Project for a new trench landfill site in Nemaska for the Cree Nation of Nemaska

Answers to COMEX questions

Final report

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0	Final report	Multiple authors	J. Rosset	J. Massicotte

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Acronyms / Abbreviations

Acronym / Abbreviation	Full Name
AGA	Annual general assembly
CDPNQ	Centre de données sur le patrimoine naturel du Québec
CNN	Cree Nation of Nemaska
EIJBRG	Eeyou Istchee James Bay Regional Government
HQ	Hydro-Québec
ISQ	Institut de la statistique du Québec
LEET	In-trench landfill
NL	Nemaska Lithium
RL	Rose Lithium
RRLIRM	Regulation respecting landfilling and incineration of residual materials

1. Introduction

The following subsections provide general details and amendments to the report *entitled Development of a New Landfill Site in Nemaska – Environmental and Social Impact Assessment* (hereinafter referred to as the impact assessment report, Stantec, May 2024), while detailed responses to the questions are provided in Section 2.

1.1 Modification to the plans

The design of the in-trench landfill site (LEET) has been slightly modified to take into account several factors:

- Construction of the project in two phases, due to the limited budget available for the initial development:
  - Phase 1: Construction of the access road, general infrastructure, and the first half of the landfill site.
  - Phase 2: Construction of the second half of the landfill site.
- Reduction in the height of the south-side berm (4 meters instead of 8), widening of the entire peripheral berm while maintaining an outer slope of 1 in 3 (instead of 1 in 2 initially), Lowering of the bottom of the trench and removal of the slope to reduce the risk of water resurgence and accumulation against the berm (related to question QC-4).
- Addition of a ditch along the berms to the east and south to collect runoff and discharge it into the natural environment at a point that will be monitored.
- Modification of the fence, which is extended by one meter underground and horizontally outward at the top, and modification of the gate, designed to prevent bears and wolves from digging under it and to avoid any intrusion of nuisance animals into the LEET (related to question QC-13).
- Addition of new observation wells (related to question QC-11).

A new set of plans has therefore been issued and is presented to the 0, including the layout of the two constructions phases. The plans also include the 50-meter buffer zone around the trench and the Hydro-Québec line.

Table 1 List of plans and revisions

Page	Description	Comments
VR0000	Title page	Updated for the study response to questions
VR0001	Caption	Remains unchanged
VR0002	Proposed site and access route	Updated for the response to questions study
VR0003	Proposed access route	Updated for the response to questions study
VR0004	Phase 1 – Proposed site	Updated for the response to questions study
VR0005	Phase 2 – Proposed site	Updated for the response to questions study

Page	Description	Comments
VR0010	Sections and details	Updated for the question response study

1.2 Projected quantities, capacity, and phasing

The quantity of residual materials to be disposed of has been revised in light of the quantities disposed of and compaction factors observed at the Nemaska LEET from 2017 to 2024 and trends observed in Quebec (in connection with question QC-1). Detailed explanations are provided in section 2.

Table 3.2 of the impact study report is therefore replaced by Table 2 below.

Table 2 Volume of materials, capacity, and estimated service life (new LEET)

Characteristics	Phase	Phase	Total
Disposal area	16,059 m^2	20,679 m^2	36,738 m^2
Excavated material	93,372 m^3	56,575 m^3	149,947 m^3
Volume of the berm	23,395 m^3	23,138 m^3	46,533 m^3
Site capacity	88,310 m^3	131,690 m^3	220,000 m^3
Expected lifespan	26 years	25 years	51 years
Class B soil volume required for weekly covering	12,604 m^3	20,396 m^3	35,473 m^3
Minimum volume of Class B soil required for final cover (45 cm)	7,227 m^3	9,306 m^3	16,533 m^3
Minimum volume of organic soil required for final cover (15 cm)	2,409 m^3	3,102 m^3	5,511 m^3

1.3 Update of project costs section 3.3 page 37

The changes made to the plans have an impact on costs. Therefore, Table 3-8 Opinion on probable construction costs in the impact study report is replaced by Table 3 below.

Table 3 Updated opinion on probable construction costs

	Element	Phase	Phase	Total
1.0	Studies	$156,298	-	$156,298
2	Construction (access road and landfill site)	$5,508,950	$3,858,750	$9,367,700
3	Engineering	$333,601	$52,300	$385,901
4.0	Construction supervision	$130,500	$75,000	$205,500
5	Permit fees (government)	$31,302	$2,170	$33,472
	Subtotal	**$6,160,651**	**$3,988,220**	**$10,148,871**
6.0	Indexation 2023–2025	$454,630	$1,173,970	$1,628,600
7	Contingency	$926,757	$774,330	$1,701,087
	TOTAL	**$7,542,038**	**$5,936,520**	**$13,478,558**

1.4 Site selection study presented in Appendix B of the impact study report

This study is mentioned several times in the questions that identify discrepancies between certain information presented therein and information also presented in the impact study report, particularly regarding quantity projections, groundwater characteristics, and post-closure management.

The site selection study is presented in the appendix B of the impact study report for the sole purpose of documenting the site selection process and that the other results presented should not be considered, as other data has been obtained since then and only the results presented in the impact study report should be taken into account.

2. Answers to questions and comments

2.1 QC- 1. Page 21 and 180, section 1.5.3 and Appendix B

The proponent uses data collected between 2013 and 2018 to estimate future landfill requirements. It also makes assumptions about these requirements, particularly regarding the growth rate of waste production in the coming years. These assumptions, also found in section 2.2.2 of Appendix B (page 180), are reportedly based on *the Waste Management Master Plan* produced by the Nation Cree de Nemaska (NCN) in 2012.

The proponent must use more recent data to assess future landfill requirements or, at a minimum, confirm the validity of its projections using the quantities that have been recently landfilled at the existing LEET. The proponent must also justify the calculation assumptions presented in this section. For example, it must provide information supporting its assumption that there will be a decline in the growth rate of waste generation in the coming years.

The projection of the quantities of residual materials to be landfilled has been revised based on more recent data that is representative of the current situation. The main updates are as follows:

Reference data on annual volumes landfilled:

The projections were recalculated based on the volumes buried in Nemaska's trench landfill site (LEET) annual reports covering the period from 2017 to 2024, which also include cover materials corresponding to 15% of the volumes of residual materials buried. In addition, the observed density was 0.3 from 2017 to 2021, then increased to 0.4 from 2022 onwards, thanks to the use of a waste compactor. The per capita volumes buried in recent years are presented at Table 4 .

Table 4 Volumes buried in Nemaska landfill from 2017 to 2024

Year	Volume buried per capita including 15% of cover material (m^3)	Estimated density (t/m^3)	Volume buried per capita with a density of 0.5 t/m^3 (m^3)
2017	3.27	0	1.96
2018	3.42	0.3	2.05
2019	3.08	0.3	1.85
2020	3.36	0.3	2.01
2021	3.05	0.3	1.83
2022	2.58	0.4	2.06
2023	2.38	0.4	1.90
2024	2.26	0.4	1.81
		AVERAGE	1.94

With the establishment of the new landfill site and the optimisation of the compactor's use, a density of 0.5 t/m^3 was used to calculate the average volume buried per capita to be used as a starting point in 2024, i.e. 1.94 m^3/capita.

Population projections

The population forecasts used are based on the latest projections published by the Institut de la statistique du Québec (ISQ) in December 2024 for the period from 2021 to 2041 (ISQ, 2024). For the period after 2041, an average annual growth rate of 0.972% was applied, corresponding to the average growth rate between 2031 and 2041 according to ISQ data.

Assumptions on per capita waste generation

In the impact study report, the growth rate of waste generation per capita fell from 2.0% in 2013 to 1.0% between 2033 and 2054, then to 0.5% after 2054 to reflect a trend observed at the provincial level.

