

8.3.4 Follow up and Monitoring Programs

An exhaustive air quality monitoring plan (AQMP) is currently under review by the NL, QC and Kativik authorities. The AQMP will consist in the installation of a network of air monitoring equipment at several locations for several air pollutants such as: NOx, TPM, $PM_{2.5}$, metals and dustfall. A draft version of the AQMP is provided in Volume 1 Appendix XXIV.

8.4 WATER AND AQUATIC FAUNA CUMULATIVE EFFECTS ASSESSMENT

8.4.1 Scoping

Hydrology and hydrography, water quality and aquatic fauna cumulative effects are intertwined and will be assessed together in this section.

The cumulative anthropogenic disturbances considered here lie within the RSA or the Howells River watershed upstream of the mouth of Elross Creek (~800 km^2). Near the Howse Project mine area, past IOCC mining activities have cause considerable changes to the local hydrography, potentially causing fish habitat loss or alteration and water quality degradation downstream (namely in Elross Creek). Other ongoing DSO mining activities (TSMC and LIM) contribute to water quality degradation and fish habitat loss. The Taconite project, which may vary in scale depending on the option selected (Labmag and KéMag deposits), and Block 103 will also potentially result in fish habitat loss and water quality degradation in the Howells River watershed.

8.4.2 Analysis

Water quantity changes are expected to be small and limited to the Howells river watershed. Therefore, no cumulative water budget changes are expected at the Howells River watershed scale. The same reasoning applies to water quality at the Howells River watershed scale.

At a smaller scale (Elross, Burnetta and Goodream creeks), some changes to the water budget are expected from the Howse Project, namely: a 4% reduction in area of the Pinette Lake watershed, a 9% increase in the area of the Goodream Creek watershed at the junction with HOWSEB, and a 72% increase in area of the Burnetta Creek watershed at the junction with HOWSEA. The only other projects impacting on those watersheds are past IOCC and DSO3 projects. As far as Burnetta Creek is concerned, none of those other project had an effect on its water budget or water quality and there is therefore there is no cumulative effect to consider in that watershed.

For the Goodream Creek watershed, the only accumulation of effects would come from Timmins 4 pit exploitation (DSO3 Project), but the impact of that activity only lasted a short while and is already completed with no detectable adverse environmental effect (only a few day of discharging essentially limited to surface mine drainage). Therefore, the predicted water budget effects will not be cumulative in Goodream Creek and will come solely from the Howse Project.

Concerning Elross Creek, the 4% reduction of the Pinette Lake watershed was evaluated as negligible to the water budget of Elross Creek watershed in section 7.3.9 and past IOCC and DSO3 projects are only redirecting surface drainage from the same watershed, therefore, no cumulative effect on water budget are expected in that watershed either.

As for water quality, sampling following the Timmins 4 pit termination does not suggest any contamination of Goodream Creek. Indeed, water quality, according to basic chemistry (pH, conductivity, dissolved oxygen and turbidity), does not show any substantial change after the discharge as shown by data from 2013 and 2014 Real Time Water Quality annual deployment reports (NLDEC, 2013b and 2014d). Therefore, no cumulative effect on water quality is expected in that watershed either. In Elross Creek, there are no water quality effects expected from the Howse Project and no cumulative effect on water quality of Elross Creek is therefore expected either.

8.4.3 Mitigation

Since no cumulative effect is expected from Howse Project, no mitigation measures are suggested here.

The largest cumulative effect will come from the different mining projects discharging their effluent into the Howells River watershed, ultimately ending up in Howells River, a fish habitat that hosts many species of fish, including Ouananiche. It is also a socially important water body where subsistence fishing and recreation is common. No at-risk fish species have been documented in Howells River. Concerning water quality and aquatic fauna, the accumulation of effects will take place in the Howells River since the projects discharge in different tributaries or directly in Howells River. Therefore, since the Howse Project dilution factor is above 1 in 50 once the effluent reaches Howells River, and since the discharge is more than 4 km upstream of the Howells River itself, increasing sedimentation and filtration potential, a very small proportion of any potential cumulative effect would be linked to this project. The relative cumulative effect of Howse Project on water quality and aquatic fauna is therefore considered negligible in the Howells River, particularly when compared to planned (Taconite) Projects. It is therefore considered as non-significant and further cumulative effect analysis should not be conducted in the context of this EIS.

8.4.4 Residual Effects Significance Assessment

Larger mining projects located close to Howells River could have an effect on its water quality, but enforcement of tight monitoring programs as required by the MMER should keep effects at an acceptable level (low effect) if water quality and aquatic fauna monitoring of Howells River is implemented to identify changes early on.

Since no cumulative effect is expected from the Howse Project, no significance assessment will be performed for this component.

8.4.5 Follow up and Monitoring Programs

A water quality monitoring program will be implemented at the limit of the LSA to confirm that contaminants do not reach beyond the LSA as stated above. It will consists of a quarterly water quality sampling at Triangle and Burnetta Lake discharges. Full details are provided in section 9.1.6.

In the unlikely event that there are contaminants reaching beyond the LSA, Howse Project should be included in a multi-project monitoring program that could take the form of a comprehensive EEM based on the MMER but spread between the different project inflows in the Howells River and paid for by the projects involved according to their respective contaminant discharge quantities.

8.5 WETLANDS CUMULATIVE EFFECTS ASSESSMENT

8.5.1 Scoping

The cumulative effects of loss of wetlands from the Howse Project and nearby Projects is considered for this cumulative effect assessment. The study area considered for cumulative assessment corresponds to an area of 280 km^2 which represents the upper section of the Howells river watershed.

The past mining activities are not considered for the cumulative effects on loss of wetlands. Although it is inconceivable that past IOCC operations did not destroy wetlands in the Howse Project RSA, the lack of literature on wetland distribution prior to IOCC activities precludes the possibility of assessing the cumulative effects of past projects. Observations of current wetland distribution allows us to infer that a wetland was sectioned by an IOCC road in the area where the OB stockpile/waste dump are currently proposed under the Howse Project. However, the original extent of this wetland was not documented and so the damage resulting from past IOCC activities cannot be assessed. It is therefore impossible to quantify the loss of wetlands from the past IOCC mining activities. It is also impossible to evaluate the loss of wetlands that might result from the future projects. Consequently, only the current mining operations are considered for the loss of wetlands.

Current mining operations that are considered in this analysis are the LIM Projects (James, Silver Yards and Redmond) and TSMC Projects (DSO 1a, 2a, 2b). On LIM Properties (1 300 ha), a total 133 ha of wetlands were identified on the properties. Less than 1 ha was expected to be affected by the mining operations (LIM 2009). For the TSMC projects, a terrestrial ecosystem mapping was carried out and about 27 000 ha of wetland were identified and 15 ha was expected to be affected by the different mining projects (NML and PFWA, 2009).

Including Howse, about 37 ha of wetlands are expected to be affected by mining operations. Wetlands are common on the territory and are even more present regionally in the Howells River and Swampy Bay watersheds. No unique type of wetlands will be loss due to mining operations. Based on the fact that the affected area is non-significant, wetlands are not considered as VC for the cumulative impact assessment and therefore not require further analysis.

8.6 CARIBOU CUMULATIVE EFFECTS ASSESSMENT

8.6.1 Scoping

The cumulative effects of noise and light from the Howse Project and nearby Projects on both migratory and boreal forest ecotypes are considered for this cumulative effect assessment. The study area considered for cumulative assessment corresponds to the entire GRCH herd range and the Lac Joseph and Québec herds ranges, which overlap the Tshiuetin and QNS&L railways corridor. This large study area is included because it allows the Proponent to further consider herd-wide effects. As presented in Figure 8-1, several past, present or future mining projects are concentrated in the RSA, increasing the probability of cumulative effects on both caribou ecotypes.

Cumulative anthropogenic disturbances originate from the Schefferville area, the Labrador-West area, and rail traffic occurring over a 573-km long corridor (Figure 8-1). As such, in addition to Howse-derived noise and light disturbances, we consider the effect of the rail traffic on caribou for the period 1954-2024, which corresponds to the beginning of industrial activities in the region and planned ending of the Howse Project activities. The Howse Project makes use of existing rail infrastructure and so we consider the additional effects of Howse only, which are associated with rail traffic effects.

We use technical studies for Noise and Vibration and Light, which were produced specifically for the Howse Project for our analyses below. (Volume 2, Appendices F and G, respectively). Both these studies consider DSO3 activities

8.6.2 Analysis

<u>Noise and Light</u>

Near the Howse Project mine area, past IOCC mining activities and other DSO mining activities are ongoing and contribute to anthropogenic disturbances such as noise and light emissions. The Taconite project, which may vary in scale depending on the option selected (Labmag, KéMag or combined projects), and Block 103 will also increase anthropogenic disturbance and functional habitat loss (Section 8.2). Under the present ecological context it is expected that caribou have become habituated to the noise associated with the mining activities in the Schefferville region and that the addition of noise from the Howse mining activities will not significantly affect caribou behavior. This is furthered by the assessment that average pre-Howse noise levels are 34.6 dBA (averaged from 9 receptors) and the addition of Howse noise levels yield an expected mean value of 36.9 dBA. Analysis of the future worse-case scenario (including train operations, crushing site, roads and mini-plant) yields a mean value of 38.4 dBA (see Volume 2 Supporting Study F for full analysis details). Volume 2 Supporting Study F reports that a crusher which will serve to produce and sell material to first nations as well as the Mine Track Drill will account for the highest noise effects calculated.

According to light modelling results, the cumulative effects of Howse and surrounding projects will be highest in winter, due to snow reflectance. Under this nighttime scenario, the artificial sky brightness due to Howse and surrounding projects is negligible (for example, at Irony Mountain, the artificial sky radiance level is 8.9% of the natural radiance in winter but 7.5% of that amount is coming from Schefferville (Volume 2 Supporting Study G). Further, at a distance of 15 km from the Howse site, the contribution of DSO3 Projects to artificial light relative the contribution of Schefferville/Kawawachikamach is equal, indicating that at this threshold of caribou perception, artificial light contribution to the night sky is negligible.

<u>Railway</u>

The presence of caribou in the Howse Project RSA will be affected by the proximity of the QNS&L railway. A full list of projects considered for the cumulative effects analysis is available in Section 2.1. Further noise and light disturbance is expected if the following linear infrastructure is developed:

- a new railway to accommodate the upcoming activities planned by Champion Iron Resources Limited and Adriana Resources; and
- a ferroduct planned by NML and TSMC (Taconite project) to transport iron concentrate from Schefferville to Sept-Îles.

The presence of the railroad represents functional habitat loss for caribou (Nelleman and Cameron, 1998), as their ranges overlap the QNS&L railway. In the near future, the area may be crossed by three railways with associated increasing traffic. The linear infrastructure can destroy/fragment habitat, cause avoidance by caribou, and create movement corridors by predators. Although all of these effects are possible, they are impossible to predict at this stage. The Proponent therefore is committed to practicing adaptive management and be engaged with local caribou groups to be updated on sightings.

Consulted participants mentioned repeatedly that the caribou was absent in the area during IOCC operations, which ended in 1982. The caribou came back in the area when operations ended, and then left again once mining activities resumed in the area, around 2005. For the participants, there is a clear relation between mining activities and the absence of caribou, although they are aware that mining is not the only factor.

8.6.3 Mitigation

In addition to the previsouly-mentioned standard and specific mitigation measures for caribou (no power lines will be constructed for the Howse Project, most activities will be during the day time, and there will be limited mining activities during the winter months), the proponent will practice adaptive management of the caribou in the vicinity of the Howse Project. Cooperation with local caribou monitoring programs allow HML to stay informed on the local herds and take a proactive approach if caribou are seen within certain buffer zones around the Howse Project and its neighboring projects. HML/TSMC also suggest to put in place a Caribou joint comity if other companies (NML, Champion, Adriana) start their operations. This comity will be responsible to jointly plan their mitigation measures if caribou are seen in the region.

Volume 2 Supporting Study F recommends locating the First Nations crusher (currently slated to be south of the deposit) further north to reduce noise effects. Further, the noise effects of the drill can be mitigated by reducing drilling speed and time, utilising a noise shroud and a mobile noise screen. It is noted here that the First Nations crusher is currently no longer considered as a component of the Howse Project.

8.6.4 Residual Effects Significance Assessment

At the level of the RSA, the Howse and surrounding Projects activities- noise, light and railway - exhibit a very small amount of disturbance on caribou, and the ecological services to the herds are largely preserved. Further, the DSO and Howse project are implemented in an already disturbed zone and the effect of Howse on caribou habitat is minimal if compared to other larger projects such as DSO, Taconite or Adriana. .

The project and activities surrounding the Howse Project are located in an area that has historically been continuously and significantly altered by human activities for decades. This disturbance is expected to continue indefinitely. Within this context of a pre-established mining complex, the Howse footprint is not expected to cause significant detrimental additions to this unfavorable ecological context. The GRCH has experienced significant declines over the last several decades, thereby producing a precarious ecological context for the GRCH. However, caribou are known to be resilient to disturbances caused by mining infrastructures (i.e. Weir et al., 2007), and have shown plasticity in their adaptability to anthropogenically-altered landscaped. It is expected that following a site restauration program, the ecological context of the GRCH will not be altered by the Howse Project.

Table 8-4 presents assessment criteria applicable specifically to caribou.

Table 8-4 Assessment Criteria Applicable for the Cumulative Effects on Caribou

TIMING		
Inconsequential timing	**Moderate** timing	**Unfavorable timing**
Timing of predicted Howse activities are not expected to affect any sensitive activities in the caribou life cycle.	Timing of predicted Howse activities may affect some caribou activities, i.e.: winter forage availability migration routes.	Timing of predicted Howse activities may affect some key caribou activities, i.e.: the calving period.
SPATIAL EXTENT		
Site specific	**Local**	**Regional**
The Howse Project and surrounding projects activates will effects a small portion of the RSA	The Howse Project and surrounding projects activates will effects at least half of the RSA	The Howse Project and surrounding projects activates will effects nearly all of the RSA
DURATION		
Short	**Medium**	**Long**
The effect of the Howse Project and surrounding projects on caribou will last less than 12 months and will not likely cause changes to the caribou herds.	The effect of the Howse Project and surrounding projects on the caribou will last between 12 or 24 months corresponding to one (maximum of two) caribou annual migration. Extends beyond the preparation/construction phase, but shorter than the lifespan of the Project.	Longer than 24 months, possibly as long as the project duration. The Howse Project and surrounding projects will likely cause long-term demographic changes to the caribou.
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
The caribou are expected to return to their pre-Howse population status and distribution.	Effect on caribou will persists after the decommissioning and reclamation phase but caribou are expected to largely return to their pre-Howse status.	Caribou will be permanently altered by the Howse Project and surrounding projects.
MAGNITUDE		
Low	**Moderate**	**High**
Effect will be at the individual level.	Effect will be felt on a subsection of the nearby caribou herds.	Effect will be at the herd-level.
FREQUENCY		
Once	**Intermittent**	**Continual**
The disturbance will occur once.	The disturbance will be occasional, such as only at night.	The disturbance will be year round.

<u>Timing</u>

All mining activities will occur throughout the year. In particular, caribou will exhibit deterrence behavior related to noise and light, which will be produced continuously, and so the timing of the disturbance may occur during the calving period, and so the effect is high (Value of 3)

Spatial extent

The effects of noise and light and the railway will effects a small area when compared to adjacent anthropogenic activities. Further, the Howse Project will have effects on a small portion of the RSA (Value of 1).

Duration

The effects of noise and light will occur for as long as the project duration. However, although caribou are known to alter their behaviour to avoid anthropogenically-disturbed areas, they can also become accustomed to these disturbances over time (Haskell and Ballard 2008; Johnson and Russell 2014) Further, the Howse Project duration is short (approximately 12 years) relative other Projects (up to the year 2050), and therefore has a relatively short effect on caribou (Value of 2).

Reversibility

Although with the Howse Project alone, the caribou could be expected to return to area at the end of the Howse activities, the cumulative effects of the surrounding mine activities will make this reversibility *at the end of the Howse Project* unlikely. However, once the anthropogenic disturbances end and sites are largely restored, it is not unreasonable that caribou will return to the Schefferville area with time. (Value of 1).

Magnitude

The magnitude of the effects of light and noise on caribou is negligible, since Howse includes only 1 pit, as compared to the rest of the complex of DSO-wide operations, and so is not expected to contribute substantially to the overall light and noise production. Further, the effects on the railway on caribou will likely be at the individual level, since herds overlap with the rail line is small (Value of 1).

Frequency

Light disturbance will only occur at night, and noise disturbance will be continuous. However, when added and compared to DSO, noise and light will be continual (Value of 2).

8.6.4.1 Significance

The cumulative residual effects of the Howse Project on caribou are expected to be non-significant (value of 10). This is expected given the scale of the Howse Project relative the Project *complexes* in the vicinity. Further, the Howse Project makes use of pre-existing facilities where possible, thus reducing detrimental effects on caribou.

The most damaging characteristics of light a noise effects on caribou are the duration of the effect (the entire life of the mine) and the frequency (discontinuous/regular).

Likelihood

The likelihood of Howse having an effect on the GRCH herd is **unlikely** because no caribou have been seen in the vicinity of the Howse Project in the last 5 years and calving grounds have shifted away from the area.

8.6.5 Follow up and Monitoring Programs

Monitoring Programs such as the Ungava Program (see details in Table 7-83) will allow HML to stay informed on caribou movements in the area and practice an adaptive management method in the monitoring of caribou.

8.7 AVIFAUNA CUMULATIVE EFFECTS ASSESSMENT

8.7.1 Scoping

The cumulative effects of noise, light and habitat loss from the Howse Project and nearby Projects on, grouses, ptarmigans, migrating birds and species at risk are considered for the cumulative effect assessment. Near the Howse Project mine area, past IOCC mining activities significantly modified habitat distribution and have caused habitat loss for avifauna. Other ongoing DSO mining activities (TSMC and LIM) haves also contributed to habitat loss but also to noise and light. The Taconite project, which may vary in scale depending on the option selected (Labmag and KéMag deposits), and Block 103 will also increase habitat loss for birds much more than Howse Project will ever do. In total, 114 species can be found regionally, and most of them are protected by the Migratory Bird Convention or the Species at Risk Act. There are no official population estimates for the Rusty Blackbird and Gray-cheeked Thrush, which are at-risk species in Labrador. However, from a regional point of view (20 km radius), it is estimated that suitable habitats could support up to 1,094 Rusty Blackbird pairs and 6,254 Gray-cheeked Thrush pairs (Section 7.4.8.2). There are no population estimates for Red-necked Phalarope nor Bank Swallow. No species of birds found in the region is exclusive to this geographic zone. However, several past, present or future mining projects, are concentrated in the RSA, increasing the probability of cumulative effects on avifauna.

8.7.2 Analysis

<u>Habitat loss, Noise and Light</u>

Cumulative anthropogenic disturbances mainly occur in the Schefferville area. Near the Howse Project mine area, past IOCC mining activities significantly modified the local landscape and potential bird habitats. Other DSO (TSMC and LIM) mining activities are ongoing and contribute to anthropogenic disturbances such as noise and light emissions. The Taconite project, which may vary in scale depending on the selected option (LabMag and KéMag deposits), and Block 103 will also increase anthropogenic disturbance and habitat loss.

Cumulative habitat loss caused by mining projects in the Schefferville vicinity remains the main threat for bird survival, including for the Rusty Blackbird, Gray-cheeked Thrush and Red-necked Phalarope, which are at-risk species. However, suitable habitats remain common, both locally and regionally, and most of the territory is still undisturbed. Therefore, no bird species are seriously threatened in the short and medium term. As the abandoned pit will constitute potential breeding habitats for Bank Swallow, cumulative effects for this species can be considered as beneficial.

In the long term, the increasing number of mining projects in the RSA could pose a more significant threat in terms of habitat loss for the Rusty Blackbird the Gray-cheeked Thrush and the Red-necked Phalarope, three species at risk found in the LSA. Bank Swallow is found in the LSA but eventually benefits of potential nesting sites in abandoned pits.

The Harlequin Duck and Short-eared Owl, which are also at-risk species, can be found in the RSA but are not directly affected by the Howse mining project. However, these species could potentially be harmed by the cumulative effects of the various projects over the long term.

The Howse Project area does not support significant breeding and staging areas for ducks and geese. High-quality breeding and staging habitats are found in the Howells River Valley, as indicated by the surveys (Section 7.4.8.1).

According to light modelling, the cumulative effects of Howse and surrounding projects will be highest in winter due to snow reflectance a period where no species at risk or birds protected under the Migratory Bird Convention are present.

The effects of noise from the Howse and DSO3 Projects will, at maximum, 5 dba at 1 km from the site. The exceedance over 5dba threshold is primarily due to the drilling activities and the First Nations crusher on tires. Therefore, potential disturbances on birds caused by noise will be extremely limited.

8.7.3 Mitigation

In addition to the previously mentioned standard and specific mitigations measures for avifauna, the proponent will participate to breeding birds and species at risk monitoring surveys as a follow up. Rusty Blackbird, Gray-cheeked Thrush, Red-necked Phalarope and Bank Swallow will be specifically monitored at a local scale to generate better population understanding of their response to the Project.

8.7.4 Residual Effects Significance Assessment

Birds breeding in boreal ecosystems where frequent small and large scale natural disturbance have occurred historically may be more resilient to human-induced to habitat changes. The subarctic forest is heavily fragmented, with strong edaphic and elevational gradients at the local and regional scales which have forced birds to adapt to patchy habitats. Further, the RSA does not include any unique habitats. As such, it is expected that avifauna will find alternate breeding grounds nearby and thus is generally considered as being resilient to such disturbance.

Table 8-5 Assessment Criteria Applicable for the Cumulative Effects on Avifauna

ECOLOGICAL CONTEXT		
Inconsequential timing	**Moderate** timing	**Unfavorable timing**
Timing of predicted Howse activities are not expected to affect any sensitive activities in the bird's life cycle.	Timing of predicted Howse activities may affect some bird's activities, i.e.: migration, late rearing, moulting.	Timing of predicted Howse activities may affect some critical bird's activities, i.e.: breeding and brooding or during migration in an important staging area.
SPATIAL EXTENT		
Site specific	**Local**	**Regional**
The Howse Project and surrounding activities will effect a small portion of the RSA	The Howse Project and surrounding projects activities will effect at least half of the RSA	The Howse Project and surrounding projects activities will effect nearly all of the RSA
DURATION		
Short	**Medium**	**Long**
The effect of the Howse Project and surrounding projects on avifauna will last less than 12 months and will not likely cause en effect on the population.	The effect of the Howse Project and surrounding projects on the avifauna will last between 12 or 24 months. Extends beyond the preparation/construction phase, but shorter than the lifespan of the Project.	Longer than 24 months, possibly as long as the project duration. The Howse Project and surrounding projects will likely cause long-term demographic changes to the avifauna.

REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
The avifauna is expected to return to their pre-Howse population status and distribution.	Effect on avifauna will persists after the decommissioning and reclamation phase but avifauna are expected to largely return to their pre-Howse status.	Avifauna will be permanently altered by the Howse Project and surrounding projects.
MAGNITUDE		
Low	**Moderate**	**High**
Effects will likely be on a few individual birds	Effects will likely have be on groups of birds.	Effects will likely be on bird populations level
FREQUENCY		
Once	**Intermittent**	**Continual**
The disturbance will occur once.	The disturbance will be occasional or intermittent	The disturbance will be year round.

