Environment and Climate Change Canada Final Advice

As part of the environmental assessment of the James Bay Lithium Mine Project

Background to the Federal Environmental Assessment

This Final advice for the James Bay Lithium Mine Project (the Project) is submitted by Environment and Climate Change Canada (ECCC) as part of the federal environmental assessment process. It has been prepared based on documentation made available to date by the proponent, Galaxy Lithium (Canada) Inc. and submitted to either the Impact Assessment Agency of Canada(the Agency) or the Joint Assessment Committee (JAC) comprised of the Cree Nation Government and the Agency as part of this process, as well as to the Environmental and Social Impact Review Panel (COMEX). Should changes be made to the proposed project, this advice may need to be revisited.

In addition, please note that as part of the environmental assessment process, ECCC provides technical and scientific information and expertise to support the responsible authority in its assessment of the effects of the project on the receiving environment. Any information or comments received from ECCC in this context do not relieve the proponent of its obligations to comply with all applicable federal laws and regulations.

The following text has not been verified in detail by ECCC experts. Therefore, the French version takes precedence over this version in all cases, including quotes from the proponent's documentation. Finally, the names of Québec provincial departments presented in this document may have changed over time, and these changes are not reflected in the present document.

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Elements of the environment

This section presents ECCC's responses to questions specific to those elements of the environment whose changes caused by the project may have effects on the valued components identified by the Joint Assessment Committee. These are presented in Appendix 1 of the Agency's request for final advice. The components of the environment within the mandate of ECCC and discussed below are

- Air quality
- Surface and ground water
- Hydrology

AIR QUALITY

Existing environment and baseline conditions

The current ambient air quality status for gaseous contaminants and particulate matter is described in the original Environmental Impact Statement (EIS) (WSP Canada Inc., 2018, Volume 2) and repeated in Section 6.2.10 of the revised EIS (WSP Canada Inc., 2021a). Due to the lack of measurement stations near the study site, the description of this component is essentially based on concentrations recommended for projects in northern environments according to the Guide de modélisation de la dispersion des émissions atmosphériques des projets miniers (MDDELCC, 2017a, MELCC Guide) published on the Ministère de l'Environnement et de la Lutte contre les changements climatiques (MELCC) website. The gaseous contaminants considered are carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2) while only total particulate matter (TPM), respirable particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$) were considered for solid contaminants.

Concerning $PM_{2.5}$, since the MELCC Guide does not mention any value for these for the annual period, the initial concentration (4.5 µg/m^3) was established from measurements made at the Pémonca station located more than 400 km from the site. For the concentrations of respirable particles of less than 10 µm (PM_{10}), no initial concentration is also specified in the guide for the daily and annual periods. Initial concentrations were therefore established by interpolation with TPM and $PM_{2.5}$ using an annual TPM concentration of 8 µg/m^3, evaluated at the Lac-Édouard station. Thus, for PM_{10}, initial concentrations of 21.8 µg/m^3 and 5.5 µg/m^3 were obtained for the 24-hour and annual periods respectively.

In order to compare the specific concentrations recommended in the MELCC Guide with data from an existing network of air quality measurement stations for a similar environment, data from the northernmost stations of the Réseau de surveillance de la qualité de l'air du Québec (RSQAQ) were analyzed by the proponent. These are the Lac-Édouard, Radisson, Pémonca and Senneterre stations (WSP Canada Inc., 2021a, Table 6-21b). Of these, the Radisson station was considered the most representative of the study area. However, only 774 hourly measurements are available at this station for the year 2017. The statistics for this year are given for information purposes only (WSP Canada Inc., 2019b). Nevertheless, the proponent confirms that, based on the results of the data analysis of the three additional stations, the initial concentrations of 40 µg/m^3 and 15 µg/m^3, for TPM and $PM_{2.5}$, respectively, measured at the Pémonca station are adequate to characterize the study site (WSP Canada Inc., 2019b).

The proponent has completed the description of ambient air quality with consideration of wildfires while specifying their potential impact on the ambient air quality of the area and site involved. According to the 2018 EIS, "the risk of wildfire, in the project area, is considered very high." The proponent indicated that forest fire mapping provided by the Ministère des Forêts, de la Faune et des Parcs du Québec (MFFP) was analyzed to assess the frequency and importance of forest fires in the study area (WSP Canada Inc., 2021a). The results show that the intensity of fires varies greatly from one year to the next. The size of forest fires is also variable, but according to the data compiled (WSP Canada Inc., 2021a), "the majority (96%) of fires have burned less than 75 km^2 " and "only a few large fires over 750 km^2 have occurred since 1972".

With respect to quantifying the impact of wildfires on air quality, the proponent used the *BlueSky Framework* (BSF) software suite to present a single day average fire case of 75 km^2 with results indicating that the $PM_{2.5}$ concentration would reach 140 µg/m^3 at approximately 12 km from the fire origin and only 15 µg/m^3 at approximately 50 km from the fire origin. The proponent concluded that the initial $PM_{2.5}$ concentration of 15 µg/m^3, chosen for the daily period, would incorporate the impact of forest fires on air quality in the study area of the future mine site (WSP Canada Inc., 2019b).

In summary, the proponent described the air quality in the area as "very good" due to the remoteness of industrial activities, the closest of which would be more than 100 km from the study site (based on data reported by companies to the National Pollutant Release Inventory).

ECCC advice and recommendations

ECCC believes that the description of the baseline condition has some shortcomings due to the methodology used to collect the baseline data. Indeed, due to the absence of measurement stations on site or near the local or regional study area, the proponent used default concentrations from the *Règlement sur l'assainissement de l'atmosphère* (RAA) to characterize the ambient air quality. The proponent also used a station (Pemonka) that was far from the site to determine the concentration of fine particles ($PM_{2.5}$). The proponent also relied on an analysis of data from additional stations to justify its approach and confirm that the initial concentrations adopted are adequate to characterize the ambient air quality of the study site. However, with the exception of the Radisson station, which has insufficient data, the other northernmost RSQAQ stations are equally distant from the project site (several hundred kilometers) and it would be difficult to confidently attest to their representativeness in describing the ambient air quality of the study area. Thus, the use of recommendations established in the MELCC Guide or of measurement stations that are far from the project site could not allow for the description of air quality in the local study area with any assurance. However, according to the proponent, the initial concentration presented in the impact study and based on the values recommended by the MELCC Guide for projects in remote areas is conservative and would not represent the conditions that would currently exist in the study area.

In the absence of measurement stations near the site, it is generally recommended that measurement stations be installed prior to the project and that data be recorded over a period of time that allows for seasonal variations. This would have provided a more confident description of the baseline air quality condition.

In addition, the impact of wildfires, which are increasing in size and frequency with climate change, was incorporated using a utility model to quantify the impact. However, the proponent only studied one case of an average fire of 75 km^2 during a single day to support its conclusion. It is well known that smoke plumes typically generate very high concentrations of contaminants, including $PM_{2.5}$. Based on observations collected in Northern Quebec, $PM_{2.5}$ concentrations can reach a few hundred µg/m^3 during the summer and can far exceed 15µg/m^3 on different days in the summer (Moore et *al.*, 2006). Thus, there would be uncertainty in determining a realistic initial concentration for $PM_{2.5}$, in particular. The initial concentrations established for the baseline conditions could be underestimated for much of the year, especially in summer. In addition, the example and the data used in the software (BSF) to assess the impact of forest fires are not truly representative. In fact, the proponent cautions that “conclusions should be interpreted with caution as many assumptions were made in the analysis and the results are not derived from a complete modeling process as required by government authorities”.

In addition, it would be difficult to make an objective conclusion without better evidence. Indeed, by averaging hourly, daily and annual observations of forest fire events for a full year's data, it would be possible to generate concentrations much lower than those representative of forest fire events. This appears to be confirmed in the proponent's compilation of results for the relevant monitoring stations (WSP Canada Inc., 2021a, Table 6-21b). However, these averages, which are used for comparison to existing standards, would not be representative of air quality according to seasons or forest fire events, for example.

In summary, although the proponent has provided additional information for all of the deficiencies identified during the environmental assessment process, the description of the baseline condition still presents uncertainties with respect to the concentrations of contaminants already present on a seasonal basis, particularly for particulate matter.

It is important to note that the accuracy of the baseline description is of particular importance in determining the air quality impacts of the project. Initial ambient air pollutant concentrations must be added to the modeled project contaminant concentrations and compared to hourly, daily and annual standards. Lack of information and inadequate description of ambient air quality can affect the modelled results and introduce many uncertainties in the magnitude of the project's impact on air quality. Nevertheless, in the absence of measured data, the concentrations recommended in the MELCC Guide for northern projects may be acceptable in this particular case.

Given the deficiencies identified during the review of the impact study, and following the responses and clarifications provided by the proponent to ECCC's requests for additional information, the baseline was described sufficiently considering the remote location of the project and the lack of available information.

Changes caused by the project

Potential environmental effects on air quality were described in Section 7.2.5 of the 2018 EIS (WSP Canada Inc., 2018, pp. 7-34 to 7-37). Effects were primarily documented through initial modeling of contaminant concentration and atmospheric dispersion in the study area for the construction and operation phases. The methodology used by the proponent to assess the impact on air quality for these two phases is based on the MELCC's guide to atmospheric dispersion modeling (Leduc, 2005). Two scenarios were considered: construction and operation. An additional scenario, with a view to reducing crystalline silica emissions, was also carried out for the operation phase by including modifications to the operations, notably to the mining plan and the classes of trucks used (WSP Canada Inc., 2019b, pp. 94-97). However, the proponent failed to include emissions from generators and the concrete plant for the construction phase and emissions from the transport of concentrate on the Billy-Diamond road from the mine site to Matagami (385 km) for the operation phase. The proponent has completed the study as requested by the Agency in Appendix C of the revised 2021 EIS (WSP Canada Inc., 2021a) by including emission sources from generators, the concrete plant (WSP Canada Inc., 2020a, R-AD2-60 and 104 A) and B), p. 23) as well as emissions from the transportation of concentrate between the mine and Matagami (WSP Canada Inc., 2020a, Appendix R-AD2-60/140-1).

In addition, the Agency had asked the proponent to propose mitigation measures to ensure compliance with the Quebec Normes et critères québécois de qualité de l'atmosphère relatifs (Air Quality Standards and Criteria) for crystalline silica and to conduct additional scenario modeling incorporating these new measures to verify their effectiveness. Thus, the proponent revised the entire project to optimize it and at the same time reduce the magnitude of crystalline silica exceedances (WSP Canada Inc., 2019d, R-122, p. 79).

Significant changes have been made to the mine site layout from the 2018 study in the revised 2021 EIS (WSP Canada Inc., 2021a, Section 1.6, pp. 1-3 to 1-10). The main changes are to the following structures:

- The development of four waste rock and tailings storage facilities instead of one, as well as the relocation of the organic material and loose deposits storage facility from the 2018 study.
- Haul roads that would support shorter trips than what was planned in 2018.
- The location of the concentrator, worker camp and service building which are now closer to the Billy-Diamond Highway compared to the 2018 project.
- Larger capacity of concentrate haulage trucks and trucks used to transport ore to the crusher compared to 2018.

A second modeling exercise was conducted in 2021 to take into account recent modifications to the mining project. According to the proponent, the modifications considered would not change the significance of the impact, which was considered "minor" for all phases of the project (WSP Canada Inc., 2021a, Section 7.2.5, pp. 7-45 to 7-51 and Section 7.2.9, Table 7-12, p. 7-57). Environmental effects related to the new mine infrastructure layout and other changes were also revised to reflect the project modifications (WSP Canada Inc., 2021a, Section 4.10.1, pp. 4-89 to 4-99).

Only the modeling results for the new mine site configuration presented in the revised EIS (WSP Canada Inc., 2021a, Appendix C, Tables 16, 17, 18 and 19, pp. 30-35) are discussed below.

Construction

Project activities during the construction phase for the 2018 EIS include, but are not limited to, peat removal, road construction, concentrator construction, waste rock storage facility preparation, dike construction, and quarrying and borrow pits for construction material supply. However, the proponent indicates that only three activities were considered in the air quality modeling, namely rock (quarry) and sand (borrow pit) extraction and rock crushing and screening (WSP Canada Inc., 2018, Étude de la modélisation de la dispersion atmosphérique, Tables 2, 3 and 4, pp. 11-13). These would be the activities with the highest air emissions. Indeed, they would represent the "worst-case" scenario due to the large quantities of materials to be handled and transported as well as the large use of equipment planned for these activities (WSP Canada Inc., 2019b, ACÉE-61, pp. 83-84). This approach does not appear to have been adopted in the new modeling. Instead, the report refers to the "*Material Movement Log"* established by the proponent (WSP Canada Inc., 2022a, Appendix R-CCE3-3A). This log would present all activities and materials handled and transported on the mine site for both phases.

The contaminants considered in the impact study are the Common Air Contaminants (CACs) including nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2), volatile organic compounds (VOCs) and particulate matter (TPM, PM_{10} and $PM_{2.5}$) as well as 19 metals and metalloids and crystalline silica. The effect on air quality was assessed using the RAA standards and the Canadian Council of Ministers of the Environment (CCME) Canadian Ambient Air Quality Standards (CAAQS).

According to the modeling report (WSP Canada Inc., 2021a, Appendix C), the activities that could potentially impact air quality are site preparation activities including drilling, blasting, material handling, use of generators and machinery on unpaved roads, building heating and concrete plant operations. These are sources of contaminant emissions such as dust and combustion gases. Wind erosion of materials exposed to the wind is also a source of dust emissions. It is important to note that an attenuation factor of 80% and 95% for the summer and winter months respectively was applied to the emission rates to represent a reduction in particulate matter emitted from regular road watering or rainfall.

For the construction scenario, modeling results are presented in Tables 16 to 19 of Appendix C of WSP Canada Inc. (2021a) for the application area and sensitive receptors.

Overall, concentrations of modeled contaminants are below applicable ambient air quality limits, with the exception of NO_2 for the CAAQS hourly period. NO_2 concentrations are above the CAAQS at locations near the application limit and at sensitive receptors associated with traditional activities.

In the application domain (Table 16):

- The maximum 1-hour NO_2 concentrations are 185 µg/m^3 or 164% of the 2020 CAAQS and 234% of the 2025 CAAQS. The exceedance frequencies are 48 and 75 days over a 5-year period for the 2020 and 2025 CAAQS, respectively. The project contribution accounts for 82% of the total concentration. It should be noted that nitrogen dioxide concentrations are 97% of the MELCC hourly standard.
- $PM_{2.5}$ concentrations , while below the daily standards, still represent 92% of the MELCC standards and 71% of the CAAQS criteria at the domain limit.
- The concentration of PM_{10} reaches 77% and 37% of the World Health Organization (WHO) limit values for the daily and annual periods, respectively.
- TPM concentrations are 65% of the MELCC daily standard.

For sensitive receptors (Table 17):

- The maximum 1-hour NO_2 concentrations occur at the location of traditional activities with maximum concentrations of 150 µg/m^3 or 133% of the 2020 CAAQS and 190% of the 2025 CAAQS.

<u>Deposition of particulate matter</u>

The results of the total particulate matter (TPM) deposition modeling were compiled within the application domain and for selected sensitive receptors (Tables 18 and 19).

- For the construction scenario, the monthly deposition in the application area is 2.66 g/m^2. For the

sensitive receptors, the maximum monthly deposition occurs at the Traditional Activity receptor with a deposition of 0.8341 g/m^2. At the km 381 truck stop and Cree Camp the maximum monthly depositions are 0.821 g/m^2 and 0.801 g/m^2, respectively (updated Tables 18 and 19 sent by email).

Comparing the results with the former deposition standard of 7.5 g/m^2 per month of the former *Règlement sur la qualité de l'air* of the Province of Quebec, there would be no exceedances at the various sensitive receptors.

Operation

Modeling during the operations phase considers the following production activities: pit operations, including waste rock, ore and overburden mining, blasting, and operations in the industrial sector. From the pit, the ore would be transported to the ore storage facility and the waste rock would be transported to the waste rock storage facility, along with the tailings produced in the processing unit.

The approach taken to determine the "worst case" scenario in the new modeling study in 2021 (WSP Canada Inc., 2021a, Appendix C) was based on maximum rates for mining, material movement and milling. Based on these criteria, year 14 would represent the "worst case scenario". The proponent refers to the material movement log for the life of the mine to support this choice. Air contaminant emissions during operations include particulate matter (TPM, PM_{10}, $PM_{2,5}$), combustion gases (CO, NOx, VOC, SO_2), metals and silica.

The activities that could affect air quality during the operation phase are similar to the construction activities, to which must be added the emissions from the ore processing plant (concentrator). This plant has dust collectors that are sources of particulate matter. The heating and ventilation of the plant as well as the camp use propane as a fuel and therefore constitute an additional source of combustion gases.

For exhaust emissions, the revised EIS considers off-road vehicles that meet Group 4, 4i or 3 standards. While the original study had a broader range of categories by including those that met Group 2, 3, 4 and 4i standards.

For the operation scenario, modeling results are presented in Tables 21 through 24 of the modeling report (WSP Canada Inc., 2021a, Appendix C) for the application area and sensitive receptors.

- The total particulate matter (TPM) concentration over a daily period is 101% of the MELCC standard in the application domain. For sensitive receptors, this concentration would decrease to 72% for the traditional activity receptor.
- Modeled nitrogen dioxide concentrations show exceedances of the CCME 1-hour standard. The maximum modeled 1-hour NO_2 concentration in the application domain (221 µg/m³) exceeds the applicable limit value for the year 2020 by 196% and for 2025 by 280%. The contribution of the project is 97% of the total concentration. Exceedances of 170% of the hourly CAAQS standard for NO_2 applicable to the sensitive receptor traditional activity are predicted for 2020 and 243% for 2025 (192 µg/m³).

<u>Crystalline silica</u>

In the air dispersion modeling study of the revised EIS, the results for crystalline silica show, for both hourly and annual criteria, exceedances of the MELCC Normes et critères québécois de qualité de l'atmosphère (Quebec Air Quality Standards and Criteria) in the domain of application and at sensitive receptors.

- Exceedances of 179% of the hourly standard and 436% of the annual standard for crystalline silica are achieved in the application domain. The concentrations are 41.2 µg/m³ and 0.305 µg/m³ for the hourly and annual periods, respectively. The project contribution being 85% and 87% in both cases.
- Exceedances of 261% of the annual standard for crystalline silica are reached at the traditional activity receptor with a concentration of 0.143 µg/m³ and at the km 381 truck stop with a concentration of 0.109 µg/m³ representing 213% of the standard. However, concentrations reach a maximum of 87% of the hourly standard at the two sensitive receptors already mentioned.

Metals

Although the metals do not exceed the MELCC standards, two metals in particular come close. These are arsenic and chromium (VI or hexavalent).

- Arsenic reaches 87% and 81% of the standard in the application area and at the traditional activity receptor, respectively. However, the project contribution is 24% and 17% in both cases.
- The modeled chromium concentration is 95% and 80% of the standard for hexavalent chromium in the application area and at the traditional activity receptor, respectively. The project contribution is 47% and 37% in both cases.

Thus, of the common air contaminants (CAC), only total particulate matter (TPM), crystalline silica, and nitrogen dioxides show exceedances of the standards used by the proponent in the air dispersion study both in the application domain and at some sensitive receptors.

Deposition of particulate matter

The results of the total particulate matter (TPM) deposition modeling were compiled within the application domain and for selected sensitive receptors (Tables 23 and 24).

- For the operation scenario, the maximum monthly deposition in the application area is 4.82 g/m^2. Maximum monthly modeled deposition still occurs at the traditional activity receptor with 2.49 g/m^2. At the km 381 truck stop and Cree camp, monthly deposition rates are 1.62 g/m^2 and 0.0991 g/m^2, respectively.

Comparing the results with the former deposition standard of 7.5 g/m^2 per month of the former *Règlement sur la qualité de l'air* (*Air Quality Regulations)* of the Province of Quebec, there would be no exceedances at the various sensitive receptors. However, transportation (routing) on the mine site represents the main source of particulate matter emissions. It is important to note that the proponent used attenuation rates of 80% and 95% in the calculation of particulate matter emissions from unpaved roads.

Transport of the concentrate from the mine site to Matagami

The proponent performed a separate modeling for the area corresponding to the road linking the mine site to the town of Matagami (WSP Canada Inc., 2020a, Appendix R-AD2-60/140-1). The modeling was performed on a section of the James Bay highway (Billy-Diamond) which is within the air dispersion modeling domain. The predicted concentrations along the entire length of this road are considered to be the same as those estimated for the section that is within the modeling domain. The results of this modeling for the original project conditions are presented in Appendix R-AD2-60/140-2 of WSP Canada Inc (2020a), while the results for the revised project are provided in Appendix H of WSP Canada Inc (2021a). The approach taken for both studies is the same, but the difference is primarily in the characteristics of the trucks used for transportation. The optimized project would use trucks with an average weight of approximately 80 tonnes compared to the original study's approximately 40 tons trucks.

During operation of the revised project (WSP Canada Inc., 2021a, Appendix H of Appendix C), 22 trucks per day (round trip) would travel between the mine site and Matagami to transport ore concentrate. In addition to the concentrate vehicles, fuel delivery trucks (31 trucks per day) were included in the modeling, bringing the total number to 53 vehicles. Truck traffic on paved roads could result in dust emissions from vehicle movement on the road and from fuel combustion by the trucks. The combustion of fuel in the engines of these vehicles also results in the release of combustion gases (such as SO_2, NOx, CO and VOCs).

- For TPM, the first maximum concentration reaches 63% of the MELCC daily standard (75.8 µg/m^3).
- For PM_{10}, the concentration is 26.8 µg/m^3, which is 54% of the WHO daily limit and it is 7.33 µg/m^3 for the WHO annual standard (37% of the standard).
- For $PM_{2.5}$, the concentration can be as high as 16 µg/m^3 for the CCME daily standard, or 59% of the standard.

Based on both modeling studies (original and revised project), concentrations of total particulate matter (TPM), PM_{10} and $PM_{2.5}$ from concentrate transport and fuel transport along the Billy-Diamond Highway from the mine site to Matagami would be below the applicable ambient air quality criteria.

Restoration and Post-restoration

The impact of these two phases has been briefly described in qualitative terms and therefore has not been quantified (WSP Canada Inc., 2021a, Section 7.2.5). The restoration phase essentially involves infrastructure dismantling operations, pit rehabilitation, hazardous materials and waste management, and transportation and traffic. In addition, restoration activities would be "less likely to emit dust". The impacts would be associated with the same activities as in the construction phase, but they would be of "shorter" duration. Thus, according to the proponent, the impact on the quality of the atmosphere was "judged to be of minor importance".

ECCC advice and recommendations

Methodology

Environmental effects on air quality were assessed using an air dispersion model to estimate contaminant concentrations and dispersion. The dispersion model used for the project is a recognized methodology (AERMOD) and was reviewed in its entirety including model inputs and options. ECCC considers that it generally meets the requirements set out in the MELCC Guide and addresses the issues important to the assessment of the effects of the project.

The modeling domain selected for the local study area covers an area of 27 km x 27 km, which is also consistent with the MELCC modeling guide. Sensitive receptors within the selected domain were considered. The density of the receptor grid is within reasonable limits to generate a good representativeness of the estimated concentrations.

Due to the lack of meteorological stations near or representative of the mine project site, meteorological data from meteorological re-analysis were used to obtain the meteorological data required for modeling (WSP Canada Inc., 2021a, Section 6.2.10, pp. 6-59 to 6-60). This approach is consistent with the recommendations of the MELCC Guide and appropriate in the context of this project.

Potential effects

Activities that could affect air quality are primarily related to all construction, operation and restoration activities. All of these activities would produce solid and gaseous air pollutants (combustion products), including fugitive emissions (dust). The potential adverse effects of the Project would be the deterioration of air quality conditions during all phases of the Project.

Atmospheric dispersion modeling of contaminants indicates that the project is likely to result in an increase in the concentration of total particulate matter (TPM) above standards including crystalline silica in the atmosphere, as well as an increase in the concentration of nitrogen dioxide above CAAQS standards.

With respect to exhaust emissions, the revised EIS (WSP Canada Inc., 2021a) considers off-road vehicles that meet Group 4, 4i or 3 standards. Whereas the original EIS (WSP Canada Inc., 2018) had a broader range of categories by including those that met Group 2, 3, 4 and 4i standards. ECCC believes that the latter approach is more conservative. However, ECCC would like to point out that regardless of which modeling study is analyzed, both have exceedances of the CAAQS for nitrogen dioxide. It will therefore be important for the proponent to adopt effective mitigation measures and implement them rigorously to limit exceedances.

Modeled concentrations of particulate matter and dust deposition were obtained using a 75% attenuation rate in the original 2018 EIS and 80% and 95% in the revised study. According to ECCC, these rates are overestimated and, in practice, could not be achieved at all times. According to MELCC, the results of the Golder Associates study for establishing mitigation rates for frozen soils could not be transposed to other projects since the characteristics of the materials used to cover roads are different from one location to another (WSP Canada Inc., 2019d, p. 133). ECCC believes that concentrations of particulate matter, including silica, and their off-site deposition at sensitive receptors may therefore be underestimated. These concentrations could possibly have more frequent or greater exceedances of the standards than predicted by the proponent. Moreover, it is not excluded that particulate matter could be transported over greater distances and that it could be deposited on nearby water bodies and other sensitive receptors depending on the prevailing winds.

