






THE IMPACTS OF MINING ACTIVITIES ON WATER

A technical and legislative guide to support collective action

Produced by Eau Secours with the support of the Coalition Québec meilleure mine, MiningWatch Canada, the Western Mining Action Network, Coalition QLAIM, and the Regroupement Vigilance mines Abitibi-Témiscamingue

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Table of Contents

Introduction

In Quebec, the media often singles out the mining industry for being a repeat offender. This reputation stems from the bad practices of certain mine developers who have abandoned contaminated mine sites and left Quebec residents on the hook for billions of dollars for restoration, turned rivers red for dozens of kilometres, or have used lakes as dumping grounds for the tailings from iron ore processing plants.

There is a growing awareness about the environmental cost of mining and the fragility of the natural world. Citizens and communities who are experiencing these negative impacts are increasingly denouncing the industry's archaic practices – practices which remain possible thanks to an outdated legislative framework.

At the same time, demand for minerals used in the manufacturing of energy transition technologies such as lithium, graphite and cobalt[1] has risen sharply. Over the last two years, both the provincial government of Quebec and the Canadian federal government have each launched a strategy to develop and exploit these minerals.[2] Strong demand for gold since 2020 has also pushed the price to historically high levels. Indeed, investors have flocked to this safe-haven asset because of, among other things, uncertainty tied to the COVID-19 pandemic.[3] These two phenomena have resulted in a sharp increase in the granting of mining titles (claims) in Quebec, which will likely translate into the development of additional mines in the years to come.

This guide brings together the basic scientific, technical, and legal knowledge related to mining with the goal of supporting local populations, Indigenous nations, municipalities, Regional County Municipalities (MRCs) in Quebec, environmental protection organizations, grassroots committees, and other entities and individuals who are organizing against such projects in their regions and territories. The information is presented in such a way as to draw the reader's attention to the key issues associated with mining which could have significant or irreversible impacts on water. The guide goes into detail about much of the legislation governing these projects, and while some of the mentioned legislation may be specific to the province of Quebec, many other jurisdictions have similar laws or legal frameworks. The reader could take what's outlined here as a starting point and apply it to their own circumstances. The final chapter lays out possible actions that can be taken at the regional, municipal, and local levels to ensure that new mining projects are carried out with due regard for the integrity of the environment and for the health and well-being of future generations.

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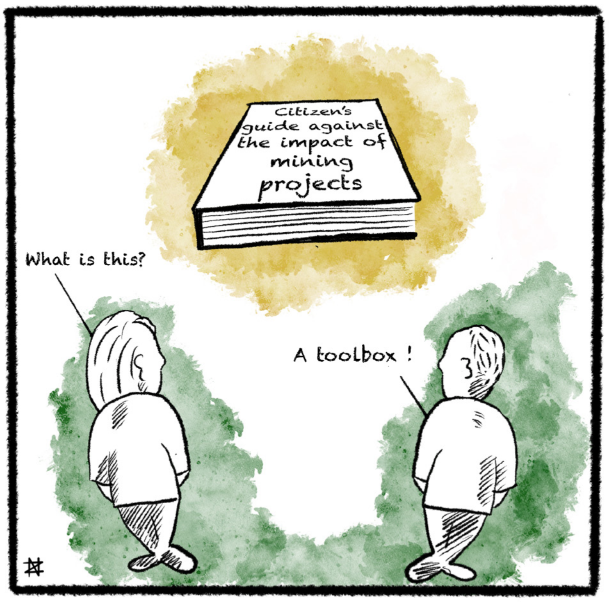
1 Twenty-two minerals are considered critical and strategic by the Quebec government. They are listed in the appendix to the Plan mentioned in footnote 2.

2 Government of Quebec. *Québec Plan for the Development of Critical and Strategic Minerals*, 2020. https://www.quebec.ca/en/government/policies-orientations/quebec-plan-development-critical-strategic-minerals; and Natural Resources Canada. *The Canadian Critical Minerals Strategy: From Exploration to Recycling: Powering the Green and Digital Economy for Canada and the World*, 2022. https://www.canada.ca/en/campaign/critical-minerals-in-canada/canadian-critical-minerals-strategy.html

3 Natural Resources Canada. *Gold Facts*. Accessed online February 3, 2023: https://natural-resources.canada.ca/our-natural-resources/minerals-mining/minerals-metals-facts/gold-facts/20514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Chapter 1 – Mining cycle

1.1 Exploration

Mineral exploration involves all of the surveys, operations, and work conducted for the purpose of discovering and classifying a mineral deposit suitable to be mined.[4]

A contractor's first step is to identify the geological evidence present in a given region by analyzing existing maps or historical documentation. Evidence can include traces observed on or near the earth's surface, which suggest that a mineral substance may be present in the vicinity and in interesting quantities, but whose true extent is yet unknown.[5] When the presence of presumed profitable evidence is confirmed, field exploration continues through the activities outlined in the table below. The goal of these activities is to obtain more information to complete the studies that will define whether a mineable deposit is present, i.e. whether it contains the desired **mineral** in the sufficient quantity and grade to be profitable.

Table 1 - Categorization of the different types of mineral exploration work as outlined by the Coalition Québec meilleure mine[6]

Type of work	Preliminary exploration	Intermediate exploration	Advanced exploration
Drilling, stripping, excavation	Activities related to **surveying** that do not exceed the following criteria	Weight of heavy machinery ≥ 2 metric tons	**Drilling** ≥ 15,000 linear m/year
Moving or sampling soil or rock and bulk sampling		Volume moved or sampled ≥ 1000 m3 or area impacted ≥ 1 ha	Volume ≥ 1000 m3 or area ≥ 4 ha
Deforestation		Cumulative area of all mining titles concerned ≥ 1 ha	*Ibid* ≥ 4 ha
Flights by helicopter or bush plane		Altitude < 600 m, duration ≥ 6 h/day for > 5 days/30 total days	*Same* for > 20 days/60 total days

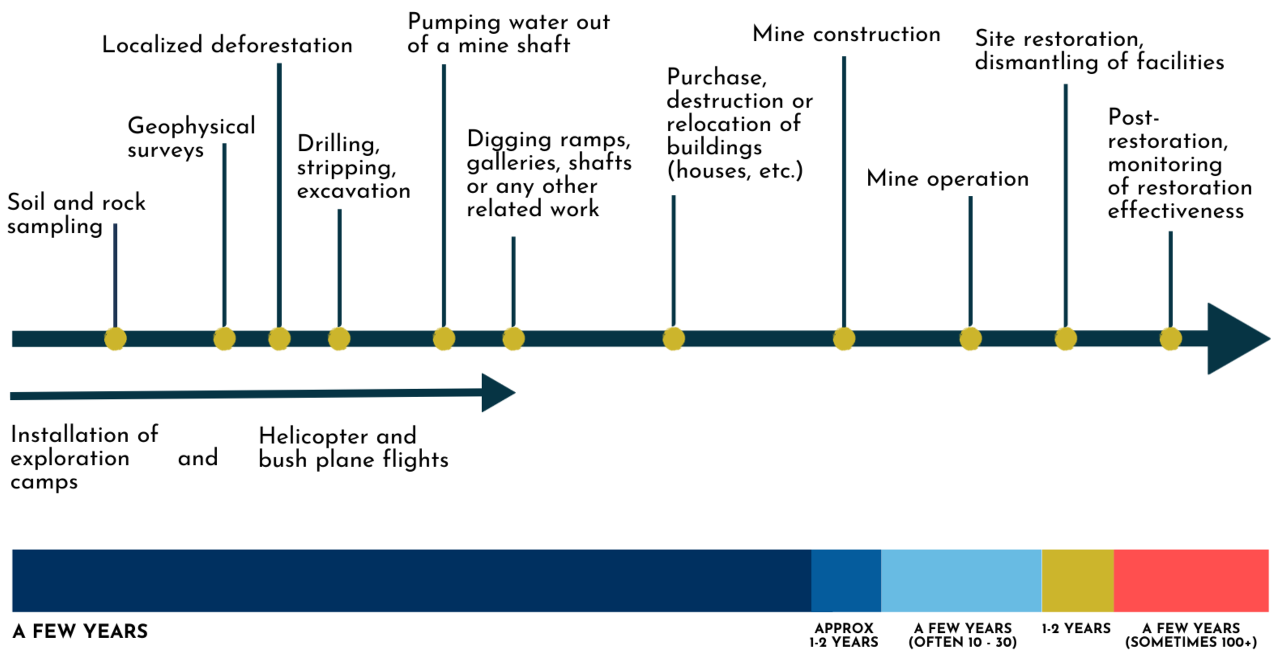
4 Ministère des Affaires municipales et de l'Habitation, section *Aménagement du territoire. Orientations gouvernementales - Activité minière : Les travaux d'exploration minière*, accessed online June 6, 2023: https://www.mamh.gouv.qc.ca/amenagement-du-territoire/orientations-gouvernementales/activite-miniere/#c16941

5 Ministère des Ressources naturelles et des Forêts. *Le processus de développement minéral*, accessed online June 6, 2023: https://gq.mines.gouv.qc.ca/geologie-pour-tous/processus-developpement-mineral/#:~:text=L'exploration%20de%20base%20constitue,suffisantes%20pour%20%C3%AAtre%20exploit%C3%A9e%20commercially.

6 Ecojustice. *Setting a Gold Standard – Reforming Quebec's Mining Act.* https://www.ecojustice.ca/wp-content/uploads/2014/11/Setting-a-Gold-Standard-2009.pdf

Setting up exploration camps		Use > 4 people for > 200 person-days/year	Use > 8 people for > 2000 person-days/year
Digging ramps, tunnels, shafts or other related structures (jacking)	N.A.	N.A.	All jacking work
Purchase, destruction or relocation of buildings (expropriation)	N.A.	N.A.	All expropriation activities
Pumping water out of a mine shaft (dewatering)	N.A.	N.A.	All **dewatering** work

Here's a typical timeline for the development of a mining project, from the initial exploration phases through to the exploitation phase:



Of all these mineral exploration activities, the collection of **rock** or **soil samples** is one of the most common, and therefore has the greatest impact on the environment and the people who live there. This is generally done by drilling or excavation, either manually or by using machinery.

©Émile Cloutier-Brassard

1.1.1 Sample collection by drilling, excavation, and bulk sampling

Diamond drilling is the most common type of mineral exploration drilling. It produces cylindrical pieces of rock that are extracted from bedrock called "cores," which allows an assessment of the rock's properties – particularly its mineral and metal content.[7] The length of a diamond drill hole can range from just a few metres to several thousand metres. The size of the machinery, meanwhile, can vary from that of a simple portable tool to that of a small house. In the case of the latter, a bulldozer, skidder, or other machine of comparable size and strength is needed to transport the drill to the sampling site. In general, all of these machines (drills, bulldozers, etc.) are powered by diesel and hydraulic engines.[8]

Other sampling methods include **trenching** and bulk sampling through blasting. These types of sampling both require heavy machinery. Bulk sampling involves the collection of samples taken more haphazardly from excavated soil trenches or areas of blasted rock. This type of sampling can be carried out by mechanical excavators, and involves the collection of very large volumes of samples – up to several hundred tonnes. The aim of this exploration activity is to define more precisely the location of minerals that could be extracted as part of a potential mining operation.[9]

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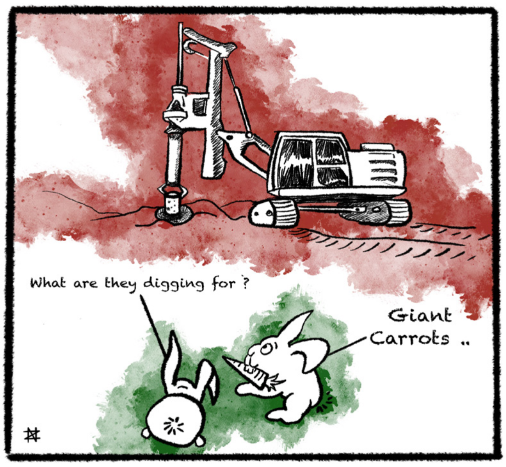
7 Drilling, Mines and Minerals Division, Ontario Ministry of Natural Resources and Forestry

8 Ibid

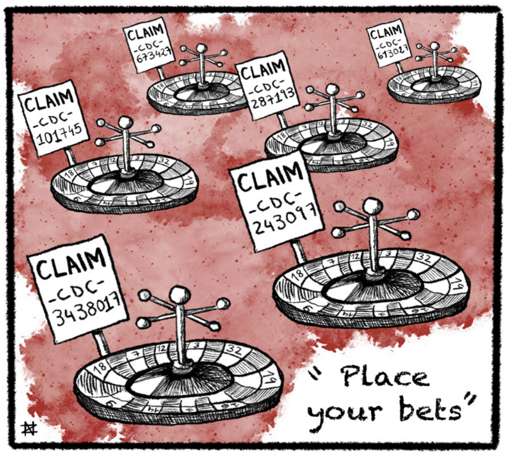
9 Ministère de L'énergie et des Ressources Naturelles. *Guide du promoteur pour une autorisation d'échantillonnage en vrac*, March 2021. https://mrnf.gouv.qc.ca/wp-content/uploads/GM_promoteur_echantillonnage_vrac.pdf

1.1.2 From exploration to mining

Most exploration projects will never become a mine. Only one in ten exploration projects make it to the drilling stage, and approximately 1 in 1000 drilling projects lead to the discovery of a mineable mineral deposit. In short, it is estimated that it takes more than 1000 exploration projects for a mine to see the light of day. This means that most exploration projects are only carried out on a limited scale. But it also means that it takes a lot of exploration work before a mine can be considered, and that these numerous exploration projects – often located in the same region – can generate significant and cumulative impacts. It generally takes 10 to 15 years and investments of up to several tens of millions of dollars[10] for a mining project to become a mine.



In Quebec, only the holder of a **claim**, also known as an exploration mining title issued by the Ministry of Natural Resources (we'll use the French acronym MRNF in this Guide to refer to the *Ministère des Ressources Naturelles*), is authorized to carry out mineral exploration within a designated area.[11] On average, the claim area corresponds to approximately 50 hectares or 0.5 square kilometres.



Almost all of Quebec's public and private land can be explored by developers for ore. Certain restrictions apply, most of which are recorded in the MRNF's GESTIM database.[12] For example, a private landowner can refuse access to their land for exploration work (see section 5.2). In addition, RCMs can ask the government to exclude sectors of their territory (e.g. urbanized areas, parks, flood zones, heritage sites) from mineral exploration under the framework for **territories incompatible with mining activity** (TIAM - acronym in French) managed by the Minister of Municipal Affairs (*Ministère des Affaires municipales* - MAMH), in consultation with the MRNF.

