ANNEXE A : DOCUMENTS DE SOUTIEN PRÉLIMINAIRES

A-1 BATHYMÉTRIE ET HYDROLOGIE

A-2 CADRAGE ENVIRONNEMENTAL ET SOCIAL

A-3 MILIEU AQUATIQUE

A-4 TRANSPORT

A-5 MICROMAMMIFÈRES

A-6 GÉOCHIMIE

A-7 QUALITÉ DE L'AIR

A-8 POTENTIEL ARCHÉOLOGIQUE

Aquatic Environment Baseline Conditions

Aquatic Characterization – 2022 Field Campaigns

Report presented to

Patriot Battery Metals Inc.

June 1, 2023

Project 22-0095

Realization Team

Niigaan

Pierre-Olivier Côté, biologist, B. Sc	Project management and scientific revision
Jeff Goulet, biologist, B. Sc.	Data compilation, analysis, redaction
Audrey Bédard, biologist, M. Sc	Redaction
Marc-André Nault, biologist, B. Sc.	Field work
Tommy Saint-Pierre, biologist, B. Sc	Field work
Antoine Sicotte, Wildlife technician	Field work
Jacinthe Daoust, Wildlife technician	Field work
Ariel Jacques, Wildlife technician	Field work
Étienne Mercier, Wildlife technician	Field work
François Corbeil, Wildlife technician	Field work
Christopher Adam, biologist, B. Sc	Field work
Harvey Bearskin, Community	Field work
Kim Tremblay, geographer, DEC	Mapping
Joanne Paris, administrative assistant	Edition

Prepared by :

<original signed by>

Jeff Goulet
Biologist, B. Sc

Approved by :

<original signed by>

Pierre-Olivier Côté
Biologist, B. Sc

N° revision	Date	Description of modification | emission
01	2023-06-01	Preliminary

Scope and Limitation

This document is to be used for the sole purpose for which it was prepared. It is intended for the client for whom it was produced, and the latter is free to share it with a third party should the client so decide.

This document has been produced with the data collected in the field and the information available on the various elements studied at the date of this report. The technical analyses based on the interpretation of the various sections of the law and regulations in force are not and should not, at any time, be considered as legal advice or a substitute for such advice.

The maps bearing the Niigaan logo are the result of a compilation of information from public databases and inventory data collected in the field. They were not prepared by a land surveyor and should not be considered as such. Niigaan is not responsible for erroneous conclusions due to the deliberate concealment or unavailability of relevant information at the time the mandate was carried out.

The analyses developed in this document are presented for information purposes only and the final decision regarding the various intervention methods and official protection zones is the responsibility of the *Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs du Québec* (MELCCFP) and/or other government departments and agencies (provincial, federal) or the municipality concerned.

Consequently, Niigaan shall not be held liable for any work carried out on the environment prior to obtaining all necessary authorizations, nor for any damages suffered by a third party as a result of a decision made or based on this report. Niigaan has no relationship with the client, nor any interest in the property under study. Niigaan ensures the integrity of the work performed by avoiding any conflict-of-interest situations.

Reference to Quote

Niigaan. 2023. Aquatic Environment Baseline Conditions - Aquatic Characterization – 2022 Field Campaigns. Rapport du projet 22-0095. 88 pages + annexes.

Table of Content

List of Maps

List of Photos

List of Tables

List of Appendices

1 Introduction

1.1 Context and Objective

This document is a part of the studies aimed at describing the baseline condition of the natural and social environments that could be influenced by the development of the Corvette mining project. The components of the natural environment must be considered in order to establish a baseline condition that will allow the impacts of the project to be assessed. These components fall into two broad categories: the physical environment and the biological environment. The biological components that must be studied include vegetation, mammals, birds, herpetofauna and aquatic fauna. Aquatic fauna is unique in that the quality of their environment is dependent on activities and uses that may be located at a distance. The extent of the hydrographic network in the Corvette mining project area and its multiple interconnections therefore imply that the inventory area may extends beyond the direct mining activities.

The purpose of the aquatic environment baseline is to identify and document the aquatic environments likely to be affected by the Corvette Mining Project.

More precisely, this study aimed to :

- Characterized the fish habitat potential of the watercourse and waterbodies in the study area.
- Validate the hydrographic network and document the status of water environments.
- Validate the presence of fish in the hydrographic network and describe the composition of fish communities.

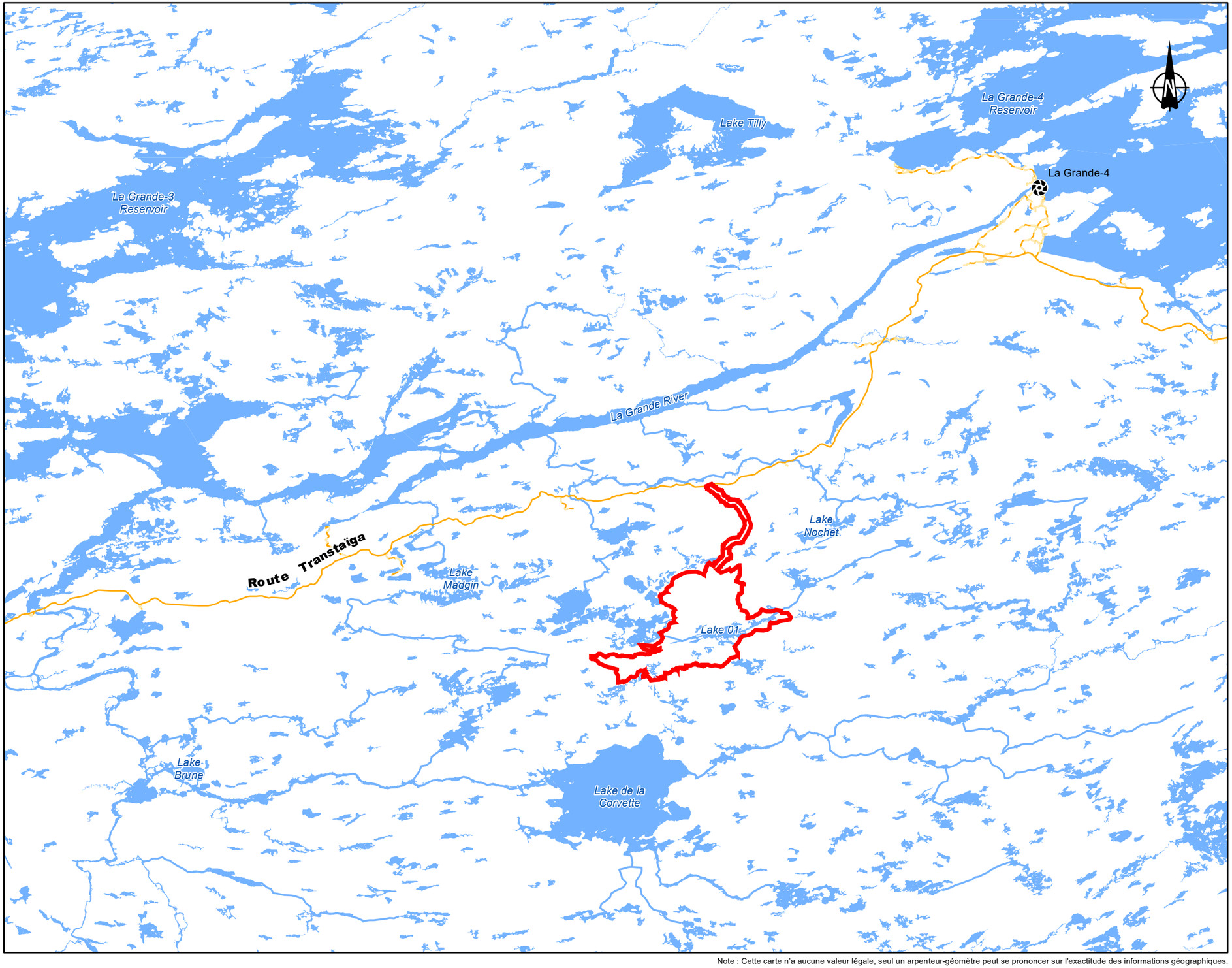
1.2 Study Area

The study area is located in the Nord-du-Québec administrative region in the territory of Eeyou Istchee Baie-James. It is located in public territory, approximately 10 km northeast of Corvette Lake and about 40 km southwest of the La Grande 4 hydroelectric facilities (map 1).

Moreover, it covers Category III lands in the territory governed by the James Bay and Northern Quebec Agreement and intersects with trapline VC07 used by members of the Chisasibi Cree First Nation and the trapline MO2A used by members of the Mistissini Cree First Nation.

According to the Quebec's ecological reference framework, the study area is part of the *Buttons de l'Opinaca* natural region of the *Collines de la Grande Rivière* natural province. It also belongs to the boreal vegetation zone, to the continuous boreal forest subzone and to the spruce-lichen bioclimatic domain.

The study area is divided among three main watersheds, presented on map 2. The first watershed, named Lake PE1 Watershed, is situated in the center of the study area and includes lake PE1 and its tributaries. The second watershed (La Grande Watershed) is situated north of lake PE1 and include the streams and lakes that flow directly toward the La Grande River, without going through lake PE1. This watershed is subdivided into two smaller watersheds, the first (La Grande A) being the watershed that received the water from lake PE1 outlet and the later (La Grande B) is farther north and completely independent of lake PE1 outlet. Finally, the third watershed encompass the water streams and waterbodies south of lakePE1 that flow toward Lake de la Corvette, thus named lake de la Corvette watershed.



Note : Cette carte n'a aucune valeur légale, seul un arpenteur-géomètre peut se prononcer sur l'exactitude des informations géographiques.

Map 1
Project location

Carte 1
Localisation du projet

Limit / Limite

Work study area / Zone d'étude des travaux (ZET)

Hydrogrpahy / Hydrographie

Watercourse / Cours d'eau

Waterbody / Plan d'eau

Infrastructure / Infrastructure

Generatin station / Centrale

Road network / Réseau routier

Collector road / Route collectrice

Local road / Route locale

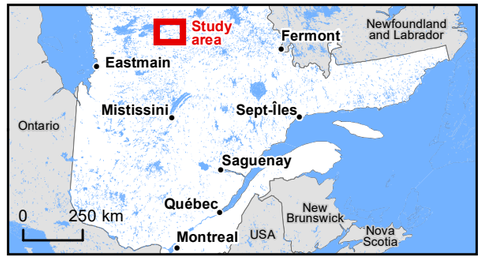
Other road / Autre route

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDGA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 3 6 km

NAD 1983 CSRS MTM 8

1:350 000



Environmental and social survey

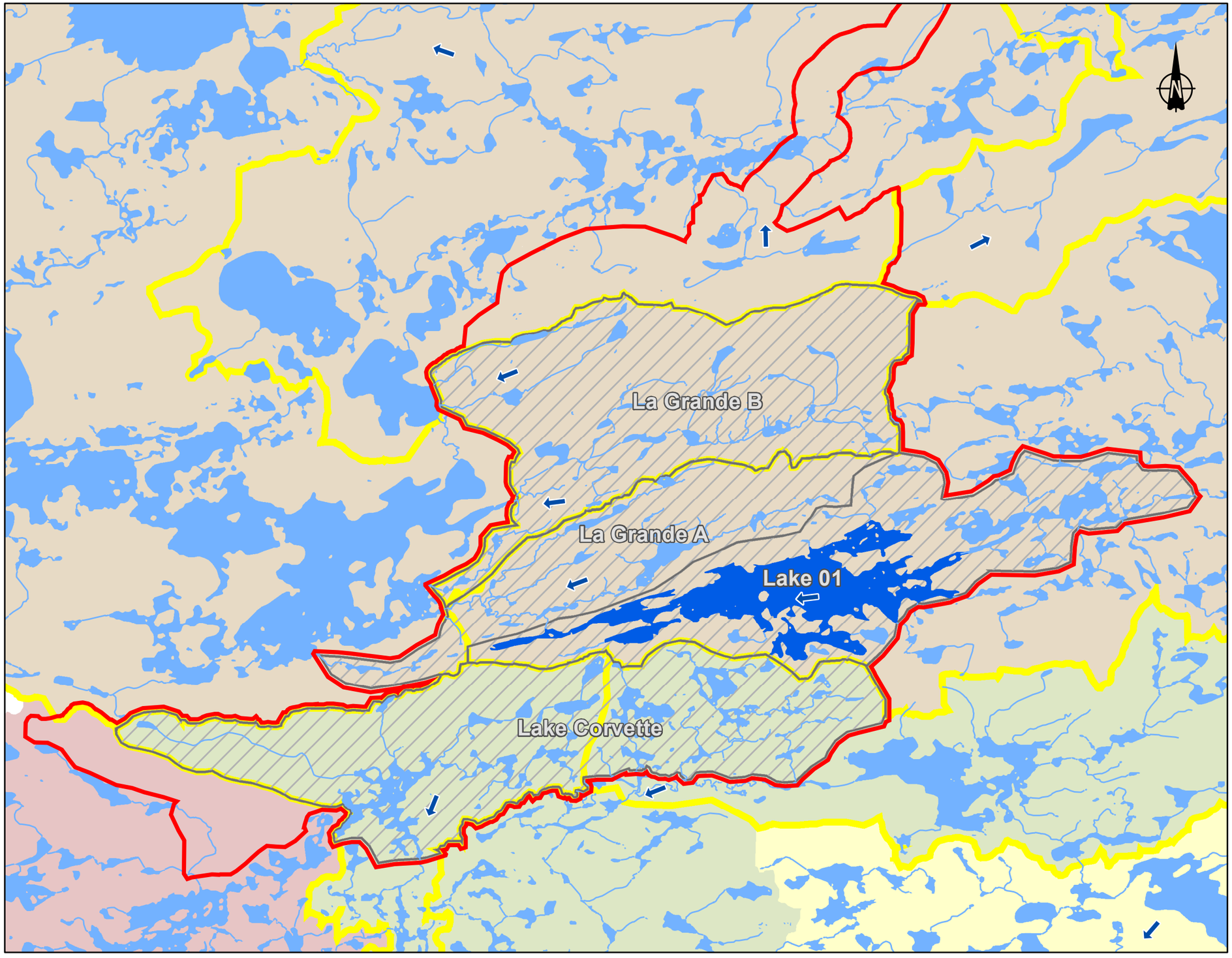
Project : 22-0095

May, 2023
Approved by :
Pierre-Olivier Côté

NIIGAAN

Map 2
Study area location

Carte 2
Localisation de la zone d'étude



Limit / Limite

- Work study area / Zone d'étude des travaux (ZET)
- Sub-sector / Sous-secteurs

Hydrogrpahy / Hydrographie

- Flow direction / Sens de l'écoulement
- Watercourse / Cours d'eau
- Waterbody / Plan d'eau
- Lake 01 / Lac 01
- Sub-watershed / Sous-bassin-versant

Main watersheds / Bassins versants principaux

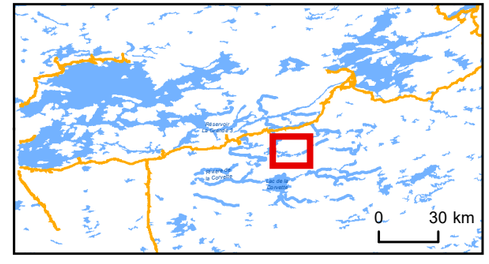
- La Grande river / Rivière La Grande
- Lake de la Corvette Center / Lac de la Corvette Centre
- Lake de la Covette West / Lac de la Corvette Ouest
- Lake de la Covette East / Lac de la Corvette Est

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDGA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 0,6 1,2 km

NAD 1983 CSRS MTM 8

1:60 000



Environmental and social survey

Project : 22-0095

May, 2023
Approved by :
Pierre-Olivier Côté

NIIGAAN

Note : Cette carte n'a aucune valeur légale, seul un arpenteur-géomètre peut se prononcer sur l'exactitude des informations géographiques.

2 Methodology

The fieldwork took place over approximately two weeks, from September 22 to October 6, 2022. All work were done by a team of professional composed of biologists and wildlife technicians specialised in fish habitat and hydrology.

The global methodology of the project is summarized on maps 3 (Appendix 2).

2.1 Existing Data

The preparations preceding the inventories on the field were realized by compiling various sources of information including data transmitted by BBA inc. and associated consultants, as well as data available in the open databases mentioned below:

- Geobase of Quebec Hydrographic System /Géobase du réseau hydrographique du Québec (GRHQ) (MERN, 2019);
- Hydrographic Basins Database /Base de données des bassins hydrographiques (MELCC, 2019);
- Online & interactive ecoforestry maps Forêt Ouverte /Cartes écoforestières interactives « Forêt ouverte » (https://www.foretouverte.gouv.qc.ca/) (MFFP, 2022);
- Satellite imagery from Google Earth Pro©.

2.2 Waterbody Characterization

The lake and waterbody studied correspond to the ones that are susceptible to be impacted by the project on the basis of the different scenarios. Thus, each waterbody in the studied area has been thoroughly characterized (bathymetric survey, fish habitat characterisation and fish sampling) with a focus on lake PE1 and the surrounding area.

2.2.1 Fish Habitat Characterization

Waterbody targeted for this study where thoroughly traveled by boat. The physical characteristic of the waterbody was described mostly along homogenous segment of the shoreline. The characterisation focused on the following:

- Lakebed and shore substrate
- Riparian vegetation
- Bank slope, bank height, nature and erosion intensity
- Presence of aquatic grass bed and vegetation below the boundary of the littoral zone

- Presence of woody debris
- Presence of shoal
- Fish habitat potential: Spawning ground, nursery area, feeding area and shelter

Substrate and presence of aquatic vegetation are visually evaluated within the littoral. The littoral is divided into several longitudinal homogeneous bands (BH) in order to accurately describe the different substrate and vegetation assemblages within the littoral, when the distribution of these two elements is considered too heterogeneous. The percent cover of different substrate size classes was assessed according to the *Service de la Faune aquatique* (2011) methodology and according to the standard substrate classes presented in Table 1.

Table 1 Grain size class of substrate

Granulometric class	Code	Size
Roc or bedrock	R	-
Coarse boulder	Bx	> 500 mm
Boulder	B	250 à 500 mm
Cobble	Co	80 à 250 mm
Pebble	P	40 à 80 mm
Gravel	G	5 à 40 mm
Sand	Sa	0,125 à 5 mm
Silt	Si	< 0,125 mm
Clay	Cl	< 0,125 mm
Organic	O	-

Source : SFA, 2011.

The presence of potential fish habitat was assessed and documented, and the various potential habitats were located according to the method described in section 2.4.

2.2.2 Bathymetric Survey

2.2.2.1 Equipment and Precision

For the main lake (lake PE1) the bathymetric surveys were carried out from a motorized boat using a single beam echo sounder, model Echotrac CV100 from Odom Teledyne, whose optimum accuracy is 0.015 meters. The echo sounder was calibrated for substrate (gain, power) and water temperature (sound velocity) measured at the surface on the day of the surveys.

The data captured by the sonar was positioned in a terrestrial coordinate system using a high-precision GPS. The device used was a Trimble R12s operating in dual frequency mode. This device is compatible with GNSS satellite constellation. The optimal accuracy of this device is 0.010 meters in planimetry and 0.015 meters in altimetry.

The navigation system used was the Hypack hydrography software. This system recorded one (1) point per second, which allowed to draw an excellent picture of the riverbed. It should be noted that the bathymetric data was cross-checked on site during the surveys using a measuring tape.

For the other lakes of the study area, a Garmin 178 C sonar was used to register depth and position. The sonar optimal depth reading accuracy is about 0,10 meters and the GPS component of the device has an accuracy of approximately 3 meters.

2.2.2.2 Data Collection

The surveys were carried out following planned cross sections. For lake PE1, the area closest to the projected mining pit and from the outlet was travelled alonf a tight transect pattern set 50 meters apart. Further from the projected mining pit, a looser pattern where the transects were set 100 meters apart was followed. Longitudinal sections were also made in order to adequately grid the two areas. In most lakes, transect spacing varied between 25 and 100 meters.

Some small waterbodies or pond were not the subject of a bathymetric survey. In this case only the maximal depth was measured.

2.2.2.3 Data Processing

Data processing was carried out on the ArcGis 10.8.1 geomatics platform using the Spatial and 3D Analyst extensions. It aimed to ensure the quality of the data as well as to eliminate erroneous or aberrant data. Specifically, the data were:

- Corrected to revised GPS elevation, where applicable
- Manually cleaned to remove outliers
- Checked at intersections

A matrix called a “grid” was created from the cleaned bathymetric data. A grid is an interpolated surface formed by cells resulting from the intersection of columns and rows. A “Z-value” elevation is assigned to each cell by interpolating the sounding points collected during the bathymetric survey. The size of the cells is determined by the density of the bathymetric survey.

The data collected was used to calculate the area, volume, maximum depth, average depth, perimeter and shoreline development index of the water bodies. The Shoreline Development Index (SDI) is the ratio of the area of a lake to the area that a circle of circumference equal to the perimeter of the lake would have. An SDI of 1 is equivalent to a perfect circle, while a high SDI is associated with a long, jagged lake.

2.2.3 Water Physicochemistry

The measurement of physicochemical parameters was carried out using a YSI ProDSS multiparameter probe. The physicochemical profile of the water column was carried-out at the deepest part of the waterbody. The first measurement was taken at a depth of 0,5 m, then one measurement was done at each 0,5 m depth interval, till the last one is taken at 0,5 m from the bottom of the waterbody.

At each depth sampled, the following measurements were taken:

- Temperature (°C)
- Dissolved oxygen (% of saturation and mg/L)
- pH
- Conductivity (µs/cm)

A Secchi disk was also used to determine the photic zone of the waterbodies.

2.3 Watercourse Characterization

Studied watercourse correspond to the ones that are susceptible to be impacted by the project based on the different scenarios. Thus, stream in the studied area has been thoroughly characterized (bathymetric survey, fish habitat characterisation and fish sampling) with an emphasis on the hydrographic network downstream from lake PE1.

2.3.1 Fish Habitat Characterization

In order to obtain an accurate appreciation of the studied aquatic environment, the general characteristics of watercourse are assessed both quantitatively and qualitatively. The aquatic environment is divided along homogenous segment and initially intend to determine the flow type based on Malavoi and Souchon classification (2001).

Table 2 Description of the different categories of flow types

Flow Type	Description
Waterfall	Segment of a watercourse where the bed presents an abrupt change in level. The streambed is generally made of rock, sometimes with large boulders. They are obstacles to fish migration, often impassable.
Cascade	Staircase-like slope dominated by rock and large boulders. These are obstacles to fish migration that can be crossed or impassable, depending on the case.
Rapid	Slight break in the slope where the current is strong, the surface of the water is broken by the presence of coarse materials that are outcropping. The granulometry of the bed generally ranges from large blocks to pebbles.

Flow Type	Description
Riffles	A shallow area that forms a shoal or slight break in the slope of the streambed. The flow is fairly strong and the granulometry is usually in the gravel, pebble and cobble range.
Runs	Segment where the water depth is shallow (less than 60 cm) and the current is moderate. The surface of the water often has ripples due to the presence of substrate near the surface. The substrate is generally composed of coarse sand, gravel or pebbles.
Lotic channel	Segment where the depth of water, about 1 m or more, is relatively constant. The current is moderate to fast and the water surface remains relatively smooth. The granulometry is often coarser (gravel to cobble).
Flat	Segment where the water depth is shallow (less than 60 cm) and the current is slow. The water surface remains smooth. The granulometry of the substrate is fine (silt or sand).
Lentic channel	Segment where the depth of water, about 1 m or more, is relatively constant. The current is slow and the water surface remains smooth. The granulometry of the substrate if often fine (silt or sand).
Pool	A deep zone often located at the foot of an obstacle and usually corresponding to a widening of the watercourse. The current is slow, favoring sedimentation. The exception to this definition are the basins interspersed in the sections of the waterfalls and cascades: of smaller dimension, they are made up mainly of rock and coarse materials.

Source : adapted from Malavoi and Souchon, 2001.

For each homogeneous segment, the following measures were noted:

- The type and direction of flow
- The wetted width of the stream and width between the boundary of the littoral (BL width)
- An estimate of flow velocity, water level and water depth at the most representative locations of the segments as a whole
- Barrier to fish passage
- Bank slope, bank height, nature and intensity of erosion
- Type of substrate and evidence of clogging by fine particles
- The potential of fish habitat, the potential of spawning areas to be present, and the presence of shelter
- The percent cover of riparian and aquatic vegetation
- Anthropogenic disturbance

Slope and slope height were estimated visually while measurements of the dimensions and profile of each homogeneous segment, i.e., average depth as well as the wetted width of the section were calculated with a measuring tape. Current velocity was measured using a Swoffer 2100 current meter with a reading range of 0.03 to 7.5 m/s and an accuracy of 0.01 m/s. When the flow velocity is below the reading range of the instrument, a visual estimate of the velocity is made using a drifting object.

Substrate and presence of aquatic vegetation are visually assessed within the littoral. The littoral is divided into several longitudinal homogeneous bands to describe the different substrate and vegetation assemblages more accurately within the littoral, when the distribution of these two

elements is considered too heterogeneous. The percent of cover of different substrate size classes was assessed according to the *Service de la Faune aquatique* (2011) methodology and according to the classes presented in Table 1.

The measurement of physico-chemical parameters is carried out using a YSI ProDSS multiparameter probe. Measurements are taken at a location representative of the conditions found in the watercourses. Several stations can be carried out as needed to obtain a representative picture of the physico-chemical conditions associated with the watercourses.

The presence of potential fish habitat was assessed, and the various potential habitats were located according to the method described in section 2.4. Barriers to fish movement encountered during the characterization were also described and located. These can be impassable, impassable with reservation, passable with reservation or passable. An impassable obstacle is a major obstacle whose drop and/or configuration limits fish migration. An obstacle who is defined as been impassable with reservation is an obstacle that is impassable most of the time, but where configuration of the watercourse could allow, under certain hydrological conditions, the passage of fish (during periods of flood, for example). A conditionally passable barrier is a barrier to migration only under certain hydrological conditions (e.g., during low flow). A passable barrier is one that can be crossed without difficulty and therefore allows the free movement of fish (adapted from Boudreau, 1984).

A GPS point was taken at the beginning and end of each segment. Thus, the length of the segment was calculated with ArcGIS software.

2.3.2 Water Physicochemistry

The measurement of physicochemical parameters was carried out using a YSI ProDSS multiparameter probe. Only a surface physicochemistry measurement was done at a depth of 0,3 m.

The following measurements were taken:

- Temperature (°C)
- Dissolved oxygen (% of saturation and mg/L)
- pH
- Conductivity (µs/cm)

2.4 Fish Habitat Assessment

Fish presence assessment in a waterbody or watercourse is based on fish sampling and eDNA sampling results. It is classified according to the following categories:

- Confirmed: Fish caught/seen during conventional fish sampling.
- Not confirmed: No fish caught/seen by conventional fish sampling, but positive detection by eDNA sampling.
- Absent: No evidence of fish by both conventional and eDNA sampling.
- To be determined: No data available yet.

2.4.1 Fish Sampling

Fish sampling required the use of gillnets, hoop nets, bait traps, angling and opportunistic visual sighting. In watercourse, an electrofisher was used in addition to angling and visual sighting. The fishing method and effort has been applied in relation with the type and size of the waterbodies and in accordance with the Ministère des Forêts, de la Faune et des Parcs (MFFP) directive. The details concerning the fishing effort and the specific gear used in each lake and watercourse are given in the results. The characteristics of the fishing gear used are as follow:

- Gill net: 15,24 m long by 2,4 m heigh, 6 panel construct, walleye model.
- Alaskan hoop net: 1,82 m by 1,22 m frame, 7,01 m by 1,22 m wings and 2 cm mesh.
- small hoop net: 0,80 m by 0,80 m frame, 2 m by 0,80 m wings and 1 cm mesh.
- Bait trap: 60 cm long, 25 cm diameter and 2,5 cm entrance.
- Electrofisher: Smith-Root LR 24 electrofisher.

Use of nonlethal gear like hoop nets, electrofisher and bait traps was favoured over lethal engine like gill net, when possible, especially in small and shallower waterbody where hoop nets are effectives. Hoop nets and bait trap were wet for a maximum of one night and gill net had to be hauled every three hours to minimalize fish casualties as stipulated in the SEG permit issued by the MFFP. Thus, the effort unit for hoop net, gill net and bait trap is 1 hour. As for angling and electrofishing, the effort unit is respectively 1 minute and 1 second of effective fishing (line wet or continuous discharge).

The goal been to document fish presence and describe the fish community in term of species, the choice of gear, the setting depth and the localisation of the sampling station were determined to maximise catch and to thoroughly target the different habitat and thus fish diversity. Captured fish were identified to the species, counted and then returned to the water. In cases of casualties, the fish were given to the local community.

All sampling were done in accordance with the MFFP's inventory method standardisation guide (SFA, 2011).

The locations of the fish sampling stations are shown on map 3 (Appendix 2).

2.4.2 eDNA Sampling and Analysis

eDNA approach was used to further assess the species richness in strategically targeted lakes and streams in the potentially impacted area. Water samples were collected following the instructions and practices prescribed in the standard protocol for water sampling and sterilization procedures to determine the presence of wildlife species in water environments by eDNA analysis in Quebec (MFFP, 2021). Both the syringe and the pump method were for water sampling. All sampling equipment (sample bottle, syringe, filter, intake pump tubing etc.) was single use, with the exception of the sampling pole to which the sample bottle was attached in case of syringe sampling. The pole was used to minimize contact with the water body being sampled. The pole was carefully sterilized with a 20% bleach solution before each sampling and between stations.

Sample were filtered on-site directly after sampling. The filters containing the eDNA were individually bagged and identified.

To ensure that field manipulations did not cause contamination in the harvested sample, fields blank has been done for nearly one in two samples. The field blank is collected by filtering 250 ml of distilled water. Since the filters containing the sample are directly bagged individually on-site, no cooler blank was needed.

The location of the eDNA sampling stations is shown on map 3 (Appendix 2).

2.4.3 Fish Habitat Functions and Potential

Habitat functions (rearing, feeding, resting/sheltering, spawning, movement - including migration) were determined primarily on the basis of substrate composition, the presence of grass bed, and flow ftypes (watercourse only). They were assigned based on professional judgment, according to the species listed or potentially present and the life stage associated with the environments (fry, juvenile, adult, spawning).

Spawning potential was assessed using criteria established by the Ontario Ministry of Transportation (MTO, 2009) based on the major fish guilds potentially present, namely lithopelagic, whitewater lithophilic, stillwater lithophilic, stillwater phytolithophilic, phytophilic, psammophilic, pelagic, and speleophilic species (Table 3). The characteristics considered to establish spawning potential are flow velocity (if applicable), average depth, substrate size classes, and density of aquatic and semi-aquatic vegetation.

Table 3 Description of the different fish guilds based on reproduction preference.

Guildes	Type d'habitat utilisé pour la fraie
Lithopelagophilic	Deposit their eggs on a mineral substrate, eggs and larvae are pelagic.
Lithophilic	Deposit their eggs on a mineral substrate and the larvae remain in the substrate after hatching.
Pelagophilic	Lay their eggs in the water column.
Phytolithophilic	Deposit their eggs on various materials (mineral or plant) and the presence of plants is not mandatory.
Phytophilic	Deposit their eggs in plants and the larvae develop there.
Polyphilic	Lay their eggs on several types of substrat without preferences.
Speleophilic	Lay in cavities or under overhanging surfaces.
Psammophilic	Lay their eggs on sand

Adapted from MTO 2009.

When present, spawning sites are identified as confirmed or potential. Confirmed spawning areas are those where specific work or previous reliable data have identified spawning of a particular species (observation of spawning individuals or eggs). Potential spawning sites are those that have the characteristics of spawning sites but have not been confirmed for use.

Fish habitat potential in a waterbody or watercourse is, however, based on fishing results, habitat quality assessment and on connectivity between the habitats. Fish habitat potential is then classified according to the following categories:

- Confirmed: Fish caught/seen or direct connectivity without obstacle with a confirmed fish habitat.
- Likely: No evidence of fish, but habitat favorable to fish presence or/and connectivity uncertain with a confirmed fish habitat.
- Unlikely: No evidence of fish and fish habitat is marginal at best. No evident connectivity with a confirmed fish habitat or presence of obstacles to fish passage.
- No potential Habitat unsuitable for fish survival or no fish detected despite extensive fishing effort and absence of connectivity with a fish habitat.

3 Results

3.1 Lake PE1 Watershed

Within Lake PE1 Watershed, three lakes (including Lake PE1) and four distinct watercourses were studied. Lake PE1 is the main and largest waterbody of the study area and is the most likely to be impacted by the projected mining development. Indeed, the main mining pit might be located directly in the west sector of the lake. Thus, Lake PE1 has been thoroughly characterized and divided into two sectors, which are named sector West and East, sector East being less likely to be as severely impacted than sector West. The other waterbody of Lake PE1 watershed that were studied are two lakes upstream from Lake PE1, named lake PE325 and PE72. Lake PE325 was thought to be a continuity of Lake PE1, but field observation confirmed the presence of a stream featuring a riffle between Lake PE1 and the eastern part of the lake now known as PE325. Contrary to PE325, lake PE72 in clearly distinct of Lake PE1 and is situated upstream and southwest of the latter.

The studied watercourses in this watershed are all connected to the lakes mentioned above. The watercourses CE1 and CE19 are the outlet of Lake PE1 and lake PE72 respectively, whereas CE26 is a tributary to lake PE72 and CE27 connect Lake PE1 and PE325.

3.1.1 Waterbodies Characterization

Studied waterbodies of Lake PE1 watershed has been thoroughly characterized. To fully document the heterogeneity of the waterbodies, Lake PE1 has been divided into 96 homogeneous segments, whereas lakes PE325 and PE72 were characterized according to respectively 16 and 2 segments.

Detailed results from the characterization are presented segment-by-segment in Appendix 1 and on map 4 (Appendix 3), while the main characteristics of the waterbodies are summarized in Table 4.