ECCC believes that the changes to the configuration of the overburden storage area, including the elevation, discussed in the March 2022 response document (WSP Canada Inc., 2022b, p. 12) could generate impacts (positive or negative) on the modeled concentrations from the project. Since the assessment of the significance of these changes has not been completed, ECCC believes that this provides additional imprecision on the assessment of the project's impacts on air quality.

Finally, taking into account the proponent's responses to the Agency's requests for additional information and considering all of the available information, the potential environmental effects on air quality were adequately described overall, with the exception of the optimistic mitigation rates (75-95%) used in the estimation of particulate matter emissions.

The proponent described and interpreted the results according to the options it considered reasonable. The choice of optimistic controls (such as the 75-95% mitigation measures in the modelling) and the choice of gear types such as Tier 4 could influence the modelling results and therefore the significance of the environmental effects. Interpretation of environmental effects on air quality should therefore be adjusted accordingly.

Mitigation measures

Chapter 7 of the original EIS (WSP Canada Inc., 2018) presents the significance of the environmental effects as well as the specific mitigation measures adopted to lessen the effects during the construction and operation phases of the Project. All common mitigation measures have been presented in this chapter. These are numbered and summarized in a summary table. With regard to the mitigation measures for air quality, the proponent presents in this same table some measures that affect transportation, traffic and machinery. The same information is found in Table 7-5 of the revised EIS (WSP Canada Inc., 2021a) with a few additions to address the Agency's concerns and the new project configuration or optimization. Thus, the standard mitigation measures identified as AIR 01 through AIR 05 and NOR 11 will be applied for construction. For operations, two mitigation measures have been added to those already included in the original EIS. These are AIR 06 and AIR 07 related to monitoring and maintenance of dust collectors, respectively. For the restoration phase, measures AIR 01 to AIR 03 plus NOR 11 will be applied. For the post-restoration phase, no measures are considered "since no mining activities likely to modify air quality will take place" (WSP Canada Inc., 20121a, Section 7.2.5, p. 7-48). The main mitigation measures planned by the proponent are presented in the following:

- Regularly watering roads, work areas and stockpiles to prevent resuspension and dust emission and ensuring that a record is kept of water and dust control application during construction and operation of the site. The frequency and intensity of road watering will be tied to weather conditions and air quality monitoring (AIR 01).
- Avoid unnecessary idling of engines to reduce noise and disturbance from exhaust, smoke, dust, or other contaminants that may come from the machinery (AIR 02).
- Limit the speed of vehicles on the various work sites and for mine operations (AIR 03).
- Optimize stripping based on actual needs so as not to overexpose unused stripped areas to wind erosion and/or restrict access to these areas if they are not used for long enough periods (AIR 05).
- Ensure regular maintenance of the dust collectors to maintain this cleaning efficiency at all times (AIR 07).
- Ensure that exhaust systems on vehicles and machinery are in good condition and operating optimally to minimize airborne contaminant emissions, and ensure that dust collection systems are in good condition for equipment and machinery equipped with them (NOR 11).

ECCC advice and recommendations

Potential environmental effects on air quality are associated with emissions of dust, particulate matter, crystalline silica, and gaseous contaminants during construction, operation, and restoration activities. Due to the anticipated exceedances of modeled concentrations of TPM and other contaminants, and due to the uncertainties already highlighted, ECCC believes that mitigation measures should be implemented rigorously to be effective in significantly reducing the potential adverse effects of the project on air quality.

Although it is all the measures considered by the proponent that would contribute to reducing the overall impact on air quality, it is still possible to identify the following mitigation measures as key measures for the construction, operation and restoration phases. The description of some of these measures may have been modified by ECCC to clarify or strengthen them.

- Use non-friable, non-clay materials with good road abrasion resistance for road construction and maintenance. Road maintenance shall be performed in a thorough and documented manner. Documentation of road maintenance shall be available for inspection as required.
- Maintain roads on a regular basis to maintain a good running surface and low silt content.
- Water roads and work areas regularly and apply dust suppressants, if necessary, to areas where traffic may cause dust raising despite regular watering.
- Implement a road watering management program to monitor the effectiveness of planned control measures (frequency and intensity of road watering to be matched to weather conditions).
- Progressively restore the waste rock storage facilities throughout the various phases of the project in order to minimize the emission of particulate matter generated by wind erosion.
- Install, inspect daily and maintain dust collectors on drills and dust collectors used in the industrial complex during operations. Dust collected by these devices will be disposed of in a manner that prevents its dispersion.
- Avoid blasting and handling of granular materials during periods of high winds or when prevailing winds may carry dust to sensitive areas (such as the km 381 truck stop) to avoid dispersion of dust, including silica and blasting gases off the mine site.
- Implement additional measures to prevent the dispersal of dry and fine materials 'generated' by drilling activities, including blasting.
- Install blasting mats during blasting to retain particles in the work area.
- Prohibit idling to reduce fuel consumption and the use of block heaters.
- Optimize the number of transportation vehicle trips used during construction and operation (for equipment, excavated or backfilled soil, personnel, etc.) to reduce air emissions.
- Perform regular inspection and maintenance of site equipment and generators.
- Limit the speed of vehicles to 25 kilometers per hour on roads within the property boundaries of the designated project and to require that all persons comply with this limit.
- Wash the concentrate trucks before driving on the Matagami road to further reduce the amount of dust during transport (WSP Canada Inc., 2020c, CCE-17).
- Use zero-emission equipment and vehicles or, if a particular zero-emission equipment or vehicle is not available, use equipment or vehicles that run on diesel or low-carbon fuels such as natural gas, propane, renewable fuel or hydrogen, while meeting Group 4 emission standards.

In addition, the proponent has committed to implementing a dust management plan that includes numerous other mitigation measures before the construction phase begins. The proponent will also be required to rigorously implement all of these measures and revise the plan based on the results of air quality monitoring.

Monitoring and follow-up programs

Monitoring program

A preliminary environmental monitoring program is also planned, but has been described in a summary way (WSP Canada Inc., 2021a, section 10.3.1, pp. 10-3 to 10-5). According to the proponent, a detailed monitoring program will be submitted at the time of application for the Project's certificates of approval (certificats d’autorisation). It is intended to ensure compliance with all measures taken by the proponent, to comply with regulations, to follow up on its environmental management activities and to achieve its environmental targets and objectives.

Follow-up program

A preliminary air quality monitoring program is outlined in the original EIS (WSP Canada Inc., 2018, Section 10.4.5). This program includes the installation of a meteorological station. Due to the modeling results for particulate matter concentrations, the proponent was asked to develop a dust management plan. This plan provides for the monitoring of TPM, PM_{10} and $PM_{2.5}$, as well as metals and crystalline silica. The analysis methods and frequencies are described in greater detail for all the contaminants monitored. The proponent plans to modulate this monitoring according to the results collected.

The dust management plan for the optimized project (Appendix E of Annex C, WSP Canada Inc., 2021a) provides more detail on air quality monitoring, the essential elements of which are reproduced in the following:

- A meteorological station would be installed in the short term at a representative location to acquire sufficient data to determine the positioning of the ambient air stations at the start of the project.
- The installation of an on-site measurement station to determine air quality towards the km 381 truck stop. Based on the modeling, higher concentrations are anticipated at this sensitive receptor.
- The monitoring has been extended to PM_{10} and $PM_{2.5}$, in addition to TPM as well as metals and crystalline silica. However, it is planned to adjust this monitoring according to the results collected. Any adjustments to the monitoring program will be made in agreement with the MELCC (WSP Canada Inc., 2022a, p. 33).
- Ambient air quality monitoring of crystalline silica concentrations is planned at the km 381 truck stop.
- Continuous monitoring of fine particles (PM_{10} and $PM_{2.5}$) is envisaged, while monitoring of TPM and crystalline silica will be performed once every 6 days.
- Monitoring of NO_2 generated during blasting activities would be accomplished through visual observation of these events. Measures will be taken to manage and reduce NO_2 (e.g., use of double detonators or electric detonators).
- An adaptive mitigation management program would be implemented (WSP Canada Inc., 2021a, Appendix E of Annex C, Section 9). The proponent envisions a system that would trigger an alarm if 80% of the standard was reached. In such cases, additional mitigation measures would be applied such as modifying or discontinuing the activities responsible for these increases.

It should be noted that the management plan calls for the addition of a nephelometer to continuously measure staff exposure to particles.

In conclusion, the proponent specifies that air quality monitoring and follow-up programs would be applied during the construction and operation phases to ensure compliance with standards. It should be noted that a follow-up committee would be set up by the proponent before the mine is built (WSP Canada Inc., 2021a, pp. 10-1 to 10-3).

ECCC advice and recommendations

Monitoring

The air quality monitoring program would be implemented during the construction and operation phases to ensure compliance. The preliminary monitoring program presented in the Impact Assessment was broadly outlined. The details of this plan were not provided and therefore could not be thoroughly evaluated. It would be submitted at the time of application for the project's authorization certificates. According to the proponent, "it could be submitted to the relevant authorities at their request" (WSP Canada Inc., 2021a, p. 10-4).

ECCC recommends that the proponent submit a detailed monitoring program to the Agency in consultation with ECCC and other jurisdictions prior to the start of the construction phase.

Follow-up

The follow-up program first presented has been enhanced with the dust management plan. The objective of the follow-up program is to measure the impact of mining activities on local air quality. According to the

proponent, it would be carried out to "determine the compliance and acceptability of the mining operations in relation to the MELCC's Normes et critères québécois de qualité de l'atmosphère" (WSP Canada Inc., 2021a). This program will primarily involve ambient air sampling.

A meteorological station and an air quality measurement station are included in the dust management plan. Monitoring of particulate matter (TPM, PM_{10} and $PM_{2.5}$), metals and silica would be conducted during construction and operation. However, nitrogen dioxide would not be directly measured.

Given the anticipated exceedances of the hourly CAAQS for NO_2 during construction and operation, and that the use of motorized equipment on the project site could represent a significant contribution of NO_2, ECCC recommends adding NO_2 monitoring for these phases of the project. In addition, due to arsenic and hexavalent chromium concentrations that were modeled to be close to the RAA standards, ECCC believes that these two metals should be included in the suite of metals monitored by the proponent.

In addition to determining compliance with the MELCC's Quebec Air Quality Standards and Criteria (Normes et critères québécois de la qualité de l'atmosphère), ECCC recommends that the proponent compare the concentrations of fine particulate matter ($PM_{2.5}$) and nitrogen dioxide to the federal standards (CAAQS).

Finally, ECCC recommends that the proponent submit a detailed monitoring program to the Agency in consultation with ECCC and other relevant authorities prior to the start of the construction phase.

SURFACE AND GROUND WATER

Existing environment and baseline conditions

Baseline conditions for surface and ground water quality was first described in Section 6.2.8 of the original 2018 Environmental Impact Statement (EIS) (WSP Canada Inc., 2018, Volume 2, pp. 6-28 to 6-40) as well as in the revised July 2021 EIS (WSP Canada Inc., 2021a, pp. 6-37 to 6-50). Sampling campaigns were conducted and the results of the observed concentrations were compared to the Canadian Council of Ministers of the Environment (CCME) and the Ministère de l'Environnement et de la lutte contre les changements climatiques (MELCC) surface water quality criteria.

Surface water

The study area is located within the Eastmain River watershed. It is crossed in a west-east direction by six streams identified as CE1 to CE6 (WSP Canada Inc., 2021a, Map 6-8, p. 6-39). Streams CE1, CE2 and CE6 flow west towards the Miskimatao River and then join the Eastmain River. Streams CE3, CE4 and CE5 flow eastward to join the Eastmain River (WSP Canada Inc., 2021a, p. 6-18). Stream CE3 flows through Lake Asini Kasachipet and into Lake Asiyan Akwakwatipusich, which is located at the eastern end of the Study Area. Stream CE4 originates in Lake Kapisikama. Another "unnamed" lake is located north of the local study area.

Section 6.2.8.1 of the revised EIS (WSP Canada Inc., 2021a, pp. 6-37 to 6-45) presents the key characteristics of the surface water quality that were measured during the six monthly sampling campaigns in 2017. Sampling was conducted at the nine sampling stations shown on Map 6-8 on a monthly basis from June through November 2017 to be representative, according to the proponent, of annual variability.

According to the proponent, there are only two potential anthropogenic sources of surface water contamination in the study area. The first is a former remote landfill or lieu d'enfouissement en territoire isolé (LETI). This is located at the proposed pit site. A truck stop with a gas station is also located in the study area, near km 381 of the Billy-Diamond Highway. The remainder of the study area is natural and not affected by any other form of direct anthropogenic pollution. Considering the location and point source nature of these potential sources of contamination, the proponent hypothesizes that the current concentrations of the various parameters in the surface waters of the study area correspond to levels of natural origin (WSP Canada Inc., 2021a, p. 6-43).

Values measured during the 2017 campaigns were compared to the following surface water quality criteria:

- MELCC: prevention of contamination of aquatic organisms (CPC[EO]); protection of aquatic life, chronic effect (CVAC).
- Canadian Council of Ministers of the Environment (CCME): Water Quality Guidelines (Freshwater), Protection of Aquatic Life - Long Term Effect

The pH results obtained at all nine stations during the sampling campaigns ranged from 3.37 to 6.27, which is outside the recommended range for both the MELCC criteria and the CCME guideline (between 6.5 and 9). Dissolved oxygen concentrations were below the CCME guideline at all nine stations in half of the surveys, with values between 0.94 and 9.30 mg/L. In addition, dissolved oxygen values below the CCME guideline and the MELCC CVAC criterion were noted at some stations during the other sampling campaigns. According to the proponent, the low pH and dissolved oxygen values can be explained by the nature of the soils encountered in and around the study area, which acidify the surface water and naturally decrease oxygen concentrations (WSP Canada Inc., 2021a, p. 6-43).

With regard to dissolved metals, the proponent mentions that their concentrations measured during the 2017 campaigns are generally low and that, according to the literature consulted, the concentrations of dissolved metals are within the known natural concentration ranges for Canadian surface waters (WSP Canada Inc., 2021a, p. 6-44). Nevertheless, exceedances of CCME or MELCC criteria were measured for one or more metals at all nine sampling stations. Exceedances were observed, in order of importance, for aluminum, iron, arsenic, beryllium, lead, manganese, and mercury. This information indicates that the background concentration of surface waters for these seven metals may exceed at least one water quality criterion.

Groundwater

Key groundwater quality characteristics in the study area are presented in Section 6.2.8.2 of the revised EIS (WSP Canada Inc., 2021a). Three sampling campaigns were conducted in August 2017 and February and May 2018 to determine baseline conditions. Information on these campaigns is presented in detail in the Specialized Hydrogeology Study (Étude spécialisée sur l'hydrogéologie, WSP Canada Inc., 2018).

A total of 36 groundwater samples were collected during the three field seasons. The locations of the twenty wells used are shown on Map 6-5 (WSP Canada Inc., 2021a, p. 6-25). The selection of parameters was based on the risks associated with the use of the site and the requirements of MELCC Directive 019 (D019). These include basic physicochemical parameters (alkalinity, conductivity, hardness, suspended solids (SS), pH, total dissolved solids), inorganic compounds (total cyanides, fluorides, nitrates, nitrites, sulphides), major ions (bicarbonates, calcium, carbonates, chlorides, magnesium, potassium, sodium and sulphates), petroleum hydrocarbons C_{10}-C_{50}, several dissolved metals (scanning) and radionuclides (WSP Canada Inc., 2021a, p. 6-46).

Considering that groundwater at the study site could resurface into surface water, the results were compared to the Resurgence in surface water (Résurgence dans l'eau de surface , RES) criteria of the MELCC's Intervention Guide - Soil Protection and Remediation of Contaminated Sites (Guide d'intervention – Protection des sols et réhabilitation des terrains contaminés; Beaulieu, 2016; Intervention Guide). The MELCC has also established, for groundwater, alert thresholds corresponding to a concentration above which a loss of the resource and a risk of effect on health, uses and the environment should be apprehended. Thus, for the site under study, located less than 1 km from several streams and lakes, an alert threshold of 50% was applied. It should be noted that the simulation results of the updated specialized study on hydrogeology (WSP Canada Inc., 2021a, Appendix J, Section 5.3.2, p. 47) corroborate the hypothesis that surface waters (streams and lakes) would be mostly discharge zones for water from the groundwater.

The analytical results of the sampling campaigns are presented in the revised EIS (WSP Canada Inc., 2021a, Section 6.2.8.2, pp. 6-45 to 6-50). Of the 36 samples analyzed, 15 samples exceeded RES criteria for any of the following metals: silver, copper, manganese and zinc. An additional fifteen samples have exceedances of the alert criteria for any of the above metals or barium. Arsenic, nickel, and lead do not have exceedances of the RES criteria or the alert threshold, but the background level provides a representative view of the study site. For aluminum, iron, and lithium, they do not exhibit RES criteria or

alert thresholds, but the result provides an estimate of background levels (WSP Canada Inc., 2021a, Section 6.2.8.2 and Table 6-17, pp. 6-49 and 6-50).

Based on the results of the statistical analysis, background values for the following parameters may exceed the RES criterion or alert level in some wells: barium, copper, manganese and zinc. The concentrations obtained for silver indicate that background levels are also likely to exceed the RES criterion or alert level in some wells, on occasion. However, the number of analyses with concentrations below the detection limit was too large to perform a statistical analysis for this parameter.

ECCC advice and recommendations

The main characteristics of surface water and groundwater quality were obtained by conducting sampling campaigns at nine stations and twenty wells in the study area. The data obtained provided a picture of the water quality in the area of influence of the project prior to its implementation.

It is generally recommended that sampling be conducted on a monthly basis for a minimum of one year to cover the annual variability in surface water physicochemical quality. However, the study included six samples at nine stations that were conducted between June and November 2017, which appears to be less than the recommended number. However, while the sampling frequency and time period do not precisely match the recommendations, they can be considered acceptable due to the location of the mining project and associated climatic constraints. With respect to the number and location of stations for the characterization of the baseline conditions and that would be likely to be affected by the project, ECCC considers them adequate, although another sampling campaign would have been desirable to confirm the observed data. Despite this deficiency, ECCC believes that, overall, the proponent's description of the component is acceptable.

In determining baseline groundwater conditions, ECCC believes that the proponent has taken an appropriate approach by conducting sampling campaigns over three time periods and sampling from twenty observation wells.

Changes caused by the project

The potential environmental effects of the Project on surface and ground water quality were described in Subsection 7.2.4 of the revised EIS (WSP Canada Inc., 2021a, pp. 7-42 to 7-45). Effects were documented for each of the project life cycle activities, namely construction, operation, restoring and post-restoring. Additional information was provided by the proponent in response to requests for clarification from the Joint Assessment Committee (JAC) and is contained in the proponent's responses (WSP Canada Inc. 2021b, 2022a, 2022b, 2022e).

Changes to groundwater and surface water quality are associated with, but not limited to, the characteristics and storage of materials and infrastructure development during construction, operation and post-closure (restoration and post-restoration). Particular attention is given to changes in water quality due to acid mine drainage and metal leaching from the storage of waste rock, ore, tailings, overburden, and potential construction materials. However, since it is primarily the geochemical behaviour of these materials that would dictate their management over the life cycle of the project, the proponent's geochemical study of the materials is presented first in the following.

Geochemical characterization of materials

Static tests

Geochemical tests were carried out on the materials that would be extracted from the mine site in order to evaluate their geochemical behavior and to manage them according to the rules in force. To carry out these studies, waste rock samples were taken from five lithologies present on the site in order to cover all the waste rock that would be extracted from the pit. These were the waste rock pegmatite (I1G) that contains the ore, the gneiss (M1), the banded gneiss (M2), the volcanic rock (V3) and the basalt (V3B). Representative ore samples (I1G) and tailings samples from the metallurgical tests were also selected for this study. In addition, two types of surface soils present in the project area (sand and clay) were also tested. The tests were conducted in accordance with the requirements of MELCC Directive 019.

The selected samples were first subjected to metal analyses and various static tests to determine their characteristics and to verify their geochemical behaviour (WSP Canada Inc., 2018, Geochemistry Specialist Study: Étude spécialisée sur la géochimie). For waste rock, the results of the *Toxicity characteristic le*aching *procedure (TCLP)* indicated "leaching of certain metals, primarily arsenic, silver, barium, copper, manganese, nickel, lead and zinc" (WSP Canada Inc., 2021a, p. 4-39). Preliminary static tests also showed that the gneiss (M1) and banded gneiss (M2) samples showed 30% and 50% of potential of acid generation (PAG) respectively (WSP Canada Inc., 2021a, Table 4-9, p. 4-39). Furthermore, the proponent mentions that "comparing the results to the criteria established by the URSTM [Unité de Recherche et de Service en Technologie Minérale] and the Mine Environment Neutral Drainage Program (MEND), 70% of them are located in the uncertainty zone, while 20% are considered PAG and 10% NPAG [not potentially acid generating] for the M1 unit, while 40% of the M2 unit samples are located in the uncertainty zone, 55% are considered PAG and 5% NPAG. Thus, the waste rock from units M1 and M2 would be considered PAG" (Table 4-9, page 4-39). The proponent mentions, however, that the results of these analyses "indicate that all of the waste rock is considered 'low risk' with respect to D019".

For pegmatite (I1G), the results would indicate that 96% of the ore samples submitted for analysis would be considered "low risk" material, but that the ore is considered leachable with respect to the Directive 019. Thus, "83% of the samples would leach manganese, 50% zinc and 46% copper. Finally, between 13% and 42% of the ore samples analyzed would leach arsenic and/or barium and/or cadmium and/or nickel and/or lead". Leaching tests, less aggressive than the TCLP test, were also performed on ore samples. The results of these tests also indicated leaching of arsenic, silver, copper, mercury, nickel and zinc (Table 4-10, p. 4-40).

With respect to tailings, all samples submitted to the TCLP test did not show any exceedance of the established criteria. However, the tailings samples analyzed are leachable to metals with respect to D019, and would not be potentially acid generating (NPAG). However, all of the samples analyzed showed exceedances of the Intervention Guide RES criteria for copper and manganese, while others (33%) showed an exceedance of the RES criteria for cadmium and one sample for mercury. The results are summarized in Table 4-11 of the impact statement (2021, p. 4-41).

For the sand and clay (overburden) units, total metals analysis showed concentrations above the background levels established for the Superior Geological Province (generic criteria "A") for arsenic and hexavalent chromium for the soil unit, and for cadmium and chromium for the clay unit (WSP Canada Inc., 2021a, pp. 4-41 and 4-42). For the clay samples, exceedances of the RES criteria in the Intervention Guide (Beaulieu, 2016) were obtained for copper, lead, zinc, and manganese with the TCLP tests. No exceedances were noted for sand samples. With the *Synthetic Precipitation Leaching* Procedure (SPLP) tests, clay samples showed exceedances of the Intervention Guide RES criterion for barium, copper, lead, and zinc.

<u>Kinetic tests</u>

Subsequently, kinetic column tests were conducted over a 50-week period on waste rock and tailings samples to complement the conclusions obtained on the acid generation and leaching potential of these materials. The results indicate that the acid generating potential of the waste rock under saturated and unsaturated conditions and the tailings is "not significant". The tailings and waste rock were therefore "considered non-acid generating", according to the proponent. With respect to the leachability of these materials, the waste rock under unsaturated and saturated conditions and the tailings would be potentially leachable in the "short term". However, metal leaching would be limited and would meet applicable criteria and requirements (D019 and RES[1]) after an average of 12 weeks. The results showed that waste rock and tailings would have leaching potential for several metals. The most significant exceedances occurred for arsenic and iron when compared to the Directive 019 and *Metal and Diamond Mining Effluent Regulations* (MDMER) criteria for final effluent quality at a mine site (WSP Canada Inc., 2019b, Appendix R-7). A significant proportion of silver, barium, copper, mercury, manganese, lead, and zinc concentrations were also above criteria (RES). At the end of the observed period, the proponent deemed these materials qualified as low risk according to D019 (WSP Canada Inc., 2019b, Appendix R-7).

[1] RES: provincial criteria for groundwater resurgence to surface water

Additional kinetic column tests were carried out for 25 weeks on an ore sample and a diabase sample, since it was envisaged that the latter lithology would be used as construction material on the site. However, this scenario was abandoned by the promoter. As with the previous results, the acid generating potential of both the ore and the diabase would be "not significant". With respect to metal leaching potential, no exceedances were observed for the ore after the 12th week of testing, except for mercury (week 25). For the diabase column, exceedances of applicable criteria cease after the 11th week, except for mercury (weeks 22 and 23), and a one-time result at the 16th week for copper. Thus, mercury concentrations above the limit of detection (LOD) were obtained punctually even at the end of the test for both columns (ore and diabase). The RES criterion for mercury is below the LOD. Since mercury does not follow a downward trend, the ore and diabase would be considered leachable in mercury even after 25 weeks. These results indicate that the ore and diabase are also potentially leachable, on a "short-term" basis, for some metals. These are silver, copper, lead and zinc in the case of the ore. For diabase, it is silver, barium, cadmium, copper, iron, lead and zinc (WSP Canada Inc., 2020b).