10 The life of a mine. https://oma.on.ca/en/ontario-mining/resources/LIFE-OF-A-MINE-CHART-web-690.png

11 Ministère des Ressources naturelles et des Forêts. *Exploration Rights*. https://mrnf.gouv.qc.ca/en/mines/mining-rights/exploration-rights.

12 Ministère des Ressources naturelles et des Forêts. *Gestion des titres miniers*, accessed July 21, 2023. https://gestim.mines.gouv.qc.ca/MRN_GestimP_Presentation/ODM02101_login.aspx

1.2 Exploitation

1.2.1 Planning, environmental assessment and construction

Once the economic, technical and legal feasibility of a project has been established, a developer will consider operating a mine. Although the concept of social acceptability is, for the moment, relatively poorly defined, it is no less important when it comes to analyzing the feasibility of a given project.[13] The initial stages of mine development include producing technical and economic studies and environmental assessments. A **mining permit** and environmental authorizations must then be obtained before the mine can enter the planning and construction phases. At this stage, the MRNF also requires a financial guarantee from the developer to ensure that once operations have been completed, the site is reclaimed and the environment restored.[14] Only then do actual mining operations begin – with ore extraction, processing, and transportation taking place along with the transportation and storage of the mine waste generated by operations.

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During the planning stage, all aspects of the future mine are examined and planned out, including determining the process for extracting and separating ore, as well as all requirements for infrastructure, schedules for construction and commissioning, and all related environmental and social aspects of operations.[15]

Mine site construction takes anywhere from a few months to around two years. This phase begins with clearing the land, deforestation, **stripping**, and levelling. Mining infrastructure is then built: access roads to the site, site roads, mine waste management areas, power generation and distribution infrastructure, industrial area (ore processing, vehicle maintenance, storage of explosives, chemicals and petroleum products), buildings (offices, accommodation areas) and wastewater collection and treatment facilities.

The scale and complexity of what is carried out during construction vary enormously from one project to another. Mining sites can range from small and medium-sized underground infrastructures to huge open-pit mines, with surface areas ranging from hundreds to thousands of hectares.

13 Nantel, Marc. *Dossier minier : L'acceptabilité sociale, une simple façade*, February 15, 2023. https://lautjournal.info/20230215/dossier-minier-lacceptabilite-sociale-une-simple-facade

14 Ministère des Ressources naturelles et des Forêts. *Mining Reclamation - Legislative Provisions*, accessed June 19, 2023. https://mrnf.gouv.qc.ca/en/mines/mining-reclamation/legislative-provisions/

15 Ministère des Affaires municipales et de l'Habitation. *Orientations gouvernementales - Activité minière*, accessed June 19, 2023. https://www.mamh.gouv.qc.ca/amenagement-du-territoire/orientations-gouvernementales/activite-miniere/

1.2.2 Exploitation

The exploitation phase of a mine typically lasts between 10 and 30 years. The main activities that take place during this phase are the extraction and processing of ore, as well as the management of mining waste and water.[16]

Where applicable, open-pit mining is often the preferred method for developers to extract ore, as the economic cost per tonne of ore extracted in this way is significantly lower than that of ore extracted using underground methods. It should be emphasized that environmental and social costs are not taken into account in the mining developer's financial analysis. Open-pit mines generate much more solid waste than underground mines; it is estimated that the weight of solid mining waste is around six times greater for open-pit mines than for underground mines for the same quantity of substance mined (gold, iron, lithium, etc.). Underground mines have a much lower ratio between the volume of waste rock and the volume of ore extracted, simply because extraction is more selective.

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In open-pit iron mines, around 3 tonnes of solid waste are generated for every tonne of iron produced. For other metals (e.g. nickel, zinc, lithium), between 20 and 200 tonnes of solid waste are generated per tonne of metal.[17] In other words, 95 to 99% of the rock extracted is solid waste. The excavated rock from which the ore has been extracted is referred to as **waste rock**. It's important to stress that while this rock is not actually 'waste' from a geological perspective, through the eyes of the developer using an economic lens, it is something that holds no value. In gold mines, actual gold is present in the approximate proportion of one gram (1 g) per tonne (1 t) of ore mined.[18, 19] And to get to the ore, hundreds of thousands more tonnes of waste rock will be unearthed, which means approximately 3 million tonnes of waste rock and processed ore (tailings) could be leftover for every 1 tonne of gold produced. In summary, we obtain the following ratios:

16 For more information on the number of mining projects under development and active mines, as well as the minerals extracted in Quebec, see: Ministère des Ressources naturelles et des Forêts. *Mineral resource maps*, section *Producing mines and mines in care and maintenance*, and *Mining projects* in PDF format. Accessed June 19, 2023. https://mrnf.gouv.qc.ca/en/mines/publications/mineral-resource-maps/

17 MiningWatch Canada. *Mine Waste in Canada: A Growing Liability*, October 5, 2020. https://miningwatch.ca/blog/2020/10/5/mine-waste-canada-growing-liability

18 Interview. "*L'industrie minière crée des phénomènes qu'elle ne sait pas maîtriser*" in Z: Revue itinérante d'enquête et de critique sociale, 2018/1, issue 12, p. 50-53. https://www.cairn.info/revue-z-2018-1-page-50.htm

19 Benzaazoua, Mostafa. *Innovations en environnement minier : entre gestion intégrée en amont et restauration en aval*, UQAT, p.7. https://www.uqat.ca/resan/doc/mostafabenzaazoua.pdf

Table 2: Quantity of mining waste generated by open-pit mining per tonne of substance mined (source: MiningWatch Canada)

Substance	Quantity of mining waste (tailings and waste rock) generated for each tonne of element extracted from an open-pit mine
Iron	3-10 tonnes and beyond
Lithium, graphite	20-40 tonnes and beyond
Copper, nickel, zinc, etc.	200-500 tonnes and beyond
Gold	1 million tonnes and beyond

Typically, waste rock is transported to the mine waste storage area. It is stored in heaps, called **stockpiles**, which increase in size over the years. If chemically neutral, some of this waste rock can also be used for road construction in the early stages of a project, or to backfill excavated areas of the site.

The extracted ore is then transported to the industrial sector of the mine site for treatment. The aim is to separate the richest portion of the ore from other mineral substances that hold no economic value. The tailings produced during ore processing take the form of fine particles mixed with a certain percentage of water. They form a slurry that is transported to a **tailings facility**, a naturally- or artificially-dammed area designed to contain the tailings. Tailings ponds can contain anywhere from a few million to a few billion tonnes of mine tailings. In thicker mixes, tailings can also be stored among waste rock in stockpiles. This method of storage is known as "co-disposal" and is described in detail in section 3.4.2 of this Guide.

It's important to note that tailings impoundments and stockpiles remain on the mine site in perpetuity. Safety is therefore a very important factor in choosing the method for storing mine waste to ensure structural integrity. The most significant structural risk is a breach in a dam, which could result in a spill of tailings into the surrounding environment.

Another important activity during mine operations is water management. All water which has come into contact with mining operations must be collected and decontaminated before being released into the surrounding environment. This water comes mainly from rainwater runoff from the site, percolation of rainwater through the stockpiles, and waste water from the tailings ponds. **Mine water**, which must be pumped from the **pit** during rock extraction operations, is another major source of water that must be managed on a mine site. All of this water must be transported through pipes and ditches to settling or decontamination stations before being released into local waterways.

1.3 Restoration and post-restoration

When all the ore has been extracted, or when extraction is no longer profitable, mining operations cease. The site can sometimes be temporarily put on care and maintenance, to be reopened if conditions become more favourable to the profitability of the mine's operations.[20]

20 Government of Quebec. *Les travaux d'exploitation minière - Les orientations gouvernementales en aménagement du territoire*, accessed June 19, 2023. https://www.mamh.gouv.qc.ca/fileadmin/publications/amenagement_territoire/orientations_gouvernementales/travaux_exploitation_miniere.pdf

Once the mine is closed, the site must be secured, dismantled, and restored in accordance with the plan approved by the MRNF during the pre-development stages.

A closed mine becomes safe when access to potentially hazardous structures is controlled (e.g. shafts, pits, tailings facilities). At closure, infrastructure no longer required is also dismantled (roads, ore or water treatment plants, etc.).

We must also ensure that the structures that will remain in place are stable and, if necessary, impermeable. Work may therefore be undertaken to further stabilize the banks, benches, stockpiles, dikes and any other structures that could crack, collapse or leak contaminated water. It is also common for some water collection and treatment facilities to remain on site after closure, since it is rare that water quality will return to a satisfactory level so quickly following contact with mining activities.

A closed mine site will generally undergo landscaping and re-profiling to improve its visual appearance and to restore vegetation, soil, and water flow close to their initial state. Topsoil (**overburden**) stored during operation can be used for this purpose. Large-scale seeding is also an option for re-greening the site. It should be noted, however, that given the scale of the work carried out and the impacts generated, it is never possible to return the site to its original state. Restoration therefore can only ever be considered partial.

After restoration, the site must be monitored on a regular, long-term basis to guarantee the site's structural integrity and the water quality draining from the site.

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Chapter 2 - Impacts of mining activities on water

A mining project has significant impacts on all aspects of the environment: water, soil, climate, fauna, flora, sensitive environments (e.g. eskers, wetlands), the economy, the activities of local populations, the exercising of ancestral and treaty rights by Indigenous peoples, and so on. This Guide specifically focuses on the impacts on water. These impacts are overlapping and complex, and remain a major technical and financial challenge for mining developers.

2.1 Exploration

While the impact of mineral exploration activities on water is not on the same scale as an operating mine, depending on the type of work being carried out and the concentration of exploration activities in a given region, it can still be significant.

Some impacts of clearing land, deforestation, and stripping including: the destruction of ecosystems through the removal of thousands of cubic meters of soil and vegetation; the excavation or compaction of soils, wetlands or riverbeds affected by the construction of crossings (trenches, ruts, excavations, backfilling); erosion of soils, which generate suspended solids (TSS) in the water; and risks of hydrocarbon spills.

©Google Maps; Revimat

Similarly, drilling activities can have significant effects on water, such as: contamination of groundwater through hydrocarbon spills or by injecting drilling fluid laden with heavy metals,[21] degradation of aquatic

21 Wikipedia. *Boue de forage*, accessed online June 19, 2023. https://fr.wikipedia.org/wiki/Boue_de_forage. An English page is also available: *Drilling Fluid*, https://en.wikipedia.org/wiki/Drilling_fluid. It should be noted that the quantity of drilling fluid

ecosystems when water is pumped away from these environments for the purpose of injecting it into boreholes, contamination of multiple water tables, or disrupting the hydrography when drilling creates a connection between ground and surface water tables.[22]

2.2 Construction and operation

The construction and operation of mining sites permanently affect water and aquatic ecosystems, as streams and lakes are diverted or drained – in whole or in part – to access and extract the ore below. Building mining infrastructure, notably the pit and stockpiles, also involves permanently changing the regional **hydrographic network**, as the land and natural flows of water are modified. Federal legislation (see section 4.2.1.1) allows for the destruction of waterways, bodies of water, and wetlands, in permitting under certain conditions these areas to be used as mine waste dumps.[23] This use of aquatic environments is highly contested, however, notably by the authors of this Guide. It is a practice that, in the opinion of our organizations, the Quebec government should systematically prevent.[24]

The quality of surface water is also subject to major impacts, especially from excavating rocks and processing ore. Similarly, if contaminants leach underground, groundwater quality can be irreversibly altered.

2.2.1 Construction

As a result of deforestation, stripping of vegetation cover and soil levelling, site construction generally affects the **watershed**'s hydrographic network, as well as the **hydrological regime** of the remaining bodies of water. Indeed, the development of a mine site often requires the destruction or modification of local water sources and wetlands in order to build infrastructure or to circumscribe the future extraction pit. As a result, the regional[25] water cycle is thrown out of balance, as the main inflows and outflows of water are altered. Any aquatic, subaquatic, terrestrial or avian species dependent on these ground or surface waters are also impacted by these modifications to the water cycle.

These modifications include changes to the hydrographic network, changes to wetlands and groundwater, destruction of these environments, backfilling with sand, earth or gravel, dewatering of these environments and water contamination. The following is a list of expected impacts during the construction phase for a mine:

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varies between 10 and 100 kg per borehole. Its presence in the environment can therefore quickly become significant, as multiple sites are drilled.

22 A particularly dramatic example of this type of impact is that of Almaden Minerals in Mexico's Sierra Norte de Puebla region, featured in the following report by Radio-Canada: *Minières canadiennes : les nouveaux conquistadors*. February 27, 2020. https://ici.radio-canada.ca/tele/enquete/site/segments/reportage/155637/mines-minieres-compagnie-mexique-colombie-amazonie-canada-conflit

23 Environment and Climate Change Canada. *Status Report on the Performance of Mines Subject to the Metal Mining and Diamond Mining Effluent Regulations in 2018*, Table 10. https://publications.gc.ca/collections/collection_2022/eccc/En11-20-2018-eng.pdf

24 To our knowledge, one of the most notable exceptions to this use of lakes is the Mont-Wright mine site, where the past use of a lake (Hesse Lake) as a mine waste dump has been regularized, covering a surface area of 405 hectares. And recently, the provincial government authorized a project to store mining waste in eight lakes at the Bloom Lake mine site on the Nitassinan (Côte-Nord). However, this was done against the recommendation of the Bureau d'audiences publiques sur l'environnement (BAPE) and a large part of the Quebec population. On this last point, see in particular: Gouvernement du Québec. *Decree 166-2022*, February 16, 2022, Gazette officielle du Québec. https://www.environnement.gouv.qc.ca/evaluations/decret/2022/166-2022.pdf

25 Réseau québécois sur les eaux souterraines. *Les eaux souterraines*. Accessed June 19, 2023. https://rqes.ca/les-eaux-souterraines/

- **Eutrophication** of bodies of water from the release of nitrogen compounds from explosives;
- Generation of suspended solids (TSS) in surface waters as a result of road construction, excavation of granular materials and machinery traffic;
- Oil spills or leaks from machinery or fuel tanks;
- Encroachment on waterways and wetlands by machinery and other vehicles;
- Generation of contaminants (heavy metals, acidic pH, etc.) in water (rainwater or other) coming into contact with materials extracted from the site (waste rock, overburden, etc.);
- Generation of TSS, increase in pH of surrounding waters and consumption of sand and water associated with the on-site manufacturing of concrete, where applicable;
- Generation of domestic wastewater on site.

