



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

SOILS AND SEDIMENTS

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

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Acronyms and Abbreviations

IAAC	Impact Assessment Agency of Canada
CCME	Canadian Council of Ministers of the Environment
CEPA	Canadian Environmental Protection Act
COMEX	Environmental and Social Impact Review Committee
CSA	Canadian Standards Association
CV	Valued Component
ECCC	Environment and Climate Change Canada
ESA	Environmental site assessment
ESIA	Environmental and Social Impact Assessment
FG	Fluvioglacial formations (surface geological formations)
IAA	Impact Assessment Act
JBNQA	James Bay and Northern Quebec Agreement
LPRR	Land Protection and Rehabilitation Regulation
LQE	Environmental Quality Act
LSA	Local Study Area
M	Morainic formations (surface geological formations)
MDDEP	Ministry of Sustainable Development, Environment and Parks
MELCC	Ministry of the Environment and the Fight against Climate Change
MELCCFP	Ministry of the Environment and the Fight against Climate Change, Wildlife and Parks
MRNF	Ministry of Natural Resources and Forestry
MSMER	Metal and Diamond Mining Effluent Regulations
NBC	Natural background content
O	Organic formations (surface geological formations)
PAHS	Polycyclic aromatic hydrocarbons
PDA	Project Development Area
PEC	Probable Effect Concentration
PHCs	Petroleum hydrocarbons
PSRTC	Soil protection and rehabilitation of contaminated land (Intervention guide / Policy)
RDL	Reported Detection Limit
REC	Rare Effect Concentration
RI	Residual impacts
RSA	Regional Study Area
TEC	Threshold effect concentration
TSF	Tailings Storage Facility

15.0 Soils and Sediments

15.1 Scope of Assessment

15.1.1 Regulatory and Policy Setting

Assessing the impact of a mining project on soils and sediments in Quebec is based on a legal framework and specific tools designed to prevent, manage and mitigate environmental risks. Because it is located in the Eeyou Istchee-James Bay territory of Northern Quebec, the Troilus project is governed by the James Bay and Northern Quebec Agreement (JBNQA).

The Troilus mining project site lies within the territory of the Eeyou Istchee James Bay regional government. More specifically, the site is located within the territory of the Cree community of Mistissini, on Category III lands as defined by the JBNQA. Category III lands are public lands that are part of the domain of the State. On Category III lands, Indigenous people have the right to hunt, fish and trap, without a permit, without bag limits and at any time, subject to the principle of conservation (COMEX, 2022).

In Quebec, the assessment of a mining project's impact on soils and sediments is governed by several regulatory requirements, policies and guides. Federal regulations will be used as back-up, mainly in the form of recommendations or guides.

15.1.1.1 Provincial Regulatory Context

Environment Quality Act (LQE)

The LQE requires that any project likely to have a significant impact on the environment, such as a mining project, undergo an environmental assessment. The law also requires the production of an impact study, which must include an assessment of impacts on soils and sediments. Section IV of Chapter IV of Title 1 of the LQE sets out the rules for protecting and rehabilitating land in the event of contamination and includes various regulations such as the Land Protection and Rehabilitation Regulation (LPRR).

Soil protection and contaminated land remediation policy (PSRTC)

This policy provides a framework for the management of contaminated soils, imposing standards for their quality and providing guidelines for their safe management. It applies to mining projects because of the risks of contamination associated with mineral extraction and processing.

Directive 019 in the mining sector

This MELCCFP (2012) document contains specific requirements for soil protection, as well as environmental monitoring of mining projects. It imposes:

- Standards for the management of mine tailings;
- The obligation to characterize soils and sediments that could be affected by the project;

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- Follow-up measures in the event of contamination.

Directive sur la réalisation d'étude d'impact sur l'environnement (French only)

This MELCCFP directive (2024) specifies expectations for impact studies, including analysis of the potential impacts of a mining project on soils and sediments, in particular :

- Soil physico-chemical characteristics;
- Risks of soil and sediment contamination by heavy metals or other substances;
- Mitigation and rehabilitation measures.

Standards and guidelines for soil and sediment quality

The MELCCFP regularly publishes standards and criteria for soil and sediment, such as :

- Soil quality criteria for different uses: criteria grid in the Intervention Guide - Soil protection and rehabilitation of contaminated land (MELCCFP, 2021);
- Criteria for assessing contaminated sediments in aquatic environments: the reference values calculated by the Canadian Council of Ministers of the Environment (CCME), namely the Threshold Effect Concentration (TEC), the Rare Effect Concentration (REC) and the Probable Effect Concentration (PEC), are adopted as criteria for assessing sediment quality. The document *Critères pour l'évaluation de la qualité des sédiments au Québec et cadres d'application : prévention, dragage et restauration*, from which these criteria are drawn, is mentioned in the MELCCFP Intervention Guide mentioned above.

These tools serve as a reference for assessing the impacts of a mining project and developing appropriate soil and sediment management plans.

15.1.1.2 Federal Regulatory Context

As the environment is a shared jurisdiction, provincial regulations take precedence for soils. However, if a mining project is likely to affect aquatic habitats or sediments in watercourses, it may be subject to federal requirements. The Fisheries Act (FA) protects aquatic habitats, while the EIA requires assessment of both positive and adverse impacts on soils and sediments.

To this end, the following federal guides and recommendations are used for soil and sediment characterization:

- Guide sur la caractérisation environnementale des sites dans le cadre de l'évaluation des risques pour l'environnement et la santé humaine (CCME, 2016) and Canadian Soil Quality Guidelines (CCME, 1999);
- Guide de caractérisation physico-chimique et toxicologique des sédiments (MDDELCC & ECCC, 2016).

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15.1.2 Influence of Consultation and Engagement

Consultation with the stakeholders concerned enabled us to incorporate their expectations and concerns into the project, as well as deepen our knowledge of the environment.

In the context of this project, the Cree Nation of Mistissini, as well as other Indigenous land users who were consulted, expressed the following concerns (Table 15.1) related to the soil and sediment component¹ :

Table 15.1 Summary of soil and sediment concerns

Impacts		Mitigation measures proposed by Troilus
Historical	Anticipated	
Dust pollution from tailings storage facility	Dust pollution from the tailings storage facility and ore stockpiles, particularly in windy conditions.	Include progressive revegetation of tailings in tailings management plan. Include dust prevention, or a dust-free solution, in the waste and tailings management process: ensure that a dust prevention program is in place to avoid dust emissions from the tailings facility and the site in general. Ore storage in a dome and use of covered conveyors.
Oil and liquid leaks not properly managed during previous operation	-	Have a strict oil and fluid management plan to prevent leaks into the environment, including an equipment maintenance program to reduce the potential for leaks/spills.
Slopes too steep for some waste rock piles	Development of waste rock or tailings piles with excessively steep slopes.	Several benches will be installed on infrastructures such as waste rock piles and tailings facilities. Slope geometry will be at least 2.5:1V.
Presence of silica and cyanides in dust and in the dispersion radius	-	All materials to be excavated and stockpiled will be characterized for concentrations of metals, cyanides and silica. No cyanides are expected to be released as part of the proposed new project.
Undeclared spills	-	Avoidance of uncontrolled spills; Implementation of an equipment maintenance program and a spill and reporting procedure.

Regarding soil and sediment VC, no traditional knowledge was available at the time the assessment was prepared, but Troilus will continue to take into account information that will be received during the detailed planning and design of the project.

15.1.3 Potential Impacts, Pathways and Measurable Parameters

The potential impacts of the Troilus mining project on soils and sediments are mainly related to the risk of soil erosion and metal contamination associated with dust from mining, transport and storage activities on and off the mine site. Accidental spills and leaks of hazardous products, including petroleum products, add to these contamination risks.

¹ TROILUS GOLD *New Troilus Project Preliminary consultation in preparation for the initial project description to the Impact Assessment Agency of Canada*
Meeting with members of the Cree Nation of Mistissini held on January 19, 2022

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The construction of new infrastructures and the management of hazardous and residual materials could have an impact on soils and sediments.

To assess the impact of the new project, it is important to know the existing state of soils and sediments on the site. This requires knowledge of the impact on soils and sediments of historical mining activities on the site from 1996 to 2010, as well as an assessment of soil quality based on the guidelines and guides for natural background assessment and physicochemical characterization of initial soil conditions prior to implementation of the new industrial project.

Table 15.2 below summarizes the potential impacts identified, with the corresponding pathways and measurable parameters for each impact.

Table 15.2 Potential impacts, impact pathways and measurable parameters

Potential impact	Impact Pathway	Measurable parameters
Exposure of land users to contaminated soils already present on the site	Direct contact with contaminated soil.	Concentration of: heavy metals (including As, Cd, Cr, Cu, Hg, Ni, Pb, Zn).
	Ingestion of fruit and plants growing on contaminated soil.	
Soil and sediment erosion - new project	Construction and operation of the mine, as well as dismantling and reclamation activities following closure, could result in changes to exposed soil surfaces, leading to soil erosion and leaching of materials.	Quantitative: Surface area of exposed areas and existing contaminated soils. Increased TSS, nutrients and heavy metals in surface waters.
	Modification of erosion and sediment deposition processes, which could have an impact on aquatic fauna and water flow.	Qualitative: Risk of wind and runoff erosion: sedimentation in watercourses, changes in drainage conditions, accumulation areas.
Alteration of soil and sediment quality - new project	Partial soil and sediment contamination resulting from leaks, accidental releases or dust fallout.	Heavy metals, PHCs, VOCs, phenolic compounds, explosives, formaldehydes, phthalates, ammoniacal nitrogen, sulfur, cyanides.
	Cross-contamination by handling contaminated soils and sediments already present on site.	

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15.1.4 Spatial and Temporal Boundaries

15.1.4.1 Spatial Boundaries

Project Development Area (PDA)

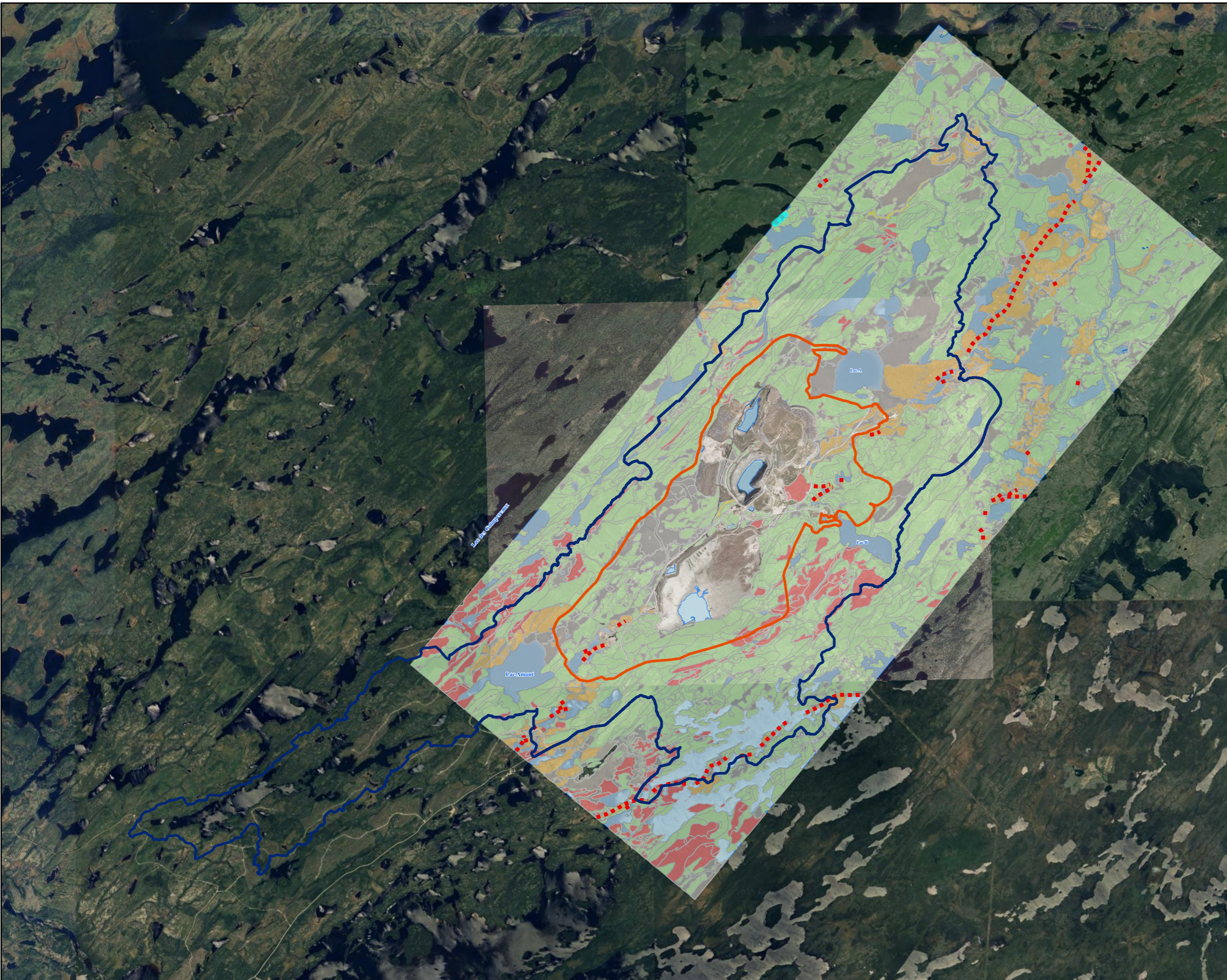
The PDA for soil and sediment VC encompasses the project's footprint on soils and sediments and is the predicted area of physical disturbance to these components associated with project construction, operation, closure and remediation. It includes the four open pits (2 existing and 2 new), the tailings facility, the ore processing plant and other mine-related infrastructure.

Local Study Area (LSA)

The LSA encompasses the site boundaries where the project's direct and indirect impacts on soils and sediments can be predicted or measured with a reasonable level of accuracy and confidence. For soils (Map 15.1), the LSA includes the PDA and a buffer zone of 0-300 m around it, broadly corresponding to the sub-watershed (hydrological LSA). The LSA is considered sufficiently large to allow a reliable assessment of the project's impacts on soils and sediments, and its potential cumulative impacts and previous, existing and reasonably foreseeable developments.

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LÉGENDE / LEGEND

- Zone de développement du projet / Project Development Area
- Zone d'étude locale / Local Study Area
- Esker / Esker

Dépôt de surface / Surface Deposits

- Anthropogénique / Anthropogenic (A)
- Colluvion / Colluvium (C)
- Fluvial / Fluvial (F)
- Fluvioglacière / Fluvioglacial (FG)
- Morainique (Till) / Morainic (Till) (M)
- Eau surfacique / Surface Water (N)
- Organique / Organic (O)
- Roc / Rock (R)

1				
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

Dépôts de surface et zone d'étude locale / Surface Deposits and Local Study Area

NO. PROJET / PROJECT NO. 240433/167040485	DATE 03/ 04/ 2025
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Regional Study Area (RSA)

The RSA establishes the context for determining the significance of project-specific impacts. It covers the project's watersheds, as defined in the hydrological framework (see Map 11.2 in Chapter 11).

The following components are taken into account in delimiting the project area:

- Open pits;
- Tailings storage facility;
- Ore storage areas;
- Waste rock piles;
- Overburden piles;
- Bibou Creek diversion;
- Access road diversion;
- Power line relocation;
- Ore processing plant;
- Ditches and contact water collection basins;
- Industrial and domestic water treatment plant;
- Drinking water collection, treatment and distribution system;
- Accommodation facilities;
- Related buildings.

