10 Summary of residual impacts on issues

The project will have positive and negative impacts on various components of the physical, biological, and social environments. The significance of residual impacts after application of the mitigation or enhancement measures in the various phases of the project (construction, operations, and closure) is summarized in the project's environmental summary (Tables 10-1). A complete list of mitigation measures is provided in Appendix 8-2.

From this residual impact analysis, a few issues emerge that represent negative impacts of moderate residual significance. Recognition of these impacts is essential to help select which environmental components should be subject to a cumulative impact assessment (Chapter 9) and possible environmental monitoring measures (Chapter 13). Components with moderate residual impacts (no major residual impacts are generated by the project) include:

- **Surface water quality**, which will be subject to a moderate residual impact during the operations phase due to a constant inflow of water from mine effluent. Although this effluent will be regularly monitored and its treatment will ensure compliance with standards, a minor increase in loads is anticipated in the receiving environment downstream of the effluent over the duration of operations.
- **Aquatic wildlife (fish) and habitats**, which will be subject to a moderate residual impact during the construction and operations phases. During construction, the impact will be linked to the loss of aquatic habitat due to the draining of part of Lake L01 to create the open pit and the installation of the diversion channel to drain water from Lake L01. In fact, the natural effluent from Lake L01 is located in the part that needs to be drained. The diversion channel will introduce water from the lake upstream of the natural effluent. During the operations phase, the anticipated effect of the effluent on surface water quality will cause the moderate impact.
- **Wetlands and water environments**, which will be subject to a moderate residual impact during the construction phase due to the encroachment on 120.4 ha of wetlands.
- **Wildlife species of special status**, which will be subject to a moderate residual impact during the construction phase mainly associated with habitat loss (deforestation). A moderate residual impact during operations is also anticipated due to the effects of disturbance and the risks of collision and mortality.
- **Terrestrial wildlife (large wildlife, avian fauna including migratory birds)**, which will be subject to a moderate residual impact during the operations phase, mainly due to the effects of disturbance and the risks of collision and mortality.
- **Physical, psychological, and social health**, which will be subject to a moderate residual impact at all phases of the project. During the construction and operations phases, the impact will mainly be related to job creation, which will provide additional income for some members of the community and require them to be absent from home to work at the mine. Although these effects may seem positive at first glance, they can cause tensions within the community between those members who are chosen and those who are not. Furthermore, contact with non-Indigenous people could generate tensions and various social problems. During the closure phase, the loss of well-paid jobs would be the main source of impact.

- **Road safety**, which will be subject to a moderate residual impact in the operations phase. In fact, increased traffic on the Trans-Taiga Road and Billy-Diamond Highway due to ore transport to Matagami and supply needs could lead to accelerated road deterioration and increase the risk of accidents.
- **Hunting and trapping of terrestrial wildlife and waterfowl**, which will be subject to a moderate residual impact during the construction phase. This impact will mainly be caused by the loss of land available for these activities as well as the opening up of the area to hunters who are not from the region's Indigenous communities.
- **Well-being on the land** refers to all activities carried out on the land that are closely linked to Indigenous culture (transmission of values and language, mental health and healing, ancestral memory, etc.). After assessment, it was determined that this VEC largely overlapped with that relating to physical, psychological, and social health, and the analysis of the impacts of these two VECs was addressed in the section on health.
- **Climate change mitigation (GHG emissions, energy transition)**, which, during the operations phase, will have a moderate residual impact due to the regional nature of the impact and the larger quantities of GHGs generated during this phase.

Besides the residual negative impacts, the project will also have various positive impacts including:

- In terms of the physical environment, during the closure phase, the drained section of Lake L01 will be gradually refilled with water, and restoration work will be carried out to return the soil, surface water, and groundwater to their pre-project conditions.
- In terms of the biological environment, during the closure phase, the restoration of vegetation cover, wetlands, and watercourses will contribute to improving the habitats of fish, terrestrial wildlife, and wildlife species of special status.
- In terms of the social environment, the work during the construction, operations, and closure phases will generate economic benefits for the regional population. In addition, a positive impact is anticipated during the closure phase for users of the CH39 trapline, as facilities will be removed from the land and the nuisance will cease. Lastly, the end of mining activities at this site will allow traditional land use to return somewhat to pre-project conditions.

Table 10-1 Summary of impacts by issue

Affected component	Project phase	Primary source of impact	Description of potential impacts	Common and specific mitigation (or enhancement) measures (Appendix 8-2)	Significance of residual impact
Issue No. 1 - Preservation of aquatic habitat quality					
Hydrology (Hydrodynamic and hydro-sedimentary conditions)	Construction	Site organization, stripping and clearing, surface preparation, access development, transport and traffic related to materials and supplies	Alterations to hydrodynamic and hydrosedimentary conditions associated with the construction of the Lake L01 diversion channel	Common mitigation measures: Section: Soil, surface water, and sediment quality Specific mitigation measures: P31 and P32	Minor
	Operations	Water use and management, as well as transport and traffic related to ore and supplies	Alterations in hydrodynamic and hydro-sedimentary conditions associated with mine effluent	Common mitigation measures: Section: Soil, surface water, and sediment quality Specific mitigation measures: P33	Minor
	Closure	Final restoration	Avoids additional impact by leaving the diversion channel in place and refilling the mine pits connected to Lake L01	Common mitigation measures: Section: Soil, surface water, and sediment quality Specific mitigation measures: N/A	Moderate (+) Minor (-)
Surface water quality	Construction	Site organization, stripping and clearing, surface preparation and access development, transport and traffic related to materials and supplies, production and management of residual and hazardous materials	Alteration of surface water quality	Common mitigation measures: Sections: Ambient air; Soil, surface water, and sediment quality Specific mitigation measures: P24 and P25	Minor
	Operations	Water use and management, transport and traffic related to ore and obtaining supplies, production and management of residual and hazardous materials	Alteration of surface water quality	Common mitigation measures: Sections: Ambient air; Soil, surface water, and sediment quality Specific mitigation measures: P25, P29, P30, and P38	Moderate[1]
	Closure	Final restoration, production and management of residual and hazardous materials	Gradual improvement in water quality Low risk of contamination during restoration work	Common mitigation measures: Sections: Ambient air; Soil, surface water, and sediment quality; Vegetation and wetlands Specific mitigation measures: P23 and P25	Major (+) Minor (-)
Aquatic wildlife (fish) and habitats	Construction	Site organization, stripping and clearing, surface preparation and access development, construction of structures and infrastructure, transport and traffic related to materials and supplies	Disturbance of wildlife activities and aquatic habitats due to loss of fish habitat surface area	Common mitigation measures: Sections: Ambient air; Soil, surface water, and sediment quality; Wildlife and wildlife habitat Specific mitigation measures: P25, P31, P32, and P33	Moderate
	Operations	Water use and management, transport and traffic related to ore and supplies, production and management of residual and hazardous materials	Disturbance of wildlife activities and aquatic habitats due to mine effluent discharge	Common mitigation measures: Sections: Ambient air; Soil, surface water, and sediment quality; Wildlife and wildlife habitat Specific mitigation measures: P25, P31, P32, P33, and P46.	Moderate
	Closure	Final restoration, production and management of residual and hazardous materials	Progressive restoration of aquatic ecosystem functions and improvement of habitat quality Low risk of contamination during restoration work	Common mitigation measures: Sections: Ambient air; Soil, surface water, and sediment quality; Wildlife and wildlife habitat Specific mitigation measures: P23 and P25	Minor

[1] It should be noted that the expected residual impact on water quality is minor, as the design of the industrial wastewater treatment plant is intended to ensure compliance with the requirements of Directive 019. The medium significance rating is mainly attributable to the assignment of a medium duration to this impact based on the established definitions, although this duration does not in any way affect effluent quality.

Affected component	Project phase	Primary source of impact	Description of potential impacts	Common and specific mitigation (or enhancement) measures (Appendix 8-2)	Significance of residual impact
Issue No. 2 – Preservation of soil and groundwater quality					
Soil quality	Construction	Site organization, stripping and clearing, surface preparation and access development, transport and traffic related to materials and supplies, and production and management of residual and hazardous materials	Alteration of the physical and chemical quality of soils	Common mitigation measures: Section: Soil, surface water, and sediment quality Specific mitigation measures: N/A	Minor
	Operations	Transport and traffic related to ore and supplies, production and management of residual and hazardous materials	Alteration of the physical and chemical quality of soils	Common mitigation measures: Section: Soil, surface water, and sediment quality Specific mitigation measures: N/A	Minor
	Closure	Transport and traffic during closure work, final restoration, and production and management of residual and hazardous materials	Remediation of affected soils Low risk of temporary soil disturbance and contamination during closure work	Common mitigation measures: Section: Soil, surface water, and sediment quality Specific mitigation measures: N/A	Major (+) Minor (-)
Groundwater quality	Construction	Site organization, stripping and clearing, surface preparation and access development, construction of structures and infrastructure, transport and traffic related to materials and supplies, and production and management of residual and hazardous materials	Alteration of groundwater quality	Common mitigation measures: Sections: Soil, surface water, and sediment quality; Hydrology and hydrogeology Specific mitigation measures: P25	Minor
	Operations	Water use and management, transport and traffic related to ore and supplies, production and management of residual and hazardous materials	Alteration of groundwater quality	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P25 and P38	Minor
	Closure	Final restoration, production and management of residual and hazardous materials	Gradual improvement in groundwater quality Low risk of contamination during closure work	Common mitigation measures: Same as for the construction phase Sections: Soil, surface water, and sediment quality; Hydrology and hydrogeology Specific mitigation measures: P25	Major (+) Minor (-)
Issue No. 3 – Preservation of wetlands and habitats of interest to terrestrial wildlife and plants					
Wetlands and water environments	Construction	Site organization, stripping and clearing, surface preparation and access development, transport and traffic related to materials and supplies, production and management of residual and hazardous materials	Loss of area and disruption of the quality of wetlands and water environments.	Common mitigation measures: Sections: Ambient air; Soil, surface water, and sediment quality; Vegetation and wetlands Specific mitigation measures: P24 and P25	Moderate
	Operations	The presence and operation of new infrastructure , water use and management, transport and traffic related to ore and obtaining supplies, production and management of residual and hazardous materials	Disruption of the quality of wetlands and water environments	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P01, P245, P25, P29, P30, P31, P32 and P33	Minor
	Closure	Final restoration, production and management of residual and hazardous materials	Restoration of wetlands and water environments Low risk of contamination of wetlands and water environments during closure work	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P01, P23, P24, and P25	Major (+) Minor (-)
Wildlife species of special status	Construction	Site organization, stripping and clearing, surface preparation and access development, construction of structures and infrastructure, transport and traffic related to materials and supplies, production and management of residual and hazardous materials	Disturbance of activities and loss of habitat for wildlife species of special status	Common mitigation measures: Sections: Ambient air; Acoustic environment and vibrations; Soil, surface water, and sediment quality; Vegetation and wetlands; Wildlife and wildlife habitat; Planning, land use, and land tenure Specific mitigation measures: P03, P04, P24, P25, P39, P40, P41, and P43	Moderate
	Operations	The presence and operation of new infrastructure, water use and management, transport and traffic related to ore and supplies, production and management of residual and hazardous materials	Disturbance of activities of wildlife species of special status	Common mitigation measures: Sections: Ambient air; Acoustic environment and vibrations; Soil, surface water, and sediment quality; Vegetation and wetlands; Wildlife and wildlife habitat; Planning, land use, and land tenure Specific mitigation measures: P03, P04, P25, P39, P40, P41, and P43	Moderate
	Closure	The presence of site remnants, final restoration, production and management of hazardous waste materials	Improvement of habitats favouring the resumption of activities by wildlife species of special status Low risk of habitat contamination during closure work	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P03, P04, P23, P25, P39, P40, P41, and P43	Major (+) Minor (-)

Affected component	Project phase	Primary source of impact	Description of potential impacts	Common and specific mitigation (or enhancement) measures (Appendix 8-2)	Significance of residual impact
Terrestrial wildlife (large animals, avian fauna including migratory birds)	Construction	Site organization, stripping and clearing, surface preparation and access development, transport and traffic related to materials and supplies, production and management of residual and hazardous materials	Disturbance of terrestrial wildlife activities due to nuisances and habitat loss	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P25, P39, P40, P41, and P43	Minor to Moderate
	Operations	The presence and operation of new infrastructure, transport and traffic related to ore and supplies, production and management of residual and hazardous materials	Disturbance of terrestrial wildlife activities due to nuisances	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P25, P39, P41, and P43	Moderate
	Closure	The presence of site remnants, final restoration, production, and management of residual and hazardous materials	Improvement of habitats favouring the resumption of terrestrial wildlife activities Low risk of habitat contamination during closure work	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P23, P25, P39, P41, P43, and P44	Moderate (+) Minor (-)
Forest cover	Construction	Site organization, stripping and clearing, surface preparation, and access development	Loss of forest cover associated with clearing land required for mine infrastructure and operations	Common mitigation measures: Sections: Soil, surface water, and sediment quality; Vegetation and wetlands; Wildlife and wildlife habitat; Planning, land use, and land tenure Specific mitigation measures: P23, P24, and P25	Minor
	Operations	Presence and operation of new infrastructure, transport of mineral, procurement and traffic	Disturbance of forest cover maintained on the edges of the site (damage caused by traffic, dust)	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P23, P24, P25, P29, and P30	Minor
	Closure	Transport and traffic during the work, site remnants, and final restoration	Restoration of cleared areas through revegetation Potential damage to forest cover components and area not cleared for revegetation	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P23, P24, and P25	Major (+) Minor (-)
Issue No. 4 – Preserving the quality of life of the local population					
Air quality	Construction	Site organization, stripping and clearing, surface preparation and access development, construction of structures and infrastructure, transport and traffic related to materials and supplies, production and management of residual and hazardous materials	Alteration of air quality due to the emission of air pollutants and dust	Common mitigation measures: Sections: Ambient air; Vegetation and wetlands and water environments Specific mitigation measures: P01, P19, P24, P25, P29, and P30	Minor
	Operations	The presence and operation of new infrastructure, transport and traffic related to ore and supplies, and the production and management of residual and hazardous materials	Alteration of air quality due to the emission of air pollutants and dust	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P01, P19, P25, P29, and P30	Minor
	Closure	Transport and traffic during the work, final restoration, production and management of residual and hazardous materials	Gradual improvement in air quality Low risk of temporary disruption to air quality during closure work	Common mitigation measures: Ambient air section Specific mitigation measures: N/A	Major (+) Minor (-)
Issue No. 5 – Preservation of the health, safety, and socioeconomic conditions of the regional population					
Physical, psychological, and social health	Construction	Water use and management, Transport and traffic related to materials and supplies, production and management of residual and hazardous materials, workforce, and purchasing of goods	Disruption to the physical, psychological, and social health of regional populations	Common mitigation measures: Sections: Ambient air; Acoustic environment and vibrations; Soil, surface water, and sediment quality; Vegetation and wetlands; Wildlife and wildlife habitat; Planning, land use, and land tenure; Quality of life and well-being; Traditional land use by Indigenous peoples Specific mitigation measures: P14, P15, P16, P17, P19, P20, P21, P22, P24, P25, and P45	Moderate
	Operations	Water use and management, transport and traffic related to ore and supplies, production and management of residual and hazardous materials			
	Closure	The presence of site remnants, final restoration, production and management of residual and hazardous materials, workforce, and purchasing of goods and services	Disruption to the physical, psychological, and social health of regional populations Gradual reclaiming of the land	Common mitigation measures: Same as for the construction and operations phases Specific mitigation measures: P06, P10, P11, P13, P21, P23, and P42.	Moderate (-) Major (+)

Affected component	Project phase	Primary source of impact	Description of potential impacts	Common and specific mitigation (or enhancement) measures (Appendix 8-2)	Significance of residual impact
Economic benefits (job creation, economic partnerships)	Construction	Site organization, stripping and clearing, surface preparation and access development, construction of structures and infrastructure, transport and traffic related to materials and supplies, workforce, and purchasing of goods and services	Contribution to local and regional economic development	Common mitigation measures: Sections: Population, economy, and employment; Quality of life and well-being Specific mitigation measures: N/A	Major (+)
	Operations	The presence and operation of new infrastructure, transport and traffic related to minerals and supplies, workforce, and purchasing of goods	Contribution to local and regional economic development	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P19	Major (+) Moderate (-)
	Closure	Final restoration, workforce, and purchasing of goods and services	Loss of local and regional economic benefits	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P09, P10, P11, P19, and P42	Moderate (-) (+)
Road safety	Construction	Transport and traffic related to materials and supplies	Increased risks of deterioration in road safety	Common mitigation measures: Sections: Quality of life and well-being; Traditional land use by Indigenous peoples; Infrastructure and public services Specific mitigation measures: P26, P34, P35, and P36	Minor
	Operations	Transport and traffic related to ore and supplies	Increased risks of deterioration in road safety	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P26, P34, P35, and P36	Moderate
	Closure	Final restoration	Reduced risk of road safety disruption	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P26, P34, P35, and P36	Major (+) Minor (-)
Issue No. 6 – Preservation of the traditional activities and practices of Indigenous peoples and the activities and practices of non-Indigenous peoples					
Hunting and trapping of terrestrial wildlife and waterfowl	Construction	Site organization, stripping and clearing, surface preparation and access development, transport and traffic related to materials and supplies	Disturbance of hunting and trapping activities	Common mitigation measures: Sections; Acoustic environment and vibrations; Quality of life and well-being; Traditional land use by Indigenous peoples; Planning, land use, and land tenure; Wildlife and wildlife habitat Specific mitigation measures: P14, P15, P19, P24, P25, and P45	Minor
	Operations	The presence and operation of new infrastructure, water use and management, transport and traffic related to minerals and supplies	Disturbance of hunting and trapping activities	Common mitigation measures: Sections: Acoustic environment and vibrations; Soil, surface water, and sediment quality; Quality of life and well-being; Traditional land use by Indigenous peoples; Planning, land use, and land tenure; Wildlife and wildlife habitat Specific mitigation measures: P14, P15, P19, P24, P25, and P45	Moderate
	Closure	The presence of site remnants, final restoration, production and management of residual and hazardous materials	Gradual improvement in hunting and trapping conditions Low risk of contamination of hunting and trapping areas during the work	Common mitigation measures: Same as for the operations phase Specific mitigation measures: P23 and P25	Major (+) Minor (-)
Fishing	Construction	Site organization, stripping and clearing, surface preparation and access development, transport and traffic related to materials and supplies, production and management of residual and hazardous materials	Disturbance of fishing activities	Common mitigation measures: Sections; Soil and surface water quality; Hydrology and hydrogeology; Vegetation and wetlands; Traditional land use by Indigenous peoples Specific mitigation measures: P14, P15, P19, and P25	Minor
	Operations	Water use and management, transport and traffic related to minerals and supplies, production and management of residual and hazardous materials	Disturbance of fishing activities	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P14, P15, P19, and P25	Minor
	Closure	Final restoration, production and management of residual and hazardous materials	Gradual improvement in fishing conditions Low risk of contamination of fishing areas during closure work	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P23 and P25	Moderate (+) Minor (-)

Affected component	Project phase	Primary source of impact	Description of potential impacts	Common and specific mitigation (or enhancement) measures (Appendix 8-2)	Significance of residual impact
Harvesting of valued plant species	Construction	Site organization, stripping and clearing, surface preparation and access development, transport and traffic related to materials and supplies, production and management of residual and hazardous materials	Disturbance of activities involving the gathering of valued plant species	Common mitigation measures: Sections: Ambient air; Soil, water, and sediment quality; Vegetation and wetlands; Planning, land use, and land tenure; Traditional land use by Indigenous peoples Specific mitigation measures: P14, P15, P19, P24, and P25	Minor
	Operations	The presence and operation of new infrastructure, water use and management, transport and traffic related to minerals and supplies, and the production and management of residual and hazardous materials	Disturbance of activities involving the gathering of valued plant species	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P14, P15, and P25	Minor
	Closure	The presence of site remnants, final restoration, production and management of residual and hazardous materials	Gradual improvement in harvesting conditions for valued plant species Low risk of contamination of fishing areas during closure work	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P14, P23, P24, and P25	Moderate **(+)** Minor (-)
Well-being on the land	Well-being on the land refers to all activities carried out on the land that are closely linked to Indigenous culture (transmission of values and language, mental health and healing, ancestral memory, etc.). After assessment, it was determined that this VEC largely overlapped with that relating to physical, psychological, and social health, and the analysis of the impacts of these two VECs was addressed in the section on health.				
Issue No. 7 – Consideration of climate change					
Climate change mitigation (GHG emissions, Energy transition)	Construction	Site organization, stripping and clearing, surface preparation and access development, construction of structures and infrastructure, transport and traffic related to materials and supplies, production and management of residual and hazardous materials	Contribution to the overall increase in GHG emissions	Common mitigation measures: Sections: Ambient air; Vegetation and wetlands Specific mitigation measures: P25 and P26	Minor
	Operations	The presence and operation of new infrastructure, the transport and traffic related to minerals and supplies, production and management of residual and hazardous materials	Contribution to the overall increase in GHG emissions	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P25 and P26	Moderate
	Closure	Transport and traffic during construction, final restoration, production and management of residual and hazardous materials	Reduction in overall GHG emissions Low contribution to GHG emissions during closure work	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P25 and P26	Major (+)Minor (-)

11 Climate change resilience

The guidelines for conducting an impact assessment require climate change to be taken into account in the environmental assessment of the project. The project's impact on the issue of combating climate change through the reduction of GHG emissions was discussed in Chapters 8 and 9.

This chapter addresses the adaptation and resilience of the project to current and future climate conditions, while taking climate change into account. It presents a summary of the methodology and main results of the project's climate change risk and vulnerability assessment, the detailed report of which can be found in Appendix 11-1.

It is important for PMET to emphasize that the traditional Indigenous knowledge of local communities can serve as a valuable source of information for understanding the local impacts of climate change. PMET recognizes the value of this knowledge and is committed to continuing dialogue with Cree land users in order to better incorporate their observations, whenever possible, into the project's adaptation and monitoring efforts in response to climate change.

11.1 Methodology

The following steps were taken in accordance with the guidelines set out in the document *Les changements climatiques et l'évaluation environnementale Guide à l'intention de l'initiateur du projet* [Climate Change and Environmental Assessment: Guide for project initiators] (hereinafter, "the Guide") from the Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP), which are themselves compliant with the requirements of ISO 31000:2018 on risk management and ISO 14901:2021 on climate change adaptation.

Preliminary step

- Description of the project, its environment, its lifespan, and applicable codes.

Step 1: Identify climate hazards that could affect the project, as well as the components of the site that could be affected by these hazards. Positive impacts (opportunities) will also be identified

- Identification of project components for the different phases (operations, dismantling/restoration, post-restoration).
- Identification of climate hazards relevant to the project.
- Identification of interactions between various climate hazards and project components for the operations phase and restoration/post-restoration phases.

Step 2: Define the vulnerability of components by assessing their sensitivity and adaptability to each climate hazard

- Assessment of the sensitivity of each component to potential impacts, taking into account infrastructure and environmental design criteria and thresholds (i.e., the project's potential to be exposed to and affected by identified climate hazards, based on mitigation/adaptation measures already in place).

- Assessment of the resilience of project components to potential impacts (i.e., the project's ability to adapt to climate change, including weather variability and extreme events, mitigate potential damage, take advantage of opportunities, or cope with the most significant impacts).
- Assessment of the vulnerability level of each potential impact by combining sensitivity and adaptive capacity.

Step 3: Establish the likelihood of impacts, which depends on the likelihood of observing changes in the occurrence of climate hazards and the vulnerability of components to these hazards

- Assessment of the likelihood of each potential impact, considering the likelihood of climate change and the vulnerability of components. When the impact likelihood score is low or very low, the interactions are not retained for the rest of the process.

Step 4: Determine the initial risk level for each climate-component interaction, based on the likelihood of impacts and the severity of consequences

- Assessment of the severity of the consequences for each impact identified and the resulting level of risk.

Step 5: Propose adaptation measures to reduce the risk level

- Determination of risk reduction and adaptation strategies for risks identified as moderate, high, or very high to improve the resilience of the project.
- Consultation with Cree land users to understand their views on the proposed climate change adaptation strategies.

11.2 Future trends in climate hazards that may impact the project

Climate change will have an impact on the water cycle and the frequency of extreme weather events. These effects can be positive or negative and will affect both construction costs and the lifespan of infrastructure. Therefore, climate hazards that could impact the project must be identified.

A climate hazard is defined as a hazard whose origin is wholly or partly related to one or more climate variables. Certain characteristics, such as intensity, probability of occurrence or recurrence, and spatial location, can be used to identify climate hazards that are likely to have an impact.

The relevant climate hazards have been selected for the site and can be categorized as follows:

- extreme precipitation/flooding;
- freezing rain;
- heat waves;
- freeze-thaw cycles and winter thaw;
- drought and forest fires;
- strong winds and thunderstorm activity;
- snowfall;

- extreme cold snaps;
- longer summers.

Table 11-1 presents the potential impacts identified for each component of the infrastructure considered, as well as interactions with the climate.

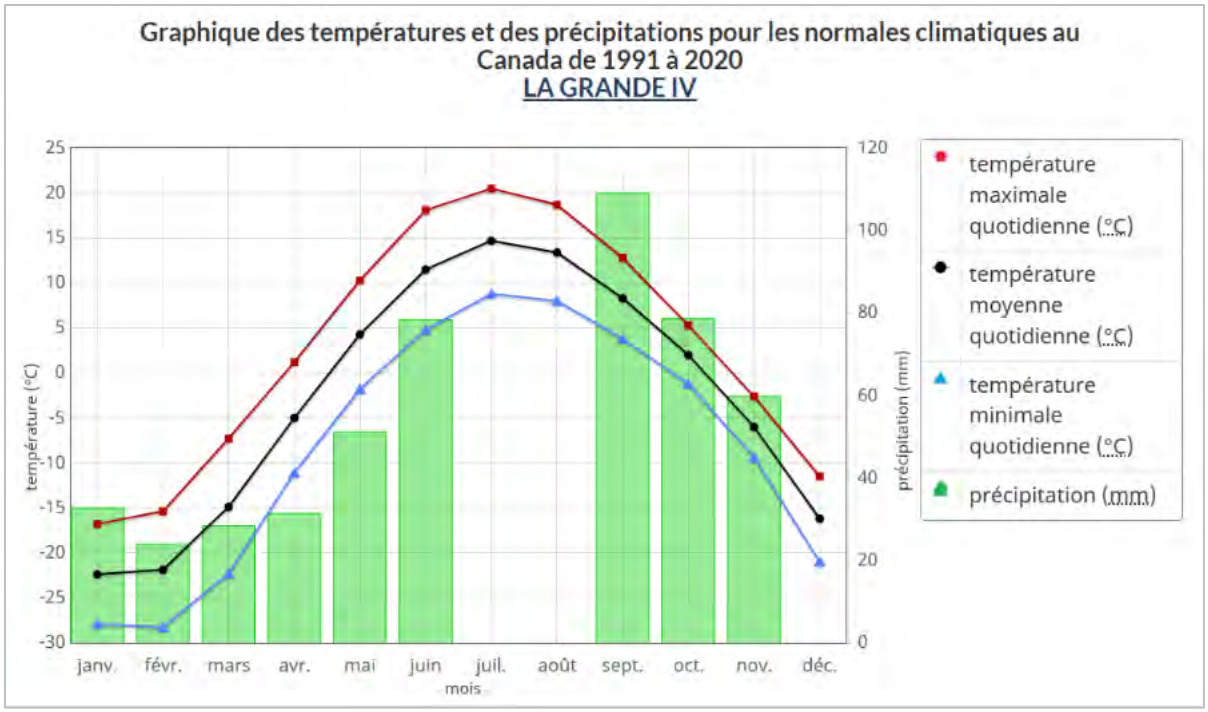
Table 11-1 Interactions considered between component categories and climate hazards (operations phase)

Component category	Extreme precipitation/flooding	Freezing rain	Heat waves	Freeze-thaw cycles and winter thaws	Drought and forest fires	Strong winds and thunderstorm activity	Snowfall	Extreme cold snaps	Longer summers
Mining infrastructure	Y	N	N	Y	Y	Y	Y	N	N
Buildings	Y	Y	Y	Y	Y	Y	Y	Y	N
Water treatment infrastructure	Y	N	N	N	Y	N	Y	N	N
Energy infrastructure	Y	Y	Y	Y	Y	Y	Y	N	Y
Transportation and support infrastructure	Y	Y	N	Y	N	N	Y	N	Y
Mining operations	Y	Y	Y	N	Y	Y	Y	Y	N

11.2.1 Reference climate profile

According to the Köppen classification, the study area is characterized by a cold and humid continental climate (Dfb), the main features being high seasonal variability in average daily temperature and evenly distributed average annual precipitation throughout the year. The average annual temperature is -2.7°C, with average daily maximum and minimum temperatures of 2.8°C and -8.1°C, respectively (ECCC, 2025).

Figure 11-1 shows the monthly climate norms for temperature and precipitation recorded between 1991 and 2020 at the La Grande IV weather station.



Source : ECCC, 2025

Figure 11-1 Monthly climate norms for temperature and precipitation

11.2.2 Future climate profile

Climate projections were established using the SSP5-8.5 scenario and time horizons covering the project's lifetime, i.e., short term (2011–2040), medium term (2041–2070), and long term (2071–2100).

These indicate a marked increase in annual temperatures, with hotter summers and milder winters, although winter cold spells remain possible. The number of days with temperatures above 28 C is expected to increase significantly. Precipitation is also expected to intensify, particularly liquid precipitation. Extreme precipitation events, both in duration and intensity, are also on the rise, which could lead to increased risks of flooding and erosion. Snow load could be affected by increased frequency of rain on snow and freeze-thaw cycles, influencing infrastructure stability. Freezing rain is expected to remain relatively stable, but could become slightly more frequent in the medium term under the moderate scenario and in the long term under the high scenario. Finally, wind projections are subject to considerable uncertainty, but the trend shows an increase in the number of dusty days.

Furthermore, indicators related to forest fires show an upward trend, particularly the duration of the fire season and the Fire Weather Index (FWI).

A summary of climate projections is provided in Table 11-2.

Table 11-2 Summary of climate projections (SSP5-8.5)

Climate hazard	Indicator name	Unit	Historical value (50th percentile)	Short-term projections (2011–2040)			Short-term[1] trend	Medium-term projections (2041–2070)			Medium-term trend	Long-term projections (2071–2100)			Long-term trend
				10th percentile	50th percentile	90th percentile		10th percentile	50th percentile	90th percentile		10th percentile	50th percentile	90th percentile	
Extreme precipitation/flooding	Maximum 1 day rainfall	mm	23	18	25	37	↑	20	27	42	↑	21	30	42	↑
	Extreme precipitation 15 min (1:10 years)[2]	mm/hr	N/A	N/A	N/A	N/A	↑	N/A	N/A	N/A	↑	N/A	N/A	N/A	↑
	Extreme precipitation 24 h (1:100 years)[2]	mm/hr	N/A	N/A	N/A	N/A	↑	N/A	N/A	N/A	↑	N/A	N/A	N/A	↑
	Total annual rainfall	mm	702	645	754	867	↑	701	811	943	↑	767	908	1063	↑
Freezing rain	Intense freezing rain events (≥10 mm)	-	0.05	0.03	0.07	0.18	↑	0.01	0.06	0.19	↑	0.03	0.13	0.23	↑
Heat waves	Number of days with a maximum temperature above 28°C	Days	1	0	4	12	↑	2	10	31	↑	6	24	60	↑
	Number of days with a maximum temperature above 34°C	Days	0	0	0	1	-	0	0	5	-	0	2	17	↑
Freeze-thaw cycles and winter thaws	Number of winter freeze-thaw cycles	Cycles	0	0	0	3	-	0	1	3	↑	0	1	6	↑
Drought and forest fires	Number of consecutive days with less than 1 mm of precipitation	Days	65	59	66	73	↑	59	66	73	↑	58	65	73	-
	FWI May to September[3]	-	3	-	3	12	-	-	4	14	↑	-	5	16	↑
Strong winds and thunderstorm activity	Number of days with maximum wind speed > 17.2 m/s (number of storm days)	Days	0	0	0	0	-	0	0	1	-	0	0	1	-
	Number of days with maximum wind speed > 5.6 m/s (number of dusty days)	Days	215	204	219	238	↑	197	226	244	↑	205	230	247	↑
Snowfall	Annual total snowfall	mm	229	189	238	290	↑	185	239	299	↑	174	238	306	↑
	Combined rain and snow load	kPa	2.5	2.1	2.6	3.1	↑	2.1	2.6	3.3	↑	2.0	2.7	3.3	↑
	Average daily spring temperature	°C	-5.2	-6.3	-3.7	-1.0	↑	-4.5	-1.5	1.8	↑	-1.8	1.6	5.8	↑
Extreme cold snaps	Annual number of days with a minimum temperature below -30 °C	Days	34	5	20	36	↓	0	5	20	↓	0	0	4	↓
Longer summers	Growing degree-day (GDD) (10 °C)	°C-days	60	55	103	187	↑	106	199	360	↑	205	364	692	↑
	Cooling degree days (CDD)	°C-days	17	10	37	91	↑	29	87	229	↑	79	201	496	↑

Notes:
1. The trend is established by comparing the median of the future horizon with the historical median.
2. Projections for short-term extreme precipitation indicators are not available (see Section 4.2.2).
3. The available data are the mean and the 95th percentile.

11.3 Climate change impacts in the construction and operations phases, and mitigation measures

No assessment of the impact of climate change has been specifically carried out on construction activities, as these are carried out over a short period of time. However, the short-term horizon (2011–2040) allows us to draw up a risk profile under current conditions.

Table 11-3 below presents the risk profile between climate hazards and components in the operations phase, which was assessed for the time horizons relevant to this phase, i.e., the short-term horizon (2011–2040) and the medium-term horizon (2041–2070).

Table 11-3 Risk profile of the operations phase for future horizons (SSP5-8.5)

Risk level	Number of interactions	
	2011–2040	2041–2070
Very low	0	0
Low	9	8
Moderate	2	3
High	14	12
Very high	4	6

It is expected that very low and low risks can be managed largely through existing design standards and maintenance operations and standards. Consequently, the remainder of the assessment and recommendations focus on moderate to very high risks.

Table 11-4 below details the adaptation measures according to the associated impacts and risks, as well as the estimated level of residual risk if the measures are implemented.

In addition to the measures provided, it is recommended that all emergency plans be reviewed, taking into account the increased frequency and intensity of future climate events such as storms, heat waves, and forest fires. It is also recommended that existing budgets for repairs and replacements be adjusted after such events. Finally, it is likely that site operations will be disrupted more frequently in the future.

An anticipated residual risk level is provided, which is a subjective estimate of the level of risk that may remain after implementation of the proposed resilience measures. Although the adaptation measures provided are intended to reduce the initial level of risk, this residual level of risk can only be confirmed after the measures have been implemented. The effectiveness of measures can vary greatly depending on the extent to which they are implemented.

Table 11-4 Risks and adaptation measures for the operations phase

Category	Systems/components	Potential impacts	SSP5-8.5 Preliminary risk score 2020	SSP5-8.5 Preliminary risk score 2050	Proposed adaptation measures	Final risk rating (residual risk)
Mining infrastructure	Pit for mining the CV5 spodumene pegmatite deposit; underground mine, ramps, portals, including underground ventilation infrastructure	Water accumulation in the pit and underground mine and increased pumping demand	High	Very high	Monitor water levels regularly, especially after extreme events. Have backup pumping equipment available to use in case of breakdown or extreme events.	Low
	Waste rock and tailings storage facilities	Increased metal leaching and treatment requirements	Very high	Very high	Develop a site-specific climate dataset in accordance with industry standards, including Appendix B of the Mining Association of Canada's Guide on Climate Change Adaptation for the Mining Sector (2021), to support climate-conscious planning and design. The focus should be on developing relevant variables related to extreme precipitation to support water balance modelling and water management. Continuous improvement practices should be considered to review and update the climate dataset, either as part of a regular review cycle or when sufficient climate data or projections become available (e.g., the publication of a new assessment report by the Intergovernmental Panel on Climate Change).	Moderate
	Pit for mining the CV5 spodumene pegmatite deposit; Waste rock and tailings storage areas; Overburden storage areas; HG and LG blending piles; Organics storage area; Run-of-mine (ROM) storage areas	Loss of slope stability/slope erosion	High	Very high	Develop a site-specific climate dataset in accordance with industry standards, including Appendix B of the Mining Association of Canada's Guide on Climate Change Adaptation for the Mining Sector (2021), to support climate-conscious planning and design. The focus should be on developing relevant variables related to extreme precipitation to support water balance modelling and water management. Schedule regular inspections of slopes, especially after extreme precipitation events and in the spring when snowmelt is accompanied by heavy rains, to anticipate potential failures.	Low
Buildings	Process plant (crusher and concentrator); Paste backfill plant; Aggregate crushing plant; Wastewater treatment plant (mine water treatment plant); Camp; Administration building and laboratory; Site's guard post (gatehouse); Warehouse; Fire station; First Nations cultural centre; Workshop; Laboratory; Mill office; Concrete plant; Compressor room; Construction site container; Mechanical service garage; Dry room; Emulsion plant and explosives storage buildings; Potable water treatment plant	Major damage caused by forest fires or extreme wind events	Very high	Very high	Schedule building envelope inspections to proactively detect weaknesses or deterioration. Provide firebreaks around buildings. Ensure that weather alerts and active fire alerts are included in safety protocols and evacuation and containment plans for personnel in the event of forest fires near the site. Close all air inlets in the event of a fire to preserve air quality inside buildings and underground mines.	Moderate
		Inadequate roof drainage, water infiltration	High	High	Ensure that site-specific climate projections are taken into account in the design of roof drainage systems. Ensure increased maintenance of joints to prevent water infiltration. Plan for potential overflow from gutters and downspouts and ensure that water is directed away from buildings.	Low
		Risk of blocked drains/gutters and increased need for snow and ice removal	Moderate	Moderate	Schedule inspection and preventive cleaning of roof drainage systems before and during winter to prevent blockages caused by ice or debris. Design roofs to promote natural drainage and limit accumulation.	Low
	Emulsion warehouse and explosives storage buildings	Potential decrease in product stability; explosions	Very high	Very high	Provide enhanced thermal insulation to maintain a stable temperature inside the warehouse and factory. Provide climate-controlled storage for heat-sensitive detonators and emulsions. Ensure that there is a firebreak around the warehouse and factory. Ensure that the factory has dedicated water tanks and firefighting equipment. Have an evacuation plan in place in case of a fire nearby. Provide personnel training on climate risks related to forest fires and on emergency protocols.	Moderate

Category	Systems/components	Potential impacts	SSP5-8.5 Preliminary risk score 2020	SSP5-8.5 Preliminary risk score 2050	Proposed adaptation measures	Final risk rating (residual risk)
Water treatment infrastructure	Management of mine water/contact water (ditches, contact water treatment pond, contact water and process water treatment pond, contaminated contact water pond, sedimentation pond and polishing pond, pumping stations, contact snow deposit area)	Exceeding the capacity of water collection and storage infrastructure/Insufficient pumping	High	High	Develop a site-specific climate dataset in accordance with industry standards, including Appendix B of the Mining Association of Canada's Guide on Climate Change Adaptation for the Mining Sector (2021), to support climate-conscious planning and design. The focus should be on developing relevant variables related to extreme precipitation to support water balance modelling and water management. Continuous improvement practices should be considered to review and update the climate dataset, either as part of a regular review cycle or when sufficient climate data or projections become available (e.g., the publication of a new assessment report by the Intergovernmental Panel on Climate Change). Identify at-risk ponds. Monitor the water level in at-risk ponds based on weather forecasts and ensure that pumps are working properly to prevent overflow in the event of excessive accumulation.	Low
	Mine water treatment plant	Increase in mine water and decrease in downstream capacity to convey flow; Increased need for treatment and increased maintenance	High	High	Develop a site-specific climate dataset in accordance with industry standards, including Appendix B of the Mining Association of Canada's Guide on Climate Change Adaptation for the Mining Sector (2021), to support climate-conscious planning and design. The focus should be on developing relevant variables related to extreme precipitation to support water balance modelling and water management. Ensure that pond capacity is sufficient to accommodate water during peak flow periods. Ensure that the capacity of the wastewater treatment plant takes into account site-specific climate projections. Anticipate extreme events by integrating weather forecast monitoring and adjusting process operations. Schedule more frequent maintenance of equipment to account for increased use, with a view to preventing breakdowns, extending its service life, and ensuring its proper functioning.	Low
Energy infrastructure	Power supply line (120 kV); Main electrical substation on site and electrical distribution network on site	Prolonged power outages; Damage to electrical equipment	High	High	Ensure that critical equipment is connected to an emergency generator to guarantee its operation in the event of more frequent and/or prolonged power outages linked to the intensification of extreme weather events. Plan to install lightning arresters or surge protection devices on electrical equipment to limit damage caused by lightning storms and ensure continuity of operations. Be prepared to elevate electrical equipment if there is a risk of local flooding. Ensure that the emergency plan incorporates scenarios involving more frequent and/or prolonged power outages.	Moderate
	Fuel storage area and refuelling station (fuel storage and distribution); Propane tanks	Increased soil saturation leading to increased pressure on foundations, damaging tanks and silos	Low	Moderate	Plan for tank protection and regular maintenance. Include peripheral drainage systems (ditches) to remove water. If areas at risk of saturation or surface water accumulation are anticipated, raise the tank bases to prevent damage. Schedule inspections of areas after extreme events and after winter to identify cracks, subsidence, or deformation.	Low
	Communication services following an Industry 4.0 style operation (i.e., short-interval control, predictive maintenance, VOD, on-site teleoperation, and a local integrated operation centre)	Decreased or lost communication	High	High	Ensure that systems critical to operations are connected to generators or that redundancy can be added. Provide a backup communication method (satellite, radios).	Moderate
Transportation and support infrastructure	Access roads, secondary roads, haul roads, bridges, and culverts	Deterioration of roads	Moderate	Moderate	Set aside a contingency budget to cover any increase in premature deterioration. Establish a program of regular road inspections to detect early signs of deterioration, such as potholes and cracks. Schedule preventive maintenance activities, especially after winter.	Low
	Access roads, secondary roads, haul roads, bridges, and culverts	Increased need for snow removal/de-icing/abrasives	High	High	Adopt an operations planning approach that is flexible enough to adapt to unexpected changes in weather conditions. Prioritize weather monitoring and make arrangements for snowplows, de-icing salt, and abrasives accordingly.	Low
	Bridges, culverts, and ditches (non-contact water)	Insufficient drainage of site, service roads, and access roads (low risk); Risk of blockages	High	High	Develop a site-specific climate dataset in accordance with industry standards, including Appendix B of the Mining Association of Canada's Guide on Climate Change Adaptation for the Mining Sector (2021), to support climate-conscious planning and design. The focus should be on developing relevant variables related to extreme precipitation to support water balance modelling and water management. Ensure regular maintenance of ditches to maintain their drainage capacity.	Low
	Lake L01 dams	Dam failure (due to pressure or erosion) and flooding	High	High	Develop a site-specific climate dataset in accordance with industry standards, including Appendix B of the Mining Association of Canada's Guide on Climate Change Adaptation for the Mining Sector (2021), to support climate-conscious planning and design. The focus should be on developing relevant variables related to extreme precipitation to support water balance modelling and water management. Provide hydrological modelling of the watershed that takes climate change into account to anticipate new flow regimes by integrating climate scenarios into water management plans. Develop emergency response plans to react quickly in the event of early signs of dam failure (this may include mobilizing response resources). Establish continuous monitoring systems to track the stability of dams, especially after extreme weather events.	Moderate

Category	Systems/components	Potential impacts	SSP5-8.5 Preliminary risk score 2020	SSP5-8.5 Preliminary risk score 2050	Proposed adaptation measures	Final risk rating (residual risk)
	Lake L01 diversion channel	Exceeding channel capacity/channel erosion and flooding	High	High	Develop a site-specific climate dataset in accordance with industry standards, including Appendix B of the Mining Association of Canada's Guide on Climate Change Adaptation for the Mining Sector (2021), to support climate-conscious planning and design. The focus should be on developing relevant variables related to extreme precipitation to support water balance modelling and water management. Schedule inspections and preventive repairs of the diversion channel. Schedule post-event inspections to detect weakened or damaged areas. Provide a secondary or emergency diversion channel to absorb excess water.	Moderate
Mining operations	Personnel getting around; Getting supplies; Operations and maintenance	Difficulty getting around; Disruption to operations and/or loss of productivity at work	High	High	Develop emergency plans and management procedures to deal with climate disruptions. Include protocols for personnel safety, infrastructure protection, and continuity of operations specific to climate disruptions. Ensure strategic reserves of materials, critical equipment, and spare parts are in place to minimize the impact of supply chain delays.	Moderate
	Operations and maintenance	Poor outdoor working conditions; Disruption of operations and/or loss of productivity at work	High	High	Raise awareness and train staff on the risks associated with extreme high temperatures. Ensure that they are aware of the signs of heat-related illness (e.g., heatstroke) and the preventive measures to take. Modify work schedules to minimize exposure to the highest temperatures of the day. Schedule the most physically demanding tasks during the cooler hours of the day.	Moderate
	Staff getting around; Getting supplies	Loss of accessibility and isolation of the site	High	High	Develop comprehensive emergency plans that include specific procedures for dealing with temporary site isolation in the event of a weather event. These should include safety aspects, supply needs, emergency medical care, and communication with local authorities. Train staff to respond effectively in the event of temporary isolation, with an emphasis on personal safety, supply management, and emergency protocols. Develop flexible logistics plans that take into account seasonal variations and climate risks. Ensure that suppliers and carriers are aware of potential challenges. Ensure that systems critical to operations are connected to generators or that redundancy can be added. Provide a backup communication method (satellite, radios).	Moderate
	Transportation of the product (spodumene concentrate); Supply	Site access closed due to forest fires	Very high	Very high	Develop emergency plans and management procedures to deal with climate disruptions. Include protocols for personnel safety, infrastructure protection, and continuity of operations. Develop an operations continuity plan in case of restricted access. Plan a flexible schedule for critical activities to avoid high-risk periods. Plan alternative evacuation routes, including fire and monitoring services, to bypass high-risk areas. Integrate SOPFEU alerts to anticipate closures. Train personnel on the risks associated with forest fires and on emergency procedures. Monitor the spread of the fire and ensure that evacuation is completed well before access is cut off. Ensure that the immediate area around buildings does not contain any flammable materials (refer to the FireSmart guide for more details).	High

11.4 Climate change impacts in the closure phase and mitigation measures

Table 11-5 below presents the risk profile between climate hazards and components in the restoration and post-restoration, which was assessed for the time horizons relevant to this phase, namely the medium term (2041–2070) and the long term (2071–2100).

Table 11-5 Risk profile of the restoration and post-restoration phase for future horizons (SSP5-8.5)

Risk level	Number of interactions	
	2041–2070	2071–2100
Very low	0	0
Low	2	1
Moderate	2	3
High	1	0
Very high	1	2

It is expected that very low and low risks can be managed largely through existing design standards and maintenance operations and standards. Consequently, the remainder of the assessment and recommendations focus on moderate to very high risks.

Table 11-6 below details the adaptation measures according to the associated impacts and risks, as well as the estimated level of residual risk if the measures are implemented.

In addition to the measures provided, it is recommended that all emergency plans be reviewed, taking into account the increased frequency and intensity of future climate events such as storms, heat waves, and forest fires. It is also recommended that existing budgets for repairs and replacements be adjusted after such events.

An anticipated residual risk level is provided, which is a subjective estimate of the level of risk that may remain after implementation of the proposed resilience measures. Although the adaptation measures provided are intended to reduce the initial level of risk, this residual level of risk can only be confirmed after the measures have been implemented. The effectiveness of measures can vary greatly depending on the extent to which they are implemented.

Table 11-6 Risks and adaptation measures for the restoration and post-restoration phase

Systems/components	Potential impacts	SSP5-8.5 Preliminary risk score 2050	SSP5-8.5 Preliminary risk score 2080	Proposed adaptation measures	Final risk rating (residual risk)
Covering of storage areas (Stockpiles 001 and 002)	Erosion of piles Increase in dust	Moderate	Moderate	Implement temporary erosion control measures and best management practices to reduce the risk of erosion during the first few years (until vegetation is well established). Plan to monitor vegetation cover to detect barren or sensitive areas	Moderate
Diversion/drainage structures	Surface erosion of spillways due to runoff. Regressive erosion (internal) that can lead to dam failure Water infiltration that raises the water table and can affect slope stability Exceeding the capacity of structures	Very high	Very high	Take into account site-specific climate change projections when designing diversion and drainage structures. Provide excess water diversion channels, secondary diversion channels, or emergency overflow channels to prevent flooding. Stabilize riverbanks to limit erosion.	Moderate
Roads, ditches, bridges, and culverts	Damage to roads resulting in loss of accessibility to restored sites for monitoring purposes. Ice formation in culverts and reduced drainage capacity. Increased need for de-icing and snow removal Increased dust concentration	Moderate	Moderate	Consider site-specific climate change projections when designing culverts and ditches. Plan for increased road monitoring and maintenance activities due to climate change to maintain access to monitoring activities. Anticipate potential delays for monitoring activities due to extreme events that pose a danger to workers. Raise awareness among workers about the dangers and precautions to be taken.	Low
Vegetation	Difficulties in planting vegetation due to extreme heat, strong winds, and drought Forest fires could destroy vegetation on the site, leading to increased runoff and erosion	High	Very high	Implement soil stabilization measures, such as vegetation cover that is resistant to drought and extreme temperatures. Develop a post-event revegetation plan with species adapted to extreme weather conditions.	Moderate
Monitoring activities	Loss of accessibility to restored sites for monitoring purposes (damage to access roads)	Low	Moderate	Plan for increased road monitoring and maintenance activities in connection with climate change to maintain the access required for monitoring activities. Anticipate potential delays for monitoring activities due to extreme events that pose a danger to workers. Raise awareness among workers about the dangers and precautions to be taken.	Low

12 Accident risk management

12.1 Introduction

A thorough understanding of potential accidents and failures related to planned project activities, including the associated risks in terms of the probability and consequences of such unforeseen events, is essential for PMET's risk management and emergency preparedness.

The first line of defence against accidents and failures is the implementation of current best practices in environmental protection, health, and safety. Thus, potential accidents and failures are associated with risks that will remain after the following measures have been implemented, even with exemplary and rigorously applied management systems:

- best management practices;
- use of the most advanced technologies;
- rigorous control of permitted discharges into the environment and residual environmental effects;
- implementation of training programs and tools to ensure safe operation of facilities.

Despite prevention, if such events do occur, it is essential to be able to minimize the effects on the environment through planning and designing effective mitigation measures and implementing an emergency response plan (ERP).

The project is located at a considerable distance (more than 10 km) from any dwellings and poses little risk to local populations in the event of an accident. However, an accident could affect people on site, property, and the environment. The site is also located more than 300 km away from municipal emergency services. It is therefore important to identify the risks so that the resources are in place to respond diligently and confidently in the event of a major accident.

The project was conceived with these measures in mind during its design and planning, and on site emergency response will be put in place over the project's entire life cycle. The probability of occurrence of unforeseen accidents and malfunctions is therefore reduced. The implementation of preventive measures will also reduce the consequences of any unplanned event or accident. This approach is part of a responsible management approach whose objective is to reduce risks at the source and mitigate the effects unplanned events could have on the environment.

PMET is committed to ensuring that the risk management process, adapted and applied within the framework of the project, will sufficiently reduce the plausible consequences of identified accident scenarios to keep the level of risk as low as reasonably practicable.

12.2 Assessment of major technological accident risks

12.2.1 Objectives and scope

The purpose of the risk analysis of major technological accidents related to the project is to identify potential hazards and assess their possible consequences. It also serves to identify protective measures to prevent these potential accidents or reduce their frequency and consequences.

The risks covered by this analysis are major unplanned events that could have consequences beyond the project site and harm the public or the environment. It does not cover risks to the health and safety of workers during normal operations.

12.2.2 Methodology for determining risks

The concept of risk involves the following components:

- the dangers that are identified in accident scenarios;
- the severity of the consequences of these accident scenarios;
- the probability of these accident scenarios occurring.

The approach used meets the requirements of the MELCCFP's guide to analyzing major technological risks entitled: *Analyse de risques d'accident technologiques majeurs* (Théberge, 2002), hereafter referred to as the MELCCFP Guide. The analysis also complies with the main recommendations of the Risk Management Guide for Major Technological Accidents published by the Major Industrial Accidents Reduction Council (CRAIM, 2017).

The first steps involve identifying sensitive environmental elements and external hazards related to activities, infrastructure, or equipment present on site, as well as establishing a history of past accidents at similar facilities. Subsequently, accident scenarios related to risks are developed.

In subsequent steps, the potential consequences of the scenarios are identified, and the probabilities of occurrence are estimated. The safety measures to be implemented are also determined to eliminate or reduce the risk of accidents. A risk management plan, including a contingency plan, will also be established to manage residual risks that cannot be eliminated.

The methodologies used in the various stages mentioned are explained in the following subsections.

12.2.2.1 Hazard identification and accident scenario development

Hazard identification aims to list the specific hazards associated with the project. The following hazard sources are assessed:

- external hazards of natural origin;
- external hazards of anthropogenic origin;
- hazards related to activities on the site (project infrastructure and equipment).

The purpose of this identification is to establish the worst-case accident scenarios, their causes, and the preventive and control measures to be implemented.

12.2.2.2 Assessment of the severity of the consequences of accident scenarios

The severity of the consequences of each of the worst accident scenarios identified was determined by experts. Two substances stored at the project site are listed in Schedule 1 of ECCC's Environmental Emergency Regulations. These are compressed natural gas and ammonium nitrate. Their concentrations and quantities stored exceed the thresholds specified in Schedule 1 of the Regulations. The consequences of scenarios involving these substances have therefore been quantified using modelling.

12.2.2.3 Estimation of probabilities of occurrence

Accident scenarios were analyzed for their likelihood. The probabilities were mainly established based on accidents that occurred at similar sites in previous years.

12.2.2.4 Determination of risk levels

Criteria that consider the severity of the consequences of the incident and the probability of the event occurring were used to assess the level of risk.

These criteria are presented in the following tables:

- Table 12-1: Probability of occurrence level;
- Table 12-2: Level of severity of consequences;
- Table 12-3: Risk grid;
- Table 12-4: Acceptability criteria.

Probability of occurrence level

The probability of occurrence is the potential for an identified hazard to cause an incident or accident.

The probabilities of occurrence were established qualitatively based on accident history, analysis of the project facilities, and the preventive measures put in place. Table 12-1 defines the probability levels that have been established.

Table 12-1 Probability of occurrence level

Probability level	Definition
Very high	Common event: may occur more than once a year Will occur in the short term
High	Highly probable event: may occur less than once a year May occur several times during the project
Moderate	Probable event: may occur less than once every five years May occur once during the lifetime of the project
Low	Improbable event: may occur less than once every 20 years Could happen, has happened in the industry (globally)
Very low	Highly improbable event: likely to occur less than once every 100 years Not impossible given current knowledge, but not encountered globally over many years of production. Would only occur in exceptional circumstances

Level of severity of consequences

The following factors may be taken into account when determining the level of severity:

- People: health and safety of workers on site and people within the radius of impact at the time of the incident.
- Environment: direct impacts on the environment (water, air, soil, wildlife, plants).
- Property: damage to infrastructure and property, and impacts on operations.

The severity levels of the consequences are determined according to the consequences described in Table 12-2.

The severity level of each element taken into account (people, environment, and/or property) is determined. The final severity level, however, is that of the highest. For example, an accident could have a low level of severity in terms of property damage, but a high level of severity in terms of environmental damage. The severity level of the accident would then be high.

Risk level

Once the probability of a risk and its severity have been assessed, it is then possible to determine the risk level of an event using the grid shown in Table 12-3.

The risk level identified takes into account the prevention and mitigation measures in place, provided that these measures are robust and reliable.

Table 12-4 presents the risk acceptability criteria.

Table 12-2 Level of severity of consequences

Level of severity of consequences	Community	Workers	Environment	Property
Very high	– Several members of the community significantly affected – Potential evacuation of the community – Significant impacts on lifestyle (traditional land use, access to roads, access to services)	– Human loss caused by the results of the accident, such as explosion or dam failure	– Regional contamination of watercourses, soil, air, or groundwater – Disturbance of wildlife and/or plant species at the regional level – Contamination of aquifers and potable water sources	– Major damage to property rendering buildings unusable – Interruption of operations for more than a month
High	– Several members of the community potentially affected – Measurable impacts on lifestyle (traditional land use, access to roads, access to services)	– Permanent disability(ies)	– Contamination of watercourses, soil, air, or groundwater extending beyond the site – Disturbance of wildlife and/or plant species in an area extending beyond the site – Local contamination of the aquifer	– Major damage to property that renders buildings unusable – Interruption of operations for more than a week, less than a month
Moderate	– Some members of the community potentially affected – Minor impacts on lifestyle (traditional land use, access to roads, access to services)	– Serious injuries – Temporary disabilities	– Minor short-term contamination of watercourses, soil, air, or groundwater that may locally extend beyond the site. – Disturbance of wildlife and/or plant species in an area extending near the site, or the presence of habitats with sensitive elements, or the presence of a special-status wildlife or plant species	– Significant damage – Interruption of operations lasting more than one day but less than one week
Low	– Some members of the community potentially affected	– Injuries requiring medical attention – Injuries requiring changes to work duties – Loss of quality of life – Minor illnesses	– Major incident whose impacts remain within the boundaries of the site – Some of the wildlife and/or plant species present on the site are subject to negative impacts.	– Minor damage – Interruption of operations for one day

Level of severity of consequences	Community	Workers	Environment	Property
Very low	– No measurable impact on the community	– Injury requiring first aid – Minor impact on quality of life (mild discomfort)	– Minor incident – No risk of contamination of sensitive environments (watercourses, wetlands) – No disturbance to wildlife and/or plant species	– No damage – Interruption of operations for twelve hours or less

Notes:
- In the event of a spill, severity levels are determined in order of importance (minor, major, significant, very significant). The order of importance takes into account the quantity spilled as well as the nature and characteristics of the product involved (e.g., toxicity, flammability).
- A contained hazardous material spill means that the spill can be controlled/contained on site using mitigation or prevention measures that are in place.

