



**Environmental and Social Impact
Assessment for the Troilus Mine Project**

Alternatives Assessment

Environmental and Social Impact Assessment for the Troilus Mine Project

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Acronyms and abbreviations

AGP	AGP Mining Consultants Inc.
BOD	Biological Oxygen Demand
CLIC	Centre logistique intermodal à Chibougamau (Intermodal Logistics Center of Chibougamau)
CN	Canadian National
COD	Chemical Oxygen Demand
COMEV	Environmental and Social Impact Evaluating Committee
EDC	Export Development Canada
EDC	Export Development Canada
EPA	Environmental Protection Agency
ESIA	Environmental and Social Impact Assessment
GHG	Greenhouse Gasses
HT	High Voltage
IAAC	Impact Assessment Agency of Canada
kV	kilovolt
LEET	Lieu d'enfouissement en tranchée (Trench Landfill)
LET	Lieu d'enfouissement technique (Engineered Landfill)
MELCCFP	Ministère de l'Environnement et de la Lutte contre les changements climatiques, de la Faune et des Parcs (Ministry of the Environment, and the Fight against Climate Change, Wildlife and Parks)
MVA	Megavolt-ampere
TSF	Tailings Storage Facility
TSS	Total Suspended Solids

2. Alternatives Assessment

As specified in the guidelines established by the provincial (Ministry of Environment, the Fight Against Climate Change, Wildlife and Parks [MELCCFP]) and federal (Impact Assessment Agency of Canada [IAAC]) authorities for the preparation of the Environmental and Social Impact Assessment (ESIA) for the Troilus Gold Corp. (Troilus) mine project, this chapter presents the alternatives studied in relation to the project's location, route and technologies.

The Troilus mine site has been mined historically, and most of the alternatives studied are based on experience gained from previous operations or the possible reuse of existing infrastructure.

However, a comparative analysis of alternatives is carried out to ensure that those to be included in the project adequately address the major concerns of stakeholders and government agencies. The choice of certain alternatives is based on a multi-criteria analysis, including a weighting of the selected criteria.

2.1 Location and route alternatives

To meet the requirements of provincial and federal directives, Troilus analyzed alternatives for certain project-specific components. The alternatives studied are presented in the sections below.

2.1.1 Infrastructure

From the outset of project design, it was determined that certain existing infrastructure built since the former Troilus mine was in operation would be reused wherever possible to reduce the footprint. Table 2.1 below shows the existing infrastructure that will be reused as part of this project.

Table 2.1 Existing infrastructure on the Troilus site

Location	Existing Infrastructure	Reuse
J4 and 87 open pits	Open pits	Re-use and expansion of pits J4 and 87.
Fresh water pumping station - Lake A	Pumping point and piping	The fresh-water pumping point remained the same as in the first operation. The piping is still in place and will be reused.
High-voltage (HV) substation	Existing 50 MVA	Extension to 75 MVA
Incoming power line	Existing 161 kV	Reuse and realignment along the east side of the existing Tailings Storage Facility (TSF).
Site power lines	25 kV Existing	Reuse and extension to SW pit, remote pumping stations and camp.
Roads	Site access roads	Reuse of 39 km and extension of approximately six kilometers to the site of the new processing plant.
Roads	Site roads	Reuse of all existing site roads; realignment and extension to new mill site.
Tailings Storage Facility (TSF)	Existing	Future increases required.

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Location	Existing Infrastructure	Reuse
TSF water treatment plant	Existing	Sufficient for first two years of operation.
Helicopter landing area	Existing	Reuse
Trench landfill (LEET)	Existing	Reuse of the LEET with remaining capacity until final capacity is reached. Residual materials will then be sent to the Chibougamau engineered landfill site (LET).
Waste rock piles	Waste rock pile 87	Some waste rock piles will be reused and expanded for future operations.
Camp sector	Camp development area	The former camp area will be reused for future camp development.

2.1.1.1 Waste Rock Pile and Tailing Storage Facility

Troilus considered several alternatives for the location of the waste rock piles and the TSF. The main criteria for choosing locations for the waste rock piles and tailings storage facility (TSF) were: within the watershed, outside the watershed, and reuse of existing infrastructure.

In addition, two workshops were held on November 14 and 15, 2022, and March 19, 2024, to take into account the concerns and recommendations of land users in selecting infrastructure locations.

It is important to note that the infrastructure sizing and design are presented as a guide, to give the reader a general idea of the infrastructure that could be built. No detailed design has been carried out for alternatives 1 and 2, for the reasons detailed below.

Alternative 1: location of waste rock piles and TSF outside the watershed.

Troilus considered locating the waste rock and tailings storage facility outside the Lake A watershed (PE43), as illustrated in Figure 2.1 below.

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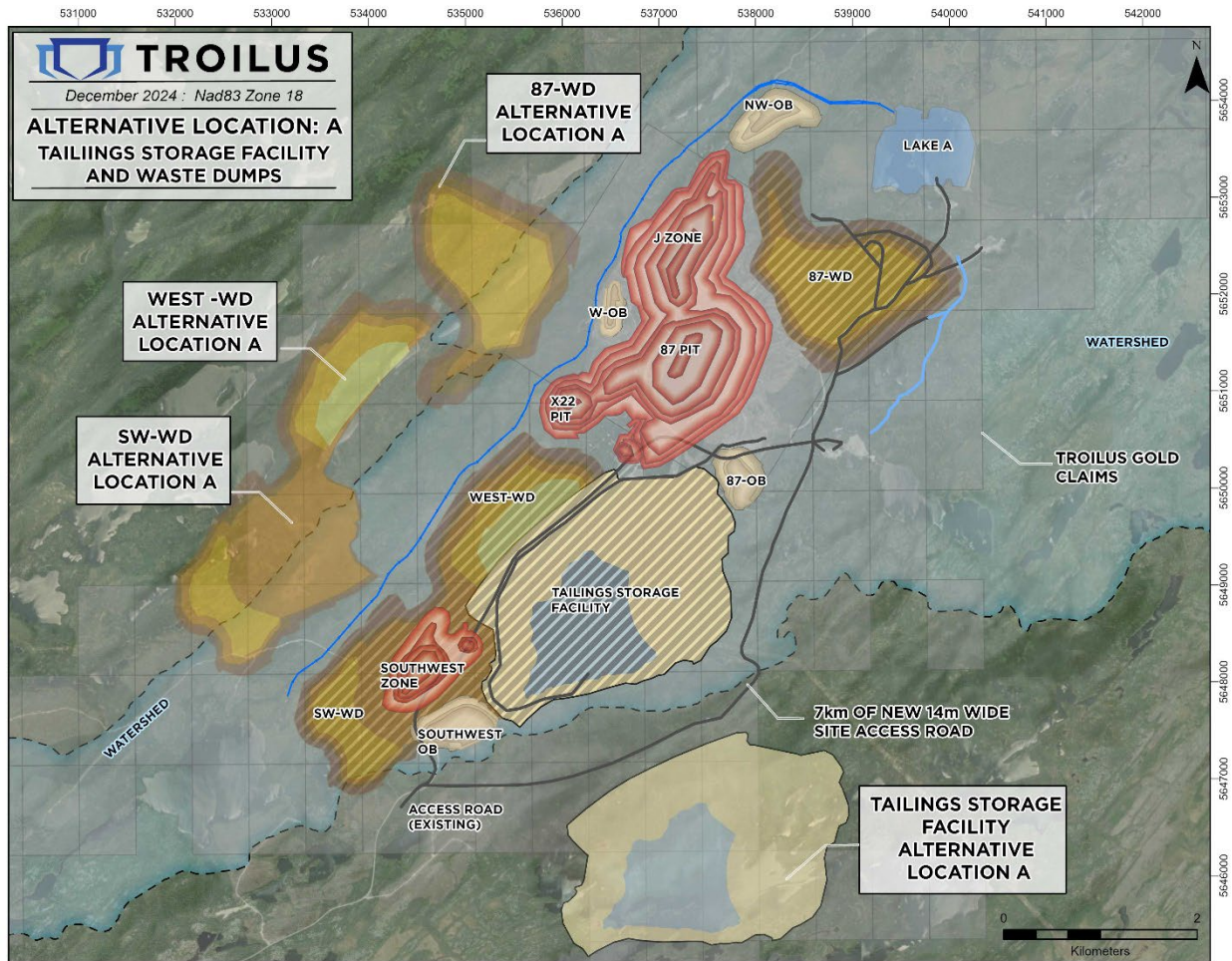


Figure 2.1 Infrastructures considered outside the main impacted watershed (Troilus)

Alternative 2: Waste rock piles and TSF located within the watershed

Troilus considered locating the waste rock and tailings storage facility within the Lake A watershed (PE43), as illustrated in Figure 2.2 below.

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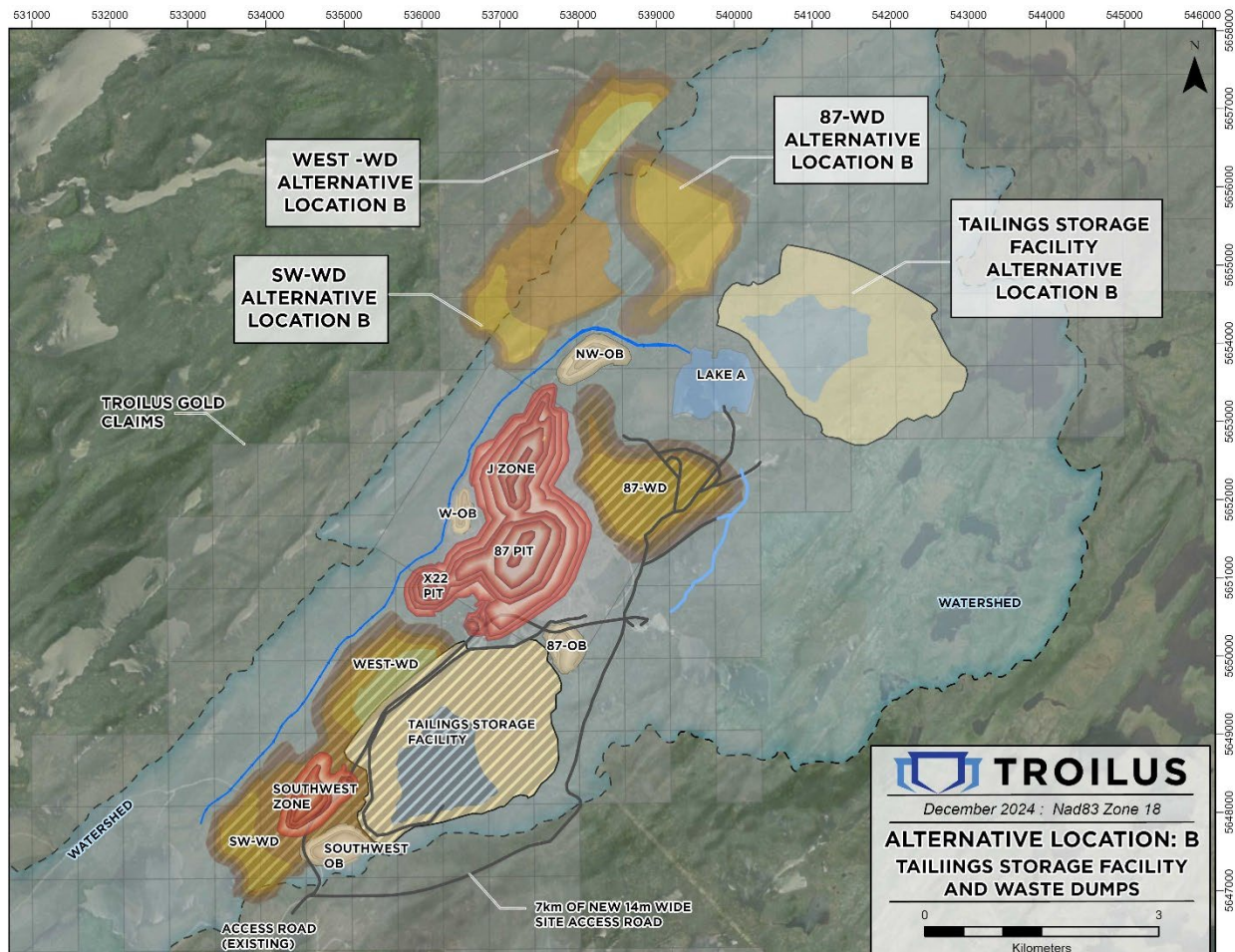


Figure 2.2 Infrastructures considered within the impacted watershed (Troilus)

Alternative 3: maximum reuse of existing infrastructure

This alternative aims to reuse old infrastructure wherever possible. The tailings storage facility used during the operation of the old mine will again be used for the present project. The current 340 ha tailings facility will be expanded to 491 ha to accommodate up to 169 million tonnes of additional tailings. In addition, the waste rock pile north of pit 87 will be reused to store waste rock from the new operation.

Evaluation of alternatives :

The evaluation of alternatives was based on the anticipated impacts of each Alternative, taking into account the following criteria:

- **Environmental criteria**, such as the impact of the alternatives on various plant and wildlife habitats, including physical components such as air, soil and water;
- **Health and social criteria**, such as the impact of the alternative on land use and human health;

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- **Technical criteria** such as the technical and economic feasibility of the proposed alternative;
Example: distance to be covered, complexity of water management structures.

It is important to note that all alternatives under study involve the diversion of the Bibou Creek, as this is required for the development of pits J 87 and X22. The diversion of Bibou Creek is therefore not a factor in the evaluation of tailings storage facility and waste rock pile locations.

Table 2.2 Evaluation of mining infrastructure alternatives

Alternatives	Environmental Criteria	Health And Social Criteria	Technical / Economic Criteria	Total
1 (development of mining infrastructures in a different watershed)	1	1	1	3
2 (development of mining infrastructures within the same watershed, downstream of the site)	2	2	1	5
3 (maximum reuse of mining infrastructures and development of new infrastructures in the area disturbed by the historic operation)	3	3	3	9

Note:

1= Presents major impacts/challenges not present in the other alternatives under study.

2= Contains potentially significant impacts/challenges not present in the other alternatives under study.

3= Has reduced impacts/challenges compared to other alternatives under study.

Alternatives selection :

Alternative 1:

The Troilus mine site is located at the head of its watershed. In addition, the infrastructure built during the first mining operation presents constraints to the development of new infrastructure. The design of mining infrastructure such as waste rock piles and the tailing storage facility in another watershed may present fewer limitations than the development of infrastructure in a restricted area with existing infrastructure.

That said, the environmental impact of this alternative would be greater for several reasons:

1. The impacted area would be larger;
2. New habitats outside the existing impact zone would be affected;
3. Effluents would be discharged into different watersheds;
4. Bibou Creek Diversion would still be required.

In terms of health and social constraints, infrastructure sprawl would have a major impact on land use. In addition, potential sources of contamination such as tailings and waste rock piles would be diffuse and more difficult to control. By grouping anticipated effluents together, the proponent would be able to control environmental discharge and implement mitigation measures such as a treatment system, which would be difficult to envisage if the infrastructures were developed in a different watershed.

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Finally, there are no technical advantages to alternative 1, other than the fact that the infrastructure design would present fewer constraints due to the fact that the areas under study are green fields. Travelling distances would be greater, which would have a major impact on operating costs and greenhouse gas (GHG) emissions.