15.1.4.2 Temporal Boundaries

The temporal boundary of the soil and sediment quality assessment includes all phases of the project, from the start of construction through to post-restoration, the duration of which has not yet been determined. According to the current project schedule, the project phases include :

- Construction (Year -3 to Year -1)
- Operation
 - Operations phase 1 (Years 1 to Year 21): processing with ore extraction
 - Operations phase 2 (Year 22): milling with no ore extraction
- Decommissioning and Closure
 - Active closure (Year 22 to Year 24)
 - Passive closure (Years 24+)

Refer to Chapter 3 of the ESIA (Project Description) for a detailed description of activities planned during each phase.

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15.1.5 Residual Impacts (RI) Characterizations

The characterizations used to assess the project's residual impacts on soils and sediments are presented in Table 15.3.

Table 15.3 Characterization of residual impacts on soil and sediment

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual impact	<p>Positive - a RI that improves quality relative to the reference state.</p> <p>Adverse - a RI that worsens quality compared with the reference state.</p> <p>Neutral - no change in quality compared with the reference state.</p>
Magnitude	The amount of change in measurable parameters or VC relative to existing conditions.	<p>No measurable change</p> <p>Low - a measurable change in quality/quantity, but within the normal variability of baseline conditions.</p> <p>Moderate - a measurable change in quality/quantity from baseline conditions, but quality parameters do not affect the ability of soils and sediments to function within a natural ecosystem or to support plant growth.</p> <p>High - a measurable change in quality/quantity that affects the soil's ability to function within a natural ecosystem or to support plant growth.</p>
Geographic Extent	The geographical area in which a residual impact occurs.	<p>PDA – residual Impacts are restricted to the PDA</p> <p>LSA – residual Impacts extend into the LSA</p> <p>RSA – residual Impacts extend into the RSA</p>
Timing	Considers when the residual impact is expected to occur, where relevant to the VC ..	<p>Zero sensitivity - The timing chosen has no impact on soil and sediment.</p> <p>Moderate sensitivity - The timing chosen has a moderate impact, and the impacts are manageable with proper planning and mitigation measures.</p> <p>High sensitivity - residual impacts occur during the period of high sensitivity.</p>
Duration	The time required until the measurable parameter or the VC returns to its existing condition, or the residual impact can no longer be measured or otherwise perceived .	<p>Short term – the RI is limited to the construction phase.</p> <p>Medium term – the RI may occur during construction and operation (25 years).</p> <p>Long term – the RI extends beyond the operating phase (>25 years).</p>
Frequency	Identifies how often the residual impact occurs and how often during the project or in a specific phase .	<p>Single event</p> <p>Multiple irregular event - occurs at irregular intervals.</p> <p>Multiple regular event - occurs at regular intervals.</p> <p>Continuous - occurs continuously.</p>
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases .	<p>Reversible - the RI is likely to be reversed after completion of the activity and reclamation.</p> <p>Irreversible - RI is unlikely to be reversed.</p>

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15.1.6 Significance Definition

The adverse impacts of the project on soils and sediments are characterized using the IAAC ranking system: negligible, low, moderate or high:

- **Negligible or low:** Impacts are likely to be negligible or low if they are of negligible or low magnitude, of short duration, infrequent, of small spatial extent, reversible or easily avoidable, and to generate few or minor impacts on soil and sediment quality. Mitigation measures will allow baseline conditions to remain largely unchanged;
- **Moderate :** Impacts are likely to be of moderate magnitude if they are of moderate magnitude, moderate duration, occasional, possibly/partially reversible, and to generate a moderate level of impacts on soil and sediment quality. Mitigation measures may not fully eliminate, reduce, control or compensate for impacts, but should preserve the environmental quality of soils and sediments;
- **High:** Impacts are likely to be of high magnitude if they are large, permanent/long-term, frequent, irreversible and extend over a large area or into an area of exclusive/preferred or ecologically/environmentally sensitive indigenous use. High levels of impact on soils and sediments are expected. There is a high degree of uncertainty as to the effectiveness of mitigation measures, or mitigation measures that are unable to fully address impacts, such that impacted soils and sediments become significantly degraded.

15.2 Existing Conditions

This section summarizes the site's topographical conditions, as well as existing and pre-development (pre-1996) soil and sediment characteristics.

Pre-development site conditions were summarized in Genivar (2009a) from data collected as part of the environmental and social impact assessment for the original Troilus Mine project (Entraco, 1993). The description of existing soil and sediment characteristics is based on the most recent studies conducted at the site by BluMetric and other consultants.

The various Phase I and II site characterization and environmental assessment reports referenced in this section are presented in Appendix G2.1.

15.2.1 Methods

15.2.1.1 Topography and Surface Drainage

The description of topography and surface drainage at the site is based on a review of the data and information available on Genivar (2009a and b), SNC-Lavalin (2014 and 2018) and WSP (2024).

15.2.1.2 Soils

As part of the Troilus project's ESIA, a search for existing information was carried out prior to describing existing and pre-development soil and sediment conditions on the site. Thus, to establish the site's history of use, an environmental site assessment (ESA Phase I) was carried out by BluMetric (2023) in

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accordance with the *Land Characterization Guide* (Quebec Publications, 2003) and the approach described in the Canadian Standards Association (CSA) standard Z768-01: *Environmental Site Assessment, Phase I*. The work consisted of a review of historical records, a site visit and an interview with the Troilus team to assess the potential for contamination of the site under study, and to determine whether there was any evidence of actual or potential contamination due to past and current activities.

The description of the VC is also based on Phase I, Phase II and Phase III ESA studies conducted on the project site from 1996 to 2024 in areas affected or unaffected by anthropogenic activities, particularly mining activities prior to the current project.

The assessment of the site's existing condition was complemented by a characterization of a buffer zone, which designates the transition zone between the former industrial zone and the area not impacted by former mining activities. The buffer zone covers soils within a radius of 50 to 300 m around the former installations.

Following characterization of the buffer zone, a physicochemical characterization of the state of soils not impacted by former mining activities was carried out by BluMetric in 2024 (appendix G2.2). This study identified the characteristics of soils likely to be disturbed by project-related activities, and provided the data required for the eventual assessment of their impacts, mitigation measures, and management and monitoring plans. This study defines the baseline condition of soils within the project footprint.

This physicochemical soil characterization (Appendix G2.3), carried out in accordance with the *Guide to the physicochemical characterization of the initial state of soils before the implementation of an industrial project* (MDDELCC, 2016) also allows to determine background levels of metals in the soil.

In detail, the methodology used for the physicochemical characterization of the initial soil status is based on the information and results of previous studies, to determine only those sectors of the study area with no history of use and no risk of contamination for the implementation of the characterization.

This methodology is also based on the mapping of soil types or surface deposit formations found in the project's Local Study Area (LSA) (Map 15.1). Thus, the main surface deposit formations encountered in the LSA were targeted by drilling to determine their initial quality. These were moraine formations (M), organic formations (O) and fluvio-glacial formations (FG). The spatial distribution of boreholes is designed to take account of variations in material texture as a function of relief and vegetation cover.

Sampling and Analysis Strategy

The sampling strategy, developed in accordance with the guide, enabled us to cover the study area and obtain the minimum number of samples per deposit type required for statistical analysis (Ouellette, 2012). The locations selected enable stratigraphic cross-sections to be made, thus intersecting the different layers of deposits and identifying the lateral limits of the main formations present.

Each sampling station is located in three spatial dimensions using GPS. Sampling, transport and preservation procedures are carried out in accordance with the various MELCCFP sampling guides for environmental analysis. Given the sampling investigation methods used, samples are of the spot type.

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The parameters of the analytical program were determined based on the recommendations of Guide 2024 and correspond to those recommended by Directive 019 (MDDEP, 2012):

- Metals and metalloids (Group I of Schedules I and II of the LPRR): Ag, As, Ba, Cd, Co, Cr, Cu, Sn, Mn, Hg, Mo, Ni, Pb, Se, Zn and U;
- Inorganic and organic substances likely to be released or discharged by future operations: PHCs C₁₀-C₅₀, phenolic compounds, total organic carbon, total cyanides and sulfur.

The location of soil sampling stations is shown on Maps 15.2 and 15.3. Map 15.2 shows all the sampling points for the initial soil characterization, while Map 15.3 shows all the sampling stations for the various soil characterizations between 2022 and 2024.

Sampling Method

Boreholes were drilled using hand augers or mechanical shovels. Continuous samples, taken directly from the auger or shovel, were selected according to the stratigraphy encountered and organoleptic observations:

- An initial sample was taken from the top 10 cm of soil, to target the organic soil layer that might pick up metallic contaminants.
- Subsequently, an additional sample was taken for each stratigraphic unit or per 0.5 m thickness.

Samples were preserved under the prescribed conditions and within the prescribed timeframe and sent to an accredited laboratory. Sampling equipment was either single-use (Ziploc® plastic bags, nitrile gloves, sampling jars) or cleaned before each use (stainless steel trowel, auger bucket). Tools in contact with any soil were pre-washed according to the procedure described in the *Guide Sampling for Environmental Analysis Guide, Book 5: Soil Sampling*.

Reference Criteria

The environmental quality of soils is assessed in accordance with applicable criteria A, B and C of the MELCCFP's *Intervention guide for Soil protection and Rehabilitation of contaminated land* and Appendices I and II of the LPRR.

Determining Natural Background Metal Levels

Natural background levels (NBL) of metals in soils according to the surface geological formation on which they were developed were calculated in accordance with the *Physicochemical Characterization Guide* for each given parameter, based on a minimum of thirty sample analysis results from at least thirty boreholes drilled in areas unaffected by previous human activity.

A data validation of the analytical results was carried out to target abnormally high (potentially outlier) data that could not be explained. Where necessary, these invalid results were removed from the database used to determine natural background levels. Analytical results were then statistically processed. This was done for each of the typical layers and for all the analytical parameters, determining the following points:

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- Minimum value (lowest value obtained for all data);
- The maximum value (highest value obtained for all data);
- The first quartile (Q₁) (25% of selected data are below this value);
- The median (50% of data retained are below this value);
- The third quartile (Q₃) (75% of data retained are below this value).

Also, as recommended by the *Guide to the physicochemical characterization of initial soil state prior to the establishment of an industrial project*, background levels were determined by performing the upper vibrissa calculation for each parameter (MDDELCC, 2016). The equation used is as follows:

$$\text{Upper vibrissa} = ((Q_3 - Q_1) \times 1.5) + Q_3$$

Thus, the value of the upper vibrissa determines the maximum concentration that is considered the natural background grade for each of the typical stratigraphic layers. The upper vibrissa value was then compared with the 90th and 98th percentiles (90 or 98% of the data retained are below this value).

The locations of the boreholes drilled as part of the physico-chemical characterization of the initial soil conditions are shown on Map 15.2.

15.2.1.3 Sediment

The data and information used to describe sediments come from the baseline study of surface water and sediment quality at the Troilus mine site, carried out by Wachiih (2024).

Sediment characterization was carried out in accordance with the following guides:

- *Guide to the physicochemical characterization of aquatic environment state prior to the establishment of an industrial project* (MDDELCC, 2017);
- Guide for physicochemical and toxicological characterization of sediments (MDDELCC and ECCC, 2016).

The parameters analyzed in the sediment samples collected were metals characteristic of the activities carried out on the site, total organic carbon, sulfur, PHCs C₁₀-C₅₀, granulometry and moisture percentage. The particle size analysis was used to determine the specific surface area of the sediments and, subsequently, to estimate their adsorption capacity for metals and organic substances.

The locations of the various sediment sampling stations are shown on Map 15.4.

Sediment quality results are compared with the document entitled *Criteria for the Assessment of Sediment Quality in Quebec and Application Frameworks: Prevention, Dredging and Remediation* (EC and MDDEFP, 2007).

A summary of sediment quality criterion exceedances is shown on Map 15.8 and in Table 7 of the Wachiih (2024) report, for all monitoring performed. Certificates of analysis for results obtained in 2022 and 2023 are available in Appendix 5 of the same report.

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Sediment sampling was carried out, as recommended in the guide, at a minimum of three exposed stations in each of the main receiving streams and one control station per reference zone (MDDELCC, 2017). The sampling method used refers to sediment sampling by grabbing (CCME, 2011).

A Wildco brand stainless-steel Ekman sediment grab was used for sampling, allowing samples of sediment to be taken from the surface layer in order to determine and assess the horizontal distribution of their characteristics.

Sampling equipment was cleaned prior to each sampling session, in accordance with the standard procedures described in the guide EC (2002) cited above. For sampling in 2023, five duplicates were taken at a single sampling station.

Once collected, the soil samples were stored in cool, airtight containers at around 4°C to ensure sample integrity, and protected from light. They were then transported to the laboratory as quickly as possible. The 2022 and 2023 analyses were carried out by AGAT laboratories, as were the follow-ups carried out in 2014, 2015, 2018 and 2019.

Samples for particle size analysis were collected in the same way and stored in plastic bags.

15.2.2 Pre-Development Conditions

15.2.2.1 Topography and Soils

The topographical conditions of the site prior to the industrial and mining development of 1996, surveyed in Genivar (2009a and b), show that the relief is irregular with an average elevation of 400 m with elongated rocky hills in the north-east/south-west axis for the southern and north-western sectors, while the gently undulating eastern and central areas are covered by loose deposits of various origins. Glacial deposits predominate, while fluvio-glacial deposits, represented by eskers, are found in the central and southeastern parts of the region. Surface drainage from the development area is generally to the north or northeast. No environmental studies on soil quality prior to site development (before 1996) are available.

15.2.2.2 Sediment

The only available data on sediment quality prior to site development comes from Entraco (1993). This report indicates that stream sediment sampling was carried out at four locations: S-1, S-2, S-3 and S-4 (see drawing G05, Entraco (1993)).

Copper was found in proportions of up to 99 mg/kg (Table 15.4) on a dry basis (S-2). Zinc is also present in significant proportions, reaching 45 mg/kg for sample S-4. Finally, all these streams flowing over organic deposits contain a high proportion of organic matter (15,000 to 29,000 mg/kg).

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

Table 15.4 Results of chemical analyses of sediment samples (expressed in mg/kg, dry basis) (Entraco, 1993)

Parameters	S-1	S-2	S-3	S-4
Arsenic	0.11	<0.05	<0.05	<0.05
Cadmium	<1	<1	<1	<1
Copper	6	99	17	35
Mercury	<0.05	<0.05	<0.05	<0.05
Lead	<10	<10	<10	<10
Zinc	12	9	14	45
Organic matter	15 000	22100	17900	29000

Particle size analysis indicates that most of these sediments consist of fine material (<5 mm), except for sample S-1 where some grains are up to 25 mm in diameter.

Table 15.5 summarizes the results of sediment particle size analysis under pre-development conditions.

Table 15.5 Sediment particle size analysis results (% passing)

Sieve	S-1	S-2	S-3	S-4
40 mm	100	100	100	100
25 mm	74.6	100	100	100
20 mm	72.1	100	100	100
16 mm	71	100	100	100
10 mm	64.8	100	100	100
5 mm	56.4	98.6	100	99.5
2.5 mm	50.2	98	99.8	97.2
1.25 mm	40.7	94.9	98.5	89.8
630 µm	27.3	87.3	94.1	80.3
315 µm	18.1	75.4	76.6	73.9
160 µm	5.5	60.5	38.2	55.5
80 µm	2.2	43.6	12.2	33.3

15.2.3 Existing Conditions

15.2.3.1 Topography and Surface Drainage

Located in a region covered with black spruce forests, swamps, peat bogs, lakes and ponds, the study area has a moderate to slightly rugged topography, dominated by rocky massifs to the south and north. The southern massif consists of rocky hills aligned on a northeast/southwest axis with a maximum altitude of 520 m, while to the north extends a rocky ridge oriented northeast/southwest with a maximum altitude of 430 m (SNC-Lavalin, 2018). Within these rocky massifs are some twenty eskers evenly distributed over a 5 to 10 km area.