Table 12-3 Risk levels

Level of severity of consequences	**Very high**	Moderate	High	Very high	Very high	Very high
	High	Moderate	Moderate	High	Very high	Very high
	Moderate	Low	Moderate	Moderate	High	Very high
	Low	Low	Low	Moderate	Moderate	High
	Very low	Very low	Low	Low	Moderate	Moderate
		Very low	**Low**	**Moderate**	**High**	**Very high**
	Probability of occurrence					

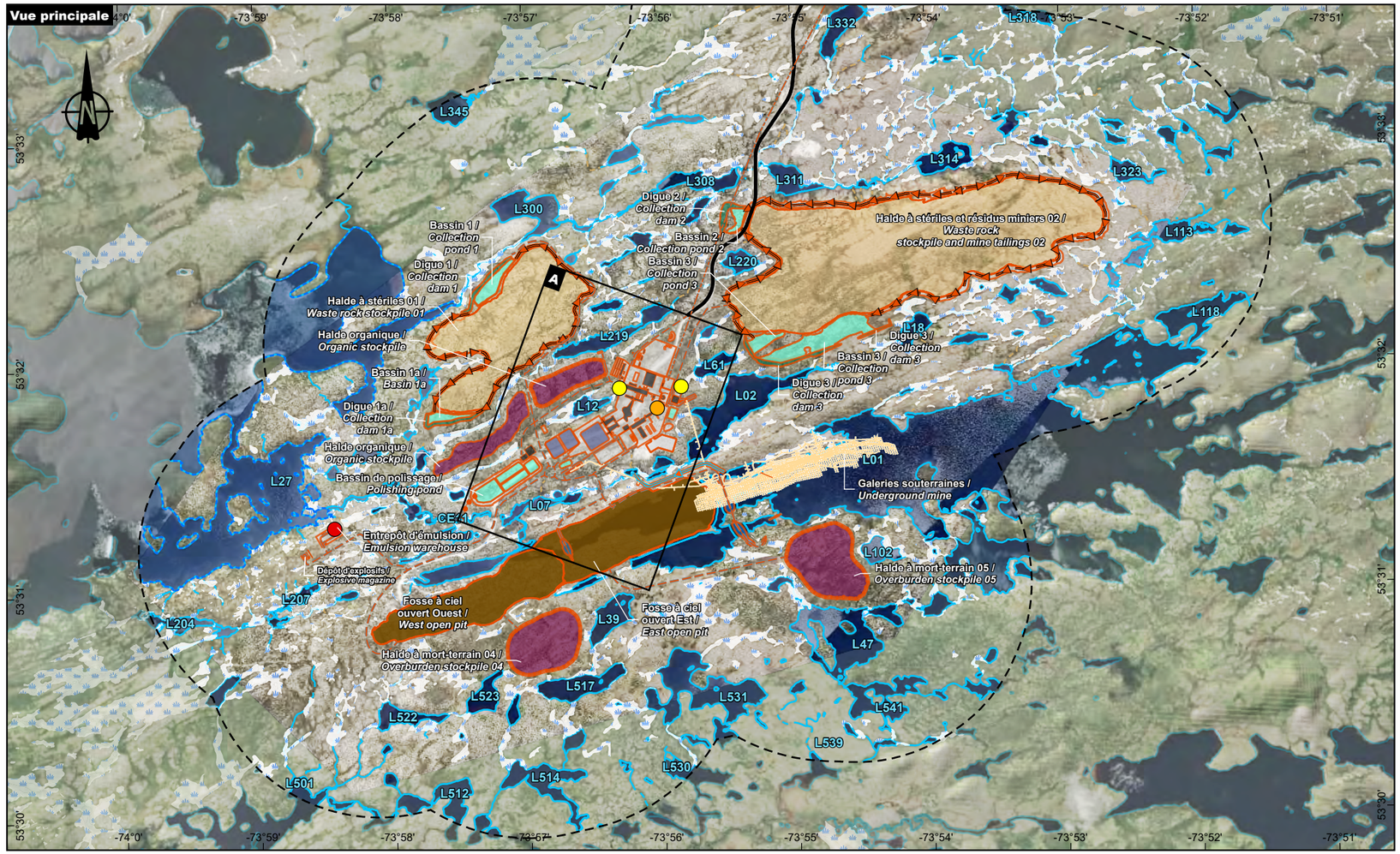
Table 12-4 Project acceptability criteria

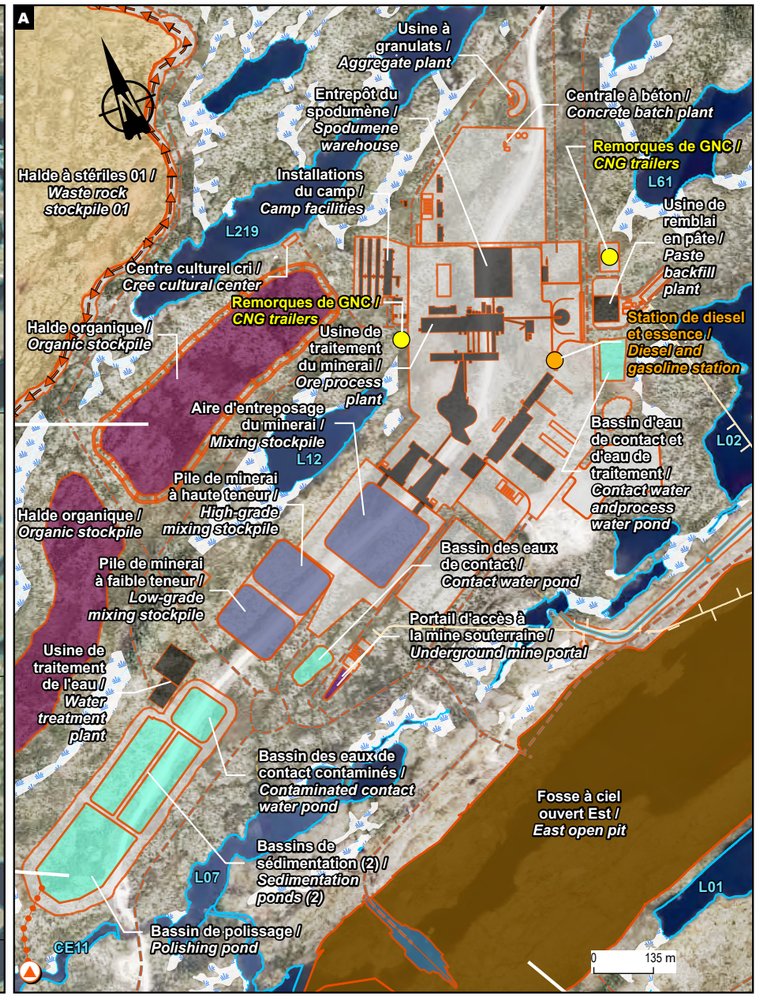
Risk level	Definition
Very high	Unacceptable risk likely to cause major damage. Management is advised and must ensure that alternative solutions are put in place.
High	Risk that requires preventive control measures and risk reduction plans, as well as regular risk reassessment.
Moderate	Risk that is reasonably reduced but must be subject to continuous improvement to achieve, under economically acceptable conditions, the lowest possible risk level, taking into account the state of knowledge and practices and the vulnerability of the facility's environment.
Low	Acceptable risk. Control measures must be known and applied. Periodic monitoring is necessary.
Very low	Negligible risk

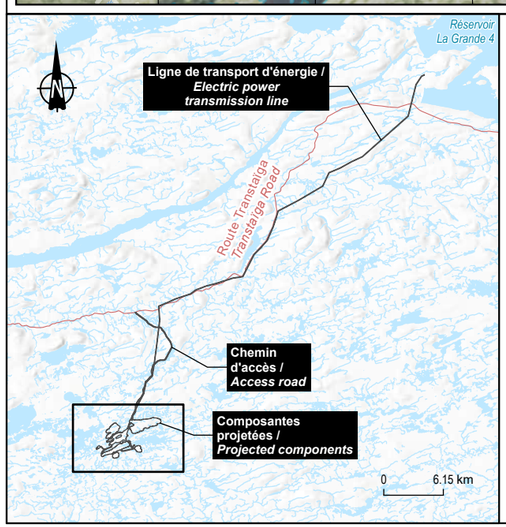
12.2.3 Identification of sensitive environmental components

The sensitive environmental components to be considered for the purposes of this technological risk analysis are those that, due to their proximity, could be affected by a major accident occurring at the project site. These are mainly public places, infrastructure, and sensitive or protected environmental elements. Sensitive elements were identified within a radius of approximately 1.5 km around the facilities (Map 12-1).

The following sections identify the major sensitive elements considered for this project.







Zones d'étude / *Study Areas*

- Projet / *Project*
- Éléments sensibles / *Sensitive elements*

Composantes du projet / *Project Components*

Existante / *Existing*

- Chemin d'accès / *Access road*

Infrastructures à risque / *At-risk Infrastructure*

- Entrepôt de nitrate d'ammonium / *Ammonium nitrate storage area*
- Remorques de GNC / *CNG trailers*
- Station de diesel et essence / *Diesel and gasoline station*

Projetées / *Projected*

- Effluent minier / *Mining effluent*
- Barrage / *Dam*
- Canal / *Channel*
- Canal de dérivation / *Diversion Channel*
- Chemin secondaire / *Secondary road*
- Fossé / *Ditch*
- Galerie souterraine / *Underground mine*
- Ligne de transport d'énergie / *Power transmission line*
- Aire d'entreposage du minerai mixte / *Mixed ore stockpile*
- Autre / *Other*
- Bâtiment ou équipement / *Building or equipment*
- Digue / *Dam*
- Bassin / *Basin*
- Digue des bassins / *Basins dam*
- Fosse / *Pit*
- Halde à mort-terrain et organique / *Overburden stockpile*
- Halde à stériles et/ou résidus / *Waste rock and/or tailings stockpile*
- Portail d'accès à la mine souterraine / *Underground mine portal*

Composantes de l'écosystème / *Ecosystem Components*

- Milieux humides / *Wetland*

Milieux hydriques / *Hydrous Environments*

- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*

- Intermittent / *Intermitent*
- Permanent / *Permanent*
- Souterrain / *Underground*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 12-1 / *Map 12-1*
Emplacement des infrastructures à risques et milieux sensibles / *Location of at-Risk Infrastructure and Sensitive Environments*

Sources / Sources

SDA, 1/20 000, MERN, 2024-02
CanVec+, 1/50 000, RNCan, 2014
CanVec, 1/250 000, RNCan, 2017
BDGA, 1/1 000 000, MRN Québec, 2014
BDGA, 1/1 000 000, MRN Québec, 2002
AQréseau+, réseau routier, MERN, 2024-03-01
G Services Miniers, Composantes projetées, CASN-A-001-GE-SKE-0005-A, 2025

0 420 840 m

UTM, fuseau 18, NAD83 (CSRS)

2026-03-31

Préparation / Prepared by : M. Lemieux
Dessin / Drawn by : M. Dupraz
Approbation / Approved by : M-H. Brisson
CA0001724_3318_eie_ch12_c01_260226.aprx
CA0001724_3318_eie_c12_01_105_risques_260331

La précision des limites et les mesures montrées sur ce document ne doivent pas servir à des fins d'ingénierie ou de délimitation foncière. Aucune analyse foncière n'a été effectuée par un arpenteur-géomètre. / Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.

12.2.3.1 Hydrology

The project site is located within two primary watersheds, namely those of the La Grande and Pontois rivers, the Pontois River itself being a tributary of the La Grande River.

The watersheds are composed of several rivers and lakes, as shown on Map 12-1. The most significant lakes located near the planned facilities are Lakes L01 and L27.

12.2.3.2 Social environment

Infrastructure

The main road in the regional study area is Billy-Diamond Highway, formerly known as James Bay Highway. The Trans-Taiga Road begins at kilometre 544 of this road. The project site is located south of the Trans-Taiga Road, approximately 20 km from kilometre 270.

The Trans-Taiga Road leads to Caniapiscau and provides access to several facilities at the La Grande hydroelectric complex. This is a gravel road administered by Hydro-Québec but maintained by the SDBJ, stretching 666 km, generally in an east-west direction (James Bay Road, undated).

The Billy-Diamond Highway, which connects Matagami to Radisson, has a truck stop at kilometre 381 (the only place along the highway with a gas station) and six emergency telephones.

Current use of land and resources for traditional purposes

The project is located in the Eeyou Istchee James Bay territory, which has nine Cree communities and more than 300 traplines. The communities of Chisasibi, Wemindji, and Mistissini are the three communities most likely to be affected by the project.

However, all of the project site infrastructure is located in area of trapline CH39, which is part of the traditional territory of the Cree community of Chisasibi. Several campsites set up in this area are used by the community. These campsites are mainly located in the northern section of the traplines, along the Trans-Taiga Road or the La Grande River. Two campsites are located at kilometre 258 of the Trans-Taiga Road, and three other campsites are located at two sites in the Lac Katatipawasakakamaw area north of the Trans-Taiga.

12.2.3.3 Natural environment

Vegetation

The project site is located in the spruce-lichen stand bioclimatic domain (western subdomain) and in the Eastmain and Sakami River, Robert Bourassa Reservoir, and Lac Naococane ecological regions.

These three regions and this domain are composed of natural environments resulting from disturbances, most of which can be attributed to forest fires dating back several decades. These areas do not have a dominant tree stratum, but rather regeneration consisting mainly of black spruce, jack pine, and tamarack (*Larix laricina*) in the shrub stage, with a canopy cover of more than 10%. It is therefore estimated that these areas will become wooded again in the long or short term if they are not disturbed again.

In addition to the immature forest surrounding the site, there are also a few wetlands. The main types of wetlands are, in ascending order of surface area, wooded ombrotrophic bogs, open ombrotrophic bogs, tree swamps, shrub swamps, open fens, wooded fens, ponds or shallow waters, and marshes.

Terrestrial fauna

Inventories conducted confirmed the presence of woodland caribou, migratory caribou, moose, black bears, and grey wolves at the project site. The migratory caribou is the species of greatest concern given its importance to the Cree community and the rapid decline of its population.

The inventories also identified eight species of small mammals: the southern red-backed vole, the deer mouse, the western heather vole, the meadow vole, the northern bog lemming, the southern bog lemming, the meadow jumping mouse, and the cinereus shrew. These species have been observed in a variety of habitats, including softwood stands, regenerating areas, peatlands, and lichen tundra.

Fish and fish habitat

The project includes several bodies of water classified as fish habitat, such as lakes L01, L07, L02, L12, L61, L219, and L220. The effluent from mine water treatment is directed to Watercourse CE11, then to Lake L27, which are also fish habitats.

All information concerning the reference state of fish and benthic invertebrate habitat and analysis of metal content in fish flesh is available in appendices 6-16 to 6-18.

Avian fauna

Across all seasons, the various inventory methods used in the study area identified 109 bird species at the project site, including 11 at-risk species and 94 migratory bird species as defined by the Migratory Birds Convention Act, 1994. The 11 species at risk are the red crossbill *percna* subspecies, the evening grosbeak, the rusty blackbird, the olive-sided flycatcher, the common nighthawk, the short-eared owl, the bald eagle, the golden eagle, the peregrine falcon, the bank swallow, and the lesser yellowlegs.

Chiropterans

The inventory confirmed the presence of five species and a two-species complex at the site, namely bats of the genus *Myotis*, the northern long-eared bat and the big brown bat among the resident species, and the silver-haired bat, hoary bat, and red bat for the migratory species, as well as the big brown bat/silver-haired bat complex. However, most of the recordings obtained during the inventories were of the hoary bat.

No critical habitats (maternity roosts or hibernacula) were observed during the specific field research conducted, nor were any suggested by the results of the acoustic inventory. However, the presence of maternity roosts within the survey area remains a possibility, given the density of stumps observed on the site.

12.2.3.4 Archaeological sites

Four archaeological sites have been identified on the shores of Lac du Requin Marteau (Lake Katatipawasakamaw), 30 km northeast of the project site, along the Trans-Taiga Road. No other known sites are located near the project site.

12.2.4 Historical record of accidents

The historical record of accidents helps identify hazards and to establish the accident scenarios that will be used in the risk assessment. It can also be used to improve the design of infrastructure and equipment, to determine the required safety equipment, and to better define the risk management plan.

The ARIA database of the Bureau d'analyse des risques et pollutions industriels (BARPI) of the French ministry of ecology and sustainable development was consulted on their website. This database is widely used in industrial risk prevention and includes feedback on major accidents with human and/or environmental impacts worldwide.

This research is not intended to be exhaustive; its purpose is to help identify potential accident scenarios, assess their causes and potential consequences, and estimate their probability of occurrence. Furthermore, not all of the accidents identified necessarily occurred at sites with the same characteristics as the Project (type of mine [open pit or underground], ore mined, processing method used, operating conditions, etc.).

12.2.4.1 Accidents related to project activities

Since ore mining is not specific to the lithium industry, the ARIA database search was extended to the project's activities in general. Accidents that have occurred between January 2015 and December 2025 in the context of the following activities were investigated:

- B.07.10: mining of iron ores;
- B.07-21: mining of uranium and thorium ores;
- B.07.29: mining of other non-ferrous metal ores;
- B.08.99: other mining activities;
- 20.11Z — Manufacture of industrial gases;
- 35.21Z — Production of gaseous fuels;
- 20.15 — Manufacture of fertilizers and nitrogen compounds;
- 49.41 — Freight transport by road;
- 42.2 — Construction of utility projects.

The search results are presented in Table 12-5.

Among the recorded accidents related to extractive activities, the most relevant to the project were selected. They were classified by type of event, i.e., dam failures, collapses/landslides, discharge of contaminated water to the environment, fires, explosions, and others.

Since January 2015, 14 incidents related to extractive activities have been recorded. The accidents included:

- landslides, collapses, rockfalls, in approximately 7.1% of cases (1 accident);
- a dam failure or storage pond overflow, in approximately 21.4% of cases (3 accidents);
- an explosion in approximately 14.3% of cases (2 accidents);
- a fire in approximately 28.6% of cases (4 accidents);
- a spill or leak of contaminants in approximately 28.6% of cases (4 accidents).

Table 12-5 Accidents related to extractive activities

Date	Country	ARIA number	Description of the incident	Causes (if known)
Dam failure/Overflow				
25/01/2019	Brazil	53027	In the early afternoon, one of the three dams holding back liquid waste from an iron mine broke. A breach in the 86 m high embankment structure caused its collapse and the release of 12.7 million m³ of toxic effluents. A destructive wave of mud buried the site's administrative buildings and part of the village downstream. The consequences of the accident were considerable. According to the reports of May 2019, there were 243 dead, 27 missing, and hundreds injured. Rescue efforts were suspended for one day due to the risk of a second dam failure at the site. The manager pumped out the associated reservoir before resuming the search. Most of the victims were mine employees who were in a canteen on the site when it was destroyed by the mudslide. Heavy material damage was noted: houses destroyed, railway bridge washed away, drinking water and electricity supply networks out of order, vehicles buried… The toxic flow spread over dozens of km² destroying crops, as well as all flora and wildlife. Drinking water sources were rendered unsafe for consumption.	Assumptions: – Inadequate internal drainage combined with high groundwater levels. – The attainment of maximum undrained strength due to internal creep and loss of suction in the material above the groundwater level. – A dam structure not designed to contain liquefied materials.
13/09/2015	France	49416	On Friday, September 11, staff at a uranium mine received a Météo-France alert announcing a major rainfall episode. The levels in the 10,000 L and 50,000 L effluent storage basins were then lowered. On Saturday, September 12, the rainfall caused a greater than 50-year flood event in MAS D'ALARY. The mine site was flooded. The staff encountered difficulties in accessing the site; the roads were cut off, and the automatic gate at the entrance was out of order. They entered the site at 9:30 p.m. and found that the 10,000-litre basin was 75% full. The 4 pumps were working to return the water to the 50,000 L basin. The lack of ferric chloride caused the pH of the treated water to rise. The safety valve then opened to return the water to the 10,000 L basin, which contributed to it also being filled. To limit this flow, the staff forced the pH safety valve to close. In spite of these interventions, the 10,000 L basin overflowed on Sunday, September 13, at 5:00 a.m., for 49 hours. Untreated water was discharged into the natural environment. The normal uranium content in MAS D'ALARY was 1.6 mg/l. During the flooding, the concentration rose to 3.81 mg/l. With daily monitoring, the return to normal was noted in December 2015. Measurements from the various piezometers around the site did not show any impact on the groundwater.	Weather conditions Management error

Date	Country	ARIA number	Description of the incident	Causes (if known)
05/11/2015	Brazil	47369	At 3:30 p.m., a breach occurred in a dam retaining iron ore waste. Draining of the reservoir had been initiated, but the structure breached at 4:20 p.m. The reservoir emptied completely into the valley below, causing a second dam to break. A mudslide of about 60 million tonnes engulfed a village of 620 inhabitants. The operator notified some residents by phone, but the list of residents was incomplete. The operator was not equipped with an alarm siren as required by good operating practice. No public alert or evacuation plan was in place. Nineteen people died and an ecological disaster was caused. Small tremors were recorded in the area on the day of the accident, but no link to the failure of these embankment dams was established. The dam was at the limit of its capacity and was in the process of being raised. The accident scenarios had largely minimized the magnitude of the flow of tailings in case of failure; they were based on a construction height of 45 m in 2008, whereas the dam was twice as high on the day of the accident.	Poor design and structural failure
Collapse/Landslide				
11-11/2023	France	61485	A resident discovered a hole 10 metres deep and 3 metres wide at the surface near a path. This hole was caused by ground subsidence linked to the presence of an old uranium mine tunnel close to the surface. A security perimeter was established, then expanded and reinforced over the following days. The former operator commissioned a consulting firm to determine how to fill in the subsidence and secure the site in the long term. This ground movement was probably caused by the heavy rains of the previous days.	Weather conditions
Discharge of contaminated water into the environment				
28/04/2022	France	58978	At the end of the day, emergency services responded to reports of an orange/reddish discolouration on the NIVE and its tributary, the LAXIA. The origin of this discolouration was the collapse of the riprap installed when the old iron pyrite mines were closed in 1978. This caused the release of water containing ferruginous mud contained within. The pH of the water dropped from 7 to 5.8. Acidification caused the death of fish, which were found on the banks of the LAXIA. The conurbation's water authority, in collaboration with the water supply network operator, put in place monitoring and emergency measures to enable nearby residents to continue drinking tap water without any risk. Downstream water intakes on the LAXIA were shut down as a precautionary measure, while other intakes were being monitored. A fish farm downstream was also alerted. An impact assessment on wildlife and plants was carried out. As a precautionary measure and pending the results of tests to detect any dangerous metals, particularly arsenic and mercury, the prefect decided to temporarily ban freshwater fishing on the LAXIA. The Inspectorate of facilities classified for environmental protection conducted an investigation to consider solutions for filling in the mine entrance. A municipal decree prohibited access to watercourses and former mine sites. The next day, the pH was back to normal, but there were still small amounts of polluted water coming out of two tunnels, including some coloured water from one of them. A deposit of ferruginous sludge was present on the bottom of the riverbed and on the banks. Trout and almost all macroinvertebrate wildlife were found dead over a stretch of several hundred metres. Various observations on the fish confirmed that the water was loaded with sulphuric acid.	-

Date	Country	ARIA number	Description of the incident	Causes (if known)
			A fish inventory was carried out by the fishing federation to estimate the extent of the impact on fish stocks. Furthermore, the riverbed still contained a significant amount of muddy material that had been deposited there. It seemed highly likely that, at the next flood, this material would be remobilized by the runoff, causing the colour of the river to turn orange again. However, the impact was not expected to be the same, as the substance responsible for the mortality appeared to be sulphuric acid emitted by the rock present in the mine and carried along with the underground water flow.	
15/10/2018	France	52510	Following floods in the Aude region, arsenic pollution from a gold mine that had been closed since 2004 was suspected. According to press reports, the floods caused the collapse of mine effluent retention ponds filled with arsenic, cyanide, and heavy metals, impacting the ORBIEL valley. The riverbed was stripped to a depth of nearly 3 m. Health monitoring was set up. The toxic legacy of the mine included arsenic (a toxic carcinogen), lead, and cyanide. A public health investigation was launched. In August 2019, the local regional health agency announced that 38 children living near the former mine had higher than average levels of arsenic. The first cases had been discovered two months earlier.	Weather conditions
04/07/2018	France	56140	The Office National des Forêts, accompanied by 2 gendarmes, noticed some pollution at the Kokioko Creek where a gold mine was located. The rate of suspended solids was 4,800 times higher than the legally permitted rate. The site's basins were open, allowing the muddy water to flow directly into the creek. The discharge of mud increased the turbidity, which decreased the oxygen level, clogged the soil, asphyxiated the flora, and destroyed natural habitats and biodiversity. Rehabilitation of the site with revegetation should have begun in the dry season, and not in rainy weather, to avoid sludge runoff that would damage aquatic fauna and flora. The operators were brought before the criminal court two years later for these actions. The environmental protection associations are civil parties alongside the France Nature Environnement federation. The prosecutor requested an 80,000-euro penalty.	
06/08/2015	United States	46802	The environmental agency was conducting an engineering study at a former gold mine to assess the mine's water discharges, ways to treat the water, and options for reclaiming the site. As workers excavated above an old access tunnel, pressurized water escaped and spilled into the nearby stream. Approximately 11,500 m^3 of coloured water loaded with lead, copper, arsenic, iron, and zinc polluted 160 km of downstream rivers. The authorities prohibited navigation, swimming, watering of farm animals, and consumption of water from certain catchments. Lead and arsenic levels were 12,000 and 26 times higher than acceptable levels respectively.	-

Date	Country	ARIA number	Description of the incident	Causes (if known)
Fires				
12/05/2025	France	64452	During the night, a fire broke out on several crushers in a quarry. The fire went out on its own. The staff noticed the damage the next morning. Several crushers were damaged. The supply of talc from the quarry to the processing plant was interrupted for a few days, but alternative solutions were quickly found. The restoration work was expected to take at least 10 months. The operator has estimated the cost of the incident at around €3 million (destroyed equipment, rental of replacement equipment). The analysis of CCTV footage confirms that the fire was started deliberately.	Malicious intent
8/12/2020	France	56528	At around 1:30 p.m., demonstrators tried to break into a cobalt and nickel hydrometallurgical plant. The PPI (specific emergency response plan) was initiated. Non-essential personnel was evacuated. The site was secured and the installations were shut down according to the emergency procedure. Around 11:30 p.m., 2 days later, the gendarmerie responded after shots were fired. Mining machines were stolen. Various production shutdown scenarios were considered due to the risk of SO_2 and SO_3 release: – rapid shutdown of the acid solution plant; – shutdown of the acid solution plant within 24 to 48 hours. A cold shutdown was carried out 4 days after the beginning of the incidents. The fusion component restarted. The SO2 was converted to SO3 to avoid corrosion and to empty the SO2 pipeline, thus preventing the risk of pollution in case of malicious acts. The discharge and neutralization plant was reactivated as well as the lime production plant. The access road to the mine was unusable, concrete blocks prevented access to the mine site, and 80% of the heavy machinery was immobilized. Around 2 a.m., 7 days after the event had started, a major fire broke out on the mine site, affecting technical facilities and numerous vehicles. After the site was secured by the police, the plant's security teams began fighting the fire. Most of the extinguishing water was collected in a special retention basin. Following the numerous rains of the previous days, the already high water level in the retention basin overflowed at the end of the night before daybreak. Firefighters left the site 19 days later. A technical facility, numerous vehicles, and containers with 2 m^3-3 m^3 of coolant and 10 m^3 of engine oil were destroyed. An oil spill was detected on the KWE due to the overflow of the retention basin. The protests were sparked by the sale of the site to a consortium.	Malicious intent
21/12/2018	France	52805	At around 12:30 p.m., a fire broke out in a cavity in an underground quarry. Municipal services secured access to the cave. A homeless person was overcome by smoke inhalation. The fire weakened two support pillars.	-

Date	Country	ARIA number	Description of the incident	Causes (if known)
09/07/2017	France	49980	A fire broke out at approximately 4:30 a.m. on an 11 km-long fixed conveyor used to transport ore at a mining facility. The operator's staff detected the fire and extinguished it. A 350 m-long section of a conveyor belt and metal supports were damaged by the fire. The damage was estimated at several hundred thousand euros. The operator proceeded with repairs. Activities resumed 8 days after the fire. The cause of the fire was believed to be malicious intent. A similar fire had already occurred on this fixed conveyor 5 months earlier.	Malicious intent
Explosions				
21/03/2017	Saint Lucia	49423	Shortly before 5:30 p.m., a container of dynamite exploded in a quarry. The explosion killed 3 people and injured about 20 others. Some of the injured were taken to Martinique for treatment. The site was burned and the operating machinery was completely destroyed. The explosion was heard for miles around. Some witnesses reported that the walls of the houses shook and that they thought it was an earthquake. Several workers were welding the top of a barrel containing explosives. It is believed that sparks ignited the barrel and caused the disaster.	Incorrect work procedure
24/12/2015	Nigeria	47520	A tank truck carrying gas exploded at around 1 p.m. at a gas complex in southern Nigeria, causing a violent fire. The fire lasted several hours, plunging the city of Nnewi into a thick cloud of black smoke. The fire destroyed gas tanks, cars, and gas cylinders.	Unknown

12.3 Hazard identification

External hazards are events from natural or anthropogenic sources that can affect the proper functioning or integrity of the site.

12.3.1 External hazards of natural origin

12.3.1.1 Climate change

According to the climate change risk and vulnerability assessment, the most concerning climate risks mainly relate to extreme precipitation, forest fires, high winds, and extreme temperatures, which affect the stability of mining infrastructure, worker safety, and operational continuity. Water accumulation in the pit and underground mine, as well as in treatment ponds, represents a major challenge that can lead to increased pumping demand and exceed the capacity of water management systems. Extreme precipitation and freeze-thaw cycles also increase the risk of erosion and slope instability in waste rock stockpiles and ore storage areas.

Therefore, the risk of flooding in the pit and underground mine in the project area is taken into account in this assessment. It should be noted that this risk can be reduced by implementing the recommendations mentioned in the climate change risk and vulnerability assessment, presented in Appendix 11-1.

12.3.1.2 Earthquakes

Eastern Canada is located in a stable continental region of the North American Plate, resulting in relatively low seismic activity. According to the National Earthquake Database (Gouvernement du Canada, 2026), no earthquakes have been recorded since 1980 within a 200 km radius of the project site. The earthquake risk is therefore considered negligible.

It should be noted that all structural facilities will comply with the seismic standards of the Quebec Construction Code and the National Building Code of Canada.

12.3.1.3 Floods

Flooding usually occurs upstream of sills (raising of the watercourse or narrowing of the banks) that impede the flow of water. Ice jams can also contribute to flooding by obstructing the flow of water, particularly at stream constrictions during spring freshet.

Several watercourses are located near the project site and could cause flooding. Extreme precipitation events, rapid snowmelt, and increased rain-on-snow events are all events that can increase the likelihood of flooding. However, in terms of the project site, this would likely result in local accumulation. The water would then be drained through the existing drainage system.

The risk of major flooding at the project site is considered low.

12.3.1.4 Ground instability

The site's elevation varies between 335 m and 340 m above mean sea level (BBA, 2025). The site is relatively flat, with a slight slope toward the north (BBA, 2025).

Given the low gradient encountered at the project site, and considering that the project site is located in an area with very low susceptibility to landslides, the risk associated to the instability of surface deposits is considered negligible. However, landslides are likely to be affected by climate change. Therefore, stockpile erosion and landslides could occur at the site through triggers or exacerbating factors such as extreme precipitation events and increased total annual precipitation.

12.3.1.5 Extreme weather events

Extreme weather events can occur in summer in the form of heavy rain, hail, and strong winds. In winter, these conditions can include heavy snowfall, strong winds, or freezing rain. All these phenomena are caused by specific conditions associated with temperature and humidity gradients between different air masses.

The consequences of these extreme weather conditions can be direct or indirect. Wind, precipitation, snow, and ice can cause overloading, directly compromising the structural integrity of buildings and equipment.

The design of buildings and equipment will comply with applicable codes and regulations to withstand the additional loads created by extreme weather conditions. In addition, excessive snow and ice loads will be removed as required. However, extreme weather conditions remain a plausible accident scenario to consider, especially given the impact of climate change on the frequency of such incidents.

12.3.1.6 Forest fires

The Ministère des Ressources naturelles et des Forêts (MRNF) is responsible for forest fire management in Quebec. However, the Ministère is supported by the Société de protection des forêts contre le feu (SOPFEU) in the prevention, detection, and fighting of fires. The project site is located in the northern protection zone of the SOPFEU classification of the territory. Unlike the intensive zone, where all fires are fought, the northern zone focuses on observation and targeted intervention to protect communities and strategic infrastructure. A human-caused fire prevention program is also in effect (Gouvernement du Québec, 2026).

The geographic location of the assessment site indicates a relatively high probability of forest fires developing around the site. In addition, the number of days conducive to the spread of forest fires will increase by 2050 due to climate change, according to projections outlined in the site's climate change resilience study sectoral report provided in Appendix 11-1.

Consequently, the risk of forest fires in the project area is considered to be very high.

12.3.2 External hazards of anthropogenic origin

12.3.2.1 Air transportation

The closest airport to the site under study is La Grande-4 Airport. It is located approximately 50 km, as the crow flies, southwest of the site.

The risk of airplane crashes is highest in the landing and take-off maneuvering areas. For large aircraft, this area is approximately 8.5 km long from the end of the runways and approximately 5 km wide. For small aircraft, this area forms a circle of about 4 km around the centre of the runway (De Grandmont, 1994). The project site is therefore located outside the landing and take-off maneuvering areas of any airfield.

In addition to the risk of accidents being high over the immediate surroundings of an airport, the risks are also high in air traffic corridors. Excluding these areas, the probability of an aircraft crash at any given location is considered very low.

12.3.2.2 Power transmission

The power transmission line located near the site is Hydro-Québec's transmission corridor (735 kV), located 14 km north of the site, along the Trans-Taiga Road. A 120 kV substation will be built near Hydro-Québec's Tilly substation, along with a 53-km-long power line to bring electricity to the site.

During the construction phase, prior to the installation of this power line, a diesel-powered thermal power plant will be set up to meet the site's energy needs.

12.3.2.3 Vandalism and trespassing

The project site could be the target of ill-intentioned individuals. Trespassing and vandalism are potential dangers. However, the following measures limit the risks:

- there will be a gatehouse at the site entrance;
- site access controllers will be able to track on-site personnel and material;
- surveillance cameras will be installed on site and linked to the gatehouse;
- an intercom system will be available;
- fencing will also be installed to prevent access to the site from forest roads;
- explosives (ammonium nitrate) will be stored underground.

12.3.3 Identification of hazards related to site activities

The main infrastructure planned for the project is as follows. It is presented in Map 12-1:

- an open pit;
- an underground mine;

- a mine garage and a wash bay;
- an area for loading and handling explosives;
- a concentrate loading area;
- a tailings loading area;
- a paste backfill plant;
- tailings storage facilities;
- a waste rock and overburden stockpile;
- water management structures;
- electricity supply infrastructure;
- a main access road and internal roads;
- a workers' camp;
- mechanical workshops;
- warehouses;
- a fuel storage area and a refuelling station;
- an emulsion warehouse and an explosives warehouse.

The main hazards identified on the site are related to the following activities:

- operation of a mining pit;
- operation of an underground mine;
- ore processing
- use of air treatment systems;
- storage and use of chemicals;
- storage and use of explosives;
- storage and use of petroleum products;
- storage and use of flammable gases;
- operation of a sewage treatment plant;
- storage of waste rock, overburden, and tailings;
- presence of retention dikes;
- transport of mine tailings;
- transportation of hazardous materials and concentrates.

12.4 Potential accident risks

12.4.1 Open pit mining

This section covers the risks associated with the mining pit. Two accident scenarios have been identified:

- Flooding of the pit.
- Rockfall along the walls of the pit.

12.4.1.1 Pit flooding

Water infiltration is an inherent hazard in mining operations. Surface or groundwater could enter the pit as a result of damage to the rock caused by blasting, or due to faults in the rock structure exhibiting excessive cracking, which could lead to water flowing into the pit or significant flooding. Any excess water that seeps into the pit will then need to be pumped out, resulting in a halt to pit operations.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of flooding in the pit:

- Conducting geological and geotechnical studies to characterize the site.
- Monitoring the effects of blasting (in pits) on the formation of excessive cracking.
- Installation of pumps to bring water to the surface.
- Diversion of rainwater from areas not affected by mining operations, as much as possible, to prevent it from reaching the mine pit.
- Design and operation of the pit in accordance with the criteria of the Canadian Dam Association and the *Dam Safety Act* (R.S.Q. c. S-3.1.01).
- Use of the structure's operating manual issued by the designer.
- Implementation of an inspection program according to the designer's specifications.
- Monitoring water levels.

Probability of occurrence

Flooding of the pit due to water infiltration could occur, as this type of incident has occurred at similar sites. Furthermore, disruptions related to climate change tend to increase the likelihood of such an event occurring. The probability of occurrence is considered **moderate**.

Severity

The consequences of such a flood would potentially include injuries, as well as the shutdown of pit operations from one day for up to a month. The severity level is considered **moderate**.

Estimation of the risk level

Table 12-6 Risk level for the open pit – Flooding due to water infiltration

Probability of occurrence	Severity level	Risk level
Moderate	Moderate	Moderate

The risk level is based on risks to people and property.

12.4.1.2 Rockfall and landslides along the walls of the pit

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of rockfall and landslides along the pit walls:

- Conducting geological and hydrogeological studies to characterize the site.
- Design of pit slopes in accordance with the *Regulation respecting occupational health and safety in mines* (R.R.Q., c. S-2.1, r. 14)
- Implementation of a monitoring system for potential landslides or rockfalls in the pit.
- Dimensioning of sill and rib pillars to ensure the stability of the mining pit slope.

Probability of occurrence

Rockfalls or the sliding of unconsolidated deposits along the pit walls could occur. The accident history shows that this type of accident has already occurred several times at similar sites. However, given the preventive measures taken, the probability of occurrence is considered **low**.

Severity

This type of accident can cause injuries ranging from permanent disability to significant economic damage. The severity level is considered **high**.

Estimation of the risk level

Table 12-7 Risk level for the open pit – Rockfall along the pit walls

Probability of occurrence	Severity level	Risk level
Low	High	Moderate

The risk level is based on risks to people and property.

12.4.2 Underground mine

This section covers the risks associated with the underground mine. Three accident scenarios have been identified:

- Mine flooding.
- Fire in the underground mine.
- Underground subsidence.

12.4.2.1 Mine flooding

Water infiltration is an inherent hazard in mining operations. In an underground mine, fractures in the rock connected to water tables above the excavation could lead to flooding.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of flooding in the underground mine:

- Design of the pumping system, following a hydrogeological study, by oversizing the pumps to remove all anticipated mine drainage water.
- Installation of a water-level sensor at the bottom of the mine, with a continuous monitoring system.
- Redundancy in water evacuation pumps.
- Temporary suspension of underground operations in the event of a hazardous situation.
- Refuge stations that comply with the requirements of the *Regulation respecting occupational health and safety in mines*.
- Maintaining an up-to-date emergency response plan, including an evacuation procedure for the underground mine.
- Monitoring water levels.

Probability of occurrence

Flooding of the underground mine due to water infiltration could occur, as this type of incident has occurred at similar sites. The probability of occurrence is considered **low moderate**.

Severity

The consequences of such a flood would potentially include injuries, as well as the shutdown of underground operations between one day and one week. The severity level is considered **moderate**.

Estimation of the risk level

Table 12-8 Risk level for flooding due to water infiltration in the underground mine

Probability of occurrence	Severity level	Risk level
Low	Moderate	Moderate

The risk level is based on risks to people and property.

12.4.2.2 Fire in the underground mine

A fire could break out in various parts of the mine, leading to consequences for workers, mine evacuation, and financial losses.

The main potential sources of fire include flammable materials, fuels (such as diesel), hydraulic and lubricating oils, vehicle tires, conveyor belts, explosives, and electrical equipment.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of fire in the underground mine:

- An on-site team of mine rescue workers trained by the CNESST.
- Fire fighting equipment in vehicles.
- Automatic fire-extinguishing systems in vehicles and in facilities storing fuel and flammable liquids.
- Preventive vehicle maintenance.
- Operating procedures, particularly for refuelling vehicles.
- Inspection program for vehicles and facilities storing fuel and flammable liquids.
- Refuge stations that comply with the requirements of the *Regulation respecting occupational health and safety in mines*.
- Maintaining an up-to-date emergency response plan, including an evacuation procedure for the underground mine.
- Maintaining an up-to-date emergency response plan, including a procedure for responding to fires in underground mines.

Probability of occurrence

Fires may occur during the lifetime of the future underground mine. The probability of occurrence is considered **moderate**.

Severity

A fire in an underground mine could cause injuries that could lead to disability. The severity level is considered **moderate.** However, mitigation measures (refuge stations, fire-extinguishing systems, firefighting equipment) help to minimize the risk of loss of life.

Estimation of the risk level

Table 12-9 Fire risk level in the underground mine

Probability of occurrence	Severity level	Risk level
Moderate	Moderate	Moderate

The risk level is based on risks to people and property.

12.4.2.3 Underground subsidence

Unstable rock or high stress levels within the rock can cause rockfall.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of underground subsidence.

- Mining design based on the stability characteristics of the rock mass.
- Continuous monitoring by staff specializing in rock mechanics.
- Surface monitoring in accordance with health and safety standards in mines.
- Procedure for inspecting rock mechanics.
- Monitoring of underground stresses.
- Closure of areas at risk of subsidence or collapse.
- Maintaining an up-to-date emergency response plan, including an evacuation procedure for the mining area.

Probability of occurrence

Subsidence could only occur in exceptional circumstances. The probability of occurrence is considered **very low**.

Severity

Subsidence in underground mines could result in serious injury to workers and/or loss of life, as well as causing a significant disruption to production, leading to major economic losses. The severity level is considered **very high**.

Estimation of the risk level

Table 12-10 Risk level for underground subsidence

Probability of occurrence	Severity level	Risk level
Very low	Very high	Moderate

The risk level is based on risks to people and property.

12.4.3 Ore processing

This section covers the risks associated with ore processing. Four accident scenarios have been identified:

- Fires.
- Dust emissions.

12.4.3.1 Fires

A fire may break out in the ore processing facilities. Potential causes may include:

- Welding on equipment with an internal rubber lining.
- Friction of conveyor belts.
- Short circuit or overheating in an electric motor.
- Use of faulty backup heating equipment or systems.
- Negligence while performing hot work.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of fire at the ore processing facilities:

- Maintenance of conveyor to prevent belt misalignment and friction.
- Use of lubricating oil with a low flash point.
- Monitoring and preventive maintenance of hydraulic systems.
- Installation of thermostatic sprinklers on the conveyors, as well as a water leak alarm system connected to the fire control panel.
- Design based on National Fire Protection Association (NFPA) standards.
- Fire extinguishers at each conveyor drive unit and in all areas where there is a risk of fire.
- Firefighting water supply network and hydrants.
- Sprinkler systems in offices, workshops, and throughout the plant.
- Fire brigade training.
- Maintaining a sufficient supply of water for firefighting at all times.
- Maintaining an up-to-date emergency response plan, including a fire response procedure.

Probability of occurrence

A fire could break out at the future facilities, as this type of incident has already occurred at similar sites. However, this is not a likely event given the preventive measures in place. The probability of occurrence is considered **low**.

Severity

In general, when a fire breaks out in a building, the consequences are primarily health effects associated with thermal radiation and toxic fumes. The severity of a fire can vary, but it can result in serious injury or even permanent disability. It can also result in financial losses (business disruption, significant damage to expensive equipment, etc.).

If an incident were to spread beyond buildings and infrastructure, the natural environment could be affected. The anticipated impacts would mainly include vegetation mortality, disruptions to forest development, and the relatively long-term loss of habitat or plant species that support the presence of various wildlife species. Vegetation fires affect the ecological role of forests at every level: species, stand, and landscape. The water quality of the affected watercourses could also be affected by the discharge of particulate matter and other contaminants into the water.

The severity level is considered **high**.

Estimation of the risk level

Table 12-11 Fire risk level at ore processing facilities

Probability of occurrence	Severity level	Risk level
Low	High	Moderate

The risk level is based on risks to people, the environment, and property.

12.4.3.2 Discharge environmentally non-compliant (atmospheric discharge)

Handling, crushing and conveying operations may release dust into the atmosphere. The process plant will be fitted with dust collectors in the required locations to control dust emissions. However, the following events could result in the accidental release of dust into the atmosphere:

- Malfunction in a cleaning system: design or operational error, human error, breakdown, etc.
- Monitoring equipment failure or damage.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of exposure to dust:

- Preventive maintenance of dust collectors.
- Monitoring of pressure inside the filters.
- Ducted dust extraction system.
- Water spraying in areas where tailings are handled, as well as on access roads.
- Inspection program.

Probability of occurrence

Dust emissions and exposure to dust could occur during the facility's operational life. This is believed to be a likely incident. The probability of occurrence is considered **moderate**.

Severity

Such emissions are likely to have an impact on the health of workers in the vicinity. The main product likely to be emitted is spodumene. However, it is not a highly toxic product.

Dust emissions in traffic and handling areas can reduce visibility. At the environmental level, the impact will be limited to the property. Vegetation near traffic areas and handling areas may be affected in some locations. Consequently, the severity level is considered **low**.

Estimation of the risk level

Table 12-12 Risk level for dust exposure

Probability of occurrence	Severity level	Risk level
Moderate	Low	Moderate

The risk level is based on risks to people and the environment.

12.4.4 Storage and use of chemicals

Products, some of which are classified as dangerous goods under the *Transportation of Dangerous Goods Regulations* (SOR/2008-34) or the *Controlled Products Regulations* (SOR/88-66), are used as reagents or additives for ore processing in the process plant and for the treatment of mine wastewater.

Table 12-13 lists the main products used in ore processing, along with their storage methods and estimated quantities. Table 12-14 shows the characteristics of these products.

Accidental spills of chemical(s) may occur during the transport, use, handling, or storage of these products. Equipment failure or human error can also be the cause of such spills.

Table 12-13 Main products used in ore processing

Product	Use	Storage method	Annual quantity used (t)	Maximum quantity stored (t)
Ferrosilicon (Ferrosilicium [FeSi])	Weighting agent	1-tonne flexible bags, stored on pallets in a dry, well-ventilated warehouse	1000	50
Magnafloc 10	Anionic flocculating agent	25 kg bags on pallets, stored in a dry, well-ventilated room	10	2

Table 12-14 Characteristics of the main products used in ore processing

Product	Characteristics			
	State	Colour	Reactivity	Classification
Ferrosilicon (Ferrosilicium [FeSi])	Solid	Silver-grey metallic powder	Reacts with strong acids, may react with water to create hydrogen vapours. Dust is flammable.	
Magnafloc 10	Solid	White powder and granules	Non-reactive. However, dust can be an irritant and makes surfaces slippery when it comes into contact with water.	Non-hazardous

Table 12-15 lists the main products used for water treatment, along with their storage methods and estimated quantities. Table 12-16 shows the characteristics of these products.

Table 12-15 Main products used for water treatment

Product	Use	Storage method	Annual quantity used (t)	Maximum quantity stored (t)
Ferric sulphate	Coagulant	Stored in 1 m^3 containers	224.4	20
Anionic polymer	Coagulant	Stored in original bags on wooden pallets	2.24	1
Cationic polymer	Coagulant	Stored in original bags on wooden pallets	1.22	1

Table 12-16 Characteristics of the main products used for water treatment

Product	Characteristics			
	State	Colour	Reactivity	Classification
Ferric sulphate	Liquid	Reddish brown	Non-reactive, incompatible with carbon steel, bronze, carbon, alloys, nylon, and aluminum.	
Anionic polymer	Solid (powder)	White	Non-reactive.	-
Cationic polymer	Solid	White	Non-reactive.	-

Preventive and control measures

The preventive and control measures listed below will be implemented to reduce the risk of chemical spills.

Storage

Storage will be in accordance with compatible product classes as defined by the Workplace Hazardous Materials Information System (WHMIS-GHS), the *National Fire Code* (NFC), and the *Regulation respecting hazardous materials*.

Dedicated storage areas will be provided, and storage procedures will take into account any incompatibilities between products.

Secondary containment systems at transfer points shall be designed to contain the worst-case spill scenario. The volume to be contained will be specified for each reagent supplied in bulk, based on the transfer rates and the supplier's recommendations.

All used chemicals that cannot be reused will be stored for up to one year in accordance with the *Regulation respecting hazardous materials.* Spent hazardous materials will be recovered by companies authorized to recover the products concerned. Safe collection areas with specialized containers for categorized waste and used hazardous materials will be provided at appropriate locations depending on the production site. These temporary storage areas will be inspected on a regular basis and their operating procedures will be made clear to all employees to avoid mixing errors or container spills.

Handling

Chemicals will be used in accordance with supplier guidelines and applicable regulations. When handling chemicals, appropriate personal protective equipment (e.g., safety glasses or goggles, chemical-resistant gloves [neoprene, butyl rubber, rubber, or leather], appropriate protective clothing [e.g., face shields]) shall be mandatory. Equipment to be used in critical areas will be indicated by signs. They will also be defined in advance in an occupational health and safety program.

Training

Employees responsible for handling and transporting hazardous materials will have received specific training on the handling and hazards involved, such as Transportation of Dangerous Substances, WHMIS, or other training appropriate to the task. Employees must be familiar with the information contained in the material safety data sheets of the hazardous products used.

Transport

Plans are in place for the chemicals to be transported to the site by truck. Transportation procedures will then comply with the *Transportation of Dangerous Substances Regulation* and the Transportation of dangerous substances guide (Ministère des transports, 2019). Hazardous materials will be placed in compliant, leak-proof containers to limit the risk of a spill should they be tipped over by the transporter.

Emergency response equipment

Spill kits specific to the nature and quantities of the substances will be strategically placed on the site (storage and refuelling areas). The contents of these kits will be checked periodically.

Emergency showers and eye wash stations will also be installed in areas where chemicals are used.

Emergency response plan

An emergency plan will be drawn up and kept up to date. It will include a procedure for responding to spills of hazardous materials, including chemicals.

Probability of occurrence

A chemical spill is an unlikely event given the preventive measures in place. However, it could happen, as it has occurred at similar sites. The probability of occurrence is considered **low**.

Severity

In the event of a chemical spill, the substance, if solid, will accumulate near its storage bag. Even in liquid form, it is unlikely to reach a watercourse. The severity level of the environmental impact is considered low given the quantities involved, the fact that these products will be used and stored indoors, and the mitigation measures put in place. The impact would therefore be very localized.

However, in the event of a spill:

- When ferrosilicon comes into contact with water, it releases a flammable, highly explosive gas as well as a toxic gas, phosphine (or hydrogen phosphide).
- Magnafloc can irritate eyes and the respiratory system and, when it comes into contact with water, can make floors slippery, posing a slip hazard to staff working in the area.
- When exposed to temperatures above 300 °C, ferric sulphate can produce sulphur oxide or flammable hydrogen, which may result in an explosion. In the event of a spill, it is recommended that workers be evacuated.

The severity level is considered **high** due to the reactivity of ferrosilicon.

Estimation of the risk level

Table 12-17 Risk level associated with chemical spills

Probability of occurrence	Severity level	Risk level
Low	High	Moderate

The risk level is based on risks to people and the environment.

12.4.5 Storage and handling of explosives

Blasting in the pit and underground mine will be carried out using two types of emulsion explosives: Fortis Clear, consisting of ammonium nitrate and petroleum distillate (naphtha), and Subek Charge, composed of ammonium nitrate, sodium nitrate, petroleum, and surfactant. Storage operations will be carried out in an above-ground storage facility and in the temporary explosives storage area located in the underground mine.

Quantity of ammonium nitrate emulsion on site will be a maximum of 31,500 tonnes, with a concentration of between 60% and 80%.

Ammonium nitrate is listed in the RUE as a substance with the potential to cause a major industrial accident (CAS No. 6484-52-2). The specified threshold quantity is 20 metric tonnes. The quantity intended for storage is therefore greater than this threshold quantity.

This section covers the risks associated with the use and storage of ammonium nitrate. Two major accident scenarios have been identified:

- Uncontrolled explosions (above ground or underground).
- Theft of explosive materials.

12.4.5.1 Uncontrolled explosions

An uncontrolled explosion could occur as a result of an accident involving a transport vehicle, a fire at an explosives storage site, or a poorly controlled blast.

Preventive and control measures

The preventive and control measures listed below will be implemented to reduce the risk of uncontrolled explosions on the surface.

Use

- To prevent any negligence or error, the handling and use of explosives will be entrusted to an accredited service provider specializing in this field.
- Workers handling explosives must hold an explosives certificate issued by the Sûreté du Québec.
- All sources of heat and open flames, as well as other pyrotechnic or flammable materials, must be removed before beginning to recover the dispersed products, as an explosive may detonate if it comes into contact with a fire.
- Specific checks will be carried out to verify the dimensions, depth, and orientation of the blast holes, as well as the charges.
- Weather conditions (e.g., rain, wind) can affect the effectiveness of a blast. If there is water in the blast holes, the detonation will not be as effective as in dry conditions. Some of the explosives, namely ammonium nitrate, could also turn into nitrogen oxide vapours, a toxic gas. The blasting schedule will be drawn up taking weather conditions into account to minimize the risk of failed blasts and to protect workers.
- Blasting operations must comply with the requirements of the *Regulation respecting occupational health and safety in mines* (R.R.Q., c. S-2.1, r. 14).
- No-smoking signs will be posted in the explosives assembly area and within the blasting zones.
- Particular attention will be paid to emissions resulting from the detonation of wet explosives or faulty blasts, so as not to harm workers' health or the environment.

Storage

The management of facilities for the storage and preparation of explosives will also be the responsibility of the specialized contractor. The contractor must ensure that:

- The storage conditions (location, distance, dimensions, etc.) comply with the relevant provincial and federal regulations, including the *Regulation respecting hazardous materials* (R.S.Q., c. Q-2, r. 32), the quantity-distance principles of the Explosives Regulatory Division (ERD), and the Guidelines for Bulk Explosives Facilities (Ressources naturelles Canada, 2018).
- Explosives are stored in warehouses. These warehouses will be secured to prevent unauthorized access and will comply with provincial and federal explosives legislation (CQLR c E-22, r 1 and R.S.C., c. E-17) regarding construction standards, safety distances from site buildings, protective measures, and well-ventilated, moisture-free locations.
- The products used are clearly identified.
- Explosives and blasting agents are stored separately.

Transport

The transport of explosives will also be carried out by a specialized contractor, in accordance with the requirements set out in the *Regulation respecting hazardous materials*. Vehicles used to transport explosive materials will be clearly marked, and the personnel transporting them will have the necessary training and skills.

Emergency response plan

An emergency plan will be drawn up and kept up to date. It will include a response procedure for accidents involving explosives.

Probability of occurrence

Explosions could occur, but only in exceptional circumstances. The probability of occurrence is considered **very low**.

Severity

The use of ammonium nitrate in explosives results in the emission of gases, namely carbon dioxide (CO_2), nitrogen (N_2), hydrogen (H_2), nitrogen oxides (NOx), sulphur dioxide (SO_2), and carbon monoxide (CO). Under normal operating conditions during blasting operations, none of these gases poses a risk to the health of workers. However, the nitrogen oxide fumes produced by burning ammonium nitrate are extremely toxic.

An explosion is a physical phenomenon involving the rapid release of a large amount of energy in the form of high-pressure, high-temperature gas. It is a pressure wave accompanied by fragmentation effects (shrapnel) and/or thermal effects (heat emission). Impact distances are difficult to estimate as they depend on the terrain, the presence of obstacles and/or buildings in the vicinity, and the quantity of explosive materials involved.

An explosion can cause flammable materials to ignite due to the heat generated or the projection of burning debris. In such cases, the impacts on environmental components, as well as the preventive and control measures, will be those established for fires.

Such incidents could result in serious injury or, in the worst-case scenario, loss of life. Depending on where the explosion occurs, it could also cause significant damage to property and result in operations being suspended for around a month.

Vegetation near the site of the explosion could be destroyed by the heat. As the distance from the explosion site increases and in the absence of a fire, the potential impacts on vegetation will be linked to the effects of the blast and flying debris. As for the wildlife within the impact radius, the potential consequences include injury or even death. There are also concerns about the reduced availability of feeding grounds and shelter when habitats are disturbed. Lastly, the water environment could also be affected by debris and contaminants entering the water.

Therefore, the severity level is considered **very high**. To better assess the consequences of such incidents, a quantitative impact assessment was carried out. The results are presented in Section 12.5.

Estimation of the risk level

Table 12-18 Risk level for an uncontrolled surface explosion

Probability of occurrence	Severity level	Risk level
Very low	Very high	Moderate

The risk level is based on risks to people, the environment, and property.

12.4.5.2 Theft of explosive materials

Stolen explosives could be used for criminal purposes.

Preventive and control measures

The following preventive and control measures will be implemented to reduce the risk of theft of explosive materials:

- Supervised delivery of explosives at all times.
- Keeping inventory records of explosives and detonators up to date.
- Warehouses located within fenced-off areas.
- Keeping the emergency response plan up to date. It will include a procedure for responding to thefts of explosives.

Probability of occurrence

Theft of explosive materials could occur, but only in exceptional circumstances, particularly given the considerable distance between the site and public areas; the likelihood is therefore considered to be **very low**.

Severity

The malicious use of stolen explosives could result in serious injury and/or loss of life. The severity level is considered **very high**.

Estimation of the risk level

Taking into account both probability and severity, the risk level for the theft of explosive materials is assessed as **moderate**.

Table 12-19 Risk level for the theft of explosives

Probability of occurrence	Severity level	Risk level
Very low	Very high	Moderate

The risk level is based on risks to people and property.

12.4.6 Storage and use of petroleum products

During the construction phase, a 20,000-litre diesel tank is to be used to meet the site's requirements.

During Phase 1 of operations, three diesel tanks will be added. Each will have a capacity of 50,000 litres and will be installed at the fuel farm. These tanks will be above-ground and double-walled.

Three additional diesel tanks, each with a capacity of 50,000 litres, will be installed from the third year onwards.

Finally, a backup power plant consisting of three diesel generators, each with a capacity of 2 MW, will ensure the continuity of critical operations in the event of a power failure.

The fuel will be delivered by tank trucks. The characteristics of diesel fuel are shown in Table 12-20.

Table 12-20 Diesel fuel characteristics

Product	State	Flash point (°C)	Self-ignition temperature (°C)	Flammability limits		Reactivity	Classification
				LFL	UFL		
Diesel	Liquid	>40	>225	0.7	6	Strong oxidizing agents and strong acids	

Diesel is a product of petroleum distillation and is composed of various hydrocarbons in the C_{10} series and higher. It appears as a clear, yellow liquid. It is not very volatile at room temperature, but can emit vapours that form an explosive mixture with air when heated. Diesel is less dense than water (density of 0.85) and insoluble in water.

The risk of flammability associated with flammable products is linked to:

- the release of the product into the atmosphere in such quantities that it falls within the flammability range;
- the presence of an ignition source.

Diesel is listed in the RUE as a substance with the potential to cause a major technological accident (CAS 68334-30-5, CAS 68476-30-2, CAS 68476-31-3, CAS 68476-34-6). The specified threshold quantity is 2,500 metric tonnes. The quantity intended for storage is therefore below this threshold.

Lastly, hydraulic and lubricating oils, as well as grease, will also be used. These oils are hydrocarbons and come from a relatively heavy fraction of petroleum. They are viscous and have high flash points.

This section covers the risks associated with the transport, storage, and use of petroleum products. Three accident scenarios have been identified:

- Petroleum product spills.
- Fires and/or explosions of petroleum products.
- Oil and grease spills.

12.4.6.1 Petroleum product spills

The main factors likely to cause accidental spills of petroleum products are:

- accidents involving the transport of a petroleum product by truck on the site;
- collisions causing fuel tank breakage (vehicle, machinery, or other);
- leaks in valves, pipes, or connections;
- machinery breakdowns;
- corrosion of equipment;
- overflowing tanks or other containers during filling;
- human error.

Preventive and control measures

The preventive and control measures listed below will be implemented to reduce the risk of petroleum product spills.

In the construction phase

- Plan sufficient emergency petroleum and chemical recovery kits and place them at sensitive locations.
- Frequently inspect machinery to ensure it is in good condition (it must be clean and free from any leaks of contaminated substances) and that fuel and lubricant tanks are completely leakproof. If a leak is found, repair it immediately.
- Take the usual precautions when carrying out maintenance (oil changes, lubrication, etc.) and refuelling machinery on the work site to prevent any accidental spills. Maintenance work must only be carried out in authorized areas designated for this purpose (garage, mechanical workshop); refuelling must take place within the areas marked out for this purpose.
- All fixed equipment containing oil and/or fuel (e.g., lighting towers, generators, crushers, screens) located within 60 metres of a watercourse or body of water must be fitted with a leakproof recovery system. The equipment must carry absorbent material to respond quickly and effectively to accidental spills.
- No maintenance of vehicles or machinery is permitted outside the areas designated for this purpose.

- Mark out access points, routes, and work areas before starting work, and prohibit parking and the movement of machinery and vehicles outside these areas.
- Fuel for the machinery will be supplied by road. All suppliers must comply with the *Transportation of Dangerous Goods Act* and the *Regulation respecting hazardous materials*. They will need to draw up safety and emergency procedures.
- Contractors must hold a licence to operate high-risk petroleum equipment if they install or use an above-ground tank with a capacity of 10,000 litres or more of diesel fuel, or a tank with a capacity of 2,500 litres or more of gasoline. This licence comes with monitoring and maintenance requirements.

In the operations phase

- The design of transfer points, equipment, and tanks will comply with the requirements of applicable regulations, standards, codes, and industry best practice.
- The tanks will be installed on a concrete slab.
- The tanks will be double-walled and will have a secondary containment basin with a capacity sufficient to hold 110% of the stored volume.
- A fuel tank level detection system will be installed. This equipment will be used to check the level of the tanks to prevent any overflow and to confirm the structural integrity of the double walls.
- A separator will be installed downstream of the fuel depot to treat accidental spills before they enter the drainage system.
- A procedure for the receipt and distribution of petroleum products will be drawn up.
- Tanks and associated equipment will undergo preventive maintenance to prevent breakdowns and premature wear and tear.
- Workers involved in the transfer and handling of bulk petroleum products will receive training.
- Spill kits containing absorbent materials will be placed near transfer and handling points.
- A routine inspection program for petroleum product transfer and storage facilities will be introduced.
- The emergency response plan will include a procedure for dealing with spills of hazardous materials, including petroleum products.