In summary, alternative 1 has a number of environmental, health/social and technical disadvantages, including:

- Larger footprint;
- Impact on more than one watershed;
- Longer transport for waste rock and tailings;
- Greater production of GHGs;
- Greater disturbance to wildlife and land users.

For all these reasons, alternative 1 was not retained.

Alternative 2:

As previously mentioned, the mine site is located at the head of its watershed and already includes several mining infrastructures. To avoid constraints associated with existing infrastructure, the Troilus team examined the advantages and disadvantages of developing future infrastructure downstream of the current site.

In terms of environmental constraints, building infrastructure downstream of the site would have an impact on water quality, as potential sources of contamination would be further away from the current site, reducing the natural dilution that mitigates the project's potential impact on surface water quality. In addition, the area downstream of the site is marked by the presence of wetland complexes that support important ecological functions.

Although this alternative has more advantages than alternative 1, for the reasons listed below, it was not retained.

Identified benefits include :

- Preservation of restored infrastructures;
- Only one watershed impacted.

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Disadvantages include :

- Large footprint;
- Longer transport for waste rock and tailings;
- Higher operating costs;
- Higher GHG emissions; Greater disturbance to wildlife and land users.

Alternative 3 :

Alternative 3 involves reusing existing infrastructure and building new infrastructure in areas close to existing infrastructure. It has the fewest environmental, social/sanitary and technical drawbacks, for the following reasons:

- Minimization of the impacted footprint;
- Only one watershed will be impacted;
- Lower GHG emissions;
- Lower operating costs;
- Lower disturbance to wildlife and land users, as the environment is already disturbed.

In addition, land users agreed that reusing existing infrastructures was desirable to limit the impact on wildlife, flora and their land uses. This option also allows the engineering team to optimize water management on the site according to the infrastructures currently in place.

It is therefore Troilus' opinion that alternatives 3 presents the fewest disadvantages and the most advantages in environmental, technical and social terms. Alternative 3 is therefore retained.

2.1.1.2 Ore Stockpile

The location of the low-grade ore stockpile was chosen on the basis of the following factors:

- Proximity to process plant;
- Impact on fish habitat;
- Impact on important habitats;
- Impact on water management structures.

The area selected for the location of the ore stockpile during the feasibility study involved building the ore stockpile below natural streams. To avoid impacting fish habitat and the natural flow of Lake B, the ore stockpile was relocated to the southeast.

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The suggested new location would reduce environmental impacts for the following reasons:

- Elimination of the need for a clean water diversion channel (DC2B-4km);
- Avoidance of impacts on fish-bearing streams;
- Avoidance of the wetland complex to the west;
- Maintain a distance equal to or greater than 30 meters from fish-bearing streams and waterbodies;
- Use of the natural topography of the area to allow efficient drainage of the network of contact water ditches.

Figure 2.3 below shows the original and modified locations of the ore stockpile

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Halde à minerai basse teneur-emplacement original



Halde à minerai basse teneur-emplacement modifié



Figure 2.3 Original and Modified Location-Low-Grade Ore Stockpile

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2.1.1.3 Overburden Stockpile

The proposed location of the overburden stockpiles was discussed with land users at the water management workshops held in 2022 and 2024, and at the closure plan workshop held in 2025. Their proposed locations are therefore representative of the interests of land users in terms of future use of the site and proximity to the infrastructure to be restored.

2.1.2 Access Road and Power Supply Line

As part of the new project, the existing power line and access road will have to be relocated over various lengths to accommodate the proposed future mining infrastructures. Approximately 39 km of the access road will be reused. The last section will have to be diverted to the east to avoid future infrastructures, and an extension of around 2 km (14 m wide) will have to be built to provide access to the mine site. It is also planned to relocate the power line some 3 km towards the mine site to accommodate the future raising of the tailings storage facility.

The project site is currently supplied by a 161 kV line operated by Hydro-Québec, with a maximum capacity of 75 MVA. The existing high-voltage substation is rated at 50 MVA and includes various equipment such as circuit breakers, transformers and a 25 kV electrical distribution system for site services. The 25 kV overhead distribution system on site needs to be expanded to accommodate new mining services, buildings, infrastructures and pumping stations. Mining equipment and water management pumps will be powered by transformers adapted from the 25 kV overhead lines.

In order to minimize the project's environmental and social impacts, particularly its encroachment on sensitive environments, the locations of the proposed access road and power supply line will be combined on a part of the route.

Four alternative locations have been proposed for relocating the eastern portion of the access road and extending the power line. Each of the alternatives considered combines part of the access road alignment and the power line under the same right of way. An assessment analysis study for the access road and power line (BluMetric, 2024a) is presented in Appendix C1. Map 2.1 below details the route of the four proposed options.

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Infrastructures proposées / Proposed Infrastructure

- Chemin d'accès proposée (Variante 2 [6,51km]) / Proposed Access Road (Variant 2 [6.51km])
- Ligne de transport d'énergie proposée (Variante 2) / Proposed Power Line (Variant 2)
- Fosse / Open Pit
- Halde à minerai / Ore Stockpile
- Halde à mort-terrain / Overburden Pile
- Halde à stérile / Waste Rock Pile
- Halde à stérile super* / Super Waste Rock Pile*
- Aire d'entreposage de minerai / ROM Pad
- Parc à résidus miniers / Tailings Management Facility
- Usine de traitement de minerai / Ore Processing Plant

Chemin d'accès / Access Roads

- Variante 1 (11,55km) / Variant 1 (11.55km)
- Variante 2 (6,51km) / Variant 2 (6.51km)
- Variante 3 (11,58km) / Variant 3 (11.58km)
- Variante 4 (11,44km) / Variant 4 (11.44km)

* : Une partie de la halde à stérile super sera construite sur la halde à stérile sud-ouest, la halde à stérile ouest et la fosse sud-ouest / Parts of the Super Waste Rock Pile will be constructed over the existing Southwest, and West Waste Rock Piles, and the South West Pit

LÉGENDE / LEGEND

- Limite de lot / Property Limits
- Limite du bail de surface du parc à résidus miniers / Tailings Management Facility Lease Boundary
- Limite du bail minier / Mining Lease Boundary
- Kernel Caribou Secteur Assinica et Temiscamie - Zone de grande importance / Kernel Caribou Assinica and Temiscamie Area of Significance
- Zone à haut risque d'accident / High Risk Accident Zone
- Littoral / Body of Water
- Lacs (GRHQ) / Lakes (GRHQ)
- Cours d'eau permanent / Permanent Watercourse
- Cours d'eau intermittent / Intermittent Watercourse
- Camp de chasse / Hunting Camp
- Tannière / Tannery

Milieux humides potentiels / Potential Wetlands (MELCCFP, 2019)

- Marécage / Swamp
- Milieu humide / Wetland
- Tourbière / Bog

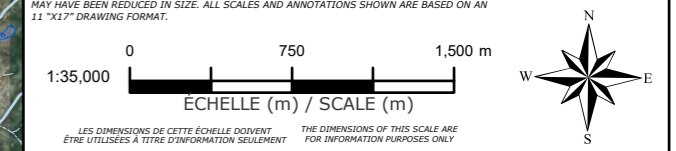
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RÉFÉRENCES/REFERENCES

Chemin d'accès, BluMetric 18 June 2025
Base Map: Bing, 06 June 2023

NOTES

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CLIENT
Troilus Gold Corp.

PROJET/PROJECT
Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessment for the Troilus Mine Project

TITRE/TITLE
Chemin d'accès Variante 1-4 / Access Road Variants 1-4

NO. PROJET / PROJECT NO. 240433 / 167040485
DATE 06/ 19/ 2025

CONÇU / CHECKED S. Sene
RÉVISÉ / VERIFIED C. Gardois

DESSINÉ / DRAWN M. Baker
Figure No. 2.1
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Alternative 1: Route length approx. 12 km

Alternative 1 is an approximately 12 km route linking the mine site to the western section of the existing access road, leading to the Route du Nord. As each Alternative combines the access road and the power line, the power line will be relocated and will follow the access road for around 6 km from the on-site power transformer station. The route of this alternative is characterized by a mountainous course with an average gradient varying between 4.2% and 5.8%. It should be noted that this alternative involves blasting work in some areas. Backfilling will also be required, as there may be little granular material available on site, increasing the cost of transporting gravel.

This route crosses 11 watercourses, 5 of them permanent and 6 intermittent. It bypasses several wetlands, thus avoiding the need for bridges and complex management of environmental issues associated with wetlands.

Alternative 2: route length approx. 6 km

Alternative 2 is the shortest route to the site, totalling around 6 km. Following this route from the electrical transformer station, the power supply line will have to be relocated over a length of around 3 km.

The route of this alternative presents road safety issues due to the risk of collisions and accidental spills that could be caused by the shape of the route, which features sharp bends. It should be noted that the route passes close to a portion of the east dam of the existing tailings facility (TSF-E), which lies immediately west of the second right-angle bend in the proposed route.

The route crosses 9 watercourses, all intermittent, and avoids any marshes, swamps, bogs, ponds or waterbodies.

Alternative 3: route length approx. 12 km

With a total length of around 12 km, alternative 3 follows the same route as Alternative 1 for the most part, except for a distance of 4.2 km, and then follows the route of Alternative 1, reducing its length by 180 m compared to Alternative 1. The power supply line will be relocated within the access road right ofway over a distance of around 6 km, starting from the existing electrical transformer substation.

The route for this option crosses 11 watercourses, 5 of which are permanent and 6 intermittent. It also crosses a wetland and will require the construction of several bridges and culverts, a major technical and economic constraint. The average gradient along the entire route varies between 3.8% and 5.3%. The average elevation is 418.7 m and varies between 380 and 476 m.

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Alternative 4: Route length approx. 12 km

This alternative has a total length of around 12 km, similar to the previous option. For 9 km, it partly follows the same route as alternative 1. The route for this option follows existing drilling paths on some sections, and therefore has the advantage of avoiding or reducing the impacts associated with construction work, especially blasting.

Alternative selection :

The Pugh matrix was used as a decision analysis tool in the selection of alternatives.

Table 2.3 details the comparison criteria used to evaluate the proposed alternatives.

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Table 2.3 Comparison of Alternatives Evaluated According to Criteria

N°	Criteria	Indicators	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
			Pts	Justification	Pts	Justification	Pts	Justification	Pts	Justification
1	Total footprint	Surface area	5,1	Surface area: 34.6 ha	20	Surface area: 19.5 ha	4,9	Surface area: 34.7 ha	5,4	Surface area: 34.3 ha
2	Presence of old infrastructures	Presence of existing roads and possibility of reuse	0	No existing road.	0	No existing road.	0	No existing road.	10	Some drilling paths.
3	Presence of mining infrastructures	Proximity of vulnerable infrastructures or at-risk for the road.	10	No infrastructure at risk near the road.	0	The route passes close to a portion of the east dam of the existing tailings facility (TSF-E), which lies immediately west of the second right-angle bend in the proposed route. Potential technical and infrastructure safety issues have been raised and will need to be confirmed to verify whether a route modification is necessary, and whether the positioning of the route in this location is appropriate.	10	No infrastructure at risk near the road	10	No infrastructure at risk near the road.
4	Encroachment on wetlands	Number of : Marshes, Swamps, Peat bogs, Ponds.	11, 25	Marshes: 1 Swamps: 0 Peat bogs: 0 Ponds: 0 Located between two lakes	15	Marshes: 0 Swamps: 0 Peat bogs: 0 Ponds: 0	11, 25	Marshes: 1 Swamps: 0 Peat bogs: 0 Ponds: 0 Located between two lakes	11,2 5	Marshes: 1 Swamps: 0 Peat bogs: 0 Ponds: 0 Located between two lakes

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N°	Criteria	Indicators	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
			Pts	Justification	Pts	Justification	Pts	Justification	Pts	Justification
5	Encroachment in bodies of water	Number of : Lakes, Permanent watercourses, Intermittent watercourse.	5	Lakes: 0 Permanent watercourse.: 5 Intermittent watercourse.: 6	10	Lakes: 0 Permanent watercourse.: 0 Intermittent watercourse.: 9	5	Lakes: 0 Permanent watercourse.: 5 Intermittent watercourse.: 6	5	Lakes: 0 Permanent watercourse.: 4 Intermittent watercourse.: 6
6	Biological constraints	Presence of species with special designation	5	No species with special designation with a probability of occurrence specific to this Alternative.	5	No species with special designation with a probability of occurrence specific to this Alternative.	5	No species with special designation with a probability of occurrence specific to this Alternative.	5	No species with special designation with a probability of occurrence specific to this Alternative.
7	Topographic constraints	Slope, Elevation (Relief).	7	Slope: max. 22.5%, avg. 2% and 5.8 Elevation: 422.4 m	6	Slope: max. 23.6%, avg. 5% and 7.8%, Elevation: 418.7 m	7	Slope: max. 20.7%, avg. 3.8 and 5.3 Elevation: 418.7 m	8	Slope: max. 22.7%, avg. 2.9 and 4.4%. Elevation: 405.9 m
8	Geological constraints	Presence of rocks or outcrops requiring blasting.	5	Yes	10	No	10	No	5	Yes
9	Proximity to residences or camps	Number of : Residences, Camps.	6	Camp about 2.3 km away	8	Camp about 3 km away	6	Camp about 2.3 km away	6	Camp about 2.3 km away
10	Traditional land use	Presence of hunting, fishing, trapping and gathering areas	0	The Alternative is located on a Cree family trapline.	0	The Alternative is located on a Cree family trapline.	0	The Alternative is located on a Cree family trapline.	0	The Alternative is located on a Cree family trapline.
11	GHG emissions	Quantity of GHGs	6,7	Large quantity of GHGs, as this option covers a large distance (12 km).	10	Low GHG emissions, as this option covers the shortest distance (approx. 6 km)	6,7	High GHG emissions, as this option covers the greatest distance (12 km).	6,8	High GHG emissions, as this option covers the third longest distance of the 4 alternatives (12 km).

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





N°	Criteria	Indicators	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
			Pts	Justification	Pts	Justification	Pts	Justification	Pts	Justification
12	Road safety	Presence of areas with configurations presenting risks of collisions and accidental spills.	0	Several sharp bends over short distances in the western section of the route.	10	Linear route, but presence of an intersection with a relatively sharp bend in the center of the route.	2,5	Several sharp bends over short distances in the western section of the route.	12,5	Small number of sharp bends over short distances.
Total			61,05		94		68,35		84,95	

Environmental and Social Impact Assessment for the Troilus Mine Project

ALTERNATIVES ASSESSMENT












Alternative 2, shown on Map 2.2 below, is the preferred option, as its implementation involves fewer impacts on the components of the receiving environment. In particular, it avoids caribou ranges and encroachment on permanent watercourses. This Alternative would be the source of the lowest quantity of GHG emissions, due to the shorter distances involved. In addition, the access road and power supply line follow part of the same route, reducing the environmental footprint. Moreover, in economic terms, the route represents the lowest construction costs.