Based on the results of the kinetic tests, the proponent concludes that the extracted material can be considered "low risk" under D019 at the end of the observed period. However, it should be noted that some metals leached in concentrations exceeding the RES criteria and/or the discharge requirements of the final effluent of D019. Leaching was limited, in most cases, to the first few weeks of the test.

Construction phase

Sources of impact during construction would come from site preparation, infrastructure construction, water management, hazardous materials and waste management, transportation and traffic.

During the construction phase, deforestation, stripping, excavation and earthworks, as well as the circulation of vehicles and heavy machinery, would generate suspended solids (SS) that could end up in nearby rivers and water bodies. The anticipated impacts would also be related to the risk of accidental spills of petroleum hydrocarbons associated with the use, refueling and maintenance of vehicles and machinery. Potential spills of hazardous materials would also represent a potential impact on surface and ground water quality. In addition, the use of ice melters on access roads and traffic ways, to ensure the safety of the roadways in winter, could increase the concentration of salt in the surrounding soils and affect water and sediment quality. The infiltration of surface water into the soils could carry these de-icing agents to the groundwater table. Groundwater salinity could increase under access roads where the aquifer is more vulnerable. According to the proponent, the use of de-icing agents will be limited and, due to the phenomena of dilution, dispersion and retention, it would therefore be very unlikely that the salinity of the surface and ground water would increase significantly.

<u>Water management</u>

The revised EIS includes more detail on water management during the construction phase than the original 2018 EIS (WSP Canada Inc., 2018). However, the planned water management infrastructure have been modified several times based on the proponent's different proposals for the use of leachable waste rock in the design of haul roads (WSP Canada Inc., 2021a, 2021b, 2022a, 2022b, 2022e).

For example, the latest version of the documentation describing the evolution of the site construction and associated water management infrastructure is presented for months 1, 6 and 12 of the construction phase in WSP Canada Inc (2022b). Maps 4-8 REV through 4-10 REV also illustrate this evolution.

According to these maps, during the first six months of construction, runoff from the roads would be directed into ditches and into the environment. A sediment barrier would be installed in the vicinity of stream CE3.

According to the same document (WSP Canada Inc., 2022b), starting in the 6th month of construction, a series of watertight pipes would be installed to direct water from the temporary ponds in the waste rock extraction area and the one located near one of the access roads to the pit, the industrial water pond and the access road to the explosives plant (Map 4-9 REV) to a water treatment plant (construction WTP). All water generated from this point in the construction phase would be collected and treated prior to discharge.

Finally, during the construction phase, a total length of 4 km of haul road not located in the co-disposal storage facilities, including the ditches that border them, would be waterproofed with a geomembrane (WSP Canada Inc., 2022e). See section on water management in relation to haul road construction below.

Water management for the concrete manufacturing plant and the administrative and industrial sector

During the construction phase, a temporary concrete plant and crushing plant would be used until the industrial complex and mine infrastructure are built. The machinery required for the operation of the concrete plant would include truck-mounted cutters, a crane truck to handle the cement bags or a loader to feed the plant with sand and crushed stone, and a tanker truck to feed the fresh water tank required for cement production. The temporary locations of the concrete plant and crushing plant are shown on Map 4-1 of the revised EIS (WSP Canada Inc., 2021a, p. 4-7). An aggregate storage area would be located adjacent to the plant within the footprint of the areas affected by the mine development.

The aggregate needed to manufacture the concrete would come from a quarry already in operation at km 394 of the Billy-Diamond Highway (WSP Canada Inc., 2021a, p. 4-12). According to the proponent, the Société de développement de la Baie-James (SDBJ) holds a permit that was issued by the Ministère de l'Énergie et des Ressources naturelles (MERN) and the MELCC. According to the proponent, this quarry has the required authorizations, it is already in operation and its materials are authorized for road and ditch construction (WSP Canada Inc., 2021b). However, no geochemical leaching test results are currently available for these materials (WSP Canada Inc., 2022b).

The water that would come into contact with the concrete plant was to be directed to a well for treatment (separation of suspended solids and adjustment of the pH of the water) prior to transfer to the treatment plant. Instead, the January 2022 response document (WSP Canada Inc., 2022a, p. 63) states that “Runoff from the administrative and industrial areas [including the concrete plant wastewater] will be directed to the plant water pond to be constructed in the first month of the construction phase or to temporary water ponds. The water collected in these ponds will then be pumped and piped in watertight pipes to the water management pond under construction and then treated at the WTP”.

The equipment and concrete mixers wash area would be located at the process plant site within the footprint of the plant pad stormwater management pond. An impervious pond would be constructed to collect and treat wash water from the concrete mixers (WSP Canada Inc., 2021a, p. 4-17). "It will be waterproofed with a geotextile and HDPE-40 or equivalent membrane, covered with fine gravel. Water will be monitored for SS, oil and grease, and pH before discharge to the environment."

Water management related to haul road construction and waste rock disposal area

The borrow pit at km 381, close to the engineered landfill site, would be mined over an area of 2.5 ha for mine purposes (WSP Canada Inc., 2021a, Map 4-4 and WSP Canada Inc., 2022a, R-CCE3-40, p. 73). However, due to the limited amount of borrow pit material available in the project area, the proponent wished to use the overburden and waste rock excavated from the pit for site road construction (WSP Canada Inc., 2021a, Section 4.4.3, p. 4-12).

The latest proposal for the design of haul roads outside of the co-disposal storage facilities presented in WSP Canada Inc. (2022e) includes a 1.5 m layer of compacted granular material, two 300 mm layers of fine material (sand) with a 1.5 mm linear low density polyethylene (LLDPE) geomembrane in between, a 1 m thick subgrade layer of 0-300 mm crushed waste rock and finally a 400 mm thick wearing course of 25-100 mm crushed waste rock. The geomembrane would prevent contamination from the waste rock in the road design from reaching the groundwater. The geomembrane would also cover the ditches bordering these roads, so that contact water from the roads would be directed first to the ditches and then to pumping stations. This water would then be directed through watertight pipes to a temporary water management pond and ultimately to the construction WTP. The construction WTP would be built "for the treatment of problematic elements (iron and arsenic) with a treatment capacity for the leaching of crushed materials" (WSP Canada Inc., 2022b).

Concerning the design and waterproofing of haul roads over a total length of 4 km, including the use of a geomembrane, the proponent relies on a document prepared by Groupe Alphard (2022) to document the effectiveness and durability of this design for a 20-year mining period. Several recommendations are presented and the proponent commits to respecting those listed in section 8 of this document (WSP Canada Inc., 2022e). In connection with the improvement opportunities proposed by the Groupe Alphard, the proponent undertakes to evaluate the possibility of using certain geosynthetic materials. Finally, this document presents the installation of the geomembrane as a sensitive step in maintaining the integrity of the geomembrane during the life of the project and a quality assurance and control program for the

construction (installation) and operation phases is presented. This program is, however, only indicative and will need to be adjusted during detailed engineering and included in the plans and specifications for haul road construction (Groupe Alphard. 2022, p. 16).

Finally, in its July 2022 response document (WSP Canada Inc., 2022e), the proponent provides justifications for two sections of haul road that are not intended to be impervious, namely the road to the potential explosives plant, as well as the roads to the southwest waste rock and tailings storage facility and the northwest section of the pit.

Water treatment plant

During the construction period of the mine infrastructure, runoff would be directed to a temporary water management pond located to the northwest of the site (eastern end of the proposed North water management pond). A small treatment plant (construction WTP) would be located just east of the temporary pond as early as the 6th months to control and treat the water quality prior to discharge to the environment (WSP Canada Inc., 2021b, R-CCE-57A, pp. 25-26, WSP Canada Inc., 2022b). The collected leachate would be characterized before and after treatment at the construction WTP and as long as the leachate does not meet the requirements of the *Metal and Diamond Mining Effluent Regulations* (MDMER) or D019, it would be retained in the pond. According to the description provided to MELCC and confirmed through discussions with the consultant WSP, the maximum treatment capacity of the unit would be 125 m^3/h (WSP Canada Inc., 2022d, p. 4 and email from WSP to the Agency dated June 30, 2022). The design would be based on the maximum effluent flow to be treated (125 m^3/h) as well as the most restrictive criteria (MDMER or D019) for arsenic, iron and SS. It would be able to achieve a SS removal rate of 99% and would be constructed so that it would only require an expansion to meet the necessary capacities for the operation phase. The process used would be a combination of pH adjustment and the addition of flocculants to precipitate metals. These precipitates would be periodically removed and stored for future disposal with the tailings (G Mining Services, 2022).

Operation phase

Sources of impact during operations are primarily represented by the pit operation and other active infrastructure such as the ore processing plant and material storage areas. Runoff from ore, tailings and waste rock storage facilities, handling of hazardous materials and waste materials, and transportation of materials and traffic are also potential sources of impact (WSP Canada Inc., 2021a).

As with construction, the use and maintenance of machinery and the possibility of accidental leaks or spills during the operation phase could generate contaminants and affect water quality. The petroleum product storage area and the mechanical workshop represent an additional risk. Nevertheless, according to the proponent, the impact of these leaks would generally be limited if they were detected and controlled quickly.

Water management of the co-disposal storage facities, overburden storage facility, haul roads and the North basin area

In the new mine site configuration, waste rock and tailings generated during mining operations would be disposed of in four separate co-disposal storage facilities over the life of the mine, which are described in Section 4.8.2 of the revised EIS (WSP Canada Inc., 2021a, p. 4-55). The co-disposal method involves constructing a mixed stockpile by mixing the two types of materials in the same site. Thus, filtered tailings cells would be placed inside storage facilities and encapsulated by the waste rock, with a "transition layer" between the two to prevent "particle migration". A portion of the waste rock would be stored in the pit when resource development is complete, which would be an extension of the East storage facility. The location of the waste rock and tailings storage facilities is shown on Map 4-1 (WSP Canada Inc., 2021a, Section 4.3, p. 4-7 and Appendix B, p. 4). An overburden storage facility would be located north of the site, just south of the North water management pond.

Runoff and seepage from the co-disposal and overburden storage facilities would be collected via collection ditches (WSP Canada Inc., 2021a, Section 4.9.2, p. 4-73) and directed to the East and North water management ponds. Water from the East water management pond would then be pumped to the North pond. Alternatively, under the new road construction concept (WSP Canada Inc., 2022b), contact water

from haul roads outside of storage facilities would be collected in waterproofed ditches and directed to pumping stations and then pumped to the North water management basin.

According to the proponent, the waste rock would not have the potential to generate acid rock drainage (ARD; WSP Canada Inc., 2021a, Section 4.7.5, p. 4-42). With respect to tailings, the results of kinetic testing indicated a non-significant potential for acid generation (WSP Canada Inc., 2021a, Section 4.7.5, p. 4-42). Also, according to the results presented in Appendix R-7 of WSP Canada Inc. (2019b), waste rock and tailings exhibited leaching potential for several metals in the kinetic column tests.

Following the geochemical tests, the proponent carried out a model to estimate the concentrations of metals that could be found in the surface water of the mine site. The main results of this modeling indicate arsenic levels higher than the criteria of Directive 019 or the MDMER applicable to the final effluent (monthly averages) in the basin that must ultimately collect the water from all storage facilities, i.e. the "North" water management basin. The modeling predicts arsenic levels above 0.1 mg/L in this pond for the entire season modeled (May to October) and for the entire operation phase, as well as concentrations above 0.2 mg/L for the last ten years of operation (WSP Canada Inc., 2021a, Appendix B, p. 14).

According to the proponent, the model was set up to simulate the sorption of arsenic and other metals onto iron precipitates by assuming good contact between percolating water and iron precipitates in the storage facilities prior to the mixing of runoff and infiltration into the North water management pond. However, the author of the study mentions that it is possible that this sorption process is less effective at the field scale and that the arsenic concentrations in the pond water turn out to be higher than expected. Another phenomenon explained in the first modeling report (WSP Canada Inc., 2019c, Appendix R-AD-31, p. 26), and which remains applicable for the second modeling, is related to extreme flushing events of salt *build-ups* in waste rock and tailings storage facilities. Massive solubilization of these salt build-ups could also contribute to increased arsenic levels in the North basin water. These "flushes" can occur during large variations in climate (e.g., drought and water evaporation followed by heavy precipitation). The author of the study states that such "flushing" can be expected to occur at least once a year. This is because large variations in climate are expected to occur with increasing frequency due to climate change. Furthermore, it is noted in the July 2021 update of this modeling (WSP Canada Inc., 2021a, Appendix B, p. 14) that the values of the simulated parameters are subject to some degree of uncertainty and can fluctuate significantly within and between years due to changing climate conditions. For example, a drier year than the years from which the data were derived would result in higher arsenic concentrations in reality.

In order to assess the effects of the co-disposal storage facilities on water quality in the natural environment, the proponent has also completed dissolved metal transport modeling of storage facilities that could be released to surface and ground water. This modeling is described in the Specialized Study on Hydrogeology (Étude spécialisée sur l'hydrogéologie; WSP Canada Inc., 2021a, Appendix J, Section 7). The author specifies that metal transport modeling provides an order of magnitude of dissolved metal concentrations in groundwater and their evolution over time, including estimated resurgence in surface water, and not an exact concentration at a given point (Section 7.2.1, p. 73). An analysis was conducted for arsenic and copper. The results of this modeling are presented in Section 7.3 (p. 74). Based on the results, the co-disposal storage facilities would have no impact on the quality of streams CE1, CE3, CE4 and CE5. Only stream CE2 would be impacted, notably by arsenic concentrations from the "Northeast" co-disposal storage facility. They also indicate that arsenic in the surface deposits is captured by the collector ditches until the end of operations since the presence of arsenic remains within the footprint of the storage facilities in the "After 20 years" (Après 20 ans) image on Map 15 (p. 75). In the following simulations, after 50, 100 and 200 years, it appears that arsenic presence decreases in the surface deposits to concentrations below the natural background level for arsenic (0.094 mg/L, Table 26 Surface Water and Groundwater Criteria for Arsenic, p. 81). The results also show that some of the arsenic concentrations percolate through bedrock and resurface in surface deposits. These concentrations are at all times below the background level (0.094 mg/L). According to Figure 4 (p. 79), groundwater resurfaced in stream CE2 from the Northeast storage facility 100 years later at concentrations that appear to be well below the natural background level for arsenic (0.094 mg/L) and thus below the minimum discharge standard for mine effluents (0.1 mg/L - MDMER). For the other pits, arsenic concentrations that are not captured by the ditches and percolate to bedrock would not resurface in the surface deposits.

Furthermore, the results of the percolation rates from the calibrated model to the clay deposits and till under the West (0.05 L/m^2 /d), North-East (0.26 L/m^2 /d), South-West (0.06 L/m^2 /d) and East (0.13 L/m^2 /d) storage facilities would meet the percolation rate standard of 3.3 L/m^2/d set by Directive 019. The percolation rate for the secondary pond (0.08 L/m^2/d), which is located in the vicinity of the East storage facility, also meets the standard. The percolation rate under the main pond (North pond) would be 3.9 L/m^2/d and would exceed the established standard, while it would be 0.46 L/m^2/d if a 0.5 m clay liner was installed (WSP Canada Inc., 2021a, Appendix J, Section 6.5, Table 22, p. 71). These results indicate that the on-site hydrogeological conditions and the nature of the substrate would allow compliance with the groundwater protection objectives of Directive 019, with the exception of the North basin. A minimum 0.5 m clay liner should be included in the design of this pond to meet the percolation rate required by D019. The proponent does not plan to use protection under storage facilities due to the modeling results.

Water management in the industrial and administrative sector

The ore is classified as leachable for various parameters (As, Mn, Cu, Zn, etc.) as defined in Directive 019. Measures to protect the water table and surface water are therefore planned for the storage of ore on the site. Thus, the ore storage area and the industrial water basin would be impermeable with an HDPE geomembrane. The perimeter ditch draining water from the ore stockpile to the industrial water pond would also be waterproofed (WSP Canada Inc., 2021a, Section 4.8.3 and WSP Canada Inc., 2022a, R-CCE3-35, p. 65).

Water treatment plant - Operation

The water treatment plant (WTP) would be similar to the one used in the construction phase, but with a larger treatment capacity to accommodate the operation phase and treat mine water from all areas, including the waste rock and tailings storage facilities, the ore storage facility, mine water and water collected in the main water management pond. As specified for the construction phase, its process would consist of a combination of pH adjustment and the addition of flocculants to precipitate metals. These precipitates would be periodically removed and stored for future disposal with the tailings (G Mining Services, 2022).

Finally, an updated water balance would be completed during detailed engineering to refine water management over the life of the mine. The water quality prediction model would also be updated to reflect the revised water balance. "These updated models will become the design criteria for the WTP expansion for the operations phase" (WSP Canada Inc., 2022d). If contaminants of concern, such as lithium, were to have concentrations that exceeded discharge limits, additional modules with different treatment technologies may need to be added (G Mining Services, 2022).

Closure, restoration and post-restoration

Water management

As with construction and operation, transportation and traffic would represent major sources of impact during the restoration phase. Also, the dismantling activities of the infrastructures, the rehabilitation of the pit, the management of water, hazardous materials and residual materials could negatively affect water quality. The anticipated impacts would be similar to those of the operation phase since the infrastructures (waste rock and tailings storage areas, water retention ponds and water treatment) will remain in place on the mine site.

Restoration work, after the site has ceased operation, should be spread over three years. According to the proponent, since the waste rock and tailings are considered NPAG and non-leachable in the long term (WSP Canada Inc., 2021a), water quality would no longer be an issue one year after the end of operations. It was anticipated that in Year 1 of the restoration phase, the pit water management infrastructure would be dismantled. Subsequently, the pits, ditches and the East water management pond would be restored and closed in Year 2. Finally, the main water management pond and the WTP would be closed and dismantled in Year 3 of restoration. No infrastructure or buildings would be left in place during the post-restoration phase (WSP Canada Inc. 2021b, R-CCE-53E, p.18). However, the proponent adds a nuance by specifying that "if metal concentrations exceed applicable standards, the WTP will be maintained in operation as long as necessary" (WSP Canada Inc. 2022a, R-CCE3-30, p. 52). In addition, the proponent plans to conduct additional modeling in the early years of mine operation with the results of analyses to "refine the closure

plan. The closure scenario can then be adjusted accordingly and the restoration plan updated to reflect these changes" (WSP Canada Inc. 2022a, R-CCE3-30, p. 52).

Main Water Management Basin (North) and WTP

In section 4.13.8 of the revised EIS (WSP Canada Inc., 2021a, p. 4-117), the proponent states that the North water management basin dike would be breached (location shown on Map 4-12, p. 4-115) during restoration activities. The proponent also states that the water treatment plant would be dismantled after completion of the post-closure environmental monitoring program.

The proponent has also committed to monitor effluent in accordance with the MDMER under the same terms as in the operations phase and for as long as necessary since the main WTP will be in operation. The proponent also plans to monitor water quality in stream CE2 and at the locations where the dikes have been breached "until the situation is deemed stable and back to baseline conditions" (WSP Canada Inc., 2022a, R-CCE3-48, p. 91).

Pit lake - Water quality

In the post-restoration phase, the pit will recharge naturally with precipitation and groundwater to a level of equilibrium with the water table. Recharge of the pit will come primarily from precipitation, with less groundwater input (WSP Canada Inc., 2021a, Section 4.13.7 p. 4-117). The proponent intends to construct a spillway and ditches around the pit to avoid potential overflows into the natural environment. However, the collected water would be directed to stream CE3. According to the water quality modeling study, the pit is expected to fill in 98 to 138 years, depending on the groundwater flow rate (WSP Canada Inc., 2021a, Appendix B, Section 4.2.2, p. 20), however, the revised EIS (WSP Canada Inc., 2021a, p. 4-89) states in section 4.9.4 that the pit would fill in 120 to 180 years.

The water quality modelling carried out by the proponent (WSP Canada Inc., 2021a, Appendix B) and modified following consideration of the diabase (WSP Canada Inc., 2021b, Appendix R-CCE-57) was also intended to estimate the quality of the water accumulated in the pit after mine closure. The results of the geochemical tests had indicated a potential problem for certain metals, including iron and arsenic. The main results of the modeling indicate that arsenic would have concentrations in excess of the Directive 019 or MDMER criteria for mine effluent (monthly averages). The revised EIS (WSP Canada Inc., 2021a, Appendix B, Section 4.4 and Figure 10, p. 28) and the October 2021 proponent responses (WSP Canada Inc., 2021b, Appendix R-CCE-57, Figure 2, p. 10) show that in-pit arsenic estimates are above 0.1 mg/L throughout the modelled period from mine closure to 180 years later. Specifically, arsenic levels increase from 0.223 mg/L at year 0 and reach 0.168 mg/L after 180 years. There may also be degradation of water quality in the pit lake as some of the precipitation water would be in contact with the exposed rock walls (WSP Canada Inc., 2021a, Section 7.2.4, p. 7-45).

According to the proponent, post-restoration activities at the site would recreate surface runoff conditions close to the original conditions, and when the water management infrastructure at the site is dismantled, the original physicochemical nature of the surface water would be restored. The proponent states in WSP Canada Inc (2022a, R-CCE3-32) that it used a conservative approach by not considering precipitation to consider lower dilution factors for metals in the pit and concludes that the concentrations that would be observed in the environment should be lower than those calculated in the modeling.

Material used for haul roads

In its March 2022 response document (WSP Canada Inc., 2022b), the proponent states that the "restoration plan has been modified to revise costs to relocate the top layers of the roads (subgrade and wearing courses) to the waste rock storage facilities and to provide for the disposal of the geomembrane in a licensed landfill. Loose road base material would be characterized prior to reuse for site remediation. If any portion was found to be contaminated with leachate from the waste rock, it would be transported to the waste rock storage facilities, if any portion was found to be contaminated with hydrocarbons, it would be transported to a licensed site."

The work completion schedule for the restoration and post-restoration phases presented in the March 2022 restoration plan (Table 18) does not show any specific phases for removal of these roads.

ECCC advice and recommendations

The potential environmental effects of the project on water quality were essentially documented by modeling the contaminated mine water and its transport from the structures and through the various substrates present in the study area. A summary of some of the requests for clarification of these effects, along with the proponent's responses and adjustments, is presented below, with an indication of the gaps or aspects for which there are still uncertainties.

Activities that may affect water quality are related to all activities throughout the life of the mine and beyond, i.e. construction, operation, restoration and post- restoration. For the construction phase, this includes work and equipment related to site preparation and development, including deforestation, stripping, handling of materials (waste rock), transportation and installation of the geomembrane. For the operation phase, there are the production and expansion activities of the mine site which include, among others, the handling and transportation of materials, blasting and ore processing. All of these activities would generate contaminants that could be released to surface and ground water. The potential adverse effects of the project would therefore be the deterioration of surface and ground water quality during all phases of the project (construction, operation, restoration and post- restoration).

Overall, ECCC is of the opinion that the description of the effects is adequate and sufficient considering all the available information and as long as all the commitments and recommendations presented in the documentation are implemented, including those put forward by the consultant Groupe Alphard in its technical opinion on the road concept planned for the haul roads, as well as those of the consultant Englobe in its counter-expertise report on this design and confirmed in the minutes of the meeting of August 4, 2022 (AÉIC, 2022).

Finally, as part of this advice, ECCC considered the updated concentration standards for the various metals in Appendix IV of the May 2018 MDMER. The proponent had used the previous version of MDMER Appendix IV in the revised EIS.

Geochemical characterization of materials

The geochemical characteristics of the materials handled at the mine site would have a negative impact on the aquatic environment if proper management of these materials was not adopted. The first step was to characterize these materials in order to develop appropriate management methods and prevent contamination of surface and ground water. Thus, the proponent carried out a geochemical characterization program of the materials that would be generated by the exploitation of the deposit (waste rock, ore, tailings, overburden) in accordance with the recommendations formulated in Directive 019 and those described in the *Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials* (Price, 2009) of the Mine Environment Neutral Drainage (MEND) program. Material characterization and static and kinetic testing were performed on a number of samples to assess their chemical composition, acid rock drainage (ARD) potential, and metal leaching potential.

The static test study showed that waste rock from all rock units leaches metals to varying degrees under the same guideline.

Contrary to the proponent's assertion, ECCC is of the opinion that the geochemical characterization results, including kinetic column tests, indicate that waste rock and tailings should be considered leachable. The proponent will therefore need to consider the groundwater protection requirements for leachable materials as outlined in MELCC mining Directive 019 for the design of pit storage areas.

With respect to the results of the kinetic column tests, the proponent concluded that the waste rock would not be likely to generate acid rock drainage (WSP Canada Inc., 2021a, Section 4.7.5, p. 4-42). However, it should be noted that the samples submitted for kinetic testing were selected based on their spatial distribution in the pit and not on their NP/AP (neutralization potential/acid potential) ratio. Consequently, the results of the kinetic tests may have been underestimated, particularly with respect to acid rock drainage for the gneiss (M1) and banded gneiss (M2) lithologies.