Without being exhaustive, this list summarizes several of the main impacts observed at mine sites during construction. When the above-mentioned contaminants find their way into the surface water without being contained or treated, they can seep into the groundwater as water percolates through the permeable soil. This has the potential to cause contamination which is nearly impossible to eradicate later, as decontaminating groundwater is a very costly and arduous operation. When groundwater is contaminated, therefore, the most common response is to contain the water rather than clean it up, thereby sacrificing potential water sources.

All of these potential problems may also be encountered during the operational phase. Further impacts are detailed in the following section.


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2.2.2 Exploitation

Mining exploitation operations consist mainly of excavating rock and extracting the desired ore, which will then be processed. This activity is the main source of waste in Quebec. It is estimated that the quantity of mining waste in Quebec in 2019 (235 million tonnes) corresponded to 50 times the quantity of domestic waste produced in the province as a whole (5 million tonnes),[26] generating potentially significant impacts on aquatic ecosystems. The section below provides an overview of the potential impacts of mining operations.

2.2.2.1 BLASTING

During the operation phase – and to a lesser extent during the construction phase – rock located in the pit or shaft must be first fragmented in order to be excavated. This is usually done by drilling and blasting. The first step is to drill holes and insert explosive charges (typically Ammonium nitrate-fuel oil - ANFO). When these charges explode, they release large quantities of nitrogen compounds, which can have negative impacts when they reach local water sources through runoff (including eutrophication).

26 MiningWatch Canada. *Turning Down the Heat: Can we mine our way out of the climate crisis?*, international conference, November 2020. https://miningwatch.ca/sites/default/files/miningwatch_review_page.pdf

©Getty Images, Canva

2.2.2.2 Production and storage of mine waste

Mine waste produced during the operation phase consists of waste rock, overburden, and tailings. Most of the overburden is removed during mine construction, but a significant quantity will be left to be removed as the open pit is enlarged. Overburden and waste rock are generally stored in stockpiles, whereas tailings are stored in tailings impoundments or are co-disposed (section 3.4.2) together with waste rock.

Accidental spillage due to a dam failure is a major environmental risk associated with tailings impoundments. Although the occurrence of this risk is relatively low, dam failures have occurred a dozen times in Quebec over the past 10 years.[27] The environmental impacts associated with a mine tailings spill are very significant, as waves of sludge destroy and contaminate everything they encounter, including communities and waterways, over distances that can exceed tens of kilometres.

Waste rock piles are more stable than tailings impoundments as they are essentially composed of solid waste. The main environmental risks associated with waste rock piles are geochemical: **acid mine drainage** (AMD) and **contaminated neutral drainage** (CND). These phenomena are due to chemical reactions between certain minerals contained in waste rock (sulphides, minerals containing heavy metals, etc.) and their environment (air and water).[28] It should be noted that overburden stockpiles, tailings im-

27 Coalition pour que le Québec ait Meilleure Mine. *BAPE Projet d'agrandissement mine Mont Wright*, January 23, 2018. https://miningwatch.ca/sites/default/files/2018-01-23-bapemontwright-rv.pdf

28 Bussière, Bruno. *Restauration des sites miniers : ne pas répéter les erreurs du passé.* IRME UQAT-Polytechnique, pages 15-16. https://www.e4m.fsg.ulaval.ca/fileadmin/documents/Evenements/Presentation_ULaval-Chaire_CRSNG-UQAT-BBussiere.pdf; International Network for Acid Prevention. *The Global Acid Rock Drainage Guide*, 2014. http://www.gardguide.com/index.php?title=Main_Page; Veillette, Julie. *Bilan sur l'incidence des mines de métaux sur le milieu aquatique*, Environment Cana-

poundments and piles of loose materials and concentrated ore following the extraction process can also produce AMD and CND, as these materials may also contain minerals which become problematic when exposed to the elements. The contaminants and acidity generated by AMD and CND have devastating effects on aquatic flora and fauna if they are not neutralized. In addition to being toxic, most dissolved metals are bioaccumulative, meaning that living organisms that ingest them cannot eliminate them. As a result, these metals find their way into the food chain, including the fish we catch and into the humans who eat them, for an indefinite period and over a sometimes vast area.

2.2.2.3 Ore separation

Rock extracted from the pit is processed to recover valuable minerals. First, the ore (i.e. the rock containing the minerals of interest) is crushed into coarse particles. It is then crushed again to obtain finer particles. Grinding is carried out using water, sometimes with the addition of certain chemical substances (e.g. lime, sodium carbonate, sodium cyanide, sulfur dioxide) to improve the separation of the minerals from the ore.[29] The subsequent separation process may be physical or chemical. The most common physical separation processes are magnetic separation, gravity separation, and flotation separation (the latter also uses chemical reagents such as xanthates, sulfosalts, and thiosalts). The main chemical separation process is **leaching**, in which a chemical agent is used to dissolve the desired metal. The addition of such products contributes to the overall contamination generated by mining sites - cyanide, widely used in gold mining, being one of the most toxic chemical agents in the industry.

2.2.2.4 Mining effluent

Quebec is particularly rich when it comes to water resources, such as lakes and rivers. Large quantities of water regularly pass through mining sites, especially in northern Quebec. All water that comes in and circulates at a mining site must be collected and discharged from the site in the form of **mining effluent**, as required by provincial and federal jurisdiction. Indeed, since mining activities have a high potential for water contamination, all sources of water produced at a mine site must be collected at one or more points to be monitored and treated by the mining company. Water is then discharged into one or more pre-selected waterways. The water discharged at these points make up the mining effluent.[30]

Other contaminants potentially found in these effluent waters include nitrogen products, AMD, CND, chemicals associated with ore separation, TSS, and petroleum products. Beyond the individual effect of each contaminant on local water sources, greater overall toxicity can also be caused by the interaction of the various contaminants with one another – meaning that in certain situations, even if the regulatory standards for each contaminant taken separately are met, an effluent as a whole may still remain toxic to aquatic organisms.

da, Environmental Protection Branch, Montreal, September 2002. https://publications.gc.ca/collections/collection_2020/eccc/en154/En154-106-2002-fra.pdf

29 Environment Canada. Environmental Code of Practice for Metal Mines, 2009. https://www.ec.gc.ca/lcpe-cepa/documents/codes/mm/mm-eng.pdf

30 Sources of water at a mine site include: groundwater, precipitation (rain or snow), runoff from roads, stockpiles and other mining infrastructure, water from reservoir basins or ditches, water from tailings ponds, effluent from the process plant (ore processing), effluent from the industrial wastewater treatment plant (and domestic wastewater if applicable), and water pumped from excavations or underground structures (mine drainage).

2.2.2.5 Clearing pits and work areas

During excavation, the pit area continuously floods due to groundwater exfiltration, precipitation, and runoff. To work in a dry area, the mine developer dewaters the pit. This is usually done using pumps installed at the bottom of the excavated area. Whichever dewatering process is chosen, the pumped water will be treated with the rest of the water which makes up the mine effluent. Pumping groundwater to a lower level causes what is known as a "drawdown" of the water table, i.e. a localized decrease in the groundwater level within a certain radius around the pit.

Lowering the water table can have a major impact on the area's hydrological regime, as it reduces the amount of groundwater available to recharge surface water bodies (lakes, rivers, etc.). Reduced water flows and volumes, in turn, increase the concentration of contaminants in surface waters. If the mine site is located near residential areas, the drawdown may also affect the water supply in drinking wells.


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2.2.2.6 Water consumption and fees

When compared with other industrial sectors, royalties paid to the provincial government by mining companies for the use of water is low. As of March 2023, royalties stood at just $2.50 per million litres, compared with $70 per million litres for many other sectors.[31] Yet this industrial sector typically consumes tens of millions of litres of water every day for ore concentrator operations alone. This reality, and the low associated costs, threatens to dry up water sources for more fragile environments, whose water recharge is potentially too slow to compensate for the high water consumption.

What's more, current regulations do not require that mining companies prove that their water use is compatible with the short- and medium-term needs of municipalities who share the same water resources, nor do regulations require that data on water use be made public; this, however, would be an important way to promote a more holistic management of resources.

31 LégisQuébec. Q-23, r. 42.1 - *Regulation respecting the charges payable for the use of water*, https://www.legisquebec.gouv.qc.ca/en/document/cr/Q-2,%20r.%2042.1. At the time of publication, a major amendment to the regulation is being considered. It is therefore expected that these charges will be revised upwards in the coming months.

2.3 Restoration and post-restoration

The impacts of rehabilitating a site where mining activities have temporarily or permanently ceased can be both positive and negative. Revegetation of the site, stabilizing the soil, and reprofiling the land topography are considered beneficial, in that these activities help to reduce soil erosion and, consequently, the input of TSS into local waterways.

On the other hand, any activity requiring heavy machinery (dismantling or stabilizing facilities, backfilling, etc.) generates impacts related to the generation of TSS, potential oil spills, waste, and other contaminants (metal structures, pipes, plastics, etc.). Similarly, the impacts associated with the presence of mining waste on site remain the same as in the operation phase (AMD, CND, TSS, etc.), since this waste, although often covered by a layer of vegetation, remains in place in perpetuity. Similarly, the contamination of water runoff on the site, as well as hydrogeological imbalances linked to the flooding[32] of mining excavations (pits or galleries), affect surrounding water quality in addition to throwing the local water cycle out of balance.

All of these risks are associated with sites that have been restored, but obviously multiply tenfold for sites abandoned before restoration. This practice is becoming less and less common, not least because of recent legislative updates aimed at preventing situations where developers declare bankruptcy and pack up before restoring their site – which is a strategy essentially aimed at maximizing profits and minimizing costs. The fact remains, however, that Quebec still has more than 400 abandoned mine sites[33] waiting to be restored. It's a risk associated with this type of project, and a heavy environmental liability with which we must now collectively come to terms.

32 E.g.: James Bay lithium mine project, whose pit will only fill with water after more than 100 years.

33 Ministère des Ressources Naturelles et des Forêts. *Reclamation of Mining Sites under Effective Public Responsibility*, Gouvernement du Québec, accessed online April 10, 2023. https://mrnf.gouv.qc.ca/en/mines/mining-reclamation/reclamation-of-abandoned-mining-sites/

Chapter 3 – Main mitigation measures

The government requires mining developers to apply mitigation measures to reduce the environmental impact of the various phases of their projects. These measures vary according to specific components of the environment in question and, in particular, the applicable federal and/or provincial legislation (see sections 4.1.2 and 4.2.2).

All mining projects (except exploration projects) must receive a certificate of authorization from the MELCC (section 4.1.2). The plans and specifications, as well as the description of activities seeking approval, necessarily include mitigation measures as they are drafted in compliance with the *Environment Quality Act* (EQA). The assignment of **Effluent Discharge Objectives (EDOs)** by the MELCC to projects subject to authorization under the EQA also helps meet this objective.

In addition, the MELCC has an inspection program for the EQA and its regulations, including a program to verify the conditions outlined in the certificates of authorization. The capacity of this program, however, is very limited and "*the ministry is not sufficiently equipped to protect the environment with its current team of inspectors and lawyers [translation]*."[34] As a result, "*Quebec companies are largely left to their own devices [translation]*"[35] when it comes to applying the required mitigation measures, highlighting the importance of strong citizen oversight until substantial improvements can be made to the current system for resource extraction.

3.1 Environmental assessment

Completing a high-quality environmental assessment, or impact assessment, is the stage in project development with the greatest potential for positive impact on the environment and local communities. The assessment's findings should be followed in a rigorous and ongoing manner throughout the implementation of the project (for further details, see sections 4.1.2.1 and 4.2.2). The purpose of such an assessment is to evaluate the extent of the project's ecological and socio-economic impacts and determine which mitigation measures will be used to minimize the project's environmental footprint.

The description for the mining project is reviewed and questioned by government experts from various ministries. Public consultations take place, during which results and scenarios are presented and discussed. Participants have the opportunity to ask questions and make comments about the project or its environmental assessment.

Among the elements evaluated in the context of the development of a mining project are:

- An assessment of the site's geology and mineralogy;
- An inventory of the site's water resources and an analysis of the water quality;
- Hydrological and hydrogeological studies to quantify the water flowing over the site and define groundwater flow characteristics;

34 Francoeur, Louis-Gilles; Ramacieri, Jonathan. *La caution verte: Le désengagement de l'État québécois en environnement*, Éditions Écosociété, 2022, p.56.

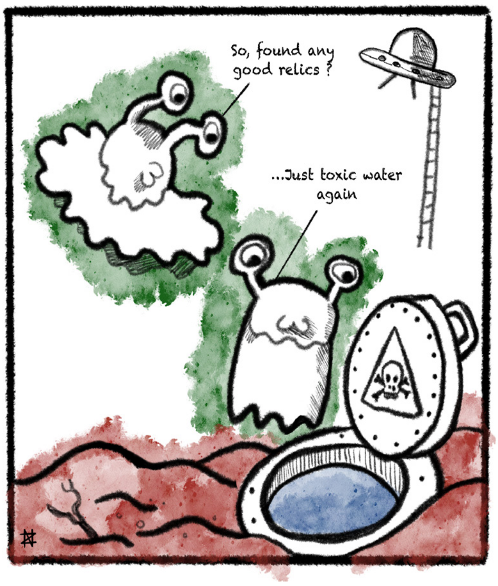
35 Ibid, p. 52

- A geochemical study to estimate the contamination that mining activity will generate (see section 3.1.1);
- Modeling the accumulation of certain metals in groundwater and surface water;[36]
- Follow-up plans to verify the accuracy of the environmental assessment and the effectiveness of mitigation measures (i.e. monitoring of surface and groundwater quality), to be developed in consultation with the populations affected.

In spite of these critical elements, and in the experience of the authors of this Guide, environmental assessments often take a direction that is incompatible with sustainable development,[37] as assessments are sometimes quick to dismiss the notion of cumulative impacts and the **carrying capacity** of local environments; proof lies in the fact that the government approves all mining projects that reach the stage of environmental assessment.[38] Financial interests, therefore, always hold overwhelming power in political decision-making. That said, environmental assessments remain an extremely relevant tool for information gathering purposes. The public consultations during this stage are also an excellent opportunity to highlight certain current or future issues and can encourage project modifications. The authors of this Guide strongly encourage the public to take part in these consultations, despite the overrepresentation of economic interests in the decision-making process.