Infrastructures proposées / Proposed Infrastructure




-  Chemin d'accès proposée (Variante 2 [6,51km]) / Proposed Access Road (Variant 2 [6.51km])
-  Ligne de transport d'énergie proposée (Variante 2) / Proposed Power Line (Variant 2)
-  Usine de traitement de minerai / Ore Processing Plant
-  Fosse / Open Pit
-  Halde à minerai / Ore Stockpile
-  Halde à mort-terrain / Overburden Pile
-  Halde à stérile / Waste Rock Pile
-  Halde à stérile super* / Super Waste Rock Pile*
-  Aire d'entreposage de minerai / ROM Pad
-  Parc à résidus miniers / Tailings Management Facility

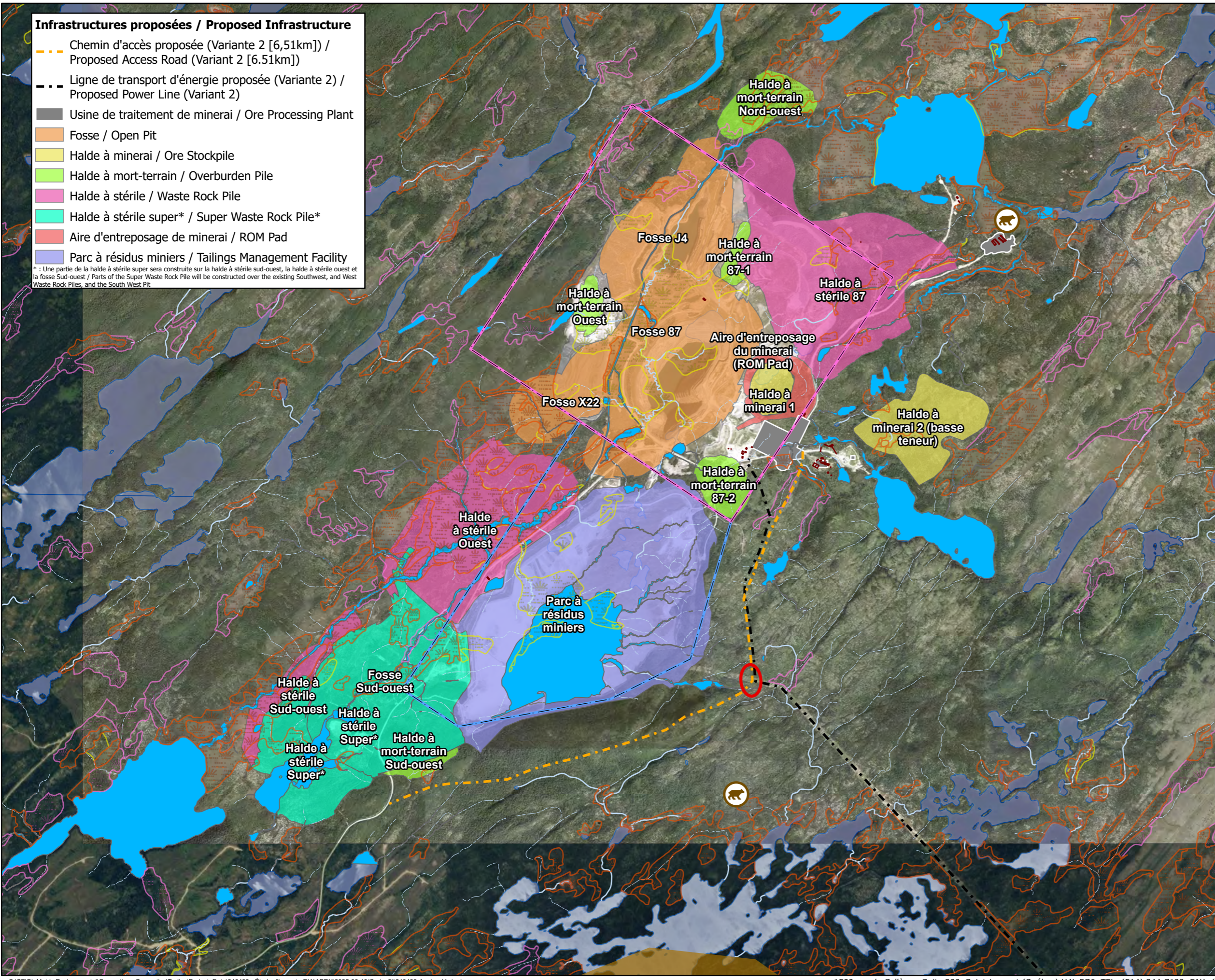
* : Une partie de la halde à stérile super sera construite sur la halde à stérile sud-ouest, la halde à stérile ouest et la fosse Sud-ouest / Parts of the Super Waste Rock Pile will be constructed over the existing Southwest, and West Waste Rock Piles, and the South West Pit

LÉGENDE / LEGEND

-  Limite de lot / Property Limits
-  Limite du bail de surface du parc à résidus miniers / Tailings Management Facility Lease Boundary
-  Limite du bail minier / Mining Lease Boundary
-  Kernel Caribou Secteur Assinica et Temiscamie - Zone de grande importance / Kernel Caribou Assinica and Temiscamie Area of Significance
-  Zone à haut risque d'accident / High Risk Accident Zone
-  Lacs (GRHQ) / Lakes (GRHQ)
-  Littoral / Body of Water
-  Cours d'eau permanent / Permanent Watercourse
-  Cours d'eau intermittent / Intermittent Watercourse
-  Camp de chasse / Hunting Camp
-  Tannière / Tannery

Milieux humides potentiels / Potential Wetlands (MELCCFP, 2019)

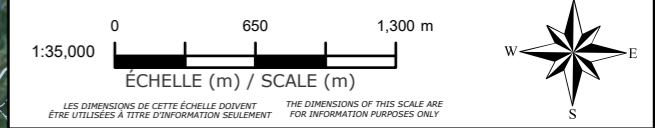
-  Marécage / Swamp
-  Milieu humide / Wetland
-  Tourbière / Bog



4				
RÉV.	DESCRIPTION	DD/MM/YY	BY	VERIF.

RÉFÉRENCES/REFERENCES
 Chemin d'accès: BluMetric, June 2025
 Base Map: Bing, 06 June 2023

NOTES
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CLIENT
Troilus Gold Corp.

PROJET/PROJECT
Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessment for the Troilus Mine Project

TITRE/TITLE
Chemin d'accès Variante 2 / Access Road Variant 2

NO. PROJET / PROJECT NO. 240433 / 167040485 **DATE** 06/ 19/ 2025

CONÇU / CHECKED S. Sene **RÉVISÉ / VERIFIED** C. Gardois

DESSINÉ / DRAWN M. Baker **Figure No.** 2.2 **ED./REV.** 4

Environmental and Social Impact Assessment for the Troilus Mine Project

ALTERNATIVES ASSESSMENT

Environmental and Social Impact Assessment for the Troilus Mine Project

ALTERNATIVES ASSESSMENT

2.1.3 Worker Accommodations

The Troilus team examined the issue of worker accommodation, but few options were technically or economically feasible. As a result, the choice of the proposed location for the workers' camp took the following elements into consideration:

- Existing drinking water wells;
- Proximity to existing infrastructure: power line, wastewater treatment system;
- Proximity to the industrial sector;
- Reuse of previously impacted areas;
- Nearby walking path;
- Existing lease.

For the above reasons, the site shown in Figure 2.4 was selected for the mining camp. This location corresponds to the historical location of the camp on the site.

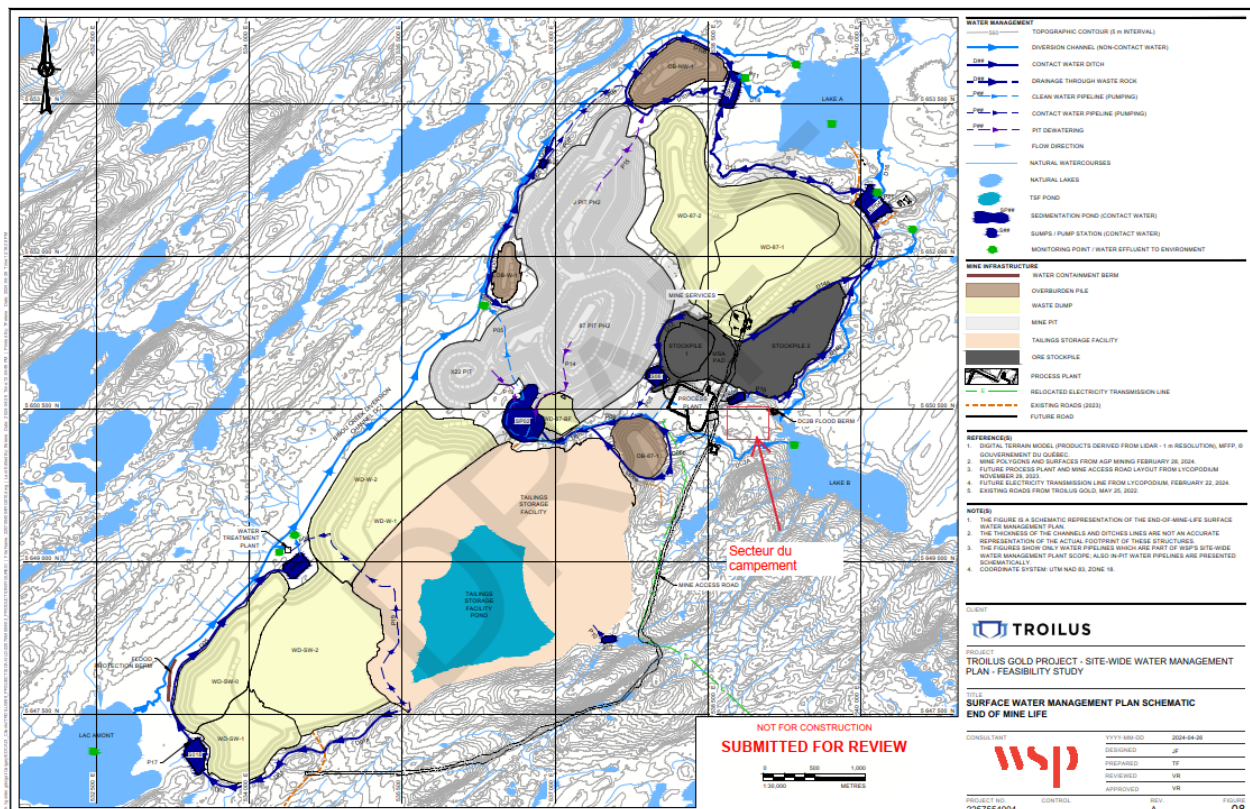


Figure 2.4 Location of the Camp Area on the Troilus Site

Environmental and Social Impact Assessment for the Troilus Mine Project

ALTERNATIVES ASSESSMENT

2.1.4 Bibou Creek Diversion

The operation of open pits 87 and J, an essential activity for the Troilus mining project, requires the diversion of a creek that drains water from the Troilus mine valley. This creek, formerly known as the Unnamed Creek, was diverted over a length of approximately 4 km during construction of the historical mining site (1996-2010), because its original path passed through pits 87 and J4 (Figure 2.5).

The new mining project includes the development of two new pits (X22 and Southwest) and the expansion of two existing pits, Pits 87 and J4. The pitJ will require the diversion of the same watercourse, now referred as Bibou Creek.

Figure 2.5 below shows the current location of Bibou Creek, its historical location and the major upstream waterbodies, namely Lac Amont (PE2) and Lac A (PE43). It is important to note that Bibou Creek is a culturally significant watercourse that plays a crucial role in supplying water to Lake A (PE43), where some land users have camps that are occupied seasonally and permanently .

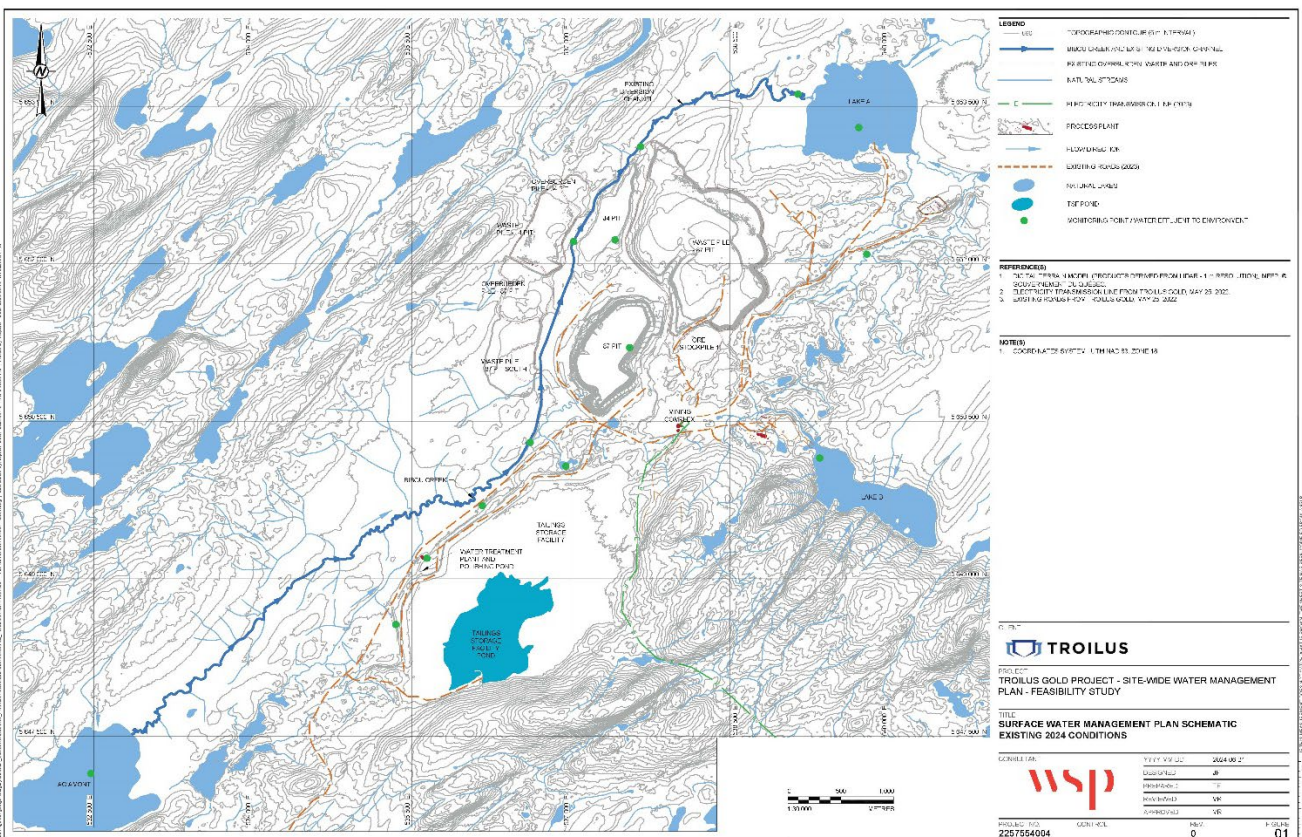


Figure 2.5 Current Layout of the Site and Bibou Creek

Environmental and Social Impact Assessment for the Troilus Mine Project

ALTERNATIVES ASSESSMENT

Troilus has organized a series of workshops with land users in 2022 and 2024 to ensure that the proposed new layout and its design are consistent with future land use, environmental protection and that land users' concerns are known and addressed. The summaries of these workshops for the years 2022 and 2024 are attached in Appendices C.2 and C.3 respectively.

At the 2022 workshop, three scenarios were presented to land users to highlight the advantages and disadvantages of each option.

The first scenario presented involved building a dam at the outlet of Lac Amont to raise the water level so that the diversion of the Bibou Creek could be made on the western side of the watershed. Scenario 1 is shown in figure 2.6 below.