To refine these figures, a detailed analysis of provincial data compiled in RECYC-QUÉBEC's waste management reports between 2000 and 2021 was conducted to highlight changes in the per capita generation rate.

Subsequently, a trend curve for annual per capita waste generation rates was determined based on the analyzed RECYC-QUÉBEC data, shifted by five years to reflect an economic catch-up effect specific to the northern and remote context of Nemaska. This made it possible to calculate the annual growth rates until the end of the LEET's lifetime. The annual growth rate of total waste generation per capita (including all streams) thus varies between 1.83% in 2025 and 0.99% from 2070 onwards.

Table 1-3 of the impact study report is replaced by Table 5 , below. The volume of residual materials from Rose Lithium (RL) has been added based on data shared by the Nemaska Cree Nation.

Table 5 Estimated volume of residual materials to be disposed of at the new Nemaska landfill site from 2026 to 2076, in m³

Year	NCN	HQ	NL	RL	Annual volume	Covering materials (15%)	Total	Cumulative volume
2026	1,778	15	0	0	1,936	290	**2,227**	**2,227**
2030	1,956	172	300	52	2,480	372	**2,852**	**13,313**
2035	2,203	186	300	52	2,741	411	**3,152**	**28,485**
2,040	2,497	200	300	52	3,049	457	**3,506**	**45,323**
2045	2,798	214	300	52	3,364	505	**3,868**	**63,930**
2050	3,122	228	300	52	3,702	555	**4,257**	**84,427**
2055	3,469	242	300	52	4,063	609	**4,672**	**106,946**
2,060	3,842	256	0	52	4,150	622	**4,772**	**131,285**
2,065	4,242	270	0	52	4,563	684	**5,248**	**156,560**
2,070	4,670	284	0	0	4,953	743	**5,697**	**184,012**
2,076	5,235	301	0	0	5,536	830	**6,366**	**220,498**

With the update of the quantity projections, the LEET lifetime is estimated at 51 years, compared to the 35 years initially estimated in the impact study report. This is mainly due to the decrease in population growth according to the latest ISQ data and the application of a density of 0.5 instead of 0.4 in the impact study report.

2.2 QC- 2. Page 21, Table 3-4

The developer must provide an updated schedule taking into account that the redevelopment of the former landfill site is an integral part of the current project.

Table 3.4 - Project schedule presented in the impact study report is replaced by Table 6 , below, updated to take into account the redevelopment of the former LEET, the two-phase implementation and the increase in the project's lifespan.

Table 6 Updated project schedule

Project element	Deadline
Redesign of the former LEET	
Study and fieldwork	Fall 2025 – Winter 2026
Closure plans and estimates, and tender documents	Spring – Fall 2026
Call for tenders	Winter
Closure work on existing LEET	Spring–Summer 2027
Post-closure management	Starting in 2027
New LEET – Phase 1	
Final plans and estimates, and tender documents	Fall 2025 – Winter 2026
Tender	Winter
Request for authorization from MELCCFP and approval	Fall 2025 – Spring 2026
Deforestation permit	Winter
Construction	Summer–Fall 2026
Start of operations and training	Fall 2026 – Winter 2027
Closure of phase 1	2052
New LEET – Phase 2	
Plans, estimates, and tender documents	2049
Call for tenders	2050–2051
If applicable, request authorization from the MELCCFP and obtain approval (according to the conditions obtained during phase 1)	2049
Construction	2051
Start of phase 2 operations	2052
Phase 2 closure	2053
Post-closure management	From 2053

2.3 QC- 3. Page 22, section 1.5.3

Table 1-3 (page 22) presents the quantities of residual materials expected annually until 2060. According to this table, it is estimated that a total volume of 215,444 m^3 of material (including cover material) will be sent to the LEET over its 35-year lifetime.

For residual materials from Nemaska Lithium, the proponent uses a density of 0.4 tons/m^3, or 150 tons for 375 m^3, which is lower than the estimates put forward in the explanatory note to section 41 of *the Application Guide for the Regulation respecting the disposal and incineration of residual materials (*REIMR) for compacted residual materials. It is estimated that waste compacted with a tracked bulldozer can have a density of 0.5 to 0.6 tons per m^3, while waste compacted with a waste compactor can reach a density of 1 ton per m^3. Several places in the impact study, including Table 3-7 in section 3.2.3 (page 36), mention that a compactor will be used to compact residual materials.

The proponent must reassess its landfill requirements by incorporating one or more compaction factors representative of the expected operating conditions at the LEET. It must also justify the choice of these compaction factors.

As presented in the response to question QC-1, a reassessment of the projected volumes to be landfilled was carried out taking into account the representative bulk densities for the operating conditions of the current landfill site.

Although the MRIM Application Guide mentions bulk densities of up to 0.5 to 0.6 t/m^3 with a bulldozer and up to 1 t/m^3 with a waste compactor, these values are not representative of operating conditions at the Nemaska LEET.

In fact, field data observations over several years show that these bulk densities cannot be achieved in Nemaska, as in other equivalent northern and isolated communities. The average density observed with a bulldozer is approximately 0.3 t/m^3, while with the use of the waste compactor since 2022, the density has increased to approximately 0.4 t/m^3. With the implementation of the new LEET and the optimization of the compactor's use, a density of 0.5 $^{t/m^3}$has been used for quantity projections. This reflects a conservative approach aimed at reflecting the best realistic operating conditions without overestimating compaction performance.

2.4 QC- 4. Page 28 and 387, Section 3.1.1 and Appendix D

In its project description, the proponent states that "the embankment will increase the capacity of the landfill, limit the visibility of landfill operations, prevent surface water contamination and prevent the dispersion of residual materials by wind."

The cross-sectional profile in drawing VR0004 attached to Appendix D (page 387) shows the berm to the southeast. The height of the berm is more than 8 m on its side facing the outside of the disposal area. This side faces the road surrounding the site and directly faces the outside of the site.

The explanatory note to section 91 of the IRMR Application Guide states that a "LEET may be constructed as an embankment using peripheral berms." However, it specifies that although "there is no limit to the height of such berms, [...] due to the higher risk of leachate resurgence, they should be limited to a few meters (2 to 3 m)."

The proponent must confirm, with supporting evidence, that the perimeter berm at the site will be designed to prevent leachate resurgence despite a height of more than 8 m and demonstrate through a visual simulation that the site will not be visible from the North Road.

The response to question QC-4 is presented below in two parts.

Avoiding leachate resurgence at perimeter berms

As indicated in Section 1, the LEET plans have been modified to take into account several comments of COMEX. In particular, the height of the south-side berm has been reduced (to 4m on the outer side and 2m on the inner side), its width has been increased while maintaining an outer slope of one in three (compared to one in two initially), and the bottom of the trench has been lowered and given a zero slope, This was done to increase the infiltration capacity of runoff and leachate within the LEET, reduce the risk of water accumulation against the south berm, and thus limit the risk of resurgence.

In addition to these design measures, a hydraulic assessment of the landfill site was carried out using PCSWMM software to analyze its capacity to manage extreme rainfall events and prevent any off-site leachate resurgence during operation. The complete methodology, simulation parameters, and results are detailed in the technical note presented in the 0 of this report. It should be noted that the simulations are made with a 100-year return period increased by the climate change factor.

Several compaction scenarios were simulated, ranging from low to high density. The infiltration time varies between 6 and 23h depending on the scenario, while the peak infiltration is generally absorbed between 0.5 and 6h. The simulations thus demonstrate that precipitation water infiltrates in less than 24h, even in the case of high compaction and low porosity (pessimistic scenario), and that there will therefore be no accumulation in the LEET, preventing resurgence outside the LEET. This demonstrates that the design and local hydrogeological conditions prevent resurgence, even under climate change conditions.