3.1.1 Geochemical characterization

To assess the extent of AMD, CND, and metal leaching, various geochemical tests are carried out to produce a geochemical characterization. According to the MELCC *Characterization guide for mine tailings and ore* (*Guide de caractérisation des résidus miniers et du minerai*),[39] the objective of this characterization process is to obtain adequate knowledge about the different geochemical and environmental properties. It should also enable us to predict how these sites will evolve over time under different storage conditions and exposure to air and water, depending on the local climate. A well-planned and executed geochemical characterization therefore enables the developer to determine an optimized method for storing waste that minimizes the release of contaminants into the environment, even after operation.



36 This type of study enables us to verify the impacts of storing mine waste or filling the pit over the long term, i.e. 50, 100 or even 200 years after mine closure, in some cases.

37 "*Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (translation)*", Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs. À propos du développement durable - Définition, accessed online June 21, 2023. https://www.environnement.gouv.qc.ca/developpement/definition.htm#definition

38 "*Since the end of the 19th century, the Quebec government has never rejected a single mining project (translation).*" Taken from Handal Caravantes, Laura. "L'histoire d'une triple dépossession", note 8, p. 148, in Simon Tremblay-Pépin (ed.), Dépossession - Une histoire économique du Québec contemporain, t. 1, Montreal, Lux Éditeur, 2015.

39 MELCC. Guide de caractérisation des résidus miniers et du minerai, June 2020, p.1. https://www.environnement.gouv.qc.ca/Industriel/secteur-minier/guide-caracterisation-minerai.pdf

Typical tests performed in this type of study include static tests,[40] leaching tests,[41] and kinetic tests.[42] For more information on these tests, please refer to the sources provided in the footnotes. It should also be noted that to ensure the validity and relevance of these tests, developers are required to ensure that samples[43] are representative: the number of chosen samples must be sufficient and spatially well-distributed, to accurately represent the mineralogy of the mine site and the conditions under which the mine waste will be stored.

3.2 Exploration

As mentioned above, mineral exploration activities are not subject to any environmental assessment process whatsoever. The monitoring of these activities is based almost exclusively on the principle of company self-regulation. Citizen oversight can therefore play a decisive role in the application of best industry practices. It is to the advantage of local populations impacted by mining exploration activities to be aware of mitigation measures that are currently recommended, to ensure they are being applied or to pressure the mining and exploration companies to apply them. The measures listed in this section are based on the recommendations of Environment and Climate Change Canada's *Environmental Code of Practice for Metal Mines*[44] and the *Recommended Practices for Mine Surveying [Pratiques recommandées dans le cadre de travaux de sondage minier]* from the Quebec Ministry of the Environment, Climate Change, Fauna, and Parks (*Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs* - MDDELCC).[45] In all cases, it should be remembered that the most effective measures for mitigating impact is to reduce the impacts at the source – and this should be given top priority.

3.2.1 Mitigation measures for the transportation of machinery and personnel

The following is a summary of some of the mitigation measures that can be applied when carrying out mineral exploration work in order to limit environmental impact:

- Limit clearing activities, both in the planning of access roads for equipment and by using natural clearings for activities. To limit the risk of erosion and the generation of dust, we recommend keeping the time between clearing and restoration to an absolute minimum;
- Avoid water, wetlands, and spawning grounds when moving machinery. Ensure that no fine particles reach these areas;

40 These tests are typically fast and inexpensive. For more information, see Bassolé, Moubié Richard. *Pertinence des essais de lixiviation en batch dans la prédiction du comportement hydrogéochimique des rejets miniers* [Master's thesis, École Polytechnique de Montréal]. PolyPublie, 2016, pp.8-9. https://publications.polymtl.ca/2281/; MELCC. June 2020, pp. 20 and 23, cited above.

41 Bassolé. 2016, p.12, quoted above; MELLC. June 2020, p.26, previously cited; Centre d'expertise en analyse environnementale du Québec. *Protocole de lixiviation pour les espèces inorganiques*, September 8, 2010. https://www.ceaeq.gouv.qc.ca/methodes/pdf/MA100Lixcom11.pdf

42 Bassolé. 2016, pp.9-10, quoted above; MELCC. June 2020, pp.23 and 27, quoted above. It should be noted that according to the MELCC Guide: "*It is strongly recommended that kinetic testing be carried out for all materials with leaching potential in order to make a more accurate assessment of the chemical load suitable for release into contact water (translation)*" (MELCC, June 2020, p.27).

43 MELCC. June 2020, pp.11-14, quoted above.

44 Environment Canada. *Environmental Code of Practice for Metal Mines*, 2009, Table 4.1, p.56.

45 Ministère du Développement durable, de l'Environnement et de la Lutte contre les Changements Climatiques (MDDELCC). Pratiques recommandées dans le cadre de travaux de sondage minier, November 2014. Accessed on https://www.bibliotheque.assnat.qc.ca/DepotNumerique_v2/AffichageNotice.aspx?idn=76851

- Limit the use of fill in aquatic environments;
- Limit bank erosion and activities that promote sedimentation in waterways;
- Restore the profile for streams and river banks at the end of operations;
- Carry out work in or near wetlands in winter, when the ground is frozen, to limit the impact of machinery;
- Install geotextiles under backfill, where required, to reclaim backfill material after mineral exploration activities;
- Use the lightest possible equipment for off-trail travel.

3.2.2 Mitigation measures to be applied at the work site for exploration

Similarly, here is a brief summary of some of the measures that can be applied to mitigate the impacts of mineral exploration activities where they take place:

- Limit the risk of contaminant spills and/or sedimentation (TSS, hydrocarbons, etc.) in waterways, bodies of water, and wetlands (section 3.3.2);
- Prevent hydrocarbon leaks (maintenance of machinery, use of taps, etc.);
- Draw up an emergency plan to be applied in the event of a hydrocarbon leak;
- Use biodegradable lubricants when drilling;[46]
- Limit water withdrawals to a certain percentage of the low-flow rate of the waterway from which the water is being taken (this percentage must be calculated on a case-by-case basis, but is typically around 10% of the low-flow rate of the waterway);
- Respect certain minimum distances (3 or 30 metres, sometimes more),[47] between drilling points and the infrastructure sustaining the public water supply (wells, etc.)

In addition to the measures listed in this section, measures mentioned in section 3.2.1 of this Guide are also applicable here. It should also be noted that scientific knowledge is still lacking when it comes to adequately characterizing the impact of mineral exploration activities on sources of groundwater.[48] The utmost caution must therefore be exercised when carrying out such work.

3.2.3 Mitigation measures to be applied when restoring exploration sites

Once exploration work has been completed, applying certain additional best practices can also help minimize the risks and impacts of these activities on ecosystems:

- Restore the site to a condition close to its original state (backfilling and levelling excavated or rutted areas, or water and sludge retention structures, planting vegetation in areas where soils have been exposed, seeding excavated areas, laying biodegradable mulch or netting where necessary to limit erosion in seeded areas, removing or cutting borehole casings to ground level, etc.);
- Plug and seal drill holes;
- Stabilize and seed the slopes of excavated or damaged banks;
- Collect and dispose of all residual materials generated on work sites.

It should be noted that specific measures are applicable when work is carried out by aerial navigation,

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46 For a sample list of such lubricants, see: MDDELCC, November 2014, p.4, cited above.

47 These distances are typically defined in the *Règlement sur le prélèvement des eaux et leur protection* (RPEP).

48 Government of Canada. *Groundwater contamination*, accessed June 21, 2023. https://www.canada.ca/en/environment-climate-change/services/water-overview/pollution-causes-effects/groundwater-contamination.html

3.3 Mitigation measures during construction

This section lists some of the most interesting mitigation measures for protecting sources of water and wetlands during the construction of a mining project. Most of the measures presented here are taken from section 4.3 of the *Environmental Code of Practice for Metal Mines*,[49] as well as from our analyses of various mining projects.

3.3.1 Avoidance or mitigation of impacts on sensitive areas

As a first step, the government should instruct companies to avoid building any facilities or roads in areas deemed ecologically sensitive. Such areas should be identified systematically in consultation with stakeholders, local Indigenous and/or non-Indigenous communities and government representatives before construction work begins. It is also recommended that road construction should not include steep bends, to limit the risk of accidents, and that snow cleared from sites should not be dumped or piled up on ice-covered lakes, streams or bodies of water, or on groundwater recharge zones (eskers, moraines, etc.) or other ecologically sensitive environments.

In the event that total avoidance of generating impact is impossible, emphasis must be placed on mitigation. The following subsections outline such mitigation measures.

3.3.2 Controlling erosion and the generation of suspended solids (TSS)

Generally speaking, controlling erosion and the generation of TSS should be a measure applied systematically during the construction of a mining project. Ditches and trenches can be dug around work areas to direct water runoff away from exposed soils and towards areas where it can infiltrate into the ground, or towards settling basins, depending on whether or not it is loaded with TSS. Similarly, the use of devices such as geotextiles, mesh, straw, sediment barriers and traps, cofferdams and turbidity curtains may be appropriate. Temporary dewatering of work areas is recommended. It is preferable to limit grading of work areas to avoid unnecessarily exposing soils to runoff. To prevent water from washing away these materials, overburden should be piled up outside high-water marks.

3.3.3 Managing site water, controlling and preventing the introduction of contaminants into the environment

As with the management of erosion and sedimentation on the construction site, on-site water management must be duly planned and detailed in one or more water management plans. Most of the following recommendations should be included, and developers should make written commitments to implementing these measures that are so essential for protecting water-based ecosystems.

As field experts have on constant repeat,[50] it is essential from the outset to prevent any contamination of water on the site and in the surrounding area. Strong site water management upholds this as a priority. In addition, we recommend:

49 Environment Canada. *Environmental Code of Practice for Metal Mines*, 2009, section 4.3, pp.58-70.

50 On March 9, 2023, Carmen Mihaela Neculita, Canada Research Chair in Mining Water Treatment and Management, began a conference by reminding us that water treatment is *not* a universal solution, but that priority should be given to preventing contamination.

- Storing hazardous materials on sealed surfaces;
- Using explosives which contain less nitrogenous products than ANFO-type explosives;
- Using non-acid or nonmetal-generating waste rock for the construction of structures;
- Limiting the production of contaminant-generating tailings;
- Do not discharge waste, debris or other materials into the aquatic environment;
- Clean site machinery before it arrives on site;
- Divert uncontaminated runoff to the surrounding environment, but collect wastewater or contaminated water for treatment or recirculation;
- Maximize the retention period of wastewater or contaminant-laden water;
- Build water treatment facilities to decontaminate water. These facilities should be designed to maximize the recycling of water on site;
- Establish and comply with water quality criteria, in particular by defining project-specific Effluent Discharge Objectives (EDOs).

3.3.4 Accident prevention and stability

Given that mine waste retention structures (waste rock piles, tailings impoundments and associated water retention facilities) will remain in place for a long time following mining operations, it is essential to take long-term monitoring and inspection of these structures into account during the construction phase. Appropriate instrumentation should therefore be installed during this early stage to ensure adequate monitoring of the stability of structures (dikes, etc.) during and after project completion. In addition, storage tanks and containment facilities for petroleum products and other chemical substances must be built in a way to prevent accidental spills from reaching the surrounding ecosystems, surface water, and the water table.

3.4 Mitigation measures for operations

The most obvious measure to control contaminated water from a mine site is to purify it using settling ponds and eventually passing it through a water treatment plant. There are, however, several other measures that need to be taken into consideration and implemented upstream of mine water treatment to reduce the generation of contaminants and the flow of water out of a mine site.

3.4.1 Mine site design

In the majority of cases, sites are designed to maximize economic benefit and minimize development costs, as determined through the **feasibility study**, which assesses the profitability of the project. It is typically only at a later stage in the development process, when environmental assessments are carried out, that environmental impacts are discussed and analyzed. That said, at each of these stages, it is often possible to demand (to varying degrees of success) that the planning of a mine site respects certain criteria and takes into account the carrying capacity of the local environment, including the following considerations:

- Minimize the quantity and toxicity of solid and liquid waste;
- Minimize the encroachment of site infrastructure on lakes, streams and wetlands;
- Minimize the removal of overburden;
- Maximize the use of the extraction pit(s) by storing mine waste in it(them);

- Minimize the amount of water in tailings impoundments to increase the geotechnical stability of storage areas and reduce the risk of dam failure;
- Maximize the use of existing infrastructure (roads, buildings, power lines, etc.).


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3.4.2 Mine waste management

According to Environment and Climate Change Canada's *Environmental Code of Practice for Metal Mines*, prevention and control of AMD or CND must take precedence in the design of waste rock piles, tailings impoundments, and associated water management facilities.[51] According to UQAT's Research Chair in Integrated Management of Mining Waste, better management and control of the environmental impacts of mining waste during operations will lead to easier site closure, and will be economically advantageous.[52] Other techniques for the relative safe storage of mine waste include:

- Oxygen barriers;[53]
- Barriers to water infiltration;[54]
- Environmental desulfurization;[55]
- Co-disposal of waste rock and tailings.[56]

For a more detailed explanation of these different practices, we refer readers to the sources outlined in the footnotes or to the extended, online version of this Guide.

3.4.3 Sealing certain areas of the mine site

An important mitigation measure in the management of mine tailings and in the prevention of environmental contamination is the waterproofing of soils under sites that store mine waste (waste rock, tailings), under roads and under certain operational areas. This can occur naturally, when the ground is composed of impermeable clays that limit the penetration of contaminants into the soil. However, impermeability can also be ensured artificially, with impermeable backfill or the installation of a synthetic geomembrane under issue areas. It should be noted, however, that the impermeability of such layers is never complete, and the lifespan of geomembranes is less than 100 years. Additional measures therefore need to be considered, to limit any possible contamination of groundwater.

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51 Environment Canada. *Environmental Code of Practice for Metal Mines*, 2009, p.61.

52 Benzaazoua, UQAT. Previously cited.

53 Bussière et al. Guide de bonnes pratiques en restauration minière dans un contexte de changements climatiques, Unité de recherche et de service en technologie minérale, February 2022, pp.13-17. https://www.environnement.gouv.qc.ca/Industriel/secteur-minier/guide-bonnes-pratiques-restauration-miniere.pdf

54 Ibid, pp.18-19.

55 Skandrani, Ahlem. *La désulfuration par flottation des résidus miniers altérés porteurs d'or*, Master's thesis, Polytechnique Montréal, 2019, pp.6 and 9-17. https://publications.polymtl.ca/3917/ ; Webinaires Mines et environnement UQAT. *Reducing Contaminated Acid and Neutral Mine Drainage from Tailings (translated)*, 2023, 56:37 minutes. https://www.youtube.com/watch?v=g5ccbHUOLvo; Recommendation 310 of Environment Canada's *Environmental Code of Practice for Metal Mines*, at pages 9 and 61, cited above.