Table 4 Characteristics of studied waterbodies in Lake PE1 Watershed

Waterbody	Maximal depth (m)	Shore composition (%)				Occurrence of fish habitat (ID)		
		Bedrock	Coarse Substrate	Fine substrate	Grass bed	Shoal	Potential spawning ground	Aquatic grass bed
Lake PE1 (West)	12,61	13,03	83,33	2,46	1,18	H10, H11, H16, H17, H23, H28, H30, H31, H38	-	H6, H9
Lake PE1 (East)	19,47	2,20	92,35	5,05	0,40	H12, H13, H15, H19-H22, H24-	H2, H7, H8	H1, H3-H5, H14

Waterbody	Maximal depth (m)	Shore composition (%)				Occurrence of fish habitat (ID)		
		Bedrock	Coarse Substrate	Fine substrate	Grass bed	Shoal	Potential spawning ground	Aquatic grass bed
						H27, H29, H32-H37		
PE325	6,08	0,89	99,11	0,00	0,00	H73, H75, H77-H79, H81-H84	H74, H76	H72, H80
PE72	UND	0,00	64,98	0,00	35,02	-	-	-

3.1.1.1 Lake PE1

Although Lake PE1 has been divided into 96 different homogeneous segments, coarse substrate covers most of the shoreline. Indeed, more than 80% of the shoreline is composed of coarse substrate, while bedrock, fine sediment and aquatic grass bed represents together less than 20% of the shoreline composition. Thus, segment segregation has often been done based on observable difference within the composition of subsequent coarse substate dominated segment rather than significant difference in the shoreline composition. In addition, a distinct segment was systematically created for each island encountered. It can also be observed that the shoreline composition is similar between the western and eastern sectors of Lake PE1, although bedrock occupies a larger portion of the western shoreline and fines substrates are more abundant on the eastern shoreline.

Many shoals were observed on Lake PE1, most of them being on the East sector of the lake (17 out of 26). Three potentials spawning grounds and seven grass beds were also observed during the characterization. These last are described in detail in section 3.1.5.4.

Photos 1 to 4 show the main types of shorelines observed during the characterization of the lake.

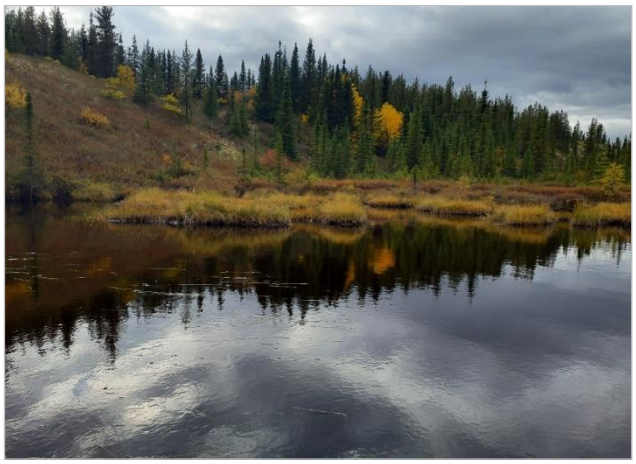


Photo 1. Aquatic grass bed on the shore of Lake PE1 segment SH7

Photo 2. Bedrock on the shore of Lake PE1 segment SH12

Photo 3. Coarse substrates compose the shoreline at segment Lake PE1 segment SH5

Photo 4. Fine substrate on shore of segment SH20 of Lake PE1

3.1.1.2 Lakes PE325 and PE72

Lake PE325 is located directly upstream of Lake PE1 and share similar characteristics. Indeed, the shoreline of lake PE325 is once again vastly dominated by coarse substrate (99 %). In fact, the coarse substrate occupies the entire bank except for one segment, where the bank is composed of bedrock (1 % of total shoreline). Shoals are also common in this lake, and some grass beds and a potential spawning ground has also been observed.

Lake PE72 is a relatively small lake located south-west and upstream from Lake PE1. Again, most of the lake shoreline show coarse substrate (65 %). However, the southwestern end of the lake is covered with aquatic grass beds (35 % of total shoreline).

Photos 5 to 8 show respectively the main types of shorelines observed during the characterization lake PE325 and PE72.

Photo 5. Coarse substrate on the shore of PE325 segment SH2

Photo 6. Bedrock on the shore of PE325 segment SH16

Photo 7. General appearance of shores on lake PE72 (SH1)

Photo 8. Grass beds on the shore of PE72 SH2

3.1.1.3 Bathymetry and Morphometry

Bathymetric surveys were conducted on Lake PE1 and lake PE325 in order to document the morphometry of those lakes. The results are presented on Table 5 and on maps 1 to 4 of Appendix 5.

Table 5 Morphometry of the studied waterbodies

Waterbody	Area (m)	Volume (m^3)	SDI	Depth (m)	
				Mean	Maximum
Lake PE1 (whole)	4 452 992	21 121 912	42,93	4,73	19,47
Lake PE1 (West only)	1 032 235	3 158 159	19,52	3,03	12,61
Lake PE1 (East only)	3 660 669	19 018 400	26,74	5,24	19,47
PE325	990 374	1 842 745	25,63	1,84	6,08

Lake PE1 show the highest area and volume of all studied lakes, with values of respectively 4 452 992 m^2 and 21 121 912 m^3. Of this area, the West sector of the lake occupy 1 032 235 m^2 whereas the East sector span over 3 660 669 m^2. PE325 is considerably smaller with an area of 990 374 ^{2} and a volume of 1 842 745 m^3.

The SDI is high for both Lake PE1 and PE325. Those high numbers correspond well to the shape of the lakes who are jagged and show many coves. It's interesting to note that the East sector of Lake PE1 show a higher SDI than the West sector of the lake. It's useful to recall that lakes with a high SDI are more likely to offer abundant riparian habitat for fish population.

Mean depth in Lake PE1 is around 4,7 m, whereas a maximum depth of 19,5 m is found near the center of the lake, in the western parts of the East sector. Depths are generally shallower in the West sector of the lake, with a mean depth of around 3 m. Depth in lake PE325 rarely reaches 4 meters and average around 2 m. The maximum depth is 6 m and can be found near the center of the lake.

3.1.1.4 Water Physicochemistry

Physicochemical data were taken on September 26, 2022, and October 1st respectively at Lake PE1 and lake PE72. At Lake PE1, the measurements did not reach the bottom of the lake because the reading cable of the probe was 10 meter long, thus the reading stop at 10 meters from the surface. Therefore, the physicochemical profile of the lake is incomplete. In addition, the thermocline was not detected during the fall survey. This may be due to the late nature of the surveys.

The location of the physicochemistry stations is presented on map 4 (Appendix 3).

Table 6 Physicochemical characteristics of waterbodies in the Lake PE1 watershed

PE ID	Station ID	station depth (m)	Secchi mean depth (m)	Photic zone lower limit (m)	Sampled Depth (m)	Water temperature (°C)	Dissolved oxygen		pH	Conductivity (µs/cm)
							%	mg/L		
PE1	PHY1	18,0	3,22	7,73	0,5	11,36	94,7	10,33	6,35	8
					1,0	11,35	95,5	10,45	6,28	8
					2,0	11,09	95,6	10,50	6,35	8
					3,0	11,05	94,9	10,45	6,26	8
					4,0	11,03	95,0	10,47	6,24	8
					5,0	11,01	94,6	10,43	6,24	8
					6,0	11,00	94,2	10,39	6,22	8
					7,0	10,99	94,4	10,42	6,22	8
					8,0	10,97	94,2	10,40	6,22	8
					9,0	10,89	93,9	10,35	6,25	8
					10,0	10,77	92,7	10,28	6,05	8
PE72	PHY20	1,0	UND	UND	0,5	6,30	85,6	10,73	6,03	10
			UND	UND	1,0	5,90	100	12,34	5,71	9

The data available suggest that Lake PE1 and PE72 are well oxygenated. Indeed, dissolved oxygen level are all over 10 mg/l. At a temperature of 10°C, the threshold for the protection of aquatic life

(chronic effect) relative to oxygen is set at 6 mg/L of dissolved O2 for cold water organisms and at 5 mg/L of dissolved O2 for warm water organisms. The value measured during our visit is largely above the above-mentioned thresholds and the environment is therefore suitable to aquatic life.

Measured pH values are generally between 6 and 6.5, which is within the tolerance range for most fish species (Binesse, 1983). However, the pH measured of 5.71 near the bottom of lake PE72 could be limiting for fish (Binesse, 1983).

Conductivity is lower than 10 µs/cm in these lakes, which indicates the very low productivity of these waterbodies (Binesse, 1983).

3.1.2 Watercourse Characterization

A total of four different watercourses has been studied in Lake PE1 watershed. Studied watercourses has all been extensively travelled and characterized. To fully document the watercourses, between one and five homogeneous segments were needed depending on the stream's heterogeneity.

Results from the characterization are presented segment-by-segment in Table 7 and on map 4 (Appendix 3).

Table 7 Characteristics of studied watercourse in Lake PE1 Watershed

CE	SH	Flow status	Main flow type	Wetted Width (m)	Littoral boundary Width (m)	Current velocity (m/s)	Mean Depth (m)	Dominant Substrate	Habitat ID
CE1	SH1	Perennial	Lentic channel	15,0	17,0	0,03	0,80	B, Bx, Co	-
	SH2	Perennial	Runs	7,0	9,2	0,50	0,50	B, Bx, Co	-
	SH3	Perennial	Pool	35,0	40,0	0,05	0,40	Co, B, Bx	-
	SH4	Perennial	Runs	7,0	9,0	0,60	0,60	B, Bx, Co	-
	SH5	Perennial	Cascade	5,0	7,0	1,00	0,30	Bx, B, R	-
CE19	SH1	Perennial	Underground	-		-	-	B	-
	SH2	Perennial	Flat	0,5	0,7	0,07	0,10	O	-
	SH3	Perennial	Underground	-	-	-	-	B	-
CE26	SH1	Perennial	Flat	1,0	UND	0,00	UND	O	H97
CE27	SH1	Perennial	Lentic channel	25,0	UND	0,00	UND	Co, P, G	-
	SH2	Perennial	Lotic channel	25,0	26,0	0,50	0,80	B, Bx, Co	-

CE	SH	Flow status	Main flow type	Wetted Width (m)	Littoral boundary Width (m)	Current velocity (m/s)	Mean Depth (m)	Dominant Substrate	Habitat ID
	SH3	Perennial	Runs	10,0	11,0	0,70	0,50	B, Bx, Co	-

CE = Watercourse ID; SH = Homogenous segment; O = Organic; Cl = Clay; Si = Silt; Sa = Sand; G = Gravel; P = Pebble; Co = Cobble; B = Boulder; Bx = Coarse boulder; R = Roc.

Studied streams in Lake PE1 watershed are all perennial and show a distinct streambed, except for CE19 where the flow is sometimes underground (SH1 and SH3).

CE1 and CE27, which are respectively Lake PE1 outlet and tributary, are the largest of the characterized stream in Lake PE1 watershed. Both offer varied flow type that goes from lotic to lentic environment and a coarse substrate dominated mostly by boulders. In contrast, CE19 is a relatively small stream, where the flow, when visible, is narrow and shallow. CE26 is characterized by an almost stagnant flow and a vast overflow plain on both side of the river.

Photos 9 to 12 show the general aspect of the studied streams.

Photo 9. Aspect of CE1 at SH4

Photo 10. Aspect of CE19 at SH2

Photo 11. Aspect of CE26 at SH1

Photo 12. Aspect of CE27 at SH2

3.1.2.1 Water Physicochemistry

Water physicochemistry was not conducted in watercourses of Lake PE1 watershed during the 2022 field campaigns, thus no data is presented in this section.

3.1.3 Fish Habitat Assessment

Conventional fish sampling and eDNA sampling were conducted to document the presence of fish and species richness of the water environments. These results allow us to determine confirmed and potential fish habitats at the scale of Lake PE1 watershed. Map 5 (Appendix 4) display the location of the sampling stations and the results of the fish habitat potential analysis.

3.1.3.1 Fish Sampling

In order to confirm the presence of fish in the Lake PE1 watershed and to document the ichthyological population, the CE1 stream, as well as lakes PE72 and Lake PE1 were the object of an experimental fishing effort. Lake PE1 was subject to the greatest fishing effort. In fact, in addition to angling, 10 bait traps were installed, as well as four gill nets and four hoop nets. In lake PE72, four bait traps and two hoop nets were installed, while stream CE1 was only fish by angling. The fishing effort confirmed the presence of fish in the studied waterbodies and watercourse of Lake PE1 watershed. In total, 37 fishes from 8 different species were captured. Table 8 presents the results of the fishing effort.

Table 8 Fishing result in Lake PE1 watershed

ID	Station	Gear	Effort	Number of captured individuals by species								CPUE
				SAFO	MAMA	LOLO	CACO	SANA	ESLU	RHAT	PRCY	
PE1	B01	Bait trap	19	-	-	-	-	-	-	-	-	0,000
	B02	Bait trap	19	-	-	-	-	-	-	-	-	0,000
	B03	Bait trap	19	-	1	-	-	-	-	-	-	0,053
	B04	Bait trap	19	-	-	-	-	-	-	-	-	0,000
	B05	Bait trap	20	-	3	-	-	-	-	-	-	0,150
	B06	Bait trap	22	-	-	-	-	-	-	-	-	0,000
	B07	Bait trap	22	-	-	-	-	-	-	-	-	0,000
	B08	Bait trap	22	-	-	1	-	-	-	-	-	0,045
	B09	Bait trap	22	-	-	-	-	-	-	-	-	0,000
	B10	Bait trap	22	-	-	-	-	-	-	-	-	0,000
	FM1	Gill net	3	-	-	-	2	-	-	-	-	0,667

ID	Station	Gear	Effort	Number of captured individuals by species								CPUE
				SAFO	MAMA	LOLO	CACO	SANA	ESLU	RHAT	PRCY	
	FM2	Gill net	2	-	-	-	-	1	-	-	-	0,500
	FM3	Gill net	6	-	-	-	2	1	-	-	-	0,500
	FM4	Gill net	5	-	-	-	-	-	-	-	-	0,000
	LP1	Fishing rod	15	-	-	-	-	-	1	-	-	0,067
	LP2	Fishing rod	15	-	-	-	-	-	1	-	-	0,067
	FA1	Hoop net	22	-	5	1	4	-	-	-	-	0,455
	FA2	Hoop net	23	-	-	-	-	-	-	-	-	0,000
	FA3	Hoop net	22	-	2	1	1	-	-	-	-	0,182
	FA4	Hoop net	20	-	2	-	-	-	-	-	-	0,100
	VS1	Visual sighting	NA	-	-	-	-	-	1	-	-	NA
	VS2	Visual sighting	NA	-	-	-	-	-	1	-	-	NA
PE 72	BO28	Bait trap	23	-	-	-	-	-	-	-	-	0,000
	BO29	Bait trap	23	-	-	-	-	-	-	-	-	0,000
	BO30	Bait trap	22	-	-	-	-	-	-	-	-	0,000
	BO31	Bait trap	23	-	-	-	-	-	-	-	-	0,000
	FA17	Hoop net	23	-	-	-	1	-	-	1	1	0,130
	FA18	Hoop net	22	-	-	1	1	-	-	-	-	0,091
CE1	LP4	Fishing rod	15	2	-	-	-	-	-	-	-	0,133
	LP5	Fishing rod	15	-	-	-	-	-	-	-	-	0,000

SAFO = Salvelinus fontinalis; MAMA – Margariscus margarita; LOLO = Lota lota; CACO = Catostomus commersonii; SANA = Salvelinus namaycus; ESLU = Esox lucius; RHAT = Rhinichthys atrtalutus; Prosopium cylindraceum; CPUE = Capture per unit of effort

3.1.3.2 eDNA Analysis

The analysis of the eDNA contained in the samples indicate de presence of 8 different fish species in lake PE1. It is interesting to note that among these species, four had not been inventoried in lake PE1 during the fishing effort: longnose sucker (*Catostomus Catostomus*), lake chub (*Couesius plumbus*), round whitefish (*Prosopium cylindraceum*) and a species of sculpin (*Cottidae sp*).

In lake PE72, the presence of three different fish species is hinted by the eDNA analytical results and among those, the pearl dace (*Margariscus margarita*) had not been found during the fishing effort. Table 9 presents the results of the eDNA analysis.

Table 9 Analytical results of the eDNA sampled in the Lake PE1 watershed

Lake ID	Station	Filter method	Species detected									
			CACA	MAMA	CACO	Cottidae sp	COPL	ESLU	LOLO	Salvelinus Sp	SANA	PRCY
PE1	ADNe1	Syringe	X	-	X	X	X	X	X	-	X	-
		Pump	X	-	X	X	X	X	X	-	X	-
	ADNe2	Pump	X	-	X	X	X	X	X	-	-	-
	ADNe3	Pump	X	-	X	X	X	X	X	-	-	-
	ADNe4	Pump	X	-	X	X	X	X	X	X	-	X
	ADNe5	Syringe	X	-	-	-	-	-	-	-	-	-
		Pump	-	-	X	X	X	X	X	-	-	-
	Blanc1	Pump	-	-	-	-	-	-	-	-	-	-
PE72	ADNe6	Pump	-	X	-	-	-	-	X	X	-	-
	ADNe7	Syringe	-	X	-	-	-	-	-	-	-	-
		Pump	-	X	-	-	-	-	X	-	-	-
	Blanc2	Pump	-	-	-	-	-	-	-	-	-	-

CACA = Castostomus Catostomus; MAMA = Margariscus margarita; CACO = Catastomus commersonii; COPL = Couesius plumbus; ESLU = Esox lucius; LOLO = Lota lota; SANA = Salvelinus namaycus; PRCY = Prosopium cylindraceum.

3.1.3.3 Fish Habitat Functions and Potential

In general, the lakes and streams characterized in the lake PE1 watershed present interesting conditions for aquatic wildlife. Table 10 summarizes the habitat potential characterized and the fish presence assessment. Map 5 (Appendix 4) shows the different habitats observed in the PE1 watershed.

Lake PE1, because of its dimensions and characteristics, offers quality habitat that can potentially support a large and diverse fish population. Indeed, its developed shoreline and the presence of coarse substrate along the shore is conducive to the growth of young fish, while the presence of significant depth found in the lake is also suitable for the larger fish associated with the deeper waterbody, such as lake trout (*Salvelinus namaycus*). Furthermore, the abundance of rocky shoal observed in the lake is also conducive to fish feeding, in addition to being able to provide refuge for small specimens. In addition, some shorelines offer clean, coarse substrate where the grain size, depth, slope, and presence of nearby pools are appropriate to lake trout spawning. This is for instance the case for the habitats identified as H2, H7 and H8, located in the east sector of the lake and described in Table 11. Lake PE1 is generally poor in aquatic vegetation, although some aquatic grass beds were observed in the eastern sector of the lake (H1, H3 to H5 and H14). These aquatic grass beds can be used for fish rearing, feeding, and spawning of phytophilic species, such as northern pike (*Esox lucius*).

Lake PE325 provides similar conditions to Lake PE1 in terms of shoreline development and prevailing substrate characteristics. However, the generally much shallower depth is less favorable to certain species of fish such as lake trout. The conditions are nonetheless generally favourable to the feeding and growth of fish. Aquatic vegetation is rare in this lake and no aquatic grass beds were observed during the characterization. It was also observed during the passage in the sector that two of the tributaries of the lake present conditions favourable to the spawning of lithophilic fish such as brook trout (*Salvelinus fontinalis*).

Lake PE72, on the other hand, is much smaller and has a richly vegetated shoreline, especially at its western tip, where the shoreline presents a vast floodplain. This lake doesn't seem to offer many opportunities for lithophile spawning, however the floodplain is interesting for spring spawning phytophile fish, like northern pike. In general, the waterbody offers favourable conditions for rearing and foraging.

The quality of habitat provided by streams in the watershed varies considerably in terms of habitat function and quality from one stream to another. The CE1 stream is characterized by an alternance of whitewater and pool sections, where conditions are conducive to the feeding of certain fish species, such as salmonids. Stream CE27 also has similar habitat conditions. Indeed, the transition between the lentic and lotic environment is also favourable to fish feeding. CE26, which is a tributary of lake 72, shows large aquatic grass beds on both sides of the stream. Thus, CE26 is a quality habitat for rearing and spawning of phytophilic fish. CE19 in the other hand doesn’t show promising fish habitat. Indeed, most of the stream is underground.

The analysis of the characteristics of the watercourses and waterbodies, the fishing results, and the connectivity of the water network make it possible to affirm that all the environments characterized in Lake PE1 watershed are frequented by fish, as shown on map 5 (Appendix 4). Thus, every studied stream and lake in the watershed are to be considered as fish habitat.

Table 10 Fish habitat overview in lake PE1 watershed

PE / CE ID	Spawning potential		Rearing	Feeding	Habitat ID			Fish presence	Fish habitat potential
	Lithophil	Phytophil			Shoal	Potential spawning ground	Aquatic grass bed		
Lake PE1 (west)	Low	Low	Low	High	H10, H11, H16, H17, H23, H28, H30, H31, H38	-	H6, H9	Confirmed	Confirmed
Lake PE1 (East)	Average	Average	Average	High	H12, H13, H15, H19-H22, H24-H27, H29, H32-H37	H2, H7, H8	H1, H3-H5, H14, H18	Confirmed	Confirmed
PE325	Low to average	Low	Average	High	H73, H75, H77-H79, H81-H84	H74, H76	-	Confirmed	Confirmed
PE72	Marginal	High	High	High	-	-	-	Confirmed	Confirmed
CE1	Low	None	Low	High	-	-	-	Confirmed	Confirmed
CE19	None	None	None	None	-	-	-	To be determined	Unlikely
CE26	None	High	High	Average	-	-	H97	Confirmed	Confirmed
CE27	Low	None	Low	High	-	-	-	Confirmed	Confirmed

3.1.3.4 Specific Habitat Description

A total of 49 fish habitat were identified in the studied waterbodies and watercourses of Lake PE1 watershed (Table 10). Most of them are shoals (36) observed in lake PE1, although 9 aquatics grass beds and 5 potentials spawning grounds were observed as well.

Aquatic grass beds are generally composed of emerged plants that could not be identified and that covers between 80 and 100 % of the habitat. Some submerged plants are also present, mainly water-milfoil (*Myriophyllum* sp.).

Gravel composes most of the spawning ground substrate, but pebble is also dominant in some habitat.

Table 11 presents the characteristics of 14 different habitats of interest observed. Map 5 shows the different habitats observed in the Lake PE1 watershed.

Table 11 Habitat description in lake PE1 watershed

Waterbody / Watercourse ID	Habitat ID	Area (m^2)	Mean depth (m)	Substrate composition	% aquatic vegetation cover		
					Emergent	Flooded	Floating
PE1	H1	150	0,4	O	100	0	0
	H2	400	1,0	Co, B, P	0	0	0
	H3	100	0,0	O	100	0	0
	H4	30	0,0	O	100	0	0
	H5	100	0,0	O	80	0	0
	H6	100	0,0	O	100	0	0
	H7	500	0,5	Co, B, P, G	0	0	0
	H8	250	0,5	Co, B	0	0	0
	H9	250	1,0	O	30	15	15
	H14	50	0,5	SA, B, BX, S	0	30	0
	H18	50	2,0	UND	0	15	15
PE325	H74	100	0,15	G, P, Co	0	0	0
	H76	100	0,15	G, P, B, Co	0	30	10
CE27	H97	2000	0,0	O	90	0	0

3.2 La Grande A Watershed

Within La Grande A Watershed, fourteen lakes and twenty-seven distinct watercourses were studied. This watershed can be represented in three sectors corresponding to three strings of streams and waterbodies flowing from east to west. The south sector, downstream of lake PE2, is the most likely to be impacted by the projected mining development. Indeed, the water could be deviated in those watercourses and waterbodies depending on the size of the main mining pit, possibly located south. Lake PE2 is the main waterbody in this watershed and has been thoroughly characterized. Lakes PE18, PE61, PE62 and PE63 are upstream of lake PE2 while lakes PE3 to PE10 are downstream.

The studied watercourses in this watershed are all connected to the lakes. The watercourses CE5 being the outlet of lake PE2, whereas CE10, CE20, CE32 and CE54 are its tributaries. Map 4 (Appendix 3) show the studied watercourses and waterbodies.

3.2.1 Waterbodies Characterization

Studied waterbodies of La Grande A watershed have been thoroughly characterized. An average of 5 homogeneous segments were used to describe the heterogeneity of the waterbodies in this watershed, although for lake PE2 and PE7, respectively 20 and 13 segments were caracterized.

It is also interesting to note that according to *Environment Quality Act* of Québec, some waterbodies (PE4, PE5, PE11 and PE63) are instead considered wetlands (ponds) since their low water level are less than 2 m (EQA, c. Q-2, r. 0.1). As a precaution, waterbodies with water levels only sightly above 2 m were considered as lakes even if the maximal depth may be less then 2 m during dryer months. For instance, PE6 will require a second validation in the field during the low water period to confirm its status as lake or wetland.

In order to present the general characterization of the studied waterbodies in the following sections, the waterbodies were regrouped into four groups:

- Lakes PE18 and PE63, upstream of PE2.
- Lake PE2 and its tributary PE61.
- Lakes PE3, PE4, PE5, PE6, PE7 and PE8; forming a string downstream of PE2.
- PE9, PE10, PE11 and PE12.

Detailed results from the characterization are presented segment-by-segment in Appendix 1 and on map 4 (Appendix 3), while the main characteristics of the waterbodies are summarized in Table 12.

Table 12 Characteristics of studied waterbodies in La Grande A Watershed

Waterbody	Pond or lake	Maximal depth (m)	Shore composition (%)				Occurrence of fish habitat (ID)		
			Bedrock	Coarse Substrate	Fine substrate	Grass bed	Shoal	Potential spawning ground	Aquatic grass bed
PE2	Lake	6,17	0,00	92,53	6,62	0,84	H40, H42, H43, H45	-	H46
PE3	Lake	3,18	0,00	57,51	12,72	29,77	-	-	H46-H49
PE4	Pond	1,42	0,00	100,00	0,00	0,00	-	-	H50-H53
PE5	Pond	1,87	0,00	26,23	0,00	73,77	-	-	H54, H55
PE6	Lake	2,34	0,00	0,00	0,00	100,00	-	-	H56
PE7	Lake	3,53	0,00	72,55	17,41	10,04	-	H58	H59
PE8	Lake	3,68	0,00	0,00	0,00	100,00	-	-	H60-H62
PE9	Lake	UND	4,69	45,01	0,00	50,31	-	-	H63
PE10	Lake	UND	26,04	25,06	11,74	37,16	-	-	H64
PE11	Pond	1,71	0,00	0,00	0,00	100,00	-	-	-
PE12	Lake	UND	0,00	34,17	65,83	0,00	-	-	H65, H66
PE18	Lake	UND	0,00	70,65	29,35	0,00	-	-	-
PE61	Lake	UND	0,00	31,39	68,61	0,00	-	-	H71
PE63	Pond	< 1,00	0,00	0,00	0,00	0,00	-	-	-

3.2.1.1 Lake PE18 and P63

Lakes PE18 and PE63 are upstream of lake PE2 and directly connected to it by separate streams, (watercourse CE20 for PE18 and watercourse CE31 for PE63).

Only one homogenous segment was necessary to represent Lake PE63 while three homogeneous segments were used to describe Lake PE18, where coarse substrate covers most of the shoreline. Indeed, 70.65 % of the shoreline is composed of coarse substrate, while fine sediment covers 29.35 % of the shoreline composition.

Field surveys confirm that waterbody PE63 is not a lake, but rather a pond (wetland) according to provincial legislation in Quebec. Since the water depth was approximately of 5 cm when visited, no physicochemical parameters could be measured.

Photos 13 and 14 show the main types of shorelines observed during the characterization of the lake PE18 and PE63.

Photo 13. Coarse substrate on the shore of Lake PE18 segment SH1

Photo 14. Aspect of PE63 segment SH1

3.2.1.2 Lake PE2 and PE61

Lake PE2 is the main lake in La Grande A watershed and PE61 is one of its tributaries, which is directly connected via watercourse CE10.

Although Lake PE2 has been divided into 20 different homogeneous segments, coarse substrate covers most of the shoreline (92.53 %). On the other hand, lake PE61 has been divided into 6 different homogeneous segments and is mostly represented by fine substrate, which covers 68.61 %.

Four shoals were observed on Lake PE2, most of them being on the eastern sector of the lake (around segment SH4). Four grass beds were also observed during the characterization of this lake and another one was observed during the characterization of lake PE61.

Photos 15 to 18 show the main type of shorelines observed during the characterization of the lakes PE2 and PE61.

Photo 15. Coarse substrate on the shore of Lake PE2 segment SH1

Photo 16. Aquatic grass bed on the shore of Lake PE2 segment SH16

Photo 17. Fine substrate on the shore of Lake PE61 segment SH3

Photo 18. Aquatic grass bed on the shore of Lake PE61 segment SH6

3.2.1.3 Lake PE3, PE4, PE5, PE6, PE7 and PE8

These lakes are all located downstream of lake PE2. Waterbody PE4 is directly connected to the latter and to PE3 by two distinct tributaries, respectively CE5 and CE6. Then, downstream of PE4 is PE5 and PE7 while PE6 and PE8 appears to be isolated waterbodies.

Lake PE3 has been divided into 5 homogeneous segments while PE7 has been divided in thirteen segments. Both waterbodies have a shoreline mostly covered by coarse substrate. In fact, coarse substrate represents 57.51 % of lake PE3 and 72.55 % of lake PE7shoreline composition.

Waterbodies PE4 and PE5, as previously mentioned, are deemed to be ponds (wetlands) instead of lakes because their maximal depth is less than 2 m. They were described by respectively 2 and 3 different homogeneous segments. The shoreline of PE4 is composed of coarse substrate, which covers 100 % of it, whereas coarse substrate only covers 26.23 % of PE5 shoreline. The latter being mostly composed of grass bed that covers 73.77 %.

Only one homogeneous segment was necessary to describe Lake PE6 and PE8. The shoreline composition of the two waterbodies is covered by grass bed, which represents 100 % of it.

Photos 19 to 30 show the main type of shoreline and potential fish habitat observed during the characterization of the lakes PE3, PE4, PE5, PE6, PE7 and PE8.

Photo 19. Coarse substrate on the shore of Lake PE3 segment SH2

Photo 20. Aquatic grass bed of Lake PE3 segment SH5

Photo 21. Coarse substrate on the shore of Lake PE4 segment SH1

Photo 22. Aquatic grass bed of Lake PE4 segment SH2

Photo 23. Grass bed on the shore of Lake PE5 segment SH3

Photo 24. Aquatic grass bed of Lake PE5 segment SH2

Photo 25. Grass bed on the shore of Lake PE6 segment SH1

Photo 26. Aquatic grass bed of Lake PE6 segment SH1

Photo 27. Coarse substrate on the shore of Lake PE7 segment SH6

Photo 28. Potential spawning ground of Lake PE7 segment SH9

Photo 29. Grass bed on the shore of Lake PE8 segment SH1

Photo 30. Aquatic grass bed of Lake PE8 segment SH1

3.2.1.4 Lake PE9, PE10, PE11 and PE12

Lakes PE9 and PE12 are mainly connected to lake PE10 via watercourses CE13/CE11 and CE3, respectively. Also, waterbody PE11 is directly upstream of PE9 and connected to it by stream CE14.

Lake PE9 has been divided into 8 different homogeneous segments while PE10 was divided into 9 segments, but aquatic grass bed covers the higher shore composition for both these lakes. Indeed, aquatic grass beds represents 37.16 % of lake PE10 and 50.31 % of lake PE9. Coarse substrate also covers an important proportion of lake PE9 shoreline, with 45.01 %.

Waterbody PE11, as previously mentioned, is considered a wetland (pond) instead of a waterbody because of its water depth of less than 2 m. Only one homogeneous segment was necessary to describe the shoreline, which is represented by 100 % of grass bed.

Lake PE12, further north-east than the three previous, has been divided into 3 different homogeneous segments and fine substrate composes most of the shoreline with 65.83 % while coarse sediment covers 34.17 % of the shoreline composition.

A few potential fish habitats were observed including one for lakes PE9 and PE10 and two for lake PE12. They are all aquatic grass beds.

Photos 31 to 38 show the main types of shorelines observed during the characterization of the lakes PE9, PE10, PE11 and PE12.

Photo 31. Grass bed on the shore of Lake PE9 segment SH4

Photo 32. Aquatic grass bed of Lake PE9 segment SH1

Photo 33. Grass bed on the shore of Lake PE10 segment SH6

Photo 34. Aquatic grass bed of Lake PE10 segment SH4

Photo 35. Aspect of Lake PE11 segment SH1

Photo 36. Coarse substrate on the shore of Lake PE12 segment SH3

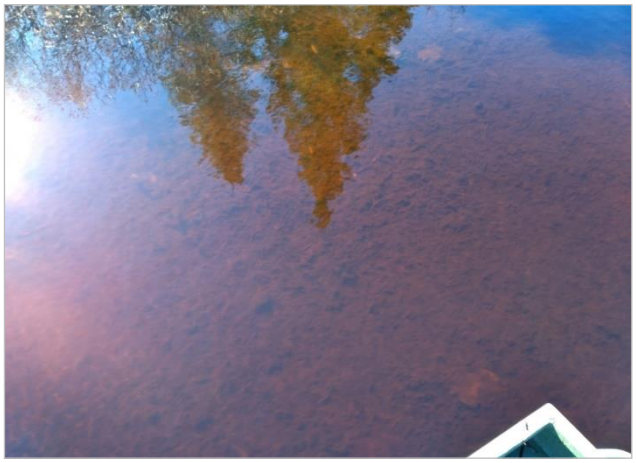


Photo 37. Fine sediments on the shore of Lake PE12 segment SH2

Photo 38. Aquatic grass bed of Lake PE12 segment SH2

3.2.1.5 Bathymetry and Morphometry

Bathymetric surveys were conducted on 8 waterbodies (Lake PE2 to PE8 and Lake PE11) in order to document their morphometry. The results are presented on Table 13 and on maps 5 to 12 of appendix 5.

