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

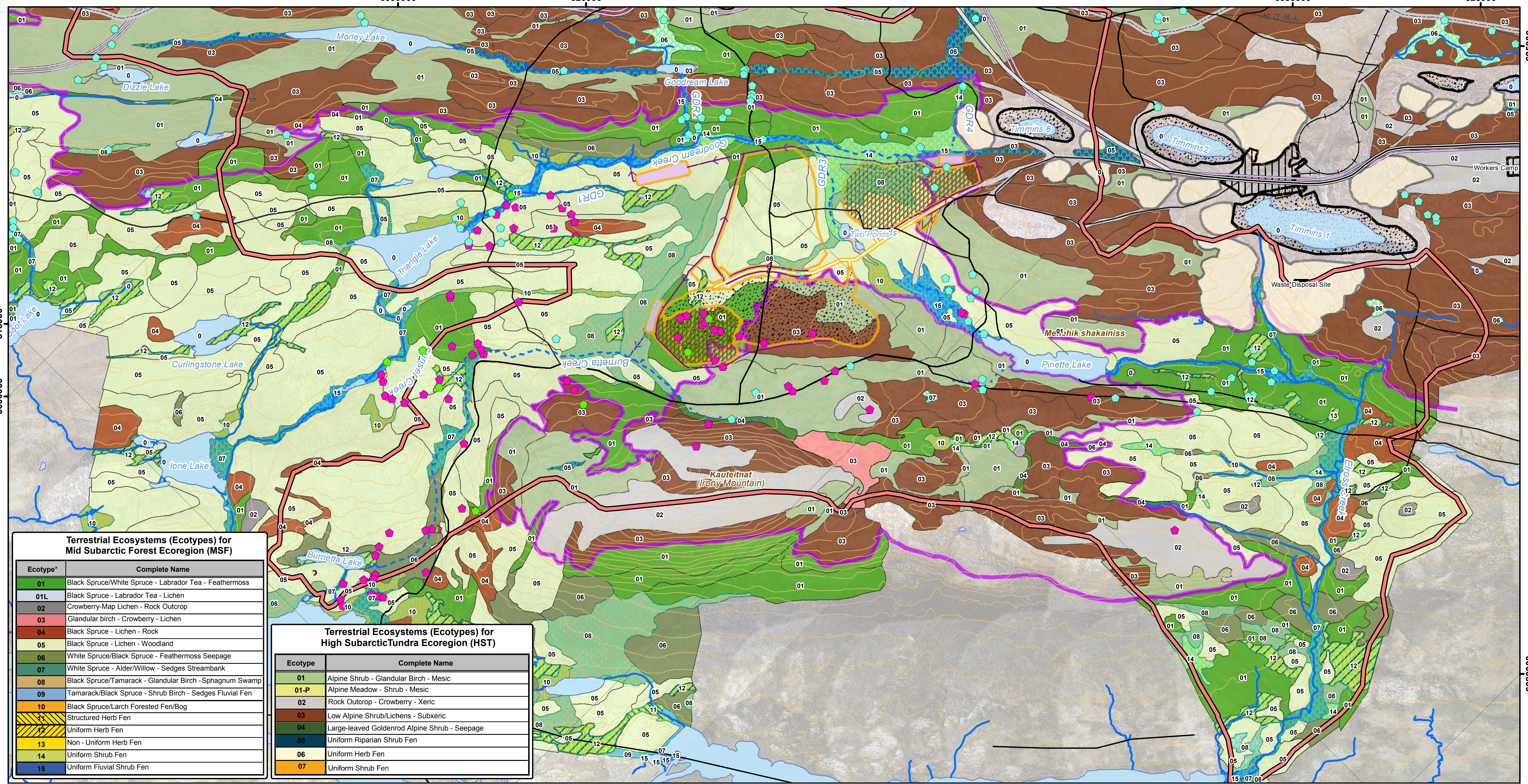
The LSA consists of the Burnetta Creek, western part of Goodream Creek and Elross Creek watershed limits. The effect of the project should not be felt outside the limit of these watersheds. The RSA represents all terrestrial ecosystem mapping (TEM) done in the same regional area, which represents 280 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