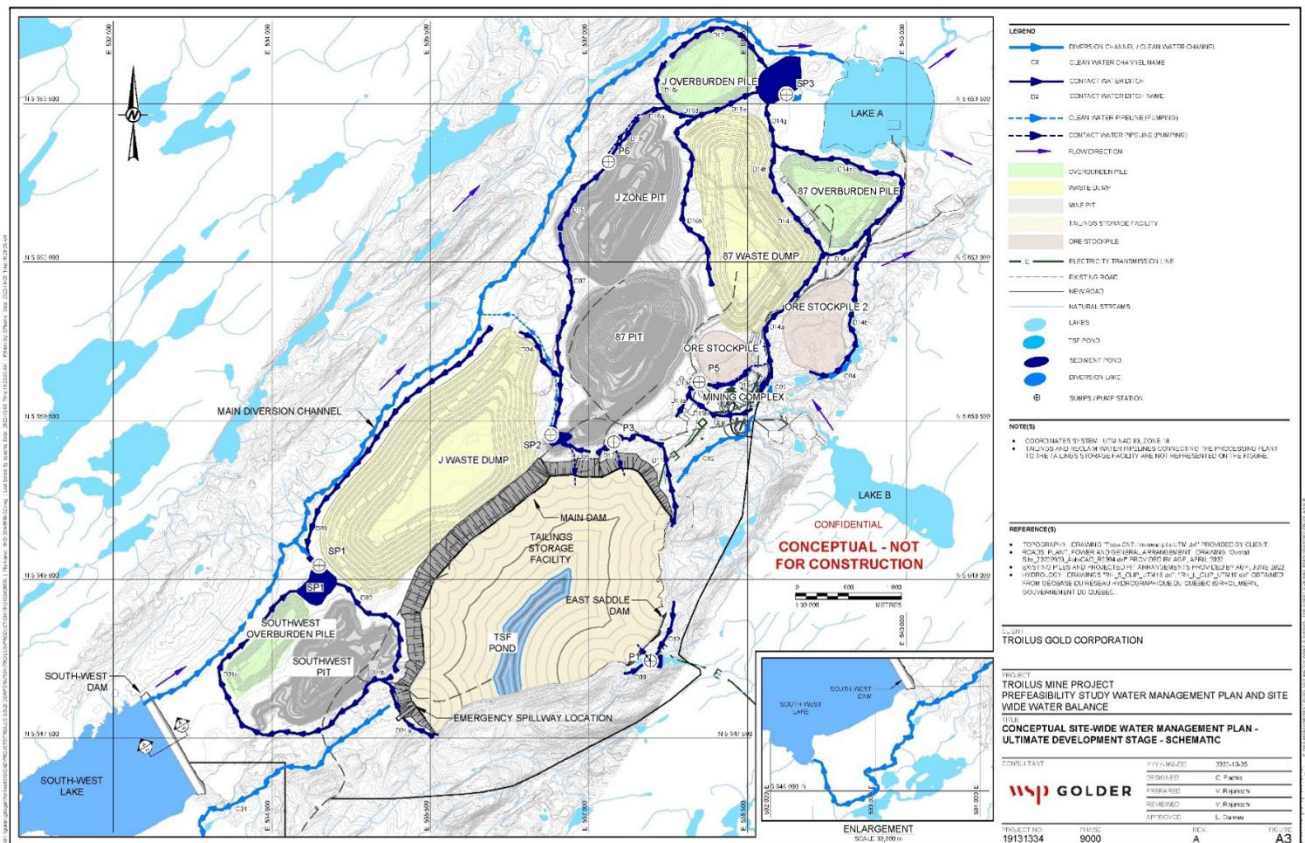


Figure 2.6 Scenario 1 - Diversion of Bibou Creek to the west using a dam built on Bibou Creek

The second scenario involved keeping the creek on its current course as far as possible, so that it would flow into pit 87 or J4. Water collected in the pits from Bibou Creek would then be characterized and pumped back to the environment. A conceptual plan for Scenario 2 is shown in Figure 2.7.

Environmental and Social Impact Assessment for the Troilus Mine Project
ALTERNATIVES ASSESSMENT

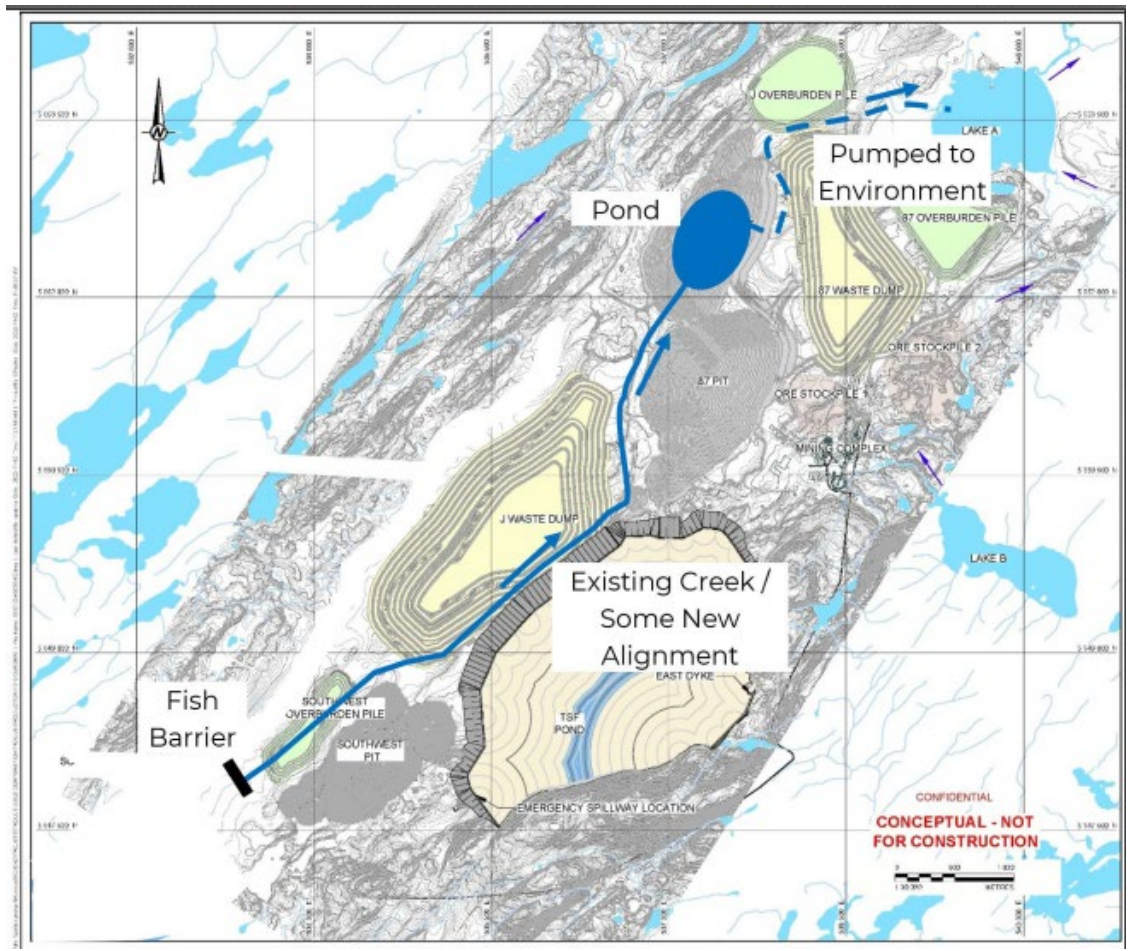


Figure 2.7 Scenario 2 - Maintain current route of Bibou Creek, pump water collected in pits to environment

The third option was to create a new outlet to another watershed for Lac Amont, which feeds Bibou Creek. Option 3 is shown in Figure 2.8 below.

Environmental and Social Impact Assessment for the Troilus Mine Project

ALTERNATIVES ASSESSMENT

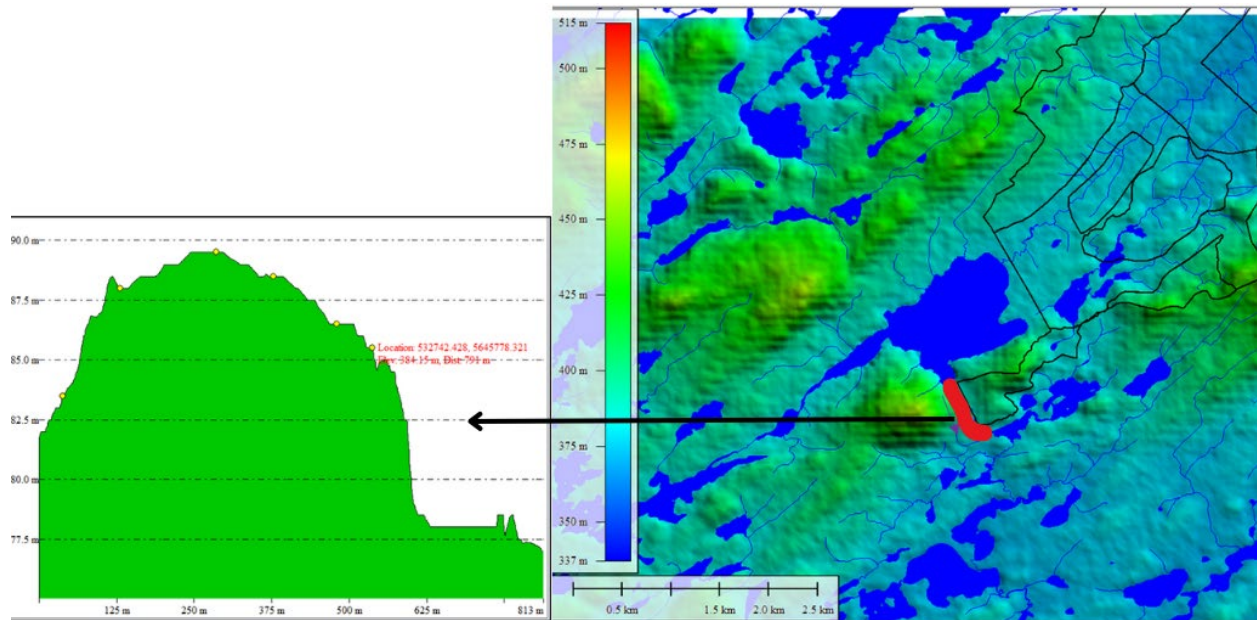


Figure 2.8 Scenario 3 - Bibou Creek diversion, Diversion to another watershed

Other scenarios were tested, such as diverting Bibou Creek to the outlet of Lake B, which eventually flows into Lake A, but this scenario was abandoned due to the topography of the study area, as well as other operational and environmental constraints such as the sizing of the Lake B outlet and the need for a clean water channel running through the industrial sector.

The three selected scenarios were presented to land users at an initial two-day workshop held in Montreal on November 14 and 15, 2022. Following the presentation of the three scenarios, working groups were formed with those present. Each group was made up of land users, engineering consultants such as WSP and BluMetric, and members of the Troilus team, ensuring that one land user was present in each working group.

Table 2.4 below summarizes the advantages and disadvantages noted for each option.

Table 2.4 Comparison of advantages/disadvantages of different Bibou Creek diversion scenarios

Scenarios	Advantages	Disadvantages	Comments
Scenario 1: Construction of a dam on the upstream lake to divert the creek to the west of the mine site.	Separates contact water from clean water.	High cost: excavation over nearly 10 km.	
	No changes required throughout operation/closure.	Construction of a dam on an unimpacted lake: risky structure, could impact fish passage.	Construction of a dam on Lac Amont (PE2) is not desired by land users. However, maintaining the creek diversion from the construction to the closure is an important element for land users.

Environmental and Social Impact Assessment for the Troilus Mine Project

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Scenarios	Advantages	Disadvantages	Comments
	Water management is simplified around the south-west pit.	Risk of valley flooding (in the event of a beaver dam): the creek would no longer be the valley's lowest point.	
		Risk of infiltration (loss of surface water) depending on soil permeability.	The creek could be waterproofed in sections.
		Lac Amont (PE2) would be impacted by the proposed infrastructure: rise in water level.	Lac Amont (PE2) is used by land users for fishing and goose hunting.
Scenario 2: Maintain the watercourse in its original state as far as possible.	Little or no modification to the natural sections of the creek.	No separation of contact water and clean water.	Would contravene Directive 019 (avoid contact of clean water with mining infrastructure)
		Fish movement would be restricted from Lac Amont as well as from Lac A.	
	No dam construction.	Creek alignment would change over time with expansion and infrastructure development.	Infrastructure would be built around the existing creek to limit impact on Bibou Creek; technical and operational challenge.
		Elimination of the waste rock pile on the edge of the TSF, which improves the stability of the future TSF.	
Scenario 3: Creating a diversion channel to divert water from Lac Amont (PE2) into another watershed	Very little water management required.	Possible freshwater deficit for operations and to maintain hydraulic connectivity of Lake A.	
	Reduced excavation costs.	A channel would still have to be created to allow mine effluent to be discharged.	
	Fewer constraints on the development of the various proposed infrastructures.	More complex and costly authorization process (baseline must cover neighbouring watershed, more expensive authorization costs).	
		Impact on 2 watersheds instead of one.	
		Water management (mining effluents) would still be required in operations and at closure.	
		Loss of main water supply to Lake A (PE43).	

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Following discussions with land users, it was agreed that Scenarios 2 and 3 had more disadvantages than advantages, and were dropped in favor of Scenario 1. Although scenario 1 was the most feasible option from both an operational and environmental point of view, the presence of a dam at the outlet of Lac Amont was not desired by land users for a number of reasons, but in particular for safety reasons and for the potential impact of a rise in the level of Lac Amont (flooding of the surrounding area, obstacle to fish passage, water quality of Lac Amont).

It was therefore agreed with the land users that the engineering team would further analyze Scenario 1, checking all options that did not involve building a dam on Lac Amont. Following this analysis, another workshop would be organized with land users.

As agreed, a second water management workshop was held in March 2024. This workshop was attended by representatives of the Cree Nation of Mistissini, the Cree Board of Health and Social Services of James Bay, the Cree Nation Government, as well as those present at the workshop held in 2022. First, a summary of the scenarios presented in 2022, including their advantages and disadvantages, was presented. The reasons why scenario 1 was chosen were explained, and the concerns expressed by users regarding this scenario were summarized.

Following these explanations, the WSP engineering team presented its approach since the 2022 workshop, which included a detailed analysis of the area's topography in order to find a solution that would not involve building a dam on Lac Amont. Two important elements enabled the engineering team to propose a scenario that incorporated the positive aspects of Scenario 1, without the need to build a dam on Lac Amont to raise the water level:

1. The construction of a protective berm downstream of Lac Amont, which would allow the diversion to begin downstream of Lac Amont;
2. Excavation of the diversion channel through a valley downstream of pit J4, which would allow Bibou Creek to be diverted towards Lake A, based on the current topography.

The location of these two elements is shown in Figure 2.9.