In addition, waste rock and tailings will not be stored separately on site. Rather, the co-disposal method is anticipated. Kinetic tests with a mixture of tailings and waste rock could have been considered in the specialized study on geochemistry. According to the proponent, the kinetic tests on waste rock and tailings

"demonstrate that the waste rock/tailings mixture is comparable to the waste rock and tailings, each considered independently, in terms of leachate quality" (WSP Canada Inc. 2019b, Response R-7, p. 11). However, the proponent's response is not documented and is not supported by evidence such as additional kinetic tests (column or otherwise) involving actual mixing of the two materials, tailings and waste rock. Thus, there is still uncertainty as to the geochemical behaviour of these two materials stored together on the pits and their potential impact on the aquatic environment.

In short, according to ECCC, the proponent's interpretation of the results on the geochemical behaviour of the materials studied involves many uncertainties. Because of the potential risks of contamination of the aquatic environment, it is therefore recommended that the proponent :

- Conduct additional kinetic tests with a representative mixture of tailings and waste rock to simulate the co-disposition of tailings and waste rock prior to construction.
- Review the design criteria for the storage of waste rock and tailings based on their potential leachability and acidity to meet all requirements of “Directive 019 de l’industrie minière”.
- Continue the study of the geochemical behaviour of tailings and mine waste rock under conditions representative of reality in order to make modifications to the project, if necessary. These follow-ups should also make it possible to validate or modify the restoration concept during the operation phase.

Construction phase

Construction WTP

ECCC notes the proponent's commitment to build an WTP during the construction phase to treat mine site water that may be contaminated.

Storage areas for materials extracted from the pit

According to the revised EIS (WSP Canada Inc., 2021a), the surface water management strategy is based on several elements, including detour of clean water to limit the mixing of natural runoff with contact water and thus reduce the volume of contact water to be managed; collection of all runoff and seepage from the tailings and waste rock and overburden accumulation areas; the construction of non-impervious collection ditches in the storage facilities to direct contact water from these areas to the water retention ponds or open pit and then to the main water management pond on site. The objective is also to provide a single final discharge point to stream CE2. During the construction period of the mine infrastructure, runoff will be directed to a water management pond near the construction WTP to the northwest of the site. This small treatment plant would be built at the start of construction to control and treat water quality prior to discharge to the environment. During operation, this same WTP would be expanded and developed to treat the final effluent prior to discharge to stream CE2 during the operation and restoration phases.

The water management described above is based on a material characterization, a geochemical study, and dissolved metal transport modeling to assess the impact of the co-disposal storage facilities on the environment.

The results of the dissolved metal transport modeling study show that the percolation rates from the calibrated model to the clay deposits and till under the waste rock storage facilities would meet the percolation rate standard established by the D019. The proponent therefore does not plan to use any protection under the waste rock and tailings storage facilities because of the results obtained and their interpretation.

According to ECCC, the approach recommended by the proponent for the management of waste rock and tailings would present a potential risk of surface and ground water contamination during all phases of the project. In fact, the uncertainties inherent in hydrogeological modelling of a complex reality and the limits of geochemical studies carried out on a laboratory scale should nuance the results obtained during their interpretation. Moreover, ditches, as designed in reality, do not present an absolute efficiency in the capture of contaminated water. Because of these uncertainties and the potential risks of contamination, it would be desirable for the proponent to provide additional conservative alternatives, in particular the impermeabilization of waste rock and tailings storage areas as well as collection ditches, to be able to

prevent the potential contamination of these waters. The installation of a water treatment plant at the beginning of the mine site development is also a measure that should be implemented at the beginning of the project. ECCC therefore makes the following recommendations:

- Waterproofing of the North basin to meet the percolation rate established in Directive 019.
- Installation of the water treatment plant for the construction phase of the mining project.
- Establishment of the treatment plant for the operation and subsequent phases (restoration and post- restoration). ECCC acknowledges that the latter two commitments have already been made by the proponent in the present impact study.

Finally, ECCC notes the proponent's commitment to use a geomembrane to waterproof the ore storage facility, the industrial water pond and the peripheral ditch draining water from the ore storage facility to the industrial water pond.

Use of waste rock for haul road construction

In the revised EIS and in the October 2021 and January 2022 response documents (WSP Canada Inc., 2021a, 2021b, 2022a, R-CCE4-37), the proponent described a method of treating waste rock by exposing the material to the weather to leach metals prior to its use as haul road construction material. This method had several uncertainties regarding surface and ground water quality due to the leachable nature of the waste rock. The residual leaching potential of this material could not be overlooked and contaminants would inevitably be found in runoff and groundwater.

It is from the March 2022 response document (WSP Canada Inc., 2022b) that the proponent presents an alternative design for haul roads that are not located in the co-disposal storage facilities by including the use of a geomembrane to seal these roads as well as the ditches that border them.

This type of geomembrane appears to be typically used to waterproof storage infrastructures and the proponent was not able to rely on or document similar cases where a geomembrane would have been used to waterproof roads used several times a day by trucks with a capacity of about 100 metric tons. The proponent therefore entrusted this task to the specialized firm Groupe Alphard in order to document the effectiveness and durability of this measure for the entire duration of the mine's operation, including environmental effects such as sustained rainfall events, water accumulation, freeze-thaw cycles and others, as well as the prolonged use of dust and de-icing products. In its technical opinion, Groupe Alphard presents an improvement to the proposed design as well as a series of measures to maintain the integrity of the geomembrane and thus maximize the protection of the groundwater under these roads (Groupe Alphard, 2022).

The Joint assessment committee (JAC) has retained the services of a counter-expert (Englobe, through Public Services and Procurement Canada) to evaluate the proponent's concept. According to the conclusions of its report, Englobe confirms that the general concept proposed would address the problem of contaminated water management and that the recommendations presented in the Groupe Alphard report (2022) offer an improvement to this concept. However, Englobe's counter-expertise report identifies a few shortcomings and presents additional recommendations that the proponent should implement in order to ensure the integrity of the geomembrane and greater protection of groundwater. In particular, the Englobe report states that the road cross-section presented is "an interesting starting point" for the haul road concept; that the choice of geomembrane is appropriate and that appropriate installation methods are critical to the performance of the haul road concept; and that the durability of the geomembrane would be adequate for the life of the project, provided that measures to promote its durability are implemented.

ECCC also notes that the Groupe Alphard advice considers a 20-year mining period and that no measures to protect groundwater are provided in the event that the project lasts longer. In this regard, Englobe's counter-expertise report mentions that these measures must take into account the life of the project and foresee a possible extension of the mine life or delays in the work, and that the proponent should ensure the sustainability of these measures. Therefore, ECCC recommends that the proponent provide groundwater protection measures at haul roads should the project last longer than anticipated.

On the other hand, ECCC had noted inconsistencies as to whether or not the waterproofing of several road sections was planned. This is the case for the section located to the northwest of the pit and allowing access

to the South-West storage facility. For the latter, the proponent mentions that the waterproofing of the road would not be necessary since the water will percolate towards the pit. The consultant Englobe recommends, however, that a follow-up of the quality of the soils as well as a piezometric follow-up be carried out in order to validate that the groundwater is indeed flowing towards the pit (Englobe, 2022, p. 6). In addition to the piezometric monitoring recommended by Englobe, ECCC also recommends groundwater quality monitoring. The section of road to the explosives storage area located between the West co-disposal and the overburden storage facilities would also not be waterproofed. While the proponent states that improvements at the storage facilities (e.g., ditches) will capture percolating water, ECCC is concerned that the presence of sand in the surface deposits under this section of road (WSP Canada Inc., 2021a, Map 6-4) would facilitate the flow of contamination caused by the leaching of waste rock used in road construction into groundwater. The waste rock used in the road surface layers would be susceptible to constant fragmentation by passing trucks and would increase the leachable surface. In addition, Englobe's counter-expertise report mentions that the absence of a geomembrane on these roads still presents a risk of soil and groundwater contamination, even if a more distant collection of percolating water is planned.

With respect to the waterproofed ditches along the roads, the proponent mentioned that the snow that would accumulate in the ditches would not be removed, but that before the snow melt begins, a water flow channel in the bottom of the ditch will be created in order to facilitate the melting and the passage of water, and thus avoid ice jams; if there are ice jams, they will be removed. No risk of damage is foreseen since these activities will take place above the gravel layer, and thus above the geotextiles. However, ECCC is concerned about the maintenance activities in the ditch prior to snowmelt and the overflow of the ditch during spring melt. ECCC recommends that measures be put in place to ensure that all ditch operations are conducted in a manner that is safe for the geotextile and allows for effective control of freeze-thaw and melt flows.

A report of a multi-stakeholder meeting (JAC, proponent, WSP, Alphard, Englobe and other experts, August 4, 2022) (AÉIC, 2022), the purpose of which was to clarify some of the design elements and the recommendations of the counter-expert, shows the final recommendations presented by the consultants and the commitments of the proponent.

As such, ECCC notes that the multi- stakeholder meeting conclusions commit the proponent to identify on the plans any haul roads constructed with waste rock and geomembrane. The proponent also undertakes to identify on the plans any roads that are likely to become haul roads constructed with waste rock and geomembrane, either as currently planned or in a subsequent phase of work, which may include temporary roads, circulation roads, the access road to the temporary pumping station and any new roads. In addition, the proponent will be required to ensure the direction of groundwater flow prior to undertaking any work related to haul roads. The proponent will also ensure that it has a sufficient number of groundwater monitoring wells that are spatially well located to ensure data interpretation, including the installation of an additional observation well southwest of PO29-2021 (AÉIC, 2022).

Regarding the material used in the construction of the roads coming from outside the site, ECCC is of the opinion that any material imported from outside the mine site will have to meet certain conditions regarding its geochemical quality (absence of metal leaching and acid generation potential). Furthermore, ECCC notes the proponent's commitment not to use diabase or the M2 rock formation (banded gneiss) as construction material.

Given the lack of documentation of similar cases where geomembranes have been used in the design of haul roads and the "accidental perforations that can reasonably be anticipated for any geosynthetic containment structure" (Groupe Alphard, 2022, p.13), ECCC believes that as many measures as possible should be implemented in order to avoid groundwater contamination and that uncertainty would remain even if all these measures were taken. Therefore, ECCC believes that careful monitoring of groundwater quality along the haul roads is essential to verify the effectiveness of the geomembrane and to provide for remedial action in the event of contamination throughout the project. ECCC also notes the proponent's commitment that no work related to haul road construction will take place during winter.

Since the QA/QC program presented by the Groupe Alphard is provided for guidance only and, as mentioned above, installation is a critical step in maintaining the integrity of the geomembrane, ECCC recommends that this program be analyzed by a competent third party after detailed engineering to ensure that it is appropriate for this project.

In summary, based on the expert opinions of the Groupe Alphard and Englobe and the recommendations presented, enhanced and confirmed in the Agency's report (AÉIC, 2022), ECCC is of the opinion that the haul road concept as proposed could in principle minimize groundwater contamination. However, all recommendations, including the final QA/QC program (see below), will need to be rigorously followed.

Water management in the concrete plant

On the one hand, it is mentioned that an impermeable basin would be built to collect and treat the washing water from the concrete mixers before being discharged into the environment. On the other hand, it is not known when the water from the concrete plant site would be pumped to the construction WTP. ECCC reminds the proponent that it must ensure that the requirements of the *Fisheries Act* are met and also meet the requirements of the MDMER once the site becomes subject to these regulations.

Operation phase

Water treatment plant

With respect to the disposal of sludge from the WTP, ECCC is of the opinion that this sludge may be an additional potential source of metals that could be released to groundwater. ECCC recommends that the proponent consider the quality of this sludge in the management of the waste rock and tailings storage areas.

Water management

Following the results of the kinetic column tests, an update of the surface water quality modeling was carried out by the proponent with more complete geochemical test results (WSP Canada Inc., 2021a, Appendix B) and updated to take into account the presence of diabase in the waste rock (WSP Canada Inc., 2021b, R-CCE-57). This study covers all of the infrastructure, including the pond and pit, and presents a water balance for the site. The objective was to further determine the effects of the project on surface water by estimating the effluent quality of the North water management pond during the construction and operation phases and the quality of the water accumulated in the pit after mine closure. ECCC believes that the main results of the geochemical modeling of the North water management basin indicate that arsenic would exceed the Directive 019 or MDMER criteria for final effluent for all years modeled, i.e., during the construction and operation phases (WSP Canada Inc. 2021a, Figure 6 p. 14).

In addition, under the new haul road design, the resulting runoff would be directed to the North basin, resulting in increased levels of contaminants, including arsenic, in the North basin. As a result, arsenic concentrations in the pond water would be even higher than expected. It is therefore recommended that the proponent:

- Ensure that the proposed treatment unit is capable of handling higher than expected arsenic concentrations.

Finally, an increasing trend in arsenic concentrations in the North basin would be apparent from the 6th year of operation and levels would even be above 0.2 mg/L during the last 10 years of operation for dry conditions (WSP Canada Inc., 2021a, Appendix B, Figure 6, p. 14). Thus, based on the information on arsenic in surface water available to date, decommissioning of water management infrastructure should be planned for the very long term by the proponent to ensure that mine effluents meet applicable discharge standards.

Closure, restoration and post-restoration

Water management

The quality of the water that would be discharged into stream CE3 following the filling of the pit is a major concern because of the presence of contaminants, including arsenic. In its January 2022 response document (WSP Canada Inc., 2022a, R-CCE3-32, p. 54), the proponent mentions that the scenarios in the modeling calculations excluded water inputs from precipitation, in order to "consider lower dilution factors for metals in the pit". Thus, "the concentrations that will be observed in the environment should therefore be lower than those calculated in the modeling". With regard to the effect of the discharge of water from the pit on the quality of the water of the CE3, the proponent adds that "the initial quality of the water of the CE3

stream as well as its flow must also be considered". Indeed, according to the proponent, "... arsenic concentrations are naturally high in the sector (approximately 0.1 mg/L) ...". However, after checking Tables 6 to 14 of the specialized aquatic habitat study (Étude spécialisée sur l'habitat aquatique WSP Canada Inc., 2018), ECCC found that naturally occurring arsenic concentrations in streams are approximately two orders of magnitude lower than the 0.1 mg/L reported by the proponent. Furthermore, the proponent minimizes the effect of the spill on the quality of the CE3 by invoking the phenomenon of dilution. In fact, a minimum mixing factor of 3 would be required, according to the calculated average annual flows and low-water periods in CE3. ECCC does not agree with the analysis proposed by the proponent to determine the effect that this spill would have on the water quality of CE3 because of the dilution principle, which is not acceptable to ECCC.

According to the proponent, post-restoration activities on the site would recreate surface runoff conditions close to the original conditions and when the water management infrastructure on the site is dismantled, the original physicochemical nature of the surface water would be restored. However, modelling results regarding the quality of the water that would accumulate in the pit (WSP Canada Inc., 2021a, Appendix B) indicate that the quality of the water could be problematic. Thus, ECCC recommends to:

- Ensure that MDMER and *Fisheries Act* requirements are met at all times.

<u>Material used for haulage roads</u>

Regarding the sections of haul road that would not be waterproofed, ECCC is of the opinion that there remains a risk of contamination under these sections of road and that the soils under these sections should be subject to the same measures presented by the proponent in WSP Canada Inc. (2021b) in relation to the loose materials that were used for the bedding. Thus, these should be "characterized prior to their reuse for site restoration. If a portion was found to be contaminated by waste rock leachate, it would be transported to the waste rock storage facilities, and if a portion was found to be contaminated by hydrocarbons, it would be transported to a site authorized for this purpose".

Mitigation measures

Chapter 7 of the original 2018 EIS (WSP Canada Inc., 2018) presents the significance of the environmental effects as well as the specific mitigation measures adopted to lessen the effects during the construction and operation of the Project. All common mitigation measures have been presented in this chapter. These are numbered and grouped in a summary table. For water quality mitigation measures, the same information is included in the 2021 revised EIS (WSP Canada Inc., 2021a) with the exception of a few additions to address concerns of the JAC and other stakeholders based on the new project configuration or optimization (Table 7-5, pp. 7-12 to 7-14). For example, measures QUA 05, QUA 14, QUA 15, and NOR 3 were added to those already included in the 2018 version. In summary, the mitigation measures presented by the proponent for each of the three phases of the project are standard good practice measures mostly related to the protection of water and soil from SS and petroleum hydrocarbons. The proponent presents a few other measures related to sanitary aspects, contamination caused by material stored in the pits and hydrology.

Regarding the design of the haul roads located outside the co-disposal storage facilities, the proponent presented its final proposal in its July 2022 response document and based its arguments regarding the effectiveness, durability and sustainability of this design on a document written by the consultant Groupe Alphard (2022). The consultant presented a series of measures that would be implemented during all three phases of the project, but primarily during construction and specifically related to the geomembrane installation and the quality assurance/quality control (QA/QC) program. The JAC then asked the consultant Englobe to provide a second opinion in relation to the design of these roads. In its report, Englobe provided additional measures to improve groundwater protection associated with haul roads located outside of the co-disposal storage facilities. Various discussions subsequently took place between the parties to optimize these recommendations and they were confirmed in the minutes of a meeting held on August 4, 2022 (AÉIC, 2022).

Construction phase

Common mitigation measures SUR 01, SUR 02, SUR 03, SUR 04, QUA 01 to QUA 05, QUA 08 to QUA 13, NOR 02 to NOR 04, NOR 07 to NOR 09 would be applied to reduce and control Project impacts on water and sediment quality (WSP Canada Inc., 2021a, p. 7-42).

Operation phase

The standard construction mitigation measures QUA 01 to QUA 05, QUA 12, QUA 13 and QUA 15, NOR 02 to NOR 04, NOR 06 to NOR 09, presented above will also be applied during the operation phase to reduce the impact of the project on water and sediment quality.

Restoration phase

Routine mitigation measures SUR 01, SUR 03, SUR 04, QUA 01 through QUA 05, QUA 07 through QUA 13, NOR 01 through NOR 04, NOR 09, and NOR 10 will be implemented to reduce the project's impact on water and sediment quality.

ECCC advice and recommendations

The potential environmental effects described by the proponent on surface and ground water quality are associated with dust emissions and other contaminants as well as the potential for spills of petroleum products and hazardous materials during construction, operation and restoration activities. The description of impacts should also take into account the leachable nature of the material stored in the storage facilities and the use of waste rock in the design of certain sections of the haul roads. Thus, because of the anticipated exceedances of modeled concentrations of arsenic and other contaminants, and because of the uncertainties already noted, ECCC believes that mitigation measures should be implemented rigorously to significantly reduce the adverse effects of the project on water quality.

While it is the totality of the measures considered that would contribute to reducing the overall impact on surface and ground water quality, it is still possible to identify the following mitigation measures as key measures for the construction, operation, and restoration phases. The description of some of these measures may have been modified by ECCC to clarify or strengthen them:

- Rehabilitate stream banks disturbed by construction as soon as possible to minimize erosion and sedimentation. If disturbed surfaces cannot be permanently stabilized before winter, implement temporary protection measures.
- In areas of watercourse crossings, perform deforestation activity immediately prior to construction to minimize erosion.
- Stabilize or continuously protect exposed surfaces as soon as possible to reduce SS transport (revegetation) and limit leaching of materials.
- Limit the transport of fine particles into the water environment beyond the immediate work area by an effective means (sediment trap, sediment barrier, containment curtain, etc.).
- Equip any stationary equipment containing oil and/or fuel (e.g., light tower, generator, crusher, screener, etc.) located within 60 m of a watercourse or body of water with a watertight recovery system. The equipment must be equipped with absorbents in order to respond quickly and effectively in the event of an accidental spill.
- Ensure, through frequent inspections, that the machinery is in good condition (clean and free of any leaking contaminants) and that the fuel and lubricant tanks are completely sealed. If a leak is detected, the tank should be repaired immediately.
- Prohibit all maintenance of vehicles and machinery outside of designated areas.
- Refuel vehicles and machinery at designated locations in accordance with good housekeeping practices.
- During the construction phase, collect and treat water from the concrete plant and industrial area, the waste rock extraction area, and the future explosives plant area.

- During the operations phase, collect and treat water from the industrial sector (including the ore milling process), pit dewatering (mine water), runoff from ore, co-disposal (tailings and waste rock) and overburden storage facilities, and runoff from haul road ditches on the mine site.
- Manage the explosives factory to avoid any discharge into the environment surrounding the mine site:
    - Sanitary discharges will be collected in a sealed pit and disposed of externally.
    - Used oil and other non-recyclable waste will be disposed of externally by a licensed company for revaluation or disposal.
    - The trucks containing the explosives will be washed inside the building and the wash water will be sent to the oil separator then filtered and recycled.

The following additional measures are also recommended by ECCC:

- Install temporary and permanent sedimentation ponds to minimize suspended solids discharges, and install a functional water treatment plant at the start of construction works.
- Install a sediment barrier during the first few months of construction to protect the CE3 from drainage that would be directed to it from ditches associated with roads under construction.
- Waterproofing of ore storage areas and all collection ditches.
- Waterproof the bottom of the North basin to meet the percolation rate established in Directive 019.
- Maintain continuous effluent treatment at the WTP during operation and subsequent phases (restoration and post- restoration) as long as there is a final effluent and provide for necessary adjustments to optimize treatment in case of exceedances of monitored parameters.
- Install a waterproof basin to collect and treat the water used to wash the concrete mixers.
- Implement measures to ensure that all maintenance operations in waterproofed ditches along haul roads are conducted without risk to the geotextile and allow for effective control of freeze-thaw and melt flows.

Furthermore, given the potential for groundwater contamination associated with the use of leachable waste rock in the design of haul roads and the importance of protecting groundwater, all measures to mitigate effects on groundwater quality presented in the Groupe Alphard document (2022), supplemented or modified in the Englobe document (2022) and subsequently confirmed (AÉIC, 2022) covering all phases of the project, as well as the rigorous implementation of a quality assurance and quality control plan tailored to the project, would be necessary and very important for the protection of the water quality of the receiving environment.

Note that ECCC relies on Englobe's expertise regarding the technical effectiveness and uncertainty of mitigation measures to protect groundwater quality associated with haul roads as presented in the Groupe Alphard document (2022) and its counter-expertise report (Englobe, 2022) and subsequently confirmed (AÉIC, 2022).

Moreover, it is always difficult to objectively evaluate the adequacy and effectiveness of the measures planned to preserve surface and ground water quality. In fact, their effectiveness will only be demonstrated at the time of their application on site. Therefore, ECCC is of the opinion that the implementation of all the mitigation measures listed or discussed above in a rigorous manner with a monitoring and follow-up program of these measures would allow to confirm the significance of the effects and to take corrective measures, if necessary.

Monitoring and follow-up programs

Monitoring

An environmental monitoring program, including compliance with applicable legislative and regulatory requirements and proposed mitigation measures, was presented in Chapter 10 of the revised EIS (WSP Canada Inc., 2021a, Section 10.3, pp. 10-3 to 10-5). According to the proponent, the measures and means considered to ensure such monitoring will be identified in the monitoring program at the time of its completion and the detailed monitoring program would be submitted at the time of application for a

certificate of approval for the Project. Once the proponent has received authorization for its project, discussions will be held with the tallymen of traplines RE2, VC33 and VC35 and/or Eastmain's environmental services to determine their interest and willingness to become actively involved in the monitoring activities.

The monitoring program would be integrated into an Environmental and social management plan (ESMP), which would specify follow-up activities on all biophysical and human components related to the project. Therefore, the proponent did not present a water quality monitoring program in its EIS.

Follow-up of surface water quality

A surface water quality monitoring program is presented in section 10.4.1 of the revised EIS (WSP Canada Inc., 2021a, pp. 10-6 to 10-7). This follow-up would be conducted to comply with the federal MDMER and provincial D019. In addition, a follow-up program for the environmental discharge objectives (objectifs environnementaux de rejet: OER) to be achieved would be defined at a later date by the MELCC. Metal Mining Environmental Effects Monitoring (EEM) studies would also be conducted to assess the potential effects of the effluent on fish, fish habitat and fisheries resources. The study area covered by the EEM would include streams exposed to the mine effluent (CE2) and a reference stream located outside the mine influence zone. The same stations used to establish baseline conditions would be used (WSP Canada Inc., 2021a, Subsection 6.2.8.1, Map 6-8, p. 6-39).

Water from the overburden storage facility would be collected and directed to the main retention pond.

It should be noted that the surface water quality monitoring program established for the operation phase would also be carried out during the construction phase, taking into account compliance with the *Fisheries Act* and the requirements of the MDMER (WSP Canada Inc., 2022a, R-CCE3-36).

For post-operational monitoring (closure and post-closure), the main water treatment plant (WTP) would be in operation as long as needed and effluent monitoring would be conducted in accordance with the MDMER. "When the WTP is dismantled (in Year 3 of closure if water quality is acceptable in the main retention pond), additional water samples will be collected from the CE2 and from the breached dike locations. This monitoring will be conducted 6 times per year during ice-free periods at minimum 30-day intervals for 5 years or until the situation is deemed stable and back to baseline conditions."