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According to WSP (2024), the local topography shows a valley oriented N220°, which is sub-parallel to glacial erosion forms representing relics of regional northeast/southwest glacial flow, with a relatively marked relief (between 365 and 400 m) between two hills. The historic Troilus mine is located at an elevation of 375 m on the western flank of a 500 m-high hill. The local topography is therefore undulating and irregular, with rocky outcrops intersecting loose deposits. Surface drainage water from the study site is discharged by infiltration into the soil and by runoff into streams, wetlands, lakes or pits.

15.2.3.2 Mapping Surface Deposits

Map 15.1 illustrates the distribution of surface deposits across the Local Study Area. It is based on data from the MRNF and Troilus' mapping of surface deposits in the Local Study Area. The topographic depression occupied by the Troilus project area is filled by glacial till sediments, juxtaglacial sediments and organic deposits, mostly peat. The bedrock is sporadically subcropping. The valley is bounded to the northwest by longitudinal forms of thin till or tapered bedrock.

The main surface formations encountered in the study area are therefore morainal deposits (Till), organic deposits (O), thin fluvial deposits and fluvio-glacial formations (FG) in addition to rock outcrops.

In the Project Development Area, drilling results from Troilus (WSP, 2024) indicate the presence of :

- Two main zones of fluvio-glacial, juxtaglacial deposits. The first zone originates east of Pit 87, where it takes the form of a narrow (~ 30 m) sinuous portion of esker that, in its northeasterly extension, presents more extensive sectors of juxtaglacial sediments, reaching a width of nearly 1.5 km in the eastern sector of Lake A (PE43). This broad zone progresses to the northeast, reorganizing itself into a continuous esker nearly 200 m wide.
- The second zone of juxtaglacial sediments borders the southwestern limit of the projected SW pit footprint, and forms low-relief masses organizing into a discontinuous esker string southeast of Lake Amont (PE2).
- Thin metric bands of fluvial deposits are present on the banks of postglacial streams. Numerous wetlands have developed in the hollows of poorly drained valleys, whose beds are essentially composed of sandy-silty tills that have fostered the development of wetlands.
- Open and wooded peat bogs form large, interconnected complexes on either side of Bibou Creek and around Lakes A (PE43) and A1. Stream banks, including Bibou Creek, may contain riparian peat zones averaging 3.5 m in width, showing shrubby assemblages. At the boundaries of the PDA, unconsolidated deposits generally vary in thickness from 1 m to approximately 15 m. These contain horizons of sandy-silty glacial till with varying percentages of clast or boulder inclusions.

15.2.3.3 Phase I Environmental Site Assessment

To establish the site's history of use, a Phase I Environmental Site Assessment (ESA) was carried out by BluMetric (2023) in accordance with the *Land Characterization Guide* (Québec Publications, 2003).

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

The work consisted of a review of historical records, a site visit and an interview with the Troilus team to assess the potential for contamination of the site under study, and to determine whether the site presents evidence of actual or potential contamination due to past and current activities. No measurements, geotechnical studies, ecological studies or wetland studies were carried out during the Phase I ESA.

Based on all the information available and collected at the time of the Phase I ESA, 18 sources of potential contamination were identified on the study site, with potential contaminants associated with each source (Table 15.6).

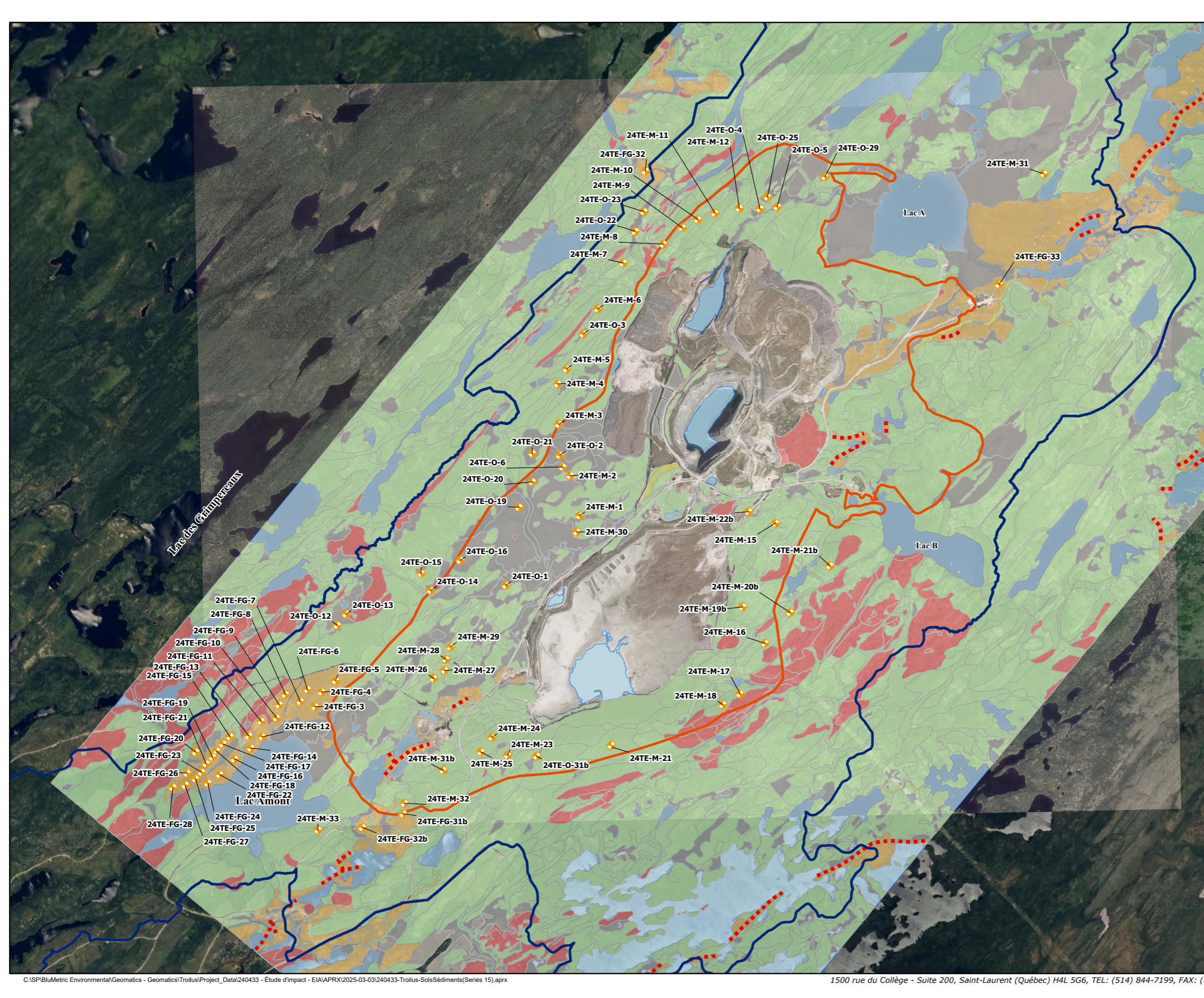
These various sources of potential contamination were the subject of Phase II ESA studies in 2023 and 2024 (BluMetric, 2024), considering the parameters listed in Table 15.3, with the exception of :

- Source 8 - Gasoline reservoir;
- Source 15 - Former Lake Bouteille;
- Source 16 - Trench disposal area;
- Source 17 - North and south septic fields.

The full reports of these various Phase II ESA studies conducted prior to 2023 are presented in Appendix G2.2. The drilling and sampling points for the complementary Phase II ESA conducted by BluMetric consider the results of the various characterization studies carried out on the site (Genivar, 2008; Stavibel, 2012; SNC-Lavalin, 2018; Golder, 2020), while verifying data from previous studies where doubts existed.

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS



LÉGENDE / LEGEND

- Zone de développement du projet / Project Development Area
- Zone d'étude locale / Local Study Area
- Esker / Esker
- ◆ Points de Sondage / Sampling Points

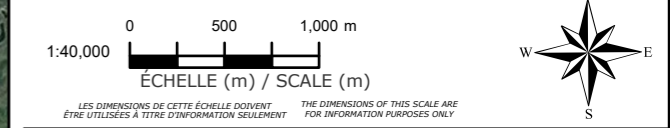
Dépôt de surface / Surface Deposits

- Anthropogénique / Anthropogenic (A)
- Colluvion / Colluvium (C)
- Fluvial / Fluival (F)
- Fluvio-glaciaire / Fluvio-glacial (FG)
- Morainique (Till) / Morainic (Till) (M)
- Eau surfacique / Surface Water (N)
- Organique / Organic (O)
- Roc / Rock (R)

1				
RÉV.	DESCRIPTION	DD/MM/YY	BY	VERIF.

RÉFÉRENCES/REFERENCES
 Base Map: Bing, 06 June 2023

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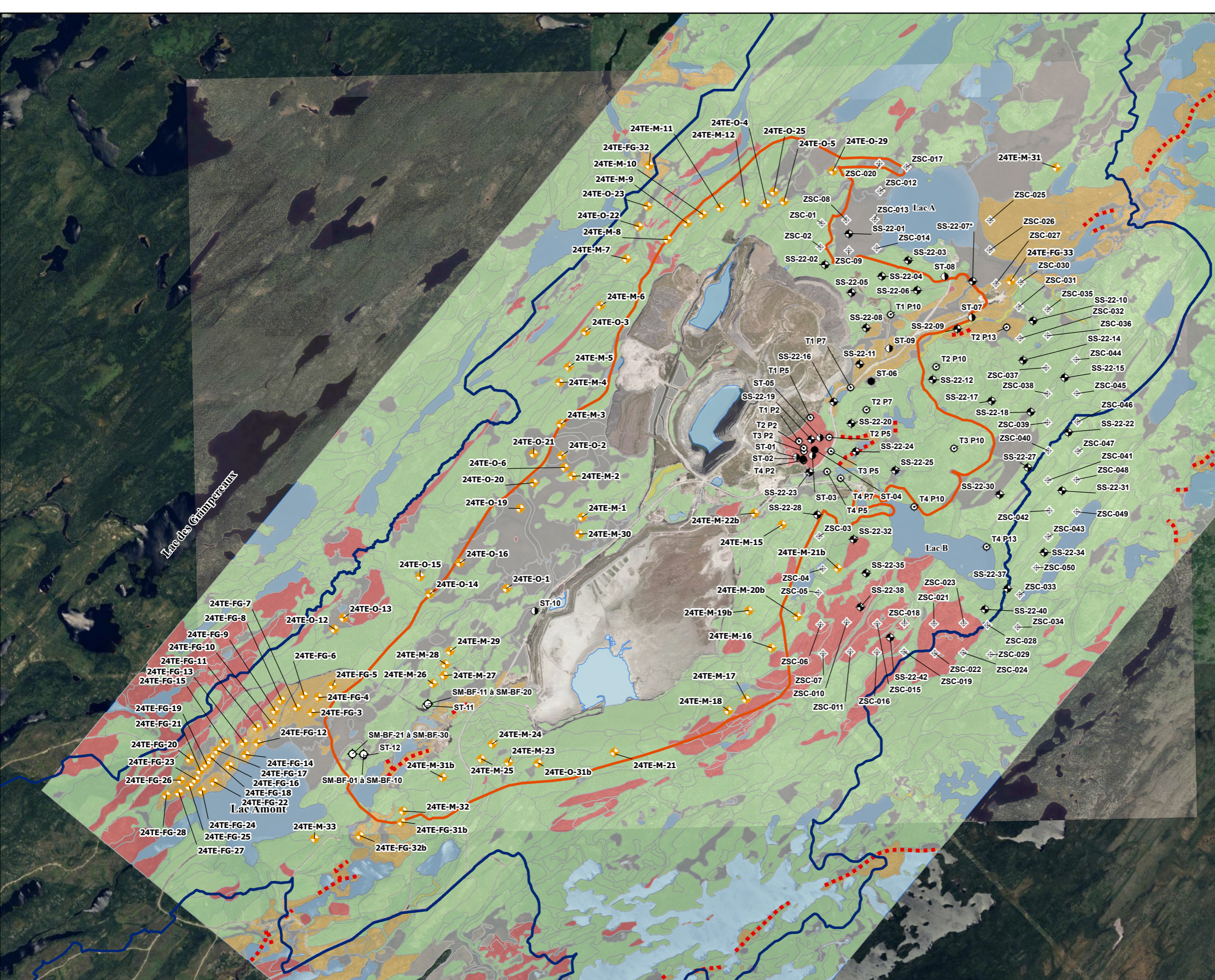
PROJET/PROJECT
Étude d'impact sur l'environnement et le milieu social pour le projet de mine Troilus / Environmental and Social Impact Assessment for the Troilus Mine Project

TITRE/TITLE
Points d'échantillonnage des sols pour la caractérisation de l'état initial / Soil Sampling Locations Characterization of Initial Conditions

NO. PROJET / PROJECT NO. 240433/167040485	DATE 03/ 04/ 2025	
CONÇU / CHECKED C. Ndong	RÉVISÉ / VERIFIED L. Agassounon	
DESSINÉ / DRAWN M. Baker	Figure No. 15.2	ED./REV. 1

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS



LÉGENDE / LEGEND

- Zone de développement du projet / Project Development Area
- Zone d'étude locale / Local Study Area
- Esker / Esker
- Sondage / Sampling Point (2024)
- Sondage / Sampling Point (Golder, 2022)
- Sondage / Sampling Point (STAVIBEL, 2013)
- Sondage / Sampling Point (SNC-Lavalin, 2014)
- Sondage / Sampling Point (SNC-Lavalin, 2014 et Troilus Gold, 2019)
- Sondage / Sampling Point (SNC-Lavalin, 2018)
- Sondage / Sampling Point (Troilus Gold, 2021)

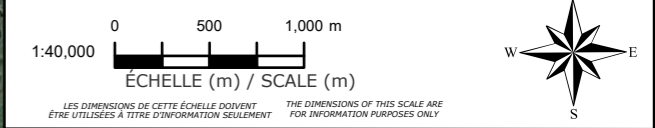
Dépôt de surface / Surface Deposits

- Anthropogénique / Anthropogenic (A)
- Colluvion / Colluvium (C)
- Fluvial / Fluival (F)
- Fluvioglaciare / Fluvioglacial (FG)
- Morainique (Till) / Morainic (Till) (M)
- Eau surfacique / Surface Water (N)
- Organique / Organic (O)
- Roc / Rock (R)

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RÉV.	DESCRIPTION	DD/MM/YY	BY	VERIF.