Visual simulation from the northern road

Visual simulations were prepared based on the site's topographic survey, the available topography of the surrounding terrain (LiDAR data, Resources Canada, 2000), images available on Google Street View (July 2022), and taking into account the plant species listed in the impact study report and their characteristics.

The visual simulations are presented for two points on the North Road, located approximately 700 meters from the LEET, respectively to the southwest (Figure 1) and northeast (Figure 2).

Figure 1 **Visual simulation from the road north to southwest: above, visibility of the landfill site (phase 2); below, visibility with the landfill site shown in transparency (red)**

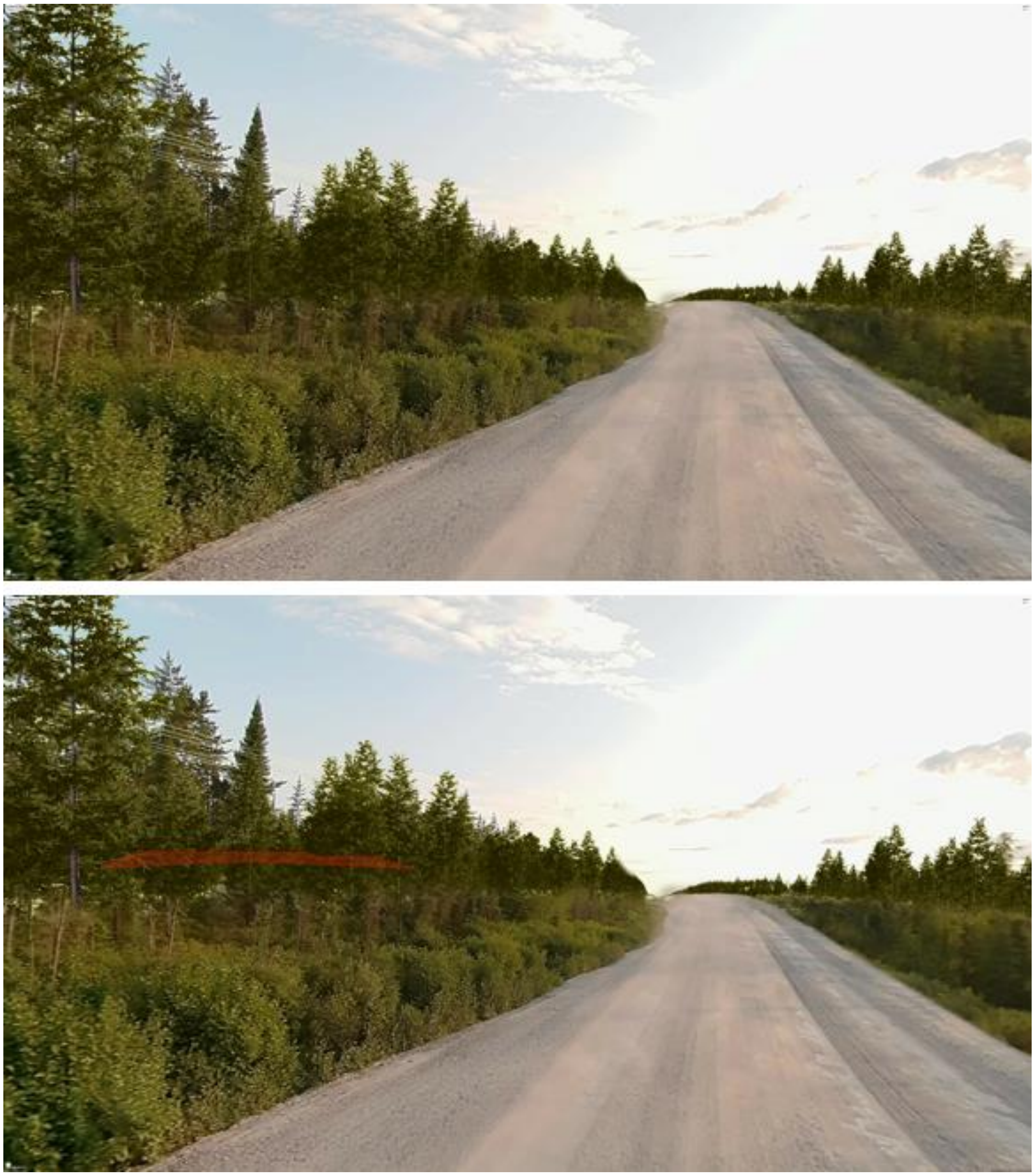

Figure 2 **Visual simulation from the road north to northeast: above, visibility of the landfill site (phase 2); below, visibility with the position of the landfill site shown transparently (red)**

These figures show that at a distance of approximately 700 meters, the landfill site should not be visible from the northern road.

2.5 QC- 5. General

The proponent must indicate whether an "expansion" area is possible on the periphery of the site to accommodate any overflow at the end of the new LEET's life. If so, the proponent must include it in

the buffer zone that must surround the residual material disposal area in accordance with section 18 of the REIMR.

No expansion area is planned on the periphery of the site.

2.6 QC- 6. Page 30, Section 3.1.3

In the project description, the proponent states that "topsoil will be removed and stored on site for reuse as a vegetative layer for the berm and final closure. Excavated material will be used to construct the berm and the surplus will be stored on site for reuse as weekly cover during operations."

The proponent must specify the storage conditions for excavated material and topsoil. It must also ensure that the materials will not be carried away by wind and precipitation and explain the measures that will be put in place to minimize losses during the operating period.

The topsoil layer will be stripped in the areas developed during Phase 1 and stored on the eastern side of the site. The stockpile will be covered with a fast-acting hydroseeding mix that includes a biotic matrix for erosion control, ensuring that the materials are not carried away by wind or precipitation. The topsoil will be used for the final cover of Phase 1. Subsequently, the topsoil layer will be stripped during the development of Phase 2 and also stored on the eastern side of the site under the same conditions. It will be used for the final cover of Phase 2 during the closure of the landfill site.

Class B excavated materials will be stored in two separate stockpiles:

- One stockpile of up to 56,000 m³, originating from the initial development work (general components and Phase 1), will be covered with a fast-acting hydroseeding mix including a biotic matrix for erosion control, to ensure that materials are not carried away by wind or precipitation. This stockpile will not be used until the closure of the landfill site, when 9,300 m³ will be used for the final cover of Phase 2. The surplus will remain in place, leveled and stabilized as needed, and seeded. Note that the volume may be reduced if Class B excavation materials are used for the closure of the current landfill site.

- A second stockpile of up to 20,500 m³, also originating from the initial development work (general components and Phase 1 — 13,000 m³), and later from Phase 2 excavation work (approximately 20,500 m³). These materials will be used for weekly cover (12,604 m³ during Phase 1 operations, and 20,396 m³ for Phase 2). Since materials will be regularly used from this stockpile, it will be covered with a removable LLPDE woven membrane held in place by sandbags, to ensure that materials are not carried away by wind and precipitation.

Additionally, a portion of the materials excavated during Phase 2 development (7,227 m³) will be used directly for the final cover of Phase 1, without requiring storage.

The various stockpiles are identified in the plans in Appendix A.

2.7 QC- 7. Page 35, Section 3.2.3

In the presentation of the sequence for burying residual materials in the trench, the proponent specifies that "each week, a dumping area will be established where residual materials will be

dumped into the trench. The unloading area will gradually move along the edge of the trench as it is filled." This description is accompanied by a figure showing the unloading, compaction, and covering of residual materials (Figure 3-5).

The proponent must provide details on the sequence of filling the trench and specify what is meant by "along the edge of the trench." Figure 3-5 suggests that the residual materials will be accumulated gradually from the bottom of the trench (the point furthest from the entrance). This would result in a single front advancing as the maximum expected elevation is reached. The proponent must confirm this.