Regarding the water that would accumulate in the pit, the proponent indicates in response to question R-CCE3-32 (WSP Canada Inc. 2022a) in the context of the waste rock leaching process that was planned but subsequently withdrawn that "additional modeling in the early years of the mine will be conducted with analytical results to refine the closure plan. The closure scenario could then be adjusted accordingly and the restoration plan would be updated to reflect the changes. "The restoration plan will in any case have to be updated every 5 years to meet the requirements of the [provincial] *Mining Act* (*Loi sur les mines*). No action items are presented regarding pit water.

Follow-up of groundwater quality

Groundwater quality follow-up is presented in Chapter 10 of the revised EIS (WSP Canada Inc., 2021a, Section 10.4.2, pp. 10-8 to 10-12) and was subsequently completed (WSP Canada Inc. 2022b, 2022e). A network of monitoring wells would be installed around facilities that have the potential to affect groundwater quality (required by Directive 019).

Thus, follow-up wells would be distributed upstream and downstream of the waste rock storage facilities (16 sites), the pit (4 sites), the industrial sector (4 sites) and the explosives storage area (3 sites) (WSP Canada Inc., 2021a, section 10.4.2, Table 10-2, p. 10-11). The set of wells planned for groundwater monitoring is presented in Map 2 of WSP Canada Inc (2022b). Follow-up would include groundwater quality and water levels around the pit.

The parameters to be analyzed were selected based on the uses of the site and also include those required under D019. The sampling frequency would be twice a year, during summer low flow and spring freshet. The analytical program parameters would be:

- Petroleum hydrocarbons C_{10}-C_{50}.

- Major ions (bicarbonates, calcium, carbonates, chlorides, fluoride, magnesium, potassium, sodium, sulfates).
- Dissolved metals (Ag, Al, As, B, Cd, Co, Cr, Cu, Fe, Hg, Li, Mn, Mo, Ni, Pb, Se, Sb, Sn, Sr, Ta, Ti, U, V, Zn)
- Nutrients (ammonia nitrogen, total Kjeldahl nitrogen, nitrates, nitrites, total phosphorus)
- Total cyanides, total dissolved solids, total sulfides.
- The pH, electrical conductivity, temperature, dissolved oxygen and oxidation-reduction potential (ORP).

In addition, due to the use of waste rock in the construction of haul roads, the proponent has added three additional wells to monitor groundwater along the non-haul road sections (WSP Canada Inc., 2022b). These wells would be added to the groundwater follow-up of the developments at risk. These wells would be sampled seasonally, four times per year if conditions permit, to provide more accurate follow-up and to assess annual and seasonal trends for each parameter (WSP Canada Inc., 2022e). Actions would be taken to address potential water quality deterioration during monitoring based on the extent and intensity of the contamination. These actions could be one or a combination of the solutions presented in WSP Canada Inc (2022e): drainage trench, pumping wells and dipole investigation and remediation.

Considering that groundwater from the study site could resurface into surface water, chemical analysis results would be compared to the MELCC RES criteria (Beaulieu, 2021). In addition, the RES criteria for metals would be adjusted to a water hardness of 10 mg/L, which is representative of the water in the surrounding streams.

Given the exceedances of certain criteria (Cu, Ba, Mn, Zn) during the collection of groundwater samples, a pre-work background assessment was conducted. The results were presented in the specialized study on hydrogeology (WSP Canada Inc., 2018, Étude spécialisée sur l'hydrogéologie, Section 5.4). The background levels assessed would therefore be used as a criterion in the event that they exceeded the RES criterion. Finally, for parameters with no criteria, the results will be compared to values generally observed in groundwater as well as to concentrations obtained under baseline conditions.

ECCC advice and recommendations

The follow-up program presented in the impact study and in the various sets of responses was generally adequately documented by the proponent. However, only a draft version of the monitoring program was available for evaluation.

Monitoring

The absence of the final monitoring program did not allow for a timely assessment. Thus, ECCC is of the opinion that uncertainties remain as to the adequacy of this program to prevent and preserve the quality of surface and ground water impacted by the project. ECCC therefore recommends that the proponent provide a copy to the Agency for evaluation by the competent authorities prior to the construction phase**.**

Follow-up

Due to the exceedances of the natural concentration for some metals, both for surface water and groundwater, the relevant reference stations and observation wells, which were used to describe the baseline conditions, should be monitored during all phases of the project (as an example, see the recommendations of the MELCC Guide de caractérisation physicochimique (MDDELCC, 2017b). ECCC therefore recommends resuming the monitoring of these stations and observation wells, with particular attention to streams CE2 and CE3, from the beginning of mining activities to be able to detect increases in concentrations indicating an accumulation of pollutants in the aquatic environment.

Surface water

The proposed follow-up program would include the stream exposed to the mine effluent (CE2). ECCC recommends that monitoring of the natural environment also include Asiyan Akwakwatipusich Lake and the "unnamed" lake located north of the study area. Potential changes should be measured in these areas due to airborne particulate matter that may also be deposited there during the construction and operation

phases. This follow-up will also demonstrate that the risk of deposition of particulate matter on these water bodies is low or high.

In addition, ECCC recommends adding lithium to the follow-up plan, in addition to the metals identified in the initial waterbody baseline conditions, as it is the metal of interest for the project. MELCC also presents surface water quality criteria for lithium for the protection of aquatic life (acute and chronic effects). The same requirements as for other substances monitored under the EEM program from the MDMER should be observed.

ECCC also recommends that the surface water quality follow-up plan be implemented at the beginning of construction and that it be maintained throughout all phases of the project, i.e., construction, operation, closure and post-closure.

With regard to the quality of the water that would accumulate in the pit, ECCC recommends that the geochemical behaviour of the tailings and mine waste rock be studied under conditions representative of mining operations in order to make changes to the project, if necessary. These follow-ups should also make it possible to validate or modify the restoration concept during the operation phase. In addition, given the exceedances of standards predicted by the modeling, ECCC also recommends monitoring the quality of the water that will accumulate in the pit. This monitoring should cover at least the post-restoration phase.

Groundwater

ECCC acknowledges the proponent's commitment to monitor the groundwater associated with the sections of haul roads located outside storage facilities by adding three observation wells and by ensuring a seasonal monitoring frequency as well as providing for measures in case of possible contamination (drainage trench, pumping wells as well as investigation by the dipole method and repair work). ECCC is of the opinion that this monitoring should begin as soon as the haul roads are constructed in order to catch any contamination as soon as possible.

For the sections of haul road that would not be waterproofed but where waste rock would be used, the proponent does not anticipate additional monitoring wells. ECCC is of the opinion that there is uncertainty as to whether well P029-2021 (WSP Canada Inc. Map 2, 2022b) would be able to validate the direction of flow associated with the section of road at the northwest end of the pit that would not be waterproofed.

ECCC is of the opinion that an additional well for piezometric and water quality monitoring should be installed between this section of road and CE3 to ensure the direction of flow and the quality of the groundwater at this location. ECCC also believes that the soils on either side of these sections should be checked for quality during the restoration phase to ensure proper management.

HYDROLOGY

Existing environment and baseline conditions

The proponent provides a summary of the existing environment and baseline conditions in the original 2018 EIS and in a specialized hydrology study (Étude spécialisée en hydrologie , WSP Canada Inc., 2018). This information was further clarified in response to question CCE-4 (WSP Canada Inc., 2020b).

The project would encroach on 4 small watersheds (CE2 to CE5) and affect their flows. The proponent described the basic surface hydrology conditions in terms of low flow (baseflow), flood, and seasonal and interannual discharge variation, as well as the watershed boundaries.

Annual and monthly mean flows were estimated for the watersheds potentially affected by the basin transfer method using data from the rivière à l'Eau Claire hydrometric station, the closest station to the project. Flood flows are estimated by the rational method, the recommended method for small watersheds. Low flows are estimated by regression using the stations located around the mine site, a method recommended by the MELCC. Field measurements provided the flows and water levels needed to calibrate a HEC-RAS hydraulic model.

ECCC advice and recommendations

ECCC is of the opinion that the proponent has described the baseline surface hydrology conditions in terms of low flow, flood, seasonal and interannual flow variation, and watershed boundaries, using conservative methods. ECCC is satisfied with the description of baseline hydrologic conditions.

Changes caused by the project

The proponent provided a summary of changes to hydrology caused by the Project in the original 2018 EIS and in the specialized hydrology study (WSP Canada Inc., 2018). Additional information was presented in response to CCE-4 (WSP Canada Inc., 2020a), in the revised 2021 EIS (WSP Canada Inc., 2021a) and in response to CCE3-37 (WSP Canada Inc., 2022a).

The anticipated changes are primarily related to:

- Alteration of watershed boundaries (project encroachment).
- The lowering of the water table and the loss of groundwater that feeds surface water.
- Discharges from the water treatment plant (WTP) and pit pumping water.

Estimates of low-flow, high-flow, and monthly mean flows were accomplished using the size of the modified watersheds, the projected discharges, and the influence of groundwater drawdown. The HEC-RAS model, calibrated with measurements taken in the field, was used to estimate the effects of the project on water levels, but can only observe that the levels are controlled by the presence of branches and beaver dams. In this regard, the proponent mentions that the "simulations performed represent the current state of the watercourse as surveyed in 2017 and 2018, but it should be noted that these conditions could change if the hydraulic controls are moved, removed or modified" (WSP Canada Inc., 2021a).

Project impacts on stream characteristic flows are presented in Table 7-8 of the revised EIS (WSP Canada Inc., 2021a). In its March 2022 response document to MELCC (WSP Canada Inc. 2022c, R-QC4-13), the proponent updates the impacts of the project on the characteristic flows of the CE2 according to the new version of the water balance dated March 2022, which considers mining discharges over 12 months. In summary, depending on the type of flow calculated, the proponent predicts that the flows of the CE2 would vary between +70 % and + 368 % for low water flows, between +13 % and + 82 % for average monthly flows and between -1 % and - 9 % for flood flows. Streamflow in CE3 would vary by -37% at low flow, -20% for average monthly flows and -22% for flood flows, while CE4 would vary by -97% at low flow, -35% for average monthly flows and -35% for flood flows. Finally, the flows of stream CE5 would vary by -3% in low water, -7% for monthly average flows and -11% for flood flows. These flow estimates take into account changes in watershed area, pumped water inflow, and groundwater drawdown caused by the presence of the pit.

All effluent from the project during the construction and operation phases would be discharged to stream CE2, greatly increasing low flows and moderately increasing flood flows. The proponent does not anticipate any residual impacts after full closure of the site, other than the creation of a new lake within the pit and small changes in the area of the CE2 to CE5 watersheds. The proponent estimates that the pit would take between 98 and 138 years to fill (WSP Canada Inc., 2021a).

The proponent states that climate change is included in the design of the project infrastructure (WSP Canada Inc., 2021a, Appendix B of Appendix A). The proponent conducted a qualitative analysis of the effects of climate change on streams, but chose to exclude them from the quantitative assessment of the project's effects on streams given the uncertainty in the available knowledge about the effect of climate change in the region (WSP Canada Inc., 2021a). Climate change could also affect the estimate of time required to fill the pit.

ECCC advice and recommendations

ECCC is of the opinion that the proponent has estimated the effects of the project for all phases of the project sufficiently for the purposes of the environmental assessment.

Mitigation measures

The proponent provides a summary of mitigation measures in Chapter 7 of the revised EIS (WSP Canada Inc., 2021a).

The drawdown of the water table during the operation phase of the project would result in a reduction in flow in several streams located around the pit. In the case of stream CE2, this reduction would be compensated by the effluent from the water treatment plant, except for the months of May and June when the reduction in flow would not be compensated.

For the restoration/post-restoration phase, the revegetated storage facilities would have a slight impact on the time of concentration[2] of watersheds CE2 and CE3. The proponent mentions that efforts would however be made to promote the creation of wetlands when possible in the low-slope areas, in order to limit this increase in peak flows.

ECCC advice and recommendations

ECCC recommends the following additional key measure:

- Operate the water treatment plant in such a way as to reproduce the natural flow variations of the CE2 stream, taking into account the storage capacity of the sedimentation basin.

ECCC believes that the creation of post-closure/restoration wetlands in low slope areas adjacent to revegetated storage facilities in the CE2 and CE3 watersheds would help to limit the increase in peak flows and could potentially reduce the input of suspended solids into these streams. However, ECCC recommends that these wetlands be located so that they receive all runoff from storage facilities without threatening the stability of their slopes.

Based on these recommendations, ECCC believes that implementation of the mitigation measures would minimize the effects of the project on local hydrology.

Monitoring and follow-up programs

The proponent provides a summary of follow-up programs in Chapter 10 of the revised EIS (WSP Canada Inc., 2021a), but does not describe any specific water quantity follow-up programs.

ECCC advice and recommendations

Given the magnitude of the impacts described on streams CE2, CE3 and CE4, ECCC recommends that the proponent present a follow-up program of water levels and flows during the construction phases, and post-restoration phases, including water levels and flows in each of the CE2, CE3 and CE4 watersheds, in order to verify the accuracy of the environmental assessment and to judge the effectiveness of the mitigation measures. This follow-up program should specify, at a minimum, the location of the measurement sites, the frequency of the measurements and the duration of the follow-up, the methodology, the content and frequency of the reports, the intervention thresholds including the type of flows used for these thresholds, as well as the adaptive measures in case of non-compliance with these thresholds.

For the post-restoration phase of the site, ECCC recommends that the monitoring program be developed to allow for confirmation of effects on streams for at least three years after the completion of restoration activities.

Finally, ECCC recommends that the detailed follow-up program related to the surface water hydrology component be developed and presented to the responsible authorities for review and comment so that it can be finalized prior to the start of construction.

Valued Environmental Components

This section presents ECCC's responses to the specific questions on the valued components identified by the Joint Assessment Committee (JAC) for the environmental analysis and presented in Appendix 2 of the

[2] Time of concentration is a concept used in hydrology to measure the response of a watershed to a rainfall event (Source: Wikipedia)

Agency's request for final advice. The valued components within the mandate of ECCC and discussed below are as follows:

- Transboundary Effects - Greenhouse Gas Emissions
- Wetlands
- Migratory birds, including avian species at risk
- Other species at risk

TRANSBOUNDARY EFFECTS - GREENHOUSE GAS EMISSIONS

Baseline conditions

The project guidelines did not include any requirements related to greenhouse gas (GHG) emissions in the project study area. Therefore, the proponent did not provide any specific information on this aspect in the ambient air quality documentation.

Potential environmental effects

Greenhouse gas emissions from the project were first estimated in a technical note in the original EIS (WSP Canada Inc., 2018, Appendix E) for mine activities related to the three phases of the project, construction, operation and restoration, and then in the revised 2021 EIS following optimization of the mine site layout (WSP Canada Inc., 2021a, Appendix D of Appendix C). The sources of GHG emissions are virtually the same as those related to contaminant emissions. For construction and restoration, these are mainly truck and machinery traffic related to mine site development and restoration. For operations, there are also sources related to the transportation and processing of ore within the mine site. More specifically:

- During construction, direct sources of GHG emissions come from off-road heavy equipment, trucks and road vehicles used for the construction of the mine access road, site clearing and stripping, industrial and infrastructure development. Other sources of direct GHG emissions include the use of generators for power, heat production and heating, and the use of explosives. Indirect emissions include the shipping of supplies to the site and employee travel.
- During operations, direct GHG emissions are generated by blasting, heavy off-road equipment, trucks and road vehicles used to extract overburden, ore and waste rock and transport them to the mine site, transportation of tailings, and heat generation. Indirect emissions include the transportation of employees, inputs and machinery to the site, the use of electrical energy from the network and finally the transportation of the concentrate to the final delivery location.
- During restoration, which is expected to last two years, emission sources are from the dismantling activities of the concentrator and associated buildings and from the revegetation activities of the storage facilities. These emissions come from broadly the same sources as during construction.

The GHGs emitted by the project are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). They come from the consumption of diesel in mobile equipment and generators, propane in the heating units and the use of explosives.

Table 1 provides a summary of direct and indirect GHG emissions for the different phases of the project. Under the new conditions and project optimization, the amount of direct GHG emissions from all activities during the construction, operation and restoration phases would be 615 200 tCO_2eq. According to the proponent, optimizing the mine layout and, in particular, using larger capacity haul trucks would reduce direct emissions by almost half (approximately 40%) compared to the original 2018 EIS. Indirect GHG emissions, which were estimated at 230 600 tCO_2eq, would increase by approximately 10% for the optimized project.

GHG emissions (direct and indirect) during the first year of construction would be 18 585 tCO_2eq. However, total GHG emissions during the entire construction period (18 months) would actually be approximately 27 900 tCO_2eq.

For the operations phase, total annual GHG emissions (direct and indirect) from the project range from 41 847 to 47 958 tCO_2eq (WSP Canada Inc., 2021a, Appendix D of Annex C, Table D.13). As a result of these estimates, the James Bay Lithium Mine Project would be subject to federal and provincial GHG emissions reporting. The proponent would also be required to participate in Quebec's cap-and-trade system, or "carbon market". Among other things, the SPEDE targets facilities that emit 25 000 metric tons or more of CO_2 equivalent annually.

Table 1: Estimated direct and indirect GHG emissions (rounded values) for the different phases of the project, including the transportation of concentrate between the mine site and the town of Matagami.

Phase (Year)	**CO_2eq emissions (tons)**								
	Direct emissions					**Indirect emissions**			Total
	Explosives	Road transport (on site)	Off-road mobile equipment	Stationary combustion	**Total direct**	Electricity	Off-site transportation	**Total indirect**	Total (direct +indirect)
Construction (Year -1)	152.5	963.1	2 464	10 768	**14 348**	73	4 164	**4 237**	**18 585**
Operation (Sum of years +1 to 18)	10242.2	91425.0	188 496	290 754	**580 914**	1 314	222 984	**224 298**	**805 210**
Restoration (Year 19)	134.3	1329.0	2 321	16 153	**19 937**	73	1 995	**2 068**	**22 005**
TOTAL	10 529	93 717	193 281	317 675	**615 200**	1 460	229 143	**230 600**	**845 800**

Since GHG emissions for the transportation of the concentrate from Matagami to a final destination in the operations phase were not accounted for in the original EIS, the proponent produced two additional scenarios that account for the transportation of the concentrate to the port of Trois-Rivières (WSP Canada Inc., 2019b, R-67, pp. 105-106). Table 2 presents the additional annual emissions under the scenarios considered. For scenario 1, the proponent considered truck transportation from the mine to Matagami (400 km) and from Matagami to the port of Trois-Rivières (550 km) for a total of 950 km. For scenario 2, the proponent considered transportation by truck from the mine to Matagami (400 km) and by train from Matagami to the port of Trois-Rivières (550 km). The distances include round trips. Thus, there would be additional annual GHG emissions of 16 708 tCO2eq, if the transportation was done by truck only, and 9 664 tCO2eq with a combination of truck and train transportation, the latter scenario being the one retained by the proponent.

Table 2: Estimates of annual GHG emissions for the transportation of concentrate between the mine site and the port of Trois-Rivières.

Transport scenario	**Annual GHG emissions (tonnes)**			
	CO_2	**CH_4**	**N_2O**	**CO_2eq**
400 km by truck - Mine to Matagami only	6 912	0,28	0,39	7 035
550 km by train - Matagami to the port of Trois-Rivières.	n.a.	n.a.	n.a.	2 629
Scenario 1: 950 km by truck - Mine at the port of Trois-Rivières	16 417	0.67	0.92	16 708
Scenario 2: 400 km by truck and 550 km by train - Mine to the port of Trois-Rivières	n.a.	n.a.	n.a.	9 664

For restoration, the GHG estimate is based on one year only (WSP Canada Inc., 2021a, Appendix D of Appendix C, Table D.13, p. 15). However, according to the project schedule, the restoration phase is

expected to last 2 years (WSP Canada Inc., 2021a, Section 4.14, Figure 4-19, p. 4-119). During an exchange of information between the Agency and the proponent in May 2022, it was specified that the restoration phase would be three years in duration and that the emissions presented in Table 1 for this phase would represent the total emissions for the three years.

Importance of GHG emissions

Total annual GHG emissions (direct and indirect) from project operations range from 41 847 to 47 958 tCO2eq (WSP Canada Inc., 2021a, Appendix D of Annex C, Table D.13). On an annual basis, the contribution of project operations to total provincial and federal GHG emissions would range from 0.05% to 0.06% and 0.006% to 0.007%, respectively.

The mining project is part of the federal mineral products industry sector. The proponent indicates in Table D.12 (WSP Canada Inc., 2021a, Appendix D of Annex C) that annual emissions from this sector were 8 800 kilotonnes of CO_2eq for the year 2019. It is estimated that a maximum of approximately 48 kilotonnes of CO2eq of GHG emissions (direct and indirect) would be released in year 14 of operation for the Project. Thus, GHG emissions for the mining project operations would represent a maximum of 0.54% of the federal mineral products sector emissions compared to the sector emissions in 2019.

ECCC advice and recommendations

GHG emissions were estimated using a well-established and recognized methodology. The sources of GHG emissions are, for construction and closure, truck and machinery traffic related to mine site development and restoration. For operations, there are also sources related to the transportation and processing of ore within the mine site. ECCC requested the addition of GHG emissions for the transportation of the product to the port of Trois-Rivières, a source that the proponent had omitted in its first estimate.

In addition, ECCC believes that the GHG emissions from the transportation of geomembrane for road construction discussed in the March 2022 document (WSP Canada Inc., 2022b, p.12) have not been estimated and the GHG report should have been modified accordingly. Thus, the reported GHG emissions would be underestimated for the construction and restoration of the site. ECCC believes that this provides additional inaccuracy in the assessment of the project's GHG emissions.

GHG Mitigation Measures

GHG mitigation measures are presented in Appendix E of the original EIS (WSP Canada Inc., 2018) as commitments:

- The use of electricity as an energy source for most of the site's activities.
- Provide eco-driving training to truck drivers.
- Monitor fuel and electricity consumption.
- Progressive restoration of the operating site and examination of opportunities to optimize the project's infrastructure and technologies to reduce CO_2.

Not all of the previous measures are repeated in the revised EIS (WSP Canada Inc., 2021a, Appendix D of Appendix C), with the exception of the use of electricity as an energy source. The new measures mentioned in this report are:

- Equipment and vehicles will be proactively maintained to improve/maintain energy efficiency.
- Equipment and vehicle idling times will be kept to a minimum.
- Cold starts will be limited as much as possible.

Also, the proponent mentioned that it will not be possible to acquire all the required equipment in electric version. Only one cart, two buses and nine pick-ups, available in electric version, will be acquired for the project. However, the proponent seems to be willing to integrate the other equipment when it is available in electric version: "their development remains under surveillance for their eventual integration" (WSP Canada Inc., 2021a, p. 4-95).

Moreover, according to the promoter, Hydro-Quebec would not be able to supply all the power required by the project. For this reason, propane would be used for heating. However, this option would represent the most important source of GHG emissions from stationary combustion. The proponent states that if it were possible to replace propane with hydroelectricity, "it will be done" (WSP Canada Inc., 2019d, R-8, pp. 6-7). The installation of conveyors to transport ore to the concentrator as well as to transport waste rock to the waste rock storage facilities would be an interesting option to reduce GHG emissions related to truck transportation. However, this option, which has the advantage of reducing both GHG and dust emissions, would currently be limited by the project's electricity supply. However, the proponent commits to conducting a feasibility study on the subject (WSP Canada Inc., 2019d, R-9, p. 7). With regard to the use of wind energy, the proponent plans to "install a station to collect the necessary data to be able to evaluate the wind potential for back-up energy at the beginning of the operation" (WSP Canada Inc., 2019d, R-10, p. 7).

ECCC advice and recommendations

According to the proponent, the site plan has been optimized to reduce the length of haul roads and the amount of fuel burned by haul trucks. This optimization is presented as a mitigation measure in the revised EIS. According to ECCC, this could not be the case since mitigation measures must relate to the project that would be built and not to its optimization. In addition, the total road lengths are virtually equivalent in the two studies (approximately 1 km less distance in favour of the revised project).

Direct and indirect GHG emissions were estimated for each phase of the mine project (construction, operation and restoration) and compared to provincial and federal emissions as well as to the federal mineral products industry sector. Mitigation measures were proposed by the proponent to reduce the project's contribution to overall GHG emissions, and while the totality of the measures considered in both studies would contribute to reducing GHG emissions, it is possible to identify the following mitigation measures as key measures. The description of some of these measures may have been modified by ECCC to clarify or strengthen them:

- Prefer the use of electrical equipment in the mine operation.
- Prohibit idling of engines.
- Use energy-efficient equipment, construction standards and designs, procedures and operating methods.
- Monitor fuel and electricity consumption.
- Eco-driving training for the drivers of the trucks that transport the materials.

With respect to the proponent's commitments to acquire electrical equipment, ECCC recommends that the proponent formalize these in a formal monitoring program that would consist of monitoring "any technological advances in the field of energy in order to reduce its dependence on fossil fuels" (WSP Canada Inc., 2021a, p. 4-96), but also implement the projects already considered in the event that sufficient electrical power is provided for all the project's infrastructure.