Timing

Howse Project activities will occur throughout the year, with minimal winter blasting. Birds might exhibit deterrence behavior related to noise and light from the Project since noise and light produced by the Howse Project activities will be produced continuously. There will be no vegetation clearing during summer, when critical bird activities occurs. As there is no important staging area in the Howse area during spring and fall migration, the timing is thus evaluated as moderate (Value of 2).

Spatial extent

Avifauna will modify their breeding behaviour as a direct result of the Howse Project. However, the effect will be a small area when compared to adjacent anthropogenic activities. Further, the Howse Project will have effects on a small portion of the RSA. The cumulative effects of noise and light will be negligible too on a regional point of view. (Value of 1).

Duration

The avifauna is expected to interact with the effects of noise, light and habitat loss for the entire duration of the project, and as long as the mining site will not be restored. However, the Howse Project duration is short (approximately 12 years) relative to other Projects (up to the year 2050), and therefore has a relatively short effect on avifauna (Value of 2).

Reversibility

Although with the Howse Project alone, some avifauna will have to find new breeding sites, no species is expected to be temporarily or permanently extirpated of the RSA. Therefore, once the anthropogenic disturbances end and sites are largely restored, it is highly likely that all species of birds encountered will return to the sites (Value of 1).

Magnitude

The magnitude of the effects of light, noise and habitat loss on birds is negligible, since Howse includes only one pit, as compared to the rest of the complex of DSO-wide operations, and so is not expected to contribute substantially to the overall light, noise production. Habitat loss will essentially have an effect in the LSA due to the abundance of residual natural habitats nearby (Value of 1).

Frequency

Light disturbance will only occur at night, and noise disturbance will be continuous. However, when added and compared to DSO, noise and light will be continual. Habitat loss will be dealt more during the breeding season during the breeding season, between May and August which represent 25% of the year. (Value of 2).

8.7.4.1 Significance

The cumulative residual effects of the Howse Project on avifauna are expected to be non-significant (value of 9). The primary threat to avifauna in general following mitigation measures is habitat alteration, specifically related to the duration and frequency of noise and light disturbance, which can result in behavioral reactions

This non-significant effect is expected given the scale of the Howse Project relative to the Project *complexes* in the vicinity. Further, by making use of pre-existing facilities where possible, the detrimental effects on avifauna in general are reduced, particularly habitat loss. As a matter of fact, an important part of the Howse Project is located on already altered habitats with very low potential for avifauna use, limiting to a minimum adverse effects.

Likelihood

The likelihood of Howse having an effect on grouses, ptarmigans, migrating birds and on species at risk such as Rusty Blackbird, Gray-cheeked Thrush, Red-necked Phalarope and Bank Swallow is **likely** because all of these species were observed in the vicinity of the Howse Project in the last 5 years, including in 2015. As no Common Nighthawk nor Olive-sided Flycatcher have been seen in the vicinity of the Howse Project, the probability of Howse having an effect on these components is **very unlikely**.

8.7.5 Follow up and Monitoring Programs

Breeding bird surveys with point count methods and species at risk adapted protocols will allow HML to stay informed on avifauna in the area.

8.8 HUMAN HEALTH CUMULATIVE EFFECT ASSESSMENT

8.8.1 Scoping

The effects of air emissions from the Howse Project and nearby projects (e.g. DSO3 and DSO4) on air quality are considered in this cumulative effect assessment. The study area considered for cumulative assessment encompasses sensitive receptors of interest in the RSA and mining / processing / hauling activities associated with Howse, DSO3 and DSO4 located within the LSA. The air dispersion modelling report provides explanations on how air emissions sources from the three projects were incorporated in the calculations. The Howse, DSO3 and DSO4 projects are interconnected and their operation schedules will coincide at a future point. This interconnection necessitated a global approach to the air modelling study.

8.8.2 Analysis

Similar to the analysis of health risk for the project-only operation, a multi-media exposure and risk assessment was conducted to assess cumulative health risk form the project plus other local/regional activities.

For non-carcinogenic substances, a hazard quotient (HQ) is the measurement endpoint and is calculated as the ratio of the estimated daily exposure (dose) to the safe dose for each contaminant. These contaminants are threshold acting stressors, in that no health risks are predicted provided a threshold of safe exposure is not exceeded. The hazard quotient is a numerical metric of how a receptor's daily dose compares to what is toxicologically considered to be the safe dose, over a prolonged (chronic) period.

For substances with a non-threshold dose response (i.e., carcinogens) the risk estimate is a calculation of the Incremental Lifetime Cancer Risk (ILCR). ILCR is the predicted risk of an individual in a population of a given size developing cancer over a lifetime. The ILCR is expressed as the one additional person per "n" people that would develop cancer, where the magnitude of n reflects the risks (i.e., probability) to that population. For example, in Canada the lifetime probability of developing cancer is ~0.4 (40%), or 40 out of 100 people. An increase in the incremental lifetime cancer risk of 1E-5, would result in a probability of 0.40001, a 0.0025% increase relative to background cancer incidence. Due to the estimation nature of the prediction of ILCR, Health Canada recommends that ILCRs only be calculated for adult exposures.

To provide interpretive insight on the risk (impact) levels and conservative assumptions employed to offset various sources of uncertainty normally encountered in health risk assessment, the following categories were used to describe the risk magnitudes for non-carcinogenic compounds:

- **Negligible: HQ<1.0.** (consistent with Health Canada (2010a,b) guidance for a comprehensive multi-media exposure and has become accepted common practice)
- **Low and likely to be negligible: 1.0>HQ≤10** (acknowledges in this case that considerable conservatism is employed by the risk assessor and that over estimation of risk is likely)
- **Potentially elevated: HQ>10** (acknowledges in this case that considerable conservatism is employed by the risk assessor and that over estimation of risk is likely)

In cases where an estimated HQ may exceed any of the above categories by a change of <10% from the Baseline case, the Baseline is noted as the risk driver, and the incremental contribution from the Project is considered separately for interpretation of significance.

For carcinogenic compounds, the magnitude of the cancer risk was rated as follows with similar interpretation as note above for hazard quotients:

- Negligible: ILCR ≤ $1x10^{-5}$
- Low and likely to be negligible: $1x10^{-5}$ < ILCR ≤$1x10^{-4}$
- Potentially elevated: ILCR>$1x10^{-4}$

Numerical results for the human health cumulative effects assessment are presented in Table 8-6 and Table 8-7 for adult and toddler receptors, respectively. The effects were predicted based on air quality modelling performed specifically for the cumulative effects scenario.

Table 8-6 Predicted incremental Hazard Quotients for Adult receptors for the Cumulative Scenario assessment

	POTENTIAL CONTAMINANT OF CONCERN	ROUTE OF EXPOSURE					TOTAL
		Soil Ingestion	Particulate Inhalation	Soil Dermal Contact	Surface Water Ingestion	Country Food Ingestion	
CUMULAT IVE INCREME	Arsenic	3.3E-05	2.2E-04	8.6E-06	0.0E+00	4.1E-03	4.4E-03
	Barium	3.7E-08	1.2E-06	4.5E-07	0.0E+00	0.0E+00	1.6E-06
	Beryllium	1.9E-10	2.0E-07	2.3E-07	0.0E+00	2.3E-07	6.7E-07

	Chromium	3.8E-07	9.7E-05	2.5E-05	0.0E+00	4.0E-04	5.3E-04
	Iron	1.6E-04	1.2E-02	1.4E-04	0.0E+00	0.0E+00	1.2E-02
	Lead	1.5E-05	8.2E-05	1.3E-04	0.0E+00	5.5E-04	7.8E-04
	Manganese	9.0E-08	1.3E-05	1.9E-05	0.0E+00	0.0E+00	3.3E-05
	Mercury	4.8E-08	2.2E-04	4.1E-07	0.0E+00	2.6E-05	2.5E-04
	Molybdenum	3.2E-11	2.2E-10	2.7E-12	0.0E+00	1.4E-08	1.4E-08
	Selenium	2.9E-11	1.7E-10	2.5E-12	0.0E+00	1.1E-09	1.3E-09

Table 8-7 Predicted incremental Hazard Quotients for Toddler receptors for the Cumulative Scenario assessment

	POTENTIAL CONTAMINANT OF CONCERN	ROUTE OF EXPOSURE					TOTAL
		Soil Ingestion	Particulate Inhalation	Soil Dermal Contact	Surface Water Ingestion	Country Food Ingestion	
CUMULATIVE INCREMENT	Arsenic	5.7E-04	9.6E-04	1.5E-05	0.0E+00	1.0E-02	1.2E-02
	Barium	6.3E-07	5.0E-06	7.8E-07	0.0E+00	0.0E+00	6.4E-06
	Beryllium	3.3E-09	8.7E-07	4.0E-07	0.0E+00	4.7E-07	1.7E-06
	Chromium	6.5E-06	4.1E-04	4.3E-05	0.0E+00	1.2E-03	1.6E-03
	Iron	2.8E-03	5.2E-02	2.4E-04	0.0E+00	0.0E+00	5.5E-02
	Lead	2.6E-04	3.5E-04	2.3E-04	0.0E+00	1.3E-03	2.2E-03
	Manganese	1.8E-06	6.5E-05	3.8E-05	0.0E+00	0.0E+00	1.1E-04
	Mercury	8.3E-07	9.6E-04	7.1E-07	0.0E+00	6.5E-05	1.0E-03
	Molybdenum	6.6E-10	1.1E-09	5.7E-12	0.0E+00	6.0E-08	6.2E-08
	Selenium	4.6E-10	6.7E-10	4.0E-12	0.0E+00	2.8E-09	3.9E-09

- The predicted non-carcinogenic effects to adults and toddlers as provided above in Table 8-6 and Table 8-7 in the form of hazard quotients (HQs) indicate *the incremental cumulative operational risks to human health are negligible.*
- The predicted carcinogenic effects to adults (not tabulated but available from the HHRA technical support document) *indicate the incremental lifetime cancer risk (ILCR) from cumulative operational interactions to human health are negligible*.

8.8.3 Mitigation

Given that predicted effects to human health were negligible for the cumulative scenario, specific mitigation measures for human health under the cumulative effects scenario are not strictly warranted. However, mitigation measures for air quality are a prudent course of action. Mitigation for air quality in the cumulative scenario are listed in the air quality section of the EIS, and are reproduced below for convenience.

In addition to the previously-mentioned standard and specific mitigation measures for air quality, the proponent will practice adaptive management of the air quality in the vicinity of the Howse Project and in DSO areas as a whole. Adaptive management will be based on the air quality *monitoring plan (AQMP) currently under review by the NL, QC and Kativik authorities. The AQMP will consist in the installation of a network of air monitoring equipment at several locations for several air pollutants such as: NOx, TPM, $PM_{2.5}$, metals and dustfall.*

8.8.4 Residual Effects Significance Assessment

The human health context of the residual effect significance for the cumulative effects scenario employs the same six criteria to characterize the significance of health effects of the project-only scenario: timing (as it relates to project activities or receptor behaviours), spatial extent (LSA versus RSA extent of an effect), duration (duration of a predicted effect), reversibility of a predicted effect, magnitude (measure as the hazard quotient or incremental lifetime cancer risk), and frequency of the effect. The criteria and the rationale for how they have been assigned to the residual effects are further defined in Table 8-8.

Table 8-8 Assessment Criteria Applicable for the cumulative effects on Human Health Risk

TIMING		
Inconsequential timing	**Moderate** timing	**Unfavorable timing**
Timing and seasonality of predicted Howse activities or human receptor activities has no significant effect on Human Health.	Timing and seasonality of predicted Howse activities or human receptors activities may affect Human Health.	Timing and seasonality of predicted Howse activities or receptors activities will significantly affect Human Health.
SPATIAL EXTENT		
Site specific	**Local**	**Regional**
Effects are limited to the footprint of the project.	Effects extend beyond the footprint, but do not extend outside the LSA. Further, a subsection of Human Health Risk habitat will be altered.	The effect of the Howse Project will affect Human Health Risk in substantial part or the entire RSA.
DURATION		
Short	**Medium**	**Long**
The effect of the Howse Project will last less than 12 months.	The effect of the Howse Project will last between 12 or 24 months (Extends beyond the preparation/construction phase, but shorter than the lifespan of the Project).	Health effects will last longer than 24 months, possibly as long as the project duration.
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Health Effects expected to return to their pre-Howse levels.	Health Effects can be reversed but only in certain locations and not others; or certain health effects may be reversible but others may not be reversible.	Health Effects are not reversible (e.g. cancer)
MAGNITUDE		
Low	**Moderate**	**High**
Hazard Quotients ≤1.0 and Incremental Cancer Risks ≤ 10^{-5} -or- Change in Risk relative to Baseline Case is <10%	1.0< Hazard Quotients ≤10 or 10^{-5} < Incremental Cancer Risks ≤10^{-4}	Hazard Quotients >10 or Incremental Cancer Risks >10^{-4}
FREQUENCY		

Once	**Intermittent**	**Continual**
When no health effect occurs.	N/A	When health effects occur it is considered continuous.

Timing

The criterion *timing* in the present context relates to how the timing of project activities or human receptor activities could exacerbate or ameliorate exposure and health risk. Air quality and the presence/absence of human receptors are the most relevant factors. Other factors such as dietary exposure are extended over long time-lines (e.g. year-round consumption of frozen traditional foods tends to dampen a seasonal exposure). Noteworthy in this risk assessment, is the adoptions of exposure scenarios with worse-case exposure concentration and the assumption of receptors being present and exposed – notwithstanding the seasonality of hunting camps and summertime recreation. The multimedia exposure predicted total and pathway-specific exposure to yield negligible risk. Given this risk estimate is predicated on worse-case assumptions (e.g., conservatively high dietary consumption, high concentrations of air quality parameters), the influence of timing on the residual effect, although plausible, is considered inconsequential because the risk worse-case risk is negligible, and therefore *timing* is assigned a value of 1.

In the future, as new industrial entities become active in the area, it would be prudent to revisit and if warranted coordinate activities that may affect air quality or other environmental media to preserve the status of negligible residual effect of *timing* towards human health.

Spatial Extent

The concept of variable exposure concentrations beyond the project footprint is plausible. Because the health effects under the conservative assumptions are predicted to be negligible, the criterion of spatial extent is assigned a value of 1.

Duration

The residual effect criterion *duration* is considered in the context of duration of a significant health effect; the duration ranging from <12months to >24mo, the latter which may also encompass a significant risk of lifetime cancer. In the present instance, all conservatively assessed exposure pathways yielded negligible risk, as characterized by acceptable risk level defined by Health Canada. Accordingly, the criterion of duration of residual effect is assigned a value of 1.

Reversibility

The residual effect criterion *reversibility* is considered in the context of whether a significant health effect, if it was to occur, would be reversible within the timeframe of the project and/or physiologically reversible (e.g., cancer health effect). In the present instance, all conservatively assessed exposure pathways yielded negligible risk, as characterized by acceptable risk level defined by Health Canada. Accordingly, the criterion of reversibility does not strictly apply, and is assigned a value of 1.

Magnitude

The residual effect criterion *magnitude* is considered in the context of risk magnitude previously defined for ranges of hazard quotients (for non-cancer endpoints) and incremental lifetime cancer risk (ILCR). The categories were developed with consideration for Health Canada policy on acceptable health risk and conservative assumptions employed in the risk assessment. In the present instance, all conservatively assessed exposure pathways yielded negligible risk, as characterized by acceptable risk level defined by Health Canada. Accordingly, the residual effect criterion magnitude is assigned a value of 1.

Frequency

The residual effect criterion *frequency* is considered in the simplified context of whether a significant health effect is predicted to occur or not occur. It has not been considered in the context of number of people, as generally Health Canada policy for human health risk assessment is to consider significance of health risk to an individual, rather than frequency within a population. In the present instance, all conservatively assessed exposure pathways yielded negligible risk, as characterized by acceptable risk level defined by Health Canada. Accordingly, the residual effect criterion frequency is assigned a value of 1.

8.8.4.1 Significance

An overall cumulative effect of the Howse Project on human health is non-significant (value of 6). This conclusion is based on conservative exposure assumptions that err on the side of over – rather than under-estimating human exposure scenarios.

Likelihood

The likelihood for cumulative effects to human health based on current knowledge of the Howse project and external ancillary activities is considered very low, because the multimedia exposure assessment has employed numerous conservative assumptions, with consideration to traditional foods, Aboriginal traditional activities, and a comprehensive evaluation of the interaction of mine activities, air emissions and meteorological conditions that will influence air quality. Notwithstanding the conservative assumptions, the magnitude of health risk was found to be negligible for all exposure pathways, both individually and additively.

8.8.5 Follow up and Monitoring Programs

Monitoring for residual effects (project only or cumulative) is best focussed on indicators of exposure as this is more proactive than monitoring health effects per se. Monitoring health effects (i.e., health conditions) may also not provide robust cause-effect relationship.

Monitoring of exposure should target exposure media quality, specifically (i) air quality, game and fish meat quality, and berries/plant items, that may be traditionally consumed.

With respect to air quality monitoring, an exhaustive air quality monitoring report (AQMR) is currently under review by the NL, QC and Kativik authorities. The AQMR will consist in the installation of a network of air monitoring equipment at several locations for several air pollutants such as: NOx, TPM, $PM_{2.5}$, metals and dustfall. A draft version of the AQMR is provided in Volume 1 Appendix XXIV.

8.9 SOCIOECONOMIC CONDITIONS OF ABORIGINAL PEOPLE

8.9.1 Scoping

Cumulative effects of the Howse Project and surrounding projects on socioeconomic conditions of Aboriginal people include:

- the possibilities for employment and training; and
- contracting opportunities.

Both represent positive benefits for the local population, as the mining industry is the core economic sector in the Schefferville area outside of local government institutions. However, comments made during the consultation process indicated that a) the perceived benefits from mining companies are not meeting expectations in terms of the number of jobs and contracts at the local level and b) these positive benefits are contrasted by environmental effects of mining activities.

Spatial boundaries for this component are limited to the RSA, which follows the footprint of the Project roughly from the Schefferville region to Sept-Îles, from where the ore will be transported for transformation overseas. For the purpose of the cumulative effect assessment, the RSA includes three zones of populated areas: Schefferville, Labrador West and Sept-Îles areas.

The temporal boundaries go back to the beginning of the IOCC mine construction, which included the construction of the QNS&L railway in the 1940s, and coincide with the progressive sedentarization of the Innu and Naskapi in the Schefferville area, as well as with the creation of the municipality of Schefferville (1955) (Clément 2009a; Cooke 1976). The upper temporal limit corresponds to the end of the post-closure phase of the Howse Project activities, around 2037, which is 5 years following project decommissioning, once site closure and restoration works, and site monitoring are complete, and site stabilization has been reached.

The following analysis is based on concerns raised during Howse Project consultations with Aboriginal community members and land-users, as well as on existing literature on social effects of mining Projects (Alderon Iron Ore Corp. 2014; NML and PFWA 2009; Storey and Hamilton 2013). Information available from provincial and federal authorities regarding past, present, and future projects in the RSA was also taken into account (Table 8-2).

8.9.2 Analysis

Employment and training, as well as contracting, are essential to the local economy and to the maintenance and improvement of the quality of life of its residents.

The Schefferville region is characterized by:

- a limited labour pool with respect to:
  - population (less than 1,000 people 15 and over (Statistics Canada, 2011);
  - education levels (see section 7.5.3.2); and
  - the availability of a qualified labour force.
- a limited number of contractors and of services offered, with few if any opportunities for business diversification.

The *Comité sectoriel de Main-d'oeuvre de l'industrie des mines* (2015) has predicted that from 2015-2025, there will be 2,829 jobs in the mining sector on the North Shore region of Québec, given the low prices of the iron ore. It is difficult, however, to predict how many of these jobs are forecasted for the Schefferville region, which do not take into account jobs located on the Labrador side of the border.

There were approximately 1,000 people employed on the DSO Project in September, 2015, based on Full-Time Equivalent hours recorded, of which 150 were members of the NIMLJ, NNK and ITUM, and of the remaining workers, close to 60% were residents of NL. This number will decrease significantly to approximately 250 people in 2016 when the project's construction period has ended. There are three other projects planned to begin in the Schefferville region between 2015 and 2018 (DSO 4-2a, DSO 4-2b and Block 103, Table 8-2). In a context where the local availability of labour force and contactors will not be able to meet the demands, companies need to rely on a fly in- fly out system of operation which diminishes economic benefits at the local level by fulfilling jobs and giving contracts at the regional level. It is expected that the majority of these 'outside' workers will originate from Newfoundland and Labrador and Québec, as per Newfoundland and Labrador Benefits agreements (see section 7.5.3.5) and as per the trend for the DSO Project.

Aboriginal groups have signed IBAs for mining projects in the Schefferville region that establish employment and contracting priorities for Aboriginal Groups in order to secure a portion of the labour force and contracts required for the construction, operation and decommissioning of Projects. Training is essential to increase the capacity of the local population to fulfill job requirements, ideally technical jobs, and to seek career advancement, within mining companies and their contractors.

The mining sector is characterized by economic boom and bust cycles: the industry thrives when prices of iron are high, and retracts when prices slump. Employment and contracting opportunities are directly affected by these cycles. At the moment:

- The Schefferville region is seeing a decrease in employment and contracting opportunities, when compared to the number of projects that were under study from 2009-2012;
- Prices of iron ore are not expected to increase for the next 18 months[28]. Given that Schefferville is located on the Labrador Through, an increase in mining projects can be foreseen in the medium term, and when this occurs, the situation will likely change rapidly.
- HML is the only mining company operating in the region, (through its DSO Project) and employs a significant number of Innu and Naskapi (close to 150 in September of 2015).

Boom periods are positive for employment and contracting opportunities for the local communities. The cumulated effects of simultaneous projects can lead to competition between companies to recruit and to retain employees. Meeting labour needs may become difficult. Families benefit from the earnings, and municipalities and governments from taxation revenues.

During such periods, positive cumulated economic benefits will be felt throughout the RSA and potentially in other regions of NL and Québec, through employment and contracting opportunities that will be filled under a fly-in and fly-out regime. These opportunities will increase for the mining operation itself, and for the operation and maintenance of the railway and for port activities.

In contrast, downturn periods are associated to lay-offs and loss of business opportunities and may have significant negative effects on the local economy and on families. As explained in Section 7.5.1, the closing of the IOCC was a difficult experience for the Innu, the Naskapi and the non-Aboriginal population of Schefferville who remained in the region. This period was characterized by profound economic difficulties and affected the quality of life of all residents of Schefferville area. The recent reduction in mining activities – as of 2013 – has already affected the local communities in terms of job opportunities, as observed during the consultations for the Howse Project. Downturn effects may be enhanced in the context of cumulated projects, especially if all cease or reduce activities at the same time. This could occur between 2016 and 2032, depending on the length of the boom and bust cycles. This situation is due to absence of economic diversification in Schefferville area, as there are few job opportunities aside from mining activities and governmental organizations and services.

