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Mistissini Airport Opportunity Study

Preliminary Study

Consultant Reference: LGA-1-MI-T-TGN-RT-0001_01

2024-03-20

Vision Eeyou Istchee

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Stantec ▪ DESFOR ▪ SYSTRA

with subconsultant KPMG

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PRELIMINARY STUDY

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1. INTRODUCTION

1.1 CONTEXT

The Cree Nation of Mistissini would like to build a new airfield to provide air transport service for its residents and help in the development of new commercial and industrial opportunities in the region. Eight (8) potential sites have been identified and will be analyzed in this study to define the optimal site to build a new aerodrome.

1.2 MANDATE

As defined in our proposal, the Cree Nation of Mistissini would like to conduct a preliminary study to explore the possible sites associated with the construction of a new aerodrome in the vicinity of the community. The mandate includes:

1. Analysis and identification of potential sites,
2. Definition of the optimal site,
3. Preparation of a preliminary plan.

1.3 REFERENCE DOCUMENTS

The following documents are available to carry out the mandate.

- Map of surface deposits in the region.
- Lidar survey.
- Topographic and stratigraphic maps of the region.

1.4 DESIGN DOCUMENTS

The design documents used in this analysis are presented in Table 1-1.

Table 1-1: Design documents

Title	Organism	Edition
Aerodrome Standards and Recommended Practices (TP 312)	Transport Canada	5e edition, modification 1 (2020/01/15)
Aerodrome Design Manual – Part 1, Runways	International Civil Aviation Organization	3e edition, amendment 2 (2017/04/28)
AC 150/5325-4B - Runway Length Requirements for Airport Design	Federal Aviation Administration (FAA)	Date modified 2005/07/01
Manual of pavement structural design (ASG-19)	Transport Canada	July 1992
Canadian Aviation Regulations, Part III, (SOR/96-433)	Transport Canada	Date modified 2021/05/04

2. IDENTIFICATION OF POTENTIAL SITES

This section summarizes all the basis information needed for the analysis. First, the specifications required for the airfield infrastructures are listed. Second, the potential sites are identified and presented in detail.

2.1 AERODROME CHARACTERISTICS

Stantec suggested the use of a Dash 8-300 aircraft. For the purposes of this study, this aircraft will be considered as critical aircraft. It is part of the Aircraft Group Number (AGN) IIIA according to TP 312 5th edition based on its approach speed under 121 knots. For this study, to establish a comfortable location, Stantec used design parameters for a Precision AGN IIIB gravel runway. Table 2-1 below summarizes the parameters of the preliminary concept used in this study.

Table 2-1: Parameters of the preliminary concept

Item	Projected parameters
Runway length	1,524 m (5 000 ft)
Runway width	45 m (148 ft)
Longitudinal slope (max.)	1.5 %
Transverse slope (Unpaved surface) (max.)	2.5%
Runway safety area (min.)	75 m
Permissible transverse slope range in the runway safety area	0 to – 2.5%
Runway strip width (min.)	122 m
Runway strip length (min.)	61 m

2.2 PRELIMINARY POTENTIAL SITES

To begin the analysis of potential sites, a plan combining the contour lines was prepared. Since no geotechnical survey were done, hypotheses were made from maps of surface deposits in the region and digital elevation model derived from Lidar data. The plan identified six (6) preliminary sites. After discussions with the client, three (3) more sites were identified. See Appendix A for the identified site locations.

It is important to note that no visit to the region was carried out to confirm the viability of the nine (9) sites. Further studies should proceed with a site visit to confirm the hypotheses of this report. Furthermore, weather surveys will be essential to determine local weather, periods of darkening, ceiling elevation, surface fog, precipitation, wind direction and speed in future stages. Figure 2-1 shows the locations of the nine (9) preliminary sites.

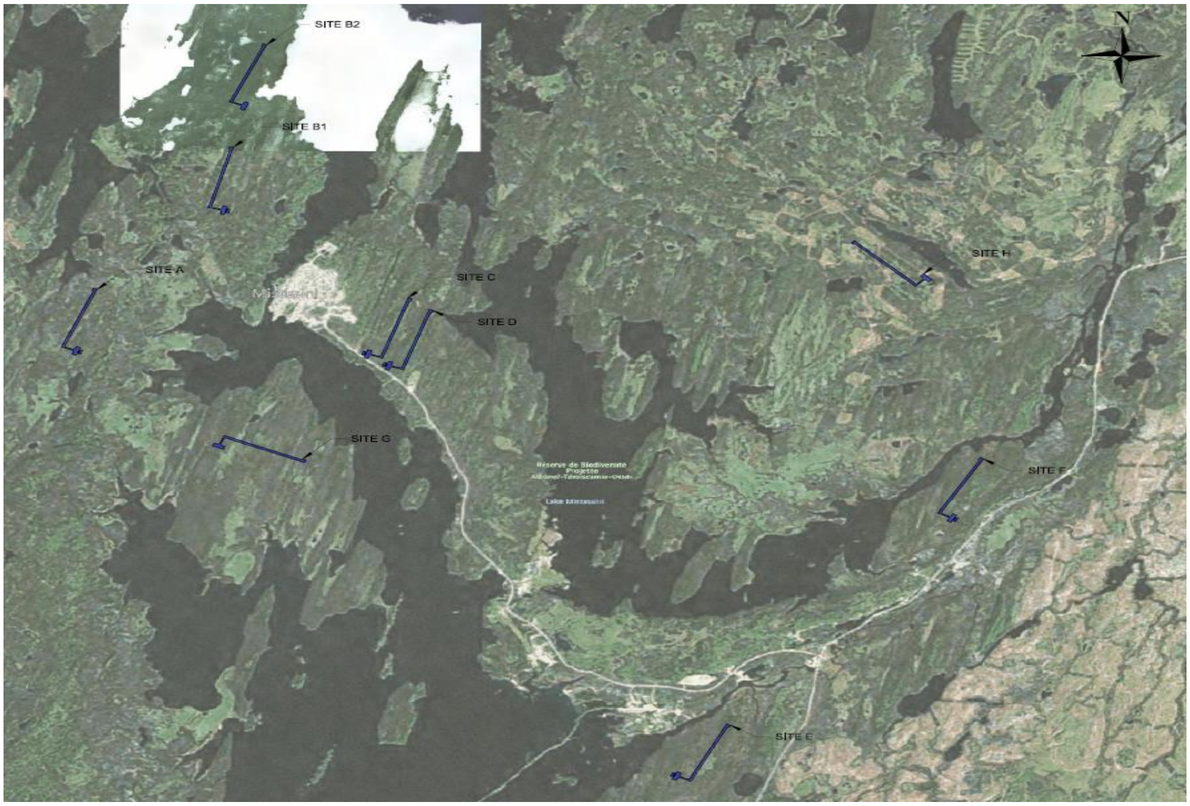


Figure 2-1: Overview of the location of the nine preliminary sites

Site A is located to the southwest of the community and could be accessed from the road leading to the sand pit. It consists of a southwest/northeast-trending till ridge that rises between 5-10 m above the surrounding terrain. The site is bounded at its northeastern end by a stream. Small streams running parallel to the ridge may also need to be backfilled in its southwestern portion. Category 1A land boundary is located at a short distance from the south-western end of the site and strict compliance to this boundary could constrain development. The ridge also shows signs of gullying along its northeast flank, which may increase in response to site clearing for construction.

Site B1 is located northwest of the community of Mistissini and could be accessed by forking the road leading to the sand pit with a new, 1600 m long access road towards the north. The site is a southwest/northeast-trending till ridge rising between 5 – 15 m above the surrounding terrain. The land bordering the ridge is essentially occupied by wetlands drained by small streams. The slopes of the ridge are prone to gully erosion, which could increase following site clearing.

Site B2 is located northwest of the community of Mistissini and could be accessed by forking the road leading to the sand pit with a new, 3900 m long access road towards the north. The is southwest/northeast-trending sitting in an assemblage of sandy fluvio-glacial deposits including esker ridges and hummocky topography rising up to 25m above the surrounding terrain. These deposits are prone to aeolian transport and are often re-worked into dunes.

Sites C and D are located to the southeast of the community, north of Main Street. Both sites occupy comparable terrain each on its own till ridge running southwest/northeast, running parallel to each other, with site D 450 m further from the community. The ridges become narrower at their northeastern end. Small streams flow toward the north on the sides of the ridges, running parallel to the landforms.

Site E is located approximately 27 km southeast of the community of Mistissini, and about 3 km south from the intersection of Route 167 and Main Street. The site is currently accessible via the logging road network connecting to Route 167. It consists of a southwest/northeast-trending till ridge rising approximately 5 to 10 m above the surrounding terrain. The site is bordered to the south by a lake and to the north by the Rivière à La Perche. In addition to its distance from the community, its main constraint is that it is located out of 1A land category.

Site F is located more than 20 km southeast of the community, 700 m to the west of route 167 and about 4.5 km northeast of its intersection with Main Street. The site consists of a southwest/northeast-trending till ridge and is currently accessible via the existing logging road network. The site is essentially limited by the dimensions of the ridge and the presence of the Chalifour River, which flows to the west and north of the ridge. A small, north flowing stream runs along the eastern edge of the ridge. It should be noted that the ridge shows signs of gullying on its northwest flank, which could increase in response to the clearing of the site.

Site G is located to the south of the community, on the other side of the bay, and could be accessed from a 3.1 km extension of the road leading to the sand pit. The site is low lying and surrounded by wetlands. It sits across a set of subdued southwest/northeast-trending till ridges, separated by wetlands and generally poorly drained soils. A direct access road would have to cross thick peat deposits and flood-prone wetlands.

Site H is located northeast of the community. It is currently not accessible from land, but is 3.2 km west of Route 167. This site would need a 4km road and water crossing connecting it with route 167. The topography at the site is uneven and hummocky, and the site is located on top of a series of bedrock terraces. Surface deposits are thin, made mostly of till veneers and covered by various thickness of organics. Drainage is generally poor at the site, with multiple wetlands and small ponds scattered around the proposed infrastructure layout.

2.3 SELECTED POTENTIAL SITES

When studying potential airport sites, various factors must be analysed to determine the most suitable location for the airport. Here are some key considerations that were taken into account for Mistissini:

- **Accessibility**: accessibility of each site in terms of proximity to major transportation networks such as highways, railways, and waterways.
- **Topography and Terrain**: the topography and terrain of each site, including factors such as elevation, slope, and soil conditions.
- **Environmental Impact:** the environmental impact of each site, including considerations such as habitat disruption, wildlife migration patterns, and potential pollution sources.
- **Urban Development:** the potential for urban development around each site, including factors such as population growth, land use zoning, and infrastructure development.
- **Airspace Considerations:** airspace constraints and considerations for each site, including factors such as proximity to other airports, airspace restrictions, and potential conflicts with military operations or flight paths.
- **Utility Infrastructure:** the availability and capacity of utility infrastructure such as water, power, and telecommunications at each site.
- **Community Engagement:** Engage with local communities and stakeholders to gather feedback and assess community support for each potential airport site.

- **Regulatory and Legal Considerations:** regulatory requirements and legal considerations for airport development at each site, including zoning regulations, environmental permits, and compliance with aviation safety standards.

By carefully considering these factors and conducting a comprehensive analysis, we are able to make an informed decision on the most suitable location for the airport that aligns with the needs and priorities of the city and its residents.

With the information gathered thru various discussions with the Cree Nation and the Cree Health Board, three of nine potential sites were confirmed as contenders to receive a future airport. The sites are:

- Site B1
- Site F
- Site G

Figure 2-2 below shows the three best suited locations. The circles represent 5km radius from the community center. Site B1 & G are closest to the community, within a 5km radius and site F is the furthest one at roughly 12km. These measurements are aerial.

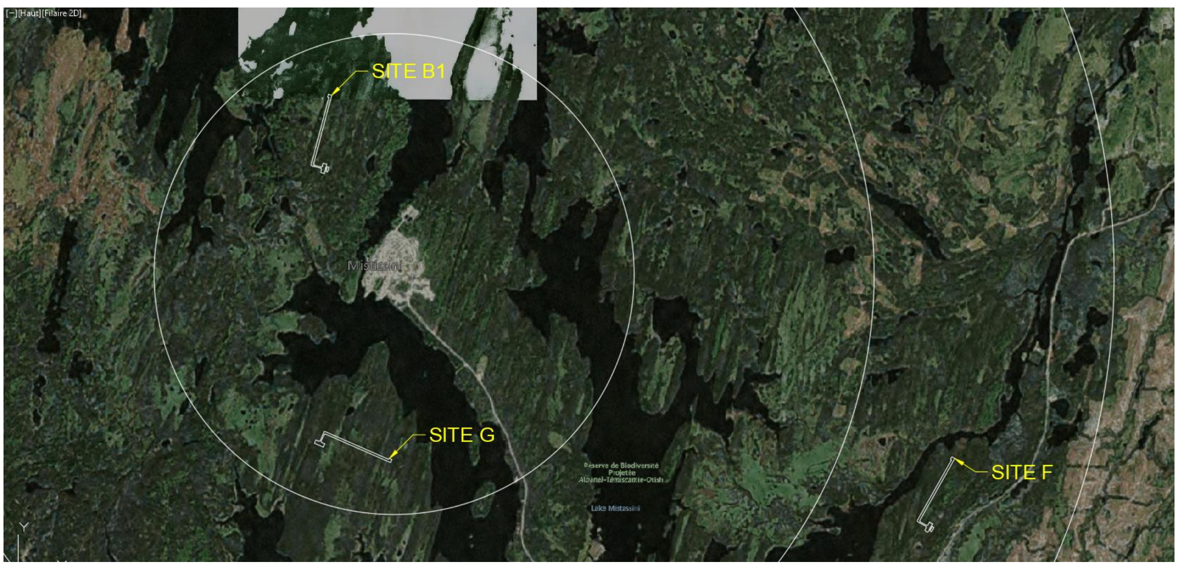


Figure 2-2: Overview of selected sites

A preliminary obstacle limitation surfaces (OLS) was built for each of the three (3) remaining sites and each sites were assessed from the general topography of the region.

The "OLS" is a surface that establishes the limit to which objects may project into the airspace associated with an aerodrome so that aircraft operations at the aerodrome may be conducted safely. OLS consist of the following:

- An inner transitional surface. A complex surface extending lengthwise on the runway strip that extends upwards and outwards to the outer obstacle identification surface.
- An approach surface. An inclined plane preceding the threshold of a runway.
- A Take-off surface. An inclined plane beyond the end of the runway or clearway.
- And a transitional surface. A complex surface along the side of the runway strip and all or part of the side of the approach surface, that slopes upwards and outwards to a specified height established for each aerodrome.

At the exception of the natural terrain that would need to be leveled and profiled to build a aerodrome and it's infrastructure, no significant obstacles were observed around sites B1 and G. Unfortunately, Site F presented issues with the lateral transitional slopes for the OLS. For that reason alone, this site was removed from the potential site list.

An overall plan of the two selected sites is presented in Appendix B. Figure 2-3 shows a plan view of the OLS for Site B1 and figure 2-4 shows a plan view of the OLS for site G. An overall map of the sites and the territories is presented in Appendix C.