Table 13 Morphometry of the studied waterbodies

Waterbody	Area (m)	Volume (m^3)	SDI	Depth (m)	
				Mean	Maximum
PE2	235 661	511 354	5,80	2,17	6,17
PE3	11 378	15 992	1,50	1,41	3,18
PE4	5 410	2 552	3,57	0,47	1,42
PE5	5 652	1 187	3,07	0,21	1,87
PE6	1 068	1 526	1,14	1,43	2.34
PE7	44 566	41 950	9,30	0,94	3,53
PE8	4 421	6 273	1,53	1,42	3,68
PE11	1 350	1 052	1,44	0,78	1,71

Lake PE2 has the largest area and volume of all studied lakes in this watershed, with values of respectively 235 661 m^2 and 511 354 m^3. By contrast, lake PE6 is the smallest with an area of 1 068 m^2 and lake PE11 is the one with the smallest volume (1 052 m^3).

The SDI is low for the studied waterbodies of La Grande A watershed. Those numbers correspond roughly to the shape of a circle, meaning that the lakes are of regular shape. The highest SDI is calculated on lake PE7 which has an elongated and narrow shape.

Mean depth in Lake PE2 is around 2,17 m, whereas a maximum depth of 6,17 m is found near the center-east of the lake. Depths are generally shallower in the West sector of the lake, with a mean depth of around 2 m. The center of lake PE2 is composed of two sectors reaching a depth of 5 m that are separated by an area of shallow water. The other lakes in the watershed are shallower with an average depth of about 1 m and a maximum depth of roughly 2 m.

3.2.1.6 Water Physicochemistry

Physicochemical data (Table 14) were taken between September 24th, 2022, and October 4th. The thermocline was not detected in any of the waterbodies during the fall survey. This may be due to the shallowness of some waterbodies or the late nature of the surveys.

The location of the physicochemistry stations is presented on map 4 (Appendix 3).

Table 14 Physicochemical characteristics of waterbodies in the La Grande A watershed

CE/PE ID	Station ID	station depth (m)	Secchi mean depth (m)	Photic zone lower limit (m)	Sampled Depth (m)	Water temperature (°C)	Dissolved oxygen		pH	Conductivity (µs/cm)
							%	mg/L		
PE2	PHY2	5,0	-	-	0,3	10.3	96.0	10.80	6.76	13.0
					0.5	9.6	95.3	10.87	6.68	12.0
					1.0	9.4	94.1	10.75	6.65	13.0
					2.0	9.3	93.0	10.64	6.68	13.0
					3.0	9.0	91.0	10.51	6.61	13.0
					4.5	8.9	80.0	10.15	6.56	13.0
PE4	PHY3	1.0	-	-	0.3	10.0	92.1	10.37	5.93	11.0
					0.5	10.0	91.3	10.32	5.84	13.0
					1.0	10.0	92.0	10.35	6.20	14.0
PE5	PHY4	1.0	-	-	0.3	10.2	95.0	10.70	5.63	13.0
					0.5	10.2	94.3	10.65	4.90	13.0
					1.0	10.2	92.0	10.35	4.71	14.0
PE6	PHY5	1.9	1.9	1.9	0.3	9.3	97.8	11.23	7.36	14.0
					0.5	9.3	97.3	11.20	7.29	13.0
					1.0	9.3	97.8	11.21	7.30	14.0
					1.5	9.3	97.3	11.20	7.29	14.0
PE7	PHY6	2.6	-	-	0.3	9.6	101.0	11.52	6.84	10.0
PE8	PHY7	2.4	2.2	2.4	0.3	8.7	95.9	11.12	6.69	15.0
					0.5	8.7	95.3	11.10	6.69	15.0
					1.0	8.7	94.8	11.00	6.72	15.0
					1.5	8.7	94.2	10.99	4.70	14.0
					2.0	8.7	94.5	11.01	6.70	14.0
PE9	PHY8	0.3	-	-	0.3	7.3	99.6	12.01	6.32	13.0
PE10	PHY9	2.0	-	-	0.3	8.2	101.8	11.99	6.59	9.0
PE11	PHY10	0.3	-	-	0.3	7.4	94.4	11.34	5.64	14.4
PE12	PHY11	1.3	1.3	1.3	0.3	6.1	95.1	11.82	5.78	15.6
					0.5	6.1	95.1	11.82	5.92	15.6

CE/PE ID	Station ID	station depth (m)	Secchi mean depth (m)	Photic zone lower limit (m)	Sampled Depth (m)	Water temperature (°C)	Dissolved oxygen		pH	Conductivity (µs/cm)
							%	mg/L		
					1.0	6.1	95.2	11.83	5.99	15.6
PE18	PHY13	1.2	0.9	1.2	0.3	5.7	93.2	11.68	5.92	13.4
					1.0	5.7	92.8	11.64	5.95	13.4
PE61	PHY19	2.5	1.9	2.5	0.3	6.5	93.2	11.45	6.05	16.9
					1.0	6.5	92.8	11.41	6.31	16.9
					2.0	6.4	92.4	11.38	6.37	16.9
					2.5	6.0	88.5	11.10	6.46	17.0

The data available suggest that all studied waterbodies in this watershed are well oxygenated. Indeed, dissolved oxygen level are all over 10 mg/L. As previously mentioned, the threshold for the protection of aquatic life relative to oxygen is set at 6 mg/L of dissolved O2 for cold water organisms and at 5 mg/L of dissolved O2 for warm water organisms when temperature is 10°C while it is set at 7 mg/L of dissolved O2 for cold water organisms and at 6 mg/L of dissolved O2 for warm water organisms when temperature is 5°C. The value measured during our visit is largely above the above-mentioned thresholds and the environment is therefore suitable to aquatic life.

Measured pH values are generally between 4.7 and 7.4, which is partly below and partly within the tolerance range for most fish species (Binesse, 1983). Survival of many fish is compromised when pH is below 6, which is recorded in four waterbodies (lake PE5 and PE11, surface of lake PE12 and near bottom of lake PE8). On the contrary, measured pH revolving around neutrality (pH = 7) indicates a well suiting habitat for normal aquatic life (Binesse, 1983). Lakes PE2, PE6, PE7, most of PE8, PE9, PE10 and PE19 therefore are in optimal pH range for most fish species.

Conductivity is mostly between 9 and 17 µs/cm in these lakes, which indicates the very low productivity of these waterbodies (Binesse, 1983).

3.2.2 Watercourse Characterization

A total of twenty-seven different watercourses were studied in La Grande A watershed. Studied watercourses were all extensively travelled but only half of them were fully characterized due to lack of time during the fall survey. The characterization of these watercourses will be completed during the next surveys. To fully document the watercourses, between one and eleven homogeneous segments were needed depending on the stream's heterogeneity.

Most of the studied streams (20 out of 27) in La Grande A watershed are completely perennial as well as segment SH4 of stream CE32. The flow status of three streams (CE29, CE32 and part of

CE34 and CE36) is intermittent while another stream (CE30) is a runoff. Additionally, the homogenous segment SH2 of stream CE20 and SH1 of CE36 are reputed as wetlands. The watercourse CE9 and CE12 are deemed to be non-existent, which means that no watercourse seems to connect the waterbodies PE7 and PE8 (map 4, Appendix 3). Stream CE34 also has a non-existing section (segment SH1). Homogeneous segments mainly offer flat flow type (for 33 segments), but runs (15), lentic channel (12) and underground (12) flow types are also relatively common. Some riffle (3), lotic channel (2), rapid (1) and pool (1) flow types are present as well.

Twelve potential fish habitats were identified among six of the characterized streams. Those habitats will be further described in section 3.2.5.3.

Results from the characterization are presented segment-by-segment in Table 15 and on map 4 (Appendix 3).

Photos 39 to 65 show the general aspect of the studied streams.

Table 15 Characteristics of studied watercourse in La Grande A Watershed

CE ID	SH	Flow status	Main flow type	Wetted Width (m)	Littoral boundary Width (m)	Current velocity (m/s)	Mean Depth (m)	Dominant Substrate	Habitat ID
CE2	SH1	Perennial	Lentic channel	UND	UND	UND	UND	UND	-
	SH2	Perennial	Riffle	UND	UND	UND	UND	UND	-
	SH3	Perennial	Flat	UND	UND	UND	UND	UND	-
	SH4	Perennial	Flat	UND	UND	UND	UND	UND	-
CE3	SH1	Perennial	Flat	UND	UND	UND	UND	UND	-
	SH2	Perennial	Underground	-	-	-	-	-	-
	SH3	Perennial	Flat	UND	UND	UND	UND	UND	-
	SH4	Perennial	Runs	UND	UND	UND	UND	UND	-
	SH5	Perennial	Flat	UND	UND	UND	UND	UND	-
	SH6	Perennial	Underground	-	-	-	-	-	-
CE4	SH1	Perennial	Underground	-	-	-	-	-	-
	SH2	Perennial	Flat	UND	UND	UND	UND	UND	-
CE5	SH1	Perennial	Rapid	1.5	2.5	0.60	0.15	B, Bx, R	-
	SH2	Perennial	Flat	3.5-8.0	5.0-8.8	0.05-0.15	0.30	B, Bx, Co	H85
	SH3	Perennial	Underground	-	-	-	-	-	-
	SH4	Perennial	Flat	2.0	2.6	0.15	0.1	Co, P, B	-
	SH5	Perennial	Pool	5.0	7.0	0.01	0.90	B, O, P	-
	SH6	Perennial	Flat	5.0	5.8	0.10	0.25	Co, B, P	H86, H88
	SH7	Perennial	Runs	1.2	2.2	0.25	0.10	Co, B, O	-

CE ID	SH	Flow status	Main flow type	Wetted Width (m)	Littoral boundary Width (m)	Current velocity (m/s)	Mean Depth (m)	Dominant Substrate	Habitat ID
	SH8	Perennial	Flat	1.2	4.0	0.05	0.25	Co, P, G	-
CE6	SH1	Perennial	Flat	1.0	3.0	0.05	0.10	Co, B, G	-
CE7	SH1	Perennial	Runs	2.5	9.0	0.50	0.20	Co, B, R, P	H89
	SH2	Perennial	Riffle	2.0	5.0	0.55	0.10	B, Co, Bx	-
	SH3	Perennial	Riffle	2.0	3.2	0.50	0.10	B, Bx, O	-
CE8	SH1	Perennial	Runs	1.2	2.2	0.35	0.20	Co, B, P, O	-
	SH2	Perennial	Lentic channel	5.5	9.0	0.01	0.65	B, O, P	H90
	SH3	Perennial	Runs	2.0	4.0	0.30	0.15	Co, P, G, B	H91
	SH4	Perennial	Flat	4.0	8.0	0.10	0.40	Sa, O, Co	-
	SH5	Perennial	Flat	5.5	10.0	0.01	0.40	O, Bx	-
CE9	SH1	Non-existent	-	-	-	-	-	-	-
CE10	SH1	Perennial	Flat	UND	UND	UND	UND	UND	-
	SH2	Perennial	Runs	UND	UND	UND	UND	UND	-
	SH3	Perennial	Underground	-	-	-	-	-	-
	SH4	Perennial	Flat	UND	UND	UND	UND	UND	-
CE11	SH1	Perennial	Lentic channel	17-40	35-41	0.10	0.80	Co, B, Sa	
	SH2	Perennial	Runs	12.0	13.0	0.50	0.20	P, Co, B, Sa	
	SH3	Perennial	Flat	15.0	17.0	0.25	0.60	Sa, O, Bx	
	SH4	Perennial	Runs	15.0	16.0	0.35	0.35	P, Co, B	
	SH5	Perennial	Flat	15.0	17.0	0.10	0.60	B, O, Sa, G	H92, H93, H94
	SH6	Perennial	Lentic channel	19,5	21,0	0,10	0,70	G, P, O, Sa	
	SH7	Perennial	Lentic channel	10.0	14.0	0.10	0.75	Sa, O, Co	
	SH8	Perennial	Runs	10.0	11.0	0.40	0.50	Co, B, P	
	SH9	Perennial	Lentic channel	18.0	19.0	0.30	0.70	B, Co, Bx	
	SH10	Perennial	Runs	15.0	17.5	0.40	0.50	B, Co, Bx	
	SH11	Perennial	Lotic channel	28.0	29.0	0.15	0.75	Sa, G, O	
CE12	SH1	Non-existent	-	-	-	-	-	-	-
CE13	SH1	Perennial	Flat	1.0	2.4	0.15	0.40	P, Co, G, O	-
CE14	SH1	Perennial	Flat	0.3	1.0	0.01	0.20	O	-
CE15	SH1	Perennial	Lentic channel	20.0	28.0	0.02	1.30	Sa, O	-
	SH2	Perennial	Runs	1.0	14.0	0.30	0.60	Co, B, P, Bx	-
	SH3	Perennial	Lentic channel	15.0	16.0	0.10	1.00	Sa, O, G	-
	SH4	Perennial	Runs	13.0	14.0	0.50	0.40	B, Co	-

CE ID	SH	Flow status	Main flow type	Wetted Width (m)	Littoral boundary Width (m)	Current velocity (m/s)	Mean Depth (m)	Dominant Substrate	Habitat ID
	SH5	Perennial	Lentic channel	45.0	48.0	0.10	0.70	Sa, O, B	-
	SH6	Perennial	Runs	25.0	27.0	0.40	0.50	Co, Sa, B	-
	SH7	Perennial	Lentic channel	45.0	48.0	0.10	0.90	Sa, O	-
	SH8	Perennial	Lotic channel	21.0	23.0	0.30	0.75	Co, P, B	-
	SH9	Perennial	Lentic channel	30.0	31.0	0.10	0.80	B, Co, P, Sa	-
CE20	SH1	Perennial	Flat	UND	UND	UND	UND	UND	-
	SH2	Wetland	-	-	-	-	-	-	-
	SH3	Perennial	Underground	-	-	-	-	-	-
	SH4	Perennial	Lentic channel	UND	UND	UND	UND	UND	-
CE28	SH1	Perennial	Flat	UND	UND	UND	UND	UND	-
CE29	SH1	Intermittent	Flat	UND	UND	UND	UND	UND	-
	SH2	Intermittent	Underground	-	-	-	-	-	-
CE30	SH1	Runoff	-	-	-	-	-	-	-
CE31	SH1	Perennial	Underground	-	-	-	-	-	-
	SH2	Perennial	Underground	-	-	-	-	-	-
	SH3	Perennial	Flat	UND	UND	UND	UND	UND	-
CE32	SH1	Intermittent	Underground	-	-	-	-	-	-
	SH2	Intermittent	Flat	UND	UND	UND	UND	UND	-
	SH3	Intermittent	Underground	-	-	-	-	-	-
	SH4	Perennial	Flat	UND	UND	UND	UND	UND	-
CE33	SH1	Perennial	Flat	UND	UND	UND	UND	UND	H98, H99
CE34	SH1	Non-existent	-	-	-	-	-	-	-
	SH2	Intermittent	Flat	UND	UND	UND	UND	UND	-
CE35	SH1	Perennial	Flat	UND	UND	UND	UND	UND	-
	SH2	Perennial	Underground	-	-	-	-	-	-
CE36	SH1	Wetland	-	-	-	-	-	-	-
	SH2	Intermittent	Underground	-	-	-	-	-	-
CE53	SH1	Perennial	Runs	UND	UND	UND	UND	UND	H111
	SH2	Perennial	Underground	-	-	-	-	-	-
CE54	SH1	Perennial	Flat	UND	UND	UND	UND	UND	-
	SH2	Perennial	Flat	UND	UND	UND	UND	UND	-
CE55	SH1	Perennial	Runs	UND	UND	UND	UND	UND	-

CE = Watercourse ID; SH = Homogenous segment; O = Organic; Cl = Clay; Si = Silt; Sa = Sand; G = Gravel; P = Pebble; Co = Cobble; B = Boulder; Bx = Coarse boulder; R = Roc.

UND = Undetermined (characterization will be completed during the next surveys)

Photo 39. Aspect of CE2 at SH1

Photo 40. Aspect of CE3 at SH3

Photo 41. Aspect of CE4 at SH2

Photo 42. Aspect of CE5 at SH4

Photo 43. Aspect of CE6 at SH5

Photo 44. Aspect of CE7 at SH3

Photo 45. Aspect of CE8 at SH4

Photo 46. Aspect of CE9 at SH1

Photo 47. Aspect of CE10 at SH1

Photo 48. Aspect of CE11 at SH1

Photo 49. Aspect of CE12 at SH1

Photo 50. Aspect of CE13 at SH1

Photo 51. Aspect of CE14 at SH1

Photo 52. Aspect of CE15 at SH5

Photo 53. Aspect of CE20 at SH4

Photo 54. Aspect of CE28 at SH1

Photo 55. Aspect of CE29 at SH1

Photo 56. Aspect of CE30 at SH1

Photo 57. Aspect of CE31 at SH2

Photo 58. Aspect of CE32 at SH2

Photo 59. Aspect of CE33 at SH1

Photo 60. Aspect of CE34 at SH2

Photo 61. Aspect of CE35 at SH1

Photo 62. Aspect of CE36 at SH2

Photo 63. Aspect of CE53 at SH1

Photo 64. Aspect of CE54 at SH2

Photo 65. Aspect of CE55 at SH1

3.2.2.1 Water Physicochemistry

Physicochemical data were taken between September 24th, 2022, and October 4th. Table 16 presents the physicochemical characteristics of studied watercourse in the La Grande A watershed.

The location of the physicochemistry stations is presented on map 4 (Appendix 3).

Table 16 Physicochemical characteristics of watercourses in the La Grande A watershed

CE ID	Station ID	station depth (m)	Sampled Depth (m)	Water temperature (°C)	Dissolved oxygen		pH	Conductivity (µs/cm)
					%	mg/L		
CE2	PHY31	0.2	0.3	6.8	89.9	10.97	5.89	15.4
	PHY32	0.2	0.3	6.0	82.3	10.23	5.81	16.3
CE4	PHY33	0.3	0.3	6.8	97.4	11.90	5.49	12.7
CE8	PHY34	0.2	0.3	8.4	102.0	11.95	5.32	12.0
	PHY35	0.3	0.3	8.4	102.0	11.90	5.68	13.0
CE11	PHY36	0.6	0.3	8.7	98.8	11.50	6.28	9.6
CE28	PHY40	0.1	0.3	7.4	69.7	8.40	4.84	15.7
CE29	PHY41	0.1	0.3	6.7	83.6	10.23	4.82	17.7
CE31	PHY42	0.2	0.3	8.5	85.4	9.99	4.71	20.1
CE32	PHY43	0.2	0.3	6.7	63.9	7.82	4.78	19.0
CE33	PHY44	0.2	0.3	6.5	86.8	10.70	5.21	53.1
CE34	PHY45	0.1	0.3	7.0	75.6	9.18	4.95	22.3
CE35	PHY46	0.2	0.3	7.0	84.5	10.26	4.56	14.3
CE36	PHY47	0.1	0.3	7.5	80.1	9.57	4.90	17.5
CE53	PHY61	0.1	0.3	6.6	90.7	11.13	5.46	21.1
CE54	PHY62	0.4	0.3	8.2	69.4	8.19	4.38	33.9
CE20	PHY64	0.2	0.3	6.0	88.7	11.03	5.69	13.6
CE10	PHY65	0.2	0.3	6.4	91.0	11.22	5.95	17.9

The data available suggest that every studied and watercourse in this watershed are well oxygenated. Indeed, dissolved oxygen level are all over 7 mg/L. As previously mentioned, the threshold for the protection of aquatic life relative to oxygen is set at 6 mg/L of dissolved O2 for cold water organisms and at 5 mg/L of dissolved O2 for warm water organisms when temperature is 10°C while it is set at 7 mg/L of dissolved O2 for cold water organisms and at 6 mg/L of dissolved

O2 for warm water organisms when temperature is 5°C. The value measured during our visit is largely above the above-mentioned thresholds and the environment is therefore suitable to aquatic life.

Measured pH values are generally between 4.3 and 6.2, which is mainly below the tolerance range for most fish species (Binesse, 1983). Survival of many fish is compromised when pH is below 6, which is recorded in every studied watercourse, CE11 excepted. On the contrary, measured pH revolving around neutrality (pH = 7) indicates a well suiting habitat for normal aquatic life (Binesse, 1983). Watercourse CE11 therefore is in optimal pH range for most fish species.

Conductivity is mostly between 9 and 33 µs/cm, which indicates the very low productivity of these watercourse, except for CE33 that shows a low productivity with 53 µs/cm (Binesse, 1983).

3.2.3 Fish Habitat Assessment

Conventional fish sampling and eDNA sampling were conducted to document the presence of fish and species richness of the water environments. These results allow us to determine confirmed and potential fish habitats at the scale of La Grande A watershed. Map 5 (Appendix 4) display the location of the sampling stations and the results of the fish habitat potential analysis.

3.2.3.1 Fish Sampling

In order to confirm the presence of fish in the La Grande A watershed and to document the ichthyological population, 10 lakes and 8 streams of the watershed were the object of an experimental fishing effort. Lake PE2 was the waterbody subject to the greatest fishing effort. In fact, in addition to angling and visual sighting, 4 bait traps as well as 4 hoop nets were installed. The fishing effort confirmed the presence of fish in some of the studied waterbodies and watercourse of La Grande A watershed. In total, 118 fishes from 6 different species were captured. Table 17 presents the results of the fishing effort.

Table 17 Fishing result in La Grande A Watershed

ID	Station	Gear	Effort	Number of captured individuals by species						CPUE
				SAFO	MAMA	LOLO	CACO	ESLU	Cyprinidae sp.	
PE2	BO11	Bait trap	22	-	-	-	-	-	-	0,000
	BO12	Bait trap	22	-	-	-	-	-	-	0,000
	BO13	Bait trap	23	-	-	-	-	-	-	0,000

ID	Station	Gear	Effort	Number of captured individuals by species						CPUE
				SAFO	MAMA	LOLO	CACO	ESLU	Cyprinidae sp.	
	BO14	Bait trap	22	-	-	-	-	-	-	0,000
	FA5	Hoop net	21	-	-	-	-	-	-	0,000
	FA6	Hoop net	20	-	-	-	-	-	-	0,000
	FA7	Hoop net	20	-	-	-	-	-	-	0,000
	FA8	Hoop net	19	-	-	-	-	-	-	0,000
	LP3	Fishing rod	15	-	-	-	-	1	-	0,067
	VS3	Visual Sighting	-	-	-	-	-	1	-	-
	VS4	Visual Sighting	-	-	-	-	-	1	-	-
	VS5	Visual Sighting	-	-	-	-	-	1	-	-
	VS6	Visual Sighting	-	-	-	-	-	2	-	-
PE3	BO15	Bait trap	22	-	1	-	-	-	-	0,045
	BO16	Bait trap	22	-	-	-	-	-	-	0,000
	BO17	Bait trap	22	-	-	-	-	-	-	0,000
	BO18	Bait trap	22	-	1	-	-	-	-	0,045
	FA10	Hoop net	20	-	-	-	4	-	-	0,200
	FA9	Hoop net	20	-	-	-	78	-	-	3,900
PE5	VS7	Visual Sighting	-	-	-	-	-	1	-	-
PE6	BO19	Bait trap	21	-	-	-	-	-	-	0,000
	BO20	Bait trap	21	-	-	-	-	-	-	0,000
	BO21	Bait trap	21	-	-	-	-	-	-	0,000
	BO22	Bait trap	21	-	-	-	-	-	-	0,000
	FA11	Hoop net	21	-	-	-	-	-	-	0,000
	FA12	Hoop net	22	-	-	-	-	-	-	0,000
PE7	FA13	Hoop net	20	-	-	2	-	-	-	0,100
	VS8	Visual Sighting	-	-	-	-	-	1	-	-
PE8	BO23	Bait trap	21	-	-	-	-	-	-	0,000
	BO24	Bait trap	22	-	-	-	-	-	-	0,000
	FA14	Hoop net	21	-	-	-	-	-	-	0,000
	FA15	Hoop net	21	-	-	-	-	-	-	0,000

ID	Station	Gear	Effort	Number of captured individuals by species						CPUE
				SAFO	MAMA	LOLO	CACO	ESLU	Cyprinidae sp.	
PE9	VS9	Visual Sighting	-	-	-	-	-	1	-	-
PE10	FA19	Hoop net	19	-	1	1	-	-	-	0,105
	VS10	Visual Sighting	-	-	-	-	-	1	-	-
	BO26	Bait trap	25	-	-	-	-	-	-	0,000
	BO27	Bait trap	25	-	1	-	-	-	-	0,040
PE11	BO25	Bait trap	17	-	-	-	-	-	-	0,000
	FA16	Hoop net	17	-	-	-	6	-	-	0,353
PE17	VS12	Visual sighting	-	-	-	-	-	-	4	-
PE63	EF4	Electrofishing	27	-	-	-	-	-	-	0,000
CE3	EF18	Electrofishing	150	6	-	-	-	-	-	0,040
CE4	EF19	Electrofishing	83	-	-	-	-	-	-	0,000
CE11	VS11	Visual Sighting	-	-	-	-	-	1	-	-
CE14	VS10	Visual Sighting	-	-	-	-	1	-	-	-
CE28	EF1	Electrofishing	204	-	1	-	-	-	-	0,005
CE31	EF2	Electrofishing	71	-	-	-	-	-	-	0,000
CE32	EF3	Electrofishing	31	-	-	-	-	-	-	0,000
CE54	EF17	Electrofishing	134	-	-	-	-	-	-	0,000

SAFO = *Salvelinus fontinalis*; MAMA – *Margariscus margarita*; LOLO = *Lota lota*; CACO = *Catostomus commersonii*; ESLU = *Esox lucius*; CPUE = Capture per unit of effort

3.2.3.2 eDNA Sampling and Analysis

The analysis of the eDNA contained in the samples indicate de presence of 10 different fish species in lake PE2 and PE10. Moreover, six of those species represents an addition to the ones identified during the fishing effort in those lakes: longnose sucker (*Catostomus Catostomus*), lake chub (*Couesius plumbus*), round whitefish (*Prosopium cylindraceum*), lake trout (*Salvelinus namaycus*) as well as a species of sculpin (*Cottidae* sp.) and a species of carp (*Hypophthalmichthys* sp), the latter being certainly a mistake from the lab. Indeed, this genus of carp is not likely to be found in the study area. Furthermore, it is possible that a DNA sample belonging to a genetically related species for which the laboratory does not have a primer, for example a cyprin, was amplified by default with the primer of the genus hypophthalmichthys.

Among the species found during the fishing effort in lakes PE3, PE10 and watercourse CE28, note that the pearl dace (*Margariscus margarita*) was not identify by the eDNA analytical results. Table 18 presents the results of the eDNA analysis.

Table 18 Analytical results of the eDNA sampled in the La Grande A watershed

Lake ID	Station	Filter method	Species detected									
			CACA	SA sp.	CACO	HY sp	COPL	ESLU	LOLO	CO sp	SANA	PRCY
PE2	ADNe8	Syringe	-	-	-	X	-	X	X	-	-	-
		Pump	X	-	X	-	X	X	X	X	-	-
	ADNe9	Pump	-	-	-	-	-	-	X	-	-	-
	Blanc 9	Pump	-	-	-	-	-	-	-	-	-	-
PE10	ADNe10	Syringe	X	X	X	-	X	X	-	X	X	X
		Pump	X	X	X	-	X	X	X	X	-	-
	Blanc 10	Pump	-	-	-	-	-	-	-	-	-	-
PE63	ADNe11	Syringe	-	-	-	-	-	-	-	-	-	-
		Pump	-	-	-	-	-	-	-	-	-	-
	Blanc 11	Pump	-	-	-	-	-	-	-	-	-	-

CACA = *Castostomus Catostomus*; SA sp = *Salvelinus* sp.; CACO = *Catastomus commersonii*; HY sp = Hypophthalmichthys sp; COPL = *Couesius plumbus*; ESLU = *Esox lucius*; LOLO = *Lota lota*; CO sp = *Cottidae* sp; SANA = *Salvelinus namaycus*; PRCY = *Prosopium cylindraceum*.

3.2.3.3 Fish Habitat Functions and Potential

In general, the lakes characterized in the La Grande A watershed show interesting conditions for aquatic wildlife. Streams however generally offer fewer interesting conditions, with some exceptions. Table 19 summarizes the habitat potential characterized and the classified fish presence.

Lake PE2 presents a relatively good spawning potential for phytophilic fishes such as northern pike, who was observed in this waterbody during the fish sampling, while the many shoals surveyed indicates high feeding potential. Lake PE3 demonstrate a high potential for spawning of phytophilic species and rearing habitat. In fact, many longnose suckers were caught there during fish sampling efforts. In general, condition in Lake doesn't show a lot of potential in PE7, but the potential is high regarding feeding habitat.

Lakes PE5 and PE8 do not seem favourable for rearing and reproduction since the measured pH, below 5.5, could be limiting for the fish. Nevertheless, the presence of aquatic grass bed offers interesting feeding habitat and refuge to certain small species. PE63, also, do not show adequate fish habitat as the very low water level could jeopardize the survival of fish during the winter season.

Only few streams are manifesting fine conditions for fish habitat. For instance, stream CE5 presents an alternation of flow types going from lentic to lotic and from flat to pool in addition to the presence of some aquatic grass beds which offers excellent potential for fish feeding. Stream CE11 is the

one with the best potential among the studied streams in this watershed with high potential for phytophilic species spawning, rearing, and feeding habitats. Furthermore, potential spawning grounds on gravel have been observed along with brook trout fries and young northern pike. CE11 also shows aquatic grass bed that represents high potential feeding habitat.

On the contrary, half of the characterized streams demonstrate none, marginal or low fish habitat potential. Although potential spawning sites were listed in stream CE8, the measured pH could be limiting for fish rearing and reproduction. The same explanation applies for watercourses CE28, CE29, CE33, CE34 and CE53.

The analysis of the characteristics of the watercourses and waterbodies, the fishing results, and the connectivity of the water network make it possible to affirm that almost all the environments characterized in La Grande A watershed are frequented by fish, as shown on map 5 (Appendix 4). Among the waterbodies, 11 of them demonstrate confirmed or likely fish habitat potential while the other 3 are considered unlikely or no potential for fish habitat potential. For the watercourses, only 3 of them shows no potential (CE30, CE31 and CE36) while all others are confirmed fish habitats or are susceptible to be used by fish.

Table 19 Fish habitat overview in La Grande A watershed

PE / CE ID	Spawning potential		Rearing	Feeding	Habitat ID			Fish Presence	Fish Habitat Potential
	Lithophil	Phytophil			Shoal	Potential spawning ground	Aquatic grass bed		
PE2	Low	Low to average	Low	High	H40, H42, H43, H45	-	H46	Confirmed	Confirmed
PE3	Marginal	High	High	Average	-	-	H47-H49	Confirmed	Confirmed
PE4	Low	Average to High	Average	Average	-	-	H50-H53	Confirmed	Confirmed
PE5	Marginal	Low	Low	Average	-	-	H54, H55	Confirmed	Confirmed
PE6	Marginal	Average	Average	Low	-	-	H56	To be determined	Unlikely
PE7	Low to average	Average	Average	High	-	H58	H59	Confirmed	Confirmed
PE8	None	Low	None	Average	-	-	H60-H62	To be determined	Unlikely
PE9	Low	Average	Average	Average	-	-	H63	Confirmed	Confirmed
PE10	Low	Average	Average	Average	-	-	H64	Confirmed	Confirmed
PE11	None	Average	Average	Average	-	-	-	Confirmed	Confirmed
PE12	Marginal	Average	Average	Average	-	-	H65, H66	Confirmed	Confirmed
PE17	UND	UND	UND	UND	-	-	-	Confirmed	Confirmed

PE / CE ID	Spawning potential		Rearing	Feeding	Habitat ID			Fish Presence	Fish Habitat Potential
	Lithophil	Phytophil			Shoal	Potential spawning ground	Aquatic grass bed		
PE18	Low to average	Low	Average	Average	-	-	-	To be determined	Likely
PE61	Low	Low	Average	Average	-	-	H71	To be determined	Likely
PE63	None	None	None	None	-	-	-	Absent	No potential
CE2	Low	Marginal	Low	Average	-	-	-	Confirmed	Confirmed
CE3	Marginal	Marginal	Low	Low	-	-	-	Confirmed	Confirmed
CE4	None	Average	Average	Low	-	-	-	To be determined	Unlikely
CE5	Low to average	Average	Average	High	-	-	H85, H86	Confirmed	Confirmed
CE7	Low to average	Low	Low	Average	-	-	H89	Confirmed	Confirmed
CE8	Average	Low	Low	Low	-	H90, H91	-	Confirmed	Confirmed
CE10	None	Average	Average	Low	-	-	-	Confirmed	Confirmed
CE11	Average	High	High	High	-	H92, H93	H94	Confirmed	Confirmed
CE13	Marginal	Low	Average	Low	-	-	-	Confirmed	Confirmed
CE14	None	Low	Average	Marginal	-	-	-	Confirmed	Confirmed
CE15	Average	Low	Low	Average	-	-	-	Confirmed	Confirmed
CE20	None	Low	Low	Marginal	-	-	-	Confirmed	Confirmed
CE28	None	None	Marginal	Marginal	-	-	-	Confirmed	Confirmed
CE29	None	None	Marginal	Marginal	-	-	-	Confirmed	Confirmed
CE30	None	None	None	None	-	-	-	Absent	No potential
CE31	None	None	None	None	-	-	-	Absent	No potential
CE32	None	None	Marginal	Marginal	-	-	-	Confirmed	Confirmed
CE33	Marginal	None	Marginal	Marginal	-	H98	H99	To be determined	Likely
CE34	None	Low	Marginal	Marginal	-	-	-	To be determined	Likely
CE35	None	None	Marginal	Marginal	-	-	-	To be determined	Likely
CE36	None	None	None	None	-	-	-	Absent	No potential

PE / CE ID	Spawning potential		Rearing	Feeding	Habitat ID			Fish Presence	Fish Habitat Potential
	Lithophil	Phytophil			Shoal	Potential spawning ground	Aquatic grass bed		
CE53	Low	Marginal	Low	Marginal	-	H111	-	Confirmed	Confirmed
CE54	None	None	Marginal	Marginal	-	-	-	Confirmed	Confirmed
CE55	None	None	Marginal	Marginal	-	-	-	Confirmed	Confirmed

3.2.3.4 Specific Habitat Description

A total of 35 fish habitat were identified in the studied waterbodies and watercourses of La Grande A watershed (Table 19). Most of them are aquatic grass beds (24), but 4 shoals and 7 spawning grounds were observed as well.