8.9.3 Mitigation

Any measures to minimize effects of mining activities on socioeconomic conditions will require the collaboration of all mining companies operating in the region and of local authorities in terms of assessments, implementation of measures, and monitoring. As such, the following measures and recommendations do not only concern HML, but the Schefferville region as a whole, where direct project effects are felt. The measures proposed below are for HML to implement, while the proposed

[28] http://www.bloomberg.com/news/articles/2015-08-17/goldman-sees-iron-ore-slumping-30-on-supplies-peaking-demand. See also http://investingnews.com/daily/resource-investing/base-metals-investing/iron-investing/iron-ore-price-forecast-patricia-mohr-scotiabank/

recommendations require collaboration between mining companies, governments, and the affected communities.

Measures

While the Howse Project itself will have positive effects on employment, training and contracting, the local population has expressed that they would like to maximize these benefits at the local level.

HML addresses issues regarding cumulative effects with local authorities through its IBA Implementation Committees, the Community HSE Committee, the Regional Steering Committee on Mining Issues, the elaboration of the joint emergency preparedness plan, and indirectly through its support and participation in Caribou Ungava. While there are currently no other mining companies operating in the region, it is through these means, or variations of these established jointly with other active mining companies, that measures aimed at mitigation effects will be elaborated. HML is also sits on the Labrador West Regional Task Force which aims to collaboratively address regional issues shared by municipalities, governments and mining companies. *HML will continue with its involvement in these means, and other initiatives, aimed at mitigating cumulative effects.*

Recommendations

With respect to the maximization of benefits and minimization of impacts to the Schefferville region, several actions can be taken by HML to overcome this difficulty:

- continue to work with local communities to maximize employment and business opportunities via respective IBA Implementation Committees;
- continue to address all HML/TSMC mining matters (Howse, Goodwood, DSO) under the aegis of the HSE Committee to monitor impacts and cumulative effects of mining operations.
- continue to participate in the Regional Steering Committee on Mining Issues (Schefferville), and the Labrador West Regional Task Force, and collaborate with other mining companies operating in the region to assess, address and monitor cumulative effects relating to mining. Discussion themes will be according to needs and priorities, and will include training, employment, contracting, and other issues that relate to the quality of life of the residents such as infrastructure capacity; traffic and road safety; effects of a fly-in, fly-out operation; communication with the local population; availability of public services; local sustainable development.
- continue to adhere to the Joint Emergency Preparedness Plan and collaborate with communities and other mining companies in doing so;
- Continue to collaborate in the Ungava Caribou research program in order to assess cumulative effects of mining on the GRCH;
- Work with mining associations and government to discuss and address cumulative effects issues
- Work with governments and communities to prepare a map showing all mining projects (proposed and ongoing), and which will guide land-users in harvesting resources in safe locations. These maps will be posted in public places.

8.9.4 Residual Effects Significance Assessment

The following table outlines the assessment criteria used to determine cumulative effects on socioeconomic conditions. The criteria and the rationale for how they have been assigned to the residual effects are further defined in Table 8-9.

Table 8-9 Assessment Criteria Applicable for the cumulative effects on Conditions of Aboriginal People

TIMING		
Inconsequential	**Moderate**	**Considerable**
Will not have an effect	Will have a moderate effect at times	Will have an effect at all times during all phases of the Project
SPATIAL EXTENT		
Site specific	**Local**	**Regional**
The Howse Project and surrounding projects activities will impact a small portion of the RSA	The Howse Project and surrounding projects activities will impact at least half of the RSA	The Howse Project and surrounding projects activities will impact nearly all of the RSA
DURATION		
Short	**Medium**	**Long**
The effect of the Howse Project and surrounding projects on socioeconomic conditions will last less than 12 months and will not likely cause changes.	Extends beyond the preparation/construction phase, but shorter than the lifespan of the Project.	The Howse Project and surrounding projects will likely cause long-term changes to socioeconomic.
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Full restoration of pre-development situation likely.	Effect on socioeconomic conditions will persists after the decommissioning and abandonment phase but are expected to largely return to their pre-Howse status.	Socioeconomic conditions will be permanently altered by the Howse Project and surrounding projects.
MAGNITUDE		
Low	**Moderate**	**High**
Affects a small proportion (<5%) of the population in the RSA.	Affects a limited proportion (5%-15%) of the population in the RSA.	Affects a significant proportion (>15%) of the population in the RSA.
FREQUENCY		
Once	**Intermittent**	**Continual**
~Once per year	Occasional/intermittent	Year-round (continual)

<u>Timing</u>

At the level of the RSA, the timing of the Howse Project alone has direct positive effects on socioeconomic conditions given that it will ensure that DSO operations are maintained, which are now the only mining activities taking place in the Schefferville region. However, it is difficult to predict when the price of ore will increase and at what point in time other mining companies will advance with their work in the Schefferville area. In the medium-term, it can reasonably be expected that projects other than Howse will be launched given the geological resources present in the Schefferville area. The timing effects of the cumulative effects are therefore considered moderate (Value of 2).

<u>Spatial Extent</u>

The spatial extent is local because the Howse Project and surrounding projects and activities will affect, likely positively, the socioeconomic conditions of Schefferville area generally (Value of 2).

Duration

The duration of the effect is difficult to predict as it will depend on mining sector conditions and interest in the Schefferville region by investors. Minimally, benefits associated with the Howse Project will be long since effects will be felt throughout its lifespan (Value of 3).

Reversibility

The effect will be partially reversible considering, for example, that skills learned during employment are transferable to other jobs; local enterprises will have obtained experience helping them to obtain other contracts; and economic benefits will be reflected tangibly in improvements in the quality of life of the local population (Value of 2).

Magnitude

In the medium-term, it can reasonably be expected that projects other than Howse will become operational given the geology of Schefferville area. The magnitude of the effect could be moderate as it could affect a limited proportion (<15%) of the population in the RSA (Value of 2).

Frequency

The frequency is continual, as employment and contracts and required on a day-to-day basis for mining operations (Value of 2).

8.9.4.1 Significance

The cumulative residual effects of the Howse Project on socioeconomic conditions of aboriginal people are expected to be non-significant (value of 13, positive).

Likelihood

The likelihood of the Howse Project having a positive effect on socioeconomic conditions is high.

8.9.5 Follow up and Monitoring Programs

The means listed in Section 7.5.3.5.3, and variations thereof in collaboration with other mining companies once they become active in the region, should be implemented.

8.10 SUBSISTENCE AND TRADITIONAL ACTIVITIES

8.10.1 Scoping

Cumulative effects for subsistence and traditional activities are concentrated in the Schefferville area, where members of the NIMLJ and the NNK are particularly active, and where ITUM members are holders of family traplines. Subsistence and traditional activities include the following components:

- access to the local road network, access to lands, and road safety;
- subsistence and traditional caribou hunting;
- subsistence and traditional activities (hunting, fishing, trapping and berry/medicinal plant harvesting); and
- preservation of and access to Kauteitnat.

Spatial boundaries for this component are limited to the RSA, which follows the Project footprint roughly from the Schefferville area to Sept-Îles, from where the ore will be transported for transformation (Table

8-2). For the purpose of the cumulative effect assessment, the RSA includes three zones of populated areas: Schefferville, Labrador West and Sept-Îles.

The temporal boundaries go back to the beginning of the IOCC mine construction, which included the construction of the QNS&L railway in the 1940s, and coincide with the progressive sedentarization of the Innu and Naskapi in Schefferville area, as well as with the creation of the municipality of Schefferville (1955) (Clément 2009a; Cooke 1976). The upper temporal limit corresponds to the end of the post-closure phase of the Howse Project activities, around 2037, which is 5 years following project decommissioning, once site closure and restoration works, and site monitoring are complete, and site stabilization has been reached.

The following analysis is based on concerns raised during the Howse Project consultations with Aboriginal community members and land-users, as well as on existing literature on effects of mining Projects on harvesting activities and ATK (Alderon Iron Ore Corp. 2012; NML and PFWA 2009; Clément 2009a,b; Weiler 2009a,b; Volume 2 Supporting Study C). Information available from provincial and federal authorities regarding past, present, and future projects in the RSA was also taken into account.

8.10.2 Analysis

Mining activities have an impact on subsistence and traditional activities in a number of ways, as discussed during the consultations with land-users, including by:

- physically altering the environment where resources are harvested (open pits, waste rock piles, access roads, etc.);
- generating road traffic and issues related to access to land and road safety ; and
- generating dust potentially affecting air, land and water that in turn, potentially affecting wildlife and human health.

The consultations for the Howse Project revealed that the local population negatively anticipates the cumulative effects of future projects on subsistence and traditional pursuits, based on their experience with the IOCC and with the more recent mining projects, when several mining companies were operating in Schefferville area simultaneously (2008-2013).

While the number of projects and operations has diminished since 2013, it is important to keep in mind that Schefferville is located on the Labrador Through and that several projects may be developed or reactivated once the price of ore increases. The significance of the cumulative effects on land-use and subsistence activities varies according to the number of mining projects in the area.

<u>Access to the local road network, access to lands, and road safety</u>

Past IOCC mining activities have significantly modified the landscape in the Schefferville area, and harvesters currently rely on the road network that was built by IOCC to access the land during the period after spring thaw and before the accumulation of snow. With the development of mining, there are expectations that the road network, which will likely expand with each project, will be used in the future for traditional pursuits in the area (fast, safe, no need for camps, etc.). When mining activities cease, roads will be left for the use of the local population.

Harvesting activities carried out in the DSO project area, which includes the Howse Project proposed site, are limited (Volume 2 Appendices C and D). Harvesters either travel through this area to reach other locations (for the Innu, Rosemary Lake area in particular), or choose to go elsewhere to avoid disturbance by the mining activities. Local land-users have the opportunity to go elsewhere in the vicinity of Schefferville, as other similar harvesting sites can be found nearby. These alternatives may be reduced as projects develop in the future, requiring further travel, or may be constrained in other ways (other sources of contamination, other family trapline holders, etc.). The displacement of land-use activities may have several implications, including:

- Financial costs for families:
  - Increase in expenses related to equipment (fuel, camps, vehicles, etc.) and time spent reaching locations;
  - Increase in expenses on store-bought food as a result of reduced accessibility of traditional food;
- "Cultural costs":
  - ATK is location-specific as well as species-specific. Going farther afield means frequenting areas about which knowledge is partial, and that knowledge may be not shared or only partially shared.
  - It may be harder to involve youths in harvesting activities that require longer trips (e.g., school outings on the land may be more difficult to organize).

Cumulative effects relative to access to land and road safety only affect the Schefferville area. Road safety may be an issue when mining vehicles and land-users share the same roads. As such, the cumulative effects of mining projects could pose a limitation in terms of easy access to some harvesting zones (work sites being made off-limits for safety reasons, escorts through work zones) (Section 7.5.2.1). Bypass roads play an important role in diminishing risks in terms of road safety. Future issues will largely depend on the specific location of mining projects in the region.

<u>Subsistence and traditional caribou hunting</u>

All Aboriginal groups (NIMLJ, NNK, ITUM, NCC and IN) have expressed concerns regarding the preservation of caribou and of their cultural heritage, in which the caribou plays a key role (Section 7.5.2.1). It is expected that mining activities (noise and light, for instance) as well as the use of the QNS&L railway will continue to affect caribou habitat, taking into consideration the precarious state of the resource, and other current and future projects in the area (Menihek Generating Station, TSH, etc., see Section 8.2). The relation between effects of mining and the decline of the George River Caribou Herd has not been established as of yet. Cumulative effects on caribou subsistence hunting may be felt in the portion of the RSA where caribou may be found (Labrador West and Schefferville areas).

<u>Subsistence and traditional activities (hunting, fishing, trapping and berry/medicinal plant harvesting)</u>

Subsistence and traditional activities are already impacted by mining activities in Schefferville area. A key element raised during the consultation process is the fear of contamination of resources. As mining projects develop in the area, the population's fear of consuming contaminated resources will increase, depending on the location and scope of these Projects[29]. It is important to note that land-use is also highly related to the perception of land integrity. Land-users may refrain from using areas where they have doubts regarding the quality of the resources or on potential environmental contamination. This is turn may have an effect on ATK and on knowledge shared between generations of users.

Given the potential for multiple mining projects in the area, site restoration is of prime importance to the local population, as indicated during the consultations, as well as for the ITUM, NCC, and IN (Chapter 4). Proper decommissioning and restoration represent the only way for a safeguarded environment in the future, though there is recognition that this will take time, and that the landscape in the Schefferville area

---

[29] However, the HHRA study (Volume 2 Supporting Study D) has demonstrated that resources would not be contaminated by dust generated by mining activities including road traffic.

will continue to be affected by mining activities. Such cumulative effects will be felt in the Schefferville area where resources are harvested.

Preservation and access to Kauteitnat

The potential cumulative effects on Kauteitnat are only relative to Schefferville area. The importance and cultural significance of Kauteitnat for the local population has been presented in Section 7.5.2.1. Potential cumulative effects on Kauteitnat will largely depend on the location of future projects. Until the prices of iron ore increase, there will be no further effects on Kauteitnat. Local land users will continue to have access to Kauteitnat.

8.10.3 Mitigation

Any measures to minimize effects of mining activities on subsistence hunting and activities will require the collaboration of all mining companies operating in one given area and of local authorities in terms of assessments, implementation of measures, and monitoring. As such, the following recommendations does not only concern HML, but the Schefferville area as a whole, where direct project effects are felt. The proposed recommendations require concerted actions between mining companies, governments, and the affected communities.

Recommendations

The following means have been identified to oversee and address cumulative impacts on subsistence and traditional activities.

With respect to the maximization of benefits and minimization of impacts to the Schefferville region, several actions can be taken by HML to overcome this difficulty:

- continue to address all HML/TSMC mining matters (Howse, Goodwood, DSO) under the aegis of the HSE Committee to monitor impacts and cumulative effects of mining operations.
- continue to participate in the Regional Steering Committee on Mining Issues (Schefferville), and the Labrador West Regional Task Force, and collaborate with other mining companies operating in the region to assess, address and monitor cumulative effects relating to mining.
- continue to collaborate with Université Laval, the government of Québec and the GNL in the Ungava Caribou research program in order to assess cumulative effects of mining on the GRCH;
- work with mining associations and government to discuss and address cumulative effects issues;
- work with governments and communities to prepare a map showing all mining projects (proposed and ongoing), and which will guide land-users in harvesting resources in safe locations. These maps will be posted in public places.

8.10.4 Residual Effects Significance Assessment

Mining development will continue in northern Québec and Labrador. In the long term, environmental disturbances caused by mining and other related projects are expected to increase, which could potentially further impact access to land, road safety and subsistence and traditional activities by Aboriginals. However, roads built by mining companies would be positive in the long term by allowing greater and easier access to the territory. During the construction and operations phases, however, a collaborative approach between the mining industry and harvesters will need to be maintained in order to ensure continued cohabitation with land-users.

At the moment, access to land is maintained, but it is difficult to predict how this could change with the advent of several mining projects in the Schefferville area.

The following table outlines the assessment criteria used to determine cumulative effects on subsistence and traditional activities.

Table 8-10 Assessment Criteria Applicable for the cumulative effects on Subsistence and Traditional Activities

TIMING		
Inconsequential	**Moderate**	**Considerable**
Will not have an effect	Will have a moderate effect at times	Will have an effect at all times during all phases of the Project
SPATIAL EXTENT		
Site specific	**Local**	**Regional**
The Howse Project and surrounding projects activities will impact a small portion of the RSA	The Howse Project and surrounding projects activities will impact at least half of the RSA	The Howse Project and surrounding projects activities will impact nearly all of the RSA
DURATION		
Short	**Medium**	**Long**
The effect of the Howse Project and surrounding projects on subsistence and traditional activities will last less than 12 months and will not likely cause changes to the subsistence and traditional activities.	Extends beyond the preparation/construction phase, but shorter than the lifespan of the Project.	The Howse Project and surrounding projects will likely cause long-term changes to the subsistence and traditional activities.
REVERSIBILITY		
Reversible	**Partially reversible**	**Not reversible**
Full restoration of pre-development situation likely.	Effect on subsistence and traditional activities will persists after the decommissioning and abandonment phase but subsistence and traditional activities are expected to largely return to their pre-Howse status.	Subsistence and traditional activities will be permanently altered by the Howse Project and surrounding projects.
MAGNITUDE		
Low	**Moderate**	**High**
Affects a small proportion (<5%) of the population in the RSA.	Affects a limited proportion (5%-15%) of the population in the RSA.	Affects a significant proportion (>15%) of the population in the RSA.
FREQUENCY		
Once	**Intermittent**	**Continual**
~once per year	Occasional/intermittent	Year-round (continual)

Timing

The Howse Project activities alone will have a moderate effect on the timing of subsistence and traditional activities as levels of impacts will vary for each component (e.g. waterfowl harvesting). However, these activities take place in an already active mining area. The cumulative effects of future potential projects, could impact the timing of subsistence and traditional activities in the RSA. The timing of cumulative effects is therefore considered moderate (Value of 2).

Spatial Extent

The spatial extent is site specific because the Howse Project and surrounding project activities will impact a limited portion of the RSA (Value of 1).

Duration

The duration of the effect will be long since effects will minimally be felt throughout the lifespan of the Project (Value of 3).

Reversibility

The effect will be partially reversible considering that a partial restoration to pre-development situation is likely. Roads built in the context of mining projects will also continue to be used by locals even after the end of operations (Value of 2).

Magnitude

The magnitude of the effect will be low since it affects a small proportion (<5%) of the population in the RSA and considering that alternative access to the territory will be available (bypass road). The magnitude of the effects of the Howse project (one pit) is also negligible, as compared to the rest of the DSO-wide operations and other potentials mining projects in the area (Value of 1).

Frequency

Land users tend to frequent the territory intermittently and seasonally (for example during hunting seasons or on the week-end for recreational purposes) and for a short periods of time (round trips in a single day). The frequency of the effect has been considered intermittent (Value of 2).

8.10.4.1 Significance

The cumulative residual effects of the Howse Project on subsidence and traditional activities is expected to be non-significant (value of 11).

Likelihood

There is a high likelihood that projects will be developed in Schefferville area in the future due to its location on the Labrador Through.

8.10.5 Follow up and Monitoring Programs

In addition to the monitoring measures in place for the Howse project (Chapter 9), HML is involved in various working groups, including its Community HSE Committee, Regional Steering Committee on Mining Issues, Caribou Ungava, and the Labrador West Regional Task Force, whose mandates include monitoring and addressing cumulative effects.

9 ENVIRONMENTAL MONITORING AND FOLLOW-UP

The environmental monitoring and follow-up plans presented in this section were designed to be easily integrated into the overall monitoring plan for TSMC's DSO project. The programs are presented for all VCs of the Howse EIS and they are designed to clarify some of the uncertainties inherent to the assessment process as well as to ensure that the Howse Project does not affect the VCs more than anticipated in the present document. Namely, the Proponent is committed to obtaining field data for those components which were assessed based on theoretical data. These uncertainties largely arise from environmental predictions on air emissions and permafrost conditions components.

The EPP (Volume 1 Appendix Ia) describes commitments to air, noise, surface/ground water monitoring as well as avifauna, fish and fish habitat, harvested animals, and caribou.

HML has also put in place various communication and socioeconomic monitoring mechanisms collaboratively with affected Aboriginal communities, which will be maintained for the Howse Project. During the last year of operations, the Proponent will conduct and evaluation the results of all of the environmental monitoring activities conducted on the Howse Project activities during the Operations phase. These results will allow the Proponent to adapt the closure and follow up program to the specific environmental issues identified for the Howse site. Any such environmental issue identified during the Operations phase will be targeted in order to improve the efficiency of the follow up program. Any issues or exceedances identified during the follow up program will be addressed in compliance with and applicable regulations and standards as well as in cooperation with local community.

9.1 PHYSICAL ENVIRONMENT

9.1.1 Air Quality

The Proponent is committed to monitoring atmospheric air quality, and, when the specific emitters are quantified and identified, will propose effective reduction measures. Air quality will be monitored using a combination of standard reference and site-specific sampling methods as per NL guidance document GD-PPD-065 (Guidelines for Ambient Air Monitoring, December 16, 2010). An Ambient Air Monitoring Plan will be prepared by TSMC and submitted to the provincial authorities for approval. Atmospheric air quality measurements include: TPM, PM10, PM2.5 dustfall, NO_2 and metals.

Conceptually, the atmospheric air quality plan will consist of:

- selecting sampling locations based on air modelling results and identified sensitive receptors;
- selecting appropriate sampling equipment and methods allowing for short-term (e.g., 1 hour), medium-term (24 hours) and long-term (monthly) monitoring of dust and NOx;
- obtaining local meteorological information, such as wind speed, direction and temperature;
- applying monitoring methods and equipment that can provide reliable, accurate and representative data, considering the climate in this region; and
- ensuring that monitoring results are actionable and that corrective actions are applied promptly to minimize effects on air quality, if necessary.

A draft Ambient Air Quality Monitoring Plan (Volume 1 Appendix XXIV) and a Draft Plan for the Prevention and Management of Blast Generated NOx (Volume 1 Appendix XIX) are appended to this study.

Greenhouse Gas Emissions

Since 2012, TSMC has reported its GHG emissions through the National Pollutant Release Inventory (NPRI) on an annual basis as well as for the GNL. In addition to continuing with this practice, HML will finalize an action plan for the reduction of GHGs following the acquisition of data on emissions from the Howse Project once the Howse plant is fully operational (dryer and wet plant).

9.1.2 Noise and Vibration

Noise will be monitored on a monthly basis in the Howse area (timeline to be defined). HML has committed to preparing a mitigation plan for the drill noise, which will be implemented should complaints occur. Example methods of reducing drill noise include:

- reducing drilling speed;
- reducing drilling time;
- using a noise shroud around the drill; and
- using a mobile noise screen.

A record of blasting data will include vibration speed, ground vibration frequency, air pressure, and dynamiting patterns. Blasts will be monitored for both vibration and overpressure, at the closest privately owned sensitive receiver adjacent to the site. HML is committed to implementing a seismograph for one year to assess vibration speed (peak particle velocity) during blasting. The blasting activity will be upgraded as needed, depending on results.

HML will employ blast monitoring techniques using seismographs in nearby deposits being mined to determine the extent of any ground vibration effects in order to ensure that there is no effect on Pinette Lake. Mining of the Howse deposit will begin in the most Northern part of the planned pit, which is also the farthest point from Pinette Lake. Continued seismographic monitoring in the Howse area away from Pinette will confirm if ground vibration behaves comparably to the areas previously monitored. Pinette Lake to an acceptable level to ensure that there is zero effect on any faults that may exist as part of the lake bed.

9.1.3 Surface and Groundwater Quality

Water quality will be monitored through several means. First, GNL's RTWQ Monitoring Network already has Instant Water Monitoring Stations in Goodream Creek and Elross Creek. These stations supply live information on water levels plus a number of water quality parameters. Other stations could be installed in the LSA at the GNL's request. The Howse Project is also subject to the *Environmental Control Water and Sewage Regulations, 2003* (Newfoundland and Labrador Regulation 65/03), under the *Water Resources Act* (O.C. 2003-231), and existing effluent monitoring for physico-chemical parameters at TSMC's DSO projects will be extended to Howse Project. Finally, the mine is subject to the *Metal Mining Effluent Regulations* (SOR/2002-222), under the *Fisheries Act* (R.S.C., 1985, c. F-14); once again, the monitoring program already in place for TSMC's DSO projects will be extended to include the Howse Project. The combination of these programs will ensure proper monitoring of water quality during mine operation.