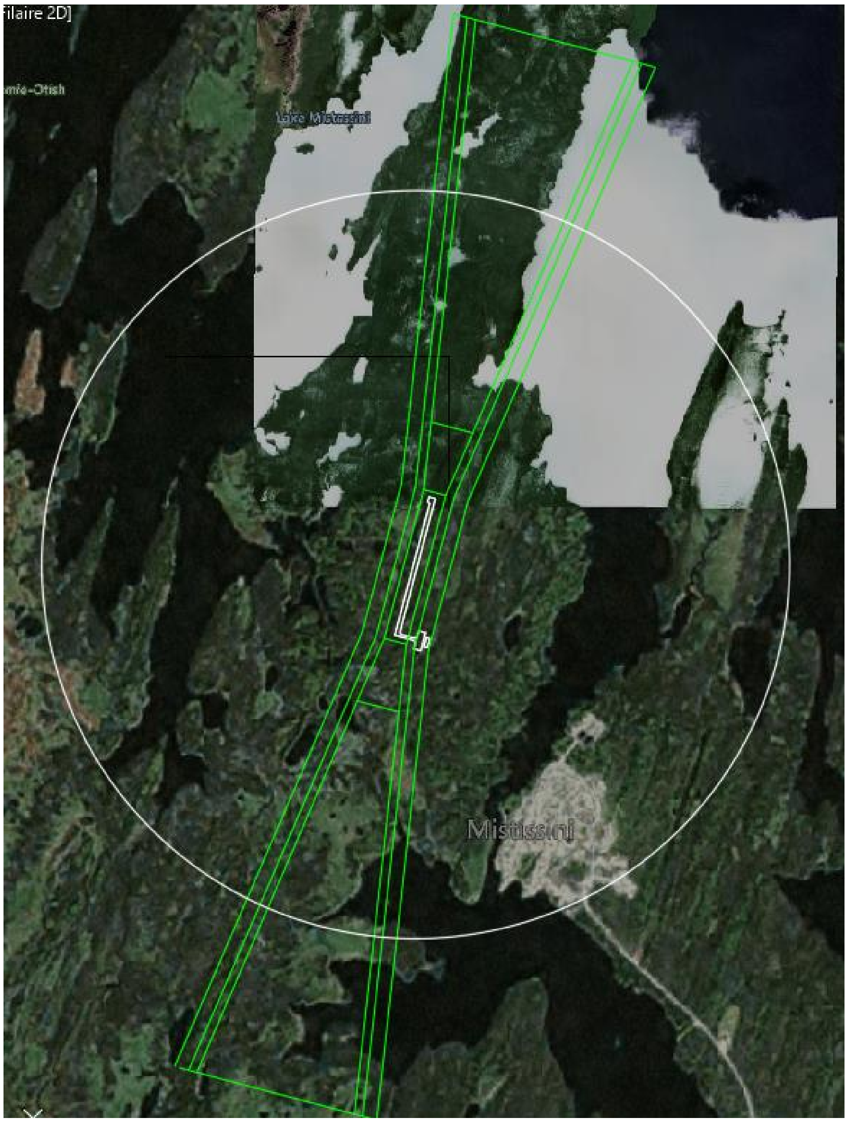


Figure 2-3: Map view of the OLS of Site B1

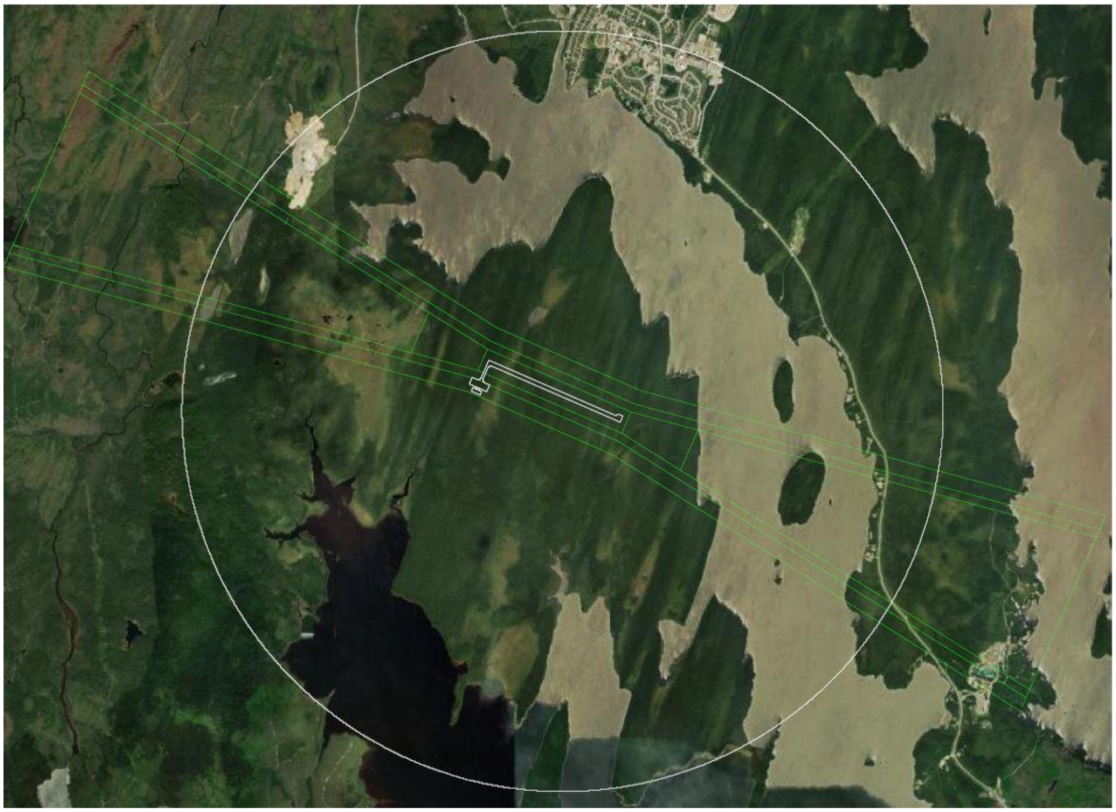


Figure 2-4: Map view of the OLS of Site G

Table 2-2 summarizes the characteristics of each of the selected sites according to the constraints analyzed.

Table 2-2: Summary of the characteristics of each of the selected sites

Site	Topography	Stratigraphy	Distance from community (by road)	Distance from existing road	Other considerations
B1	412.3 to 425.7 m	Till	2 km (2.7 km)	1.2 km	• Gullying at northwest end
F	398.4 to 407.2 m	Till	10.9 km (18.5 km)	0.4 km (crossed by resource road)	• 12 m hill with gullying to the northeast
G	391.9 to 400 m	Till	3.1 km (7.6 km)	3.1 km	• Crosses peat / wetlands. Poor drainage.

2.3.1 Site B1

A surface deposit and constraint map of Site B1 is presented in Appendix C. Site B1 sits on top of an elongated hill (drumlin) gently rising toward the northeast, which is part of a series of elongated glacial features. The hilltop of the drumlin where the runway is located features a relatively flat area that spans about 200 m across. The drumlin crests follow a south-southwest to north-northeast orientation, and the runway is only approximately oriented in the main axis of the crest. The western limit of the hilltop displays steep slopes up to 41%, while the eastern edge is gentler, with slopes usually below 20%.

The drumlins are created from thick till deposits, and they are bound to the west and the east by poorly drained organic veneers. Other types of deposits to the west include shallow till deposits on bedrock and a fluvio-glacial deposit complex. To the east, the drumlin crests are usually separated by peat veneers and poorly drained areas, while sand and silty deposits are found to the south. Bedrock composition is mostly dolomitic and breccia, but these are rarely found immediately at the surface, and mostly emerge to the southeast of the mapped area.

Site B1 is the closest to town, at a straight distance of 2 km from the Mistissini bridge on the western edge of town and 1.2 km from the existing road leading to the sand pit. The hill exhibits some gullying in the deposits at the northwestern end of the runway, and the slopes on each side of the hill are typically prone to gullying and rill erosion, which could increase with deforestation. The hilltop itself should be moderately-well drained because of the topography, but surrounding areas immediately to the east, south and west can be poorly drained.

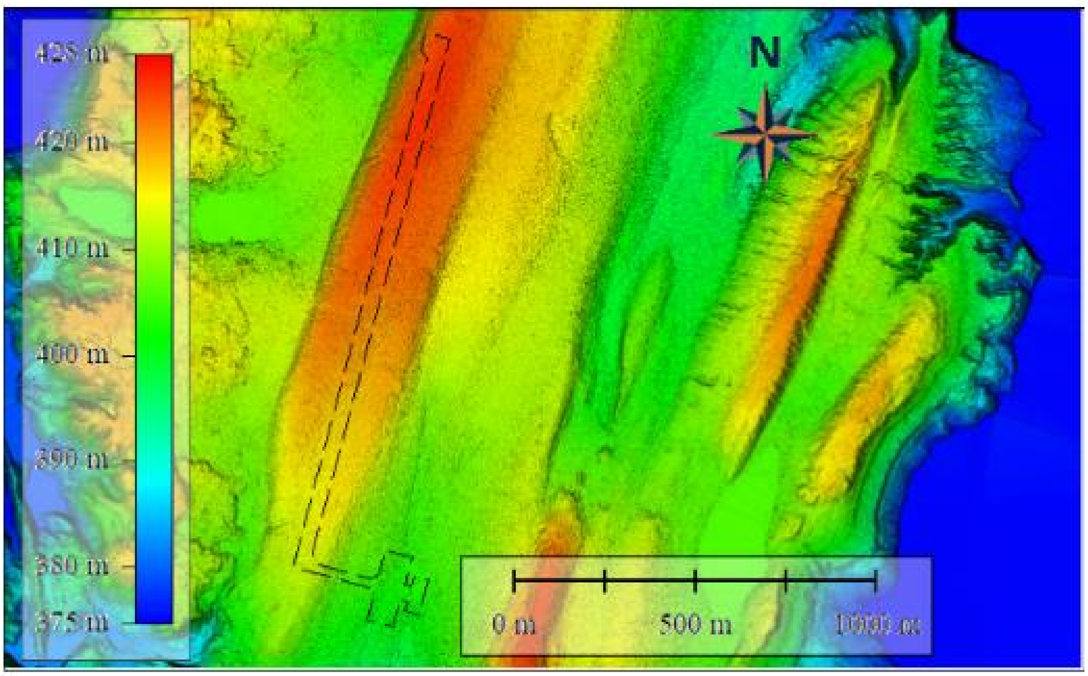


Figure 2-5: Digital elevation model from lidar data at Site B1

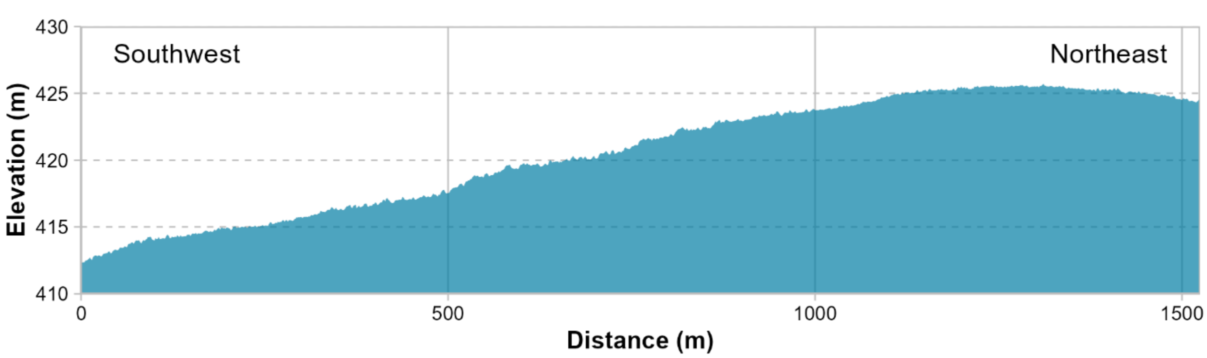


Figure 2-6: Elevations along the runway at Site B1

2.3.2 Site F

A surface deposit and constraint map of Site F is presented in Appendix C. Site F is located east of community, approximately 400 m from Route 167. It sits on a series of elongated drumlin hills and is oriented at a 15° to 20° angle from the main orientation of the glacial features (south-southwest to north-northeast). The topography along the runway rises gently (< 4% slopes) by 7 m to a flat area about 550 m long, before dropping by 8 m toward the northeast along a < 2% general slope. A hill cresting at 417.5 m also follows the east edge of the runway.

The entire runway is located on thick till deposit, the extent of which ends in the river to the north and west, and in a succession of organic veneers, thin till on dolomitic bedrock as well as fluvio-glacial and eolian sands to the east.

This site is the farthest from town, 18.5 km by road. Surficial deposits are prone to gullying within the area, with some gullying found along the slope immediately on the eastern edge of the runway. The site is generally well-drained because of topography, but local depressions between drumlin features could be prone to waterlogging.

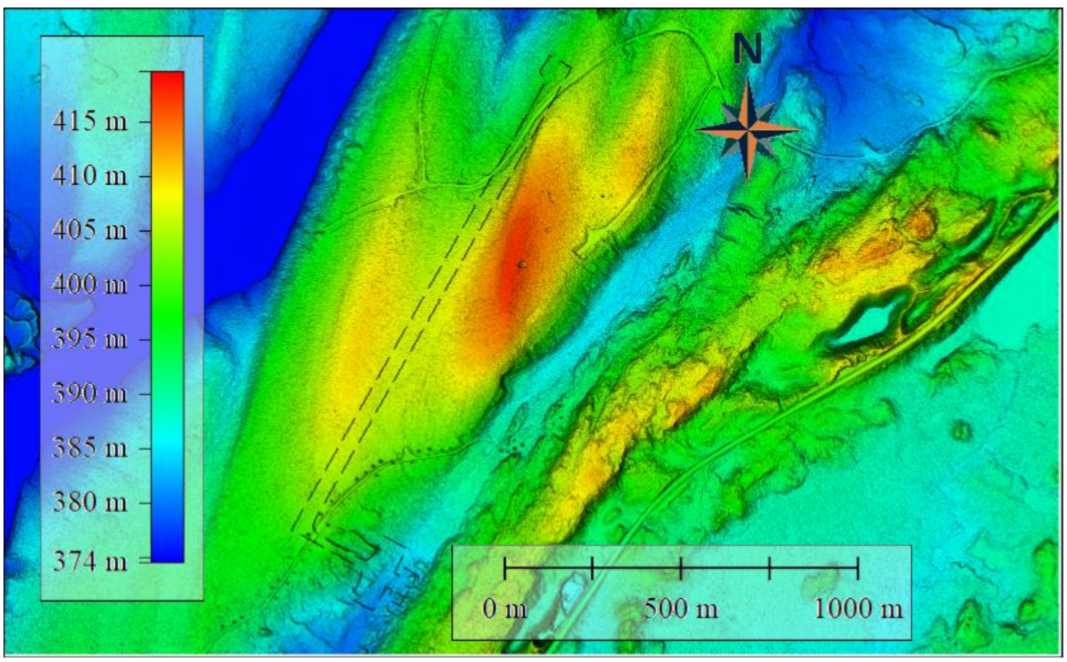


Figure 2-7: Digital elevation model from lidar data at Site F

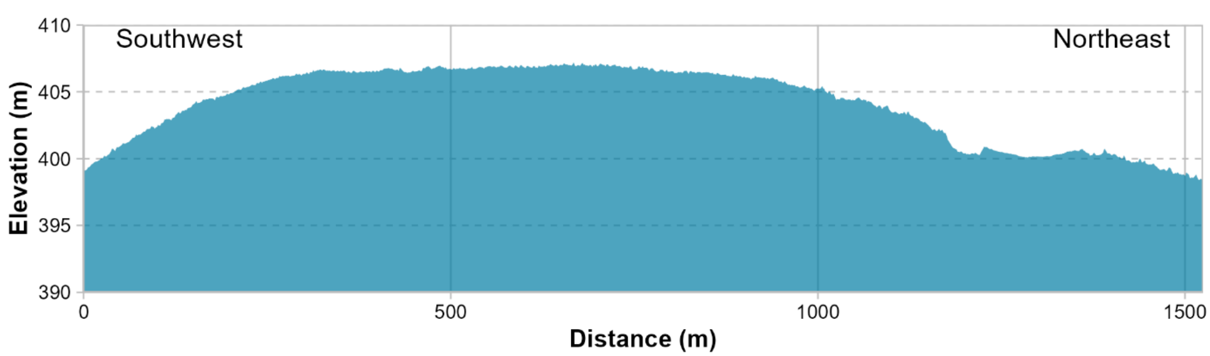


Figure 2-8: Elevations along the runway at Site F

2.3.3 Site G

A surface deposit and constraint map of Site G is presented in Appendix C. Site G is located 3.1 km south of town across Post Bay. The runway is perpendicular to a series of elongated hills (drumlins), and the elevation at the site varies between 400 m at the western end to 391.9 m at the eastern end of the runway. Slopes are generally very gentle (< 2.5%), except past the western and southwestern ends of the runway, where they steepen southward to reach 7 to 30% grades.