RÉFÉRENCES/REFERENCES
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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
Localisation des stations d'échantillonnage des sols lors de caractérisation 2022-2024 / Soil Sampling Locations 2022-2024

NO. PROJET / PROJECT NO.
 240433 / 167040485

DATE
 03/ 04/ 2025

CONÇU / CHECKED
 C. Ndong

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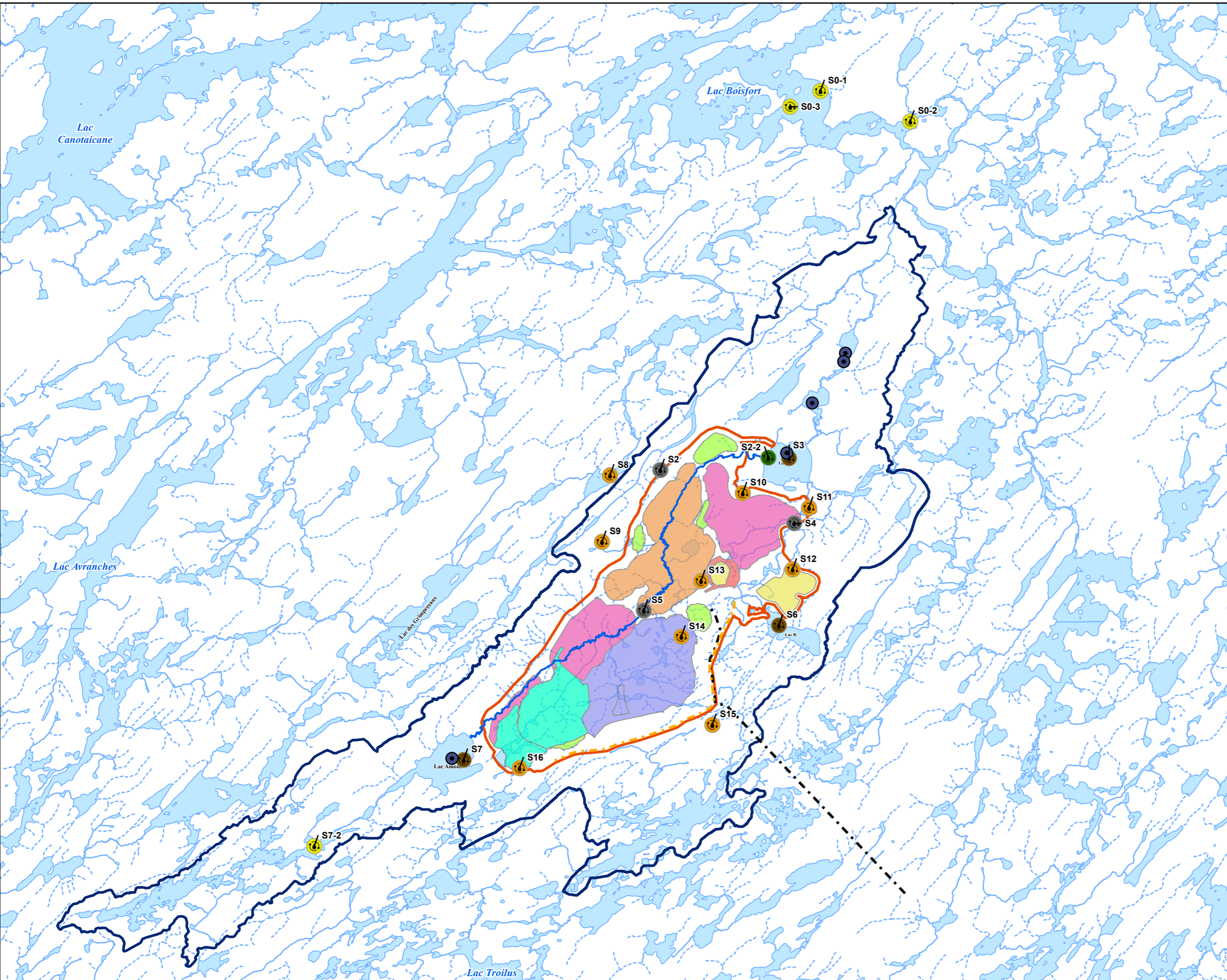
DESSINÉ / DRAWN
 M. Baker

Figure No.
 15.3

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Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS



LÉGENDE / LEGEND

- Zone de développement du projet / Project Development Area
- Zone d'étude locale / Local Study Area
- Plan d'eau / Lake
- Cours d'eau permanent / Permanent Watercourse
- Cours d'eau intermittent / Intermittent Watercourse
- Ligne électrique projetée / Proposed Power Line
- Chemin d'accès projetée / Proposed Access Road
- Station d'échantillonnage de l'eau, des sédiments et du benthos / Surface Water, Sediment, and Benthos Sampling Location (1997)
- Qualité des sédiments / Sediment Sample (2013, 2014, 2015, 2018, 2019)
- Qualité des sédiments / Sediment Sample (2019)
- Qualité des sédiments / Sediment Sample (2022)
- Qualité des sédiments / Sediment Sample (2023)
- Qualité des sédiments / Sediment Sample (2022, 2023)

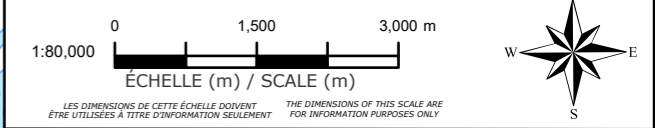
Infrastructure minière projetée / Proposed Mine Infrastructure

- Fosse / Pit
- Aire d'entreposage du minerai / Mineral Storage Area
- Halde à mort-terrain / Overburden Storage Area
- Halde à stérile / Waste Rock Storage Area
- Halde à stérile - Super / Waste Rock Storage Area - Super
- Plateforme de la zone de stockage du minerai / Mineral Stocking Platform
- Parc à résidus miniers / Tailings Storage Facility

1				
RÉV.	DESCRIPTION	DD/MM/YY	BY	VERIF.

RÉFÉRENCES/REFERENCES
 Base Map: Bing, 06 June 2023

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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
Localisation des stations d'échantillonnage des sédiments (Wachih Ressources, 2024) / Sediment Sampling Locations (Wachih Ressources, 2024)

NO. PROJET / PROJECT NO. 240433 / 167040485 **DATE** 03/ 04/ 2025

CONÇU / CHECKED C. Ndong **RÉVISÉ / VERIFIED** L. Agassounon

DESSINÉ / DRAWN M. Baker **Figure No.** 15.4 **ED./REV.** 1

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

Table 15.6 Potential sources of contamination

Study site area/sector	Source n°	Elements of interest	Characterization parameters
Industrial complex located southeast of lot 4 960 027 under study	1	Administration building Foam insulation may contain asbestos	PHCs C ₁₀ -C ₅₀ , metals, PAHs, VOCs, asbestos
	2	Gyratory crusher	PHCs C ₁₀ -C ₅₀ , metals, PAHs, VOCs, asbestos
	3	Electrical substation	PHCs C ₁₀ -C ₅₀ , metals, PAHs, VOCs
	4	Concentrator	PHCs C ₁₀ -C ₅₀ , metals (including mercury), PAHs, VOCs, asbestos, glycol, phenolic compounds, sulfur, non-chlorinated benzene compounds
	5	Concentrator generator set	PHCs C ₁₀ -C ₅₀ , HAP
	6	Cold shed warehouse (storage of small machinery)	PHCs C ₁₀ -C ₅₀ , metals, PAHs, BTEX
	7	Zone 2 for old storage	Copper
	8	Gasoline tank	PHCs C ₁₀ -C ₅₀ , HAM, BTEX, Copper
	9	Diesel tank farm	PHCs C ₁₀ -C ₅₀ , HAP, BTEX
	10	Used oil tank and tank truck	PHCs C ₁₀ -C ₅₀ , metals, PAHs, VOCs
	11	MDR storage area	Copper
	12	Backyard	PHCs C ₁₀ -C ₅₀ , metals, PAHs, BTEX
	13	Environmental laboratory and MDR sorting center	PHCs C ₁₀ -C ₅₀ , HAP, COV
	14	Kenny Awashish Garage	PHCs C ₁₀ -C ₅₀ , metals, PAHs, VOCs
Former mining area (lot 4 960 027)	15	Former Lake Bouteille	Copper
Trench disposal	16	Trench disposal area	PHCs C ₁₀ -C ₅₀ , metals, PAHs, VOCs
Temporary and permanent camps	17	North and south septic fields	Coliforms
	18	Permanent camp	PHCs C ₁₀ -C ₅₀ , metals, PAHs



Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS



Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

15.2.3.4 Soil Characterization in the Buffer Zone

The buffer zone is the area between the area impacted by previous activities and the remaining natural environment. Following the Phase I ESA, a buffer zone characterization was carried out in accordance with discussions with the MELCCFP. In 2023, in the buffer zone, 70 exploration trenches with an average depth of 1.0 m were made using a 15 cm diameter hand auger. The trenches were resealed with the excavated material immediately after sampling. Stratigraphic and environmental properties were observed and recorded at each hole. Descriptions included color, moisture content, presence of debris and organoleptic observations. Detailed descriptions can be found in the trench field sheets presented in BluMetric (2024) (Appendix G2.2).

Analytical results for the 104 soil samples (including 15 duplicates) are summarized on Map 15.5.

PHCs C₁₀-C₅₀

- No sample showed PHCs C₁₀-C₅₀ concentrations in excess of criterion C.
- Seven samples (23TE-79-1, 23TE-82-1, 23TE-85-2, 23TE-88-1, 23TE-91-1, 23TE-93-1 and 23TE-98-1) showed PHCs C₁₀-C₅₀ concentrations in the B-C range.
- Twenty-two (22) samples (23TE-77-1, 23TE-80-1, 23TE-81-1, 23TE-84-1, 23TE-87-1, 23TE-90-1, 23TE-94-1, 23TE-95-1, 23TE-102-1, 23TE-107-1, 23TE-108-1, 23TE-109-1, 23TE-117-1, 23TE-119-1, 23TE-121-1, 23TE-123-1, 23TE-126-1, 23TE-127-1, 23TE-131-1, 23TE-132-1, 23TE-135-1 and 23TE-141-1) showed PHCs C₁₀-C₅₀ concentrations in the A-B range.
- All the samples listed had a high proportion of organic matter which may contain biogenic hydrocarbons and are therefore not of petroleum origin. A chromatogram with petroleum product identification (PPI) was therefore performed on each of the samples in which PHCs C₁₀-C₅₀ analysis showed values above the laboratory detection limit. The result was that the hydrocarbon profile identified in the samples analyzed did not correspond to any of the laboratory's certified standards, and therefore to any of the known types of PHCs, particularly in industry. This suggests that the high PHCs C₁₀-C₅₀ concentrations observed in the buffer zone are linked to the interference of biogenic hydrocarbons naturally present in the organic soil analyzed. These interpretations were confirmed by the results of PAH analysis in the samples.
- All other samples analyzed showed PHCs C₁₀-C₅₀ concentrations below criterion A or the laboratory detection limit. These results therefore meet criterion B applicable to the site.

PAHs

All soil samples analyzed showed PAH concentrations below the laboratory detection limit, except for sample 23TE-93-1 with concentrations in the A-B Guide range for several PAHs.

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

Metals

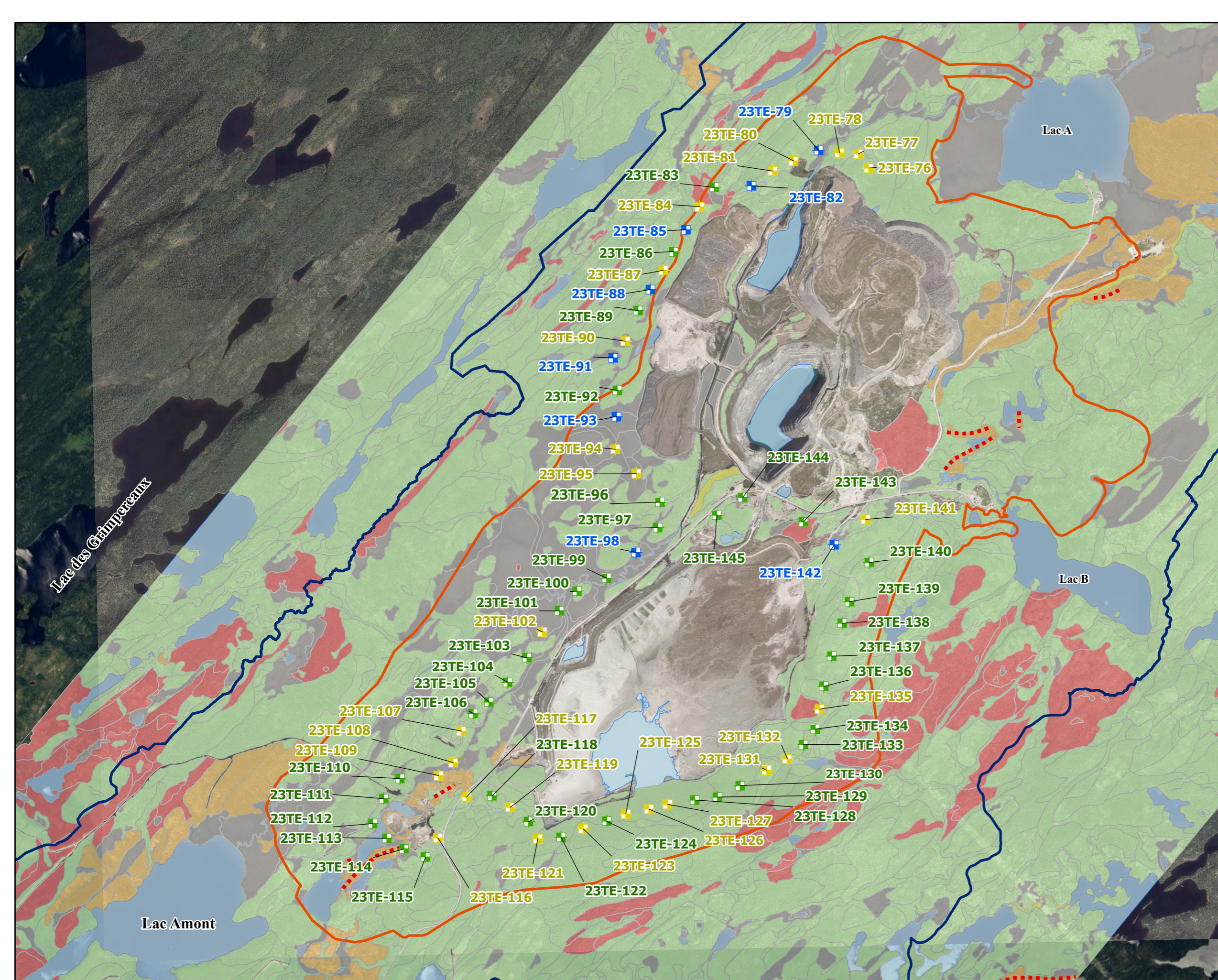
- No samples showed metal concentrations in excess of criteria C.
- Only sample 23TE-142-1 showed a copper concentration in the B-C range of the Guide.
- Thirteen (13) samples (23TE-61-1, 23TE-77-1, 23TE-80-1, 23TE-84-1, 23TE-85-2, 23TE-87-1, 23TE-88-1, 23TE-116-1, 23TE-119-1, 23TE-123-1, 23TE-125-1, 23TE-126-1 and 23TE-141-1) showed silver, arsenic, cadmium, copper, lead and/or zinc concentrations in the A-B range.
- All other samples analyzed showed metal concentrations below A criteria or laboratory detection limits.

Full analytical results are presented in BluMetric (2024), while Map 15.5 shows a summary of analytical results by sample location.

In summary, ecosystems sensitive or vulnerable to acidification resulting from the deposition of atmospheric contaminants were delineated in the document entitled *Rehabilitation Plan - Environmental Monitoring Program - Contingency Plan* (BluMetric, 2024) submitted to the MELCCFP by Troilus. These ecosystems are essentially located in the former industrial zone and to the southeast and northeast of the camp area.