The proponent confirms that the residual materials will be accumulated gradually from the bottom of the trench, at the point furthest from the entrance, with a single front advancing as the maximum anticipated elevation is reached, according to the schematic filling sequence shown at Figure 3 below. The starting front will be represented by the number 1 in black, up to 8, then once the line is filled, the sequence will start again, in blue and then green and so on.

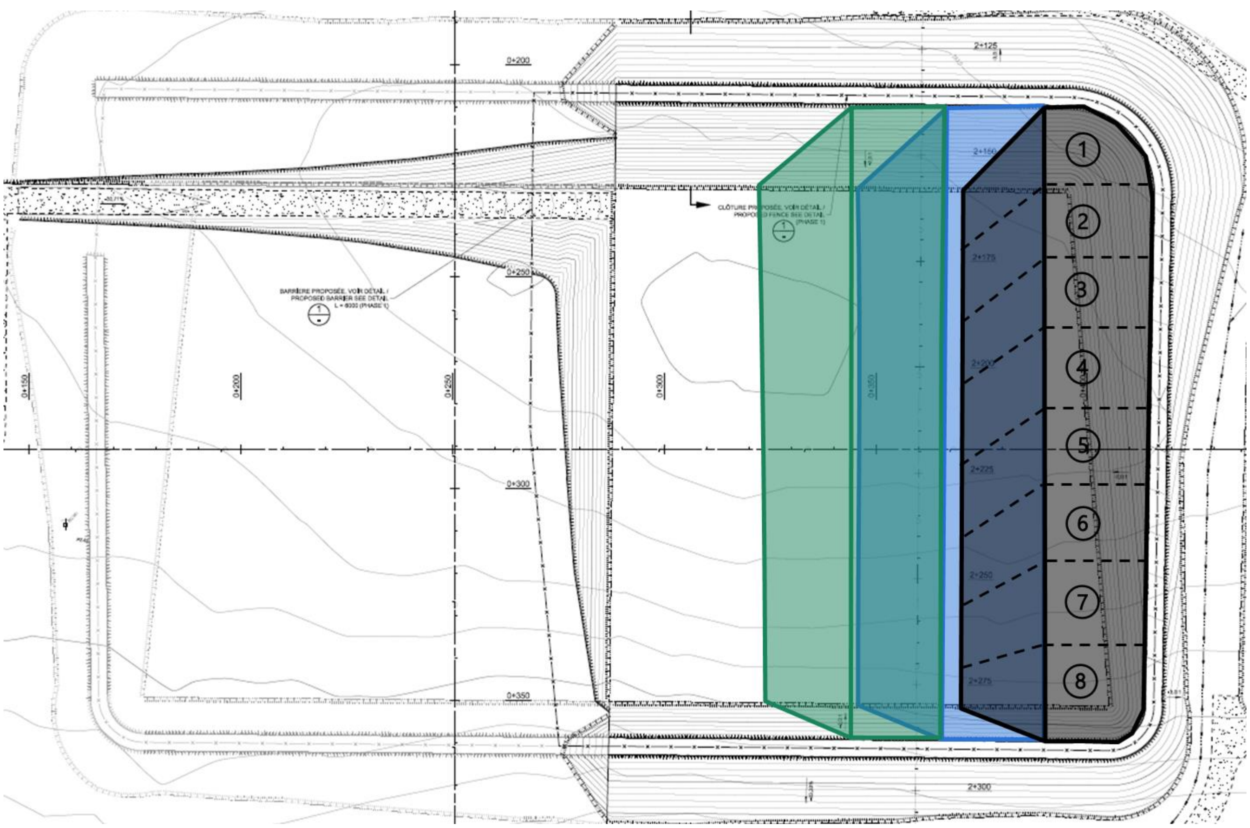

Figure 3 **Single-front filling sequence for the landfill site**

2.8 QC- 8. Page 37, Section 3.3

In Tables 3-8 and 3-9, the proponent presents an estimate of the project's construction costs and annual operating costs. However, it fails to include an estimate of the costs associated with the closure and post-closure management of the new site.

Section 93 of the REIMR states that "the provisions of sections 80 to 85 apply, with the necessary modifications, to the closure of a trench landfill site and its post-closure management." Furthermore, according to section 83, "the obligations prescribed by the provisions of this section continue to apply, with the necessary modifications, to any engineered landfill site that has been permanently closed, for as long as it is likely to constitute a source of contamination."

Upon closure of the new LEET, the operator is therefore responsible for maintaining the integrity of the final cover of the buried residual materials, monitoring and maintaining any collection and treatment systems (water, leachate, etc.) and groundwater observation wells, and conducting sampling and analysis campaigns. etc.) and groundwater observation wells, and for conducting sampling and analysis campaigns.

The proponent must submit an estimate of the costs associated with the closure and post-closure management of the new LEET and describe how it will cover these expenses. In addition, it must qualify and describe the borrow materials it intends to use for the closure of the site.

The provisions of Sections 80 to 85, as well as those of Sections 83 and 93 of the REIMR, have been taken into account in the planning of the closure and post-closure management of the new LEET.

Table 7 and Table 2.

Table 8 show, respectively, the closure costs for the two phases and the annual post-closure management costs. The latter will apply as long as the site is likely to constitute a source of contamination, in accordance with Section 83 of the REIMR.

Table 7 Opinion on the probable closure costs

	Item	Phase	Phase	Total
1.1	Site survey and assessment	$10,000	$15,000	$25,000
1.	Plans and specifications	$25,000	$30,000	$55,000
1.3	Work	$650,164	$821,602	$1,471,766
1.4	Supervision	$72,000	$80,000	$152,000
1.5	Closing report	-	$6,000	$6,000
1.6	Contingencies (20%)	$151,430	$190,520	$341,950
	TOTAL	**$908,594**	**$1,143,122**	**$2,051,716**

The closure costs will be covered by capital funds planned in the Nemaska Cree Nation budget.

The borrow materials used for the closure will come from the materials (Class B and organic soil) resulting from the opening works of Phases 1 and 2 and stored on site in sufficient quantities to meet the closure needs, as shown in Table 2.

Table 8 Opinion on probable annual post-closure management costs

	Item	Annual cost CAD
1.1	Maintenance of the integrity of the final cover of the buried materials	$28,120
1.2	Maintenance of groundwater observation wells	$2,300
1.	Maintenance of fence, gate, and sign	$6,750
1.	Environmental monitoring and annual report	$25,130

	Item		Annual cost CAD
1.	Contingencies (10%)		$6,230
		Total	**$68,530**

Annual post-closure management costs will be included in the Cree Nation of Nemaska's waste management operating budget.

2.9 QC- 9. Page 43, Map 4-3

The proponent intends to route the access road to the landfill site through a wetland. Taking into account the "avoid-minimize-compensate" approach, the proponent must justify the route of the road through this wetland.

Appendix C of the impact statement describes in detail the process for selecting the access road to the landfill site. Three possible route options were identified based on the topographical and geomorphological characteristics of the area and were evaluated.

Avoid

The characterization of the natural environments on the site revealed that the northern and northeastern sectors of the landfill site are more terrestrial (no wetlands were identified). In the sector between Route du Nord and the future landfill site, the slope is particularly steep, which limited the possibility of a road. Further west, an initial road option (Option 1) was identified. However, it was rejected due to its steep slope and because a Hydro-Québec right-of-way crosses the area. This right-of-way is used by the area's Indigenous and non-Indigenous communities to travel by all-terrain vehicle or snowmobile, which could cause accidents. The northern road, the main access route to the site, also curves in this area, which raises road safety concerns if the junction with the access road is located there.