Thick till deposits form the drumlins, and the expression of the underlying dolomitic bedrock topography is not visible in the landforms. The landforms are more subdued than at sites B1 and F, and as the runway crosses multiple drumlins, the depressions between the individual crests are partly filled by thin organic veneers topping the till deposits.

The site is 7.6 km from the town by road, including the additional 3.1 km of roadway that would need to be built across poorly drained organic terrain. Drainage at the runway site is generally poor, with a low topographic gradient toward the south-southwest that orients drainage pathways across the runway. These areas of high water tables are locations where organic material buildup will be most important.

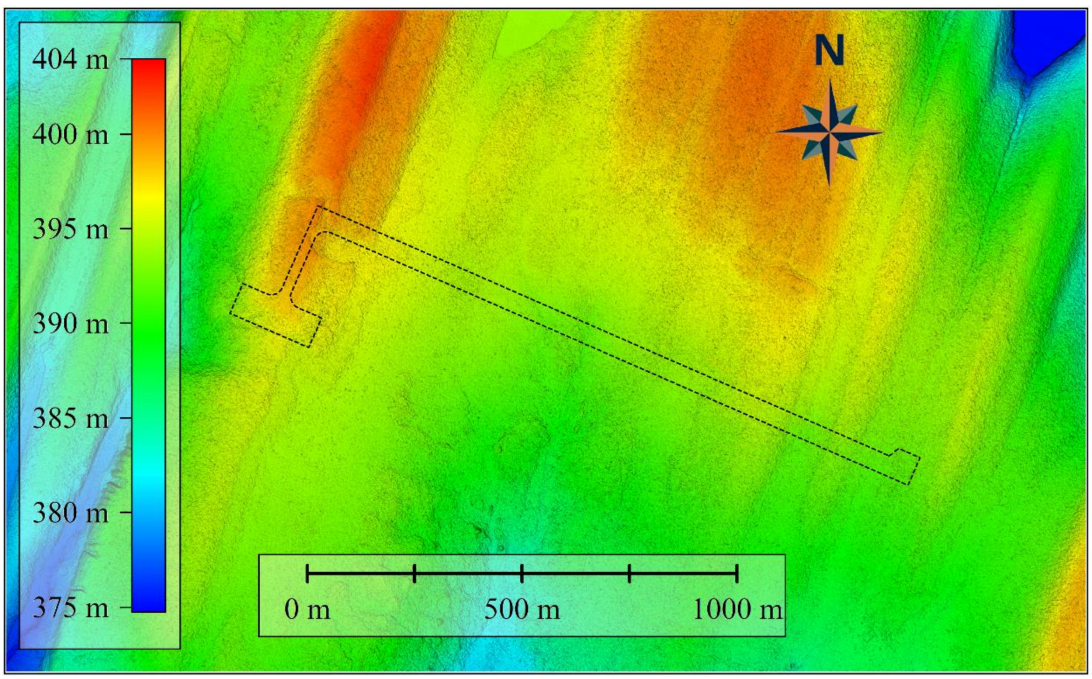


Figure 2-9: Digital elevation model from lidar data at Site G

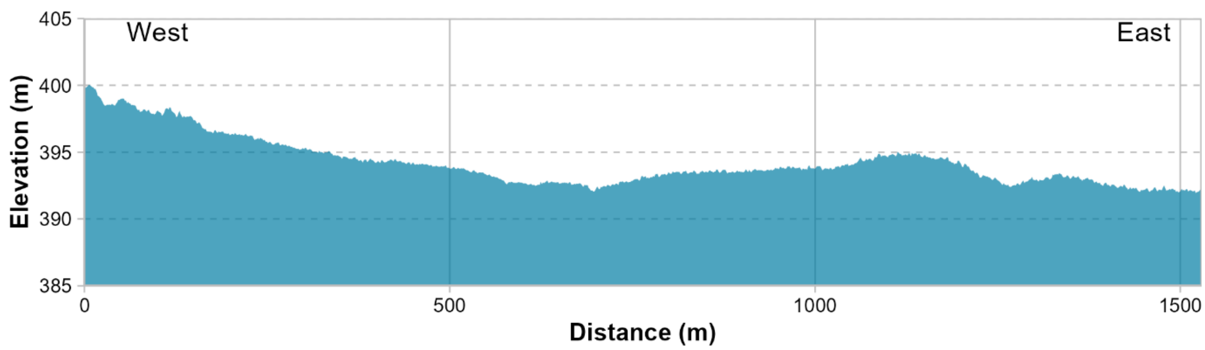


Figure 2-10: Elevations along the runway at Site G

3. WEATHER DATA

When planning the construction of a new airport runway, it's crucial to consider a range of weather factors that can impact operations and safety. Here's a list of important weather information to consider:

- **Wind**: Wind direction and speed are critical for runway orientation and design. Runways are typically aligned to accommodate prevailing wind patterns for safe takeoff and landing.
- **Temperature**: Temperature affects aircraft performance, runway surface conditions, and de-icing requirements during cold weather.
- **Precipitation**: Rain, snow, sleet, and hail can affect runway friction, visibility, and braking action. Drainage systems must also be designed to handle precipitation effectively.
- **Visibility**: Poor visibility due to fog, mist, haze, or precipitation can affect aircraft operations, especially during takeoff, landing, and taxiing.
- **Cloud Cover**: Cloud cover can affect visual flight rules (VFR) and instrument flight rules (IFR) operations, as well as runway lighting requirements.
- **Thunderstorms**: Thunderstorms bring hazards such as lightning, strong winds, heavy rain, hail, and microbursts. These conditions can disrupt operations and pose safety risks.
- **Turbulence**: Turbulence, especially associated with thunderstorms or strong winds, can impact aircraft stability during takeoff, landing, and taxiing.
- **Crosswinds**: Knowledge of crosswind patterns is crucial for runway design and operation to ensure aircraft can safely take off and land under varying wind conditions.
- **Gusts**: Sudden gusts of wind can affect aircraft control during takeoff, landing, and taxiing.
- **Microclimates:** Consider local microclimate variations that might affect weather conditions around the airport, such as temperature inversions or coastal influences.
- **Lightning Detection:** Lightning detection systems can provide advanced warning of approaching thunderstorms and help mitigate the risk of lightning strikes.

By considering these weather factors, the runway design would maximizes safety and efficiency under various weather conditions. Additionally, integrating real-time weather monitoring systems before the planning stages of the project can help ensure safety and operational efficiency of the future infrastructure.

Here are a few common types of AWOS systems along with their features:

- AWOS I: Provides current altimeter setting, temperature, dew point, wind speed, and direction.
- AWOS II: Provides all AWOS I features plus visibility.
- AWOS-III: This system provides continuous weather monitoring and reporting with high accuracy. It typically includes sensors for measuring wind speed and direction, temperature, dew point, altimeter setting, visibility, and cloud height. AWOS-III systems are suitable for medium to large airports with moderate to high traffic volumes.

When selecting an AWOS system, one should consider factors such as accuracy, reliability, compliance with regulatory requirements (e.g., TC, ICAO or FAA standards), ease of installation and maintenance, integration capabilities with other systems, and available support services from the manufacturer or vendor.

It is also important to consider that weather can vary between two sites within 5 kilometers of each other due to microclimatic influences and local topography. Here are some factors that can cause variations in weather conditions over relatively short distances:

- Elevation: Even slight differences in elevation can lead to variations in temperature, precipitation, and wind patterns. Higher elevations tend to be cooler and may receive more precipitation compared to lower-lying areas.
- Terrain: The presence of hills, mountains, valleys, or bodies of water can affect local wind patterns and precipitation distribution. Wind can be funneled or diverted by terrain features, leading to differences in wind speed and direction.
- Urbanization: Urban areas tend to create their own microclimates due to the heat island effect, which can result in higher temperatures compared to surrounding rural areas. Buildings and pavement absorb and radiate heat, influencing local temperature and humidity levels.
- Vegetation: The type and density of vegetation can impact local microclimates by affecting factors such as evapotranspiration, shading, and surface roughness. Forested areas may be cooler and more humid than open fields or developed areas.
- Water Bodies: Proximity to lakes, rivers, or coastlines can influence weather conditions by moderating temperatures and generating local wind patterns. Bodies of water can also contribute to increased humidity and fog formation.
- Weather Systems: Small-scale weather phenomena such as localized thunderstorms, convective clouds, or sea breezes can produce rapid changes in weather conditions over short distances.

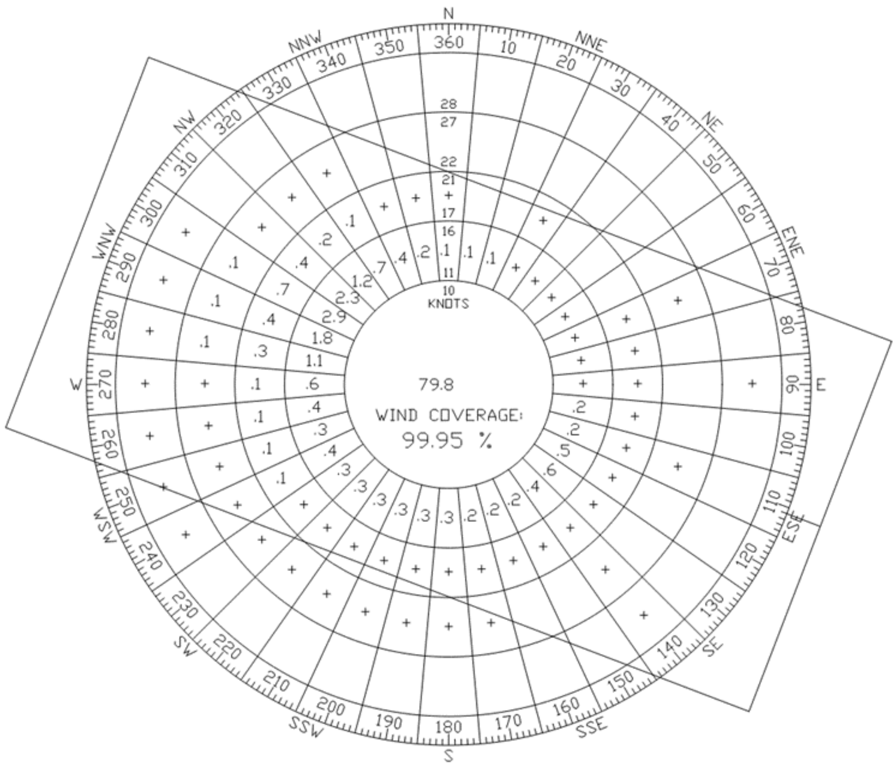
Due to these factors, it's essential to consider the specific microclimatic influences and local variations when collecting and interpreting weather data for planning purposes, especially in aviation.

The Cree Nation should install a Automated Weather Observing System (AWOS) I or II in order to record and compile weather data during a period of at least 12 to 24 months. It is recommended that a AWOS weather station be installed at each site to accurately measure the wind patterns, including direction, speed and gusts.

4. WIND ROSE

A preliminary runway usability assessment was carried out using the FAA wind analysis tool. The available data shows that a runway orientation of 11-29 achieves a runway usability above the 95% as recommended by ICAO. This correspondes with the orientation of Site G.

Based on wind data from the Chibougamau/Chapais Airport (YMT) a runway usability of 99% can be expected for aircraft capable of operating in crosswinds of 13 knots, aircraft with a crosswind limit of 13 knots include the Beech King Air 200 and the Pilatus PC-12, which are frequently used at northern airports. Dash 8s have a higher crosswind limit, for most Dash 8 variants, the maximum demonstrated crosswind component is typically around 27 to 30 knots, although this can vary slightly depending on factors such as aircraft configuration, pilot technique, and runway conditions. In this case a 11-29 orientation would achieve 99.95% coverage.



This wind analysis is based on true north. True north refers to the direction towards the geographic North Pole. For runway orientation, true north is typically used as the reference for runway headings. This ensures consistency in navigation and air traffic control, as aircraft navigation systems primarily use true north as the reference for heading information. The runway's orientation must be corrected to magnetic north to be compatible with aircraft instruments. Magnetic declination varies depending on the geographic location and changes over time due to factors such as shifts in the Earth's magnetic field. The preliminary corrected value for Mistissini would be 13-31.

It is important to understand that wind data can vary from region to region. Chibougamau/Chapais Airport (YMT) wind data is valid for that region alone. Mistissini's wind data could be different from Chibougamau and wind data between site B1 and G could also differ as mentioned above.

5. COMPARATIVE ANALYSIS OF SELECTED POTENTIAL SITES

The comparative analysis of the selected potential sites was carried out according to two comparison criteria; first, the excavated material and embankments associated with the construction of the runways and secondly the costs of the work.

5.1 CONSTRUCTION CUTTINGS AND BACKFILLINGS

For each site, a runway profile was designed, and a cross-section type was applied to produce a projected area of the infrastructure required for the runway. Thus, it was possible to choose the ideal location of the runway, respecting the preliminary orientation while minimizing the excavated material as well as the contribution of new materials. A detail plan and profile view of each site is presented in Appendix B.

The infrastructure surface of the proposed runway was then compared to the surface of the land in order to assess the volumes of cutting and backfilling materials for each site. Figure 5-1 shows the typical cross-section of the runway.