56 Toma Christine L. *Analyse comparative des différentes méthodes de gestion intégrée des rejets miniers permettant de minimiser l'impact des opérations minières*, Université de Sherbrooke, May 2021, pp.37-42. https://savoirs.usherbrooke.ca/bitstream/handle/11143/18420/l_toma_christine_MEnv_2021.pdf?sequence=4&isAllowed=y; Benzaazoua, UQAT, p.44. Previously cited.

3.4.4 Water treatment

Once all preliminary measures for contamination control and water management (drains, pipes, sealing of certain areas, etc.) have been implemented at the mine site, it is crucial to treat the remaining contaminated water. This water is typically sent first to settling basins, where it is subjected to an initial sedimentation of TSS and other contaminants. Flocculants can be added to accelerate this sedimentation. Then, depending on the nature of the contaminants present in the water, several types of treatment can be applied at a water treatment plant set up for this purpose. Acidic water can be neutralized with lime, and certain metals can be precipitated by coagulation-flocculation treatments. Then, if necessary, concentrations of contaminants still exceeding standards can be lowered by other physico-chemical or filtration processes.[57] Finally, treated water is sometimes directed back into one of these so-called "polishing" basins, to allow a final settling of TSS before being released back into the environment.

Finally, when the water meets standards or *Effluent Discharge Objectives (EDOs)*, it is discharged into the environment via mine effluent. At this point, we recommend a single effluent. This simplifies water treatment and makes it easier to monitor the quality of discharged water.[58]

3.5 Restoring the mine site

Mine site restoration is the final stage of the project. It consists of a partial reclamation of the site, to ensure that no contaminants are released into the environment, that a minimum of waste remains, that the site is safe for the public and animals, and that it can be used for other purposes and restored to an aesthetically acceptable state wherever possible.

3.5.1 Broad measures for mine site restoration

Measures considered to restore a mine site include:

- Dismantling infrastructure (roads, buildings, warehouses, etc.) and reselling, recovering, or recycling construction materials and machinery;
- Stabilizing, securing and greening waste rock piles and tailings management facilities;
- Backfilling, revegetating and securing open-pit mines.[59]

Some of these activities can be carried out gradually during the mine operation phase.

57 Veillette, Julie. *Bilan sur l'incidence des mines de métaux sur le milieu aquatique*, Environment Canada, Environmental Protection Branch, Montreal, September 2002, pp.11-16. https://publications.gc.ca/collections/collection_2020/eccc/en154/En154-106-2002-fra.pdf

58 It should be noted that developers sometimes seek to dilute contaminants in rivers and natural environments. We must be critical of this practice, given that it is often geared towards minimizing water treatment activities – and therefore the associated costs. This practice ultimately allows mining companies to release water that is more heavily contaminated than it should be.

59 For more information, see Environment Canada, 2009, pp.76-79. Previously cited.

3.5.2 Management of site water during the restoration phase

As mentioned several times in the previous sections, water at the mine site often needs to be managed or even treated in the medium-to-long term following site closure. It is therefore necessary to identify water treatment or management infrastructure that will no longer be needed, and to close (dike, cover, revegetate, etc.) these structures. Any structures that are still needed to manage runoff or mine drainage on the closed site must be properly maintained, and their integrity and effectiveness monitored and corrected as necessary. All water coming into contact with the closed mine site and potentially carrying contaminants must be treated in the same way as during the exploitation phase. This remains the responsibility of the company developing the mining project.

Plans, a financial guarantee, equipment, and personnel must be supplied, hired, or paid for by the company that formerly owned the project and is now responsible for wastewater treatment at its closed site. Finally, the company[60] must also monitor the site, and therefore the treatment of this water.

In order to limit the need for long-term treatment of site water, rainwater, or meltwater, diversion structures may be dug or erected. These structures are designed to prevent the surrounding water from coming into contact with the surfaces and materials of the closed mine site, thereby avoiding most of the associated risks of water contamination.[61]

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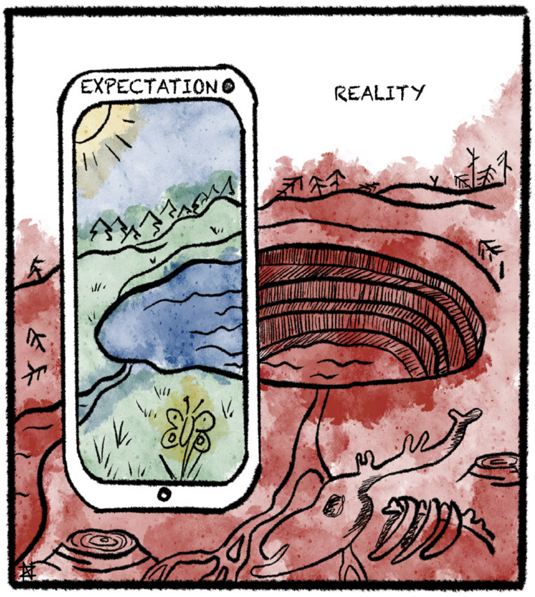
60 Ibid, pp. 81-82.

61 Bussière et al, February 2022, p. 24, cited above.

Chapter 4 – Legal framework

The mineral resources found in the territories of Indigenous nations living in areas also known as Quebec have been coveted since the very beginning of colonization.[62] While the Supreme Court of Canada now recognizes that mining activities may affect the **Indigenous and treaty rights** of Indigenous peoples, this has not always been the case.[63] Despite this recognition by Canada's highest court, many parts of the federal, provincial and territorial legal systems are still failing in their duty to consult and accommodate Indigenous groups prior to the issuance of permits requested by mining companies.[64]



Under the *Constitution Act, 1867*, provinces that make up the federation of Canada have exclusive jurisdiction over the "*exploration [...], development, conservation and management of non-renewable natural resources*."[65] In other words, when it comes to mining resources at the provincial level, the Quebec government is the only one who dictates the rules. That said, legislative mechanisms exist at both federal and provincial levels to subject projects which meet certain regulatory thresholds to an environmental assessment process. This explains why the same mining project can undergo an environmental assessment before both the *Bureau d'audiences publiques sur l'environnement* (BAPE) and the Impact Assessment Agency of Canada (IAAC).

Even within Quebec's borders, the rules governing the development of mining projects are not the same everywhere. The mining standards of territories covered by agreements between governments and the Eeyou (Cree), Inuit, and Naskapi Nations deviate in certain respects from the overall legal framework of southern Quebec, in order to meet particular standards arising from so-called modern treaties.[66] These distinctions will be highlighted in this Guide where applicable.

The following sections present the federal and provincial legal frameworks which govern and oversee mining activities with the most significant effects on water.[67] This normative framework is presented

62 The first Western mining projects go back to the time of Samuel de Champlain's first voyages. Samuel de Champlain, Le second voyage en Nouvelle-France en l'an 1609, 1609, [online].

63 *The Constitution Act, 1982, Schedule B to the Canada Act 1982*, 1982, c. 11 (U.K.), Part II, s. 35; *Haida Nation v. British Columbia* (Minister of Forests), 2004 SCC 73, par. 45 et seq.; *Delgamuukw v. British Columbia*, [1997] 3 SCR 1010; *Tsilhqot'in Nation v. British Columbia*, 2014 SCC 44; *Taku River Tlingit First Nation v. British Columbia* (Project Assessment Director), 2004 SCC 74.

64 For an in-depth look at the important issue of environmental racism that has been at the heart of Quebec's mining regime since it was founded over 150 years ago, see Rodrigue Turgeon's article "Haro sur les claims miniers, ces instruments de torture coloniale", in Sabaa Khan (ed.), La nature de l'injustice : racisme et inégalités environnementales, Montreal, Éditions Écosociété, 2023, from page 163 to page 184.

65 *Constitution Act, 1867*, 30 & 31 Vict. c. 3 (U.K.) (hereinafter "Constitution Act, 1867"), art. 92(A), para. 1, par. a) and b).

66 *James Bay and Northern Québec Agreement*, LQE, c. Q-2, chapter II, chapters 22 and 23; *Regulation respecting the assessment and review of environmental and social impacts in the James Bay and Northern Québec territory*, RLRQ, c. Q-2, r. 25; *Regulation respecting the assessment and review of environmental impacts in a part of Northeastern Québec*, c. Q-2, r. 24.

67 Although extremely important, environmental components other than those associated with water are not covered in this Guide.

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based on a typical mining project that has no additional on-site processing of ore (other than extraction), nor the presence of an airport, rail, or port terminal.

4.1 Provincial government of Quebec

The following sections summarize the federal and provincial legal frameworks governing the most significant impacts of mining activities on water in Quebec.

4.1.1 Mining Act

Rooted in the 1864 *Gold Mining Act* adopted by the Lower Canada Legislative Assembly – which was largely inspired by the Californian legal framework of the gold rush era (1820s), and subsequently renamed the *General Mining Act* in 1880 – today's *Mining Act*[68] is the primary piece of legislation governing mining activity in Quebec.

Revised little since then, this law incorporates elements from the 1991, 1998, and 2013 reforms. The 1991 reform required mining companies to submit a restoration plan and a financial guarantee covering 70% of the anticipated cost of restoration work on tailings impoundment areas when mining operations are carried out. The 1998 amendments introduced the concept of acquiring a mining claim by designating it on a map, via the Internet, thereby facilitating third-party access to and appropriation of the territory's mineral resources. Developments in 2013 included lowering (but not entirely) the **registration threshold** for submitting mining projects to BAPE, requiring payment of all financial guarantees over three years[69] and including the notion of territories incompatible with mining activities (TIAM - acronym in French).[70]

68 *Mining Act*, RLRQ, c. M-13.1. https://www.legisquebec.gouv.qc.ca/en/document/cs/M-13.1; see also the *Regulation* under the *Mining Act: Regulation respecting mineral substances other than petroleum, natural gas and brine*, RLRQ, c. M-13.1, r.2; on the granting of exploration titles under the *Mining Act*, see : *Titres d'exploration*, Ministère des Ressources naturelles et des Forêts; on the environmental supervision of mining activity and, in particular, the shortcomings of this supervision, see: Turgeon, Rodrigue. *Biorestauration du passif minier québécois : errance étatique entre plaies environnementales et failles normatives*, Master's essay, Université de Sherbrooke, 2020, chapter 3: Portrait global du cadre juridique du régime minier québécois. https://savoirs.usherbrooke.ca/handle/11143/17668

69 However, major gaps remain in the payment and usefulness of these guarantees. For more information and possible solutions, see the insert (in French) entitled "*Des avancées nécessaires en matière de restauration minière*" in section 4.1.1 of the online version of this Guide.

70 The Quebec government, in its Direction on land-use planning (*Orientations gouvernementales en aménagement du territoire*- OGAT), frames the definition of Territories Incompatible with Mining Activities (TIAM): Gouvernement du Qué-

There are two mechanisms in the *Mining Ac*t to curb or even prohibit mining activities. In both cases, it is the Minister of Natural Resources who retains the discretionary power to apply these mechanisms or not, which presents a clear conflict of interest given the Minister's role ensuring the "mineral development"[71] of the province. These mechanisms are:

- Section 304, which allows for an immediate moratorium on the granting of exploration permits in unclaimed territories, for reasons of public interest;
- Section 82, which allows for land to be withdrawn from allowing mining activity as acceptable use in the name of public utility.

However, the use of these articles is complex, as one refers to the notion of *public interest*, while the other relies on the notion of *public utility*, which is far less inclusive than the former. As the law currently stands, it can be difficult to obtain the withdrawal of mining claims (section 82) based on the criteria suggested by section 304.[72] This is a good example of the need for fundamental reform of the *Mining Act*, to introduce a decentralized mechanism for withdrawing mining claims that no longer depends solely on the will of the Minister of Natural Resources.[73]

4.1.2 Environmental Quality Act

Quebec's main law to protect the environment and living species from pollution is the *Environment Quality Act* (EQA),[74] passed in 1972. The Minister of the Environment is responsible for its application. Section 20 of the Act outlines a general prohibition on pollution,[75] while going into further detail about three types of illegal action related to pollution.[76] Equally noteworthy, section 22 of the EQA requires ministerial authorization for any activity likely to contaminate or alter the quality of the environment, and section 26 gives the Minister the power to restrict the development of projects that exceed the carrying capacity of an ecosystem.

Many regulations under the EQA are designed to regulate a multitude of activities and substances, and restrict the release of contaminants into the water. However, despite the mining sector's importance in Quebec and the scale of pollution tied to it, the EQA still does not include any regulations targeting this specific sector. The adoption of such a regulation is a key demand of the Coalition Québec meilleure

bec, Ministère des Affaires municipales et de l'Habitation. *Les orientations gouvernementales en aménagement du territoire*, Québec, 2016, https://consultation.quebec.ca/processes/orientations-amenagement-territoire; seven criteria of the 2016 OGAT-Mines include: (1) Activity of an urban and residential nature; (2) Activity of an historical, cultural or heritage nature; (3) Agricultural activity; (4) Agrotourism activity; (5) Intensive recreational tourism activity; (6) Conservation activity; (7) Activity for the withdrawal of groundwater or surface water for human consumption. With regards to the difficulties encountered in having a territory recognized as being incompatible with mining activity, read: Champagne, Éric-Pierre. *Demandes d'exclusion d'activités minières : Les villes se heurtent à Québec*, La Presse, April 20, 2023, https://www.lapresse.ca/actualites/environnement/2023-04-20/demandes-d-exclusion-d-activites-minieres/les-villes-se-heurtent-a-quebec.php

71 Mining Act, RLRQ, c. M-13.1, preamble, par. 4. Cited above.

72 For an example of an official moratorium and withdrawal request letter, see the Mine pas notre esker campaign page of our various organizations: Eau Secours, Québec Meilleure Mine (QMM), Regroupement Vigilance Mines Abitibi-Témiscamingue (REVIMAT), MiningWatch Canada: Campagne Mine pas notre esker, online. P.ex. : https://miningwatch.ca/fr/eskers

73 Such a mechanism should give more power back to the local populations affected by these projects. See Coalition Québec meilleure mine, *Mémoire sur la consultation sur l'encadrement minier*, May 18, 2023, section "gouvernance et régime minier", p. 14 to 18. http://quebecmeilleuremine.org/wp-content/uploads/2023/05/2023-05-18-QMM-Memoire-Consultation-sur-lencadrement-minier.pdf

74 *Environment Quality Act*, RLRQ, c. Q-2. https://www.legisquebec.gouv.qc.ca/en/document/cs/Q-2

75 Ibid, a. 20.

76 For more information, see in particular: Baril, Jean. *Guide citoyen du droit québécois de l'environnement*, Chapter 3 - *Il est interdit de polluer… sauf si on y est autorisé*, Éditions Écosociété, 2018. p. 55.

mine and its members.[77] Recently, even the Quebec Mining Association indicated its support for this regulatory shift.[78] However, this measure has been slow to be adopted.