Minimize

The third road option (Option 3) was more suitable in terms of topography, but as it was longer, it required clearing a greater length of forest and crossing several small wetlands and had higher investment and operating costs.

The option chosen (Option 2) is more direct and crosses only one wetland complex, which is located directly adjacent to the North Road. The encroachment is estimated at 730 m^2.

Compensation

The proponent is committed to offsetting the wetland encroachment as part of the ministerial approval process.

2.10 QC- 10. General

The proponent makes no reference to the Sustainable Forest Development Regulation (SFDR) and does not mention what will happen to the wood from deforestation. All work related to multi-use roads in public forests must comply with the requirements of the RADF and the Sustainable Forest

Land Planning Act. The proponent must also ensure that clearing activities are authorized by an intervention permit issued by the Harricana Nord management unit, particularly for site preparation.

The proponent will ensure compliance with the requirements of the RADF and the Sustainable Forest Land Planning Act, and obtain valid intervention permits for site preparation.

2.11 QC- 11. Page 47, section 4.2.3 and appendices

The proponent states that "the main groundwater flow is toward the tributary of Champion Lake southeast of the site." However, the groundwater elevation map included in the same section (page 47) only partially supports this statement, , in particular because the information it contains covers only half of the site. This map presents essentially the same hydrogeological information as map 230448-FIG5b.DWG produced by BluMetric Environmental (Appendix F – Section 3.3.3, page 435). Both are reportedly based solely on the results of the groundwater level sampling campaign of August 4, 2020.

Furthermore, the map in BluMetric's report for the August 4, 2020, campaign differs slightly from the one produced by BluMetric for the December 1, 2017, campaign (Appendix F – Section 3.3.3, page 433) and significantly from the one produced by Stantec for the same sampling campaign and attached to the site selection study (Appendix B – Appendix E, page 327). In the latter map, two groundwater flow directions are shown.

In addition, the ground elevations of the various sampling points presented in Table 1 of the BluMetric report (Appendix F – Section 3.3.2, page 425) do not correspond to what is shown on the map in section 4.2.3 of the impact study (page 47) or to what is found in the 2017 drilling reports (Appendix B – Appendix G, page 347). No explanation for these differences is provided in the documents.

a) **The groundwater level is a crucial factor in the design of a landfill site. The proponent must provide a complete and verifiable representation of the groundwater level at the future landfill site. This representation must be based on reliable data, which may require the drilling of new wells if some of them are not compliant (in particular PZ-02, PZ-04, and PZ-05).**

b) **The proponent must also validate the topography of the site and ensure that it is adequately represented in the various documents provided with the environmental study.**

Regarding item b) of the question on topography: As indicated in Section 1, the site selection study presented in Appendix B of the impact assessment report is included solely to document the site selection process. The other results presented should not be considered, as more accurate data has since been obtained. Specifically, the elevations of the wells in the drilling reports (2017) (Appendix B of the impact assessment report) were determined using the LiDAR data available at the time, whereas those presented in the BluMetric Environnement Inc. report (2023) (Appendix F of the impact assessment report) were based on a precise topographic survey of the site.

Furthermore, an error occurred during the preparation of the map in Section 4.2.3 of the impact assessment (page 47). General LiDAR data, rather than the precise topographic survey, was used for the elevations, which explains the discrepancies. The map in Section 4.2.3 should therefore not be considered. A complementary hydrogeological study was conducted by BluMetric Environnement Inc. in 2025 (Appendix C of this document), providing a representation of groundwater across the site based on topographic survey data.

We also confirm that the topographic survey data was used for the analyses and results presented in the hydrogeological study report by BluMetric Environnement Inc. in Appendix F of the impact assessment report (except for Figure 2, which presents LiDAR data), as well as in the revised plans (Appendix A) and the technical note on the hydraulic evaluation of the LEET (Appendix B) of this document.

Regarding item a) of the question on the complete and reliable representation of groundwater levels: The complementary hydrogeological technical note (Appendix C of this document) demonstrates that, from a local perspective, the project footprint is located directly over a piezometric high (or dome). Thus, the hydraulic upstream of the aquifer lies beneath the project footprint, and the downstream area surrounds it. During high water periods, groundwater will flow on both sides of the piezometric dome. During low water periods, the local flow direction will be more or less aligned with the regional flow direction, i.e., from southeast to northwest.

2.12 QC- 12. Page 45, Sections 4.2.2 and 4.2.3, and page 201, Appendix B

In sections 4.2.2 and 4.2.3, the proponent presents the hydrographic network of the LEET project area but does not comment on the flood risks that may occur at the site. However, this point is addressed in section 6.2 of Appendix B (page 201): "Site 4 has sufficient drainage and is located behind a hill, away from flood response areas."

Section 14 of the REIMR specifies that "it is prohibited to develop a technical landfill site in the flood zone of a watercourse or body of water that is located within the low-flow flood zone."

The proponent must confirm, with supporting documentation, that the selected site is not located in a low-flow flood zone. If the proponent does not have the necessary mapping to make this demonstration, it must provide additional explanations, other than those put forward in the site selection study document, allowing the proponent to assess the flood risks at the site.

The detailed response to question QC-12 is documented in the technical note on the LEET hydraulic assessment, presented in 0.

Given the unavailability of official flood zone and floodplain mapping for the entire Nemaska area, the following elements were verified to ensure the boundaries of the floodplains relative to the proposed landfill site:

- According to the contour lines, the site is located at an average elevation of 260 m (Figure 2-1).
- Approximately 1.3 km away, the elevation of the watercourse is 239 m (a drop of 21 m over a distance of 1.3 km), naturally directing any overflow toward the valley and away from the landfill.
- The very tight contour lines (dropping from an elevation of 260 m to 240 m) form a natural barrier, which explains why even in the event of flooding, the site will not be affected.

- Piezometric readings taken at several times of the year (December 2017, August 2020, June 2021) show that the water table remains more than 2 m below the surface. And, as the soil was not saturated during these three campaigns, no flooding occurred during these periods.

It can therefore be concluded that the site is not located in a low-flow flood zone.

2.13 QC- 13. Page 34, section 3.2.1; page 74, section 5.2.2

The presence of black bears at landfill sites is a growing problem in the James Bay region. This issue has been raised by several Indigenous communities and is particularly prevalent at a number of mining sites. The installation of an electric fence around the site has also been suggested (page 74) because access to the LEET by animals is a concern mentioned by members of the Nemaska Cree Nation.

The proponent states that "The landfill will be fenced, and a barrier will be installed to restrict public access. The fence will also reduce the number of loiterers and scavengers, as well as the spread of residual materials outside the landfill area by animals and wind."

The proponent must submit additional measures to prevent or avoid any invasion of nuisance animals in the LEET. Among other things, it is recommended that part of the fence be extended at least one meter underground and horizontally outward from the fence to prevent bears from climbing over or digging under the fence. It would also be important for the access gate to be designed to prevent bears and wolves from passing under it.

Additional measures are outlined in the plans (page VR0010, Appendix A) and are intended to prevent or deter any intrusion of nuisance animals into the LEET. These measures specifically aim to prevent animals from climbing over or passing underneath. They include:

- Extending the fence one meter underground and installing three rows of outward-angled barbed wire at the top of the fence;

- Installing three rows of outward-angled barbed wire at the top of the access gate, maintaining a maximum gap of 100 mm between the bottom of the gate and the ground, and implementing an underground system to prevent animals from passing underneath—such as a mesh or iron bars buried up to one meter deep, or a concrete threshold (to be determined, not shown on the plans).

2.14 QC- 14. Page 61, section 4.3.5

It is stated that no specific wildlife inventory was conducted as part of the impact study, only consultation of the interactive map of the Centre de données sur le patrimoine naturel du Québec (CDPNQ).