Probability of occurrence

A petroleum product spill, regardless of the quantity spilled, could occur several times over the course of the mine's operational life. The probability is considered **high**.

Severity

A spill of petroleum products into a retention pond or onto a waterproof surface such as a concrete slab will have no consequences once it has been cleaned up.

In the event of an uncontained spill of petroleum products, the product could flow onto the ground by gravity and accumulate in a low-lying area. In the worst-case scenario—although this is highly unlikely—the spill could reach a wetland, Lake L12, and Lake L02, which flows into Lake L07.

A spill of petroleum products could also cause a fire if the oil slick catches fire. This scenario is assessed in the following section.

Although such a spill could be major, it would be contained at the site of the incident, given the preventive measures in place (double-walled tanks, containment systems, etc.) and the response resources available (spill kits and containment measures) The affected environment may be the soil, a wetland or, in the worst-case scenario, a watercourse, depending on the location, the volume, and the containment level of the spill. The severity level can range from l**ow (soil) to moderate (wetlands or watercourses).**

Estimation of the risk level

Table 12-21 Risk level associated with spills of petroleum products

Probability of occurrence	Severity level	Risk level
High	Moderate	High

The risk level is based on environmental risks.

12.4.6.2 Fires and/or explosions of petroleum products

A fire involving petroleum products could occur in the diesel storage area or during its transport and distribution.

Preventive and control measures

The following preventive and control measures will be implemented to reduce the risk of fire and/or explosion involving petroleum products:

- The design of transfer points, equipment, and tanks will comply with the requirements of applicable regulations, standards, codes, and industry best practice.
- Installation of the tanks on concrete slabs.
- Diesel tank level detection: instrumentation designed to monitor tank levels to prevent overflow and to ensure the structural integrity of the double walls.
- Development of a procedure for the receipt and distribution of petroleum products.
- Preventive maintenance of tanks and associated equipment to prevent breakdowns and premature wear.
- Training for workers involved in the transfer and handling of bulk petroleum hydrocarbons.
- Fire brigade training.
- Assessment of risks and compliance at transfer and storage facilities for petroleum products as part of internal inspections.
- A water reserve for fire protection.
- Maintaining an up-to-date emergency response plan, including a fire response procedure.

Probability of occurrence

A fire or even an explosion involving petroleum products could occur in exceptional circumstances, such as a fire near petroleum product tanks or the ignition of fuel following a spill. The probability of occurrence is considered **very low**.

Severity

Fires

In the event of a fire involving petroleum product tanks, it is unlikely that the fire will spread to neighbouring infrastructure given their location. Therefore, only impacts on the people present, on infrastructure, and on vegetation are taken into account due to the heat released.

Explosions

An explosion is a physical phenomenon involving the rapid release of a large amount of energy in the form of high-pressure, high-temperature gas. It is a pressure wave accompanied by fragmentation effects (shrapnel) and/or thermal effects (heat emission). Impact distances are difficult to estimate, as they depend on the terrain, the presence of obstacles and/or buildings, and the quantity of explosive materials involved.

An explosion involving petroleum products can cause flammable materials to ignite as a result of the heat generated or flying burning debris. In such cases, the impacts on environmental components, as well as the preventive and control measures, will be those set out in the previous section. However, this type of incident could cause permanent disability or even loss of life within the blast radius, as well as significant damage to nearby buildings and infrastructure, requiring a halt to production and resulting in substantial economic losses. In terms of the impact on the environment, the vegetation near the site of the explosion (the petroleum product storage area) could be destroyed by the heat. As the distance from the explosion site increases and in the absence of a fire, the potential impacts on vegetation will be linked to the effects of the blast and flying debris. With regard to wildlife within the blast radius, the potential effects could include injury or even death.

The severity level is considered **very high**.

Estimation of the risk level

Table 12-22 Risk level for fire involving petroleum products

Probability of occurrence	Severity level	Risk level
Very low	Very high	Moderate

The risk level is based on risks to people and property.

12.4.6.3 Oil and grease spills

A spill of petroleum products such as lubricating oils and grease could occur. The causes could include equipment failure, operator error, or a spill from equipment.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of oil and grease spills:

- The design of transfer points, equipment, and tanks will comply with the requirements of applicable regulations, standards, codes, and industry best practice.
- Equipment for containing spills in storage, distribution, and usage areas.
- Environmental protection and awareness training for workers;
- Spill kits containing absorbent materials will be kept near transfer and handling points.
- Maintaining an up-to-date emergency response plan that includes a procedure for dealing with spills of hazardous materials, including oils and grease.

Probability of occurrence

An oil and grease spill is unlikely given the preventive measures in place. However, it could occur. The probability of occurrence is considered **low**.

Severity

The severity level of the impact on the natural environment is considered **low** given the quantities involved, the fact that these products will be used and stored indoors, and the mitigation measures that have been put in place. The impact will be **low** and, as a result, very localized.

Estimation of the risk level

Table 12-23 Risk level for oil and grease spills

Probability of occurrence	Severity level	Risk level
Low	Low	Low

The risk level is based on environmental risks.

12.4.7 Storage and use of flammable gases

Compressed natural gas (CNG) will be used to heat the concentrator and auxiliary buildings, as well as the camp. This will be delivered by a supplier via a high-pressure (up to 4,300 psi) trailer system, serving as both delivery and mobile storage units.

Up to three trailers can be stored at two locations, for a total of six trailers. Each trailer contains four tanks, with a total capacity of 11,700 m^3 of CNG.

The characteristics of CNG are shown in Table 12-24.

Table 12-24 CNG characteristics

Product	State	Flash point (°C)	Self-ignition temperature (°C)	Explosive limits		Reactivity	Classification
				LFL (%)	UFL (%)		
CNG	Gas	-188	>580	5	15	Not compatible with oxidants	

CNG is primarily (83% to 95%) composed of methane (CH_4), along with ethane and propane. It looks like a colourless gas and smells of sulphur, or rotten eggs. CNG is less dense than air (density of 0.56).

The explosion risk associated with CNG is linked to:

- a rise in temperature;
- an energy source causing an explosion due to pressure in the tanks;
- the presence of an ignition source.

Methane, ethane and propane are listed in the RUE and in the MELCCFP Guide as substances with the potential to cause a major technological accident. The threshold quantity specified for this gas is 4.5 metric tonnes. The quantity intended for storage is therefore greater than this threshold quantity.

Two accident scenarios have been identified:

- Fire affecting a CNG tank.
- Explosion of a CNG tank.

12.4.7.1 Fire affecting a CNG tank

A fire could break out if CNG leaks in the presence of an ignition source. The gas could then ignite. Such a leak could be caused by a tank failure, or by a collision with a vehicle travelling in the area.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of fire affecting a CNG tank:

- Design of storage facilities, equipment, and trailers in accordance with the requirements of applicable regulations, standards, codes, and industry best practices.
- Development of a procedure for the receipt and distribution of CNG.
- Preventive maintenance of trailers and related equipment to prevent breakdowns and premature wear and tear.
- Training for workers involved in the transfer and handling of CNG and the decompression unit.
- Fire brigade training.
- Assessment of risks and compliance at CNG transfer and storage facilities as part of internal inspections.
- A water reserve for fire protection.
- Maintaining an up-to-date emergency response plan, including a fire response procedure.

Probability of occurrence

Ignition of CNG may occur in exceptional circumstances. The probability of occurrence is considered **very low**.

Severity

In the event of CNG igniting, it is highly likely that the blast will spread to neighbouring infrastructure given its location. Consequently, the severity level is considered **high**. To better assess the consequences of such incidents, a quantitative impact assessment was carried out. The results are presented in Section 12.5.

Estimation of the risk level

Table12-25 Risk level for fire involving a CNG tank

Probability of occurrence	Severity level	Risk level
Very low	High	Moderate

The risk level is based on risks to people and property.

12.4.7.2 Explosion of a CNG tank

A cloud of CNG vapour could form following a leak from a pipe or valve caused by equipment failure. These vapours are likely to accumulate, creating explosive concentrations.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of a CNG tank exploding:

- Design of storage facilities, equipment, and trailers in accordance with the requirements of applicable regulations, standards, codes, and industry best practices.
- Development of a procedure for the receipt and distribution of CNG.
- Preventive maintenance of trailers and related equipment to prevent breakdowns and premature wear and tear.
- Training for workers involved in the transfer and handling of CNG and the decompression unit.
- Fire brigade training.
- Assessment of risks and compliance at CNG transfer and storage facilities as part of internal inspections.
- Maintaining an emergency response plan that includes a procedure for responding to CNG leaks.

Probability of occurrence

A CNG tank could explode in exceptional circumstances. The probability of occurrence is considered **very low**.

Severity

An explosion of a CNG tank can cause flammable materials to ignite due to the heat generated or flying burning debris. It could also potentially cause nearby tanks to explode, leading to loss of life and major damage to the surrounding infrastructure, resulting in significant disruption to production and major economic losses.

In terms of the impact on the environment, the vegetation near the site of the explosion (the CNG trailer storage area) could be destroyed by the heat. As the distance from the explosion site increases and in the absence of a fire, the potential impacts on vegetation will be linked to the effects of the blast and flying debris. With regard to wildlife within the blast radius, the potential effects could include injury or even death.

Consequently, the severity level is considered **very high**. To better assess the consequences of such an incident, a quantitative assessment was carried out. The results are presented in Section 12.5.

Estimation of the risk level

Table 12-26 Risk level for explosion of a CNG tank

Probability of occurrence	Severity level	Risk level
Very low	Very high	Moderate

The risk level is based on risks to people and property.

12.4.8 Mine water treatment

Malfunction of the water treatment system could result in the accidental release of deleterious substances to the final effluent. Potential causes may include:

- A malfunctioning water treatment system.
- Failure or damage to monitoring equipment.
- Design, operational, or human error.

Preventive and control measures

The following preventive and control measures will be implemented to reduce the risk of non-compliant discharges into the final effluent:

- Monitoring the effectiveness of the treatment through regular tests.
- Continuous measurement of environmental discharge standards (continuous for pH and flow) as required by Directive 019 and the MDMER.
- Continuous monitoring of pH and turbidity by instruments connected to the site's automation network, with data available in the plant control room.

Probability of occurrence

It is possible that the final effluent fails to comply with the required standards, as this has already occurred at similar sites. Consequently, the probability of occurrence is considered **low**.

Severity

Discharge of untreated or partially treated contact water or water from mine dewatering could contaminate surface waters (watercourses and water bodies) in violation of the *Metal and Diamond Mining Effluent Regulations* (MDMER) and Directive 019 on the mining industry.

In addition, the release of environmentally harmful substances could result in impacts to wildlife and/or plant species in an area extending beyond the site.

The discharge of untreated effluent is likely to have an impact on the water quality of Lake 07, Lake L27, Lake L01 and Watercourse CE11. These lakes and watercourses are all fish habitats.

Fish can ingest toxic substances and pass them on to the predators that eat them. Discharge of untreated raw water into the aquatic environment can affect the health of fish communities. In general, fish populations may be affected by a discharge at different times of the year if their habitat or prey are affected with respect to spawning, nursery, feeding, migration, and overwintering.

Fish with the ability to move through their habitat and potentially move to a less contaminant-exposed environment during a spill are less likely to experience the effects of such an event, except during the spawning and egg incubation period.

Consequently, the severity level is considered **high**.

Estimation of the risk level

Table 12-27 Risk level associated with the discharge of water that does not meet final effluent standards

Probability of occurrence	Severity level	Risk level
Low	High	Moderate

The risk level is based on risks to the environment.

12.4.9 Accumulation areas and retention structures

Accumulation (containment) areas will be established around the process plant, the open pit and the underground tunnels:

- South of the open pit and underground tunnels: overburden stockpiles.
- North of the process plant: two organics stockpiles and one waste rock stockpile.
- Northeast of the process plant: a waste rock tailings stockpile.

A seepage bond for runoff and seepage water, together with a dike, will be constructed around each of the containment areas (Map 12-1).

This section covers the risks associated with accumulation areas and retention structures. The identified risks are:

- Collapse of a stockpile.
- The failure of a retention dike or dam.

12.4.9.1 Collapse of a stockpile

Instability in the slopes of the stockpiles could cause tailings or waste rock to collapse (slide) outside the containment area. This instability could be caused by extreme weather conditions, or by errors and omissions during construction.

Preventive and control measures

The following preventive and control measures will be implemented to reduce the risk of a stockpile collapsing:

- Hydrogeological and geotechnical studies.
- Analysis of slope stability.
- Establishment of a monitoring program.

Probability of occurrence

Collapse could occur, but it is an unlikely scenario. Consequently, the probability of occurrence is considered **low**.

Severity

Depending on the location of the collapse, there could be repercussions on infrastructure (buildings, power lines, roads, etc.). The presence of workers at the time of the collapse would also increase the severity. Consequently, the severity level is considered **high**.

Estimation of the risk level

Table 12-28 Risk level for a stockpile collapsing

Probability of occurrence	Severity level	Risk level
Low	High	Moderate

The risk level is based on the risk to workers and property.

12.4.9.2 Failure of a retention structure

The failure of a retention dike or dam could be caused by:

- an extreme weather event (extreme flooding, very heavy rain, strong winds, etc.);
- an earthquake;
- errors or omissions during dam construction;
- aging of the structure.

Preventive and control measures

The following preventive and mitigation measures will be put in place to reduce the risk of dam failure:

- Conducting a risk assessment of dam failures and their potential consequences.
- Design of retention structures in accordance with the criteria of the Canadian Dam Association, the *Dam Safety Act*, and its regulations.
- The design and construction of diversion channels.
- Conducting geological and hydrogeological surveys, including assessments of dam stability.
- Incorporation of local seismic data into dam design.
- Ongoing implementation of the operational manual for the structures, which will be issued by the designer.
- Establishment of an inspection and maintenance program for the retention structures.
- Monitoring equipment.
- Maintaining an up-to-date emergency response plan, including a procedure for responding to dam failure (to be provided).

Probability of occurrence

Failure can occur, but it would be an exceptional situation. Consequently, the probability of occurrence is considered **very low**.

Severity

A breach of the west pit dike would result in flooding of the pit, which has sufficient retention capacity to contain the water from Lake L01.

A breach of the east pit dike would, in turn, result in the release of water from Lake L01 into watercourse CE15. This water would then flow toward Lake L027, thereby causing impacts beyond the boundaries of PMET's property. Such a failure would lead to significant downstream flooding. A dam breach study is presented in Appendix 12-1. This study classifies both retention structures (the east and west dikes) of Lake L01 as having high consequences in the event of failure (High Consequences).

Consequently, the level of severity is considered to be **very high** for environmental components.

Estimation of the risk level

Table 12-29 Risk level for the failure of a retention structure

Probability of occurrence	Severity level	Risk level
Very low	Very high	Moderate

The risk level is based on the risk to people, the environment, and property.

12.4.10 Road transportation

The site will be accessible exclusively via the Trans-Taiga Road. Two categories of hazards that can lead to major accidents have been identified for road transportation:

- Accidents involving hazardous materials.
- Accidents involving trucks carrying spodumene.

12.4.10.1 Accident involving hazardous materials

Hazardous materials and other chemicals will be transported using tank trucks and 53-foot enclosed trucks. An accident involving hazardous materials on the Trans-Taiga Road could result from a spill from a tank truck containing petroleum products (diesel, gasoline) or chemicals (solid or liquid). The causes may be:

- loss of control of the vehicle by the driver due to adverse weather conditions, human error, or illness;
- collisions with other vehicles or with animals.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of hazardous material spills on the road network:

- Use of roads designed in accordance with the standards of the Ministère des Transports et de la Mobilité durable (MTMD) for heavy goods vehicle transport.
- Training for drivers assigned to transport dangerous goods.
- Preventive vehicle maintenance to prevent breakdowns and premature wear and tear.
- Maintaining an emergency response plan, including a procedure for responding to road traffic accidents.

Probability of occurrence

Spills of hazardous materials on the road network are possible, as these types of situations have already occurred. However, these incidents are unlikely. Consequently, the probability of occurrence is considered **low**.

Severity

The severity of the incident will depend on the nature of the substance involved, its state (solid or liquid), the quantity spilled, and the location of the spill. Depending on where it occurs, the spill could reach a watercourse or simply contaminate the local soil.

Land-based spills

Some of the product, if it is liquid, will seep into the soil until it encounters an impermeable layer or a water-saturated zone such as an aquifer. The ratio of runoff to infiltration depends on the permeability of the soil and the characteristics of the spilled product. Some components of the spilled product may eventually volatilize into the air. Upon contact with groundwater, some of the product is also likely to solubilize.

The extent of the impact of a land-based spill will depend on the time of year, weather conditions, the characteristics of the spilled product, the quantity spilled, and the penetration depth of the product into the soil, among other factors.

Potential impact on vegetation

The likely effects of a hazardous materials spill on vegetation would be:

- loss of pigmentation in leaves, the appearance of spots on leaves, and a reduction in plant density, stem height, and the number of leaves per stem;
- alteration of the reproductive strategy of plants;
- the death of exposed plants;
- the relatively long-term loss of plant habitats or species that support the presence of several wildlife species.

Potential impact on wetlands

In the event of a spill of hazardous materials into a wetland, the product would come into contact with plants, sediments, and the underlying soil. A spill in such an environment would cause damage to the ecosystem and to aquatic wildlife and plants, including the relatively long-term loss of plant habitats or species that are conducive to the presence of wildlife species. It would also result in the use of complex remediation techniques and, subsequently, the replacement of the environment. The costs of restoring these environments are significant and depend largely on the volume of spilled material, the response time, and the effectiveness of the response strategies employed. The environmental impact will depend on the ecological value of the wetland affected.

Potential impact on terrestrial wildlife and avian fauna and their habitats

Spills of hazardous substances can cause health problems for any animal that comes into direct or indirect contact with the substance. Mammals, reptiles and various species of birds that come into direct physical contact with the spilled products could, depending on the product, suffer skin and eye damage or chemical burns, which could be fatal.

Animals affected by the spilled product may experience reproductive difficulties due to illness or disruption to their normal reproductive patterns. Birds may experience a reduction in both the number of their eggs and their shell thickness. Generally speaking, mammal and bird populations may be affected by a land-based spill if their habitat or prey are affected in terms of reproduction, rearing of young, feeding and/or wintering.

However, mammals and birds that are able to move around their habitat and relocate to an area less exposed to contaminants in the event of a spill are likely to be less affected by such an incident.

Potential impact on herpetofauna and their habitats

Herpetofauna populations living in terrestrial habitats may be affected by such a spill if their habitat or prey are affected in terms of reproduction, rearing, feeding, and wintering.

Herpetofauna are a group with limited mobility and find it more difficult to move to an environment less exposed to contaminants in the event of a spill. This group is more likely to be affected by such an event, particularly during the breeding season, the egg-incubation period, and the larval stages.

The potential effects on herpetofauna are:

- the mortality of individuals who have come into contact with the product;
- a decreased production of eggs and larvae;
- the deterioration of the quality of breeding, feeding, and shelter sites.

Spill into the aquatic environment

As mentioned earlier, in the event of a spill of hazardous materials into the soil, the substance will flow by gravity and could reach a watercourse. The environments likely to be affected would therefore be water environments, as well as benthic fauna and fish and their habitats.

Potential impact on water environments

Several watercourses and bodies of water are present along the roads leading to the site.

Most petroleum products are insoluble in water. When they spill into water, they spread across the surface, where they form an oily film, or sink to the bottom in the case of heavy petroleum products. Most chemicals are water-soluble and are quickly diluted. In any case, a deterioration in water quality is expected, including sediment contamination.

Potential impact on benthos and its habitat

Potential effects on the benthic community would be contamination that could lead to their mortality, a decrease in benthic abundance and diversity, as well as a decrease in recruitment (eggs and larvae), food consumption, and growth rate.

Potential impact on fish and fish habitat

Fish, mollusks, and crustaceans can ingest toxic substances and pass them on to the predators that eat them. A spill of hazardous substances into the aquatic environment can seriously harm the next generation of fish, mollusks, and crustaceans.

In general, fish populations may be affected by a discharge at different times of the year if their habitat or prey are affected with respect to spawning, nursery, feeding, migration, and wintering.

Fish with the ability to move through their habitat and potentially move to a less contaminant-exposed environment during a spill are less likely to experience the effects of such an event, except during the spawning and egg incubation period.

In view of the above, the level of severity may vary from **low to high** depending on the circumstances. By conservative estimates, it is considered **high**.

Estimation of the risk level

Table 12-30 Risk level for a road accident involving hazardous materials

Probability of occurrence	Severity level	Risk level
Low	High	Moderate

The risk level is based on risks to the environment.

12.4.10.2 Accidents involving trucks carrying ore concentrate.

The spodumene ore concentrate will be transported in closed semi-trailer trucks. Trucks transporting spodumene could cause road accidents resulting in spodumene spills.

The causes may be:

- loss of control of the vehicle by the driver due to adverse weather conditions, human error, or illness;
- collisions with other vehicles or with animals.

Preventive and control measures

The following preventive and mitigation measures will be implemented to reduce the risk of ore spills on the road network:

- Use of roads designed in accordance with the standards of the Ministère des Transports et de la Mobilité durable (MTMD) for heavy goods vehicle transport.
- Training for drivers assigned to transport dangerous goods.
- Preventive vehicle maintenance to prevent breakdowns and premature wear and tear.
- Maintaining an emergency response plan, including a procedure for responding to road traffic accidents.

Probability of occurrence

Spodumene could spill onto the road network. However, these incidents are unlikely. Consequently, the probability of occurrence is considered **low**.

Severity

The anticipated impacts on the natural environment will be confined to the location of the spill. As spodumene is solid, it will only spread if it reaches a watercourse, in which case it will tend to settle at the bottom. The severity level is considered **low**.

Estimation of the risk level

Table 12-31 Risk level for a road accident involving ore concentrate

Probability of occurrence	Severity level	Risk level
Low	Low	Low

The risk level is based on risks to the environment.

12.4.11 Risks associated with outside hazards

12.4.11.1 Forest fires

Several forest fires have occurred in previous years near the project site. Forest fires can result from human activity, but the most common cause is lightning.

Preventive and control measures

The following preventive and control measures will be implemented to reduce the impact of forest fires:

- Removal of peat down to the bedrock, over a 35-metre radius around the ore processing facilities, the mine water treatment plant, and the explosives storage site.
- Clearing the site of undergrowth.
- Implementation of a regular inspection program.
- Raising staff awareness of the issue of forest fires.
- Agreement reached with SOPFEU.
- Regular review of fire hazard information provided by SOPFEU.
- A water reserve for fire protection.
- Water supply network with a fire hydrant.
- Training of a brigade to combat forest fires.
- Maintaining an emergency response plan that includes a procedure for responding to forest fires.

Probability of occurrence

Given the history of forest fires in the project area, the probability of occurrence is considered **high**.

Severity

A forest fire threatening the facilities could result in serious injury to emergency personnel and significant damage to the infrastructure if the fire were to reach it. However, this will be minimized due to the mitigation measures in place.

The impact on environmental components will vary depending on the scale of the fire and how it spreads.

Potential impact on vegetation

There are several types of fire, each with different impacts on terrestrial vegetation:

- Crown fires burn trees along their entire length right up to the top. These are the most intense and dangerous of all wildfires.
- Surface fires burn only the litter and humus. These are the easiest fires to put out and the ones that cause the least damage to forests.
- Ground fires (sometimes known as underground fires or deep fires) occur in large accumulations of humus, peat, and other similar dead plant matter that become dry enough to burn. These fires move very slowly, but can be difficult to extinguish completely. Sometimes, particularly during long periods of drought, such fires burn deep underground throughout the winter and resurface when spring arrives.

In the event of a fire, the anticipated impacts would mainly include vegetation mortality, disruptions to forest development, and the relatively long-term loss of plant habitats or species that support the presence of several wildlife species. Vegetation fires affect the ecological role of forests at every level: species, stand, and landscape.

Potential impact on terrestrial wildlife and avian fauna and their habitats

Fires have an impact on terrestrial wildlife and avian species, whose need for shelter and food forces them to move as the type of forest changes. Closely linked to the vegetation of its habitat, terrestrial wildlife responds to fire by fleeing and avoiding the area, both during the event and in the wake of changes to the vegetation cover.

In the event of a fire, the anticipated impacts on terrestrial wildlife and avian fauna include potential mortality during the rearing season, a reduction in the availability of foraging areas and shelter when habitats are disturbed, and the destruction of eggs during the nesting season.

Potential impact on water environments

A fire could affect water quality by introducing particulate matter and other contaminants into the water and causing them to spread.

Potential impact on herpetofauna and its habitat

Forest fires have an impact on herpetofauna, whose need for shelter and food forces them to move as the type of forest changes. Closely linked to the vegetation of its habitat, herpetofauna responds to fire by fleeing and avoiding the area, both during the event and in the wake of changes to the vegetation cover.

In the event of a fire, the anticipated impacts on herpetofauna include potential mortality and the destruction of eggs during the incubation period, as well as a reduction in the availability of feeding grounds and shelter when habitats are disturbed.

In view of the above, the severity is considered **moderate**.

Estimation of the risk level

Table 12-32 Forest fire risk level

Probability of occurrence	Severity level	Risk level
High	Moderate	High

The risk level is based on the risk to property and the environment.

12.4.11.2 Extreme weather conditions

Unusual, or even extreme, weather conditions may occur. These could include strong winds, heavy snowfall, periods of freezing rain, lightning, etc.

Preventive and control measures

The following preventive and mitigation measures will be implemented to reduce the risks associated with extreme weather conditions:

- Design of infrastructure in compliance with applicable laws, regulations, and codes.
- Emergency generators on site.
- Spare electrical parts on site.
- Emergency response plan covering evacuation procedures for the mine area.

Probability of occurrence

Extreme weather conditions may occur. However, these would be exceptional situations. The probability of occurrence is therefore considered **very low**.

Severity

The consequences of such conditions can vary, but could include significant damage to infrastructure and power lines, leaving the site without electricity for an extended period and causing a major disruption to operations. Such a situation might require the evacuation of mine workers for their own safety.

The severity level is considered **high**.

Estimation of the risk level

Table 12-33 Risk level for extreme weather conditions

Probability of occurrence	Severity level	Risk level
Very low	High	Moderate

The risk level is based on the risk to people, the environment, and property.

12.4.12 Summary of risks

The technological risks identified in the preceding sections are summarized in Table 12-34.

Table 12-34 Summary of technological risks

Number	Risk	Probability	Severity	Risk level
1	Pit flooding	Moderate	Moderate	Moderate
2	Rockfall and landslide	Low	High	Moderate
3	Underground mine flooding	Low	Moderate	Moderate
4	Fire in the mine	Moderate	Moderate	Moderate
5	Underground subsidence	Very low	Very high	Moderate
6	Fire at ore processing facilities	Low	High	Moderate
7	Environmentally non-compliant atmospheric discharge	Moderate	Low	Moderate
8	Chemical spill	Low	High	Moderate
9	Uncontrolled explosion	Very low	Very high	Moderate
10	Theft of explosive materials	Very low	Very high	Moderate
11	Petroleum product spill	High	Moderate	High
12	Fires and/or explosions of petroleum products	Very low	Very high	Moderate
13	Oil and grease spill	Low	Low	Low
14	Fire involving a CNG tank	Very low	High	Moderate
15	Explosion involving a CNG tank	Very low	Very high	Moderate
16	Discharge of raw effluent	Low	High	Moderate
17	Collapse of a stockpile	Low	High	Moderate
18	Failure of a retention structure	Very low	Very high	Moderate
19	Accident involving hazardous materials	Low	High	Moderate
20	Accident involving a truck carrying ore concentrate.	Low	Low	Low
21	Forest fires	High	Moderate	High
22	Extreme weather conditions	Very low	High	Moderate

12.5 Quantitative assessment of consequences

12.5.1 Incident involving hazardous materials

As part of the risk analysis of major technological accidents associated with the project, a modelling exercise was performed to assess the consequences of accidents involving CNG and ammonium nitrate emulsion (Appendix 12-2). These are two substances present on the site during the operations phase in concentrations and quantities exceeding the RUE thresholds and posing a high risk of significant consequences.

12.5.1.1 Methodology

The methodology used and the parameters employed in the modelling are described in detail in the modelling report included in Appendix 12-2.

The PHAST (Process Hazard Analysis Software Tool) model, version 7.2, was used to perform the CNG consequence modelling. The PHAST model was developed by DNV GL based on a publication by the Dutch committee for disaster prevention. Analytical models included in PHAST for release, dispersion, and explosions of gaseous and liquid hazardous materials include flow and spray discharge, pool evaporation, vapour cloud dispersion, vapour cloud explosion, heat flux of fires (jet fires, pool fires, and boiling liquid expanding vapour explosion), and vessel rupture.

Version 7.2 of PHAST is unable to model explosions involving solid or semi-solid materials such as ammonium nitrate emulsion. It is limited to the assessment of substances in liquid or gaseous form. Therefore, the Kingery-Bulmash blast parameter calculation for a hemispherical free field air-blast was employed.

12.5.1.2 Flammability range

The emission of CNG is a fire or explosion hazard under the following conditions:

- presence of a flammable substance;
- presence of an oxidizer (oxygen/air);
- presence of an ignition source (spark/high heat).

The flammable or explosive range is defined by the lower flammability limit (LFL) and the upper flammability limit (UFL). At concentrations below the CNG lower flammability limit (40,321 ppm), the mixture is too lean to burn.

12.5.1.3 Overpressure effect

The overpressure levels normally evaluated to determine the consequences of an explosion accident are shown in Table 12-35.

Impact distances were assessed for a 1 psi overpressure explosion. This would result in partial demolition of buildings (rendering them unusable with 90% of the windows broken) and is considered the threshold for minor damage to structures. This threshold is also the level at which irreversible effects can occur and is considered the zone of significant danger to human life. This is the threshold for emergency planning recommended by CRAIM,

the Conseil pour la réduction des accidents industriels majeurs [Council for the reduction of major industrial accidents].

Table 12-35 Thresholds of overpressure effects

Overpressure		Effects on structures	Effects on humans
kPa	Psi		
2.1	0.3	Safe distance (0.95 probability of no serious damage below this value); damage limited to the ceilings of houses; 10% windows breaking.	Effect thresholds delimiting the area of indirect effects of windows breaking on humans.
6.9	**1**	Partial demolition of houses making them uninhabitable, 90% of windows broken, threshold for slight damage to structures.	Thresholds of irreversible effects delimiting the "zone of significant danger to human life."
13.8	2	Partial collapse of ceilings and walls of houses. Possible damage to large hydrocarbon tanks.	Thresholds of lethal effects delimiting the "zone of serious danger to human life."
20.7	**3**	The steel structures of the buildings are deformed and torn from their foundations, threshold of significant destruction of windows, thresholds of domino effects.	Thresholds of lethal effects delimiting the "zone of very serious danger to human life."

12.5.1.4 Thermal exposure

The thermal exposure that can be experienced by people exposed to a fire depends on several factors and will vary between individuals. It is usually quantified by limiting the physical calculations to the fire source, i.e., the thermal radiation flux (kW/m^2) and the exposure time (seconds) of individuals. The exposure time may be limited by the duration of the fire and/or the reaction time of the exposed individuals.

The various thermal exposure thresholds are presented in Table 12-36.

Table 12-36 Thermal exposure thresholds

Flux (kW/m^2)	Load $(kW/m^2)^{4/3}.s$	Effects on structures	Effects on humans
3	600	n/a	Thresholds of irreversible effects delimiting the "zone of significant danger to human life."
5	**1,000**	Threshold of significant destruction of windows.	Second-degree burns after 40 seconds, threshold of lethal effects delimiting the "zone of serious danger for human life."
8	**1,800**	Threshold of domino effects and corresponding to the threshold of serious damage on structures.	Thresholds of lethal effects delimiting the "zone of very serious dangers to human life."

n/a: not applicable.

The impact distances were evaluated at a thermal radiation of 5 kW/m^2 since at this level there is a significant destruction of glass and it is the threshold of lethal effects delimiting the zone of serious danger for human life (second-degree burns after 40 seconds). This is the threshold for emergency planning recommended by CRAIM.

12.5.1.5 Domino effect

CRAIM defines a domino effect as follows: “A first incident which, by its consequences, may generate or result in other event(s) or accident(s) whose consequences will add to the first, either inside or outside the site.” Domino effects are a chain reaction following a first accident resulting from the relative proximity of equipment.

To trigger a second event, the consequences resulting from the first accident must reach certain thresholds that are damaging to the nearby equipment. The thresholds used to evaluate domino effects are those provided in the CRAIM guide, i.e., 20.7 kPa (3 psi) for overpressure and 8 kW/m^2 for thermal radiation.

12.5.1.6 Assessed scenarios

Compressed natural gas

It should be noted that there are plans to install three 11,700 m^3 CNG trailers at two locations on the site, bringing the total to six trailers. Each trailer is divided into four tanks, each with a capacity of 2,925 m^3.

The following scenarios were considered:

- Worst-case scenario: Catastrophic failure of a CNG tank (a tank in a trailer).
- Alternative scenario: A leak from a 0,5 cm opening in a CNG tank.
- Domino effect: Given the proximity between the four tanks that make up one trailer and the other two trailers, two domino effects were considered, namely:
  - A domino effect on the four tanks of the same trailer;
  - A domino effect on the tanks of the three trailers (12 tanks).

Ammonium nitrate

The following scenario was selected for the assessment of the consequences of storing ammonium nitrate emulsion:

- Worst-case scenario: Explosion of the entire stock of ammonium nitrate emulsion stored in the surface storage facility (30,000 kg).

12.5.1.7 Modelling results (impact distances)

Compressed natural gas

Worst-case scenario

The scenario involving a CNG tank, which has the greatest impact distance, is the worst-case scenario (complete emptying of the tank). In such a scenario, the greatest calculated impact distances are:

- 1,425 m for thermal radiation of 5 kW/m^2;
- 1,313 m for a 1 psi. overpressure.

Alternative scenario

With regard to the alternative scenario assessed (a leak escaping from a 0,5 cm diameter hole in a CNG tank), the calculated impact distances for the thermal effect and overpressure are 16 and 17 metres respectively.

Domino effect

The impact distances calculated for the domino effect thresholds are:

- 1,119 m for thermal radiation;
- 667 m for overpressure.

As a result, the explosion of a CNG tank in a trailer would cause the other tanks in that trailer to explode, as well as the trailers nearby.

If one of the two trailers explodes (four tanks), the maximum impact distances calculated are:

- 2,120 m for thermal radiation of 5 kW/m^2;
- 2,084 m for a 1 psi. overpressure.

For the explosion of the tanks on the three trailers, i.e., 12 tanks, the maximum impact distances calculated are:

- 2,890 m for thermal radiation of 5 kW/m^2;
- 3,006 m for a 1 psi. overpressure.

The explosion of all 12 tanks is quantified as the most catastrophic scenario for this product.

Summary of calculated maximum impact distances

Table 12-37 Maximum impact distances calculated for different scenarios involving CNG (emergency planning thresholds)

Scenario	Effect	Impact distance (m)
Worst case (1 tank)	Thermal	1,425
	Overpressure	1,313
Alternative (1 tank)	Thermal	16
	Overpressure	17
Domino effect (4 tanks)	Thermal	2,120
	Overpressure	2,084
Domino effect (12 tanks)	Thermal	2,890
	Overpressure	3,006

Further details on the various scenarios assessed and the impact distances calculated for CNG are presented in the modelling report included in Appendix 12-2). The figures used to visualize these distances on a map of the site are also presented in this appendix.

Maps 3, 5 and 7 in Appendix 12-2 show the calculated impact distances for the domino-effect thresholds. It appears that, in the event of an incident involving one or more CNG tanks on the same trailer, the trailers present at the other location, as well as the diesel storage tank, would fall within the domino-effect zone. It should be noted, however, that the presence of infrastructure between the tanks may provide attenuation of the overpressure wave, which was not taken into account in the analysis.

Ammonium nitrate

The explosion of an ammonium nitrate emulsion tank would cause all tanks stored in the surface depot to explode, resulting in the explosion of 30,000 kg of emulsion. This scenario is the most catastrophic for this product. The calculated blast wave for 1 psi and resulting from this scenario extends over a distance of 648 m around the storage site.

Further details are provided in the modelling report included in Appendix 12-2.

12.5.1.8 Potential impacts on sensitive environments

Several sensitive environments could be affected by an accident involving compressed natural gas or ammonium nitrate.

Incidents involving CNG would have major impacts on buildings and infrastructure and would therefore require the evacuation of all workers present on site.

An explosion could also affect the stability of nearby waste rock piles or retention structures. The explosion and subsequent incidents could impact nearby lakes and watercourses (L01, L07, L02, L12, L61, L219, L220, CE11 and L27), as well as the wetlands surrounding the site. Ultimately, the impact could extend to fishing areas located west of the site.

An explosion involving ammonium nitrate emulsion would, in turn, have major impacts on explosive storage and handling facilities and would require the evacuation of workers in the affected area. It would also impact lakes L27 and L207, as well as wetlands and fishing areas located near the explosives facility.

12.5.2 Failure of a retention structure

A breach study of the Lake L01 water retention structures (the east and west pit dikes) was conducted by AtkinsRéalis. It is presented in Appendix 12-2, where the methodology used is described. The following sections summarize the results of this study.

The failure of the western dike of Lake L01 would have an impact on the open pit. Since this scenario has no impact outside the PMET property, the failure assessment did not quantitatively assess the water level that would be reached in the pit.

The failure of the dike located west of Lake L01 is the scenario with the greatest impact on people and the environment.

Table 12-38 shows water levels and arrival times at various sensitive points in the event of a breach of the west dike, for the scenario involving favourable weather conditions.

Table 12-38 Water levels and wave arrival times at various sensitive points for the scenario involving favourable weather conditions

Affected environment	Distance from the dike (km)	Maximum water level (m)	Wave arrival time (h)	Time to reach maximum level (h)
Lake L01 dike	0.0	5.6	<1	<1
Effluent into the environment	0.5	1.4	<1	<1
Watercourse CE15	1.5	2.3	<1	1.4
Lake L027 inflow	2.5	1.3	<1	2.2
Cottages	13.5	0.6	12	96

Table 12-39 shows water levels and arrival times at various critical points in the event of a breach of the west dike, for the scenario involving worsening weather conditions.

Table 12-39 Water levels and wave arrival times at various sensitive points for the scenario involving worsening weather conditions

Affected environment	Distance from the dike (km)	Maximum water level (m)	Wave arrival time (h)	Time to reach maximum level (h)
Lake L01 dike	0.0	7.0	<1	<1
Effluent into the environment	0.5	2.1	<1	<1
Watercourse CE15	1.5	2.8	<1	<1
Lake L027 inflow	2.5	1.1	<1	24
Cottages	13.5	1.1	4	27

Further details on the results of the failure assessment and figures illustrating these results are presented in Appendix 12-1.

12.5.2.1 Potential impacts on sensitive environments

In the event of a breach of the east dike, the open pit would need to be evacuated. However, the water could be contained within the pit.

In the event of a breach of the west dike, the resulting flood wave could reach the natural environment outside the site over a distance exceeding 13,5 km. A cabin located on the west side of Lake L27 would be reached by the flood wave within 4 to 12 hours, and water depths could reach up to 1,1 m.

12.6 Risk management program

To ensure the safety of workers, the public, and the environment during mining activities, a risk management program will be established. The main features of this program will be as follows:

- implementation of an environmental and health and safety management system;
- environmental monitoring during the construction and operation phases;
- development of standard operating procedures;

- setting up an equipment maintenance program and a periodic inspection program;
- training workers, particularly on the operation of equipment, the risks inherent in activities, as well as safe work methods and personal protective equipment;
- visual identification system for stored chemicals, piping, and connections to loading and unloading areas;
- safe storage of chemicals;
- investigation of accidents and incidents to determine causes and implement corrective actions;
- rigorous change management process.

Accordingly, policies have been developed. These are environmental policies and health and safety policies. These are available in PMET's internal documentation.

12.7 Preliminary emergency response plan (ERP)

An ERP is an indispensable tool to ensure a quick and effective response when an emergency situation arises. A preliminary plan has been developed for the project and is presented in Appendix 12-3.

The emergency response plan will be provided to internal stakeholders, updated annually, readily available in emergency situations, and easy to consult. It will provide a link between municipal/regional authorities and the project operations team.

Response measures will be in accordance with applicable regulations and industry best practices. When required, this plan will be revised and adapted to any new activity on the site.

13 Preliminary monitoring and follow-up program

In connection with activities relating to the construction, operation and closure phases of the Shaakichiuwaanaan project (the Project), PMET Resources Inc. (PMET) will allocate the necessary human and financial resources to implement the project's environmental monitoring and follow-up program. The following sections outline the activities proposed for the program.

13.1 Environmental monitoring

The project will be subject to environmental monitoring to ensure that the proponent complies with its environmental commitments and obligations, as well as with applicable laws, regulations, and conditions. A due diligence review will be carried out to ensure compliance with the specific provisions set out in the government decree and with all contractual conditions included in the plans and specifications. The implementation of the mitigation measures and commitments set out in the impact assessment, as well as in the addenda submitted in response to questions and comments from the MELCCFP and IAAC or any other authority, will also be monitored as part of this monitoring process. This will begin as soon as work starts on site, continue throughout the construction phase, and remain in place until the environment has been rehabilitated.

A key part of the program is to ensure that all the necessary applications for authorizations and permits have been submitted to the relevant authorities and that these authorizations or permits have been issued before work begins.

In collaboration with the main contractor, the site managers, and the environmental supervisor will organize a kick-off meeting at the start of the work. One of the main aims of this meeting will be to inform and raise awareness among site staff about the environmental monitoring program and the safety measures applicable during the work and monitoring activities. In general, the environmental supervisor will carry out regular inspections of work areas, ensure strict compliance with commitments, obligations, measures, and requirements, assess the effectiveness of the measures implemented, and record any non-compliance observed. The findings will be forwarded to the site manager so that preventive and corrective measures can be implemented promptly, if necessary. The supervisor will also ensure that any spill is reported immediately to the relevant authorities.

During the work, mitigation measures will be strictly adhered to, particularly when carrying out work near sensitive areas, watercourses, or bodies of water. Particular attention will be paid to emissions of suspended solids in the water and to the detection of any accidental spills of petroleum products. Photographs will be taken to document how the work is carried out.

The restoration work carried out during the site's closure will also be subject to appropriate monitoring, based on the requirements applied during the construction phase.

The main activities included in the environmental monitoring program include:

- Following up and supervising all actions that require preventive, mitigation or corrective measures.

- Ensuring that work is carried out in compliance with laws, regulations, and the terms of authorizations and permits, and establishing mechanisms to track potential non-compliance (protection of water environments, air quality, management of residual and hazardous materials, etc.).
- Monitoring the construction of ponds and the management of excavated soil.
- Monitoring retaining structures during the operations phase.
- Ensuring that work areas are properly marked off and preventing machinery from encroaching on them.
- Providing environmental support and raising worker awareness of the impacts of their activities.
- Ensuring compliance with refuelling procedures for petroleum-powered equipment.
- Verifying the presence and effectiveness of containment measures for fuel tanks on mobile equipment (pumps, generators, etc.).
- Overseeing and following up on procedures for accidental spills, including managing the temporary storage of contaminated soil, if necessary.
- Ensuring compliance with biological rest periods and the proper implementation of the environmental follow-up measures associated with the project.
- Ensuring that all necessary authorizations and permits have been obtained. In this regard, a consolidated list of the conditions and commitments resulting from the environmental impact assessment and the permits issued will be prepared and kept up to date.

It is important to note that the proposed monitoring activities have been presented to the concerned Cree communities, and more specifically to the tallyman of trapline CH39. In addition, PMET commits to working collaboratively with the Cree communities to develop a land guardian program, whose members will be involved in monitoring and environmental follow-up activities.

13.2 Environmental follow-up

An environmental follow-up program will be implemented during the construction, operations, and closure phases of the project. The closure phase consists of two distinct periods: the post-operations sub-phase, which covers the interval between the cessation of production and the completion of restoration work, and the post-restoration sub-phase, which begins once restoration work is completed and continues until a condition deemed satisfactory for the protection of the receiving environment is achieved.

The restoration program and related follow-up activities will be reviewed every five years, in accordance with the requirements of the Mining Act and the procedures set out in the *Guide de préparation du plan de réaménagement et de restauration des sites miniers au Québec* [“Guide for preparing mine site reclamation and restoration plans in Quebec”] (MRNF, 2024).

This environmental follow-up program will be adjusted in accordance with the conditions set forth in the permits issued for the project. Its purpose is to detect and document any environmental changes from the reference state, whether or not they are attributable to the project, to verify the accuracy of the impact assessment, and to evaluate the effectiveness of the mitigation measures outlined in the EIA.

Throughout the various stages of the project, the proposed follow-up will focus on, but not be limited to, the following aspects:

- follow-ups associated with mining operations;
- follow-ups associated with the physical environment;
- follow-ups associated with the biological environment;
- follow-ups associated with the social environment;
- other follow-ups associated with habitat compensation projects;
- the annual monitoring and follow-up report;
- the follow-up calendar.

The following sections outline the various aspects of the overall environmental follow-up program. This program will be carried out in accordance with the relevant municipal and government requirements for the project. It is possible that the follow-ups may be adjusted based on the results obtained, or that additional follow-ups may be proposed as the project progresses. The overall schedule for environmental follow-ups is presented in Appendix 13-1.

13.2.1 Mining operations

13.2.1.1 Geochemistry of ore, waste rock, and tailings

As part of the activities related to the restoration plan, which must be updated every five years, a geochemical characterization of the tailings, waste rock, and ore will be conducted. This study will cover the sectors that are scheduled to begin operations within the next five years. This characterization will begin in the year prior to the renewal of the site restoration plan and will be based on the recommendations of the *Guide de caractérisation des résidus miniers et du minerai* [“Guide to the characterization of tailings and ore”] (MELCC, 2020a) to ensure that the tests meet expectations, particularly regarding the number of samples, the nature of the tests to be conducted, and the content of the reports presenting the results. The characterization of the ore, waste rock, and tailings will be completed by the end of the operations phase.

Sampling plans

Waste rock

The sampling plan for the mine’s waste rock is set out below:

- Collect annual grab samples (approximately 2 kg each) annually from the waste rock pile, ensuring that there are at least one and no more than five samples per major waste rock lithology mined during the period.
- Ensure that the samples collected are visually representative of the various materials/lithologies placed on the stockpile within the allotted time and are reasonably distributed across the surface of the freshly placed materials (i.e., materials placed since the previous sampling).

- The schedule for sample collection may vary but should not exceed once a year. A recommended frequency for sample collection is twice a year.
- Samples must be collected by a certified geologist with experience in geochemistry who can confirm that the samples collected are representative.

It should be noted that construction rock (if sourced from waste rock) will be subject to a standard operating procedure to confirm that it is non-acid generating (non-PAG). This procedure includes systematic sampling of waste rock potentially intended for construction activities and its analysis to ensure proper segregation between non-PAG materials and those that are PAG.The amount of waste rock(i.e., truckloads/t) placed at each level of the mine's rock stockpiles and/or used for construction purposes will be recorded by the mine planning department and reported to the mine geologist. This information will be provided to the project geochemist prior to the annual geochemical inspection of the site, so that the inspection can be planned and the annual report prepared.

Tailings

The sampling plan for the tailings is set out below:

- Collect tailings samples throughout each year, representative of the variability in the ore processed during the period covered by each sample; this number is subject to revision following analysis of the results.
- Sampling must be performed or supervised by a qualified person who can certify the samples (usually a geologist or an engineer). A detailed description of the sampling method must be documented.

Testing program

Samples of waste rock and tailings will undergo certain static tests at a laboratory accredited by the Centre d'expertise en analyse environnementale du Québec (CEAEQ) for the tests performed. This program consists of a set of standardized methods and specific tests designed to provide information on the acid-generating potential and metal mobility of the sampled mining materials.

The following static tests are recommended for all samples collected:

- Analysis of the metallic composition in the solid phase according to method MA.200 - Met 1.2 (MELCCFP, 2023a): Br, Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, F, Fe, Hg, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Se, Si, Sn, Sr, Th, Ti, Tl, U, V, W and Zn;
- Acid-base balance (ABB), including total sulphur, sulphate (SO_4), total carbon (C), and total carbonate (CO_3), in accordance with standard MA.110 ACISOL 1.0 (MELCCFP, 2024).

A subset of samples must be subjected to a leaching test. The subsets must include at least 50 % of the samples collected, ensuring that all samples with solid-phase metal concentrations (MA.200) exceed the respective criteria for Soil A, as outlined in the *Guide de caractérisation des résidus miniers et du minerai* ["Guide to the characterization of tailings and ore"] (MELCC, 2020a), are included in the selected subset. The following leaching tests must be carried out:

- Leaching test conducted using the synthetic precipitation leaching procedure (SPLP), which simulates acid rain in accordance with the MA method. 100-Lix.com.1.1 (MELCCFP, 2023b).
- Leaching test according to the CTEU-9 procedure, which uses a pH-neutral water leachate, in accordance with the MA method. 100-Lix.com.1.1 (MELCCFP, 2023b).

- Leaching test in accordance with the TCLP (*Toxicity Characteristic Leaching Procedure*) using the MA method 100 - Lix.com.1.1 (MELCCFP, 2023b).
- Analysis of the following parameters in the leachate from the two leaching tests (SPLP, CTEU-9.): Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, total P, Pb, Sb, Se, Si, Sn, Sr, Th, Ti, Tl, U, V, W, Zn, Hg, F, Cl, SO_4, PO_4, NO_2, NO_3, Br, pH, acidity, alkalinity, conductivity, carbonates, and bicarbonates.

Frequency and duration of follow-up

It is recommended that an annual site visit be carried out by a geologist with expertise in geochemistry to carry out:

- Sampling of waste rock and tailings, as described in Section 14.2.1.1, for geochemical analysis.
- A visual inspection of the rocks and tailings at the site, and any signs of acid rock drainage (ARD).

Follow-up report

The results of the geochemical tests will be interpreted internally by a certified professional and included annually in the site's follow-up report. Every five years, a comprehensive report will be prepared that will present the results of sampling and ongoing follow-up of tailings and waste rock. Although it is recommended that a separate annual geochemical report be prepared by a geologist with expertise in geochemistry, it is also acceptable to include the results of the geochemical follow-up as part of other reporting requirements.

13.2.1.2 Water management and retention structures

A follow-up program for water retention structuresis required under *Directive 019 on the mining industry* (MELCCFP, 2025b). These follow-up activities will be carried out by PMET and will include all water management structures located on the project site. These structures will undergo routine visual inspections throughout the year (starting from the time of their construction), namely:

- Regular inspections, conducted on a weekly basis, consisting of a detailed visual examination of the dikes.
- A detailed seasonal visual inspection, conducted at least four times a year by a qualified person who has received appropriate training, consisting of a detailed examination of the relevant infrastructure components to ensure that there are no defects. The components to be inspected will include retaining structures, ditches, spillways, culverts, and pipelines.
- An annual statutory inspection conducted by a specialist in geotechnical engineering and structural design, which involves visually assessing the condition of the components whose proper functioning ensures the safety of the site. This inspection should ideally be performed in the spring, after the snow has melted but before vegetation begins to grow. An inspection report, accompanied by photographs, will be drawn up and sent to the Ministère.
- If necessary, a specific inspection will be conducted to track the progress of any abnormal observations noted during previous detailed or statutory inspections.

These inspections will be carried out in accordance with best practices and in compliance with the requirements of *Directive 019 on the mining industry* (MELCCFP, 2025b). The details of these conditions will be set forth in the ministerial permits to be issued for the project.

13.2.1.3 Environmental incidents and accidents

The project-related accident risk analysis, conducted as part of the environmental impact assessment (EIA) process, identified the incidents and accidents most likely to occur and that could have an impact on the environment. Accordingly, a preliminary emergency management plan has been developed and is included in the appendix (Appendix 12-3).

The results of the analysis suggest that the events most likely to occur are those associated with spills of petroleum products, forest fires, and mine fires. A summary of the identified risks is presented in Section 12.4.12 of this report. Risk mitigation measures are listed for each of the risks identified in the previous chapter. In addition, Section 12.6 of this report describes PMET's risk management program.

13.2.1.4 Residual and hazardous materials management

Various types of residual and hazardous materials will be generated during the construction, operations and closure phases of the project.
The follow-up measures implemented will aim to confirm that the volumes and types of non-hazardous residual materials estimated in the EIA are being adhered to, and that their treatment and sorting are carried out in accordance with the procedures established at the various sites authorized by the MELCCFP.

The environmental team will follow up with employees to ensure that sorting and recycling methods are being properly implemented. The site environmental manager will conduct regular inspections of the storage areas and report any non-compliance observed to the relevant users and supervisors so that the required corrective actions can be taken.

Additional follow-up will also ensure that cardboard waste is stored and reused to feed the on-site composter, and that the compost produced is used for progressive restoration work.

PMET will ensure that the site is kept clean at all times.
Outdoor trash cans will be emptied daily, containers will be kept tightly closed, and the team will ensure that no waste accumulates around the sorting centre facilities or in areas where trash cans are located.

Lastly, the environmental manager will ensure compliance with the hazardous materials management plan—which must be developed prior to submitting the application for ministerial authorization—and will oversee the implementation of its requirements on site.

13.2.1.5 Drinking water distribution network

During the operations phase, the camp will have an accommodation capacity of 672 beds.To supply drinking water to the entire camp, PMET will draw surface water from Lake L308, located approximately 1.5 km from the camp.

PMET will implement a drinking water quality testing program, conducted prior to the construction of the facilities to establish baseline conditions, and maintained throughout the operations phase. This follow-up will ensure that the water used to supply the camp meets applicable standards at all times and remains in compliance with public health requirements and those of the MELCCFP.

Location and number of sampling stations

The locations and number of sampling stations (3 stations) are based on the *Guide de caractérisation physicochimique de l'état initial du milieu aquatique avant l'implantation d'un projet industriel* ["Guide to the physicochemical characterization of the baseline conditions of the aquatic environment prior to the implementation of an industrial project"] MDDELCC, 2017). The three stations will be spread out to cover the entire surface of the lake.

Follow-up to establish the baseline water quality

In accordance with the *Guide de conception des installations de production d'eau potable, volume 1* ["Design guide for drinking water production facilities, volume 1"] (MDDELCC, 2015a), the water will undergo comprehensive analytical tests for 180 days, or 90 days if filtration is used. All parameters listed in Tables 6-1 (microbiological, inorganic, and physical parameters) and 6-2 (organic parameters) of the guide will be analyzed. The frequency of testing will vary depending on the parameters (see Tables 6-1 and 6-2 in the guide).

Follow-up during the operations phase

The sampling frequencies and the various physicochemical and biological parameters for drinking water samples are taken from the *Regulation respecting the quality of drinking* water (Q-2, r.40) and are presented in Table 13-1.

Table 13-1 Sampling frequency and applicable physicochemical and biological parameters

Substance	Clients served	Minimum number of samples	Sampling period
Total coliforms and E. coli	21 to 1,000 persons	2	Monthly
Some substances listed in Schedule 1 of the Regulation respecting the quality of drinking water[1, 2]	≥21	1	Annually, between July 1 and October 1
Nitrates + Nitrites	≥21	1	During each of the quarters beginning on January 1, April 1, July 1, and October 1 respectively, with a minimum interval of two months between the dates of the samplings
Lead and copper	≥501 and ≤5000	5	Annually, between July 1 and October 1
Chlorites, chlorates[3]	All	1	During each of the quarters beginning on January 1, April 1, July 1, and October 1 respectively, with a minimum interval of two months between the dates of the samplings
Trihalomethanes	≥21 and ≤5000	1	
Turbidity	All	1	Monthly

Notes: 1 Antimony, arsenic, barium, boron, bromates, cadmium, chromium, cyanides, fluorides, mercury, lead, selenium and uranium.
2 Iron and manganese will be added to this list since they are specifically targeted by the treatment being applied.
3 The pH must be measured at the time of sampling and recorded on the test request form.

13.2.1.6 Sewage water

Given that workers will be present on site during the construction, operations and closure phases, the sewage treatment system will need to be monitored throughout these phases.

The sewage treatment system to be installed at the project site will require regular follow-up to ensure that its components are functioning properly and to detect any defects that could lead to contamination. As mentioned in Chapter 5 (Section 5.4.7) of this EIA, the sewage treatment system will consist of a modular biological treatment system combining primary sedimentation, biofiltration, and UV disinfection. An analysis program for the proposed system will be developed in accordance with the MELCCFP's requirements, specifying the parameters to be analyzed and the sampling frequency. This analysis program will be finalized upon receipt of the ministerial authorization for the sewage system to be issued for the project.

Test results will be sent to a laboratory accredited by the MELCCFP, when required for the relevant parameter. It should be noted that treatment targets will be established during the authorization process. These standards will be based on the final treatment units selected and the *Guide pour l'établissement des normes de rejet d'une installation de traitement des eaux usées d'origine domestique* ["Guide for establishing discharge standards for domestic wastewater treatment facilities"] (MELCC, 2020b).

Ultimately, the sewage treatment process will generate sewage sludge, which will be dewatered on site and then transported by a specialized contractor to a facility authorized to manage it.

13.2.2 Physical environment

13.2.2.1 Ambient air

The ambient air quality follow-up program will have two components: one focusing on emissions from diffuse sources and the other on emissions from stationary sources.

Emissions from diffuse sources

The objective of the ambient air quality follow-up program for emissions from diffuse sources is to measure the impact of mining activities on air quality and to determine whether these activities comply with and are acceptable under applicable standards and criteria.

During the construction phase, potential impacts will stem primarily from stripping and clearing, the construction of structures and infrastructure, as well as transportation and traffic on roads. The planned follow-up will ensure that air emissions comply with the limit values set by the standards and criteria and that mitigation measures (such as road watering using tank trucks) are effective.

During the operations phase, potential impacts will stem primarily from drilling and blasting activities, the transport of ore and waste rock, loading, crushing, and grinding operations, outdoor storage, and diesel engines. *Directive 019 on the mining industry* does not specify the frequency of air quality follow-up—this is determined on a case-by-case basis. In this case, ambient air quality follow-up will begin as soon as operations start, using permanent sampling stations, and may be adjusted based on the results obtained. The locations of the sampling points will be determined based on the prevailing wind directions specific to the site, which will be obtained from data collected by the on-site weather station. The location will also be determined based on the results of the modelling and the position of the sensitive receptors. The exact location of the sampling stations will be specified when the construction permit application is submitted.

The ambient air quality follow-up program for the project will cover all air emissions resulting from the project's operations, namely:

- total suspended particulates (TSP) and fine particulate matter ($PM_{2.5}$);
- crystalline silica dust;
- metals and metalloids.

Sampling will be conducted in accordance with the methods set forth in the document, *List of Designated Reference and Equivalent Methods* (US EPA, 2024). The results of the tests will be compared to the standards set forth in the document, *Normes et critères québécois de qualité de l'atmosphère, version 10* (Quebec standards and criteria for air quality, version 10) published by the *Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs* (MELCCFP, 2025a). If the tests show that an air quality standard has been exceeded, the situation will be investigated, and corrective measures will be taken as appropriate. Table 13-2 summarizes the applicable standards for currently identified parameters to be assessed at the project site.