The environmental monitoring plan has been developed based on preliminary information, and should be considered a conceptual design only. The environmental monitoring plan is subject to change based on the final site plan, consultations, site visits, feasibility, and government approvals. Figure 9-1 shows the proposed water monitoring plan.

As described in EPP (Volume 1 Appendix Ia), if possible, quarterly groundwater monitoring will occur on-site in accordance with the issued Certificate of Operation.

9.1.4 Surface Water Monitoring Station

Surface water quality will be monitored weekly and four times per calendar year. There are two types of surface water monitoring stations currently operational in the LSA. There are the instant monitoring stations that were characterized and at which hydrometric and water quality data are manually collected when accessible. There are also the RTWQ monitoring stations, which provide continuous water quality data and thus better insight into the effect of the mining operations on receiving waters than traditional grab samples.

Parameters measured by RTWQ stations are: temperature, pH, specific conductivity, dissolved oxygen and turbidity, which can be used to further calculate additional parameters such as total dissolved solids (TDS) and percent saturation. Additional sensors can be added to measure additional parameters, if needed. Water quantity data can also be measured by RTWQ stations (i.e., discharge, using stage height and velocity data).

The environmental monitoring program will provide effective real-time monitoring at the Howse Project site in accordance with the Canada-Newfoundland Water Quality Monitoring Agreement. To achieve this, the two instant monitoring stations that are already operational in the area could be upgraded to RTWQ monitoring stations at the request of the authorities. The provincial and federal governments will be responsible for the installation or relocation of real-time monitoring stations, as well as data collection and maintenance, as part of the Environment Canada/GNL’s RTWQ Monitoring Program. The stations and their intended use in the environmental monitoring program are listed below.

IHH1 (Instant Monitoring Station)

Hydrometric station IHH1 monitors Burnetta Creek, downstream from the proposed sedimentation ponds HOWSEA. This station currently monitors water quantity and requires that manual readings be taken. Water quality should also be monitored at this location, to provide insight into any contaminants in Burnetta Creek caused by the discharge from sedimentation ponds HOWSEA or other mining effluents. The proposed HSW1 station is at the same location as the IHH1 station and will fulfill this function (Section 9.1.6).

IHH4 (Instant Monitoring Station)

Hydrometric station IHH4 monitors Goodream Creek, close to its discharge point into Triangle Lake. It is downstream from Timmins 4 sedimentation pond 3 and sedimentation pond HOWSEB. This station currently requires manual readings.

IHH3 (Instant Monitoring Station)

Hydrometric station IHH3 is located in PIN1, the tributary to Pinette Lake. This station is located downstream from the Project, but water quality in this stream should not be affected by mining operations since all runoff from this watershed is diverted to Timmins 4 sedimentation pond 3. Currently, IHH3 also requires that stage height and velocity readings be taken manually. Surface water sampling for quality parameters is already done at sampling location COA SW13, which is part of the DSO4 project. This sampling should continue with the Howse Project, to provide insight on any contaminants of concern that may accidently enter Pinette Lake from that source.

GRH1 (Gaging ruler installed in Pinette Lake)

Gaging ruler GRH1 is located near IHH3 station, on littoral of Pinette Lake. This ruler is a staff gage currently installed to adequately monitor the variation of lake water levels. Reading should continue to allow the knowledge of the natural regime and future changes. The staff gage can be read visually from the shore.

NF03OB0040 (RTWQ Monitoring Station)

RTWQ Monitoring station NF03OB0040 (Goodream Creek, 2 km northwest of Timmins 6) is already part of the RTWQ Program in Newfoundland and Labrador. It is currently located upstream from sedimentation pond HOWSEB, but downstream from Timmins 4 sedimentation pond 3. This monitoring station could be moved downstream from sedimentation pond HOWSEB in order to monitor contamination from both the Howse Project and TSMC's DSO project. If the relocation of the monitoring station is determined not to be feasible or beneficial to the monitoring of both projects, an additional monitoring station should be installed in Goodream Creek, downstream from the discharge point of sedimentation pond HOWSEB, ideally at the IHH4 station, which has road access, or at the proposed HSW3 station (Section 9.1.6).

9.1.5 Effluent Monitoring

Effluent Discharge Criteria (EDC) parameters are usually tested weekly in effluent grab samples. Acute Lethality Test (ALT) parameters will only require monthly testing. An overview of the effluent monitoring schedule, including monitoring locations, is presented in Table 9-1.

Table 9-1 Effluent Monitoring Schedule

MONITORING LOCATION	PARAMETRES	FREQUENCY
1. Sedimentation Pond HOWSEA discharge into Burnetta Creek 2. Sedimentation Pond HOWSEB discharge into Goodream Creek 3. Timmins 4 Sedimentation Pond 3 discharge into Goodream Creek	EDC (excluding ALT) See Table 9-2 for specific parameters and limits	Weekly (minimum of 24 hours apart)
	ALT (conducted as per Environment Canada's Environmental Protection Service reference method EPS/1/RM-13 Section 5 or 6)	Monthly (minimum of 15 days apart)

Monitoring locations were selected to ensure that all effluent diverted into receiving waters is monitored regularly. All measured parameters will be compared to the EDC specified by the Certificate of Approval from the GNL. The expected parameters and concentrations are shown in Table 9-2 below, but may change once the Certificate of Approval has been issued.

Table 9-2 Effluent Discharge Criteria (EDC)

PARAMETRE	MAXIMUM ALLOWED MONTHLY MEAN CONCENTRATION	MAXIMUM ALLOWED CONCENTRATION IN A COMPOSITE SAMPLE	MAXIMUM ALLOWED CONCENTRATION IN A GRAB SAMPLE
Arsenic	0.50 mg/L	0.75 mg/L	1.00 mg/L
Copper	0.30 mg/L	0.45 mg/L	0.60 mg/L
Lead	0.20 mg/L	0.30 mg/L	0.40 mg/L
Nickel	0.50 mg/L	0.75 mg/L	1.00 mg/L
Zinc	0.50 mg/L	0.75 mg/L	1.00 mg/L
TSS	15.00 mg/L	22.50 mg/L	30.00 mg/L
Radium 224	0.37 Bq/L	0.74 Bq/L	1.11 Bq/L

PARAMETRE	MAXIMUM ALLOWED MONTHLY MEAN CONCENTRATION	MAXIMUM ALLOWED CONCENTRATION IN A COMPOSITE SAMPLE	MAXIMUM ALLOWED CONCENTRATION IN A GRAB SAMPLE
pH	Allowable Range 5.5 – 9.0 units		
ALT	Toxic pass		

Sampling frequency will decrease or increase depending on the results of previous consecutive tests, as specified by the Certificate of Approval. The conditions that would lead to a change in sampling frequency are outlined in Table 9-3 below.

Table 9-3 Changes in Sampling/Testing Frequency

PARAMETRE	TEST RESULTS	NEW TESTING FREQUENCY
Arsenic	Parameter's monthly mean concentration in the effluent is less than 10% of the maximum allowed mean concentration for the 12 months immediately preceding the most recent test	Once per calendar quarter
Copper		
Lead		
Nickel		
Zinc		
Radium 224	Concentration of radium 226 is less than 0.037 Bq/L in 10 consecutive tests	
ALT	Effluent is not determined to be acutely lethal over a period of 12 consecutive months.	
pH	Parameter testing frequency cannot be reduced.	
TSS	Parameter testing frequency cannot be reduced.	

The Department of Environment and Conservation will be notified in writing at least 30 days prior to a reduction in the testing frequency for any parameter. If during the next testing event, test results no longer meet the requirements for a parameter, that parameter will be tested at the original frequency shown in Table 9-1.

If an ALT determines that any sample is acutely lethal, a grab sample must be collected from the final discharge point of the failing site. An ALT must be performed, and an aliquot of the failing sample must be analyzed for the parameters listed in Table 9-2. Samples should then be collected twice per month until three consecutive tests determine that the effluent is no longer acutely lethal. After the third consecutive non-acutely lethal test, the ALTs must be conducted at the original testing frequency.

If the results of three consecutive ALTs show that the effluent is acutely lethal, a toxicity identification evaluation must be performed to determine the specific toxin causing the problem. A report outlining measures to prevent or reduce the toxin must then be submitted to the director of the Department of Environment and Conservation within 60 days of the third consecutive failed test.

Flow measurements at the effluent discharge of each sedimentation pond will be monitored through the installation of a Parshall flume in the ditches downstream from the permeable rockfill dikes of the pond. A Parshall flume reading will be taken at the same time that a water sample is collected.

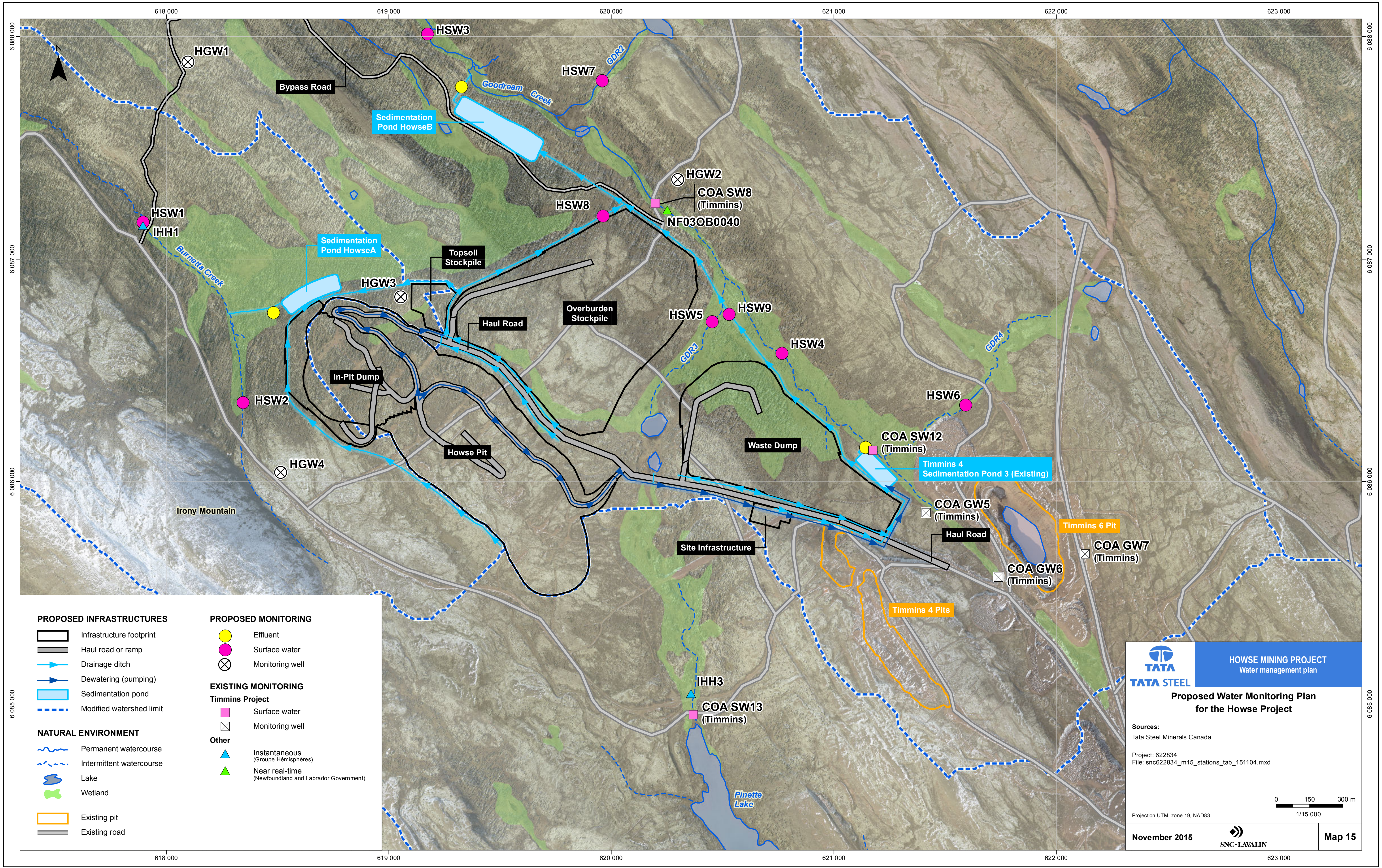
9.1.6 Water Chemistry Analysis (Surface and Groundwater)

In addition to the RTWQ monitoring system and effluent monitoring, groundwater and surface water grab samples will be collected four times a year and analyzed by a laboratory that has been certified by the Canadian Association for Environmental Analytical Laboratories. Monitoring locations and parameters to be tested are presented in Table 9-4 and Figure 9-1. As the monitoring program progresses, it may be appropriate to relocate, add or remove monitoring locations as needed.

Table 9-4 Water Chemistry Analysis Program

SAMPLE TYPE	STATION NUMBER	MONITORING LOCATIONS	PARAMETRES
Surface Water	HSW1	Burnetta Creek, downstream from Sedimentation Pond HOWSEA	General Parameters: temperature, dissolved oxygen (DO), nitrate + nitrite, nitrate, nitrite, pH, TSS, color, sodium, potassium, calcium, sulfide, magnesium, ammonia, alkalinity, sulfate, chloride, turbidity, reactive silica, orthophosphate, phenolics, carbonate ($CaCO_2$), hardness ($CaCO_3$), bicarbonate, TPH. Metals Scan: aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, mercury, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, radium, vanadium, zinc.
	HSW2	Burnetta Creek, upstream from Sedimentation Pond HOWSEA	
	HSW3	Goodream Creek, downstream from Sedimentation Pond HOWSEB	
	HSW4	Goodream Creek, northeast of Waste Rock Dump 2	
	COA SW12 (Timmins)	North of Timmins 4 Sedimentation Pond 3 (COA SW12 from Timmins Site)	
	HSW5	GDR3 stream between the Overburden Stockpile and Waste Rock Dump 2	
	HSW6	GDR4 stream northeast of Timmins 4 Sedimentation Pond 3	
	HSW7	GDR2 stream flowing into Goodream Creek, northeast of Sedimentation Pond HOWSEB	
	HSW8	Drainage ditch north of the Overburden Stockpile	
	COA SW8 (Timmins)	Goodream Creek, northeast of the Overburden Stockpile (COA SW8 – Timmins Site)	
	COA SW13	Stream north of Pinette Lake (COA SW13 – Timmins Site)	
	HSW9	Drainage ditch north of Waste Rock Dump 2	
Groundwater	HGW1	Northwest of the Howse Pit	
	HGW2	East of the Overburden Stockpile and Goodream Creek	
	HGW3	West of the Overburden Stockpile	
	COA GW5 (Timmins)	Southeast of Timmins 4 Sedimentation Pond 3 (COA GW5 -Timmins Site)	
	HGW3	West of the Howse Pit	

SAMPLE TYPE	STATION NUMBER	MONITORING LOCATIONS	PARAMETRES
		TSS analysis not required for groundwater samples. TPH analysis to be performed on sedimentation pond samples.	



C:\Projets\622834 Howse\interne\diffusion\produit\note_technique_2015\snc622834_m15_stations_tab_151104.mxd

Groundwater will be sampled using monitoring wells. The latter will be selected not only to obtain groundwater samples, but also to monitor the depth of groundwater, fluctuations in the water table and changes in groundwater flow direction that could be caused by pit dewatering, changes in surface drainage and permafrost melting. The installation of additional monitoring wells may be required if the current wells prove unsuitable for groundwater sampling/monitoring, based on hydrogeology/geology data, well depth, and well condition. Monitoring wells will be selected and installed in areas affected by potential mine effluents and also in areas that allow background sample collection. At least one monitoring well will be required as a reference well within each watershed of concern, up-gradient and away from all potential mine influences.

The number of surface water sampling sites required and their locations were determined based on the hydrological and geological characteristics of the area, the characteristics of the expected contaminants, anthropologic influences and ease of access. Sampling sites will be established downstream from contamination points, and reference sites will also be established up-gradient from potential contamination points.

Quality Assurance / Quality Control (QA/QC)

QA/QC samples will be taken regularly to ensure that proper field and laboratory techniques are being followed and to ensure the integrity of the results. A minimum of 10% of the samples submitted will be QA/QC samples, such as field duplicates, split samples, trip blanks and/or field blanks. Before each sampling event, discussions with the laboratory analyzing the samples will help determine the QA/QC protocols to be followed.

9.1.7 Permafrost

Two thermistors will be installed in spring of 2016 to monitor ground temperature in strategic locations, e.g. those that are inside an area with (low) permafrost potential.

9.2 BIOLOGICAL ENVIRONMENT

Currently, the Proponent is committed to performing wildlife surveys every five years on the TSMC / HML properties. Further, In addition, the Proponent is analyzing the feasibility of performing water footprint surveys on TSMC properties.

9.2.1 Wetlands

Although it is not expected that wetlands be affected by pit dewatering, (Section 7.4.2), the Proponent is committed to monitoring of wetlands during the routine site inspections and a wetland disturbance survey will also be conducted every five years.

Water table monitoring wells, consisting of perforated pipe should be installed before the beginning of the construction phase in order to obtain some measures before pit dewatering begins. Measurement should be taken once a month, but once every two week from the beginning of operation phase until dewatering ends. Construction of water table monitoring wells is described in USACE (2005). Transects of wells should be positioned in CMH-04, CMH-05 and CMH-06 (see Figure 7-30 for the location of these wetlands). The wells should be spaced 50 m apart.

Monitoring for rare plants

Prior to any work in a non-disturbed area, TSMC's environmental team will perform a screening for rare plants in the area. If a rare plant is discovered, the area will be isolated and specific measures to protect the species will be implemented.

9.2.2 Caribou

Caribou are being monitored for HML under an agreement between TSMC and the Ungava project and CARMA. This monitoring consists of telemetric data currently available from the CARMA program and there are presently 70 live collars on the GRCH which are being monitored for HML under this agreement. The decision to purchase more collars will be joint between all the partners in the UNGAVA program. Under this program, HML's Environmental Specialist / Permit Manager will be notified when migratory tundra caribou venture within 100 km of the Howse Project. Upon receipt of such a notice, operations will continue with caution. **If monitoring data from the radio collars indicate that some of the caribou have moved to within 20 km of the Howse Project, TSMC will institute surveys within that radius to monitor their movements in greater detail**.

Survey details will be evaluated during the early years of operation. Initially, preference will be given to fixed-point observations along high ground areas adjacent to the Howse Project activity sites and to snowmobile- and ATV-based searches by members of the local First Nations hired by HML, with instructions to avoid disturbing the animals. It is expected that the inclusion of Aboriginal people's help will benefit from the knowledge about the movements of caribou in the area. If ground-based surveys do not prove to be useful or feasible, HML will initiate aerial surveys. Special care will be taken at all times not to interfere with the activities of First Nation hunters.

The data collected during the surveys (number, age and sex; location of sightings; topography of sighting location) will be communicated frequently to the authorities concerned, who will be asked for advice with respect to the course of action to be followed, the overall goal being to reduce nuisance.

At no time will the Proponent use rubber bullets to repell caribou. The Newfoundland and Labrador Wildlife Division should be contacted to determine appropriate action should caribou not move away from project activities.

As per EPP (Volume 1 Appendix Ia) document, sedentary caribou will be monitored on site through regular site inspections and employee information sessions. Should a sedentary caribou be detected in the vicinity of the DSO Timmins project, the animal's location and direction should be noted and monitored.

9.2.3 Avifauna

The Proponent will engage in breeding birds and species at risk monitoring surveys every five years. Surveys with point count methods will allow HML to stay informed on avifauna in the area. In order to keep track of possible changes in bird populations, these surveys will be conducted in every habitat present in the Howse area, after the end of the construction phase.

Special attention will be directed on species at risk. Uses of playback in proper habitat will be part of an adapted protocol to ensure that Rusty Blackbird and Gray-cheeked Thrush are still using the remaining habitats. Red-necked Phalarope will be monitored in marshy habitats as Burnetta Creek. A surveillance program will be developed as well in existing pits for Bank Swallows. Finally, uses of wetlands and lakes in the study zone by waterfowl for breeding and staging will also be monitored properly every five years.

The Rusty Blackbird, Gray-cheeked Thrush, Red-necked Phalarope and the Bank Swallow will all be specifically monitored at a local scale.

The proponent is committed to surveying the Howse Pit vertical walls in early and mid-summer every year that the mine is in the operations phase. Should the Bank Swallow be detected, deterrence measures will be taken to render the site inhospitable (noise, plastic covering of pit walls, etc.) for nesting. Any nest found will be protected with a buffer zone determined by a setback distance appropriate to the species, the level of the disturbance and the landscape context, until the young have permanently left the vicinity of the nest. Setback distance suggested by Environment Canada (Environment Canada, 2015) is up to 50 m or more for swallow colonies.

Bank Swallow is the only species at risk susceptible to use the habitat left by the mining sites where restauration activities will take place. If a Bank Swallow nest or a colony is found during the follow up program, the Proponent is committed to ceasing all activities in order to allow for any natural behavior to proceed. Further, it is recommended that the Proponent stop any restauration activities in the vicinity of the sighting in order to improve the changes that an at-risk species establish at the Howse site following the operations phase. As per during the operatins phase above, any nest found will be protected with a buffer zone determined by a setback distance appropriate to the species, the level of the disturbance and the landscape context, until the young have permanently left the vicinity of the nest. Setback distance suggested by Environment Canada (Environment Canada, 2015) is up to 50 m or more for swallow colonies.

9.2.4 Aquatic Fauna

Aquatic fauna will be monitored in accordance with the *Metal Mining Effluent Regulations* (SOR/2002-222), under the *Fisheries Act* (R.S.C., 1985, c. F-14). These regulations require rigorous monitoring of fish and benthic invertebrates potentially affected by mine effluent, hence ensuring proper monitoring of this component. They also include an effluent and water quality monitoring program that allows for sound scientific interpretation of the results.

Any worker observations of unusual fish mortality will also be conveyed to local environmental technicians for immediate follow-up, and adequate measures will be taken to eliminate the identified cause.

9.3 SOCIOECONOMIC ENVIRONMENT

HML has put in place various communication and socioeconomic monitoring mechanisms collaboratively with affected Aboriginal communities, which will be maintained for the Howse Project. In addition to complying with all regulatory requirements, and to applying its EPP, HML will continue to carry-out the following monitoring, mitigation and communication measures pertaining to community issues:

- community HSE Committee meetings, held 3-4 times per year, to provide a forum for HML and affected Aboriginal communities to discuss and address as a group health, safety and environmental matters relating to the Howse and DSO Projects, and to assess Project effects and monitoring measures in place. Participation in meetings by experts on matters requiring specific advice, will continue to be possible and encouraged. Information from Committee meetings, including presentations and minutes, is made available electronically to Committee members and environmental information on the Project is made available on the Committee shared drive. HML will work with Committee members to inform the community at-large of the salient points of the matters discussed;
- agreement Implementation Committee meetings, held periodically and on an individual basis with each Aboriginal group, to assess :
    - aboriginal employment levels and training carried out, in relation to HML's activities, and gender equity;
    - aboriginal contracting levels;
    - financial benefits flowing to the communities, as per its agreements;
- regional Steering Committee on Mining Issues to discuss and address issues faced by residents in the region as they relate to mining activities; and
- HML Environment, Safety and Community Affairs personnel present on-site, in the Schefferville region and that can be reached 7 days per week, responsible for assessing and responding to community matters and/or concerns.