Environmental and Social Impact Assessment for the Troilus Mine Project

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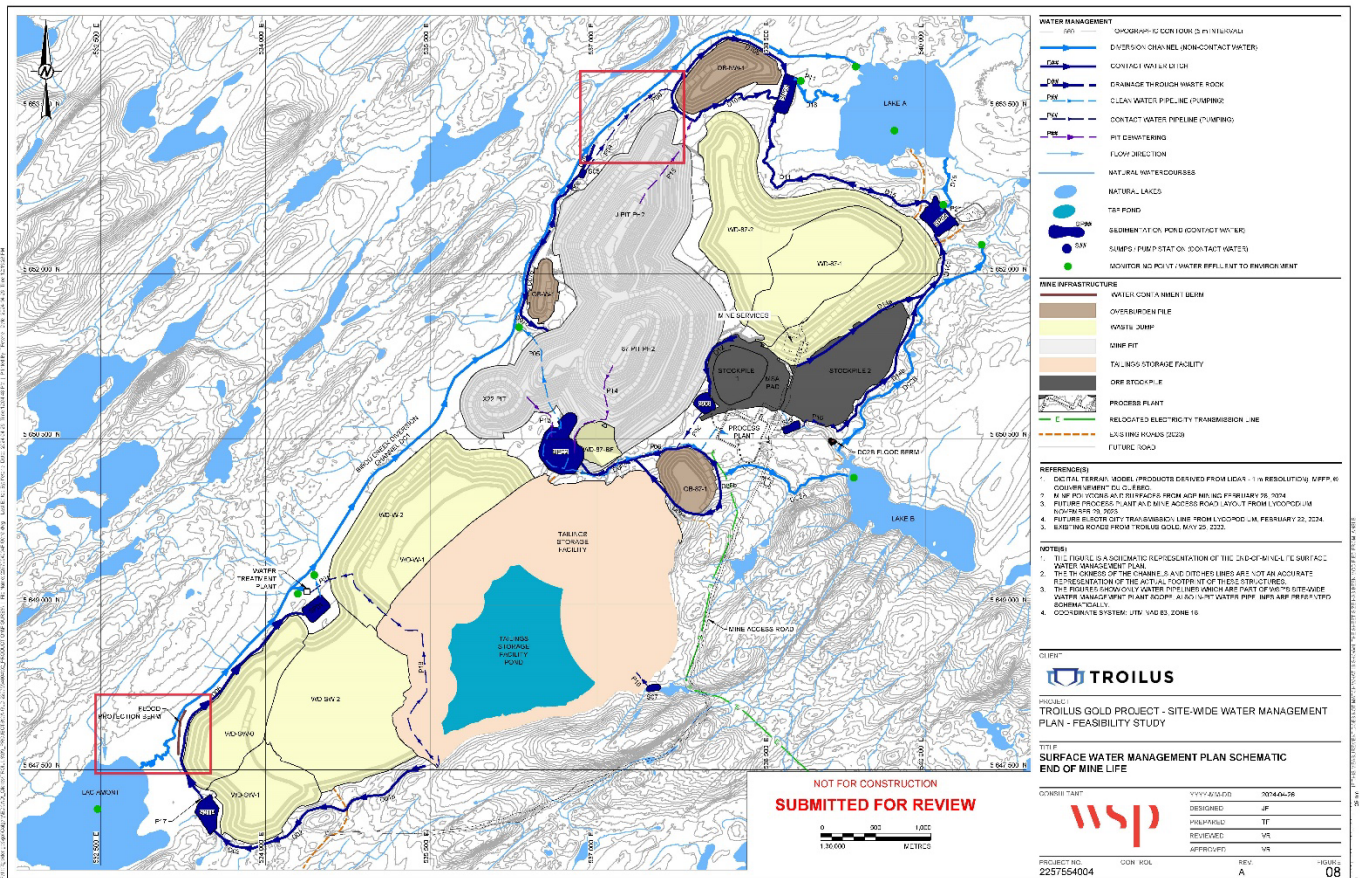


Figure 2.9 Bibou Creek Diversion Layout - Scenario without dam development

Building a flood protection berm downstream of Lac Amont and excavating the channel through a mountain so that the creek routefollows a valley downstream of the J4 pit would avoid the need to build a dam on Lac Amont.

That said, this scenario would involve new risks, such as the stability of the structure in the excavation section close to pit J4. This risk would be acceptable during operations, but too high in the post-restoration period, when the structure would no longer be monitored.

The scenario presented therefore implied that the diversion would be maintained during construction, operation and closure, until pits 87 and J were filled with water, at which point the creek would be diverted to the open pits, or the overflow would flow to Lake A through the remnants of the creek's original course. To this end, and according with the recommendations of land users, the upstream section of the creek diversion would be developed as a fish habitat, with meanders, rest areas and other conditions favourable to fish settlement, while the downstream section, which would be dismantled, would be designed to allow fish passage, but not as a fish habitat (see Figure 2.10).

Environmental and Social Impact Assessment for the Troilus Mine Project

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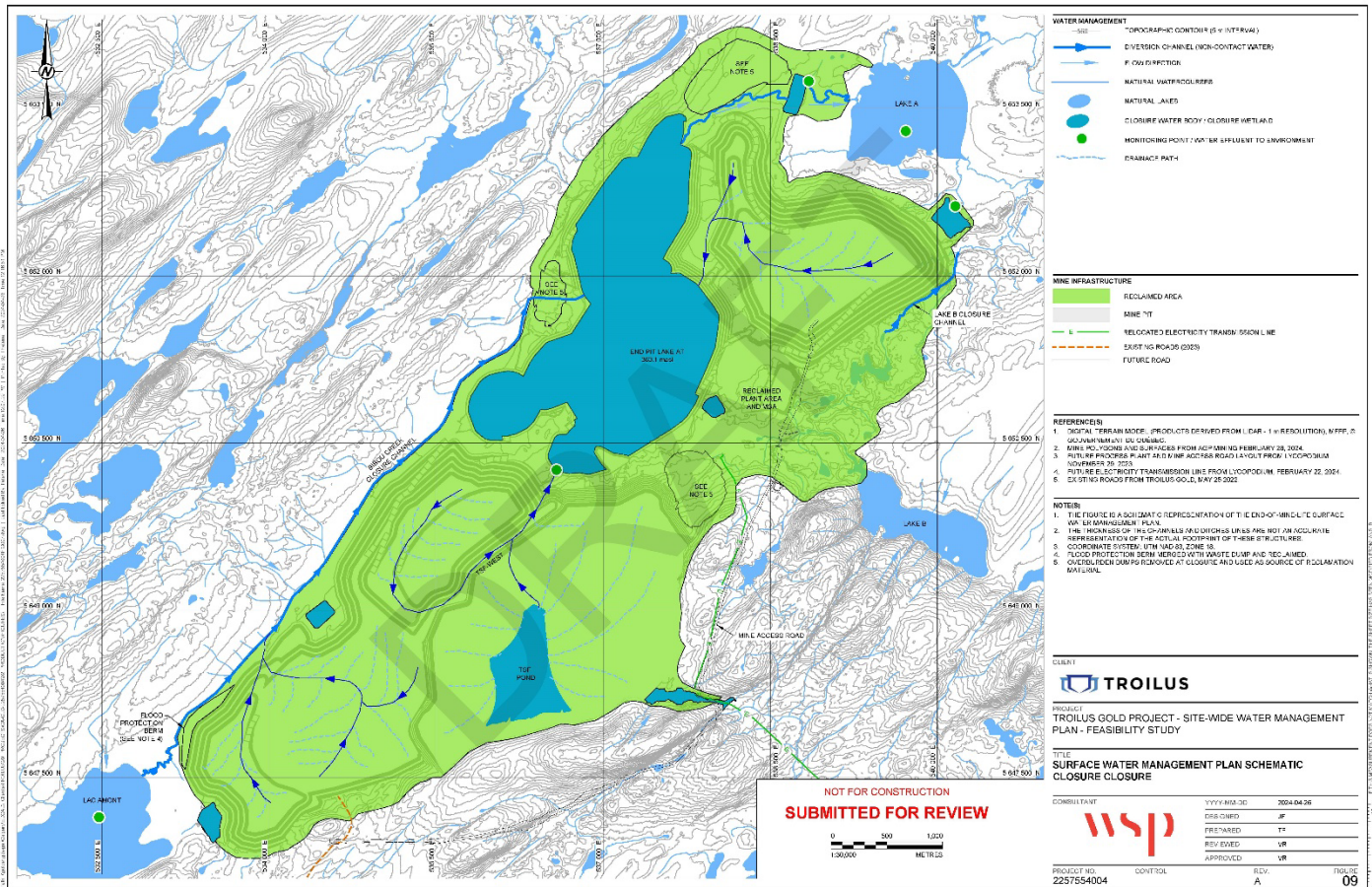


Figure 2.10 Scenario - Post-closure Without Dam Development

Land users were satisfied with the new layout and the effort made to comply with their recommendations, but insisted that the alignment had to be maintained from construction to post-closure, without modification.

The Troilus team and its engineering consultants are currently developing a plan that will allow the entire Bibou Creek diversion to be maintained under Scenario 1 without dam construction. This plan will be the subject of further consultation with land users to ensure that it meets future land use, land user safety and environmental protection requirements.

Design details for the Bibou Creek diversion (WSP, 2024a), including measures to ensure fish habitat and fish passage through the diversion, are detailed in Appendix C.4.

2.1.5 Off-Site Transport

This section deals with the transportation of copper concentrate, fuel and future mine workers.

Environmental and Social Impact Assessment for the Troilus Mine Project

ALTERNATIVES ASSESSMENT

2.1.5.1 Concentrate transportation

The Troilus mining project involves the daily transportation of a gold-bearing copper concentrate produced directly at the site to a smelter. The quantity produced would be 240 tonnes per day, representing 6 round trips using a 40-tonne capacity truck.

At this stage of the project, no definitive agreement between the proponent and a buyer (smelter) has been reached. That said, there are two possible options for the destination of the concentrate. These options were retained following a conditional letter of interest for project financing and a market and logistics study (Appendices C.5 and C.6) as part of the feasibility study. Export Development Canada ("EDC") plans to finance the Troilus project up to US\$300 million. This investment, although not confirmed, would require part of the processing of the copper and gold concentrate to be carried out in Canada. The Horne smelter in Rouyn-Noranda is a likely destination for the copper and gold concentrate produced by the Troilus mine.

In addition, two Scandinavian export credit agencies, Finnvera (Finland) and EKN (Sweden), and also Euler Hermes Aktiengesellschaft ("Euler Hermes"), representing the German Federal Ministry for Economic Affairs and Climate Action as export credit agency, have signed letters of interest for financing of up to US\$1 billion. This financing, if confirmed, will mean that part of the copper and gold concentrate produced by the Troilus mine will be shipped overseas.

The two destinations selected at this stage of the project are 1) the Horne smelter in Rouyn-Noranda, and 2) the port of Quebec, Saguenay or Montreal. The number of transports to each destination remains to be defined. To simplify the assessment, Troilus assumes that 1/3 of the concentrate will be sent to the Horne smelter, representing 2 trips per day (round trip), and that 2/3 of the concentrate will be sent to the port of Quebec, Saguenay or Montreal, representing 4 trips per day (round trip).

Four options were identified in the study for transporting the copper and gold concentrate from the Troilus project to the Horne smelter or to a port (BluMetric, 2024b). Each option specifies the point of departure (the Troilus site), the destination and the number of kilometers to be covered. The study is also available in Appendix C.7

- **Option 1:** This option considers transportation to the Horne smelter in Rouyn-Noranda, Quebec, by three alternative modes of transport:
 - Option 1A: transport by road (truck) entirely. For this option, depending on the roads to be used, a distance ranging from 660 km to 700 km will be covered;
 - Option 1B: Road transport over a distance of approximately 212 km between the Troilus site and Chapais, followed by rail transport over a distance of 470 km to the Horne smelter. This option is only feasible if a 77-km section of railway track is reopened (Cree Development Corporation, 2022), and if a transshipment site is set up in Chibougamau or Chapais. A project concerning the development of an intermodal transportation logistics center (Projet CLIC) has been proposed by the City of Chibougamau, but so far this project has not been developed further (Environmental and Social Impact Evaluating Committee [COMEV], 2017).

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- Option 1C: Transport by road over a distance of approximately 770 km to Matagami. Transportation will then continue from Matagami to the Horne smelter by rail over a distance of 407 km. This option includes an intermodal transfer at the Matagami transshipment site.
- **Option 2:** This option envisages the transport of concentrate to the Port of Saguenay, considering three alternatives, depending on the mode of transport:
 - Option 2A: this route would be entirely by road over a distance of 550 km;
 - Option 2B: the route would be approximately 172 km by road from the Troilus site to Chibougamau. Transportation would then continue by rail from Chibougamau to the Port of Saguenay over a distance of 385 km. An intermodal transfer will be planned at the Chibougamau transshipment site, should the site be redeveloped.
- **Option 3:** This option envisages the transport of concentrate to the Port of Quebec, taking into account 2 alternatives depending on the mode of transport:
 - Option 3A: this route would be entirely by road over a distance of approximately 694 km;
 - Option 3B: this route would be approximately 172 km by road between the Troilus site and Chibougamau. The route would then continue by rail over a distance of 639 km from Chibougamau to the Port of Quebec. An intermodal transfer will be provided at the Chibougamau transshipment site, should the site be redeveloped.
- **Option 4:** This option envisages the transport of concentrate to the Port of Montreal, taking into account 2 alternatives depending on the mode of transport and the transfer to a transshipment site:
 - Option 4A: this route would be entirely by road over a distance of approximately 680 km;
 - Option 4B: approximately 171 km by road and 700 km by rail. An intermodal transfer would be planned at the Chibougamau transshipment site; and
 - Option 4C: approximately 765 km by road and 944 km by rail. An intermodal transfer will be planned at the Matagami transshipment site.

Considering the different modes of transport under consideration, the availability of the concentrate's transport and transit infrastructures was analyzed. The advantages and disadvantages of each port were also analyzed. These analyses are summarized in Tables 2.5 and 2.6.

Table 2.5 Analysis of Transshipment Site Advantages and Disadvantages

Transshipment site		
Location	Advantages	Disadvantages
Chibougamau	<ul style="list-style-type: none"> • Closest Potential transshipment site to the Troilus site. • Minimizes concentrate trucking distance from the mine site (reduced GHG emissions). • Minimizes the distance and time required to transport concentrate by rail from the transshipment site to the targeted port facilities. • Minimizes project-related truck traffic on roads. 	<ul style="list-style-type: none"> • Implementation of the transshipment site is under discussion with the relevant authorities and is not yet in place. This option cannot be retained until the project is completed.

Environmental and Social Impact Assessment for the Troilus Mine Project

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	<ul style="list-style-type: none"> Provides a potential link to the port of Saguenay, Montreal or Quebec via the Canadian National rail network. Potentially minimizes the size of the railcar and truck fleet by reducing cycle times (detailed analysis required). Maximizes economic benefits for the city of Chibougamau. 	
Matagami	<ul style="list-style-type: none"> Only available, functional and closest facility to the Troilus site. Equipped with enclosed warehouses for concentrate storage and facilities for bulk material transshipment. Allow direct rail link to the Port of Montreal and the Horne smelter. 	<ul style="list-style-type: none"> Long trucking distances. Long distance by rail. Higher transportation-related GHG emissions.