Aquatic grass beds are generally composed of emerged plants such as sedge (*Carex* sp.) and horsetail (*Equisetum* sp.) that covers between 30 and 100 % of the habitat. Some submerged plants are also present, mainly bur-reed (*Sparganium* sp.) and pondweed (*Potamogeton* sp.).

Gravel composes most of the spawning ground substrate, but pebble and cobble are also dominant in some habitat.

Table 20 presents the characteristics of 32 different habitats of interest observed. Map 5 (Appendix 4) shows the different habitats observed in the La Grande A watershed.

Table 20 Habitat description in La Grande A watershed

Waterbody / Watercourse ID	Habitat ID	Area (m^2)	Mean depth (m)	Substrate composition	% aquatic vegetation cover		
					Emergent	Flooded	Floating
PE2	H46	50	0.15	O	80	0	0
PE3	H47	140	0.45	O	40	0	5
	H48	650	0.45	O	35	0	10
	H49	500	0.00	O	80	0	0
PE4	H50	130	0.00	O	80	0	0
	H51	350	0.00	O	70	0	0
	H52	40	0.00	O	60	0	0
	H53	800	0.00	O	50	0	0
PE5	H54	1000	0.10	O	75	0	0

Waterbody / Watercourse ID	Habitat ID	Area (m^2)	Mean depth (m)	Substrate composition	% aquatic vegetation cover		
					Emergent	Flooded	Floating
	H55	65	0.00	O	90	0	0
PE6	H56	315	0.00	O	95	0	0
PE7	H58	25	0.25	G, O, Sa	0	0	0
	H59	1500	0.00	O	80	0	0
PE8	H60	75	0.00	O	95	0	0
	H61	75	0.00	O	80	0	0
	H62	65	0.02	O	80	0	0
PE9	H63	660	0.05	O	60	0	0
PE10	H64	350	0.30	O	0	75	0
PE12	H65	2500	0.05	O	90	0	0
	H66	750	0.05	O	80	0	0
PE61	H71	50	0.30	O	30	0	20
CE5	H85	200	0.50	O	50	50	0
	H86	80	1.00	O	30	70	0
CE7	H89	10	0.50	Sa	0	0	0
CE8	H90	6	0.15	G, P, Co, Sa	0	0	0
	H91	20	0.15	Co, P, Sa	0	0	0
CE11	H92	240	0.40	G, Sa	0	0	0
	H93	8	0.40	G, Sa	0	0	0
	H94	50	0.05	O	85	0	0
CE33	H98	5	0.10	G, P, Sa	0	0	0
	H99	350	0.00	P	100	0	0
CE53	H111	8	0.10	P, G, Sa	0	0	0

3.3 La Grande B Watershed

Within La Grande B Watershed, seven lakes and sixteen distinct watercourses were studied. In this watershed, the characterization effort was mainly aimed at confirming the status of small waterbodies in the sector, as well as validating the hydrographic connectivity between the various

waterbodies and watercourses. Thus the lakes and rivers whose status is easily verifiable cartographically were not visited during this campaign. Studied watercourses and waterbodies are identified on map 4 (Appendix 3).

3.3.1 Waterbodies Characterization

Studied waterbodies of La Grande B watershed has been thoroughly characterized. Only one homogeneous segment was needed to describe each characterized waterbody.

It is also interesting to note that according to *Environment Quality Act* of Québec, waterbodies PE160 and PE186 are instead considered as wetlands (ponds) since their low water level is less than 2 m (EAQ, c. Q-2, r. 0.1). Subsequently, other waterbodies were considered as lakes even if the maximal depth was only slightly more than 2 m and may be below 2 m during dryer months. For instance, some waterbodies (PE159, PE161 and PE184) will require a second validation in the field during the low water period to confirm their status as lake or wetland.

Detailed results from the characterization are presented segment-by-segment in Appendix 1 and on map 4 (Appendix 3), while the main characteristics of the waterbodies are summarized in Table 21.

Table 21 Characteristics of studied waterbodies in La Grande B Watershed

Waterbody	Pond or lake	Maximal depth (m)	Shore composition (%)				Occurrence of fish habitat (ID)		
			Bedrock	Coarse Substrate	Fine substrate	Grass bed	Shoal	Potential spawning ground	Aquatic grass bed
PE159	Lake	2.7	0.00	0.00	0.00	100.00	-	-	-
PE160	Pond	1.7	0.00	0.00	0.00	100.00	-	-	-
PE161	Lake	2.1	0.00	0.00	0.00	100.00	-	-	-
PE184	Lake	2.6	0.00	0.00	0.00	100.00	-	-	-
PE186	Pond	<2.0	0.00	0.00	0.00	100.00	-	-	-
PE188	Lake	>2.0	0.00	0.00	0.00	100.00	-	-	-
PE211	Lake	2.6	0.00	0.00	0.00	100.00	-	-	-

Every studied waterbody of this watershed are modest in size and presents a shoreline composition of 100 % grass bed. No occurrence of potential fish habitat was reported following the 2022 fall survey.

Photos 66 to 72 show the main types of shorelines observed during the characterization of each studied waterbody in La Grande B watershed.

Photo 66. Grass bed on the shore of PE159 segment SH1

Photo 67. Grass bed on the shore of PE160 segment SH1

Photo 68. Grass bed on the shore of Lake PE161 segment SH1

Photo 69. Grass bed on the shore of Lake PE184 segment SH1

Photo 70. Grass bed on the shore of PE186 segment SH1

Photo 71. Grass bed on the shore of Lake PE188 segment SH1

Photo 72. Grass bed on the shore of Lake PE211 segment SH1

3.3.1.1 Bathymetry and Morphometry

Bathymetric surveys were not conducted in La Grande B watershed; thus no data is presented in this section.

3.3.1.2 Water Physicochemistry

Physicochemical data (Table 22) were taken between September 27th, 2022, and September 30th. Furthermore, the thermocline was not detected in any of the waterbodies during the fall survey. This may be due to the shallowness of some waterbodies or the late nature of the surveys.

The location of the physicochemistry stations is presented on map 4 (Appendix 3).

Table 22 Physicochemical characteristics of waterbodies in the La Grande B watershed

CE/PE ID	Station ID	station depth (m)	Secchi mean depth (m)	Photic zone lower limit (m)	Sampled Depth (m)	Water temperature (°C)	Dissolved oxygen		pH	Conductivity (µs/cm)
							%	mg/L		
PE159	PHY21	2.7	1.4	2.7	0.3	7.3	67.3	8.09	4.59	15.6
					1.0	7.2	62.7	7.51	4.77	16.7
					2.0	6.6	39.5	4.05	5.07	26.6
					2.5	6.5	28.2	3.34	5.57	44.0
PE160	PHY22	1.7	1.4	1.7	0.3	8.0	73.5	8.71	4.72	10.5
					1.0	8.0	72.6	8.61	4.81	10.4
					1.5	7.9	72.1	8.56	4.82	10.4
PE161	PHY23	2.1	1.1	2.1	0.3	8.3	73.7	8.67	4.38	12.7
					1.0	8.2	73.3	8.63	4.47	12.6
					2.0	8.2	72.9	8.59	4.55	12.6
PE184	PHY24	2.6	1.3	2.6	0.3	8.6	76.9	8.96	5.77	37.8
					1.0	8.6	75.6	8.82	5.96	37.8
					2.0	8.5	75.2	8.79	6.02	37.9
					2.5	8.4	71.7	8.49	6.17	37.9
PE186	PHY25	0.3	-	-	0.3	8.9	95.3	11.03	3.53	16.2
PE188	PHY26	1.8	1.6	1.8	0.3	9.7	89.6	10.19	5.83	23.8
					1.0	9.7	88.9	10.12	6.04	23.8
					2.0	9.7	88.1	10.03	6.15	24.4
PE221	PHY27	2.6	-	-	0.3	7.3	83.0	9.97	3.82	16.9
					1.0	7.3	82.2	9.90	3.86	16.8
					2.0	7.3	81.9	9.86	3.85	16.8
					2.5	7.3	81.4	9.82	3.93	16.9

The data available suggest that most of the studied waterbodies are well oxygenated. Indeed, dissolved oxygen level are all over 8 mg/L, except for the bottom of PE159. At a temperature of 10°C, protection of aquatic life relative to oxygen is set at 6 mg/L of dissolved O2 for cold water organisms and at 5 mg/L of dissolved O2 for warm water organisms while it is set at 7 mg/L of dissolved O2 for cold water organisms and at 6 mg/L of dissolved O2 for warm water organisms when temperature is 5°C. The value measured during our visit is above the above-mentioned

thresholds and the environment is therefore suitable to aquatic life. However, bottom of waterbody PE159 could be limiting for aquatic life as the dissolved O2 is below 5 mg/L.

Measured pH values are generally between 3.5 and 6.2, which is below the tolerance range for most fish species and therefore are limiting for fish (Binesse, 1983). However, the pH measured of 6 and higher near the bottom of lake PE184 and PE188 could allow a normal life cycle for fish (Binesse, 1983).

Conductivity is lower than 45 µs/cm in these lakes, which indicates the very low productivity of these waterbodies (Binesse, 1983).

3.3.2 Watercourse Characterization

A total of sixteen different watercourses were studied in La Grande B watershed. Studied watercourses has all been extensively travelled but were summarily characterized due to lack of time during the fall survey. The characterization of these watercourse will be completed during the next field campaigns. To document the watercourses, between one and four homogeneous segments were needed depending on the stream's heterogeneity.

Many streams of this watershed are completely perennial (8 out of 17 watercourses) and so are two segments from watercourse CE47. Five streams and 4 additional segments showed an intermittent flow status. Also, 2 segments are deemed non-existent (in CE50 and CE51). Homogeneous segments mainly offer underground flow type (21 out of 40 segments), but flats (14) are also common. Some runs (2) are presents as well.

No potential fish habitat was observed during the 2022 fall survey among the seventeen characterized streams.

Results from the characterization are presented segment-by-segment in Table 23 and on map 4 (Appendix 3).

Photos 73 to 88 show the general aspect of the studied streams.

Table 23 Characteristics of studied watercourse in La Grande B Watershed

CE ID	SH	Flow status	Main flow type	Wetted Width (m)	Current velocity (m/s)	Mean Depth (m)	Dominant Substrate	Habitat ID
CE37	SH1	Intermittent	Flat	0.15	0.00	0.03	O	-
	SH2	Intermittent	Flat	0.25	0.05	0.10	O	-
	SH3	Intermittent	Underground	-	-	-	-	-
CE38	SH1	Intermittent	Flat	0.30	0.01	0.05	O	-

CE ID	SH	Flow status	Main flow type	Wetted Width (m)	Current velocity (m/s)	Mean Depth (m)	Dominant Substrate	Habitat ID
	SH2	Intermittent	Underground	-	-	-	-	-
CE39	SH1	Perennial	Underground	-	-	-	-	-
	SH2	Perennial	Underground	-	-	-	-	-
	SH3	Perennial	Flat	0.15	0.00	0.05	O	-
	SH4	Perennial	Underground	-	-	-	-	-
CE40	SH1	Perennial	Flat	0.50	0.01	0.15	O	-
	SH2	Perennial	Underground	-	-	-	-	-
CE41	SH1	Intermittent	Underground	-	-	-	-	-
	SH2	Intermittent	Underground	-	-	-	-	-
CE42	SH1	Perennial	Underground	-	-	-	-	-
	SH2	Perennial	Flat	0.50	0.01	0.20	O	-
	SH3	Perennial	Underground	-	-	-	-	-
CE43	SH1	Perennial	Flat	0.40	0.00	0.15	O	-
	SH2	Perennial	Underground	-	-	-	-	-
CE44	SH1	Intermittent	Underground	-	-	-	-	-
CE45	SH1	Intermittent	Underground	-	-	-	-	-
	SH2	Intermittent	Flat	0.25	0.00	0.10	O	-
CE46	SH1	Perennial	Flat	0.30	0.01	0.10	O	-
	SH2	Perennial	Underground	-	-	-	-	-
CE47	SH1	Perennial	Runs	0.50	0.30	0.10	O	-
	SH2	Perennial	Underground	-	-	-	-	-
	SH3	Intermittent	Flat	0.20	0.10	0.10	O	-
	SH4	Intermittent	Underground	-	-	-	-	-
CE48	SH1	Perennial	Flat	0.40	0.05	0.15	O, B	-
	SH2	Perennial	Underground	-	-	-	-	-
CE49	SH1	Perennial	Underground	-	-	-	-	-
	SH2	Perennial	Runs	0.30	0.30	0.10	O, Co	-
CE50	SH1	Non-existant	-	-	-	-	-	-
	SH2	Intermittent	Flat	0.10	0.00	0.02	O	-
CE51	SH1	Intermittent	Flat	0.40	0.01	0.15	O	-
	SH2	Intermittent	Underground	-	-	-	-	-
	SH3	Non-existant	-	-	-	-	-	-
CE52	SH1	Perennial	Flat	0.40	0.01	0.10	O	-
	SH2	Perennial	Underground	-	-	-	-	-

Photo 73. Aspect of CE37 at SH2

Photo 74. Aspect of CE38 at SH1

Photo 75. Aspect of CE39 at SH3

Photo 76. Aspect of CE40 at SH1

Photo 77. Aspect of CE41 at SH2

Photo 78. Aspect of CE42 at SH2

Photo 79. Aspect of CE43 at SH1

Photo 80. Aspect of CE44 at SH1

Photo 81. Aspect of CE45 at SH2

Photo 82. Aspect of CE46 at SH1

Photo 83. Aspect of CE47 at SH3

Photo 84. Aspect of CE48 at SH1

Photo 85. Aspect of CE49 at SH2

Photo 86. Aspect of CE50 at SH2

Photo 87. Aspect of CE51 at SH1

Photo 88. Aspect of CE52 at SH1

3.3.2.1 Water Physicochemistry

Physicochemical data were taken between September 24th, 2022, and October 4th. Table 24 presents the physicochemical characteristics of studied watercourse in the La Grande B watershed.

The location of the physicochemistry stations is presented on map 4 (Appendix 3).

Table 24 Physicochemical characteristics of watercourses in the La Grande B watershed

CE ID	Station ID	station depth (m)	Sampled Depth (m)	Water temperature (°C)	Dissolved oxygen		pH	Conductivity (µs/cm)
					%	mg/L		
CE37	PHY48	0.1	0.3	6.0	82.4	10.25	5.23	15.5
CE38	PHY49	0.1	0.3	6.6	73.2	8.94	4.33	15.6
CE39	PHY50	0.2	0.3	6.0	78.8	9.80	5.25	21.2
	PHY51	0.2	0.3	5.4	86.7	10.93	5.80	24.0
CE40	PHY52	0.1	0.3	7.5	87.4	10.47	5.79	33.2
CE42	PHY53	0.2	0.3	6.7	72.7	8.88	5.53	48.6
CE45	PHY54	0.15	0.3	6.7	88.6	10.83	5.08	29.5
CE47	PHY55	0.15	0.3	6.6	86.4	10.60	5.31	23.5
CE48	PHY56	0.15	0.3	5.8	69.5	8.67	5.02	20.1
CE49	PHY57	0.1	0.3	9.9	87.0	9.86	5.14	22.1
CE50	PHY58	0.25	0.3	7.3	66.3	7.99	5.43	62.0
CE51	PHY59	0.25	0.3	7.2	87.3	10.53	4.70	14.9
CE52	PHY60	0.15	0.3	8.1	78.2	9.23	4.41	24.4

The data available suggest that every studied and watercourse in this watershed are well oxygenated. Indeed, dissolved oxygen level are all over 7 mg/L. As previously mentioned, the threshold for the protection of aquatic life relative to oxygen is set at 6 mg/L of dissolved O2 for cold water organisms and at 5 mg/L of dissolved O2 for warm water organisms when temperature is 10°C while it is set at 7 mg/L of dissolved O2 for cold water organisms and at 6 mg/L of dissolved O2 for warm water organisms when temperature is 5°C. The values measured during our visit are all above the above-mentioned thresholds and the environment is therefore suitable to aquatic life.

Measured pH values are generally between 4.3 and 5.8, which is below the tolerance range for most fish species (Binesse, 1983). Survival of many fish is compromised when pH is below 6, which is recorded in every studied watercourse.

Conductivity is mostly between 14 and 50 µs/cm, which indicates the very low productivity of these watercourse, except for CE50 that shows a low productivity with 62 µs/cm (Binesse, 1983).

3.3.3 Fish Habitat Assessment

Conventional fish sampling and eDNA sampling were conducted to document the presence of fish and species richness of the water environments. These results allow us to determine confirmed and potential fish habitats at the scale of La Grande B watershed. Map 5 (Appendix 4) display the location of the sampling stations and the results of the fish habitat potential analysis.

3.3.3.1 Fish Sampling

In order to confirm the presence of fish in the La Grande B watershed and to document the ichthyological population, 7 lakes and 11 streams of the watershed were the object of an experimental fishing effort. Lake PE184, where bait traps and hoop nets were installed and where electrofishing was conducted, was subject to the greatest fishing effort. The fishing effort confirmed the presence of fish in one of the studied waterbodies and three of the studied watercourses of La Grande B watershed. In total, 4 fishes from 2 different species were captured. Table 25 presents the results of the fishing effort.

Table 25 Fishing result in La Grande B Watershed

PE/CE ID	Station ID	Gear	Effort	Number of captured individuals by species		CPUE
				SAFO	ESLU	
PE159	FA21	Hoop net	21	-	-	0.000
	BO34	Bait trap	21	-	-	0.000
	BO35	Bait trap	21	-	-	0.000
PE160	FA20	Hoop net	22	-	-	0.000
	BO36	Bait trap	26	-	-	0.000
	BO37	Bait trap	26	-	-	0.000
PE161	FA22	Hoop net	26	-	-	0.000
	BO38	Bait trap	25	-	-	0.000
	BO39	Bait trap	25	-	-	0.000
PE184	FA23	Hoop net	25	1	-	0.040
	EF14	Electrofishing	82	-	-	0.000
	BO40	Bait trap	22	-	-	0.000
PE186	BO41	Bait trap	21	-	-	0.000

PE/CE ID	Station ID	Gear	Effort	Number of captured individuals by species		CPUE
				SAFO	ESLU	
PE188	FA24	Hoop net	22	-	-	0.000
	BO42	Bait trap	22	-	-	0.000
	BO43	Bait trap	22	-	-	0.000
PE211	FA25	Hoop net	22	-	-	0.000
	FA21	Hoop net	21	-	-	0.000
	BO44	Bait trap	21	-	-	0.000
CE37	EF5	Electrofishing	59	-	-	0.000
CE38	EF6	Electrofishing	53	-	-	0.000
CE39	EF7	Electrofishing	62	-	-	0.000
	EF8	Electrofishing	81	-	-	0.000
CE40	EF9	Electrofishing	70	-	-	0.000
CE42	EF10	Electrofishing	142	2	-	0.014
CE45	LP6	Fishing rod	15	-	1	0.067
CE47	EF11	Electrofishing	148	-	-	0.000
CE48	EF12	Electrofishing	51	-	-	0.000
CE49	EF13	Electrofishing	131	-	-	0.000
CE51	EF15	Electrofishing	80	-	-	0.000
CE52	EF16	Electrofishing	43	-	-	0.000

3.3.3.2 eDNA Sampling and Analysis

The analysis of the eDNA contained in the samples indicate de presence of a total of 3 different fish genus in lake PE184 and PE186. It is interesting to note that among these species, two genus had not been inventoried during the fishing effort: *Catostomus* sp. and *Coregonus* sp.

Table 26 presents the results of the eDNA analysis.

Table 27 Analytical results of the eDNA sampled in the La Grande B watershed

Lake ID	Station	Filter method	Species detected		
			Catostomus sp	Coregonus sp	Salvelinus sp
PE159	ADNe12	Pump	-	-	-
		Syringe	-	-	-
	Blanc 12	Pump	-	-	-
PE160	ADNe13	Pump	-	-	-
PE161	ADNe14	Pump	-	-	-
PE184	ADNe15	Pump	-	-	X
PE186	ADNe16	Syringe	-	X	-
	ADNe16	Pump	X	X	-
	Blanc 16	Pump	-	-	-
PE188	ADNe17	Pump	-	-	-
PE211	ADNe18	Pump	-	-	-
	Blanc 18	Pump	-	-	-

3.3.3.3 Fish Habitat Functions and Potential

In general, the lakes and streams characterized in the La Grande B watershed do not present interesting conditions for aquatic wildlife. Table 27 summarizes the habitat potential characterized and the classified fish presence.

Lake PE184 is the only one, among the studied waterbodies of this watershed, where the presence of fish was confirmed by both conventional fish sampling and eDNA analysis. It confirmed that this waterbody is a fish habitat. Also, the rearing and feeding as well as spawning for phytophilic species potential was evaluated as average.

By contrast, other waterbody could be limiting for aquatic life since the measured pH is below 5, for PE160 and PE161, or even below 4 (PE186 and PE211). Therefore, it is surprising that eDNA results indicate positive detection of fish species in PE186. Waterbody PE159 also demonstrate poor fish conditions. Indeed, the acid pH (particularly near the surface) and the anoxia (low dissolved oxygen concentration) recorded near the bottom are limiting for fish survival and would probably favor winterkill.

Most of the studied watercourses show marginal potential for fish presence and habitat. In general, they are characterized by an alternance of underground sections and narrow flow bed surrounded by *Ericaceae*.

The analysis of the characteristics of the watercourses and waterbodies, the fishing results, and the connectivity of the water network make it possible to affirm that less then half of the environments characterized in La Grande B watershed are frequented by fish, as shown on maps 5 (Appendix 4). Among the waterbodies, only one of them demonstrate confirmed fish habitat potential while the other 6 are considered unlikely or no potential for fish habitat potential. For the watercourses, half of them show unlikely or no potential while the other half are confirmed of likely.

Table 28 Fish habitat overview in La Grande B watershed

PE / CE ID	Spawning potential		Rearing	Feeding	Habitat ID			Fish Presence	Fish Habitat Potential
	Lithophil	Phytophil			Shoal	Potential spawning ground	Aquatic grass bed		
PE159	None	Marginal	Marginal	Low	-	-	-	Absent	No potential
PE160	None	Marginal	Marginal	Low	-	-	-	Absent	No potential
PE161	None	Marginal	Marginal	Low	-	-	-	Absent	No potential
PE184	None	Average	Average	Average	-	-	-	Confirmed	Confirmed
PE186	None	Marginal	Marginal	Low	-	-	-	Not confirmed	No potential
PE188	None	Average	Average	Average	-	-	-	Absent	No potential
PE211	None	Marginal	Marginal	Low	-	-	-	Absent	No potential
CE37	None	Marginal	Marginal	Marginal	-	-	-	To be determined	No potential
CE38	None	Marginal	Marginal	Marginal	-	-	-	To be determined	No potential
CE39	None	Marginal	Marginal	Marginal	-	-	-	To be determined	No potential
CE40	Low	Marginal	Marginal	Marginal	-	H100	-	To be determined	Likely
CE41	None	None	None	None	-	-	-	To be determined	No potential
CE42	None	Marginal	Marginal	Marginal	-	-	-	Confirmed	Confirmed
CE43	None	Marginal	Marginal	Marginal	-	-	-	To be determined	Confirmed

PE / CE ID	Spawning potential		Rearing	Feeding	Habitat ID			Fish Presence	Fish Habitat Potential
	Lithophil	Phytophil			Shoal	Potential spawning ground	Aquatic grass bed		
CE44	None	None	None	None	-	-	-	To be determined	No potential
CE45	None	Marginal	Marginal	Marginal	-	-	-	Confirmed	No potential
CE46	None	Marginal	Marginal	Marginal	-	-	-	To be determined	Likely
CE47	None	Marginal	Marginal	Marginal	-	-	-	To be determined	Likely
CE48	None	Marginal	Marginal	Marginal	-	-	-	To be determined	Likely
CE49	None	Marginal	Marginal	Marginal	-	-	-	To be determined	Likely
CE50	None	Marginal	Marginal	Marginal	-	-	-	To be determined	Unlikely
CE51	None	Marginal	Marginal	Marginal	-	-	-	To be determined	Likely
CE52	None	Marginal	Marginal	Marginal	-	-	-	To be determined	Unlikely

3.3.3.4 Specific Habitat Description

Currently, only one notable fish habitat was identified in the studied waterbodies and watercourses of La Grande B (Table 27).

It is located in stream CE40 and consist of a small potential spawning ground principally composed of pebble substrate.

Table 28 presents the characteristics of the habitat of interest observed. Map 4 (Appendix 3) show the different habitats observed in the La Grande B watershed.

Table 29 Habitat description in La Grande B watershed

Waterbody / Watercourse ID	Habitat ID	Area (m^2)	Mean depth (m)	Substrate composition	% aquatic vegetation cover		
					Emergent	Flooded	Floating
CE40	H100	8	0.05	P, G, Co	0	0	0

3.4 Lake de la Corvette Watershed

Within Lake de la Corvette Watershed, five waterbodies and eight distinct watercourses were studied. In this sector, the characterization effort was concentrated on the water bodies and streams located closest to the potential mining pit, notably around lakes PE39 and PE40. Particular attention was also paid to validate the hydrological connectivity in the area. Studied watercourses and waterbodies are identified on map 4 (Appendix 3).

3.4.1 Waterbodies Characterization

Studied waterbodies of Lake de la Corvette watershed has been thoroughly characterized. To fully document the heterogeneity of the waterbodies, between one and three homogeneous segments were used, although a total of 10 segments were require on lake PE47.

As noted previously, according to *Environment Quality Act* of Québec, some waterbodies (PE39, PE40 and PE46) are instead considered wetlands (ponds) since their low water level is less than 2 m (EQA, c. Q-2, r. 0.1). This is the case for the PE40 and PE46 waterbodies, the latter being ponds.

Detailed results from the characterization are presented segment-by-segment in Appendix 1 and on map 4 (Appendix 3), while the main characteristics of the waterbodies are summarized in Table 29.

Table 30 Characteristics of studied waterbodies in Lake de la Corvette Watershed

Waterbody	Lake or pond	Maximal depth (m)	Shore composition (%)				Occurrence of fish habitat (ID)		
			Bedrock	Coarse Substrate	Fine substrate	Grass bed	Shoal	Potential spawning ground	Aquatic grass bed
PE39	Lake	>2.0	0.00	14.11	85.89	0.00	-	-	H67
PE40	Pond	1.0	0.00	0.00	0.00	100.00	-	-	H68
PE46	Pond	1.0	0.00	0.00	0.00	100.00	-	-	H69
PE47	Lake	>3.5	0.00	95.45	4.55	0.00	-	-	H70
PE48	Lake	>3.2	0.00	100.00	0.00	0.00	-	-	-

3.4.1.1 Wetlands PE39, PE40 and PE46

Waterbodies PE40 and PE46 presents a shoreline composition of 100 % grass bed while PE39 possess a shoreline mainly composed of fine substrate (representing 85.89 %) and coarse substrate (covering 14.11 %).

In each of these waterbodies, a single potential fish habitat, an aquatic grass bed, was identified.

Photos 89 to 92 show the main types of shorelines observed during the characterization of the waterbodies PE39, PE40 and PE46.

Photo 89. Aspect of PE39 segment SH1

Photo 90. Aquatic grass bed of PE39

Photo 91. Aspect of PE40 segment SH1

Photo 92. Aspect of PE46 segment SH1

3.4.1.2 Lakes PE47 and PE48

Although Lake PE47 has been divided into 10 different homogeneous segments, coarse substrate covers most of the shoreline. Indeed, 95.45 % of the shoreline is composed of coarse substrate, while fine sediment represents only 4.55 % of the shoreline composition. Lake PE47 also present a shoreline dominated by coarse substrate, which covers 100 % of the composition.

One aquatic grass bed was observed on lake PE47. It will be described in section 3.4.3.3. The presence of a few shoals was also noted during the aerial surveys.

Photos 93 to 95 show the main types of shorelines observed during the characterization of lake PE47 and PE48.

Photo 93. Coarse substrate on the shore of PE47 segment SH6

Photo 94. Shoal observed in PE47

Photo 95. Coarse substrate on the shore of PE47 segment SH1

3.4.1.3 Bathymetry and Morphometry

Bathymetric surveys were not conducted in Lake de la Corvette watershed, thus no data is presented in this section.

3.4.1.4 Water Phyicochemistry

Physicochemical data (Table 30) were taken between October 1st, 2022, and October 2nd. The thermocline was not detected in any of the waterbodies during the fall survey. This may be due to the shallowness of some waterbodies or the late nature of the surveys.

The location of the physicochemistry stations is presented on map 4 (Appendix 3).

Table 31 Physicochemical characteristics of waterbodies in the Lake de la Corvette watershed

CE/PE ID	Station ID	station depth (m)	Secchi mean depth (m)	Photic zone lower limit (m)	Sampled Depth (m)	Water temperature (°C)	Dissolved oxygen		pH	Conductivity (µs/cm)
							%	mg/L		
PE39	PHY14	1.2	1.2	1.2	0.5	5.9	100.0	12.44	6.44	6.0
PE40	PHY15	1.0	1.0	1.0	0.5	4.7	95.0	12.20	5.81	9.0
PE46	PHY16	1.0	1.0	1.0	0.5	4.5	95.0	12.29	5.88	9.0
PE47	PHY17	3.5	3.5	3.5	0.5	8.9	99.0	11.14	6.57	8.0
					1	8.9	95.9	11.07	6.51	8.0
					2	8.9	95.8	11.09	6.55	8.0
					3	8.9	95.6	11.04	6.59	8.0
					3.5	8.9	95.3	11.05	6.45	8.0
PE48	PHY18	3.2	3.2	3.2	0.5	7.2	92.0	11.15	6.53	8.0
					1	7.2	94.0	11.36	6.50	8.0
					2	7.3	92.4	11.16	6.59	8.0
					3	7.4	92.8	10.40	6.50	10.0

The data available suggest that all studied waterbodies are well oxygenated. Indeed, dissolved oxygen level are all over 10 mg/L. As previously mentioned, the threshold for the protection of aquatic life relative to oxygen is set at 6 mg/L of dissolved O2 for cold water organisms and at 5 mg/L of dissolved O2 for warm water organisms when temperature is 10°C while it is set at 7 mg/L of dissolved O2 for cold water organisms and at 6 mg/L of dissolved O2 for warm water organisms when temperature is 5°C. The values measured during our visit are largely above the above-mentioned thresholds and the environment is therefore suitable to aquatic life.

Measured pH values are generally between 6 and 6.6, which is within the tolerance range for most fish species (Binesse, 1983). However, survival of many fish is compromised when pH is below 6, which is recorded in waterbodies PE40 and PE46.

Conductivity is lower than 10 µs/cm in these waterbodies, which indicates their very low productivity (Binesse, 1983).

3.4.2 Watercourse Characterization

A total of eight different watercourses were studied in La Grande B watershed. Studied watercourses has all been extensively travelled but were summarily characterized due to lack of time during the fall survey. The characterization of these watercourse will be completed during the next field campaigns. To fully document the watercourses one homogeneous segments was enough for most of the studied streams while two segments were required for CE21 and three segments for CE24 to better describe the stream's heterogeneity.

Half of the characterized streams of this watershed are perennial (4 out of 8 watercourses). Three streams showed an intermittent flow status. Also, one watercourse is deemed non-existent (CE25). Thus, there is no connectivity between PE48 and PE01. Furthermore, CE17 doesn't connect with PE41. PE40 is thus isolated from the hydrographic network.

Studied watercourses in this watershed often show underground flow (5 out of 11 segments), but flat (1), runs (1) and lentic channel (1) are also observed.

Two potential fish habitats were observed during the 2022 fall survey among the eight characterized streams. They are described in section 3.4.3.3.

Results from the characterization are presented segment-by-segment in Table 31 and on map 4 (Appendix 3).

Photos 96 to 103 show the general aspect of the studied streams.

Table 32 Characteristics of studied watercourse in Lake de la Corvette Watershed

CE ID	SH	Flow status	Main flow Type	Wetted Width (m)	Littoral boundary Width (m)	Current velocity (m/s)	Mean Depth (m)	Dominant Substrate	Habitat ID
CE16	SH1	Intermittent	Underground	-	-	-	-	-	-
CE17	SH1	Intermittent	Underground	-	-	-	-	-	-
CE18	SH1	Perennial	Runs	1.5	1.5	0.50	0.2	Bx, B	-
CE21	SH1	Perennial	Flat	1.5	40.0	0.01	0.4	O	H95

CE ID	SH	Flow status	Main flow Type	Wetted Width (m)	Littoral boundary Width (m)	Current velocity (m/s)	Mean Depth (m)	Dominant Substrate	Habitat ID
	SH2	Perennial	Underground	-	-	-	-	-	-
CE22	SH1	Perennial	Flat	1.0	20.0	0.10	0.2	O, B	-
CE23	SH1	Perennial	Lentic channel	2.0	30.0	0.10	0.5	O	H96
CE24	SH1	Intermittent	Underground	-	-	-	-	-	-
	SH2	Wetland	-	-	-	-	-	-	-
	SH3	Intermittent	Underground	-	-	-	-	-	-
CE25	SH1	Non-existant	-	-	-	-	-	-	-

CE = Watercourse ID; SH = Homogenous segment; O = Organic; Cl = Clay; Si = Silt; Sa = Sand; G = Gravel; P = Pebble; Co = Cobble; B = Boulder; Bx = Coarse boulder; R = Roc.

Photo 96. Aspect of CE16 at SH1

Photo 97. Aspect of CE17 at SH1

Photo 98. Aspect of CE18 at SH1

Photo 99. Aspect of CE21 at SH1

Photo 100. Aspect of CE22 at SH1

Photo 101. Aspect of CE23 at SH1

Photo 102. Aspect of CE24 at SH3

Photo 103. Aspect of CE25 at SH1

3.4.2.1 Water Physicochemistry

Physicochemical data were taken between October 1st, 2022, and October 2nd. Table 32 presents the physicochemical characteristics of studied watercourse in the Lac de la Corvette watershed.

The location of the physicochemistry stations is presented on map 4 (Appendix 3).