In addition, ECCC recommends the following additional key actions:

- Use zero-emission equipment and vehicles, or if not available, that run on diesel or low-carbon diesel fuel in accordance with Group 4 emission standards[3] .
- Use of motorized equipment in good working order.
- Select energy efficient equipment, machinery, and vehicles (selection of energy efficient vehicles and machinery) when purchasing new or replacement equipment by being up-to-date on the best energy efficient technologies available on the market.

[3] These requirements apply to manufacturers and importers of engines or equipment. The proponent need only ensure that the vehicles meet the requirements of the group.

Residual Environmental Effects

The impact assessment did not address residual environmental effects related to greenhouse gas (GHG) emissions.

Although the above mitigation measures would reduce emissions, GHGs would be emitted during all phases of the project and would contribute to Canadian and global GHG emissions. Therefore, residual environmental effects would be expected for this component.

Cumulative effects

The impact assessment did not address cumulative effects related to greenhouse gas (GHG) emissions.

Although the above mitigation measures would reduce emissions, GHGs would be emitted during all phases of the project and would contribute to Canadian and global GHG emissions. Therefore, it is expected that the Project would contribute to cumulative effects related to GHG emissions.

Monitoring and follow-up programs

Monitoring program

See section on mitigation measures.

Follow-up program

Not applicable.

WETLANDS

Reference state

The proponent described the baseline condition of wetlands present in the local study area in Section 6.3.1 of the 2021 Revised EIS (WSP Canada Inc., 2021a), in the Flora Specific Study of the original 2018 EIS (Étude spécialisée sur la flore, WSP Canada Inc., 2018), the Supplemental Technical Note (WSP Canada Inc., 2021a), as well as in response to question ACEE-70 (WSP Canada Inc., 2019b).

The proponent characterized the wetlands through inventories conducted in the summer of 2017 and 2020. According to the documentation presented, the wetland area totals 2891 ha in the local study area, which corresponds to 78.6% of the total area of the local study area, and is composed mostly of open, forested and shrub bogs.

According to the proponent, the wetlands identified in the study area offer mainly functions of conservation of biological diversity through which the peat bogs offer a potential for feeding, shelter and reproduction of living species.

The proponent specified that no special-status plant species were detected during the vegetation inventories.

ECCC advice and recommendations

ECCC notes that wetlands are present in large quantities in the project study area.

In general, ECCC is of the opinion that the baseline wetland condition has been adequately described for the purposes of the environmental analysis of the project.

Although the description of the biological functions of the wetlands provided by the proponent is limited, it nonetheless confirms their role as habitat for avian fauna, particularly for the Common Nighthawk and the Rusty Blackbird.

Potential environmental effects

The proponent identified potential effects of the Project on wetlands in Section 7.3.1 of the revised EIS (WSP Canada Inc., 2021a), as well as in response to ACEE-70, CCE-5 and CCE-50 (WSP Canada Inc., 2020a, 2020c and 2022a).

The proponent indicates that a portion of the wetlands present in the study area would be destroyed, as they would be directly encroached upon by the project's infrastructure. These losses of wetlands would notably lead to the destruction and modification of natural habitats for fauna and flora.

The proponent has also identified potential indirect effects on wetlands. These effects include alteration of hydrology that may lead to dewatering, and alteration of terrestrial and wetland plant community composition associated with alteration of surface water flow patterns through drainage ditches, as well as dewatering of the pit.

Finally, the proponent identifies potential effects of the project on wetlands in relation to the risks of accidental hydrocarbon spills as well as the introduction and propagation of invasive exotic species.

ECCC advice and recommendations

ECCC believes that the proponent has identified the main sources of impact and the main potential environmental effects (direct and indirect) of the project on wetlands and their functions.

Mitigation measures

The proponent has identified mitigation measures for potential effects of the Project on wetlands in Section 7.3.1 and Table 7-5 of the revised EIS (WSP Canada Inc., 2021a). The proponent also addresses mitigation for adverse effects on wetlands in response to ACEE-71 (WSP Canada Inc., 2019b).

Standard mitigation measures have been included for each phase of the project to avoid and reduce all types of potential impacts of the project on wetlands.

The proponent also undertakes to compensate for the loss of wetlands attributable to the project in accordance with the provincial legislation in force.

ECCC advice and recommendations

ECCC considers the avoidance of work in wetlands to be a key mitigation measure and the most effective measure. ECCC is satisfied with the application of the avoid-minimize-compensate sequence that has led the proponent to site project components in a manner that limits the permanent loss of wetlands and their functions (Revised EIS (WSP Canada Inc., 2021a), p.7-59) and response to question ACEE-6 (WSP Canada Inc., 2019b)).

ECCC is also satisfied with the mitigation measures proposed by the proponent listed below. These are key measures to reduce the effects of the project on adjacent wetlands and to minimize the risk of contamination and the spread of invasive alien species (WSP Canada Inc., 2021a):

- Maintain drainage conditions in wetlands adjacent to work areas.
- Apply measures to limit erosion and leaching of materials.
- Apply measures to limit the risk of oil spills.
- Implement measures to limit the spread of invasive alien species.

ECCC highlights the proponent's commitment to compensate for the loss of wetlands in a manner that meets the requirements of the Government of Quebec and the Cree Nation Government. For its part, ECCC believes that the implementation of compensatory measures for wetlands should make it possible to compensate for the loss of their functions, in particular the loss of habitat for migratory birds and for species at risk. ECCC recommends that the compensation plan:

- Clearly demonstrates how it would reduce losses of wetland function, specifying the functions that will be compensated and the balance of losses after compensation.
- Relies on the *Operational Framework for Use of Conservation Allowances* (Environment Canada, 2012)

and be implemented before wetland loss occurs.

- Identifies and justifies the performance indicators that will be used to evaluate the success of the compensation measures and, identifies additional measures that could be implemented in the event that the expected results are not achieved.
- Demonstrates that the sustainability of the compensation will be assured.
- Be submitted to the Agency and appropriate authorities as soon as possible for review and comment.

Residual Environmental Effects

The proponent described the residual effects of the Project on wetlands in Section 7.3.1 of the revised EIS (WSP Canada Inc., 2021a), as well as in response to questions ACEE-70, CCE-5 and CCE-50 (WSP Canada Inc., 2020a, 2020c and 2022a).

The proponent estimates that the work required for the development of future mining infrastructures will result in the transformation of approximately 305 ha of wetlands. Despite the fact that the wetlands identified are common and abundant in the sector, and the implementation of impact avoidance and reduction measures, the proponent recognizes that the areas affected will be significant. As presented in measure NOR15, the proponent plans to develop a project to compensate for the loss of wetlands or water bodies.

The proponent considers that residual effects related to the risks of accidental hydrocarbon spills as well as the introduction and propagation of invasive alien species are unlikely, given the mitigation measures that it is committed to implementing.

On the other hand, despite the implementation of mitigation measures, the proponent anticipates that the installation of mining infrastructure would result in a modification of the drainage pattern in the work zone, and that certain wetlands could undergo modifications, in particular a partial dewatering around the periphery of the drainage ditches (WSP Canada Inc., 2021a, p. 7-59). Indeed, the proponent anticipates that the installation of drainage ditches along the edge of the infrastructures will have a direct effect on the water table perched in the peat bogs over an area of approximately 25 m from the ditches.

The proponent also anticipates that the dewatering of the pit could cause a drop in the water table in the peat bogs. The proponent emphasizes the significant uncertainties regarding the magnitude and extent of this residual impact on the wetlands. However, the proponent believes that the groundwater drawdown associated with the dewatering of the pit would be a temporary impact that should not cause any permanent loss of wetlands.

ECCC advice and recommendations

ECCC is of the opinion that the residual environmental effects of the project on wetlands have been adequately documented by the proponent.

ECCC is of the opinion that the mitigation measures that the proponent has committed to implement, including compensation for permanent wetland losses, will minimize the residual environmental effects of the project on wetlands.

However, ECCC notes the uncertainties inherent in any wetland compensation project. The proponent would have to carry out follow-up and corrective measures may have to be put in place. This follow-up should also be done on a long-term basis to ensure that the wetland functions are recovered and maintained over time.

ECCC is of the opinion that there is also uncertainty regarding the indirect effects caused by the drainage ditches and pit dewatering. Monitoring of these effects could address these uncertainties (refer to the follow-up program section below).

Cumulative effects

The proponent did not identify wetlands as a valued component for the cumulative effects assessment in the revised EIS (WSP Canada Inc., 2021a). The methodology used to identify valued components that led to the exclusion of wetlands from the assessment is presented in Section 8.4.

ECCC advice and recommendations

ECCC has no comments.

Monitoring and follow-up programs

Monitoring program

The proponent outlines the environmental monitoring it intends to apply throughout the life of the project in Section 10.3 of the revised EIS (WSP Canada Inc., 2021a). The purpose of environmental monitoring is to ensure that mitigation measures are properly implemented and that laws and regulations to which the project is subject are followed. No wetland-specific monitoring is planned.

ECCC advice and recommendations

ECCC is satisfied with the proponent's environmental monitoring commitments. These would allow the proponent to ensure that wetland mitigation measures are implemented.

ECCC notes that implementation of the environmental monitoring program would assist in the identification of unanticipated sources of potential effects that may occur on wetlands.

Follow-up program

The proponent outlines its wetland follow-up program in Section 10.4.5 of the revised EIS (WSP Canada Inc., 2021a) and in response to question CCE-50 (WSP Canada Inc., 2021a and 2022a). The follow-up proposed by the proponent includes detailed vegetation inventories in identified plots to assess the indirect impacts of the project on terrestrial and wetland plant communities and to reassess, based on the results, the areas that need to be compensated.

The proposed follow-up also includes the measurement of the water table in wells located along transects in a 25 m band around the mining infrastructures, in order to evaluate the impact of the water table drawdown on the water level in the peat bogs.

ECCC advice and recommendations

ECCC is satisfied with the proponent's follow-up commitments for wetlands and considers these to be key measures.

ECCC believes that monitoring of wetlands adjacent to those that would be temporarily or permanently encroached upon would provide an opportunity to determine the actual indirect effects of the project on wetlands and to ensure that the planned protection measures are effective. Therefore, ECCC recommends a follow-up of the indirect effects caused by the drainage ditches and pit dewatering to address these uncertainties.

ECCC recommends that the wetland follow-up program be presented as soon as possible to the Agency and the appropriate authorities to review the objectives, methodology, performance indicators and duration needed to adequately assess the effectiveness of the mitigation or compensation measures that will be implemented for wetlands.

In addition, since detecting changes in wetland composition or distribution may take several years, the follow-up period should be long enough to assess the maintenance of wetland integrity over the long term.

Since the proponent plans to develop a wetland compensation plan, ECCC also recommends that a section on wetland compensation follow-up be included in the follow-up program. This follow-up should also be done on a long-term basis to ensure that their functions are recovered and maintained over time.

MIGRATORY BIRDS (including migratory birds and avian species at risk)

Baseline conditions

The baseline conditions of migratory birds are presented in Section 6.3.5 of the 2021 revised EIS (WSP Canada Inc., 2021a), in the Terrestrial and Avian Fauna Specific Study (Étude spécialisée sur les faunes terrestre et avienne WSP Canada Inc., 2018), and in response to questions ACEE-77, 78, and 79, (WSP Canada Inc., 2019b).

The proponent developed a portrait of the avifauna for each of the major bird groups (waterfowl, land and aquatic birds) using various existing data sources and data from inventories conducted in 2017.

A specific inventory was conducted during the spring migration of waterfowl, a group of birds valued by local communities for hunting purposes. Waterfowl and aquatic birds (47 specimens of 8 species) were observed during these inventories, and no notable concentration areas were identified. The inventory of terrestrial breeding birds detected 472 individuals representing 32 species.

According to the proponent, the context of the bird inventories carried out within the framework of this project is particular, insofar as recent and repetitive forest fires have considerably transformed the local environment, making it difficult to compare it to undisturbed environments or to the state prior to the fires. Furthermore, the proponent indicates that the data available for the study area is scarce and does not cover the winter season. He specifies that the sector is not covered by the Eastern waterfowl follow-up Program (Programme de suivi de la sauvagine de l'Es), and the SOS-POP database does not contain any data for the study area. According to the proponent, this also limits the use of existing data to document baseline conditions since the analysis of historical data cannot be used to describe the bird community that will be affected by the construction of the project.

The proponent described the bird species likely to frequent the study area during the different periods of the year (spring and fall migrations and nesting period), and provided abundance indices.

The proponent assessed the potential for avian species at risk to occur in the study areas, and described and mapped the potential habitats for these species. A total of 9 species at risk would be present or likely to be present. The inventories confirmed the presence of the Common Nighthawk (threatened) and the Rusty Blackbird (Special Concern). Other avian species listed in Schedule 1 of the *Species at Risk Act* (SARA) that are likely to frequent the project area and that were not detected during the inventories are the Short-eared Owl (Special Concern), the Bank Swallow (Threatened), the Olive-sided Flycatcher (Threatened), the Canada Warbler (Threatened), the Yellow Rail (Special Concern) and the Red-necked Phalarope (Special Concern). The Hudsonian Godwit is likely to be present and threatened according to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (not listed on Schedule 1 of SARA).

ECCC advice and recommendations

In general, ECCC is satisfied with the baseline description of this component.

The abundance and use of the study area by birds during the spring, summer and fall periods were described and allow for the environmental analysis of the project.

The proponent demonstrated that the potential habitats were sufficiently covered by the inventories to provide a representative picture of the study area.

However, ECCC is of the opinion that the limitations encountered by the proponent with respect to the quantity and quality of existing data increase the level of uncertainty with respect to the validity and representativeness of the information that is presented to document the baseline, including the results of the inventories.

ECCC notes that many species are likely to nest in the restricted study area, including the Common Nighthawk and Rusty Blackbird (both species at risk and confirmed to be nesting), as well as the Bank Swallow and Olive-sided Flycatcher, for which potential nesting habitat has been documented in the project footprint area.

ECCC confirms that no critical habitat for avian fauna at risk is present in the local study area.

For avian species that are not protected under the *Migratory Birds Convention Act,1994* (MBCA) (e.g., birds

of prey), and particularly for those that also have species at risk status under SARA (Short-eared Owl and Rusty Blackbird), ECCC suggests that the Agency consult with the Ministère des Forêts, de la Faune et des Parcs du Québec (MFFP), which is responsible for their management and protection in Québec.

Potential environmental effects

The proponent identifies the potential effects of all phases of the project on avian wildlife in Section 7.3.5 of the revised EIS (WSP Canada Inc., 2021a), as well as in response to ACEE-79, 80, 81, 82, CCE-5 and CCE-6 (WSP Canada Inc., 2019b and WSP Canada Inc., 2020c).

The potential environmental effects identified by the proponent are associated with:

- To habitat loss or degradation for common and special status species.
- Disturbance caused by noise, vibrations or light (avoidance of certain noisy sectors, impacts on reproductive success, modifications in terms of interspecific communication).
- Increased risk of collision and mortality.
- Contamination related to the use of water management ponds by avian wildlife (where harmful substances may be found).

ECCC advice and recommendations

ECCC notes that in the revised EIS (WSP Canada Inc., 2021a), the potential environmental effects (direct and indirect) of the project on migratory birds were identified but not described by the proponent. ECCC believes that a detailed description of the potential effects would have better guided the proponent in selecting effective mitigation measures and developing monitoring and follow-up programs.

As the proponent has provided details only on residual effects, which are those that take into account the implementation of mitigation measures, ECCC provides more detailed comments in this section of the advice.

Mitigation measures

The proponent identified mitigation measures for potential effects of the Project on avian wildlife in Section 7.3.5 and Table 7-5 of the revised EIS (WSP Canada Inc., 2021a). The proponent also addresses mitigation for adverse effects on avian wildlife in response to ACEE-80, 81 and CCE-6 (WSP Canada Inc., 2019b and WSP Canada Inc., 2020c).

In summary, the proponent plans to implement mitigation measures concerning deforestation outside the nesting period of migratory birds, revegetation and habitat restoration at the end of the work, as well as measures concerning the use of water management basins by birds and borrow pits to avoid impacts on the nesting of the Bank Swallow.

The proponent also commits to implementing standard mitigation measures for the protection of terrestrial vegetation and wetlands, soil and water quality, light and noise mitigation measures, and measures to reduce the risk of collision and mortality with vehicles and infrastructure.

ECCC advice and recommendations

ECCC has reviewed the mitigation measures proposed by the proponent and recommends that the following mitigation measures be implemented to avoid and reduce the effects of the project on avian wildlife.

Measures to be implemented by the proponent must be consistent with the MBCA, the *Migratory Birds Regulations* and SARA. It is important that measures be put in place to avoid adverse effects on birds, their nests or eggs during all phases of the project and particularly for the period from late April to mid-August (ECCC, 2019). ECCC recommends that the proponent consider the ECCC Guidelines to avoid harm to migratory birds (ECCC, 2019).

ECCC believes that it is essential to avoid any activity that is detrimental to migratory birds during the nesting season in order to avoid injuring, killing or disturbing migratory birds or destroying and disturbing

their nests and eggs. In this regard, ECCC notes that the proponent has not made a firm commitment to carry out all deforestation activities (clearing) outside the breeding season. Therefore, ECCC believes that deforestation activities outside of the nesting season for migratory birds is a key mitigation measure. For avian species at risk, ECCC recommends that species-specific nesting periods be taken into account in order to target project activities that could affect these species.

If any deforestation activity work is to take place during this period, ECCC recommends that active nest searching not be conducted. This is because nest searchers may disturb or stress nesting birds. Also, in most habitats, the probability of locating all nests in a given search area is low (ECCC, 2019).

To determine if migratory birds are nesting in an area at a particular time, consider using non-intrusive monitoring methods to avoid disturbing migratory birds during nesting (e.g., listening stations). If nests are found in the work area, ECCC recommends that a protection zone be established around the nest until nesting is complete. It is important to note that birds react differently depending on the level of disturbance. This level of disturbance can be determined by considering the intensity, duration, frequency and proximity of the activity, but also the cumulative effect of all activities in the vicinity of the nest. Thus, protection distances must take into account this interaction between factors, being more extended for types of activities likely to be the cause of greater disturbance. In particular cases, specific recommendations or requirements may apply and may be found in documents such as species at risk recovery strategies or other official documents.

Furthermore, in order to avoid negative effects on migratory birds during the nesting period, ECCC advises against scaring birds as suggested by the proponent, although the proponent proposes to use this practice only if necessary and before the start of nesting, so that individuals avoid the areas targeted for deforestation. It should be noted that general nesting times for birds are determined using the best available information. Since these dates often apply to a large area, it is possible that locally the nesting season may begin and end earlier or later than the dates used due to site-specific microclimatic conditions, or due to inter-annual climatic variations (e.g., early spring, cold and rainy summer). In this context, ECCC considers that scaring birds, even before the start of the nesting season, would result in a risk of adverse effect on migratory birds.

ECCC notes that the mitigation measures proposed by the proponent concerning the use of borrow pits are consistent with the recommendations made in the following document: Bank Swallow (Riparia riparia): in sandpits and quarries.

ECCC is satisfied with the proposed mitigation measures to manage noise and light and, where appropriate, the use of water management ponds by avian wildlife.

In summary, ECCC considers the following to be key measures:

1. Avoid adverse effects on birds, their nests, or eggs during all phases of the project and especially for the period from late April through mid-August (ECCC, 2019).
2. Implement measures to prevent the use of water management basins by migratory birds.
3. Provide measures for the use of borrow pits to avoid impacts on Bank Swallow nesting.
4. Re-vegetate and restore, at the end of the work, the habitat losses caused by deforestation.
5. Apply routine mitigation measures to protect terrestrial vegetation and wetlands, soil and water quality.
6. Apply noise and light reduction measures.
7. Carry out any activity, including deforestation (clearing), that could affect migratory birds' nesting season, between the end of April and mid-August, in order to prevent the destruction of nests.
8. In the event that it is not technically or economically feasible to avoid work during the nesting season:
   - Ensure that no nests are present in the work area by using non-intrusive methods.
   - Implement protective measures in the event that nests are found in the work area.
9. Conduct bird follow-up (see section on follow-up below).

Residual Environmental Effects

The proponent describes residual effects on avian wildlife and assesses their significance in Section 7.3.5 of the revised EIS (WSP Canada Inc., 2021a), and in response to ACEE-79, 80, 81, 82, CCE-5 and CEC-6 (WSP Canada Inc., 2019b and WSP Canada Inc., 2020c).

The proponent evaluated the potential habitat losses, including those related to deforestation activities, the opening and operation of quarries and borrow pits, and estimated the number of breeding bird couples affected by these losses.

The proponent also indicates that "during the site preparation, construction and operation phases, incidental bird mortality could occur through incidental take, i.e. inadvertently injuring, killing or disturbing birds or destroying or disturbing their nests or eggs, particularly during deforestation operations" (WSP Canada Inc., 2021a, p. 7-76).

Taking into account the mitigation measures that the proponent is committed to implementing, the proponent believes that the project is not likely to cause significant adverse effects on avian fauna, including avian species at risk likely to be present, in both the restricted and extended study areas.

ECCC advice and recommendations

ECCC notes that the proponent considers incidental take to be a residual effect of the project. ECCC would like to point out that under the *Migratory Birds Convention Act, 1994* (MBCA) and its regulations, no person shall "disturb, destroy or take a nest [...] or an egg of a migratory bird". SARA also prohibits "killing, harming, harassing, capturing or taking an individual of a wildlife species listed as extirpated, endangered or threatened". ECCC believes that the best approach to avoid violating the MBCA is to fully understand the potential risk of impact to migratory birds, their nests and eggs and to take reasonable precautions and appropriate avoidance measures.

Also, since the proponent has not committed to carrying out the deforestation activities outside of the nesting period, ECCC considers that the project carries a risk of causing adverse effects on the reproduction of migratory birds. ECCC believes that a firm commitment to implement this key measure would significantly reduce the remaining uncertainties in this regard.

In addition, ECCC believes that losses of nesting and feeding habitat will have residual effects on birds, including breeding couples that will need to relocate to similar habitats nearby. When similar habitats become more scarce, this can lead to increased bird densities in the same habitat and lead to resource scarcity and increased predation. Habitat destruction and degradation contribute directly or indirectly to the decline of some of the more vulnerable species. Some couples of birds will successfully establish themselves elsewhere, while others will not, due to their greater vulnerability to disturbance of breeding habitat, intra- and inter-specific competition, or predation. For land and water bird species (including species at risk), ECCC is of the opinion that the mitigation measures planned by the proponent (*see* key measures #3 and #4) will make it possible to minimize the residual environmental effects related to these habitat losses.

Cumulative effects

The proponent selected avian species at risk as a valued component of the ecosystem. Specifically, eight avian species at risk were selected for analysis: Common Nighthawk, Short-eared Owl, Bank Swallow, Canada Warbler, Olive-sided Flycatcher, Yellow Rail, Red-necked Phalarope and Rusty Blackbird. The cumulative effects of the Project on avian species at risk are presented in Section 8.6.2 of the revised EIS (WSP Canada Inc., 2021a).

The proponent considers that the cumulative effects on birds are essentially related to the loss and modification of habitats, as well as to the increase in disturbance caused by the projects likely to be carried out in the vicinity of the designated project.

The proponent considers that the cumulative effect will not be significant for avian species at risk. The proponent considers that no additional mitigation measures are required to counterbalance the cumulative effects on migratory birds.

ECCC advice and recommendations

ECCC is satisfied with the cumulative effects assessment on avian species at risk provided by the proponent. The proponent has provided a specific analysis for each of the avian species at risk listed on Schedule 1 of SARA. ECCC considers this to be an appropriate methodological approach, consistent with the Agency's recommendations[4] , given that each of these species faces unique realities, threats or issues.

Given the uncertainties about the reasons for the decline of avian species at risk, any additional losses or habitat modifications are likely to have an effect on them. Project activities as well as past, present and future projects, actions and events identified by the proponent may have cumulative effects on the nesting habitat of species at risk (habitat modification and loss) as well as on the nesting activities of these species (disturbance due to the presence of infrastructures and activities).

Even if habitats are present in abundance in the vicinity of the project, over time, the accumulation of residual effects may reduce the availability of quality habitats for species, thereby increasing intra- and inter-specific competition.

Although the proponent did not propose any mitigation measures to reduce cumulative effects on birds and their habitats, ECCC believes that the proponent should implement any additional measures that would reduce, mitigate or compensate for habitat losses for species at risk and species with declining populations.

Monitoring and follow-up programs

Monitoring program

The proponent commits to developing and implementing environmental monitoring measures specific to the use of water management ponds by avian wildlife during the operational phase, which are outlined in the revised EIS (WSP Canada Inc., 2021a, section 10.4.11.2), as well as in response to question CCE-8 (WSP Canada Inc., 2020c). The proponent indicates in particular that bi-monthly monitoring of the ponds would be carried out during the period when they are free of ice, i.e., approximately from mid-May to mid-November. The frequency of visits would be increased during the spring and fall migration periods, to weekly, or shorter as needed. The proponent emphasizes that exclusion measures could be put in place in the event that the use of the ponds by birds poses a risk to their health or survival.