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS



LÉGENDE / LEGEND

- Zone de développement du projet / Project Development Area
- Zone d'étude locale / Local Study Area
- Esker / Esker

Dépôt de surface / Surface Deposits

- Anthropogénique / Anthropogenic (A)
- Colluvion / Colluvium (C)
- Fluvial / Fluvial (F)
- Fluvioglacière / Fluvioglacial (FG)
- Morainique (Till) / Morainic (Till) (M)
- Eau surfacique / Surface Water (N)
- Organique / Organic (O)
- Roc / Rock (R)

Codes des résultats de sol / Soil Sample Results

Guide (RPRT), MELCCFP 2021

- <A
- A-B (< ANNEXE I)
- B-C (ANNEXE I-II)
- >C (>ANNEXE II)

1				
RÉV.	DESCRIPTION	DD/MM/YY	BY	VERIF.

RÉFÉRENCES/REFERENCES
Base Map: Bing, 06 June 2023

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0 500 1,000 m
ÉCHELLE (m) / SCALE (m)

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
Localisation des sondages et résultats des analyses des sols dans la zone tampon / Sampling Locations and Soil Analysis Results in the Buffer Zone

NO. PROJET / PROJECT NO. 240433 / 167040485	DATE 03/ 04/ 2025
CONÇU / CHECKED C. Ndong	RÉVISÉ / VERIFIED L. Agassounon
DESSINÉ / DRAWN M. Baker	Figure No. 15.5
	ED./REV. 1

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

15.2.3.5 Soil Characterization in the Camp Area

This area includes a former temporary camp and the existing permanent camp. It also houses water pumping and treatment facilities, groundwater pumping wells, a septic field, a generator storage area and a propane tank.

All the analytical results of the soil samples taken and submitted for analysis of metals, HP and PAHs showed concentrations below the Guide's A criteria. These results satisfy the B criteria applicable to the site. Detections observed were exclusively for metals, while all soil samples analyzed showed HP and PAH concentrations below laboratory detection limits.

Map 15.6 shows a summary of the characterization work carried out in the camp area. Detailed results can be found in the characterization report in Appendix G2.2.

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS



LÉGENDE / LEGEND

- Zone de développement du projet / Project Development Area
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- Eau surfacique / Surface Water (N)
- Organique / Organic (O)
- Roc / Rock (R)

Sondage / Sampling Point (Golder, 2020)

- Concentration inférieure aux valeurs de l'annexe I du RPRT / Concentration less than the limits in RPRT Annex I
- Concentration supérieure aux valeurs de l'annexe I du RPRT mais inférieures à celles de l'annexe II / Concentration greater than the limits in RPRT Annex I but less than the limits in RPRT Annex II
- Concentration supérieure aux valeurs de l'annexe II du RPRT / Concentration greater than the limits in RPRT Annex II

Sondage / Sampling Point (BluMetric, 2023)

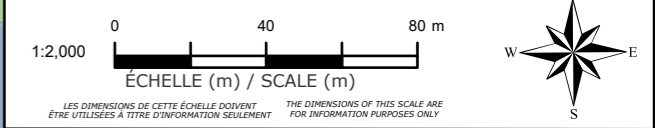
Codes des résultats de sol / Soil Sampling Results - Guide (RPRT), MELCCFP 2021

- <A
- A-B (<ANNEXE I)
- B-C (ANNEXE I-II)
- >C (>ANNEXE II)

1				
RÉV.	DESCRIPTION	DD/MM/YY	BY	VERIF.

RÉFÉRENCES/REFERENCES
 Base Map: Bing, 06 June 2023

NOTES
 CES INFORMATIONS NE PEUVENT ÊTRE REPRODUITES SANS L'AUTORISATION ÉCRITE DE BLUMETRIC ENVIRONMENTAL INC. NE PAS AGRANDIR ET RÉDUIRE LA TAILLE DE CE DESSIN. CE DESSIN A PEUT-ÊTRE ÉTÉ RÉDUIT. TOUTES LES ÉCHELLES ET ANNOTATIONS INDIQUÉES SONT BASÉES SUR UN FORMAT DE DESSIN DE 11"X17".
 THIS INFORMATION MAY NOT BE REPRODUCED WITHOUT THE WRITTEN PERMISSION OF BLUMETRIC ENVIRONMENTAL INC. DO NOT ENLARGE OR REDUCE THE SIZE OF THIS DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED IN SIZE. ALL SCALES AND ANNOTATIONS SHOWN ARE BASED ON AN 11"X17" DRAWING FORMAT.



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

Localisation des sondages et résultats des analyses des sols du secteur des campements / Soil Sampling Locations and Analytical Results in the Camp Sector



NO. PROJET / PROJECT NO. 240433 / 167040485	DATE 03/ 04/ 2025
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CONÇU / CHECKED C. Ndong	RÉVISÉ / VERIFIED L. Agassounon
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DESSINÉ / DRAWN M. Baker	Figure No. 15.6	ED./REV. 1
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Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

15.2.3.6 Physicochemical Quality of Natural Soils

Soil characterization based on the sources of contamination identified during the Phase I ESA and the characterization of a buffer zone have made it possible to delineate an area free of impact from previous activities which was the subject of a characterization of the initial state of the soils prior to implementation of the new Troilus industrial project and the estimation of natural background levels (Troilus, 2025).

Soil Description

Work carried out by BluMetric in 2024 to complement data from WSP (2024) and Golder (2022) has enabled us to establish the stratigraphic profile of soils in the area not impacted by former activities.

Depending on the surface geological formation in which the borehole was drilled (BluMetric 2023 and 2024; WSP, 2024 and Golder, 2022), the soil stratigraphic profile is as follows:

- Morainic formations (M): moist, black or dark brown organic soil on the surface to a maximum depth of 0.55 m, followed by sand, with a variable proportion of gravel or silt, brown, grey or beige, and moist, to depths ranging from 0.39 to 16.10 m (in BH-23-79). These are essentially sandy or sandy-silty glacial till deposits with varying percentages of clast inclusions;
- Organic formations (O): black or dark-brown organic soil, generally saturated, with a thickness from the surface ranging from 0.1 to 1.98 m (in BH-23-21), followed by a sometimes dark-brown, saturated, silty sand. These organic soils are generally found in peat bogs and other wetlands on either side of Bibou Creek and around lakes;
- Fluvioglacial formations (FG): moist, black or dark-brown organic soil on the surface to a maximum depth of 0.75 m, followed by grey, brown or beige sand, with some silt or gravel to depths of over 7 m in boreholes. These are essentially N220°-trending juxtaglacial deposits identified in two sectors of the Troilus Project Development Area (Map 15.1), namely to the east of pit 87 with its esker extension to the northeast, and at the southwestern limit of the SW pit.

Alluvial deposits are reported in the local project area and consist of silty sand along stream banks. These deposits were not sampled as part of this physicochemical characterization, but borehole data show thicknesses ranging from 0.3 to 11.4 m (WSP, 2024).

In all formations, plant debris and roots are found in the first ten centimetres, often corresponding to the organic soil layer, as well as pebbles and boulders throughout the stratigraphic profile. No traces of residual material, odours or visual clues indicating the presence of potential contamination were observed during the survey work. More detailed information on the stratigraphic profile for each of the boreholes is presented in the borehole logs in Appendix G2.3.

Soil Sensitivity to Erosion and Risk of Thaw Settlement

Given the granular nature of fluvioglacial and morainal soils and their low cohesion, these soils are very sensitive to erosion when exposed. It is therefore advisable to maintain vegetation cover. Bare areas are the most at risk. These bare areas are located in the former industrial sector, and their seeding is provided for in the rehabilitation plan submitted to the MELCCFP by Troilus in 2024.

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

In fluvioglacial and morainal deposits, the risk of ground settlement and instability due to ground thaw is low. However, the risk is higher for organic soils, due to their more spongy nature.

Chemical analysis results

The environmental quality results of the soils sampled as part of the physicochemical characterization of natural soils are classified according to the lithological formation of these soils:

Fluvioglacial formation (FG)

- The analytical results of all soil samples, for all parameters analyzed, indicate concentrations below the C criteria.
- Only one sample, 24TE-FG-24-2, taken from a depth of 0.1 to 0.45 m, showed a selenium concentration in the B-C range.

Several samples, taken at depths ranging from 0 to 0.75 m, showed results in the A-B range for PHCs C₁₀-C₅₀, metals and cyanides.

Moraine formation (M)

- The analytical results of all soil samples, for all parameters analyzed, indicate concentrations below the C criteria.
- Two samples showed concentrations in the B-C range:
 - 24TE-M-29-1 taken between 0 and 0.1 m depth in PHCs C₁₀-C₅₀, and
 - 24TE-M-16-2, taken between 0.1 and 0.5 m depth in molybdenum.
- Several samples, taken at depths ranging from 0 to 0.55 m, showed concentrations in the A-B range for PHCs C₁₀-C₅₀, metals and cyanides.

Organic formation (O)

- The analytical results of all soil samples, for all parameters analyzed, indicate concentrations below the C criteria.
- Four organic soil samples (24TE-O-25-2, 24TE-O-4-2, 24TE-O-2-1 and 24TE-O-29-1) showed PHCs C₁₀-C₅₀ concentrations in the B-C range.
- Several samples, taken at depths ranging from 0 to 1 m, showed concentrations in the A-B range for PHCs C₁₀-C₅₀, metals, phenols (o-cresol) and cyanides.

Exceedances of criterion A in PHCs were only observed around organic deposits or in the top 10 cm of other areas of organic soils. These samples also showed high concentrations of total organic carbon (TOC). As noted during the characterization of the buffer zone, the high PHCs C₁₀-C₅₀ concentrations observed in samples taken from organic formations are thought to be related to the interference of biogenic hydrocarbons present in the organic soil analyzed.

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

Maps 15.7a, b and c show the location of the test pits and a summary of the environmental quality of the soils sampled and analyzed as part of this physico-chemical characterization of natural soils.

Analysis results are presented in Troilus (2025) (Appendix G2.3).

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

CODES DES RÉSULTATS DE SOL
Guide (RPRT), MELCCFP 2021

- > C (> ANNEXE II)
- B-C (ANNEXE I-II)
- A-B (< ANNEXE I)
- < A
- ND Non détecté

LÉGENDE / LEGEND

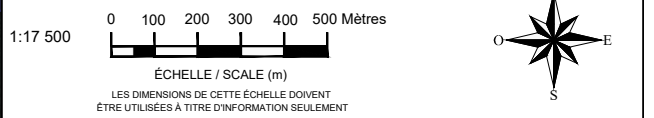
- Zone de développement du projet / Project Development Area
- Zone d'étude locale / Local Study Area
- Sondage / Sampling Point
- Nom de l'échantillon / Sample name
- Date d'échantillonnage / Sample date
- Profondeur échantillon / Sample depth
- Résultat / Result
- Paramètres / Parameters :
 - HP - Hydrocarbures pétroliers / Petroleum hydrocarbons (C₁₀-C₅₀)
 - Métaux / Metals - 15
 - Composés phénoliques / Phenolic compounds
 - Cyanures totaux / Total cyanides

- Infrastructure minière projeté / Proposed Mine Infrastructure**
- Fosse / Pit
 - Aire d'entreposage du minerai / Mineral Storage Area
 - Halde à mort-terrain / Overburden Storage Area
 - Halde à stérile / Waste Rock Storage Area
 - Halde à stérile - Super / Waste Rock Storage Area - Super
 - Plate-forme de la zone de stockage du minerai / Mineral Stocking Platform
 - Parc à résidus miniers / Tailings Storage Facility
 - Bassin du parc de résidus / Tailings Storage Pond

1	Mise à jour des infrastructures du site	2025/03/04	KT	LA
RÉV.	DESCRIPTION	AA/MM/JJ	PAR	VÉRIF.

RÉFÉRENCES / REFERENCES
FOND AÉRIEN MTM NAD83 FUSEAU 8, SERVICE D'IMAGERIE DU QUÉBEC, 2023.

NOTES
CES INFORMATIONS NE PEUVENT ÊTRE REPRODUITES SANS L'AUTORISATION ÉCRITE DE BLUMETRIC ENVIRONNEMENT INC. NE PAS AGRANDIR ET RÉDUIRE LA TAILLE DE CE DESSIN. CE DESSIN A PEUT-ÊTRE ÊTÉ RÉDUIT. TOUTES LES ÉCHELLES ET ANNOTATIONS INDIQUÉES SONT BASÉES SUR UN FORMAT DE DESSIN DE 11x17".



CLIENT / CLIENT

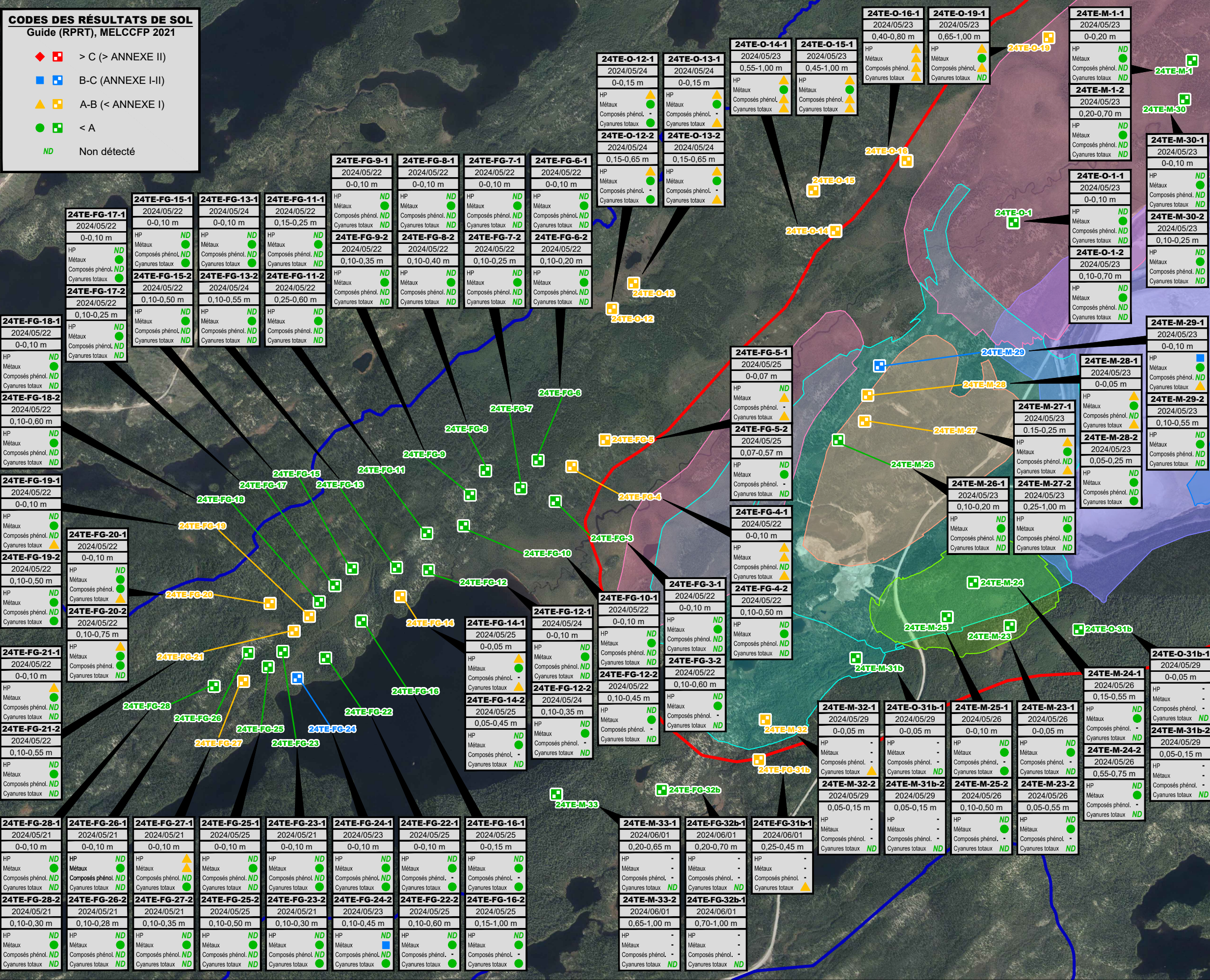
Troilus Gold Corp.