10 DECOMMISSIONING AND REHABILITATION

The Howse site will be restored to its existing conditions following the mine closure and a full closure plan will be submitted to the government as per NL mining regulations, in the spring of 2016. Being aware of the difficult process of restoration due to the Howse Project's location (e.g. climate and soil conditions), HML will conduct a study/review of applicable restoration methods. TSMC is currently seeking different research program partnerships with governments, research institutes (notably NRcan, University of Laval, Mcgill university, …) to support the future closure plan. The Proponent will not request a release certificate prior to consulting with First Nations, local communities and governments to develop the best approach. The main elements of the plan are set out in the sections below.

10.1 OBJECTIVES AND SCOPE OF THE REHABILITATION AND CLOSURE PLAN

The overall objectives of the rehabilitation and closure plan are to:

- provide a balanced, maintenance-free environment for fish, wildlife and plants;
- create a landscape compatible with surrounding areas while taking into account that previous disturbances caused by IOCC mining operations should not be the responsibility of HML;
- keep potential sources of pollution, fire hazards and public liability at an acceptable level and develop mitigation measures, if required; and
- provide a safe environment for long-term public access.

The rehabilitation and closure plan will include details on the natural and existing features of the site. It will include the following components:

- physical and chemical stability of the pit and waste rock dumps;
- natural aesthetic requirements;
- revegetation and wildlife habitats;
- water management;
- air quality;
- noise levels; and
- long-term land use.

10.2 PROPOSED APPROACH TO REHABILITATION AND CLOSURE

The main steps leading to rehabilitation and closure include:

- rehabilitation and closure planning;
- mine construction;
- mine operation / environmental monitoring / progressive rehabilitation;
- review of the rehabilitation and closure plan;
- closure rehabilitation;
- post-closure monitoring; and
- relinquishment of land.

10.3 PROGRESSIVE REHABILITATION

Progressive rehabilitation throughout the life of the project will include a waste management plan (see Section 5.10 in EPP document (Volume 1 Appendix Ia), revegetation/ecological restoration studies, geotechnical and slope stability studies, and in-pit mining methods.

10.3.1 Operational Monitoring

A comprehensive environmental monitoring program will be conducted as part of mining operations (see Chapter 9 in the current document), and the data collected will be used to evaluate the progressive rehabilitation program on an ongoing basis.

10.3.2 Reporting on Progressive Rehabilitation

Progressive rehabilitation activities will be reported as part of the annual operational reporting requirements. Under the *Mining Act,* a detailed report is required on the progressive rehabilitation work completed in the past year and the activities planned for the coming year.

10.4 REHABILITATION AND CLOSURE

10.4.1 Revegetation and Restoration

All areas affected by mining activities (sedimentation ponds, waste rock dumps, overburden stockpile) must be revegetated to control erosion and restore the site's natural conditions (taking into account that these were already at the onset of the Howse Project activities) and functions. Before revegetation, the land must be scarified and fertilized where necessary. Where applicable, the stockpiled organic soil must be spread. In general, grass and bushes must be planted to prevent soil erosion and facilitate the formation of humus. Types of ecosystems that could potentially be created using the Howse Project infrastructure will be specified and associated restoration methods described.

10.4.2 Contaminated Soils

Section 3 of the EPP (Volume 1 Appendix Ia) considers the potential discovery of contaminated soil soils. Following the end of mining activities, the land will be characterized in order to determine whether the resulting contaminated soils need to be rehabilitated. This characterization must include:

- the determination of the contamination level;
- the determination of the precise location and extent of the contamination;
- the determination of the volume of each contaminant; and
- the determination of methods to rehabilitate potentially contaminated sites.

Any spills that occur during the course of the Howse Project operations will be managed and reported in accordance with regulations and Section 6.3 of EPP document (Volume 1 Appendix Ia).

10.4.3 Support Infrastructure, Equipment and Heavy Machinery

During the final Decommissioning and Reclamation phase, the Proponent intends to continue with this practice by relocating generators, trailers and pumps to other DSO Projects. The exact fate of each of these items will be determined as needed during the Decommissioning and Reclamation phase.

All surface installations will be dismantled. Pumps, generators and pipes for the dewatering wells will be removed using excavators and flatbed trucks. Some of the wells may be used as control wells.

Mining equipment and heavy machinery must be removed from the site once it has been checked for contamination. During rehabilitation, equipment areas will be checked for any leakage and decontamination must be undertaken as required.

10.4.4 Open Pit

The Proponent intends to apply a mixed conventional and in pit method of mineral extraction, which will facilitate the restoration process during the operations phase of the Project. The priority in closing the open pit is to prevent wildlife and the public from accessing the pit floor, ensure stability of the slopes and maintain water quality once the pit has flooded. The ramp will be blocked at the pit exit using berms to restrict public access while maintaining access to the pit.

The Howse pit will be decommissioned through a sequence of events designed to maintain long-term wall stability. Flooding of the Howse pit will be allowed to occur naturally from groundwater inflows, snowmelt and rainfall within the pit catchment areas. The pit walls will be excavated to a stable slope angle during mining operations. Exact slope angles will be determined based on engineering specifications, historical pit slope stability in the region, and following a geotechnical pit wall stability study.

Pit water quality will be monitored on a regular basis as flooding proceeds. The pit benches lying in overburden will be regraded in order to facilitate revegetation. The extent of regrading will depend on pilot tests conducted during operations, which will determine optimal vegetation compositions and slope angles for vegetation regrowth.

All perimeter collection ditches will be regraded and contoured in accordance with the surrounding landscape.

During the Decommissioning and Rehabilitation phase, rock barricades consisting of rocks 1-2 m in diameter will be placed 10 m from the edge of the pit. The exact distance from the edge of the pit will be confirmed once a geotechnical assessment of the slopes is completed. These rock barricades will act as a warning and a protective barrier to prevent people and vehicles from going straight over the top of the wall. Signs in English and French will be posted approximately 15 m apart around the pit perimeter.

10.4.5 Waste Rock Dumps and Overburden Stockpile

The end goal of vegetation of the waste rock dumps is to return the area to the state it was in prior to TSMC's mining activities. The vegetation cover of the waste rock dumps should reflect the vegetation in place prior to work by TSMC.

The overburden stockpile will be active over the lifetime of the mine and will be used in progressive site rehabilitation, as well as in the final closure phase. Since the overburden in the Howse area is thick (between 21 m and 50 m), any overburden remaining in the stockpile at the end of the Howse pit operation will be regraded and contoured.

Pending the completion of a complete revegetation study, and based on local site conditions, it is assumed that the most effective revegetation strategy will consist of revegetating small sheltered areas first. This method would concentrate the limited organic materials in areas relatively protected from wind and water scour. The accumulated organic material from these 'vegetation islands' will subsequently disperse and provide a sufficient base for the same vegetation to spread and cover additional areas naturally.

The percentage of the waste rock dump that will be completely vegetated will be evaluated during progressive rehabilitation. Revegetation may not be possible in some areas due to strong winds and high elevations. In such cases, potential mitigation measures will be evaluated as part of the progressive rehabilitation efforts. It is noteworthy that the In-Pit method will allow the Proponent to limit the size of the waste rock piles considerably, which will facilitate the rehabilitation process.

10.4.6 Sedimentation Ponds

Sedimentation ponds will be restored. Various options will be analyzed, including wildlife ponds, wetlands and fill. Treatment sludge will be disposed of according to NL standards.

10.4.7 Howse Haul Road

The Howse haul road will not be decommissioned, and will remain available for use by local communities.

11 LITERATURE CITED AND PERSONAL COMMUNICATIONS

Personal Communications

André, D., Environmental Coordinator, MLJ, September 24 2014

Bouchard, J., Sécurité du Québec Director, Schefferville, September 26 2014

Cloutier, P., physician in NNK, NIMLJ and Schefferville, September 24 2014

Coggan, C. Atmacinta, Economy and Employment – NNK, 2013 and 2014 (for validation)

Corbeil, G., NNK Public Works, October 28 2014

Cordova, O., TSH Director, November 3 2014

Côté, S.D., *Localization of George River Caribou Herd Radio-Collared Individuals*, Map dating from 2014-12-08 from Caribou Ungava

Einish, L., *Centre de la petite enfance Uatikuss,* September 23 2015

Elders, NNK, September 26 2014

Elders, NIMLJ, September 25 2014

Fortin, C., Caribou data, December 15 2014 and January 22 2014

Gaudreault, D., Nurse at the CLSC Naskapi, September 25 2014

Guanish, G., NNK Environmental Coordinator, September 22 2014

ITUM, Louis (Sylvestre) Mackenzie family trapline holder, 207

ITUM, Jean-Marie Mackenzie family, trapline holder, 211

Jean-Hairet, T., Nurse at the dispensary of Matimekush, personal communication, September 26 2014

Jean-Pierre, D., School Principal, MLJ, September 24 2014

Joncas, P., Administrator, Schefferville, September 22 2014

Lalonde, D., AECOM Project Manager, Environment, Montreal, November 10 2015

Lévesque, S., Non-Aboriginal harvester, Schefferville, September 25 2014

Lavoie, V., Director, Société de développement économique montagnaise, November 3 2014

Mackenzie, M., Chief, ITUM, November 3 2014

MacKenzie, R., Chief, Matimekush Lac-John, September 23 and 24 2014

Malec, M., ITUM Police Force, November 5 2014

Martin, D., Naskapi Police Force Chief, September 25 2014

Michel, A. ITUM Environmental Coordinator, November 3 2014

NIMLJ Council member, September 23 2014

NNK Chief and Council, September 22 2014

Pelletier, Y., NNK CLSC, Financial Administrator, September 24 2014

Porlier, J., Nurse, Schefferville CLSC, September 27 2014

Porlier, G., Businessman and non-Aboriginal harvester, Schefferville, September 25 2014

Sandy-Robinson, R., Naskapi Development Corporation, September 22 2014

Statistics Canada, data collection methodology, 2011 Census, June 2012

TATA Steel Minerals Canada [TSMC], *DSO-Timmins Wildlife Sightings 2014*, January 2015

Thiagarajan (BK) Balakrishnan, Chief geologist, NML

Tootoosis, C., School Principal, Kawawachikamach, September 24 2014

Young land-users, NNK, October 27 2014

Young land-users, NIMLJ, October 28 2014

Database Consulted

AONQ [Atlas des oiseaux nicheurs du Québec] (2014) *Résultats de l'Atlas*. Online : http://www.atlas-oiseaux.qc.ca/donneesqc/cartes.jsp?lang=fr., page consulted September 2014

Ebird (2014). Sullivan, B.L., C.L. Wood, M.J. Iliff, R.E. Bonney, D. Fink, and S. Kelling. 2009. *eBird: a citizen-based bird observation network in the biological sciences*. Biological Conservation 142: 2282-2292. Consulted October 2014

Environment Canada, 2015. *Historical Climate Data*. http://climate.weather.gc.ca/index_e.html#access. Consulted for Schefferville on August 2015

LUA [Land Use Atlas] (2013) *Department of Environment and Conservation, Land Management Division*. Online: http://www.env.gov.nl.ca, page consulted November 2013

Maps Consulted

Natural Resources Canada (1993) Canada-Permafrost [map]. Fifth Edition, National Atlas of Canada

Laws Consulted

Government of Canada, *Canadian Constitution Act*, 1867-1982

Government of Canada. *Canadian Environmental Assessment Act*, 2012 (S.C. 2012, c. 19, s. 52)

Government of Canada. *Indian Act* (R.S.C., 1985-c, l-5)

Government of Canada. *Metal Mining Effluent Regulations*. SOR 2002 - 222

Government of Newfoundland and Labrador*. Environmental Assessment Regulation, 2003 under the Environmental Protection Act (O.C. 2003-220)*

Government of Newfoundland and Labrador. *Environmental Protection Act* (EPA) SNL2002 CHAPTER E-14.2

Government of Newfoundland and Labrador*. Mining Act*, 1999, SNL1999 CHAPTER M-15.1

Government of Newfoundland and Labrador. Air Pollution Regulation, 2004 under the Environmental Protection Act (O.C. 2004-232) Amended by: 94/1034/14, Schedule A – Table I: Ambient Air Quality Standards at Reference Conditions

Government of Newfoundland and Labrador. *Environmental Control Water and Sewage Regulations*, Regulation 65/03

Govenment of Newfoundland and Labrador. *Policy for Development in Wetland, Newfoundland and Labrador*, W.R. 97-2

Government of Newfoundland and Labrador. *Water Resources Act*, SNL2002 CHAPTER W-4.01

Government of Québec, Atmospheric quality standards, Sections 197 and 198 and Schedule K of the Clean Air Regulation, Q-2, r. 4.1

Governement of Canada, Migratory Birds Convention Act, 1994

Government of Québec, *Loi sur l'aménagement et l'urbanisme* (L.R.Q., c. A-19.1)

Agreements Consulted

Memorandum of Agreement Concerning the Voisey's Bay Project (2002) Online: http://www.laa.gov.nl.ca/laa/land_claims/MemorandumAgreement.pdf

New Dawn Agreement – The Tshash Pepapen Agreement (2008) Online: http://www.releases.gov.nl.ca/releases/2008/exec/0926n07agreement.pdf

Labrador Innu Land Claims Agreement-in-Principle (2011). On line: http://www.aadnc-aandc.gc.ca/DAM/DAM-INTER-HQ/STAGING/texte-text/ccl_farim_nl_labinnu_caip_1331749872252_eng.pdf

The James Bay and Northern Québec Agreement (JBNQA, 1975)

The Northeastern Québec Agreement (NEQA, 1978)

The Agreement Respecting the Implementation of the Northeastern Québec Agreement (1980)

The Cree-Naskapi (of Québec) Act (CNQA, 1984)

The Partnership Agreement on Economic and Community Development Between Naskapis and Québec (2009)

Bibliography

Aboriginal Affairs and Northern Development Canada [AANDC] (2014) *First Nation Profiles and Indian Register*. Online: http://www.aadnc-aandc.gc.ca, page consulted between September and December 2014

Adriana Resources Inc. (2015) *Lac Otelnuk Project, Québec*. Online: http://www.adrianaresources.com/s/LacOtelnuk.asp, page consulted January 2015

AECOM Canada Ltd. (2009) *Breeding Bird Monitoring Report – James, Redmond, Silver Yards, Knob Lake, Houston, Howse, and Proposed Road Crossing Areas*. Submitted to Labrador Iron Mines, 31 p.

Aerial Consulting (2014). *Adult Education* and *Training: System Analysis* and *Development in the Kawawachikamach-Schefferville Region*. Draft Report

Alderon Iron Ore Corp. (2014) *Kami Project.* Online: http://www.alderonironore.com/projects/kami/, page consulted January 2015

Alliance Stratégique Innue (2012). Online. Page consulted January 2012

AMEC Earth & Environmental (2012) *2006 Fish and Fish Habitat Surveys, Howells River Basin, Labrador*. New Millennium Capital Corp. Report TF1178901, 96 pages and 8 appendices

AMEC Earth & Environmental (2009*) Fish and Fish Habitat Investigation for the Direct-Shipping Ore Project*, New Millennium Capital Corp. Report TF8165902. Prepared for Groupe Hémisphères, 39 p. and 3 appendices

Andrews, J.T., G.H. Miller, J.S. Vincent and W.W. Shilts (1986) *Quaternary correlations in Arctic Canada.* Quaternary Science Reviews 5: 243-249

ArcelorMittal (2014a) *Complexe minier de Mont-Wright*. Online: https://www.arcelormittal.com/minescanada/a_propos/installations/Mont_Wright.aspx, page consulted January 2015

ArcelorMittal (2014b) *Mine de Fire Lake.* Online: https://www.arcelormittal.com/minescanada/a_propos/installations/Mine_FireLake.aspx, page consulted January 2015

Arkéos inc. (2012) *Projet de minerai de fer à enfournement direct - Phase 2. Provinces de Québec et de Terre-Neuve-et-Labrador. Inventaire archéologique, 2011 (chemin Goodwood-Timmins et voies d'accès secondaires)*. Soumis à NML et Tata Steel Minerals Canada Ltée

Arkéos inc. (2008a) *Projet KéMag-Programme de forage-Printemps 2007*. Inventaire archéologique préalable aux forages et étude de potentiel archéologique, lac Harris, Nouveau-Québec. Soumis à NML et PFWA

Arkéos inc. (2008b) *Projet de minerai de fer à enfournement direct : Programme d'exploration, été 2008*. Inventaire archéologique. Soumis à NML et PFWA

Armitage, P. (2010) *Innu of Labrador Contemporary Land Use Study*. Submitted to Innu Nation, Sheshatshiu and Natuashish, Labrador

Armitage, P. and M. Stopp (2003) *Labrador Innu Land Use in Relation to the Proposed Trans Labrador Highway, Cartwright Junction to Happy Valley-Goose Bay, and Assessment of Highway Effects on Innu Land Use*. Submitted by Innu Environmental Limited Partnership to Department of Works, Services and Transportation, Government of Newfoundland and Labrador

Artefactuel (2013) *Projet Taconite 2013 - Inventaire des sites S-1 (GgDu-1) et S-2 (GgDu-2), près du lac Harris, Nouveau-Québe*c. Soumis à NML

Assemblée des Premières Nations du Québec (2014). *Les besoins en logement des Premières nations du Québec et du Labrador*. Online : http://www.apnql-afnql.com/fr/dossiers/img/logement/BesoinsLogement-2014-resume-fr-en.pdf, page consulted November 2014

Agence de la santé et des services sociaux de la Côte-Nord [ASSSCN] (2010) *Enquête Santé Côte-Nord 2010*. Rapport RLS Caniapiscau. Online: http://www.agencesante09.gouv.qc.ca/fileadmin/documents/Documentation/Statistiques_etudes_et_analyses/Enquetes_de_sante/ESCN_2010_-_Caniapiscau.pdf, page consulted December 2014

Agence de la santé et des services sociaux de la Côte-Nord [ASSSCN] (2014). Online: http://www.agencesante09.gouv.qc.ca/. Page consulted December 2014

Altman, B. and R. Sallabanks (2012) *Olive-sided Flycatcher (Contopus cooperi),* The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/502 doi:10.2173/bna.502

Astrolab (2014) *Light pollution*. Online: http://astrolab-parc-national-mont-megantic.org/en/homepage-light-pollution.htm, page consulted January 2015

Australian Explosives Industry and Safety Group Inc. (2011) *Code of Practice – Prevention and Management of Blast Generated NOx Gases in Surface Blasting*. 2nd Edition, 43 p.

Bash, J., C. Berman and S. Bolton (2001) *Effects of Turbidity and Suspended Solids on Salmonids*. Center for Streamside Studies, University of Washington, 56 p. and 4 appendices

Beak (1980) *Fisheries resources of tributaries of the lower Churchill River*. Prepared by Beak Consultants Limited for the Lower Churchill Development Corporation, St. John's, Newfoundland and Labrador

Berg, L. (1982) *The effect of exposure to short-term pulses of suspended sediment on the behavior of juvenile salmonids*. P. 177-196 in G.F. Hartman et al. [eds.] Proceedings of the Carnation Creek workshop: a ten-year review. Department of Fisheries and Oceans, Pacific Biological Station, Nanaimo, Canada

Berg, L. and T.G. Northcote (1985) C*hanges in territorial, gill- flaring, and feeding behaviour in juvenile coho salmon (Oncohynchus kisutch) following short-term pulses of suspended sediment*. Canadian Journal of Fisheries and Aquatic Sciences 42: 1410-1417

Bergerud, A.T. (1970) *Population dynamics of the Willow Ptarmigan Lagopus lagopus alleni L. in Newfoundland* 1955-1965. Oikos 21: 299-325

Bergerud, A.T., R.D. Jakimchuk and D.R. Carruthers (1984) *The Buffalo of the North: Caribou (Rangifer tarandus) and Human Developments*. Arctic 37(1): 7-22

Bird, D.M. et J. Junda (2012) *Inventaire du hibou des marais (Asio flammeus) réalisé aux sites miniers LabMag et KéMag les 30 juin et 1er juillet 2012*. Préparé pour New Millenium Iron, 31 p.

Boag, D.A. and M.A. Schroeder. (1992) *Spruce Grouse (Falcipennis canadensis), The Birds of North America Online (A. Poole, Ed.).* Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/005 doi:10.2173/bna.5, page consulted December 2014

Boulanger, J., K.G. Poole, A. Gunn and J. Wierzchowski (2012) *Estimating the zone of influence of industrial developments on wildlife: a migratory caribou Rangifer tarandus groenlandicus and diamond mine case study*. Wildlife Biology 18: 164-179

Brace Centre for Water Resources Management (2005) *Low-Flow Measurements on Howells River, Labrador – 2005*. Prepared for LabMag GP Inc.

Bradbury, C., A.S. Power and M.M. Roberge (2001) St*andard Methods Guides for the Classification/Quantification of Lacustrine Habitat in Newfoundland and Labrador.* Department of Fisheries and Oceans Canada, St. John's, NF. 60 p

Broders, H.G. and G.J. Forbes (2004) *Interspecific and intersexual variation in roost-site selection of northern long-eared and little brown bats in the Greater Fundy National Park ecosystem*. Journal of Wildlife Management 68(3):602-610

Brown, R. (2005) *Observations in the Howells River Basin, Labrador, 1983-2002*. Submitted to LabMag GP Inc

Brumm, H. (2004) *The impact of environmental noise on song amplitude in a territorial bird*. Journal of Animal Ecology 73(3) : 434-440

Brunet, R., R. Duhamel et J. Léger (2008) *Synthèse des résultats d'inventaires fauniques – 2006 (Herpétofaune, micromammifères, chiroptères, cougars, carcajous et insectes).* Submitted on behalf of Envirotel 3000 inc. to LabMag GP Inc

Brunet, R. et R. Duhamel (2005a) *Revue de littérature et plan d'échantillonnage : insectes, herpétofaune, micromammifères et chiroptères*. Submitted on behalf of Envirotel 3000 inc. to LabMag GP Inc

Brunet, R. et R. Duhamel (2005b) *Échantillonnage 2005 : herpétofaune, micromammifères et chiroptères. Préliminaire.* Submitted on behalf of Envirotel 3000 inc. to LabMag GP Inc

BSI British Standards (2008) *Code of practice for noise and vibration on construction and open sites – Part 1: Noise*

Cameron, R.D., W.T. Smith, R.G. White and B. Griffith (2005) *Central Arctic Caribou and Petroleum Development: Distributional, Nutritional, and Reproductive Implications*. Arctic 58(1): 1-9

Canadian Environmental Assessment Agency [CEAA] (2015a) A*ddressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012*. Canadian Environmental Assessment Agency, 6 p.