The proponent also undertakes to monitor borrow pits between mid-May and mid-August to verify whether they are used for Bank Swallow nesting. The proponent outlines the monitoring program specific to this issue that it commits to implementing in the revised EIS (WSP Canada Inc., 2021a, section 10.4.11.2).

ECCC advice and recommendations

ECCC recommends that the monitoring program be completed and submitted to the appropriate authorities prior to the beginning of construction. Since the inventories used to describe the baseline conditions of migratory birds were conducted in 2017, i.e., five years ago, ECCC recommends that the proponent update the migratory bird inventories before undertaking its monitoring program. The proponent should pay particular attention to species at risk as well as to habitats that have undergone significant transformations since 2017.

ECCC believes that the monitoring program should not be limited solely to issues related to the use of water management ponds by avian wildlife and the use of borrow pits for Bank Swallow nesting.

The monitoring program should cover all activities or operations that have the potential to affect birds and avian species at risk during all phases of the project. For each activity, the proponent should identify measures to be implemented to ensure that nuisance or disturbance is minimized, particularly during the nesting period.

The monitoring program should include monitoring of the work to be done to ensure that no migratory bird nests or eggs are destroyed. Special attention should be given to all bird species at risk (not just the Bank Swallow), such as the Common Nighthawk, which is likely to use the bare vegetated areas in the project area.

[4] Technical Guidance: Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act (2012) (CEAA, March 2018).

Furthermore, ECCC recommends that the proponent add a component on the protection of avian fauna to the training of employees. This training should include awareness of the presence of migratory bird nests and what to do if a nest is found. The training should also make employees aware to report any use of the water management ponds by avian wildlife to the environmental officer.
As mentioned above, ECCC notes that the monitoring measures proposed by the proponent concerning the use of borrow pits are consistent with the recommendations made in the following document: Bank Swallow (Riparia riparia): in sandpits and quarries. ECCC expects that monitoring measures will be put in place as soon as a borrow pit is used (particularly during the construction period) and there is a potential for nesting.

ECCC recommends that the monitoring program be updated periodically to take into account changes in regulations, such as the review of the status of wildlife species by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or SARA. These changes may require additional measures to be put in place to mitigate the effects of the project on species affected by changes in their status.

Follow-up program

The proponent outlines the environmental follow-up program for avian wildlife in the revised EIS (WSP Canada Inc., 2021a, Section 10.4.11.2), as well as in response to questions ACEE-84 and CCE-10 (WSP Canada Inc., 2019b and WSP Canada Inc., 2020c).

The proponent indicates that "five-yearly inventories would be carried out, starting in the fifth year of mine operation and continuing until the fifth year following final closure" (WSP Canada Inc., 2021a, p.10-22). The purpose of this follow-up would be to document the actual effect of the mine on "the evolution of local populations of avian species at risk and to adjust mitigation measures as needed. These inventories will also make it possible to document the effect of the gradual restoration of borrow pits, quarries and pits, as well as natural habitats affected by forest fires on bird populations" (WSP Canada Inc., 2020c, CCE-10).

ECCC advice and recommendations

ECCC is satisfied with the proponent's commitment to conduct avian follow-up, and considers this monitoring to be a key measure. ECCC believes that the information presented by the proponent on the follow-up program is incomplete, and that a more detailed version should be developed and presented before construction begins. The follow-up program should verify the accuracy of the environmental assessment conclusions and the effectiveness of mitigation measures. ECCC recommends that the final migratory bird follow-up program include adaptive management measures that may need to be implemented by the proponent, if any, to mitigate any unanticipated adverse environmental effects.

ECCC recommends that the follow-up program identify performance indicators to assess the effectiveness of mitigation measures and determine if additional mitigation measures are required. All types of predicted residual effects should also be assessed and documented, including those related to collisions and mortalities that may occur.

ECCC recommends that monitoring reports include the following elements: results, analysis of results, and contingency measures, if any. A schedule for submission of follow-up reports should be established according to the different activities and phases of the project. This schedule would be included in the follow-up program. The information gathered during these follow-ups will allow us to improve the state of knowledge on these species and on the proposed measures.

Impacts on the current use of lands and resources for traditional purposes by Aboriginal peoples

The proponent reports in section 7.4.1.1 (WSP Canada Inc., 2021a) that land users are concerned about noise, vibrations and air pollution that could be harmful to wildlife and regenerating vegetation since the forest fire in 2013. More specifically for waterfowl and goose hunting, users mention that noise and odours from the mine could have a repulsive impact on geese and could even affect their migratory route. In response to question CCE3-51 (WSP Canada Inc., 2022a), the proponent indicated that, during the goose hunting season, there are no plans to reduce the number of blasting operations since goose hunting is mainly done along the coast of the Eastmain River estuary and the James Bay estuary and not in the area

of the proposed mine site. However, the proponent proposes to discuss this point with the follow-up committee, which should reach the tallymen, so the hunters.

ECCC advice and recommendations

The potential environmental effects of the Project on migratory birds of interest for subsistence and traditional hunting are primarily associated with activities that are likely to cause disturbance, either through noise, vibration or light. Depending on the intensity of disturbance, some species may flee, abandon or even avoid certain areas during all seasons, including the hunting season.

ECCC believes that several elements or variants must be considered in assessing the effects of disturbance on migratory birds and potential impacts on hunting success (e.g., proximity to water bodies, gathering location of geese, distance of geese from blasting site, location of hunting sites, power of explosive charge, annual abundance and productivity of geese, climatic conditions, tolerance and acclimatization of geese to noise, etc.).

As ECCC does not consider that it has all the expertise and information necessary to adequately assess the effects of disturbance on wildlife, and that much of this information is held by the proponent as well as tallymen and community representatives, ECCC suggests that a mechanism for information exchange and discussion between parties be established to promote the development of a protocol or measures to minimize the effects of disturbance on hunting success. ECCC suggests that a mechanism be put in place for information exchange and discussion between the parties to promote the development of a protocol or measures to minimize the effects of disturbance on hunting success.

OTHER SPECIES AT RISK

Baseline conditions

According to information provided by the proponent in the revised 2021 EIS (WSP Canada Inc., 2021a), five species at risk are likely to frequent the study area, namely the Little Brown Myotis, the Northern Myotis, the Woodland Caribou, Boreal population, the Caribou, Eastern Migratory population and the Wolverine.

Chiropterans at risk (Little Brown Myotis and Northern Myotis)

The proponent presented the baseline conditions of the “chiropteran at risk” component in Section 6.3.6 of the revised EIS (WSP Canada Inc. , 2021a), in the specific terrestrial and avian fauna study of the original 2018 EIS (Étude spécialisée sur la faune terrestre et avienne; WSP Canada Inc. , 2018), as well as in response to question ACEE-85 of the Agency's first information request (WSP Canada Inc., 2019b).

The picture of land use by endangered chiropterans was developed using various existing data sources as well as data from acoustic inventories conducted for the project in the summer and fall of 2017. These inventories confirmed the presence of bats in the genus Myotis, which includes the Little Brown Myotis and the Northern Myotis, both of which are endangered species listed on Schedule 1 of the SARA.

However, the proponent indicates that only three calls of bats of the genus Myotis were recorded, which would be explained by the "general poverty of the environment and the northern nature of the study site." It is also pointed out that the mature forest stands have almost disappeared from the study area following the forest fires that have affected the sector over the past decade probably helps to explain the low bat numbers. In his opinion, this would considerably reduce the potential for the presence of quality roosting and maternity sites.

The proponent conducted a literature search to evaluate the potential presence of hibernacula. The analysis of the documents consulted led to the conclusion that no natural cavities or mining openings are known in the sector. The proponent has evaluated that the potential for the presence of a hibernacula in the study area is nil.

Woodland Caribou, Boreal population and Caribou, Eastern Migratory population

The proponent presented the baseline conditions for the Boreal population of Woodland Caribou (woodland caribou) and the Eastern Migratory population of Caribou (migratory caribou) in Section 6.3.2.1 of the EIS (WSP Canada Inc., 2021) and in response to questions ACEE-86 and CCE-11 (WSP Canada Inc., 2019b and 2021b).

EIS mentions that the project study area is located in an overlap area of the distriburion ranges of woodland caribou and eastern migratory caribou of the Rivière aux Feuilles population. Thus, individuals from these two designatable units would be likely to frequent the project study area.

The proponent conducted an aerial inventory of large wildlife in winter 2018 in an area covering 1 600 km^2, which did not detect the presence of caribou.

In addition to the inventory data, the land use of these two species at risk was profiled using Québec government inventory data as well as scientific articles and reports.

Woodland Caribou, Boreal population

The proponent indicates that the project study area is included in the 621 562 km^2 conservation unit QC-6, where the rate of disturbance has been estimated at 30% and the population occupying it is likely to be self-sustaining.

The proponent states, however, that individuals from the local population (herd) designated Nottaway are the most likely to frequent the project study area. According to a study report cited by the proponent in the revised EIS, this population would be considered non-self-sufficient (WSP Canada Inc., 2021a, p.6-96).

The proponent assessed the current rate of habitat disturbance in the study area. The proponent calculated that the project would be located in an area with a 68% disturbance rate within 50 km of the project. In addition, the project footprint would represent one of the most anthropogenic (26%) and natural (90%) disturbed areas in the study area within 5 km of the mine center (WSP Canada Inc., 2021a, p.6-105).

The proponent has described and mapped habitats with the biophysical characteristics required by woodland caribou to carry out their life processes (WSP Canada Inc., 2021a, Map 6-16).

In summary, the proponent assesses that the study area offers poor habitat conditions for caribou due to its high rate of disturbance and the fact that the species has used the study area very little over the past decade. Therefore, its actual probability of occurrence in the study area is considered insignificant in the short to medium term, as noted in its response CCE-12 (WSP Canada Inc., 2021b).

Caribou, Eastern Migratory population

The proponent indicates that migratory caribou are likely to frequent the study area during the winter period, from mid-November to mid-March, in search of food (WSP Canada Inc., 2021a, p.6-90). According to the proponent, telemetric monitoring data transmitted by the MFFP indicate that over the past decade, individuals of the Rivière aux Feuilles population have frequented the study area within a radius of 20 km or more from the center of the proposed mine. In fact, use is mainly concentrated to the northeast of the study area, around Opinica reservoir (WSP Canada Inc., 2021a, Map 6-15).

Wolverine, Eastern population

The proponent presented the baseline condition for wolverine in the EIS in Section 6.3.2.2 (WSP Canada Inc. 2021a). The picture of wolverine land use was developed using various existing data sources. According to the proponent, the probability of finding this species in the study area is low.

ECCC advice and recommendations

In general, ECCC is satisfied with the description of the use of the study area by terrestrial species at risk. The abundance and description of the use of the study area by species at risk during different periods of their life cycle were adequately described for the purpose of the environmental analysis of the project.

Chiropterans at risk (Little Brown Myotis and Northern Myotis)

The description of chiropteran land use is satisfactory and ECCC has no specific comments on this component.

Woodland Caribou, Boreal population

ECCC is of the opinion that the proponent has correctly interpreted the various components of critical habitat identified in the recovery strategy. The biophysical characteristics required by woodland caribou to carry out their life processes have been identified and are relevant to the context of the Québec population (QC-6). Indeed, this local population is located in the Hudson plains ecozone and the classes selected by the proponent to establish potential habitat (large scale, calving and winter) are consistent with the biophysical characteristics identified in Table H-5 of the recovery strategy (ECCC, 2020).

According to the Woodland caribou (Rangifer tarandus caribou): recovery strategy progress report 2012 to 2017, the rate of disturbance of the QC-6 range is estimated at 32%. The local population of Nottaway, found in the project area, totals over 100 individuals and is believed to be declining (ECCC, 2017).

ECCC notes that, according to the MFFP, the project area is relatively unused by woodland caribou due to the fact that the habitat is generally unsuitable due to the large areas that have recently burned (MFFP, 2020).

Caribou, Eastern Migratory Population

With respect to the Eastern Migratory population Caribou, it should be noted that COSEWIC recommended an endangered status for this species in 2017. ECCC is of the opinion that the baseline assessment for migratory caribou is satisfactory, although succinct. ECCC notes that, according to the proponent, the study area is located in an overlap zone between the ranges of the woodland caribou and the migratory caribou of the Rivière aux Feuilles population. Thus, individuals from these two designatable units are likely to frequent the project study area.

Wolverine, Eastern population

Although succinct, the description of wolverine land use is satisfactory. Due to the absence of recent confirmed observations of individuals, there is considerable uncertainty as to the persistence of the wolverine population in Quebec. In this context, although the project is located within the range of the species, and potential habitats and food sources for the species are located in the project area, its presence is unlikely.

The proponent has not identified specific mitigation measures for wolverine and ECCC will not provide advice on this species in subsequent sections.

Potential environmental effects

Chiropterans at risk (Little Brown Myotis and Northern Myotis)

The proponent lists the potential effects of the Project on endangered chiropterans in Section 7.3.6 of the revised EIS (WSP Canada Inc., 2021a). The proponent identifies habitat loss (direct and indirect) and disturbance (noise, light and vibration) as potential effects of the Project on this component.

Woodland Caribou, Boreal Population and Caribou, Eastern Migratory Population

The proponent identifies the sources of impact as well as the potential effects of the Project on the woodland caribou and migratory caribou in section 7.3.2 of the revised EIS (WSP Canada Inc., 2021a). The potential environmental effects identified by the proponent are associated with habitat loss and alteration, increased risk of predation and collisions, and disturbance. Losses of habitat with the biophysical characteristics required by woodland caribou to carry out their life processes were also quantified.

ECCC advice and recommendations

ECCC notes that in the revised EIS, the potential environmental effects (direct and indirect) of the project on species at risk (other than avian species) were identified but not described by the proponent. ECCC

believes that a detailed description of the potential effects would have better guided the proponent in selecting effective mitigation measures and developing monitoring and follow-up programs.

Chiropterans at risk (Little Brown Myotis and Northern Myotis)

With respect to chiropterans, ECCC notes that the risk of mortality would be increased if chiropterans were present during land deforestation activities (clearing), particularly if a maternity roosts was present, a site where females give birth and raise their young.

Woodland Caribou, Boreal population

ECCC notes that according to the recovery strategy for Woodland Caribou, Boreal Population, habitat alteration (loss, degradation or fragmentation) caused by human activities (including mining) and predation are threats of high concern for the species. The effects of habitat alteration can result in a reduction in the viability of a local population of woodland caribou due to a decrease in habitat quality and area, and may even result in a decrease in range size or even extirpation of the local population (ECCC 2020).

Furthermore, as indicated by the MFFP, woodland caribou is a species that is "particularly vulnerable to predation and to an increase in predator densities in a sector, due to the attraction that poorly managed waste materials can represent for them" (MFFP, 2020). Although the zone of influence of the project appears to be infrequently used by woodland caribou, the increase in predator density, particularly in relation to the volumes of waste generated and their management, would constitute a potential adverse effect of the project on caribou.

Caribou, Eastern Migratory Population

The proponent has made a very cursory assessment of the effects of the Project on migratory caribou. However, ECCC expects the effects of the project to be similar to the effects described by the proponent for woodland caribou. Thus, the remainder of the ECCC's advice will focus on woodland caribou.

Mitigation measures

Chiropterans at risk (Little Brown Myotis and Northern Myotis)

The proponent has presented its proposed mitigation measures for chiropteran species at risk in Section 7.3.6 and Table 7-5 of the EIS (WSP Canada Inc., 2021a).

In particular, the proponent plans to implement routine terrestrial vegetation and wetland protection measures and noise, light and air emission management measures that apply to chiropteran species at risk.

The proponent also plans to implement the following mitigation measures:

- Prohibit or restrict deforestation activities as much as possible during the breeding season of chiropterans.
- Prior to dismantling a building or other facility, conduct an inspection (construction voids) to verify its potential use as a maternity or roosting area for chiropterans. If necessary, implement protective measures to ensure the survival of bats.

Woodland Caribou, Boreal population

The mitigation measures that the proponent commits to implementing for woodland caribou are presented in Section 7.3.2, Table 7-5 and Section 10.4.11.4 of the revised EIS (WSP Canada Inc., 2021a) and in Response CCE-12 (WSP Canada Inc., 2021b).

The main mitigation measures identified by the proponent to reduce the impacts on woodland caribou and their habitat are:

- Implement a set of measures to minimize the infrastructure footprint (road, pits, ponds, etc.) to reduce the project's impact on habitat.
- Apply light and noise reduction measures.

- Establish a traffic management plan, including the addition of appropriate signage in specific areas including areas of highest risk of collision with large wildlife.
- Ensure that any sightings of caribou in the vicinity of or within the zone of influence of the project are reported to the operations manager and the environmental manager and, if necessary, that additional measures are implemented to reduce the risk of disturbance and collision.
- Educate workers about not feeding animals and not leaving food around to avoid attracting wildlife to work areas.
- Limit wildlife access to food waste by installing a composter, and by installing lids on garbage bins.
- Incorporate a woodland caribou module into the training of mine employees and contractors.
- Close and reforest the road and the mine site during the closure phase. Give preference to softwood species for reforestation.

ECCC advice and recommendations

ECCC is of the opinion that all mitigation measures proposed by the proponent are appropriate to minimize the effects of the project on individuals and habitat of species at risk, and should be implemented in a timely manner, regardless of the significance of the effects.

Chiropterans at risk (Little Brown Myotis and Northern Myotis)

ECCC is of the opinion that the mitigation measures proposed by the proponent are appropriate. ECCC is also of the opinion that carrying out the deforestation activities outside the breeding season of these species is a key mitigation measure to avoid injuring, killing or disturbing chiropterans.

Woodland Caribou, Boreal population

ECCC recommends that the proponent develop and implement an action plan in the event of the presence of woodland caribou in the vicinity of the mine or during the transportation of ore, in order to minimize the effects of the project on individuals. This action plan should detail clear procedures to be taken if an individual is detected in the zone of influence of the mine, as well as the set of measures that would be implemented according to the most probable scenarios, in order to reduce the risks of disturbance and collision. ECCC considers that the development and implementation of an action plan would be a key measure.

ECCC notes, however, that the effectiveness of such an action plan would rely on the early detectability of caribou in the project zone of influence. Thus, the effectiveness of detection would influence the success of subsequent measures identified in the action plan that would be implemented to avoid effects on individuals. In this regard, ECCC agrees with the proponent that a caribou protection component should be added to the training program for mine employees and contractors. ECCC also recommends that the Agency and the competent authorities, including ECCC and the Quebec government, be consulted before the implementation of the action plan to ensure that it is carried out in the most effective way possible to protect the individuals of this species.

Furthermore, ECCC recommends that revegetation of the mine site be carried out in a manner that mitigates the effects of the project on woodland caribou habitat. ECCC is of the opinion that site restoration should be done in a progressive manner and should focus on the creation of habitats favourable to species at risk, including woodland caribou.

ECCC is satisfied with the proponent's commitments regarding waste management to minimize the risk of attracting predators (e.g. wolves, black bears) to the territory.

ECCC believes that the mitigation measures proposed for woodland caribou are also relevant to migratory caribou.

Residual Environmental Effects

Chiropterans at risk (Little Brown Myotis and Northern Myotis)

The proponent has described and assessed the residual effects of its Project on endangered chiropterans in Section 7.3.6 of the EIS (WSP Canada Inc., 2021a).

The proponent considers that the project is not likely to cause significant residual effects on these species, nor on their habitat.

According to the proponent, the loss (direct and indirect) of nearly 111 ha of habitat represents the main impact of the project on the chiropteran species at risk. The proponent indicates, however, that on a regional scale, numerous replacement habitats of equal or superior quality would be present, as much for the needs in terms of daytime roosts, maternity and feeding sites. The proponent believes that the loss of habitat would lead to a displacement of populations to alternative sites.

Woodland Caribou, Boreal population

With regard to woodland caribou, the residual effects are described in section 7.3.2 of the EIS (WSP Canada Inc., 2021a) as well as in response to questions CCE-12 and CCE-13 (WSP Canada Inc., 2021b). The proponent concludes that the project is not likely to cause significant residual effects on these species.

The proponent quantified the loss of habitat with the biophysical characteristics required by woodland caribou to carry out their life processes. According to the proponent, "it is possible to retain that, in a very conservative (precautionary) approach, the project will cause an additional disturbance of 671.5 ha of habitat for woodland caribou in the zone of influence of the proposed mine, including shrubby and open peatlands. Of this area, approximately 298.1 ha would be associated with alteration within the proposed mine footprint" (WSP Canada Inc., 2021b, p.44).

Furthermore, the proponent considers that the project is not likely to cause significant effects on the woodland caribou and its habitat, nor on the migratory caribou and its habitat. Conclusions are based on the poor habitat conditions present in the study area (high disturbance rate) and on the "insignificant" probability of the presence of individuals in the short and medium term.

ECCC advice and recommendations

ECCC is of the opinion that the mitigation measures planned by the proponent will minimize the residual environmental effects of the project on the two species of chiropterans at risk as well as on the Woodland Caribou, Boreal population and the Eastern migratory population Caribou.

Provided that all mitigation measures outlined by the proponent are implemented in a timely manner, ECCC agrees with the proponent's conclusion regarding the residual effects of the project on each species at risk.

Chiropterans at risk (Little Brown Myotis and Northern Myotis)

In general, ECCC is satisfied with the analysis of the residual effects of the project on Little Brown and Northern Myotis and their habitat.

ECCC notes, however, that the potential for recovery of roosting habitats such as maternity colonies or male roosting sites was not assessed in forested areas of the study area. Although rare in the study area due to recent wildfires, wooded areas with snags (chicot) could support this type of summering habitat that is of great importance to the life history of chiropterans. The recovery stragegy (ECCC, 2018) identifies the destruction or degradation of roosting habitat as a threat to the recovery of these species.

Since the proponent has not made a firm commitment to carry out all deforestation activitiy outside the breeding season, ECCC considers that the project is likely to cause residual adverse effects on chiropterans. Thus, ECCC believes that a firm commitment to implement this measure would alleviate the uncertainties that remain regarding the potential presence of maternity or resting sites for males in the work area.

Woodland Caribou, Boreal population

ECCC is satisfied with the assessment of the residual effects of the project on woodland caribou and their habitat.

ECCC is of the opinion that some environmental effects will remain despite the implementation of mitigation measures, particularly those associated with habitat alteration in the zone of influence of the Project, even though the habitat would generally be unsuitable. The project will induce habitat alterations without contributing significantly to the increase in the rate of habitat disturbance at the Quebec distribution range scale (QC-6).

ECCC would like to reiterate that the population and distribution objectives identified in the recovery strategy are to maintain existing self-sustaining local populations at their current status. According to the Woodland Caribou recovery strategy progress report, the rate of disturbance in the Quebec distribution range (QC-6) increased from 30% to 32% between 2012 and 2017 (ECCC, 2017). The recovery strategy sets a minimum of 65% undisturbed habitat as the threshold for disturbance management that would allow a local population to be self-sustaining. The local population of Quebec woodland caribou (QC-6) is therefore considered self-sustaining.

Because of the nature of critical habitat for woodland caribou, the precise location of this 65% undisturbed habitat within each range will vary over time. This habitat availability and arrangement should be such that woodland caribou can move throughout the range to access the required habitat when needed. The key element of this designation is the achievement and maintenance of a continuous overall range condition that ensures a dynamic system of habitat availability and biophysical characteristics that woodland caribou need to function. This dynamic system constitutes the habitat condition necessary for woodland caribou recovery.

Furthermore, ECCC is of the opinion that effects on individuals are possible even though the project area would be relatively infrequently used by the species and that woodland caribou are likely to avoid the project area during the construction and operation phases. In addition, road transport attributable to the project will increase the risk of collisions as well as the effects related to land fragmentation. It should be recalled that the local population of Nottaway, found in the project sector, is in decline (ECCC, 2017) and not self-sufficient according to a study report cited by the proponent in its EIS. In this context, as a precautionary measure and with a view to reducing uncertainties regarding the risks to individuals should caribou be present in the project's area of influence during the construction and operation phases, ECCC considers that monitoring and follow-up measures should be put in place to prevent the project's effects on individuals.

Cumulative effects

Chiropterans at risk (Little Brown Myotis and Northern Myotis)

The analysis of cumulative effects on endangered chiropterans is presented in Section 8.6.1 of the revised EIS (WSP Canada Inc., 2021a).

According to the proponent, the cumulative effects would be associated with a slight increase in disturbance and habitat losses caused by the project, which could be combined with those of other past, present and reasonably foreseeable future physical activities. The proponent concludes that there will be no significant cumulative effect for endangered chiropterans, particularly considering the large areas of replacement habitat available for these species. It considers that no additional mitigation measures are required.

Woodland Caribou, Boreal population

The proponent submitted a cumulative effects analysis for woodland caribou in response to question CCE-13 (WSP Canada Inc. 2021b). The proponent estimates that the relative contribution of the project to cumulative effects would be low. For example, Project-related habitat loss in the study area (50 km radius from the proposed mine center) would be less than 0.1% and would be located in an area where features offer little quality for caribou to satisfy their life cycle.

In addition, the proponent believes that very few large-scale projects would have a probability of occurring during the mine's operating period (approximately 19 years).