Table 13-2 Air quality standards and criteria applicable to the parameters assessed at the project site

Substance	Type of particles in the standard	Period	Limit value[1] (µg/m³)	Type of reference value
Total suspended particulates (TSP)	-	24 hours	120	Standard
Fine particulate matter (PM2.5) -	-	24 hours	30	Standard
Silver (Ag)	TSP	1 year	0.23	Standard
Arsenic (As)	TSP	1 year	0.003	Standard
Barium (Ba)	TSP	1 year	0.05	Standard
Beryllium (Be)	TSP	1 year	0.0004	Standard
Cadmium (Cd)	TSP	1 year	0.0036	Standard
Cobalt (Co)	TSP	1 year	0.1	Criteria
Chromium [hexavalent chromium compounds (CrVI)]	TSP	1 year	0.004	Standard
Chromium [trivalent chromium compounds (CrIII)]	TSP	1 year	0.1	Standard
Copper (Cu)	TSP	24 hours	2.5	Standard
Mercury (Hg)	TSP	1 year	0.005	Standard

Substance	Type of particles in the standard	Period	Limit value[1] (µg/m³)	Type of reference value
Lithium (Li)	TSP	1 hour	2	Criteria
Magnesium (Mg)	TSP	1 hour	24	Criteria
Manganese (Mn)	PM10	1 year	0.08	Criteria
Nickel (Ni)	PM10	24 hours	0.07	Standard
Nickel (Ni)	PM10	1 year	0.02	Standard
Lead (Pb)	TSP	1 year	0.1	Standard
Antimony (Sb)	TSP	1 year	0.17	Standard
Selenium (Se)	TSP	1 hour	2	Criteria
Crystalline silica (SiO_2)	PM10	1 hour	23	Criteria
Crystalline silica (SiO_2)	PM4	1 year	0.07	Criteria
Tin (Sn)	TSP	4 minutes	2	Criteria
Tin (Sn)	TSP	1 year	0.1	Criteria
Titanium (Ti)	PM10	24 hours	2.5	Criteria
Vanadium (V)	TSP	1 year	1	Standard
Zinc (Zn)	TSP	24 hours	2.5	Standard

Notes: [1] MELCCFP, 2025a. Normes et critères québécois de qualité de l'atmosphère, version 10, Québec, Direction de la qualité de l'air et du climat, [online]. www.environnement.gouv.qc.ca/air/criteres/index.htm

Emissions from stationary sources

In addition to emissions from diffuse sources generated by general project activities, the ore processing and paste backfill plants will include various chimneys, each of which will be a stationary source of emissions. These emissions will also be monitored using the standard methods outlined in the *Sampling Guide for Environmental Analysis – Booklet 4 – Sampling of Atmospheric Emissions from Stationary Sources* (MDDELCC, 2016a). As stipulated by the *Clean Air Regulation (CAR)*, sampling must begin no later than one year after the plants begin operations and must be repeated every three years.

For each stationary emission source, as required by *Directive 019 on the Mining Industry* (MELCCFP, 2025b), the following information must be provided:

- the nature of contaminants, quantity emitted (MT/year), flow rate (m^3/h), gas temperature (°C) and contaminant concentration (mg/Nm^3);
- purification systems or measures taken to prevent, eliminate, or reduce the release of contaminants, and the percentage of efficiency;
- how and where dusts are stored, deposited, or disposed of (if dry dust collectors are used).

Ambient air quality follow-up will end at the time of plant dismantling.

13.2.2.2 Greenhouse gases

Monitoring greenhouse gas (GHG) emissions is a legal requirement under the *Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere* (RDOCECA) at the provincial level and the *National Pollutant Release Inventory* (NPRI) at the federal level. This requirement applies to the construction, operations and closure phases of a facility, provided that certain minimum thresholds are met.

As part of the GHG estimates presented in the EIA, the following project activities have been identified as sources of GHG emissions and are therefore included in the GHG emissions follow-up:

- fuel consumption (diesel, gasoline, compressed natural gas) of machinery and equipment during the construction phase;
- fuel consumption (diesel, gasoline, compressed natural gas) of machinery and equipment during the operations phase;
- fuel consumption (diesel, compressed natural gas) from stationary sources during the construction and operations phases;
- electricity consumption from the grid.

For each piece of equipment, the data obtained through the emission calculation protocols will be added up by converting CH_4, N_2O, and refrigerant emissions into CO_2 equivalents, using the global warming potential (GWP) of these gases. These GWP values are listed in the *Guide de quantification des émissions de gaz à effet de serre* ["Guide to quantifying greenhouse gas emissions"] (MELCCFP, 2025c). The emissions inventory will also comply with the reporting requirements of the *Federal GHG Reporting Program*. It will also include follow-up related to the federal government's NPRI.

Reports will be submitted through the electronic platforms of both levels of government, and the reports will be certified by a third party acting as an auditor. Every three years, in the interest of transparency, the auditing firm will be changed. At this time, it is not anticipated that the developer will be subject to the Cap-and-trade (C&T) system, as emissions from stationary sources are estimated to be below 25,000 t CO_2 eq per year.

13.2.2.3 Acoustic environment and vibrations

The purpose of this follow-up is to assess changes in ambient noise, vibrations, and air overpressure that may result from project activities. It will be used to assess the effectiveness of the mitigation measures that have been implemented and, if necessary, to adjust them. Acoustic follow-up will also help identify the sources of noise responsible for noise levels that could cause disturbances or discomfort for workers and land users. As for monitoring vibrations and air overpressure, the goal will be to confirm compliance with applicable standards and, if necessary, to adjust the blasting plan.

Acoustic environment

According to *Directive 019 on the mining industry* (MELCCFP, 2025b), the operator of a mine under construction or in operation must establish a self-monitoring program to track noise levels associated with construction and operations. In addition, the assessment of ambient noise must be conducted in accordance with the requirements of the new guidelines (MELCCFP, 2026)[1]. During construction, these standards must be supplemented by the *Lignes directrices relativement aux niveaux sonores provenant d'un chantier de construction industriel* ["Guidelines on noise levels from industrial construction sites"] (MDDELCC 2015b).

[1] Directive 019 respecting the mining industry refers to Instruction Note 98-01 (NI 98-01). However, NI 98-01 was recently (January 2026) replaced by the Environmental Noise Management Guidelines.

At the federal level, Health Canada recommends assessing the impacts of noise on human health based on changes in the percentage of the population experiencing significant annoyance (% HA) by type of noise (tonal noise, impact noise, etc.) (Health Canada, 2017).

Frequency and duration of the follow-up

Noise levels are monitored at least once at the start of each major phase of construction work. The sampling period for a noise monitoring study covers a 12-hour workday (between 7 a.m. and 7 p.m.) and is used to determine the daytime assessment noise level as defined in the technical guidelines. The need for additional noise monitoring during any of the construction phases is assessed based on the baseline noise level, measured over a 12-hour period, obtained during the initial noise monitoring for each phase of the work. In addition, should there be a change in work methods or the addition of new equipment, these changes will be subject to a new noise follow-up assessment. Measurements are taken between May and October.

During operations, noise levels are monitored twice per season, between May and October, on a day that is representative of the project's activity. The first measurement is taken at the start of the season, and the second is taken when an operational change occurs that is likely to result in a significant change in noise levels. Each acoustic monitoring session lasts 24 hours.

At the monitoring station, noise measurements are taken every five seconds. The exact location of the monitoring stations will be specified at the time the construction authorization application is submitted. These measures take into account the average noise level (A- and C-weighted) as well as the maximum level observed. A more detailed analysis by frequency band is also performed to better characterize the sounds. Based on this data, statistics are generated every hour to provide an overview of noise trends. Audio recordings and audio signals are also stored, making it easier to identify the source of the noise heard, whether they are traffic-related, human activity, impact noises, or ambient sounds. Lastly, the GPS coordinates of the measurement point are recorded to accurately locate each data point.

The proponent must also maintain a record of noise-related complaints and submit it to the Ministère upon request. For each complaint, specific information must be recorded and kept for a period of five years.

Report

An annual report is prepared summarizing the results of the measurements and data processing, including the sound levels measured with or without recording, in third-octave frequency bands, and sound levels as needed.

During the construction period, the report also provides the following information:

- the date of the noise measurements;
- the exact sampling period and position;
- hourly weather conditions:
  - temperature;
  - wind speed and direction;
  - relative humidity;

    - road conditions (dry or wet);
    - precipitation;
- noise levels measured without recording (ambient noise): $L_{Aeq\text{-}1h}$, $L_{Ceq\text{-}1h}$, $L_{d(7\ a.m.\ to\ 10\ p.m.)}$, $L_{n(10\ p.m.\ to\ 7\ a.m.)}$, L_{dn}, $L_{AF1\text{-}1h}$, $L_{AF10\text{-}1h}$, $L_{AF50\text{-}1h}$, $L_{AF90\text{-}1h}$, $L_{AF95\text{-}1h}$, and $L_{AFTmax5}$;
- the hourly linear equivalent continuous sound pressure levels measured in third-octave bands ($L_{Zeq,1h\ (1/3\ oct.)}$) will be provided;
- sound levels measured and recorded (specific noise): $L_{Aeq\text{-}1h}$;
- the assessment of hourly noise levels and the necessary corrective measures:
    - equivalent sound level of the specific noise: $L_{Aeq\text{-}1h}$;
    - corrective terms (K_I, K_T and K_S);
    - profiles of the $L_{Aeq\text{-}5s}$ and $L_{Aeq\text{-}1h}$ sound levels and wind speed;
    - an assessment of the percentage of people who are highly annoyed (HA);
    - analysis of the results against the specified limits;
    - the additional mitigation measures that have been implemented in the event that limits are exceeded.

During the operations phase, an annual report is prepared. It contains the same information as that provided during the construction phase, with the following exceptions:

- noise levels measured without recording (ambient noise): $L_{Aeq,\ 24\ h}$, $L_{Aeq,\ 12h\ (7\ a.m.\ to\ 7\ p.m.)}$, $L_{Aeq,\ 12h\ (7\ p.m.\ to\ 7\ a.m.)}$, $L_{Ceq\ 24h}$, $L_{Aeq\text{-}1h}$, $L_{Ceq\text{-}1h}$, $L_{d(7\ a.m.\ to\ 10\ p.m.)}$, $L_{n(10\ p.m.\ to\ 7\ a.m.)}$, L_{dn}, $L_{AF10\text{-}1h}$, $L_{AF50\text{-}1h}$, $L_{AF90\text{-}1h}$, $L_{AF95\text{-}1h}$, and $L_{AFTmax5}$;
- sound levels measured and recorded (specific noise): $L_{Aeq\text{-}1h}$, $L_{Ceq\text{-}1h}$.

The report must also include any complaints received.

Vibrations

A program for the self-monitoring of blasting operations and vibration monitoring has been developed to meet the requirements of Directive 019 (2025 version). Given the proximity of the work camp (less than 1 km away), this program aims to protect workers, land users, critical infrastructure, and aquatic habitats from the potential effects of ground vibrations and air overpressure. The main objectives are to:

- ensure that blasting complies with regulatory standards;
- minimize impacts on sensitive receptors (human and aquatic);
- ensure transparency by setting up a communication program.

Frequency and duration of the follow-up

As specified in Section 3.4.3 of *Directive 019 on the mining industry* (MELCCFP, 2025b), PMET will comply with the requirements regarding ground vibrations and air pressure surges, namely:

- the maximum permissible particle velocity during blasting, which is 12.7 mm/s, measured at the point of impact;

- the maximum air overpressure, which is 128 linear decibels, measured at the point of impact, except for water supply wells;
- that no mineral substances are projected outside the mine site;
- that clear communication will be maintained with local residents and workers regarding blasting schedules.

Vibration monitoring is performed during every blasting operation. The measured parameters include, in particular, the frequency and peak velocity of the particles, which are systematically compared to the applicable maximum limit.

The results are recorded in a database and kept for a minimum of five years. If regulatory thresholds are exceeded or emissions are observed outside the site, the MELCCFP is notified immediately, and appropriate corrective measures are taken.

Additional follow-up is conducted in the aquatic environment. A hydrophone will be installed in Lake L01, located near the pit, to measure pressure changes caused by the detonations. The data collected is used to verify compliance with the 100 kPa threshold established by federal standards (Wright and Hopky, 1998) for fish protection and, if necessary, to adjust the propagation calculations based on observed conditions. The follow-up program also takes into account the protection of potential spawning grounds in Lake L01 and the surrounding watercourses and water bodies, for which a limit of 13 mm/s is enforced during the egg incubation period of salmonids (August 31 to June 1) and other species of interest (April 15 to June 1).

Report

All collected data, including vibration measurements, air overpressure readings, weather conditions, blasting parameters, and quality control results, are recorded in a specific logbook and kept for a minimum of five years. This logbook must include:

- the identity of the person responsible for the measurements;
- the geographic coordinates of the measurement points and the affected residences;
- the technical specifications of the instruments used and the date of their last calibration;
- the observed weather conditions and any relevant observations related to the context of the measurements;
- the dates and times of the measurements;
- a statement confirming that all procedures were performed in accordance with current monitoring protocols and best practices.

The recorded data is used to verify the compliance of blasting operations, adjust prediction models, and optimize the planning of future operations.

An annual summary of ground vibration and air overpressure results is included in the operational activity report submitted to the MELCCFP, in accordance with the requirements of Directive 019 (MELCCFP, 2025b).

13.2.2.4 Ambient light

No specific follow-up is planned for ambient light, except for a follow-up of the mitigation measures presented in Appendix 8-2.

13.2.2.5 Soil

In accordance with the requirements of Section 3.12.2.1 of Directive 019 on the mining industry (MELCCFP, 2025b) and Section 31.51 of the Environment Quality Act (EQA), soil characterizations of the mining site will be carried out prior to construction activities in order to establish baseline conditions for existing soil quality. Another characterization will be conducted prior to restoration work. The purpose of this assessment is to identify and limit potential contaminant emissions and, if necessary, to adjust the restoration work based on the results obtained.

13.2.2.6 Hydrology

Hydrological monitoring focuses primarily on variations in water volumes at the effluent, on the development of a diversion channel for waters from Lake L01, as well as on potential changes to the hydrological regimes of water bodies that may experience a reduction in water inputs as a result of watershed loss and groundwater drawdown. During the construction phase, water volumes in the receiving watercourse of the mine effluent, as well as effects on the watersheds of the affected water bodies, will gradually increase until the start-up of mining operations.

The environmental monitoring program applicable to construction activities will be implemented by the environmental monitor assigned to the site. The environmental monitor will ensure the rigorous implementation of the planned mitigation measures and compliance with these measures by all teams working on the site.

Flow and Water Level Monitoring

In order to assess the effects of the mining project on flows and water levels in watercourses within the study area, the following activities are proposed:

- The installation of six water-level monitoring probes is planned in Lakes L308, L219, L01, L02 and L07, as well as in watercourse CE15 (Map 13-1). Some of these probes will be installed at the same locations as those used during field campaigns conducted to establish baseline conditions, allowing for comparison of pre- and post-project conditions. Additional probes will also be installed at strategic locations to more thoroughly document the Project's potential impacts. Finally, one probe will be installed in a watercourse not affected by the mining project to serve as a reference site and to allow analysis of interannual variations independently of the Project's influence. The probes will therefore be installed at the following locations:
  - Locations previously used for baseline conditions:
    - Lake L02 (LL13)
    - Lake L219 (LL9)
    - Lake L308 (LL10)
    - CE15 (LL5)

- New locations:
  - Lake L01 (eastern portion)
  - Lake L07

- Water-level monitoring probes will be installed in the spring, after ice-out of lakes and watercourses, and retrieved in the fall, prior to freeze-up. This approach will allow documentation of periods of high hydrological activity, notably following snowmelt and during fall precipitation events, as well as summer low-flow periods.
- Precipitation will be recorded continuously between the spring and fall monitoring campaigns using the meteorological station already in place at the mine site. These data will be used to interpret variations in water levels measured by the probes and to distinguish potential Project-related effects from natural interannual variability in hydrological conditions.
- Flow measurements will be conducted at the locations where probes are installed in watercourses, or at lake outlets for probes located in lacustrine environments. These measurements, based on the determination of flow velocities to derive discharge, will be carried out twice per year: in the spring during probe installation and in the fall during probe removal. This frequency will provide data representative of contrasting hydraulic conditions, including both low- and high-flow periods.

Erosion Monitoring

- According to the hydraulic study conducted by Atkins Réalis (Appendix 8-3), the opening of the diversion channel between Lake L01 and Lake L05 and the closure of watercourse CE01 (the natural outlet of Lake L01) could result in changes to received flow volumes (flooding risks) and generate downstream erosion.
- For a 1:2-year return period (used for modelling purposes, as it is more frequent), erosion and deposition processes may occur in four sectors between the outlet of the diversion channel into watercourse CE05 and Lake L27 (Map 13-1), namely:
  - in watercourse CE08, approximately 1.2 km downstream of the diversion channel outlet;
  - at the outlet of Lake L07, in watercourse CE11, approximately 2.2 km downstream of the diversion channel outlet;
  - in watercourse CE11, immediately upstream of Lake L10, approximately 2.9 km downstream of the diversion channel outlet;
  - in watercourse CE15, approximately midway between Lakes L10 and L27 and about 3.6 km downstream of the diversion channel outlet.

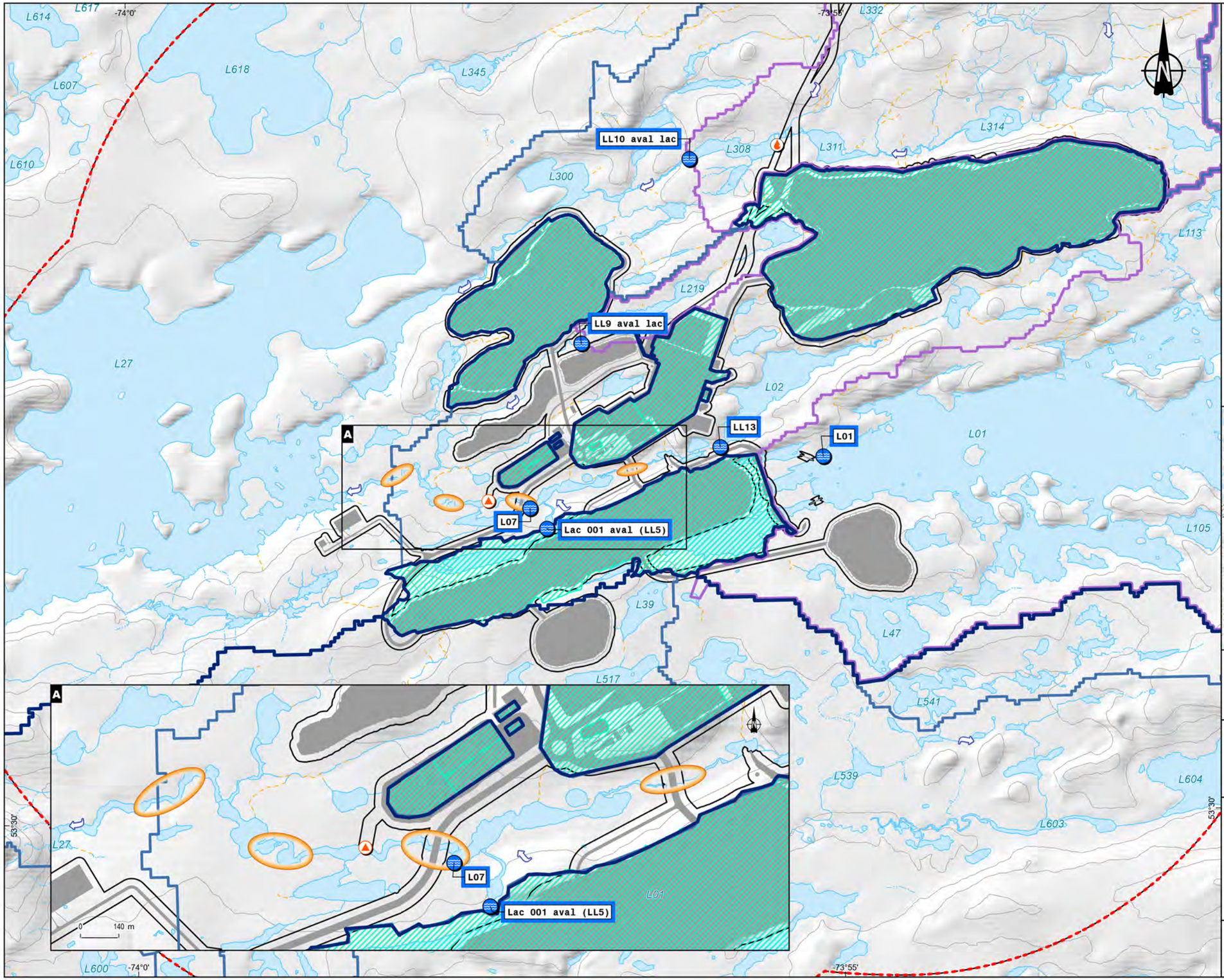
Monitoring of field conditions in these four sectors is therefore planned to ensure the maintenance of their integrity and to confirm that the increase in flow does not adversely affect the stability of the watercourses. To this end, the following activities are planned:

- Site visits to the four potentially problematic sectors will be conducted on foot three times per year. In particular, one visit will take place immediately following snowmelt, which represents a period of high hydrological activity during which the effluent is expected to operate at maximum capacity and therefore constitutes a critical period from an erosion-potential perspective. These visits may be carried out concurrently with hydrological monitoring, where feasible and relevant.

- During each visit, photographic and descriptive documentation will be collected to record the condition of the watercourse, particularly the banks, at different times of the year.
- Attention will also be given to changes in hydraulic conditions unrelated to the Project, including, but not limited to, the formation or failure of beaver dams and the presence of woody debris accumulations.
- Field observations will be analyzed in conjunction with water-level and flow data collected as part of the hydrological monitoring program, in order to establish relationships between measured hydraulic conditions and the morphodynamic evolution observed in the field.
- Should erosion phenomena be observed, the frequency of inspections may be increased to more closely document ongoing processes. Where applicable, localized bank-stabilization measures, such as riprap, may be implemented.

This monitoring will be carried out in Years 1 and 2, then in Years 5 and 6, as well as once at the end of site restoration activities. A monitoring report presenting the data collected, their analysis, and the associated conclusions will be prepared at the end of each monitoring period.

No specific hydrological monitoring is planned during the closure phase, as the natural environment is expected to return to an equilibrium state comparable to that observed prior to Project implementation.



Zones d'étude / *Study Areas*

Projet / *Project*

Locale - Biophysique / *Local - Biophysical*

Composantes du projet / *Project Components*

Effluent minier / *Mining effluent*

Prise d'eau / *Water intake*

Autres composantes projetées / *Other projected components*

Hydrologie / *Hydrology*

Sens d'écoulement de l'eau / *Waterflow direction*

Zone de collecte d'eau de ruissellement / *Runoff water collection area*

Suivi des débits et niveaux d'eau / *Flow and Water Level Monitoring*

sondes de mesure des niveaux d'eau / *Water level monitoring sensors*

Zone de suivi de l'érosion / *Erosion monitoring zone*

Bassins versants projetés / *Projected Watersheds*

Principal / *Principal*

Intermédiaire / *Intermediate*

Sous-bassin versant / *Sub-watershed*

Hydrographie / *Hydrography*

Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*

Intermittent / *Intermitent*

Permanent / *Permanent*

Souterrain / *Underground*



Projet minier Shaakichiuwaanaan /
Shaakichiuwaanaan Mining Project

Étude d'impact sur l'environnement - Impacts /
Environmental Impact Assessment - Impacts

Carte 13-1 / *Map 13-1*
Stations de suivis hydrologiques et des zones d'érosion potentielles / *Hydrological Monitoring Stations and Potential Erosion Zones*

Sources :
CanVec, 1/250 000, RNCan, 2017
BDGA, 1M, MERN, 2014
Cartographie écologique de la végétation du Nord Québécois, MFFP, 2013

0 300 600 m
NAD 1983 CSRS UTM Zone 18N

2026-03-28

Préparation / Preparation : E. Sormain
Dessin / Drawing : M. Leclair
Approbation / Approval : M.-H. Brisson
CA0001724_3318_eie_ch13_c01_c02_260328.aprx
CA0001724_3318_eie_c13_01_171_suivi_erosion_hydro_260328

13.2.2.7 Mine effluent

The purpose of monitoring mine effluent is to verify that the effluent quality complies with applicable standards and criteria at all times, as well as to collect the information needed to evaluate and interpret the results of biological follow-up (benthos and fish). This monitoring includes characterizing the mine effluent and conducting lethal and sublethal toxicity tests using samples taken from the effluent.

In accordance with Directive 019 on the mining industry (MELCCFP, 2025b) and the Metal and Diamond Mining Effluent Regulations (MDMER), regular follow-up of the final effluent continues until the project proponent submits an application to transition to post-restoration follow-up. The provisions of Part 4 of the MDMER set forth the requirements that operating mines must meet to be recognized as closed. In addition, depending on the nature of the ore, the process, the tailings, or the environmental discharge objectives (EDOs), additional requirements applicable to the discharge point of the final effluent may be specified when the ministerial authorization is issued.

A summary of the general parameters under assessment is presented below.

Directive 019

In accordance with Directive 019 on the mining industry (MELCCFP, 2025b), samples will be collected using the methods prescribed in *Cahier 2 – Échantillonnage des rejets liquides* [Booklet 2 – Sampling of liquid discharges] and its addendum, *Types et méthodes d'échantillonnage* [Sampling types and methods] (MDDELCC, 2016b). A grab sample or a 24-hour composite sample shall be collected daily, and the parameters listed in Table 3.3 of the directive (Table 13-3 below) shall be measured at the frequencies indicated.

Sampling of the parameters associated with Columns II, III, and IV must be accompanied by measurements of flow rate and pH. The parameters in Columns III and IV must be sampled simultaneously with one of the samplings carried out for the parameters in Column II, and the parameters in Column IV must also be sampled at the same time as those in Column III. The prescribed frequencies are maintained until the start of post-operations follow-up.

For the parameters in Columns II, III, and IV, for which testing is required on a tri-weekly, weekly, monthly, or quarterly basis, a minimum interval of 24 hours, 4 days, 15 days, and 45 days, respectively, must be observed between two measurements or two sampling campaigns.

Table 13-3 Sampling, analysis, and measurement frequencies for routine monitoring of the final effluent

	Frequency			
	Column I	**Column II**	**Column III**	**Column IX**
	Continuous[1]	3/wk.	1/wk.	Another frequency
Parameter	pH	TSS	As	Acute toxicity Rainbow trout (*Oncorhynchus mykiss*) and Daphnia (*Daphnia magna*) (1/month) Petroleum hydrocarbons C_{10}-C_{50} (1/quarter) Radium 226 (1/quarter)
	Flow rate	Flow rate	Cu	
		pH	Fe	
			Ni	
			Pb	
			Zn	
			Total cyanides[2]	
			Ammoniacal nitrogen	

Notes: 1 For facilities generating more than 1,000 m³/day of effluent (annual average calculated based on days with effluent discharge), continuous measuring of pH and flow rate is required.
2 Applies only to the final effluent from facilities that use or have used cyanides in their processes.

Metal and Diamond Mining Effluent Regulations (MDMER)

Monitoring of the final effluent also includes measuring all physicochemical parameters at the frequencies specified by the MDMER. Table 13-4 provides details of the tests required under this regulation. Sampling and measurements will be conducted in accordance with the requirements of Directive 019 on the mining industry (MELCCFP, 2025b), the MDMER, and the *Sampling Guide for Environmental Analysis – Booklet 2* and its addendum (MDDELCC, 2016b).

Standard precautions will be followed to prevent contamination during sampling, handling, and transport of samples. Parameter tests will be carried out by a MELCCFP-accredited laboratory in accordance with the testing methods recognized by the MELCCFP. Strict quality control and quality assurance measures will be implemented for all sampling and testing activities.

The follow-up requirements (parameters, frequencies, detection limits, etc.) and reporting procedures will be specified in the permits issued at the start of operations These follow-up activities will be carried out by the proponent in accordance with the conditions established by government authorities.

Table 13-4 Parameters and measurement or sampling frequency for final mine effluent under the MDMER

Parameters	Frequency
pH, temperature, As, Cu, Ni, Pb, Zn, Ra-226, total cyanides, total suspended solids, un-ionized ammonia	Once a week[1, 3]
Acute lethality	Once a month[2]
Hardness, alkalinity, conductivity, nitrate, chloride, sulphate, phosphorus, Al, Cd, Cr, Co, Fe, Hg, Mn, Mo, Se, Tl, U	Four times a year
Sublethal toxicity [test for measuring the inhibition of growth using the freshwater macrophyte, *Lemna minor* (Reference method EPS 1/RM/37), published by the Ministère de l'Environnement and applied to the biological parameter based on the number of thalli]	Twice a year

Notes:
1 The owner or operator of a mine, other than a uranium mine, may reduce the frequency of conducting tests relating to the concentration of radium 226 at a final discharge point to not less than once in each calendar quarter, each test being conducted at least one month apart, if the concentration of radium 226 at that final discharge point is less than 0.037 Bq/L for 10 consecutive weeks
2 The owner or operator of a mine may reduce the frequency of conducting an acute lethality test at a final discharge point to once in each calendar quarter if the effluent from that final discharge point is determined not to be acutely lethal by that acute lethality test for 12 consecutive months.
3 The owner or operator of a mine may reduce the frequency of conducting tests relating to the concentrations of arsenic, copper, cyanide, lead, nickel, zinc or un-ionized ammonia at a final discharge point to not less than once in each calendar quarter, each test being conducted at least one month apart, if that substance's monthly mean concentration at that final discharge point is less than 10% of the value set out in column 2 of Schedule 4 of the MDMER for 12 consecutive months.

Post-closure environmental monitoring will be conducted over a period of four years, until the completion of restoration activities. During this period, the mine water management system will remain operational.

During the post-operations phase, all potential sources of contamination located upstream of the final effluent discharge point will be monitored. The quality of runoff water from any other potential source of contamination will also be checked. Sample collection and flow measurement at the sampling station will be conducted in accordance with the frequencies and durations specified in Table 3.3 of Directive 019 on the mining industry (MELCCFP, 2025b), i.e., Table 13-3 above.

Post-restoration environmental monitoring will be conducted over a five-year period. Following restoration of the mining site, there will be two effluents at Waste Rock Pile 01 and two effluents at Waste Rock Pile 02, due to the creation of breaches in the dikes of the water management ponds associated with these waste rock piles. As a result, four surface water effluents will be monitored. Sampling frequencies will comply with the requirements of Directive 019, namely six times per year. Mine wastewater monitoring will be carried out in accordance with Section 3.11 of Directive 019. A sampling station will be installed at each discharge point, and the water will be treated as required prior to discharge to the environment.

Over the previous five years of water quality follow-up, if the requirements of Section 3.11.3 of Directive 019 are met and downward trends in contaminant concentrations are observed, the gradual discontinuation of certain follow-up activities may be considered, subject to approval by the MELCCFP.

13.2.2.8 Surface water

Surface water quality follow-up will be conducted in addition to the characterization of mine effluent required under the MDMER. The goal is to monitor the project's performance and track changes in environmental conditions in the waters of the receiving environment. The monitoring will also provide measurements of environmental variables to support the interpretation of the results of the biological follow-up (benthos and fish). The surface water quality monitoring parameters for the receiving environment targeted by the MDMER are presented in Table 13-5.

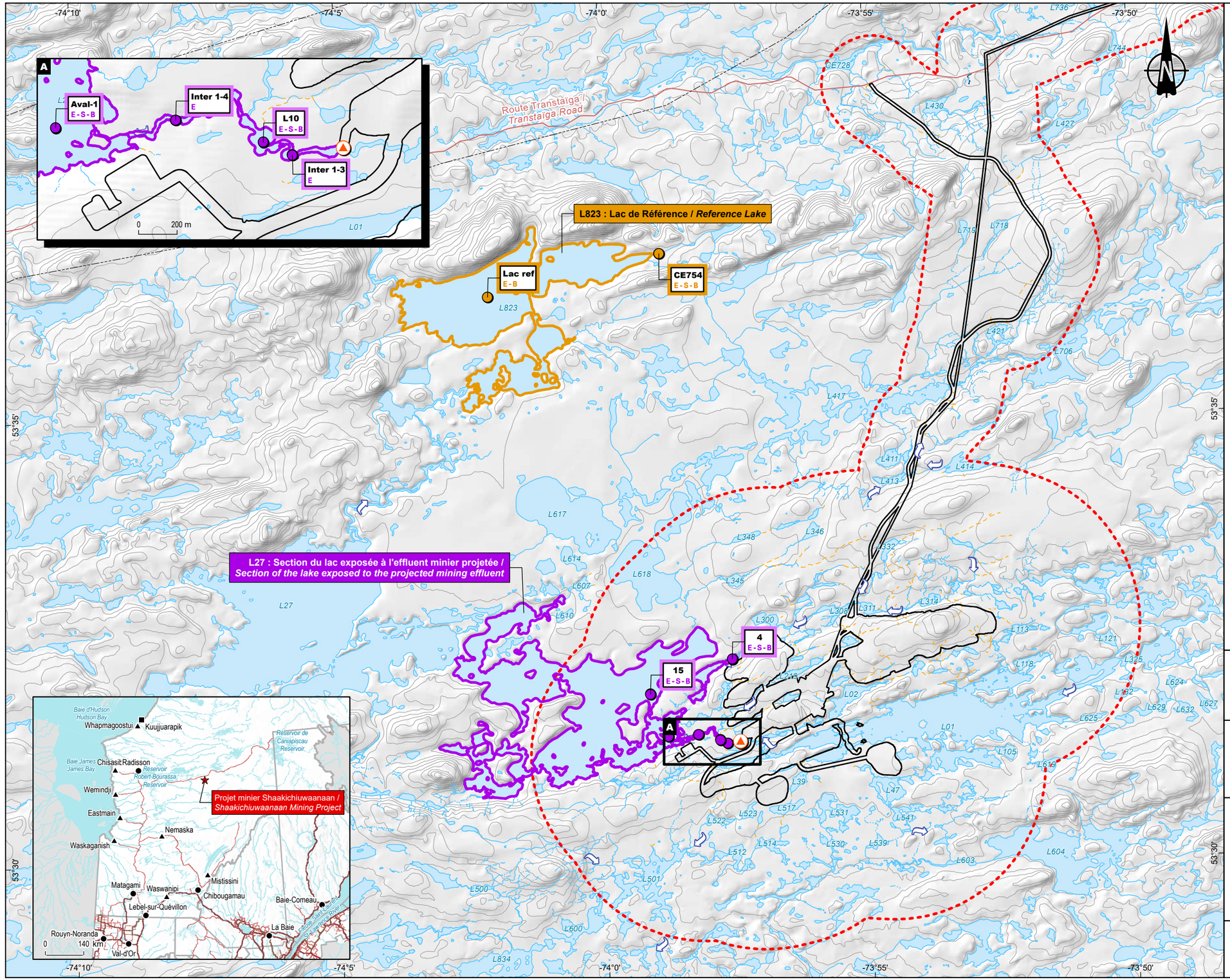
Table 13-5 Parameters considered for surface water monitoring under the MDMER

Parameters	Frequency
pH, hardness, alkalinity, conductivity, temperature, dissolved oxygen	Four times a year
Harmful substances referred to in Article 3 (As, Cu, total cyanide, Pb, Ni, Zn, TSS, Ra-226, un-ionized ammonia)	
Substances listed in paragraph 4(1) of Schedule 5 (Al, Cd, Cr, Co, Fe, Hg, Mn, Mo, Se, Tl, U, nitrate, chloride, sulphate, phosphorus)	

Monitoring conducted under the MDMER during exploration activities will continue through the post-restoration phase. Surface water sampling stations will be located at the sites designated for the project, specifically downstream of the mine effluent in watercourses CE11 and CE15 and Lakes L10 and L27, as well as in the reference lake and watercourse (Lake 823 and its tributary) (Map 13-2). Sampling and measurements will be conducted in accordance with the requirements of Directive 019 on the mining industry and the MDMER.

Standard precautions will be followed to prevent contamination during collection, handling, and transport of samples. Parameter tests will be carried out by a MELCCFP-accredited laboratory in accordance with the testing methods recognized by the MELCCFP. Strict quality control and quality assurance measures will be implemented for all sampling and testing activities.

The detection limits specified in the MDMER will be rigorously verified to ensure that all test results are compliant.



Zones d'étude / *Study Areas*

- Projet / *Project*
- Locale - Biophysique / *Local - Biophysical*

Composantes du projet projetées / *Projected Project Components*

- Effluent / *Effluent*

Stations de suivi / *Monitoring Stations*

Eau de surface, sédiment et benthos / *Surface Water, Sediment and Benthos*

- Exposée à l'effluent minier projetée / *Exposed to the projected mining effluent*
- Référence / *Reference*

Communautés de poisson / *Fish Communities*

- Exposée à l'effluent minier projetée / *Exposed to the projected mining effluent*
- Référence / *Reference*

Étiquette / *Label*

15
E-S-B

- Nom de la station / *Station name*
- Type d'échantillon/ *Sample type*

Code / *Code*	Échantillon / *Sample*
E	Eau de surface / *Surface water*
S	Sédiment / *Sediment*
B	Benthos / *Benthos*

Hydrographie / *Hydrography*

- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*

- Intermittent / *Intermitent*
- Permanent / *Permanent*
- Permanent partiellement souterrain / *Partially underground permanent*
- Intermittent partiellement souterrain / *Partially underground intermittent*
- Souterrain / *Underground*
- Sens d'écoulement de l'eau / *Waterflow direction*

Infrastructures / *Infrastructure*

- Ligne de transport d'énergie / *Electric power transmission line*
- Centrale hydroélectrique / *Hydroelectric generating station*

Réseau routier / *Road Network*

- Route collectrice municipale / *Municipal collector road*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 13-2 / *Map 13-2*

Stations de suivi de l'eau de surface, des sédiments, des communautés de poissons et de benthos / *Surface Water, Sediment, Fish and Benthos Monitoring Stations*

Sources :

CanVec, 1/250 000, RNCan, 2017
BDGA, 1M, MERN, 2014
Cartographie écologique de la végétation du Nord Québécois, MFFP, 2013
Synergis, État de référence du milieu aquatique pour le projet Shaakichiuwaanaan, 12-2025

0 800 1 600 m
NAD 1983 CSRS UTM Zone 18N

2026-03-27

Préparation / Preparation : I. Cartier
Dessin / Drawing : P. Boulay
Approbation / Approval : M.-H. Brisson
CA0001724_3318_eie_ch13_c2_260327.aprx
CA0001724_3318_eie_c13_02_122_suivi_benthos_260327

13.2.2.9 Sediments

Sediment monitoring will be conducted at the same locations and with the same frequency as the monitoring of surface water and benthic invertebrate communities (Map 13-2) to determine whether mine operations are affecting the quality of sediments in the receiving environments. The methodology to be applied is described in detail in Chapter 7 of the *Metal Mining Technical Guidance for Environmental Effects Monitoring* (Government of Canada, 2012). The sediment monitoring parameters at the project site are the following:

- total organic carbon, total phosphorus, humidity, total solids;
- sediment grain size distribution.

Since the choice of parameters to be measured in sediments varies from site to site and since the determination of total metal concentrations is not a requirement of the national Environmental Effects Monitoring (EEM) program, it is suggested that a baseline analysis be conducted by measuring, at a minimum, the same applicable parameters as those specified for surface water, namely:

- Al, As, Cd, Cl^- (chloride), CN^- (total cyanide), Co, Cr, Cu, Fe, Hg, Mn, Mo, NH_3 (partially), Ni, NO_3^-, P (phosphorus), Pb, Se, SO_4^{2-} (sulphate), Tl, U, Zn, Ra-226.

13.2.2.10 Hydrogeology and groundwater quality

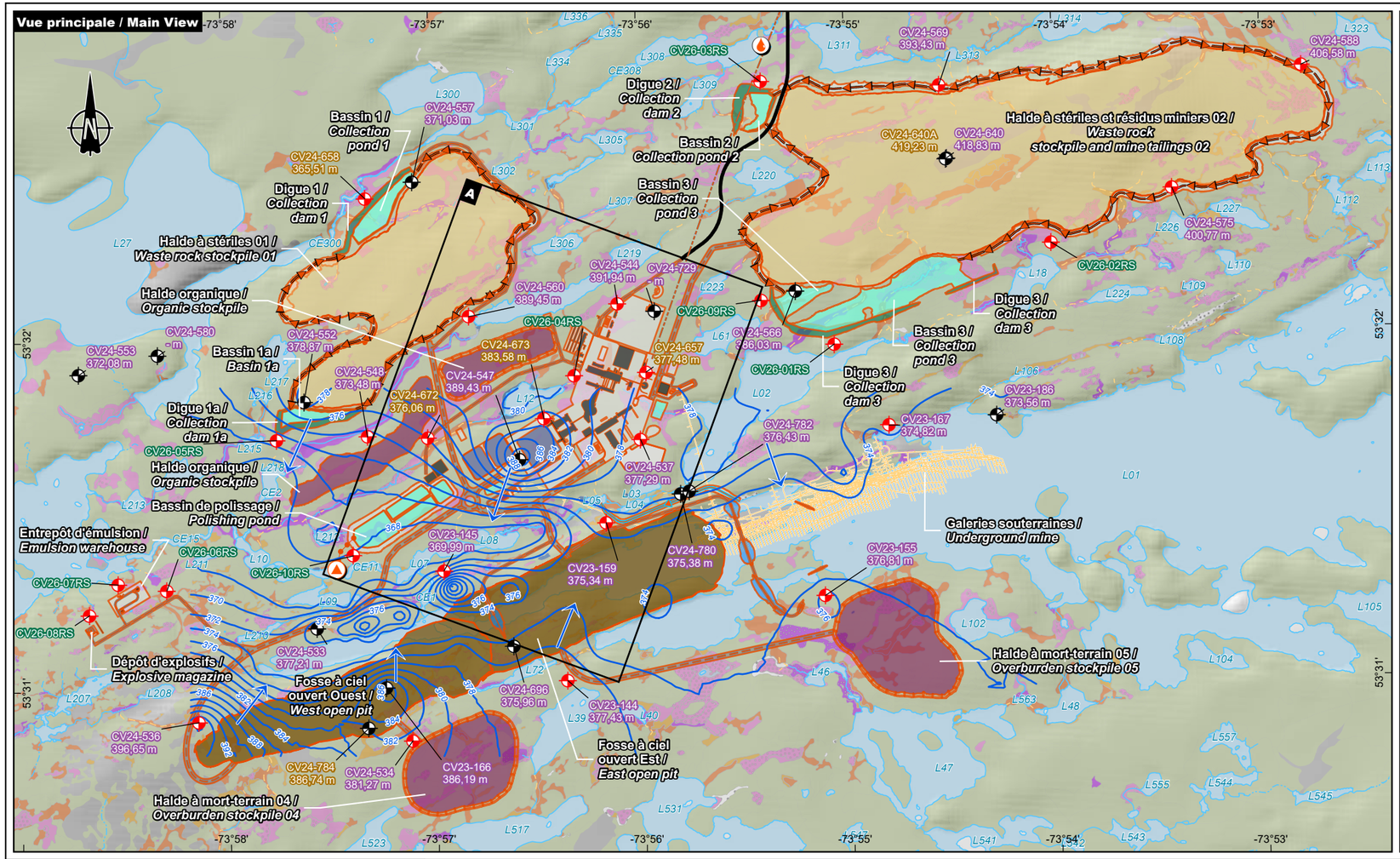
According to Directive 019 on the mining industry (MELCCFP, 2025b), a groundwater quality monitoring program, including piezometric monitoring, must be set up near any high-risk facility such as a process plant, a tailings storage area, a petroleum or chemical storage area, etc. The monitoring thus verifies the potential for significant degradation of groundwater quality during mining operations. This follow-up will continue through the post-restoration period.

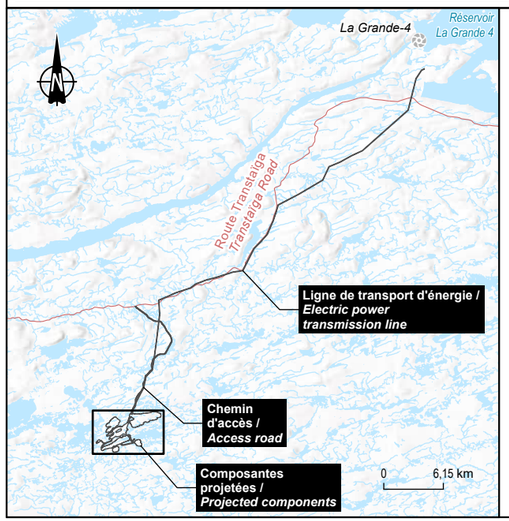
Monitoring water levels

Piezometric monitoring will be conducted at locations where observation wells are installed to monitor groundwater quality (Map 13-3). In accordance with Directive 019 on the mining industry (MELCCFP, 2025b), measurements must be taken at least twice a year—in the spring and summer—to account for periods of high and low water flow.

The general procedure will consist of:

- identifying the observation well;
- taking GPS coordinates (if previously surveyed);
- measuring the height of the casing in relation to the ground;
- measuring water elevation (static level) relative to the casing prior to sampling;
- sampling groundwater.





Zone d'étude / *Study Area*

- Projet / *Project*

Composantes du projet / *Project Components*

Existante / *Existing*

- Chemin d'accès / *Access road*

Projetées / *Projected*

- Effluent minier / *Mining effluent*
- Prise d'eau / *Water intake*
- Barrage / *Dam*
- Canal / *Channel*
- Canal de dérivation / *Diversion Channel*
- Chemin secondaire / *Secondary road*
- Fossé / *Ditch*
- Galerie souterraine / *Underground mine*
- Ligne de transport d'énergie / *Power transmission line*
- Aire d'entreposage du minerai mixte / *Mixed ore stockpile*
- Autre / *Other*
- Bâtiment ou équipement / *Building or equipment*
- Digue / *Dam*
- Bassin / *Basin*
- Digue des bassins / *Basins dam*
- Fosse / *Pit*
- Halde à mort-terrain et organique / *Overburden stockpile*
- Halde à stériles et/ou résidus / *Waste rock and/or tailings stockpile*
- Portail d'accès à la mine souterraine / *Underground mine portal*
- Voie de circulation / *Roadway*

Piézométrie / *Piezometry*

- Courbe piézométrique (m) / *Piezometric level curve (m)*
- Direction d'écoulement / *Flow direction*

Composantes du projet / *Project Components*

- Puits d'observation / *Observation well*
- Puits d'observation proposé pour le suivi / *Proposed observation well for monitoring*
- CV24-536 396,65 m — Nom de la station / *Station name*; Élévation du niveau d'eau / *Water level elevation*; Couleur / *Color*; Unité hydrostratigraphique / *Dydrostratigraphic unit*
- CV24-536 — Roc / *Rock*
- CV24-536 — Dépôt meuble/ *Unconsolidated deposit*
- CV26-01RS — Roc et dépôt meuble / *Rock and unconsolidated deposit*

Composantes de l'écosystème / *Ecosystem Components*

- Milieux terrestres / *Terrestrial Environments*

Cours d'eau / *Watercourses*

- Intermittent / *Intermitent*
- Permanent / *Permanent*
- Souterrain / *Underground*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*

- Plan d'eau / *Waterbody*
- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière minérotrophe ouverte / *Open fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 13-3 / *Map 13-3*
Réseau de surveillance des eaux souterraines / *Groundwater Monitoring System*

Sources / Sources

SDA, 1/20 000, MERN, 2024-02
CanVec+, 1/50 000, RNCan, 2014
CanVec, 1/250 000, RNCan, 2017
BDGA, 1/1 000 000, MRN Québec, 2014
BDGA, 1/1 000 000, MRN Québec, 2002
AQréseau+, réseau routier, MERN, 2024-03-01
G Services Miniers, Composantes projetées, CASN-A-001-GE-SKE-0005-A, 2025

0 260 520 m
UTM, fuseau 18, NAD83 (CSRS)

2026-03-27

Préparation / Prepared by : A. Hamel
Dessin / Drawn by : M. Dupraz
Approbation / Approved by : M-H. Brisson
CA0001724_3318_eie_ch13_c3_260317.aprx
CA0001724_3318_eie_c13_03_154_souterrains_260327

La précision des limites et les mesures montrées sur ce document ne doivent pas servir à des fins d'ingénierie ou de délimitation foncière. Aucune analyse foncière n'a été effectuée par un arpenteur-géomètre. /
Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.

Groundwater quality follow-up

Groundwater sampling will be conducted using recognized standard methods at the stations shown on Map 13-2. During sampling, the following parameters will be measured: pH, electrical conductivity, dissolved oxygen, oxydo-reduction potential (ORP), and temperature. Procedures are described in the *Sampling Guide for Environmental Analysis: Booklet 3 – Groundwater Sampling* (MDDEP, 2011). Well-water is usually sampled using dedicated systems in each well to limit the risk of cross-contamination.

The parameters to be tested are those specified in Table 3.1 of Section 3.1.1 of Directive 019 on the mining industry (MELCCFP, 2025b), with the exception of total suspended solids, as well as major ions (Ca^{+2}, HCO^{3-}, K^{+}, Mg^{+2}, Na^{+}, Cl, $SO4^{-2}$), phosphorus, pH, and electrical conductivity. For groundwater, however, dissolved metals will be measured (rather than extractable metals). Depending on the type of ore, process, or tailings, additional parameters may be included in the groundwater quality monitoring requirements specified in authorizations issued by government authorities. Analytical parameters will therefore include the following:

- petroleum hydrocarbons C_{10}-C_{50};
- major ions (bicarbonates, calcium, chlorides, magnesium, potassium, sodium, and sulphates);
- dissolved metals (antimony, silver, arsenic, barium, boron, cadmium, cobalt, copper, iron, manganese, total chromium, mercury, molybdenum, lithium, nickel, lead, selenium, uranium, zinc);
- nitrites, nitrates, ammoniacal nitrogen;
- sulphides, total phosphorus;
- pH, electrical conductivity;
- radium 226.

To confirm the validity of the methods used to measure the various parameters, a quality control program will be implemented. Replicate samples will be taken during monitoring, corresponding to at least 10% of the samples taken. These samples will be sent to the laboratory for testing and to check that their results match those of the original samples. Field blanks and travel blanks are also taken during each campaign and sent to the laboratory.

The results of the chemical tests will be compared to the Resurgence in Surface Water Criteria (RSW) outlined in the *Guide d'intervention – Protection des sols et réhabilitation des terrains contaminés* ["Response guide – Soil protection and contaminated site remediation"] (Beaulieu, 2021). In addition, RES criteria for metals will be adjusted according to a hardness that is representative of the water in the surrounding environment. If required, recommendations regarding corrective actions or modifications to the groundwater monitoring program will be provided.

In accordance with the requirements of Section 3.10 of Directive 019 on the mining industry (MELCCFP, 2025b) and Section 31.51 of the EQA, PMET will conduct a characterization of the mine site prior to carrying out restoration work to identify and limit the release of contaminants and, ultimately, to adjust the work to be performed as necessary.

13.2.3 Biological environment

13.2.3.1 Vegetation and wetlands

Revegetation of affected areas

The proposed restoration work at the site includes revegetation of all areas affected by mining activities, in accordance with the *Guide de préparation du plan de réaménagement et de restauration des sites miniers au Québec* [“Guide for the preparation of mine site reclamation and restoration plans in Quebec”] (MRNF, 2024).. To ensure that the species planted are appropriate, that they grow well, and that the site’s future use is taken into account, the site restoration will be planned in collaboration with the Cree tallyman.

Post-revegetation monitoring during the post-restoration period will be conducted for a minimum of five years in the form of annual inspections and for a period of fifteen years in the form of triennial inspections. Inspections will primarily consist of a visual assessment of various parameters, including plant condition, surface area showing vegetation establishment, soil erosion, among others. Following each site inspection, a report will be submitted annually to the MRNF for a period of five years. After this period, if applicable, a request to discontinue this monitoring will be submitted to the MRNF.

13.2.3.2 Ichthyofauna

Biological follow-up is required under the EEM program (Government of Canada, 2012), a requirement of the MDMER. This follow-up program involves developing a study plan, followed by the sampling and testing of sentinel fish populations in areas exposed to mine effluent and in a reference area. Effluent toxicity tests are also required.

Before conducting the biological follow-up, a study plan must be submitted to and approved by Environment and Climate Change Canada (ECCC) at least six months before fieldwork begins. Its purpose is to describe the procedure for the biological monitoring study. The study plan must include information relevant to site characterization, sampling methods and time frames, testing methods, and the quality assurance and quality control measures that will be implemented to validate the study in question, as well as a summary of information from previous biological studies. Once the study plan has been approved, biological monitoring can begin. For the project site, biological monitoring includes the following:

- monitoring of sentinel fish populations;
- monitoring of benthic invertebrate communities;
- monitoring of environmental support variables and sediment quality.

Monitoring will be conducted on two fish populations to determine whether the mine effluent has an impact on the ichthyofauna. The water bodies studied will be Lake L823 (reference water body) and Lake L27 (exposed water body) (Figure 13-2). Two sentinel species will be proposed for the project, including the northern pike. The second species will be identified when the study plan is submitted to federal authorities. Monitoring these populations will help determine whether there are differences in their growth, reproduction, survival, and condition, and will allow for the monitoring of mercury concentrations in fish tissues, as needed (an indicator of the fish's suitability for consumption). Samples will be collected from the exposed area of Lake L27 and the unexposed reference area of Lake L823 to statistically compare any significant differences in the following parameters:

- age (survival);
- height by age (body weight by age);
- relative gonadal weight (gonadal weight relative to body weight, energy use, and reproduction);
- condition (body weight relative to body length, energy storage, and fitness);
- relative liver weight (liver weight relative to body weight, energy storage, and condition).

No specific monitoring has been implemented for lake sturgeon, given the absence of this species within the local study area.

13.2.3.3 Benthos

In accordance with regulatory requirements, mining companies must conduct a study of benthic invertebrate communities to assess the potential impact of their effluents on fish habitat. For this purpose, samples of benthic invertebrates will be collected in the same areas as those selected for monitoring surface water and sediments (Map 13-2). The assessment of the potential effects of the effluent on benthic communities will be based on an analysis of the following community descriptors:

- total invertebrate density;
- richness (number of taxa);
- evenness.

Sampling will be conducted during the mine's operations phase, beginning no sooner than one month after the mine has reached a regular and stable operating regime. Sampling will take place between September and October, a period when the diversity of benthic invertebrate communities in watercourses is at its highest. Periodic follow-up of benthic invertebrate communities is recommended and will continue as long as the mine effluent remains subject to the requirements of the Metal and Diamond Mining Effluent Regulations (MDMER).

13.2.3.4 Herpetofauna

No monitoring of herpetofauna is currently planned, apart from the monitoring of the mitigation measures presented in Appendix 8-2.

13.2.3.5 Avian fauna

The bird follow-up program aims to identify and document any changes in the environment (whether or not related to the Project) compared to the reference state established between 2023 and 2025. It will also be used to verify the accuracy of the impact assessment and to assess the effectiveness of the mitigation measures outlined in the EIA.

Monitoring frequency

A bird inventory will be conducted during the first year of construction and the first year of operations. Depending on the results obtained during these initial years of monitoring, the program may continue every five years thereafter, until the post-restoration period.

Migratory birds

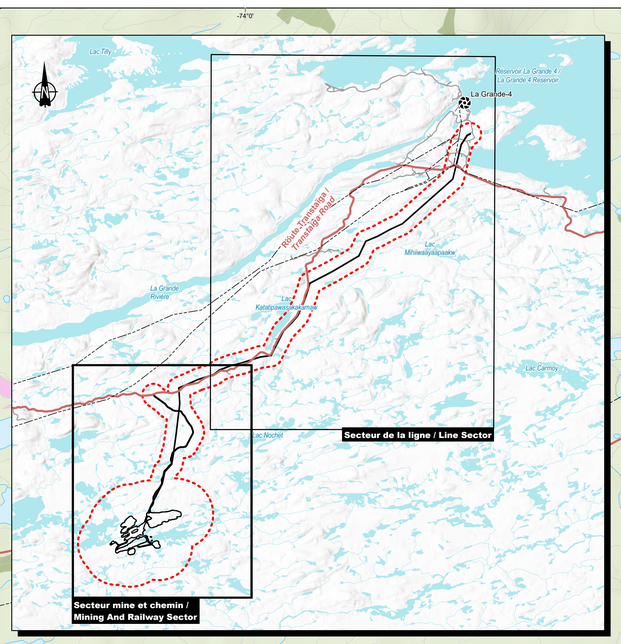
Bird monitoring includes carrying out inventories of migratory birds, particularly forest-dwelling and wetland-associated birds. The methods selected are primarily designed to detect species of special status, but they also serve to identify all species present in the local study area. Daily surveys by point counts.

Sampling plan

The sampling plan was designed to ensure representative coverage of the various habitats frequented by forest and wetland-associated land birds. Habitats found within the biophysical local study area include softwood, mixedwood, hardwood, and regenerating forests; lichen tundra; scrublands; closed and open wetlands; bare ground; boulder fields; and anthropogenic environments. As shown in Map 13-4, 60 daytime listening stations were set up in the biophysical LSA. Table 13-6 lists the listening stations that will be included in this biological monitoring program. To ensure that the data collected is independent, all stations are located at least 300 metres apart. The stations were located within one kilometre or less of the LSA and do not include the northeast sector of the power line, as no surveys were conducted there between 2023 and 2025. Should new surveys be carried out in this sector, additional listening stations could be added to enable comparative monitoring.

The listening stations selected are primarily from inventories conducted between 2023 and 2025. Some stations were relocated or added to better target a diversity of habitats and to cover all areas surrounding the mine infrastructure. In addition to areas targeting diurnal species with special status. (33 stations), additional stations were also included to ensure a balanced representation of the main habitats used by migratory birds in the study area (27 stations). The data collected during the baseline studies will also be used for comparison purposes.

It should be noted that the number and location of listening stations may be revised during the construction and operations phases depending on changes in habitats and available access.



Route Transtaïga / Transtaiga Road

HIRI-01 ENAM-01 HIMA-02 HIMA-03 PE-01 HIRI-02 ENAM-02 PE-02 HIRI-03 HIRI-04 HIRI-05 ENAM-04 PE-03 PE-04 PE-05 PE-06 PE-07 ENAM-04 PE-08 PE-09 PE-10 ENAM-05 HIRI-06 ENAM-06 HIRI-07 ENAM-07 HIRI-08 PE-11 HIRI-09 PE-12 PE-13 PE-14 PE-15 PE-16 PE-17 PE-18 ENAM-14 PE-19 PE-20 PE-21 PE-22 PE-23 PE-24 PE-25 PE-26 PE-27 PE-28 HIRI-10 PE-29 ENAM-08 PE-30 PE-31 PE-32 PE-33 PE-34 PE-35 ENAM-09 ENAM-10 PE-36 PE-38 PE-39 PE-37 PE-40 PE-41 PE-42 HIRI-11 PE-43 PE-44 PE-45 ENAM-11 PE-46 ENAM-12 PE-47 PE-49 PE-48 PE-51 PE-50 ENAM-13 PE-53 PE-52 PE-56 PE-55 PE-54 PE-57 PE-58 PE-60 PE-59 HIMA-04

Lac Nochet

-74°0' -73°54' -75°48' 53°36'

Zones d'étude / *Study Areas*
- Projet / *Project*
- Biophysique - Locale / *Biophysical - Local*

Infrastructures / *Infrastructure*
- Centrale / *Power plant*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*
- Route collectrice municipale / *Municipal collector road*

Station d'inventaire / *Inventory Station*

Types d'inventaire / *Inventory Types*
- Engoulevent d'Amérique / *Common nighthawk*
- Hibou des marais / *Short-eared owl*
- Hirondelle de rivage / *Bank swallow*
- Point d'écoute / *Listening station*

Composantes de l'écosystème / *Ecosystem Components*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*
- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière minérotrophe ouverte / *Open fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*
- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*
- Intermittent / *Intermitent*
- Permanent / *Permanent*
- Permanent partiellement souterrain / *Partially underground permanent*
- Souterrain / *Underground*

Milieux terrestres / *Terrestrial Environments*
- Feuillu / *Deciduous*
- Mixte / *Mixed-wood*
- Résineux / *Softwood*
- Arbustaie / *Scrubland*
- Lande à lichens / *Lichen tundra*
- Régénération / *Regeneration*

Autres milieux / *Other Environments*
- Anthropique / *Anthropogenic*
- Champ de blocs / *Boulder field*
- Île / *Island*
- Surface dénudée / *Dry barren*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*
Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 13-4a / *Map 13-4a*
Plan d'inventaire de la faune aviaire / *Avian Fauna Inventory Plan*

Sources / Sources
ADIréseau+, réseau routier, MERN, 2016
BDOA, TM, MERN, 2014.
CanVec, 250k,RNCan, 2017

0 190 380 m
UTM, fuseau 18, NAD83 (CSRS)

2026-03-24

Préparation / Prepared by : C. Villeneuve
Dessin / Drawn by : P. Boulay
Approbation / Approved by : É. D'Astous
CA0001724_3318_ele_c13_04_260309.aprx
CA0001724_3318_ele_c13_04_GF_128_avifaune_260324_A0

wsp

La précision des limites et les mesures montrées sur ce document ne doivent pas servir à des fins d'ingénierie ou de délimitation foncière. Aucune analyse foncière n'a été effectuée par un arpenteur-géomètre. /
Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.