The proponent must justify why a wildlife inventory is not necessary.

No specific wildlife inventory was conducted as part of this project, as observations made during the ecological characterization of the vegetation revealed no evidence of the presence of wildlife species with special status (threatened, vulnerable or susceptible to becoming so) or wildlife habitats considered sensitive or priority.

In addition, it was deemed that interviews with the trap master would provide more relevant information, as he has been frequenting the area for several years.

Despite the absence of specific inventories, certain mitigation measures were incorporated into the project from the outset to ensure that impacts on certain wildlife groups are reduced and to limit access to the landfill site by large wildlife. Wildlife mitigation measures are described in the response to question QC-15, in the amended section 7.3.3.3.

2.15 QC- 15. Page 61, section 4.3.5

Based on consultation of the interactive map of the Centre de données sur le patrimoine naturel du Québec (CDPNQ), the proponent states that "no wildlife species with a precarious status has been identified in the inventory area or within an 8 km radius of it."

However, the project site is located within the range of a wildlife species designated as vulnerable, namely the woodland caribou (Assinica population). Based on a 2003 Hydro-Québec document, the proponent also states that "essential habitat for woodland caribou (Rangifer tarandus) is located approximately 150 km southwest of the study area, between Rupert, Manitu and Boisrobert lakes."

The proponent must refer to more recent documents, such as the recent MELCCFP inventory report (2023) on the Assinica woodland caribou population, to better describe the current situation of the project's natural environment. This information should be considered in the assessment of the value of the valued components in order to better mitigate the residual impacts related to traffic and access to the LEET by animals and predation of the vulnerable species.

It appears that the CDPNQ data used for the impact study are incorrect. The relevant sections of the impact study report have been amended to reflect the updated information. Any reference to the absence of species with special status is therefore incorrect and must be removed.

4.3.5. Terrestrial fauna

A consultation of the interactive map of the Centre de données sur le patrimoine naturel du Québec (CDPNQ) provided data on the occurrence of wildlife species with precarious status within an 8 km radius of the inventory area. According to the CDPNQ (2025), woodland caribou (*Rangifer tarandus caribou* pop.14), American whipsnake (*Chordeiles minor)*, short-eared owl (*Asio flammeus)* and rusty-breasted grouse (*Euphagus carolinus)* are present within this radius. These species will be discussed in the following sections (4.3.5.2 Mammals and 4.3.6. Avifauna).

4.3.5.2. Mammals

Forest caribou

The forest caribou of the local population (herd), known as Assinica, are most likely to frequent the study area. The project is located in the northern part of the Assinica herd's range. It is also possible that individuals from the Nottoway, Tesmiscamie, and James Bay herds may also frequent the study area, as their ranges are located near Nemaska (Szor and Gingras 2024, MELCCFP, 2025). At the provincial level, woodland caribou are protected in Quebec, having been designated as vulnerable in February 2005 under the Vulnerable Species Protection Act (VSP Act) (Government of Quebec, 2024). This species is also protected in Canada, as it has been listed as threatened in Schedule 1 of the Species at Risk Act since June

2003 (Government of Canada, 2024). At the federal level, the project is located in the woodland caribou's critical habitat (Environment and Climate Change Canada, 2020) and in the QC6 range. The caribou population using this range is considered self-sustaining (Environment and Climate Change Canada, 2024).

The types of habitats used by caribou vary with the seasons. In winter, caribou prefer mature coniferous forests, with or without lichen. In spring, they prefer dry barren areas such as lichen heaths, coniferous forests over 90 years old, and open coniferous stands. At calving time, females isolate themselves and use young, open stands and bogs, depending on availability. In summer, caribou select coniferous forests over 50 years old, peat bogs, and dry bare areas (lichen heaths), but clear-cuts are usually avoided in order to separate themselves spatially from predators (ERCFQ, 2013).

Several forest caribou inventories have been conducted by the Ministère des Forêts, de la Faune et des Parcs (MFFP) over the past few decades. The inventory conducted on behalf of the MFFP in 2003 (Brodeur et al., 2003) for the Assinica and Broadback herds generated an estimate of 1.5 individuals per 100 km$^{(2)}$ for a total of 515 individuals. The inventory conducted on behalf of the MFFP in 2013 (Brodeur et al., 2017) for the Assinica herd estimated 2.4 per 100 km^2 for a total of 580 caribou. Following the inventory conducted in the winter of 2023, the total abundance of the Assinica forest caribou population is estimated at 949 individuals, with a density of 3.2 caribou per 100 $^{km^2.}$The growth of the Assinica population is estimated at approximately 32% over the last 10 years (Szor and Gingras 2024). REFERENCES

Chiroptera

Six species of chiroptera are potentially present in the study area (MELCCFP 2024), namely the silver-haired bat (*Lasionycteris noctivagans*), the hoary bat (*Lasiurus cinereus)*, the little brown bat (*Myotis lucifugus)*, the big brown bat (*Eptesicus fucus)*, the red bat (*Lasiurus borealis)* and the northern bat (*Myotis septentrionalis)*. Of these, only the great brown bat does not have special status. The status of each species, at the provincial and federal levels, is described in Table 9.

The little brown bat and the northern bat are considered forest species that prefer to feed under forest cover, in trails and along forest edges. They prefer mature stands and avoid clearings or heavily logged forest habitats. The little brown bat is more common near water bodies and wetlands than the northern bat (Grindal 1999; Segers & Broders 2014).

The hoary and silver-washed bats are both migratory species. The hoary bat is a species that roosts in tree foliage during the breeding season, while the silver-washed bat prefers shelters in cavities or under tree bark. Both species use feeding habitats spread over a home range of several square kilometers during the summer season (Kunz & Lumsden 2003; Gorresen *et al.* 2015).

The red bat is also a migratory tree-dwelling species. Like the hoary bat, it roosts in tree foliage and usually chooses deciduous trees over conifers (Hutchinson and Lacki, 2000, ERCSQ 2021).

All of these species could potentially use the project site for feeding or as a resting area.

Table 9 Chiroptera species present in the study area

Common name	*Species*	Status	
		Provincial[1]	**Federal**[2]

Ash-colored bat	*Lasiurus cinereus*	Vulnerable	Endangered
Silver-haired bat	*Lasionycteris noctivagans*	Vulnerable	Endangered
Little brown bat	*Myotis lucifugus*	Endangered	Endangered
Rufous bat	*Lasiurus borealis*	Vulnerable	Endangered
Northern bat	*Northern bat*	Endangered	Endangered

[1] Status according to the Act respecting endangered or vulnerable species in Quebec (Government of Quebec 2024)
[2] Status according to Schedule 1 of the Species at Risk Act (Government of Canada, 2024)
*Not listed in Schedule 1 of the Species at Risk Act, status according to COSEWIC

No specific inventory was conducted as part of this impact assessment, but mitigation measures were developed to protect the species during its breeding season (see Section 7.3.3.3, modified below).

4.3.6. Avifauna

In Quebec, black spruce and moss-covered spruce forests provide habitat for 150 species of nesting birds. The species most frequently observed in the Nemaska area are the black duck (*Anas rubripes*), Canada goose (*Branta canadensis)*, snow goose (*Anser caerulescens)*, brant goose (*Branta bernicla)*, loon (*Gavia immer)*, northern pintail (Anas acuta*)*, spruce grouse (*Tympanuchus phasianellus)*, wood grouse (*Canachites canadensis)*, the ruffed grouse (*Bonasa umbellus)*, the willow ptarmigan (*Lagopus lagopus)*, the osprey (*Pandion haliaetus)*, the bald eagle (*Haliaeetus leucocephalus)* and other small forest birds.

