



# TROILUS

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## ENVIRONMENTAL EVALUATION - DEWATERING OF J4 AND 87 PITS SUMMARY



November 2019

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## 1. INTRODUCTION AND APPLICANT IDENTIFICATION

This document is a summary of the impact study for the dewatering of the J4 and 87 pits. The information necessary for a good understanding of the project and the issues are part of this document. The full impact study includes 12 chapters and 11 appendixes, to support the explanations of the text.

Troilus Gold is a company registered in January 2018 whose objective is the development of resources on the site of the former Troilus mine. Ended in 2018, Troilus Gold acquired the rights to First Quantum Minerals' property, and therefore the related restoration obligations.

The Troilus mine operated from November 1996 to April 2009. The mine produced more than two million ounces of gold and nearly 70,000 tonnes of copper. Following the completion of the mining operations, the concentrator continued to process low grade ore until June 2010. At the end of operations, the site was restored from 2011 to 2019.

As part of the advanced exploration work, Troilus Gold wants better access to the deposit to continue its exploration work from the walls and floor of the pits.

### 1.1 Identification of Applicant

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Troilus Gold  
36 Lombard Street  
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Tel : 581-481-8557

Chibougamau Office :  
Troilus Gold  
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Chibougamau (Québec) G8P 1N5  
Tel : 418 770-5990

The applicant for the application is Troilus Gold from the Chibougamau Office. Mrs. Jacqueline Leroux is the signatory authorized to file this application. Ms. Leroux's contact information is:

Jacqueline.leroux@troilusgold.com  
Director of Environnement  
418-770-5990

Any request for information or questions relating to this application should be addressed to Mrs. Leroux.



## **1.2 Consultants participation in the Impact Study**

The production of the impact study was made possible thanks to the collaboration of several experts in different fields. Here are their names and expertise for this document:

Ann Lamontagne of Lamont inc. was responsible for the methodology, impact analysis, and report production and chapter coordination.

DDM is responsible for some of the characterization of fish habitats on the receiving watercourse, the assessment of changes in fish habitat components, the estimation of maximum pumping rates, and the production of fish habitat cards.

MH<sub>2</sub>O firm studied the water regime of the watercourse.

The firm Polygeo coordinated field studies to document the geomorphological context and the identification of sensitive areas.

The Desfor Group is responsible for the characterization of vegetation and wetlands and Wachihih has characterized a portion of the receiving stream from the proposed effluent.

The Troilus Gold team took over the community consultations and project description.



## 2. PROJECT LOCATION

The former Troilus mine, located in the Evans-Frotet greenstone belt, is approximately 51 ° 00 'north latitude and 74 ° 28' west longitude, about 175 km north of Chibougamau. Figure 2.1 shows the location plan of the site. Access to the mine site is provided by a road section of approximately 44 km in length, starting at KP 108 on Route du Nord, and oriented in a north-easterly direction.

The former mine site occupies land, in unorganized territory, described as Lot 1 of the cadastre of the Rupert River Basin, registration division of Lac St-Jean-Ouest.

The site is located on the territory of the community of Mistassini on Category III lands. The families who are directly affected by the mine-site project are the Awashish, Petawabano and Neeposh families.

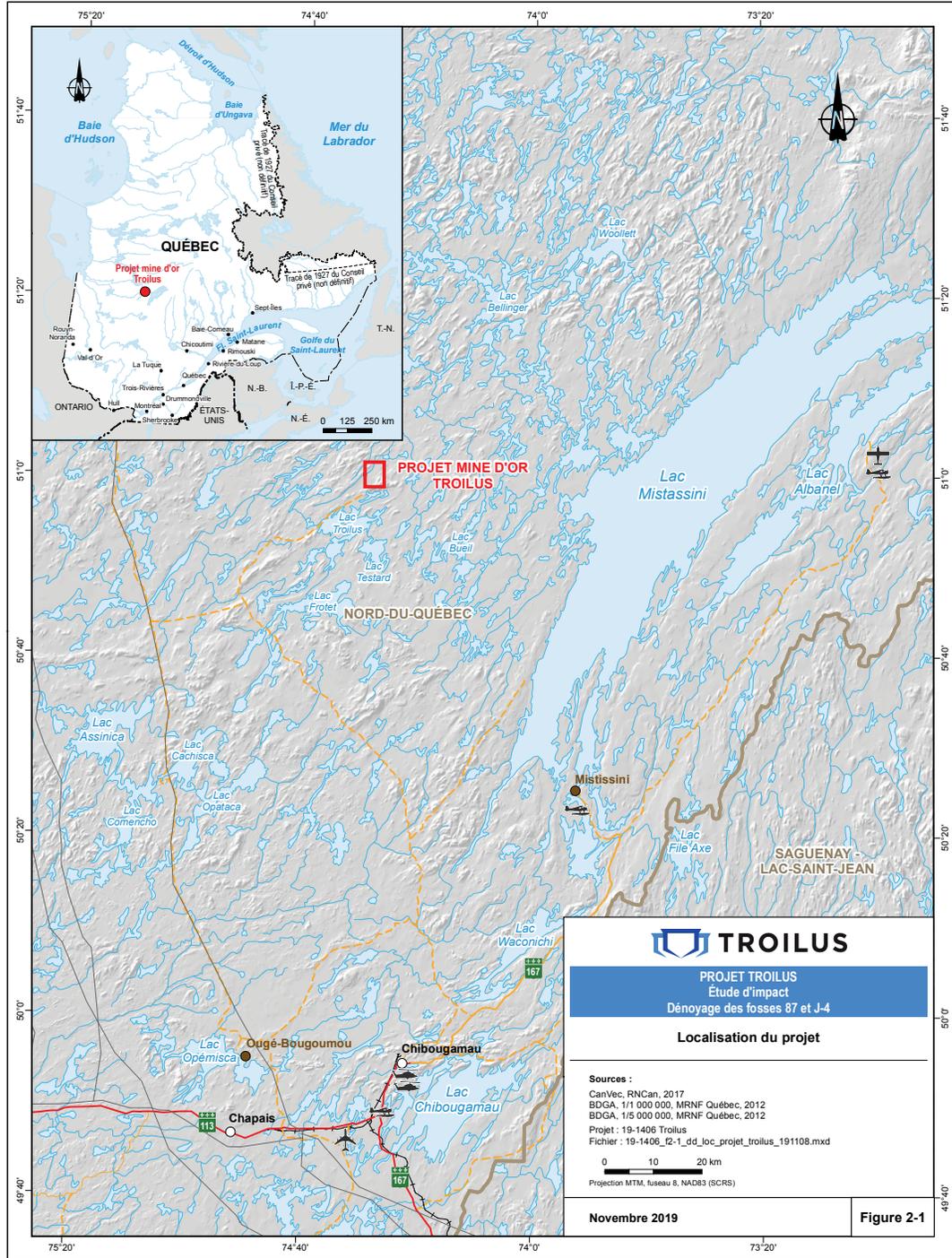


Figure 2.1 Troilus Gold property location

### 3. ALTERNATIVE ANALYSIS

#### 3.1 Project justification

As part of the exploration work, Troilus Gold wishes to have better access to the deposit in order to further evaluate the gold potential of the property. Indeed, the discovery of a new deep mineralized zone in the winter of 2019, along the east wall of the J4 pit, suggests that this zone could continue to the surface.

The dewatering of the J4 and 87 pits will allow the installation of diamond drills on the benches to drill to the east (N123 °) at an angle of 45 °. The proposed program is 4 drill holes as shown in Figure 3.1. Drilling may also be done from the floor of the pits.