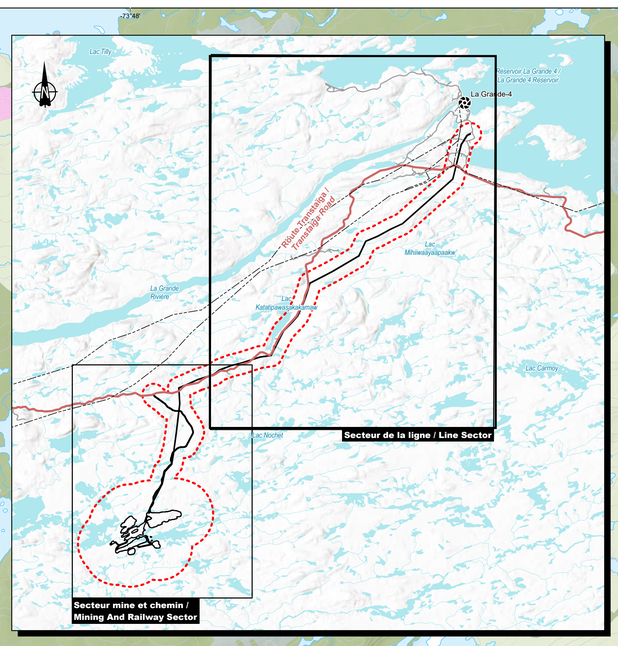
-73°48'
-73°42'
-73°36'
-73°30'
53°54'
53°48'
53°42'

Réservoir
La Grande 4

Lac Nochet

Route Transtaïga /
Transtaiga Road

L781
L780
L762
L822
L804
L805
L793
L792
L796
L771
L769
L768
L767
L766
L765
L764
L761
L760
L757
L756
L754
L753
L752
L751
L749
L748
L747
L746
L745
L744
L743
L742
L728
L830
L831
L832
L833
L834
L835
L836
L837
L838
L839
L840
L841
L842
L843
L844
L845
L846
L847
L848
L849
L850
L851
L852
L853
L854
L855
L856
L857
L858
L859
L860
L861
L862
L863
L864
L865
L866
L867
L868
L869
L870
L871
L872
L873
L874
L875
L876
L877
L878
L879
L880
L881
L882
L883
L884
L885
L886
L887
L888
L889
L890
L891
L892
L893
L894
L895
L896
L897
L898
L899
L900
L901
L902
L903
L904
L905
L906
L907
L908
L909
L910
L911
L912
L913
L914
L915
L916
L917
L918
L919
L920
L921



Zones d'étude / *Study Areas*
- Projet / *Project*
- Biophysique - Locale / *Biophysical - Local*

Infrastructures / *Infrastructure*
- Centrale / *Power plant*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*
- Route collectrice municipale / *Municipal collector road*
- Autre / *Other*

Station d'inventaire / *Inventory Station*

Types d'inventaire / *Inventory Types*
- Hibou des marais / *Short-eared owl*

Composantes de l'écosystème / *Ecosystem Components*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*
- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière minérotrophe ouverte / *Open fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*
- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*
- Intermittent / *Intermittent*
- Permanent / *Permanent*
- Permanent souterrain / *Underground permanent*
- Souterrain / *Underground*

Milieux terrestres / *Terrestrial Environments*
- Mixte / *Mixed-wood*
- Résineux / *Softwood*
- Arbustaie / *Scrubland*
- Lande à lichens / *Lichen tundra*
- Régénération / *Regeneration*

Autres milieux / *Other Environments*
- Anthropique / *Anthropogenic*
- Champ de blocs / *Boulder field*
- Île / *Island*
- Ligne de transport d'énergie / *Electric power transmission line*
- Surface dénudée / *Dry barren*

Projet minier Shaakichiuwaanaan /
Shaakichiuwaanaan Mining Project
Étude d'impact sur l'environnement /
Environmental Impact Assessment

Carte 13-4b / *Map 13-4b*
Plan d'inventaire de la faune aviaire / *Avian Fauna Inventory Plan*

Sources / Sources
ADIréseaux, réseau routier, MERN, 2016
BDGA, 1M, MERN, 2014
CanVec, 250k,RNCan, 2017

0 310 620 m
UTM, fuseau 18, NAD83 (CSRS)

2026-03-24

Préparation / Prepared by : C. Villeneuve
Dessin / Drawn by : P. Boulay
Approbation / Approved by : É. D'Astous
CA0001724_3318_ele_c13_04_260309.aprx
CA0001724_3318_ele_c13_04_GF_128_avifaune_260324_A0

wsp

La précision des limites et les mesures montrées sur ce document ne doivent pas servir à des fins d'ingénierie ou de délimitation foncière. Aucune analyse foncière n'a été effectuée par un arpenteur-géomètre. /
Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.

Table 13-6 List of stations where avian fauna are monitored

Type of inventory	Target species	Station	Habitat	Geographic coordinates	
				Latitude	Longitude
Nightawk observation point	Common Nightawk	ENAM-01	Anthropogenic	53,64396	-73,911152
Nightawk observation point	Common Nightawk	ENAM-02	Regenaration	53,638201	-73,897659
Nightawk observation point	Common Nightawk	ENAM-04	Regenaration	53,618424	-73,860826
Nightawk observation point	Common Nightawk	ENAM-04	Regenaration	53,630248	-73,874508
Nightawk observation point	Common Nightawk	ENAM-05	Regenaration	53,598828	-73,883474
Nightawk observation point	Common Nightawk	ENAM-06	Regenaration	53,593076	-73,889444
Nightawk observation point	Common Nightawk	ENAM-07	Regenaration	53,580618	-73,89987
Nightawk observation point	Common Nightawk	ENAM-08	Regenaration	53,549067	-73,916508
Nightawk observation point	Common Nightawk	ENAM-09	Regenaration	53,545496	-73,877239
Nightawk observation point	Common Nightawk	ENAM-10	Regenaration	53,541893	-73,952202
Nightawk observation point	Common Nightawk	ENAM-11	Regenaration	53,51831	-73,977165
Nightawk observation point	Common Nightawk	ENAM-12	Regenaration	53,517642	-73,906973
Nightawk observation point	Common Nightawk	ENAM-13	Regenaration	53,51018	-73,951775
Nightawk observation point	Common Nightawk	ENAM-14	Regenaration	53,561504	-73,913889
Short-eared owl observation point	Short-eared owl	HIMA-01	Shrub swamp	53,757028	-73,625651
Short-eared owl observation point	Short-eared owl	HIMA-02	Regenaration	53,643983	-73,887569
Short-eared owl observation point	Short-eared owl	HIMA-03	Coniferous	53,64084	-73,899726
Short-eared owl observation point	Short-eared owl	HIMA-04	Open ombrotrophic bog	53,504326	-73,959627
Bank swallow observation point	Bank swallow	HIRI-01	Roadside	53,645153	-73,913803
Bank swallow observation point	Bank swallow	HIRI-02	Quarry	53,64099	-73,904506
Bank swallow observation point	Bank swallow	HIRI-03	Quarry	53,636408	-73,895329

Type of inventory	Target species	Station	Habitat	Geographic coordinates	
				Latitude	Longitude
Bank swallow observation point	Bank swallow	HIRI-04	Roadside	53,632848	-73,889538
Bank swallow observation point	Bank swallow	HIRI-05	Roadside	53,632454	-73,877985
Bank swallow observation point	Bank swallow	HIRI-06	Quarry	53,593303	-73,890317
Bank swallow observation point	Bank swallow	HIRI-07	Quarry	53,591306	-73,888465
Bank swallow observation point	Bank swallow	HIRI-08	Quarry	53,580279	-73,900549
Bank swallow observation point	Bank swallow	HIRI-09	Roadside	53,57262	-73,903912
Bank swallow observation point	Bank swallow	HIRI-10	Quarry	53,549263	-73,915052
Bank swallow observation point	Bank swallow	HIRI-11	Quarry	53,527411	-73,934963
Listening point	Rusty Blackbird Lesser yellowlegs	PE-01	Open ombrotrophic bog	53,641052	-73,899067
Listening point	Olive-sided Flycatcher	PE-02	Regenaration	53,638464	-73,897119
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-03	Open ombrotrophic bog	53,629975	-73,87257
Listening point	Migratory birds	PE-04	Regenaration	53,629806	-73,877084
Listening point	Rusty Blackbird Lesser Yellowlegs; Olive-sided Flycatcher	PE-05	Open ombrotrophic bog	53,624361	-73,869866
Listening point	Migratory birds	PE-06	Scrubland	53,62118	-73,868415
Listening point	Olive-sided Flycatcher	PE-07	Open ombrotrophic bog	53,618451	-73,866558
Listening point	Olive-sided Flycatcher	PE-08	Open ombrotrophic bog	53,615756	-73,865475
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-09	Open ombrotrophic bog	53,606954	-73,881171
Listening point	Olive-sided Flycatcher	PE-10	Open ombrotrophic bog	53,604006	-73,880579
Listening point	Migratory birds	PE-11	Coniferous	53,573785	-73,898246
Listening point	Migratory birds	PE-12	Coniferous	53,569338	-73,906171
Listening point	Migratory birds	PE-13	Lichen tundra	53,566963	-73,896946
Listening point	Migratory birds	PE-14	Regenaration	53,565432	-73,924325
Listening point	Migratory birds	PE-15	Coniferous	53,563627	-73,892888
Listening point	Migratory birds	PE-16	Coniferous	53,562842	-73,898017
Listening point	Rusty Blackbird Lesser Yellowlegsr	PE-17	Open ombrotrophic bog	53,562577	-73,924291
Listening point	Migratory birds	PE-18	Regenaration	53,562173	-73,930302
Listening point	Migratory birds	PE-19	Regenaration	53,560095	-73,902261
Listening point	Olive-sided Flycatcher	PE-20	Treed swamp	53,557185	-73,908388

Type of inventory	Target species	Station	Habitat	Geographic coordinates	
				Latitude	Longitude
Listening point	Migratory birds	PE-21	Regenaration	53,557017	-73,913392
Listening point	Rusty Blackbird Lesser Yellowlegsr	PE-22	Marsh	53,553249	-73,911725
Listening point	Migratory birds	PE-23	Regenaration	53,552348	-73,878847
Listening point	Olive-sided Flycatcher	PE-24	Open ombrotrophic bog	53,551818	-73,884441
Listening point	Rusty Blackbird Lesser Yellowlegsr	PE-25	Open ombrotrophic bog	53,550673	-73,905674
Listening point	Olive-sided Flycatcher	PE-26	Coniferous	53,550116	-73,91834
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-27	Open ombrotrophic bog	53,549973	-73,873706
Listening point	Olive-sided Flycatcher	PE-28	Regenaration	53,549729	-73,928197
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-29	Open ombrotrophic bog	53,549226	-73,879571
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-30	Treed swamp	53,548271	-73,923747
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-31	Open ombrotrophic bog	53,546892	-73,90171
Listening point	Migratory birds	PE-32	Coniferous	53,546464	-73,91992
Listening point	Migratory birds	PE-33	Regenaration	53,546002	-73,906207
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-34	Treed swamp	53,545955	-73,875441
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-35	Treed swamp	53,545955	-73,875441
Listening point	Migratory birds	PE-36	Lichen tundra	53,541966	-73,944313
Listening point	Olive-sided Flycatcher	PE-37	Coniferous	53,537171	-73,901505
Listening point	Migratory birds	PE-38	Coniferous	53,536811	-73,932387
Listening point	Olive-sided Flycatcher	PE-39	Coniferous	53,536638	-73,926168
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-40	Treed swamp	53,53487	-73,904527
Listening point	Olive-sided Flycatcher	PE-41	Regenaration	53,530112	-73,96589
Listening point	Migratory birds	PE-42	Open ombrotrophic bog	53,528192	-73,959259
Listening point	Olive-sided Flycatcher	PE-43	Regenaration	53,523318	-73,960999
Listening point	Olive-sided Flycatcher	PE-44	Regenaration	53,520426	-73,953291
Listening point	Migratory birds	PE-45	Coniferous	53,520365	-73,908825
Listening point	Migratory birds	PE-46	Lichen Tundra	53,517829	-73,969218
Listening point	Migratory birds	PE-47	Coniferous	53,515896	-73,906639
Listening point	Migratory birds	PE-48	Regeneration	53,511486	-73,957231
Listening point	Migratory birds	PE-49	Lichen Tundra	53,511446	-73,97491
Listening point	Migratory birds	PE-50	Lichen Tundra	53,511307	-73,969394
Listening point	Rusty Blackbird Lesser Yellowlegsr	PE-51	Open ombrotrophic bog	53,510592	-73,983239

Type of inventory	Target species	Station	Habitat	Geographic coordinates	
				Latitude	Longitude
Listening point	Olive-sided Flycatcher	PE-52	Coniferous	53,510388	-73,907376
Listening point	Migratory birds	PE-53	Regeneration	53,510225	-73,914518
Listening point	Rusty Blackbird Lesser Yellowlegsr	PE-54	Open ombrotrophic bog	53,508995	-73,952762
Listening point	Rusty Blackbird Lesser Yellowlegsr	PE-55	Open ombrotrophic bog	53,508995	-73,952762
Listening point	Migratory birds	PE-56	Lichen Tundra	53,508224	-73,977146
Listening point	Migratory birds	PE-57	Regeneration	53,507513	-73,913265
Listening point	Rusty Blackbird Lesser Yellowlegsr	PE-58	Open ombrotrophic bog	53,506748	-73,908559
Listening point	Olive-sided Flycatcher	PE-59	Regeneration	53,506513	-73,955951
Listening point	Migratory birds	PE-60	Lichen Tundra	53,506293	-73,963266

Follow-up period

For migratory birds, one point count survey is scheduled per follow-up year, between June 11 and July 13. In fact, according to the nesting calendar query tool for the ecoregions covering the study area, the nesting period for most forest-dwelling and wetland-associated land birds falls within these dates (Birds Canada, 2026). This approach will not pose a significant challenge in interpreting the results for early- and late-breeding species, given that the breeding season is relatively short at this latitude.

During the inventories, birds will be recorded for 10 minutes at each station, starting half an hour before sunrise and continuing until approximately 5 hours afterward, on days when weather conditions are optimal—that is, with no rain and little or no wind. The distance between the individuals detected and the observer will also be recorded in three categories: between 0 m and 50 m, between 50 m and 100 m, or more than 100 m. In addition, at the end of each listening period, song playback will be used to increase the probability of detecting the target species.

Methodology

For migratory birds, the daytime survey approach using point counts will be used (Environment Canada, 1997) to obtain quantitative data on the densities of breeding pairs of the target species (Blondel et al., 1981; Bibby et al., 1992; Ralph et al., 1995).

While travelling between stations, sightings of new species, rare species, or at-risk species will also be recorded. Any recorded entries of species of special status will be georeferenced. Special attention will also be paid to bird behaviour to determine their breeding status according to the codes of the Quebec Breeding Bird Atlas (AONQ, 2026).

The data collected will be analyzed to determine the number of indicated pairs per hectare (IP/ha)—a measure of density—for the target species and other species inventoried in their habitat and across the study area, with a view to comparing data across different monitoring years. Abundance (number of IP per listening station) will also be analyzed.

Applicable criteria

Density (number of pairs per hectare) and abundance (total number of pairs) are the quantitative parameters that will be used to assess the extent of changes relative to the reference state. Birds Canada's population trends will also be compared with the results obtained (ECCC, 2025).

Follow-up report

For each station used for the inventory, the following information will be recorded on a field data sheet:

- the number of the point count location;
- the date and time of the visit;
- the name(s) of the observer(s);
- weather conditions;
- any other relevant information.

In addition, for each individual observed, the following information will be recorded:

- the species;
- the number of individuals;
- sex (male, female, or undetermined);
- age group (adult, immature, or juvenile);
- behaviour (singing, flying, calling, etc.);
- the distance(s) from the observer.

The results of these follow-ups will be forwarded to the relevant authorities.

Species of special status

Species of special status that are likely to nest in the biophysical local study area are the focus of this follow-up program.

Six species of special status could be affected by the Project during the nesting season: the common nighthawk (*Chordeiles minor*), the short-eared owl (*Asio flammeus*), the bank swallow (*Riparia riparia*), the olive-sided flycatcher (*Contopus cooperi*), the lesser yellowlegs (*Tringa flavipes*), and the rusty blackbird (*Euphagus carolinus*).

This document also outlines the procedure to follow if bird nests are discovered.

Lastly, it should be noted that if an issue involving a bird species of special status were to arise during the follow-up, corrective measures would be proposed in the follow-up report and could be discussed with the relevant authorities.

Olive-sided flycatcher, rusty blackbird, and lesser yellowlegs

Sampling plan

The sampling plan for the olive-sided flycatcher, the rusty blackbird, and the lesser yellowlegs was developed based on the potential habitats of each species and the records from baseline studies. As shown in Figure 13-4, 60 daytime listening stations were set up in the biophysical LSA. Table 13-6 lists the listening stations that will be included in this biological monitoring program. To ensure that the data collected is independent, all stations are located at least 300 metres apart. The stations were located within one kilometre or less of the ZEP and do not include the northeast sector of the power line, as no surveys were conducted there between 2023 and 2025. Should new surveys be conducted in this sector, additional listening stations could be added to enable comparative monitoring.

The listening stations selected are primarily from inventories conducted between 2023 and 2025. Some stations were relocated or added to better target habitats of species with special status and to ensure coverage of all areas surrounding the mine infrastructure. In addition to stations targeting a variety of habitats for migratory birds (27 stations), areas where diurnal species of special concern were detected during the nesting season, as well as stations located within their potential habitat, were included (33 stations). The data collected during the baseline studies will also be used for comparison purposes.

It should be noted that the number and location of listening stations may be revised during the construction and operations phases depending on changes in habitats and available access.

Follow-up period

As with the monitoring of migratory birds, only one inventory per listening site is scheduled per monitoring year, between June 11 and July 13. Thus, the inventory period covers the entire nesting season of the species of special concern included in the follow-up program, including the olive-sided flycatcher, the rusty blackbird, and the lesser yellowlegs.

Methodology

For migratory birds, the daytime survey approach using point counts will be used (Environment Canada, 1997) to obtain quantitative data on the densities of breeding pairs of the target species (Blondel et al., 1981; Bibby et al., 1992; Ralph et al., 1995).

While travelling between stations, sightings of new species, rare species, or at-risk species will also be recorded. Any recorded entries of species of special status will be georeferenced. Special attention will also be paid to bird behaviour to determine their breeding status according to the codes of the Quebec Breeding Bird Atlas (AONQ, 2026).

The data collected will be analyzed to determine the number of indicated pairs per hectare (IP/ha)—a measure of density—for the target species and other species inventoried in their habitat and across the study area, with a view to comparing data across different monitoring years. Abundance (number of IPs per listening station) will also be analyzed.

Applicable criteria

Density (number of pairs per hectare) and abundance (total number of pairs) of the target species are the quantitative parameters that will be used to assess the extent of change relative to the reference state. Birds Canada's population trends will also be compared with the results obtained (ECCC, 2025).

Follow-up report

For each station used for the inventory, the following information will be recorded on a field data sheet:

- the number of the point count location;
- the date and time of the visit;
- the name(s) of the observer(s);
- weather conditions;
- any other relevant information.

In addition, for each individual observed, the following information will be recorded:

- the species;
- the number of individuals;
- sex (male, female, or undetermined);
- age group (adult, immature, or juvenile);
- behaviour (singing, flying, calling, etc.);
- the distance(s) from the observer.

The results of these follow-ups will be forwarded to the relevant authorities.

Common nighthawk

Sampling plan

The sampling plan was designed so that the inventory stations cover habitats potentially used by this species. The stations inventoried as part of the 2024 and 2025 baseline studies have been prioritized. These stations are located primarily along access roads, near open areas. As shown in Map 13-4, 14 twilight listening stations were set up in the biophysical LSA. Table 13-6 lists the listening stations that will be included in this biological monitoring program.

It should be noted that the number and location of listening stations may be adjusted during the construction and operations phases depending on changes in habitats and available access, particularly if new open habitats are created following clearing.

Monitoring period

In accordance with the Birds Canada protocol (2025), nighttime surveys will be conducted between June 15 and July 15 to monitor the common nighthawk. The point counts, each lasting six minutes per station, will begin no earlier than 30 minutes before sunset and will end at nightfall. The ideal inventory conditions are fair weather, little or no wind, and clear skies. It should be noted that, since inventories are conducted during daylight hours—that is, between 30 minutes before sunset and nightfall—they do not need to be conducted on a night when there is a full moon.

Methodology

Nighttime surveys will be conducted at listening stations in accordance with the Birds Canada protocol (2025) and its subsequent revisions. Inventories will thus be conducted in the species' potential habitat located on the periphery of the mine, as well as near infrastructure where the species might nest or forage.

Applicable criteria and quality control

The abundance of common nighthawk, estimated by the number of pairs, is the quantitative parameter that will be used to assess the extent of changes relative to the reference state. Bird population trends in Canada will also be compared with the results obtained (ECCC, 2025).

Monitoring report

Each observation will be recorded on a field data sheet containing the following information:

- the name(s) of the observer(s);
- the date and time of the site visit;
- the number of the observation point.

If one or more individuals were heard, these details will be listed:

- the species name;
- the number of individuals heard;
- the age group of the individuals (adult, immature, or juvenile);
- the time of listening;
- weather conditions;
- the type of detection (wingbeat, call, sighting, or undetected);
- any other relevant information.

The results of these follow-ups will be forwarded to the relevant authorities.

Short-eared owl

Sampling plan

The sampling plan was designed so that the inventory stations cover habitats potentially used by this species. As shown in Map 13-4, 4 observation stations were set up in the biophysical LSA. These stations are located primarily along access roads, near open areas. Table 13-6 lists the listening stations that will be included in this biological monitoring program.

It should be noted that the number and location of stations may be adjusted during the construction and operations phases depending on changes in habitats and available access points, particularly to ensure safe movement at night.

Monitoring period

Inventories are carried out on evenings when there is no rain or fog, and winds are light (≤ 20 km/h or ≤ 3 on the Beaufort scale). They range from 10 minutes to 100 minutes before civil twilight.

During inventory years, two field surveys are conducted in the summer: the first between May 1 and 25, followed by the second between June 5 and 30. If there is still snow on the ground, the first visit may be postponed until the ground is sufficiently clear. The second visit must take place at least 10 days after the first.

Methodology

The inventory method used for this species is based on the protocol developed by the Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP, 2025d).

Applicable criteria and quality control

The abundance of long-eared owl, estimated by the number of pairs, is the quantitative parameter that will be used to assess the extent of changes relative to the reference state. Bird population trends in Canada will also be compared with the results obtained (ECCC, 2025).

Follow-up report

The location of each short-eared owl (or any other bird of prey) heard or seen is marked on a map and recorded in the field data sheet, which will include the following information:

- the name(s) of the observer(s);
- the date and time of the visit;
- the number of the observation point;
- the weather conditions.

If one or more individuals are observed, the following details are recorded:

- species name;
- number of individuals observed;
- age group of the individuals (adult, immature, or juvenile);

- time of observation;
- behaviour (resting, hunting, intraspecific or interspecific aggression, courtship, copulation, and food transport);
- any other relevant information.

The results of these follow-ups will be forwarded to the relevant authorities.

Bank swallow

Sampling plan

The sampling plan was designed so that the inventory stations cover habitats potentially used by this species. As shown on Map 13-4, 11 observation stations have been set up in the biophysical LSA. These stations are specifically located in the species' potential habitats, near sites where individuals have been observed in the past. Table 13-6 lists the listening stations that will be included in this biological monitoring program.

It should be noted that the number and location of stations may be adjusted during the operations phase depending on changes in habitats and available access, particularly if new sites containing aggregates emerge during the construction and operations phases.

Follow-up period

Each year of the follow-up, a site visit will be conducted at the stations during the species' nesting season and the migratory bird inventory period, specifically from June 11 to July 13.

In addition, on-site staff will conduct bimonthly surveys of this species each year of operations, from late April through mid-August, at all designated quarries used for material extraction from the site and at existing colonies in the wild. Any chance sightings of nesting signs will also be recorded.

Methodology

The bank swallow typically nests on embankment walls with a gradient greater than 70° (Government of Canada, 2022b). This species is therefore likely to use the borrow pits in the LSA during the nesting season. Precautions are therefore being taken to reduce the likelihood of the bank swallow nesting in the project's borrow pits. These precautions are described in the mitigation measures in Appendix 8-2.

Surveys are conducted using observation points (visual counts) to tally the number of nests and birds at various sites. Inventories and site visits are carried out by a qualified professional.

Applicable criteria

For bank swallows, the number of colonies, cavities, active nests, and individuals observed are the quantitative parameters that will be used to assess the extent of changes relative to the reference state. Bird population trends in Canada will also be compared with the results obtained (ECCC, 2025).

Follow-up report

For each station included in the inventory, the following information will be recorded on a field data sheet:

- the number of the observation point (borrow pit visited);
- the date and time of the visit;
- the name(s) of the observer(s);
- the weather conditions.

In addition, should the borrow pit be used by a colony of bank swallows, the following data will be recorded:

- the number of cavities observed;
- the condition of the cavities (e.g., destroyed cavity);
- the number of individuals observed;
- the behaviour of individuals (restlessness, flying, feeding, bringing food to the nests, etc.);
- the age group of the individuals (adult, immature, or juvenile);
- the time of observation;
- any other relevant information.

The results of these follow-ups will be forwarded to the relevant authorities.

Procedure to follow if nests are discovered

If a bird's nest is discovered during the **construction** phase, the proposed procedure consists of the following five steps:

- Step 1: Registering a nest;
- Step 2: Establishment of the protection zone;
- Step 3: Marking out the protection zone;
- Step 4: Monitoring of nests and construction work carried out in the vicinity;
- Step 5: Monitoring report.

Step 1: Registering a nest

When a nest is located, the species, location (GPS coordinates), habitat, and stage of development of the nest are recorded. Clearing and construction activities will then be reassessed to determine whether the work can be relocated, delayed, or modified so as not to impact the birds, their eggs, or the nest.

Step 2: Establishment of the protection zone

If activities cannot be relocated, postponed, or modified in a way that avoids impacting the birds, eggs, or nest, an appropriate protection zone (buffer zone) will be established and enforced on-site to protect the nest location. The boundaries of this protection zone will be determined by a qualified person, based on the species and habitat, as well as the type, intensity, and duration of the disturbance. The guidelines established by the Government of Canada (2023) to minimize disturbances to migratory birds will be followed.

Examples of protection zones are shown in Table 13-7. These distances are provided for reference only and will be adjusted based on various factors, such as the birds' prior exposure to disturbances, the intensity of the disturbance, and the type of habitat.

Table 13-7 Recommended buffer zones around bird nests

Species	Protection zone (m)
Sandhill crane	100 m to 1,000 m
Birds of prey – active	1,000 m
Birds of prey – inactive	50 m to 1,000 m (depending on the level of disturbance)
Species of special status	Up to 100 m
Water birds and shorebirds	Up to 100 m
Waterfowl	10 m to 30 m, up to 50 m
Colony of swallows	10 m to 25 m, up to 50 m
Most passerine birds and other small birds	1 m to 5 m up to 10 m to 50 m

Note: 1 Shorter distances are often associated with urban or industrial environments, whereas longer distances are associated with urban areas.

Step 3: Marking out the protection zone

The buffer zone will be established using painted survey stakes, flagging tape, or other marking materials to clearly delineate its boundaries. The nest itself will not be identified or marked to minimize the risk of predation.

The nest's coordinates will be included on the marking, along with its direction. Once the buffer zone has been established, a qualified person will regularly monitor the nest from a distance to detect any signs of disturbance. If necessary, work will be suspended immediately, and the buffer zone will be reassessed. In addition, the work in question will be reassessed to reduce the level of disturbance, and, if necessary, it may be postponed until the chicks have left the nest.

Step 4: Monitoring of nests and construction work carried out in the vicinity

None of the buffer zones established may be cleared or developed until a qualified person has confirmed that the birds have left the nest and the surrounding area (fledglings). All of this will be determined based on the stage of development observed during the initial survey and on estimates derived from the species' life cycle (incubation period and fledging time), as well as on field observations. It should be noted that it is prohibited to damage, destroy, remove, or disturb the nests of migratory birds when they contain a live bird or a viable egg (Government of Canada, 2022b).

If a nest is located near a path or road, vehicles may proceed with caution. However, they will not be allowed to stop in the recommended buffer zone. Places where stopping is prohibited will be clearly marked.

Step 5: Monitoring report

The presence of nests belonging to migratory birds and species at risk, as well as the measures taken to ensure their protection, will be documented in an environmental monitoring report.

Annual report

An annual report summarizing the results of the observations conducted will be prepared and submitted at the end of each completed monitoring year. Among other things, the report will address the following:

- The accuracy of the environmental assessment, including an evaluation of the effectiveness of the mitigation measures implemented by PMET to address the project's adverse environmental impacts on migratory and/or at-risk bird species, including their nests and eggs.
- The extent of environmental changes relative to the baseline conditions established in the EIA that require the implementation of modified or additional mitigation measures.
- According to the results obtained during the year-long bird monitoring study, the assessment—namely, whether the technically and economically feasible mitigation measures that PMET will implement to reduce impact levels to below the target levels—shows that the impact levels have been met or exceeded.
- The status of specific, measurable milestones that must be achieved by the end of the follow-up program, while putting the findings into perspective with regard to the accuracy of the environmental assessment and/or the effectiveness of the mitigation measures.
- Reviewing follow-up and monitoring programs and, if necessary, updating them to ensure that the objectives pursued are aligned with the nature of the results obtained.

13.2.3.6 Mammals – Large wildlife

Due to their large size and weight, certain species of large wildlife are particularly vulnerable to road collisions, which can have serious consequences both for the animals involved (e.g., severe injuries, mortality, loss of offspring) and for the safety of road users. For this reason, PMET will establish and maintain a specific register of all wildlife-vehicle collisions occurring within the project site boundaries and along the access road.

In particular, all incidents involving the following species will be recorded: woodland or migratory caribou (*Rangifer tarandus caribou*), moose (*Alces alces*), black bear (*Ursus americanus*), and grey wolf (*Canis lupus*). All injured animals will be reported to the appropriate authorities without delay. The register shall include, at a minimum, the following information:

- the species involved;
- the number of animals involved;
- the date and time of the incident;
- the exact location where the collision occurred;
- the condition of the animal (or animals) after the incident (i.e., immobilized or still moving).

PMET will maintain a second register compiling sightings of the same species (i.e., woodland caribou, moose, black bear, and grey wolf) within the boundaries of the mine site (including borrow pits). The following data will be recorded in the register:

- the species observed;
- the number of animals observed;
- the date of observation;
- the exact location where the animal was observed.

The information compiled in these registers will be used to assess potential issues and, if necessary, develop appropriate corrective measures. By incorporating this data, PMET will be able to implement appropriate protection strategies, particularly during critical periods or in areas where animals are most active. Such measures will promote better coexistence with wildlife by reducing the impact of project activities on animal populations, while improving safety for workers and road users.

Woodland and migratory caribou

PMET will document the presence of caribou, specifically the population in the West James Bay sector (woodland) and the Leaf River herd (LRH) (migratory), recorded within the project's biophysical RSA. PMET wishes to enter into a partnership agreement with MELCCFP to fit and use telemetry collars on woodland caribou that may be found in the biophysical RSA. This will provide the data needed to conduct geospatial analysis and improve our understanding of the migration patterns of these populations, while offering real-time visualization of how woodland caribou use the land during the follow-up period agreed upon with the MELCCFP. At the end of the follow-up period, a report will be prepared and submitted to the MELCCFP on a confidential basis. Given the sensitive nature of the data collected, it will not be made public.

Black bear

The black bear is a species found within the project's biophysical LSA, with individual bears and signs of their presence frequently observed. The presence of bears near mining operations is not necessarily a problem, especially if these animals feed on natural organic matter found in the surrounding environment. However, anthropogenic food products can attract black bears. That is why they must remain out of reach of wild animals at all times, especially black bears.

To achieve this, PMET has implemented a waste management system in accordance with the 3R-RD principles, which includes:

- a fully fenced sorting centre (with underground fencing and a motorized gate);
- a composter located at the sorting centre;
- trash containers equipped with bear-proof lids;
- a changing daily schedule for collection of trash from the containers.

This waste management system will remain in place throughout the mine's construction and operations phases. These measures will, in particular, reduce the risk of black bears becoming accustomed to human presence. Despite this, bears may be attracted by the odours given off by trash—even if it is out of reach—as well as by odours coming from kitchens or any other place where food is stored.

Bears attracted by food sources may thus venture close to buildings or attempt to enter them, which could pose a public safety risk. In situations where PMET determines that the presence of a bear poses a risk to worker safety, the local wildlife protection office of the Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP) will be notified immediately so that a qualified person can assess the situation and determine the appropriate measures to be taken. If the competent authorities decide to euthanize the animal and if this procedure can be performed safely, a tallyman may be called upon to assist, thereby ensuring that the edible meat is utilized.

In addition, workers will be provided with educational materials aimed at preventing the feeding of wild animals, whether intentional or resulting from the presence of food waste accessible to wildlife. This measure is intended to promote safe coexistence with black bears and to limit the negative impacts of human activities on the bear populations in the project area.

13.2.3.7 Mammals – Chiropterans

The bat monitoring program described in this section is intended to limit disturbances that could harm bats and, to the extent possible given the very low levels of activity recorded during the surveys, to investigate any potential effects of light and noise on their activities during the various phases of the project.

This biological monitoring program covers all bat species found at the site. With regard to resident species, which overwinter in the province, acoustic surveys conducted from 2023 to 2025 confirmed the presence, within the project's biophysical LSA, of two species and one species complex: the big brown bat (*Eptesicus fuscus*), the northern long-eared bat (*Myotis septentrionalis*), and the *Myotis* complex, which, at this latitude, includes the northern long-eared bat and the little brown bat (*Myotis lucifugus*), although the latter was not specifically identified. The little brown bat and the northern long-eared bat are considered threatened in Quebec (Gouvernement du Québec, 2025) and endangered in Canada (Government of Canada, 2025). These surveys also revealed the presence of three migratory bat species: the silver-haired bat (*Lasionycteris noctivagans*), the red bat (*Lasiurus borealis*), and the hoary bat (*Lasiurus cinereus*). These migratory species are included in the List of vulnerable wildlife species (red bat) or species which are likely to be designated as threatened or vulnerable (silver-haired and hoary bats) in Quebec (Gouvernement du Québec, 2025). Furthermore, these three species are considered endangered in Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2023), although they have not yet been listed in Schedule 1 of the *Species at Risk Act* (SARA; Government of Canada, 2025).

Monitoring of potential maternity roosts

The surveys conducted identified several potential maternity roost sites (rock outcrops or rocky structures) within the study area. However, this study was limited to certain areas, largely due to the limited accessibility of the study area, and bats are known to frequently change roost sites, even during a given breeding season (ECCC, 2018). Consequently, monitoring will focus on this type of habitat more generally when it is located in the immediate vicinity of project activities. It will also examine potential anthropogenic maternity roosts that might be provided by the mine's various facilities.

Throughout the various phases of the project, special attention will be paid to signs of bat presence in both anthropogenic and natural structures located in the immediate vicinity of project activities. These signs may include noises (scratching or vocalizations), the presence of guano (droppings similar to those of mice, but longer, tapered, and segmented) on surfaces or on the ground, or the smell of damp earth ("old damp cellar") (MELCCFP, 2023d). These signs of presence will be monitored during the bat breeding season, which, at this latitude, runs from June 15 to August 14 (MELCCFP, 2023).

With regard to potential sites of anthropogenic origin, this opportunistic monitoring will focus on buildings or other structures that may provide potential entry points for bats. These may include hollow spaces in exterior siding, poorly aligned metal panels, or ventilation openings without grills, all of which could provide access to potential empty spaces within the building structure. As for natural structures, attention will be focused on snags or hollow trees with a fairly large diameter at breast height (DBH) (30 cm or more), as well as on south-facing rock formations, which could be used by bats (Tremblay and Jutras, 2010).

If such habitats are identified—in the immediate vicinity of planned construction projects liable to cause their disappearance (clearing of trees or dismantling of anthropogenic structures) or to impair their quality (particularly through noise or vibrations)—a biologist or wildlife technician will conduct a survey to look for signs of bats. If the presence of a maternity roost—that is, a group of female bats that gather to give birth and raise their young—is suspected, the MELCCFP will be notified immediately.

Procedure to follow if an occupied maternity roost is discovered

Step 1: Establishment of a buffer zone

If a maternity roost or shelter occupied by bats is identified during the breeding season (June 15 to August 14 at this latitude), and if activities cannot be relocated, delayed, or modified in a way that does not affect this maternity roost or resting site, a protection zone with a radius of 100 m (buffer zone) will be established to ensure its protection throughout the breeding season.

Where appropriate, particularly for certain activities that generate significant noise pollution (such as blasting), the establishment of a buffer zone could be replaced by the installation of a noise barrier (vertically mounted sound-insulating panels).

Step 2: Marking out the protection zone

The protection zone will be marked using painted survey stakes, flagging tape, or any other marking materials. The maternity roost itself will not be marked, and no markers will be placed in its immediate vicinity to minimize the risk of predation. The site's coordinates will be marked on the marker, along with the direction and distance from the site.

Step 3: Monitoring of the maternity roost and construction work being carried out nearby

Once the protection zone has been established, a qualified person will closely monitor the site for any signs of disturbance, such as bats emerging from the maternity roost or flying around it during the day. If such observations are made, construction activities must cease immediately, and the protection zone must be reassessed. The activity in question will then be postponed until the end of the bat breeding season (August 15) or until the young bats have left the site.

No designated protection zone may be cleared of trees or developed before the end of the bat breeding season (August 15), or until a biologist or wildlife technician has confirmed that the young bats have left the site following a routine check of bat activity (visual and acoustic).

If a maternity roost is located near a path or road, vehicles may drive through with caution. However, they will not be allowed to stop in the recommended buffer zone. Places where stopping is prohibited will be clearly marked.

Step 4: Monitoring report

PMET will use monitoring reports to document the possible presence of bat maternity roosts, as well as the measures taken to ensure their protection. The monitoring reports will be included in the annual environmental report on PMET's operations.

Monitoring of bat activity

During the construction and operations phases, bat activity will be monitored in the vicinity of the mine site's facilities. This monitoring program is designed to assess any indirect habitat loss that may be associated with disturbances to bats, particularly those caused by ambient noise and nighttime lighting.

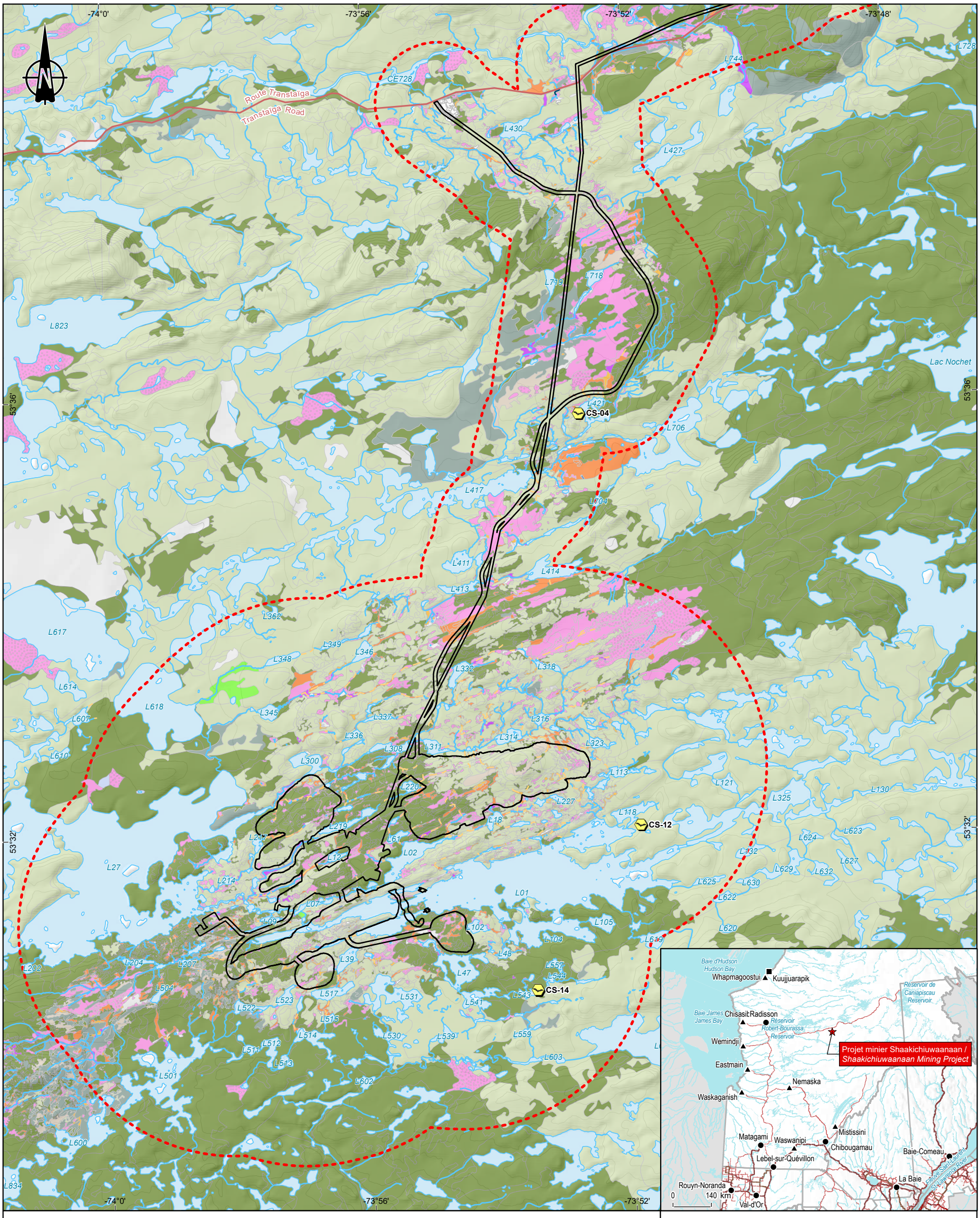
Sampling plan

For this follow-up, some of the monitoring stations used during the 2023, 2024, and 2025 surveys will be re-established to cover different noise levels, based on the noise modelling carried out during the impact assessment, as the highest levels could potentially disturb the bats. Given the project's northern location, the relatively limited diversity of habitats, and the very low levels of activity observed during bat inventories, three monitoring stations should in principle be sufficient for this program. Thus, the CS-04, CS-12, and CS-14 stations used for the 2023–2025 inventories will be retained for monitoring, covering anticipated noise levels ranging from 30 dB to 50 dB(A). Map 13-5 shows the locations of the sampling stations.

Sampling method

At each sampling station, bat activity will be measured using ultrasonic detectors (SM4 Wildlife Acoustics), as in acoustic surveys. These will be paired with two other automated measuring devices, enabling the simultaneous recording of bat activity and changes in noise levels and nighttime light levels (intrusive light). These parameters are, in fact, the main components that could disturb bats.

Lastly, for each sampling station, the habitat will be briefly described (main species, canopy height, etc.).



Zones d'étude / *Study Areas*

- Projet / *Project*
- Biophysique - Locale / *Biophysical - Local*

Réseau routier / *Road Network*

- Route collectrice municipale / *Municipal collector road*

Chiroptères / *Chiroptera*

- Station acoustique / *Acoustic station*

Composantes de l'écosystème / *Ecosystem Components*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*

- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*
- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*

- Intermittent / *Intermitent*
- Permanent / *Permanent*
- Permanent partiellement souterrain / *Partially underground permanent*
- Souterrain / *Underground*

Milieux terrestres / *Terrestrial Environments*

- Feuillu / *Deciduous*
- Mixte / *Mixed-wood*
- Résineux / *Softwood*
- Arbustaie / *Scrubland*
- Lande à lichens / *Lichen tundra*
- Régénération / *Regeneration*

Autres milieux / *Other Environments*

- Autre milieu / *Other environments*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 13-5 / *Map 13-5*
Stations de suivi des chiroptères / Location of Chiroptera Monitoring Stations

Sources / Sources

AQréseau+, réseau routier, MERN, 2016
BDGA, 1M, MERN, 2014
CanVec, 250k,RNCan, 2017

0 650 1 300 m

UTM, fuseau 18, NAD83 (CSRS)

2026-03-25

Préparation / Prepared by : R. Duhamel
Dessin / Drawn by : P. Boulay
Approbation / Approved by : M-H. Brisson
CA0001724_3318_eie_ch13_c5_260325.aprx
CA0001724_3318_eie_c13_5_127_chiro_260325

La précision des limites et les mesures montrées sur ce document ne doivent pas servir à des fins d'ingénierie ou de délimitation foncière. Aucune analyse foncière n'a été effectuée par un arpenteur-géomètre. / Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.

Frequency and duration of follow-up

Each year of the follow-up, the nocturnal activity of bats will be continuously monitored during the breeding season, from June 15 to August 14. Given the very low levels of activity observed during the bat surveys carried out between 2023 and 2025, all surveyed nights will be included in the analysis, regardless of weather conditions, so as to limit the risk of losing observations collected on nights when conditions are less favourable. Ambient noise and nighttime light levels will be monitored simultaneously during the same period (June 15 to August 14), with measurements taken during nighttime hours at intervals to be determined later based on the equipment used.

The activity levels recorded for bats can thus be analyzed in conjunction with the noise and nighttime light measurements taken simultaneously during bat breeding season.

This follow-up will initially cover the construction phase and the first year of the operations phase. Depending on the results obtained during these initial years of monitoring, the program may continue every five years thereafter.

Applicable criteria

The data collected during the monitoring should help confirm the continued presence of bats in the monitored habitats and, if necessary, assess the actual effects of the project on bat activity. Bat activity at monitoring stations will also be compared with the overall activity levels recorded during acoustic surveys conducted from 2023 to 2025; however, any differences observed should be interpreted with caution, as surveys conducted during the breeding seasons of 2024 and 2025 revealed significant year-to-year variations.

Follow-up report

For each follow-up year, a detailed report presenting the results will be produced. This report will correlate bat activity (number of sightings per night) with the noise and light levels recorded at each station. The report will also highlight changes in bat activity and in noise and light levels recorded at the site over the years of follow-up, comparing the results with the reference state or with data from previous years of follow-up.

13.2.3.8 Mammals – Other species

No monitoring is currently planned for other mammal species, apart from the monitoring of mitigation measures presented in Appendix 8-2.

13.2.3.9 Wildlife and plant species of special status

The various species of special status present or potentially present in the project's local study area, as well as the components to which they relate in the preceding sections, are presented in Table 13-7. The "Reference" column in the follow-up program refers to the sections of this document where information related to this species can be found.

Table 13-8 Species of special status that are present or potentially present in the local study area

French name	Scientific name	Status		Confirmed presence in the local study area (Yes/No)	Reference in the follow-up program
		Quebec[1]	Canada[2]		
Flora					
Brown-edged pussytoes	*Antennaria rosea subsp. confinis*	LDTV	–	No	Vegetation and wetlands (Section 13.2.3.1)
Modest aster	*Canadanthus modestus*	LDTV	–	No	
Spatulate moonwort	*Botrychium spathulatum*	LDTV	–	No	
Botrychium ascendens	*Botrychium ascendens*	LDTV	–	No	
Ojibway waterwort	*Elatine ojibwayensis*	LDTV	–	No	
Rocky Mountain willowherb	*Epilobium saximontanum*	LDTV	–	No	
Limestone swamp bedstraw	*Galium brevipes*	LDTV	–	No	
Nahanni oak fern	*Gymnocarpium continentale*	LDTV	–	No	
Purple meadow-rue	*Thalictrum dasycarpum*	LDTV	–	No	
McCall willow	*Salix maccalliana*	LDTV	–	No	
Ichthyofauna					
Yellow sturgeon	*Acipenser fulvescens*	SDMV	P	No	Ichthyofauna (Section 13.2.3.2)
Avian fauna					
Golden eagle	*Aquila chrysaetos*	V	NAR	Yes	Avian fauna (Section 13.2.3.5)
Harlequin duck	*Histrionicus histrionicus*	V	SC	No	
Short-billed dowitcher	*Limnodromus griseus*	-	TH	No	
Common nighthawk	*Chordeiles minor*	LDTV	SC	Yes	
Peregrine falcon	*Falco peregrinus*	LDTV	NAR	Yes	
Evening grosbeak	Coccothraustes vespertinus	–	SC	Yes	
Short-eared owl	*Asio flammeus*	LDTV	SC (COSEWIC: TH)	Yes	
Bank swallow	*Riparia riparia*	–	TH	Yes	

French name	Scientific name	Status		Confirmed presence in the local study area (Yes/No)	Reference in the follow-up program
		Quebec[1]	Canada[2]		
Olive-sided flycatcher	*Contopus cooperi*	V	SC	Yes	
Lesser yellowlegs	*Tringa flavipes*	–	TH	Yes	
Bald eagle	*Haliaeetus leucocephalus*	V	NAR	Yes	
Rusty blackbird	*Euphagus carolinus*	LDTV	SC	Yes	
Mammals					
Woodland caribou (forest)	*Rangifer tarandus caribou*	V	TH	Yes	Large wildlife (Section 13.2.3.6)
Little brown bat	*Myotis lucifugus*	TH	ES	Yes	Chiropterans (Section 13.2.3.7)
Northern long-eared bat	*Myotis septentrionalis*	TH	ES	Yes	
Silver-haired bat	*Lasionycteris noctivagans*	LDTV	– (COSEWIC: ES)	Yes	
Hoary bat	*Lasiurus cinereus*	LDTV	– (COSEWIC: ES)	Yes	
Red bat (eastern)	*Lasiurus borealis*	V	– (COSEWIC: ES)	Yes	
Southern bog lemming	*Synaptomys cooperi*	LDTV	-	Yes	
Rock vole	*Microtus chrotorrhinus*	LDTV	-	No	

Note: Species potentially present in the local study area were identified through a literature review as part of the of the present environmental impactassessment conducted in 2025–26. This documentary research consisted of conducting a literature review and consulting geospatial databases within a 50 km radius of the mine site's centroid.

1: Species status in Quebec (July 2025): LDTV: Likely to be designated as threatened or vulnerable; V: Vulnerable; TH: Threatened.

2: Species status in Canada (SARA) (July 2025): SC: Special concern; Th Threatened; ES: Endangered species; NAR: Not at risk.

13.2.4 Social environment

13.2.4.1 Cree communities, localities, and municipalities, and the regional economy

Socioeconomic conditions

In collaboration with the affected Cree communities, PMET will ensure a follow-up of the available annual statistics regarding employment and income for Cree workers employed at the mine site and those within these communities. The goal will be, on the one hand, to determine whether there is a correlation between the statistics for the small group working at the mine and those for the community. If there are discrepancies in the statistical data, measures will be developed in collaboration with representatives from these communities to promote hiring and, if necessary, review the associated incomes.

Community well-being and human health

Grievance mechanism

PMET will develop a grievance mechanism for handling complaints directly related to PMET operations, comments, and concerns to ensure the well-being of Cree community, Chisasibi community and the Jamésiens representatives who may be affected by the project. This mechanism will be designed to ensure formal and transparent management of feedback from land users. They will be able to submit their complaints, concerns, or comments through various channels, including electronically or by contacting staff directly at the Shaakichiuwaanaan site (by phone, email, or in person). When a complaint or comment is registered in the mechanism, the relevant parties will be notified. A resolution process involving the review of the complaint or comment and the preparation of an appropriate response will then be initiated. Each case will be tracked and documented to ensure transparency and efficient handling.

The user who has made a complaint or comment will be kept informed throughout the process about the measures taken and the resolutions reached. The mechanism will become operational at the start of the mining project's construction phase and will continue through the end of the restoration phase. This continuity will ensure that stakeholder feedback is always appropriately considered and handled throughout the project life cycle.

Current use of land resources and resources for traditional purposes

Fish flesh

Fish populations will be monitored every three years as part of the EEM program, continuing until after the mine closes. The purpose of this study is to determine whether mine effluent has an impact on the fish population. The water bodies studied will be those identified by ECCC, which currently include Lake L823 (a non-exposed water body) and Lake L27 (an exposed water body) (Map 13-2). The sentinel species selected for the project will be the northern pike and another species proposed when the study plan is submitted to ECCC. The follow-up will determine whether there are differences in growth, reproduction, survival, and the condition of the populations exposed to mine effluent, and will monitor mercury concentrations in fish tissues, if necessary (an indicator of the fish's potential for consumption).

A study on metals in fish flesh will be conducted only if the REMMMD thresholds are exceeded. As part of the monitoring of fish flesh contamination, only one species (the northern pike) will be tested. Fish flesh (muscle) will be tested for mercury and scanned for other metals.

Plants valued by the Cree

Monitoring the plants traditionally valued by Cree land users will help assess the metal content in the parts of the plants that are consumed. The purpose of this follow-up is to identify and document any changes in the environment compared to the baseline levels established in 2025, and assess if these changes could be related to the project development. This follow-up will also be used to verify the accuracy of the predictions included in the impact assessment and to assess the effectiveness of the project's mitigation measures.

Sampling plan

Samples taken in identified areas that are considered both exposed or not exposed to potential impacts from project activities will form part of the environmental follow-up program. Four sampling quadrants (PL-01 through PL-04) were selected, in consultation with the family of the tallyman of trapline CH39, to measure existing metal concentrations in the vegetation (Map 13-6). Two of the quadrants were located within the biophysical LSA and fall within the project's area of influence (PL-01 and PL-02), while the other two are located outside the area of influence of the particulate matter emission concentrations predicted by atmospheric dispersion modelling (PL-02 and PL-04).

A total of 72 structural tissue samples (excluding replicate field samples) will be collected, including Labrador tea leaves and blueberry plant fruits. Approximately 20 g (wet weight) will be collected for each sample of leaves and berries. Fruits and leaves that have reached full maturity will be selected whenever possible.

As part of this project, one replicate field sample per species is to be collected from each quadrant (eight replicate samples in total). These replicates represent at least 10% of the total samples submitted for analysis for each plant species.

Table 13-9 shows the quadrant distribution details by habitat type.

Tableau 13-9 Distribution of plant quadrats by habitat type

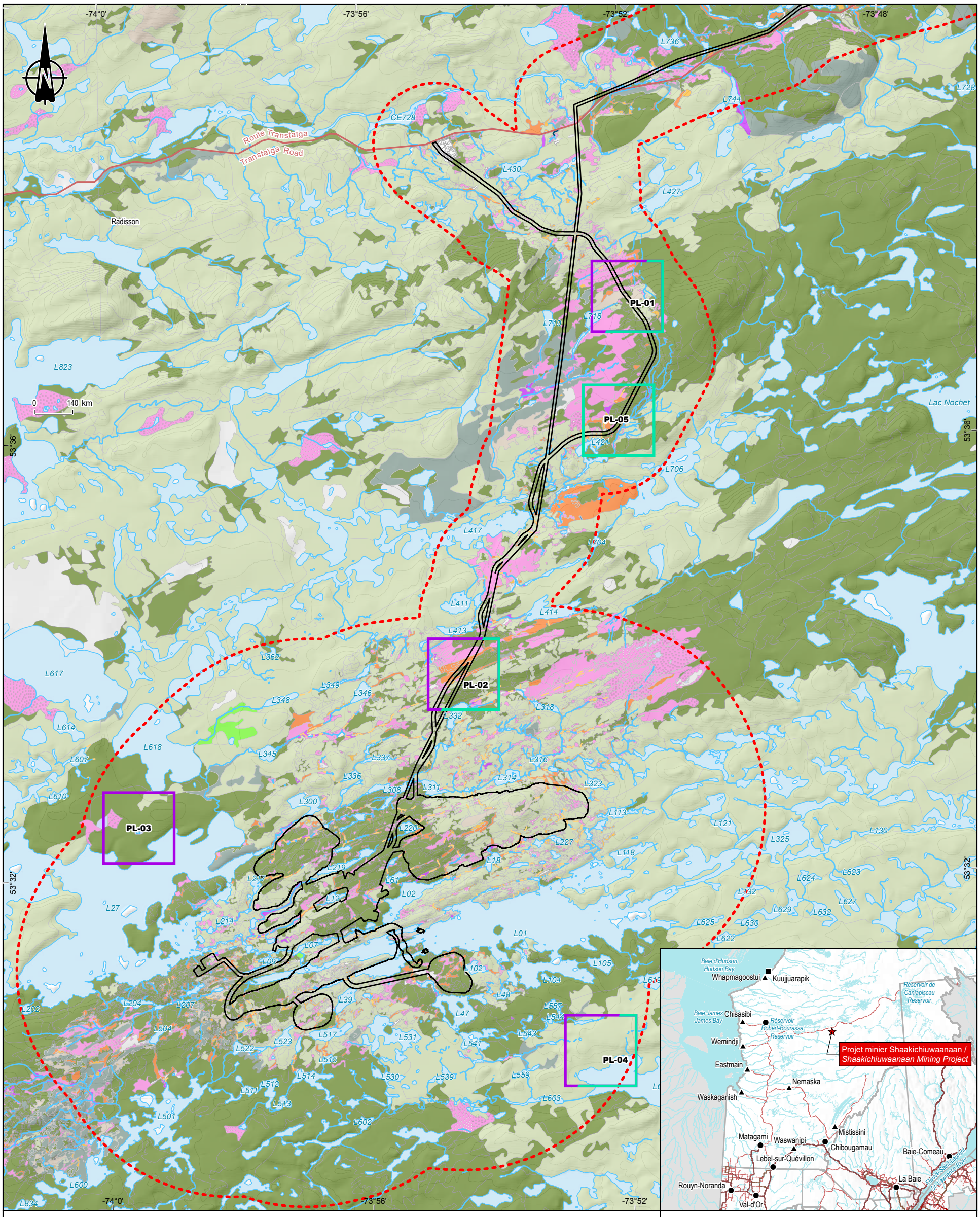
Quadrant name	Natural environment	Latitude	Longitude	Quadrant in areas potentially affected by the mine site
PL-01	Regenerating forest, softwood stand, wooded ombrotrophic bog	53.618518	-73.864205	Yes
PL-02	Regenerating forest, softwood stand	53.566078	-73.902136	Yes
PL-03	Softwood stand	53.543649	-73.989786	No
PL-04	Regenerating forest	53.507653	-73.872916	No

Methodology

A sampling protocol will be followed to minimize sources of contamination from the environment, the specimens being sampled, and the laboratory handling. Nitrile gloves will be used for sampling and replaced between sampling quadrant. To be as representative as possible of traditional harvesting conditions, no cutting tools will be used. A separate bag will be used for each sample within each quadrant.

Samples will be frozen within 24 hours of collection in preparation for metal assay. Samples will be stored in hermetically sealed “Ziploc” or equivalent bags, and kept at a minimum of -20 °C. Prior to freezing, tissues will be kept cool, ideally at 4°C in a cooler.

The tissue analysis will be conducted in a laboratory accredited by the Quebec government. A laboratory quality assurance and quality control program will be implemented in accordance with best practices. The parameters to be analysed are listed in Table 13-10.



Zones d'étude / *Study Areas*

- Projet / *Project*
- Biophysique - Locale / *Biophysical - Local*

Réseau routier / *Road Network*

- Route collectrice municipale / *Municipal collector road*

Écotoxicologie / *Ecotoxicology*

- Placette d'échantillonnage de gibier/ *Game sample plot*
- Placette d'échantillonnage de plante / *Plant sample plot*

Composantes de l'écosystème / *Ecosystem Components*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*

- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*
- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*

- Intermittent / *Intermitent*
- Permanent / *Permanent*
- Permanent partiellement souterrain / *Partially underground permanent*
- Souterrain / *Underground*

Milieux terrestres / *Terrestrial Environments*

- Feuillu / *Deciduous*
- Mixte / *Mixed-wood*
- Résineux / *Softwood*
- Arbustaie / *Scrubland*
- Lande à lichens / *Lichen tundra*
- Régénération / *Regeneration*

Autres milieux / *Other Environments*

- Anthropique / *Anthropogenic*
- Champ de blocs / *Boulder field*
- Ile / *Island*
- Surface dénudée / *Dry barren*

Projet minier Shaakichiuwaanaan /
Shaakichiuwaanaan Mining Project

Étude d'impact sur l'environnement /
Environmental Impact Assessment

Carte 13-6 / *Map 13-6*
Localisation des placettes d'échantillonnage des plantes et du gibier par type de milieu / Location of Plant and Game Sampling Plots by Habitat Type

Sources / Sources
AQréseau+, réseau routier, MERN, 2016
BDGA, 1M, MERN, 2014
CanVec, 250k,RNCan, 2017

0 650 1 300 m
UTM, fuseau 18, NAD83 (CSRS)

2026-03-25

Préparation / Prepared by : K. Cadoret
Dessin / Drawn by : P. Boulay
Approbation / Approved by : M-H. Brisson
CA0001724_3318_eie_ch13_c6_260325.aprx
CA0001724_3318_eie_c13_6_118_plantes_gibier_260325

La précision des limites et les mesures montrées sur ce document ne doivent pas servir à des fins d'ingénierie ou de délimitation foncière. Aucune analyse foncière n'a été effectuée par un arpenteur-géomètre. /
Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.