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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

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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

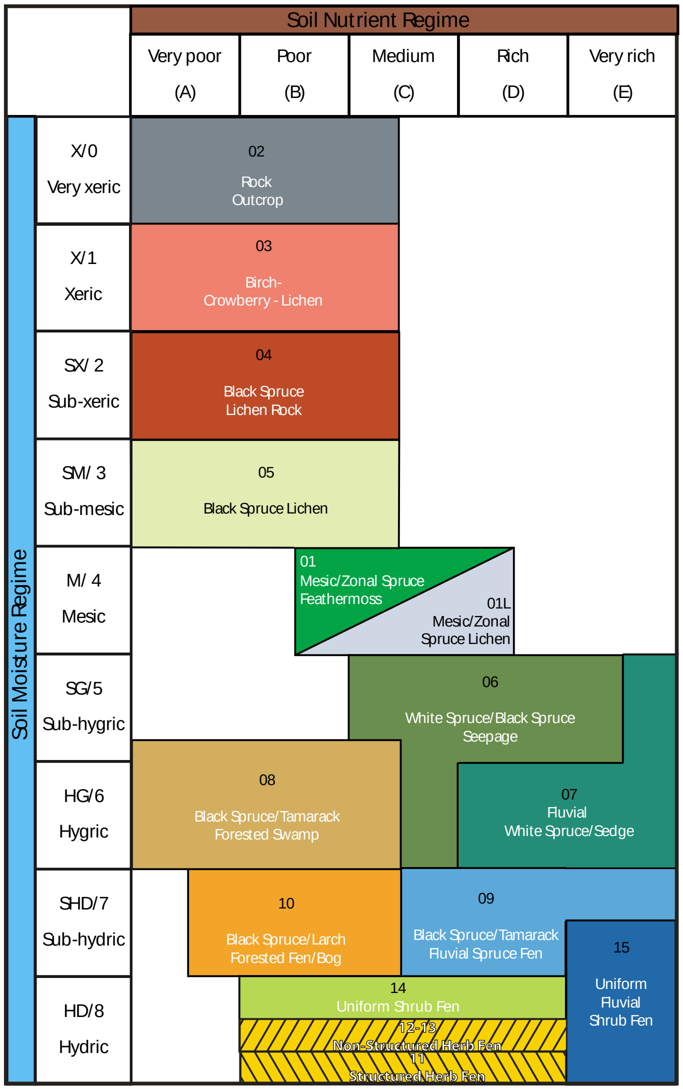


Figure 7-31 Edatopic Grid for the MSF Ecoregion

<u>High Subarctic Tundra (HST) Ecoregion</u>

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

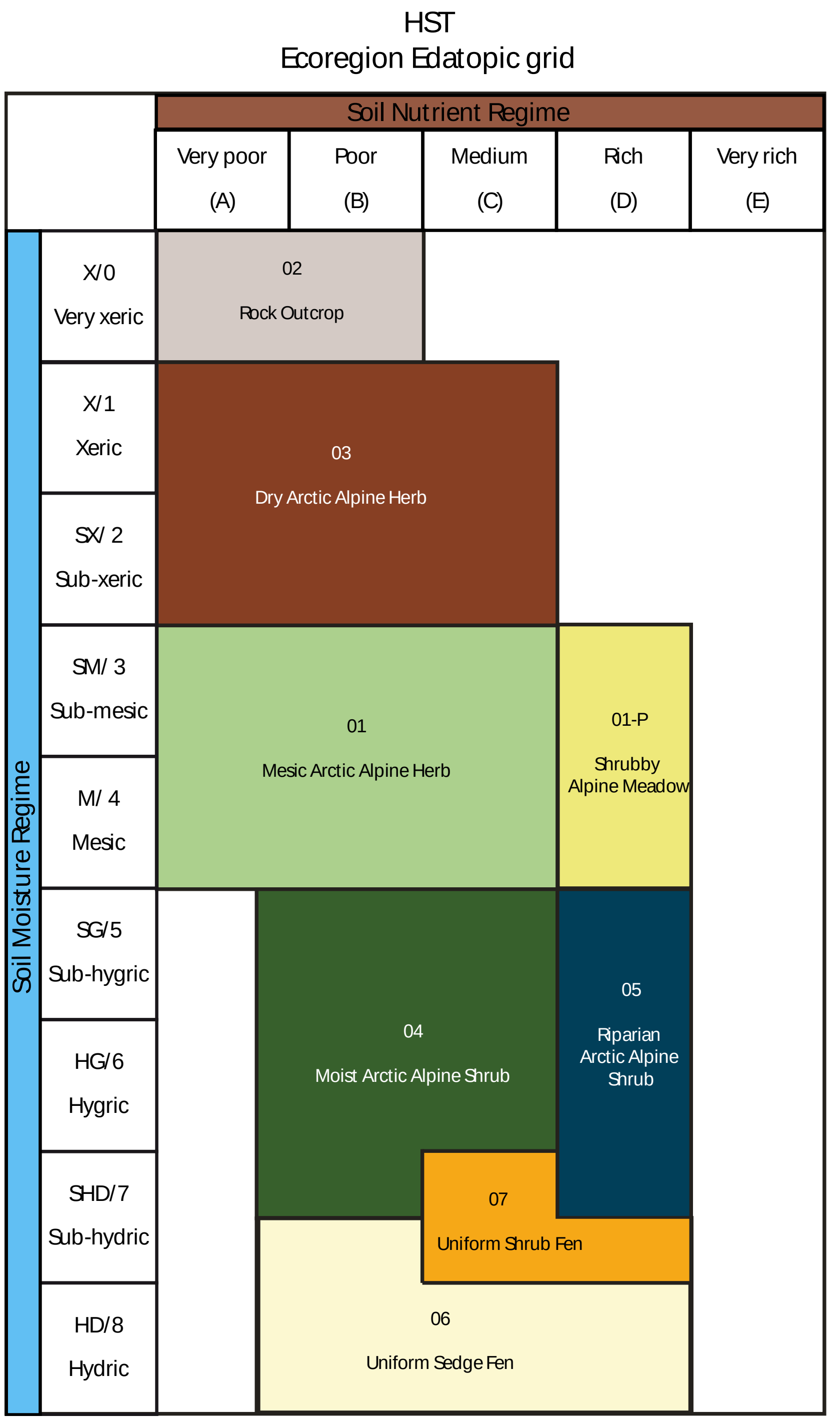


Figure 7-32 Edatopic Grid for the HST Ecoregion

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**

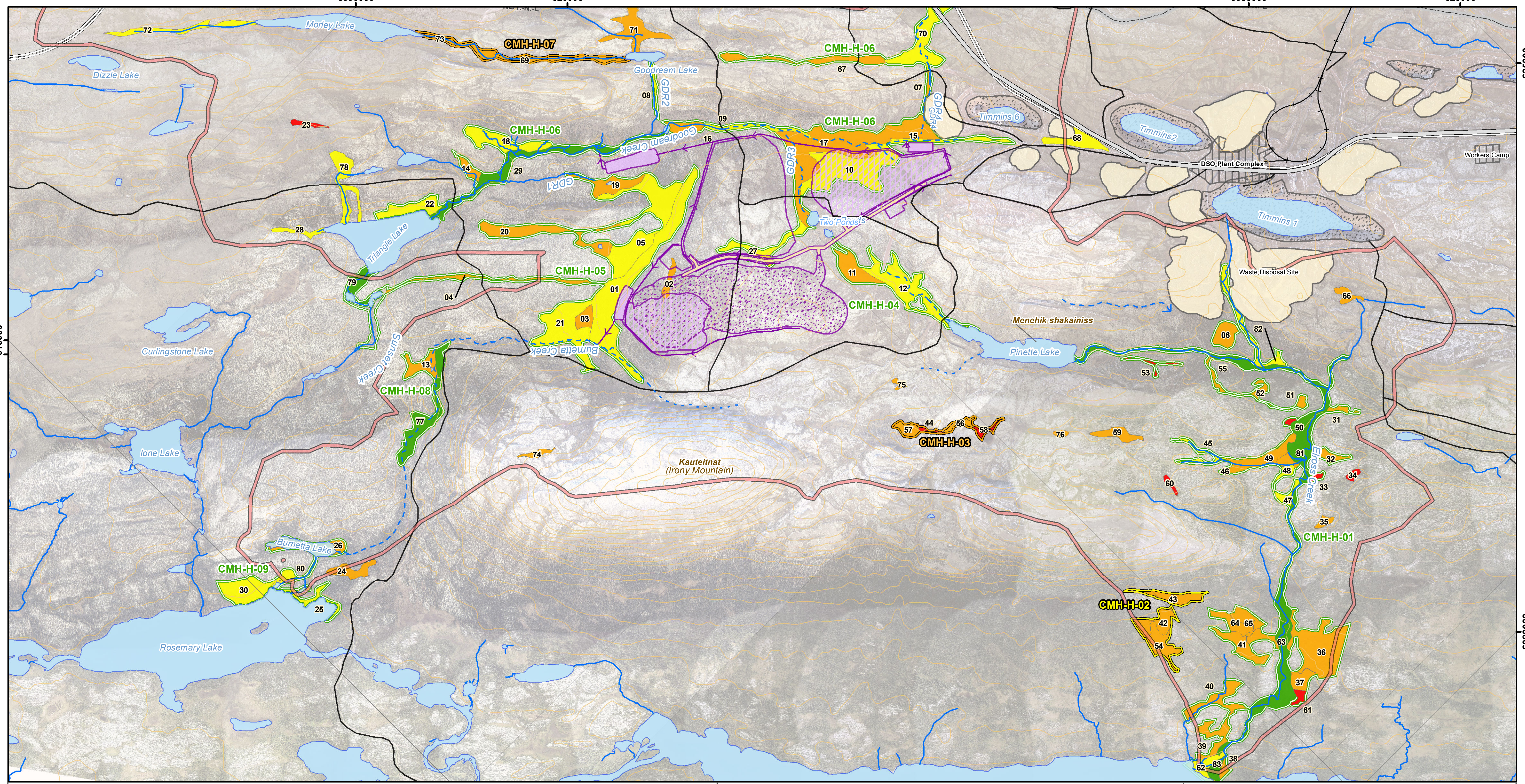
<u>Wetland Functions and Ecological Value Assessment</u>

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
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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

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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,
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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