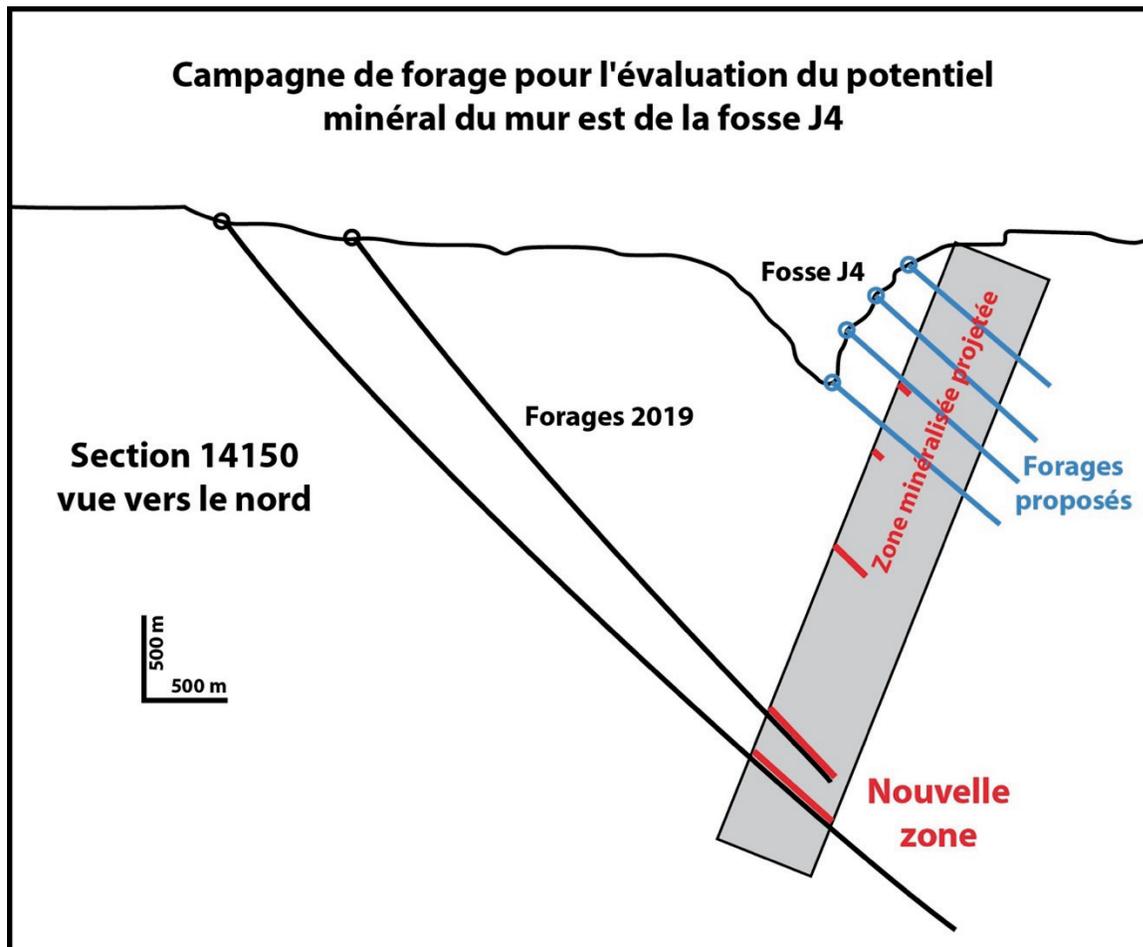


Figure 3.1 Diagram of proposed drill holes



## **3.2 Alternatives to dewatering**

The alternative to dewatering the pits would be drilling from the surface of the water in winter on the ice above the pits. For obvious reasons of risks and health and safety, this option is not retained. The only way to intercept potential areas along the wall is to drill from benches on the east side.

## **3.3 Pumping Flowrates**

For the dewatering of the pits, the pumping rate has been the subject of a study of alternatives. Two regimes were considered. A variable flow regime allowing a constant flow in the stream during the dewatering period and a fixed flow regime to represent seasonal flow variations in the stream. Modeling has been done at some critical sections to evaluate the maximum stream flow at these locations. A constant flow of pumping would increase the intensity of spring floods and floods during extreme rain events which is undesirable for the stability of the stream and spawning grounds.

Therefore, it was decided that pumping would be variable flow so as not to exceed the capacity of habitats to withstand flow velocities and thus limit the impacts on the banks.

## **3.4 Selected solutions and subsequent steps to dewatering**

Dewatering the pits is the safest way to continue exploration work. Once pits are empty, exploration activities can begin

## **4. DESCRIPTION OR RECEIVING ENVIRONMENT**

### **4.1 Description of the site regarding the project**

The mine site has already been in operation and was the subject of an impact study in 1993. Sectorial studies, restoration plans, design reports, etc. were filed to the authorities between 1993 and the closure of the mine site. Some information on the natural environment has been derived from these studies while others come from more recent data. Only the components related to the issues below are retained for a more complete description :

- Conservation and protection of surface and underground water resources (quantity and quality);
- The preservation of the integrity of the hydrographic network and its processes;
- Maintaining the quantity of flora and fauna habitats and their quality.

And these issues affect the following components:

Biophysical environment:

- Hydrogeology
- Hydrology
- Surface water quality
- Soils
- Fish and its habitat
- Vegetation and wetlands

#### **Surface water quality**

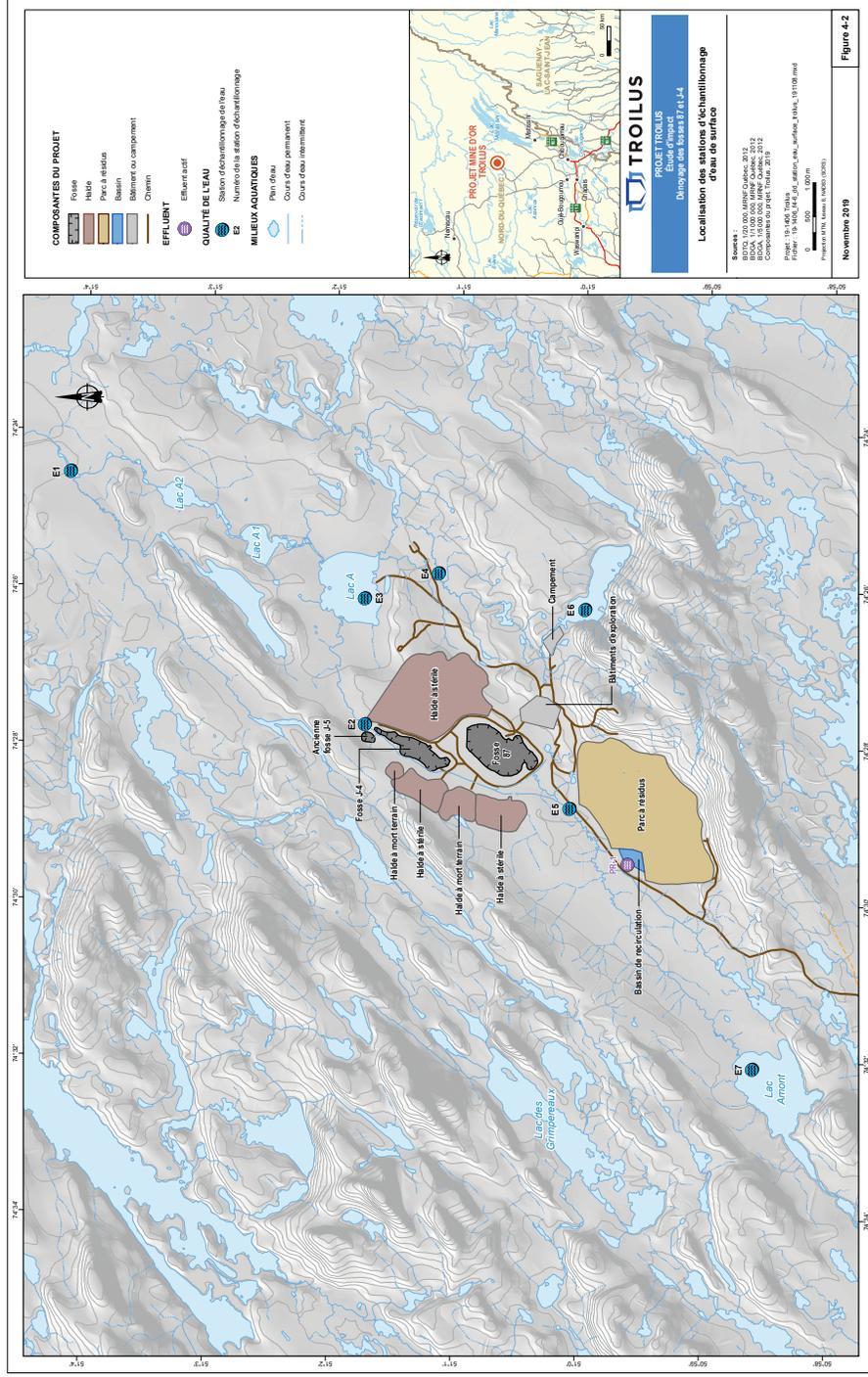
During the operation, stations were sampled regularly as part of the EEM follow-up of the Metal Mining Effluent Regulations (MMER) and provincial monitoring. Figure 4.1 shows the location of sampling stations and release points when the mine was in operation.