Table 33 Physicochemical characteristics of watercourses in the Lake de la Corvette watershed

CE/PE ID	Station ID	station depth (m)	Secchi mean depth (m)	Photic zone lower limit (m)	Sampled Depth (m)	Water temperature (°C)	Dissolved oxygen		pH	Conductivity (µs/cm)
							%	mg/L		
CE18	PHY37	0.2	-	-	0.1	8.5	95.8	11.20	6.40	7.0
CE21	PHY38	0.5	-	-	0.3	3.9	86.0	11.19	5.75	10.0
CE24	PHY39	0.2	-	-	0.1	5.4	99.0	12.00	6.52	7.0

All characterized watercourses are well oxygenated. Indeed, dissolved oxygen level are all over 10 mg/l. At a temperature of 10°C, the threshold for the protection of aquatic life (chronic effect) relative to oxygen is set at 6 mg/L of dissolved O2 for cold water organisms and at 5 mg/L of dissolved O2 for warm water organisms. At a temperature of 5°C, the threshold is set at 7 mg/L of dissolved O2 for cold water organisms and at 6 mg/L of dissolved O2 for warm water organisms. The value measured during our visit is largely above the above-mentioned thresholds and the environment is therefore suitable to aquatic life.

Measured pH values are generally above 6, which is within the tolerance range for most fish species (Binesse, 1983). However, survival of many fish is compromised when pH is below 6, which is recorded in watercourse CE21 (Binesse, 1983).

Conductivity is lower than 10 µs/cm in these watercourses, which indicates their very low productivity (Binesse, 1983).

3.4.3 Fish Habitat Assessment

3.4.3.1 Fish Sampling and eDNA Analysis

The watercourses and waterbodies in the Lac de la Corvette watershed were not included in the sampling effort, thus no data is presented in this section.

3.4.3.2 Fish Habitat Functions and Potential

In general, the waterbodies and watercourses characterized in the Lac de la Corvette watershed present interesting conditions for aquatic wildlife. Table 33 summarizes the habitat potential characterized and the classified fish presence.

The characteristics of lake PE47 and PE48 explains the average to high potential evaluated for spawning, rearing and feeding of aquatic species (table 33). Indeed, lake PE47 show abundant vegetation on the shoreline which can be used by phytophiles species and PE48 rocky shoreline is interesting for litophiles fishes. Both those habitat types are adequate for rearing and alimentation.

By contrast, waterbodies that were identified as wetlands (PE39, PE40 and PE46) present none to low potential for fish spawning, rearing and feeding. Besides, the potential could be revised downwards considering that the low water level could favor winterkill.

Most of the studied watercourses are characterized by an alternance of underground sections and narrow flow bed surrounded by *Ericaceae*, which usually don't offer optimal conditions for fish presence. That explains the unlikely habitat potential evaluated in watercourses CE16 and CE17. On the other hand, CE21 to CE24 demonstrate average to high potential for spawning of phytophilic species and rearing.

The analysis of the characteristics of the watercourses and waterbodies and the connectivity of the water network make it possible to estimate that most of the characterized environments in Lac de la Corvette watershed are likely frequented by fish, as shown on maps 5 (Appendix 4). Every waterbody demonstrates likely fish habitat potential. For the watercourses, five are considered likely to shelter fish population while two others are unlikely. Thus, for the time being, every studied stream and lake in the watershed are to be considered as fish habitat.

Table 34 Fish habitat overview in Lake de la Corvette watershed

PE / CE ID	Spawning potential		Rearing	Feeding	Habitat ID			Fish Presence	Fish Habitat Potential
	Lithophil	Phytophil			Shoal	Potential spawning ground	Aquatic grass bed		
PE39	None	Low	Low	Marginal	-	-	H67	To be determined	Likely
PE40	None	Low	Low	Marginal	-	-	H68	To be determined	Likely
PE46	None	Low	Low	Marginal	-	-	H69	To be determined	Likely
PE47	Low	Average to high	Average	Average to high	-	-	H70	To be determined	Likely
PE48	Low to average	Low	Average	Average	-	-	-	To be determined	Likely

PE / CE ID	Spawning potential		Rearing	Feeding	Habitat ID			Fish Presence	Fish Habitat Potential
	Lithophil	Phytophil			Shoal	Potential spawning ground	Aquatic grass bed		
CE16	None	None	None	None	-	-	-	To be determined	Unlikely
CE17	None	None	None	None	-	-	-	To be determined	Unlikely
CE18	Marginal	Marginal	Low	Low	-	-	-	To be determined	Likely
CE21	None	High	Average	Average	-	-	H95	To be determined	Likely
CE22	None	Average	Average	Low	-	-	-	To be determined	Likely
CE23	None	High	Average	Average	-	-	H96	To be determined	Likely
CE24	Marginal	Average	Average	Low	-	-	-	To be determined	Likely

3.4.3.3 Specific Habitat Description

A total of 6 notable fish habitats were identified in the studied waterbodies and watercourses of Lac de la Corvette watershed (Table 33). All of them are aquatic grass beds.

Aquatic grass beds are generally semi-aquatic and composed of emerged plants such as sedge (*Carex* sp.) that covers 100 % of the habitat. Habitat H67, however, is composed of burreed (*Sparganium* sp.), a floating plant that covers 100 % of the grass bed.

Table 34 presents the characteristics of the observed habitats of interest. Maps 5 (Appendix 4) show the different habitats observed in the Lac de la Corvette watershed.

Table 35 Habitat description in Lake de la Corvette watershed

Waterbody / Watercourse ID	Habitat ID	Area (m^2)	Mean depth (m)	Substrate composition	% aquatic vegetation cover		
					Emergent	Flooded	Floating
PE39	H67	40	0.60	O	0	0	100
PE40	H68	2000	0.00	O	100	0	0
PE46	H69	3000	0.00	O	100	0	0
PE47	H70	2000	0.00	O	100	0	0
CE21	H95	2000	0.00	O	100	0	0
CE23	H96	4000	0.00	O	100	0	0

4 References

Binesse, M. 1983. Protection et amélioration des cours d'eau : objectif faune aquatique. MLCP. Direction générale de la faune, 153 pages.

Boudreau, A. 1984. Méthodologie utilisée pour la photo-interprétation des rivières à saumon de la Côte-Nord. Rapport présenté au ministère du Loisir, de la Chasse et de la Faune du Québec.

Malavoi, J.R. et Y. Souchon. 2001. Description standardisée des principaux faciès d'écoulement observables en rivière : clé de détermination qualitative et mesures physiques. Bull. Fr. Pêche Piscic. 365/366 : 357-372.

Ministère de l'Environnement et de la lutte contre les changements climatiques (MELCC). 2019. Bassins hydrographiques multiéchelles du Québec. Données cartographiques du Gouvernement du Québec. https://www.donneesquebec.ca/recherche/fr/dataset/bassins-hydrographiques-multi-echelles-du-quebec

Ministère des Forêts, de la Faune et des Parcs (MFFP). 2021. Protocole standardisé des procédures de stérilisation et d'échantillonnage d'eau afin de déterminer la présence d'espèces fauniques dans les milieux hydriques par l'analyse d'ADNe au Québec. Gouvernement du Québec. Québec. 13 pages.

Ministère des Forêts, de la Faune et des Parcs (MFFP). 2022. Carte interactive « Forêt ouverte ». https://www.foretouverte.gouv.qc.ca/

Ministère de l'Énergie et des Ressources naturelles (MERN). 2019. Géobase du réseau hydrographique du Québec (GRHQ). Données cartographiques du Gouvernement du Québec. https://www.donneesquebec.ca/recherche/fr/dataset/grhq

Ministry of Transportation of Ontario (MTO). 2009. Environmental Guide for Fish and Fish Habitat, Section 6: Analysis of Fish and Fish Habitat Sensitivity.

Service de la Faune aquatique (SFA). 2011. Guide de normalisation des méthodes d'inventaire ichtyologique en eaux intérieures, Tome I, Acquisition de données, ministère des Ressources naturelles et de la Faune, Québec, 137p.

Appendix 1

Characteristics of homogeneous segments of studied waterbodies

Table 1 Characteristics of homogeneous segments of studied waterbodies in lake PE-01 watershed

WS	PE	SH	Transparency	Transect ID	Bank Height (m)	Slope	Erosion	Riparian vegetation (%)			BH ID	Grain size class of substrate										Substrate condition	Littoral vegetation presence								
								Herbaceous	Shrubs	Wooded		O	C	SI	SA	G	P	C	B	Bx	R		Emergent vegetation (%)	Dominant emerging species	Sub-dominant emerging species	Submerged vegetation (%)	Dominant submerged species	Sub-dominant submerged species	Floating vegetation (%)	Dominant floating species	Sub-dominant floating species
Lake-01	PE1	SH1	Clear	T-1	<5	LO	-	0	100	5	B-1	0	0	0	0	0	10	35	35	10	10	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH2	Clear	T-1	<5	AV	-	0	100	10	B-1	0	0	0	0	0	0	0	5	5	90	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH3	Clear	T-1	<5	AV	-	0	100	10	B-1	0	0	0	0	0	0	30	30	40	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH4	Clear	T-1	<5	LO	A	0	100	15	B-1	0	0	0	0	0	15	25	25	25	10	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH5	Clear	T-1	<5	AV	A	0	100	40	B-1	0	0	0	25	10	15	25	25	0	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH6	Clear	T-1	<5	AV	-	0	100	20	B-1	15	0	0	0	0	10	30	25	20	0	Clogged	0	-	-	0	-	-	0	-	-
		SH7	Clear	T-1	<5	LO	-	30	80	15	B-1	90	0	0	0	0	0	10	0	0	0	Clogged	0	-	-	0	-	-	0	Bur-reed	-
		SH8	Clear	T-1	<5	LO	-	0	100	10	B-1	25	0	0	0	0	0	25	30	20	0	Clogged	0	-	-	0	-	-	0	-	-
		SH9	Clear	T-1	<5	AV	-	0	100	20	B-1	0	0	0	5	5	5	45	25	15	0	Clogged	0	-	-	0	-	-	0	-	-
		SH10	Clear	T-1	<5	LO	-	0	100	10	B-1	20	0	0	0	0	20	25	20	15	0	Clogged	0	-	-	0	-	-	0	-	-
		SH11	Clear	T-1	<5	LO	A	0	100	15	B-1	0	0	0	0	0	10	40	35	15	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH12	Clear	T-1	<5	LO	A	0	100	15	B-1	0	0	0	0	0	0	0	5	5	90	Clogged	0	-	-	0	-	-	0	-	-
		SH13	Clear	T-1	<5	LO	-	0	100	10	B-1	0	0	0	0	0	25	25	25	25	0	UND	0	-	-	0	-	-	0	-	-
		SH14	Clear	T-1	<5	LO	-	0	100	5	B-1	0	0	0	0	0	0	20	20	20	40	Clogged	0	-	-	0	-	-	0	-	-
		SH15	Clear	T-1	<5	LO	-	10	95	10	B-1	0	0	0	0	0	30	40	30	0	0	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-2	0	0	75	0	0	0	0	25	0	0	Clogged	0	-	-	0	-	-	0	-	-
		SH16	Clear	T-1	<5	LO	-	5	95	5	B-1	0	0	0	0	0	0	0	0	10	90	Clogged	0	-	-	0	-	-	0	-	-
		SH17	Clear	T-1	<5	LO	-	3	95	5	B-1	0	0	0	20	15	15	15	15	15	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH18	Clear	T-1	<5	LO	-	5	90	5	B-1	0	0	0	0	0	0	15	15	10	60	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-2	25	0	0	75	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
		SH19	Clear	T-1	<5	LO	-	5	80	5	B-1	0	0	0	0	0	0	15	15	10	60	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH20	Clear	T-1	<5	LO	-	0	100	0	B-1	0	0	0	60	10	0	0	0	0	30	Clean	0	-	-	0	-	-	0	-	-
		SH21	Clear	T-1	<5	LO	-	5	95	5	B-1	0	0	0	0	0	0	30	30	25	15	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-2	0	0	70	0	0	0	15	10	5	0	Clogged	0	-	-	0	-	-	0	-	-

WS	PE	SH	Transparency	Transect ID	Bank Height (m)	Slope	Erosion	Riparian vegetation (%)			BH ID	Grain size class of substrate										Substrate condition	Littoral vegetation presence								
								Herbaceous	Shrubs	Wooded		O	C	SI	SA	G	P	C	B	Bx	R		Emergent vegetation (%)	Dominant emerging species	Sub-dominant emerging species	Submerged vegetation (%)	Dominant submerged species	Sub-dominant submerged species	Floating vegetation (%)	Dominant floating species	Sub-dominant floating species
		SH22	Clear	T-1	<5	LO	-	3	95	5	B-1	0	0	0	0	5	5	30	20	20	20	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH23	Clear	T-1	<5	LO	-	0	100	5	B-1	0	0	0	0	30	30	20	10	10	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH24	Clear	T-1	<5	LO	-	0	95	10	B-1	0	0	40	0	10	10	20	5	5	10	Clogged	0	-	-	0	-	-	0	-	-
		SH25	Clear	T-1	<5	LO	-	10	90	10	B-1	0	0	0	0	0	0	0	10	10	80	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH26	Clear	T-1	>5	ST	-	5	35	3	B-1	0	0	0	0	0	0	40	20	20	20	Clogged	0	-	-	0	-	-	0	-	-
		SH27	Clear	T-1	<5	LO	-	5	95	5	B-1	0	0	0	0	0	25	25	25	25	0	Clogged	0	-	-	0	-	-	0	-	-
		SH28	Turbid	T-1	>5	ST	-	5	50	5	B-1	0	0	25	0	0	0	20	15	15	25	Clogged	0	-	-	0	-	-	0	-	-
											B-2	0	0	50	0	0	0	0	30	0	20	Clogged	0	-	-	0	-	-	0	-	-
		SH29	Turbid	T-1	<5	LO	-	0	95	5	B-1	0	0	0	0	0	0	5	5	5	85	Clogged	0	-	-	0	-	-	0	-	-
		SH30	Moderately turbid	T-1	<5	LO	-	3	80	20	B-1	0	0	0	0	0	5	40	25	25	5	Clogged	0	-	-	0	-	-	0	-	-
		SH31	Clear	T-1	<5	LO	-	0	95	25	B-1	0	0	0	0	0	0	0	0	0	100	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH32	Clear	T-1	<5	LO	-	5	95	30	B-1	0	0	0	0	0	15	30	30	25	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH33	Clear	T-1	<5	AV	-	0	70	5	B-1	0	0	0	0	0	0	5	5	0	90	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH34	Clear	T-1	<5	LO	-	5	100	3	B-1	0	0	0	25	25	25	25	0	0	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH35	Clear	T-1	<5	LO	-	20	70	10	B-1	0	0	90	0	0	0	5	5	0	0	Clogged	0	-	-	0	-	-	0	-	-
		SH36	Clear	T-1	>5	AV	-	10	80	3	B-1	0	0	0	30	10	30	30	0	0	0	UND	0	-	-	0	-	-	0	-	-
		SH37	Clear	T-1	<5	AV	-	3	90	3	B-1	0	0	0	0	5	10	30	25	20	10	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH38	Clear	T-1	<5	AV	-	5	40	0	B-1	0	0	0	0	0	0	0	0	10	90	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH39	Clear	T-1	<5	AV	-	0	80	0	B-1	0	0	0	0	0	0	30	30	30	10	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH40	Clear	T-1	NA	UND	A	0	80	0	B-1	95	0	0	0	0	0	0	0	5	0	Clogged	100	-	-	0	-	-	0	-	-
		SH41	Clear	T-1	<5	LO	-	0	100	5	B-1	0	0	15	25	0	0	20	20	20	0	Clogged	0	-	-	0	-	-	0	-	-
		SH42	Clear	T-1	<5	LO	-	3	100	10	B-1	0	0	0	15	0	10	25	25	25	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH43	Clear	T-1	<5	LO	-	0	100	25	B-1	0	0	0	80	0	0	0	10	0	10	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH44	Clear	T-1	<5	LO	-	3	100	15	B-1	0	0	0	10	0	0	40	25	25	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH45	Clear	T-1	<5	LO	-	2	100	0	B-1	0	0	0	60	0	0	0	20	20	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH46	Clear	T-1	<5	AV	-	3	100	40	B-1	0	0	20	40	0	0	15	15	10	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH47	Clear	T-1	<5	LO	-	2	100	40	B-1	0	0	5	5	0	5	40	25	20	0	UND	0	-	-	0	-	-	0	-	-

WS	PE	SH	Transparency	Transect ID	Bank Height (m)	Slope	Erosion	Riparian vegetation (%)			BH ID	Grain size class of substrate										Substrate condition	Littoral vegetation presence								
								Herbaceous	Shrubs	Wooded		O	C	SI	SA	G	P	C	B	Bx	R		Emergent vegetation (%)	Dominant emerging species	Sub-dominant emerging species	Submerged vegetation (%)	Dominant submerged species	Sub-dominant submerged species	Floating vegetation (%)	Dominant floating species	Sub-dominant floating species
		SH48	Clear	T-1	<5	LO	-	5	100	10	B-1	0	0	0	100	0	0	0	0	0	0	UND	0	-	-	0	-	-	0	-	-
		SH49	Clear	T-1	<5	AV	-	2	100	50	B-1	0	0	20	20	0	0	20	25	15	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH50	Clear	T-1	<5	LO	-	3	100	20	B-1	0	0	0	0	10	10	20	30	30	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH51	Clear	T-1	<5	LO	-	2	100	15	B-1	0	0	0	0	0	0	20	40	40	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH52	Clear	T-1	<5	LO	-	0	100	5	B-1	0	0	0	0	5	5	40	25	25	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH53	Clear	T-1	<5	LO	-	0	100	20	B-1	0	0	0	0	0	0	10	45	45	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH54	Clear	T-1	<5	LO	-	2	100	5	B-1	0	0	0	0	0	5	25	35	35	0	Clogged	0	-	-	0	-	-	0	-	-
		SH55	Clear	T-1	<5	LO	-	0	100	5	B-1	0	0	0	20	0	10	50	10	10	0	Clean	0	-	-	0	-	-	0	-	-
		SH56	Clear	T-1	<5	LO	-	0	100	5	B-1	0	0	0	0	0	0	10	45	45	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH57	Clear	T-1	<5	LO	-	3	100	20	B-1	0	0	0	0	0	0	40	30	30	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH58	Clear	T-1	<5	LO	-	10	100	10	B-1	0	0	70	0	0	0	0	30	0	0	Clogged	0	-	-	0	-	-	0	-	-
		SH59	Clear	T-1	<5	LO	-	7	100	10	B-1	0	0	0	0	0	0	40	30	30	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH60	Clear	T-1	<5	LO	-	5	100	30	B-1	0	0	0	0	0	0	30	35	35	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH61	Clear	T-1	<5	LO	-	40	60	5	B-1	100	0	0	0	0	0	0	0	0	0	UND	100	-	-	0	-	-	0	-	-
		SH62	Clear	T-1	<5	LO	-	3	100	40	B-1	0	0	0	0	0	0	30	35	35	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH63	Clear	T-1	<5	LO	-	3	100	20	B-1	0	0	0	0	0	0	60	30	10	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH64	Clear	T-1	<5	LO	-	2	100	30	B-1	0	0	0	0	0	0	40	20	0	40	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH65	Clear	T-1	<5	LO	-	2	100	30	B-1	0	0	0	5	0	0	40	35	20	0	UND	0	-	-	0	-	-	0	-	-
		SH66	Clear	T-1	<5	LO	-	0	100	10	B-1	0	0	0	0	0	0	20	20	20	40	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH67	Clear	T-1	<5	LO	-	5	100	10	B-1	0	0	0	0	0	0	30	35	35	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH68	Clear	T-1	<5	LO	-	10	100	5	B-1	0	0	0	0	0	0	40	30	30	0	Clogged	0	-	-	0	-	-	0	-	-
		SH69	Clear	T-1	<5	LO	-	3	100	10	B-1	0	0	0	0	0	0	0	50	50	0	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-2	0	0	0	0	0	0	0	50	50	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH70	Clear	T-1	<5	LO	-	3	100	10	B-1	0	0	0	0	0	0	40	30	30	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH71	Clear	T-1	<5	LO	-	0	100	3	B-1	0	0	0	0	0	0	0	20	20	60	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH72	Clear	T-1	<5	LO	-	0	100	3	B-1	0	0	0	0	0	0	40	25	25	10	UND	0	-	-	0	-	-	0	-	-
		SH73	Clear	T-1	>5	AV	-	0	100	10	B-1	0	0	0	0	0	0	0	15	15	70	Moderately clogged	0	-	-	0	-	-	0	-	-

WS	PE	SH	Transparency	Transect ID	Bank Height (m)	Slope	Erosion	Riparian vegetation (%)			BH ID	Grain size class of substrate										Substrate condition	Littoral vegetation presence								
								Herbaceous	Shrubs	Wooded		O	C	SI	SA	G	P	C	B	Bx	R		Emergent vegetation (%)	Dominant emerging species	Sub-dominant emerging species	Submerged vegetation (%)	Dominant submerged species	Sub-dominant submerged species	Floating vegetation (%)	Dominant floating species	Sub-dominant floating species
		SH74	Clear	T-1	>5	AV	-	0	100	5	B-1	0	0	0	20	0	0	50	20	10	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH75	Clear	T-1	<5	AV	-	0	100	5	B-1	0	0	0	20	0	0	20	20	10	30	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH76	Clear	T-1	<5	LO	-	3	100	3	B-1	0	0	0	0	0	0	20	30	50	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH77	Clear	T-1	>5	AV	-	0	80	60	B-1	0	0	0	0	0	0	40	30	30	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH78	Clear	T-1	>5	AV	-	0	100	70	B-1	0	0	0	0	0	0	30	40	30	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH79	Clear	T-1	<5	LO	-	2	100	40	B-1	0	0	0	0	0	0	40	30	30	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH80	Clear	T-1	<5	LO	-	0	100	10	B-1	0	0	0	0	0	0	0	30	70	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH81	Clear	T-1	<5	LO	-	0	100	40	B-1	0	0	0	0	0	0	10	40	50	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH82	Clear	T-1	<5	LO	-	0	100	80	B-1	0	0	0	0	0	10	40	40	10	0	UND	0	-	-	0	-	-	0	-	-
		SH83	Clear	T-1	<5	LO	-	0	100	30	B-1	0	0	0	0	0	0	40	60	0	0	Clean	0	-	-	0	-	-	0	-	-
		SH84	Clear	T-1	<5	LO	-	0	100	10	B-1	0	0	0	0	0	0	30	70	0	0	Clean	0	-	-	0	-	-	0	-	-
		SH85	Clear	T-1	<5	LO	-	0	100	0	B-1	0	0	0	0	0	0	40	50	10	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH86	Clear	T-1	<5	LO	-	0	60	70	B-1	0	0	0	0	0	50	40	10	0	0	Clean	0	-	-	0	-	-	0	-	-
		SH87	Clear	T-1	<5	LO	-	3	100	30	B-1	0	0	0	0	0	0	10	30	10	50	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH88	Moderately turbid	T-1	<5	AV	-	5	95	10	B-1	0	0	0	25	5	5	25	40	0	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH89	Moderately turbid	T-1	<5	LO	-	2	95	20	B-1	0	0	0	20	30	25	10	5	0	10	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH90	Moderately turbid	T-1	<5	AV	-	2	95	10	B-1	0	0	0	5	5	5	45	25	15	0	Clean	0	-	-	0	-	-	0	-	-
		SH91	Moderately turbid	T-1	<5	AV	-	2	95	0	B-1	0	0	0	5	10	20	30	25	10	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH92	Moderately turbid	T-1	<5	AV	-	2	95	20	B-1	0	0	0	0	0	5	30	40	25	0	Clean	0	-	-	0	-	-	0	-	-
		SH93	Moderately turbid	T-1	<5	ST	-	2	95	5	B-1	0	0	0	0	0	0	0	0	20	80	Clean	0	-	-	0	-	-	0	-	-
		SH94	Moderately turbid	T-1	<5	LO	-	2	95	1	B-1	0	0	0	0	0	0	0	0	15	85	Clean	0	-	-	0	-	-	0	-	-
		SH95	Moderately turbid	T-1	<5	LO	-	1	95	3	B-1	0	0	0	0	0	0	0	0	95	5	Clean	0	-	-	0	-	-	0	-	-
		SH96	Moderately turbid	T-1	<5	AV	-	2	90	70	B-1	0	0	0	0	0	10	40	40	10	0	Clean	0	-	-	0	-	-	0	-	-
	PE325	SH1	Moderately turbid	T-1	>5	LO	-	5	98	20	B-1	0	0	0	0	0	0	40	15	15	30	Moderately clogged	0	-	-	0	-	-	0	-	-
																							0	-	-	0	-	-	0	-	-
				T-2	<5	ST	-	5	98	10	B-2	0	0	20	30	20	30	0	0	0	0	Moderately clogged	0	-	-	0	-	-	0	-	-
				T-3	>5	ST	-	5	98	50													0	-	-	0	-	-	0	-	-

WS	PE	SH	Transparency	Transect ID	Bank Height (m)	Slope	Erosion	Riparian vegetation (%)			BH ID	Grain size class of substrate										Substrate condition	Littoral vegetation presence								
								Herbaceous	Shrubs	Wooded		O	C	Sl	SA	G	P	C	B	Bx	R		Emergent vegetation (%)	Dominant emerging species	Sub-dominant emerging species	Submerged vegetation (%)	Dominant submerged species	Sub-dominant submerged species	Floating vegetation (%)	Dominant floating species	Sub-dominant floating species
		SH2	Moderately turbid	T-1	<5	LO	-	2	98	20	B-1	0	0	0	0	0	0	40	30	30	0	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-2	0	0	0	10	0	0	10	40	40	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH3	Moderately turbid	T-1	<5	LO	-	2	99	15	B-1	0	0	0	0	0	20	50	30	0	0	UND	0	-	-	0	-	-	0	-	-
		SH4	Moderately turbid	T-1	<5	LO	-	2	99	15	B-1	0	0	0	0	0	0	20	60	20	0	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-2	0	0	0	0	0	0	10	70	20	0	Clean	0	-	-	0	-	-	0	-	-
		SH5	Moderately turbid	T-1	>5	LO	-	20	95	10	B-1	0	0	0	0	0	20	50	20	10	0	Moderately clogged	0	-	-	0	-	-	0	-	-
				T-2	>5	ST	-	1	99	5																					
				T-3	UND	UND	-	1	99	5																					
		SH6	Moderately turbid	T-1	<5	LO	-	5	99	10	B-1	0	0	0	0	0	0	70	20	10	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH7	Moderately turbid	T-1	<5	LO	-	1	99	1	B-1	0	0	0	0	0	0	50	40	10	0	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-2	5	0	0	40	30	20	5	0	0	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH8	Moderately turbid	T-1	<5	LO	-	10	98	2	B-1	0	0	0	15	25	25	30	0	5	0	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-2	0	0	0	0	0	0	40	50	10	0	Clean	0	-	-	0	-	-	0	-	-
		SH9	Moderately turbid	T-1	<5	LO	-	10	98	5	B-1	0	0	0	0	0	0	0	0	0	100	Clean	0	-	-	0	-	-	0	-	-
											B-2	0	0	0	20	0	30	40	10	0	0	Moderately clogged	0	-	-	0	-	-	0	-	-
	PE72	SH1	Turbid	T-1	<5	LO	-	5	40	90	B-1	70	0	0	0	0	0	0		30	0	Clogged	10	Carex	-	10	-	-	0	-	-
											B-2	95	0	0	5	0	0	0	0	0	0	Clogged	140	-	-	10	-	-	0	-	-
		SH2	Turbid	T-1	<5	LO	-	80	10	50	B-1	15	0	0	20	20	15	10	15	5	0	Moderately clogged	80	-	-	0	-	-	0	-	-
											B-2	30	0	0	65	0	0	0	0	5	0	Moderately clogged	0	-	-	0	-	-	0	-	-

WS = Watershed; PE = Waterbody; UND = Undefined; LO = Low; AV = Average; ST = Strong SH = Homogenous segment; O = Organic; Cl = Clay; Si = Silt; Sa = Sand; G = Gravel; P = Pebble; Co = Cobble; B = Boulder; Bx = Coarse boulder; R = Roc.

Table 2 Characteristics of homogeneous segments of studied waterbodies in La Grande A watershed

WS	PE	SH	Transparency	Transect ID	Bank		Erosion	Riparian vegetation (%)			BH ID	Grain size class of substrate										Substrate condition	Littoral vegetation presence								
					Height (m)	Slope		Herbaceous	Shrubs	Wooded		O	C	SI	SA	G	P	C	B	Bx	R		Emergent vegetation (%)	Dominant emerging species	Sub-dominant emerging species	Submerged vegetation (%)	Dominant submerged species	Sub-dominant submerged species	Floating vegetation (%)	Dominant floating species	Sub-dominant floating species
La Grande A	PE2	SH1	Clear	T-1	<5	LO	A	10	90	15	B-1	40	0	0	0	0	0	5	20	35	0	Clogged	10	Carex Horsetail	-	0	-	-	0	-	-
		SH2	Clear	T-1	>5	AV	A	5	90	10	B-1	60	0	0	0	0	0	0	10	30	0	Clogged	0	-	-	0	-	-	0	-	-
											B-2	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	15	Pondweed	-	5	-	-
		SH3	Clear	T-1	>5	AV	A	10	90	25	B-1	10	0	0	30	5	30	15	5	5	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH4	Clear	T-1	<5	LO	A	10	95	5	B-1	20	0	0	70	0	0	0	5	5	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH5	Clear	T-1 T-1	<5 <5	LO LO	A A	10 10	95 95	5 5	B-1	5	0	0	45	40	10	0	0	0	0	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-2	30	0	0	40	5	10	10	0	5	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH6	Clear	T-1	<5	LO	A	10	95	5	B-1	15	0	0	10	5	10	40	15	5	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH7	Clear	T-1	<5	LO	A	10	95	5	B-1	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	5	-	-
		SH8	Clear	T-1	>5	LO	A	5	95	5	B-1	10	0	0	10	5	5	25	30	10	5	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH9	Clear	T-1	>5	LO	A	5	95	5	B-1	10	0	0	30	45	5	5	5	0	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH10	Clear	T-1	>5	LO	A	5	95	5	B-1	10	0	0	10	5	10	25	20	10	10	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH11	Clear	T-1	<5	LO	A	10	90	25	B-1	20	0	0	5	5	10	15	20	25	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH12	Clear	T-1	<5	LO	A	10	90	25	B-1	70	0	0	15	0	0	0	10	5	0	Clogged	10	Horsetail	-	20	Bur-reed	-	5	Water lily	-
		SH13	Clear	T-1	<5	LO	A	15	80	25	B-1	10	0	0	10	10	10	20	25	15	0	Moderately clogged	10	Horsetail	-	0	-	-	0	-	-
		SH14	Clear	T-1	<5	LO	A	5	90	15	B-1	20	0	0	30	5	5	10	20	10	0	Clogged	0	-	-	0	-	-	0	-	-
		SH16	Clear	T-1	<5	LO	A	5	90	15	B-1	5	0	0	25	15	5	30	15	5	0	Clogged	0	-	-	0	-	-	0	-	-
		SH16	Clear	T-1	<5	LO	A	5	90	15	B-1	5	0	0	15	10	10	25	15	20	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH17	Clear	T-1	<5	LO	A	5	90	15	B-1	5	0	0	40	5	5	10	20	15	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH18	Clear	T-1	<5	LO	A	5	15	25	B-1	10	0	0	40	5	5	10	20	10	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH19	Clear		<5	LO	A	5	15	25	B-1	75	0	0	5	0	0	0	10	10	0	Clogged	15	Horsetail	-	0	-	-	0	-	-
	PE3	SH1	Clear	T-1	<5	LO	A	5	85	10	B-1	65	0	0	5	0	5	5	5	0	15	Clogged	0	-	-	0	-	-	0	-	-
		SH2	Clear	T-1	<5	LO	A	5	85	10	B-1	35	0	0	10	5	10	15	15	5	5	Clogged	10	Carex	-	0	-	-	0	-	-
		SH3	Clear	T-1	<5	LO	A	5	85	10	B-1	95	0	0	5	0	0	0	0	0	0	UND	0	-	-	0	-	-	0	-	-
		SH4	Clear	T-1	<5	LO	A	5	85	10	B-1	25	0	0	0	0	0	5	40	30	0	Clogged	0	-	-	0	-	-	0	-	-