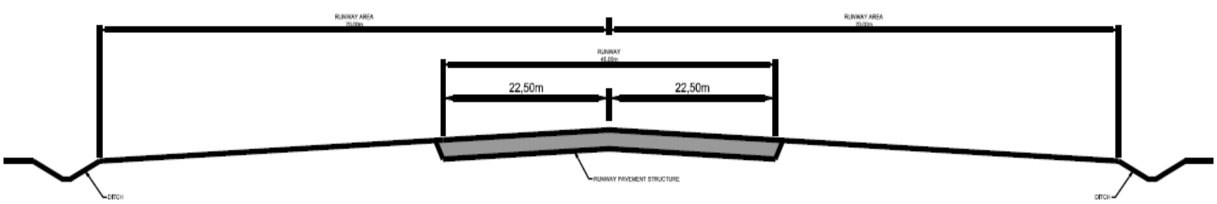


Figure 5-1: Typical cross-section of the proposed runway

A runway area / excavated material ratio was applied to assess the amount of excavated material for the airfield infrastructure for each of the sites. Without further boreholes and terrain information, existing soils were considered adequate to backfill on site and to compose subbase layer of the runway. The quantities of excavated material and backfill for runway work for each of the sites are presented in table 4-1 below.

Table 5-1: Quantities of excavated material and backfill for airport runway

Proposed site	Cut volume (m^3)	Fill volume (m^3)	Variance (m^3)
Site B1	110 000	58 000	+ 52 000
Site F	n/a	n/a	n/a
Site G	85 000	64 000	+ 21 000

5.2 CONSTRUCTION COSTS

A Class D estimate was developed based on preliminary aerodrome concepts. The cost estimate was prepared according to the needs of each site. A contingency of 40% will have to be applied taking into account the design stage and the accuracy of the information in hand.

5.2.1 Common items for the two sites

The common items were considered so because they were of the same size and represented the same type of work for each of the sites.

- The common items for the three sites are listed below.
- The mobilization of equipment is estimated at $500k.
- The instrument approach design fee is estimated at $50k.
- The gravel pavement structure of the runway, taxiway and apron is composed of a geotextile membrane, a granular subbase course of 450 mm thickness, a granular base course of 300 mm thickness and a granular "wearing course" of 150 mm thickness. A final leveling of the surface layer of all airside infrastructure is considered. The estimated cost of these activities is $6.3M.
- The construction of the terminal building and a parking area, including excavation, was estimated at $220k.
- To prohibit access of unauthorised people and control wildlife incursions into the operational area, a perimeter fence and perimeter access road were considered. The estimated cost is $800k.
- A minimum area of 70 hectares to be cleared was considered to clear the OLS from the runway at a cost of $1.4M. A cost of $20,000/ha was applied.
- The drainage system consists of open ditches and a culvert under the taxiway. The ditch is placed outside the runway safety area to comply with TP 312 5th edition. Drainage work is estimated at $345k.
- For electrical work, the proposed aerodrome is equipped with lighting consisting of runway edge lights, taxiway and apron edge lights, runway end lights, runway threshold identification lights, omnidirectional approach lighting system (ODALS) and precision approach path indicators (PAPI). The supply and installation of an AWOS weather station, as well as two windsocks were considered. The total estimated cost of the electrical work is $3.5M.

5.2.2 Specific items according to the needs of each site

Specific items have been estimated according to the needs of each site and are presented in the following subsections.

5.2.2.1 Site B1

- Based on the volumes of excavated material assessed for Site 1, the estimated cost for excavation and disposal totals $5.04M.
- In order to complete the construction of the aerodrome at Site B1, an access Road must be constructed to connect the existing road to the proposed aerodrome. The estimated cost of this activity increases the total cost of the work by more than $1M.
- Also, the construction of a medium-intensity power line is considered for the electrical connection between the proposed high-voltage line and the future terminal. The cost of this intervention is estimated at $375k.

Figure 5-2 shows a preliminary sketch of the airport concept at Site B1.

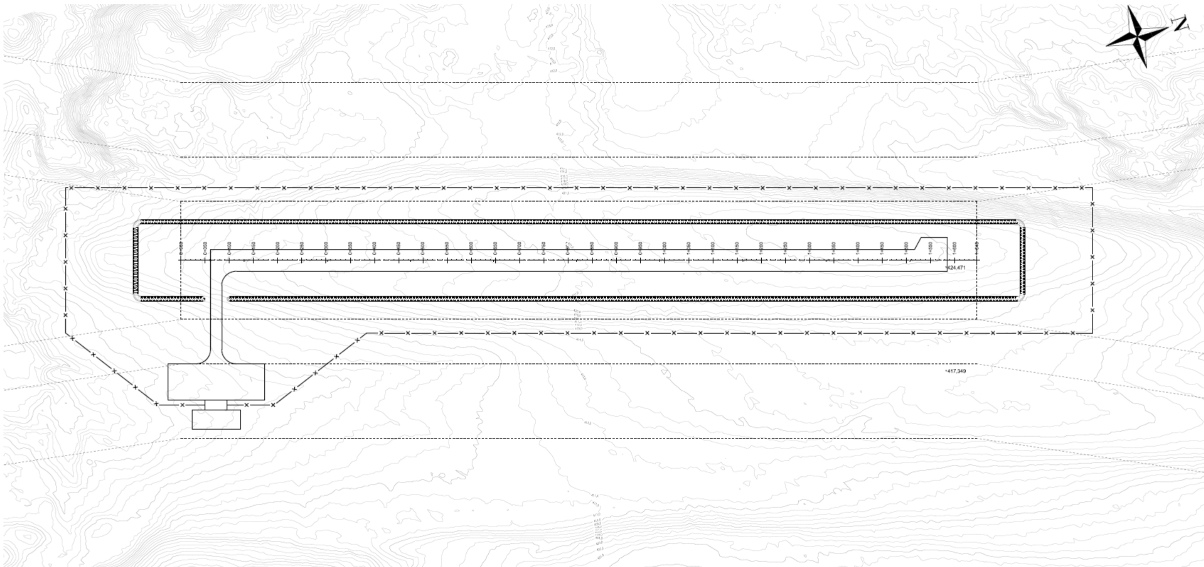


Figure 5-2: Preliminary sketch of the airport concept at Site B1.

5.2.2.2 Site G

- Based on the volume of excavated material assessed for Site G, the estimated cost for excavation and disposal totals $4.47M.
- The diversion of the Road and the access Road were valued at $2M.
- Also, the construction of a medium-intensity power line is considered for the electrical connection between the proposed high-voltage line and the future terminal. The cost of this intervention is estimated at $1.05M

Figure 5-3 shows a preliminary sketch of the airport concept at Site G.

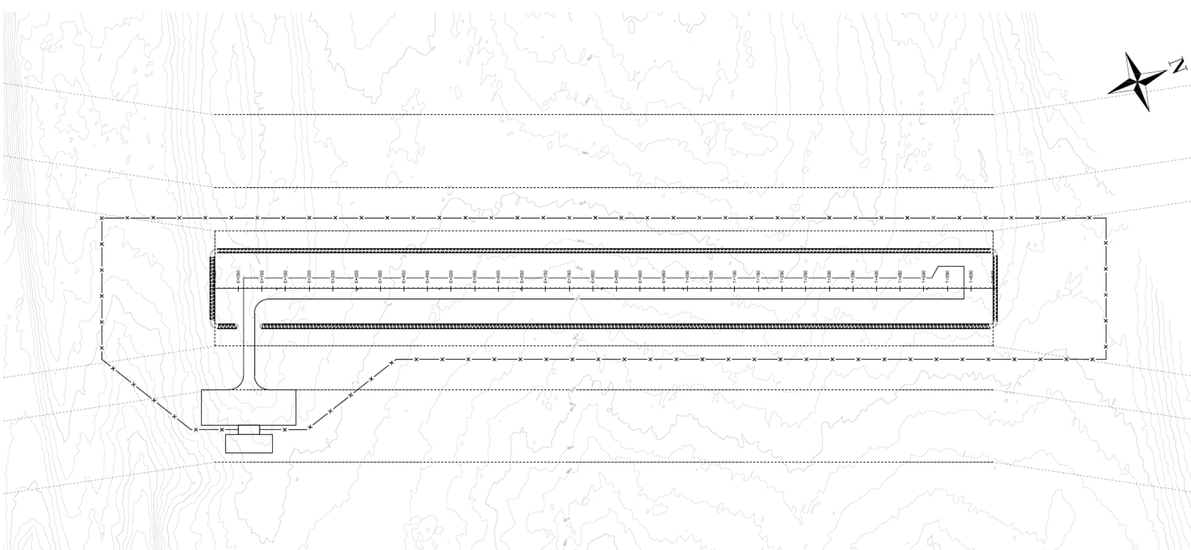


Figure 5-3: Preliminary Sketch of Airport Concept at Site G

5.3 ENVIRONMENTAL CONSTRAINTS

5.3.1 Biophysical environment

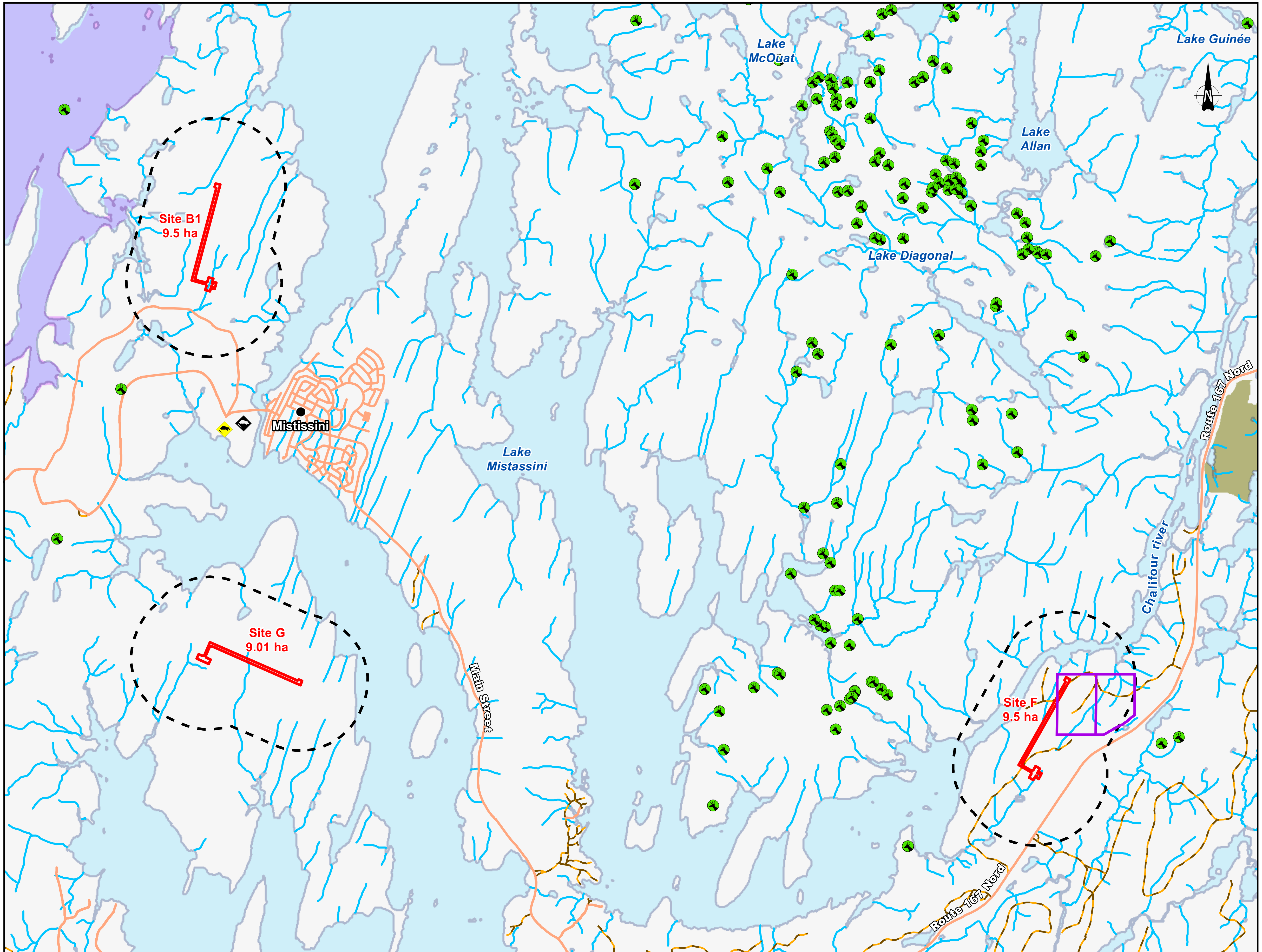
Several environmental constraints related to the biophysical environment were considered to present an overview of the environmental existing conditions of the three sites under consideration (Table 4-2). For each environmental component considered, a ranking was attributed from 1 to 3, the lowest ranking represents the site with the lowest environmental constraint and inversely the highest ranking with the highest level of constraint.

The main environmental components are illustrated on the following maps.

Table 5-2: Main environmental constraints associated with sites B1, F and G

Components	B1		F		G	
	Value	Rank	Value	Rank	Value	Rank
Mining claims (number within 1 km **buffer**) [1]	0	1	2	2	0	1
Watercourses [2] Length affected within **footprint** (linear km)	0.2	2	0.2	2	0.05	1
Watercourses [2] Length within 1 km **buffer** (linear km)	14.8	2	17.8	3	8.3	1
Waterbodies [2] Surface within **footprint** (ha)	0	1	0	1	0	1
Waterbodies [2] Surface within 1 km **buffer** (ha)	25.0	1	73.3	3	34.1	2
Wetlands [3] Surface affected within **footprint** (ha)	5.0	2	6.5	3	2.2	1
Wetlands [3] Surface within 1 km **buffer** (ha)	244.3	2	139.5	1	504.2	3
Proximity of species at risk to **footprint**, other than woodland caribou (km) [4]	1.8	3	12.9	1	3.5	2
Proximity of woodland caribou [5] Distance between closest telemetry positions and 1 km **buffer** (km)	0.9	2	0.7	3	1.8	1
Protected areas (within 1 km **buffer**) [6]	0	1	0	1	0	1
Legally protected habitats (within 1 km **buffer**) [7]	0	1	0	1	0	1
Scoring for basic components	-	**18**	-	**21**	-	**15**
Level of vegetation disturbance (% of **footprint** area) [8]	0	3	55.7	1	0	3
Distance between existing road and **footprint** (km) [8]	0.4	2	0	1	3.4	3
Total scoring	-	**23**	-	**23**	-	**21**

Sources
[1] : Système d'informations géominières (SIGÉOM, consulted on January 31, 2024)
[2] : Géobase du réseau hydrographique du Québec (GRHQ)
[3] : Base de données cartographique des milieux humides potentiels du Québec (MELCCFP, 2019)
[4] : Centre de données sur le patrimoine naturel du Québec (CDPNQ, map consulted on January 29, 2024)
[5] : Données du suivi du caribou forestier (MELCCFP, en date de décembre 2021)
[6] : Données du registre des aires protégées du Québec (MELCCFP, en date de janvier 2024)
[7] : Données cartographiques des habitats fauniques (HAFA) protégés légalement (MELCCFP, en date de novembre 2021)
[8] : Cartographie interactive Forêt Ouverte (MRNF, consulted on January 29, 2024)



Map 1

Local environmental setting

Limit

- Airport footprint
- Site B1: 697.9 ha
  Site F: 697.9 ha
  Site G: 691.4 ha
- Pending mining titles
- Municipality of Mistissini