The monitoring of effluent water quality and the unnamed stream as well as in Lake A located downstream from the project made it possible to demonstrate that the mine met the requirements of the criteria for rejection of the Directive. 019 and the Metal Mining Effluent Regulations during the years of operation. The details of the effects on the receiving environment are presented in Genivar's ESI reports published in 2009 and 2010.





Recently, Troilus undertook a site characterization study to define the baseline in the event that the mine site will go back to operation. Sampling was carried out at various places on the property, in particular at the points shown in Figure 4.2. Thus, points E1 to E7 are sampled monthly and the parameters analyzed and the results are presented in Appendix G. In the case of dewatering of pits, it is sampling point E2 which is located closest to point of release that will be used to evaluate the effects of adding contaminants to the receiving environment.



**Figure 4.2** Location of sampling stations for surface water, summer and fall 2019



## **Geomorphology of unnamed stream and Lakes A, A1 and A2**

PolyGéo has been mandated to perform photo-interpretation of surface materials along the banks of the unnamed stream and the three lakes that cross its path before it is discharged into a larger river about 14 km downstream of the mine site. The report is provided in Appendix H of the impact study.

### **Hydrogeology**

Information on hydrogeology was taken from Schedule 2 of the 2009 Genivar Restoration Plan. The report is presented in Appendix I of the EIS. At this time, a review of the conditions before and during the operation was conducted to estimate the filling time of the pits at the end of the dewatering period.

#### **4.1.2 Biological Environment**

Only the components that are likely to be modified by the dewatering of the pits have been the subject of specific inventories in the years 2018 and 2019. These are vegetation and wetlands and fish and their habitats.

### **Vegetation**

The description of the vegetation and wetlands is largely based on the results of the 3D photo-interpretation and the floristic inventory conducted by Wachih in the study area. The vegetation inventory, conducted during the week of July 7, 2019, was concentrated mainly along the tributary of Lake A and near this lake.

A total of four sampling stations were conducted in the study area using the most representative observation points possible in the area, two of which in the riparian zone of the tributary of Lake A and two in the adjacent to this body of water.



## **Wetlands**

A first validation of the presence of wetlands in the study area was carried out using georeferenced aerial photographs (3D photo-interpretation) to which information from the wetland mapping database was combined - MELCC (2018). The presence of wetlands was subsequently validated along the tributary of Lake A and at the edge of this body of water during the surveys of early July 2019.



**Figure 4.4** Open peat bog along Lake A



**Figure 4.5** Typical woodland bog

#### **Riparian environments**

Riparian vegetation in the upstream portion (upright and riprap) of the tributary of Lake A is shrubby. It consists mainly of rough alder about 3 m high.



**Figure 4.6** Riparian végétation of Lake A tributary, upstream of J4 pit (alder)



**Figure 4.7** Riparian vegetation of Lake A tributary (halfway between J4 and Lake A) consists of black spruce, tamarack, rough alder and bog-myrtle



**Figure 4.8** Riparian vegetation at the mouth of Lake A tributary (tamarack, rough alder and bog-myrtle)



**Figure 4.9** Tree vegetation predominantly ericaceous on a dry site on the south shore of Lake A



### **Precarious status floristic species**

After validation, the MELCC does not list any occurrence of flora species in a precarious status in or near the study area (CDPNQ, 2019) and no rare plant was observed during the July 2019 floristic inventories.

### **Ichtyofauna**

In 2018, Wachiih proceeded to characterize the unnamed stream from the mine site to approximately 11 km further downstream. The sectorial study reports are provided in Appendix C and D of the impact study.

In each of the watercourses characterized, there are potential or confirmed spawning grounds. Spawning grounds are identified from the quality of the substrates. Of the 14 spawning sites identified by a substrate (Wachiih), 3 were confirmed by the tallyman, Mr. Kenny Awashish. These sensitive habitats have been taken into account in the dewatering water discharge scenarios.