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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				

<u>Operation Phase</u>

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

<table>
<tr><th>CODE</th><th>MEASURE</th><th>MITIGATION EFFECT</th></tr>
<tr><td colspan="3">Tree removal and timber management (TM)</td></tr>
<tr><td>TM3</td><td>Do no clearing in the riparian strip along watercourses or in wetlands without authorization.</td><td rowspan="4">It will ensure that the impacted areas will be limited to those that were identified.</td></tr>
<tr><td>TM5</td><td>Be particularly careful in wetlands and protected areas.</td></tr>
<tr><td>TM6</td><td>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.</td></tr>
<tr><td>TM7</td><td>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.</td></tr>
<tr><td>TM8</td><td>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.</td><td rowspan="2">It will help to maintain vegetation near worksite and ensure a faster recolonization by vegetation.</td></tr>
<tr><td>TM9</td><td>Maintain a transition zone around work site in which trees are removed, but stumps are left intact to preserve the shrub stratum.</td></tr>
</table>

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.	

<u>Specific Mitigation Measures</u>

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.
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.
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.

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 (KM²)	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

<u>Literature review and Current Studies Data Used to Assess the Potential Effect</u>

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

<u>Site Construction Phase</u>

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.

<u>Operation Phase</u>

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.

Moose

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).

Black bear

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 52nd and 53rd 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).