Wildlife species at Risk

- Woodland caribou
- Rock Vole
- Southern Bog Lemming

Hydrography

- Watercourses
- Water body

Protected area

- Biological refuge
- Biodiversity reserve

Roads

- Local
- Forestry road

Data source:
Geobase of the Quebec hydrographic network (GRHQ), MERN Quebec, 2019
Potential wetlands of Quebec (CMHPQ), MELCC Quebec, 2019
BDGA 1M v1.1 , 1:1 000 000, MERN Quebec, 2021
Administrative division, SDA (20K), MERN Quebec, 2021
Road network, Address Quebec, 2020-09
Register of protected areas in Quebec, [Dataset], in Quebec Data, 2018, 240108
Occurrences of species in precarious situations, [Dataset], in Données Québec, 2022, 20240108

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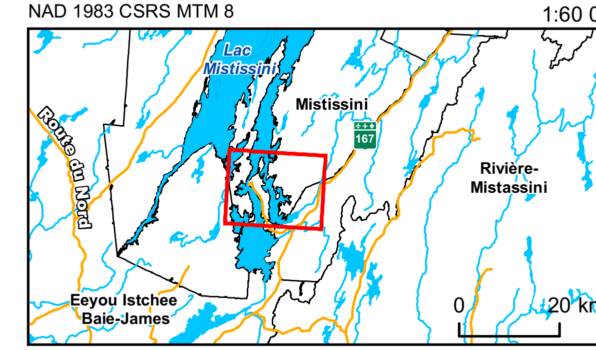


Mistissini airport project

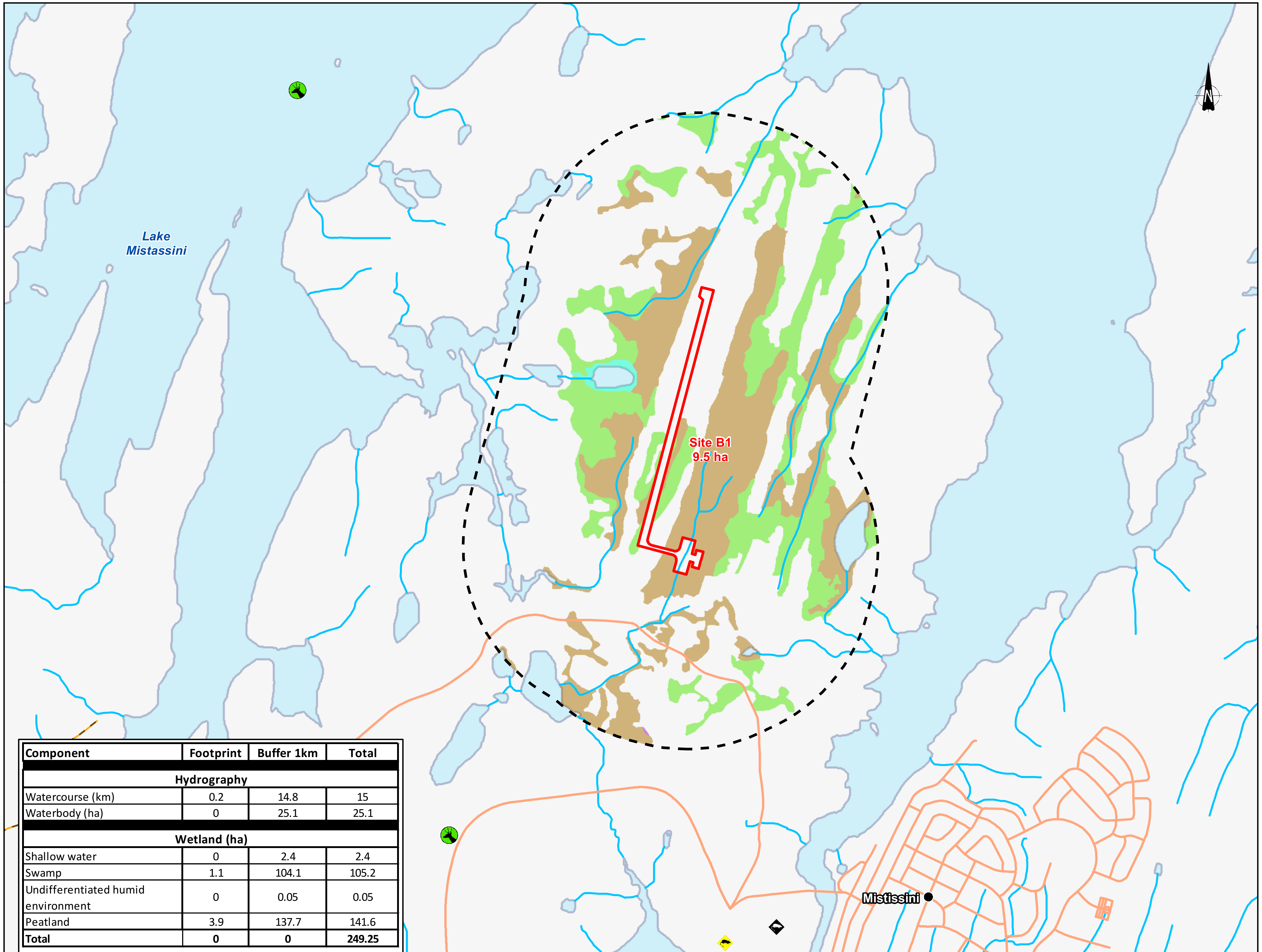
Sites assessment - Natural environment

Groupe Desfor S.E.N.C.
Projet : 21-0076-02

2024-02-01
Approved by :
Steve Therrien

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

Map 2
Environmental components of site B1



Component	Footprint	Buffer 1km	Total
Hydrography			
Watercourse (km)	0.2	14.8	15
Waterbody (ha)	0	25.1	25.1
Wetland (ha)			
Shallow water	0	2.4	2.4
Swamp	1.1	104.1	105.2
Undifferentiated humid environment	0	0.05	0.05
Peatland	3.9	137.7	141.6
Total	**0**	**0**	**249.25**

Limit
- Airport footprint
- Buffer 1km siite B1: 697.9 ha
- Municipalité de Mistissini

Wildlife Species at Risk
- Woodland caribou
- Rock Vole
- Southern Bog Lemming

Hydrography
- Watercourses
- Water body

Roads
- Local
- Forestry road

Potential wetland
- Shallow water
- Swamp
- Undifferentiated humid environment
- Peatland

Data source:
Cadastre of Quebec, MERN Quebec, 2021
Geobase of the Quebec hydrographic network (GRHQ), MERN Quebec, 2019
Potential wetlands of Quebec (CMHPQ), MELCC Quebec, 2019
BDGA 1M v1.1 , 1:1 000 000, MERN Quebec, 2021
Administrative division, SDA (20K), MERN Quebec, 2021
Road network, Address Quebec, 2020-09

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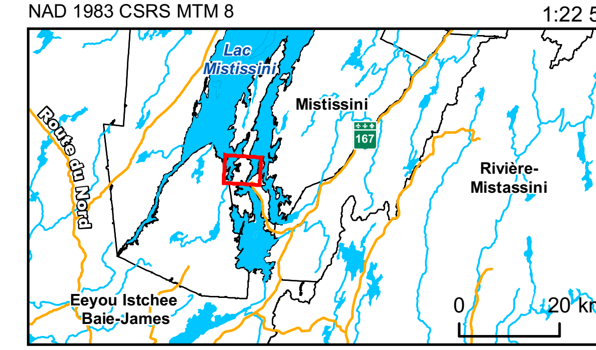
NAD 1983 CSRS MTM 8 1:22 500



Mistissini airport project

Sites assessment - Natural environment

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2024-02-01
Approved by :
Steve Therrien

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

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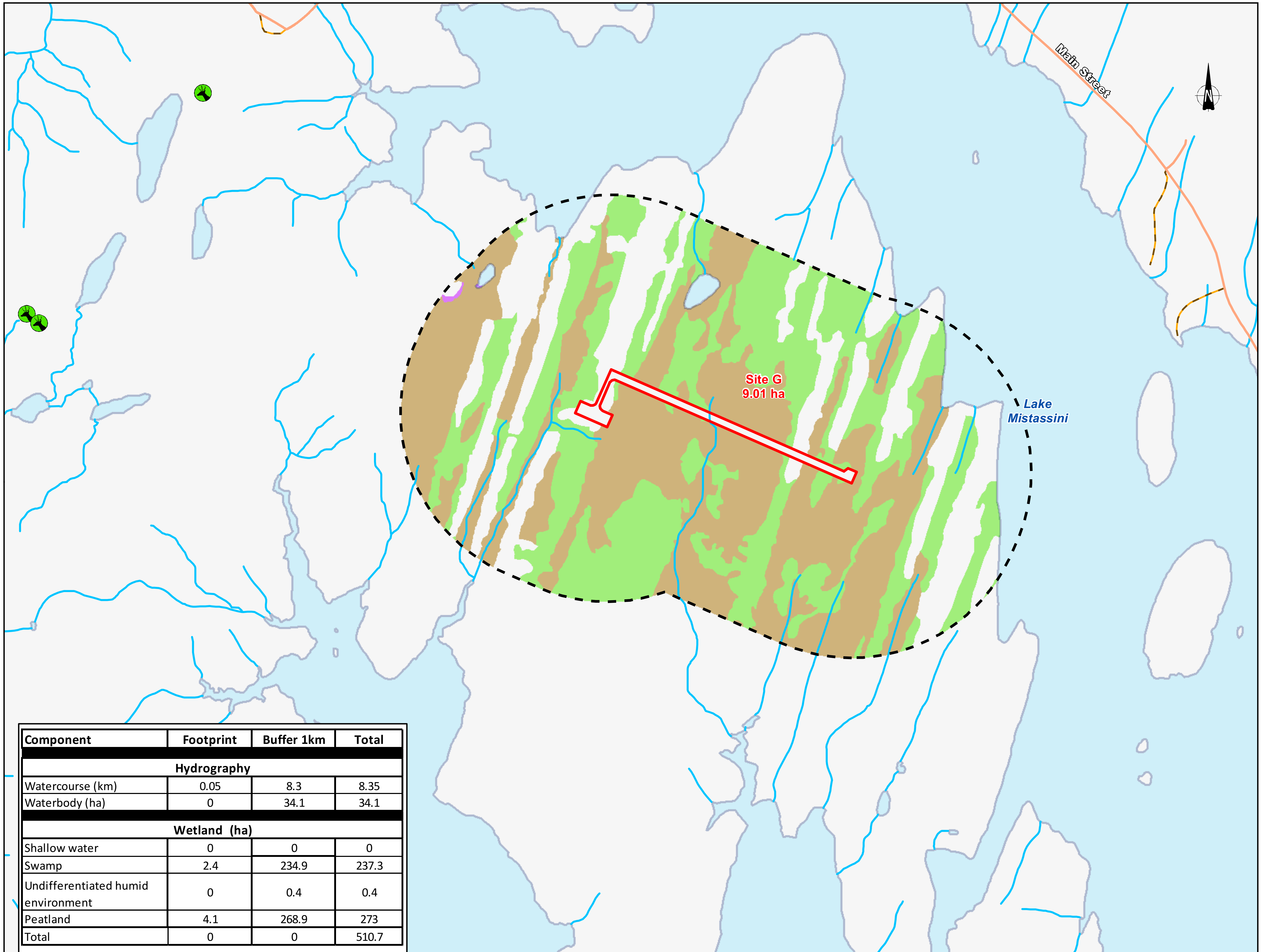
Map 3
Environmental components of site G



Component	Footprint	Buffer 1km	Total
Hydrography			
Watercourse (km)	0.05	8.3	8.35
Waterbody (ha)	0	34.1	34.1
Wetland (ha)			
Shallow water	0	0	0
Swamp	2.4	234.9	237.3
Undifferentiated humid environment	0	0.4	0.4
Peatland	4.1	268.9	273
Total	0	0	510.7

Limit
- Airport footprint
- Buffer 1km siite G: 691.4 ha

Wildlife species at Risk
- Woodland caribou

Hydrography
- Watercourses
- Water body

Potential wetland
- Swamp
- Undifferentiated humid environment
- Peatland

Roads
- Local
- Forestry road

Data source:
Cadastre of Quebec, MERN Quebec, 2021
Geobase of the Quebec hydrographic network (GRHQ), MERN Quebec, 2019
Potential wetlands of Quebec (CMHPQ), MELCC Quebec, 2019
BDGA 1M v1.1 , 1:1 000 000, MERN Quebec, 2021
Administrative division, SDA (20K), MERN Quebec, 2021
Road network, Address Quebec, 2020-09

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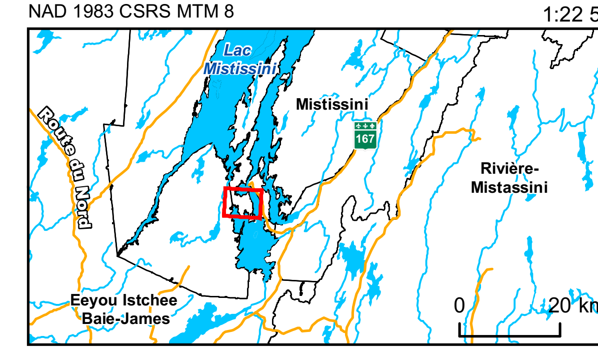

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Projet : 21-0076-02

2024-02-01
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Steve Therrien

LA GRANDE ALLIANCE

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

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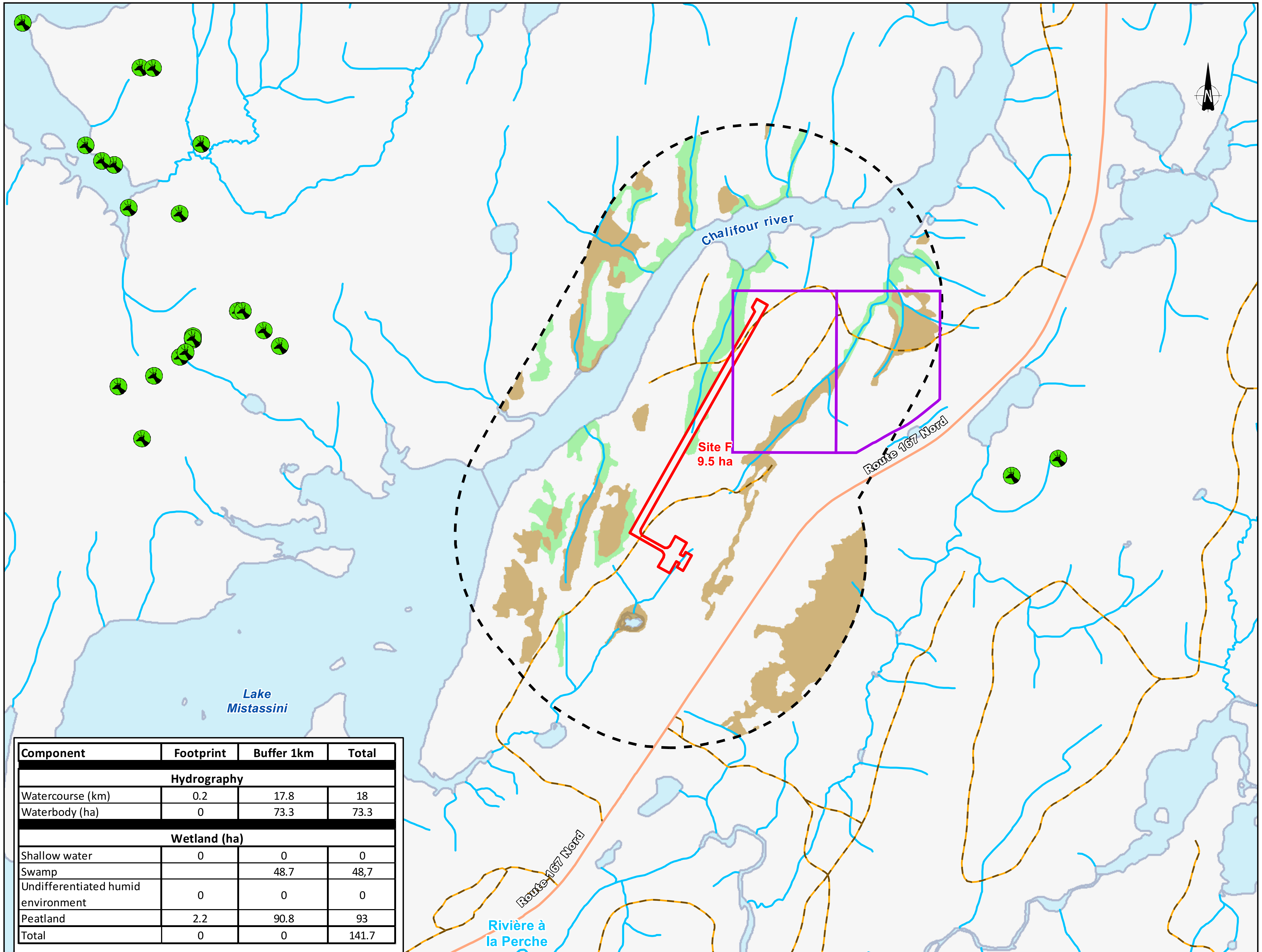