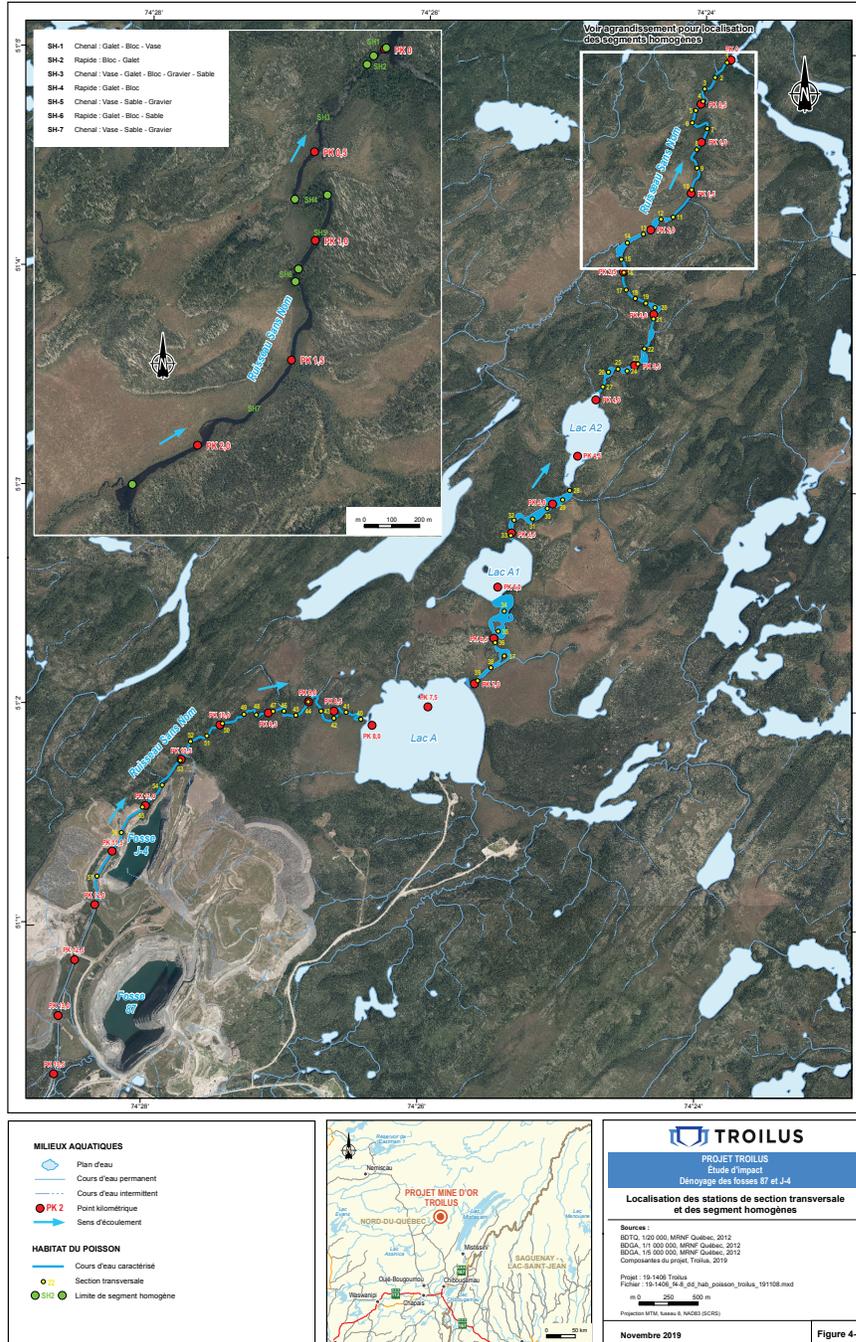


Figure 4.10 Location of homogeneous segments (DDM, Appendix D of impact study)



### **4.1.3 Human Environment**

#### **Land Use (Genivar, 2009)**

The area in question is located largely on public lands and in James Bay agreement territory.

With the exception of the southern portion and an easterly portion that overlaps with the Mistissini Category II lands, the area is located in two wildlife sanctuaries, Albanel-Mistissini-Waconichi and Assinica lakes.

In April 2017, the management of the territory was finally entirely entrusted to the Cree Nation of Mistissini via the Nibiischii Corporation. where there is an outfitter with no exclusive right operating on lakes Troilus and Frotet.

#### **Cree Consultation**

Troilus Gold has opened a local office in Mistissini and Chibougamau to ensure seamless communication between the company and stakeholders. Troilus Gold regularly holds information activities in Mistissini, and with elected representatives of local communities.

## 5. PROJECT PRESENTATION

### 5.1 Liability

According to the EQA, Article 153, the pit dewatering project could be included in the category of projects that are compulsorily subject to the impact assessment and review procedure. Following the analysis of the project description, the evaluation committee (COMEV) decided to subject the project to the environmental impact assessment and review procedure..

### 5.2 Calendar

The preparation work required for dewatering the pits will begin as soon as the permits are obtained. The preparation work should last no more than 3 months and then the pumping would begin at this time. It is expected that a delay of approximately 1 to 2 years would be required to empty both pits.

### 5.3 Project Description

The project involves emptying pits 87 and J4 from their water and discharging water into the unnamed stream located west of the pits.

#### 5.3.1 Pit Geometry

Pits 87 and J4 are located approximately 500 m apart. The geometric parameters are presented in Table 5.1.

**Tableau 5.1 Pits geometric parameters (Genivar, 2009)**

	<b>J4 Pit</b>	<b>87 Pit</b>
Area	226 255 m <sup>2</sup>	558 850 m <sup>2</sup>
Maximum depth	130 m	320 m
Top Dimension	1 245 m x 305 m	1 150 m x 625 m
Base Dimension	150 m x 70 m	400 m x 45 m
Height of benches	10 m	10 m
Angle of the walls	52 à 55 deg	52 à 55 deg

#### 5.3.2 Water volume in the pits

It is possible to estimate the current water volume taking into account the water elevation measured in 2018.

**Tableau 5.2 Water volume d'eau in the pits in September 2018**

	<b>Fosse J4</b>	<b>Fosse 87</b>
Water level (m)	360	263
Volume (Mm <sup>3</sup> )	8,748	17,606

### 5.3.3 Receiving Capacity of unnamed stream

The proposed Troilus dewatering approach is to optimize the ability of the unnamed stream to receive water while preserving the issues presented in the MELCC application dated July 3, 2019.

Based on the results obtained, it was estimated that the unnamed stream would be capable of passing a very high flow rate to about 5 m<sup>3</sup>/s before having erosion problems (Appendix H). It is the substrates associated with spawning grounds for brook trout that limit the flow because of the speed and depth of the water that would be reached in some places. The flow would be of the order of 3.5 m<sup>3</sup>/s in the most critical sections. When pumping begins, Troilus will monitor several downstream areas to ensure that adequate water levels are maintained.

### 5.3.4 Determination of flowrate

Pumping rates were estimated from several inputs:

- The annual rainfall is an average estimated from statistical data of the station of Chapais;
- Groundwater infiltration rate was calculated from theoretical considerations and field data from Genivar (2009);
- The flow of the unnamed stream is extrapolated for different conditions by transposition of watersheds;
- The volume of water in the pits is estimated from the storage curve;
- Flow velocities and water depths in the unnamed stream are estimated from a model that has not been calibrated and estimates an average velocity over a flow section.

Troilus Gold will implement follow-ups in the field to ensure that the issues defined by the department are met. Therefore, several scenarios are considered depending on the response of the receiving environment to the excess water that will be released. Examples of possibilities are:

- dewater pit J4 quickly (less than 2-3 months) with a high flow to avoid impacts of a longer duration. The flow should always ensure that the banks of the stream are not eroded and that the spawning grounds are conserved. Following dewatering of J4, a 6 to 8 month break could

allow the receiving environment to return to normal conditions and allow, for example, vegetation in wetlands to grow above water;

- Dewater pits J4 and 87 more slowly to prevent plants in wetlands from being fully submerged;
- Use a moderately high flow and avoid pumping in the winter if Lake A should not freeze sufficiently and affect traditional activities on the lake;
- Avoid dewatering between May and August so as not to affect the vegetation but to dewater with a high flow between September and December to resume the following year.

These are just examples of possible scenarios and at this point it is difficult to define which would reconcile the ability of the receiving environment to receive water while allowing users of the territory to enjoy their traditional activities. Troilus Gold commits to empty the pits with utmost respect for issues raised and stakeholders.

From the beginning of dewatering, daily inspections will be conducted along the unnamed stream primarily between the mine site and Lake A. The flow will be progressively increased depending on the response of the receiving environment. At first glance, the field surveys established a maximum water level of 350 m. Beyond that, the stream becomes too wide and floods too much territory mainly upstream of Lake A. When this rating has been reached, Troilus Gold will perform measurements of current speed and depth of water in different sections to calibrate the hydrological model.

### 5.3.5 Time required to dewater the pits

Table 5.3 shows the estimated times for three precipitation scenarios.

**Tableau 5.3 Estimated time to dewater the pits according to different scenarios**

<b>Pit</b>	<b>Water Volume (m<sup>3</sup>)</b>	<b>Dry year scenario (months)</b>	<b>Average year scenario (months)</b>	<b>Wet year scenario (months)</b>
87	17 606 273	6	8	10
J4	8 748 031	2	3	7

The pit J4 can be expected to empty over a period of between 2 and 7 months while the pit 87 could empty over a period of between 6 and 10 months. The pits will be emptied one after another starting with J4. It is estimated that dewatering could be spread over a period of up to 17 months while considering the many assumptions used in the estimation.



### 5.3.6 Water quality in the pits

Water samples were taken in the pits in the fall of 2018 to determine the concentration of the different parameters at different depths in the two pits. The characterization report done by the firm Wachiih is presented in Appendix K of the impact study.

The concentrations of all measured parameters are below the limits of Directive 019.