Canadian Environmental Assessment Agency [CEAA] (2015b) *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012*. Canadian Environmental Assessment Agency, 6 p.

Canadian Environmental Assessment Agency [CEAA] (2015c) *Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012*. Canadian Environmental Assessment Agency, 8 p.

Canadian Environmental Assessment Agency [CEAA] (2012) *Canadian Environmental Assessment Act, 2012, S.C. 2012, c. 19 s. 52*. Current to January 6, 2016, Last amended on December 31, 2014. Online: http://laws-lois.justice.gc.ca/PDF/C-15.21.pdf

Canadian Environmental Assessment Agency [CEAA] (2003) *Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners*. Published by: The Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment, 44 p.

Canada Mortgage and Housing Corporation (2011). *Perspectives du Marché de l'habitation – Faits saillants pour la région du Québec* – (4th quarter) 2011

Canada Mortgage and Housing Corporation (2014). *Housing Market Outlook — Québec Region Highlights – 2012* (4th quarter)

Cap-Ex Iron Ore Ltd. (2014) *Block 103.* Online : http://www.cap-ex.ca/projects/block-103, page consulted January 2015

Castelle, A.J., C. Conolly, S. Cooke, M. Emers, T. Erickson, E.D. Metz, S. Meyer, S. Mauermann, and M. Witter, editors (1992) *Wetland buffers: use and effectiveness*. Publ. No. 92-10, Washington State Deptartment of Ecology, Olympia. 171 p.

Castonguay, Dandenault et Associés Inc (2006) *Étude du milieu Innu, communauté de Uashat mak Mani-Utnema*. Projet de raccordement du complexe de la Romaine au réseau de transport. Presented to Hydro-Québec. November 2006

CBC News (2012) *IOC expansion slowdown may cost jobs*. 06/02/2013.Online: http://www.cbc.ca/news/canada/newfoundland-labrador/ioc-expansion-slowdown-may-cost-jobs-1.1348411, page consulted in February 2014

Cederholm, C.J. and E.O. Salo (1979) *The effects of logging road landslide siltation on the salmon and trout spawning gravels of Stequaleho Creek and the Clearwater River basin, Jefferson County, Washington, 1972-1978*. FRI-UW-7915. Fisheries Research Institute, University of Washington, Seattle. 99 p.

Cégep de Sept-îles (2014) *Programmes*. Online: http://www.cegep-sept-iles.qc.ca/fr/arts-et-lettres_74/, page consulted December 2014

Century Iron Mines (2014) *Joyce Lake DSO Project*. Online : http://centuryiron.com/projects/joyce-lake-attikamagen/, page consulted January 2015

CircumArctic Rangifer Monitoring and Assessment [CARMA] (2013) *George River Herd*. Online : http://www.caff.is/index.php?option=com_content&view=article&id=591&Itemid=1239, page consulted November 2013

Champion Iron Mines Limited (2014) *Fire Lake North Deposits*. Online: http://www.championiron.com/projects/consolidated-fire-lake-north/fire-lake-north-deposits/, page consulted January 2015

Cichowski, D.B. (1993) *Seasonal movements, habitat use, and winter feeding ecology of Woodland caribou in west-central British Columbia*. Victoria, British Columbia, Ministry of Forest, Land Management Report no 79. 54 p.

Clément, D. (2009) *Innu Use of the Territory and Knowledge of its Resources*. New Millennium Capital Corps, Direct Shipping Ore Project. Environment Impact Statement Supporting Study May 2009

Clément, D. (2012) Le bestiaire Innu: Les quadrupèdes. Presse de l'Université Laval

Cliffs Natural Resources (2015) *News Release Details*. Online: http://ir.cliffsnaturalresources.com/English/investors/news-releases/news-releases-details/2015/Cliffs-Natural-Resources-Inc-Concludes-the-Sale-of-Logan-County-Coal-and-Provides-Update-on-Bloom-Lake/default.aspx, page consulted January 2015.

Cliffs Natural Resources (2013) 2012 *Sustainability Report*. Online: http://www.cliffsnaturalresources.com/EN/CorpResponsibility/ArchivedReports/Sustainability2012/Lists/Sustainability%20Report%20Files/Attachments/36/Cliffs%202012%20Sustainability%20Report%20-%20Spill%20Management.pdf, page consulted August 2015

College of the North Atlantic (2014) Online. http://www.cna.nl.ca/, page consulted in October 2014

Commission Internationale de l'Éclairage [CIE] (2003) *Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations*

Commission scolaire du fer (2014) *Centre de formation professionnelle et générale A.W. Gagné Sept-Îles*. Online: http://www.csdufer.qc.ca/formation-professionnelle-des-adultes, page consulted November 2014

Committee on the Status of Endangered Wildlife in Canada [COSEWIC] (2014) D*atabase of wildlife species assessed by COSEWIC*. Online: http://www.cosepac.gc.ca/eng/sct1/searchform_e.cfm, page consulted November 2014

Committee on the Status of Endangered Wildlife in Canada [COSEWIC] (2003) C*OSEWIC assessment and update status report on the wolverine Gulo gulo in Canada.* Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 41 p.

Conférence régional des élus de la Côte-Nord (CRECN) (2014) Online : http://www.crecotenord.qc.ca/, page consulted in October 2014

Conant, R. (1975) *A Field Guide to Reptiles and Amphibians of Eastern and Central North America.* 2nd ed. Peterson Field Guide Series. Boston: Houghton Mifflin

Conseil des Atikamekws et des Montagnais [CAM] (1983) O*ccupation et utilisation du territoire par les Montagnais de Schefferville*

Conseil d'intervention pour l'accès des femmes au travail [CIAFT] (2011) *La mixité au travail : un défi d'égalité*

Conseil regional de l'environnement de la Côte-Nord (CRECN) (2013) *Par notre propre énergie : Portrait énergétique régional de la Côte-Nord*. On line : http://www.crecotenord.qc.ca/sites/default/files/portrait_energetique_cn.pdf

Conseil scolaire francophone provincial de Terre-Neuve-et-Labrador (2014) Online. http://www.csfp.nl.ca/, page consulted in November 2014

Conseil Tribal Mamuitun (2014) *Conseil Tribal Mamuitun* Online: http://www.mamuitun.com, consulted September 2014

Cooke, A. (1976) *Histoire des Naskapis de Schefferville*. Projet préliminaire

Costa, S. (2007) *Overview of the Commuter Mining Model*. Supporting Study for the LabMag Iron Ore Project EIS. Report prepared for New Millennium Capital Corps, Direct Shipping Ore Project

Cournoyer, L., A. Yagouti, Y. Bégin, G. Boulet et L. Vescovi (2007) *Analyse spatio-temporelle des températures pour un meilleur suivi du climat dans le nord du Québec*. Rapport présenté au Consortium Ouranos

Courtois, R., J.P. Ouellet, L. Breton, A. Gingras and C. Dussault (2007) *Effects of forest disturbance on density, space use, and mortality of woodland caribou*. Écoscience 14: 491-498

Courtoi, R. (2003) *La conservation du caribou forestier dans un contexte de perte d'habitat et de fragmentation du milieu*. Thèse présentée à l'université du Québec à Rimouski comme exigence partielle du programme de doctorat en sciences de l'environnement. 350 p.

Couturer, S., D. Jean, R. Otto and S. Rivard (2004) *Demography of migratory caribou (Rangifer tarandus) of the Nord-du-Québec region and Labrador*. Ministère des Ressources naturelles, de la Faune et des Parcs, Direction de l'aménagement de la faune du Nord-du-Québec, Direction de la recherche sur la faune, Québec, 68 p. Cumming, H.G. and D.B. Beange (1987) Dispersion and movements of woodland caribou near Lake Nipigon, Ontario. *Journal of Wildlife Management* 51: 69-79

Consei Régional de l'Environnement de la Côte-Nord (CRECN) (2013) Online : http://www.crecn.org/, page consulted December 2014

Crossman, T. (2014) *Managing mining water- The federal regulatory framework*. Presentation offered by Miller Thomson Lawyer

Centre de la Santé et des Services Sociaux (CSSS) de Sept-Îles (2014) Online : http://www.cssssi.qc.ca/, page consulted December 2014

Davis Industrial Hygiene Consulting Inc. (2014) *Respiratory Hazard DIH Assessment. Respirable Crystalline Silica and the DSO Timmins Project*. Draft Report

Davies Colley, R.J. and D.G. Smith (2000) *Suspended Sediment, Turbidity and Clarity of Water, a Review*. Unpublished draft

D'Astous, N. and P. Trimper (2011) *Spring survey of caribou in the vicinity of Schefferville, May 2009*. Addendum concerning genetic analysis. Prepared for New Millennium Capital Corp. and Labrador Iron Mines Limited. Final report – Without prejudice. April 2010. 5 p.

D'Astous, N. and P. Trimper (2010a) *Spring survey of caribou in the vicinity of Schefferville, May 2009*. Addendum concerning Blue 331. Prepared for New Millennium Capital Corp. And Labrador Iron Mines Limited. Final report – Without prejudice. April 2010. 3 p.

D'Astous, N. and P. Trimper (2010b) *Spring survey of caribou in the vicinity of Schefferville, April-May 2010*. Prepared for New Millennium Capital Corp. and Labrador Iron Mines Limited. Final report

D'Astous, N. and P. Trimper (2009) *Spring survey of caribou in the vicinity of Schefferville, May 2009*. Prepared for New Millennium Capital Corp. and Labrador Iron Mines Limited. Final report – Without prejudice. November 2009. 19 p. and appendix

DeCandido, R. and D. Allen (2006) *Nocturnal Hunting by Peregrine Falcons at the Empire State Building, New York City*. The Wilson Journal of Ornithology 118(1): 53-58

Desjarins (2014) *Régions administratives de la Côte-Nord et du Nord-du-Québec : Survol et prévisions économiques.* Online : http://www.desjardins.com/ressources/pdf/eercnnq-f.pdf?resVer=1385500289000, page consulted November 2014

Desrohes, J-F and D. Rodrigue (2004) *Amphibiens et reptiles du Québec et des Maritimes*. Waterloo, QC : Éditions Michel Quintin.Gartner Lee Limited (July 2006) *Summary of Recent Winter Sampling Events and Snow Density Survey.* Memorandum. Prepared for LabMag GP Inc

Desroiers, N., R. Morin et J. Jutras (2002) *Atlas des micromammifères du Québec.* Société de la faune et des parcs du Québec, Direction du développement de la faune. Québec, QC

Dodd, D.G. (1974) *Distribution, habitat and status of moose in the Atlantic provinces of Canada and northeastern United States*. Le Naturaliste Canadien 101: 51-65

Dooley, D, (2013) No notice. Published in the Aurora on September 16, 2013.

Drake, J.J. (1983) *Groundwater Chemistry in the Schefferville, Québec Iron Deposits*. Catena 10(1-2); 149-158.

Dubreuil, M.A. December (1979) *An Investigation into some Aspects of the Recovery of a Stream from Mining Activities: near Kata Creek, near Fleming 3 mine.* Department of Geography, McGill University, Montréal, Qc

Duhaime G., et J. Grenier (2012) *Coût de la vie dans la région de Schefferville*. Chaire condition autochtone, Université Laval

Dussault, C., J.P. Ouellet, R. Courtois, J. Huot, L. Breton, L. and H. Jolicoeur (2005). *Linking moose habitat selection to limiting factors*. Ecography 28(5): 619-628

Duthie H.C. and M.L. Ostrofsky (1974) *Plankton, Chemistry, and Physics of Lakes in the Churchill Falls Region of Labrador*. J. Fish. Res. Board Canada 31. Cited in Curtis (2004)

Dyer, S.J., J.P. O'Neill, S.M. Wasel, and S. Boutin (2001) *Avoidance of industrial development by woodland caribou*. The Journal of Wildlife Management 65 (30): 531-542

Edwards, R.Y. and R.W. Ritcey (1959) *Migrations of caribou in a mountainous area in Wells Gray Park, British Columbia*. Canadian Field-Naturalist 73: 21-25

Edmonds, E.J. (1988) *Population status, distribution and movements of woodland caribou in west-central Alberta*. Canadian Journal of Zoology 66: 817-826

Emploi-Québec (2015) *Information sur le Marché du travail (IMT)*. Online. http://imt.emploiQuébec.gouv.qc.ca/mtg/inter/noncache/contenu/asp/mtg941_accueil_fran_01.asp, consulted January 2015

Emploi-Québec, 2010. *Enquête sur les besoins de formation et les difficultés de recrutement de la main-d'œuvre auprès des entreprises, CLE Sept-Îles*. Online : http://emploiQuébec.net/publications/Liens-indirects/09_etude_Sept_Iles.pdf, page consulted November 2014

Environmental Assessment Office (2013) *Guideline for the selection of valued components and assessment of potential effects*. Government of British Columbia, Victoria, 39 p.

Environment Canada (2014) *Buffer zones and setback distances* in Technical Information. Online. https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=8D910CAC-1, page consulted October 2015

Environment Canada (2014a) *Summary review of performance of metal mines subject to the Metal Mining - Effluent Regulations in 2012*. Mining and Processing Division, Industrial Sectors Directorate, Environmental Stewardship Branch, 255 p.

Environment Canada (2014b) *Mining Project Baseline Desktop Assessment and Survey Requirements*. 4p

Environment Canada (2013a) *National Inventory Report 1990-2011 Greenhouse Gas Sources and Sinks in Canada*. Part 2. 231 p.

Environment Canada (2012a) *Recovery Strategy for the Woodland Caribou (Rangifer tarandus caribou), Boreal population, in Canada.* Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. 138 p.

Environment Canada (2012b) *Summary review of performance of metal mines subject to the Metal Mining - Effluent Regulations in 2011*. Mining and Processing Division, Industrial Sectors Directorate, Environmental Stewardship Branch, 254 p.

Environment Canada (2012c) *Metal Mining Technical Guidance for Environmental Effect Monitoring*. 550 p., ISBN 978-1-100-20496-3

Environement Canada (2011) *Summary Revew of Performance of Metal Mines Subject to the Metal Mining Effluent Regulations in 2011*. Mining and Processing Division, Industrial Sectors Directorate, Environmental Stewardship Branch, 12 p. and 5 appendices

Environment Canada (2008) *Scientific Review for the Identification of Critical Habitat for Woodland Caribou (Rangifer tarandus caribou), Boreal Population, in Canada*. August 2008. Ottawa, ON

Environment Canada (2009) *Environmental Code of Practice for Metal Mines*. Mining Section, Mining and Processing Division, Public and Resources Sectors Directorate, Environmental Stewardship Branch, Environment Canada, Ottawa. 102 p.

Environnement Canada (2004) *Évaluation scientifique 2004 des dépôts acides au Canada. Sommaire des résultats clés*. Gouvernement du Canada, Service météorologique du Canada, Downsview, ON

Équipe de rétablissement du caribou forestier du Québec [ERCFQ] (2013) *Plan de rétablissement du caribou forestier (Rangifer tarandus caribou) au Québec — 2013-2023*, produit pour le compte du ministère du Développement durable, de l'Environnement, de la Faune et des Parcs du Québec, Faune Québec, 110 p.

Federation of Digital Seismograph Networks [FDSN] (no date) *FDSN Station Book*. SCHQ - Schefferville, Québec, Canada. Online: http://www.fdsn.org/station-book/CN/SCHQ/ schq.html, page consulted September 2006

Fisheries and Oceans Canada [DFO] (2012) (Draft) *Standard Methods Guide for the Classification and Quantification of Fish Habitat in Rivers of Newfoundland and Labrador for the Determination of Harmful Alteration, Disruption or Destruction of Fish Habitat*. 20 p. and 1 appendix

Focus Graphite (2015) *Lac Knife*. Online : http://www.focusgraphite.com/projects/lac-knife/, page consulted January 2015

Fortin, C. (no date) *Extension de l'aire de répartition nordique de la salamandre à deux lignes.* Bulletin de la Société de géographie de Québec

Fortin, C., et G.J. Doucet (2008) *Micromammifères et emprises de lignes de transport d'énergie électrique situées en milieu forestier.* Le Naturaliste Canadien 132(1): 32-40

Fracflow Consultants Inc. (2006) *Hydrogeology Field Program, Howell's River, Labrador, Labmag Project, August 2005 and May 2006*. Final draft report submitted to New Millenium Capital Corp., 62 p and 2 appendices

Fuller, T.K. and L.B. Keith (1981) *Woodland caribou population dynamics in northeastern Alberta*. Journal of Wildlife Management 49: 197-213

Furlonger, C.L., H.J. Dewar and M.B. Fenton (1987) *Habitat use by foraging insectivorous bats*. Canadian Journal of Zoology 65: 284-288

Gardner, M.B. (1981) *Effects of turbidity on feeding rares and selectivity of bluegills.* Transactions of the American Fisheries Society. Traductions of the American Fisheries Society 110: 446-450

Gartner Lee Limited (2006) *Summary of Recent Winter Sampling Events and Snow Density Survey*. Memorandum submitted to LabMag GP Inc., 6 p.

Gartner Lee Limited and Groupe Hémisphères (2007) *Labrador Study Area Terrestrial Ecosystem Mapping*. Submitted to LabMag GP Inc

Gauthier, J. and Y. Aubry (sous la direction de) (1995) *Les oiseaux nicheurs du Québec : Atlas des oiseaux nicheurs du Québec méridional.* Association québécoise des groupes d'ornithologues, Société québécoise de protection des oiseaux, Service canadien de la faune, Environnement Canada, région du Québec, Montréal, 1295 p.

Genivar (2011) *Projet LabMag – Inventaires fauniques 2006. Rapport réalisé pour LabMag GP Inc.* 127 p. and 2 appendices

Genivar (2006) *Étude d'impact sur l'environnement, Projet de Mine de fer du Lac Bloom*

Geofor Environnement. January (2015a). *Hydrogeological Campaign results on HowseGibson and O'Faircheallaigh (2010) IBA Community Toolkit: Negotiation and Implementation of Impact and Benefit Agreements*. Online: http://www.ibacommunitytoolkit.ca/pdf/IBA_toolkit_March_2010_low_resolution.pdf.

Geofor Environnement. November 2015b. 2015's *Hydrogeological Campaign results on Howse deposi*t. EIA Howse property project report.

Girard, N. (2003) *Field Work Report: Avifauna, Terrestrial Wildlife and Flora. Pre-feasibility Study, Howells River (Labrador, Canada).* Prepared for LabMag GP Inc.

Golder (2014) *Technical Memorandum, Howse Pit Hydrogeological Investigation- Summary of factual data in support of environmental impact assessment process*, 011-13-1221-0104 MTA Rev. 0. 13 p.

Governement of Newfoundland and Labrador [GNL] (2015) *George River Caribou Management*. http://www.env.gov.nl.ca/env/wildlife/pdf/GRCH_2010_Consultations.pdf, page consulted October 2015

Governement of Newfoundland and Labrador [GNL] (2014a) *Guidelines for Environmental Preview Report for the Howse DSO Mine*. Honourable Dan Crummell, Minister, Department of Environment and Conservation, December 22, 2014. 7 p.

Governement of Newfoundland and Labrador [GNL] (2014b) *Provincial Government Provides Update on the George River Caribou Herd.* Online: http://www.releases.gov.nl.ca/releases/2014/env/0814n04.aspx, page consulted November 2014

Governement of Newfoundland and Labrador [GNL] (2014c) *The Economy 2014*. Economic Research and Analysis Division, Department of Finance. 86 p.

Governement of Newfoundland and Labrador (GNL), Department of Environment and Conservation (2012) *Certificate of Approval Projet Minier Raglan AA12-085571A*, August 2012

Granberg, H.B. (1973) *Indirect mapping of the snowcover for permafrost prediction at Schefferville, Québec*. Permafrost, North American Contribution, Second International Conference, National Academy of Sciences, Washington, D.C., p. 113-120.

Granberg, H.B., J.E. Lewis, T.R. Moore, P. Steer and R.K. Wright (1984) *Schefferville Permafrost Research Volume I: Parts 1a and 1b, Summary, Review and Recommendations and Catalogue of Available Materials*. Department of Geography, McGill University, Montreal, Québec; Department of Energy, Mines & Resources Canada, Earth Physics Branch, Division of Gravity, Geothermics and Geodynamics, 94 p.

Gregory, R.S. and T.G. Northcote (1993) *Surface, plantonic, and benthic foraging by juvenile chinook salmon (Oncorhynchus tshawytscha) in turbid laboratory conditions*. Canadian Journal of Fisheries and Aquatic Sciences 50: 233-240

Gregory, S.V., G.A. Lamberti, D.C. Erman, K.V. Koski, M.L. Murphy, and J.R. Sedell (1987) *Influence of forest practices on aquatic production*. Pages 233-255 in E. O. Salo and T. W. Cundy, eds. Streamside management: forestry and fishery interactions. College of Forest Resources Contribution No. 57, University of Washington, Seattle

Groupe Hémisphères (2015) *Common Nighthawk Survey for Howse Mining Project, Labrador, Summer 2015*. Technical Report submitted to Howse Minerals Limited, 11 p. and 3 appendices

Groupe Hémisphères (2014a) *Project Registration / Project Description for the DSO – Howse Property Project*. Submitted to Howse Minerals Limited, 223 p. and 4 appendices

Groupe Hémisphères (2014b) *Complementary Aquatic Survey for the New Haul Road Routings – 2014*. Technical Report Submitted to TSMC, 7 p. and 4 appendices

Groupe Hémisphères (2014c) Field Report – 2013 *Baseline Aquatic Fauna Characterization: Elross Lake Area Iron Ore Mine (ELAIOM) Environmental Effects Monitoring (EEM)*. Technical Report submitted to Tata Steel Minerals Canada Ltd., 14 p. and 3 appendices

Groupe Hémisphères (2013a) *Hydrological Campaign 2011: DSO3 and DSO4 Projects*. Technical Report submitted to Tata Steel Minerals Canada Ltd., 31 p. and 4 appendices

Groupe Hémisphères (2013b*) Field Report – Baseline Aquatic Fauna Characterization: Elross Lake Area Iron Ore Mine (ELAIOM) Environmental Effects Monitoring (EEM)*. Technical Report submitted to Tata Steel Minerals Canada Ltd., 12 p. and 2 appendices

Groupe Hémisphères (2013c) *Complementary Surveys along the Goodwood – Timmins Haul Road Routings.* Technical Report Submitted to TSMC, 11 p. and 5 appendices

Groupe Hémisphères (2012a) *Spring monitoring of Caribou in the Vicinity of the DSO3 Sector*. Final report submitted to Tata Steel Minerals Canada Ltd. 2 p. and 2 appendices

Groupe Hémisphères (2012b) *Migrating Birds Surveys at the KéMag Project Mine Site, Spring and Fall 2011*. Technical Report submitted to New Millennium Iron Corp., 25 p. and 6 appendices

Groupe Hémisphères (2012c) *Migrating Birds Surveys at the LabMag Project Mine Site, Spring and Fall 2011*. Technical Report submitted to New Millennium Iron Corp., 25 p. and 6 appendices

Groupe Hémisphères (2012d) *Survey of Breeding Birds at the KéMag Project Mine Site*. Technical Report submitted to New Millennium Iron Corp., 23 p. and 4 appendices

Groupe Hémisphères (2011a) *Cartographie des écosystèmes terrestres et des dépôts de surface : Projet de minerai de fer à enfournement direct*. Rapport technique 2008-2010 réalisé pour le compte de New Millennium Capital Corp., 159 p. and 10 appendices

Groupe Hémisphères (2011b) *Spring Survey of Caribou in the Vicinity of the DSO3 Sector*. Final report submitted to Tata Steel Minerals Canada Ltd. 7 p. and 1 appendix

Groupe Hémisphères (2011c) *Plan de mitigation pour la protection du quiscale rouilleux, Projet DSO*. Rapport technique présenté à New Millennium Capital Corp., 13 p.