The proponent believes that the residual effects of the project, which could be cumulative with the effects of past, present or future projects in the study area, would not have "significant repercussions on the maintenance of local populations located further south and on the maintenance of habitat condition in terms of area".

ECCC advice and recommendations

Chiropterans at risk (Little Brown Myotis and Northern Myotis)

ECCC is satisfied with the analysis of the proponent's cumulative effects on the two chiropteran species. ECCC recognizes that the loss of habitat caused by forest fires and anthropogenic activities identified by the proponent in the study area contribute the most to the cumulative effects on endangered chiropterans, whose populations are already very fragile due to the white-nose syndrome. ECCC is of the opinion that the contribution of the project to cumulative effects would be low, however, suitable habitat for chiropterans should remain available on a regional scale to support local populations.

Woodland Caribou, Boreal population

ECCC believes that the analysis of cumulative effects on woodland caribou presented by the proponent is cursory. ECCC acknowledges that within the cumulative effects study area, hydroelectric generation, linear structures (roads and power lines) and forest fires were the major contributors to cumulative effects in this area of the QC-6 distribution range.

As described in the Woodland Caribou Recovery Strategy, it is expected that the appropriate land and natural resource management authorities will develop plans for each distribution range. No range plan for the local Quebec population (QC-6) or equivalent document has been developed by the Quebec government to date. In the absence of a distribution range plan, it is difficult to accurately assess the long-term effects on the QC-6 distribution range and to ensure that a minimum of 65% undisturbed habitat is always present. However, based on information provided by the proponent, and according to the Report on the progress of recovery strategy implementation for the woodland caribou, boreal population (ECCC, 2017), it appears that the population and distribution objectives identified in the Woodland Caribou Recovery Strategy for the Quebec distribution range (QC-6) would not be compromised in the short to medium term.

For the Quebec distribution range as a whole (QC-6), ECCC considers that the Project's contribution to the rate of disturbance would be low, and that the Project is unlikely to compromise the objective of maintaining a minimum of 65% undisturbed habitat in this range.

Monitoring and follow-up programs

Monitoring program

The proponent proposes in section 10.4.11.4 of the revised EIS certain measures specific to woodland and migratory caribou, which fall under environmental monitoring, and which would promote the detection of caribou in the area of influence of the project and, if applicable, the rapid implementation of appropriate adaptive measures (WSP Canada Inc., 2021a).

The proponent plans to set up a communication system for truck drivers to ensure rapid reporting of signs of caribou on the road near the mine's area of influence and on the Billy-Diamond Highway.

As mentioned above, the proponent also plans to integrate a module on caribou into the training of mine employees and subcontractors, with the objective of, among other things, "developing their ability to distinguish possible signs of presence, as well as informing them of the monitoring system and action plan in the event of presence, and of the importance of reporting any observation of caribou on the site" (WSP Canada Inc., 2021a, p.10-23).

ECCC advice and recommendations

ECCC recommends that a monitoring program for species at risk be developed and submitted to the Agency and the appropriate authorities prior to the beginning of construction. It would be important that this

program identify, among other things, the activities or operations that may have an effect on species at risk and, for each of these, that it determine the measures to be put in place to ensure that nuisance or disturbance is reduced.

In particular, ECCC recommends that this program describe the monitoring measures to be implemented to verify the presence of maternities in natural sites in the event that deforestation activities are carried out during the chiropteran breeding season or if construction activities were to be carried out in residual natural habitats.

ECCC also recommends that the monitoring program be updated periodically to take into account changes in regulations, such as changes in the status of wildlife species by COSEWIC or SARA. These changes may require additional measures to be put in place to mitigate the effects of the project on species affected by changes in status.

ECCC considers the monitoring measures proposed by the proponent for woodland and migratory caribou to be key measures to minimize the effects of the Project on individuals. These measures should be detailed in the action plan that ECCC recommends in the mitigation measures section of this advice.

Follow-up program

The proponent describes the specific follow-up measures for species at risk that it commits to implement in section 10.4.11.4 of the EIS (WSP Canada Inc., 2021a).

In order to document the effects of the project on the presence of endangered chiropterans at various stages of the mine's operation until the follow-up of the restoration work, the proponent undertakes to carry out five-yearly inventories from the first year of operation until the fifth year following its final closure. These inventories would also make it possible to document the effect of the natural restoration of habitats affected by forest fires on these species.

With regard to woodland and migratory caribou, the proponent undertakes to create a joint working table with the Eastmain and Waskaganish Cree First Nations to discuss the follow-up on caribou to be carried out. The proponent indicates that this follow-up would make it possible to gather information from Indigenous knowledge concerning the fragmentation of caribou habitat and would make it possible to develop adequate mitigation measures to mitigate the potential effects of the project on the harvesting of woodland and migratory caribou for current and future users of the territory.

ECCC advice and recommendations

ECCC is satisfied with the follow-up measures proposed by the proponent concerning the Little Brown Myotis and the Northern Myotis.

ECCC welcomes the proponent's commitment to develop a follow-up program for caribou in cooperation with the Eastmain and Waskaganish Cree First Nations. However, ECCC recommends that the proponent develop and submit a specific follow-up program for woodland caribou to the Agency and the competent authorities before the project is carried out. The follow-up program should verify the accuracy of the conclusions of the environmental assessment and evaluate the effectiveness of the mitigation measures. In addition, the follow-up program may serve as a basis for implementing adaptive management, where appropriate. The follow-up program should include monitoring of predator use of the site, as recommended by the MFFP, in order to "ensure that waste management is being carried out appropriately and is not significantly increasing predator densities in the vicinity of the mine" (MFFP, 2020).

The follow-up program should also address the issue of revegetation of the mine site, particularly if the proponent commits to using softwood species that may be favourable to woodland caribou in the long term. In this case, ECCC would recommend that the follow-up program be long enough to ensure the success of the reforestation and to evaluate the relevance of implementing additional measures such as the control of hardwood species so that the restored habitats become suitable for woodland caribou and migratory caribou as soon as possible.

Other effects to consider

ECCC's responses to the questions in Appendix 3 of the Agency's request for final advice on Other Effects to Consider are presented in this section for Accident and Malfunctions.

ACCIDENTS AND MALFUNCTIONS

Analysis of the risks of accidents or malfunctions

The proponent indicated in Section 9.1 of the revised 2021 EIS (WSP Canada Inc. , 2021a) that the approach to assessing the effects of accidents and malfunctions is based on the following steps

- Identification of risks and development of accident scenarios.
- Evaluation of the consequences of accident scenarios.
- Estimation of the probability of occurrence.
- Determination of risk levels.

The main identified hazards related to the activities are presented in section 9.2 of the same document.

The proponent developed several accident and malfunction scenarios likely to occur during the construction and operation phases of the mine based on mining-related accidentology. This was done using the ARIA database of the Bureau d'analyse des risques et des pollutions industrielles (BARPI) of the French Ministry of Ecology and Sustainable Development and presented the results of case research that occurred since January 2000 in Table 9.5 (section 9.1.3.1) of the revised EIS (WSP Canada Inc. , 2021a). The level of risk for each scenario was determined using a matrix (Table 9.3) that considers the probability of the scenario occurring and the severity of the scenario.

The analysis of technological risks identified in the revised EIS is summarized in Table 9.10 (WSP Canada Inc., 2021a). Of the accident scenarios for which the proponent assessed a "moderate" level of risk, ECCC paid particular attention to the following four scenarios:

- Spillage of hazardous materials (road transport).
- Non-compliant discharge at the final effluent (Mining water treatment).
- Chemical spills (Storage and use of chemicals).
- Collapse of a tailings storage area (Tailings and mine waste rock accumulation area).

Hazardous Materials Spill (Road Transport)

The proponent indicated in section 9.3.10 (WSP Canada Inc., 2021a) that there is a risk of a spill from a tanker truck containing petroleum products (diesel, gasoline) or involving spodumene during road transport on the Billy-Diamond Highway. Consequently, accidental contamination of soil and surface water could occur.

Non-compliant discharge at the final effluent (Mine water treatment)

A mine water treatment plant would be built during the construction phase to the east of the main water management pond in the northern portion of the site (Section 9.3.3 of the revised EIS (WSP Canada Inc., 2021a)). It will treat all site drainage that would be collected in the main water management pond. A malfunction of the water treatment system could result in the accidental release of deleterious substances to the final effluent.

Chemical spills (Storage and use of chemicals)

The proponent states in section 9.3.6 of the revised EIS (WSP Canada Inc., 2021a) that accidental spills of chemicals can occur during transportation, use, handling or storage of these chemicals. Equipment failure or human error can also be the cause of such a spill.

Collapse of a storage facility (Accumulation area)

The proponent explains in section 9.3.9.1 of the revised EIS (WSP Canada Inc., 2021a) that instability of the storage facilities slopes, caused by extreme weather conditions or construction errors, could result in the collapse (sliding) of materials outside the containment area.

ECCC advice and recommendations

ECCC is of the opinion that the analysis of accident and malfunction risks has been adequately presented in the EIS. The risk assessment methodology used is based on the MELCC guide entitled "Analyse de risques d'accidents technologiques majeurs" (Théberge, 2002) (hereinafter referred to as the MELCC Guide). The proponent used the ARIA database of the BARPI and its research was extended to mineral processing in general.

Sensitive environmental elements

Sensitive elements that could be affected by accidents and malfunctions have been identified in Section 9.1.2 of the revised EIS (WSP Canada Inc., 2021a). The identification of sensitive features is limited to a radius of approximately 1.5 km around the project site (Map 9-1, p 9-7).

Hydrology

Three watercourses are located on the project site and could be affected in the event of an accidental spill of a contaminant. The project site is located within the Eastmain River watershed. Stream CE2 flows west (Map 9-1, p. 9-7) while streams CE3 and CE4 flow east.

Biological environment

The proponent mentions that several species, including large mammals, fish and birds, are present in the waterways of the study site or in the study area. Furthermore, the proponent mentions that three species of birds with special status have been inventoried on the site or its surroundings, including the Common Nighthawk, the Rusty Blackbird and the Bald Eagle. Among the mammals of the terrestrial fauna, three have a particular status. These are the Caribou, the Least Weasel and the Wolverine. However, no plants of special status were observed.

ECCC advice and recommendations

ECCC is of the opinion that the proponent has adequately identified the sensitive elements of the environment that could be affected by potential accidents and malfunctions.

Environmental effects caused by accidents and malfunctions

The proponent has presented in Section 9 of the revised EIS (WSP Canada Inc., 2021a) the potential environmental effects for each accident and malfunction scenario that may occur. Potentially affected sensitive components are identified and the potential effects on them have been explained in general terms.

Environmental effects in the event of a spill of hazardous materials

The proponent mentions that a spill of hazardous materials on the Billy-Diamond Highway could eventually occur because hazardous materials and other chemical products will be transported using trucks. The spill, depending on the location of the incident, could contaminate the soil and reach a watercourse. Reaching a watercourse could result in an effect on wildlife and habitats including fish, birds and amphibians. Some species would be more likely to feel the effects of a spill due to their limited ability to move to a less contaminated environment.

Environmental effects in case of non-compliant discharge at the final effluent

The proponent stated that a malfunction of the water treatment system due to design or operational error, human error or mechanical failure could result in the accidental release of deleterious substances to the final effluent or to the environment. He added that untreated or partially treated discharge of mine water could contaminate the waters of CE2 creek and thus violate the MDMER and D019 and adversely affect fish habitat. Impacts to wildlife or plant species may occur.

Environmental effects of a petroleum product spill

The proponent mentions that an accidental spill of petroleum products could contaminate soils with hydrocarbons at the spill site or in a watercourse, notably watercourse CE3. In the case of a watercourse,

petroleum products could affect wildlife and habitats such as fish, birds and amphibians. A fire could also occur following a spill of petroleum products.

Collapse of a storage facility (Accumulation area)

The proponent mentions that the presence of dikes surrounding the containment areas of the storage facilities would have little or no impact on the infrastructures (buildings, power lines, roads, etc.), with the exception of the traffic lane between the accumulation areas. However, the presence of workers on the site would increase the severity of the impact. However, it does not explain what the effects would be on the components of the environment.

ECCC advice and recommendations

In summary, the proponent provided general information on the potential environmental effects of accidents and malfunctions on the components of the environment that could be affected. ECCC is of the opinion that more detail could have been provided on the potential adverse effects of certain scenarios on sensitive components of the environment, particularly with respect to the scenario of instability of the slopes of the tailings and waste rock storage facilities. This last aspect would benefit from further development in the preparation of the site contingency plan, especially in the event of a breach of the dike surrounding the containment areas. However, the environmental effects caused by accidents and malfunctions were, on the whole, adequately described for the purposes of the environmental assessment.

Protective measures, preliminary emergency response protocols or preliminary emergency response plans

The proponent states that despite prevention, if accidents and malfunctions were to occur, it would be important to be able to minimize the effects on the environment through the development and implementation of appropriate mitigation measures. Preventive measures to minimize the potential risks associated with an accident or malfunction for each scenario are presented in Chapter 9 of the revised EIS (WSP Canada Inc., 2021a).

ECCC advice and recommendations

ECCC is of the opinion that the mitigation measures presented by the proponent are adequate. For each type of potential accident, the proponent has identified prevention and mitigation measures to reduce the risk of accidents and malfunctions and to minimize their effects on the environment.

ECCC considers the following to be key measures:

- Maintaining an up-to-date emergency response plan that includes a procedure for responding to spills of oil or other hazardous substances.
- Employees responsible for handling and transporting hazardous products will have received specific training on the handling and hazards involved, either in Transportation of Dangerous Goods, 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.
- Spill kits, appropriate to the nature and quantities of the substances, will be placed at strategic locations on the site (storage and refueling areas). The contents of these kits will be checked periodically.
- Implementation of a monitoring program to reduce the risk of a collapse of a hanger.

Emergency Response Plan (ERP)

In addition to the prevention and mitigation measures to be implemented, the proponent has planned for the development of an Emergency Response Plan (ERP) and has submitted a draft ERP in Appendix K of the revised EIS (WSP Canada Inc., 2021a).

The proponent states that the objectives of the emergency response plan are:

- The ERP will be known to internal interveners, updated annually, readily available in emergency situations and easy to access.
- Response actions will be in accordance with applicable regulations and good industry practice. When

required, this plan will be revised and adapted to any new activity on the site.

The proponent also provides a brief description of the key roles and responsibilities of the ERP's intervenors, as well as the alerting process that must be initiated in emergency situations. An evacuation of the site may be required during an environmental emergency and therefore the outline of the evacuation process is also presented. The proponent indicates that a report will be required following an emergency situation. Training will be required for all persons likely to be involved in an emergency situation to familiarize them with emergency procedures and roles.

ECCC advice and recommendations

ECCC is of the opinion that the protective measures, response protocols and draft emergency plans proposed by the proponent are sufficient and appropriate as they address the types of emergencies that can reasonably be expected to occur, including on-site consequences, related prevention, alerting and preparedness issues, and remedial and recovery actions. The proponent confirms that the draft ERP submitted provides only an outline of the information to be included in the ERP. ECCC notes that this draft plan will be completed prior to the project going into production, when the project definition will be more detailed.

Regarding the ERP, ECCC considers the following measures as key:

- Place the plan in a location that is easily accessible and visible to all employees. Include in the plan a mapping of sensitive elements that could be affected by an accident or malfunction. Maintain the emergency plan and the map of sensitive elements in the environment.
- Describe the emergency response measures for each of the major accident hazards being considered, including measures to protect the environment. In particular, describe what will be done in the event of a hazardous material spill to protect sensitive elements of the environment, including surface water, groundwater and wetlands, fish, migratory birds, or any other sensitive species involved.
- Identify the equipment needed to respond to these emergencies and locate it to ensure its availability.
- Provide staff training in the maintenance and use of response equipment.
- Provide a detailed spill notification procedure and emergency communication plan for external parties.

Documents consulted

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, Québec, mai 2021, 326 p. http://www.environnement.gouv.qc.ca/sol/terrains/guide-intervention/guide-interventionprotection-rehab.pdf.

Agence d'évaluation d'impact du Canada et Gouvernement de la Nation Crie (AÉIC). 2022. Compte-rendu de la réunion multipartite avec le comité conjoint d'évaluation du 4 août 2022 – Contre-expertise et recommandations sur les routes de halage. 11 pages.

Englobe. 2022. Rapport de contre-expertise. Contre-expertise de route de Halage – Mine de lithium Baie-James pour Services publics et Approvisionnement Canada. 8 pages et annexe.

Environnement Canada. 1991. La politique fédérale sur la conservation des terres humides. Service canadien de la faune, Gouvernement du Canada. 17 pages. ISBN 0-662-96940-5. http://publications.gc.ca/collections/Collection/CW66-116-1991F.pdf.

Environnement Canada. 1996. La politique fédérale sur la conservation des terres humides : Guide de mise en œuvre à l'intention des gestionnaires des terres fédérales. 32 pages.

Environnement Canada. 2012a. Cadre opérationnel pour l'utilisation d'allocation de conservation. Gouvernement du Canada. 16 p. https://www.canada.ca/fr/environnement-changement-climatique/services/developpement-durable/publications/cadre-operationnel-utilisation-allocations-conservation.html.

Environnement Canada. 2012b. Programme de rétablissement 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 Canada, Ottawa. xii + 152 p.

Environnement Canada. 2016. Programme de rétablissement du carcajou (*Gulo gulo*), population de l'Est, au Canada, Série de Programmes de rétablissement de la Loi sur les espèces en péril, Environnement Canada, Ottawa, viii + 27 p. Consulté en ligne : www.registrelep-sararegistry.gc.ca/virtual_sara/files/plans/rs_wolverine_eastern_population_f_final.pdf.

Environnement et Changement climatique Canada (ECCC). 2017. Rapport sur les progrès de la mise en oeuvre du programme de rétablissement du caribou des bois (*Rangifer tarandus caribou*), population boréale, au Canada, 2012-2017. Série de Programmes de rétablissement de la Loi sur les espèces en péril, Environnement et Changement climatique Canada, Ottawa, ix + 108 p.

Environnement et Changement climatique Canada. 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.

Environnement et Changement climatique Canada (ECCC). 2019. Lignes directrices de réduction du risque pour les oiseaux migrateurs. Consulté en ligne : https://www.canada.ca/fr/environnement-changement-climatique/services/prevention-effets-nefastes-oiseaux-migrateurs/reduction-risque-oiseaux-migrateurs.html.

Environnement et Changement climatique Canada (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. xiv + 155 pp.

G Mining Services. 2022. Memorandum. Response to question requesting water treatment plant details. May 6 2022. 3 pages et annexes.

Groupe Alphard. 2022. Avis technique. Route de halage avec géomembrane – Mine Galaxy Lithium Baie James. Dossier Alphard : GAL-002-RAP-R00. 32 pages et annexes.

Leduc, R. 2005. Guide de la modélisation de la dispersion atmosphérique, Québec, Ministère du développement durable, de l'environnement et des parcs, Direction du suivi de l'état de l'environnement, envirodoq no ENV/2005/0072, rapport no QA/49, 38p.

Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC). 2017a. Guide d'instruction. Préparation et réalisation d'une modélisation de la dispersion des émissions atmosphériques. Projets miniers. 94 pages. http://www.mddelcc.gouv.qc.ca/air/criteres/index.htm.

Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC), 2017b. 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.

Ministère de l'Environnement et de la Lutte contre les changements climatiques (MELCC), 2018. Normes et critères québécois de qualité de l'atmosphère, version 6, Québec, Direction des avis et des expertises, ISBN 978-2-550-82698-9, [En ligne]. www.environnement.gouv.qc.ca/air/criteres/index.htm

Ministère des Forêts, de la Faune et des Parcs (MFFP). 2020. Avis du ministère des Forêts, de la Faune et des Parcs. Demande d'avis du comité conjoint d'évaluation – Agence d'évaluation d'impact du Canada et Gouvernement de la Nation Crie – portant sur les effets des projets miniers Rose lithium-tantale et Baie-James sur le caribou migrateur et le caribou forestier. N/R : 20200520-3. 5 pages.

Moore, D., Copes, R., Fisk, R., Joy, R., Chan, K. et Brauer, M. 2006. Population Health Effects of Air Quality Changes Due to Forest Fires in British Columbia in 2003. Canadian Journal of Public Health. 97(2), pp. 105-108.

PRICE, W.A. 2009. Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials. Rapport préparé pour le programme MEND. 540 p. et annexes. En ligne : http://www.abandoned-mines.org/pdfs/MENDPredictionManual-Jan05.pdf.

US EPA. 2003. Arsenic Treatment Technology Evaluation Handbook for Small Systems. Office of Water. EPA 816-R-03-014. July 2003. www.epa.gov/safewater. 151 pages

Théberge, M.-C. 2002. Guide : Analyse de risques d'accidents technologiques majeurs, document de travail. Ministère de l'Environnement, Direction des évaluations environnementales. 23 pages et annexes.

WSP Canada Inc. 2018. Mine de lithium Baie-James. Étude d'impact sur l'environnement. Volume 1 à 3. Rapport produit pour Galaxy Lithium (Canada) Inc. Rapport principal (Chapitres 1 à 11), 513 pages, rapports sectoriels et annexes.

WSP Canada Inc. 2019a. Mine de lithium Baie-James. Complément à l'étude d'impact sur l'environnement. Réponses aux questions et commentaires de l'Agence Canadienne d'Évaluation Environnementale – Étape de la concordance. Rapport produit pour Galaxy Lithium (Canada) Inc. 80 pages, cartes et annexes.

WSP Canada Inc. 2019b. Mine de lithium Baie-James. Réponses à l'Agence Canadienne d'Évaluation Environnementale dans le cadre de l'analyse environnementale du projet. Rapport produit pour Galaxy Lithium (Canada) Inc. 223 pages, cartes et annexes.

WSP Canada Inc. 2019c. Mine de lithium Baie-James. Réponses aux demandes de précision sur les réponses aux questions (série 1) de l'Agence Canadienne d'Évaluation Environnementale dans le cadre de l'évaluation environnementale du projet. Rapport produit pour Galaxy Lithium (Canada) Inc. 88 pages et annexes.

WSP Canada Inc. 2019d. Mine de lithium Baie-James. Réponses aux questions et commentaires reçus du MELCC dans le cadre de l'analyse de l'étude d'impact sur l'environnement. Rapport produit pour Galaxy lithium (Canada) inc. 146 pages, cartes et annexes.

WSP Canada Inc. 2020a. Mine de lithium Baie-James. Réponses à la demande de complément d'information du 8 janvier 2020 reçue de l'Agence d'Évaluation d'Impact du Canada dans le cadre de l'évaluation environnementale du projet. Rapport produit pour Galaxy Lithium (Canada) Inc. 35 pages et annexes.

WSP Canada Inc. 2020b. Mine de lithium Baie-James. Résultats des essais cinétiques en colonnes - Minerai et diabase. Rapport produit pour Galaxy Lithium (Canada) Inc. 37 pages et annexes.

WSP Canada Inc. 2020c. Mine de lithium Baie-James. Réponses à la deuxième demande d'information (1re partie) reçue de l'Agence d'évaluation d'impact du Canada dans le cadre de l'évaluation environnementale du projet. Rapport produit pour Galaxy Lithium (Canada) Inc. 113 pages et annexes.

WSP Canada Inc. 2021a. Mine de lithium Baie-James. Étude d'impact sur l'environnement. Juillet 2021 (Version 2). Rapport produit pour Galaxy Lithium (Canada) Inc. 11 Chapitres, rapports sectoriels et annexes.

WSP Canada Inc. 2021b. Mine de lithium Baie-James. Réponses additionnelles à la deuxième demande d'information reçue de l'Agence d'Évaluation d'Impact du Canada dans le cadre de l'évaluation environnementale du projet. Rapport produit pour Galaxy Lithium (Canada) Inc. 57 pages et annexes.

WSP Canada Inc. 2022a. Mine de lithium Baie-James. Réponses à la troisième demande d'information reçue de l'Agence d'évaluation d'impact du Canada dans le cadre de l'évaluation environnementale du projet. Rapport produit pour Galaxy lithium (Canada) inc. 136 pages et annexes.

WSP Canada Inc. 2022b. Projet de Mine de lithium Baie-James. Solution de rechange pour la construction des routes. Note technique produite pour Galaxy Lithium (Canada) Inc. 14 pages et annexes.

WSP Canada Inc. 2022c. Mine de lithium Baie-James. Réponses à la 4e demande d'information reçue du Ministère de l'Environnement et de la Lutte contre les changements climatiques dans le cadre de l'évaluation environnementale du projet. Rapport produit pour Galaxy lithium (Canada) Inc. 138 pages et annexes.

WSP Canada Inc., 2022d. Note technique – Information supplémentaire à la suite des réponses à la 4e série de questions et commentaires. Projet mine de lithium Baie James. 14 mai 2022. 6 pages et annexes.

WSP Canada Inc. 2022e. Mine de lithium Baie-James. Informations complémentaires concernant les routes de halage – Projet Mine de Lithium Baie-James. Rapport produit pour Galaxy lithium (Canada) Inc. 6 pages et annexes.