The CDPNQ notes the presence of three bird species within 8 km of the project site: the American whippoorwill (*Chordeiles minor*), the short-eared owl (*Asio flammeus*) and the rusty-breasted grosbeak (*Euphagus carolinus*). The Department (personal communication) also informs that the bald eagle (*Haliaeetus leucocephalus)* is present in the project area.

The American nightjar is identified as a species that may be designated as threatened or vulnerable in Quebec, of special concern under Schedule 1 of the Species at Risk Act (SARA) in Canada, and of special concern according to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The main threats identified for this species are changes in ecological dynamics or natural processes, such as insect population declines, pesticides, light pollution, and fire management. Habitat loss or degradation is also a threat (Environment Canada, 2016). The American Whiptail uses different types of habitats but requires open areas or clearings to nest on the ground. It breeds in a wide range of open habitats (dunes, eskers, beaches, mixed and coniferous stands, burn areas, clear-cut sites, wetlands, gravelly and rocky areas, cultivated or managed areas) (Environment Canada, 2016). The project site is not particularly open or clear, but considering the presence of different natural environments, the potential for occurrence is considered moderate.

The short-eared owl is a species that is likely to be designated as threatened or vulnerable in Quebec because it has been in sharp decline in the province for several decades. Habitat loss and degradation are the main threats. At the federal level, the short-eared owl is considered a species of special concern by the COSEWIC and is listed in Schedule 1 of the SARA in Canada (Quebec Bird of Prey Recovery Team, 2021). The short-eared owl prefers large open areas and avoids forested areas. It nests in peat bogs, raised bogs, wet grasslands, island habitats, and dune environments (Quebec Bird of Prey Recovery Team, 2021).

Considering that the project site is mainly forested, the potential for this species to be present in the immediate vicinity of the site is low.

The rusty-breasted blackbird is also considered a species that could be designated as threatened or vulnerable in Quebec (LEMV). In Canada, it is considered of special concern by the COSEPAC and in Appendix 1 of the SARA. The main threats to the rusty-breasted grackler include habitat transformation (conversion of wetlands and migration areas) and habitat loss due to deforestation and changes in hydrology. The rusty-breasted grackler nests in boreal wetlands, particularly in small conifers, but also in some deciduous trees. The species has been observed in many riparian habitats, including wetlands associated with recent burns, peat bogs, riparian brush, open spruce forests with moss and lichen, sedge marshes, swamps, alder and willow thickets, and estuaries (Environment Canada, 2015).. Considering the natural habitat n the study area, the potential for the rusty-breasted blackbird to be present is considered low.

The bald eagle is a vulnerable species in Quebec. In Canada, it is not considered endangered. The main threats to the bald eagle are habitat loss along water bodies, accidental capture, and illegal hunting. The bald eagle nests in conifers over 20 m tall near large bodies of water rich in fish. The project site is not a potential nesting habitat for the bald eagle because there are no large bodies of water nearby.

Section 6.3.1. - Table 6-1

The value of the "Terrestrial fauna" environmental component is changed to Moderate, since the project is located in a provincial forest caribou range and a federal critical habitat area.

Section 7.3.3. Terrestrial and avian wildlife

The terrestrial wildlife component takes into account species with special status. The following sentence (However, no federally or provincially protected species have been reported in the CDPNQ or observed on the site) is deleted.

7.3.3.1. Description of impacts

This section remains unchanged.

7.3.3.2. Impact assessment

The value of the terrestrial fauna component is considered moderate for this assessment, as some species with special status are present in the project area and the project will cause habitat loss. During the construction phase, the degree of disturbance is considered moderate, as the impact reduces the quality of the natural habitat without compromising its integrity. During operation, the degree of disturbance is considered low, as the integrity and function of animal populations in the local area and region will not be affected.

Given that the value is moderate and the degree of disturbance is moderate during construction and low during operation, the overall intensity of the impact is considered moderate. The extent of disturbance due to land clearing and fence installation will be local. The impact will be short-term during the construction phase (ten weeks), but long-term since the loss of habitat will last for the entire life of the project. Applying the significance assessment grid, taking into account the local extent, the impact is moderate. The closure of the landfill site will have positive effects, as the pests attracted to it will no longer have a source of food.

7.3.3.3. Mitigation and residual impacts

In order to protect the nesting period of birds and bats, clearing and land preparation for the access road and landfill site must be carried out outside the breeding season, i.e. between mid-May and mid-August for this region (Arctic Plain and Cordillera, N8 [ECCC, 2025]).

Since construction work is likely to take place during the breeding season, in order to avoid disturbance during hunting periods, if nests are discovered in areas where work is planned, mitigation measures will be recommended by a qualified biologist.

The enforcement of speed limits can reduce traffic noise and the risk of collisions. Regular compaction of waste, progressive covering, and well-maintained fencing will reduce access by nuisance animals to waste as a food source (e.g., bears and wolves). The residual impact is considered minor.

Table10 Summary table of impacts on terrestrial and avian fauna

Sources	Clearing of vegetation (▼) Road traffic during construction (▼) Construction of a landfill site and access road (▼) Road traffic during operation (▼) Operation of landfill site (▼) Closure of landfill site (+)
Nature of impact (construction/operation): Negative	
Intensity	Moderate
Extent	Local
Duration	Short/long
Impact significance: Moderate	
Mitigation measures after project design	If a nest containing eggs or chicks is discovered near or within the work area, stop work and seek advice from the environmental supervisor on how to proceed. Observe speed limits. Install fencing and conduct regular inspections and maintenance during operation. Regular compaction and covering of waste.
Residual impact: Minor	

2.16 QC- 16. Page 95, Section 7.3.3

Although the proponent did not identify any species listed in the CDPNQ in the inventory area, other Ministry data indicate the confirmed presence of bats with special status and vulnerable bird species potentially present in the area, namely the bald eagle *(Haliaeetus leucocephalus*) as well as three bird species that may be designated as threatened or vulnerable, namely the American whippoorwill (*Chordeiles minor)*, the short-eared owl (*Asio flammeus)* and the rusty-sided grosbeak (*Euphagus carolinus)*.

In the section entitled "Mitigation and residual impacts" (page 97), the proponent states: "Vegetation clearing and other activities that may disturb nesting must be avoided from the end of May to the end of July. Given that construction work is likely to take place during the breeding season; in order

to respect hunting seasons, a qualified person will conduct a search for bird nests less than seven days before the start of construction work. If nests are found, mitigation measures will be recommended by a qualified biologist."

The developer must take greater account of the nesting period for bats and birds (mid-May to mid-August) when planning the various phases of infrastructure development necessary for the project. The developer must therefore indicate whether it will carry out deforestation outside this period in order to avoid any disturbance or destruction of their nesting habitat and any mortality of individuals.

The developer undertakes to carry out deforestation outside the sensitive period for bats and nesting birds, i.e. between mid-May and mid-August, and outside the autumn hunting season. (See amendments to section 7.3.3.3. to question QC-15).

2.17 QC- 17. Page 71, section 5

According to the documents provided, the proponent has implemented various information activities such as interviews with the tallyman, dissemination of project information on local radio, and public information and consultation sessions. Concerns and questions were raised, and the proponent presented a series of mitigation measures.

The proponent must demonstrate that the Eeyou Istchee James Bay Regional Government was also informed and consulted about the project.

The Eeyou Istchee James Bay Regional Government (EIJBRG) was consulted in 2017 during the site selection study and confirmed that the site was located in zone 51-06-R. and again in 2019 at the start of the impact study, confirming that the zoning allowed for the establishment of a landfill site (see emails in0).

However, despite this preliminary consultation and the submission of the project notice to COMEV in 2019, the zoning was modified during the impact assessment study, and the landfill site is now located in Zone 51-18-C (GREIBJ, 2022), which does not explicitly permit the “waste disposal site” use. Following discussions with GREIBJ services, a zoning amendment process for the LEET site was initiated by the CNN to allow for the “waste disposal site” use."