Groupe Hémisphères (2010) *Étude hydrologique et hydrogéologique : campagne d'inventaire 2009, projet DSO*. Rapport technique final réalisé pour New Millennium Capital Corp., 97 p. et 4 annexes

Groupe Hémisphères (2009a) *Inventaire 2008 et 2009 des oiseaux nicheurs du futur site DSO*. Rapport technique présenté à New Millennium Capital Corp., 22 p. and 4 appendices

Group Hémisphères (2009b) *Unofficial Translation. Survey of Fish Habitat Along Two Hypothetical Corridors for the Main Access Road Between the DSO3 and DSO4 Sectors, DSOP*. Technical report submitted to New Millennium Capital Corp., 15 p. and 7 appendices

Groupe Hémisphères (2008) *Inventaire des oiseaux nicheurs du futur site DSO*. Rapport technique présenté à New Millennium Capital Corp., 16 p. and 6 appendices

Groupe Hémisphères and Geofor Environnement (2012a) *Hydrogeological Drilling Report, Fleming 7N Area - DSOP, Project 1a*. Technical Report submitted to Tata Steel Minerals Canada Ltd. 23 p. and 3 appendices

Groupe Hémisphères and Geofor Environnement (2012b) *Hydrogeological Campaign of 2011: DSO3 and DSO4 Sectors in Newfoundland and Labrador*. Preliminary Technical Report submitted to Tata Steel Minerals Canada Ltd., 35 p. and 4 appendices

Groupe Hémisphères and Geofor Environnement (2011) *Hydrological and Hydrogeological Campaign of 2010: DSO4 Sector*. Final Technical Report prepared for New Millennium Capital Corp., 29 p and 2 appendices

Groupe Hémisphères and Groupe Synergis (2011) *Complementary Surveys of Aquatic Environments Potentially Affected by Future Mining Operations: Leroy 1 and Sunny 1 Area, Assessment Group 2a, DSO Project*, Technical Report produced for New Millennium Capital Corp., 61 p. and 6 appendices

Groupe Hémisphères and Groupe Synergis (2010) *DSOP Aquatic Environment Surveys*. Technical Report submitted to New Millennium Capital Corp., 138 pages and 10 appendices

Hanno, S.J., P.K. Eason and K. Martin (1998) *Willow Ptarmigan (Lagopus lagopus), The Birds of North America Online* (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/369 doi:10.2173/bna.369, page consulted December 2014

Hanso, A., L. Swanson, D. Ewing, G. Grabas, S. Meyer, L. Ross, M. Watmough and J. Kirby (2008) *Wetland ecological functions assessment: an overview of approaches*. Canadian Wildlife Service technical report series No. 497. Atlantic Region. 59 p.

Haskell SP and W.B. Ballard (2008) *Annual re-habituation of calving caribou to oilfields in northern Alaska: implications for expanding development*. Canadian Journal of Zoology 86: 627–637

Health Canada (2010) *Useful Information for Environmental Assessments*. Published by authority of the Minister of Health, Health Canada, 15 p.

Hegmnn, G., C. Cocklin, R. Creasey, S. Dupuis, A. Kennedy, L. Kingsley, W. Ross, H. Spaling and D. Stalker (1999) *Cumulative Effects Assessment Practitioners Guide*. Prepared by AXYS

Environmental Consulting Ltd. and the CEA Working Group for the Canadian Environmental Assessment Agency, Hull, Qc

Holt, D. W. and S. M. Leasure (1993) *Short-eared Owl (Asio flammeus).* In the Birds of North America, No. 62 (A. Poole et F. Gill, ed.). The Birds of North America inc., Philadelphia

Howse Minerals Limited [HML] (2014b) *Howse Layout* (December 5th, Option 3)

Howse Minerals Limited [HML] (2014c) *Data tables-Water Monitoring*. September 2014

Hummel, M. and J.C. Ray (2008) *Caribou and the North – A Shared Future*. Dundurn Press, Toronto, Ontario, Canada, 288 pages

IBA Research Network (2014) *List of known IBAs*. On line: http://www.impactandbenefit.com/IBA_Database_List/, page consulted in October 2014

Industrie Québec (2012) *Automne-hiver 2012 Innu Nation*. Online: http://www.innu.ca/, page consulted between October and November 2014

Institut Tshakapesh (2014) *Institut Tshakapesh*. Online: http://www.icem.ca/, page consulted January 2014

Intergovernmental Panel on Climate Change [IPCC] (2013) *Climate Change 2013: The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the IPCC [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 p.

International Finance Corporation (IFC) and European Bank for Reconstruction and Development (EBRD) (2009). *Workers's accommodation: processes and standards*. A guidance note by IFC and EBRD.

Innu Takuaikan Uashat mak Mani-Utenam [ITUM] (2014) *Rapport annuel 2013-20104, Secteur de l'habitation, des immobilisations et infrastructures d'ITUM*

Institut de la Statistiques du Québec [ISQ] (2014) *Profils statistiques par région et MRC géographiques*. Online : http://www.stat.gouv.qc.ca/statistiques/profils/region_00/region_00.htm, page consulted November 2014

International Dark-Sky Association [IDA] (2008) *Light Pollution and Wildlife*. Online: http://www.darksky.org/assets/documents/ida_wildlife_brochure.pdf, page consulted January 2015

Iron Ore Company of Canada [IOCC] (2013) *Our Wabush 3 Project*. Online: http://www.ironore.ca/en/our-wabush-3-project_335/, page consulted January 2015

Iron Ore Company of Canada [IOCC] (1974) *A Report on 'Summary of the Permafrost Studies in the Schefferville Area'*

Journeau Assoc (2015) *Permafrost Condition at TSMC Howse Deposit, Schefferville, Québec*. Prepared for Tata Steel Minerals Canada Limited, Report No. L-15-1802, September 7 2015

Johnson, C.J. and D.E Russell (2014) *Long-term distribution responses of a migratory caribou herd to human disturbance*, Biological Conservation 177: 52-63

Klassen, R.A. and S. Paradis (1998) *Surficial Geology of Western Labrador, Schefferville (NTS 23J)*. Geological Survey of Canada Open File 2198, 1:250,000

Klassn, R.A., S. Paradis, A.M. Bolduc and R.D. Thomas (1992) *Glacial landforms and deposits, Labrador, Newfoundland and eastern Québec*. Commission géologique du Canada, Carte 1814A

Korschen, C.E. and R.B. Dalghren (1992) *Human Disturbances of Waterfowl: Causes, Effects and Management*. Waterfowl Management Handbook. Page 12

Labraor Iron Mines Holdings Limited [LIM] (2015) *Schefferville Area Projects*. Online: http://www.labradorironmines.ca/project.php, page consulted January 2015

Labraor West (2014) *Shabogamo Mining.* Online: http://www.labradorwest.com/default.php?display=cid168, page consulted January 2015

Labrdor West (2014) *Labrador West*. Online : http://www.labradorwest.com/, page consulted November 2014

Labrdor Iron Mines (LIM) (2009) *Schefferville Area Iron Ore Mine (Western Labrador)*. Revised Environmental Impact Statement

La Presse (2012) *À Sept-Îles, le prix des maisons a doublé en six ans*. 26/11/2012. Online : http://affaires.lapresse.ca/portfolio/developpement-du-nord/201211/26/01-4597605-a-sept-iles-le-prix-des-maisons-a-double-en-six-ans.php, page consulted August 2014

Leadrship in Energy and Environmental Design [LEED] (2004) *Green Building Rating System for New Construction and Major Renovations.* LEED *Canada*-NC Version 1.0

Lee, Eugene M (2006) *Howells River Tributaries. Fish Habitat Surveys. LabMag Iron Ore Project. Claim Block, Mine, Pit and Concentrator. September 2005*. Final Report. Submitted on behalf of AMEC Earth & Environmental to LabMag GP. Inc.

Le Nod-Côtier (2013a) *Le CSSS de Sept-Îles inaugure une nouvelle salle de mammographie*. 19/03/2013. Online: http://lenord-cotier.com/index.php/2013/03/19/le-csss-de-sept-iles-inaugure-une-nouvelle-salle-de-mammographie/, page consulted March 2013

Le Nord-Côtier (2013b) *Taux d'inoccupation de 0,2%: La crise du logement s'intensifie*.21/05/2013 Online: http://lenord-cotier.com/index.php/2013/05/21/taux-dinoccupation-de-02-la-crise-du-logement-sintensifie/, page consulted May 2013

Le Nord-Côtier (2013c) *Lutte contre l'itinérance : Transit Sept-Îles attend un geste du fédéral.* 26/02/2013. On line : http://lenord-cotier.com/index.php/2013/02/26/lutte-contre-litinerance-transit-sept-iles-attend-un-geste-du-federal/

Le Nord-Côtier (2013d) *Baisse de l'achalandage chez Transit Sept-Îles*. 28/06/2013. Online : http://lenord-cotier.com/index.php/2013/06/28/baisse-de-lachalandage-chez-transit-sept-iles/, page consulted June 2013

Le Nord-Côtier (2012a) 18/12/2012. *Martine Ouellet voit Sept-Îles comme un carrefour de développement.* 18/12/2012. Online: http://lenord-cotier.com/index.php/2012/12/18/martine-ouellet-voit-sept-iles-comme-un-carrefour-de-developpement/, page consulted in December 2012

Le Nord-Est (2012a) *La Ville de Sept-Îles gère sa croissance*. 12/11/2012 Online: http://www.hebdosregionaux.ca/cote-nord/2012/12/11/la-ville-de-sept-iles-gere-sa-croissance, page consulted in December 2012

Le Nord Est (2012b) *Maladie de Huntington: Le pire reste à venir pour les Innus*. 25/04/2012. Online : no longer available

Le Nord-Est (2013) 22/01/2013. *28 millions de tonnes au Port de Sept-Îles et c'est pas fini !*. Online: http://www.myvirtualpaper.com/doc/hebdo_le-journal-de-baie-comeau/20130123_plienjour_opt/2013012101/33.html#32, page consulted in January 2013

Lewis, J.S. and J.L. Rachlow (2011) *Activity patterns of black bears in relation to sex, season, and daily movement rates*. Western North American Naturalist *71*(3): 388-395

Longcore, T. and C. Rich (2004) *Ecological light pollution*. Frontiers in Ecology and The Environment 2(4): 191-198

Mahoney, S.P. and J.A. Schaefer (2002) *Hydroelectric development and the disruption of migration in caribou*. Biological Conservation 107: 147-153

Mailhot, J. (1993) *Au pays des Innus: Les gens de Sheshatshit*. Recherches Amérindiennes au Québec

Mansikkaniemi, H. (1980) *Measurement of sediment transport in the Schefferville mining area, central Québec-Labrador peninsula*. In: Environmental Studies in the Central-Labrador Peninsula: Finnich Contributions. Kevo-Schefferville Subarctic Exchange Program 1978-79. McGill Subarctic Research Station

Martin, D. (2009) *Food Stories: A Labrador Inuit-Metis Community Speaks about Global Change*. PhD Thesis, Dalhousie University. Halifax, NS

Mayor, S.J., D. Schneider, J. Schaefer and S.P. Mahoney (2009) *Habitat selection at multiple scales*. Ecoscience *16*(2): 238-247

McCaffrey, M., J.-Y. Pintal and F. Schwarz (2006*) LabMag Iron Ore Project: Historic Resources Overview Assessment - Stage 1 (2006)*. Report prepared for LabMag GP Inc., Montreal. Copy on file at the Provincial Archaeology Office, Confederation Building, St. John's, NL

McCaffrey, M. (1989) *L'acquisition et l'échange de matières premières lithiques durant la préhistoire récente. Un regard vers la fosse du Labrador*. Recherches amérindiennes au Québec, Vol. 19 (2-3) : 95-107

McCaffrey, M. and D. Denton (1987) *Reconnaissance des sources de chert dans la région de Schefferville, Nouveau-Québec*, 1984. Soumis au MAC

McLean, D. (2003*) Workplaces that Work: Creating a Workplace Culture that Attracts, Retains and Promotes Women*. Prepared for the Federal/Provincial/Territorial Ministers Responsible for the Status of Women. On line: http://www.exec.gov.nl.ca/exec/wpo/publications/workplacesthatwork.pdf. Consulted in April 2013

Meades, S.J. (1990) *Natural Regions of Newfoundland and Labrador*. Protected Areas Association. 374 p.

Mining Asssociation of British Columbia (MABC) Association of Mineral Exploration British Columbia (AMEBC) and the Aggregate Producers Association of British Columbia (APABC) (2011). *Women: An Unmined Resource. A Report on Female Participation within BC's Mineral Exploration and Mining Industry*. Online. http://www.mihr.ca/en/publications/resources/Women-AnUnminedResource.AReportonFemaleParticipationwithinBCsMineralExplorationandMiningIndustry.pdf, document consulted in September 2014

Mining Association of British Columbia [MABC] *et al*.([MABC] 2011) *Women: An Unmined Resource: A Report on Female Participation within BC's Mineral Exploration and Mining Industry*

Mnistère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques [MDDELCC] (2014) *Réseaux municipaux de distribution d'eau potable*. Online: http://www.mddelcc.gouv.qc.ca/eau/potable/distribution/resultats.asp. Page consulted December 2015

Minisère du Développement durable, de l'Environnement, de la Faune et des Parcs [MDDEFP] (2006) *Traitement des plaintes sur le bruit et exigences aux entreprises qui le génèrent*- Referenced in Québec's DIRECTIVE 019-SUR L'INDUSTRIE MINIÈRE, MARS 2012

Minisère de la Forêt, de la Faune, et des Parcs [MFFP] (2014) *Inventaire des caribous du troupeau de la rivière George.* Online: https://www.mffp.gouv.qc.ca/presse/communiques-detail.jsp?id=10774, page consulted December 2014

Ministère de la santé et des services sociaux (MSSS). *Register des Naskapis, 2014*. On request

Ministère des ressources naturelles (MRN) (2013) Online. https://mern.gouv.qc.ca/ministere/historique/index.jsp, page consulted in December 2013

Ministry of the Environment of Ontario [MOE] (1985). *Ministry of Environment Guidelines on Information Required for Assessment of Blasting Noise and Vibration*. December 1985

Mitchell, G. and M. Coombs (2012) *NunatuKavut Land-Uses in the Labrador Iron Belt: Final Report, 2012 and supporting documentation: Land Use Study Interview Guide and Interviews*. Final Report. Prepared for Alderon Iron Ore Corp.

Mitchell, G. and D. Carroll (2014) *The Wabush 3 Iron Ore Project and the Land Uses of NunatuKavut-muit*

Mitsch, W.J., and J.G. Gosselink (2000) *The value of wetlands: importance of scale and landscape setting*. Ecological economics 35(1): 25-33

Moisan, M. (1996) *Rapport sur la situation du carcajou (Gulo gulo) au Québec.* Ministère de l'Environnement et de la Faune, Direction de la faune et des habitats, 65 p.

MRC de Caniapiscau (2013) *MRC de Cania*piscau. Online: http://www.caniapiscau.net, page consulted November 2014

MRC des Sept-Rivières (2014) *MRC des Sept-Rivières*. Online : http://www.septrivieres.qc.ca/main.php?sid=m&lng=2, page consulted October 2014

Nadeau, C. (1995) *Quiscale rouilleux*. 1040-1043 in Gauthier, J. and Y. Aubry (under the direction of) (1995) *Les oiseaux nicheurs du Québec : Atlas des oiseaux nicheurs du Québec méridional*, Association québécoise des groupe d'ornithologues, Société québécoise de protection des oiseaux, Canadian Wildlife Service, Environment Canada, Québec Region, Montreal, xviii + 1295 p.

Nagorsen, D. and M. Brigham (1993) *Bats of British Columbia*. Vancouver, BC: UBC Press

Nalcor Energy (2014) *Menihek*. Online: http://www.nalcorenergy.com/menihek.asp, page consulted January 2015

Nalcor Energy (2011) *Labrador–Island Transmission Link Environmental Assessment, Socioeconomic Environment: Aboriginal Communities and Land Use Component Study*. Prepared by Transfert Environnement and Stantec Consulting Inc. July 22 2011

Nametau Innu (2014) *Memory and Knowledge of Nitassina*n. Online: http://www.nametauinnu.ca/en/home/science/territory, page consulted in September 2014

Nation Innu de Matimekush-Lac John [NIMLJ] (2014*) Conseil de la Première Nation des innus de Matimekush-Lac John*. Online: http://matimekush.com, page consulted November 2014

Naskapi Nation of Kawawachikamach [NNK] (2010) *Annual Report 2009-2010*

Naskapi Nation of Kawawachikamach [NNK] (2012) *Annual Report 2011-2012*

Naskapi Nation of Kawawachikamach [NNK] (2013) *Annual Report 2012-2013*

Naskapi Nation of Kawawachikamach [NNK] (2014) *Annual Report 2013-2014*

Naskapi Nation of Kawawachikamach [NNK] (2014). Naskai Nation of Kawawachikamach. Online: http://www.naskapi.ca/, page consulted in November 2014

National Wetlands Working Group [NWWG] (1997) *The Canadian Wetland Classification System, 2nd Edition*. Wetlands Research Centre, University of Waterloo, Waterloo, Ontario, 68 p.

Nellemann, C. and R.D. Cameron (1998) *Cumulative impacts of an evolving oil-field complex on the distribution of calving caribou.* Canadian Journal of Zoology. 76 : 1425-1430

Newbold, J. D., D. C. Erman, and K. B. Ruby (1980) *Effects of logging on macroinvertebrates in streams with and without bufferstrips*. Canadian Journal of Fisheries and Aquatic Sciences 37: 1076-1085

Newbury, T.L., N.P. Simon and T.E.Chubbs (2007) *Moose, Alces alces, winter browse use in central Labrador*. The Canadian Field-Naturalist 121(4): 359-363

Newcomb, C.P. and D.D. MacDonald (1991) *Effects of suspended sediments on aquatic ecosystems*. North American J. Fisheries Management 11: 72-82

Newfoundland and Labrador Community Accounts (2014) Online. http://nl.communityaccounts.ca/, page consulted in September 2014

Newfoundland and Labrador Department of Environment and Conservation [NLDEC] (2015) *Black Bears*. Online: http://www.env.gov.nl.ca/env/wildlife/all_species/bear.html. Page consulted October 2015.

Newfoundland and Labrador Department of Environment and Conservation [NLDEC] (2014a) *Species at Risk.* Online: http://www.env.gov.nl.ca/env/wildlife/endangeredspecies/index.html, page consulted November 2014

Newfoundland and Labrador Department of Environment and Conservation [NLDEC] (2014b) *The little brown bat*. Online http://www.env.gov.nl.ca/env/snp/programs/education/animal_facts/mammals/brown_bat.html, page consulted November 2014

Newfoundland and Labrador Department of Environment and Conservation [NLDEC] (2014c) *Fish*. Department of Environment and Conservation, Online: http://www.env.gov.nl.ca/env/wildlife/all_species/inlandfish.html, page consulted November 2014

Newfoundland and Labrador Department of Environment and Conservation [NLDEC] (2014d) *Tata Steel Minerals Canada Limited – Elross Lake Network, Real-Time Water Quality & Quantity Monitoring, Annual Deployment Report 2014*. Water Resources Management Division, 26 p.

Newfoundland Labrador Department of Environment and Conservation [NLDEC] (2013a) *Hunting Ban Announced on George River Caribou Herd*. Online: http://www.releases.gov.nl.ca/releases/2013, page consulted on November 2013

Newfoundland and Labrador Department of Environment and Conservation [NLDEC] (2013b) *Tata Steel Minerals Canada Limited – Elross Lake Network, Real-Time Water Quality & Quantity Monitoring, Annual Deployment Report 2013*. Water Resources Management Division, 25 p.

Newfoundland Labrador Department of Environment and Conservation [NLDEC] (2012a) *Guideline for Plume Dispersion Modelling.* Government of Newfoundland and Labrador, GD-PPD-019.2, 2nd revision, Sept. 2012

Newfoundland and Labrador Department of Environment and Conservation [NLDEC] (2012b) *Tata Steel Minerals Canada Limited – Elross Lake Network, Real-Time Water Quality* and *Quantity Monitoring, Annual Report 2012*. Water Resources Management Division, 27 p.

Nefoundland and Labrador Department of Environment and Conservation [NLDEC] (2010) *Species Status Advisory Committee Report 2009-2010.* Government of Newfoundland and Labrador, 10 p.

Newoundland and Labrador Department of Environment and Conservation [NLDEC] (2009) *Little Brown Bat*. Online:

http://www.env.gov.nl.ca/env/snp/programs/education/animal_facts/mammals/brown_bat.html, page consulted in November 2014

Nefoundland and Labrador Department of Tourism [NLDOT] (2013) *Things to Do: Hunting*. Online: http://www.newfoundlandlabrador.com, page consulted in November 2014

Newfoundland and Labrador Heritage (2014) *Newfoundland and Labrador Heritage.* Online: http://www.heritage.nf.ca/home.html, page consulted December 2014

New Millennium Iron [NML] (2012) Newsletter 1208. Online: http://www.nmliron.com/news-media/news-releases, page consulted in September 2014

New Millennium Iron [NML] (2014) Community. Online: http://www.nmliron.com/environment-community/community/schefferville, page consulted in October 2014

New Millennium Iron [NML] (2015) The Taconite Project. Online: http://www.nmliron.com/projects/the-taconite-project, Page consulted in January 2015

New Millennium Iron [NML] (2015) News Release 15-12. Online: http://www.nmliron.com/news-media/news-releases. Page consulted in January 2016

New Millennium Capital Corp. and Paul F. Wilkinson & Associates [NML and PFWA] (2010) *Direct-Shipping Ore Project - Project 2a (Goodwood, Leroy 1, Sunny 1 and Kivivic 3S Deposits), Impact Statement* Submitted to the Government of Québec. Montréal, QC

New Millennium Capital Corp. and Paul F. Wilkinson & Associates [NML and PFWA] (2009) *Elross Lake Area Iron Ore Mine*. Environmental Impact Statement Submitted to Government of Newfoundland and Labrador. Montréal, QC

Nicholson, F.H. (1979) *Permafrost spatial and temporal variations near Schefferville, Nouveau-Québec*. Géographie physique et Quaternaire 33(3-4), p. 265-277

Nicholson, F.H. (1971) *Evolution of the Landscape of the Schefferville area*. In *The Physical Environment of the Schefferville Area*, McGill Sub-Arctic Research Laboratory, McGill University, QC.