### 5.3.7 Pumping Systems, Treatment Plant and Discharge Point

The pumping rates were established considering the preservation of the stakes or issues as defined in the chapter on the stakes. Thus, it has been established that a flow rate of the order of 2.5 to 3.5 m<sup>3</sup>/s would be the maximum flow in the stream to be met at the point of discharge. The equipment will be mounted on a pumping platform that will be moved from one pit to another. Pit J4 will be emptied first, followed by Pit 87.

total of six centrifugal pumps will be installed on the platform

With the results obtained from the sampling of the water quality of the pits, the treatment of the water would not be necessary. However, to avoid any eventuality, the plant will be installed and functional from the first day of dewatering.

The processing plant has 6 containers, including a container for power supply, one for controls, and one for the laboratory. The other three treat suspended solids (TSS), pH adjustment, metals and ammoniacal nitrogen. Processing containers contain sealed tanks for reagents, holding tanks, dosing pumps, etc.

Processing capacity of the plant is about 300 m<sup>3</sup>/hour. The reagents used, if required, would be: sodium hydroxide, sulfuric and phosphoric acids, polymer, magnesium oxide and ferric sulphate. The amount to be used of these reagents will be determined if treatment is required and depends on the concentration of the parameters to be treated.

At the outlet of the pumps, it is planned to install a rip rap to prevent erosion.

The treatment unit will be located west of pit J4, on a rock platform (green dot in Figure 5.1). One pipe will bring water to the discharge point (orange line) and the discharge point is shown in yellow in Figure 5.1.



**Figure 5.1** Water treatment plant location (green dot) and discharge point (yellow dot)

For the dewatering of pit 87, the barge and the pipe will be brought to the pit 87. The water treatment unit and the point of discharge will remain in the same place and the water will be pumped with a pipe shown in blue on Figure 5.2.



**Figure 5.2** Water treatment plant location (green dot) and discharge point (yellow dot) and the discharge pipe from pit 87



## 5.4 Greenhouse gases

Since the pumping system will run on electricity as well as the water treatment plant, dewatering the pits will not produce greenhouse gases.

## 6. INFORMATION AND CONSULTATION ACTIVITIES

### 6.1 Targeted information and consultation activities carried out

Several information activities were conducted with elected officials, the community of Mistissini in general, and families potentially impacted and historically consulted as part of the Troilus project, namely the Awashish, Neeposh and Petawabano families. Targeted meetings have been held in the context of this impact study for dewatering pits. Table 6.1 presents the results of these targeted meetings.

**Tableau 6.1 Targeted meetings on the dewatering project with stakeholders**

Title	Location	Date	Stakeholders	Troilus Employees present
Presentation and consultation for dewatering project	Mistissini	2019-10-10	Thomas Neeposh, Chief of Mistissini Hubert Petawabano, Land and environmental coordinator and Tallyman Tony Petawabano, Tallyman	Jacqueline Leroux Mathieu Michaud John Matoush
Presentation and consultation for dewatering project	Troilus Mine Site	2019-10-30	Kenny Awashish, Tallyman	Mathieu Michaud
Presentation and consultation for dewatering project	Mistissini	2019-11-01	Pamela McLeod, Local environnement administrator Hubert Petawabano, Land and environmental coordinator and Tallyman James Neeposh, Tallyman Tony Petawabano, Tallyman George Awashish, Tallyman	Mathieu Michaud John Matoush

The concerns and the responses provided during consultation are described below.:

- Questions about the Authorization process for the dewatering Project.
  - Answer: COMEV has determined that an impact study will be required; the company intends to submit this study in November 2019. Subsequently, an authorization from the Ministry of the Regional Environment will be required before dewatering begins.
- Question about the water volume in each pit and their overall volume capacity.

- Answer: The water level in pit 87 is 200m to 300m. Taking into account the shape of the pit the approximate total water volume in pit 87 is estimated at 17-18 Millions of cubic meters. Pit 87 is filled to approximately to 1/3 of its capacity. The water level in pit J4 is 180m. Taking into account the shape of the pit the volume of water in pit J4 is estimated at 8-9 Mm<sup>3</sup>. Pit J4 has almost reached its maximum volume.
- Question on the justification of dewatering the pits.
  - Answer: Dewatering is essential for the exploration and determination of the mineralized zone on the east side of pit J4 and 87 as well as reducing costs and increasing drilling accuracy under pits J4 and 87.
- Comments on the possibility of restarting the operation.
  - Answer : There are still a lot of studies to be done such as the prefeasibility study, the feasibility study and the impact study on the effects on the environment. So far the results of the 2018 and 2019 drilling campaigns are promising.
- Comment on the possibility of using a submersible camera to observe the contaminant presence deep into the pits.
  - • Answer: Contaminant concentrations can not be assessed in this way and the possibility that there is a layer of water or contaminants found in concentration visible to the naked eye is very low especially considering the results obtained during pit sampling campaign at different depths.
- Comment on the sampling frequency of pits at depth.
  - Answer : Sampling at different depths took place once in both pits. The results were informative for the company and stakeholders and it is not planned to conduct another such campaign. The surface water sampling of the 2 pits will continue to be performed as described in our overall CA. In addition, sampling during dewatering will be done daily internally and weekly by an accredited laboratory.
- Comment on the possibility of following the displacement of fish.
  - Answer : Many inventories and characterization of the fish and their habitats occurred at the mine site. These studies will be the baseline for establishing whether the fish is moved during dewatering. The monitoring plan for the dewatering project is not yet final, but there will certainly be monitoring of the quantity and quality of the fish in the impacted environment.
- Comment on the change of ice thickness on Lake A during winter.
  - Answer : The dewatering flow will be defined according to the capacity of the stream and Lake A at different times of the year.
- Comment on the concerns of traditional activities and movement on ice during dewatering
  - Answer : Safety measures and a follow-up program will be put in place to identify areas at risk on Lake A.



A communication plan has been agreed with members of the Mistissini community and includes the following elements:

- A monthly report on the activities of Troilus Gold,
- Information activities will take place, notably at Mistissini Annual General Meetings, in February and August.
- Targeted meetings with representatives of the Cree Nation of Mistissini will take place, as part of the Pre-Development Agreement signed in 2018,
- Mistissini's stakeholders have access to the Mistissini office at all times.
- Stakeholders have access to the Chibougamau office at all times
- Meetings will be organized with the communities of Chibougamau and Chapais to inform stakeholders of the progress of Troilus Gold activities.

Note that this communication plan is in evolving, as the needs of stakeholders and the progression of Troilus Gold's activities.

## **7. METHODOLOGY**

### **7.1 Methodological approach**

The methodology developed aims to achieve the objectives of the ministry by dealing with impact studies by assessing how the modifications of the components will have impacts on the issues identified for the project. As a result, the following key steps have been completed:

- ▶ Definition of the study area;
- ▶ Identification of the issues raised by the project;
- ▶ Identification of the physical, biological and human components related to the issues;
- ▶ Identification of project activities that may cause changes to the components;
- ▶ Description of the physical, biological and human environments before the project is carried out
- ▶ Determination of changes to targeted components due to project activities;
- ▶ Identification of mitigation measures;
- ▶ Determination of impacts on the issues;
- ▶ Identification of compensation measures if required;
- ▶ Development of monitoring and follow-up programs.

#### **7.1.1 Study Zone**

The area likely to be affected is the area that will be affected by the water table drawdown cone and the unnamed stream from the point of discharge to a distance estimated at approximately 12 km downstream of the point rejection. The lowering of the water table should not exceed a radius of 2.5 km from the pit walls. This value comes from the Genivar report (2009).

#### **7.1.2 Identification of the stakes brought by the project**

In the directive sent to Troilus Gold in July 2019, the MELCC identified three issues or stakes or issues on which the impact study should focus:

- Conservation and protection of surface and underground water resources (quantity and quality);
- Preservation of the integrity of the hydrographic network and its processes;
- Maintaining of the quantity of flora and fauna habitats and their quality.