Component	Footprint	Buffer 1km	Total
Hydrography			
Watercourse (km)	0.2	17.8	18
Waterbody (ha)	0	73.3	73.3
Wetland (ha)			
Shallow water	0	0	0
Swamp		48.7	48,7
Undifferentiated humid environment	0	0	0
Peatland	2.2	90.8	93
Total	0	0	141.7

Map 4

Environmental components of site F

Limit

- Airport footprint
- Buffer 1km siite F: 697.9 ha
- Pending mining titles

Wildlife species at Risk

- Woodland caribou

Hydrography

- Watercourses
- Water body

Roads

- Local
- Forestry road

Data source:
Cadastre of Quebec, MERN Quebec, 2021
Geobase of the Quebec hydrographic network (GRHQ), MERN Quebec, 2019
Potential wetlands of Quebec (CMHPQ), MELCC Quebec, 2019
BDGA 1M v1.1 , 1:1 000 000, MERN Quebec, 2021
Administrative division, SDA (20K), MERN Quebec, 2021
Road network, Address Quebec, 2020-09

0 220 440 m

NAD 1983 CSRS MTM 8 1:22 500

Mistissini airport project

Sites assessment - Natural environment

Groupe Desfor S.E.N.C.
Projet : 21-0076-02

2024-02-01
Approved by :
Steve Therrien

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

5.3.2 Cree Land Use

The three options considered are located on trapline M50, whose tallyman is Charlie Iserhoff.

To determine the impacts on Cree land use, a meeting was held on March 11, 2024 between Mr. Iserhoff's representatives, his sons Richard and John Iserhoff, and VEI representatives (Alessandro Cirella, Émilie Charest, David Laroche). Most of the interview was conducted in English, with support from Ian Diamond (liaison officer, VEI) and Errol Mianscum (community information officer, Mistissini), who translated into Cree where necessary. First, the site selection process was explained, then the location of the three selected sites were displayed. The design team ensured that the sites' protection zone and potential aircraft approach routes were understood.

Firstly, land users pointed out that the three sites are not areas used for traditional activities such as hunting, trapping, gathering or fishing. In addition, there are no camps in or around the potential sites. Nevertheless, the elders' camps located at the junction of the Mistissini access road and Route 167 could be impacted by noise associated with aircraft approaching Site F. That said, use of these camps is seasonal, during spring and fall.

Because of their proximity to Mistissini, sites B1 and G are used more extensively by community members. Site G in particular is the "playground" for young snowmobilers and quad riders in the area.

Land users also pointed out that the location of the future airport should take into consideration access in the event of a disaster, as well as for medical evacuations. For this reason, according to Richard and John Iserhoff, a site closer to the community is more desirable. However, while site B1 is closest to the community, it is also coveted for residential development. In addition, users raised the potential impact of the access road that will be required for each site, considering the total length as well as the sensitive environments (watercourses and wetlands) in which they would be built. They felt that access to site G would have the greatest impact, while site F would have the least.

Large wildlife uses the entire trapline. Moose are active there in winter. As for birds, sites B1 and G are more likely to be in the waterfowl migration corridor. The approach to site F could be aligned with the landfill site, which is populated by bald eagles. In this case, users believe that these birds fly at lower altitudes, so would impact flights to a lesser extent.

Several land-use constraints were taken into account to present an overview of existing conditions at the three sites (Table 4-3). For each constraint considered, a ranking from 1 to 3 has been assigned. The lowest ranking is assigned to the site with the lowest constraint and, conversely, the highest ranking is assigned to the site with the highest constraint.

Table 5-3: Key constraints associated with sites B1, F and G

Constraints	B1	G	F
Hunting, trapping and fishing activities	1	1	1
Camp	1	1	2
ATV and snowmobile trails	2	3	1
New access road to airport	2	3	1
Wildlife (large wildlife and birds)	2	2	1
Total score	**8**	**10**	**6**

6. CONCLUSION AND RECOMMENDATION

The objective of this mandate was to identify the optimal site from three potential sites. To do this, nine preliminary sites were identified, three of which were selected. The longitudinal profile and a standard cross-section were modelled for each site according to AGN IIIB requirements to optimize cut and backfill volumes. Following this exercise, site F was removed as it was determined unfit to accommodate the requirements for an AGN IIIB runway.

A cost estimate was prepared according to the general needs of each remaining site. As presented in Section 5.2.2.2, the economic analysis showed that the construction of the airport on site B1 and G is feasible.

A summary of the total cost of work for each site is presented in Table 6-1.

Table 6-1: Summary of total cost of work for each site

Site number	Estimated preliminary cost	Contingencies 40%	Total cost
Site B1	$23,999,250	$9,599,700	$33,598,950
Site G	$25,115,750	$10,046,300	$35,162,050

In this analysis, a 3D model was designed and applied in a 3D Contour map that was generated from Lidar for both sites. The topographical variation of the area shows that the cuttings and backfilling volumes have a great impact on the budget pricing.

A weather station should be installed at each site to collect data for at least one year to assess weather conditions and define the final orientation of the runway. The meteorological data will be analyzed by a meteorological specialist so that a wind map by quadrant (direction and velocity) is established and a more accurate idea of the climate on site is known. All information collected must be part of an aeronautical study of the site.

We recommend that geotechnical analyses be conducted at all sites to determine the nature of the soils in place. Analyses should include soil characterization, rock depth, water table depth in the runway axis and in areas of high excavation. A borehole campaign along the runway centerline should be considered for an in-depth site selection study. Geotechnical campaign should plan to have a borehole every 100m on the runway and every 50m on the taxiway and apron. Furthermore, additional boreholes should be planned along the Runway safety area (up to 75m from the runway centerline) and the runway strip (up to 122m from the center line) to account for slope stabilisation and environmental evaluation of the soils in place. Each campaign should allow for a minimum of 30 boreholes.

Furthermore, other boreholes would be required to ensure each site have enough water to provide the new airport with required drinking water and fire protection for proper sprinkler system operation. Additional boreholes could be required for the septic field installation.

Finally, following geotechnical analysis and confirmation of soil composition and of a runway final orientation, a 50 mm accuracy LIDAR survey should be conducted to survey the complete topography of the site to begin the detailed preliminary design.

Once a preferred site is selected, the following studies should be conducted in order to proceed with the preliminary design and construction:

1. Meteorological study & weather station
2. Topographical survey

3. Environmental Review - Desktop Assessment
4. Geology, geomorphology, permafrost and hydrogeological investigations
5. Hydrological Study
6. Electrical Power Supply
7. Preliminary Engineering & architectural design Services
8. Environmental and Social Impact Assessment.

Appendix A
General Sites

Stantec

Stantec Consulting Ltd
1200, Saint-Martin Blvd West, suite 300
Laval (Québec) H7S 2E4
Tel. 514.281.1010
www.stantec.com

Consultant

Notes

Issued/Revision	By	Appd	YYYY.MM.DD
A FOR INFORMATION	T.K.	M.R.	2023-12-19

File Name: GLOBAL SITES.DWG

2023-11-15
YYYY.MM.DD

Toni Keyrouz, techn.
Prepared

Toni Keyrouz, techn.
Drawn

Marco Rocha, ing.
Project Manager

Permit-Seal

Client/Project Logo

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CLIENT

MISTISSINI AIRPORT OPPORTUNITY STUDY

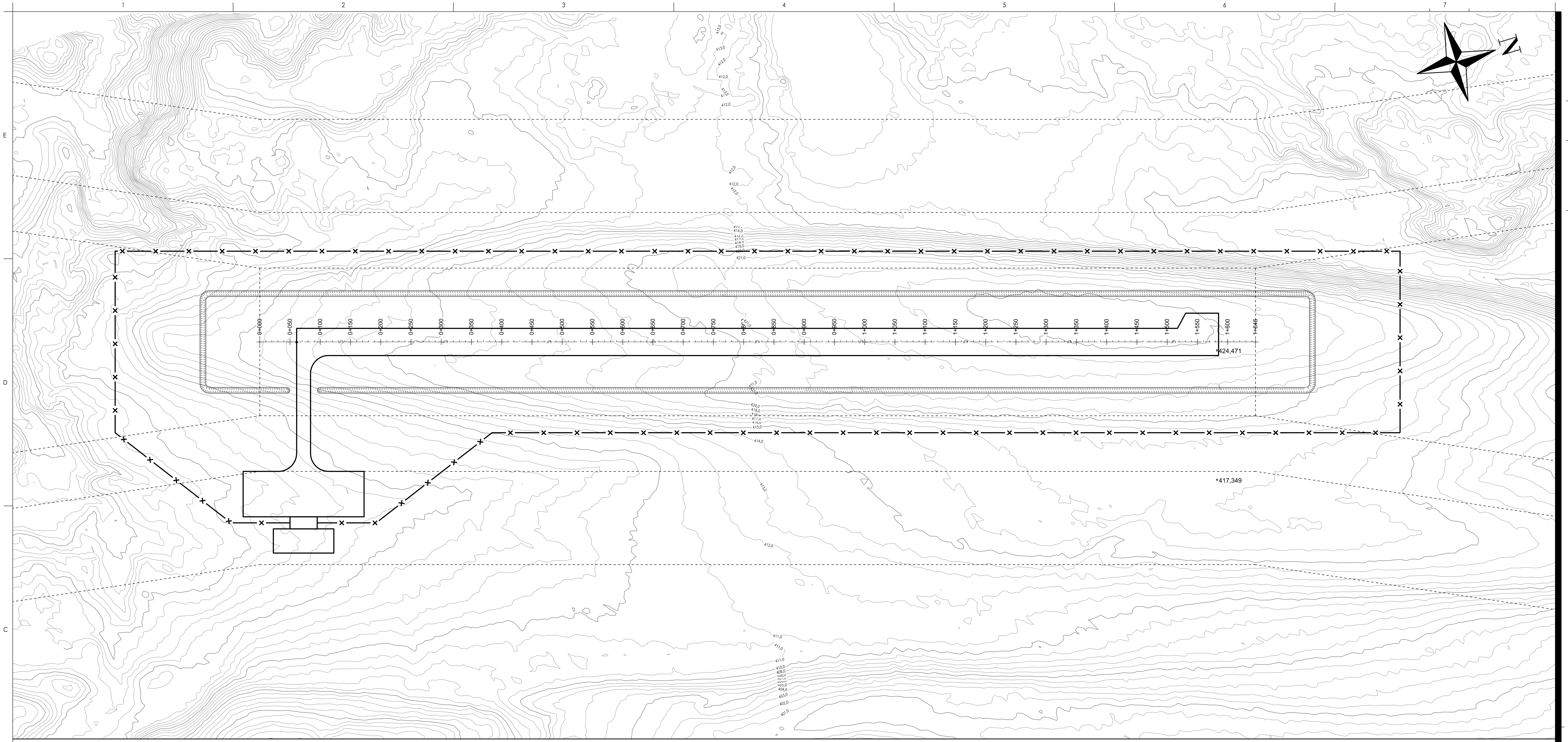
MISTISSINI, QC./CANADA

Title

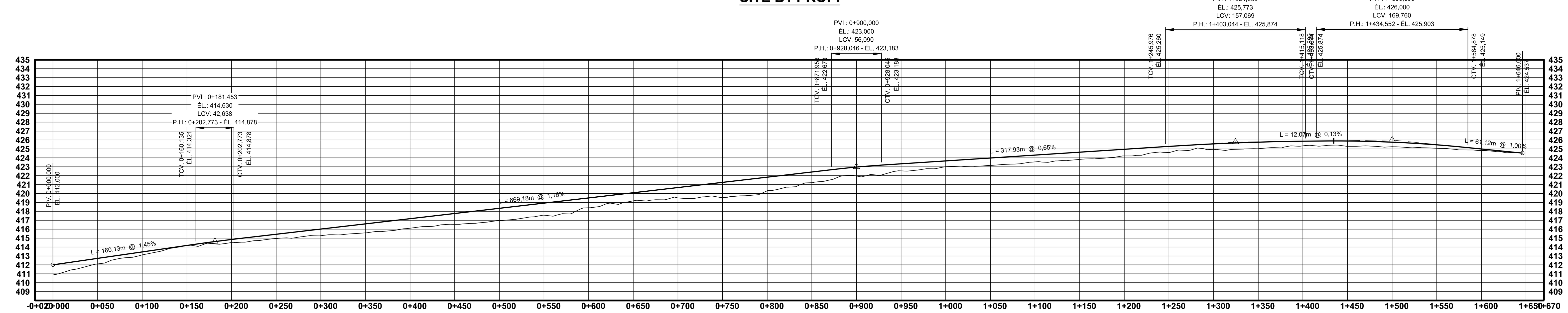
PROPOSED GENERAL SITE VIEWS

Project No. 158100425
Scale 1:2000
Iss./Rev. A
Sheet 01 of
Drawing No. **C-01**

Appendix B
Selected Sites Plan



SITE B1 PROP.