Table 13-10 List of parameters to be analysed in leaf tissue and berry samples

Parameters to be tested		
Aluminum (Al)	Cobalt (Co)	Lead (Pb)
Antimony (Sb)	Copper (Cu)	Selenium (Se)b
Silver (Ag)	Tin (Sn)	Strontium (Sr)
Arsenic (As)	Iron (Fe)	Titanium (Ti)
Barium (Ba)	Lithium (Li)	Uranium (U)
Beryllium (Be)	Manganese (Mn)	Vanadium (V)
Boron (B)	Mercury (Hg)	Zinc (Zn)
Cadmium (Cd)	Molybdenum (Mo)	
Chromium (Cr)	Nickel (Ni)	

Applicable criteria and quality control

For statistical analysis, it is recommended that concentrations below the reporting detection limit (RDL) be converted to half of the limit. The means, maximum and minimum values, and standard deviation must be calculated for each parameter analyzed.

It should be noted that there are no thresholds to respect (criteria) for the parameters analyzed in the case of these plants. In fact, there are currently no standards set by the Canadian Council of Ministers of the Environment (CCME) or the MELCCFP for the presence of metals in vegetation. In this case, the tests are only used to document the concentrations of metals present in the leaves and fruits of the two species sampled.

The documents available on the MELCCFP website regarding ecotoxicology and risk assessment were taken into account in the preparation of this report. In addition, several guides and guidelines were consulted for the characterization, assessment, and presentation of the results:

- *Procédure d'évaluation du risque écotoxicologique pour la réhabilitation des terrains contaminés* ["Procedure for ecotoxicological risk assessment for the remediation of contaminated sites"] (CEAEQ, 1998);
- *Supplemental guidance on human health risk assessment for country foods (HHRA Foods) – Federal contaminated site risk assessment in Canada* (Health Canada, 2010);
- *Lignes directrices pour la réalisation des évaluations du risque toxicologique d'origine environnementale au Québec* ["Guidelines for conducting environmental toxicological risk assessments in Quebec"] (INSP, 2012).

Frequency and duration of follow-up

The scheduling of the vegetation sampling program depends primarily on blueberry berry production, since this is the only plant species whose fruit will be harvested. Consequently, plant collection is scheduled to take place once the fruit has been produced, i.e., toward the end of summer (August). Follow-up will be carried out during the construction and operations phases of the mine, as follows:

- summer 2025 (baseline condition);
- construction phase (Year 1);
- operations phase (Years 1, 5, 10, 15, 20, 25).

The frequency of monitoring may be revised, subject to the results obtained during the operations phase, if results show that there has been no significant increase in metal concentrations compared to baseline levels.

Follow-up report

A report will be prepared after each year of sampling and analysis and will be included in the annual report submitted by PMET to the MELCCFP. This report will include the methodology (gathering method, plant locations, brief description of the plants), the results obtained, and recommendations.

Game valued by the Cree

Monitoring of game valued by Cree land users will help assess the metal content in the parts of the game that are consumed. The purpose of this program is to identify and document any changes in the environment relative to the reference state that will be established in the winter of 2027, and assess whether or not they may be related to the project development.. This program will also be used to verify the accuracy of the impact assessment and to assess the effectiveness of the project's mitigation measures.

The snowshoe hare is currently the game species selected for follow-up. This species was chosen because it is an important food source for the Cree community and is abundant in the biophysical LSA. Furthermore, because this species has a short life cycle, it allows for the assessment of short-term bioaccumulation and thus helps identify the project's potential impacts on the species. However, it is currently proposed to replace monitoring of the snowshoe hare with monitoring of the beaver or the porcupine, in accordance with requests expressed by land users. This revision to the monitoring program will be presented at the time of submission of the project-related authorization applications.

Sampling plan

The capture of animals and the collection of samples will be carried out in collaboration with the tallyman and his family. Trapping will take place in the winter, when the species is consumed by community members.

The targeted areas are located within the project's area of influence, in zones where fine particulate matter is deposited, as indicated by the atmospheric modelling. The main target area is located northeast of the planned infrastructure (Map 13-6).

The number of animals selected for follow-up has been set at 15. However, given the cyclical nature of the snowshoe hare population, this number could be adjusted upward or downward. It is also known that the home range of this species generally varies between 1.4 and 17 hectares under suboptimal conditions, which is likely to influence the spatial distribution of captures and the number of individuals sampled per sector (Godbout et al., 2001). The final locations of the capture areas and the final number of animals to be captured will be determined in consultation with the tallyman and his family, based on the planned harvesting activities.

Methodology

Selection of organs

The organs to be monitored were selected based on available information regarding the consumption of snowshoe hares by Cree users on the land and on available literature. Two tissues capable of accumulating metals will therefore be used for monitoring: muscle and liver.

Capture of animals

To comply with all the terms and conditions of the permit issued by the Ministère for the capture of wild animals for scientific, educational, or wildlife management purposes (SEG permit), field forms will be used to collect the following information:

- When setting traps, record the following information for each trap: date, time, type of trap installed, location coordinates, habitat type, and a description of the site where the trap was set.
- For each capture, the snowshoe hare will be assigned a unique identification number, and the following information will be recorded: sex, approximate age, measurements (total length with and without the tail, as well as weight), and any other relevant distinguishing characteristics.

If a snowshoe hare is captured, one of the following two options will be implemented:

- Leave the trap in place if it is believed that there may be another snowshoe hare nearby or remove the trap and move it to a different location.
- If no animals are captured after a trap-night, the trap will be left in place or moved.

Sampling method

A sampling protocol will be followed to minimize sources of contamination between the environment, the specimens being sampled, and the samples during handling. The following factors will be taken into consideration:

- To ensure the safety of field personnel when handling nitric acid (10%) and thereby minimize accidents that could lead to environmental discharges, nitrile gloves and safety goggles must be worn. Gloves must be changed after each capture.

Laboratory instruments (scalpels, forceps, scissors, etc.) should be washed with 10% nitric acid and rinsed with demineralized water before taking samples. This procedure must be repeated between each type of sample.

- A separate bag must be used for each type of sample and each carcass. The bags must be sealed tightly and labelled as follows: [Year] — [Location] — [Snowshoe hare ID] — [Tissues].
- To ensure the quality of the sampling procedures, a replicate sample must be collected in the field. Regardless of the total number of captures, which is subject to change, replicate samples must be collected. The specimens selected for the duplicates should be adult snowshoe hares whose organs are large enough to yield two samples of at least 20 grams each. The same procedures and precautions mentioned earlier must be followed when collecting the replicate samples. However, their identifiers will vary according to the following naming convention: REP—[Year] — [Location] — [Snowshoe hare ID] — [Tissues].

It should be noted that the skinning of snowshoe hares caught according to the culture and methods of the Cree family of the tallyman may be performed before tissue samples are collected, since the tissues are not exposed. Once the skin has been removed, an incision must be made in the carcass to take muscle and liver samples using previously disinfected dissection tools. Each organ must then be placed in an airtight bag.

Storage method

To ensure the integrity of the tissue samples, they must be frozen at -20 °C within 24 hours of collection. Within this time frame, the tissues must be stored in a cool place, ideally at 4°C in a cooler. The cooler used for transport must be equipped with ice packs to maintain this temperature.

Laboratory and test parameters

The tests will be conducted in a laboratory accredited by the Quebec government. A laboratory quality assurance and quality control program must then be implemented in accordance with best practices. The parameters to be tested are listed in Table 13-11.

Table 13-11 List of parameters to be analyzed in biological samples from the snowshoe hare

Aluminum (Al)	Cobalt (Co)	Lead (Pb)
Antimony (Sb)	Copper (Cu)	Selenium (Se)b
Silver (Ag)	Tin (Sn)	Strontium (Sr)
Arsenic (As)	Iron (Fe)	Titanium (Ti)
Barium (Ba)	Lithium (Li)	Uranium (U)
Beryllium (Be)	Manganese (Mn)	Vanadium (V)
Boron (B)	Mercury (Hg)	Zinc (Zn)
Cadmium (Cd)	Molybdenum (Mo)	
Chromium (Cr)	Nickel (Ni)	

Applicable criteria and quality control

If a significant increase in concentrations is detected in a monitored individual, all samples from that individual will be reanalyzed to ensure that the increase is not due to external contamination or a laboratory artifact. The tissue samples will be stored for six months after collection. The term “significant increase” is used here to refer to any increase in contamination levels in snowshoe hare tissue that could pose a risk to human health.

If the confirmed results exceed the environmental assessment’s projections, PMET will implement all modified or additional mitigation measures based on the results obtained.

Frequency and duration of follow-up

A survey of potentially concerning contaminants in the tissues of the snowshoe hare will be conducted in the winter of 2027 prior to the project’s construction. Follow-up on potentially concerning contaminants in game tissue will be conducted during the mine’s construction and operations phases as follows:

- winter 2027 (baseline level);
- construction phase (Year 1);
- operations phase (Years 1, 5, 10, 15, 20, 25).

The frequency of monitoring may be revised, subject to the results obtained during the operations phase, if those results show that there has been no significant increase in metal concentrations compared to baseline levels.

Follow-up report

A follow-up report will be prepared once the laboratory results are received. This report will include the methodology (trapping method, capture locations, and a brief description of the individual animals). In addition, the results will be interpreted in terms of potential risks to human health, and recommendations will be issued as appropriate. Since the samples will be collected in the winter, the follow-up report will be included in the following year's annual report.

Historical and cultural heritage, and significant sites and features

Interaction with the land and the various sites of importance to the Cree community representatives living near the mine site is a sensitive issue that must be preserved. PMET will hold an annual meeting with them to identify the changes caused by mining activities on this interaction with the land. When required, an assessment will be conducted to determine whether changes can be made to mining operations to mitigate the reported impacts.

In the event of the accidental discovery of an unlisted heritage or cultural site during construction work or exploration activities that will continue throughout the various phases of the project, the associated work will be interrupted, the site will be assessed, and meetings will be organized with representatives of the affected Cree communities to determine the steps to be taken to protect or relocate the site.

13.2.4.2 Public infrastructure and utilities

Traffic and road safety

PMET will develop a traffic management plan prior to the start of construction, in coordination with the local land users, Cree communities and regional stakeholders (SDBJ, Town of Matagami, etc). This plan will be implemented throughout the project and include the following elements:

- Protocol on the use of radio communication systems in transport trucks.
- Monitoring the daily flow of heavy vehicles and employee shuttle services, depending on the day and time of day.
- Monitoring of incidents involving project vehicles on the Trans-Taiga Road.
- Communication plan for local residents regarding ongoing activities and management of a complaint registry.
- Evaluation of potentially reducing traffic during hunting seasons.
- Evaluation of potentially implementing blasting and traffic restrictions during goose hunting season.
- Road safety awareness campaigns, with particular attention paid to hunting periods.
- Implementation of speed limits and appropriate road maintenance on the site.
- Analysis of opportunities to increase the use of electric vehicles on site.
- Prohibition of the use of engine braking when possible.
- Training in eco-driving and energy conservation.
- Raising awareness about wildlife and species of special concern.
- Watering haulage roads to reduce dust and using dust suppressants as needed.

- Identification of available rest areas in case of emergency.

The collected data will be systematically cross-referenced with daily traffic flows of vehicles entering and leaving the site, as well as with recorded complaints. Any substantiated complaint or proven environmental impact will result in the development and implementation of appropriate mitigation measures.

Monitoring during the operations phase is the responsibility of PMET's Environment Department. The results of this monitoring will be included in the annual environmental and social monitoring report and presented at meetings with the various follow-up committees.

Collisions with large wildlife

PMET will establish a registry of wildlife collisions. This initiative will make it possible to assess the impacts on local species and develop appropriate corrective measures. By incorporating this data, PMET will be able to implement targeted protection strategies, particularly during critical periods or on road sections identified as high-risk. The goal is to minimize the impact on biodiversity while ensuring road safety.

13.2.4.3 Archaeology

In the event of the chance discovery of a significant archaeological site, two options will be considered: either conducting a supplementary inventory or carrying out a targeted excavation to sample the site before it is destroyed by construction work. The main users of the land will be consulted on the approach to be adopted.

In any case, the areas with archaeological potential that had been identified during the initial assessment in 2024 within the project area were inventoried in 2025. In most of the areas inventoried as part of this project, no archaeological remains were found. The impact risk in these areas is therefore very low. Only one area (FjFl-2 [Area 126]) has been identified as having potential additional artifacts, however it is outside the planned development area. Should any development or activities be planned within this area, it would be subject to a specific management plan which could include further surveys and removal of discovered artifacts (Appendix 8-2).

If archaeological remains are accidentally uncovered during construction, site supervisors will immediately contact the environmental superintendent and the chance discovery procedure will be followed. Any discovery related to First Nations heritage will also be shared with the CH39 tallyman, the Cree Nation of Chisasibi and the Cree Nation Government.

13.2.4.4 Landscape

No follow-up is planned regarding the landscape component of the project.

13.2.4.5 Follow-up committee

PMET will establish a follow-up committee to ensure the ongoing participation of stakeholders in the project's implementation and follow-up. Once established, the committee will be responsible for establishing its operating procedures, including the principles of ethics, independence, and confidentiality applicable to its members. It will also define its mandate, objectives, and expected outcomes, as well as the responsibilities of each member, both with respect to the committee and to the organizations they represent, if applicable. The procedures for external communications and feedback will also be defined through consultation.

The committee's mandate will be developed collectively by its members and will reflect the issues, expectations, concerns, and challenges identified by the local community, as well as the project's current status.

At least once a year, during the follow-up committee's regular meetings, a detailed report on the complaints received—including their nature, number, and the steps taken to resolve them—will be presented to the members. The specific procedures for reviewing, processing, and presenting complaints will be established collectively by the committee members.

With regard to the Cree community, a dedicated follow-up committee—the terms and conditions of which will be specified in the Impact and Benefit Agreement (IBA)—will be established to facilitate the discussion, review, and resolution of issues that may arise during the various phases of the mining project. This committee will provide a structured and ongoing mechanism for collaboration between PMET and Cree representatives.

13.2.5 Other follow-ups

13.2.5.1 Wetland and water body compensation

The program is presented in Chapter 14. The projects associated with this program are currently being developed, and once the details are finalized, the proposed follow-up plan will be presented to government authorities for approval. Follow-ups are typically conducted in years 1, 3, and 5 after project completion.

13.2.5.2 Fish habitat compensation

The fish habitat compensation plan described in Chapter 14 details the planned activities. Follow-up assessments would be conducted in years 1, 3, and 5 following the completion of the work to confirm that the work has been carried out properly and to ensure that the objectives have been met. The physical characteristics of the structures and the conditions for the free passage of fish will be assessed based on the following parameters:

- a description of the overall condition of the structures (signs of instability, erosion, sand encroachment, scouring, etc.);
- condition of the riparian zone and rock-filled embankments;
- photographs (view upstream, view downstream, view of the banks, etc.) for comparison with the reference state;
- description and dimensions of the installed culvert:
  - wet area in the culvert;
  - reconstituted bed substrate;
  - watertightness of the reconstructed bed (signs of infiltration);
  - drop height;
  - type of flow at the outlet of the culvert, if any;
  - water depth at the upstream and downstream ends;
  - velocity of the current in the culvert;
  - description of the downstream ditch (depth, velocity of the current);
- use by fish fauna, if possible (visual observations).

These measurements will be taken at each follow-up visit to allow for comparisons. The effectiveness of the improvements will also be assessed through visual inspections. The results will be presented in a report following each follow-up.

13.2.6 Annual monitoring and follow-up report

The annual report, as required by D019 (MELCCFP, 2025b), serves as a key tool for environmental accountability for all mining operators in Quebec. It is intended to provide the Ministère with a comprehensive, transparent, and up-to-date overview of mining activities, their environmental management, and the measures taken to ensure regulatory compliance. This report serves not only to demonstrate compliance with legal requirements, but also to document efforts toward continuous improvement and the responsible management of environmental impacts associated with mining operations.

The report provides a summary of the mining activities carried out during the year. This summary must include the tonnage mined and processed, the number of production days, and any periods of temporary suspension of operations. It is also essential to report any incidents or problems that have occurred and that could have an impact on the environment, such as accidental spills, specifying the corrective measures taken to address them. This section provides an overview of operations and highlights proactive environmental risk management.

The report must detail any changes made to the accidental spill response plan, as well as the measures taken to strengthen incident prevention and management. Finally, the report must include a summary of the restoration work carried out during the year, including progressive restoration efforts, the locations and areas restored, as well as the follow-up measures put in place. This section demonstrates the operator’s commitment to rehabilitating mining sites.

The content of the annual report is organized around several key themes, each of which addresses specific requirements of D019 (MELCCFP, 2025b).

13.2.6.1 Calculation of annual loads and flow measurements

The report presents the calculation of annual loads for each parameter in the routine follow-up of the final effluent, in accordance with the methods detailed in D019 (MELCCFP, 2025b). The monthly loads are added together to calculate the annual load (expressed in kg/year) for each monitored parameter, such as arsenic, copper, iron, nickel, lead, zinc, cyanides, suspended solids, and radium-226.

The report must include the initial or annual verification report on the accuracy of flow measurement systems, as required by D019 (MELCCFP, 2025b). This report must include recommendations and an action plan for corrective measures, if necessary, as well as a follow-up on the implementation of those measures. This requirement ensures that loads are calculated with greater accuracy.

13.2.6.2 Tailings management

The annual report must include the annual quantity, in metric tonnes, of all tailings produced, as well as a breakdown by management method (backfilling, disposal in stockpiles, reuse, etc.). The area, in hectares, affected by tailings storage facilities and treatment ponds must also be specified. This information can be used to assess the environmental footprint of operations and the effectiveness of waste management.

The report also includes the annual physical stability inspection report for tailings storage facilities and associated structures, as well as the recommended corrective actions and their state of progress. The follow-up on corrective actions taken following the safety review must be detailed, including a timeline for implementing the corrective measures. This requirement is to ensure that recommendations resulting from inspections and safety reviews are effectively implemented.

13.2.6.3 Piezometric and groundwater quality follow-up

The report includes a section specifically dedicated to groundwater quality monitoring, covering the results of tests, an analysis of trends, and a description of any corrective or mitigation measures implemented, where applicable. Analysis certificates must be kept in an accessible log and made available upon request. This requirement is intended to ensure the protection of water resources and prevent any contamination resulting from mining activities.

The piezometric follow-up, that is, the measurement of groundwater levels, must also be included in the annual report. Measurements must be taken at locations where observation wells have been installed, at least twice a year, typically in the spring and summer. The report must present the results of these measurements and their interpretation.

13.2.6.4 Water report

The report provides a detailed overview of water used and discharged at the mine site, including the mine wastewater utilization rate and the mine wastewater utilization efficiency rate, calculated using the prescribed formulas. All data required for these calculations—such as the annual volume of reused mine wastewater, the annual volume of fresh water used, and the annual volume of final effluent—must be provided. This assessment is used to evaluate the effectiveness of water management and efforts to reduce fresh water consumption.

For each tailings storage facility on the site, the report must include the results of the percolation rate calculation, as well as all data necessary for that calculation. This requirement is intended to ensure that waste management facilities do not pose a risk of contamination to groundwater.

13.2.6.5 Submission and retention procedures

The annual report must be submitted to the Ministère by June 1 of each year, until the end of the transition period leading to the site's full restoration. All reports submitted, along with the documents, information, and data required to produce them, will be retained by PMET throughout the duration of the activities and until the post-restoration follow-up program is discontinued.

13.2.6.6 Annual report and follow-up

The annual report must demonstrate compliance with requirements. It is a key tool for environmental management and accountability. It will help the MELCCFP verify the compliance of PMET's activities and monitor changes in environmental impacts. In addition to the content presented above, the follow-up reports to be prepared during the year will be included as an appendix. Thus, all commitments made for a given year will be reported according to the follow-up schedule presented in the following chapter.

13.2.7 Follow-up program calendar

Appendix 13-1 provides a timeline for all follow-up activities planned as part of the environmental monitoring program throughout the various phases of the project.

14 Preliminary compensation program

14.1 Summary of loss of fish habitat, wetlands, and aquatic environments

Table 14-1 summarizes the anticipated direct loss of fish habitat, wetlands, and aquatic environments associated with the project.

Table14-1 Summary of estimated direct loss of fish habitat, wetlands, and aquatic environments

Environment	Category	Type of environment	Total (ha)
Aquatic	**Fish habitat**		
	Littoral	Watercourse	0.78
		Bodies of water	56.35
		Wetland below the littoral zone	0.05
		Sub-total fish habitat aquatic environments	**57.18**
	Not a fish habitat		
	Littoral	Watercourse	0.00
		Body of water	0.03
		Wetland below the littoral zone	4.93
		Sub-total not a fish habitat littoral	**4.97**
	Riverbank	Wetland	3.63
		Forested	6.09
		Non-forested	0.82
		Sub-total riverbank	**10.53**
		Sub-total not a fish habitat aquatic environments	**15.50**
Wetland		**Wetlands outside littoral or riverbank**	**104.68**
Total of estimated direct loss of fish habitat, wetlands, and aquatic environments			**120.19**

14.2 Fish habitat compensation plan

14.2.1 Context and losses to be compensated

As part of the project, spodumene will be extracted using a hybrid approach combining open pit and underground mining, so as to reduce the direct impact on fish habitat. Despite these efforts, the infrastructure development will result in the direct loss of approximately 57.18 ha of aquatic habitat, mainly due to the partial draining of Lake L01.

These habitats are mainly populated by white sucker (*Catostomus commersonii*) and northern pike (*Esox lucius*), with a lesser presence of lake trout (*Salvelinus namaycush*). Brook trout (*Salvelinus fontinalis*) have also been observed in the lake outlet, which offers good potential for feeding and spawning for lithophilic species, but poor potential for phytophilic species.

Mitigation measures are planned, including fish relocation and the creation of a diversion channel modelled on a natural watercourse to maintain connectivity (Appendix 14-1). However, residual impacts remain and require the implementation of a compensation plan aimed at restoring or improving equivalent habitats, in accordance with regulatory requirements, in consultation with the Cree community and government authorities (Appendix 14-2).

14.2.2 Compensation project identification

The identification of compensation projects relied on two complementary components. First, consultations were held with land users, regional organizations, and government agencies to identify priority issues and gather compensation project ideas. Next, a photo interpretation analysis was undertaken of the identified sites, disturbed areas and areas with restoration potential, such as altered watercourses, obsolete culverts, borrow pits, and abandoned mine sites.

The consultation effort revealed several major concerns relating to aquatic environments, including mercury contamination in fish flesh, which remains a significant issue for the Chisasibi community; the presence of invasive species, exacerbated by fishing tournaments and the arrival of tourists with their boats; and the degraded quality of water in some watercourses, which tallymen consider to be a cause for concern.

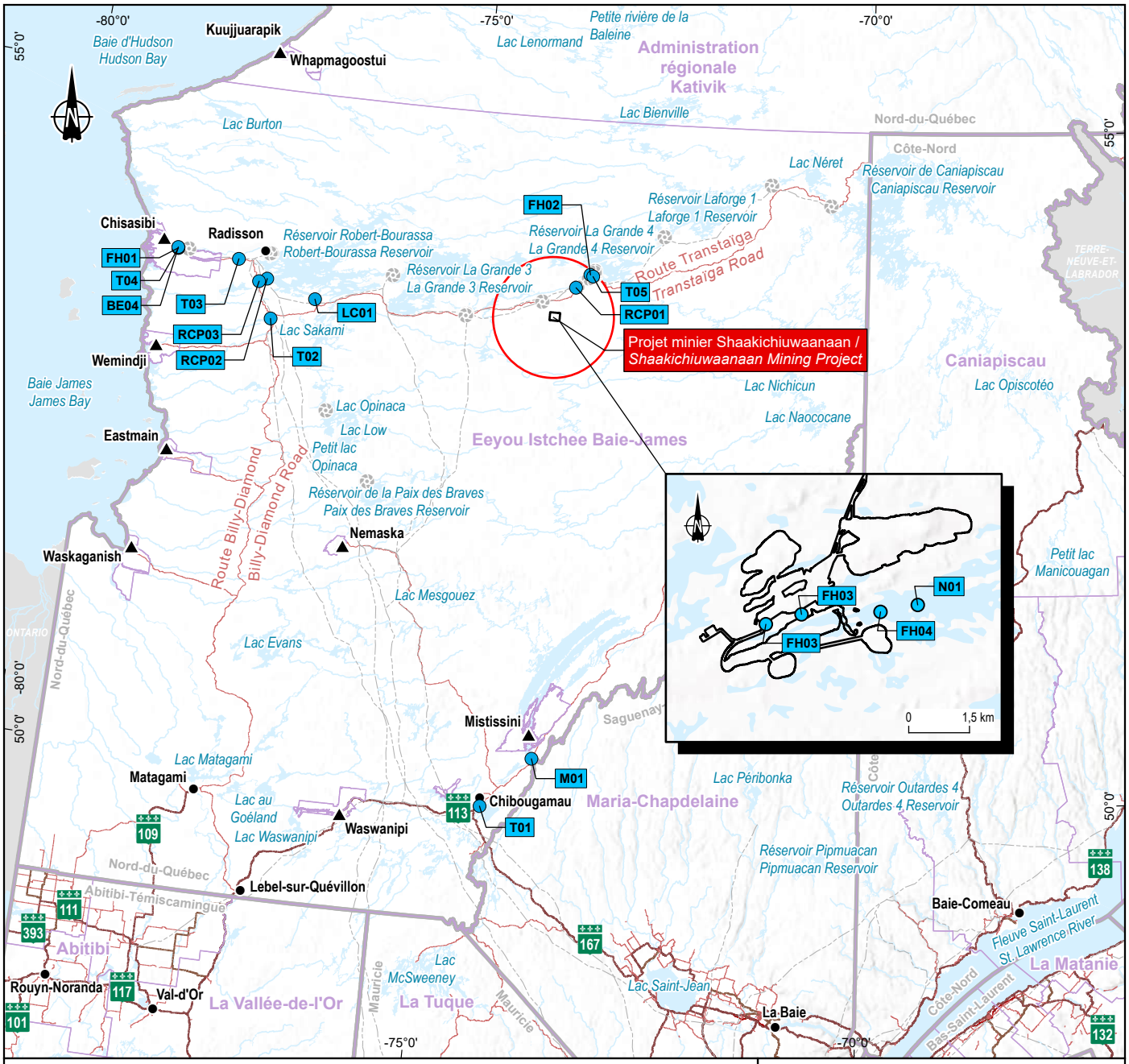
A list of potential aquatic habitat compensation projects has been developed in accordance with the principles of the Policy for applying measures to offset harmful impacts to fish and fish habitat (DFO, 2025), while incorporating the cultural values and fisheries management priorities of local Indigenous communities.

14.2.3 Identified projects

The identified compensation projects fall into different categories:

- Water level increase
- Restoration of watercourses and water bodies
- Development of spawning grounds and grass beds
- Improved fish passages (migratory pass)
- Rehabilitation of culverts
- Restoration of disturbed sites (borrow pits, abandoned mine sites)
- Measures targeting invasive species and contaminants

Some identified projects were rejected because they did not meet the compensation criteria or presented major constraints. Other projects are currently being analyzed and will be presented in detail at a later date. The projects presented below are considered “active” and have been identified as having the potential to compensate for fish habitat loss from the project. Map 14-1 shows the location of identified fish habitat compensation projects.



Zones d'étude / *Study Areas*

- Projet / *Project*
- Biophysique - Régionale / *Regional - Biophysical*

Site de compensation / *Compensation Site*

- Habitat du poisson / *Fish habitat*

Repères géographiques / *Geographical Landmarks*

- Communauté crie dans la zone d'étude du milieu humain / *Cree community in the human environment study area*
- Municipalité / *Municipality*

Infrastructures / *Infrastructure*

- Centrale hydroélectrique / *Hydroelectric generating station*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*

- Autoroute / *Highway*
- Route nationale / *National road*
- Route régionale / *Regional road*
- Autre / *Other*

Limites / *Boundaries*

- Région administrative / *Administrative Region*
- Municipalité régionale de comté (MRC) et Territoires autochtones / *Regional County Municipality (RCM) and First Nations Territories*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 14-1 / *Map 14-1*
Localisation des pistes de compensation de l'habitat du poisson / *Location of Fish Habitat Compensation Options*

Sources :
SDA, 1/20 000, MRNF, 2024-02
Canvec, 1/250 000, 1/5 000 000 et 1/15 000 000, RNCan, 2019
BDGA, 1/1 000 000, MRN Québec, 2014
BDGA, 1/5 000 000, MRNF Québec, 2010
AQréseau+, réseau routier, MERN, 2024-03-01
RNCan, Frontières géopolitiques, 2002

0 50 100 km

NAD 1983 Quebec Lambert

2026-03-27

Préparation / Preparation : F. Gagnon
Dessin / Drawing : P. Boulay
Approbation / Approval : F. Gagnon
CA0001724_3318_eie_ch14_c1_260327.aprx
CA0001724_3318_eie_c14_1_133_260327

La précision des limites et les mesures montrées sur ce document ne doivent pas servir à des fins d'ingénierie ou de délimitation foncière. Aucune analyse foncière n'a été effectuée par un arpenteur-géomètre. / Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.

14.2.4 Summary

Several fish habitat compensation projects were identified and selected to move forward based on their relevance and feasibility. The table below provides a summary of these projects, indicating the issue identified needing improvement, the work planned to address identified issues, the anticipated gain in surface area, and the potential challenges to be considered.

Table 14-2 Summary of potential fish habitat compensation projects

Project name	Issues	Planned work	Anticipated gain (ha)	Potential challenges
Raising the water level of Lake L01 (N01)	Partial drying up of Lake L01 and significant loss of fish habitat. Habitats suitable for northern pike spawning are very rare (<1% of riverbanks) and aquatic vegetation is scarce.	Raise the water level of Lake L01 using the dam planned for the mine site to increase the area and volume of fish habitat. This measure will also allow spring flooding of the riverbanks, promoting northern pike spawning and improving ecological functions (fry rearing, shelter, feeding).	2.15 to 20.71 (depending on the level-raising scenario: +10 cm to +60 cm).	Proximity to mining infrastructure and issues related to site closure. Confirmation of the volume of water retained by the dam to determine the type of structure (high or low capacity).
Development of multi-species spawning grounds at the mine site (FH03)	Scarcity of habitats suitable for spawning lithophilic species in Watercourses CE8 and CE11 at the site.	Develop multi-species spawning grounds at the crossings of Watercourses CE8 and CE11 by preserving the natural riverbed, adding suitable substrate, and installing sills to ensure favourable water conditions for lithophilic species to spawn.	Between 0.05 and 0.1 ha (exact gain to be confirmed according to the development plan).	To be determined (related to the design of the crossings and water conditions).
Development of grass beds in Lake L01 (FH04)	Lack of spawning habitats for northern pike due to the scarcity of aquatic vegetation and steep banks.	Reshape some riverbanks to create or enlarge flood plain areas during the spawning season, then replant with suitable vegetation to ensure the rapid establishment of grass beds conducive to northern pike reproduction.	2.5 ha (six preliminary sites identified, possibility of increasing the surface area).	To be determined (related to site selection and topographical constraints).
Watercourse near airport LG-4 (RCP01)	Past impacts: three crossings and the presence of an embankment disrupting the watercourse.	Restore the banks at the former crossing points and develop a water body in the embankment area, including depressions to reach the water table, gentle slopes to promote grass beds, topsoil spreading, and revegetation work (seeding, reforestation, transplantation).	0.41 ha (fish habitat).	Proximity to the runway and ownership of the land.
Watercourse (north) at Lac Desaulniers (RCP02)	Decreased quality of the fishing site (spread of willow trees) and uncertain water quality; free passage of fish not documented.	Restore the spawning ground and banks overgrown with willow, improve water quality, and take action to ensure the free passage of fish if necessary.	To be determined	To be determined

Project name	Issues	Planned work	Anticipated gain (ha)	Potential challenges
Watercourse (west) at Lac Desaulniers (RCP03)	Problematic water quality (rusty colour), possible contamination linked to a nearby landfill site.	Implement corrective measures to treat the contamination responsible for the discolouration and improve the quality of the water environment.	To be determined	To be determined
Restoration of a brook trout spawning ground (FH01)	Brook trout spawning ground near the Chisasibi public beach.	Implement measures to restore the spawning ground, including site characterization and measures to improve habitat quality and functionality.	To be determined	To be determined
Restoration of a walleye spawning ground (FH02)	Walleye spawning ground near the LG-4 power plant; spawning site unsuitable since the removal of a bridge or culvert.	Restore the spawning ground by improving habitat quality and functionality, and implement corrective measures related to the removal of the bridge or culvert.	To be determined	To be determined
Restoration of a fish pass (LC01)	Damaged pass preventing the free passage of fish between the water bodies and the Robert-Bourassa reservoir.	Reconfigure the fish pass to restore connectivity and enable species migration between watercourses and the reservoir.	Up to 124 ha (upstream water bodies).	Ownership of the dam and the pass by Hydro-Québec; legal obligations and willingness to carry out the work.
Culvert at Lac Yasinski (T02)	Issue of free passage of fish; little use of the developed spawning ground; risk of eggs being washed away on the jetty.	Rehabilitate the culvert to restore connectivity and optimize the existing spawning ground by improving hydraulic conditions and correcting the jetty (uniform level, removal of the insulating fabric, adjustment of the protective arm) to reduce the risk of eggs being washed away.	Up to 137.9 ha (water bodies) and 0.169 ha (spawning grounds).	Complex logistics (Billy-Diamond Highway, single North-Radisson route) and preserving the integrity of the existing spawning grounds.
Culverts at km 77 of the Chisasibi Road (T03)	Culverts in poor condition hindering the free passage of fish; risk of complete deterioration.	Replace culverts with a permanent structure (e.g., arch culvert) that ensures free passage at all times and preserves a natural flow bed.	Up to 36.17 km of watercourses and 183.18 ha of water bodies.	Complex logistics (single road to Chisasibi); maintaining traffic flow during construction.
Culvert at the entrance to Chisasibi borrow pit 1 (T04)	Issue of free passage for fish; accumulation of water upstream of the culvert; presence of a brook trout spawning ground upstream.	Implement appropriate measures to restore connectivity, including technical characterization of the culvert and design of a structure that facilitates the free passage of fish.	To be determined	Keep traffic flowing if the borrow pit is still in use.
Culverts near LG-4 (T05)	Crossings and culverts that may interfere with the free passage of fish and the quality of the habitat.	Implement appropriate measures to restore connectivity, including the characterization of culverts and the design of structures that facilitate the free passage of fish.	To be determined	Ownership of the rights-of-way (possibly Hydro-Québec).

Project name	Issues	Planned work	Anticipated gain (ha)	Potential challenges
Chisasibi borrow pit 1 (BE04)	Deteriorated environment; crossings hindering traffic; presence of excavated water.	Restore the borrow pit by removing residual material, apply the “rough and loose” method, enlarge the excavated water body, and develop a juxtaposed wetland (gentle slopes, drainage channels, topsoil, vegetation). Replace or adapt culverts to restore the free passage of fish.	2.5183 ha (fish habitat) + additional water and wetland environments.	Project compromised if the borrow pit is still active (access for heavy machinery).
Culvert in Chibougamau (T01)	Heavily damaged culvert hindering the free passage of fish; rising water levels upstream.	Replace the culvert with a suitable structure to restore connectivity between the two bodies of water and ensure free passage for fish at all times.	Up to 26.05 km of watercourses and 683.5 ha of water bodies.	To be determined (ownership, technical and logistical constraints).
Icon Sullivan (M01)	Homogeneous channel with no sinuosity; steep banks; contamination by tailings; old road on the riverbank.	Create a diversion channel with a basin from the existing channel; stabilize the banks at strategic locations to limit runoff; renaturalize an old road northeast of the site.	1,168 ha (fish habitat: 0.7003 ha; riverbanks: 0.4677 ha.	Presence of contaminants and instability in several areas.
Boat washing station (EEE01)	Risk of introducing invasive alien species due to fishing tournaments and the growing number of tourists arriving from the south with boats.	Set up a mobile washing station that can be moved as needed (tournaments, critical periods) and/or a fixed station at a strategic location to intercept boats coming from the south.	N/A	Ensure that the mobile station is present at the right water bodies at the right time; approve sites for a fixed station.
Environmental contaminants – traditional food (R01)	Presence of mercury in freshwater fish flesh, concerns for the health and food safety of the Chisasibi community.	Identify environmental contaminants (particularly mercury) in traditional foods; conduct sampling and analysis; disclose results and raise public awareness.	N/A	To be determined (related to methodology, sampling sites, and reporting of results).

References: (Niigaan. 2025) (DFO, 2025)

14.3 Wetland and aquatic environment compensation plan

14.3.1 Context and losses to be compensated

The planned development will result in the loss of 120.19 ha of wetlands and aquatic environments. Table 14-1 describes the type of environment per hectare in further detail.

The local project study area encompasses a total of 285 wetlands. The vast majority of these wetlands (89%) are part of a wetland complex, while 92% have an identified water connection (direct or indirect). Identified wetlands include a shallow water area, a pond, four marshes, 43 treed swamps, 17 shrubby swamps, eight forested fens, 45 open fens, 66 forested ombrotrophic bogs, and 100 open ombrotrophic bogs.

14.3.2 Project search

Due to the abundance of wetlands and aquatic environments in the region, and the limited number of disturbed environments requiring restoration, the search for compensation options could not be based solely on achieving gains comparable to losses in surface area. Particular attention was paid to identifying projects that could offset losses of affected ecological functions. However, this approach complexifies the quantification of gains, as they are not based on a direct comparison of surface areas for a given type of environment, but on enhancements to ecological functions, the equivalence of which cannot be expressed solely on an area basis..

Consultations with communities potentially affected by the project were also a central part of the process to identify compensation projects. The selected projects must meet the expectations of land users who know and use the area and who could be directly affected by the project. The main concerns expressed throughout land user consultation efforts were related to fish habitat. However, tallymen are also concerned about the increased presence of invasive species, a phenomenon exacerbated by fishing tournaments and the influx of tourists with their boats. Concerns about water quality in some watercourses were also expressed.

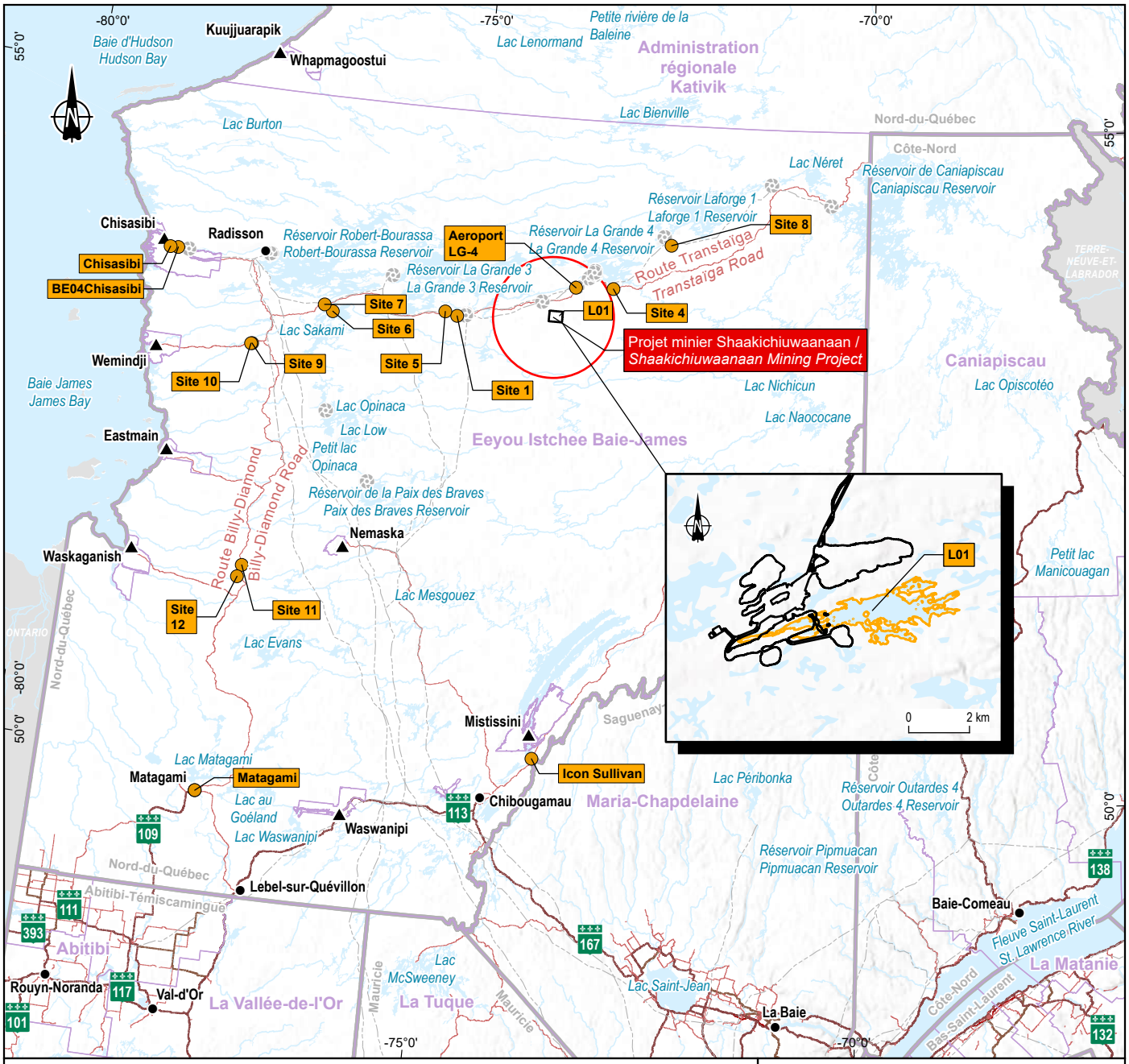
Moreover, some traditional activities practiced by land users are closely tied to wetlands and aquatic environments. The conservation of hunting of geese, ducks, and bears, may be among other measures that could be explored within wetland and water management plans.

14.3.3 Selected projects

Four main areas have been identified for wetland and water compensation projects in the project region (Appendix 14-3):

- Indirect gains from fish habitat compensation projects
- Development of former borrow bits
- Restoration of contaminated sites
- Research focus: a path forward with carbon sequestration in peatlands

The projects selected to date are considered active and offer potential for offsetting the loss of wetlands and aquatic environments. Map 14-2 shows the location of potential wetland and aquatic environment compensation projects.



Zones d'étude / *Study Areas*

- Projet / *Project*
- Biophysique - Régionale / *Regional - Biophysical*

Site de compensation / *Compensation Site*

- Milieux humides et hydriques / *Wetland and hydrous environment*

Repères géographiques / *Geographical Landmarks*

- Communauté crie dans la zone d'étude du milieu humain / *Cree community in the human environment study area*
- Municipalité / *Municipality*

Infrastructures / *Infrastructure*

- Centrale hydroélectrique / *Hydroelectric generating station*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*

- Autoroute / *Highway*
- Route nationale / *National road*
- Route régionale / *Regional road*
- Autre / *Other*

Limites / *Boundaries*

- Région administrative / *Administrative Region*
- Municipalité régionale de comté (MRC) et Territoires autochtones / *Regional County Municipality (RCM) and First Nations Territories*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 14-2 / *Map 14-2*
Localisation des pistes de compensation des milieux humides et hydriques / *Location of Wetland and Hydrous Environment Compensation Options*

Sources :
SDA, 1/20 000, MRNF, 2024-02
Canvec, 1/250 000, 1/5 000 000 et 1/15 000 000, RNCan, 2019
BDGA, 1/1 000 000, MRN Québec, 2014
BDGA, 1/5 000 000, MRNF Québec, 2010
AQréseau+, réseau routier, MERN, 2024-03-01
RNCan, Frontières géopolitiques, 2002

0 50 100 km

NAD 1983 Quebec Lambert

2026-03-27

Préparation / Preparation : F. Gagnon
Dessin / Drawing : P. Boulay
Approbation / Approval : F. Gagnon
CA0001724_3318_eie_ch14_c2_260327.aprx
CA0001724_3318_eie_c14_2_134_260327

La précision des limites et les mesures montrées sur ce document ne doivent pas servir à des fins d'ingénierie ou de délimitation foncière. Aucune analyse foncière n'a été effectuée par un arpenteur-géomètre. / Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.

14.3.4 Summary

The following table provides an overview of the various potential projects selected, highlighting the targeted issues for each identified project, the planned work to be undertaken, the expected gains in hectares, and the potential challenges to be considered.

Table 14-3 Summary of potential wetland and aquatic environment compensation projects

Project name	Issues	Planned work	Anticipated gain (ha)	Potential challenges
Raising the water level of Lake L01 (N01)	Partial drying up of Lake L01 and significant loss of fish habitat. Habitats suitable for northern pike spawning are very rare (<1% of riverbanks) and aquatic vegetation is scarce.	Raise the water level of Lake L01 using the dam planned for the mine site to increase the area and volume of fish habitat. This measure will also allow spring flooding of the riverbanks, promoting northern pike spawning and improving ecological functions (fry rearing, shelter, feeding).	2.15 to 20.71.	Proximity to mining infrastructure and issues related to site closure. Confirmation of the volume of water retained by the dam to determine the type of structure (high or low capacity).
Development of grass beds in Lake L01 (FH04)	Lack of spawning habitats for northern pike due to the scarcity of aquatic vegetation and steep banks.	Reshape some riverbanks to create or enlarge flood plain areas during the spawning season, then replant with suitable vegetation to ensure the rapid establishment of grass beds conducive to northern pike reproduction.	2.5 (six preliminary sites identified, possibility of increasing the surface area).	To be determined (related to site selection and topographical constraints).
Watercourse near airport LG-4 (RCP01)	Past impacts: three crossings and the presence of an embankment disrupting the watercourse.	Restore the banks at the former crossing points and develop a water body in the embankment area, including depressions to reach the water table, gentle slopes to promote grass beds, topsoil spreading, and revegetation work (seeding, reforestation, transplantation).	Riverbanks: 0.28; wetlands: 0.44.	Proximity to the runway and ownership of the land.
Watercourse (north) at Lac Desaulniers (RCP02)	Decreased quality of the fishing site (spread of willow trees) and uncertain water quality; free passage of fish not documented.	Restore the spawning ground and banks overgrown with willow, improve water quality, and take action to ensure the free passage of fish if necessary.	To be determined	To be determined

Project name	Issues	Planned work	Anticipated gain (ha)	Potential challenges
Chisasibi borrow pit 1 (BE04)	Deteriorated environment; crossings hindering traffic; presence of excavated water.	Restore the borrow pit by removing residual material, apply the “rough and loose” method, enlarge the excavated water body, and develop a juxtaposed wetland (gentle slopes, drainage channels, topsoil, vegetation). Replace or adapt culverts to restore the free passage of fish.	Riverbanks: 0.81; wetlands: 1.23.	Project compromised if the borrow pit is still active (access for heavy machinery).
Icon Sullivan (M01)	Homogeneous channel with no sinuosity; steep banks; contamination by tailings; old road on the riverbank.	Create a diversion channel with a basin from the existing channel; stabilize the banks at strategic locations to limit runoff; renaturalize an old road northeast of the site.	Riverbanks: 0.4677.	Presence of contaminants and instability in several areas.
Site 4	Borrow pit open under certain conditions, environment damaged by removal of material, creation of access roads, and machinery traffic.	Restoration of the site by creating wetlands through the removal of material, reshaping the landscape, revegetation, and development of floodplains.	2.84.	To be determined
Site 5 -33G06-1	Gravel borrow pit open under certain conditions, environment damaged by removal of material, creation of access roads, and machinery traffic.	Restoration of the site by creating wetlands through the removal of material, reshaping the landscape, revegetation, and development of floodplains.	2.32.	To be determined
Site 7 -33F07-1	Crushed stone borrow pit open under certain conditions, environment damaged by removal of material, creation of access roads, and machinery traffic.	Restoration of the site by creating wetlands through the removal of material, reshaping the landscape, revegetation, and development of floodplains.	4.56.	To be determined
Site 8 – 33I02-12	Closed sand borrow pit, environment damaged by removal of material, creation of access roads, and machinery traffic.	Restoration of the site by creating wetlands through the removal of material, reshaping the landscape, revegetation, and development of floodplains.	2.40.	To be determined

Project name	Issues	Planned work	Anticipated gain (ha)	Potential challenges
Site 9 – 33F04-1	Closed sand borrow pit, environment damaged by removal of material, creation of access roads, and machinery traffic.	Restoration of the site by creating wetlands through the removal of material, reshaping the landscape, revegetation, and development of floodplains.	1.98.	To be determined
Site 10 – 33F04-0	Closed gravel borrow pit, environment damaged by removal of material, creation of access roads, and machinery traffic.	Restoration of the site by creating wetlands through the removal of material, reshaping the landscape, revegetation, and development of floodplains.	8.26.	To be determined
Site 11 – 32N06-1	Closed sand borrow pit, environment damaged by removal of material, creation of access roads, and machinery traffic.	Restoration of the site by creating wetlands through the removal of material, reshaping the landscape, revegetation, and development of floodplains.	11.50.	To be determined
Site 12 – 32N06-5	Closed gravel borrow pit, environment damaged by removal of material, creation of access roads, and machinery traffic.	Restoration of the site by creating wetlands through the removal of material, reshaping the landscape, revegetation, and development of floodplains.	8.10.	To be determined
Site 1 - WJ/6-054	Contaminated site: environment damaged by soil disturbance, machinery traffic, and probable soil contamination.	Site restoration through soil decontamination, land reshaping, and wetland development.	To be determined	To be determined
Site 6 - WJ/6-028	Contaminated site: : environment damaged by soil disturbance, machinery traffic, and probable soil contamination.	Site restoration through soil decontamination, land reshaping, and wetland development.	To be determined	No access road, in the middle of a wetland complex, near the river.
Site 7 – Former dumping ground	Former illegal dumping ground containing around fifteen abandoned cars, old fuel tanks, and various other types of waste.	Site restoration through soil decontamination, land reshaping, and wetland development.	4.0.	In the middle of a wetland complex (machinery traffic).

Project name	Issues	Planned work	Anticipated gain (ha)	Potential challenges
Research Focus				
Creation of conservation areas (AMCE—Other efficient conservation measures)	Project carried out in a peatland complex.	A specialized study on carbon would be conducted, including the MELCCFP's method for quantifying carbon stocks.	To be determined	Determine site location in agreement with all stakeholders.
Knowledge acquisition	Acquire knowledge on the impact of creating a mining project (with an underground component) on the ecological functions and ecosystem services of wetlands in general, and peatlands in particular.	Mapping of plant communities, review of peatland studies, field campaigns for characterization, installation of monitoring devices, hydrological and physicochemical measurements, carbon and groundwater modelling.	To be determined	To be determined

References: (Niigaan. 2025); (MPO, 2025); (Megnan, 2024)

15 References

Chapter 1

GOVERNEMENT OF BRITISH COLUMBIA. 2002. *Business Corporations Act*, S.B.C. 2002, c. 57.

GOUVERNEMENT DU CANADA. *Loi sur l'évaluation d'impact*, L.C. 2019, ch. 28, art. 1.

RESSOURCES PMET. 2026. *Site internet*. En ligne: www.pmet.ca

Chapter 2

ECO TEC CONSULTANTS. 2024. *Retombées économiques de l'industrie minière au Québec en 2022*. [Fichier PDF], Disponible en ligne : amq_rapport_retombeeseconomiques_2024_fr-compresse.pdf. 62 p.

GOUVERNEMENT DU QUÉBEC. *Plan québécois pour la valorisation des minéraux critiques et stratégiques 2020-2025*, [Fichier PDF], Gouvernement du Québec, 2020, 45 p. [Plan québécois pour la valorisation des minéraux critiques et stratégiques 2020-2025]. Consulté le 23 octobre 2025.

GOUVERNEMENT DU QUÉBEC. *Stratégie minérale du Québec* [Fichier PDF], Gouvernement du Québec. Ministère des Ressources naturelles et de la Faune (MRNF). 2009. 46 p. [https://www.mern.gouv.qc.ca/documents/mines/strategie_minerale.pdf]. Consulté le 23 octobre 2025.

G MINING SERVICES. 2025. *NI 43-101 Technical Report, CV5 Pegmatite FS. Shaakichiuwaanaan Lithium Project James Bay Region, Quebec, Canada*. 2025. 792 p. et annexes.

MINISTÈRE DES AFFAIRES MUNICIPALES ET DE L'HABITATION (MAMH). 2023. *Région administrative 10 : Nord-du-Québec*. En ligne : https://www.mamh.gouv.qc.ca/fileadmin/publications/organisation_municipale/cartotheque/Region_10.pdf Consulté le 9 octobre 2023.

MINISTÈRE DU DÉVELOPPEMENT DURABLE, DE L'ENVIRONNEMENT ET DE LA LUTTE CONTRE LES CHANGEMENTS CLIMATIQUES (MDDELCC). 2015. *Lignes directrices relatives à la valorisation des résidus miniers*, Québec, numéros ISBN 978-2-550-72712-5 ,17 p.

MINISTÈRE DE L'ENVIRONNEMENT ET DE LA LUTTE CONTRE LES CHANGEMENTS CLIMATIQUES (MELCC). 2020. *Guide de caractérisation des résidus miniers et du minerai*, Québec, 52 p. [En ligne]. http://www.environnement.gouv.qc.ca/Industriel/secteur-minier/guidecaracterisation-minerai.pdf

MELCC. 2021. *Guide d'intervention – Protection des sols et réhabilitation des terrains contaminés.*, Beaulieu, M. Québec, mai 2021, 326 p. http://www.environnement.gouv.qc.ca/sol/terrains/guide-intervention/guide-intervention-protectionrehab.pdf

MINISTÈRE DE L'ENVIRONNEMENT, DE LA LUTTE CONTRE LES CHANGEMENTS CLIMATIQUES, DE LA FAUNE ET DES PARCS (MELCCFP). 2024. *Directive pour le projet minier Corvette*, Direction générale de l'évaluation environnementale et stratégique. 44 p.

MINISTÈRE DES RESSOURCES NATURELLES ET DES FORÊTS (MRNF). 2024. *Guide de préparation du plan de réaménagement et de restauration des sites miniers au Québec*. Direction de la restauration des sites miniers. ISBN 978-2-550-98873-1. 116 p. avec annexes. PDF en ligne : https://cdn-contenu.quebec.ca/cdn-contenu/ressources-naturelles/mines/Documents/restauration/GM_Restauration-sites-miniers.pdf

RESSOURCES NATURELLES CANADA (RNC). *Liste des minéraux critiques*. Également disponible en ligne : Les minéraux critiques : une occasion pour le Canada - Canada.ca. 2024. Consulté le 23 octobre 2025.

SECRÉTARIAT AU PLAN NORD. 2015. *Le Plan Nord à l'horizon 2035 : plan d'action 2015-2020*. Gouvernement du Québec. 47 p. En ligne : https://numerique.banq.qc.ca/patrimoine/details/52327/2670458

SOCIÉTÉ DU PLAN NORD. 2023. *Plan d'action nordique 2023-2028*, [Fichier PDF], Gouvernement du Québec, 39 p. [Plan d'action nordique 2023-2028]. Consulté le 23 octobre 2025.

Chapter 3

AGENCE D'ÉVALUATION D'IMPACT DU CANADA (AEIC) ET GOUVERNEMENT DE LA NATION CRIE (CNG). 2025. *Lignes directrices individualisées relatives à l'étude d'impact.* En ligne : https://www.iaac-aeic.gc.ca/050/documents/p89271/162823F.pdf

MELCCFP. 2023. *Guide sur la méthode d'analyse des impacts structurée par enjeux*. En ligne : https://www.environnement.gouv.qc.ca/evaluations/documents/eie-guide-par-enjeu.pdf.

G MINING SERVICES. 2025. *NI 43-101 Technical Report, CV5 Pegmatite FS. Shaakichiuwaanaan Lithium Project James Bay Region, Quebec, Canada*. 2025. 792 p. et annexes.

Chapter 4

BBA. 2025a. *Technical Report – Site Selection Alternatives for Storage of Mine Waste. Shaakichiuwaanaan Project, Eeyou Istchee James Bay Region, Québec*. Rapport préparé pour Patriot Battery Metals. 32 p. + annexes.

BBA. 2025b. Technical Report – 120 kV Transmission Line Study. Projet Shaakichiuwaanaan, région de la Baie-James, Québec. Rapport préparé pour Innova Lithium Inc. 32 p. + annexes.

G MINING SERVICES. 2025. CV5 *Pegmatite Lithium-Only Feasibility Study NI 43-101 Technical Report – Shaakichiuwaanaan Project. En ligne :* https://www.sedarplus.ca/csa-party/records/document.html?id=b944fb9b7b9517d520fe3eddc3098098f386e154c39fba4b5530fda03de2bc2a Rapport préparé pour Ressources PMET. 792 pages.

MELCCFP. 2025. *Directive 019 sur l'industrie minière* (4e éd.). ISBN 978-2-555-00464-1. En ligne : https://www.environnement.gouv.qc.ca/milieu_ind/directive019/directive-019-2025.pdf. Consulté le 17 octobre 2025.

MELCC. 2020. *Guide de caractérisation des résidus miniers et du minerai*. En ligne : https://mrnf.gouv.qc.ca/mines/publications/guides/. Consulté le 17 octobre 2025.

MRNF. 2024. *Guide de préparation du plan de réaménagement et de restauration des sites miniers au Québec*. ISBN 978-2-550-98873-1. En ligne : https://www.mrnf.gouv.qc.ca/wp-content/uploads/GM_restauration_sites_miniers_MERN.pdf. Consulté le 17 octobre 2025.

PRIMERO, 2025. TOS 2 - *Wet Plant Flowsheet DMS vs Hybrid. Shaakichiuwaanaan Lithium Project Feasibility Study* (CASN-A 620-GE-MEM-0200), Patriot Battery Metals Inc. 22 p

Chapter 5

ATKINS REALIS. 2026. *Classification des matériaux miniers du projet Shaakichiuwaanaan selon les critères du guide de caractérisation des résidus miniers et du minerai* (GCRMM). Réf : PMT-003-24A-QAQ-0001_V0. Note technique préparée pour Ressources PMET Inc. 33 p. et annexes.

BBA. 2026. *Options de bancs d'emprunt pour construction des infrastructures*. Réf : 75350037-000000-40-ERA-0001-R01. Lettre-rapport préparée pour Ressources PMET Inc. 11 p. et annexes.

G MINING SERVICES. 2025. *CV5 Pegmatite Lithium-Only Feasibility Study NI 43-101 Technical Report – Shaakichiuwaanaan Project*. En ligne *:* https://www.sedarplus.ca/csa-party/records/document.html?id=b944fb9b7b9517d520fe3eddc3098098f386e154c39fba4b5530fda03de2bc2a Rapport préparé pour Ressources PMET. 792 pages.

MELCCFP. 2025. *Directive 019 sur l'industrie minière.* Direction principale des eaux usées du ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs. En ligne : https://www.environnement.gouv.qc.ca/milieu_ind/directive019/directive-019-2025.pdf

MERN. 2022. *Guide de préparation du plan de réaménagement et de restauration des sites miniers au Québec.* En ligne : file:///C:/Users/CAVG075331/Downloads/1314816.pdf

POLY-GÉO. 2026. Identification de sites potentiels de carrières. Document de travail présenté à Innova Lithium.

VISION GEOCHEMISTRY. 2025. *Caractérisation géochimique et modélisation des matériaux de résidus miniers pour le projet Shaakichiuwaanaan (pegmatite CV5) : mise à jour de l'étude de faisabilité.* Réf. : 2405007-TR1-FR. Rapport préparé pour Ressources PMET Inc. 100 p. et annexes.

Chapter 6 - Section 6-1

No external reference

Chapter 6 - Section 6-2

CLIMATE

ENVIRONNEMENT ET CHANGEMENT CLIMATIQUE CANADA (ECCC). 2025a. Données des normales climatiques canadiennes pour 1991-2020 – Station La Grande IV. En ligne : https://climat.meteo.gc.ca/climate_normals/results_1991_2020_f.html?searchType=stnProv&lstProvince=QC&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=109000000&dispBack=0. Consulté en octobre 2025.