Table 2.6 Analysis of Port Advantages and Disadvantages

Location	Advantages	Disadvantages
Saguenay (Grande Anse sector)	The closest port to the Troilus site. The port has a rail infrastructure directly linking the Saguenay industrial port zone to the national rail network.	Limited capacity for bulk material storage. Facilities unsuitable for transshipment of high-volume bulk cargo.
Quebec City (Beauport sector)	Second closest port to the Troilus site. The Beauport sector of the Port of Quebec is a strategic, intermodally served dry bulk sector with direct access to road and rail networks.	Trains may have to transit through Montreal to reach the Port of Quebec (a detailed analysis will be required).
Montreal (Quays 39, 40, 41, 42, 43, 46, 98, 99, 100)	Montreal's port facilities have the necessary equipment and systems, with bulk vessels, closed storage domes for concentrate storage, intermodal and automated loading systems (conveyor). The port has an on-dock rail system accessible via the Canadian National (CN) rail networks.	The furthest port from the Troilus site.

Selection of options

Considering the constraints of rail infrastructure availability and transshipment sites, the most realistic alternative is to transport concentrates entirely by road. Moreover, given that transport involves social constraints, the routes avoid passing through town centers. Discussions are ongoing, and it is likely that the final destination of the concentrate will be split between the Horne smelter and the Port of Quebec, enabling the concentrate to be shipped overseas. This will further reduce the impact of concentrate transport on road infrastructure and traffic on routes 167 South and 113. The proposed routes and the number of shipments involved remain an evolving aspect of the project, subject to discussion with the entities concerned.

It should be noted that Troilus supports the initiative to redevelop the Chibougamau transshipment site, and will give priority to transporting its concentrate by rail if the CLIC project goes ahead.

Environmental and Social Impact Assessment for the Troilus Mine Project

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Table 2.7 Comparative Table of Transportation Options

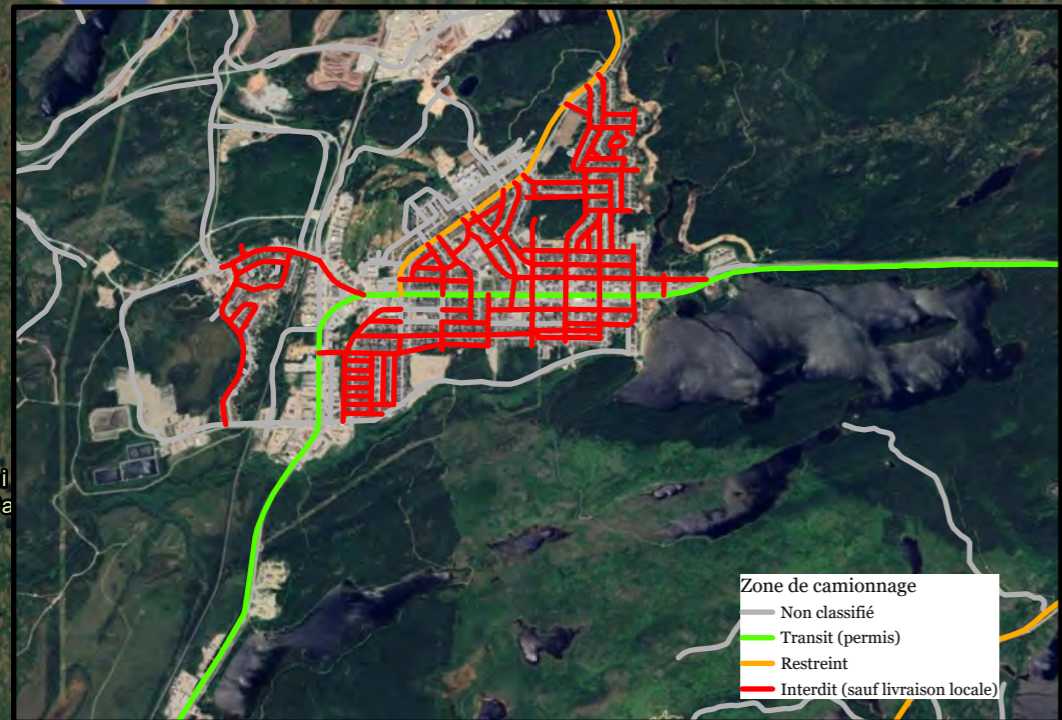
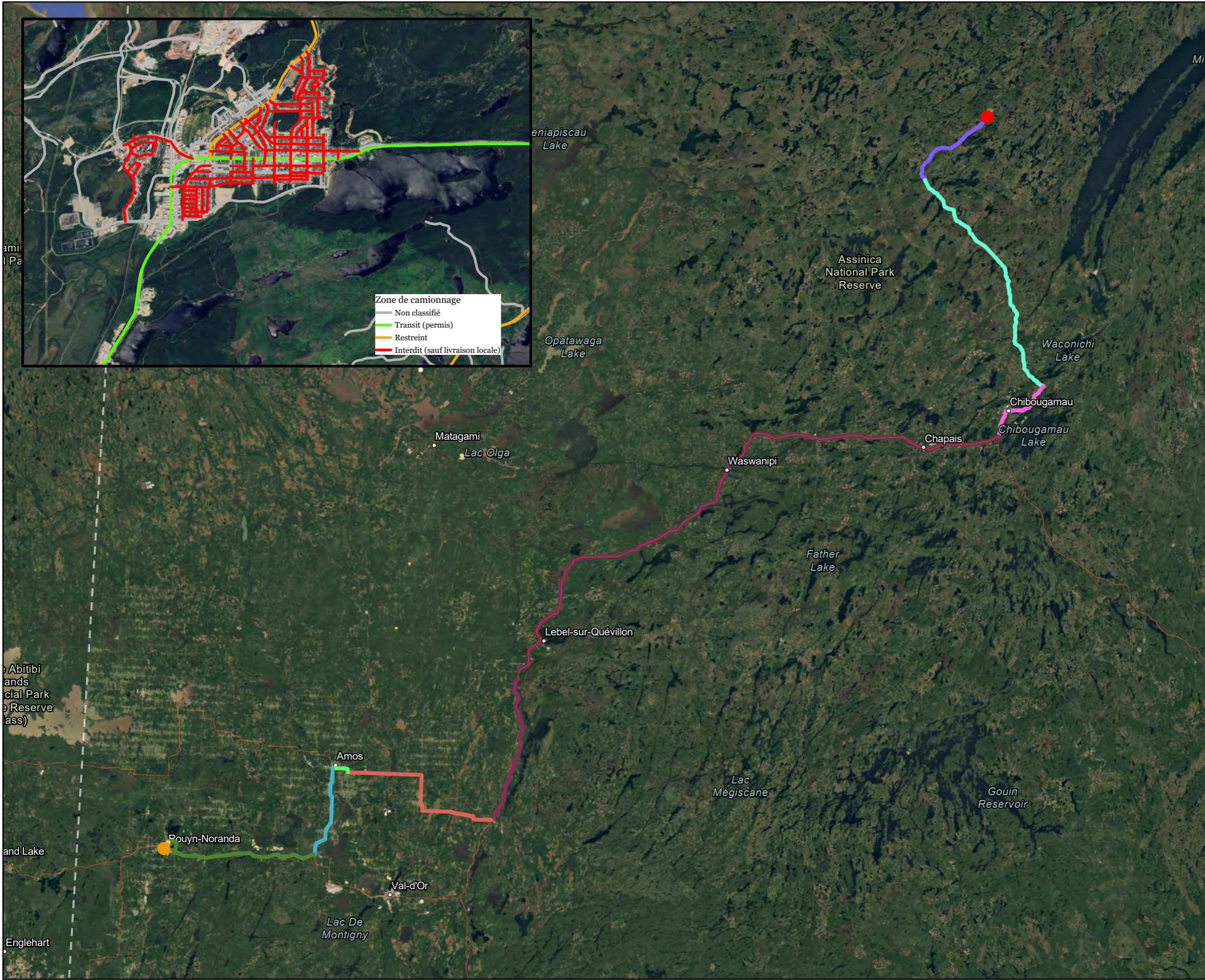
Option	Route	Characteristics	Distance	Travel time
1 A: Road transport to Horne smelter	Troilus → Rte du nord → Chibougamau → Chapais → Lebel-sur-Quévillon → Amos → Rouyn-Noranda	The route is selected according to authorized trucking zones with no load restrictions, via Senneterre, then Amos.	691 km	8 h 30
2 A: Road transport to Port of Saguenay	Troilus → Rte du nord → Chibougamau → Chapais → Saint-Félicien → Roberval → Saguenay	The Port of Saguenay is the closest port to the Troilus mine site. The Grande-Anse Marine Terminal is dedicated to the receipt, shipment and transshipment of general cargo, specialized cargo and dry bulk. The port's facilities have limited capacity for large-volume bulk transshipment.	550 km	7 h
3 A: Road transport to the Port of Quebec	Troilus → Rte du nord → Chibougamau → Chapais → Saint-Félicien → Québec	This route includes an unrestricted truck route. The Beauport sector of the Port of Quebec is a strategic dry bulk area, served intermodally by direct access to road and rail networks.	694 km	8 h 30
4A: Road transport to the Port of Montreal	Troilus → Rte du nord → Chibougamau → Shawinigan → Trois-Rivières → Montréal	Route selected according to unrestricted trucking zones. Longer route by road.	873 km	10 hrs 30 min

Considering that the concentrate is supposed to have two destinations, the options selected are Option 1A for transporting the concentrate to the Horne smelter and Option 3A for transporting the concentrate to the Port of Quebec.

The routes selected for transporting concentrate to the Horne smelter and the Port of Quebec are shown in maps 2.3 and 2.4 below.

Environmental and Social Impact Assessment for the Troilus Mine Project

ALTERNATIVES ASSESSMENT



Zone de camionnage

- Non classifié
- Transit (permis)
- Restreint
- Interdit (sauf livraison locale)

LÉGENDE / LEGEND

- Mine Troilus
- Fonderie Horne

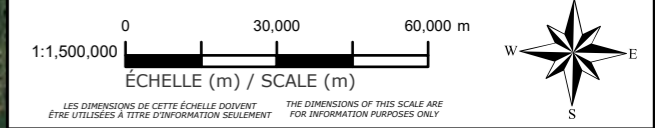
Réseau routier - Troilus à Fonderie Horne (704,9km)

- Chemin d'accès (44 km)
- Route du nord (108 km)
- Route 167 (32 km)
- Route 113 (335,8 km)
- Route 386 (74,8km)
- Route 111 (7,4km)
- Route 109 (39km)
- Route 117 (Ouest) (67,8km)
- Av. Marcel Baril (0,6km)

3				
RÉV.	DESCRIPTION	DD/MM/YY	BY	VERIF.

RÉFÉRENCES/REFERENCES
Base Map: Bing, 06 June 2023

NOTES
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CLIENT
Troilus Gold Corp.

PROJET/PROJECT
Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessment for the Troilus Mine Project

TITRE/TITLE
Variant 1-A: transport du concentré de cuivre de la mine Troilus à la fonderie Horne - Voie routière / Copper Concentrate Transportation Route from the Troilus Mine to the Horne Foundry - Road Transport

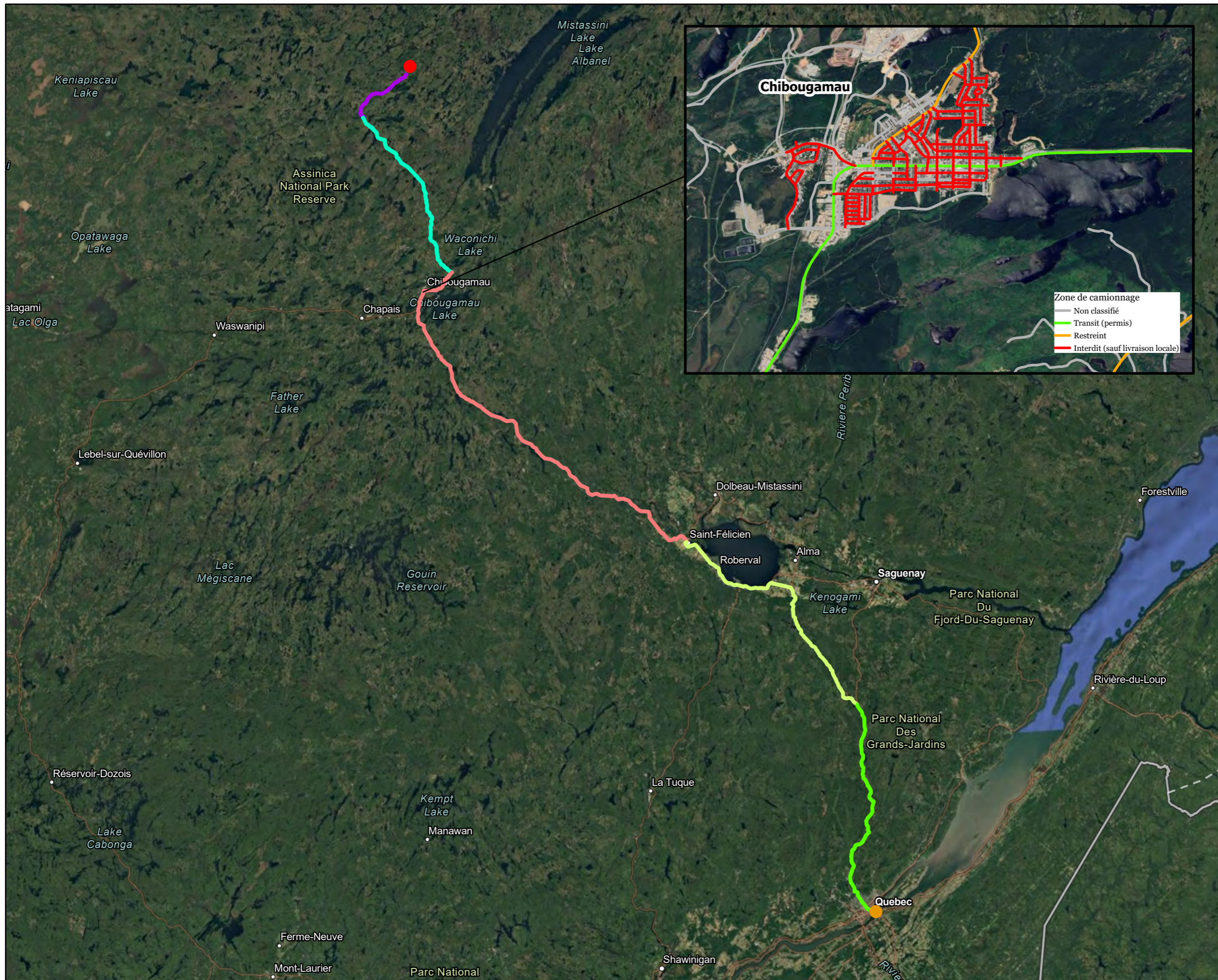
NO. PROJET / PROJECT NO. 240433 / 167040485
DATE 06/ 18/ 2025

CONÇU / CHECKED S. Sene
RÉVISÉ / VERIFIED C. Gardois

DESSINÉ / DRAWN M. Baker
Figure No. 2.3
ED./REV. 3

Environmental and Social Impact Assessment for the Troilus Mine Project

ALTERNATIVES ASSESSMENT



LÉGENDE / LEGEND

- Mine Troilus
- Port de Québec

Réseau Routier (694 km)

- Chemin d'accès (44 km)
- Route du Nord (107 km)
- Route 167 (250 km)
- Route 169 (155 km)
- Route 175 / Autoroute Laurentienne (130 km)
- Rue Saint-Paul (0,6 km)
- Boul Charest (0,8 km)
- Quai Saint-André (0,4 km)

Zone de camionnage

- Non classifié
- Transit (permis)
- Restreint
- Interdit (sauf livraison locale)

2				
RÉV.	DESCRIPTION	DD/MM/YY	BY	VERIF.

RÉFÉRENCES/REFERENCES
 Base Map: Bing, 06 June 2023

NOTES
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ÉCHELLE (m) / SCALE (m)

LES DIMENSIONS DE CETTE ÉCHELLE DOIVENT ÊTRE UTILISÉES À TITRE D'INFORMATION SEULEMENT / THE DIMENSIONS OF THIS SCALE ARE FOR INFORMATION PURPOSES ONLY

CLIENT

Troilus Gold Corp.