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Notes

Issued/Revision	By	Appd	YYYY.MM.DD
A FOR INFORMATION	T.K.	M.R.	2024-01-12

File Name: SITE_B1.DWG — 2023-11-15 (YYYY.MM.DD)

Toni Keyrouz, techn. — Prepared

Toni Keyrouz, techn. — Drawn

Marco Rocha, ing. — Project Manager

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MISTISSINI AIRPORT OPPORTUNITY STUDY

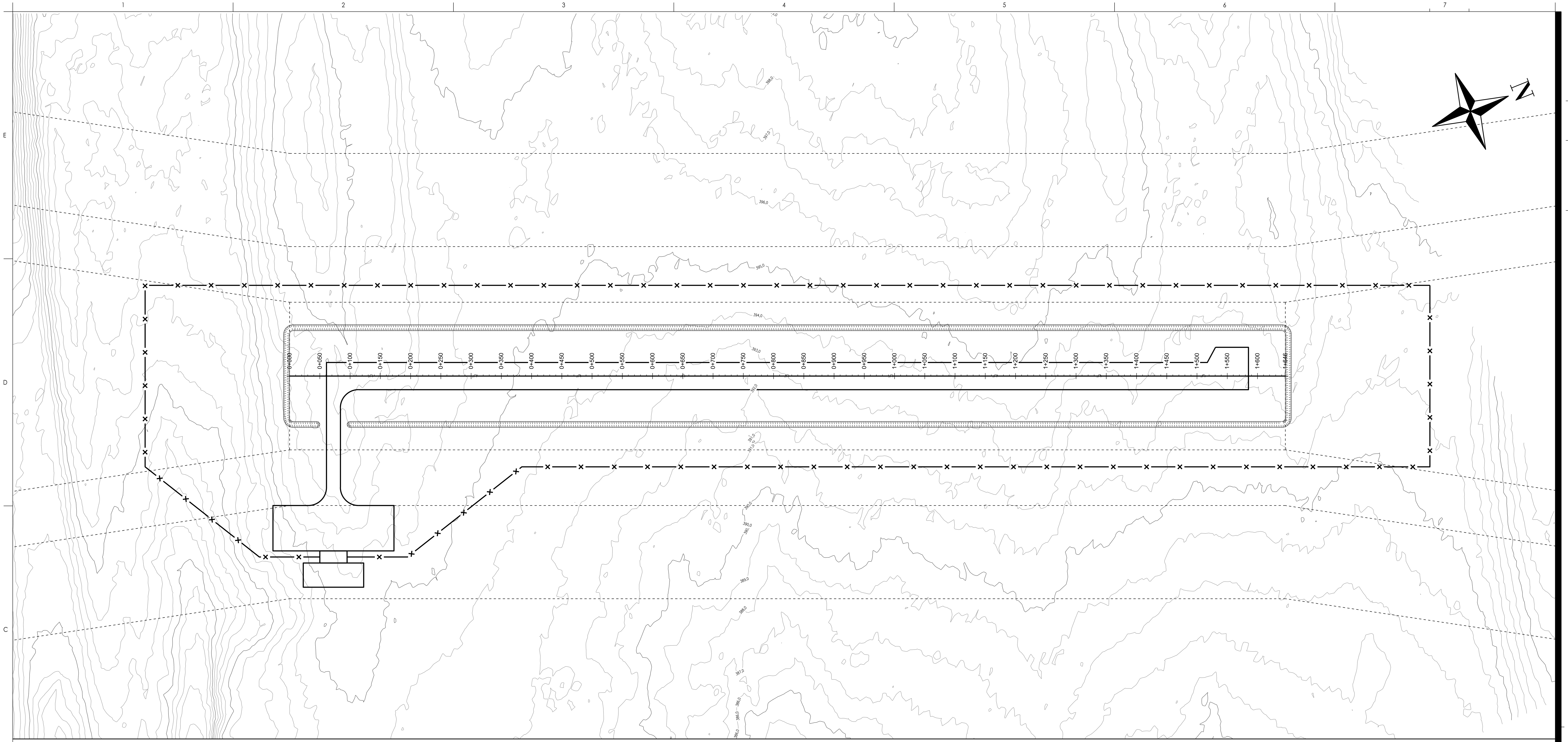
MISTISSINI, QC./CANADA

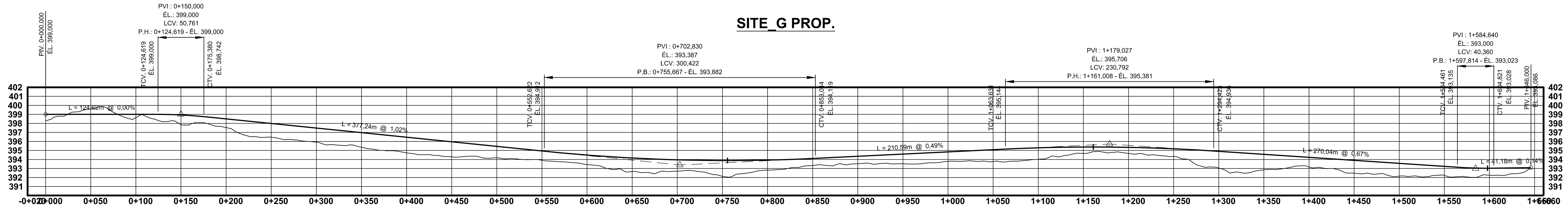
Title

PROPOSED PLAN AND PROFILE VIEW SITE B

Project No. 158100425 | Scale 1:2500

Iss./Rev. A | Sheet 02 of | Drawing No. **C-02**





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A	FOR INFORMATION	T.K.	M.R.	2024-01-12
Issued/Revision		By	Appd	YYYY.MM.DD

File Name: SITE_G.DWG — 2023-11-15 (YYYY.MM.DD)

Toni Keyrouz, techn. — Prepared

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Marco Rocha, ing. — Project Manager

Permit-Seal

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MISTISSINI AIRPORT OPPORTUNITY STUDY

MISTISSINI, QC./CANADA

Title

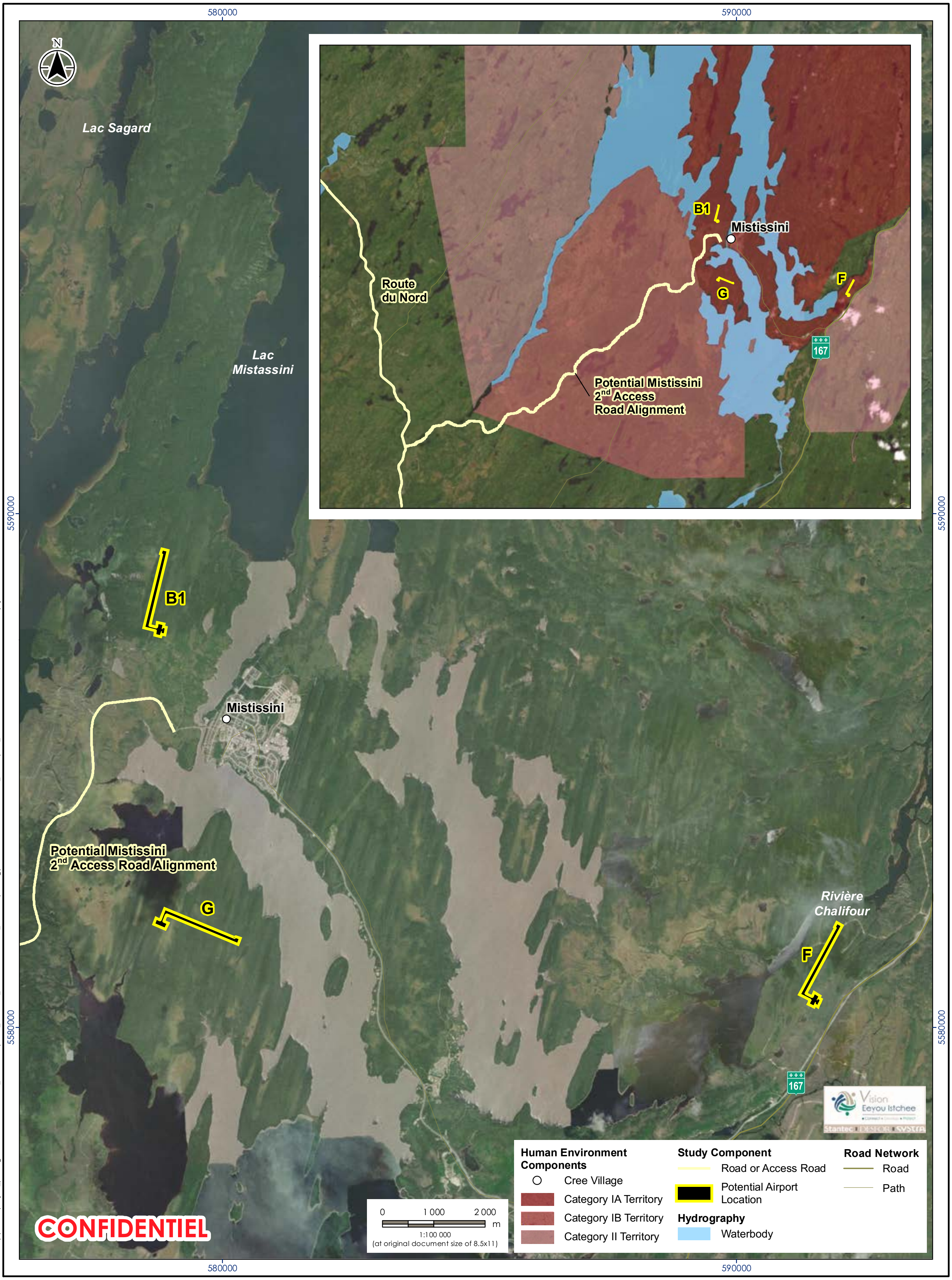
PROPOSED PLAN AND PROFILE VIEW SITE G

Project No.	Scale
158100425	1:2500

Iss./Rev.	Sheet	Drawing No.
A	01 of	C-01

Appendix C
Selected Sites Location and Terrain Maps

Mistissini Airport Opportunity Study – La Grande Alliance Infrastructure Feasibilty Study



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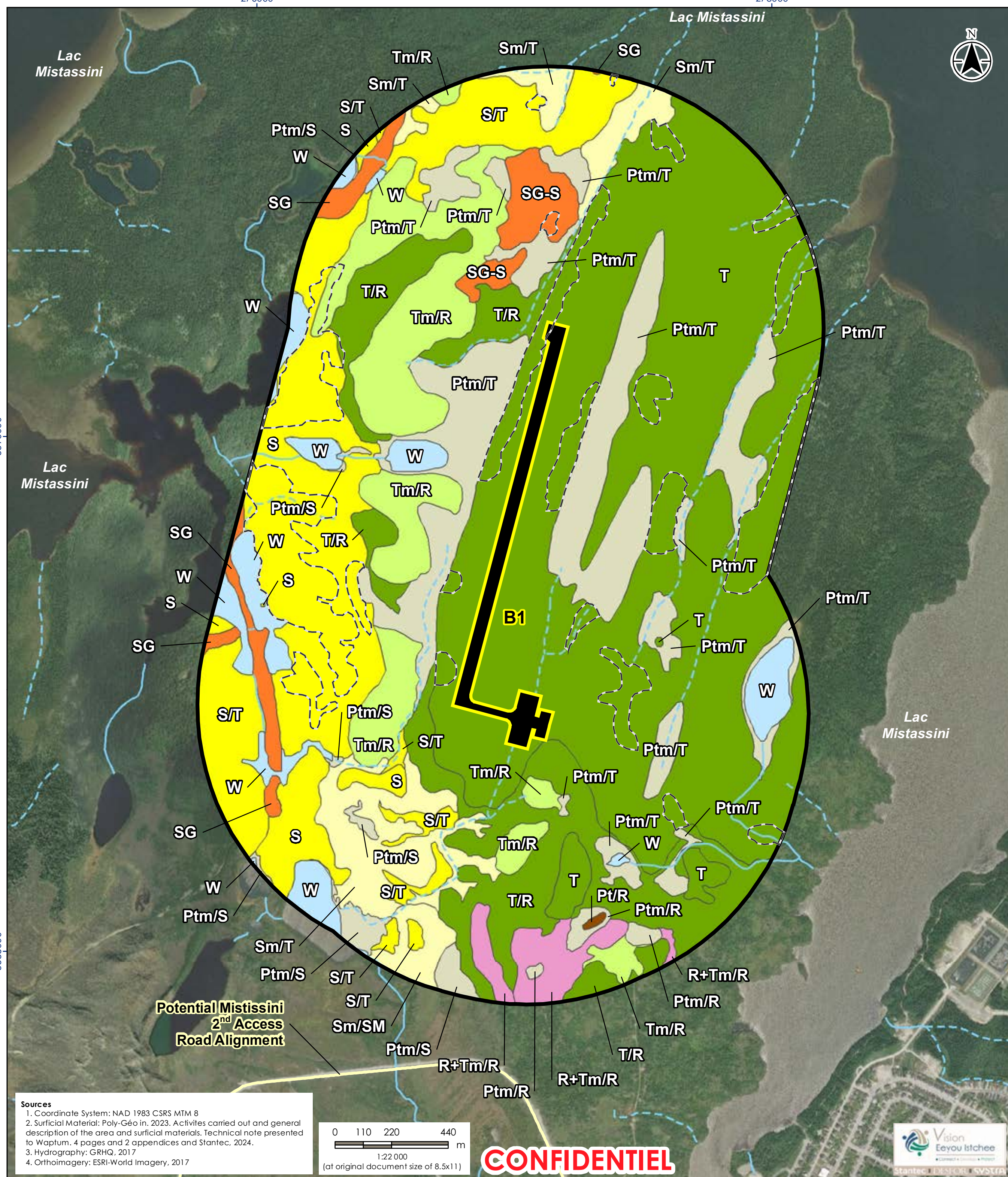
Mistissini Airport Opportunity Study – La Grande Alliance Infrastructure Feasibilty Study



Surficial Material

Surficial Material Classification

R	> 80 % of bedrock
T	Till
SG	Sand and Gravel
S	Sand
SM	Silty sand or sandy silt
Pt	Peat
W	Water body

Examples of Layer Overlapping and Thickness

Sm/T	Thin layer of sand (< 2 m thick) over till
S/T	Layer of sand (2 to 6 m thick) over till
S	Sand (> 6 m thick)

Examples of Combined Symbols

T+B	Till with boulders at the ground surface
R+Tm/R	Bedrock with a veneer of till (< 2 m thick)
T-SG	Undifferentiated till or sand and gravel

Generalized Surficial Material Classification

- Bedrock
- Till (< 2 m thick)
- Till (> 2 m thick)
- Sand and gravel (> 2 m thick)
- Sand (< 2 m thick)
- Sand (> 2 m thick)
- Peat (< 2 m thick)
- Peat (> 2 m thick)