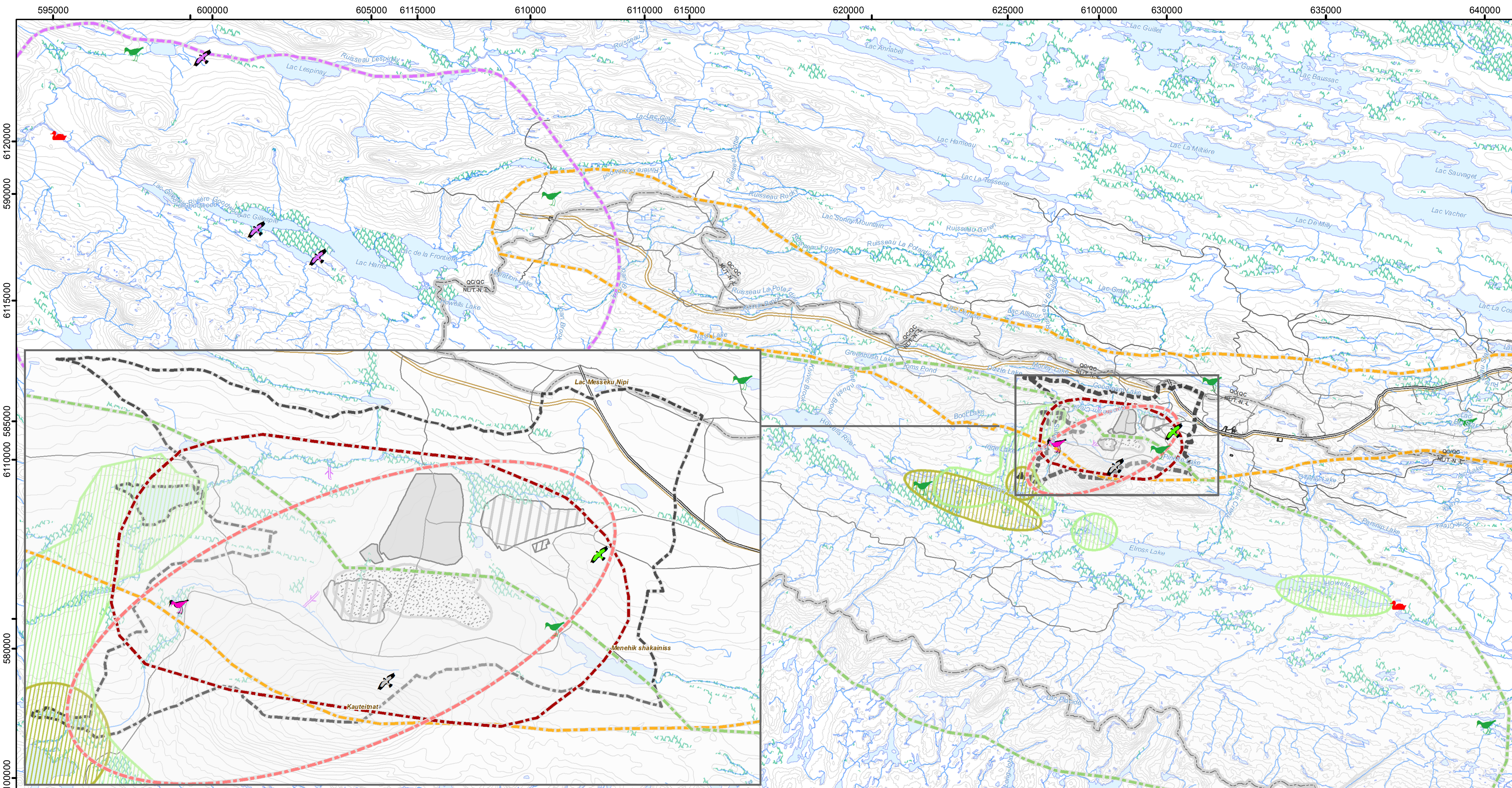
In the RSA, Rusty Blackbirds were sighted in a swamp bordering Ione Lake (Girard, 2003). A Rusty Blackbird was also observed on July 18, 2008, near Inukshuk Lake (DSO4) during a fisheries survey (Groupe Hémisphères, 2008). In 2009, two adults and a juvenile were also observed near Lake Big Star (in Québec, 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

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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.

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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

Timing

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).

Spatial Extent

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 — IN DECREASING ORDER OF IMPORTANCE	SPECIES PRESENT
			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		**m²**	**m²**
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).