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
Localisation des sondages 2024 et résumé analytiques des sols (sud) / 2024 Sampling Point Locations and Soil Analysis Results (South)

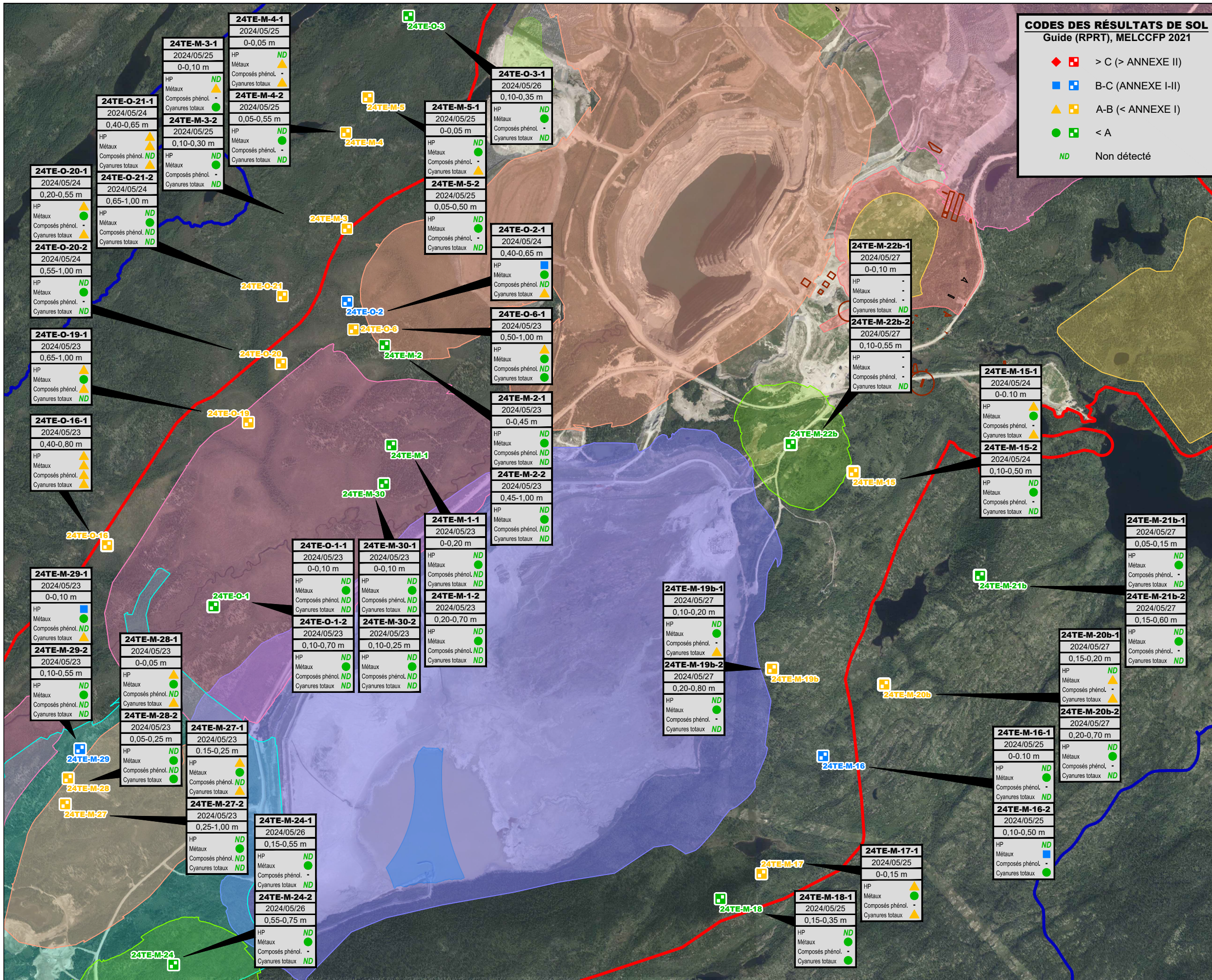


No PROJET / PROJECT NO. 240433 / 167040485	DATE 2024/08/09
CONÇU / CHECKED C.Ndong, géo.	RÉVISÉ / VERIFIED L.Agassounon, géo.
DESSINÉ / DRAWN K.Tranchemontagne	No FIGURE 15.7a
	RÉV. 1



Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS



CODES DES RÉSULTATS DE SOL
Guide (RPRT), MELCCFP 2021

- ◆ ■ > C (> ANNEXE II)
- ■ B-C (ANNEXE I-II)
- ▲ ■ A-B (< ANNEXE I)
- ■ < A
- ND Non détecté

LÉGENDE

- Zone de développement du projet / Project Development Area
- Zone d'étude locale / Local Study Area
- Sondage / Sampling Point

24TE-FG-25-1
2024/05/25
0-0,10 m

HP ND
Métaux ND
Composés phénol. ND
Cyanures totaux ND

— Résultat / Result

Paramètres / Parameters :
HP - Hydrocarbures pétroliers / Petroleum hydrocarbons (C₁₀-C₅₀)
Métaux / Metals - 15
Composés phénoliques / Phenolic compounds
Cyanures totaux / Total cyanides

Infrastructure minière projeté / Proposed Mine Infrastructure

- Infrastrucure minière / Mine Infrastructure
- Fosse / Pit
- Aire d'entreposage du minerai / Mineral Storage Area
- Halde à mort-terrain / Overburden Storage Area
- Halde à stérile / Waste Rock Storage Area
- Halde à stérile - Super / Waste Rock Storage Area - Super
- Plate-forme de la zone de stockage du minerai / Mineral Stocking Platform
- Parc à résidus miniers / Tailings Storage Facility
- Bassin du parc de résidus / Tailings Storage Pond

1	Mise à jour des infrastructures du site	2025/03/04	KT	LA
RÉV.	DESCRIPTION	AA/MM/JJ	PAR	VÉRIF.

RÉFÉRENCES
FOND AÉRIEN MTM NAD83 FUSEAU 8, SERVICE D'IMAGERIE DU QUÉBEC, 2023.

NOTES
CES INFORMATIONS NE PEUVENT ÊTRE REPRODUITES SANS L'AUTORISATION ÉCRITE DE BLUMETRIC ENVIRONNEMENT INC. NE PAS AGRANDIR ET RÉDUIRE LA TAILLE DE CE DESSIN. CE DESSIN A PEUT-ÊTRE ÉTÉ RÉDUIT. TOUTES LES ÉCHELLES ET ANNOTATIONS INDICUÉES SONT BASÉES SUR UN FORMAT DE DESSIN DE 11"x17".

1:17 500

0 100 200 300 400 500 Mètres

ÉCHELLE (m)

LES DIMENSIONS DE CETTE ÉCHELLE DOIVENT ÊTRE UTILISÉES À TITRE D'INFORMATION SEULEMENT

CLIENT

Troilus Gold Corp.

PROJET

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

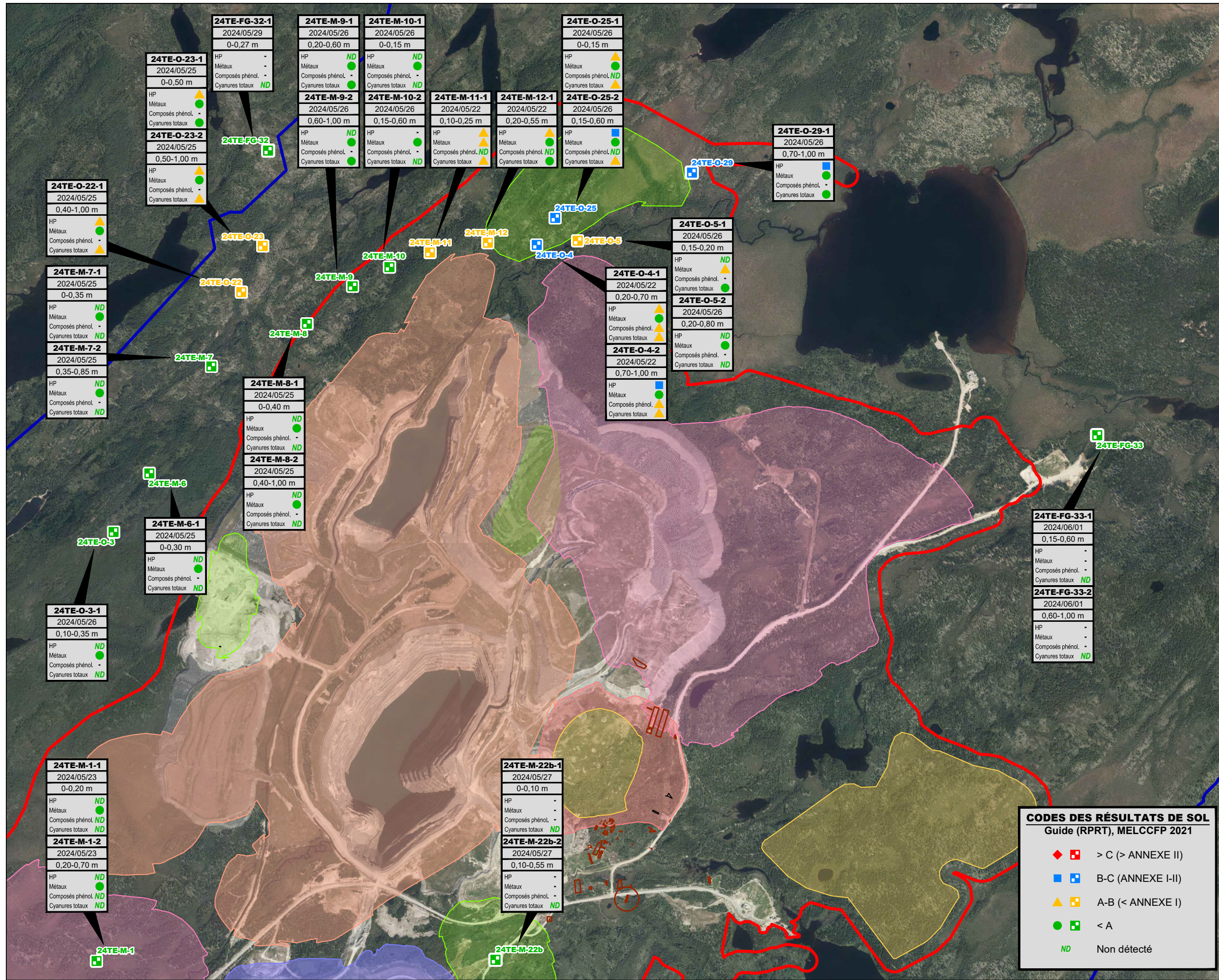
Localisation des sondages 2024 et résumé analytiques des sols (centre) / 2024 Sampling Point Locations and Soil Analysis Results (Centre)



No PROJET 240433 / 167040485	DATE 2024/08/09
CONÇU C.Ndong, géo.	RÉVISÉ L.Agassounon, géo.
DESSINÉ K.Tranchemontagne	No FIGURE 15.7b
	RÉV. 1

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS



LÉGENDE / LEGEND

- Zone de développement du projet / Project Development Area
- Zone d'étude locale / Local Study Area
- Sondage / Sampling Point

24TE-FG-25-1

- Nom de l'échantillon / Sample name
- Date d'échantillonnage / Sample date
- Profondeur échantillon / Sample depth
- Résultat / Result

Paramètres / Parameters :

- HP - Hydrocarbures pétroliers / Petroleum hydrocarbons (C₁₀-C₅₀)
- Métaux / Metals - 15
- Composés phénoliques / Phenolic compounds
- Cyanures totaux / Total cyanides

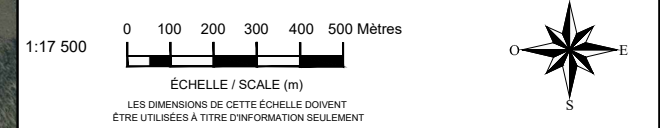
Infrastructure minière projeté / Proposed Mine Infrastructure

- Infrastructure minière / Mine Infrastructure
- Fosse / Pit
- Aire d'entreposage du minerai / Mineral Storage Area
- Halde à mort-terrain / Overburden Storage Area
- Halde à stérile / Waste Rock Storage Area
- Halde à stérile - Super / Waste Rock Storage Area - Super
- Plate-forme de la zone de stockage du minerai / Mineral Stocking Platform
- Parc à résidus miniers / Tailings Storage Facility
- Bassin du parc de résidus / Tailings Storage Pond

1	Mise à jour des infrastructures du site	2025/03/04	KT	LA
RÉV.	DESCRIPTION	AA/MM/JJ	PAR	VÉRIF.

RÉFÉRENCES / REFERENCES
 FOND AÉRIEN MTM NAD83 FUSEAU 8, SERVICE D'IMAGERIE DU QUÉBEC, 2023.

NOTES
 CES INFORMATIONS NE PEUVENT ÊTRE REPRODUITES SANS L'AUTORISATION ÉCRITE DE BLUMETRIC ENVIRONNEMENT INC. NE PAS AGRANDIR ET RÉDUIRE LA TAILLE DE CE DESSIN. CE DESSIN A PEUT-ÊTRE ÉTÉ RÉDUIT. TOUTES LES ÉCHELLES ET ANNOTATIONS INDIQUÉES SONT BASÉES SUR UN FORMAT DE DESSIN DE 11"x17".



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
Localisation des sondages 2024 et résumé analytiques des sols (nord) / 2024 Sampling Point Locations and Soil Analysis Results (North)



No PROJET / PROJECT NO. 240433 / 167040485	DATE 2024/08/09
CONÇU / CHECKED C.Ndong, géo.	RÉVISÉ / VERIFIED L.Agassounon, géo.
DESSINÉ / DRAWN K.Tranchemontagne	No FIGURE / RÉV. 15.7c / 1

CODES DES RÉSULTATS DE SOL
 Guide (RPRT), MELCCFP 2021

- > C (> ANNEXE II)
- B-C (ANNEXE I-II)
- A-B (< ANNEXE I)
- < A
- ND Non détecté

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

Environmental and Social Impact Assessment for the Troilus Mine Project

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Natural Background Levels (NBL)

For certain chemical parameters, particularly metals and metalloids, NBL sometimes exceed the generic criteria used. In such cases, the background level needs to be properly assessed, so that it can replace the generic criterion when assessing future contamination.

The NBLs were established on the basis of soil samples taken at 80 sampling points across the study area, for a total of 146 samples, in areas not impacted by previous mining activities (Map 15.7a, b, c). In accordance with the methodology described above, of these 80 sampling points, 52 samples were selected for soils in organic formations, 38 samples for morainal formations, and 40 samples for fluvio-glacial formations.