Constraint

- Gullying
- Waterbody
- Permanent
- Intermittent

Study Component

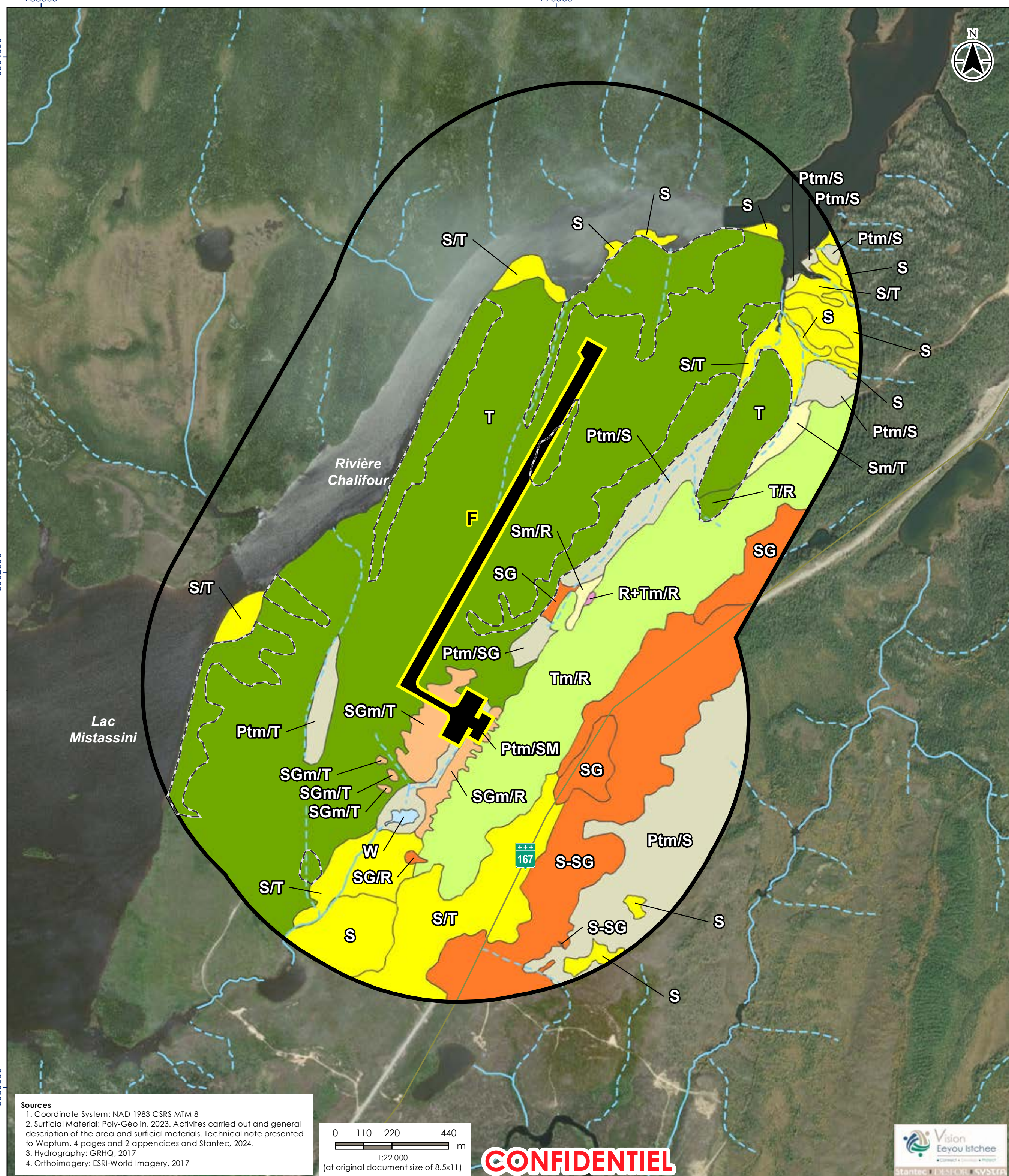
- Access Road
- Potential Airport Location
- Buffer 1 km

Road Network

- Path

\\ca0119-ppfs01\projets_partages\158100425\GO\6_Geomatique\2_Carto\1_MXD\P158100425-C0048-REVA_LocAirport_Carton_240131.mxd Revised: 2024-01-31 By: jbrunette

Mistissini Airport Opportunity Study – La Grande Alliance Infrastructure Feasibilty Study



Sources
1. Coordinate System: NAD 1983 CSRS MTM 8
2. Surficial Material: Poly-Géo in, 2023. Activites carried out and general description of the area and surficial materials. Technical note presented to Waptum. 4 pages and 2 appendices and Stantec, 2024.
3. Hydrography: GRHQ, 2017
4. Orthoimagery: ESRI-World Imagery, 2017

0 110 220 440 m
1:22 000
(at original document size of 8.5x11)

Surficial Material

Surficial Material Classification

- **R** > 80 % of bedrock
- **T** Till
- **SG** Sand and Gravel
- **S** Sand
- **SM** Silty sand or sandy silt
- **Pt** Peat
- **W** Water body

Examples of Layer Overlapping and Thickness

- **Sm/T** Thin layer of sand (< 2 m thick) over till
- **S/T** Layer of sand (2 to 6 m thick) over till
- **S** Sand (> 6 m thick)

Examples of Combined Symbols

- **T+B** Till with boulders at the ground surface
- **R+Tm/R** Bedrock with a veneer of till (< 2 m thick)
- **T-SG** Undifferentiated till or sand and gravel

Generalized Surficial Material Classification

- Bedrock
- Till (< 2 m thick)
- Till (> 2 m thick)
- Sand and gravel (< 2 m thick)
- Sand and gravel (> 2 m thick)
- Sand (< 2 m thick)
- Sand (> 2 m thick)
- Peat (< 2 m thick)

Constraint

- Gullying
- Waterbody
- Permanent
- Intermittent

Study Component

- Potential Airport Location
- Buffer 1 km

Road Network

- Road

288000 290000

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Mistissini Airport Opportunity Study – La Grande Alliance Infrastructure Feasibilty Study

Surficial Material

Surficial Material Classification

R	> 80 % of bedrock
T	Till
SG	Sand and Gravel
S	Sand
SM	Silty sand or sandy silt
Pt	Peat
W	Water body

Examples of Layer Overlapping and Thickness

Sm/T	Thin layer of sand (< 2 m thick) over till
S/T	Layer of sand (2 to 6 m thick) over till
S	Sand (> 6 m thick)

Examples of Combined Symbols

T+B	Till with boulders at the ground surface
R+Tm/R	Bedrock with a veneer of till (< 2 m thick)
T-SG	Undifferentiated till or sand and gravel

Generalized Surficial Material Classification

- Till (> 2 m thick)
- Silty sand or sandy silt (< 2 m thick)
- Peat (< 2 m thick)
- Peat (> 2 m thick)
- Waterbody
- Permanent
- Intermittent

Constraint

- Gullying

Study Component

- Potential Airport Location
- Buffer 1 km

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Appendix D
Estimations

Cost estimate for a construction of new airfield - Alamos

SITE 1: GOUDREAU ROAD

Item n°	Category of work, tool or material	Unit	Unit price	Quantity	Total price
A	GENERAL CONDITIONS				
A-1	SITE ORGANIZATION				
A-1.1	Site organization (10%)	fixed	N/A	N/A	$ 2 181 750,00
A-1.2	Mobilization of equipment	fixed	$ 500 000,00	1	$ 500 000,00
A-1.3	Mobilization and installation of a sieving site	fixed	$ 50 000,00	1	$ 50 000,00
A-2	ACCESS ROAD AND RELATED INFRASTRUCTURE				
A-2.1	Terminal	fixed	$ -	1	$ 220 000,00
A-2.2	Granular foundation for parking, including excavation	sq. m.	$ 50,00	4 000	$ 200 000,00
A-2.3	Granular foundation for access road, including excavation and ditch	li. m.	$ 400,00	2 500	$ 1 000 000,00
A-2.4	Construction of medium-voltage line	li. m.	$ 150,00	2 500	$ 375 000,00
A-3	OTHER				
A-3.1	Airport perimeter fence	fixed	$ -	1	$ 800 000,00
A-3.3	Instrument approach design costs	fixed	$ 50 000,00	N/A	$ 50 000,00
	Subtotal of section A - General conditions, taxes excluded				**$ 5 376 750,00**
B	CIVIL WORKS				
B-1	RUNWAY, TAXIWAY AND APRON DEMOLITION				
B-1.1	Deforestation	ha	$ 20 000,00	70	$ 1 400 000,00
B-1.2	Deforestation,without stump removal	ha	$ 4 500,00	50	$ 225 000,00
B-1.3	cut & fill	cu. m.	$ 30,00	168 000	$ 5 040 000,00
B-2	PAVEMENT WORKS				
B-2.1	Geotextile membrane	sq. m.	$ 3,00	90 000	$ 270 000,00
B-2.2	Profiling and compaction of the subgrade	sq. m.	$ 3,00	90 000	$ 270 000,00
B-2.3	Granular surface course and base course for runway, taxiway and apron, 450mm thick	m. t.	$ 30,00	90 000	$ 2 700 000,00
B-2.4	Wearing course for runway, taxiway and apron, 100mm thick	m. t.	$ 30,00	90 000	$ 2 700 000,00
B-2.5	Granular base levelling	sq. m.	$ 4,00	90 000	$ 360 000,00
B-3	DRAINAGE				
B-3.1	Construction of drainage ditch, including earthwork, topsoil and seeding	li. m.	$ 70,00	4 000	$ 280 000,00
B-3.2	Supply and installation of a culvert	li. m.	$ 1 000,00	65	$ 65 000,00
B-4	EARTHWORK				
B-4.1	Granular course for safety area, 150mm thick	m. t.	$ 30,00	102 600	$ 3 078 000,00
	Subtotal of section B - Civil works, taxes excluded				**$ 16 388 000,00**
C	ELECTRICITY				
C-1	RUNWAY, TAXIWAY AND APRON				
C-1.1	Supply and installation of a runway edge and threshold/runway end light	unit	$ 5 000,00	63	$ 315 000,00
C-1.2	Supply and installation of a taxiway and apron edge light	unit	$ 3 000,00	34	$ 102 000,00
C-1.3	Supply and installation of a conduct power cable	li. m.	$ 75,00	6 300	$ 472 500,00
C-1.4	Supply and installation of PAPI	unit	$ 75 000,00	2	$ 150 000,00
C-1.5	Supply and installation of runway threshold identification lights (RTIL)	unit	$ 30 000,00	2	$ 60 000,00
C-1.6	Supply and installation of omnidirectional approach lighting system (ODALS)	unit	$ 275 000,00	2	$ 550 000,00

Cost estimate for a construction of new airfield - Alamos

SITE 1: GOUDREAU ROAD

Item n°	Category of work, tool or material	Unit	Unit price	Quantity	Total price
C-2	**AIRFIELD LIGHTING FIELD ELECTRICAL CENTER AND OTHER**				
C-2.1	Supply and installation of a prefabricated FEC, including control panels, regulators, generators and ARCAL system	fixed	$ 200 000,00	1	$ 200 000,00
C-2.2	Delivery of electrical equipment	fixed	$ 20 000,00	1	$ 20 000,00
C-2.3	Supply and installation of a wind direction indicator	unit	$ 15 000,00	2	$ 30 000,00
C-2.4	Supply and installation of a weather station AWOS type	fixed	$ 300 000,00	1	$ 300 000,00
C-2.5	Electrical checks	fixed	$ 35 000,00	1	$ 35 000,00
	Subtotal of section C - Electricity, taxes excluded				**$ 2 234 500,00**
			Total		**23 999 250,00 $**
			Contingencies	40%	9 599 700,00 $
			Total		33 598 950,00 $

Cost estimate for a construction of new airfield - Alamos

SITE 2: HAWK JUNCTION ROAD

Item n°	Category of work, tool or material	Unit	Unit price	Quantity	Total price
A	**GENERAL CONDITIONS**				
A-1	**SITE ORGANIZATION**				
A-1.1	Site organization (10%)	fixed	N/A	N/A	$ 2 283 250,00
A-1.2	Mobilization of equipment	fixed	$ 500 000,00	1	$ 500 000,00
A-1.3	Mobilization and installation of a sieving site	fixed	$ 50 000,00	1	$ 50 000,00
A-2	**ACCESS ROAD AND RELATED INFRASTRUCTURE**				
A-2.1	Terminal	fixed	$ -	1	$ 220 000,00
A-2.2	Granular foundation for parking, including excavation	sq. m.	$ 50,00	4 000	$ 200 000,00
A-2.3	Granular foundation for access road, including excavation and ditch	li. m.	$ 400,00	5 000	$ 2 000 000,00
A-2.5	Construction of medium-voltage line	li. m.	$ 150,00	7 000	$ 1 050 000,00
A-3	**OTHER**				
A-3.1	Airport perimeter fence & path	fixed	$ -	1	$ 800 000,00
A-3.3	Instrument approach design costs	fixed	$ 50 000,00	N/A	$ 50 000,00
	Subtotal of section A - General conditions, taxes excluded				**$ 7 153 250,00**
B	**CIVIL WORKS**				
B-1	**RUNWAY, TAXIWAY AND APRON DEMOLITION**				
B-1.1	Deforestation	ha	$ 20 000,00	70	$ 1 400 000,00
B-1.2	Deforestation,without stump removal	ha	$ 4 500,00	30	$ 135 000,00
B-1.3	Cut & fill	cu. m.	$ 30,00	149 000	$ 4 470 000,00
B-2	**PAVEMENT WORKS**				
B-2.1	Geotextile membrane	sq. m.	$ 3,00	90 000	$ 270 000,00
B-2.2	Profiling and compaction of the subgrade	sq. m.	$ 3,00	90 000	$ 270 000,00
B-2.3	Granular surface course and base course for runway, taxiway and apron, 450mm thick	m. t.	$ 30,00	90 000	$ 2 700 000,00
B-2.4	Wearing course for runway, taxiway and apron, 100mm thick	m. t.	$ 30,00	90 000	$ 2 700 000,00
B-2.5	Granular base levelling	sq. m.	$ 4,00	90 000	$ 360 000,00
B-3	**UTILITY SERVICES**				
B-3.1	Construction of drainage ditch, including earthwork, topsoil and seeding	sq. m.	$ 70,00	4 000	$ 280 000,00
B-3.2	Supply and installation of a culvert	li. m.	$ 1 000,00	65	$ 65 000,00
B-4	**EARTHWORK**				
B-4.1	Granular course for safety area, 150mm thick	m. t.	$ 30,00	102 600	$ 3 078 000,00
	Subtotal of section B - Civil works, taxes excluded				**$ 15 728 000,00**

Cost estimate for a construction of new airfield - Alamos

SITE 2: HAWK JUNCTION ROAD

Item n°	Category of work, tool or material	Unit	Unit price	Quantity	Total price
C	**ELECTRICITY**				
C-1	**RUNWAY, TAXIWAY AND APRON**				
C-1.1	Supply and installation of a runway edge and threshold/runway end light	unit	$ 5 000,00	63	$ 315 000,00
C-1.2	Supply and installation of a taxiway and apron edge light	unit	$ 3 000,00	34	$ 102 000,00
C-1.3	Supply and installation of a conduct power cable	li. m.	$ 75,00	6 300	$ 472 500,00
C-1.4	Supply and installation of PAPI	unit	$ 75 000,00	2	$ 150 000,00
C-1.5	Supply and installation of runway threshold identification lights (RTIL)	unit	$ 30 000,00	2	$ 60 000,00
C-1.6	Supply and installation of omnidirectional approach lighting system (ODALS)	unit	$ 275 000,00	2	$ 550 000,00
C-2	**AIRFIELD LIGHTING FIELD ELECTRICAL CENTER AND OTHER**				
C-2.1	Supply and installation of a prefabricated FEC, including control panels, regulators, generators and ARCAL system	fixed	$ 200 000,00	1	$ 200 000,00
C-2.2	Delivery of electrical equipment	fixed	$ 20 000,00	1	$ 20 000,00
C-2.3	Supply and installation of a wind direction indicator	unit	$ 15 000,00	2	$ 30 000,00
C-2.4	Supply and installation of a weather station AWOS type	fixed	$ 300 000,00	1	$ 300 000,00
C-2.5	Electrical checks	fixed	$ 35 000,00	1	$ 35 000,00
	Subtotal of section C - Electricity, taxes excluded				**$ 2 234 500,00**
			Total		**25 115 750,00 $**
			Contingencies	40%	10 046 300,00 $
			Total		35 162 050,00 $

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