WS	PE	SH	Transparency	Transect ID	Bank		Erosion	Riparian vegetation (%)			BH ID	Grain size class of substrate										Substrate condition	Littoral vegetation presence								
					Height (m)	Slope		Herbaceous	Shrubs	Wooded		O	C	SI	SA	G	P	C	B	Bx	R		Emergent vegetation (%)	Dominant emerging species	Sub-dominant emerging species	Submerged vegetation (%)	Dominant submerged species	Sub-dominant submerged species	Floating vegetation (%)	Dominant floating species	Sub-dominant floating species
		SH5	Clear	T-1	<5	LO	A	5	85	10	B-1	95	0	0	0	0	0	0	0	5	0	Clogged	25	Carex	-	0	-	-	5	-	-
	PE4	SH1	T-1	<5	LO	A	5	90	10	T-1	B-1	15	0	0	30	5	10	25	10	5	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH2	Clear	T-1	<5	LO	A	5	90	10	B-1	70	0	0	5	5	0	10	10	0	0	Clogged	0	-	-	0	-	-	5	-	-
	PE5	SH1	Clear	T-1	<5	LO	A	15	90	25	B-1	15	0	0	15	25	5	30	10	0	0	Moderately clogged	10	Carex	-	5	Bur-reed	-	UND	-	-
		SH2	Clear	T-1	<5	LO	A	10	95	15	B-1	75	0	0	0	10	0	5	10	0	0	Clogged	25	Carex	-	0	-	-	15	Water lily	-
		SH3	Clear	T-1	<5	AV	A	10	80	30	B-1	30	0	0	25	15	20	10	0	0	0	Moderately clogged	20	Carex	-	0	-	-	UND	-	-
											B-2	80	0	0	0	0	0	0	20	0	0	Clogged	0	-	-	0	-	-	0	-	-
	PE6	SH1	Clear	T-1	<5	LO	A	15	90	10	B-1	100	0	0	0	0	0	0	0	0	0	Clogged	25	Carex	-	0	-	-	5	Water lily	-
	PE7	SH1	Clear	T-1	<5	LO	A	10	60	15	B-1	20	0	0	15	25	10	15	10	5	0	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-2	95	0	0	5	0	0	0	0	0	0	Clogged									
		SH2	Clear	T-1	<5	AV	A	10	80	5	B-1	15	0	0	20	20	15	10	15	5	0	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-2	30	0	0	65	0	0	0	0	5	0	Clogged									
		SH3	Clear	T-1	<5	AV	A	10	80	5	B-1	25	0	0	0	75	0	0	0	0	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH4	Clear	T-1	>5	ST	A	10	75	5	B-1	15	0	0	0	0	0	20	40	15	10	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH5	Clear	T-1	<5	AV	A	15	95	5	B-1	40	0	0	55	0	5	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
		SH6	Clear	T-1	<5	LO	A	10	90	15	B-1	20	0	0	0	0	5	30	30	15	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH7	Clear	T-1	<5	LO	A	10	90	15	B-1	65	0	0	25	0	0	5	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
		SH8	Clear	T-1	<5	LO	A	15	80	10	B-1	15	0	0	20	40	5	10	5	5	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH9	Clear	T-1	<5	AV	A	15	70	10	B-1	25	0	0	25	0	0	15	25	10	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH10	Clear	T-1	<5	LO	A	15	80	15	B-1	40	0	0	35	10	10	0	5	0	0	Clogged	0	-	-	0	-	-	0	-	-
		SH11	Clear	T-1	<5	LO	A	15	80	15	B-1	25	0	0	45	10	15	0	0	5	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH12	Clear	T-1	<5	AV	A	10	85	5	B-1	40	0	0	40	0	10	5	0	5	0	Clogged	0	-	-	0	-	-	0	-	-
		SH13	Clear	T-1	<5	LO	A	15	80	15	B-1	95	0	0	0	0	0	0	0	5	0	Clogged	0	-	-	0	-	-	0	-	-
	PE8	SH1	Clear	T-1	<5	AV	A	10	70	15	B-1	100	0	0	0	0	0	0	0	0	0	Clogged	30	Carex	-	0	-	-	5	Water lily	-
	PE9	SH1	Clear	T-1	<5	LO	A	15	80	10	B-1	50	0	0	0	0	25	20	0	5	0	Clogged	30	Carex	-	0	-	-	0	-	-
											B-2	95	0	0	0	0	0	0	0	5	0	Clogged	0	-	-	0	-	-	0	-	-

WS	PE	SH	Transparency	Transect ID	Bank		Erosion	Riparian vegetation (%)			BH ID	Grain size class of substrate										Substrate condition	Littoral vegetation presence								
					Height (m)	Slope		Herbaceous	Shrubs	Wooded		O	C	SI	SA	G	P	C	B	Bx	R		Emergent vegetation (%)	Dominant emerging species	Sub-dominant emerging species	Submerged vegetation (%)	Dominant submerged species	Sub-dominant submerged species	Floating vegetation (%)	Dominant floating species	Sub-dominant floating species
		SH2	Clear	T-1	<5	LO	A	15	80	10	B-1	95	0	0	0	0	0	5	0	0	0	Clogged	0	-	-	15	Water lily	-	0	-	-
		SH3	Clear	T-1	<5	LO	A	15	80	10	B-1	55	0	0	0	0	0	10	15	20	0	Clogged	10	Carex	-	0	-	-	0	-	-
											B-2	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
		SH4	Clear	T-1	<5	LO	A	15	80	10	B-1	100	0	0	0	0	0	0	0	0	0	Clogged	20	UND	-	0	-	-	0	-	-
		SH5	Clear	T-1	<5	LO	A	15	80	10	B-1	35	0	0	0	0	5	25	30	5	0	Clogged	10	UND	-	0	-	-	0	-	-
											B-2	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
		SH6	Clear	T-1	<5	ST	A	5	75	10	B-1	50	0	0	10	0	0	15	20	5	0	Clogged	10	-	-	0	-	-	0	-	-
											B-2	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
		SH7	Clear	T-1	<5	ST	A	0	25	5	B-1	5	0	0	0	0	0	0	0	0	95	Clogged	0	-	-	0	-	-	0	-	-
		SH8		T-1	<5	LO	A	10	90	5	B-1	15	0	0	0	10	20	40	10	5	0	Moderately clogged	5	Horsetail	-	0	-	-	0	-	-
		SH1	Clear	T-1	<5	LO	A	15	80	5	B-1	5	0	0	0	0	0	0	0	0	95	Clear	0	-	-	0	-	-	0	-	-
											B-2	30	0	0	15	0	10	30	15	0	0	Moderately clogged	0	-	-	0	-	-	0	-	-
	PE10	SH2	Clear	T-1	<5	LO	A	15	90	10	B-1	40	0	0	55	0	0	0	0	5	0	Clogged	0	-	-	15	Bur-reed	Pondweed	UND	-	-
		SH3	Clear	T-1	<5	AV	A	10	85	10	B-1	30	0	0	50	0	0	0	0	20	0	Clogged	0	-	-	60	Pondweed	Carex	UND	-	-
		SH4	Clear	T-1	<5	LO	A	10	90	5	B-1	35	0	0	15	0	5	15	20	10	0	Clogged	0	-	-	40	Bur-reed	Pondweed	UND	-	-
				T-2	<5	AV	A	10	95	15												UND	0	-	-	0	-	-	0	-	-
		SH5	Clear	T-1	<5	LO	A	5	90	10	B-1	10	0	0	75	0	0	10	5	0	0	Clogged	0	-	-	15	Bur-reed	Pondweed	0	-	-
		SH6	Clear	T-1	<5	LO	A	5	90	10	B-1	55	0	0	0	0	5	10	15	15	0	Clogged	10	Carex	-	0	-	-	0	-	-
		SH7	Clear	T-1	<5	LO	A	5	90	10	B-1	15	0	0	0	15	20	25	15	10	0	UND	0	-	-	10	Bur-reed	-	0	-	-
		SH8	Clear	T-1	<5	LO	A	15	80	10	B-1	40	0	0	30	5	0	10	10	5	0	Clogged	5	Carex	-	0	-	-	0	-	-
		SH9	Clear	T-1	<5	LO	A	15	80	10	B-1	10	0	0	10	25	15	20	20	0	0	Moderately clogged	0	-	-	25	Bur-reed	-	0	-	-
											B-2	20	0	0	50	25	0	5	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
	PE11	SH1	Clear	T-1	<5	AV	-	10	75	25	B-1	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
	PE12	SH1	Moderately turbid	T-1	<5	LO	A	75	90	35	B-1	10	0	0	0	0	0	15	60	15	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH2	Moderately turbid	T-1	<5	LO	A	75	90	35	B-1	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
		SH3	Clear	T-1	<5	LO	A	15	80	30	B-1	25	0	0	0	0	15	60	0	0	0	Moderately clogged	0	-	-	0	-	-	0	-	-

WS	PE	SH	Transparency	Transect ID	Bank		Erosion	Riparian vegetation (%)			BH ID	Grain size class of substrate										Substrate condition	Littoral vegetation presence								
					Height (m)	Slope		Herbaceous	Shrubs	Wooded		O	C	SI	SA	G	P	C	B	Bx	R		Emergent vegetation (%)	Dominant emerging species	Sub-dominant emerging species	Submerged vegetation (%)	Dominant submerged species	Sub-dominant submerged species	Floating vegetation (%)	Dominant floating species	Sub-dominant floating species
											B-2	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
	PE18	SH1	Moderately turbid	T-1	<5	LO	A	10	85	40	B-1	10	0	0	0	0	0	25	40	25	0	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-2	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
											B-3	15	0	0	0	0	10	30	30	15	0	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-4	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
		SH2	Moderately turbid	T-1	<5	LO	A	100	30	5	B-1	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
																							0			0			0		
		SH3	Moderately turbid	T-1	<5	LO	A	80	35	35	B-1	90	0	0	0	0	0	0	0	10	0	Clogged	0	-	-	0	-	-	0	-	-
											B-2	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
		SH1	Moderately turbid	T-1	<5	LO	A	15	90	30	B-1	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
											B-2	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
	PE61	SH2	UND	T-1	<5	LO	A	10	90	20	B-1	10	0	0	0	0	10	60	20	0	0	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-2	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
											B-3	10	0	0	0	0	0	40	40	10	0	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-4	90	0	0	0	0	0	0	10	0	0	Clogged	0	-	-	0	-	-	0	-	-
		SH3	Clear	T-1	<5	LO	A	20	70	35	B-1	20	0	0	70	0	0	0	0	10	0	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-2	20	0	0	70	0	0	0	10	0	0	Moderately clogged	0	-	-	0	-	-	0	-	-
		SH4	Clear	T-1	<5	LO	A	20	70	35	B-1	10	0	0	0	0	0	60	30	0	0	Clear	0	-	-	0	-	-	0	-	-
											B-2	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
		SH5	Clear	T-1	<5	LO	A	20	70	35	B-1	10	0	0	90	0	0	0	0	0	0	Moderately clogged	0	-	-	0	-	-	0	-	-
											B-2	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
		SH6	Clear	T-1	<5	LO	A	20	70	35	B-1	100	0	0	0	0	0	0	0	0	0	Clogged	0	-	-	0	-	-	0	-	-
	PE63	SH1	UND	UND	UND	UND	UND	UND	UND	UND	UND	UND	UND	UND	UND	UND	UND	UND	UND	UND	UND	UND	0	-	-	0	-	-	0	-	-

WS = Watershed; PE = Waterbody; UND = Undefined; LO = Low; AV = Average; ST = Strong SH = Homogenous segment; O = Organic; Cl = Clay; Si = Silt; Sa = Sand; G = Gravel; P = Pebble; Co = Cobble; B = Boulder; Bx = Coarse boulder; R = Roc.

Table 3 Characteristics of homogeneous segments of studied waterbodies in La Grande B watershed

WS	PE	SH	Transparency	Transect ID	Bank		Erosion	Riparian vegetation (%)			BH ID	Grain size class of substrate										Substrate condition	Littoral vegetation presence								
					Height (m)	Slope		Herbaceous	Shrubs	Wooded		O	C	SI	SA	G	P	C	B	Bx	R		Emergent vegetation (%)	Dominant emerging species	Sub-dominant emerging species	Submerged vegetation (%)	Dominant submerged species	Sub-dominant submerged species	Floating vegetation (%)	Dominant floating species	Sub-dominant floating species
La_Grande_B	PE159	SH1	Moderately turbid	T-1	<5	LO	-	75	60	35	B-1	100	0	0	0	0	0	0	0	0	0	Cloggest	80	Carex	-	0	-	-	0	-	-
	PE160	SH1	Moderately turbid	T-1	<5	LO	-	75	60	35	B-1	100	0	0	0	0	0	0	0	0	0	Cloggest	80	Carex	-	0	-	-	0	-	-
	PE161	SH1	Moderately turbid	T-1	<5	LO	-	75	60	35	B-1	100	0	0	0	0	0	0	0	0	0	Cloggest	80	Carex	-	0	-	-	0	-	-
	PE184	SH1	Moderately turbid	T-1	<5	LO	A	75	60	40	B-1	100	0	0	0	0	0	0	0	0	0	Clogged	100	Carex	-	0	-	-	0	-	-
	PE186	SH1	Moderately turbid	T-1	<5	LO	-	75	60	35	B-1	100	0	0	0	0	0	0	0	0	0	Cloggest	80	Carex	-	0	-	-	0	-	-
	PE188	SH1	Moderately turbid	T-1	<5	LO	-	75	60	35	B-1	100	0	0	0	0	0	0	0	0	0	Cloggest	80	Carex	-	0	-	-	0	-	-
	PE211	SH1	Moderately turbid	T-1	<5	LO	-	75	60	35	B-1	100	0	0	0	0	0	0	0	0	0	Cloggest	80	Carex	-	0	-	-	0	-	-

WS = Watershed; PE = Waterbody; UND = Undefined; LO = Low; AV = Average; ST = Strong SH = Homogenous segment; O = Organic; Cl = Clay; Si = Silt; Sa = Sand; G = Gravel; P = Pebble; Co = Cobble; B = Boulder; Bx = Coarse boulder; R = Roc.

Table 4 Characteristics of homogeneous segments of studied waterbodies in De la Corvette watershed

WS	PE	SH	Transparency	Transect ID	Bank		Erosion	Riparian vegetation (%)			BH ID	Grain size class of substrate										Substrate condition	Littoral vegetation presence								
					Height (m)	Slope		Herbaceous	Shrubs	Wooded		O	C	SI	SA	G	P	C	B	Bx	R		Emergent vegetation (%)	Dominant emerging species	Sub-dominant emerging species	Submerged vegetation (%)	Dominant submerged species	Sub-dominant submerged species	Floating vegetation (%)	Dominant floating species	Sub-dominant floating species
De-la-Corvette	PE39	SH1	Clear	T-1	<5	LO	A	10	90	20	B-1	100	0	0	0	0	0	0	0	0	0	Clogged	-	-	-	-	-	-	-	-	-
		SH2	Clear	T-1	<5	LO	A	0	100	0	B-1	0	0	0	0	0	0	50	30	20	0	Moderately clogged	-	-	-	-	-	-	-	-	-
		SH3	Clear	T-1	<5	LO	A	2	100	60	B-1	70	0	0	0	0	0	0	10	20	0	Moderately clogged	-	-	-	-	-	-	-	-	-
	PE40	SH1	Moderately turbid	T-1	<5	LO	A	80	15	5	B-1	100	0	0	0	0	0	0	0	0	0	Clogged	100	Carex	-	0	-	-	0	-	-
	PE46	SH1	Clear	T-1	<5	LO	A	40	30	30	B-1	100	0	0	0	0	0	0	0	0	0	Clogged	100	Carex	-	0	-	-	0	-	-
	PE47	SH1	Clear	T-1	<5	LO	A	3	100	60	B-1	20	0	0	0	0	0	0	40	40	0	UND	-	-	-	-	-	-	-	-	-
		SH2	Clear	T-1	<5	AV	A	0	100	50	B-1	60	0	0	0	0	0	0	20	20	0	Clogged	-	-	-	-	-	-	-	-	-
		SH3	Clear	T-1	<5	LO	A	25	70	20	B-1	100	0	0	0	0	0	0	0	0	0	Clogged	-	-	-	-	-	-	-	-	-
		SH4	Clear	T-1	<5	AV	A	0	100	40	B-1	10	0	0	0	0	0	20	30	40	0	UND	-	-	-	-	-	-	-	-	-
		SH5	Clear	T-1	<5	LO	A	0	100	20	B-1	20	0	0	0	0	0	10	30	40	0	Clogged	-	-	-	-	-	-	-	-	-
		SH6	Clear	T-1	<5	LO	A	0	100	30	B-1	20	0	0	0	0	0	0	40	40	0	Clogged	-	-	-	-	-	-	-	-	-

WS	PE	SH	Transparency	Transect ID	Bank		Erosion	Riparian vegetation (%)			BH ID	Grain size class of substrate										Substrate condition	Littoral vegetation presence								
					Height (m)	Slope		Herbaceous	Shrubs	Wooded		O	C	Sl	SA	G	P	C	B	Bx	R		Emergent vegetation (%)	Dominant emerging species	Sub-dominant emerging species	Submerged vegetation (%)	Dominant submerged species	Sub-dominant submerged species	Floating vegetation (%)	Dominant floating species	Sub-dominant floating species
		SH7	Clear	T-1	<5	LO	A	2	100	50	B-1	10	0	0	0	0	0	10	40	40	0	Moderately clogged	-	-	-	-	-	-	-	-	-
		SH8	Clear	T-1	<5	LO	A	3	100	5	B-1	0	0	0	0	0	0	20	40	40	0	Moderately clogged	-	-	-	-	-	-	-	-	-
		SH9	Clear	T-1	<5	LO	A	2	100	10	B-1	0	0	0	0	0	0	20	40	40	0	Moderately clogged	-	-	-	-	-	-	-	-	-
		Sh10	Clear	T-1	<5	LO	A	70	30	20	B-1	100	0	0	0	0	0	0	0	0	0	Clogged	-	-	-	-	-	-	-	-	-
	PE48	SH1	Clear	T-1	<5	LO	A	2	95	40	B-1	50	0	0	0	0	0	25	25	0	0	Moderately clogged	-	-	-	-	-	-	-	-	-

WS = Watershed; PE = Waterbody; UND = Undefined; LO = Low; AV = Average; ST = Strong SH = Homogenous segment; O = Organic; Cl = Clay; Si = Silt; Sa = Sand; G = Gravel; P = Pebble; Co = Cobble; B = Boulder; Bx = Coarse boulder; R = Roc.

Appendix 2

Methodological map

Map 3-1 : Methodology
West sector

Carte 3-1 : Méthodologie
Secteur Ouest

Limit / Limite

- Work study area / Zone d'étude des travaux (ZET)
- Sub-sector / Sous-secteurs

Hydrography / Hydrographie

- Watercourse / Cours d'eau
- Waterbody / Plan d'eau

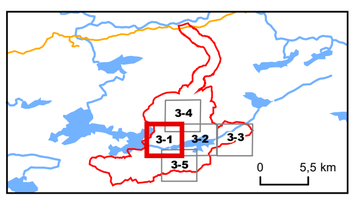
Field work / Travail de terrain

- Barometric logger / Enregistreur de barométrie
- Level logger and gauging / Enregistreur de niveau
- eDNA sampling / Échantillonnage ADNe
- Bathymetry / Bathymétrie
- Experimental fishing / Pêche expérimentale
- Physicochemistry / Physicochimie
- Characterized watercourse / Cours d'eau caractérisé
- Characterized waterbody / Plan d'eau caractérisé

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDGA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 0,1 0,2 km
NAD 1983 CSRS MTM 8

1:9 000



Environmental and social survey

Project : 22-0095

May, 2023
Approved by :
Pierre-Olivier Côté

Note : Cette carte n'a aucune valeur légale, seul un arpenteur-géomètre peut se prononcer sur l'exactitude des informations géographiques.

Map 3-2 : Methodology
Center sector

Carte 3-2 : Méthodologie
Secteur Centre

Limit / Limite

- Work study area / Zone d'étude des travaux (ZET)
- Sub-sector / Sous-secteurs

Hydrography / Hydrographie

- Watercourse / Cours d'eau
- Waterbody / Plan d'eau

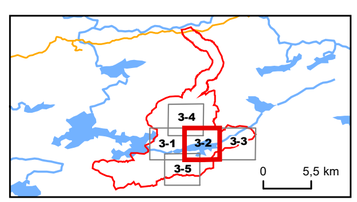
Field work / Travail de terrain

- Barometric logger / Enregistreur de barométrie
- Level logger and gauging / Enregistreur de niveau
- eDNA sampling / Échantillonnage ADNe
- Bathymetry / Bathymétrie
- Experimental fishing / Pêche expérimentale
- Physicochemistry / Physicochimie
- Characterized watercourse / Cours d'eau caractérisé
- Characterized waterbody / Plan d'eau caractérisé

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDCA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 0,1 0,2 km
NAD 1983 CSRS MTM 8

1:9 000



Environmental and social survey

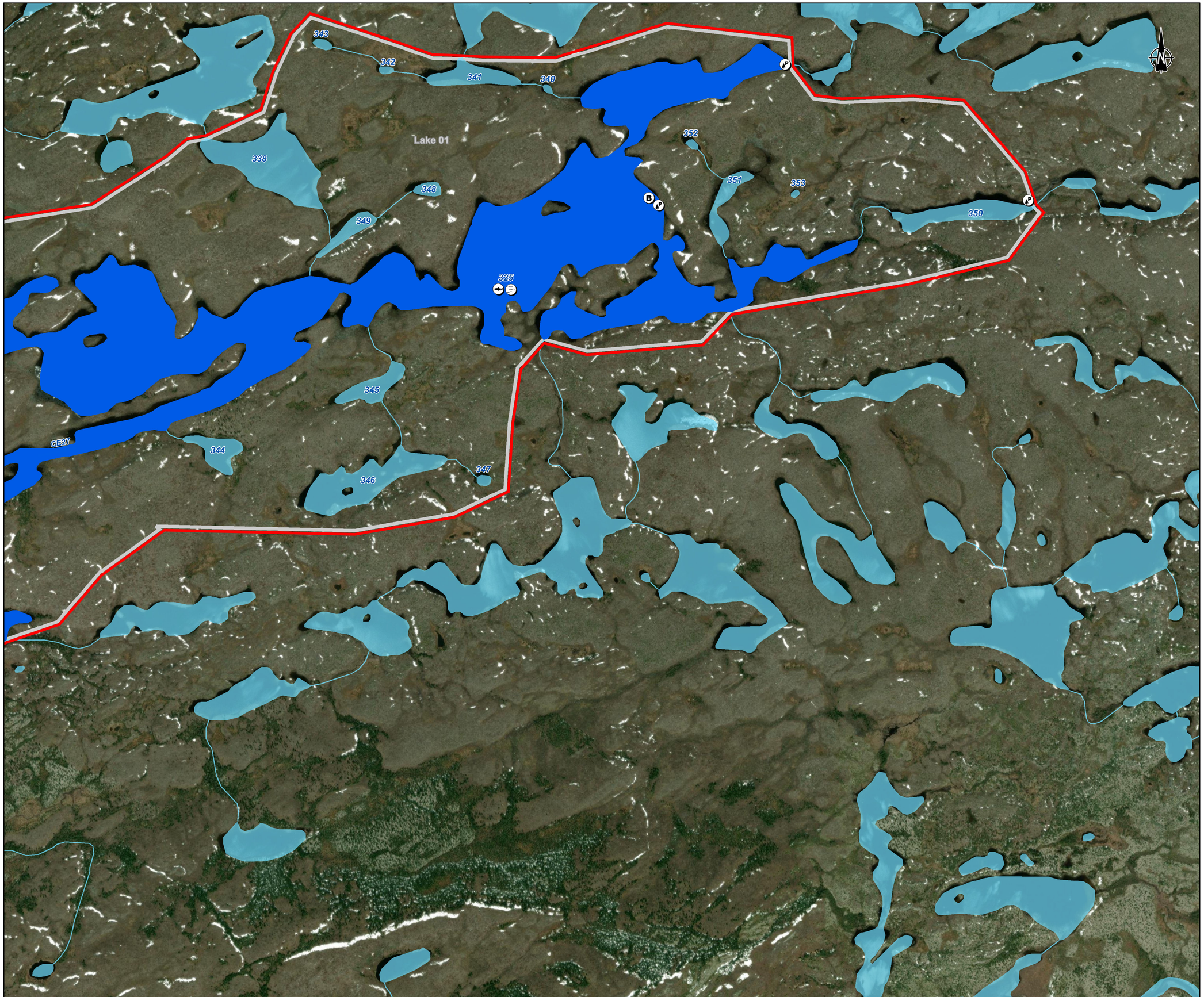
Project : 22-0095

May, 2023
Approved by :
Pierre-Olivier Côté

Note : Cette carte n'a aucune valeur légale, seul un arpenteur-géomètre peut se prononcer sur l'exactitude des informations géographiques.

Map 3-3 : Methodology
East sector

Carte 3-3 : Méthodologie
Secteur Est



Limit / Limite

- Work study area / Zone d'étude des travaux (ZET)
- Sub-sector / Sous-secteurs

Hydrography / Hydrographie

- Watercourse / Cours d'eau
- Waterbody / Plan d'eau

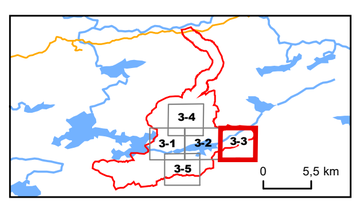
Field work / Travail de terrain

- Barometric logger / Enregistreur de barométrie
- Level logger and gauging / Enregistreur de niveau
- eDNA sampling / Échantillonnage ADNe
- Bathymetry / Bathymétrie
- Experimental fishing / Pêche expérimentale
- Physicochemistry / Physicochimie
- Characterized watercourse / Cours d'eau caractérisé
- Characterized waterbody / Plan d'eau caractérisé

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDCA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 0,1 0,2 km
NAD 1983 CSRS MTM 8

1:9 000



Environmental and social survey

Project : 22-0095

May, 2023
Approved by :
Pierre-Olivier Côté

NIIGAAN

Note : Cette carte n'a aucune valeur légale, seul un arpenteur-géomètre peut se prononcer sur l'exactitude des informations géographiques.

Map 3-4 : Methodology
North sector

Carte 3-4 : Méthodologie
Secteur Nord

Limit / Limite

- Work study area / Zone d'étude des travaux (ZET)
- Sub-sector / Sous-secteurs

Hydrography / Hydrographie

- Watercourse / Cours d'eau
- Waterbody / Plan d'eau

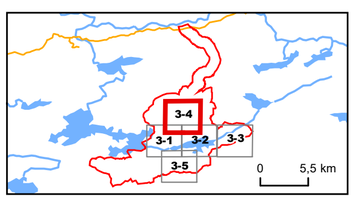
Field work / Travail de terrain

- Barometric logger / Enregistreur de barométrie
- Level logger and gauging / Enregistreur de niveau
- eDNA sampling / Échantillonnage ADNe
- Bathymetry / Bathymétrie
- Experimental fishing / Pêche expérimentale
- Physicochemistry / Physicochimie
- Characterized watercourse / Cours d'eau caractérisé
- Characterized waterbody / Plan d'eau caractérisé

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDGA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 0,1 0,2 km
NAD 1983 CSRS MTM 8

1:9 000



Environmental and social survey

Project : 22-0095

May, 2023
Approved by :
Pierre-Olivier Côté

NIIGAAN

Note : Cette carte n'a aucune valeur légale, seul un arpenteur-géomètre peut se prononcer sur l'exactitude des informations géographiques.

Map 3-5 : Methodology
South sector

Carte 3-5 : Méthodologie
Secteur Sud

Limit / Limite

- Work study area / Zone d'étude des travaux (ZET)
- Sub-sector / Sous-secteurs

Hydrography / Hydrographie

- Watercourse / Cours d'eau
- Waterbody / Plan d'eau

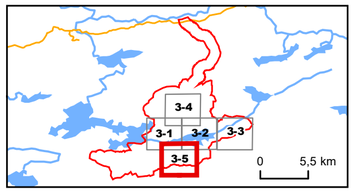
Field work / Travail de terrain

- Barometric logger / Enregistreur de barométrie
- Level logger and gauging / Enregistreur de niveau
- eDNA sampling / Échantillonnage ADNe
- Bathymetry / Bathymétrie
- Experimental fishing / Pêche expérimentale
- Physicochemistry / Physicochimie
- Characterized watercourse / Cours d'eau caractérisé
- Characterized waterbody / Plan d'eau caractérisé

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDGA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 0,1 0,2 km
NAD 1983 CSRS MTM 8

1:9 000



Environmental and social survey

Project : 22-0095

May, 2023
Approved by :
Pierre-Olivier Côté

Note : Cette carte n'a aucune valeur légale, seul un arpenteur-géomètre peut se prononcer sur l'exactitude des informations géographiques.

Appendix 3

Waterbody and watercourse characterization maps

Map 4-1 : Hydrological characterization West sector

Carte 4-1 : Caractérisation hydrologique Secteur Ouest

Limit / Limite

- Work study area / Zone d'étude des travaux (ZET)
- Sub-watershed / Sous bassin versant

Hydrography / Hydrographie

- Flow direction / Sens de l'écoulement
- Perennial watercourse / Cours d'eau permanent
- Intermittent watercourse / Cours d'eau intermittent
- Runoff / Ruissellement
- Wetland / Milieu humide
- Non-existant / Non-existant
- Waterbody / Plan d'eau
- Wetland / Milieu humide

Stream characterization / Caractérisation des cours d'eau

- Cascade / Cascade
- Rapid / Rapide
- Riffle / Radier
- Lotic channel / Chenal lotique
- Lentic channel / Chenal lentique
- Runs / Plat courant
- Flat / Plat lentique
- Pool / Fosse
- Underground / Sous-terrain

Shorline characterization / Caractérisation des berges

- Aquatic grassbed / Herbier
- Bedrock / Substrat rocheux
- Coarse substrate / Substrat grossier
- Fine substrate / Substrat fin
- To characterize / À caractériser

Obstacle / Obstacle

- Passable with reserve / Passable avec réserve
- Impassable with reserve / Infranchissable avec réserve
- Impassable / Infranchissable

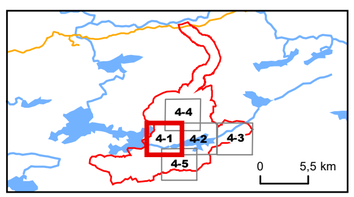
Sampling and logger / Échantillonnage et enregistreur

- Barometric logger / Enregistreur de barométrie
- Level logger and gauging / Enregistreur de niveau
- Physicochemistry / Physicochimie

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDCA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 0,1 0,2 km
NAD 1983 CSRS MTM 8

1:9 000



Environmental and social survey

Project : 22-0095

May, 2023
Approved by :
Pierre-Olivier Côté

NIIGAAN

Note : Cette carte n'a aucune valeur légale, seul un arpenteur-géomètre peut se prononcer sur l'exactitude des informations géographiques.

Map 4-2 : Hydrological characterization Center sector

Carte 4-2 : Caractérisation hydrologique Secteur Centre

Limit / Limite

- Work study area / Zone d'étude des travaux (ZET)
- Sub-watershed / Sous bassin versant

Hydrography / Hydrographie

- Flow direction / Sens de l'écoulement
- Perennial watercourse / Cours d'eau permanent
- Intermittent watercourse / Cours d'eau intermittent
- Runoff / Ruissellement
- Wetland / Milieu humide
- Non-existant / Non-existant
- Waterbody / Plan d'eau
- Wetland / Milieu humide

Stream characterization / Caractérisation des cours d'eau

- Cascade / Cascade
- Rapid / Rapide
- Riffle / Radier
- Lotic channel / Chenal lotique
- Lentic channel / Chenal lentique
- Runs / Plat courant
- Flat / Plat lentique
- Pool / Fosse
- Underground / Sous-terrain

Shorline characterization / Caractérisation des berges

- Aquatic grassbed / Herbier
- Bedrock / Substrat rocheux
- Coarse substrate / Substrat grossier
- Fine substrate / Substrat fin
- To characterize / À caractériser

Obstacle / Obstacle

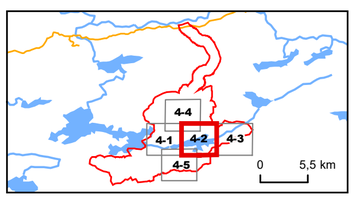
- Passable with reserve / Passable avec réserve
- Impassable with reserve / Infranchissable avec réserve
- Impassable / Infranchissable

Sampling and logger / Échantillonnage et enregistreur

- Barometric logger / Enregistreur de barométrie
- Level logger and gauging / Enregistreur de niveau
- Physicochemistry / Physicochimie

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDGA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 100 200 m
NAD 1983 CSRS MTM 8
1:9 000



Environmental and social survey

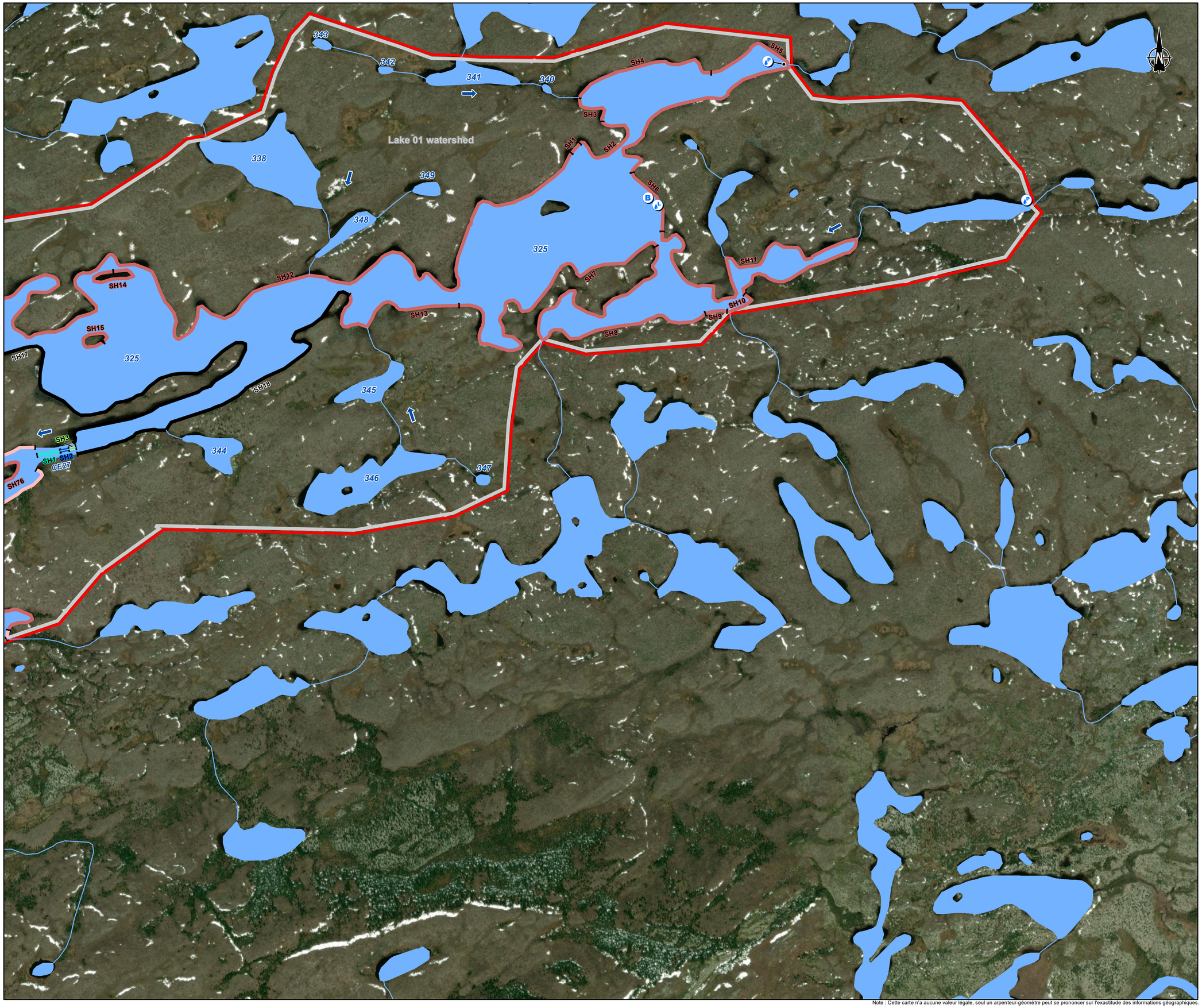
Project : 22-0095
May, 2023
Approved by :
Pierre-Olivier Côté

NIIGAAN

Note : Cette carte n'a aucune valeur légale, seul un arpenteur-géomètre peut se prononcer sur l'exactitude des informations géographiques.