ECCC. 2025b. Données des stations pour le calcul des normales climatiques au Canada de 1961 à 1990 – Station Nitchequon. En ligne : https://climat.meteo.gc.ca/climate_normals/results_1961_1990_f.html?searchType=stnProv&lstProvince=QC&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=1198&dispBack=0. Consulté en octobre 2025.

AMBIENT AIR

MELCCFP. 2025a. Guide d'instructions – Préparation et réalisation d'une modélisation de la dispersion des émissions atmosphériques – Projets miniers. Direction des politiques de l'atmosphère du ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs. 19 p. et annexes.

MELCCFP. 2025b. Normes et critères québécois de qualité de l'atmosphère, version 10, Québec, Direction principale de la qualité de l'air et du climat. En ligne : www.environnement.gouv.qc.ca/air/criteres/index.htm. Consulté en décembre 2025.

MELCCFP. 2025c. Guide de la modélisation de la dispersion atmosphérique.

GREENHOUSE GAZ

MELCCFP. 2025. GES 1990-2023 Inventaire des émissions de gaz à effet de serre en 2023 et leur évolution depuis 1990. Québec, ISBN : 978-2-555-02591-2, 72 pages.

ECCC. 2025. Rapport d'inventaire national 1990–2023 : Sources et puits de gaz à effet de serre au Canada 2025. En ligne : https://www.canada.ca/fr/environnement-changement-climatique/services/changements-climatiques/emissions-gaz-effet-serre/inventaire.html?utm_campaign=not-applicable&utm_medium=vanity-url&utm_source=canada-ca_inventaire-ges. Consulté en janvier 2026.

SOUND ENVIRONMENT

MELCCFP. 2025. Directive 019 sur l'industrie minière. Direction principale des eaux usées du ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs. En ligne : https://www.environnement.gouv.qc.ca/milieu_ind/directive019/directive-019-2025.pdf

MELCCFP. 2026. Lignes directrices relatives à la gestion du bruit environnemental. Consulté en ligne : 1342588.pdf . Mars 2026.

AMBIENT LIGHT

COMMISSION INTERNATIONALE DE L'ÉCLAIRAGE (CIE). 2003. Technical report: guide on the limitation of the effects of obtrusive light from outdoor lighting installations. Commission Internationale de l'Éclairage. 126:1997, ISBN 978 3 900734 83 1. Vienne, Autriche.

GEOLOGY AND GEOMORPHOLOGY

BBA. 2025. Évaluation de la teneur de fond naturelle dans les sols. Projet minier Shaakichiuwaanaan. Rapport préparé par BBA pour Patriot Battery Metals Inc. No réf. 7535023-000000-4E-ERA-0001 / R00.

GOUVERNEMENT DU QUÉBEC. 2026. Géologie du Québec. En ligne : Géologie du Québec | Gouvernement du Québec . Consulté en janvier 2026.

MELCCFP. 2021. Guide d'intervention – Protection des sols et réhabilitation des terrains contaminés. 283 p. et annexes.

HYDROLOGY

ECCC. 2024. Données hydrométriques historiques. En ligne. [https://eau.ec.gc.ca/search/historical_f.html] (consulté en août 2024).

MELCCFP. 2024. Historique des débits aux stations hydrométriques. En ligne. [https://www.cehq.gouv.qc.ca/atlas-hydroclimatique/stations-hydrometriques/] (consulté en août 2024).

MELCCFP. 2022. Atlas hydroclimatique du Québec méridional. En ligne. [https://www.cehq.gouv.qc.ca/atlas-hydroclimatique/] (consulté en août 2024).

MELCCFP. 2017. Estimation des débits d'étiage pour le Nord du Québec. Solution à court terme.

SURFACE WATER

MDDELCC. 2017. *Guide de caractérisation physicochimique de l'état initial du milieu aquatique avant l'implantation d'un projet industriel*. Direction générale du suivi de l'état de l'environnement, Québec. 12 p. et annexes.

NIIGAN. 2025. *État de référence du milieu aquatique pour le projet Shaakichiuwaanaan. Qualité des eaux de surface et des sédiments.* Rapport du projet 151022002 présenté à Ressources PMET inc. 78 p. et annexes.

SEDIMENTS

ENVIRONNEMENT CANADA et MINISTÈRE DU DÉVELOPPEMENT DURABLE, DE L'ENVIRONNEMENT ET DES PARCS DU QUÉBEC (ECCC et MDDEP). 2007. *Critères pour l'évaluation de la qualité des sédiments au Québec et cadres d'application : prévention, dragage et restauration*. 39 p.

HYDROGEOLOGY

BBA, 2024. Hydrogeological study – Future open pit/underground CV5, Shaakichiuwaanaan lithium property. 164 p.

BBA, 2025a. Packer testing factual report. 79 p.

BBA, 2025b. Hydrogeological characterisation – CV5 mining site, Shaakichiuwaanaan Lithium Property. 57 p. and appendices.

MAILLOUX HYDROGÉOLOGIE INC. 2026. Note technique – Évaluation hydrogéologique pour le projet de mine souterraine et de fosse à ciel ouvert – Projet Shaakichiuwaanaan – PMET Ressources. 35 p.

MRNF. 2025. Carte interactive SIGEOM. MRNF, Québec; Produits et services en ligne - Mines, https://sigeom.mines.gouv.qc.ca/signet/classes/I1108_afchCarteIntr (Système d'information géominière du Québec consulté en décembre 2025.

GROUNDWATER QUALITY

BEAULIEU, A. (2021). Guide d'intervention – Protection des sols et réhabilitation des terrains contaminés. Ministère de l'Environnement et de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP), Québec. 499 p.

MELCCFP. 2025. Directive 019 sur l'industrie minière. Direction principale des eaux usées du ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs. En ligne : https://www.environnement.gouv.qc.ca/milieu_ind/directive019/directive-019-2025.pdf

Chapter 6 - Section 6-3

VEGETATION AND WETLANDS

CENTRE DE DONNÉES SUR LE PATRIMOINE NATUREL DU QUÉBEC (CDPNQ). 2024. Potentiel, version 1.4 (mise à jour le 5 avril 2024) - outil listant les espèces floristiques menacées, vulnérables, susceptibles de l'être ou candidates basé sur les habitats et régions administratives sélectionnés. Gouvernement du Québec, ministère de l'Environnement et de la Lutte contre changements climatiques, de la Faune et des Parcs, Direction de la protection des espèces et des milieux naturels.

CDPNQ. 2025. Carte des occurrences d'espèce en situation précaire. Québec. Carte interactive. Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs. En ligne : https://services-mddelcc.maps.arcgis.com/apps/webappviewer/index.html?id=2d32025cac174712a8261b7d94a45ac2. Consulté en janvier 2025.

GOUVERNEMENT DU CANADA. 2025. Liste des espèces en péril. Annexe 1 de la Loi sur les espèces en péril. En ligne https://laws.justice.gc.ca/fra/lois/S-15.3/page-10.html#docCont. Consulté en janvier 2025.

GOUVERNEMENT DU QUÉBEC, 2025a. Liste des principales espèces exotiques envahissantes. [En ligne] : https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/faune/gestion-faune-habitats-fauniques/gestion-especes-exotiques-envahissantes-animales/liste-especes#c306329 . Consultée en janvier 2025.

MELCCFP. 2025. Sentinelle, Outil de détection des espèces exotiques envahissantes. En ligne : https://www.pub.enviroweb.gouv.qc.ca/scc/Catalogue/ConsulterCatalogue.aspx. Consulté en janvier 2025.

MRNF. 2023. Classification écologique du territoire québécois. Jeu de données disponible en ligne : https://www.donneesquebec.ca/recherche/fr/dataset/systeme-hierarchique-de-classification-ecologique-du-territoire. Consulté en janvier 2025.

MRNF. 2024a. Carte interactive Forêt ouverte. En ligne : https://www.foretouverte.gouv.qc.ca/. Consulté en juin 2024.

MRNF. 2024b. Système d'information géominière du Québec (SIGÉOM). Carte interactive. En ligne : https://sigeom.mines.gouv.qc.ca/signet/classes/I1108_afchCarteIntr. Consulté en juillet 2024.

UPRETY, Y., ASSELIN, H., DHAKAL, A. et al. 2012. Traditional use of medicinal plants in the boreal forest of Canada: review and perspectives. J Ethnobiology Ethnomedicine 8, 7. https://doi.org/10.1186/1746-4269-8-7

ICHTYOFAUNA AND BENTHOS

ACIA. 2025. Lignes directrices canadiennes sur les contaminants chimiques et les toxines dans le poisson et les produits du poisson. https://inspection.canada.ca

CCME. 2018. Recommandations canadiennes pour la qualité des eaux : Protection de la vie aquatique. Conseil canadien des ministres de l'environnement. https://ccme.ca/en/resources/canadian-environmental-quality-guidelines

NIIGAAN. 2025a. État de référence du milieu aquatique pour le projet Shaakichiuwaanaan - Caractérisation du poisson et de son habitat. Rapport du projet 151022002. 198 pages + annexes.

NIIGAAN. 2025b. État de référence du milieu aquatique pour le projet Shaakichiuwaanaan - Invertébrés benthiques. Rapport du projet 151022002. 92 pages + annexes

NIIGAAN. 2025c. État de référence du milieu aquatique pour le projet Shaakichiuwaanaan - Teneurs en métaux dans la chair des poissons. Rapport du projet 151022002. 23 pages + annexes.

HERPETOFAUNA

CDPNQ. 2025. Carte des occurrences d'espèce en situation précaire. Québec. Carte interactive. Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs. En ligne : https://services-mddelcc.maps.arcgis.com/apps/webappviewer/index.html?id=2d32025cac174712a8261b7d94a45ac2. Consulté en mars 2025.

DESROCHES, J.-F. et D. RODRIGUE. 2004. Amphibiens et reptiles du Québec et des Maritimes. Éditions Michel Quintin. 288 pages.

DONNÉES QUÉBEC. 2025. Aires de répartition des mammifères terrestres, des reptiles, des amphibiens et des poissons d'eau douce. [Jeu de données], mis à jour le 22 avril 2025.

GLOBAL BIODIVERSITY INFORMATION FACILITY (GBIF). 2025. Occurrences pour la zone d'étude régionale du projet minier Shaakichiuwaanaan. En ligne: https://www.gbif.org/. Consulté le 25 août 2025.

NIIGAAN. 2025a. Avifaune, mammifères et herpétofaune – Étude de référence – Projet minier Shaakichiuwaanaan (Corvette). Rapport final du projet 151022002. 77 pages + annexes.

SOCIÉTÉ D'HISTOIRE NATURELLE DE LA VALLÉE DU SAINT-LAURENT (SHNVSL). 2025. Atlas des amphibiens et reptiles du Québec. En ligne : www.atlasamphibiensreptiles.qc.ca. Consulté en mars 2025.

AVIAN FAUNA

BIBBY, C. J., N. D. BURGESS, D. HILL et S. MUSTOE. 2000. Bird census techniques. San Diego, Academic Press Inc.

BORDAGE, D. et N. PLANTE. 1997. Tendance des effectifs nicheurs de canard noir et de canard colvert au Québec méridional 1985-1995. Série de rapports techniques no 300. Service canadien de la faune, Environnement Canada, région du Québec. Sainte-Foy. 46 pages.

BORDAGE, D., C. LEPAGE et S. ORICHEFSKI. 2003. Inventaire en hélicoptère du plan conjoint sur le Canard noir au Québec. Rapport annuel printemps 2003. Service canadien de la faune, région du Québec, Environnement Canada. Sainte-Foy. 26 pages.

CDPNQ. 2025. Carte des occurrences d'espèce en situation précaire. Québec. Carte interactive. Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs. En ligne : https://services-mddelcc.maps.arcgis.com/apps/webappviewer/index.html?id=2d32025cac174712a8261b7d94a45ac2. Consulté en mars 2025.

COMITÉ DE RÉTABLISSEMENT DU PYGARGUE À TÊTE BLANCHE AU QUÉBEC (CRPTBQ). 2002. Plan de rétablissement du pygargue à tête blanche (*Haliaeetus leucocephalus*) au Québec, Société de la faune et des parcs du Québec, Québec, 43 p.

COMITÉ SUR LA SITUATION DES ESPÈCES EN PÉRIL AU CANADA (COSEPAC). 2016. Évaluation et Rapport de situation du COSEPAC sur le Bec-croisé des sapins de la sous-espèce percna (*Loxia curvirostra percna*) au Canada, Ottawa, xiv + 70 p.

COSEPAC. 2020. Évaluation et Rapport de situation du COSEPAC sur le Petit Chevalier (Tringa flavipes) au Canada. Ottawa, x + 70 p.

COSEPAC. 2024. Espèces sauvages canadiennes en péril 2024. En ligne : https://registre-especes.canada.ca/. Consulté le 27 octobre 2025.

COMITÉ TECHNIQUE SUR LA SAUVAGINE DU SERVICE CANADIEN DE LA FAUNE. 2023. Situation des populations d'oiseaux migrateurs considérés comme gibier au Canada – 2023. Rapport du Service canadien de la faune sur la réglementation concernant les oiseaux migrateurs numéro 58.

CORNELL LAB OF ORNITHOLOGY, OISEAUX CANADA et QUÉBEC OISEAUX. 2025. eBird Canada. Données obtenues via NatureCounts, Oiseaux Canada.

DONNÉES QUÉBEC. 2021. Aires de répartition des mammifères terrestres, des reptiles, des amphibiens et des poissons d'eau douce. Jeu de données, mis à jour le 22 avril 2025.

EBIRD. 2025. Explorateur de sites publics. En ligne : https://ebird.org/hotspots. Consulté en février 2025.

ENVIRONNEMENT CANADA (EC). 2006. Programme de rétablissement du Bec-croisé des sapins de la sous-espèce percna (*Loxia curvirostra percna*) au Canada. Série de Programmes de rétablissement de la Loi sur les espèces en péril, Ottawa, ix + 33 p.

EC. 2007. Plan de gestion de l'Arlequin plongeur (*Histrionicus histrionicus*), population de l'Est, au Canada atlantique et au Québec. Série de Plans de gestion de la Loi sur les espèces en péril, Ottawa, vii + 34 p.

EC. 2013a. Plan de gestion du Garrot d'Islande (*Bucephala islandica*), population de l'Est, au Canada. Série de Plans de gestion de la Loi sur les espèces en péril, Ottawa, iv + 16 p.

EC. 2013b. Plan de gestion du Râle jaune (*Coturnicops noveboracensis*) au Canada. Série de Plans de gestion de la Loi sur les espèces en péril, Ottawa, iii + 26 p.

EC. 2015. Plan de gestion du Quiscale rouilleux (*Euphagus carolinus*) au Canada. Série de Plans de gestion de la Loi sur les espèces en péril, Ottawa, iv + 30 p.

EC. 2016a. Programme de rétablissement de l'Engoulevent d'Amérique (*Chordeiles minor*) au Canada. Série de Programmes de rétablissement de la Loi sur les espèces en péril, Ottawa, viii + 54 p.

EC. 2016b. Programme de rétablissement du Moucherolle à côtés olive (*Contopus cooperi*) au Canada. Série de Programmes de rétablissement de la Loi sur les espèces en péril, Ottawa, vii + 57 p.

ECCC. 2018. Plan de gestion du Hibou des marais (*Asio flammeus*) au Canada. Série de Plans de gestion de la Loi sur les espèces en péril, Ottawa, v + 42 p.

ECCC. 2022a. Plan de gestion du Gros-bec errant (*Coccothraustes vespertinus*) au Canada. Série de Plans de gestion de la Loi sur les espèces en péril, Ottawa, v + 50 p.

ECCC. 2022b. Programme de rétablissement de l'Hirondelle de rivage (*Riparia riparia*) au Canada. Série de Programmes de rétablissement de la Loi sur les espèces en péril, Ottawa, ix + 141 p.

ÉQUIPE DE RÉTABLISSEMENT DES OISEAUX DE PROIE DU QUÉBEC (EROP). 2020. Plan de rétablissement de l'aigle royal (*Aquila chrysaetos*) au Québec — 2020-2030. Produit pour le ministère des Forêts, de la Faune et des Parcs, Direction générale de la gestion de la faune et des habitats, 58 p.

EROP. 2019. Bilan du rétablissement du pygargue à tête blanche (*Haliaeetus leucocephalus*) au Québec pour la période 2002-2018. Produit pour le ministère des Forêts, de la Faune et des Parcs, Direction générale de la gestion de la faune et des habitats, 44 p.

EROP. 2018. Plan de rétablissement du faucon pèlerin (*Falco peregrinus anatum/tundrius*) au Québec — 2019-2029. Produit pour le ministère des Forêts, de la Faune et des Parcs, Direction générale de la gestion de la faune et des habitats, 58 p.

GLOBAL BIODIVERSITY INFORMATION FACILITY (GBIF). 2025. Occurrences pour la zone d'étude régionale du projet minier Shaakichiuwaanaan. En ligne: https://www.gbif.org/. Consulté le 25 août 2025.

GOUVERNEMENT DU CANADA. 2025a. Bécassin roux hendersoni/griseus (*Limnodromus griseus hendersoni/griseus*). En ligne : https://registre-especes.canada.ca/index-fr.html#/especes/3035-2536. Consulté le 9 janvier 2026.

GOUVERNEMENT DU CANADA. 2025b. Liste des espèces en péril. Annexe 1 de la Loi sur les espèces en péril. En ligne : https://laws.justice.gc.ca/fra/lois/S-15.3/page-10.html. Consulté le 27 octobre 2025.

GOUVERNEMENT DU QUÉBEC. 2025a. Périodes de chasse au petit gibier 2024-2026. En ligne : https://www.quebec.ca/tourisme-loisirs-sport/activites-sportives-et-de-plein-air/chasse-sportive/periodes-limites/petit-gibier. Consulté le 27 octobre 2025.

GOUVERNEMENT DU QUÉBEC. 2025b. Liste des espèces fauniques menacées ou vulnérables. En ligne : https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/faune/gestion-faune-habitats-fauniques/especes-fauniques-menacees-vulnerables/liste. Consulté le 27 octobre 2025.

INATURALIST. 2025. Observations de qualité recherche sur iNaturalist.org. Jeu de données d'occurrences. En ligne : https://doi.org/10.15468/ab3s5x. Consulté depuis R via le paquet rgbif le 25 août 2025.

MELCCFP. 2026. Arlequin plongeur, population de l'Est. En ligne : Gouvernement du Québec. Consulté le 9 janvier 2026.

NIIGAAN. 2025a. Avifaune, mammifères et herpétofaune – Étude de référence – Projet minier Shaakichiuwaanaan (Corvette). Rapport final du projet 151022002. 77 pages + annexes.

NIIGAAN. 2025b. Campagne d'inventaire de l'avifaune 2025 – Projet minier Shaakichiuwaanaan (Corvette). Note technique 151022002. 13 pages + annexes.

OISEAUX CANADA, SERVICE CANADIEN DE LA FAUNE et QUÉBEC OISEAUX. 2025. Atlas des oiseaux nicheurs du Québec. Données obtenues via NatureCounts, Oiseaux Canada.

ROBERT, M., M.-H. HACHEY, D. LEPAGE et A.R. COUTURIER (DIR.). 2019. Deuxième atlas des oiseaux nicheurs du Québec méridional. Regroupement QuébecOiseaux, Service canadien de la faune (Environnement et Changement climatique Canada – ECCC) et Études d'Oiseaux Canada, Montréal, xxv + 694 p.

ZIOLKOWSKI JR., D.J., LUTMERDING, M., ENGLISH, W.B., et HUDSON, M-A.R.. 2024. North American Breeding Bird Survey Dataset 1966 - 2023: U.S. Geological Survey data release - Breeding Birds Detected On Quebec's "La Grande 4" (76091) BBS Route, 1979-1979. En ligne : https://www.sciencebase.gov/catalog/item/66d9ed16d34eef5af66d534b. Consulté le 29 octobre 2025.

MAMMALS – LARGE WILDLIFE

ASSEMBLÉE DES PREMIÈRES NATIONS QUÉBEC-LABRADOR (APNQL) ET INSTITUT DE DÉVELOPPEMENT DURABLE DES PREMIÈRES NATIONS DU QUÉBEC ET DU LABRADOR (IDDPNQL). 2022. Mémoire : Commission indépendante sur les caribous forestiers et montagnards. 11 p. + annexes.

BASTILLE-ROUSSEAU, G., DUSSAULT, C., COUTURIER, S., FORTIN, D., ST-LAURENT, M-H, DRAPEAU, P., DUSSAULT, C. et BRODEUR, V. 2012. Sélection d'habitat du caribou forestier en forêt boréale québécoise. 66 p.

BASTILLE-ROUSSEAU, G., POTTS, J. R., SCHAEFER, J. A., LEWIS, M. A., ELLINGTON, E. H., RAYL, N. D., MAHONEY, S. P., & MURRAY, D. L. 2015. Unveiling trade-offs in resource selection of migratory caribou using a mechanistic movement model of availability. Ecography, 38, 1049-1059.

BBA. 2022. Corvette Lithium Property – Initial Environmental and Social Scoping Report. Preliminary Economic Assessment – Socio-environmental Requirements. Rapport final préparé pour Patriot Battery Metals Inc., 7 novembre 2022, 100 p.

BÉDARD, K. 2023. Plan de gestion de l'ours noir au Québec 2020-2027. Direction de l'expertise sur la faune terrestre, l'herpétofaune et l'avifaune, Direction générale de la gestion de la faune et des habitats, ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, Québec, 37 p.

BICHET, O., DUPUCH, A., HÉBERT, C., Le BORGNE, H., ET FORTIN, D. 2016. Maintaining animal assemblages through single-species management: the case of threatened caribou in boreal forest. Ecological Applications, 26(2), 612–623.

BONIN, M., C. DUSSAULT, et S. D. CÔTÉ. 2020. Increased Trophic Position of Black Bear (Ursus americanus) at the Northern Fringe of Its Distribution Range. Canadian Journal of Zoology 98: 127–133.

BRODEUR V., A. BOURBEAU-LEMIEUX ET J. TAILLON. 2023. Mise à jour démographique des troupeaux de caribous migrateurs de la Rivière George et de la Rivière-aux-Feuilles. Présentation pour le Comité conjoint de

chasse, pêche et piégeage. Direction de la gestion de la faune du Nord-du-Québec, Direction de l'expertise sur la faune terrestre, l'herpétofaune et l'avifaune. Gouvernement du Québec. 35 p.

BROWN, G. S., F. F. MALLORY et W. J. RETTIE. 2003. *Range size and seasonal movement for female woodland caribou in the boreal forest of northeastern Ontario*. Rangifer, 14 : 227-233 p.

CHERLOC. 2025. Catalogue des centres de documentation à Hydro-Québec. En ligne : https://cherloc.ca/. Consulté le 04 septembre 2025.

COSEPAC. 2017. Évaluation et Rapport de situation du COSEPAC sur le caribou (*Rangifer tarandus*), population migratrice de l'Est et population des monts Torngat, au Canada. Comité sur la situation des espèces en péril au Canada, Ottawa. 69 p. et annexes.

COURTOIS, R. 1993. Description d'un indice de qualité d'habitat pour l'orignal (*Alces alces*) au Québec. Gouvernement du Québec, Ministère du Loisir, de la Chasse et de la Pêche, Direction générale de la ressource faunique, Gestion intégrée des ressources, document technique 93/1, 56 p.

COUTURIER, S., D. JEAN, R. OTTO et S. RIVARD. 2004. Demography of the migratory tundra caribou (*Rangifer tarandus*) of the Nord-du-Québec region and Labrador, Québec. Direction de l'aménagement de la faune du Nord-du-Québec et Direction de la recherche sur la faune, ministère des Ressources naturelles, de la Faune et des Parcs. 68 p.

CREE NATION GOVERNMENT. 2025. Caribou Update: Preliminary Report on the Leaf River Herd. Eeyou Eenou Newsletter, no. 7.

CRÊTE, M. et J. HUOT. 1993. Regulation of a large herd of migratory caribou: summer nutrition affects calf growth and body reserves of dams, Canadian Journal of Zoology, 71: 2291-2296.

DESNOYERS, M. et DUSSAULT, C. 2014. Relations entre le régime alimentaire et la dynamique des populations chez l'ours noir : revue de la littérature et des informations disponibles au Québec. Québec, ministère des Forêts, de la Faune et des Parcs, Direction générale de l'expertise sur la faune et ses habitats, 71 p.

DONNÉES QUÉBEC. 2025. Aires de répartition des mammifères terrestres en GeoPackage. En ligne : https://www.donneesquebec.ca/recherche/dataset/aires-de-repartition-faune/resource/77e2a995-2148-4746-863d-ab97cfe4978c. (Page consultée le 03 novembre 2025).

DUSSAULT, C., K. BÉDARD, J. PLOURDE, A. RENARD et S. HAMEL. 2024a. Inventaire de l'ours noir dans la pessière à mousses au Saguenay–Lac-Saint-Jean – Secteur à l'est du lac Péribonka : rapport d'inventaire, été 2022. Québec, Direction principale de l'expertise sur la faune terrestre, Direction générale de la gestion de la faune, ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, 28 p.

DUSSAULT, C., K. BÉDARD, J. PLOURDE, A. RENARD et S. HAMEL. 2024b. Inventaire de l'ours noir dans la pessière à mousses au Saguenay–Lac-Saint-Jean – Secteur à l'ouest du lac Péribonka : rapport d'inventaire, été 2022. Québec, Direction principale de l'expertise sur la faune terrestre, Direction générale de la gestion de la faune, ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, 28 p.

ÉQUIPE DE RÉTABLISSEMENT DU CARIBOU FORESTIER DU QUÉBEC (ÉRCFQ). 2013a. Lignes directrices pour l'aménagement de l'habitat du caribou forestier (*Rangifer tarandus* caribou). Produit pour le compte du ministère du Développement durable, de l'Environnement, de la Faune et des Parcs (MDDEFP). 24 p. et annexes.

ÉRCFQ. 2013b. Plan de rétablissement du caribou forestier (*Rangifer tarandus* caribou) au Québec – 2013-2023. Produit pour le compte du ministère du Développement durable, de l'Environnement, de la Faune et des Parcs du Québec (MDDEFP), Faune Québec. 110 p.

ELOWE, K. D., et W. E. DODGE. 1989. Factors Affecting Black Bear Reproductive Success and Cub Survival. Journal of Wildlife Management 53: 962–68.

ECCC. 2020. Programme de rétablissement modifié du caribou des bois (*Rangifer tarandus* caribou), population boréale, au Canada. Série de Programmes de rétablissement de la Loi sur les espèces en péril, Environnement et Changement climatique Canada, Ottawa. 155 p. et annexes.

ECCC. 2024. Évaluation des menaces imminentes pour le caribou (*Rangifer tarandus*), population boréale. Gouvernement du Canada, Environnement et Changement climatique Canada, Ottawa. 79 p. et annexes.

FORTIN, D., BUONO, P-L, FORTIN, A., COURBIN, N, TYE GINGRAS, C, MOORCROFT, P R, COURTOIS, R et DUSSAULT, C. 2013. Movement responses of carivou to human-induced habitatedges lead to their aggregation near anthropogenic features. The American Naturalist, 186 (6) 827-836 p.

GAGNON, C. A., S. HAMEL, D. E. RUSSELL, J. ANDRE, A. BUCKLE, D. HAOGAK, J. PASCAL, E. SCHAFER, T. POWELL, M. Y. SVOBODA et D. BERTEAUX. 2023. Climate, caribou and human needs linked by analysis of Indigenous and scientific knowledge. Nature Sustainability, 6(7): 769-779 p.

GOUVERNEMENT DU QUÉBEC. 2025a. Caribou des bois, écotype migrateur. Fiche des espèces fauniques. En ligne : https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/faune/animaux-sauvages-quebec/fiches-especes-fauniques/caribou-bois-ecotype-migrateur#c221759. (Page consultée le 17 novembre 2025).

GOUVERNEMENT DU QUÉBEC. 2025b. Orignal. Fiche des espèces fauniques. En ligne : https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/faune/animaux-sauvages-quebec/fiches-especes-fauniques/orignal. (Page consultée le 19 novembre 2025).

GOUVERNEMENT DU QUÉBEC. 2025c. Statistiques de chasse. En ligne : https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/faune/statistiques-donnees/statistiques-chasse#c187033. (Page consultée le 17 novembre 2025).

GOUVERNEMENT DU QUÉBEC. 2025d. Ours noir. Fiche des espèces fauniques. En ligne : https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/faune/animaux-sauvages-quebec/fiches-especes-fauniques/ours-noir. (Page consultée le 19 novembre 2025).

GOUVERNEMENT DU QUÉBEC. 2025e. Loup gris. Fiche des espèces fauniques. En ligne : https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/faune/animaux-sauvages-quebec/fiches-especes-fauniques/loup. (Page consultée le 19 novembre 2025).

GOUVERNEMENT DU QUÉBEC. 2025f. Périodes de piégeage. En ligne : https://www.quebec.ca/tourisme-et-loisirs/activites-sportives-et-de-plein-air/piegeage/periodes-piegeage. (Page consultée le 19 novembre 2025).

HÉNAULT, M. et JOLICOEUR, H. 2003. Les loups au Québec : Meutes et mystères. Société de la faune et des parcs du Québec, Direction de l'aménagement de la faune des Laurentides et Direction du développement de la faune, 129 p.

HUGIE, R. D. 1982. Black Bear Ecology and Management in the Northern Conifer-Deciduous Forests of Maine. Ann Arbor, MI: University of Montana. 217 pp.

INMAN, R. M., et M. R. PELTON. 2002. Energetic Production by Soft and Hard Mast Foods of American Black Bears in the Smoky Mountains. Ursus 13: 57–68.

JOLICOEUR, H. et HÉNAULT, M. 2002. Répartition géographique du loup et du coyote au sud du 52e parallèle et estimation de la population de loups au Québec. Société de la faune et des parcs du Québec, 56 p.

LABADIE, G., BOUDERBALA, I., BOULANGER, Y., BÉLAND, J.-M., HÉBERT, C., ALLARD, A., HEBBLEWHITE, M., ET FORTIN, D. 2024. The umbrella value of caribou management strategies for biodiversity conservation in boreal forests under global change. Science of the Total Environment, 907, 168087.

LAMONTAGNE, G., JOLICOEUR, H., et LAFOND, R. 1999. Plan de gestion de l'ours noir, 1998-2002. Direction de la faune et des habitats, Direction de la coordination opérationnelle, Faune et Parcs Québec, 336 p.

LAPOINTE, J. 1997. Plan de gestion de l'ours noir, 1998-2002. Sous la direction de Gilles Lamontagne, Hélène Jolicoeur et René Lafond. Québec, Direction de la faune et des habitats, 328 p.

LEBLOND, M., C. DUSSAULT et M.-H. ST-LAURENT. 2014. Développement et validation d'un modèle de qualité d'habitat pour le caribou forestier *Rangifer tarandus* caribou au Québec. Pour le compte du ministère des Forêts, de la Faune et des Parcs, Université du Québec à Rimouski, 87 p. et annexes.

LEFORT, S. et S. MASSÉ. 2015. Plan de gestion de l'orignal au Québec 2012-2019. Ministère des Forêts, de la Faune et des Parcs, Secteur de la faune et des parcs, Direction générale de l'expertise sur la faune et ses habitats et Direction générale du développement de la faune, 443 p.

LESMERISES, F., DUSSAULT, C. et ST-LAURENT, M.-H. 2012. Wolf habitat selection is shaped by human activities in a highly managed boreal forest. Forest Ecology and Management, 276, 125–131.

MCLAREN, A. A. D., S. E. JAMIESON, M. BOND, A. R. RODGERS, et B. R. PATTERSON. 2021. Spring Diet of American Black Bears (Ursus americanus) in a Moose (Alces alces) – Woodland Caribou (Rangifer tarandus caribou) System in Northern Ontario, Canada. Canadian Journal of Zoology 99: 721–28.

MESSIER, F., J. HUOT, D. LE HENAFF et S. LUTTICH. 1988. Demography of the George river caribou herd: evidence of population regulation by forage exploitation and range expansion, Artic, 41: 279-287.

MILNER-GULLAND, E. J., J. M. FRYXELL et A. R. E. SINCLAIR. 2011. Animal Migration: a synthesis, Oxford, Oxford University Press, 269 p.

MINISTÈRE DES FORÊTS, DE LA FAUNE ET DES PARCS (MFFP). 2018. Suivi démographique du troupeau de caribous migrateurs de la Rivière-aux-Feuilles. En ligne : https://www.newswire.ca/fr/news-releases/suivi-demographique-du-troupeau-de-caribous-migrateurs-de-la-riviere-aux-feuilles-702713422.html. Page consultée le 21 janvier 2025.

MINISTÈRE DE L'ENVIRONNEMENT ET DE LA LUTTE CONTRE LES CHANGEMENTS CLIMATIQUES (MELCC). 2021. Bilan provincial de l'exploitation du loup gris (2012-2021). Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, Québec, 21 p.

NIIGAAN. 2023. Étude de la grande faune. Cadrage environnemental. Rapport du projet 22-0095 présenté à Patriot Battery Metals Inc. 28 p. et annexes.

NOYCE, K. V., et D. L. GARSHELIS. 1994. Body Size and Blood Characteristics as Indicators of Condition and Reproductive Performance in Black Bears. Bears: Their Biology and Management 9: 481–496.

RAYMOND-BOURRET, E. 2017. Détermination des impacts respectifs de la perte et de la fragmentation de la forêt mature sur l'écologie spatiale des grands mammifères. Mémoire de maîtrise, Université du Québec à Rimouski, Département de biologie, chimie et géographie, 111 p.

ROGERS, L. L. 1987. Effects of Food Supply and Kinship on Social Behavior, Movements, and Population Growth of Black Bears in Northeastern Minnesota. Wildlife Monographs 97: 1–72.

SAMSON, C., et J. HUOT. 1995. Reproductive Biology of Female Black Bears in Relation to Body Mass in Early Winter. Journal of Mammalogy 76: 68–77.

SAMSON, C. 1996. Modèle d'indice de qualité de l'habitat pour l'ours noir (*Ursus americanus*) au Québec. Ministère de l'Environnement et de la Faune, Direction générale de la ressource faunique et des parcs. 57 p.

SAMSON, C., C. DUSSAULT, R. COURTOIS et J.-P. OUELLET. 2002. Guide d'aménagement de l'habitat de l'orignal. Société de la faune et des parcs du Québec, Fondation de la faune du Québec et ministère des Ressources naturelles du Québec, Sainte-Foy, 48 p.

SOCIÉTÉ DE LA FAUNE ET DES PARCS DU QUÉBEC. 2003. Plan de développement régional associé aux ressources fauniques du Nord-du-Québec. Direction de l'aménagement de la faune du Nord-du-Québec, Chibougamau, 115 pages.

SZOR, G. et G. GINGRAS. 2020. Inventaire aérien du caribou forestier (*Rangifer tarandus* caribou) dans les secteurs Baie-James, Rupert et la Grande, Nord-du-Québec, à l'hiver 2020. Ministère des Forêts, de la Faune et des Parcs, Direction de la gestion de la faune du Nord-du-Québec, 31 p.

TAILLON, J., V. BRODEUR et S. RIVARD. 2016. État de la situation biologique du caribou migrateur, troupeau de la Rivière-aux-Feuilles. Ministère des Forêts, de la Faune et des Parcs, Québec. 69 p.

WHITTINGTON, J., M. HEBBLEWHITE, N. J. DeCESARE, L. NEUFELD, M. BRADLEY, J. WILMSHURST et M. MUSANI. 2011. Caribou encounters with wolves increase near roads and trails: A time-to-event approach. Journal of Applied Ecology, 48 (6): 1535-1542 p.

ZELLER, K. A., D. W. WATTLES, L. CONLEE, et S. DESTAFANO. 2019. Black Bears Alter Movements in Response to Anthropogenic Features with Time of Day and Season. Movement Ecology 7: 1–14.

MAMMALS – CHIROPTERANS

CHAUVE-SOURIS AUX ABRIS. 2025. Chauves-souris aux abris. En ligne. https://chauve-souris.ca/. Consultée le 15 octobre 2025.

COSEPAC. 2023. Évaluation et Rapport de situation du COSEPAC sur la chauve-souris cendrée (*Lasiurus cinereus*), la chauve-souris rousse de l'Est *(Lasiurus borealis*) et la chauve-souris argentée (*Lasionycteris noctivagans*) au Canada, Comité sur la situation des espèces en péril au Canada, Ottawa, xxv + 116 p.

DESROSIERS, N. et R. BERTHIAUME .2024. Réseau québécois d'inventaires acoustiques de chauves-souris (Réseau Chirops) – Résultats des inventaires de 2000 à 2020. Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, Direction de l'expertise sur la faune terrestre, l'herpétofaune et l'avifaune, Service de la conservation de la biodiversité et des milieux humides, gouvernement du Québec, Québec, 70 p. + annexes.

ECCC. 2018. Programme de rétablissement de la petite chauve-souris brune (*Myotis lucifugus*), de la chauve-souris nordique (*Myotis septentrionalis*) et de la pipistrelle de l'Est (*Perimyotis subflavus*) au Canada, Série de Programmes de rétablissement de la Loi sur les espèces en péril. Ottawa. Environnement et Changement climatique Canada. ix + 189 p.

ÉQUIPE DE RÉTABLISSEMENT DES CHAUVES-SOURIS DU QUÉBEC (ERCSQ). 2019. Plan de rétablissement de trois espèces de chauves-souris résidentes du Québec : la petite chauve-souris brune (*Myotis lucifugus*), la chauve-souris nordique (*Myotis septentrionalis*) et la pipistrelle de l'Est (*Perimyotis subflavus*) — 2019-2029. Produit pour le ministère des Forêts, de la Faune et des Parcs, Direction générale de la gestion de la faune et des habitats. 102 p.

ERCSQ. 2021. Plan de rétablissement de la chauve-souris rousse (*Lasiurus borealis*) au Québec — 2021-2031. Produit pour le ministère des Forêts, de la Faune et des Parcs, Direction générale de la gestion de la faune et des habitats. 68 p.

GAUTHIER, M., G. Daoust et R. Brunet. 1995. Évaluation préliminaire du potentiel des mines désaffectées et des cavités naturelles comme habitat hivernal des chauves-souris cavernicoles au Québec. Envirotel inc. Rapport final à l'intention du ministère de l'Environnement et de la Faune.

GOUVERNEMENT DU CANADA. 2025. Liste des espèces en péril. Annexe 1 de la Loi sur les espèces en péril. En ligne. https://laws.justice.gc.ca/fra/lois/S-15.3/page-10.html#docCont Consultée le 16 octobre 2025.

GOUVERNEMENT DU QUÉBEC. 2024a. SIGÉOM | Système d'information géominière. En ligne. Https://sigeom.mines.gouv.qc.ca/signet/classes/I1102_indexAccueil?l=F. Consultée le 11 juillet 2024.

GOUVERNEMENT DU QUÉBEC. 2024b. Liste des sites miniers abandonnés en responsabilité réelle au PTSC*. En ligne. https://www.mrnf.gouv.qc.ca/wp-content/uploads/LI_sites-miniers-abandonnes.pdf. Consultée le 11 juillet 2024.

GOUVERNEMENT DU QUÉBEC. 2024c. Gîtes métallifères du Québec. En ligne : https://www.donneesquebec.ca/recherche/dataset/indices-gites-et-gisements. Consultée le 11 juillet 2024.

GOUVERNEMENT DU QUÉBEC. 2025. Liste des espèces fauniques menacées ou vulnérables. En ligne. Liste des espèces fauniques menacées ou vulnérables | Gouvernement du Québec. Consulté le 10 octobre 2025.

JUTRAS, J., M. DELORME, J. McDUFF et C. VASSEUR. 2012. Le suivi des chauves-souris du Québec. Le Naturaliste canadien, vol. 136 no 1. p. 48-52.

MAMMALS – OTHER SPECIES

BBA. 2022. Corvette Lithium Property – Initial Environmental and Social Scoping Report. Preliminary Economic Assessment – Socio-environmental Requirements. Rapport final préparé pour Patriot Battery Metals Inc., 7 novembre 2022, 100 p.

CDPNQ. 2025. Carte des occurrences d'espèces en situation précaire. En ligne : https://services-mddelcc.maps.arcgis.com/apps/webappviewer/index.html?id=2d32025cac174712a8261b7d94a45ac2. Consulté le 21 janvier 2025.

CHERLOC. 2025. Catalogue des centres de documentation à Hydro-Québec. En ligne : https://cherloc.ca/. Consulté le 04 septembre 2025.

DESROSIERS, N., R. MORIN et J. JUTRAS. 2002. Atlas des micromammifères du Québec. Société de la faune et des parcs du Québec. Direction du développement de la faune. Québec. 92 p.

FAUTEUX, D., G. LUPIEN, F. FABIANEK, J. GAGNON, M. SÉGUY, ET L. IMBEAU. 2014. An illustrated key to the mandibles of small mammals of eastern Canada. Canadian Field-naturalist 128(1): 25–37.

GLOBAL BIODIVERSITY INFORMATION FACILITY (GBIF). 2025. Occurrences pour la zone d'étude régionale du projet minier Shaakichiuwaanaan. En ligne: https://www.gbif.org/. Consulté le 25 août 2025.

MELCCFP. 2023. Protocole standardisé pour les inventaires de micromammifères au Québec, Gouvernement du Québec, Québec, 33 p. + annexe.

DONNÉES QUÉNEC. 2025. Aires de répartition des mammifères terrestres en GeoPackage. En ligne : https://www.donneesquebec.ca/recherche/dataset/aires-de-repartition-faune/resource/77e2a995-2148-4746-863d-ab97cfe4978c. Consulté le 03 novembre 2025.

NIIGAAN. 2025c. État de référence de la petite faune terrestre pour le projet Shaakichiuwaanaan – Inventaire des micromammifères. Rapport présenté à Métaux de Batteries Patriot Inc. 19 pages + annexes.

Chapter 6 - Section 6-4

ARCHÉOCONSULTANT, 2024. Étude de potentiel archéologique. Métaux de Batterie Patriot Inc. (Innova Lithium Inc.) Projet minier Corvette Eeyou Istchee Baie-James, Nord-Du-Québec, Québec. Soumis À WSP Canada Inc.

ARSENAULT J. 2025. Relance de la mine Renard - Le repreneur potentiel gagne du temps. Publié le 19 février 2025. En ligne : https://www.lapresse.ca/affaires/2025-02-19/relance-de-la-mine-renard/le-repreneur-potentiel-gagne-du-temps.php. Consulté en avril 2025.

CENTRE DE FORMATION PROFESSIONNELLE BAIE-JAMES (CFPBJ) 2025. Programmes. En ligne : https://cfpbj.ca/programmes/ Consulté en mars 2025.

CENTRE DE SERVICES SCOLAIRES DE LA BAIE-JAMES (CSSBJ).2025. Nos établissements. En ligne : https://cssbj.gouv.qc.ca/etablissements/ Consulté en mars 2025.

CENTRE RÉGIONAL DE SANTÉ ET DE SERVICES SOCIAUX DE LA BAIE-JAMES. Non daté. Centre de santé Isle-Dieu (Matagami). En ligne : https://www.crsssbaiejames.gouv.qc.ca/1389/Centre_de_sante_Isle-Dieu.html. Avril 2025.

COMITÉ D'ÉVALUATION (COMEV). 2025. Projet de démantèlement du camp principal et des camps satellites d'une ancienne pourvoirie dans le secteur de la route Transtaïga. En ligne : https://comev.ca/fiches-de-projet/projet-de-demantelement-camp-principal-camps-satellites-dune-ancienne-pourvoirie-secteur-de-route-transtaiga/. Avril 2025.

COMMISSION DE TOPONYMIE QUÉBEC. 2012. Chisasibi. En ligne : https://toponymie.gouv.qc.ca/ct/ToposWeb/Fiche.aspx?no_seq=92773

COMPÉTENCE QUÉBEC. 2025. CFP Mistissini. En ligne : https://www.inforoutefpt.org/organismes-niveau-secondaire/centres-formation-professionnelle/759403/groupes. Avril 2025.

CONSORTIUM GENIVAR-WASKA. 2020. Complexe Eastmain-Sarcelle-Rupert - Suivi sur l'utilisation du territoire par les Cris 2015-2016. Pour Hydro-Québec. Pagination multiple et annexes.

CSMO Mines. 2024. Donnes statistiques sur l'industrie minière. Récupéré sur Comité sectoriel de main-d'œuvre de l'industrie des mines : https://explorelesmines.com/fr/donnees-statistiques-sur-lindustrie-miniere/ et https://explorelesmines.com/wp-content/uploads/2023/12/EBMO_2023_rev.pdf

CREE NATION GOVERNMENT. 2023. Les Eeyou d'Eeyou Istchee. En ligne : https://www.cngov.ca/community-culture/communities/. Consulté le 9 octobre 2023.

CREE NATION GOVERNMENT. 2024. Grand Conseil des Cris (Eeyou Istchee)/Gouvernement de la Nation Crie. https://www.cngov.ca/fr/gouvernance-et-structure/gcc-ei-gnc-role-mission-vision/

CREE NATION GOVERNMENT. 2025. Gestion et conservation de la faune. https://cngov.ca/fr/environnement/gestion-et-conservation-de-la-faune/

CREE NATION OF CHISASIBI. 2024. Chisasibi Airport – YKU. En ligne : https://chisasibi.ca/departments-services/airport/. Consulté le 18 octobre 2023.

CREE NATION OF MISTISSINI. 2020a. Rules and functions of our Public Works. En ligne : https://mistissini.com/pages/departments-3/public-services-and-works/. Consulté en mars 2025.

CREE NATION OF MISTISSINI. 2020b. Mistissini Through History and Band Departments. Nation crie de Mistissini. En ligne : https://mistissini.com/. Consulté en mars 2025

CREE NATION OF WEMINDJI. 2023a. Waste Management Program. En ligne : https://wemindji.ca/waste-management-home.html. Consulté en mars 2025.

CREE NATION OF WEMINDJI. 2023b. Public Works. En ligne : https://wemindji.ca/services/departments/public-works.html#garage. Consulté en mars 2025.

CREE NATION OF WEMINDJI. 2023c. Who we are? En ligne : https://wemindji.ca/community/about/who-we-are.html. Consulté en mars 2025.

CREE TRAPPERS ASSOCIATION. 2019. Ishtchiikun. En ligne : https://creetrappers.ca/about/ishthchiikun. Consulté le 18 octobre 2023.

CREE TRAPPER ASSOCIATION. 2009. Eeyou Indoh-hoh weeshou-wehwun - Traditional Eeyou hunting law. 43 pp et annexe.

DÉCARIE. JP. 2019. Après l'or d'Éléonore, les données d'Alibaba. Publié le 17 juillet 2024 dans La Presse. En ligne : https://www.lapresse.ca/affaires/2019-07-17/apres-l-or-d-eleonore-les-donnees-d-alibaba. Consulté en avril 2025.

DESFOR. 2014. Gestion de projet Mine Opinaca 2012-2014. En ligne : https://desfor.com/wp/wp-content/uploads/2019/11/Fiche_opinaca_FR.pdf. Consulté en avril 2025.

ECOTEC CONSULTANTS. 2024. Retombées économiques de l'industrie minière au Québec en 2022. Rapport présenté à l'Association minière du Québec. En ligne : AMQ_Rapport_RetombéesÉconomiques_2024_Fr - Adobe cloud storage

EEYOU PLANNING COMMISSION. 2025. Planning for Land and Resource Use in Eeyou Istchee. https://eeyouplanningcommission.ca/

EEYOU PLANNING COMMISSION Chisasibi, 2017. Report on community input on land use planning goals – Chisasibi. https://www.eeyouplanningcommission.ca/wp-content/uploads/Chisasibi-Long-report-on-community-input-on-land-use-planning-2017-12.pdf

EEYOU PLANNING COMMISSION Mistissini, 2017. Report on community input on land use planning goals – Mistissini. En ligne : https://www.eeyouplanningcommission.ca/wp-content/uploads/Mistissini-Long-report-on-community-input-on-land-use-planning-2017-12.pdf

EEYOU PLANNING COMMISSION Wemindji, 2017. Report on community input on land use planning goals – Wemindji. En ligne : https://www.eeyouplanningcommission.ca/wp-content/uploads/Wemindji-Long-report-on-community-input-on-land-use-planning-2017-12.pdf

FÉDÉRATION DES CLUBS DE MOTONEIGISTES DU QUÉBEC (FCMQ). 2024. Carte interactive des sentiers. En ligne : https://www.fcmq.qc.ca/motoneigistes/planifier-sortie-motoneige-quebec/carte-interactive-sentiers-motoneige

GOUVERNEMENT DU QUÉBEC. 2026. Inuit. En ligne : https://www.quebec.ca/gouvernement/portrait-quebec/premieres-nations-inuits/profil-des-nations/inuit. Consulté le 4 mars 2026.

GOUVERNEMENT DU QUÉBEC. 2024. Loi sur les droits de chasse et de pêche dans les territoires de la Baie James et du Nouveau-Québec. Chapter D-13.1. À jour au 30 novembre 2024. En ligne : https://www.legisquebec.gouv.qc.ca/fr/pdf/lc/D-13.1.pdf

GOUVERNEMENT DU QUÉBEC. 2022a. Cartes des unités de gestion des animaux à fourrure. En ligne : https://www.quebec.ca/tourisme-et-loisirs/activites-sportives-et-de-plein-air/piegeage/cartes-ugaf. Consulté le 18 octobre 2023.

GOUVERNEMENT DU QUÉBEC. 2022b. Cartes des zones de chasse. En ligne : https://www.quebec.ca/tourisme-etloisirs/activites-sportives-et-de-plein-air/chasse-sportive/cartes-zones. Consulté le 18 octobre 2023.

GOUVERNEMENT RÉGIONAL D'EEYOU ISTCHEE BAIE-JAMES (GREIBJ). 2025a. Gouvernance. https://greibj-eijbrg.ca/a-propos/gouvernance

GREIBJ. 2025 b. Table locales de gestion intégrée des ressources et du territoire (GIRT). https://greibj-eijbrg.ca/territoire-1/tables-de-gestion-integree-des-ressources-et-du-territoire-girt.

GREIBJ. 2020. Règlement de zonage 213.1. https://vplus-documents.s3.ca-central-1.amazonaws.com/greibj/_publication/fichiers/Reglement%202131%20-%20Zonage(1).pdf

GRAND-QUÉBEC. 2025. Radisson. En ligne : https://grandquebec.com/nord-du-quebec/radisson/#:~:text=Une%20partie%20de%20la%20population%20de%20Radisson%20travaille,offre%20une%20vaste%20gamme%20de%20services%20aux%20touristes. Avril 2025.

GROUPE DDM. 2024. Enquêtes sur les motifs de départ de la Baie-James. Rapport d'étape présenté à l'Administration régionale Baie-James. En ligne : 23-1701-Rapport-final-20240427_eb.pdf.

GUINDON, MARTIN. 2024. La mine Éléonore mise en vente par Newmont. Publié le 22 février 2024 dans Ici Radio-Canada. En ligne : https://ici.radio-canada.ca/nouvelle/2051475/mines-economie-ndq-newmont-eleonore

GUINDON MARTIN. 2023. Les Cris de Washaw Sibi choisissent de s'établir près de Matagami. Publié le 16 août 2023. Ici Abitibi-Témiscamingue. En ligne : https://ici.radio-canada.ca/nouvelle/2003568/autochtones-cris-washaw-sibi-matagami#:~:text=La%20communaut%C3%A9%20crie%20de%20Washaw%20Sibi%20s%E2%80%99%C3%A9tablira%20finalement,quatre%20emplacements%20qu%E2%80%99ils%20avaient%20cibl%C3%A9s%20en%20novembre%20dernier.

HYDRO-QUÉBEC. 2024. Complexe de l'Eastmain–Sarcelle–Rupert – Suivi des retombées économiques 2017 2021, suivi environnemental en phase exploitation. Rapport présenté par WSP à Hydro-Québec. Pagination multiple et annexes.

INSTITUT DE LA STATISTIQUE DU QUÉBEC (ISQ). 2020. Projection estimée 2051-2081)

INSTITUT DE LA STATISTIQUE DU QUÉBEC (ISQ). 2024a. Perspectives démographiques des municipalités du Québec, 2021-2051 – Édition 2024. En ligne : https://statistique.quebec.ca/fr/document/projections-de-population-municipalites

INSTITUT DE LA STATISTIQUE DU QUÉBEC (ISQ). 2024b. Soldes migratoires avec chacune des régions administratives selon le grand groupe d'âge, MRC du Québec (classées par régions administratives), 2001-2002 à 2022-2023. En ligne : https://statistique.quebec.ca/fr/produit/tableau/soldes-migratoires-avec-chacune-des-regions-administratives-selon-le-grand-groupe-dage-mrc-du-quebec-classees-par-regions-administratives#tri_annee=42128&tri_tertr=0&tri_ages=1

ISQ. 2025. Les postes vacants au Québec par trimestre. 4e trimestre de 2024. En ligne : Les postes vacants au Québec par trimestre

LECAVALIER C. 2017. Des centaines de camps abandonnés dans le Nord. Publié le 5 mars 2017 dans le Journal de Québec. En ligne : https://www.journaldequebec.com/2017/03/05/des-centaines-de-camps-abandonnes-dans-le-nord. Mars 2025.

LI, T., DUCRUC, J-P, CÔTÉ, M-J, BELLAVANCE, D. ET POISSON, F. 2019. Les provinces naturelles : première fenêtre sur l'écologie du Québec. Québec, ministère de l'Environnement et de la Lutte contre les changements climatiques, Direction de la connaissance écologique, 24 p.

LOCALITÉ DE RADISSON. 2024. Activités et loisirs et L'histoire. Récupéré sur Localité de Radisson : https://www.localiteradisson.com/fr/activites-et-loisirs/activites-offertes/ et https://www.localiteradisson.com/fr/localite-de-radisson/l-histoire/.

MARLEAU, Jacques. 2024. Santé physique et mentale des Jamésiens : résultats de l'Enquête québécoise sur la santé de la population 2020-2021. Chiffres clés, Chibougamau, Centre régional de santé et de services sociaux de la Baie-James, Direction de santé publique, no 27, novembre 2024, 2 p En ligne : https://crsssbaiejames.gouv.qc.ca/docs/Publications/C/CC_R%C3%A9sultats%20EQSP%202020-2021_VF2024-12.pdf. Avril 2025.

MATAGAMI. 2025. Une économie en transition – Portrait économique. En ligne : https://matagami.activis.ca/ma-ville/centre-de-documentation/portrait-economique/. Avril 2025.

MATAGAMI. 2024. Histoire de la Ville de Matagami et Éducation. En ligne : https://matagami.com/histoire/ et https://matagami.com/education/.

MINISTÈRE DE L'EMPLOI ET DE LA SOLIDARITÉ SOCIALE (MTESS). 2023. Rapport annuel de gestion 2022-2023. Récupéré sur Ministère de l'Emploi et de la Solidarité Sociale : https://cdn-contenu.quebec.ca/cdn-contenu/adm/min/emploi-solidarite-sociale/publications-adm/rapport/RAG_2022-2023_MESS.pdf

MINISTÈRE DES AFFAIRES MUNICIPALES ET DE L'HABITATION (MAMH) (2010). Région administrative 10 : Nord-du-Québec. En ligne : https://www.mamh.gouv.qc.ca/organisation-municipale/organisation-territoriale/regions-administratives/nord-du-quebec. Consulté le 9 octobre 2023.

MAMH. 2023. Région administrative 10 : Nord-du-Québec. En ligne : https://www.mamh.gouv.qc.ca/fileadmin/publications/organisation_municipale/cartotheque/Region_10.pdf. Consulté le 9 octobre 2023.

MRNF. 2023. Suspension de la période de validité de certains claims miniers touchés par les feux de forêt. Avis 2023 – Mines En ligne : https://mrnf.gouv.qc.ca/mines/titres-miniers/directives-avis/avis-2023/. Mars 2025.

NORTH WEST COMPANY. 2025. About Us. En ligne : https://www.northwest.ca/about-us/company-profile

OFFICE DE LA SÉCURITÉ ÉCONOMIQUE DES CHASSEURS CRIS (OSECC). 2012-2023. Rapport annuel/Annual report. Office de la sécurité économique des chasseurs cris, anciennement office de la sécurité du revenu des chasseurs et piégeurs cris (OSRCPC), Québec. Périodes 2011-2012 à 2022-2023. Consulté en ligne : Annual Report of The Cree Hunters Economic Security Board — Chasseur cri

RAYMOND CHABOT GRANT THORNTON. 2022. Étude sur les enjeux relatifs à la main-d'œuvre, au navettage et aux incitatifs fiscaux spécifiques à la Baie-James. Rapport présenté à l'Administration régionale Baie-James (ARBJ). En ligne : ARBJ - Étude sur les enjeux relatifs à la main-d'œuvre, au navettage et aux incitatifs fiscaux spécifiques à la Baie-James - Rapport final

RELATIONS COURONNE-AUTOCHTONES ET AFFAIRES DU NORD CANADA (RCAADNC). 2025. Premières Nations. En ligne : https://fnp-ppn.aadnc-aandc.gc.ca/fnp/Main/Search/FNRegPopulation.aspx?BAND_NUMBER=61&lang=fra. Consulté en mars 2025.

ROUTE DE LA BAIE JAMES. Non-daté. Route Transtaïga. En ligne : https://routebaiejames.com/ttr/index.html#:~:text=La%20route%20Transta%C3%AFga%20est%20une%20route%20gravel%C3%A9e%20qui,s%E2%80%99%C3%A9tendent%20en%20amont%20de%20la%20rivi%C3%A8re%20La%20Grande.

SOCIÉTÉ CANADIENNE D'HYPOTHÈQUES ET DE LOGEMENT (SCHL). 2021. Création rapide de logements pour les communautés crie au Québec. En ligne : https://www.cmhc-schl.gc.ca/salle-de-presse/news-releases/2021/creation-rapide-de-logements-pour-les-communautes-crie-au-quebec

SOCIÉTÉ DE DÉVELOPPEMENT DE LA BAIE-JAMES (SDBJ). 2024. Services aéroportuaires. En ligne : https://www.sdbj.gouv.qc.ca/fr/aeroport/a-propos/. Consulté le 18 octobre 2023. Statistique Canada. 2025. Profil du recensement. Recensement de la population de 2021. Mise à jour le 15 novembre 2023. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=F.

STATISTIQUE CANADA. 2023a. (tableau). Profil du recensement, Recensement de la population de 2021, produit nº 98-316-X2021001 au catalogue de Statistique Canada. Ottawa. Diffusé le 15 novembre 2023. Tableau de profil, Profil du recensement, Recensement de la population de 2021 - Chisasibi, Terres réservées aux Cris (TC) [Subdivision de recensement], Québec; Mistissini, Terres réservées aux Cris (TC) [Subdivision de recensement], Québec; Wemindji, Terres réservées aux Cris (TC) [Subdivision de recensement], Québec

STATISTIQUE CANADA. 2023b. (tableau). Profil du recensement, Recensement de la population de 2021, produit nº 98-316-X2021001 au catalogue de Statistique Canada. Ottawa. Diffusé le 15 novembre 2023. Tableau de profil, Profil du recensement, Recensement de la population de 2021 - Matagami, Ville (V) [Subdivision de recensement], Québec;Radisson, Localité non constituée (LNC) [Localité désignée], Québec;Nord-du-Québec, Division de recensement (CDR) [Division de recensement], Québec

STATISTIQUE CANADA. 2017. Profil du recensement, Recensement de la population de 2016. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=F&Geo1=DPL&Code1=240230&Geo2=PR&Code2=24&SearchText=radisson&SearchType=Begins&SearchPR=01&B1=All&TABID=1&type=0

TAWICH DEVELOPMENT CORPORATION. 2021. Tawich Holdings Corporation & its' Subsidiaries. Presentation to Cree Nation of Wemindji's General Assembly, August 16, 2021. En ligne : http://www.tawich.ca/assets/TawichHoldingsCorporationits%E2%80%99Subsidiaries_PPP_AGA%202021-withoutfinancials.pdf

TOURISME EEYOU ISTCHEE BAIE-JAMES. 2016. Cartes et itinéraires. En ligne : https://www.escapelikeneverbefore.com/en/discover-the-region/mapsand-routes/ . Consulté le 18 octobre 2023.