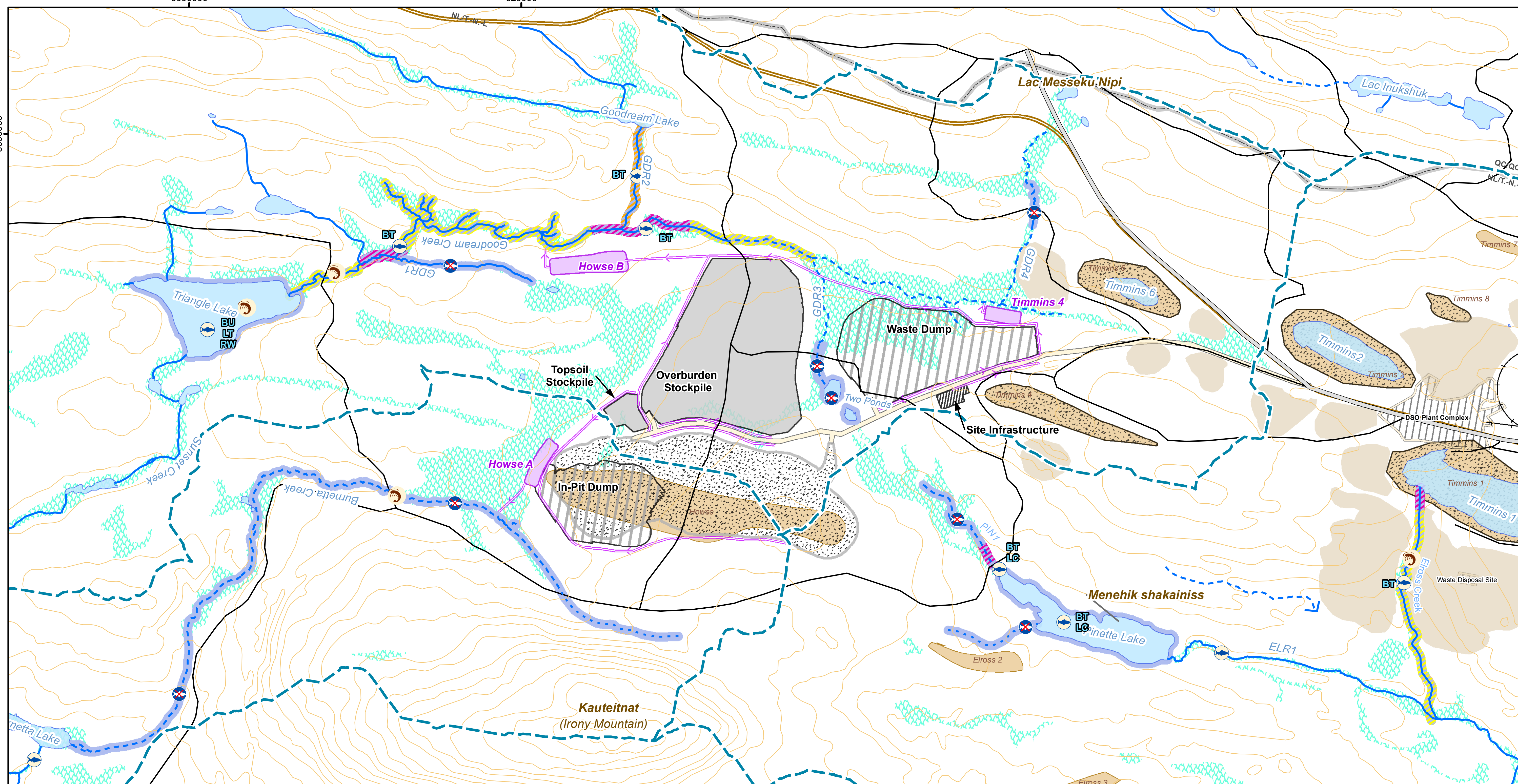
Triangle Lake

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

Lake and Stream Segments Surveyed

Habitat
- Type II
- Type III
- Type IV

Fish Species
- BT : Brook Trout
- LT : Lake Trout
- RW : Round Whitefish
- BU : Burbot
- LC : Lake Chub

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

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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 Saint-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.