### **7.1.3 Identification of the components of physical, biological and human environments related to the issues.**

Based on the issues, the components of the physical, biological and human environments were identified and efforts focused on documenting the current status of these components to be able to assess changes in the components related to the activities of the project. dewatering.

Les composantes qui ont été retenues sont :

- 1) Physical Environment
  - a) Hydrogeological regime
  - b) Underground water quality
  - c) Surface water regime
  - d) Surface water quality
  - e) Soil
- 2) Biological Environment
  - a) Vegetation and Wetlands
  - b) Fish and habitats
- 3) Human Environment
  - a) Land use

### **7.1.4 Identification of project activities that may cause modifications to the components**

Project activities that are likely to modify the components identified in the previous section are:

1. Installation of barge and pumps
2. Pumping water from pits
3. Discharge of water into the unnamed stream
4. Maintaining the pits dry

In relation to the retained issues, it was only pumping water from the pits and the discharge in the unnamed stream that were used to evaluate the changes to the components.

### **7.1.5 Impacts of Component Changes on retained Issues**

For each issue, an analysis grid was developed to highlight the project activities and the affected components related to the issue. The modification of this component was qualified according to the

method proposed in section 7.2. The modifications are evaluated considering the application of mitigation measures.

Following the assessment of the impact of the modification of the components, follow-up measures are proposed if possible to document the actual impacts.

## **7.2 Evaluation of the residual impact of a modification of a component on a retained issue.**

After applying mitigation measures, the significance of the residual impact must be assessed. The significance of the impact is related to the changes experienced by the component. Different criteria are considered in the evaluation based on a procedure that includes the following elements:

- ▶ Ecosystemic Value ;
- ▶ Socio-Economic Value;
- ▶ Intensity or degree of disturbance ;
- ▶ Range ;
- ▶ Duration.

The significance of an impact of change in a component of physical and biological environments depends on its value (sensitivity, uniqueness, rarity, reversibility) in the ecosystem and its social, cultural, economic and aesthetic value to communities.

For components of the human environment, the concerns of Aboriginal and non-Aboriginal communities influence the assessment of the significance of the impact. These may include health, safety or preservation of cultural and archaeological heritage.

## **8. DETERMINATION OF CHANGES IN TARGETED COMPONENTS DUE TO PROJECT ACTIVITIES**

The dewatering of the pits will result in modifications to components of the physical, biological and human environments. On the physical environment, these are the components related to hydrogeology and hydrology, the quality of surface water and soil. On the biological environment, these are the components related to fish and its habitat, vegetation and wetlands. For the human environment, land use may be disrupted locally during dewatering activities. The following sections list the components and anticipated changes.

### **8.1 Physical Environment**

#### **Hydrogeology**

During dewatering of the pit, the groundwater around the perimeter will undergo a drawdown (lowering of the groundwater level) locally. During the operation of the mine, the water levels were monitored and we can reasonably anticipate that the same drawdowns will be observed during the dewatering planned in 2020.

#### **Hydrology**

Pit dewatering will have an impact on the flow of the unnamed stream and downstream bodies of water. The flow will be increased to a value of about 2.5 to 3.5 m<sup>3</sup> / s. At this value, it is not expected that the stream suffers from erosion problems that the spawning grounds are negatively affected..

#### **Surface water quality**

As for the quality of surface water, dewatering pits will bring elements into the unnamed stream. Since pit water concentrations are generally lower than measured concentrations while the mine was in operation, significant impacts on surface water quality are not anticipated.

#### **Soil**

Dewatering activities will have little impact on soils. In fact, according to the speeds calculated from the flows in the stream, it is not expected to observe erosion zones..

### **8.2 Biological Environment**

#### **Fish and habitat**

Dewatering the pits will increase the flow of the unnamed stream. A total of 13 potential spawning grounds (of which 3 are confirmed) were identified during the field surveys. Simulations of flow rates and speeds show that the more water is pumped into the stream, the longer the length of the substrates becomes interesting for spawning.



Increasing flow has a positive effect on potential spawning grounds by increasing the area where white-water species can spawn.

### **Vegetation**

The increase of the water level will be done in a way that does not affect the terrestrial vegetation. The watercourse will overflow the main channel during dewatering to spill into its floodplain. Only in wetlands would the water level rise.

### **Wetlands**

The unnamed stream is mostly lined with wetlands. During dewatering, the water level will increase. Some indicators of ecosystem health will be required to ensure the integrity of the ecosystem. Water level control measures will be put in place at the beginning of the pumping, by biology experts, to ensure that the functions of the environment are preserved and not to overgrow the vegetation for a long period of time.

## **8.3 Human Environment**

### **Land use**

The Troilus mine site has always considered the hunting territories of the Awashish and Brien (M-34), Petawabano (M-40) and Neeposh (M39-A) families. Within each of these hunting grounds, there are camps that are used by family members at different times of the year (main camp, winter camp, hunting camp, etc.). The activities practiced are hunting, fishing and picking fruits and plants.

Aside from winter fishing on Lake A, the dewatering of pits should not influence these activities.

## **9. DETERMINATION OF IMPACTS ON THE RETAINED ISSUES**

The three issues retained by the MELCC are:

- Conservation and protection of surface and underground water resources (quantity and quality);
- The preservation of the integrity of the hydrographic network and its processes;
- The maintenance of the quantity of flora and fauna habitats and their quality

### **9.1 Retained issue #1 : Conservation and protection of surface and underground water resources (quantity and quality);**

This issue concerns the conservation and protection of surface and underground water resources, both in terms of the quantity of water to be preserved and in terms of quality. It is important to ensure that the dewatering of the pits and the release into the environment will maintain the integrity of the water resource. Two activities will affect the components related to the issue: the pumping of groundwater and the discharge of this water into the unnamed stream. The modified components directly related to this issue are the hydrogeological regime, the hydrological regime, and the water quality of the unnamed stream.

#### **9.1.1 Pumping water from the pits**

The pumping of water in the pits will result in a drawdown of the water table in the area of influence of the pits. This area of influence will be the same as that present at the end of Troilus mine operations in 2009. The pumping will therefore affect the "hydrogeology" component, which is an identified component related to the first issue.

#### ***Hydrogeology :***

Pumping groundwater will lower the groundwater level around the pits and consequently change the pattern of groundwater flow locally. The element of conservation of the groundwater resource that would be affected

The significance of the component was assessed as MEDIUM considering the role of groundwater recharge for water or wetlands. The socio-economic value was considered high since the groundwater supplied the industrial zone well, the exploration camp well and the wells of two users of the territory near Lake A. All these wells were used in operation whereas the pits were dry.

The intensity of the impact is rated LOW on the component since the effects of pumping are local and are not felt when in an area that is already affected by the presence of waste rock and a tailings pond and that in the past, existing wells were not affected.

Given the very local aspect of the observed changes, the extent of impact on the component is rated LOW.

The duration of the impact is considered HIGH since it will be felt as long as the pits are kept dry and past experience shows that it takes about 10 years to find equilibrium conditions.

Given the environmental significance (low) of the component, the intensity (low) of the impact, the range (low) and the duration (high), the impact strength is LOW.

### **9.1.2 Discharge of water in unnamed stream**

This activity involves the release of water into the unnamed stream near the J4 pit. A flow measurement station will be installed on the unnamed stream upstream of the discharge point so that it will never exceed the maximum flow expected to maintain the habitat. In addition, a water treatment plant will be available as needed.

Discharge of water into the stream will directly alter two components, the water regime and the water quality of the unnamed stream. These two components are related to Retained Issue # 1. Also, having a change in the water regime can have an effect on the soil component.

#### ***Hydrology***

Hydrology is modified during dewatering as the flow will be increased to ensure a constant flow in the unnamed stream. Only the unnamed stream, which will see its flow increase and its water regime modified, will be affected by the discharge of water.