Map 4-3 : Hydrological characterization East sector

Carte 4-3 : Caractérisation hydrologique Secteur Est



Limit / Limite

- Work study area / Zone d'étude des travaux (ZET)
- Sub-watershed / Sous bassin versant

Hydrography / Hydrographie

- Flow direction / Sens de l'écoulement
- Perennial watercourse / Cours d'eau permanent
- Intermittent watercourse / Cours d'eau intermittent
- Runoff / Ruissellement
- Wetland / Milieu humide
- Non-existant / Non-existant
- Waterbody / Plan d'eau
- Wetland / Milieu humide

Stream characterization / Caractérisation des cours d'eau

- Cascade / Cascade
- Rapid / Rapide
- Riffle / Radier
- Lotic channel / Chenal lotique
- Lentic channel / Chenal lentique
- Runs / Plat courant
- Flat / Plat lentique
- Pool / Fosse
- Underground / Sous-terrain

Shorline characterization / Caractérisation des berges

- Aquatic grassbed / Herbier
- Bedrock / Substrat rocheux
- Coarse substrate / Substrat grossier
- Fine substrate / Substrat fin
- To characterize / À caractériser

Obstacle / Obstacle

- Passable with reserve / Passable avec réserve
- Impassable with reserve / Infranchissable avec réserve
- Impassable / Infranchissable

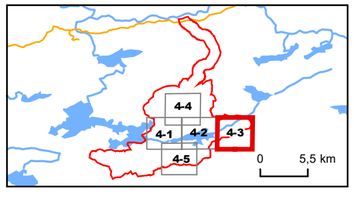
Sampling and logger / Échantillonnage et enregistreur

- Barometric logger / Enregistreur de barométrie
- Level logger and gauging / Enregistreur de niveau
- Physicochemistry / Physicochimie

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDGA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 100 200 m
NAD 1983 CSRS MTM 8

1:9 000



Environmental and social survey

Project : 22-0095

May, 2023
Approved by :
Pierre-Olivier Côté

Note : Cette carte n'a aucune valeur légale, seul un arpenteur-géomètre peut se prononcer sur l'exactitude des informations géographiques.

Map 4-4 : Hydrological characterization North sector

Carte 4-4 : Caractérisation hydrologique Secteur Nord

Limit / Limite

- Work study area / Zone d'étude des travaux (ZET)
- Sub-watershed / Sous bassin versant

Hydrography / Hydrographie

- Flow direction / Sens de l'écoulement
- Perennial watercourse / Cours d'eau permanent
- Intermittent watercourse / Cours d'eau intermittent
- Runoff / Ruissellement
- Wetland / Milieu humide
- Non-existant / Non-existant
- Waterbody / Plan d'eau
- Wetland / Milieu humide

Stream characterization / Caractérisation des cours d'eau

- Cascade / Cascade
- Rapid / Rapide
- Riffle / Radier
- Lotic channel / Chenal lotique
- Lentic channel / Chenal lentique
- Runs / Plat courant
- Flat / Plat lentique
- Pool / Fosse
- Underground / Sous-terrain

Shorline characterization / Caractérisation des berges

- Aquatic grassbed / Herbier
- Bedrock / Substrat rocheux
- Coarse substrate / Substrat grossier
- Fine substrate / Substrat fin
- To characterize / À caractériser

Obstacle / Obstacle

- Passable with reserve / Passable avec réserve
- Impassable with reserve / Infranchissable avec réserve
- Impassable / Infranchissable

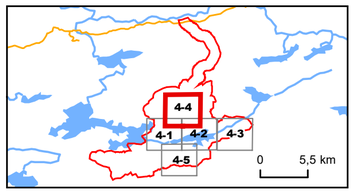
Sampling and logger / Échantillonnage et enregistreur

- Barometric logger / Enregistreur de barométrie
- Level logger and gauging / Enregistreur de niveau
- Physicochemistry / Physicochimie

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDGA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 100 200 m
NAD 1983 CSRS MTM 8

1:9 000



Environmental and social survey

Project : 22-0095

May, 2023
Approved by :
Pierre-Olivier Côté

Note : Cette carte n'a aucune valeur légale, seul un arpenteur-géomètre peut se prononcer sur l'exactitude des informations géographiques.

Map 4-5 : Hydrological characterization South sector

Carte 4-5 : Caractérisation hydrologique Secteur Sud

Limit / Limite

- Work study area / Zone d'étude des travaux (ZET)
- Sub-watershed / Sous bassin versant

Hydrography / Hydrographie

- Flow direction / Sens de l'écoulement
- Perennial watercourse / Cours d'eau permanent
- Intermittent watercourse / Cours d'eau intermittent
- Runoff / Ruissellement
- Wetland / Milieu humide
- Non-existant / Non-existant
- Waterbody / Plan d'eau
- Wetland / Milieu humide

Stream characterization / Caractérisation des cours d'eau

- Cascade / Cascade
- Rapid / Rapide
- Riffle / Radier
- Lotic channel / Chenal lotique
- Lentic channel / Chenal lentique
- Runs / Plat courant
- Flat / Plat lentique
- Pool / Fosse
- Underground / Sous-terrain

Shorline characterization / Caractérisation des berges

- Aquatic grassbed / Herbier
- Bedrock / Substrat rocheux
- Coarse substrate / Substrat grossier
- Fine substrate / Substrat fin
- To characterize / À caractériser

Obstacle / Obstacle

- Passable with reserve / Passable avec réserve
- Impassable with reserve / Infranchissable avec réserve
- Impassable / Infranchissable

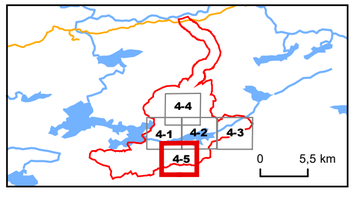
Sampling and logger / Échantillonnage et enregistreur

- Barometric logger / Enregistreur de barométrie
- Level logger and gauging / Enregistreur de niveau
- Physicochemistry / Physicochimie

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDGA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 100 200 m
NAD 1983 CSRS MTM 8

1:9 000



Environmental and social survey

Project : 22-0095

May, 2023
Approved by :
Pierre-Olivier Côté

Note : Cette carte n'a aucune valeur légale, seul un arpenteur-géomètre peut se prononcer sur l'exactitude des informations géographiques.

Appendix 4

Aquatic habitats and fish sampling maps

Map 5-1 : Aquatic habitat and exploratory fish sampling West sector

Carte 5-1 : Habitat aquatique et inventaire ichtyologique Secteur Ouest

Limit / Limite
- Work study area / Zone d'étude des travaux (ZET)
- Sub-watershed / Sous bassin versant

Hydrography / Hydrographie
- Flow direction / Sens de l'écoulement
- Perennial watercourse / Cours d'eau permanent
- Intermittent watercourse / Cours d'eau intermittent
- Runoff / Ruissellement
- Wetland / Milieu humide
- Waterbody / Plan d'eau
- Wetland / Milieu humide

Exploratory fish sampling / Inventaire piscicole
- eDNA sampling / Échantillonnage ADNe
- Bait trap / Bourolle
- Electric fishing / Pêche électrique
- Gill net / Filet maillant
- Trap / Trappe
- Angling / À la ligne
- Visual observation / Observation visuelle
- Fish present / Avec capture
- Fish absent / Sans capture

Fish presence / Présence de poisson
- Confirmed / Confirmé
- Likely / Probable
- Unlikely / Peu probable
- Absence / Absence

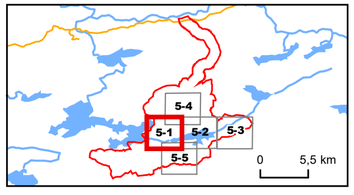
Obstacle / Obstacle
- Passable with reserve / Passable avec réserve
- Impassable with reserve / Infranchissable avec réserve
- Impassable / Infranchissable

Fish habitat / Habitat du poisson
- Aquatic grassbed / Herbier
- Pool / Fosse
- Potential spawning ground / Frayère potentielle
- Shoal / Hauts-fonds

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDGA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 0,1 0,2 km
NAD 1983 CSRS MTM 8

1:9 000



Environmental and social survey

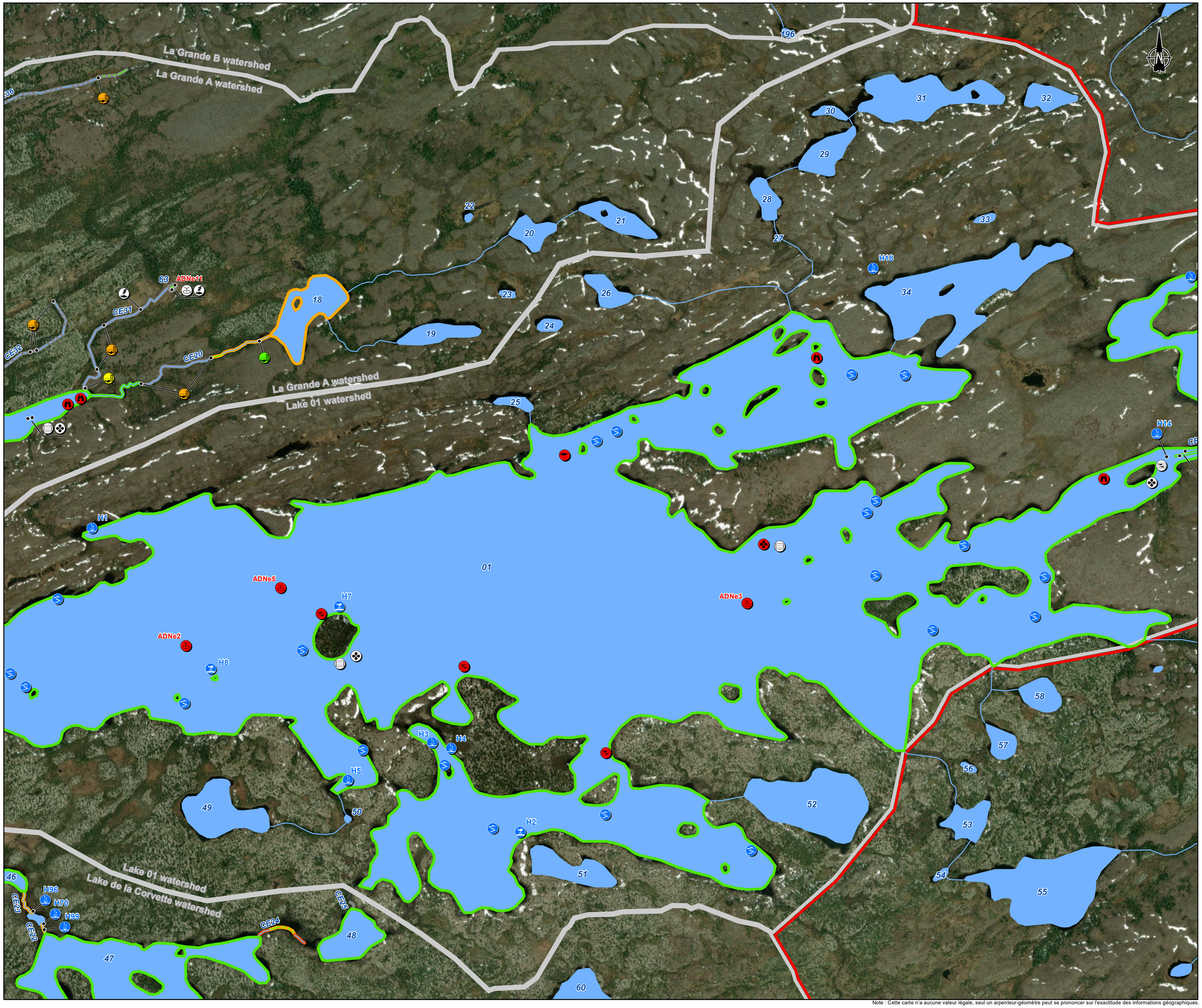
Project : 22-0095

May, 2023
Approved by :
Pierre-Olivier Côté

NIIGAAN

Map 5-2 : Aquatic habitat and exploratory fish sampling Center sector

Carte 5-2 : Habitat aquatique et inventaire ichtyologique Secteur Centre



Limit / Limite

- Work study area / Zone d'étude des travaux (ZET)
- Sub-watershed / Sous bassin versant

Hydrography / Hydrographie

- Flow direction / Sens de l'écoulement
- Perennial watercourse / Cours d'eau permanent
- Intermittent watercourse / Cours d'eau intermittent
- Runoff / Ruissellement
- Wetland / Milieu humide
- Waterbody / Plan d'eau
- Wetland / Milieu humide

Exploratory fish sampling / Inventaire piscicole

- eDNA sampling / Échantillonnage ADNe
- Bait trap / Bourolle
- Electric fishing / Pêche électrique
- Gill net / Filet maillant
- Trap / Trappe
- Angling / À la ligne
- Visual observation / Observation visuelle
- Fish present / Avec capture
- Fish absent / Sans capture

Fish presence / Présence de poisson

- Confirmed / Confirmé
- Likely / Probable
- Unlikely / Peu probable
- Absence / Absence

Obstacle / Obstacle

- Passable with reserve / Passable avec réserve
- Impassable with reserve / Infranchissable avec réserve
- Impassable / Infranchissable

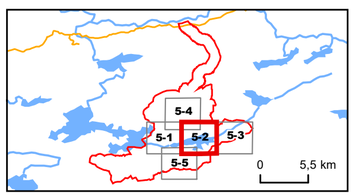
Fish habitat / Habitat du poisson

- Aquatic grassbed / Herbier
- Pool / Fosse
- Potential spawning ground / Frayère potentielle
- Shoal / Hauts-fonds

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDGA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 0,1 0,2 km
NAD 1983 CSRS MTM 8

1:9 000



Environmental and social survey

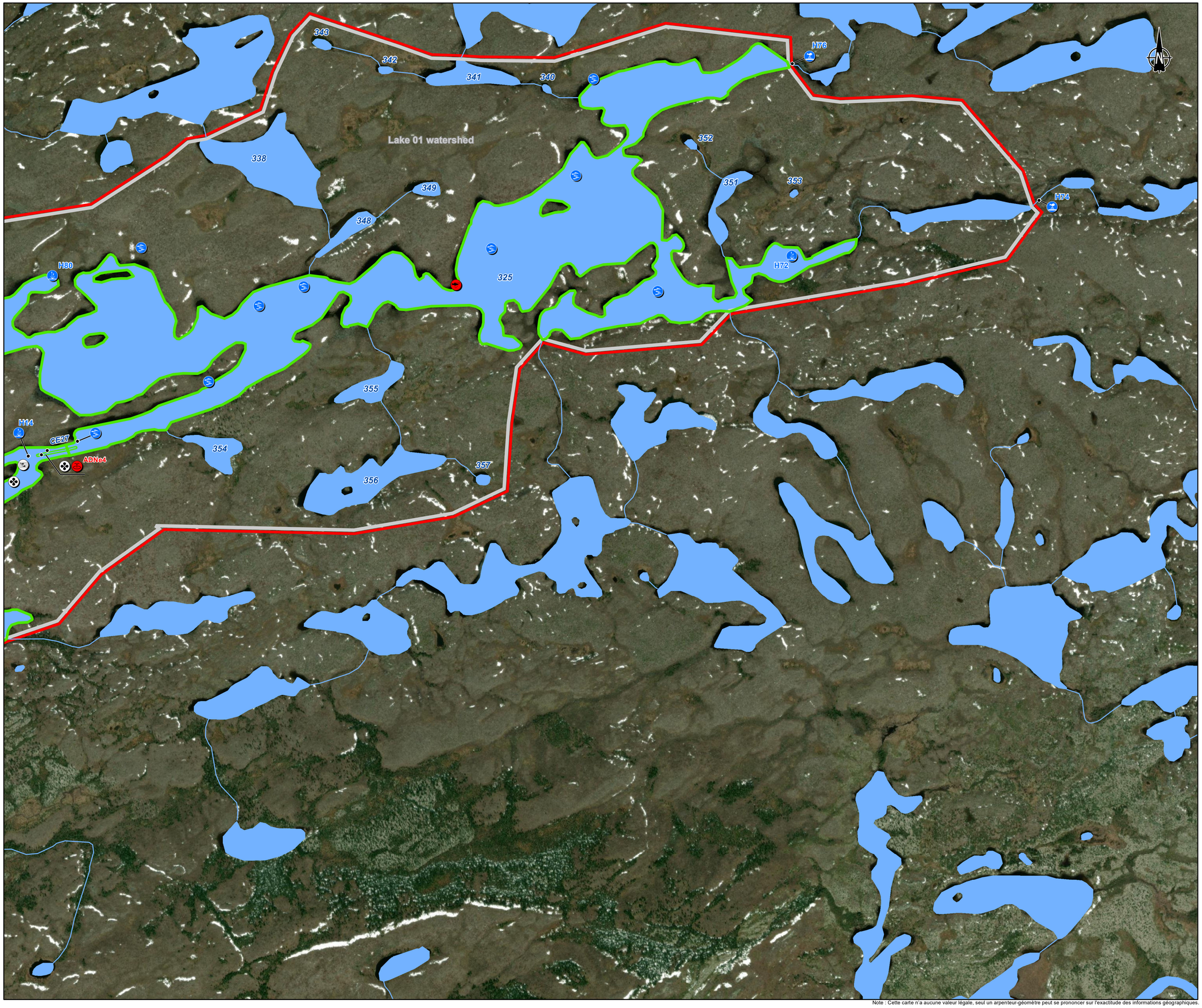
Project : 22-0095

May, 2023
Approved by :
Pierre-Olivier Côté

NIIGAAN

Map 5-3 : Aquatic habitat and exploratory fish sampling East sector

Carte 5-3 : Habitat aquatique et inventaire ichtyologique Secteur Est



Limit / Limite
- Work study area / Zone d'étude des travaux (ZET)
- Sub-watershed / Sous bassin versant

Hydrography / Hydrographie
- Flow direction / Sens de l'écoulement
- Perennial watercourse / Cours d'eau permanent
- Intermittent watercourse / Cours d'eau intermittent
- Runoff / Ruissellement
- Wetland / Milieu humide
- Waterbody / Plan d'eau
- Wetland / Milieu humide

Exploratory fish sampling / Inventaire piscicole
- eDNA sampling / Échantillonnage ADNe
- Bait trap / Bourolle
- Electric fishing / Pêche électrique
- Gill net / Filet maillant
- Trap / Trappe
- Angling / À la ligne
- Visual observation / Observation visuelle
- Fish present / Avec capture
- Fish absent / Sans capture

Fish presence / Présence de poisson
- Confirmed / Confirmé
- Likely / Probable
- Unlikely / Peu probable
- Absence / Absence

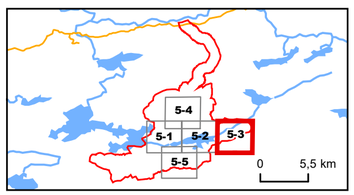
Obstacle / Obstacle
- Passable with reserve / Passable avec réserve
- Impassable with reserve / Infranchissable avec réserve
- Impassable / Infranchissable

Fish habitat / Habitat du poisson
- Aquatic grassbed / Herbier
- Pool / Fosse
- Potential spawning ground / Frayère potentielle
- Shoal / Hauts-fonds

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDGA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 0,1 0,2 km
NAD 1983 CSRS MTM 8

1:9 000



Environmental and social survey

Project : 22-0095

May, 2023
Approved by :
Pierre-Olivier Côté

Note : Cette carte n'a aucune valeur légale, seul un arpenteur-géomètre peut se prononcer sur l'exactitude des informations géographiques.

Map 5-4 : Aquatic habitat and exploratory fish sampling North sector

Carte 5-4 : Habitat aquatique et inventaire ichtyologique Secteur Nord

Limit / Limite
- Work study area / Zone d'étude des travaux (ZET)
- Sub-watershed / Sous bassin versant

Hydrography / Hydrographie
- Flow direction / Sens de l'écoulement
- Perennial watercourse / Cours d'eau permanent
- Intermittent watercourse / Cours d'eau intermittent
- Runoff / Ruissellement
- Wetland / Milieu humide
- Waterbody / Plan d'eau
- Wetland / Milieu humide

Exploratory fish sampling / Inventaire piscicole
- eDNA sampling / Échantillonnage ADNe
- Bait trap / Bourolle
- Electric fishing / Pêche électrique
- Gill net / Filet maillant
- Trap / Trappe
- Angling / À la ligne
- Visual observation / Observation visuelle
- Fish present / Avec capture
- Fish absent / Sans capture

Fish presence / Présence de poisson
- Confirmed / Confirmé
- Likely / Probable
- Unlikely / Peu probable
- Absence / Absence

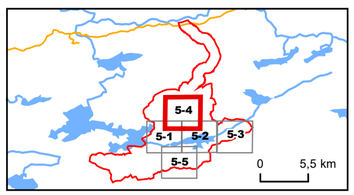
Obstacle / Obstacle
- Passable with reserve / Passable avec réserve
- Impassable with reserve / Infranchissable avec réserve
- Impassable / Infranchissable

Fish habitat / Habitat du poisson
- Aquatic grassbed / Herbier
- Pool / Fosse
- Potential spawning ground / Frayère potentielle
- Shoal / Hauts-fonds

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDGA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 0,1 0,2 km
NAD 1983 CSRS MTM 8

1:9 000



Environmental and social survey

Project : 22-0095

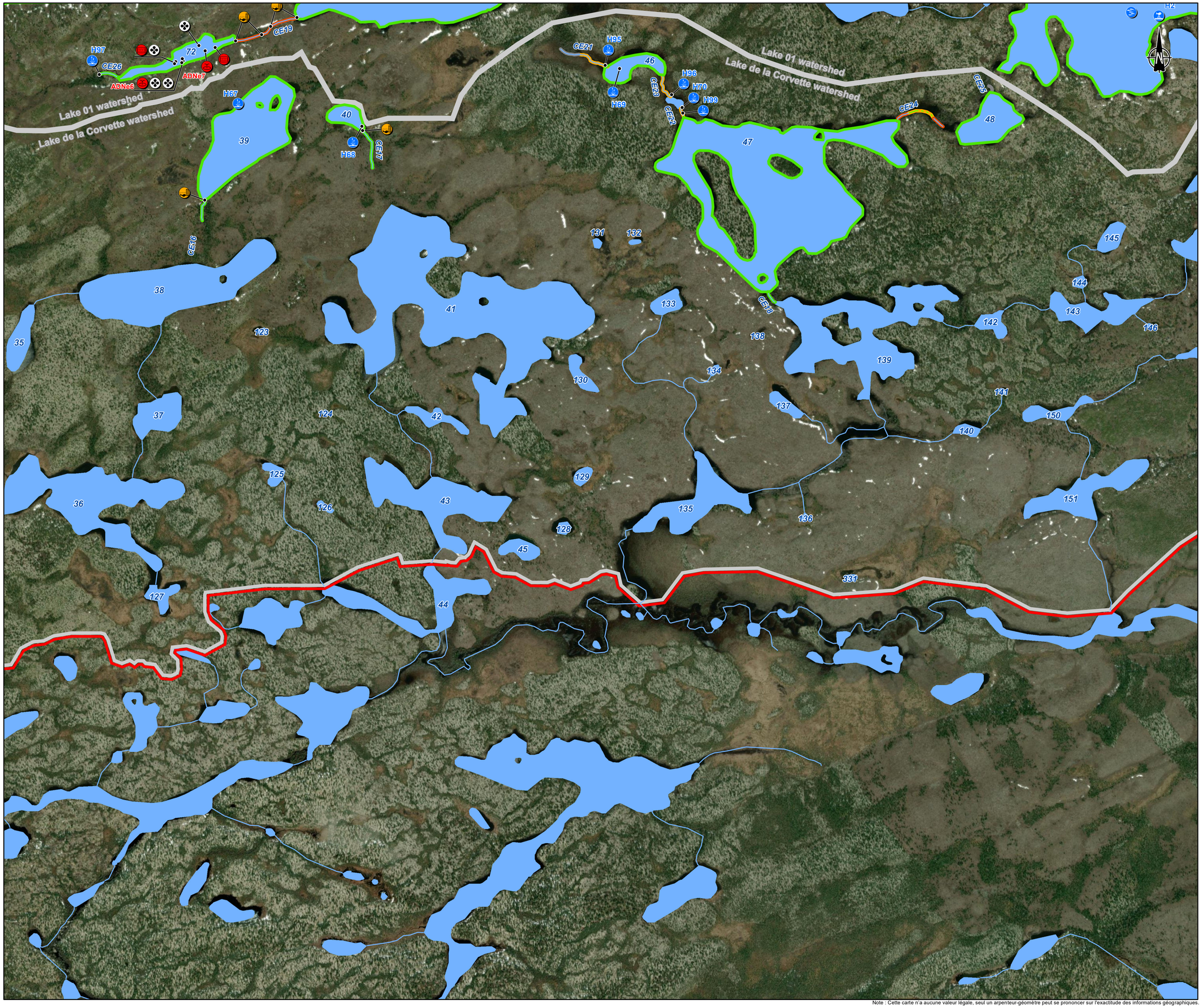
May, 2023
Approved by :
Pierre-Olivier Côté

NIIGAAN

Note : Cette carte n'a aucune valeur légale, seul un arpenteur-géomètre peut se prononcer sur l'exactitude des informations géographiques.

Map 5-5 : Aquatic habitat and exploratory fish sampling South sector

Carte 5-5 : Habitat aquatique et inventaire ichtyologique Secteur Sud



Limit / Limite
- Work study area / Zone d'étude des travaux (ZET)
- Sub-watershed / Sous bassin versant

Hydrography / Hydrographie
- Flow direction / Sens de l'écoulement
- Perennial watercourse / Cours d'eau permanent
- Intermittent watercourse / Cours d'eau intermittent
- Runoff / Ruissellement
- Wetland / Milieu humide
- Waterbody / Plan d'eau
- Wetland / Milieu humide

Exploratory fish sampling / Inventaire piscicole
- eDNA sampling / Échantillonnage ADNe
- Bait trap / Bourolle
- Electric fishing / Pêche électrique
- Gill net / Filet maillant
- Trap / Trappe
- Angling / À la ligne
- Visual observation / Observation visuelle
- Fish present / Avec capture
- Fish absent / Sans capture

Fish presence / Présence de poisson
- Confirmed / Confirmé
- Likely / Probable
- Unlikely / Peu probable
- Absence / Absence

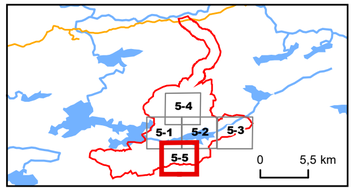
Obstacle / Obstacle
- Passable with reserve / Passable avec réserve
- Impassable with reserve / Infranchissable avec réserve
- Impassable / Infranchissable

Fish habitat / Habitat du poisson
- Aquatic grassbed / Herbier
- Pool / Fosse
- Potential spawning ground / Frayère potentielle
- Shoal / Hauts-fonds

Data sources :
Réseau routier, Adresse Québec, 2023-02
BDCA 1M, MERN Québec, 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, 2019

0 0,1 0,2 km
NAD 1983 CSRS MTM 8

1:9 000



Environmental and social survey

Project : 22-0095

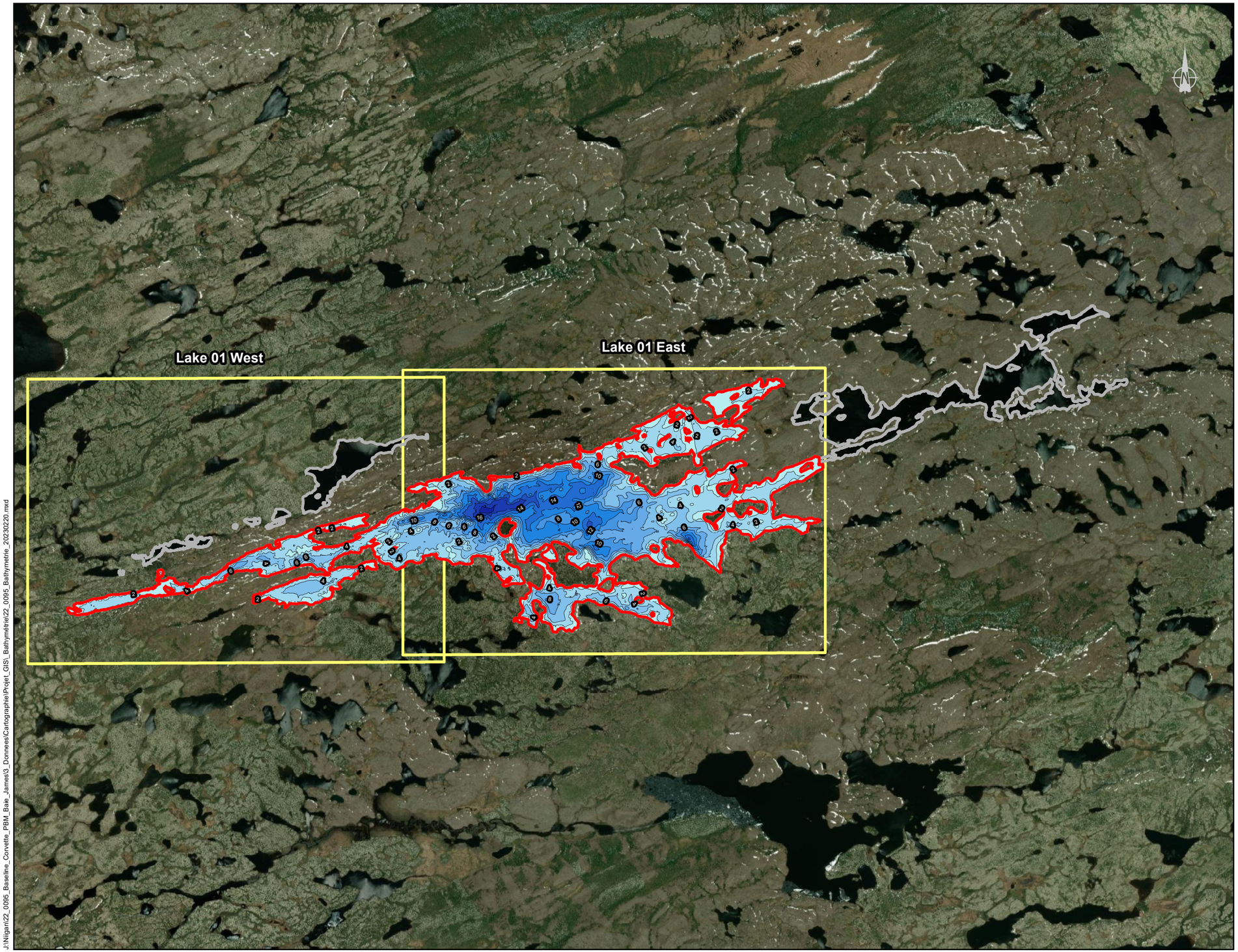
May, 2023
Approved by :
Pierre-Olivier Côté

NIIGAAN

Note : Cette carte n'a aucune valeur légale, seul un arpenteur-géomètre peut se prononcer sur l'exactitude des informations géographiques.

Appendix 5

Bathymetric maps



Bathymetric map

Lake-01

Study area

Isobath (2 meters apart)

Depth (meters)

- 0 to 2
- 2 to 4
- 4 to 6
- 6 to 8
- 8 to 10
- 10 to 12
- 12 to 14
- 14 to 16
- 16 to 18
- 18 +

Maximum depth : 19,46 meters

Mean depth : 4,73 meters

Area : 4 452 993 m²

Volume : 21 124 912 m³

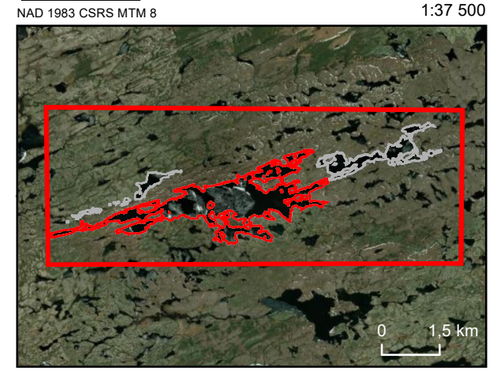
Shoreline development index : 42,93

Data sources :
Project data, Groupe Synergis, 2022
Orthophoto, World Imagery, Esri via the Community Maps Program, 1999-2023
Orthophoto, Service WMTS , Bing Maps

0 370 740 m

NAD 1983 CSRS MTM 8

1:37 500



Corvette baseline

Bathymetric survey

Niigan
Projet : 22-0095

17 february 2023
Approuved by : Patrice Ferron

Note : This map has no legal value, only a land surveyor can comment on the accuracy of the geographical information.

J:\Niigan\22_0095_Baseline_Corvette_PBM_Baie_James\3_Donnees\Cartographie\Projet_GIS_Bathymétrie\22_0095_Bathymetrie_20230220.mxd

GROUPE SYNERGIS

Bathymetric map

Lake-01 West

Study area

Isobath (2 meters apart)

Depth (meters)

- 0 to 2
- 2 to 4
- 4 to 6
- 6 to 8
- 8 to 10
- 10 to 12
- 12 to 14
- 14 to 16
- 16 to 18
- 18 +

Maximum depth : 12,61 meters

Mean depth : 3,03 meters

Area : 1 032 235 m²

Volume : 3 158 159 m³

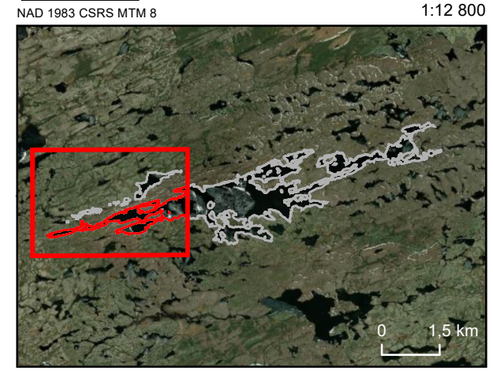
Shoreline development index : 19,52

Data sources :
Project data, Groupe Synergis, 2022
Orthophoto, World Imagery, Esri via the Community Maps Program, 1999-2023
Orthophoto, Service WMTS , Bing Maps

0 125 250 m

NAD 1983 CSRS MTM 8

1:12 800



Corvette baseline

Bathymetric survey

Niigan
Projet : 22-0095

17 february 2023
Approuved by : Patrice Ferron

J:\Niigan\22_0095_Baseline_Corvette_PBM_Baie_James\3_Donnees\Cartographie\Projet_GIS_Bathymétrie\22_0095_Bathymetrie_20230220.mxd

Note : This map has no legal value, only a land surveyor can comment on the accuracy of the geographical information.