Since the revision of the EQA in 2018, it is the *Regulation respecting the regulatory scheme applying to activities on the basis of their environmental impact* [*Règlement sur l'encadrement d'activités en fonction de leur impact sur l'environnement* - REAFIE][79] that specifies the type of oversight required for certain activities according to their level of environmental risk. The categories (activities with an environmental risk ranging from *negligible* to *high*) are summarized in an explanatory sheet that can be found on the MELCC website.[80] In short, a *negligible-risk* activity (which is most exploration activities) requires no environmental review. *Low-risk activities* (drilling in wetlands, temporary roads, etc.) require only a declaration of compliance. Only *moderate*- or *high-risk* activities require the MELCC to conduct an impact analysis or impact assessment and review procedures before issuing a ministerial authorization.[81] The main document governing the environmental analysis leading to the issuance of an authorization is *Directive 019 on the Mining Industry* [*Directive 019 sur l'industrie minière*] (section 4.1.3 of this Guide). However, this system encourages an artificial division (or "salami-slicing") of mining projects, where only certain activities require authorization and can be assessed separately. What's more, while the registry of ministerial certificates of authorization is officially public, at the time of publication, it is not available online from the Ministry of the Environment which is responsible for overseeing this issue.

4.1.2.1 Regulation concerning the environmental impact assessment and review of certain projects

The *Regulation respecting the environmental impact assessment and review of certain projects [Règlement relatif à l'évaluation et l'examen des impacts sur l'environnement de certains projets* - REEIE][82] came into force on March 23, 2018. According to this regulation, mining and ore processing activities that present a high environmental risk are subject to the environmental impact assessment and review procedure (PEEIE - acronym in French) prior to authorization by the MELCC. The complete and exact list is available in sections 22 and 23 of Part II of Schedule 1 of the *Regulation*.

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77 Coalition Québec meilleure mine, *Mémoire sur la consultation sur l'encadrement minier*, May 18, 2023, op. cit. recommendation #31, p. 20. Cited above.

78 Association Minière du Québec, *Consultations - Développement harmonieux de l'activité minière*, press release, April 19, 2023. https://amq-inc.com/consultations-developpement-harmonieux-de-lactivite-miniere/

79 Regulation respecting the regulatory scheme applying to activities on the basis of their environmental impact (REAFIE in French), c. Q-2, r. 17.1. https://www.legisquebec.gouv.qc.ca/en/document/cr/Q-2,%20r.%2017.1

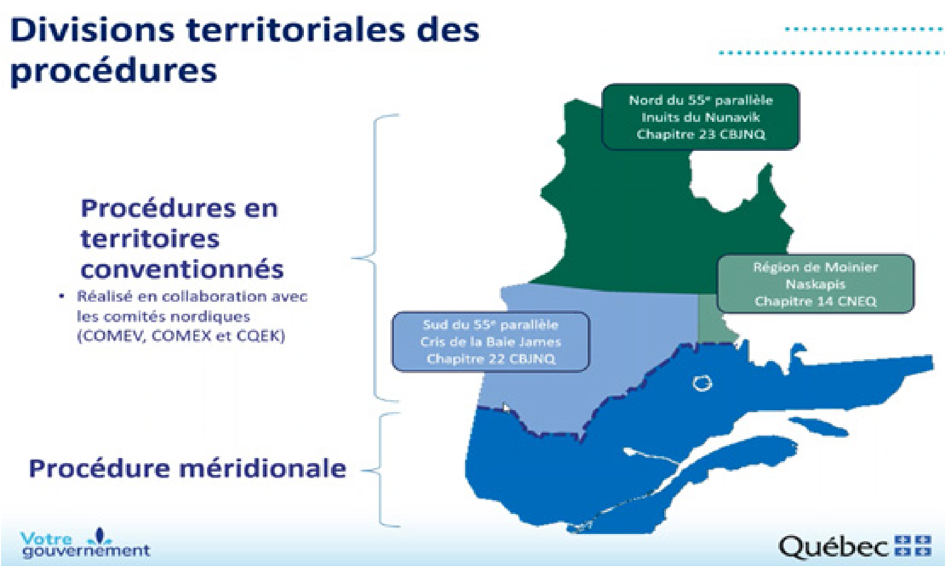
80 *Regulation respecting the regulatory scheme applying to activities on the basis of their environmental impact* (REAFIE), section *Understanding REAFIE*, Fact Sheet.

81 Authorizations issued under section 22 of the EQA. Article 78 of the REAFIE details the mining activities requiring such authorizations.

82 LQE, c. Q-2, r. 23.1, Regulation respecting the environmental impact assessment and review of certain projects. https://www.legisquebec.gouv.qc.ca/en/document/cr/Q-2,%20r.%2023.1?&target=

Procedures for assessing and reviewing the environmental and social impacts of projects have been defined according to whether they are planned for southern or northern Quebec. The boundaries are illustrated in the following figure. One of the distinguishing features of the environmental assessment procedures specific to northern environments is the privileged participation of Indigenous peoples who inhabit these territories.

Figure 3 - Figure taken from the MELCC website on the Environmental assessment of northern projects[83]



Ideally, ALL mining projects should be subject to a PEEIE.[84] This would prevent the artificial division of projects from slipping under the radar of the PEEIE. All mine site expansions – a common step in the development of these types of projects – would also then be subject to a PEEIE, while the cumulative impacts of these projects would also be scrutinized.

4.1.3 Directive 019 on the mining industry

According to the MELCC, "*Directive 019 on the mining industry is the tool commonly used for the analysis of mining projects requiring the issuance of a certificate of authorization under the EQA [translated],*" as well as for mining projects that must undergo an environmental assessment procedure. In force since 1989, it is a document providing technical guidance for the design and analysis of projects by MELCC officials, who impose certain requirements on developers before giving authorization for a project.[85]

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83 MELCC, *Environmental Assessment of Northern Projects*. https://www.environnement.gouv.qc.ca/evaluations/mil-nordique/index.htm

84 Coalition Québec meilleure mine, *Mémoire sur la consultation sur l'encadrement minier*, May 18, 2023, op. cit. recommendation #35, p. 20. Cited above.

85 MELCC, *Directive 019 sur l'industrie minière*. https://www.environnement.gouv.qc.ca/milieu_ind/directive019/ See in particular pages 32 to 36 of the Directive, dealing with the storage of mining waste in relation to soil impermeability, as well as the pH, toxicity and contaminant concentration scales for the final effluent.

However, *Directive 019* has a number of obvious shortcomings. Chief among them is the fact that it has no *regulatory force*.[86] In addition, it relies on standards only applicable at the "end of the pipe," while "economically viable" water treatment technologies greatly influence the determination of these standards. Unlike the MDMER, it does not require developers to assess the effects of mining activities on aquatic life following project development. As non-metallic mineral mines are not subject to the MDMER, this means that 20% of mines currently active in Quebec[87] are being developed without ever having their impact on aquatic life be assessed using regulatory or standards-based tools.

4.1.4 Water Act

Adopted in 2009, the *Act to affirm the collective nature of water resources and to promote better governance of water and associated environments* [*Loi affirmant le caractère collectif des ressources en eau et favorisant une meilleure gouvernance de l'eau et des milieux associés*], more colloquially known as the "*Water Act*," includes a number of measures that are interesting in theory. Article 7, in particular, underlines the principle of *transparency of information regarding water resources* (volumes of water abstracted) held by public authorities, which should allow for public access to this data.

Similarly, articles 8 to 11 deal with action for damage to water resources. In particular, these sections give the Attorney General the power to bring a legal action against anyone for damage caused to water "*in the name of the State, guardian of the nation's interests in these resources*." An interesting avenue for citizen organizing would be to exert pressure to encourage the Attorney General of Quebec to exercise this power. We could also call for section 8 of the *Water Act* to be amended to allow any interested party to exercise this right to compensation for damage caused to water, since it is a collective good.

4.2 Federal government

4.2.1 Fisheries Act

The *Fisheries Act*[88] (FA) was enacted in 1868. Its initial objectives were commercial and economic. However, as it soon became apparent that productive fisheries require a healthy fish habitat, the *Act* became the primary legislative tool over the years for protecting fish and water resources. It now prohibits the release of any harmful substance into waters frequented by or likely to reach fish. The concept of *fish*[89] is broad and can often prove useful in protecting the environment. Here are the FA's definitions: parts of fish; shellfish, crustaceans, marine animals; the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals.

The Department of Fisheries and Oceans (DFO) is responsible for the application of the *Fisheries Act*, except for the portion relating to the protection of fish and fish habitat, which is the responsibility of Environment and Climate Change Canada (ECCC). The *Act* does, however, allow certain industrial sectors to discharge, or carry out certain work, in water frequented by fish if the discharge from these activities are authorized by a regulation made under the *Act*.

86 Gagnon, Hawa-Gabrielle. *La Directive 019 sur l'industrie minière : vers un règlement*, Nature Québec, September 2014. https://naturequebec.org/wp-content/uploads/2020/11/RA14-09-12_Directive19.pdf

87 MERN. *Producing Mines and Mines in Care and Maintenance*, June 2023. https://mrnf.gouv.qc.ca/wp-content/uploads/ProducingAndMaintenanceMines.pdf

88 *Fisheries Act*, R.S.C. (1985), c. F-14. https://laws-lois.justice.gc.ca/eng/acts/f-14/FullText.html

89 Ibid., a. 2.1.

4.2.1.1 Metal and Diamond Mining Effluent Regulations

The *Metal and Diamond Mining Effluent Regulations* (MDMER)[90] are one of the regulations set out under the *Mining Act*. It authorizes the release of effluent from this type of mine into waters frequented by fish, subject to certain conditions regarding contaminant concentrations, pH and the effect of the effluent on certain aquatic species.[91]

It should be noted that mining sites with effluent flows of less than 50 cubic metres[92] per day (50 m^3/d), as well as coal mines, quarries, sand pits, and other non-metallic mineral mining facilities (graphite, mica, salt, etc.) are not covered by the MDMER. In summary, the strengths and weaknesses of the MDMER are as follows:

Strengths and weaknesses of the *Metal and Diamond Mining Effluent Regulations*	
Strengths	**Gaps**
Requires consideration of all effluents from a single mining site, which must collect all of the water that circulates through the site.	Based on the principle that decontamination technologies which influence the prescribed standards must be "economically viable," giving considerable weight to economic arguments.
	By adding bodies of water to Schedule 2 and section 5(1) of the MDMER, it allows for a natural fish-sustaining body of water to be used as a mine waste disposal site.[93]
Orders periodic Environmental Effects Monitoring (EEM) studies to verify the effectiveness of environmental measures on fish, fish habitat, and human use, enabling quantified monitoring (heavy metal concentration in fish flesh, population density, etc.) of the effects of mining activity on these species.	Delays in applying corrective measures to problematic situations can be very long (3 years between each EEM and additional variable delays before measures are applied).
	Meeting MDMER standards does not guarantee the protection of fish and fish habitat: for example, in 2019, 95% of evaluated Canadian mine sites met the standards, but 3 out of 4 metal mines had confirmed impacts on fish and fish habitat.[94]

4.2.2 Impact assessment law

The federal *Impact Assessment Act* (IAA) was passed in 2019 to replace the *Canadian Environmental Assessment Act* (CEAA), which had been in force since 1992. The main purpose of the Act is to provide a framework for the federal impact assessment process and to prevent significant adverse environmental effects from activities carried out on so-called Canadian soils.[95]

Impact assessment processes completed under the IAA are conducted by the Impact Assessment Agency of Canada (IAAC) under the responsibility of the Minister of ECCC. Projects that have been or are being

90 *Metal and Diamond Mining Effluent Regulations* (SOR/2002-222). https://laws-lois.justice.gc.ca/eng/regulations/SOR-2002-222/index.html. These regulations have been in force for metal mines since 2002 and for diamond mines since 2018.

91 See: Ibid, Part 1 - General Provisions, article 4(1).

92 One cubic metre of water = 1000 litres.

93 An audit carried out in 2021 as part of a project to expand the mine waste storage area at the Bloom Lake mine showed that every application made in Canada to designate a natural body of water as a mine waste repository has been accepted by the federal government under the MDMER. This reality is inconsistent with the spirit of the process, which is supposed to apply to exceptional situations and according to supposedly objective criteria. See : *Projet d'augmentation de la capacité d'entreposage des résidus miniers et des stériles à la mine de fer du lac Bloom* - rapport 361 du BAPE, February 2021, p. 140

94 MiningWatch Canada. Primer on Mine Water Pollution in Canada : *Are Waters & Fish Habitat Protected?*, 5 avril 2019. https://miningwatch.ca/publications/2019/4/5/primer-mine-water-pollution-canada-are-waters-fish-habitat-protected

95 *Impact Assessment Act*, S.C. 2019, c. 28, s. 1. https://laws-lois.justice.gc.ca/eng/acts/i-2.75/page-1.htm

assessed by the IAAC, and related documents, are available on the IAAC's *Registry*.[96] Projects requiring evaluation under the IAA are listed in the *Physical Activities Regulations*.[97]

The transition from the CEAA to the IAA gave rise to a number of significant legislative changes. Mining activities are now explicitly covered by the IAA. Similarly, a financial assistance program is now in place to support public participation in environmental assessments.[98] In addition, the IAA demonstrates a greater willingness to respect the rights of Indigenous peoples, considering traditional knowledge and Indigenous cultures as intrinsic components of the social environment.[99]

That said, the minimum thresholds for application of the law (tonnes of ore mined per day) remain much higher at the federal level than at the provincial level, meaning that many large-scale projects still fall under the radar of the IAA.[100]

Finally, the IAA stipulates that the IAAC must monitor the projects it has assessed and authorized, to ensure compliance with the conditions laid out by the Minister's authorization.[101] However, given that the *Act* is recent, and that project assessments often take several years to complete, it is difficult to know how effective the monitoring carried out by the IAAC will really be.