PROJET/PROJECT

Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessment for the Troilus Mine Project

TITRE/TITLE

Variante 3-A: transport du concentré de cuivre de la mine Troilus au port de Québec - Voie routière / Copper Concentrate Transportation Route from the Troilus Mine to the Quebec City Port - Road Transport

NO. PROJET / PROJECT NO. 240433 / 167040485	DATE 06/ 18/ 2025
CONÇU / CHECKED S. Sene	RÉVISÉ / VERIFIED C. Gardois
DESSINÉ / DRAWN M. Baker	Figure No. 2.4
	ED./REV. 2

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Due to the confidential nature of the gold ingots and the need to ensure their safe transportation, no detailed information on transportation arrangements can be disclosed. The number of shipments of gold ingots will be negligible compared to the number of shipments of concentrate, as approximately one gold ingot will be produced per day. In addition, shipments will be carried out at random to limit their predictability, in line with the safety requirements associated with handling gold ingots. During the historic operation, transport was carried out by helicopter, a solution that could also be used for future operations.

2.1.5.2 Fuel transport

Fuel will be delivered exclusively by road, as no other option is available. Bulk fuel supply will be provided by a storage facility located on the mine site, enabling both mining trucks and light vehicles to be supplied. Delivery trucks will be connected to the unloading pumps by flexible hoses, transferring the diesel to bulk storage tanks located in a containment area.

2.1.5.3 Employee transport

Employee transport to the Troilus mine site is based on the historical option used for the initial project. Employees will be transported by road, using buses. Buses will leave from four predefined points: Chapais, Chibougamau, Mistissini and Oujé-Bougoumou, depending on the number of workers from the communities concerned. Transportation between these points and the mine site will be provided on a round-trip basis, according to work shifts.

2.2 Technological Alternatives

2.2.1 Mining Method (Open Pit VS. Underground)

Mineral resources at the Troilus project comprise the four main mineralized zones: 87, J4, X22 and SW.

Troilus has examined several technological options for extracting the ore, either by underground mining, open-pit mining, or a combination of the two.

Option 1: Underground mining

Troilus studied underground mining. This mining method offers a number of environmental advantages, including a smaller footprint and less waste rock to manage and store on site.

The disadvantages associated with this mining method are mainly economic, with very high initial capital costs.

Unfortunately, the nature of the deposit does not lend itself to underground mining, due to the low copper and gold content of the ore. Indeed, the project's profitability depends on processing a large volume of ore to be able to recover economic quantities of copper and gold.

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Option 2: Open-pit and underground mining

In 2020, the project's preliminary economic study assessed the potential for both open-pit and underground mining. This option was considered in the event that there was insufficient ore available for open-pit mining to ensure adequate mine longevity. Following this technical study, more exploration drilling was carried out on the property, greatly increasing the amount of available ore that could be mined by open pit. However, underground mining remains a possible complement to mill feed tonnage and grade.

Option 3: Open-pit mining

This option was technically analyzed in the 2024 feasibility study (see Appendix C.8) and also takes into account previous mining activities. The evaluation of this mining method takes into account resource size, grade, grade distribution and proximity to deposit topography. In addition, this option would enable all mineralogical zones to be mined.

Selection of options :

- Option 1: The underground-only option does not allow for a viable project, and was not selected;
- Option 2: This option has high up-front capital costs and was therefore not selected;
- Option 3: This option proved to be viable from an economic, environmental and social point of view. Option 3 was therefore selected.

2.2.2 Ore processing

Troilus examined several technological options for extracting gold and copper from the milling process: heap leaching, conventional concentration including cyanide, and conventional concentration without cyanide.

Option 1: Heap leaching

This option involves a very low-cost ore treatment process for gold recovery. The process involves building a heap of ore on an impermeable liner and applying a cyanide leach solution to the top of the heap. Gold is dissolved as the leach solution seeps through the heap. The gold-rich solution is collected at the bottom of the heap and processed in a plant to recover the gold. The treated solution is then fortified with cyanide and reapplied to the heap. This process continues until economic recovery is achieved. The heap is then restored by rinsing with water, reshaping and revegetation.

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The advantages are :

- Very low capital cost compared with other treatment options:
 - Ore can be treated with much coarser particle sizes than other processes such as flotation and cyanidation, so no expensive crusher is needed;
 - Processing involves solution pumping and simple operations to recover the gold;
 - The processing plant is small compared with other processes, since the ore is processed off-site.
- Very low operating costs:
 - Ore is moved only once to a leaching platform, where it is treated by applying a solution;
 - No second handling of ore once in place.
 - Few large pieces of equipment, so energy/fuel costs are low;.
 - Restoration is by rinsing followed by reshaping and revegetation.

Disadvantages include

- Recovery is low (around 75% for gold and negligible for copper);
- Copper in the ore consumes cyanide, increasing costs and the amount of cyanide used;
- Takes up a lot of floor space, large environmental footprint;
- Higher environmental risk than conventional process, since cyanide is used in the open air;
- Compromised social acceptability.

Option 2: Conventional cyanide process

The conventional cyanide process includes crushing, grinding, gravity gold separation, flotation and cyanidation. The tailings then go to a cyanide destruction plant and are sent to the tailings facility as pulp.

The benefits are :

- Excellent recovery of gold, copper and silver (approx. 95% for gold and copper);
- Limited environmental risk, as the process takes place entirely in enclosed buildings;
- Smaller footprint.

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The disadvantages are :

- Very high chemical costs (cyanides and products to destroy them);
- A high health and safety risk when handling and storing chemicals;
- A tailings storage facility containing traces of cyanide;
- Reduced social acceptability.

Option 3: Conventional cyanide-free process

The conventional cyanide-free process includes crushing, grinding, gravity gold separation and flotation. The tailings are then sent to the tailings storage facility in the form of pulp.

The advantages of the process are :

- Good recovery of gold, copper and silver (around 92% for gold and copper);
- Low environmental risk, since the process takes place entirely in enclosed buildings and there is no cyanide;
- A smaller footprint;
- Low health and safety risk as regards the use of chemicals;
- Improved social acceptability.

The disadvantages of the process are :

- Slightly lower recovery without cyanide.

Selecting an option :

- Option 1: This option was studied with the inclusion of metallurgical recovery tests. It offers a lower recovery percentage and a higher environmental risk. It was therefore not selected;
- Option 2: This option was studied with the inclusion of metallurgical recovery tests. It presents more disadvantages than advantages, and was not retained;
- Option 3: This option was studied with the inclusion of metallurgical recovery tests. It has more environmental advantages than disadvantages, and is the preferred option.

2.2.3 Mine Waste Management

Tailings and waste rock management represents a major challenge for any mining project. Mine waste management must aim to reduce the impact on soil, groundwater, surface water and land use, while remaining technically and economically feasible. The management of waste for the Troilus mining project also includes other particularities such as the existence of storage infrastructures facility already in place. To this end, the reuse of infrastructure where this option presents no additional risk to the environment or human health and safety has been considered.

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The mine waste management proposed below has been the subject of consultation with land users, so that their recommendations and comments can be taken into account. The proposed plans are based on the comments and recommendations received.

In addition, the mining plan has been developed to optimize the footprint on site and maximize the potential for reuse of the pits as tailings storage.

Mine waste management is divided into two sections. The first section deals with the management of tailings from the ore processing plant. The second section deals with the management of wasterock.

2.2.3.1 Management of Tailings from the Ore Processing Plant

There is an existing tailings storage facility on the project site. This infrastructure represents a large footprint and its remaining capacity has been assessed by Golder and Associates in 2019 (see Appendix C.9). It has been estimated that TSF could still accommodate 169 Mt of tailings if upstream raises are considered. The mining project is expected to produce around 380 Mt of tailings during its 22 years of operation, so the remaining capacity in the existing TSF is not sufficient to store the tailings produced for the life of the mine. Although Troilus has examined the possibility of constructing a new tailings facility to store the remaining tailings produced, but it would be advantageous from a technical, economic, environmental and social point of view to use the open pits as a storage site for tailings that can't be stored on the existing TSF.

The impact on groundwater and the potential for acid mine drainage of tailings is not addressed in this chapter, but is presented in Chapter 5.2. Based on historical monitoring data and geochemical studies, tailings storage in pits remains the option with the greatest potential and the least environmental impact, according to the assessments carried out. The storage sequence and type of tailings considered are described in greater detail in Chapter 3 of the ESIA.

2.2.3.2 Mine Waste Rock Management

The new Troilus mining project involves the storage of 1.171 Mt of new mine waste rock from the four planned open pits. Considering the realities of the project site, it would be necessary to ensure that the planned development of the waste rock piles is within the mine's watershed, in order to limit the risk of contamination of surface and groundwater to another watershed, and also to ensure proper management of contact water and clean water. In addition, as analyzed for many other infrastructures, emphasis was placed on reusing existing facilities and minimizing new impacted areas.

Several waste rock piles are already in place at the Troilus mine site. However, the planned expansion of the two existing pits (87 and J4) means that some of them will have to be relocated. In order to reduce the project footprint and waste rock transportation costs, it is planned that existing waste rock piles that do not require relocation will be reused and expanded within the stability constraints established by WSP (2024b) (see Appendix C.10). Backfilling certain pits with tailings from the ore processing plant would also be recommended. Finally, a waste rock pile could be built alongside the tailings dam to increase the stability of the TSF and further reduce the footprint of the new project.

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2.2.4 Water management (supply and discharge)

Water management is an important aspect of any mining project. In the case of the Troilus Mine, which is located at the head of its watershed, several options were evaluated in relation to water management at the site. As part of the water management alternatives considered, the following aspects were further investigated:

- Treatment of wastewater from the tailings facility;
- Treatment of domestic wastewater;
- Drinking water supply.

Proposed scenarios relating to Bibou Creek diversion are not dealt with in this section, as they are covered in a separate section (section 2.1.4), given the importance attached to this element by land users.

2.2.4.1 Treatment of Wastewater from the tailings pond

The type of technology to be used to treat wastewater from the tailings pond has been analyzed in terms of the parameters that could exceed current discharge standards.

In preparation for the proposed new mining operation, Troilus commissioned WSP (2024c) to conduct an analysis of possible treatment technologies for surface water from the tailings pond. This analysis was also presented to land users for comment at the water management workshop held in 2024.

The contaminants expected to be found in the water contained in the tailings pond are essentially suspended solids in excess of provincial and federal discharge criteria. This assumption is based on historical data and the nature of the tailings from the process plant. Knowing that the existing water treatment plant will have to be replaced during operation (end-of-life, TSF raises), the analysis of the type of suspended solids treatment unit that will replace the existing treatment plant was based on the following criteria:

- Treatment efficiency;
- Reliability and complexity;
- Maintenance;
- Cost.

It should be noted that the criteria established are considered of equal importance in the comparative analysis.

The various treatment technologies that were tested are described below and shown in Figures 2.11 to 2.14:

- Lamella clarifier (sedimentation);
- Ballast and lamella clarifier (sedimentation);

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- Disc filter (membrane separation);
- Ultrafiltration (membrane separation).

A comparative analysis of the proposed technologies is presented in Tables 2.8 to 2.11.

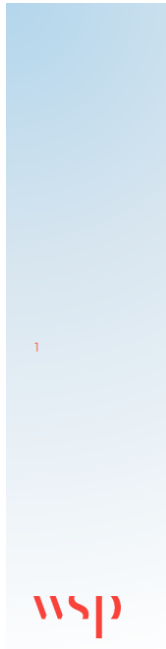
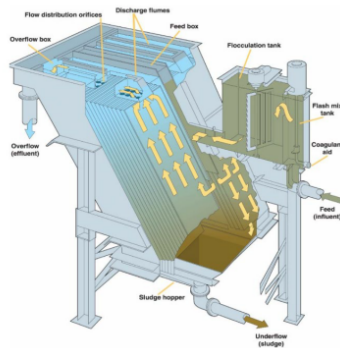


Figure1: Technologies : Clarificateur à lamelles

- -Les solides en suspension sont introduits dans des plaques inclinées et se déposent dans une chambre de collecte.
- -L'eau clarifiée déborde



Picture source:
Parkson
Lamella EcoFlow

Figure 2.11 Lamella Clarifier Technology

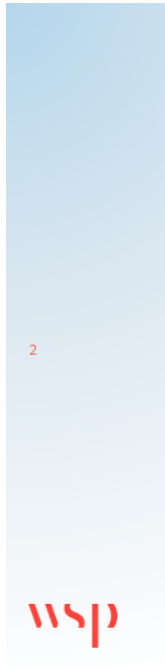
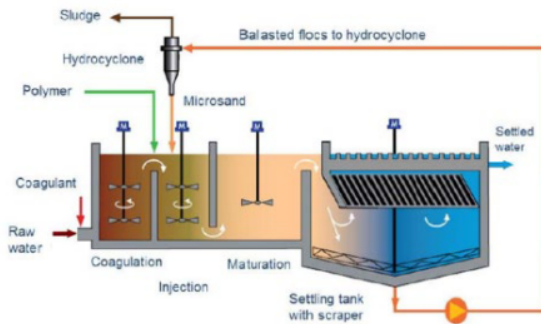


Figure 2: Technologies : Ballast + clarificateur à lamelles

- Coagulant, floculant et micro-sable ajoutés à l'eau pour la décantation des solides en suspension.
- Les matières solides sont séparées et éliminées à l'aide d'un clarificateur lamellaire solide-liquide.
- Les micro-sables et les boues sont récupérés par hydrocyclone.



Picture source:
Veolia Water Technologies Canada
ACTIFLO Ballasted Flocculation

Figure 2.12 Ballast and Lamella Clarifier Technologies

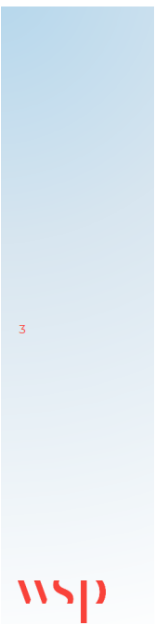
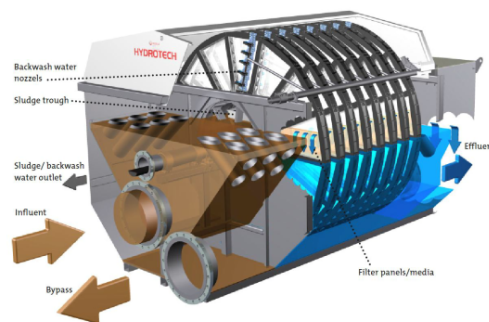


Figure 3: Technologies : Filtres à disques

- L'eau passe à travers des disques filtrants immergés avec un tissu filtrant.
- Les cycles de lavage à contre-courant éliminent les solides accumulés.