The importance of the component is HIGH given the role of rivers and lakes in preserving biodiversity. The socio-economic value was also considered high since surface water is very important for the local community.

The intensity of the impact is rated LOW on the component since the effects of the discharge are mitigated by the flow control that will not exceed the capacity of the unnamed stream.

Given the local aspect of the changes observed that could extend a few kilometers downstream of the discharge point, the extent of the impact on the component is considered MEDIUM.



The duration of the impact is considered LOW since it will be felt only during dewatering, which should not last more than 1 to 2 years.

Given the environmental importance of the (high) component, the intensity of the impact (low) and the extent (average) and the duration (low), the impact strength is LOW.

### ***Water surface Quality***

The water quality of the unnamed stream will be modified by the discharge of the water from the pits. The quality of the water in the pits meet the criteria of Directive 019 but exceeds certain criteria for the protection of aquatic life. Follow-ups during the dewatering will allow to measure the potential effect of dewatering and the experience lived in operation is that the environmental monitoring did not show any specific problems.

The importance of the component is HIGH given the importance of preserving water quality. The socio-economic value was also considered high since surface water is very important for the local community.

The intensity of the impact is rated LOW on the component since the effects of the discharge are mitigated by the establishment of a water treatment plan.

Given the local aspect of the changes observed that could extend a few kilometers downstream of the discharge point, the extent of the impact on the component is considered MEDIUM.

The duration of the impact is considered LOW since it will be felt only during dewatering, which should not last more than 1 to 2 years.

Given the environmental importance (high) of the component, the intensity (low) of the impact and range (medium) and the duration (low), the impact strength is LOW.

### ***Conclusion***

**The dewatering of the pits will be done in a way that respects the retained issue #1 and allows the conservation and protection of surface and underground water resources.**

**Tableau 9.1 Structured Impact Matrix for retained Issue # 1 Conservation and Protection of Surface and Groundwater Resources (Quantity and Quality)**

<b>Action</b>	<b>Physical Environment component concerned</b> <i>Modification</i>	<b>Impact of modifications</b> <i>Description</i>	<b>Mitigation Measures</b> <i>Description</i>	<b>Residual Impact</b> <i>Description</i>	<b>Follow-up/monitoring</b>
<b>Pumping</b> <i>Diminution of water level in the pits</i>	<b>Hydrogeology</b> <i>Drawdown of water table Change in flow direction</i>	<b>The pits will act as wells</b> <i>Part of underground water will be pumped and discharged at surface</i>	<b>None</b>	<b>Low</b>	<b>None</b>
<b>Discharge in unnamed stream</b> <i>Increase of flowrate and load in contaminants</i>	<b>Hydrology</b> <i>Modification of water regime of unnamed stream</i> <b>Soil</b> <i>Bank erosion due to increased water velocity</i> <b>Water quality</b> <i>Increase in contaminants</i>	<b>Flow of unnamed stream will be constant</b> <i>Volume will be adjusted according to the seasons</i> <b>Displacement of material</b> <i>From eroded bank to deposition area</i> <b>Alteration of surface water quality</b> <i>Additional contaminants could affect water quality</i>	<b>Flow adjustment</b>  <b>Controlling velocity of water</b>  <b>Water treatment plant</b>	<b>Low</b>  <b>Very Low</b>  <b>Low</b>	<b>Flow measurement in the unnamed stream upstream of the discharge point</b>    <b>Monitoring the water quality in the unnamed stream</b>

## **9.2 Retained Issue #2 : Preservation of the integrity of the hydrographic network and its processes;**

Table 9.2 presents the list of actions related to the components modified directly and indirectly. For each modified component, mitigation measures are presented to determine if the action can have a residual effect on the issue. If the application of the mitigation measures raises doubts about its effectiveness, a follow-up is put in place.

### **9.2.1 Pumping**

Pumping water in the pits does not affect any component related to the retained issue #2.

### **9.2.2 Water discharge in unnamed stream**

This activity involves the release of water into the unnamed stream downstream of pit J4. A flow measurement station will be installed on the unnamed stream upstream of the discharge point so as to never exceed the maximum flow that will be specified at the time of dewatering using indicators as proposed in Section 10. , a water treatment plant will be in operation to allow the discharge of water quality that will minimize the effects on the receiving environment.

Discharge of water into the stream will directly alter two components, namely the hydrology and water quality of the unnamed stream. These two components are related to Retained Issue # 2. In addition to modifying these two components, having a change in the water regime can have an effect on the soil component.

#### ***Hydrology***

Hydrology is modified during dewatering as the flow will be increased to ensure a constant flow in the unnamed stream. Only the unnamed stream, which will see its flow increase and its water regime modified, will be affected by the discharge of water.

The importance of the component is HIGH given the role of rivers and lakes in preserving biodiversity. The socio-economic value was also considered high since surface water is very important for the local community.

The intensity of the impact is rated LOW on the component since the effects of the discharge are mitigated by the flow control that will not exceed the capacity of the unnamed stream.

Given the local aspect of the changes observed that could extend a few kilometers downstream of the discharge point, the extent of the impact on the component is considered MEDIUM.

The duration of the impact is considered LOW since it will be felt only during dewatering, which should not last more than 1 to 2 years.

Given the environmental importance of the (high) component, the intensity of the impact (low) and the extent (average) and the duration (low), the impact strength is LOW

### ***Soil***

Given that there is no identified sensitive area and that current speeds will respect the values established to maintain the integrity of the stream, the modification of this component will be very small and the impact on the issue # 2 also. This component is not of interest for preservation and is not exceptional or unique. The socio-economic value was considered low.

The intensity of the impact is considered LOW on the component since the pumped flows are below the values of the 2-year recurrence peak flows.

Given the local aspect of the changes observed but which could extend a few kilometers downstream of the discharge point, the extent of the impact on the component is considered MEDIUM.

The duration of the impact is considered LOW since it will be felt only during dewatering which should not last more than 1 to 2 years.

Given the environmental importance (low) of the component, the intensity (low) of the impact, the range (medium) and the duration (low), the strength of the impact is VERY LOW.

### ***Water surface quality***

The water quality of the unnamed stream will be modified by the discharge of the water from the pits. It has been shown that although the water quality in the pits meets the criteria of Directive 019, it exceeds certain criteria for the protection of aquatic life. The presence of the treatment plant will ensure that water of adequate quality is discharged, thus allowing a LOW impact intensity on the receiving

The importance of the component is HIGH given the importance of preserving water quality. The socio-economic value was also considered high since surface water is very important for the local community.



Given the local aspect of the changes observed that could extend a few kilometers downstream of the discharge point, the range of the impact on the component is considered MEDIUM.

The duration of the impact is considered LOW since it will be felt only during dewatering, which should not last more than 1 to 2 years.

Given the environmental importance (high) of the component, the intensity (low) of the impact, the range (medium) and the duration (low), the impact force is LOW.