TREMBLAY, JEANNIE. 2020. Impacts du navettage sur les travailleurs et les travailleuses, leur famille et les communautés de la Jamésie. Étude présentée au Comité Condition féminine Baie-James. En ligne : Rapport - Impacts du navettage 02-11-2020.pdf

VISION EEYOU ISTCHEE (VEI) ET WSP. 2024. La grande alliance. Rapport addenda - impacts et bénéfices socioéconomiques par communauté. Présenté à la Société de développement crie (SDC).

WSP. 2025.Projet minier Shaakichiuwaanaan. Rapport sectoriel – Circulation.

WSP. 2024. La Grande Alliance. Étude de préfaisabilité – phases ii & iii –Infrastructure de transport Note technique 3 – Utilisation du territoire.

WSP. 2023. Projet Minier Windfall. Étude d'impact sur l'environnement. Vol. 1B. Rapport Produit Pour Minière Osisko Inc. Pagination multiple et Annexes. En ligne : https://www.ree.environnement.gouv.qc.ca/dossiers/3214-14-059/3214-14-059-5.pdf.

Chapter 7

No external reference

Chapter 8

ATKINSRÉALIS. 2025. Technical Note. Flood, Erosion, and Dispersion Studies of the Diversion Channel and CE15 River at Post-Construction of Minin Facility. 30 p.

ATKINSRÉALIS. 2026a. Étude de faisabilité pour la gestion des résidus, des stériles et des eaux. Projet Lithium Shaakichiuwaanaan. Ref. : CASN-A-370-GT-REP-0001. 106 p. et annexes.

ATKINSRÉALIS. 2026b. Hydrogeology Baseline and Numerical Modeling for Stockpile Design – Shaakichiuwaanaan Project. Ref: CASN-A-370-HY-REP-0002_C. 62 p.

BARTZKE, G. S., R. MAY, E. J. SOLBERG, C. M. ROLANDSEN et E. ROSKAFT. 2015. Differential barrier and corridor effects of power lines, roads and rivers on moose (*Alces alces*) movements. Ecosphere, 6(4), art. 67.

BEAUCHESNE, D., J.A.G. JAEGER et M.-H. ST-LAURENT. 2013. Disentangling Woodland Caribou Movements in Response to Clearcuts and Roads across Temporal Scales. PLoS ONE, 8(11), e77514.

BENÍTEZ-LÓPEZ, A., R. ALKEMADE, ROB et P. A. VERWEIJ. 2010. The impacts of roads and other infrastructure on mammal and bird populations: A meta-analysis. Biological Conservation. 143 (6): 1307-1316.

BEST, I. N., L. BROWN, C. ELKIN, L. FINNEGAN, C. J. R. McCLELLAND, et C. J. JOHNSON. 2025. Wildlife, fire, and forestry: Understanding the spatial and temporal relationships between caribou habitat and disturbance. Global Ecology and Conservation, 61, e03636.

BISHOP, C.A. et J.M. BROGAN. 2013. Estimation de la mortalité aviaire attribuable aux collisions automobiles au Canada. Écologie et conservation des oiseaux 8(2): 2.

BOULANGER, J., A. GUNN, J. Adamczewski et B. Croft. 2012. The impact of industrial development on the viability of woodland caribou populations in northern Canada. Rangifer, 32(2), 13–28.

BOULANGER, J., R. KITE, M. CAMPBELL, J. SHAW, D. LEE, et S. ATKINSON. 2024. Estimating the effects of roads on migration: a barren-ground caribou case study. Canadian Journal of Zoology, 102(3), 1–15.

BUNKLEY, J.P., C.J.W. MCCLURE, N.J. KLEIST, C.D. FRANCIS ET J.R. BARBER. 2015. Anthropogenic noise alters bat activity levels and echolocation calls. Global Ecology and Conservation 3: 62-71. https://doi.org/10.1016/j.gecco.2014.11.002

CHEN, W. J., S. G. LEBLANC, H. P. WHITE, C. PREVOST, B. MILAKOVIC, C. ROCK, G. SHARAM, H. O'KEEFE, L. COREY, B. CROFT, A. GUNN, S. VAN DER WIELEN, A. FOOTBALL, B. TRACZ, J. S. PELLISSEY et J. BOULANGER. 2017. Does Dust from Arctic Mines Affect Caribou Forage? Journal of Environmental Protection, 8(3), 258–276.

CLARKE-WOOD, B.K., K.M. JENKINS, B.S. LAW et R.V. BLAKEY. 2016. The ecological response of insectivorous bats to coastal lagoon degradation. Biological Conservation 202: 10-19. 10.1016/j.biocon.2016.08.014.

COSEPAC. 2021. Évaluation et Rapport de situation du COSEPAC sur le Hibou des marais (*Asio flammeus*) au Canada. Ottawa. xiv + 81 p.

COURTOIS, R., J.-P. OUELLET, L. BRETON, A. GINGRAS et C. DUSSAULT. 2007. Effects of forest disturbance on density, space use, and mortality of woodland caribou. Écoscience, Issue 4 : A demographic fram for reintroductions. Vol. 14 : 491-498.

DEMARS, C. A. ET S. BOUTIN. 2018. Nowhere to hide: effects of linear features on predator-prey dynamics in a large mammal system. Journal of animal ecology, 87(1), 274-284.

DESNOYERS, M. et DUSSAULT, C. 2014. Relations entre le régime alimentaire et la dynamique des populations chez l'ours noir : revue de la littérature et des informations disponibles au Québec. Québec, ministère des Forêts, de la Faune et des Parcs, Direction générale de l'expertise sur la faune et ses habitats, 71 p.

DESROSIERS, N. R., R. MORIN et J. JUTRAS 2002. Atlas des micromammifères du Québec. Société de la faune et des parcs du Québec. Direction du développement de la faune. Québec. 92 p.

DICKIE, M., N. LOVE, R. STEENWEG, C. T. LAMB, J. POLFUS, et A. T. FORD. 2023. In search of evidence-based management targets: A synthesis of the effects of linear features on woodland caribou. Ecological Indicators, 154, 110559.

EC. 2011. Évaluation scientifique aux fins de la désignation de l'habitat essentiel de la population boréale du caribou des bois (*Rangifer tarandus* caribou) au Canada. Mise à jour 2011. 116 p. et annexes.

ECCC. 2018. Programme de rétablissement de la petite chauve-souris brune (*Myotis lucifugus*), de la chauve-souris nordique (*Myotis septentrionalis*) et de la pipistrelle de l'Est (*Perimyotis subflavus*) au Canada, Série de Programmes de rétablissement de la Loi sur les espèces en péril. Ottawa. Environnement et Changement climatique Canada. ix + 189 p.

ECCC. 2020a. Programme de rétablissement modifié du caribou des bois (*Rangifer tarandus* caribou), population boréale, au Canada. Série de Programmes de rétablissement de la Loi sur les espèces en péril, Environnement et Changement climatique Canada, Ottawa. 155 p. et annexes.

ECCC. 2020b. Sujets de recherche en sciences de la faune et du paysage : toxicologie des métaux. En ligne: https://www.canada.ca/fr/environnement-changement-climatique/services/recherche-faune-science-paysage/sujets-recherche/toxicologie-metaux.html. Consulté le 25 février 2026.

ECCC. 2024. Évaluation des menaces imminentes pour le caribou (*Rangifer tarandus*), population boréale. Gouvernement du Canada, Environnement et Changement climatique Canada, Ottawa. 79 p. et annexes.

ECCC. 2025. Rapport d'inventaire national 1990–2023 : Sources et puits de gaz à effet de serre au Canada 2025. En ligne : https://www.canada.ca/fr/environnement-changement-climatique/services/changements-climatiques/emissions-gaz-effet-serre/inventaire.html?utm_campaign=not-applicable&utm_medium=vanity-url&utm_source=canada-ca_inventaire-ges. Consulté en janvier 2026.

ERCSQ. 2019. Plan de rétablissement de trois espèces de chauves-souris résidentes du Québec : la petite chauve-souris brune (*Myotis lucifugus*), la chauve-souris nordique (*Myotis septentrionalis*) et la pipistrelle de l'Est (*Perimyotis subflavus*) — 2019-2029. Produit pour le ministère des Forêts, de la Faune et des Parcs, Direction générale de la gestion de la faune et des habitats. 102 p.

FAHRIG, L. ET T. RYTWINSKI. 2009. Effects of roads on animal abundance: an empirical review and synthesis. Ecology and society. 14(1), 21 pp.

FENSOME, A. G. et F. MATHEWS. 2016. Roads and bats: a meta-analysis and review of the evidence on vehicular collisions and barrier effects. Mammal Review Early View (version en ligne des observations publiée avant l'inclusion dans un document).

FERGUSON-LEES, J. et D. A. Christie. 2005. Raptors of the world: a field guide. Christopher Helm, London.

FINCH, D, SCHOFIELD, et MATHEWS, F. 2020. Traffic noise playback reduces the activity and feeding behaviour of free-living bats. Environmental Pollution. Volume 263. Consulté en ligne : Traffic noise playback reduces the activity and feeding behaviour of free-living bats - ScienceDirect. Mars 2026.

FULLMAN, T.J., K. JOLY, D. D. GUSTINE et M. D. CAMERON. 2025. Behavioral responses of migratory caribou to semi-permeable roads in Arctic Alaska. Scientific Reports, 15(1), 1–13.

GOUVERNEMENT DU QUÉBEC. 2025. Statistiques de chasse. En ligne : https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/faune/statistiques-donnees/statistiques-chasse#c187033. (Page consultée le 17 novembre 2025).

GOUVERNEMENT DU QUÉBEC. 2026. Fiche des espèces fauniques – Campagnol-lemming de Cooper. En ligne : https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/faune/animaux-sauvages-quebec/fiches-especes-fauniques/campagnol-lemming-cooper. Consulté le 25 février 2026.

GRINDAL, S.D, J.L MORISSETTE et R.M. BRIGHAM. 1999. Concentration of bat activity in riparian habitats over an elevational gradient. Canadian Journal of Zoology, vol 77. p. 972-977.

HICKEY, M. B. C., L. ACHARYA et S. PENNINGTON. 1996. Ressource partitionning by two species of Vespertilionid bats feeding around street lights. J. Mamm., 77: 325-334.

JOLICOEUR, H. et HÉNAULT, M. 2002. Répartition géographique du loup et du coyote au sud du 52e parallèle et estimation de la population de loups au Québec. Société de la faune et des parcs du Québec, 56 p.

KING M. D., J. E. ELLIOTT et T. D. WILLIAMS. 2021. Effects of petroleum exposure on birds: A review. Science of The Total Environment. 755 (1)

KORINE, C., A.M. ADAMS, U. SHAMIR ET A. CROSS. 2015. Effect of water quality on species richness and activity of desert-dwelling bats. Mammalian Biology. 80 : 185-190

KUNC HP, SCHMIDT R. 2019. The effects of anthropogenic noise on animals : A meta-analysis. Biology-Letters. 15: 20190649.

LALIBERTÉ, D., 2004. *Répertoire des données sur les teneurs en mercure dans la chair des poissons du Québec pour la période de 1976 à 1999 inclusivement*, Québec, ministère de l'Environnement, Direction du suivi de l'état de l'environnement, Envirodoq nº ENV/2004/0375, collection nº QE/153, 66 p. Consulté en ligne : Répertoire des données sur les teneurs en mercure dans la chair des poissons du Québec pour la période de 1976 à 1999 inclusivement Mars 2026.

LAURIAN, C., C. DUSSAULT, J.-P. OUELLET, R. COURTOIS, M. POULIN et L. BRETON. 2008. Behavior of moose relative to a road network. Journal of Wildlife Management, 72(7), 1550–1557.

LEBLOND, M., C. DUSSAULT, et J.-P. OUELLET. 2012. Réponses comportementales du caribou forestier à l'élargissement d'un axe routier majeur. Le Naturaliste canadien, 136 (2) : 22-28 p.

LEBLOND, M., C. DUSSAULT, et J.-P. OUELLET. 2013. Impacts of Human Disturbance on Large Prey Species: Do Behavioral Reactions Translate to Fitness Consequences? PLoS ONE, 8(9), e73695.

LESMERISES, F., C. DUSSAULT, P. DRAPEAU et M.-H. ST-LAURENT. 2013. Évaluation des impacts des lignes de transport d'énergie sur l'écologie spatiale du caribou forestier au Québec. Rapport scientifique présenté à Hydro-Québec, 56 p. + annexes.

LESSARD, É., P. D. WALKER et E. VANDER WAL. 2026. Northern development and Rangifer risks: A review of the impacts of resource extraction for caribou and reindeer. Environmental Reviews, 34, 1–13.

MAILLOUX HYDROGÉOLOGIE INC. 2026. Note technique – Évaluation hydrogéologique pour le projet de mine souterraine et de fosse à ciel ouvert – Projet Shaakichiuwaanaan – PMET Ressources. 35 p.

MCCLURE, C.J.W., H.E. WARE, J. CARLISLE, G. KALTENECKER et J.R. BARBER. 2013. An experimental investigation into the effects of traffic noise on distributions of birds: avoiding the phantom road. Proceedings of the Royal Society, 280: 2013-2290.

McCRACKEN, G. F. 2011. Cave conservation: special problems of bats. Pages 68-95 In J. Tyburec, J. Chenger, T. Snow et C. Geiselman, eds. Bat Conservation International: Bat Conservation and Management Workshop. Bat Conservation International, Portal, AZ.

MELCCFP. 2025a. Guide d'instructions – Préparation et réalisation d'une modélisation de la dispersion des émissions atmosphériques – Projets miniers. Direction des politiques de l'atmosphère du ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs. 19 p. et annexes.

MELCCFP. 2025b. Normes et critères québécois de qualité de l'atmosphère, version 10, Québec, Direction principale de la qualité de l'air et du climat. En ligne : www.environnement.gouv.qc.ca/air/criteres/index.htm. Consulté en décembre 2025.

MELCCFP. 2025c. Guide de quantification des émissions de gaz à effet de serre, 2025, 126 p.

MELCCFP. 2025d. GES 1990-2023 Inventaire des émissions de gaz à effet de serre en 2023 et leur évolution depuis 1990. Québec, ISBN : 978-2-555-02591-2, 72 pages.

MFFP. 2021. Revue de littérature sur les facteurs impliqués dans le déclin des populations de caribous forestiers au Québec et de caribous montagnards de la Gaspésie. Gouvernement du Québec. 244 p. et annexes.

MRNF, 2023. Carte écoforestière. Données en ligne : Carte écoforestière en format PDF - Jeu de données - Données Québec . Février 2026.

NIIGAAN. 2023. Étude de la grande faune. Cadrage environnemental. Rapport du projet 22-0095 présenté à Patriot Battery Metals Inc. 28 p. et annexes.

NIIGAAN. 2025. *État de référence du milieu aquatique pour le projet Shaakichiuwaanaan. Qualité des eaux de surface et des sédiments.* Rapport du projet 151022002 présenté à Ressources PMET inc. 78 p. et annexes.

OGDEN L. J. E. 1996. Collision Course: The Hazards of Lighted Structures and Windows to Migrating Birds. Fatal Light Awareness Program (FLAP). Wildlife Damage Management, Internet Center for. University of Nebraska. 47 p.

ORTEGA, C. P. 2012. Effects of Noise Pollution on Birds: A Brief Review of Our Knowledge. Ornithological Monographs, 74: 6-22.

PILOSOF, S., C. KORINE, M.S. MOORE ET B.R. KRASNOV. 2014. Effects of sewage-water contamination on the immune response of a desert bat. Mammalian Biology 79(3) : 183-188. https://doi.org/10.1016/j.mambio.2013.10.005

PLANTE, S., C. DUSSAULT, J. H. RICHARD et S. D. CÔTÉ. 2018. Human disturbance effects and cumulative habitats loss in endangered migratory caribou. Biological Conservation, Volume 224, 129-143 p.

PLANTE, S., C. DUSSAULT, J. H. RICHARD et S. D. CÔTÉ. 2020. Human disturbance increases predation risk for migratory caribou by facilitating predator movements. Ecological Applications, 30(4), e02089.

POLFUS, J. L., M. HEBBLEWHITE et K. HEINEMEYER. 2011. Identifying indirect habitat loss and avoidance of human infrastructure by northern mountain woodland caribou. Biological Conservation, 144(11), 2637–2646.

POST, E. ET D. R. KLEIN. 1999. Caribou calf production and seasonal range quality during a population decline. The journal of wildlife management, 63(1), 335-345.

RAYMOND-BOURRET, E. 2017. Détermination des impacts respectifs de la perte et de la fragmentation de la forêt mature sur l'écologie spatiale des grands mammifères. Mémoire de maîtrise, Université du Québec à Rimouski, Département de biologie, chimie et géographie, 111 p.

REIJNEN, R., R. FOPPEN, et G. VEENBAAS. 1997. Disturbance by traffic of breeding birds: evaluation of the effect and planning and managing road corridors. Biodiversity and Conservation 6: 567-581.

ROSE, R. K. ET A. LINZEY. 2021. *Synaptomys cooperi* (Rodentia: Cricetidae). Mammalian species, 53(1007), 95-111.

RUDOLPH, T. D., P. DRAPEAU, M.-H. ST-LAURENT, et L. IMBEAU. 2012. Situation du caribou forestier (*Rangifer tarandus* caribou) sur le territoire de la Baie James dans la région Nord-du-Québec. Rapport scientifique présenté au ministère des Ressources naturelles et de la Faune et au Grand Conseil des Cris (Eeyou Istchee). Montréal, Québec. 77 p.

RUSSELL, A. L., C. M. BUTCHKOSKI, L. SAIDAK ET G. F. MCCRACKEN. 2009. Road-killed bats, highway design, and the commuting ecology of bats. Endangered Species Research 8: 49-60.

RYDELL, J. 1992. Exploitation of Insects around Streetlamps by Bats in Sweden. Functional Ecology 6(6): 744-750.

RYDELL, J. et P. A. RACEY. 1995. Street lamps and the feeding ecology of insectivorous bats. Symp. Zool. Soc. Lond., 67: 291-307.

SOCIÉTÉ DE L'ASSURANCE AUTOMOBILE DU QUÉBEC, 2026. Bilan routier. Consulté en ligne : Bilan routier - SAAQ . Mars 2026.

SCHAUB, A., J. OSTWALD ET B.M. SIEMERS. 2008. Foraging bats avoid noise. Journal of Experimental Biology 211(19): 3174–3180. https://doi.org/10.1242/jeb.022863

SENZAKI M, KADOYA T, FRANCIS CD. 2020. Direct and indirect effects of noise pollution alter biological communities in and near noise-exposed environments. Proc. R. Soc. B 287: 20200176.

SENZAKI, M., YAMAURA, Y., FRANCIS, C.D., NAKAMURA, F., 2016. Traffic noise reduces foraging efficiency in wild owls. Scientific Reports 6, 30602.

SHANNON, G., M.F. MCKENNA, L.M. ANGELONI, K.R. CROOKS, K.M. FRISTRUP, E. BROWN, K.A. WARNER, M.D. NELSON, C. WHITE, J. BRIGGS, S. MCFARLAND et G. WITTEMYER. 2015. A synthesis of two decades of research documenting the effects of noise on wildlife. Biological Review, 91 (4): 883-1148.

SOCIÉTÉ DE LA FAUNE ET DES PARCS DU QUÉBEC. 2003. Plan de développement régional associé aux ressources fauniques du Nord-du-Québec. Direction de l'aménagement de la faune du Nord-du-Québec, Chibougamau, 115 pages.

ST-LAURENT, M.-H., L.-A. RENAUD, M. LEBLOND, et D. BEAUCHESNE. 2012. Synthèse des connaissances relatives aux impacts des routes sur l'écologie du caribou. Le Naturaliste canadien, 136(2), 42–47.

ST-LAURENT, M-H., D. BEAUCHESNE. et F. LESMERISES. 2014. Évaluation des impacts des vieux chemins forestiers et des modalités de fermeture dans un contexte de restauration de l'habitat du caribou forestier au Québec. Rapport scientifique présenté au ministère des Forêts, de la Faune et des Parcs (MPPF) par l'Université du Québec au Rimouski. Rimouski, Québec. 42 p.

STONE, E.L., G. JONES ET S. HARRIS. 2009. Street Lighting Disturbs Commuting Bats. Current biology 19(13): 1123-7. 10.1016/j.cub.2009.05.058.

STONE, E.L., S. HARRIS ET G. JONES. 2015. Impacts of artificial lighting on bats: a review of challenges and solutions. Mammalian species 80(3): 213-219.

TIGNER, J., BAYNE, E. M. ET S. BOUTIN. 2014. Black bear use of seismic lines in Northern America. The journal of wildlife management, 78(2), 282-292.

TREMBLAY, J.A. ET J. JUTRAS. 2010. Les chauves-souris arboricoles en situation précaire au Québec – Synthèse et perspectives. Le Naturaliste canadien 134(1): 29-40

VISTNES, I., C. NELLEMANN, P. JORDHOY et O. STRAND. 2004. Effects of infrastructure on migration and range use of wild reindeer. Journal of Wildlife Management, 68(1), 101–108.

WEIR, J. N., S. P. MAHONEY, B. MCLAREN et S. H. FERGUSON. 2007. Effects of mine development on woodland caribou *Rangifer tarandus* distribution. Wildlife Biology, 13(1), 66-74.

WILLIS, C.K.R., C.M. VOSS, ET R.M. BRIGHAM .2006. Roost Selection by Forest-Living Female Big Brown Bats (*Eptesicus fuscus*). Journal of Mammalogy, 87(2), 345–350. http://www.jstor.org/stable/4094416

WHITTINGTON, J., M. HEBBLEWHITE, N. J. DeCESARE, L. NEUFELD, M. BRADLEY, J. WILMSHURST et M. MUSIANI. 2011. Caribou encounters with wolves increase near roads and trails: A time-to-event approach. Journal of Applied Ecology, 48 (6): 1535-1542 p.

WSP, 2025. Rapport sectoriel – Circulation. 24 p.

WSP, 2026. Étude des retombées économiques. 46 p.

YAMAZAKI, Y., H. YAMADA, M. MUROFUSHI, H. MOMOSE et K. OKANOYA. 2004. Estimation of hearing range in raptors using unconditioned responses. Ornithol Sci 3: 85–92.

Chapter 9

ATKINSRÉALIS, 2025. Technical Note. *Flood, Erosion, and Dispersion Studies of the Diversion Channel and CE 15 River at Post-Construction of Minin Facility*. 30 p.

BBA. 2022. *Corvette Lithium Property – Initial Environmental and Social Scoping Report*. Preliminary Economic Assessment – Socio-environmental Requirements. Rapport final préparé pour Patriot Battery Metals Inc., 7 novembre 2022, 100 p.

BBA, 2025. Technical Report. *120 kV Transmission Line Study*. Final Study. 32 p.

BÉDARD, K. 2023. *Plan de gestion de l'ours noir au Québec 2020-2027*. Direction de l'expertise sur la faune terrestre, l'herpétofaune et l'avifaune, Direction générale de la gestion de la faune et des habitats, ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, Québec, 37 p.

BRODEUR, V., J. PISAPIO, S. MCCARTHY, S. RIVARD et J. TAILLON. 2021. *Inventaire aérien du troupeau de caribous migrateurs de la rivière George en juillet 2020*. Ministère des Forêts, de la Faune et des Parcs, Québec, et Department of Fisheries, Forestry and Agriculture, Newfoundland and Labrador, 22 p.

COMEX, 2025. *Projet minier Éléonore*. Consulté en novembre 2025 sur le site : Projet minier Éléonore - Comex

COSEPAC. 2014. *Rapport annuel du COSEPAC 2013-2014*. Rapport présenté à la ministre de l'Environnement et au Conseil canadien pour la conservation des espèces en péril (CCCEP). 44 p.

COSEPAC. 2021. Évaluation et Rapport de situation du COSEPAC sur le Hibou des marais (Asio flammeus) au Canada. Ottawa. xiv + 81 p.

COSEPAC. 2020. Évaluation et Rapport de situation du COSEPAC sur le Petit Chevalier (Tringa flavipes) au Canada. Ottawa. x + 70 p.

COSEPAC. 2023. *Évaluation et Rapport de situation du COSEPAC sur la chauve-souris cendrée (Lasiurus cinereus), la chauve-souris rousse de l'Est (Lasiurus borealis) et la chauve-souris argentée (Lasionycteris noctivagans) au Canada*, Comité sur la situation des espèces en péril au Canada, Ottawa, xxv + 116 p.

COMMISSION DE LA CONSTRUCTION DU QUÉBEC (CCQ), 2008. *Les Cris de la Baie-James et l'industrie de la construction*. Consulté en novembre 2025 sur le site : https://www.ccq.org/-/media/Project/Ccq/Ccq-Website/PDF/AffairesAutochtones/RapportCrisFRAN.pdf?rev=53b7f77045ba4940b3d0b5b3434ac26a

CONSEIL CRIS-QUÉBEC SUR LA FORESTRIE, 2025. *Terres, UA et Aires de trappes*. Découpage administratif. Consulté en novembre 2025 sur le site : Terres, UA et aires de trappe - CCQF - CQFB

COURTOIS, R., C. DUSSAULT, A. GINGRAS et G. LAMONTAGNE. 2003. *Rapport sur la situation du caribou forestier au Québec*. Société de la faune et des parcs du Québec, Direction de la recherche sur la faune, Direction de l'aménagement de la faune de Jonquière et Direction de l'aménagement de la faune de Sept-Îles, 45 p.

COUTURIER, S., D. JEAN, R. OTTO et S. RIVARD. 2004. *Demography of the migratory tundra caribou (*Rangifer tarandus*) of the Nord-du-Québec region and Labrador, Québec*. Direction de l'aménagement de la faune du Nord-du-Québec et Direction de la recherche sur la faune, ministère des Ressources naturelles, de la Faune et des Parcs, 68 p.

DESROSIERS, N., R. MORIN et J. JUTRAS. Juin 2002. *Atlas des micromammifères du Québec*. Société de la faune et des parcs du Québec. Direction du développement de la faune. Québec. 92 p.

DESROSIERS, N. et R. BERTHIAUME. 2024. *Réseau québécois d'inventaires acoustiques de chauves-souris (Réseau Chirops) – Résultats des inventaires de 2000 à 2020*. Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, Direction de l'expertise sur la faune terrestre, l'herpétofaune et l'avifaune, Service de la conservation de la biodiversité et des milieux humides, gouvernement du Québec, Québec, 70 p. + annexes.

EC. 2013. Stratégie de conservation des oiseaux pour la région 7 au Québec : Taïga du Bouclier et plaine hudsonienne - Version abrégée. 32 p.

EC. 2017. Régions de conservation des oiseaux et stratégies. En ligne : https://www.canada.ca/fr/environnement-changement-climatique/services/conservation-oiseaux-migrateurs/regions-strategies.html. Consulté le 26 février 2026.

ECCC. 2018. Programme de rétablissement de la petite chauve-souris brune (Myotis lucifugus), de la chauve-souris nordique (Myotis septentrionalis) et de la pipistrelle de l'Est (Perimyotis subflavus) au Canada. Série de Programmes de rétablissement de la Loi sur les espèces en péril. Environnement et Changement climatique Canada, Ottawa. ix + 189 p.

ECCC. 2024. Évaluation des menaces imminentes pour le caribou (Rangifer tarandus), population boréale. Gouvernement du Canada, Environnement et Changement climatique Canada, Ottawa. 79 p. et annexes.

ECCC et OISEAUX CANADA. 2024. L'état des populations d'oiseaux au Canada - Comptes rendus sur les espèces. Données tirées de NatureCounts, Oiseaux Canada. En ligne : https://naturecounts.ca/nc/socb-epoc/search.jsp. Consulté le 3 mars 2026.

ERCSQ. 2019. *Plan de rétablissement de trois espèces de chauves-souris résidentes du Québec : la petite chauve-souris brune (Myotis lucifugus), la chauve-souris nordique (Myotis septentrionalis) et la pipistrelle de l'Est (Perimyotis subflavus*) — 2019-2029, produit pour le ministère des Forêts, de la Faune et des Parcs, Direction générale de la gestion de la faune et des habitats, 102 p.

ÉQUIPE DE RÉTABLISSEMENT DU CARIBOU FORESTIER, 2013. *Plan de rétablissement du caribou forestier (Rangifer tarandus caribou) au Québec – 2013-2023*. Consulté en novembre 2025 sur le site : Plan de rétablissement du caribou forestier (Rangifer tarandus caribou) au Québec — 2013-2023

FESTA, F., ANCILLOTTO, L., SANTINI, L., PACIFICI, M., ROCHA, R., TOSHKOVA, N., AMORIM, F., BENÍTEZ-LÓPEZ, A., DOMER, A., HAMIDOVIĆ, D., KRAMER-SCHADT, S., MATHEWS, F., RADCHUK, V., REBELO, H., RUCZYNSKI, I., SOLEM, E., TSOAR, A., RUSSO, D. AND RAZGOUR, O. 2023. *Bat responses to climate change: a systematic review*. Biological Review 98: 19-33. https://doi.org/10.1111/brv.12893

GOUVERNEMENT DU CANADA, 2025a. *Présentation d'excuses aux anciens élèves des pensionnats indiens*. Consulté en novembre 2025 sur le site : Présentation d'excuses aux anciens élèves des pensionnats indiens

GOUVERNEMENT DU CANADA, 2025b. *À propos de la Loi sur les espèces en péril*. Consulté en novembre 2025 sur le site : À propos de la Loi sur les espèces en péril - Canada.ca

GOUVERNEMENT DU CANADA. 2014. Décret modifiant l'annexe 1 de la *Loi sur les espèces en péril*. Gazette du Canada Vol. 148, no 26 — Le 17 décembre 2014.

GOUVERNEMENT DU CANADA. 2026. *Liste des espèces en péril.* Consulté en février 2026 sur le site : Loi sur les espèces en péril

GOUVERNEMENT DU QUÉBEC, 2002. *Entente Québec-Cris*. La paix des braves. Consulté en novembre 2025 sur le site : Entente Québec-Cris - La paix des braves

GOUVERNEMENT DU QUÉBEC, 2009. *Réserve de biodiversité projetée Hirondelle*. Consulté en novembre 2025 sur le site : Réserve de la biodiversité Hirondelle

GOUVERNEMENT DU QUÉBEC, 2010. *Réserve de biodiversité projetée Paakumshumwaau-Maatuskaau*. Consulté en novembre 2025 sur le site : Réserve Paakumshumwauu-Maatuskaau

GOUVERNEMENT DU QUÉBEC, 2011. *Le Plan Nord à l'horizon 2035. Un projet exemplaire de développement nordique durable*. Consulté en novembre 2025 sur le site : FLIP_Plan_Nord_FR.pdf

GOUVERNEMENT DU QUÉBEC, 2015. Le Plan Nord à l'horizon 2035. *Plan d'action 20156-2020*. Consulté en novembre 2025 sur le site : Le Plan Nord à l'horizon 2035

GOUVERNEMENT DU QUÉBEC. 2025. *Liste des espèces fauniques menacées ou vulnérables*. Consulté en février 2026 sur le site : https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/faune/gestion-faune-habitats-fauniques/especes-fauniques-menacees-vulnerables/liste

GOUVERNEMENT DU QUÉBEC. 2026. *Syndrome du museau blanc*. Consulté en février 2026 sur le site : https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/sante-animale/maladies-animales/liste-maladies-animales/syndrome-museau-blanc.

GRAND CONSEIL DES CRIS, 2025. *Entente sur la gouvernance dans le territoire de la Baie James d'Eeyou Istchee entre les Cris d'Eeyou Istchee et le Gouvernement du Québec (2012*). Consulté en novembre 2025 sur le site : Ententes et Conventions | The Grand Council of the Crees (Eeyou Istchee)

GRANDE ALLIANCE, 2021. *Résumé d'étude LGA*. Consulté en novembre 2025 sur le site : LGA_Study-Brief-1_FR.pdf

GRANDE ALLIANCE, 2023. *Route Projetée – La Grande - Whapmagoostui – Kuujjuarapik*. Carte consultée en novembre 2025 sur le site : Proposed-Whapmagoostui-Road.pdf

GRINDAL, S.D. et R.M. BRIGHAM. 1998. *Effects of small scale habitat fragmentation on activity by insectivorous bats*. Journal of Wildlife Management 62: 996-1003.

HANSKI, I., H. Henttonen, E. Korpimäki, L. Oksanen and P. Turchin. 2001. *Small-rodent dynamics and predation*. Ecology, 82(6): 1505–1520.

HENDERSON, L.E. et H.G. BRODERS. 2008. *Movements and resource selection of the northern long-eared myotis (Myotis septentrionalis) in a forest-agriculture landscape*. Journal of Mammalogy 89: 952-963.

HYDRO-QUÉBEC. 2002. *Suivi environnemental du Complexe La Grande Rapport synthèse 1978-2000; Évolution des teneurs en mercure dans les poissons*. Rapport conjoint : Direction barrages et environnement Hydro-Québec production et groupe conseil Genivar Inc. Décembre 2002. 214 p. En ligne : Q93585 final rapport synthese mercure 2003-03-10.doc

JOLICOEUR, H. et HÉNAULT, M. 2002. *Répartition géographique du loup et du coyote au sud du 52e parallèle et estimation de la population de loups au Québec*. Société de la faune et des parcs du Québec, 56 p.

JOURNAL DE MONTRÉAL, 2024. Une minière australienne s'apprête à racheter les restes de la mine Renard pour 52 M$. Consulté en novembre 2025 sur le site : Une minière australienne s'apprête à racheter les restes de la mine Renard pour 52 M$ | JDM

KORPIMÄKI, E, L. Oksanen, T. Oksanen, T. Klemola, K. Norrdahl and P. B. Banks. 2005. *Vole cycles and predation in temperate and boreal zones of Europe*. Journal of Animal Ecology 74: 1150–1159.

LAMONTAGNE, G., H. JOLICOEUR. et R. LAFOND. 1999. *Plan de gestion de l'ours noir, 1998-2002*. Direction de la faune et des habitats, Direction de la coordination opérationnelle, Faune et Parcs Québec, 336 p.

LA SENTINELLE – LE JAMÉSIEN. 2015. *40e anniversaire de la signature de la Convention de la Baie-James*. En ligne : 40e anniversaire de la signature de la Convention de la Baie-James - La Sentinelle - Actualité locale à Chibougamau

L'AURORE. 2025. *Billy-Diamond : la réhabilitation d'une route mythique au cœur d'un enjeu stratégique nordique*. Article paru le 10 septembre 2025. En ligne : Billy-Diamond : la réhabilitation d'une route mythique au cœur d'un enjeu stratégique nordique

LEFORT, S. et S. MASSÉ. 2015. *Plan de gestion de l'orignal au Québec 2012-2019*. Ministère des Forêts, de la Faune et des Parcs, Secteur de la faune et des parcs, Direction générale de l'expertise sur la faune et ses habitats et Direction générale du développement de la faune, 443 p.

L'ENCYCLOPÉDIE CANADIENNE, 2019. *Convention de la baie james et du Nord québécois*. Consulté en novembre 2025 sur le site : Convention de la baie James et du Nord québécois | l'Encyclopédie Canadienne

LA PRESSE, 2024. *La mine d'or Éléonore a un nouveau propriétaire*. Consulté en novembre 2025 sur le site : Baie-James | La mine d'or Éléonore a un nouveau propriétaire | La Presse

LE JAMÉSIEN, 2015. *40e anniversaire de la signature de la Convention de Baie-James*. Consulté en novembre 2025 sur le site : 40e anniversaire de la signature de la Convention de la Baie-James - La Sentinelle - Actualité locale à Chibougamau

MELCCFP. 2022. *Bilan provincial de l'exploitation du loup gris*. En ligne : https://cdn-contenu.quebec.ca/cdn-contenu/faune/documents/gestion-especes/Bilans/bilan-exploitation-loup-gris.pdf Consulté le 5 mars 2026.

MELCCFP, 2025a. *Réserve de territoire aux fins d'aire protégée Namewaakamiishtikw-Piskuchitishu-Siipii*. Consulté en novembre 2025 sur le site : Réserve de territoire aux fins d'aire protégé - Namewaakamiishtikw-Piskuchitishu-Siipii

MELCCFP, 2025b. *Réserve de territoire aux fins d'aire protégée Wichishkw-Uubauquushduuk*. Consulté en novembre 2025 sur le site : Réserve de territoire aux fins d'aire protégé - Wichishkw-Uubauquushduuk

MELCCFP, 2025c. *Réserve de territoire aux fins d'aire protégée Pipunishiwin-Saahkamiishtikw*. Consulté en novembre 2025 sur le site : Réserve de territoire aux fins d'aire protégée Pipunishiwin-Saahkamiishtikw

MELCCFP, 2025d. *Réserve de territoire aux fins d'aire protégée du Nord-Est-du-Lac-Nichicun*. Consulté en novembre 2025 sur le site : Réserve de territoire aux fins d'aire protégé du Nord-Est-du-Lac-Nichicun

MELCCFP, 2025e. *Réserve de territoire aux fins d'aire protégée Minahiku-Wachî*. Consulté en novembre 2025 sur le site : Réserve de territoire aux fins d'aire protégé Minahiku-Wachi

MELCCFP, 2025f. *Réserve de territoire aux fins d'aire protégée Aawiitakuch*. Consulté en novembre 2025 sur le site : Réserve de territoire aux fins d'aire protégée - Aawiitakuch

MELCCFP, 2025g. *Réserve de territoire aux fins d'aire protégée Rivière-Kanaaupscow-et-Lac-Kukamaw*. Consulté en novembre 2025 sur le site : Réserve de territoire aux fins d'aire protégé - Rivière-Kanaaupscow-et-Lac-Kukamaw

MELCCFP, 2025h. *Réserve de territoire aux fins d'aire protégée du Lac-Burton-Rivière-Roggan-et-la-Pointe-Louis-XIV*. Consulté en novembre 2025 sur le site : Réserve de territoire aux fins d'aire protégé du Lac-Burton-Rivière-Roggan-et-la-Pointe-Louis-XIV

MELCCFP, 2025i. *Espèces floristiques menacées ou vulnérables et Liste des espèces fauniques menacées au vulnérables*. Consulté en novembre 2025 sur le site : Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs

MELCCFP, 2025j. *GES Inventaire québécois des émissions de gaz à effet de serre en 2023 et leur évolution depuis 1990*. PDF : Inventaire québécois des émissions de gaz à effet de serre en 2023 et leur évolution depuis 1990

MELCCFP. 2026a. *État de situation des populations de caribous forestiers au Québec et de la population de caribous montagnards de la Gaspésie de 2018 à 2024*. Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, 54 p.

MELCCFP. 2026b. *Statistiques de chasse 2025 – Une année à succès pour la chasse à l'orignal*. En ligne : https://www.quebec.ca/nouvelles/actualites/details/statistiques-de-chasse-2025-une-annee-a-succes-pour-la-chasse-a-lorignal-68586 Consulté le 5 mars 2026.

MELCC 2021. *Liste des lieux d'enfouissement en tranchée (LEET) autorisés et en exploitation*. Consulté en novembre 2025 sur le site : PR4.1.2a

MINISTÈRE DE LA CULTURE ET DES COMMUNICATIONS, 2025. *Aéroport de La Grande Rivière*. Consulté en novembre 2025 sur le site : Aéroport de La Grande Rivière - Répertoire du patrimoine culturel du Québec

MFFP. 2021. *Revue de littérature sur les facteurs impliqués dans le déclin des populations de caribous forestiers au Québec et de caribous montagnards de la Gaspésie*. Gouvernement du Québec, 244 p. et annexes.

MRNF, 2010. *Espèces menacées et vulnérables*. Consulté en novembre 2025 sur le site : DB116

MRNF, 2025a. *SIGÉOM, Données sur les propriétés d'exploration, les projets de mine et les mines actives*. Consulté en novembre 2025 sur le site : SIGÉOM | Système d'information géominière | Carte interactive.

MRNF, 2025b. Feux de forêt. Cartographie des contours simplifiés. Consulté en novembre 2025 sur le site : Feux de forêt - Jeu de données - Données Québec

NIIGAAN. 2023. Étude de la grande faune. Cadrage environnemental. Rapport du projet 22-0095 présenté à Patriot Battery Metals Inc. 28 p. et annexes.

NIIGAAN. 2025. État de référence de la petite faune terrestre pour le projet Shaakichiuwaanaan – Inventaire des micromammifères. Rapport présenté à Métaux de Batteries Patriot Inc. 19 pages + annexes.

OISEAUX CANADA et ECCC. 2024. Rapport sur l'état des populations d'oiseaux du Canada. En ligne: https://naturecounts.ca/nc/socb-epoc/report/2024/fr/. Consulté le 27 février 2026.

OISEAUX CANADA et ICOAN. 2014. Régions de conservation des oiseaux. Publié par Oiseaux Canada au nom de l'Initiative de conservation des oiseaux de l'Amérique du Nord. En ligne : NABCI Bird Conservation Regions - Birds Canada | Oiseaux Canada. Consulté le 27 février 2026.

PARCS CANADA, 2025. Les pensionnats autochtones au Canada. Consulté en novembre 2025 sur le site : Les pensionnats autochtones au Canada - Désignations historiques nationales

PARÉ, M. et L. JOURDAIN, L. 2002. *Rapport sur l'inventaire aérien du caribou dans la partie sud-ouest de la municipalité de la Baie-James*. Société de la faune et des parcs du Québec, Direction de l'aménagement de la faune, Rouyn-Noranda (Québec), 17 p.

PARTNERS IN FLIGHT (PIF). 2020. Population Estimates Database, version 3.1. En ligne : http://pif.birdconservancy.org/PopEstimates. Consulté le 27 février 2026.

RADIO-CANADA, 2020. *Quebec and Cree Nation sign 30-year economic development deal for James Bay territory*. Consulté en novembre 2025 sur le site: Quebec and Cree Nation sign 30-year economic development deal for James Bay territory | CBC News

RADIO-CANADA, 2021. *$4.7B "Grande Alliance" project in northern Quebec is called Cree vision of development*. Consulté en novembre 2025 sur le site: $4.7B 'Grande Alliance' project in northern Quebec is called Cree vision of development | CBC News

RÉSEAU CANADIEN POUR LA SANTÉ DE LA FAUNE (RCSF). 2026. *SMB - rapports et cartes*. Consulté en février 2026 sur le site : http://www.cwhc-rcsf.ca/white_nose_syndrome_reports_and_maps.php.

SEBJ, 2025. *Complexe La Grande*. Consulté en novembre 2025 sur le site : SEBJ

SMITH, A.C., HUDSON, M-A.R., ENGLISH, W.B., et FRANCIS, C.M. 2025. *Site Web du Relevé des oiseaux nicheurs de l'Amérique du Nord - Tendances démographiques au Canada, version des données de 2023*. Environnement et Changement climatique Canada, Gatineau (Québec) K1A 0H3. En ligne : Résultats du Relevé des oiseaux nicheurs - Canada.ca. Consulté le 27 février 2026.

SOCIÉTÉ DE L'ASSURANCE AUTOMOBILE DU QUÉBEC, 2026. Bilan routier. Consulté en ligne : Bilan routier - SAAQ . Mars 2026.

SOCIÉTÉ DE LA FAUNE ET DES PARCS DU QUÉBEC. 2003. *Plan de développement régional associé aux ressources fauniques du Nord-du-Québec*. Direction de l'aménagement de la faune du Nord-du-Québec, Chibougamau, 115 pages.

SZOR, G. et G. GINGRAS. 2020. *Inventaire aérien du caribou forestier (*Rangifer tarandus caribou*) dans les secteurs Baie-James, Rupert et la Grande, Nord-du-Québec, à l'hiver 2020*. Ministère des Forêts, de la Faune et des Parcs, Direction de la gestion de la faune du Nord-du-Québec, 31 p.

TAILLON, J., V. BRODEUR et S. RIVARD. 2016. *État de la situation biologique du caribou migrateur, troupeau de la Rivière-aux-Feuilles*. Ministère des Forêts, de la Faune et des Parcs, Québec. 69 p.

U.S. FISH AND WILDLIFE SERVICE. 2025. *White-nose Syndrome Response Team*. Consulté en février 2026 sur le site : Home | White Nose Syndrome

WINSOME RESOURCES, 2025a. *Adina Lithium, un projet phare*. Consulté en novembre 2025 sur le site : Projet Adina Lithium - Winsome Resources

WINSOME RESOURCES, 2025b. *Projet Renard*. Consulté en novembre 2025 sur le site : Projet Renard - Winsome Resources

WSP. 2024. *La Grande Alliance étude de préfaisabilité - phases II & III – infrastructure de transport*. Note technique 15 aperçu de la construction, version finale. Projet no 211-08415-00. 15 p.

WSP, 2026. *Étude sectorielle des impacts sur la santé. Projet minier Shaakichiuwaanaan*.116 p.

Chapter 10

No external reference

Chapter 11

ASSOCIATION MINIÈRE DU CANADA (AMC), 2021. *Guide d'adaptation aux changements climatiques pour le secteur minier*. Document préparé par Golder. PDF : https://mining.ca/wp-content/uploads/dlm_uploads/2022/04/MAC_Guide_dadaptation_aux_changements_climatiques_pour_le_secteur_minier.pdf, 89 p. et annexes.

ECCC. 2025. *Données des normales climatiques canadiennes pour 1991-2020 – Station La Grande IV.* En ligne : https://climat.meteo.gc.ca/climate_normals/results_1991_2020_f.html?searchType=stnProv&lstProvince=QC&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=109000000&dispBack=0. Consulté en octobre 2025.

Chapter 12

BBA, 2025. Évaluation de la teneur de fond naturelle dans les sols. 130 p.

CONSEIL POUR LA RÉDUCTION DES ACCIDENTS INDUSTRIELS MAJEURS (CRAIM). 2017. *Guide de gestion des risques d'accidents technologiques majeurs*. Document PDF disponible à l'achat.

DE GRANDMONT. (1994). Étude préliminaire sur les risques d'écrasements d'avions sur le territoire de la Communauté urbaine de Montréal (CUM). *Étude réalisée pour le Bureau des mesures d'urgence de la CUM*

GOUVERNEMENT DU CANADA. 2026. *Banque nationale de données sismologiques*. Récupéré sur Séismes Canada: https://www.seismescanada.rncan.gc.ca/stndon/NEDB-BNDS/bulletin-fr.php?display=1&endtime=2026-01-27T23%3A59%3A59&eventtype=earthquake&latitude=53.461&limit=4001&longitude=-73.896&maxradius=1.802&minmagnitude=0&onlyfelt=1&starttime=1980-12-27T00%3A00%3A00

GOUVERNEMENT DU QUÉBEC. 2022. *Gestion des feux de forêt*. Récupéré sur Site officiel du gouvernement du Québec: https://mffp.gouv.qc.ca/les-forets/protection-milieu-forestier/gestion-feux-foret/

GOUVERNEMENT DU QUÉBEC. 2026. *Protection contre les feux de forêts*. Récupéré sur Gouvernement du Québec: https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/forets/protection-forets/gestion-feux/proteger#:~:text=Territoire%20prot%C3%A9g%C3%A9%20contre%20les%20incendies,des%20feux%20de%20cause%20humaine.

MINISTÈRE DES TRANSPORTS. 2019. *Guide sur le transport des matières dangereuses*. Récupéré sur Guide sur le transport des matières dangereuses: Guide sur le transport des matières dangereuses

OURANOS. 2026. *Portraits Climatiques*. 2026-01-27. Récupéré sur https://portraits.ouranos.ca/fr/spatial?c=0&discrete=1&e=CMIP6&fro=1&i=prfr_events_longer_6h&mun=0&p=50&r=qc000&s=annual-AUG&scen=rcp45&vtype=abs&w=0&yr=2021

RÉPUBLIQUE FRANÇAISE, MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE, DE LA BIODIVERSITÉ ET DES NÉGOCIATIONS INTERNATIONALES SUR LE CLIMAT ET LA NATURE. 2025. *Aria*. Récupéré sur https://www.aria.developpement-durable.gouv.fr/

RESSOURCES NATURELLES CANADA. 2018. *Directives sur les installations d'explosifs en vrac, exigences minimales*. Récupéré sur Directives sur les installations d'explosifs en vrac, exigences minimales: Directive sur les installations d'explosifs en vrac

THÉBERGE, M.-C. 2002. *Analyse de risques d'accidents technologiques majeurs*. Québec: Ministère de l'Environnement, Direction des Évaluations environnementales.

Chapter 13

ATLAS DES OISEAUX NICHEURS DU QUÉBEC (AONQ). 2026. Indices de nidification. En ligne : https://www.atlas-oiseaux.qc.ca/donneesqc/codes.jsp?lang=fr&pg=breeding. Consulté en février 2026.

BEAULIEU, M. 2021. Guide d'intervention – Protection des sols et réhabilitation des terrains contaminés. Ministère de l'Environnement et de la Lutte contre les changements climatiques. 326 p. et annexes

BIBBY, C.J., N.D. BURGESS et D.A. HILL. 1992. Bird Census Techniques. Academic press, London. 257 p.

BLONDEL, J., C. FERRY et B. FROCHOT. 1981. Points counts with unlimited distance, Estimating the number of terrestrial birds. C.J Ralph et J.M Scott Editors, Sudies in avian biology, no 6, p 414-420.GOUVERNEMENT DU CANADA. 2012. Guide technique pour l'étude de suivi des effets sur l'environnement des mines de métaux. En ligne. https://ec.gc.ca/esee-eem. Consulté en mars 2025

CENTRE D'EXPERTISE EN ANALYSE ENVIRONNEMENTALE DU QUÉBEC (CEAEQ). 1998. Procédure d'évaluation du risque écotoxicologique pour la réhabilitation des terrains contaminés. En ligne : https://www.ceaeq.gouv.qc.ca/ecotoxicologie/pere/pere.pdf 139 p.

COSEPAC. 2023. Évaluation et Rapport de situation du COSEPAC sur la chauve-souris cendrée (*Lasiurus cinereus*), la chauve-souris rousse de l'Est (*Lasiurus borealis*) et la chauve-souris argentée (*Lasionycteris noctivagans*) au Canada, Comité sur la situation des espèces en péril au Canada, Ottawa, xxv + 116 p.

ENVIRONNEMENT CANADA. 1997. Guide pour l'évaluation des impacts sur les oiseaux. Sainte-Foy. Division des évaluations environnementales et Service canadien de la faune, région du Québec. 53 p.

ECC. 2018. Programme de rétablissement de la petite chauve-souris brune (*Myotis lucifugus*), de la chauve-souris nordique (*Myotis septentrionalis*) et de la pipistrelle de l'Est (*Perimyotis subflavus*) au Canada, Série de Programmes de rétablissement de la Loi sur les espèces en péril. Ottawa. Environnement et Changement climatique Canada. ix + 189 p.

ECCC. 2025. Indicateurs canadiens de durabilité de l'environnement : Tendances des populations d'oiseaux du Canada. En ligne : www.canada.ca/fr/environnement-changement-climatique/services/indicateurs-environnementaux/tendances-populations-oiseaux.html. Consulté en février 2026.

GODBOUT, G., POIRIER, M. et R. LAFOND. 2001. Méthode de caractérisation du cycle d'abondance du lièvre à l'aide du dénombrement de crottins, à des fins de gestion des animaux à fourrure. Société de la faune et des parcs du Québec. Direction du développement de la faune et Direction de l'aménagement de la faune de l'Abitibi-Témiscamingue. Québec. 50 p.

GOUVERNEMENT DU CANADA. 2012. Guide technique pour l'étude de suivi des effets sur l'environnement des mines de métaux. En ligne : https://www.canada.ca/fr/environnement-changement-climatique/services/gestion-pollution/suivi-effets-environnement/guide-technique-mines-metaux/guide-technique-etude-suivi-effets-environnement-mines-metaux.html

GOUVERNEMENT DU CANADA. 2022a. L'hirondelle de rivage (*Riparia riparia*) : dans les sablières et les gravières 2022. Environnement et ressources naturelles. Registre public des espèces en péril. En ligne : https://www.canada.ca/fr/environnement-changement-climatique/services/registre-public-especes-peril/renseignements-connexes/hirondelle-rivage-sablieres-gravieres-2022.html. Consulté en février 2026.

GOUVERNEMENT DU CANADA. 2022b. Fiches d'information : Protection des nids en vertu du Règlement sur les oiseaux migrateurs (2022). Environnement et ressources naturelles. Prévention des effets néfastes pour les oiseaux migrateurs. En ligne : https://www.canada.ca/fr/environnement-changement-climatique/services/prevention-effets-nefastes-oiseaux-migrateurs/fiche-information-protection-nids-vertu-rom-2022.html. Consulté en février 2026.

GOUVERNEMENT DU CANADA. 2023. Lignes directrices pour éviter de nuire aux oiseaux migrateurs. En ligne : https://www.canada.ca/fr/environnement-changement-climatique/services/prevention-effets-nefastes-oiseaux-migrateurs/reduction-risque-oiseaux-migrateurs.html#toc5. Consulté en février 2026.

GOUVERNEMENT DU CANADA. 2025. Liste des espèces en péril. En ligne : https://laws.justice.gc.ca/fra/lois/S-15.3/page-10.html#docCont Loi sur les espèces en péril Consulté le 4 juin 2025.

Gouvernement du Québec. 2025. Liste des espèces fauniques menacées ou vulnérables. En ligne : https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/faune/gestion-faune-habitats-fauniques/especes-fauniques-menacees-vulnerables/liste Consulté le 4 juin 2025.

INSPQ. 2012. Lignes directrices pour la réalisation des évaluations du risque toxicologique d'origine environnementale au Québec. En ligne : https://www.inspq.qc.ca/publications/1440

MELCCFP, 2026. *Lignes directrices relatives à la gestion du bruit environnemental* [En ligne]. https://bibliotheque.cecile-rouleau.gouv.qc.ca/documents/archives/pgq/E5A1_A17_B78_2026.pdf.

MELCCFP, 2025a. Normes et critères québécois de qualité de l'atmosphère, version 10, Québec, Direction principale de la qualité de l'air et du climat, [En ligne]. www.environnement.gouv.qc.ca/air/criteres/index.htm. Consulté en mars 2025.

MELCCFP, 2025b. Directive 019 sur l'industrie minière, Québec, 95 p.

MELCCFP, 2025c. Guide de quantification des émissions de gaz à effet de serre, 126 p.

MELCCFP. 2025d. Protocole standardisé d'inventaire du hibou des marais dans le Québec méridional. Gouvernement du Québec, Québec. 27 p. + annexes.

MELCCFP, 2024. Méthode d'analyse MA. 110 – ACISOL 1.0 Détermination du pouvoir neutralisant, du potentiel de génération acide et du potentiel acidogène d'un solide (révision 8), 11p.

MELCCFP, 2023a. Méthode d'analyse MA. 200 – Mét. 1.2. Détermination des métaux : méthode par spectrométrie de masse à source ionisante au plasma d'argon (révision 9). Québec. 33 p.

MELCCFP, 2023b. Méthode d'analyse MA. 100 – Lix.Com. 1.1 Protocole de lixiviation pour les espèces inorganiques (révision 3). Québec.12 p.

MELCCFP, 2023c. Suivi environnemental des installations de traitement des eaux usées d'origine domestique. Québec. 7p.

MELCCFP. 2023d. Recueil des protocoles standardisés pour l'inventaire des colonies estivales de chauves-souris au Québec, Gouvernement du Québec, Québec, 24 p. + annexes.

MELCCFP. 2023e. Recueil des protocoles standardisés d'inventaires acoustiques de chauves-souris au Québec, Gouvernement du Québec, Québec, 44 p. + annexes.

MELCC, 2020a. Guide de caractérisation des résidus miniers et du minerai, Québec, 52 p. [En ligne]. http://www.environnement.gouv.qc.ca/Industriel/secteur-minier/guide-caracterisation-minerai.pdf. Consultée le 28 mars 2025.

MELCC, 2020b. Guide pour l'établissement des normes de rejet d'une installation de traitement des eaux usées d'origine domestique, 74 p. [En ligne]. https://www.environnement.gouv.qc.ca/eau/eaux-usees/art32/Etablissement-normes-rejet-station-epuration.pdf. Consultée le 31 mars 2025.

MDDELCC. 2006. Note d'instructions 98-01 - Traitement des plaintes sur le bruit et exigences aux entreprises qui le génèrent. Québec. 23p.

MDDELCC, 2017. Guide de caractérisation physicochimique de l'état initial du milieu aquatique avant l'implantation d'un projet industriel, Québec, Direction générale du suivi de l'état de l'environnement, ISBN 978-2-550-79556-8, 12 p. + 3 annexes.

MDDELCC, 2016a. Guide d'échantillonnage à des fins d'analyses environnementales – Cahier 4 – Échantillonnage des émissions atmosphériques en provenance de sources fixes, Québec, Centre d'expertise en analyse environnementale du Québec, 71 p.

MDDELCC, 2016b. Guide d'échantillonnage à des fins d'analyses environnementales Cahier 2 – Échantillonnage des rejets liquides, incluant l'addenda 1 : Mise à jour de la section 4. Québec, Centre d'expertise en analyse environnementale du Québec, 23 p.

MDDELCC, 2015a. Guide de conception des installations de production d'eau potable, volume 1, Québec, 298 p.

MDDELCC. 2015b. Lignes directrices relativement aux niveaux sonores provenant d'un chantier de construction industriel. [En ligne] https://www.environnement.gouv.qc.ca/publications/note-instructions/98-01/lignes-directrices-construction.pdf . Consultée le 28 mars 2025.

MINISTÈRE DU DÉVELOPPEMENT DURABLE, DE L'ENVIRONNEMENT ET DES PARCS DU QUÉBEC (MDDEP), 2011. Guide d'échantillonnage à des fins d'analyses environnementales : cahier 3 – Échantillonnage des eaux souterraines (révision 2012), Centre d'expertise en analyse environnementale du Québec, 60 p., 1 annexe. [En ligne]. http://www.ceaeq.gouv.qc.ca/documents/publications/echantillonnage.htm. Consultée en mars 2025.

MRNF, 2024. Guide de préparation du plan de réaménagement et de restauration des sites miniers au Québec, Québec, 116 p.

OISEAUX CANADA. 2025. Inventaire nord-américain des engoulevents : protocole canadien 2025. Basé sur un document écrit par Elly Knight et traduit par Audrey Lauzon et Kevin Quirion Poirier. Publié en collaboration avec Environnement et Changement climatique Canada. 26 p.

OISEAUX CANADA. 2026. Outil de requête des calendriers de nidification. En ligne : https://naturecounts.ca/apps/rnest/index.jsp?lang=FR. Page consultée le 20 février 2026.

RALPH, C.J., J.R., SAUER et S. DROEGE. 1995. Monitoring bird populations by points counts. General Technical Report PSW-GTR-149. Pacific Southwest Research Sation, Forest Service, U.S. Departement of Agriculture, Albany, Californie. 187 p.

SANTÉ CANADA. 2010. Guide supplémentaire sur l'évaluation des risques pour la santé humaine liés aux aliments d'origine locale (ÉRSHaliments) – L'évaluation des risques pour les sites contaminés fédéraux au Canada. En ligne : https://publications.gc.ca/site/eng/9.638447/publication.html

SANTÉ CANADA. 2017. Conseils pour l'évaluation des impacts sur la santé humaine dans le cadre des évaluations environnementales - Le bruit. Ottawa, 55 p.

TREMBLAY, J. A. et J. JUTRAS. 2010. Les chauves-souris arboricoles en situation précaire au Québec – Synthèse et perspectives. Le Naturaliste Canadien, vol. 134 no 1. p. 29-40

USEPA. 2024. List of Designated Reference and Equivalent Methods. United States Environmental Protection Agency. 80 p.

WRIGHT, D.G. et G.E. Hopky. 1998. Lignes directrices concernant l'utilisation d'explosifs à l'intérieur ou à proximité des eaux de pêche canadiennes, Rapport technique canadien des sciences halieutiques et aquatiques 2107, 1998, iv + 34p.

Chapter 14

MAGNAN, G., M. GARNEAU, L. PERRIER, J. BEAULNE, N.K. SANDERSON, G. PRIMEAU et D. LACHANCE. 2024. Guide d'inventaire pour l'estimation des stocks de carbone dans les milieux humides – version mai 2024, Québec, ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, Direction des milieux humides, 20 p. + annexes

NIIGAAN. 2025. Projet Shaakichiuwaanaan – Plan de compensation – Recherche de projets et étude de préfaisabilité. Rapport du projet 151024013 (22-0095-15). 84 pages.

PÊCHES et OCÉANS CANADA. 2025. Politique sur l'application de mesures visant à compenser les effets néfastes sur le poisson et son habitat. 38 p.