Picture source:
Hydrotech, [Pranger Enterprises | Mechanical Contractors](#)

Figure 2.13 Disc Filter Technologies

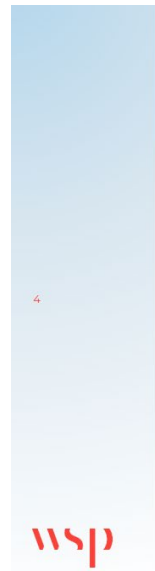


Figure 4: Technologies : Ultrafiltration

- -L'eau est pompée à travers des membranes semi-perméables.
- La surface de la membrane accumule des particules, un lavage à contre-courant périodique rétablit les performances.



Picture source:
Koch
Puron MP System

Figure 2.14 Ballast and Plate Clarifier Technologies

Table 2.8 Comparative Analysis of Wastewater Treatment Types - Sedimentation Technologies

Criteria	Lamella clarifier		Ballast + Lamella Clarifier	
	Score (1 to 5)	Comments	Score (1 to 5)	Comments
Treatment effectiveness	3	Effective removal of total suspended solids (TSS), but fine particles may be sensitive to flocculation dose.	5	Efficient TSS removal with coagulant, flocculant and ballast material.
Reliability	5	Simpler operation, less maintenance for mechanical equipment. Relies on mixing and flocculation. Less reliable with fine solids.	5	Base plate has no moving parts. Ballast recirculation requires a pump (standard) and a hydrocyclone (no moving parts), as well as standard material handling.
Complexity	5	No moving mechanical parts.	4	More complex than the lamella alone, but simple controls and a wide operating range make it possible to treat wastewater with different TSS concentrations and discharge rates.
Maintenance requirements	5	Basic maintenance only, the basic equipment (lamella) has no moving parts and requires only periodic inspection and cleaning.	5	Additional maintenance requirements associated with ballast circulation.
Tolerance to changes in influent water quality/concentration	3	Requires active operator experience to optimize fine particle removal.	5	Microsand provides better treatment of fine particles, regardless of the flow rate discharged.
Final score	21		24	

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A water treatment technology is rated between 1 (worst) and 5 (best). The best possible score is 25.

The total score is the sum of the scores for all criteria, with each criterion weighted equally.

Table 2.9 Comparative Analysis of Wastewater Treatment Types - Technologies Using Filtration

Criteria	Disc filters		Ultrafiltration	
	Score (1 à 5)	Comments	Score (1 à 5)	Comments
Treatment effectiveness	5	Efficient TSS removal due to various filter fabric options.	5	Robust TSS removal, regardless of influent quality.
Reliability	5	Minimal operator intervention. Filter clothes must be replaced periodically. Risk of clogging Requires backwash circuit and complex operating steps.	3	Highly automated UF modules must be replaced periodically. Risk of clogging Requires backwash circuit and complex operating steps. Sensitive to influent TSS load.
Complexity	4	Involves submerged filter discs, rotating equipment and periodic backwashing, but is generally simple to operate.	2	Automated, but complex, requiring skilled operators.
Maintenance requirements	4	Backwashing requires management of wastewater, equipment and maintenance. Periodic cleaning and replacement of cloths.	2	Periodic cleaning-in-place procedures. Periodic membrane replacement.
Tolerance to changes in influent water quality/concentration.	4	Can cope with rapid changes in TSS with backwash. Limited by maximum TSS treatment range.	2	Defined pore size results in sensitivity to initial TSS load. May require increased backwash frequency, although this operation is automated - minimal intervention required.
Final score	22		14	

A water treatment technology is scored between 1 (worst) and 5 (best). The best possible score is 25.

The total score is the sum of the scores for all criteria, with each criterion weighted equally.

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Table 2.10 Summary of Water Treatment Technology Analysis

Total result			
Sedimentation		Filtration	
Lamella clarifier	Ballast + lamella clarifier	Disc filters	Ultrafiltration
21	24	22	14
Comments			
<ul style="list-style-type: none"> Reliable Low maintenance Easy to operate Uses only coagulants and flocculants as chemicals 	<ul style="list-style-type: none"> Addition of microsand ballast improves settling of particles in lamellae Microsand ballast increases operational complexity and cost 	<ul style="list-style-type: none"> Flexible operation Easy control Low (or non-existent) chemical consumption High maintenance costs for cleaning and replacing filter cloths 	<ul style="list-style-type: none"> Complex operation Frequent maintenance Not typically used for high TSS applications

Table 2.11 Summary of Technology and Cost Analysis with Recommendations

	Sedimentation		Filtration									
	Lamella clarifier	Ballast and lamella clarifier	Lamella clarifier	Ballast + lamella clarifier								
Technology score	21	24	22	14								
Lifecycle cost over 20 years (CAD)	19 902 100 \$	<table border="1"> <tr> <td>1 unit</td> <td>2 units</td> </tr> <tr> <td>21 644 200 \$</td> <td>24 139 600 \$</td> </tr> </table>	1 unit	2 units	21 644 200 \$	24 139 600 \$	<table border="1"> <tr> <td>1 unit</td> <td>2 Units</td> </tr> <tr> <td>20 409 700 \$</td> <td>26 525 000 \$</td> </tr> </table>	1 unit	2 Units	20 409 700 \$	26 525 000 \$	41 299 500 \$
1 unit	2 units											
21 644 200 \$	24 139 600 \$											
1 unit	2 Units											
20 409 700 \$	26 525 000 \$											
Advantage	Simple system for basic dewatering needs	Ballast improves settling in the lamellar clarificator Site-proven technology RECOMMENDED	Low chemical addition, simple operation RECOMMENDED	Suitable for removal of fines and low TSS effluent requirements								
Disadvantage	Performance depends on floculant dosing accuracy	Additional reagent (microsand) increases construction and operating costs and involves more complex operations	Filter clothsensitive to particle size	Highest operating costs and complexity, highest operating complexity.								

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2.2.4.2 Treatment Technology Selection

The selection of a treatment unit using a sedimentation process with ballast and lamella clarifier was unanimously supported both by WSP consultants and during the presentation of the treatment types analyzed at the 2024 water management workshop with land users. One of the reasons why the use of this technology was well received is that it has proven itself during the previous operation (1996 to present) and is a technology that is well known both in the mining industry and by land users for the Troilus mining project. Some of them have offered to act as operators of water treatment plants using this technology.

a) Domestic wastewater treatment

The treatment of domestic wastewater from the workers camp and the industrial sector was analyzed in order to propose a technology adapted to the future needs and climatic conditions of the site. It was essential to select a solution capable of treating wastewater with variable flow rates, taking into account climatic fluctuations, while guaranteeing compliance with current standards.

To this end, the Troilus team carried out a review of the various technologies available for domestic wastewater treatment. The evaluation criteria for selecting a domestic wastewater treatment technology are as follows:

- Adaptability (variable daily flow);
- Ease of operation;
- Performance;
- Cost.

The various domestic wastewater treatment technologies examined, along with their operation and advantages/disadvantages, are described in Table 2.12 below.

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Table 2.12 Domestic Wastewater Treatment Technology and Operation Examined

Technology	Operation	Advantages	Disadvantages
<p>Membrane bioreactor (MBR)</p>	<p>Wastewater treatment technology that combines biodegradation by microorganisms and membrane filtration to separate solids and liquids.</p>	<p>Improved effluent quality; Smaller footprint and greater ease of automation; Uses less space than a conventional system.</p>	<p>Investment and operating costs are generally higher than those of conventional systems. Operating and maintenance costs include membrane cleaning and fouling control, as well as membrane replacement; Energy costs are also higher due to the need for air washing to control bacterial growth on the membranes; Use of chemicals to produce biosolids acceptable for disposal (Environmental Protection Agency [EPA] 2007, see Appendix C.11).</p>
<p>Moving bed membrane bioreactors (MBBR)</p>	<p>Use a moving bed of support materials, such as plastic or ceramic, to cultivate microorganisms that biodegrade contaminants present in treated water. MBBR reactors are also easy to operate and offer high pollutant separation efficiency.</p>	<p>Requires little installation space; Easy to operate, with no need for sludge recirculation or cell residence time control; Excellent effluent quality; Ability to withstand peak loads and flow variations; Continuous operation, with no need for constant attention or interruption of treatment.</p>	<p>Initial system costs; High energy requirements; Maintenance requirements can be complex.</p>

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Technology	Operation	Advantages	Disadvantages
<p>Biological treatment with Bionest filtration</p>	<p>Biological treatment in a Bionest system is carried out by bacteria naturally present in the wastewater. These bacteria fix and grow on the permanent filtrant media thanks to an oxygen supply generated by an air pump. They thus form a biofilm that purifies the water. The treated fluids are then redirected to a polishing field. By way of comparison, the size of the polishing field is 60% smaller than that of a conventional purification field.</p>	<p>Simple and robust components; Low installation, operation and maintenance costs; Modular system, which can be expanded as required; Stable treatment performance, even in winter.</p>	<p>Requires a septic field in most cases; Constant power requirements; Maintenance such as emptying can be complex and costly.</p>
<p>Conventional: sand filters</p>	<p>A traditional septic installation consists of a septic tank connected to a leaching field which, in most cases, consists of a network of perforated pipes placed on a layer of gravel and sand. This type of system is often the solution of choice because of its simplicity and the high permeability of the soil in place. Purchase and installation costs are modest, and maintenance is essentially limited to regular emptying of the septic tank.</p>	<p>Less costly Simple maintenance</p>	<p>Requires more space than other systems; Lower performance than other options.</p>

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2.2.4.3 Treatment Technology Selection

The various technologies listed above were examined according to their adaptability, ease of operation, performance and cost of installation and operation. Table 2.13 below summarizes the findings for each technology.

Table 2.13 Evaluation of Different Treatment Technologies

Type of Technology	Adaptability (Variable Daily Flow)	Ease of Operation	Performance	Cost
Membrane bioreactor (MBR)	High. Suitable for various types of wastewater, including those with high organic loads or specific contaminants.	Moderate to high. Requires regular membrane monitoring, clog management and specialized maintenance.	Very good. Provides high effluent quality with effective reduction of suspended solids, biological oxygen demand (BOD), and some nutrients. Significant odor and bacteria reduction.	Relatively high cost. High initial investment for installation and membranes, maintenance and membrane replacement costs.
Moving bed membrane bioreactors (MBBR)	Good. Suitable for domestic or industrial wastewater, with flexibility for variable flows.	Moderate. Requires effective management of the moving bed, but generally less susceptible to clogging than conventional MBRs.	Very good. Similar to MBR in terms of effluent quality, with potentially less clogging thanks to the moving bed.	High. Initial and maintenance costs comparable to MBR, but may be optimized by the presence of the moving bed.
Biological treatment with Bionest filtration	Good. Suitable for a wide range of wastewaters, including those with moderate organic loads.	Low to moderate. Easy to manage with regular maintenance, less susceptible to clogging.	Good. Effective BOD/COD reduction, but less effective for fine separation or reduction of certain nutrients or contaminants.	Moderate. Lower installation and operating costs than membrane technologies.
Conventional: sand filters	Limited. More suitable for pre-treated water or specific applications, less effective for direct treatment of heavily loaded water.	Low. Easy to operate and maintain, but often requires pre-treatment.	Medium. Good for clarification and suspended solids reduction, but not very effective for BOD, nutrient or pathogen reduction.	Low. Low initial investment and operating costs.

All the technologies examined have advantages and disadvantages. However, the Bionest modular domestic wastewater treatment technology appears to be the best option for the project’s future needs. Indeed, the fact that this system can be bonified to meet changing flows and discharge standards would enable Troilus to maintain its operations and domestic wastewater targets.

2.2.4.4 Drinking Water Supply

The Troilus project, located on the former Troilus mine site (operated from 1996 to 2010) has existing drinking water wells in the camp area, to cover future water requirements during the construction and operation phases.

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During the previous operation, these underground wells were sufficient to meet demand without major problems of quality or increased drawdown. This suggests that, in the new phase, where the number of employees will be similar, these resources will also be adequate.

A combined production of 161 m³/d, from the former permanent camp well (96 m³/d) and the temporary camp well (65 m³/d), is sufficient to provide drinking water for 805 people, using a consumption of 200 L per person per day. This supply is more than sufficient for the construction period, and could be supplemented if necessary by a surface water intake, provided that it is combined with a suitable treatment system.

In fact, the Troilus camp area is close to a surface water source unaffected by mining activities. This resource could be tapped to meet drinking water needs during the construction period, when demand is higher. Appropriate treatment, such as UV or other treatment, would be required to eliminate coliforms and guarantee the potability of the water should its use become essential.

2.2.5 Energy Sources

The selection of energy sources to be prioritized for the new Troilus mining project and the planned infrastructure is primarily influenced by the technical and economic feasibility of implementing renewable energy sources in the vicinity of the site. Reuse of existing infrastructure is preferred. The Troilus mining project site is already supplied by Hydro-Québec via an existing power line installed since the previous project. In fact, the various infrastructures and mobile and fixed equipment associated with the project would be powered by renewable energy from this existing power line. That said, the power supply currently in demand has not yet been confirmed by Hydro-Québec. Should part of the energy requirements not be authorized, Troilus will have to find its own sources of power for the project.

With this in mind, the integration of renewable energies into the Troilus mine project represents a strategic opportunity to reduce its dependence on Hydro-Québec, while promoting a more sustainable and environmentally-friendly operation. Drawing on the region's potential, several options can be considered to supply the site with clean, local energy.

Solar energy potential: The region where the Troilus mining project is located enjoys significant sunshine throughout the year. The installation of photovoltaic panels would generate a substantial amount of electricity, particularly during the summer months. These modular and scalable installations could cover a significant proportion of the mining project's energy needs, particularly for surface operations and certain processes that do not require continuous power.

Wind power: The region also has interesting wind power potential. The development of wind farms would generate electricity on a regular basis, especially during windy periods. Complementarity between solar and wind power could ensure more stable energy production, reducing the need to rely on fossil fuels or external electricity purchases.

Microgrids and storage: The creation of an integrated microgrid, combining local renewable energy production and storage systems (batteries or other technologies), can ensure a reliable and continuous supply, even during production fluctuations. This system would reduce dependence on Hydro-Québec, while guaranteeing the stability of mining operations.

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Environmental and economic benefits: Energy autonomy thanks to renewable energies would help reduce the Troilus project's carbon footprint, in line with sustainable development objectives. Moreover, in the long term, this strategy could prove economically advantageous, by limiting the costs associated with the purchase of electricity.

Troilus, in 2024, proceeded to install renewable energy sources directly at the site such as a wind turbine and solar panels. This is being done to validate the energy potential of larger-scale wind turbines and solar panels in the Troilus mine area in preparation for the proposed new project, although the majority of the energy required for the new project is expected to come from the existing power line maintained by Hydro-Québec.

Depending on the energy block granted by Hydro-Québec and the energy generated by the renewable energy pilot tests at the Troilus site, alternatives regarding the energy sources to be implemented may be further examined.

The energy potential of renewable energy sources could confirm the use of an electric fleet, as well as the possible reduction of the project's electrical demand during peak periods.

Heavy machinery and mobile equipment are expected to be powered by diesel, which will be transported by tanker to the mine site. The possibility of using more electrically-powered heavy equipment will be analyzed during the detailed engineering phase, and will also depend on the potential of renewable energy sources currently under study.

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