***Conclusion***

**The dewatering of the pits will be done in a way that respects the Retained issue #2 and allows the preservation of the integrity of the hydrographic network and its processes.**

**Tableau 9.2 Structured Impact Matrix for retained Issue # 2: Preservation of the integrity of the hydrographic network and its processes**

<b>Action</b> <i>Impact Source</i>	<b>Physical Environment Component concerned</b> <i>Direct Modification</i>	<b>Impact of modifications</b> <i>Description</i>	<b>Mitigation measures</b> <i>Description</i>	<b>Residual Impact</b> <i>Description</i>	<b>Follow-up/monitoring</b>
<b>Discharge in unnamed stream</b>  <i>Increase of flowrate and load in contaminants</i>	<b>Hydrology</b> <i>Modification of water regime in unnamed stream</i>	<i>No more low water episodes during dewatering</i>	<i>None</i>	Low	Flow measurement in the unnamed stream upstream of the discharge point
	<b>Soil</b> <i>Potential increase of erosion</i>	<b>Erosion and sanding of banks</b> <i>Increasing water velocities can promote shoreline erosion and sediment transport that will ensnare areas with lower velocities</i>	<b>Limit flow rate according to stream capacity</b>	Very Low	Monitoring the water quality in unnamed stream
	<b>Water Quality</b> <i>Increase in contaminants</i>	<b>Degradation of surface water quality</b>	<b>Water treatment plant</b>	Low	Monitoring the water quality in unnamed stream

### 9.3 Retained issue #3 : Maintaining the quantity of flora and fauna habitats and their quality

The third Retained Issue is: Maintaining the amount of plant and wildlife habitats and their quality. Two major activities are impact sources: pumping groundwater and discharging into the unnamed stream. For this issue, the components related to the biological environment will be studied in relation to the modifications made by the sources of impact. In this case, the sources of impact modify the components of the physical environment and this could lead to modifications on certain components of the biological environment.

#### 9.3.1 Pumping

Pumping of groundwater does not modify any component related to this issue.

#### 9.3.2 Discharge in unnamed stream

The discharge of water will alter two components of the physical environment: the water regime and the water quality. In both cases, we could observe a modification of the habitats of fish and fish and also wetlands.

##### ***Hydrology***

The fact that the flow will increase in the stream will have consequences on two components related to the third issue:

Wetland: Increasing the flow will increase the water level in the unnamed stream and overflow into the flood plain. As a result, part of the wetlands could be flooded during dewatering months.

Fish and fish habitat: Increased flow may affect fish habitats if current speeds are too high. A study of maximum speeds was made and the results showed that the amount of spawning grounds would increase with increasing flow in the stream. There will be only a positive effect on the number of potential spawning grounds as long as we remain at a flow rate of about 3.5 m/s for brook trout spawning grounds.

##### ***Water quality***

Water quality in the stream will be modified by dewatering the pits. Given that the water from the pit will be treated as needed, no significant change in this component is anticipated. The small change in this component could still result in a change in the fish and fish habitat component. The evaluation of the impact of this modification on the retained issue # 3 is defined as follows. The importance of the component is HIGH given the importance of fish and their habitats. The socio-economic value was also considered high since this component is very important for the local community.



The intensity of the impact is rated LOW on the component since the effects of the discharge are mitigated by the presence of a water treatment plant. Given the local aspect of the changes observed but which could extend a few kilometers downstream of the discharge point, the range of the impact on the component is considered MEDIUM. The duration of the impact is considered LOW since it will be felt only during dewatering which should not last more than 1 to 2 years.

Given the environmental importance (high) of the component, the intensity (low) of the impact, the range (medium) and the duration (low), the impact strength is LOW.

### ***Conclusion***

**Dewatering of the pits will be done in such a way as to respect this issue and to allow the maintenance of the quantity of flora and fauna habitats and their quality**

**Tableau 9.3 Structured Impact Matrix for retained Issue # 3: Maintaining the quantity of flora and fauna habitats and their quality**

<b>Action</b> <i>Impact Source</i>	<b>Physical Environment Component concerned</b> <i>Direct Modification</i>	<b>Component concerned</b> <i>Indirect Modification</i>	<b>Impact of modifications</b> <i>Description</i>	<b>Mitigation measures</b> <i>Description</i>	<b>Residual Impact</b> <i>Description</i>	<b>Follow-up/monitoring</b>
<b>Discharge in unnamed stream</b> Increase of flowrate	<b>Hydrology</b> <i>Modification of water regime</i>	<b>Fish</b> <i>Modification of velocity and depth of flow</i>	<b>Spawning areas modification</b> <i>Positive impact in this case because increased water velocity and depth increase the potential surface of spawning areas</i>	<b>Flowrate control</b>	Very Low	Measure of velocity and depth in critical sections.
	<b>Wetlands</b> <i>Flooded areas during dewatering</i>	<b>Poissons</b> <i>Contamination of fish flesh</i>	<b>Vegetation Modification</b> <i>Possible change in vegetation</i>	<b>Flowrate control</b>	Medium	Measure of level of water in specific sections
	<b>Water quality</b> <i>Increase in contaminants</i>		<b>Contamination des chairs de poisson</b> <i>Accumulation of metals could modify fish health.</i>	<b>Installation of water treatment plant</b>	Medium	Water quality monitoring.

## **10. MITIGATION MEASURES AND FOLLOW-UP**

### **10.1 Mitigations measures**

Here are the specific measures for dewatering activities:

- 1) Flow measurements upstream of the point of discharge on the unnamed stream and pumping control to never exceed a maximum flow rate of between 2.5 and 3.5 m<sup>3</sup>/s.
- 2) Treatment of pit water as required to lower contaminant concentrations to meet the criteria of Directive 019.
- 3) Supply of all equipment with electricity to limit the risk of spilling petroleum products, the emission of greenhouse gases and noise.
- 4) Installation of a rock energy dissipator at the discharge point to reduce the speed at the end of the pumping line and reduce the erosion potential.

### **10.2 Follow-up and monitoring**

To ensure the effectiveness of proposed mitigation measures, monitoring of the quality of surface water in the unnamed stream will be conducted. Also, piezometers around the site will continue to be sampled regularly and water levels will be measured.

#### **10.2.1 Flowrates in unnamed stream**

Upstream of the discharge point, a flow measurement station will be installed to ensure the capacity of the unnamed stream is respected.

#### **10.2.2 Presence of Fish**

During the targeted consultations, land users mentioned concerns about fish displacement. A follow-up will be done with the users of the territory to make sure that dewatering flows do not displace the fish populations.

#### **10.2.3 Ice cover on Lake A**

During the targeted consultations, land users in the area have raised concerns about the ice cover on Lake A. Troilus Gold will track ice cover by measuring thickness and reporting results to users in the area using the ice cover. Lake A (members of the Awashish family) to ensure the safety of travel on Lake A

The dewatering flow could be adjusted as needed

#### **10.2.4 Surface water**

Discharged dewatering water will be considered as a final effluent; pH and flow will be measured continuously, and other parameters will be sampled at the frequency prescribed by Directive 019, and will be incorporated into the monitoring program already in place at the mine site. At a minimum, the following parameters will be analyzed: pH, MES, As, Cu, Fe, Ni, Pb, Zn and toxicity.

#### **10.2.5 Underground water**

Piezometers are already installed on the site and monitoring of groundwater quality has been going on for several years. This monitoring will continue during dewatering. The monitoring program will comply with the requirements of Directive 019 (sections 2.3.2 and 2.3.3) which dictate in particular the parameters to be analyzed, the frequency of sampling, the use and the selection of the alert threshold..

Sampling will be in accordance with the Sampling Guide for Environmental Analyzes (Booklet 3). The parameters to be analyzed are as follows:

- Dissolved metals: arsenic, copper, iron, nickel, lead, zinc, total cyanides,
- Hydrocarbons C<sub>10</sub>-C<sub>50</sub>
- pH, electrical conductivity (in situ)
- Major ions (Ca<sup>+2</sup>, HCO<sub>3</sub><sup>-</sup>, K<sup>+</sup>, Mg<sup>+2</sup>, Na<sup>+</sup>, SO<sub>4</sub><sup>-2</sup>)

Follow-up will be in accordance with the terms and conditions requested by the MELCC under the conditions of current authorizations.



## 11. CONCLUSIONS

Dewatering pits 87 and J4 will allow Troilus Gold to reach drilling targets to continue exploration work on its property and confirm the presence of suspected mineralization along the east wall of pits 87 and J4.

Dewatering activities will be carried out in such a way as to ensure the protection of the environment and more particularly in relation to the retained issues defined by the MELCC. As presented, the major concerns of the MELCC have been taken into consideration and the project will not harm the Environment