The calculations leading to the determination of the NBLs were based on the analytical results of at least thirty samples representative of each of the three types of surface formations described on the site, in accordance with the recommendations of the Physicochemical Characterization Guide.

NBLs were calculated using the upper “vibrissé” method, by determining the upper 95% confidence limit of the 95th percentile of the concentration distribution. For parameters for which an adjusted NBL was not reported (<RDL), the generic “A” criterion of the Intervention Guide was established as the NBL. The results obtained are shown in Table 15.7, in which the calculated NBLs are presented in comparison with the generic soil criteria of the Guide for the Superior Province. Despite the results obtained, selenium sometimes appears with high concentrations in natural environments in the region.

Table 15.7 Calculation of natural background metal levels in soils

Parameters	Lithological units / NBL (mg/kg)			PSRTC criteria (mg/kg)		
	FG	M	O	A*	B	C
Silver (Ag)	<RDL	<RDL	<RDL	0.5	20	40
Arsenic (As)	<RDL	<RDL	<RDL	5	30	50
Barium (Ba)	17	18	113	240	500	2000
Cadmium (Cd)	<RDL	<RDL	<RDL	0.9	5	20
Chromium (Cr)	37.6	27.7	11.6	100	250	800
Cobalt (Co)	<RDL	<RDL	<RDL	30	50	300
Copper (Cu)	11	10	31	65	100	500
Manganese (Mn)	73.8	60.0	23.8	1000	1000	2200
Mercury (Hg)	0.056	0.057	0.230	0.3	2	10
Molybdenum (Mo)	<RDL	<RDL	<RDL	8	10	40
Nickel	8.1	5.4	12.1	50	100	500
Lead	9.6	<RDL	26.9	40	500	1000
Selenium	<RDL	<RDL	<RDL	3	3	10
Zinc	5	5	35	150	500	1500

*MELCCFP generic criteria for Superior geological province soils

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

In the end, the NBLs calculated from the chemical analysis results obtained on all samples taken from the three lithological units were all below the background levels established for the Superior geological province by the Guide (generic "A" criteria).

15.2.3.7 Presence of Permafrost

The Federal ESIA Guidelines for the Troilus project (see Appendix A.2) recommend "describing permafrost conditions, including the distribution of frozen and unfrozen ground, where applicable". Consultation of the Canadian Permafrost Atlas (5th edition) indicates the presence of patches of permafrost in certain isolated areas (0-10%) within the study area. Permafrost is defined as ground (or rock) in which temperature remains at 0°C (presence of ice in the ground) or below for long periods (NRC, Permafrost Subcommittee, 1988), with a minimum extending from winter to summer. Extensive drilling by WSP (2023) and BluMetric (2023 and 2024) showed no ice in the soils of the Troilus project area.

15.2.3.8 Geochemical Conditions of Surface Deposits

Surface deposits of sand and gravel or overburden type in the areas of the planned future open pits should be used as borrow pits. In addition, excavation around the perimeters of the pits is planned to ensure their stability. Excavated overburden will be temporarily stored until certain infrastructures can be restored.

In view of this use, geochemical characterization (acid generating potential/acid mine drainage, neutral drainage and metal leaching) was carried out on these deposits.

The samples used for characterization were taken from 20 exploration trenches located mainly at the sites of future pits where the overburden is to be excavated.

The results of the chemical analyses and tests carried out on these samples were compared with criteria from the *Characterization of Minerals and Tailings Guide* (MELCC, 2020) to classify the materials making up the overburden. Parameters analyzed included PHCs C₁₀-C₅₀, metals, sulfur, phenolic compounds, radionuclides, cyanides, fluorides, bromides, chlorides, nitrates and nitrites, organic carbon and pH.

The results showed that all the overburden samples were non-acidogenic and non-leachable. Only anomalies with copper levels higher than background levels were found in some overburden samples taken at depth near the contact with bedrock. These samples were taken close to copper-enriched mineralized zones.

15.2.3.9 Sediment Quality

This section presents the main sediment quality characteristics of the lakes and streams in the study area, in order to determine their existing level of contamination in relation to the various sediment quality criteria applicable to the site.

The baseline study (Appendix G.1.6) of surface water and sediment quality at the Troilus Gold mine site, carried out by Wachih (Wachih, 2024), details the methodology used, the work performed, and the results obtained.

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

Granulometry

The particle size distribution of control station S6 was largely dominated by clay (57.1%), followed by silt (29.2%) and sand (13.7%) in 2019. However, this distribution was different for previous years (2013-2018), as it was predominantly silt (from 58.6 to 76.8% between 2013 and 2018), then clay (between 18.7 and 27.4% between 2013 and 2018). For control station S7-2, grain size was distributed as follows: 82.4% silt, then 17.6% sand. For station S8, located in Lake Requin and added to the monitoring program in 2023, grain size was predominantly silt-clay at over 88%, followed by sand.

Moisture content was similar between the three control stations, at 87.4% for station S7-2, around 86% for E8, and 91% for station S6.

For the intermediate stations, grain size at stations S4, S5 and S7 was predominantly sand at 71.9%, 83.2% and 95.2% respectively in 2019. Sediment at station S4 also consisted of 22.7% silt and 4.6% clay.

Moisture content was 37% at station S4, 27% at station S5 and 19% at station S7. There were no exceedances for metals for both stations S4 and S5 in 2019, nor between 2013 and 2018 for station S7.

Metal Concentrations

Station S6 (map 15.8) was characterized by exceedances of criteria (CER² and CSE³) for several metals (cadmium, copper, mercury, arsenic, chromium and lead) between 2013 and 2019. Cadmium is the metal for which exceedances were observed for every campaign, except for the campaign carried out in 2018. For mercury, exceedances were observed at the TEC, REC and PEC⁴.

In 2022, station S7-2 showed the same exceedances as S6, also for zinc. For chromium, copper, mercury and lead, however, exceedances were only observed at REC.

For S7-2, the concentrations obtained were 6.7 mg/kg for arsenic, 30 mg/kg for chromium, 28 mg/kg for copper, 0.14 mg/kg for mercury, 26 mg/kg for lead, 111 mg/kg for zinc, and 0.95 mg/kg for cadmium. For station S8, measured cadmium and mercury concentrations exceeded REC criteria in 2023.

Concentrations in the five sub-samples ranged from 0.33 to 0.34 mg/kg for cadmium, and from 0.11 to 0.12 mg/kg for mercury. The applicable REC threshold concentrations for these two metals are 0.33 mg/kg and 0.094 mg/kg respectively, but the concentrations obtained were within the geochemical background concentrations.

Ultimately, with regard to sediment quality, several exceedances of the REC and sometimes the TEC were observed for metals including arsenic, chromium, cadmium, copper, mercury, lead and zinc in the

² REC: rare effects concentration. Concentration below which no effects are expected. The concentrations observed are generally comparable to natural concentrations.

³ TEC: Threshold Effect Concentration. When concentrations are equal to or lower than the ESC, the probability of sediment having an impact on the environment is considered low.

⁴ PEC: Probable Effect Concentration. Concentrations above this value imply that adverse biological effects are frequently observed.

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS

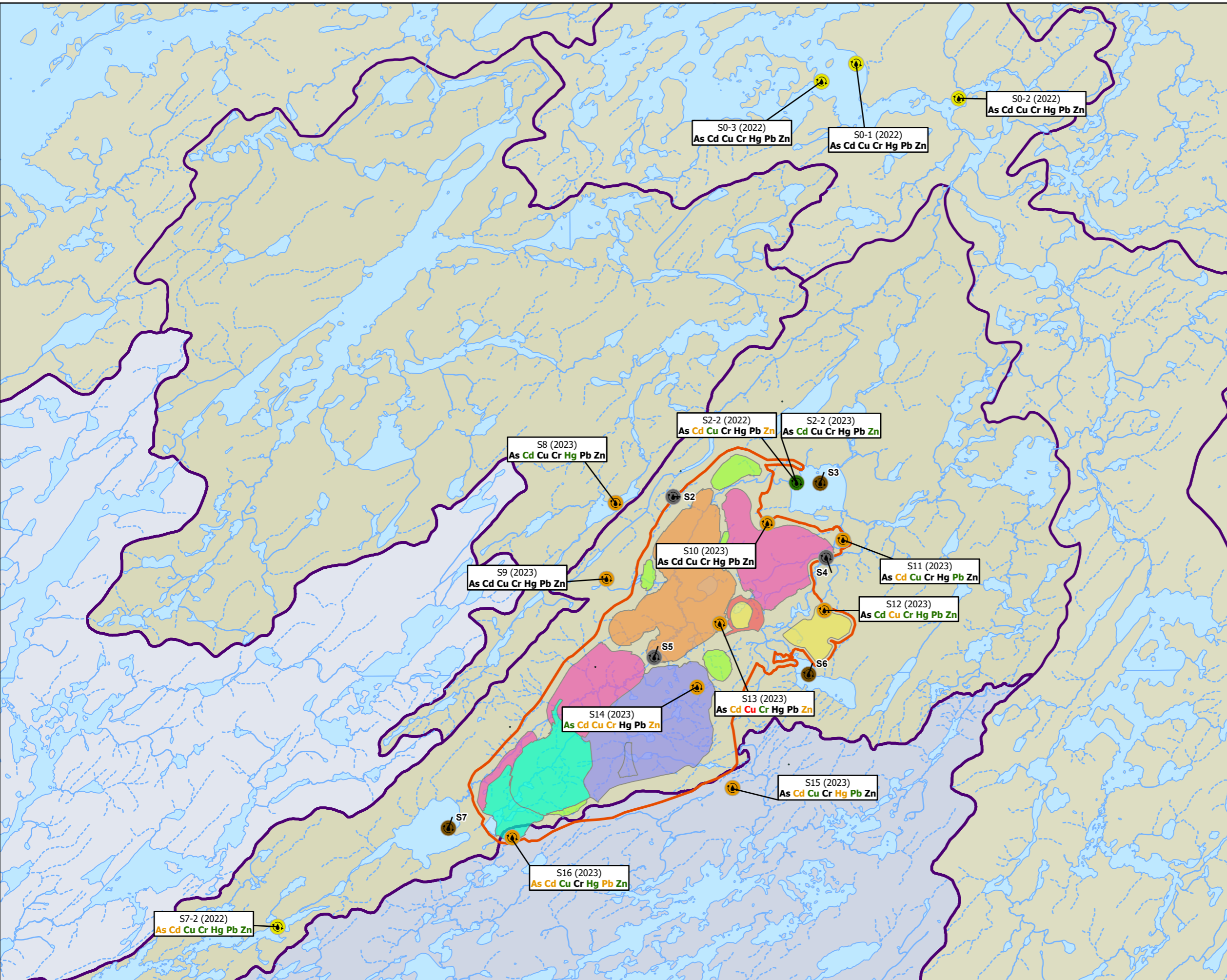
samples taken, but the concentrations obtained were generally within the geochemical background values of the study area for the metals concerned.

The location of the sediment samples and a summary of their analytical results are shown on Map 15.8.

This metal contamination in sediments is related to the historical use of the site and activities prior to the current development. Indeed, sediment quality data in the Local Study Area, collected by Genivar from 2010 to 2012 (Genivar, 2010; Genivar, 2011; Genivar, 2012), as well as data from the Phase II ESA carried out by Stavibel (Stavibel, 2013), indicated sediment contamination in several metals (chromium, copper, iron, manganese, nickel and zinc), which would be mainly related to airborne dust and effluent and exfiltration from the former tailings facility (SNC-Lavalin, 2013).

Environmental and Social Impact Assessment for the Troilus Mine Project

SOILS AND SEDIMENTS



LÉGENDE / LEGEND

- Zone de développement du projet / Project Development Area
- Bassins Versants / Watershed
- Bassin Versant Rivière Broadback / Broadback River Watershed
- Bassin Versant Rivière Rupert / Rupert River Watershed
- Plan d'eau / Lake
- Cours d'eau permanent / Permanent Watercourse
- Cours d'eau intermittent / Intermittent Watercourse
- Qualité des sédiments / Sediment Sample (2013, 2014, 2015, 2018, 2019)
- Qualité des sédiments / Sediment Sample (2019)
- Qualité des sédiments / Sediment Sample (2022)
- Qualité des sédiments / Sediment Sample (2023)
- Qualité des sédiments / Sediment Sample (2022, 2023)

Infrastructure minière projetée / Proposed Mine Infrastructure

- Fosse / Pit
- Aire d'entreposage du minerai / Mineral Storage Area
- Halde à mort-terrain / Overburden Storage Area
- Halde à stérile / Waste Rock Storage Area
- Halde à stérile - Super / Waste Rock Storage Area - Super
- Plateforme de la zone de stockage du minerai / Mineral Stocking Platform
- Parc à résidus miniers / Tailings Storage Facility

Qualité des sédiments / Sediment Quality

As: Arsenic, Cd: Cadmium, Cu: Cuivre / Copper, Cr: Chrome / Chromium, Hg: Mercure/Mercury, Pb: Plomb / Lead, Zn: Zinc

As - Concentration dépasse les critères 1, 2, 3 / Concentration exceeds criterias 1, 2, 3
As - Concentration dépasse les critères 1, 2, 3 / Concentration exceeds criterias 1, 2, 3
As - Concentration dépasse le critère 3 / Concentration exceeds criteria 3
As - Aucun dépassement / No exceedances

1				
RÉV.	DESCRIPTION	DD/MM/YY	BY	VERIF.

RÉFÉRENCES/REFERENCES
 Base Map: Bing, 06 June 2023

NOTES

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0 1,250 2,500 m
 ÉCHELLE (m) / SCALE (m)

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
Localisation des échantillons et résumé analytique des sédiments / Sediment Sampling Locations and Analytical Results

NO. PROJET / PROJECT NO. 240433 / 167040485	DATE 03/ 04/ 2025
CONÇU / CHECKED C. Ndong	RÉVISÉ / VERIFIED L. Agassounon
DESSINÉ / DRAWN M. Baker	Figure No. 15.8
	ED./REV. 1

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15.3 Project Interactions with Soils and Sediments

Table 15.8 lists the activities planned for each phase of the project, and the potential impacts of these activities on soils and sediments. Anticipated interactions between project activities and potential impacts are identified by a check mark, while a dash indicates the absence of interactions.

Some of these activities have the potential to impact soils and sediments. Based on the knowledge gained from soil and sediment characterization studies, and the experience of mining project ESIA specialists and professionals, we have identified three such impacts:

- Exposure of site users to contaminated soils already present on the site;
- Alteration of soil and sediment quality, notably through the accidental introduction of contaminants such as PHCs;
- Loss of soil stability and erosion, which could result from disturbance of the natural soil structure during activities involving soil movement (stripping, excavation, borrow pit mining) or traffic on disturbed soils.