4.3 Legal tools for species at risk

Legislation protecting endangered plant or animal species is becoming a very useful legal tool to help preserve the natural aquatic environment adjacent to proposed industrial projects across the country. Indeed, effective measures can be taken under this legislation to modify or halt project construction if a protected species is found to be present in the area. For example, both the provincial and federal environmental assessment processes automatically include an inventory of species at risk on the site of proposed projects, and list mitigation measures that should be applied to avoid affecting these species and their habitat.[102]

In short, Quebec's *Act respecting threatened or vulnerable species* [*Loi sur les espèces menacées ou vulnérables*][103] protects animal and plant species. Lists of threatened and vulnerable plant and animal species can be consulted on the relevant Quebec government websites.[104]

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96 Available online: https://iaac-aeic.gc.ca/050/evaluations?culture=en-CA

97 EIA, *Physical Activities Regulations* (SOR/2019-285). https://lois.justice.gc.ca/eng/regulations/SOR-2019-285/page-1.html. For projects subject to impact assessment, see the Schedule to the EIA, section 1(c and d), sections 18 to 25 and sections 32 to 34, in particular: Ibid., Schedule, online: https://lois.justice.gc.ca/eng/regulations/SOR-2019-285/page-2.html

98 Canadian Impact Assessment Agency. *Participant Funding Program*. https://www.canada.ca/en/impact-assessment-agency/services/public-participation/funding-programs/participant-funding-program.html

99 Canadian Environmental Assessment Agency. *Overview of the Impact Assessment Act*, Summer 2019. https://www.canada.ca/content/dam/iaac-acei/documents/mandate/president-transition-book-2019/overview-impact-assessment-act.pdf

100 A collective of environmental organizations specializing in environmental law recently demonstrated that the EIA would lead to a reduction in the number of projects assessed each year (estimated at around a dozen): Collectif d'auteurs. *Is Canada's Impact Assessment Act Working?*, May 2021. https://www.wcel.org/sites/default/files/publications/2021-impact-assessment-act-report-en-web.pdf

101 Canadian Environmental Assessment Agency, cited above.

102 For a description of this legislation and its application, see: Centre québécois du droit de l'environnement. *Protecting biodiversity*. https://www.cqde.org/fr/sinformer/protection-de-la-biodiversite/

103 *Act respecting threatened or vulnerable species*, c. E-12.01. https://www.legisquebec.gouv.qc.ca/en/document/cs/e-12.01

104 Gouvernement du Québec. *List of threatened or vulnerable wildlife species*. https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/faune/gestion-faune-habitats-fauniques/especes-fauniques-menacees-vulnerables/liste; MELCCFP.

At the federal level, the *Species at Risk Act* (SARA)[105] protects species on federal lands in Canada, as well as all aquatic species and migratory birds.[106] Federal lands include Canada's oceans and inland waters, national parks, national wildlife areas, including lands held by the Parks Canada Agency, and lands reserved for Indigenous peoples.

Finally, if a vulnerable or endangered species is located on private land, the federal government can still issue an emergency order to protect the species. The Minister of ECCC is required to recommend the adoption of such an order if the species faces imminent threat to its survival or recovery.[107]

4.4 Gaps in environmental law enforcement

Despite the relevance of these legislative tools, there are certain gaps in the scope and application of environmental laws.

Firstly, certain laws or specific sections are either not applied frequently enough (i.e., section 26 of the EQA, relating to the carrying capacity of ecosystems, and claims for damage to water in the *Water Act*, as mentioned above), or are circumvented (the MDMER tends to restrict the disposal of mining waste in fish habitats, but Appendix 2 of this same regulation allows such legislative constraints to be disregarded). We can also see that impact avoidance is often poorly applied, in favor of impact compensation alone (particularly in the application of the FA, the IAA and the MDMER). In spite of the principles set out in certain laws and regulations, it appears that the entities responsible for their application allow for these omissions or deliberate circumventions.

Plenty of case studies exist that illustrate a lack of severity when it comes to applying penalties under these laws. Far from being a deterrent, fines imposed on a company often cost less than upgrading their industrial water management or mining waste management systems. What's more, penalties generally do not include suspension of the granted authorization. Aside from these paltry fines levied on extractive companies, there is nothing in practice whatsoever to call their behaviour into question. As a result, each year we see dozens of chemical spills, contaminated water, and waste of all kinds disposed of into the environment. Concrete examples are provided in the online version of this Guide, as well as on the *Environment-Emergency response register* [*Registre des interventions d'Urgence-Environnement*][108] and, in particular, the *Environmental Offenders Registry* [*Registre des contrevenants environnementaux*][109] as part of the *Fisheries Act* [*Loi sur les pêches*], to name but a few.[110]

List of plant species designated as threatened or vulnerable or likely to be so. https://www.environnement.gouv.qc.ca/biodiversite/especes-designees-susceptibles/index.htm

105 Species at Risk Act, S.C. 2002, c. 29. https://laws.justice.gc.ca/eng/acts/s-15.3/ See Appendix 1 for a complete list of species at risk.

106 CQDE. *How do I know if a species is protected?* https://www.cqde.org/fr/sinformer-nouvelle/protection-de-la-biodiversite/protection-de-la-faune-et-de-la-flore/comment-savoir-si-une-espece-est-protegee/

107 That's what happened in 2013, when CQDE went to court to protect the western chorus frog, whose recovery was threatened by a housing project. See: Centre québécois du droit de l'environnement. *Western Chorus Frog.* https://www.cqde.org/fr/nos-actions/rainette-faux-grillon/

108 MELCC. *Urgence-Environnement response log*, available online: https://www.environnement.gouv.qc.ca/ministere/urgence_environnement/index.asp

109 Government of Canada. *Environmental Offenders Registry*, available online: https://environmental-protection.canada.ca/offenders-registry/Home?lang=en

110 Among other outlets reporting on the situation both in Quebec and in Canada, let's add this one: Meyer, Carl. *Canada failed at monitoring waste dumps from mining companies*, Canada's National Observer, April 2, 2019. https://www.nationalobserver.com/2019/04/02/news/canada-failed-monitoring-waste-dumps-mining-companies; as well as Radio-Canada's Lithium series of three reports, mentioning that "*in Quebec, there has been an environmental infraction every four days for over 10 years*

It should also be remembered that, over and above legal violations, many of the mining industry's impacts are tolerated and considered inherent to the project, without the company having to cover the environmental costs of these activities. Put simply, the "polluter pays"[111] principle is not currently applied, or is applied only to a limited extent. The application of this principle must be strengthened considerably. The same applies to the costs and royalties associated with the generation of each tonne of mining waste and the consumption of water[112] – a common good – for which companies still pay very little. From a legislative point of view, this reality upholds an extremely permissive system, in which the environmental costs of megaprojects are given very little consideration, and in which the very application of environmental laws remains relatively lax, given such a high level of repeat infringements.[113]

(translation)": *Québec à la conquête du lithium*, Radio-Canada, March 16, 2022. https://ici.radio-canada.ca/nouvelle/1869267/minerais-industrie-transition-lithium-legault?depuisRecherche=true

111 Sustainable Development Act - *The principles.* (French) https://www.environnement.gouv.qc.ca/developpement/principes.pdf

112 Ministry of Finance. *Royalties payable for the use of water.* http://www.finances.gouv.qc.ca/ministere/environnement_economie_verte/mesures-ecofiscales/fiches/redevance_exigible_utilisation_eau.asp#:~:text=Le%20taux%20de%20la%20redevance,les%20usines%20de%20produits%20chimiques.

113 In Quebec, over the past 10 years, only 9% of infractions have resulted in sanctions: Blais, Annabelle; Mathieu, Charles. *Voici les 20 pires délinquants environnementaux au Québec*, Journal de Montréal, April 19, 2022. https://www.journaldemontreal.com/2022/09/01/un-chien-de-garde-sans-dents

Chapter 5 – Role of citizens, communities and organizations

When it comes to preventing harm or the destruction of the environment by a variety of extractive projects, several courses of action can be taken by Indigenous peoples, residents, communities and the various organizations involved in protecting the land and local populations. This chapter will provide an overview as to what can be done when it comes to any mining project – before development, during development, and as the project becomes an active mine.

It's worth keeping in mind that coming together as individuals and groups concerned by these projects not only makes for stronger demands, but it helps prevent burnout among organizers. The authors of this Guide therefore recommend that you discuss the following ideas with your neighbours, community, and larger network, in an effort to create one or more citizens' committees to protect the land and the people who live there. For brevity's sake, we'll limit this list to actions that can help build healthy, sustainable grassroots movements. More details on each of the proposed actions are provided in the longer, online version of this Guide.

5.1 Preparing for a possible mine: protecting the land

As a general rule, we recommend intervening at the earliest stage possible, as the further advanced a mining project is, the more difficult it is to modify or slow down. Possible actions include:

- Identify and document the *reasons for protecting a territory* (i.e. identify vulnerable, endangered or threatened species living there, identify sensitive areas, etc.);[114]
- Communicate this information to your regional county municipality (MRC) if you're in Quebec or your municipality, which may take steps to protect certain areas under its jurisdiction. You could even request that these areas be designated as "territories incompatible with mining activities" (*Territoires incompatibles avec l'activité minière - TIAM* in French) in the legal sense of the term, which is effectively a "no-go zone" designated by the MRC and approved or not by the Minister.

5.2 What to do when a claim is issued

As soon as a *claim* is issued, additional legislative and organizing tools are needed to protect a territory. Possible actions include:

- List the mining claims in the territory you wish to protect (the online government tools *Gestion des titres miniers* (GESTIM) and *Système d'information géominière* (SIGÉOM) can be used to track the acquisition of claims in Quebec). These tools can also be used to identify certain claim owners and their mining projects. More information on these projects can then be collected on the *SEDAR* search

114 See or contact the *Registre des aires protégées au Québec*, the work of the *Réseau de milieux naturels protégés*, the Organismes de bassins versants (OBV), the *Conseils régionaux de l'environnement* (CRE) or the list of environments justifying the suspension of mining activities provided in section 304 of the *Mining Act*, among other useful resources.

engines[115] and *InfoMine* (now called The *Northern Miner Group*);
- Monitor the identified mining project sites or zones and begin initial *documentation* of instances of contamination or other harm to the environment. These problem cases can then be reported to the Ministry of the Environment via the *Urgence Environnement hotline*;[116]
- Refuse to allow mineral exploration work to be carried out on your private property, if applicable, and disseminate this information so that your neighbours can stand united against this type of work in the event that the neighbourhood as a whole does not wish to see it carried out.[117]

5.3 A PROJECT ON THE TABLE: A ROADMAP FOR ACTION

The territory you live in has been *claimed* and explored, and a project is being drawn up by the developer. That's when it becomes important to organize as a group, so you don't have to face the developer alone as the company attempts to present and advance the project with an eye towards gaining social acceptance. Here are the steps we suggest to take to organize a citizens' movement capable of making its social and environmental demands heard:

1. Build the team: rallying your neighbours, people in the immediate project area, friends, family or any other potential supporters to your cause will make you more resilient as you carry out the next steps (via social networks, door-to-door, or otherwise);
2. Know the issues and focus on the priority areas identified by the team thus far;
3. Find a spokesperson capable of representing the group's interests: if no one feels up to this role, it's always possible to enlist outside help (for example, a spokesperson from an environmental group or trade union);
4. To gain a clearer understanding of the issues at stake in the project, use an Access to Information request to obtain all exchanges between the Ministry of the Environment and the project developer, or between the latter and the *liaison committee*[118] set up for the project. These exchanges will provide you with valuable information on the developer's considerations and the expected impacts of the project. At this stage, a follow-up committee (to be distinguished from the liaison committee, described in the footnote) will be set up by the developer. It is here that the public and environmental organizations are invited to sit with the developer and the players involved. However, this type of committee is often headed by consultants specializing in communication and consultation. Few, if any, concrete actions or criticisms emerge, and very often this type of committee serves only to

115 GESTIM: https://gestim.mines.gouv.qc.ca; SIGÉOM: http://sigeom.mines.gouv.qc.ca/; SEDAR: https://www.sedar.com/; InfoMine: https://www.glacierrig.com/infomine/.

116 Government of Quebec. *Urgence Environnement*, accessed online: https://www.quebec.ca/en/government/ministere/environnement/contact-us/urgence-environnement

117 For a sample refusal letter in French, see : Coalition Québec Meilleure Mine. *Landowners and tenants | Sample letter of refusal for mineral exploration*, available online: http://quebecmeilleuremine.org/2023/05/29/modele-lettre-refus-exploration

118 Committee acting as a bridge between the developer and the local population. Usually made up of members of chambers of commerce and elected municipal officials, it is spearheaded by the developer.

promote the developer's good deeds under the guise of citizen involvement. As a result, we don’t recommend sitting on such a committee;

5. Meet with the general public by organizing public meetings, for instance, without the presence of the developer;
6. Prepare for the questions and comments that will be raised at these meetings (gather information on the project and relevant documents);
7. Listen to the concerns of the people who come to these meetings and, as far as possible, respond to and support them. The objective here is to try to reach a consensus between the concerns and demands of the people present;
8. Meet with the various stakeholders in this project, i.e. First Nations on the territory in question, elected municipal officials in an attempt to involve them in the growing movement, the local Member of Parliament, the chamber of commerce, environmental groups and, lastly, the project developer, so that the company learns about the existence of this grassroots movement. It is important to remember that the developer will no doubt have already met most of these players (elected officials, MPs and the chamber of commerce), and that it may be difficult to rally them to the cause, but this will enable the group to hear the different points of view, as well as politicize the project by meeting with elected officials, offering visibility and credibility to the movement;
9. Speak to the media as a way to get the group’s demands heard publicly, make its existence known and, eventually, rally more support for the cause;
10. Participate in meetings organized by the project developer and make your voice heard;
11. Prepare questions representative of the group's interests and go to the microphone at these meetings to ask the developer the most pertinent questions. It's not uncommon for questions to go unanswered. Writing a press release announcing that you haven't received satisfactory answers may help ensure that your questions are heard in the public arena, and putting a media spotlight on the developer may get you quicker or more satisfactory answers;
12. In the event of continued disagreement about a project under development, it is always possible to take legal action against the developer for infringing on the rights of an individual or group. Alternatively, a formal notice, class action, or similar legal action can force the hand of a developer who fails to listen to the public. This is a potentially exhausting solution, both psychologically and financially, so it's an option of last resort. It may enable you, however, to obtain fairer compensation for the impacts suffered. It may also enable you to obtain more attractive compensation at the developer’s expense.

In all cases, it's very important to remain in control in the face of potential attacks, insults, or smear campaigns. If someone tries to discredit your message and your demands, find out as much as you can and respond simply with documented facts about the impact of the presented project. If you are insulted, don't waste your precious energy responding to this type of message. And, above all, if your physical integrity is harmed, or threatened, don't hesitate to report anyone or anything to the *Sûreté du Québec* or other relevant authorities.