Bathymetric map

Lake-01 East

Study area

Isobath (2 meters apart)

Depth (meters)

- 0 to 2
- 2 to 4
- 4 to 6
- 6 to 8
- 8 to 10
- 10 to 12
- 12 to 14
- 14 to 16
- 16 to 18
- 18 +

Maximum depth : 19,46 meters

Mean depth : 5,24 meters

Area : 3 660 669 m²

Volume : 19 018 400 m³

Shoreline development index : 26,74

Data sources :

Project data, Groupe Synergis, 2022

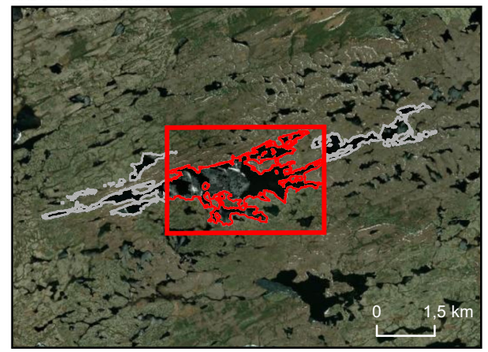
Orthophoto, World Imagery, Esri via the Community Maps Program, 1999-2023

Orthophoto, Service WMTS , Bing Maps

0 125 250 m

NAD 1983 CSRS MTM 8

1:12 980



Corvette baseline

Bathymetric survey

Niigan

Projet : 22-0095

17 february 2023

Approved by : Patrice Ferron

GROUPE SYNERGIS

J:\Niigan\22_0095_Baseline_Corvette_PBM_Baie_James\3_Donnees\Cartographie\Projet_GIS_Bathymétrie\22_0095_Bathymetrie_20230220.mxd

Note : This map has no legal value, only a land surveyor can comment on the accuracy of the geographical information.

Bathymetric map

PE-325

Study area

Isobath (1 meter apart)

Depth (meters)

- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- 4 to 5
- 5 to 6
- 6 +

Maximum depth : 6,08 meters

Mean depth : 1,84 meters

Area : 990 374 m²

Volume : 1 842 745 m³

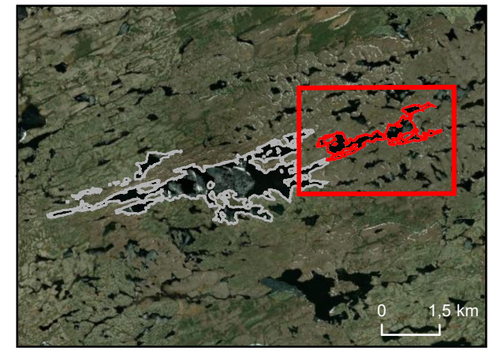
Shoreline development index : 25,63

Data sources :
Project data, Groupe Synergis, 2022
Orthophoto, World Imagery, Esri via the Community Maps Program, 1999-2023
Orthophoto, Service WMTS , Bing Maps

0 125 250 m

NAD 1983 CSRS MTM 8

1:12 800



Corvette baseline

Bathymetric survey

Niigan
Projet : 22-0095

17 february 2023
Approuved by : Patrice Ferron

GROUPE SYNERGIS

J:\Niigan\22_0095_Baseline_Corvette_PBM_Baie_James\3_Donnees\Cartographie\Projet_GIS_Bathymétrie\22_0095_Bathymetrie_20230220.mxd

Note : This map has no legal value, only a land surveyor can comment on the accuracy of the geographical information.

Bathymetric map

PE-2

Study area

Isobath (1 meter apart)

Depth (meters)

- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- 4 to 5
- 5 to 6
- 6 +

Maximum depth : 6,17 meters

Mean depth : 2,17 meters

Area : 235 661 m²

Volume : 511 354 m³

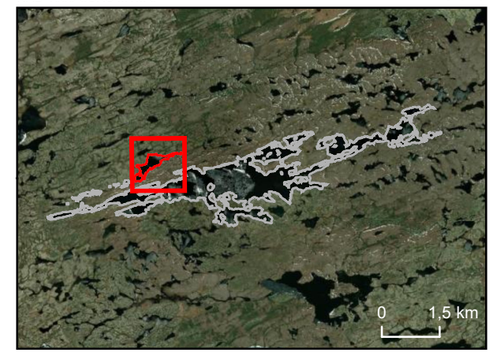
Shoreline development index : 5,80

Data sources :
Project data, Groupe Synergis, 2022
Orthophoto, World Imagery, Esri via the Community Maps Program, 1999-2023
Orthophoto, Service WMTS , Bing Maps

0 50 100 m

NAD 1983 CSRS MTM 8

1:5 640



Corvette baseline

Bathymetric survey

Niigan
Projet : 22-0095

17 february 2023
Approuved by : Patrice Ferron

GROUPE SYNERGIS

Note : This map has no legal value, only a land surveyor can comment on the accuracy of the geographical information.

J:\Niigan\22_0095_Baseline_Corvette_PBM_Baie_James\3_Donnees\Cartographie\Projet_GIS_Bathymétrie\22_0095_Bathymetrie_20230220.mxd

Bathymetric map

PE-3

Study area

Isobath (0,75 meter apart)

Depth (meters)

- 0 to 0,75
- 0,75 to 1,50
- 1,50 to 2,25
- 2,25 to 3,00
- 3,00 +

Maximum depth : 3,18 meters

Mean depth : 1,41 meters

Area : 11 378 m²

Volume : 15 992 m³

Shoreline development index : 1,50

Data sources :

Project data, Groupe Synergis, 2022

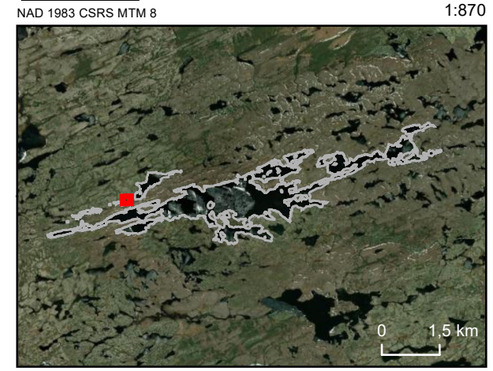
Orthophoto, World Imagery, Esri via the Community Maps Program, 1999-2023

Orthophoto, Service WMTS , Bing Maps

0 8,5 17 m

NAD 1983 CSRS MTM 8

1:870



Corvette baseline

Bathymetric survey

Niigan

Projet : 22-0095

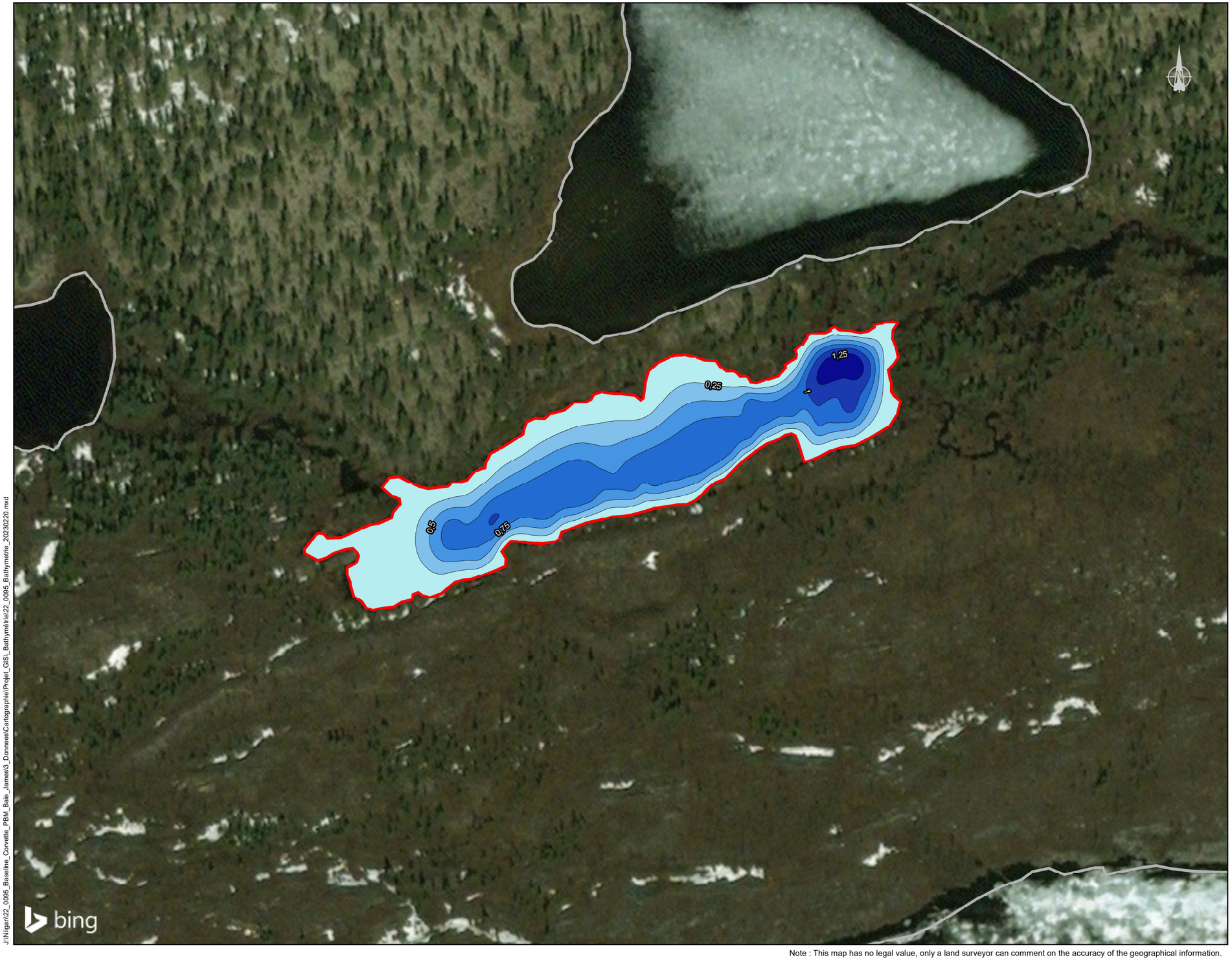
17 february 2023

Approuved by : Patrice Ferron

GROUPE SYNERGIS

Note : This map has no legal value, only a land surveyor can comment on the accuracy of the geographical information.

J:\Niigan\22_0095_Baseline_Corvette_PBM_Baie_James\3_Donnees\Cartographie\Projet_GIS_Bathymétrie\22_0095_Bathymetrie_20230220.mxd



J:\Niigan\22_0095_Baseline_Corvette_PBM_Baie_James\3_Donnees\Cartographie\Projet_GIS_Bathymétrie\22_0095_Bathymetrie_20230220.mxd

Bathymetric map

PE-4

Study area

Isobath (0,25 meter apart)

Depth (meters)

- 0 to 0,25
- 0,25 to 0,50
- 0,50 to 0,75
- 0,75 to 1,00
- 1,00 to 1,25
- 1,25 +

Maximum depth : 1,42 meters

Mean depth : 0,47 meter

Area : 5 410 m²

Volume : 2 552 m³

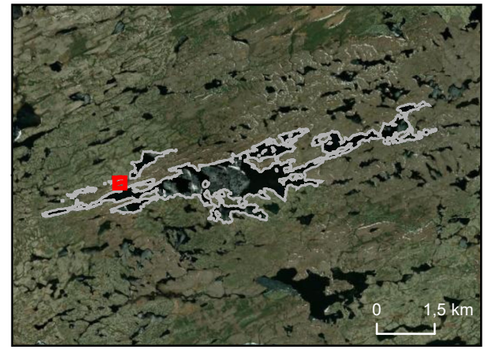
Shoreline development index : 3,57

Data sources :
Project data, Groupe Synergis, 2022
Orthophoto, World Imagery, Esri via the Community Maps Program, 1999-2023
Orthophoto, Service WMTS , Bing Maps

0 10 20 m

NAD 1983 CSRS MTM 8

1:1 150



Corvette baseline

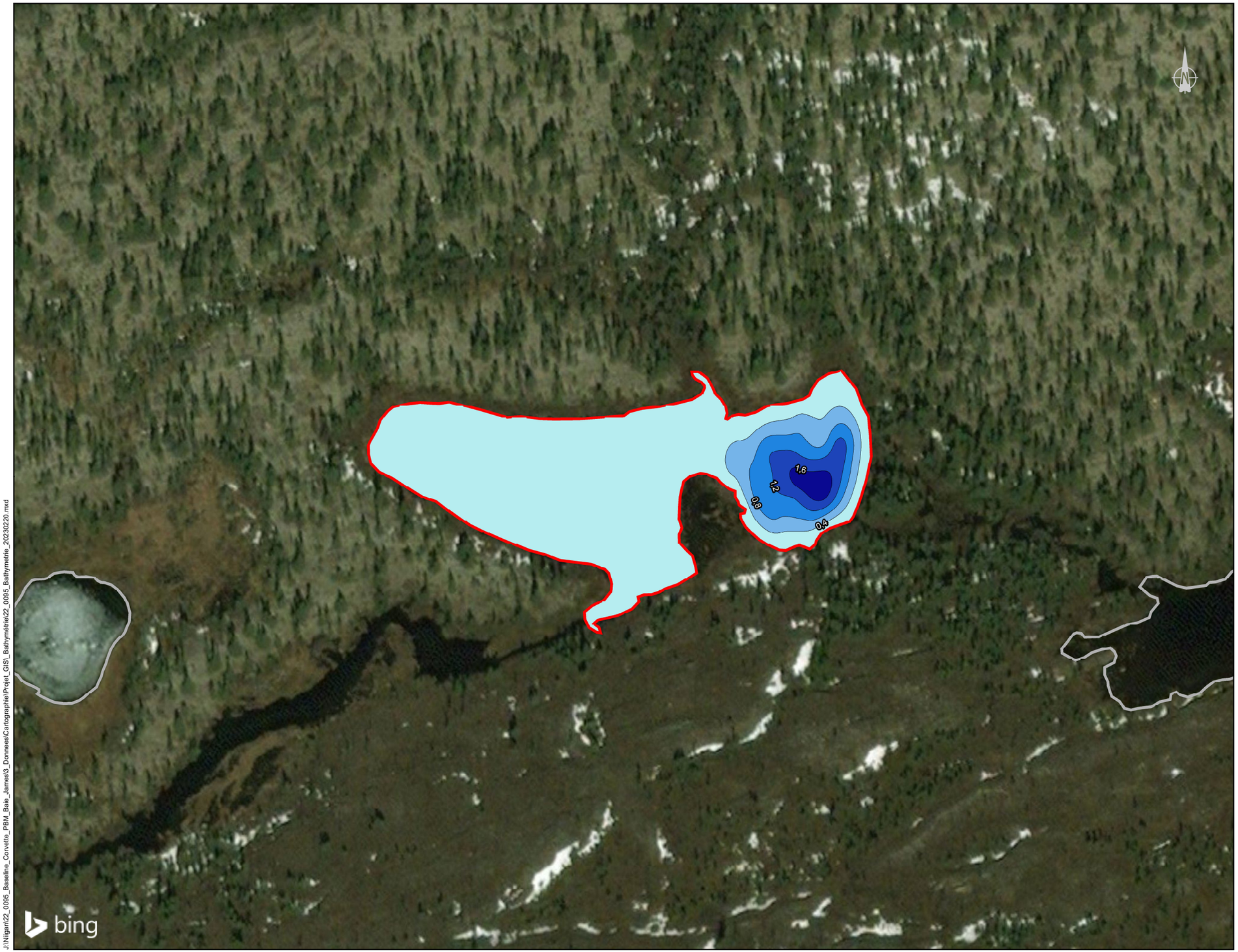
Bathymetric survey

Niigan
Projet : 22-0095

17 february 2023
Approuved by : Patrice Ferron

Note : This map has no legal value, only a land surveyor can comment on the accuracy of the geographical information.

GROUPE SYNERGIS



J:\Niigan\22_0095_Baseline_Corvette_PBM_Baie_James\3_Donnees\Cartographie\Projet_GIS_Bathymétrie\22_0095_Bathymetrie_20230220.mxd

Bathymetric map

PE-5

Study area

Isobath (0,4 meter apart)

Depth (meters)

0 to 0,4

0,4 to 0,8

0,8 to 1,2

1,2 to 1,6

1,6 +

Maximum depth : 1,87 meters

Mean depth : 0,21 meter

Area : 5 652 m²

Volume : 1 187 m³

Shoreline development index : 3,07

Data sources :

Project data, Groupe Synergis, 2022

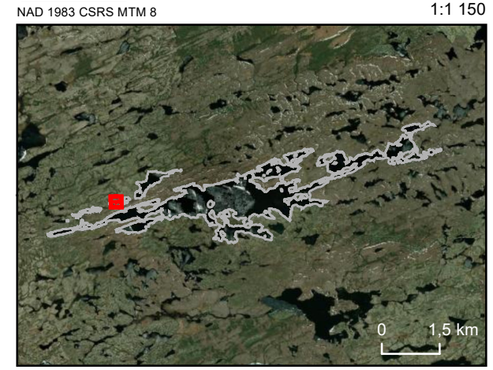
Orthophoto, World Imagery, Esri via the Community Maps Program, 1999-2023

Orthophoto, Service WMTS , Bing Maps

0 10 20 m

NAD 1983 CSRS MTM 8

1:1 150



Corvette baseline

Bathymetric survey

Niigan

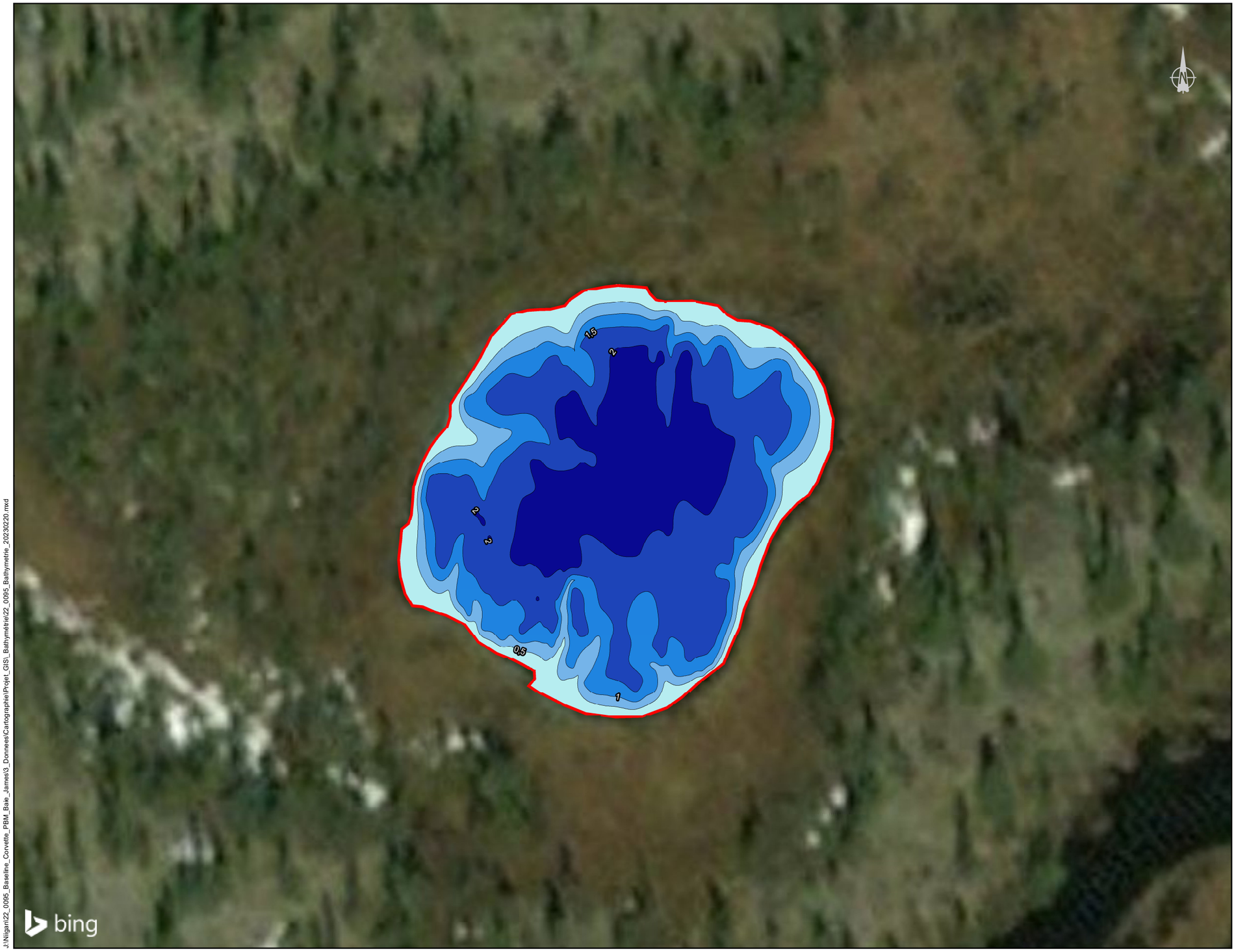
Projet : 22-0095

17 february 2023

Approuved by : Patrice Ferron

Note : This map has no legal value, only a land surveyor can comment on the accuracy of the geographical information.

GROUPE SYNERGIS



J:\Niigan\22_0095_Baseline_Corvette_PBM_Baie_James\3_Donnees\Cartographie\Projet_GIS_Bathymétrie\22_0095_Bathymetrie_20230220.mxd

Note : This map has no legal value, only a land surveyor can comment on the accuracy of the geographical information.

Bathymetric map

PE-6

Study area

Isobath (0,5 meter apart)

Depth (meters)

- 0 to 0,5
- 0,5 to 1,0
- 1,0 to 1,5
- 1,5 to 2,0
- 2,0 +

Maximum depth : 2,34 meters

Mean depth : 1,43 meters

Area : 1 068 m²

Volume : 1 526 m³

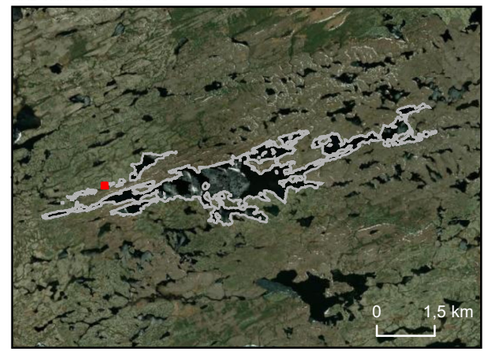
Shoreline development index : 1,14

Data sources :
Project data, Groupe Synergis, 2022
Orthophoto, World Imagery, Esri via the Community Maps Program, 1999-2023
Orthophoto, Service WMTS , Bing Maps

0 3,5 7 m

NAD 1983 CSRS MTM 8

1:350



Corvette baseline

Bathymetric survey

Niigan
Projet : 22-0095

17 february 2023
Approuved by : Patrice Ferron

GROUPE SYNERGIS

Bathymetric map

PE-7

Study area

Isobath (0,75 meter apart)

Depth (meters)

- 0 to 0,75
- 0,75 to 1,50
- 1,50 to 2,25
- 2,25 to 3,00
- 3,00 +

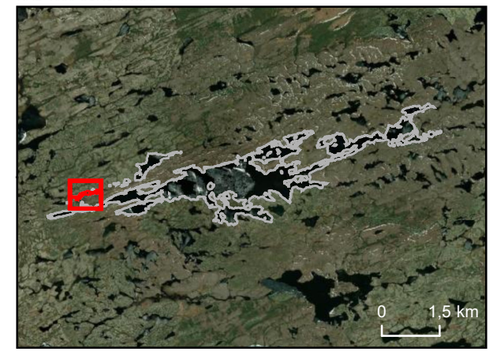
Maximum depth : 3,53 meters
Mean depth : 0,94 meter
Area : 44 566 m²
Volume : 41 950 m³
Shoreline development index : 9,30

Data sources :
Project data, Groupe Synergis, 2022
Orthophoto, World Imagery, Esri via the Community Maps Program, 1999-2023
Orthophoto, Service WMTS , Bing Maps

0 30 60 m

NAD 1983 CSRS MTM 8

1:2 960



Corvette baseline

Bathymetric survey

Niigan
Projet : 22-0095

17 february 2023
Approuved by : Patrice Ferron

GROUPE SYNERGIS

Note : This map has no legal value, only a land surveyor can comment on the accuracy of the geographical information.

J:\Niigan\22_0095_Baseline_Corvette_PBM_Baie_James\3_Donnees\Cartographie\Projet_GIS_Bathymétrie\22_0095_Bathymetrie_20230220.mxd

Bathymetric map

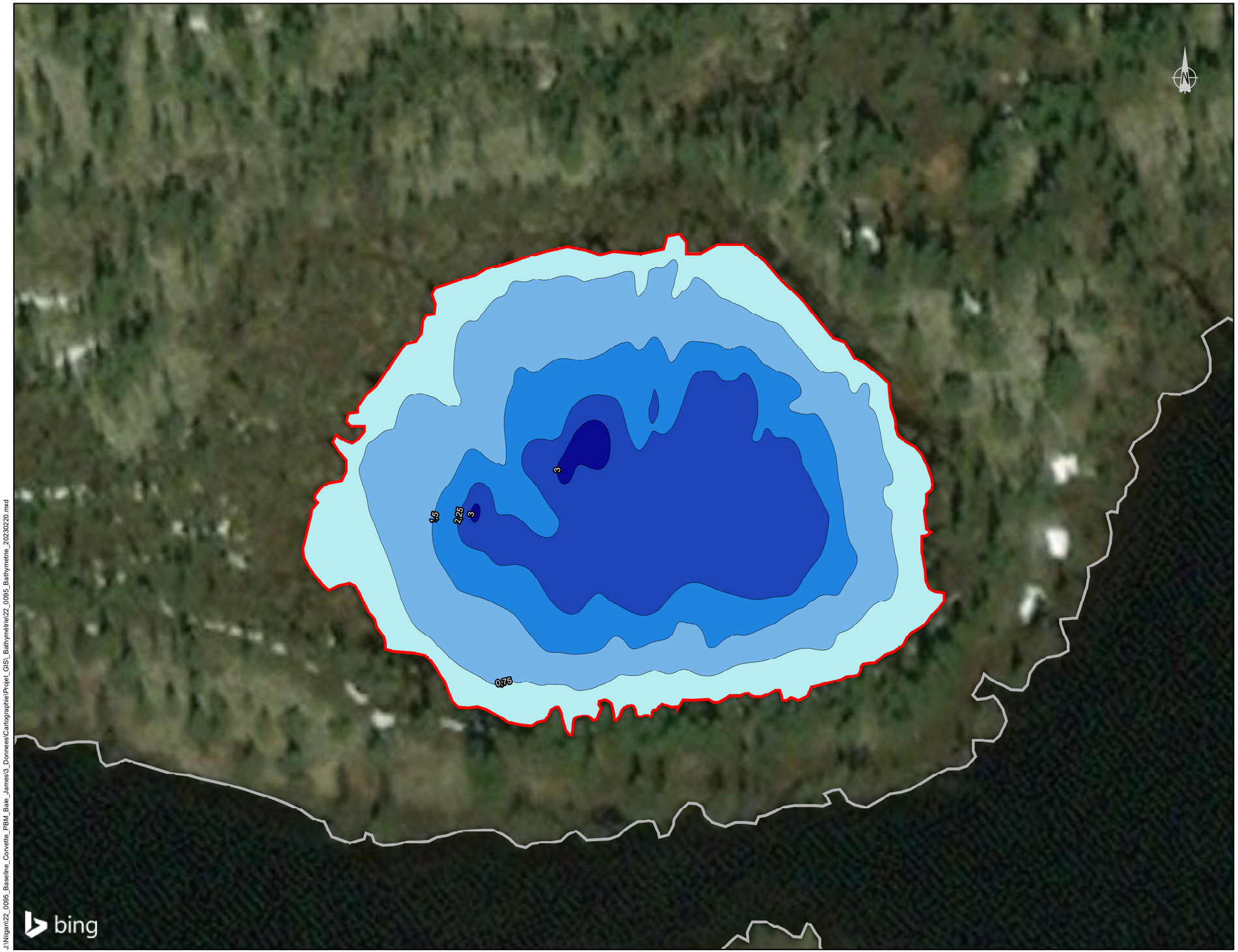
PE-8

Study area

Isobath (0,75 meter apart)

Depth (meters)

- 0 to 0,75
- 0,75 to 1,50
- 1,50 to 2,25
- 2,25 to 3,00
- 3,00 +



Maximum depth : 3,68 meters

Mean depth : 1,42 meters

Area : 4 421 m²

Volume : 6 273 m³

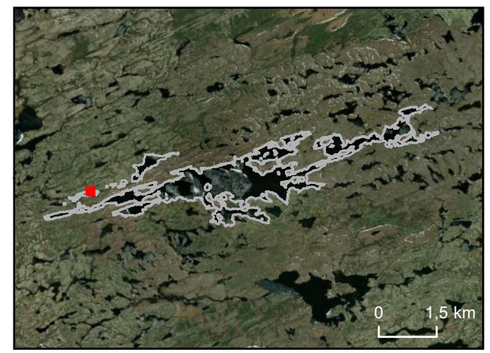
Shoreline development index : 1,53

Data sources :
Project data, Groupe Synergis, 2022
Orthophoto, World Imagery, Esri via the Community Maps Program, 1999-2023
Orthophoto, Service WMTS , Bing Maps

0 5,5 11 m

NAD 1983 CSRS MTM 8

1:540



Corvette baseline

Bathymetric survey

Niigan
Projet : 22-0095

17 february 2023
Approuved by : Patrice Ferron

GROUPE SYNERGIS

J:\Niigan\22_0095_Baseline_Corvette_PBM_Baie_James\3_Donnees\Cartographie\Projet_GIS_Bathymétrie\22_0095_Bathymetrie_20230220.mxd

Note : This map has no legal value, only a land surveyor can comment on the accuracy of the geographical information.

Bathymetric map

PE-9

Study area

Isobath (0,25 meter apart)

Depth (meters)

- 0 to 0,25
- 0,25 to 0,50
- 0,50 to 0,75
- 0,75 to 1,00
- 1,00 to 1,25
- 1,25 to 1,50
- 1,50 +

Maximum depth : 1,71 meters

Mean depth : 0,78 meter

Area : 1 350 m²

Volume : 1 052 m³

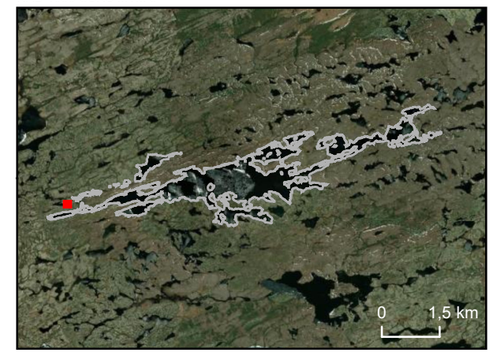
Shoreline development index : 1,44

Data sources :
Project data, Groupe Synergis, 2022
Orthophoto, World Imagery, Esri via the Community Maps Program, 1999-2023
Orthophoto, Service WMTS , Bing Maps

0 4,5 9 m

NAD 1983 CSRS MTM 8

1:450



Corvette baseline

Bathymetric survey

Niigan
Projet : 22-0095

17 february 2023
Approuved by : Patrice Ferron

J:\Niigan\22_0095_Baseline_Corvette_PBM_Baie_James\3_Donnees\Cartographie\Projet_GIS_Bathymétrie\22_0095_Bathymetrie_20230220.mxd

Note : This map has no legal value, only a land surveyor can comment on the accuracy of the geographical information.

J:\Niigan\22_0095_Baseline_Corvette_PBM_Baie_James\3_Donnees\Cartographie\Projet_GIS_Bathymétrie\22_0095_Bathymetrie_20230220.mxd

Bathymetric map

PE-11

Study area

Isobath (0,25 meter apart)

Depth (meters)

- 0 to 0,25
- 0,25 to 0,50
- 0,50 to 0,75
- 0,75 to 1,00
- 1,00 to 1,25
- 1,25 to 1,50
- 1,50 +

Maximum depth : 1,71 meters

Mean depth : 0,78 meter

Area : 1 350 m²

Volume : 1 052 m³

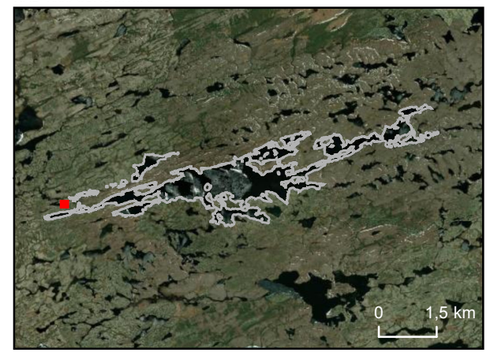
Shoreline development index : 1,44

Data sources :
Project data, Groupe Synergis, 2022
Orthophoto, World Imagery, Esri via the Community Maps Program, 1999-2023
Orthophoto, Service WMTS , Bing Maps

0 4,5 9 m

NAD 1983 CSRS MTM 8

1:450



Corvette baseline

Bathymetric survey

Niigan
Projet : 22-0095

17 february 2023
Approuved by : Patrice Ferron

Note : This map has no legal value, only a land surveyor can comment on the accuracy of the geographical information.

GROUPE SYNERGIS


NIIGAAN