Noltz, L., R. Greene and J.L. Riley (2013) *Labrador Nature Atlas. Vol. I*. Nature Conservancy of Canada, Toronto, Ontario. 204 p.

NunatuKavut Community Council [NCC] (2014) *NunatuKavut Community Council.* Online: http://www.nunatukavut.ca, page consulted in September 2014

NunatuKavut Community Council [NCC] (2013) *NunatuKavut: Our Ancient Land*. Online: http://www.nunatukavut.ca/home/, page consulted on November 2014

NunatuKavut Community Council [NCC] (2011) *NCC Strategic Plan 2010-2014*

NunatuKavut Community Council [NCC] (2010) *Unveiling NunatuKavut: Describing the Lands and the People of South / Central Labrador*. Document in Pursuit of Reclaiming a Homeland

Ogden LJE (1996) *Collision course: the hazards of lighted structures and windows to migrating birds*. Toronto, Canada: World Wildlife Fund Canada and Fatal Light Awareness Program

Ontario Ministry of the Environment [OME] (1985) *Guidelines on Information Required for Assessment of Blasting Noise and Vibration - December 1985*, Ontario Ministry of the Environment

Ontario Wetland Evaluation System [OWES] (2013) *Northern Manual, 1st Edition, version 1.2*. Government of Ontario, Ministry of Environment and Energy, 277 p.

Ouellet, H. (1993) *Bicknell's Thrush: taxonomic status and distribution*. Wilson Bull. 105:545-572

Parkn, S. (2004) *Review of Riparian Buffer Zone Effectiveness*. Technical Paper No: 2004/05, Ministry of Agriculture and Forestry, Government of New Zealand

Par, M. and C. Brassard (1994) *Écologie et plan de protection de la population de caribous de Val-d'Or, Rouyn-Noranda*. Ministère de l'Environnement et de la Faune, 56 p.+ annexes

Par, M. and J. Huot (1985) *Seasonal movements of female caribou of the Caniapiscau region, Québec*. Proceedings of the Second North American Caribou Workshop, Val Morin, Québec, 17-20 October 1984, Montreal, Center for Northern Studies and Research, McGill Subarctic Paper no 40, p. 47-55

Paon, P.W. (1994) *The effect of edge on avian nest success: how strong is the evidence?* Conservation Biology 8: 17-26

Penn, A.F. (1971) *The Composition of Waters in a Sub-Arctic Lake System*. M.Sc. thesis, McGill University, Montréal, QC. Cited in Curtis (2004)

Pinchin LeBlanc Environmental Limited (2012) *Occupational Hygiene Monitoring*

Pinchin LeBlanc Environmental Limited (2013) *Occupational Hygiene Monitoring*

Pollard, W. (2005) *The Elross Lake Automatic Weather Station*. Prepared for LabMag GP Inc.

Pomeroy, J., N. Hedstrom and J. Parviainen (1998) *The Snow Mass Balance of Wolf Creek, Yukon: Effects of Snow Sublimation and Redistribution*. National Hydrology Research Center, Environment Canada. 16 p.

Port de Sept-Îles (2014) *Prime Minister Stephen Harper to Visit Multi-User Dock*. Press releases and notices. 2014-10-14. Online: http://www.portsi.com/en/press-releases-and-notices_23?id=470, page consulted on January 20, 2015

Pouw, K., K. Campbell and L. Babel (2014) *Study to Identify BATEA for the Management and Control of Effluent Quality from Mines.* MEND Report 3.50.1, Sponsored by the Mining Association of Canada, 525 p. and 4 appendices

Powell, L.L., T.P. Hodgman, W.E. Glanz, J.D. Osenton and C.M. Fisher (2010) *Nest-site selection and nest survival of the rusty blackbird: Does timber management adjacent to wetlands create ecological traps?* The Condor 112(4): 800-809

Québec English School Board Association [QESBA] (2014) *Québec English School Board Association*. Online http://www.qesba.qc.ca/fr/commissions-scolaires/trouver-une-ecole/category/commission-scolaire-eastern-shores, page consulted in November 2014

Québec Innnu Nation (2013) *Declaration of Strengthened Unity of the Innu Nation.* Online. http://files.newswire.ca/1287/Declaration.pdf, page consulted in November 2014

Québec North Shore and Labrador Railway [QNS&L] (2015) *About QNS&L*. Online: http://www.qnsl.ca/en/about-qnsl, page consulted January 2015

Radio-Canada (2013a) *Victoire libérale dans Labrador*. May 14, 2013. Online : http://www.radio-canada.ca/nouvelles/Politique/2013/05/13/005-resultats-election-partielle-federale-labrador.shtml Page consulted May 2013

Radio-Canada (2013b) *Mike McKenzie devient chef de la communauté innue de Uashat-Maliotenam*. Online :http://www.radio-canada.ca/regions/est-Québec/2013/04/28/002-maliotenam-elections-chef.shtml, page consulted April 2013

Radio-Canada, (2013c) *Tout le monde en parlait: Schefferville, l'exil en héritage*. 30/04/2013é Online: http://www.radio-canada.ca/emissions/tout_le_monde_en_parlait/2013/, page consulted May 2013

Radio-Canada (2013d) *Côte-Nord : construction d'un nouveau pavillon au Cégep de Sept-Îles*. 25/01/2013 Online: http://www.radio-canada.ca/regions/est-Québec/2013/01/25/010-nouveau-pavillon-cegep-sept-iles.shtml, page consulted in January 2013

Radio-Canada (2013e) *Pénurie de logements à Sept-Îles : le FRAPRU dénonce l'immobilisme des gouvernements*. 16/05/2013. Online: http://ici.radio-canada.ca/regions/est-Québec/2013/05/16/008-frapru-penurie-logements-sept-iles.shtml, page consulted May 2013

Radio-Canada (2012a) 14/11/2012. *Sept-Îles engrange les surplus.* Online: http://ici.radio-canada.ca/regions/est-Québec/2012/11/14/006-sept-iles-conseil-budget.shtml,

Radio-Canada (2012b) 16/04/2012. *Scheffeville, une deuxième ruée vers le fer*. Online : http://ici.radio-canada.ca/emissions/telejournal/2011-2012/Reportage.asp?idDoc=214834

Radio-Canada (2012c) 31/10/2012. *Côte-Nord : la ruée vers le fer de Schefferville*. Online: http://ici.radio-canada.ca/regions/est-Québec/2012/10/30/005-schefferville-nouveau-klondike.shtml

Radio-Canada (2012d) 01/11/2012. *Schefferville, allier développement minier et qualité de vie*. Online : http://ici.radio-canada.ca/regions/est-Québec/2012/10/31/006-schefferville-infrastructures-defis.shtml

Radio-Canada (2012e) 30/11/2012. *Côte-Nord : différend entre le conseil de bande de Uashat-Maliotenam et Ottawa*. Online : http://ici.radio-canada.ca/regions/est-Québec/2012/11/30/005-differend-ottawa-innus.shtml

Radio-Canada (2012f) 10/09/12. Côte-Nord : *le Nitassinan au coeur d'un sommet Innu*. Online: http://ici.radio-canada.ca/regions/est-Québec/2012/09/10/012-sommet-territorial-innu.shtml

Radio-Canada (2012g) 05/11/2012. Online : http://ici.radio-canada.ca/regions/est-Québec/2012/11/05/009-schefferville-violence-jeunes.shtml

Radio-Canada (2012h) 11/12/2012. Online. http://www.radio-canada.ca/nouvelles/societe/2012/12/10/005-police-communautes-autochtones.shtml

RCPEPN [Regroupement des CPE Côte-Nord] (2013) *Regroupement des CPE Côte-Nord*. Online http://www.rcpecn.com/_home, page consulted in May 2013

Redding, J.M., C.B. Schreck and F.H. Everest (1987) *Physiological effects on coho salmon and steelhead of exposure to suspended solids*. Transactions of the American Fisheries Society 116: 737-744

Red Seal Program (2014) *Red Seal Program*. On line: http://www.red-seal.ca/w.2lc.4m.2@-eng.jsp, page consulted in November 2014

Renewable Resources Consulting Services Limited [RRCSL] (1994) *EIS: Military Flight Training. An Environmental Impact Statement on Military Flying Activities in Labrador and Québec. Technical Report 5. The Caribou Herds of Labrador and Northeastern Québec*

Resource Consultants Inc. and Endeavour Scientific Inc (2015) *Re-Analysis of Data from Metal Mining Effluent Regulations Environmental Effects Monitoring Program*. MEND Report 4.7.2b, 24 p.

Ripley, E.A., R.E. Redmann and A.A. Crowder (1996) *Environmental Effects of Mining*. St. Lucie Press, Delray Beach, Florida. 356 p.

Roche ltée. (2012) *Étude d'impact sur l'environnement - Projet minier Arnaud*

Rollings, K.P. (1997) *The Hydrology of Labrador*. Government of Newfoundland and Labrador, Department of Environment and Labour, Water Resources Management Division, 105 p. and 19 appendices

Rubega, M.A., D. Schamel and D.M. Tracy (2000) *Red-necked Phalarope (Phalaropus lobatus)*, The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online:http://bna.birds.cornell.edu/bna/species/538 doi:10.2173/bna.538

Rudolph, D. C. and J.G. Dickson (1990) *Streamside zone width and amphibian and reptile abundance*. The Southwestern Naturalist 35(4): 472-476

Saint-Laurent, M.H., L.A. Renaud, M. Leblonc and D. Beauchesne (2012) *Synthèse des connaissances relatives aux impacts des routes sur l'écologie du caribou*. Le Naturaliste Canadien, 136(2): 42-47

Saskatchewan Ministry of Environment (2015) *Common Nighthawk Survey Protocol*. Fish and Wildlife Branch Technical Report No. 2015-15.0. 3211 Albert Street, Regina, Saskatchewan. 7 p.

Schack-Kirchner, H., Fenner, P.T. and E.E. Hildebrand (2007) *Different responses in bulk density and saturated hydraulic conductivity to soil deformation by logging machinery on a Ferralsol under native forest*. Soil Use and Management, 23(3): 286-293

Schmelzer, I. (2011) *An estimate of population size and trend for the Lac Joseph caribou herd and the greater region of south central Labrador*. *Results of a large-scale aerial census conducted during March 2009*. Department of Environment and Conservation, Wildlife Division, Government of Newfoundland and Labrador. 24 p.

Schmelzer, I and R. Otto (2003) *Winter range drift in the George River Caribou Herd: a response to summer forage limitation?* Rangifer Special Issue 14: 113-122

Schmelzer, I., J. Brazil, T. Chubbs, S. French, B. Hearn, R. Jeffery, R., L. LeDrew, H. Martin, A. McNeill, R. Nuna, R. Otto, F. Phillips, G. Mitchell, G. Pittman, N. Simon and G. Yetman (2004) *Recovery strategy for three Woodland caribou herds (Rangifer tarandus caribou; Boreal population) in Labrador.* Department of Environment and Conservation, Government of Newfoundland and Labrador, Corner Brook

Schwarz, F. (2006) *LabMag Iron Ore Project – Historical resources impact assessment – Stage 2*. Report prepared for LabMag GP inc.

Scruton, D.A (1984) *A Survey of Selected Lakes in Labrador, with an Assessment of Lake Status and Sensitivity in relation to Acid Precipitation*. Technical Report No 79. DFO Fisheries Research Branch, St. John's, NL

Secrétariat aux affaires autochtones [SAA] (2014) online :http://www.autochtones.gouv.qc.ca/index.asp, page consulted May 2014

Sedell, J.R., G.H. Reeves, F.R. Hauer, J.A. Stanford and C.P. Hawkins (1990) *Role of refugia in recovery from disturbance: modern fragmented and disconnected river systems*. Environmental Management 14:711-724

Seip, D.R. (1992) *Factors limiting woodland caribou populations and their interrelationships with wolves and moose in southeastern British Columbia*. Canadian Journal of Zoology 70: 1,494-1,503

Serviz, J.A. and D.W. Martens (1987) *Some effects of suspended Fraser River sediments on sockeye salmon (Oncorhynchus nerka)*, p. 254-264. In H.D. Smith, L. Margolis, and C.C. Wood [ed.] Sockeye salmon (Oncorhynchus nerka) population biology and future management. Can. Spec. Publ. Fish. Aquat. Sci. 96.

Skaggs, R W., B.D. Phillips, G.M. Chescheir and C.C. Trettin (2011) *Effect of Minor Drainage on Hydrology of Forested Wetlands*. Transactions of the ASABE, 54(6): 2139-2149

Slabekoorn, H. and E.A. Ripmeester (2008) *Birdsong and anthropogenic noise: implications and applications for conservation*. Molecular Ecology 17(1): 72-83

Smith, C.M. (1998) *Banff National Park Harlequin Duck research project: 1997 progress report*. Unpubl. Tech. Report. Heritage Resour. Conserv., Parks Canada, Banff, AB

SNC-Lavalin (2015) *Hydrogeology Modelling*. Technical Memorandum 623418, January 2015, 17 p.

SNC-Lavalin (2014) (in preparation). *Hydrogeology and mine pit dewatering modelling. LabMag site*. New Millenium Iron

SNC-Lavalin (2013a) *KéMag Iron Ore Project – 2012 terrestrial ecosystem mapping field report*. Final Report done in collaboration with Groupe Hémisphères for New Millennium Iron/TATA Steel, 53 p. and 8 appendices

SNC-Lavalin (2012a) *KéMag Iron Ore Project – 2012 Herpetofauna and Small Mammals Surveys.* Field Report, Final Report Rev. 01 done for New Millennium Iron/TATA Steel, 7 p.

SNC-Lavalin (2012b) *LabMag* and *KéMag Iron Ore Projects 2012 Mine Site Aquatic Program Field Report.* Final Report done in collaboration with Groupe Hémisphères and AMEC for New Millennium Iron/TATA Steel, 43 pages and 3 appendices

Sooley, D.R., E.A. Luiker and M.A. Barnes (1998) *Standard Methods Guide for Freshwater Fish and Fish Habitat Surveys in Newfoundland and Labrador: Rivers* and *Streams.* Fisheries and Oceans, St. John's, NF. Iii + 50 p.

Species at Risk Act [SARA] (2014) *Official list of wildlife species at risk.* Online: http://www.sararegistry.gc.ca/sar/index/default_e.cfm, page consulted November 2014

Species at Risk [SAR] Public Registry (2014) *Factsheet on the emergency listing order for the Little Brown Myotis, the Northern Myotis and the Tri-colored Bat*. Online: http://www.registrelep-sararegistry.gc.ca/default.asp?lang=En&n=42E533D4-1, page consulted December 2014

Sorenson, D.L., M.M. McCarthy, E.J. Middlebrooks and D.B. Porcella (1977) *Suspended and dissolved solids effects on freshwater biota: a review.* United States Environmental Protection Agency, Report 600/3-77-042, Environmental Research Laboratory, Corvallis, Oregon, USA

Spence, B.C., G.A. Lomnicky, R.M. Hughes and R.P. Novitzki (1996) *An Ecosystem Approach to Salmonid Conservation. Management Technology*. TR-4501-96- 6057.Stantec inc. (2010) *Due Diligence Review of Schefferville Area Iron Ore Mine (Western Labrador* Prepared for Labrador Iron Mines Limited, 35 p and 3 appendices

Stantec inc. (2009) *Stage 1 Historic Resources Assessment*. Labrador Iron Mines 2008 Exploration Activities. Rapport inédit

Stassinu Stantec Limited Partnership (2010) *Classification of Wildlife Habitat Suitability for Houston and Howse Minerals Claims Blocks for the Schefferville Area Iron Ore Mine*. Prepared for Labrador Iron Mines Holdings Limited, 41 p. and 3 appendices

Statistics Canada (2011) *Census Profile* and *National Household Survey* Online: http://www.statcan.gc.ca, page consulted between July and December 2014

Statistics Canada (2006) *2006 Community Profiles*. Online: http://www.statcan.gc.ca, page consulted in October, 2013

Stephens, K.A., P. Graham and D. Reid (2002) *Stormwater Planning: A Guidebook for British Columbia*. British Columbia Ministry of Water, Land and Air Protection. 244 p.

Storey, K. (2010) *Fly-in/Fly-out: Implications for Community Sustainability*. Sustainability. 2(5): 1161

Storey, K. and L. Hamilton (2003) *Planning for the Impacts of Megaprojects*. In R. Rasmussen et N. Koroleva (éd.). Social and Environmental Impacts in the North: Methods in Evaluation of Socioeconomic and

Environmental Consequences of Mining and Energy Production in the Arctic and Sub-Arctic. Vol. 31. Springer Netherlands. p. 281-302

Stubbins, J.B. and P. Munro (1965) *Historical information on mine dewatering of DSO (Knob Lake).* The Canadian Institute of Mining and Metallurgy Bulletin, 58: 814-822

Sweka, J.A. and K.J. Hartman (2001) *Influence of Turbidity on Brook Trout Reactive Distance and Foraging Success*. Transaction of the American Fisheries Society 130(1): 138-146

Taillon, J. (2013) *Condition physique, allocation maternelle et utilisation spatio-temporelle des aires de mise bas du caribou migrateur, Rangifer tarandus*. Thèse de doctorat présentée à l'université Laval. 231 p.

Tata Steel Minerals Canada [TSMC] (2014) *DSO Project Activities, Environmental Protection Plan,* 339 p.

Tata Steel Minerals Canada [TSMC] (2013a) *Environmental Emergency Response Plan – Direct Shipping Ore Project*. Prepared by Sikumiut Environmental Management Ltd., 53 p. and 3 appendices

Tata Steel Minerals Canada [TSMC] (2013b) *Elross Lake Area Iron Mine – DSO Timmins Project, Draft Waste Management Plan*. 32 p. and 4 appendices

Tata Steel Minerals Canada [TSMC] (2012) *Water Monitoring Stations, no. GIS-ML-19-03.* Canada, December 2012.

Tester, F.J. and S. Blangy (2013) *Introduction: Industrial developement and mining impacts*. Inuit Studies 37 (2): 5-14

Tiner, R. (2011) *Dichotomous Keys and Mapping Codes for Wetland Landscape Position, Landform, Water Flow Path, and Waterbody Type Descriptors: Version 2.0*. U.S. Fish and Wildlife Service, National Wetlands Inventory Program, Northeast Region, Hadley, MA. 51 p.

Tiner, R. (2003) *Correlating enhanced national wetlands inventory data with wetland functions for watershed assessments: a rationale for Northeastern US Wetlands*. U.S. Fish and Wildlife Service, National Wetlands Inventory Program, Region 5, Hadley, MA. 26 p.

Tecsult (2006) Projet LabMag. *Résultats de mesures de bruit à la Howells River et à Emeril*. Tableau des résultats

Tecsult Foresterie Inc. (2000) *Récolte faunique chez les Naskapis entre juillet 1989 et juin 1993.* Rapport final. Gouvernement du Québec, Faune et Parcs, Direction régionale du Nord-du-Québec

Transport Canada [TC] (2013a) *Wabush Airport*. Online: http://wabushairport.com, page consulted November 2014

Transport Canada [TC] (2010) *Wabush Airport Air Passenger Movements*. Online: http://www.tc.gc.ca, page consulted November 2013

Transports Québec [TQ] (2012) *Amélioration de la route 389*. Online: http://www.mtq.gouv.qc.ca, page consulted November 2013

Tremblay, M., M. Allard, J.P. Savard, M. Qiisik, E. Angiyou, P. Tookalook, N. Swappie, N. Einish, T. Annanack, C. Larrivée, C. Furgal and M. Barrett (2006) *Changements climatiques au Nunavik: Accès au territoire et aux ressources*. Projet A1279 présenté au Programme sur les impacts et l'adaptation liés aux changements climatiques, Ressources Naturelles Canada

Tshiuetin Rail Transportation Inc [TSH] (2009) *Business*. Online: http:www.tshiuetin.net, page consulted November 2014

Uauitshitun Health and Social Service Center (2014) Online. http://www.uauitshitun.org/services-communautaires, page consulted in October 2014

U.S Army Corps of Engineers [USACE] (2005) *Technical standard for water-table monitoring of potential wetland sites*. WRAP Technical Notes Collection, ERDC TN-WRAP-05-2. U. S. Army Engineer Research and Development Center, Vicksburg, MS

U.S.Environmental Agency [USEPA] (2014) *Emissions Factors* and *AP 42, Compilation of Air Pollutant Emission Factors*. Online: http://www.epa.gov/ttnchie1/ap42/, page consulted December 2014

U.S. Department of Transportation [USDT] (2006a) *FHWA Roadway Construction Noise Model User's Guide*. U.S. Department of Transportation, Federal Highway Administration

U.S. Dpartment of Transportation [USDT] (2006b) *Transit Noise and Vibration Impact Assessment*. U.S. Department of Transportation, Federal Transit Administration

Unitd States Fish and Wildlife Service [USFWS] (1998) *Bull Trout Interim Conservation Guidance*. 47 p.

Ville de Sept-Îles (2014). Online. http://ville.sept-iles.qc.ca/fr, page consulted between September and December 2014

Vistns,I. and C. Nellemann (2008) *The matter of spatial and temporal scales: a review of reindeer and caribou response to human activity*. Polar Biology. 31: 399-407

Water Resources Management [WRE] (2013) *Real Time Streamflow and Climate Information*. Departement of Environment and Conservation, Newfoundland and Labrador. Online: http://www.env.gov.nl.ca/env/waterres/cycle/hydrologic/info.html

Weile, M. (2009) *Naskapi Land Use in the Schefferville, Québec, Region*. Reports 1 (January 2009) and 2 (December 2009). Final Reports presented to New Millennium Capital Corp

Weir, J.N., S.P. Mahoney, B. McLaren and S.H. Ferguson (2007) *Effects of Mine Developments on Woodland Caribou Rangifer tarandus Distribution*. Wildlife Biology 13: 66-74

Wild Species Canada (2010) Online: http://www.wildspecies.ca/home.cfm?lang=e, Updated on August 2011

Williams, K., R. Mies, D. Stokes and L. Stokes (2002) *Beginner's guide to bats*. Boston, Little, Brown and Company

Williams, G.E. and P.W. Schmidt (2004) *Paleomagnetism of the 1.88 Ga Sokoman Formation in the Schefferville-Knob Lake Area, Québec, Canada, and Implications for the Genesis of Iron Oxide Deposits in the Central New Québec Orogen*. Precambrian Research, vol. 128, p. 167-188

Women in Mining (WIN) (2010) *Ramp-up: A study on the Status of Women in Canada's Mining and Exploration Sector*. Final Report

Wolfe, S.A., B. Griffith and C. A. Gray Wolfe (2000) *Response of reindeer and caribou to human activities.* Polar Research 19(1): 63-73

World Meteorological Organization [WMO] (2009) *Manual on Estimation of Probable Maximum Precipitation (PMP)*, WMO-No.1045, ISBN 978-92-63-11045-9

Wright, D.G. and G.E. Hopky (1998) *Guidelines for the Use of Explosives in or near Canadian Fisheries Waters,* Canadian Technical Report of Fisheries and Aquatic Science. Departement of Fisheries and Ocenans, Ottawa, On

Yap, S. (1972) *Engineering properties of frozen ores from Labrador*. Unpublished Master of Engineering Thesis, McGill University, Montreal, Québec, 166 p.