To strengthen your organizing efforts, it’s a good idea to raise as many funds as possible in anticipation of future actions. Circulating petitions, demonstrating at city council meetings, or even developing a website where you can save useful documentation and keep track of the project and the group's various actions are also options. In any case, it is advisable to have a system in place for sharing documentation and knowledge in order to avoid duplicating work and to encourage the involvement of many group members. When it comes to involving many people, a good recipe for success is to have each individual work within their own field of expertise or interest, and to take care not to place all the pressure on the shoulders of one or only a handful of members.

It’s a good idea to be well prepared for the moment when a given project meets the legal threshold requiring public consultation, or even an environmental assessment before the BAPE or another relevant body. In the event that a BAPE consultation is not scheduled, it is a good idea to ask your Member of Parliament or their associated party to hold hearings in order to assess the project. Bring that message to the media to reach the broader public and increase support for this request.

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5.3.1 Before the BAPE

If a hearing does go before the BAPE, be prepared. Recall that this body only retains the power to make recommendations, but that a great deal of information will pass through there; you will likely be able to obtain documents that would otherwise have been difficult to acquire. It is also possible to facilitate greater awareness among the committees responsible for evaluating the project, who could then in turn impose conditions on the project’s development. Given that these conditions are legally enforceable, this is one of the best tools for protecting the environment or for obtaining adequate compensation for impacts generated by the project. We therefore recommend coming up with a list of questions and posing them to the developer. It is advisable that several people attend the hearings and take turns asking the prepared questions. You can call in independent experts (geologists, biologists, etc.) to help address specific issues and to give added weight to your claims. Financial assistance is available to support this type of approach.

Here are a few examples of issues that may be raised during environmental assessments and public consultations:

- *Project justification*: is this project essential to the province's development? What is the purpose of the metal or mineral to be mined?
- *Alternative solutions*: have they been evaluated according to rigorous, verifiable criteria?
- *Baseline environmental conditions*: is the sampling carried out by the developer sufficient to provide a baseline characterization of the environment and the expected project impacts? Have all potential contaminants been considered in this initial characterization?

- *Mitigation measures*: certain aspects of the project are sometimes overlooked. The effectiveness of mitigation measures are often overestimated, while project impacts often go underestimated (for instance, wastewater collection systems, sealing of water collection basins and tailings ponds, effectiveness of water treatment systems, consideration for accidents). Addressing these shortcomings can, in some cases, be the key to successful project implementation.
- *Cumulative effects*: are almost always systematically underestimated. These gaps in environmental assessments deserve to be addressed during public consultations. The Long Point First Nation Council, for example, has already addressed this key issue in March 2022 in light of Sayona Mining's *Tansim Lithium project*.[119]

- *How will the project be monitored?* It's almost always the case that the developer itself will carry out monitoring activities, in addition to the occasional annual visit by a government inspector. What measures will be put in place in the event of problems on site? The developer could pay for local samplings or citizen monitoring of the project, without requiring local residents to submit their findings to the company. This type of request could be added to the conditions imposed on the developer if the project is authorized.
- *Measures to monitor the health of the environment in which the project is located:* impact monitoring is sometimes neglected off-site (e.g. certain bodies of water near the extraction zone).

The project developer can be questioned on these points at almost any time.

5.4 Once a project has been approved: never too late to ask for best practice

Even if the project is approved, it's never too late to demand that aspects of project development be modified. It's also never too late to stop the project itself and demand the immediate restoration of the local environment. Your RCM or municipality still has the power to act on issues deemed “nuisances” (e.g. blasting, road traffic, etc.).

Furthermore, it is to your advantage to demand transparency from the mining company and elected officials. In concrete terms, this means transparent communication of data and documents such as certificates of authorization, analyses of water in the surrounding environment and soil contamination, as well as data relating to the monitoring of contaminant emissions of all kinds. We also recommend that you use the *Access to Information Act* to obtain all notices of non-compliance with the MDMER, *Directive 019* or any other law, regulation or directive. You

119 Long Point First Nation Council, *Lithium mining in ancestral territory: Sayona Mining's project assessment must study cumulative impacts and allow Long Point First Nation to conduct its own study*, March 21, 2022, accessed online. https://miningwatch.ca/news/2022/3/21/long-point-first-nation-requests-indigenous-led-impact-assessment-and-cumulative

can also request *Effluent Discharge Objects* (EDOs) for follow-up purposes, as this is the document the company will use to determine what it can release into the environment, and at what concentration. Exceeding EDOs at too high a frequency or over too long a period is considered an environmental offense. This document can therefore serve as a "roadmap" for what you need to watch out for.

As with EDOs, enforceable conditions following environmental assessments (consultations, BAPE, IAAC, etc.) require the developer to comply with rules specific to the project. It is therefore advisable to monitor actual compliance with these conditions. As these documents are sometimes voluminous, you can always list the conditions that apply to you (e.g. dust emissions, contamination of nearby waterways, vibrations due to blasting, etc.) and focus your attention there.

Finally, according to the *polluter-pays* principle enshrined in the *Sustainable Development Act*,[120] a developer should cover the full cost of environmental monitoring of its mine site, even after closure. Monitoring officially ends when the *Release Certificate*[121] is issued. This coverage could therefore take the form of a sum paid to the environmental assessment committee (e.g. IAAC, COMEX), which would redistribute it to citizens wishing to carry out this monitoring independent from the developer. The developer should also allow access to mine sites for these sampling or voluntary monitoring campaigns.

120 Ministère de l'Environnement et de la Lutte contre les Changements Climatiques. *The principles of sustainable development: a guide for action*, accessed online: https://www.environnement.gouv.qc.ca/developpement/principes_en.htm

121 Ministère des Ressources naturelles et des Forêts. *Mine reclamation - Legislative provisions*, accessed online: https://mrnf.gouv.qc.ca/en/mines/mining-reclamation/legislative-provisions/

Chapter 6 – Conclusion

In this Guide, we have provided a brief overview of the phases of development for a mining project. At a minimum, this Guide attempts to provide insight to the main impacts of mining activities on water, while presenting possible measures to mitigate and alleviate these impacts. We have outlined the main laws and legislative tools which deal with mining activities and their likely impacts on water, in order to better understand the legislative framework which governs these land-use activities. Ultimately, the Guide aims to provide some food for thought on collective action and the development of healthy movements to assert rights, defend the territory, and protect water resources.

As it stands, it is clear that the extractive industry continues to use the principle of “optimal use of mineral resources” as the basis for most of its activities. This principle, however, leads to the unbridled exploitation of land, in line with a very short-term vision for the "development" of our societies. As a result, the principles of sustainable development, reconciling mining with other land uses, and intergenerational equity are often disregarded. This level of disregard means that citizens must maintain a constant and close watch on the industry, while daring to make ambitious demands to improve the system and our relationship with the land we inhabit.

We make a few proposals that we hope will improve the framework for mining in Quebec. First and foremost, we need to increase the budget of the MELCC (which has never exceeded 0.48% of the total government budget),[122] collectively determine which deposits we really need to exploit (considering, for example, that 92% of the gold mined in Canada is only used to make jewelry or gold bars),[123] and prioritize concrete, concerted efforts towards recycling and recirculating materials in order to limit the extraction of raw minerals – but not at any price, especially if we consider the case of the Horne Foundry in Rouyn-Noranda.[124]

In any case, grassroots organizing and meaningful involvement in consultations around mining projects remains a key focus for improving mining practices. The region has suffered far too much from the greed of certain major industrial players. We therefore hope that this Guide will provide the necessary tools for a broader involvement of citizens, Indigenous nations, municipalities and environmental groups, as soon as possible. Environmental sustainability and the ability to meet our needs and those of future generations depend on it.

122 Francoeur, Louis-Gilles; Ramacieri, Jonathan. *La caution verte: Le désengagement de l'État québécois en environnement*, Chapter 1, Éditions Écosociété, 2022.

123 Natural Resources Canada. *Gold facts*. https://natural-resources.canada.ca/our-natural-resources/minerals-mining/minerals-metals-facts/gold-facts/20514

124 For more information: Regroupement Vigilance Mines Abitibi-Témiscamingue, *Horne Foundry tab*. https://reseauvigilance.ca/category/fonderie-horne/

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Glossary

Acid mine drainage (AMD): acidic water flow containing dissolved metals. This flow occurs when waste rock, ore, or tailings containing sulfide minerals come into contact with air and water, creating a reaction that oxidizes these minerals and makes it possible for them to be leached by the water flowing over these materials.

Carrying capacity (of ecosystems): the limit beyond which an ecosystem is too degraded to provide the ecological services required to ensure the well-being of the species and populations it supports. For the moment, however, there is no standardized method in the mining industry for quantifying or qualifying the carrying capacity of the various ecosystems impacted by projects.

Claim (or mining title): a real property right that gives the holder the exclusive right to explore land (public or private) for mineral substances. The claim is the only exploration title that can be issued for the exploration of mineral substances in the public domain.

Contaminated Neutral Drainage (CND): like acid mine drainage, contaminated neutral drainage consists of a flow of water that has come into contact with materials (waste rock, ore, tailings) and leached them of certain contaminating materials. This leaching is made possible by contact between the rock and oxygen, which oxidizes the minerals contained in the rock, and then the water, which leaches the aggregate. This water, which carries contaminants but has a neutral pH due to the presence of neutralizing elements (carbonates, hydroxides, silicate minerals) in this environment, is no less toxic for the environment.

Dewatering: pumping water out of an area (pit, trench, mine gallery) that needs to be kept dry, typically to carry out some kind of work.

Drilling: perforating a small-diameter hole (typically 5 to 12 centimetres) using a mechanical device called a drill. Used to take samples of soil, rock and groundwater.

Effluent: on a mine site, effluent is the combination of all water sources that are discharged into a waterway at the exit of the mine site. Water sources include runoff flowing onto or from the site, percolation water, groundwater resurgence water, exfiltration water, effluent from the ore processing plant, effluent from the water treatment plant, and water pumped from excavations or underground structures.

Effluent discharge objectives (EDOs): standards set for a specific project and calculated on the basis of the initial quality of the environment, the standards in force in the area, the expected impacts of the project and the market-available water treatment technologies. These standards are not legally enforceable, but they do set final effluent quality objectives that mining companies must meet before discharging contaminated water into the environment.

Eutrophication: a process triggered when a body of water receives a large amount of fertilizer, relative to its initial state. These nutrients lead to the proliferation of more organic matter than the body of water's self-purification processes can normally handle, resulting in "eutrophication."

Feasibility study: document compiling the results of an analysis of the degree of technical and economic feasibility of a project. It is based on temporal, budgetary and qualitative evaluation parameters. The relevance of a project is therefore assessed primarily in terms of its profitability.

Gangue: refers to all the rocks and minerals of no economic interest that surround ores or gems in their deposits. Gangue is mainly composed of waste rock.

Geophysical survey: assessment of the geological structure or mining potential of a given site, using equipment that indirectly measures certain physical properties of the subsoil (gravity, magnetism, seismicity, etc.).

Hydrographic network: all the watercourses in a given region, organized into watersheds.

Hydrological regime: "All the variations in the state and characteristics of a body of water that recur regularly in time and space and that present seasonal or other phases."[125]

Indigenous and treaty rights: collective rights of First Nations, Métis, and Inuit peoples, attributed to them by virtue of their status as original peoples to what settlers eventually named "Canada."

Leachate: liquid or filtrate that percolates through a given medium. An unsexy but demonstrative example of leachate is the "juice" that forms at the bottom of our garbage bags. In the context of mining, leachate essentially refers to water leaching dissolved contaminants through contact with ore, waste rock or tailings. Leaching is the action of producing this leachate.

Mine water: water pumped from a mine excavation to keep it dry for exploration and mining.

Mineral: solid, inorganic material made up of one or more chemical elements, but with a clearly defined crystalline structure.

Mining lease: lease granting the holder the right to exploit mineral substances other than surface mineral substances.

Ore: rock containing one or more metals or mineral substances in a percentage sufficient to justify profitable mining.

Overburden: a living layer of vegetation of little or no economic value overlying the mineable formation or rock. Overburden includes soil, humus and vegetation.

Pit: area excavated by mining operations from which the ore is extracted, i.e. the rock containing the coveted element (gold, silver, lithium, etc.). Mining pits can range in size from a few hundred meters to a few kilometers in diameter, and are generally a few dozen to a few hundred meters deep.

125 International Glossary of Hydrology, World Meteorological Organization, 469 p., 2012. https://unesdoc.unesco.org/ark:/48223/pf0000221862

Registration threshold (to submit a project before the BAPE): a scale used to determine whether or not a project will be subject to a review by the Bureau d'audiences publiques sur l'environnement (BAPE). Thresholds can correspond, for example, to a project's surface area or its productivity (in the case of mines, for example, tonnes of material extracted each day).

Rock: a homogeneous or non-homogeneous aggregate of minerals, which can take various forms (solid, friable, etc.). Rocks are generally classified according to their mode of formation (sedimentary rock, volcanic rock, metamorphic rock, etc.).

Soil: portion of the earth's crust above bedrock. Soils include sand, earth, peat and other loose surface materials.

Stockpile: land where mineral substances, concentrates from ore processing, topsoil, waste rock or any other form of mining waste are/will be accumulated.

Stripping: excavation of the soil covering the bedrock.

Tailings management facility: includes all components and functional facilities related to tailings management, such as dikes, dams, weirs, settling structures, pipelines and settling and polishing ponds.

Territory Incompatible with Mining Activity / Territoire incompatible avec l'activité minière (TIAM): a legislative tool introduced in Quebec when the Mining Act was reformed in 2013. Territories incompatible with mining activity are areas defined by MRCs, in consultation with the Quebec government, where the viability of activities taking place there would be compromised by the impacts generated by mining activity. This tool makes it possible to protect certain areas for economic, ecological or recreational reasons, or, in particular, to ensure water supplies for the population.

Trench: shallow excavation made with a manual or mechanical shovel to take soil or rock samples.

Waste rock: rock that contains no minerals in sufficient concentration to be considered ore, but which must be removed during the mining process to allow access to the ore.

Watershed: a geographical zone where water is collected by a river and its tributaries. A watershed is delimited upstream by the watershed and downstream by the point of convergence or outlet. Rainwater on either side of the watershed therefore flows in two different directions. A watershed is often subdivided into a number of sub-watersheds, corresponding to the area fed by each of the tributaries flowing into the main river.