Table 15.8 Project interactions with the valued component soil and sediment

Physical Activities	Potential impacts		
	Human exposure to contaminated soil	Soil instability and erosion	Alteration of soil and sediment quality
Construction			
Labour, equipment and materials transport to the site.	-	-	√
Vehicles and equipment operation and maintenance within the PDA.	-	√	√
Tree cutting, vegetation clearing, soil stripping and earthworks.	-	√	√
Handling and use of explosives, including blasting.	√	√	√
Construction of temporary and permanent buildings, including wastewater treatment system and drinking water collection and distribution system.	√	√	√
Construction of mining infrastructures such as stockpiles, pits and the raising of tailings management facility.	√	√	√
Construction of roads and preparation of construction surfaces including the crushing of material used for construction. Relocation of a section of the access road and the power line.	√	√	√
Construction of water management systems including ditches, diversion channel, sedimentation ponds and the water treatment plant.	√	√	√
Dewatering of natural water bodies and pits, lowering water level in tailings management facility and management of contact water.	-	-	√
Diversion of Bibou Creek (CE2)	-	√	√

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Physical Activities	Potential impacts		
	Human exposure to contaminated soil	Soil instability and erosion	Alteration of soil and sediment quality
Management of waste materials, including hazardous waste	√	-	√
Purchase of goods and services	-	-	-
Employment	√	-	-
Operations			
Labour, equipment and materials transport to the site.	-	-	√
Vehicles and equipment operation and maintenance within the PDA.	-	√	√
Relocation of power line	√	√	√
Handling and use of explosives, including blasting	√	-	√
Ore extraction from pits including drilling and hauling of waste rock.	-	-	√
Ore, waste rock and tailings storage.	√	√	√
Ore processing, including conveyor, crushing, loading and hauling on site.	√	-	√
Transport of concentrate to a smelter or a wharf.	-	-	√
Management and treatment of water on the mine site and to the environment, including drainage and contact water.	√	√	√
Progressive reclamation of disturbed areas.	√	√	√
Management of waste materials, including hazardous waste.	√	-	√
Purchase of goods and services.	-	-	-
Employment.	√	-	-
Decommissioning and Closure			
Labour, equipment and materials transport to the site.	-	-	√
Vehicles and equipment operation and maintenance within the PDA.	-	√	√
Decommissioning, dismantling and disposal of buildings and equipment.	√	√	√
Pits flooding, surface and groundwater management.	√	√	√
Reclamation of disturbed areas, including earthworks, placement of overburden and revegetation.	√	√	√
Management of waste materials, including hazardous waste.	√	-	√
Purchase of goods and services.	-	-	-
Employment.	√	-	-

Notes :

√ = Possible interaction

- = No interaction

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Interactions that are considered possible are discussed in detail in Section 15.4, in the context of pathways, standard and project-specific mitigation/improvement measures, and anticipated residual impacts.

For some activities, such as the mobilization of on-site labor and equipment and the purchase of goods and services, non-interaction with the Valued Component of soils and sediments is evident.

For other activities, a justification for the absence of anticipated interactions is provided below, according to each project phase.

Construction Phase

The dewatering of water bodies and pits, and the lowering of water levels in the tailings storage facility, will not result in the disturbance or alteration of soil and sediments. However, this is a potential impact. The dewatering of water bodies and pits is not expected to affect sediment quality or erosion and deposition zones, since the flow of water will be regulated and will not exceed the natural flow of the receiving environment. The quality of discharged water will be monitored to confirm that it is not likely to impact sediment quality.

Operations Phase

- Drainage and contact water will be collected in a network of 22 dedicated ditches, while domestic wastewater will be treated and discharged into a stream north of the camp area, in compliance with surface discharge standards.
- Future tailings are expected to have a similar chemical and mineralogical composition to the tailings already on site, which do not generate acid mine drainage. In addition, the latest tailings characterization tests conducted by Troilus in 2023 (Lamont, 2024a and 2024b) indicated that the samples tested are not potentially acid generating, as their neutralization potential is 3 to 26 times greater than their acidity potential. However, the presence of these infrastructures could increase erosion and deposition in the surrounding area.
- Soil disturbance associated with ore extraction, processing and transportation will already have occurred during construction, although the impact will continue throughout the operation (new stockpiles, continuous transportation). Consequently, the impacts of these activities on soil and sediment quality and quantity have been considered during the construction phase. The anticipated impact is greater during the construction phase.

Closure Phase

In the dismantling, restoration and rehabilitation phase, the mobilization of manpower and equipment on site would not result in the disturbance or alteration of soil and sediments, and should therefore not generate the potential impacts identified, except for the risk of spills associated with vehicles and equipment, which remains a possibility.

15.4 Assessment of Residual Impacts on Soils and Sediments

A residual impact is defined as the environmental impact remaining after the implementation of all reasonable and effective mitigation measures. In other words, it is the impact that remains despite all efforts to avoid, reduce or compensate for adverse impacts. For each of the three potential impacts selected, the residual impacts of the project are thus determined, after defining their pathways and proposed mitigation measures.

15.4.1 Human Exposure to Contaminated Soil

15.4.1.1 Project Pathways

Construction Phase

During the construction phase, the risk of human exposure to contaminated soils arises mainly from work carried out in areas contaminated by former mining activities, as highlighted in Section 15.2. Mine tailings and certain residual materials generated during construction could also end up in surface soils, with which site users are potentially in contact.

Operation phase

The risks of residual impacts identified during the construction phase are likely to persist during the operation phase.

The progressive restoration of infrastructures such as the TSF at the end of its useful life (year 10) will be a source of positive impact during the operation phase. This is a reversible adverse impact in terms of contamination due to project activities.

Closure phase

The planned soil remediation activities and the drastic reduction in the number of people working on the site during the closure phase will significantly reduce the risk of human exposure to contaminated soil.

15.4.1.2 Mitigation and Enhancement Measures

The risk of human exposure to existing contaminated soils from former operations will be minimized during each phase of the project by restricting access to areas where contaminated surface soils are present. To this end, signs will be posted around clearly delineated contaminated areas, and information and awareness sessions will be held for all site users.

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15.4.1.3 Project Residual Impacts

Construction Phase

Residual impacts related to construction-phase activities associated with the presence of infrastructure (overburden stockpiles, tailings storage facilities, etc.), if they occur, would be adverse. These impacts are likely to occur through erosion and/or deposition, and on sediment quality in terms of water management.

However, given the measures put in place to restrict access to areas of contaminated soil already in place, residual impacts would be small and limited to the PDA, which contains all the soil identified as contaminated. Also, their occurrence would necessarily be irregular and short-lived, or accidental.

Operation Phase

Residual impacts related to operating-phase activities associated with the presence of infrastructure (waste rock and overburden piles, tailings facilities, ore stockpiles, etc.), if they occur, would be adverse. These impacts are likely to occur through erosion and/or deposition, and on sediment quality in terms of water management.

However, given the measures put in place to restrict access to areas of contaminated soil already in place, residual impacts would be small and limited to the PDA, which contains all the soil identified as contaminated. Also, their occurrence would necessarily be irregular and short-lived, or accidental.

Regarding soil contamination that could be caused by future mining activities, any spills will have to be identified, reported and managed on the spot during the operation phase to avoid any potential contamination of soil, sediment, surface water and groundwater (see Section 15.4.3).

Closure Phase

Overall, closure phase activities are expected to have a one-off residual impact on the risk of human exposure to contaminated soils and sediments. This is because contaminated soils and sediments - including during dismantling activities - will have to be restored in order to make them suitable for use in line with the site's future use. Residual impacts are expected to be long-lasting, but reversible, small-scale and restricted to the PDA.

Except in the event that soils contaminated by the 1996-2010 mining operation have been reworked to accommodate the planned new infrastructure, these soils will not be subject to specific remediation work (see Section 15.4.3.3).

15.4.2 Soil and Sediment Instability and Erosion

15.4.2.1 Project Pathways

Construction Phase

During construction and development activities, the risk of soil erosion and instability is inherent in the disturbance generated by stripping, excavating, blasting, backfilling and levelling work areas.

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Infrastructure construction work, the relocation of the access road and the relocation of the power line are the main sources of soil erosion and instability risks, respectively through the exposure of the surface and the disturbance generated by stripping, excavating, blasting, backfilling and levelling work areas. The construction of ditches and diversions also creates a significant input of sediment.

Operation Phase

During the operation phase, the same risks of soil erosion and instability are observed. Mine operations are the main source of soil erosion and instability risks, respectively through blasting in the pits, dewatering, transport of materials (overburden, waste rock) to the various stockpiles, water management, etc.

However, the progressive restoration of disturbed areas over the 21 years of operation, where possible, constitutes an activity with a reversible adverse impact on soils.

Closure Phase

The dismantling of buildings and other infrastructure, as well as the flooding of pits, may modify slope stability conditions and thus create risks of soil instability.

However, restoration of disturbed sites and revegetation should minimize the residual impact of the project in terms of soil erosion risk.

The transition to complete site closure will involve the construction of water management structures to promote natural runoff, which could result in changes to soil and sediment stability and erosion.

15.4.2.2 Mitigation and Enhancement Measures

The following monitoring and/or mitigation measures will limit the significance of potential residual impacts related to soil instability and erosion:

- Limit stripping, clearing, excavation, backfilling and grading of work areas as much as possible;
- Monitor excavation and slope profiling work and ensure compliance with plans and specifications;
- Stabilize and protect exposed surfaces over the long term: reduce soil transport to reduce dust emissions, and limit the leaching of materials (through vegetation, for example);
- Maintaining a naturalized buffer zone between watercourses and construction sites.

15.4.2.3 Project Residual Impacts

Construction and Operation Phases

The magnitude of the project's residual impacts on soil/sediment instability and erosion is expected to be low, and limited to the PDA. Soil/sediment erosion impacts, and instability risks could occur in the form of multiple irregular events of varying frequency and intensity. For example, considering surface water discharge as an activity with the potential to impact erosion and act on sedimentation, these are events

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that can be regulated and controlled. Consequently, the discharge of TSS will be limited, and the discharge rate will not exceed the capacity of the creek to avoid erosion and sediment deposition in watercourses.

Impacts would be medium-term, while soil loss due to erosion is considered reversible.

Closure Phase

Closure-phase activities will include reprofiling and revegetating the surfaces of the various accumulation areas on the site. Overall, closure-phase activities are expected to have a reversible residual impact (adverse, especially in the event of soil compaction during dismantling, but of low magnitude over the extent of the PDA).

15.4.3 Alteration of Soil and Sediment Quality

15.4.3.1 Project Pathways

Construction Phase

During the construction phase, the risks of soil and sediment contamination relate mainly to accidental leaks and spills, particularly from machinery used on the mine site and infrastructure to be built (e.g. tanks, buildings). Tailings from previous mining operations and certain residual materials generated during construction may also be displaced and contribute to surface soil contamination.

Operation Phase

During the operation phase, the risk of soil and sediment contamination also arises from accidental leaks and spills, particularly from the machinery used on the mine site and the infrastructures in place (e.g. tanks and any buildings in which various substances are handled). Mine tailings and certain residual materials generated during mining operations can also be incorporated into surface soils and contaminate them, particularly during transport to the site.

The progressive restoration of certain infrastructures, which will have been used only in the first years of mine operation, will minimize impacts during the operational phase.

Closure Phase

Decommissioning activities present the same risks of accidental spills or the generation of hazardous residual materials as in the previous two phases. On the other hand, remediation of contaminated sites will have a positive impact on soil and sediment quality, if the remediation work involves contaminated soils from the previous 1996-2010 operation. Otherwise it will have a reversible adverse impact.

15.4.3.2 Mitigation and Enhancement Measures

The following follow-up and/or mitigation measures will help limit the significance of potential residual impacts related to the alteration of soil and sediment quality:

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- Appropriate training of personnel operating machinery;
- Machinery will be inspected regularly to ensure that it is in good condition and in good working order (no hydrocarbon leaks);
- Machinery will be equipped with biodegradable lubricants and containment and absorption kits for rapid containment and recovery in the event of a spill;
- The implementation of and compliance with standards for the storage and handling of noxious substances, including petroleum products;
- Liquid chemical tanks (reagents) will be stored in impermeable retention basins with a capacity of 110% of the largest tank;
- Above-ground fuel tanks will be double-walled (CAN/ULC/S601) or provided with a containment area capable of holding 110% of their volume;
- Any accidental spill will be reported immediately to the environmental manager and the alert network, in accordance with a procedure developed and approved prior to the start of construction activities on site. The affected area(s) will be immediately contained and cleaned up. Contaminated soil will be removed and disposed of at an authorized site. An internal log will be kept of all spills, interventions and corrective measures taken.

15.4.3.3 Project Residual Impacts

Construction Phase

Thanks to the application of containment and rapid recovery measures in the event of leakage or accidental spillage, the scale of residual impacts would be low to moderate during construction.

These impacts would also be short-lived, being limited to the construction phase, and reversible. Nevertheless, post-construction activities could potentially generate impacts on soils and sediments if mitigation measures are not properly applied.

Operation Phase

As in the construction phase, thanks to the application of containment and rapid recovery measures in the event of an accidental leak or spill, the scale of residual impacts would be low to moderate during mining operations.

Closure Phase

During the closure phase, areas contaminated by project activities - including post-mining dismantling - will have to be restored so that the soils in place meet site quality criteria, in order to make them suitable for future use. For these areas contaminated by project activities, the residual impacts expected in the PDA are positive. These impacts would also be short-lived and reversible, since it is not permitted to leave in place soil whose quality does not meet provincial criteria. Such soils would be excavated and sent to an authorized processing site, depending on their level of contamination, or processed in situ or stored in the existing tailings facility, depending on their level of contamination.

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However, this remediation will not involve soils and sediments contaminated by previous activities carried out between 1996 and 2010.

15.4.4 Summary of Project Residual Impacts

The residual impacts of the project on soils and sediments would be adverse overall, but reversible and of low magnitude. Their impact would generally be short- to medium-term, depending on irregular events.

Table 15.9 summarizes the anticipated residual impacts on soils and sediments.

Table 15.9 Anticipated residual impacts of the project on soils and sediments

Residual impact	Anticipated residual impacts Characterization							
	Project phase	Direction	Magnitude	Geographic extent	Timing	Duration	Frequency	Reversibility
Human exposure to contaminated soil	C	A	L	PDA	NS	ST	IR	R
	O	A	M	PDA	NS	MT	IR	R
	D	A	L	PDA	NS	LT	S	R
Soil and sediment instability and erosion	C	A	M	PDA	NS	MT	C	R
	O	A	M	PDA	NS	MT	C	R
	D	A	L	PDA	NS	MT	C	R
Alteration of soil and sediment quality	C	A	M	PDA	NS	ST	C	R
	O	A	M	PDA	NS	ST	C	R
	D	A	L	PDA	NS	ST	C	R

Project phase :

C: Construction
O: Operation
D: Decommissioning and Closure

Direction :

P: Positive
A: Adverse

Magnitude :

N: No Measurable Change
L: Low
M: Moderate
H: High

Geographical extent :

PDA: Project Development Area
LSA: Local Study Area
RSA: Regional Study Area

Timing :

NS: No sensitivity
SM: Moderate sensitivity
SE: High sensitivity

Duration :

ST : Short term
MT: Medium-term
LT : Long term

Frequency :

S : Single event
IR: Irregular event
R: Regular event
C : Continuous

Reversibility :

R : Reversible
I : Irreversible

N/A: Not applicable

15.5 Prediction Confidence

For soils and sediments, a conservative approach has been adopted in assessing the project's impacts on quality parameters such as soil and sediment contamination, as well as erosion, compaction and potential mixing of uncontaminated with contaminated soils, in order to evaluate the worst-case scenario. As a result, project impacts may be overestimated.

Confidence in predicting changes in soil and sediment quality is higher when based on professional judgment and previous characterization and remediation experience. In fact, field data collected on the baseline state of the environment provides a high level of confidence in the predicted impact on the risk of erosion and compaction. Confidence in predicting changes in soil quantity is also high, thanks to the baseline soil data collected during feasibility and characterization studies. These studies provide a high level of confidence in relation to anticipated contamination on the depth and extent of soils and other surface deposits. Proposed mitigation measures will be designed based on scientific principles and known best management practices that have proven effective at other sites to mitigate soil erosion, compaction and contamination.

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