2.18 QC- 18. Page 104, Section 7.4.3.1

In order to reduce the dispersion of waste by wind and animals, the developer proposes to install capture nets and maintain them once a year.

The proponent must provide further explanation of what these nets consist of, how effective they will be, and where they will be located.

Capture nets are lightweight, movable structures made of weather-resistant mesh installed around the perimeter of the active landfill area to retain light waste that could be carried away by the wind.

Several nets are in place at the current LEET in Nemaska, as shown in Figure 4. They will simply be moved to the new LEET when it opens. They can be positioned close to the waste front to retain any flying debris as close as possible to the source and will be moved as necessary to follow the active landfill area.

Figure 4 Capture nets currently used at the Nemaska landfill

It is important to note that capture nets are a secondary measure that complements the primary measures already in place:

- The LEET perimeter fence positioned on top of the berms.
- Regular compaction and covering of residual materials.
- Periodic cleaning of the site and its surroundings.

2.19 QC- 19. Page 109, section 10.1.1.2

The proponent states that it will prepare an annual report presenting, among other things, data on environmental monitoring and the various operations carried out on the site. However, it is not specified to whom this report is intended.

The proponent must propose means of disseminating and communicating the annual report to the Nemaska community so that it is aware of its existence and can access it.

The proponent must also undertake to send the annual report to the Provincial Administrator for information.

The annual report is intended for the MELCCFP, and the proponent undertakes to also send it to the Provincial Administrator for information.

In addition, the annual report and its results will be distributed and presented to community members each year at the CNN Annual General Assembly (AGA). Furthermore, the Director of Land and Sustainable Development will be the contact person for any questions or comments.

2.20 QC- 20. Page 110, section 10.1.4, page 37, section 3.2.4.2 and section 3.4 of Appendix K

In several places in the main document, as well as in the appendices, the proponent presents its post-closure monitoring program.

In section 10.1.4 (page 110), it states:

> **The environmental monitoring program will continue during the post-closure period, in accordance with the IRMR. During this period, monitoring activities will include:**
>
> - **Inspection of the final cover, barriers, and fence and maintenance thereof to ensure their integrity.**
> - **Monitoring, maintenance, and cleaning of the groundwater observation well system.**
> - **Water sampling and analysis.**

In Section 3.2.4.2 (page 37), it states that:

> **Environmental supervision will include:**
>
> - **Maintaining the integrity of the final cover: the final cover will be inspected for defects such as puddle formation or erosion, which will then be corrected.**
> - **Maintenance of groundwater monitoring wells: cleaning and maintenance of wells.**
> - **A water sampling and analysis campaign.**

Section 3.4 of Appendix K (page 664) explains that:

> **The post-closure management phase of the LEET includes the following activities:**
>
> - **Site cleanup, maintenance of ditches and access road.**
> - **Maintenance of the final cover.**
> - **Sampling of observation wells three times per year.**

There are notable differences between each of these presentations. The proponent must provide clarification regarding its post-closure monitoring program (e.g., frequency of inspections of the final cover, barriers, and fencing) and what it will include.

For information, the regulatory requirements in this regard are found in sections 83 and 84 of the IRMR. At a minimum, the proponent should:

- **Ensure that the integrity of the final cover and berms is maintained.**
- **Clean up the site and maintain all its components: barriers, fences, ditches, observation wells, access roads, etc.**
- **Conduct groundwater and surface water sampling campaigns, including resurgences, three times a year.**

The LEET post-closure monitoring program is clarified in this section to demonstrate its compliance with sections 83 and 84 of the IRMR and to remove differences in wording between sections 3.2.4.2 and 10.1.4 of the impact study report.

Final cover and infrastructure monitoring

Inspection frequency: A visual inspection of the final cover, berms, barriers, and fencing will be conducted at least once a year, and a site visit report will be issued describing the condition of the components and any corrections to be made.

Correction: Any defects observed (such as subsidence, erosion, broken fencing, etc.) will be corrected as soon as possible.

Maintenance of site components

The cleaning and maintenance of ditches, final cover, berms, access roads, observation wells, barriers, and fencing will be carried out at least once a year, or more frequently if required by the conditions observed on site.

Groundwater and surface water monitoring

Sampling and analysis campaigns for groundwater, surface water, and any resurgences will be conducted three times per year, in accordance with IMIR requirements.

Annual report

An annual report will be prepared to present the work carried out during the year and the results of the water sampling campaigns. As during the operational phase, the annual reports will be sent to the MELCCFP and the Provincial Administrator for information and will be presented to community members each year at the CNN AGA.

2.21 QC- 21. Page 26, section 3.4

The proponent indicates that the Sustainable Development Act (RLRQ ch D-8.1.1) does not apply to the territory of Eeyou Istchee. The COMEX wishes to emphasize that this Act does apply to this territory and the proponent must commit to incorporating its principles.

The proponent commits to incorporating the principles of the Sustainable Development Act (RLRQ ch D-8.1.1).

2.22 QC- 22. Page 110, section 10.2.2

Few details have been provided regarding surface water monitoring. It is simply stated that "surface water will also be sampled at a location downstream of the site (SW-4)."

Only the Groundwater Elevation and Observation Well Locations map, found in section 4.2.3 of the main document (page 47), shows the location of sampling point SW-4. On this map, monitoring point SW-4 is located several hundred meters from the LEET, near the North Road and in a watercourse. This location contravenes the provisions of several sections of the REIMR, in particular:

- **Section 53: Leachate and water collected by any collection system provided at a landfill site may only be discharged into the environment if they comply with the following limit values [...].**
- **Section 55: Leachate and water collected by a collection system that does not comply with the limit values prescribed in section 53 must not be diluted before being discharged into the environment, except for dilution caused by precipitation.**
- **Section 63: [...] Leachate and water to be sampled in accordance with the first paragraph must be sampled before being discharged into the environment or, if applicable, before being treated or discharged to a treatment facility; for the purposes of this section, surface water is considered to be discharged into the environment when it leaves a buffer zone established under section 18.**

Furthermore, the environmental monitoring program presented in section 10.2.1 makes no mention of monitoring resurgent water. As mentioned in question QC-3 regarding berm heights (section 3.1.1), the current configuration of the site is conducive to the formation of resurgent water. According to section 59 of the IRMR, "groundwater that resurges within the control perimeter established under section 65 is subject to the provisions of section 53, with the exception of suspended matter."

a) **The proponent must revise its surface water monitoring program to take into account the possible resurgence of groundwater and the comments mentioned above.**

b) **The proponent must locate the surface water discharge points to the environment on the appropriate plans.**

c) **The proponent must specify the extent to which increased precipitation due to climate change is taken into account in this study.**

First, as stated in the introduction and in the response to question QC-4, the plans have been revised to minimize the risk of resurgence, as demonstrated in the technical note on the hydraulic assessment of the LEET presented at 0. This note takes into account an increase in precipitation due to climate change of 19.5% during the operational phase and 31.6% during the post-closure phase according to the pessimistic emissions scenario (Representative Concentration Pathway [RCP] 8.5) from the Pacific Climate Impacts Consortium, in line with the assumption used in the climate change impact study presented in Appendix H of the impact assessment report..

Furthermore, plans VR-0002, VR-0004 and VR-0005 (0) have been revised to add a ditch along the berms to the east and south of the LEET that will be able to recover any resurgence that may occur at the foot of the berms. Surface water in the ditch will be sampled (sampling point SW-5) in order to verify their compliance with the provisions of Section 53, with the exception of suspended solids. The location of the additional sampling point SW-5 and the surface water discharge point are presented in Figure 5 and in the plans in Appendix A.

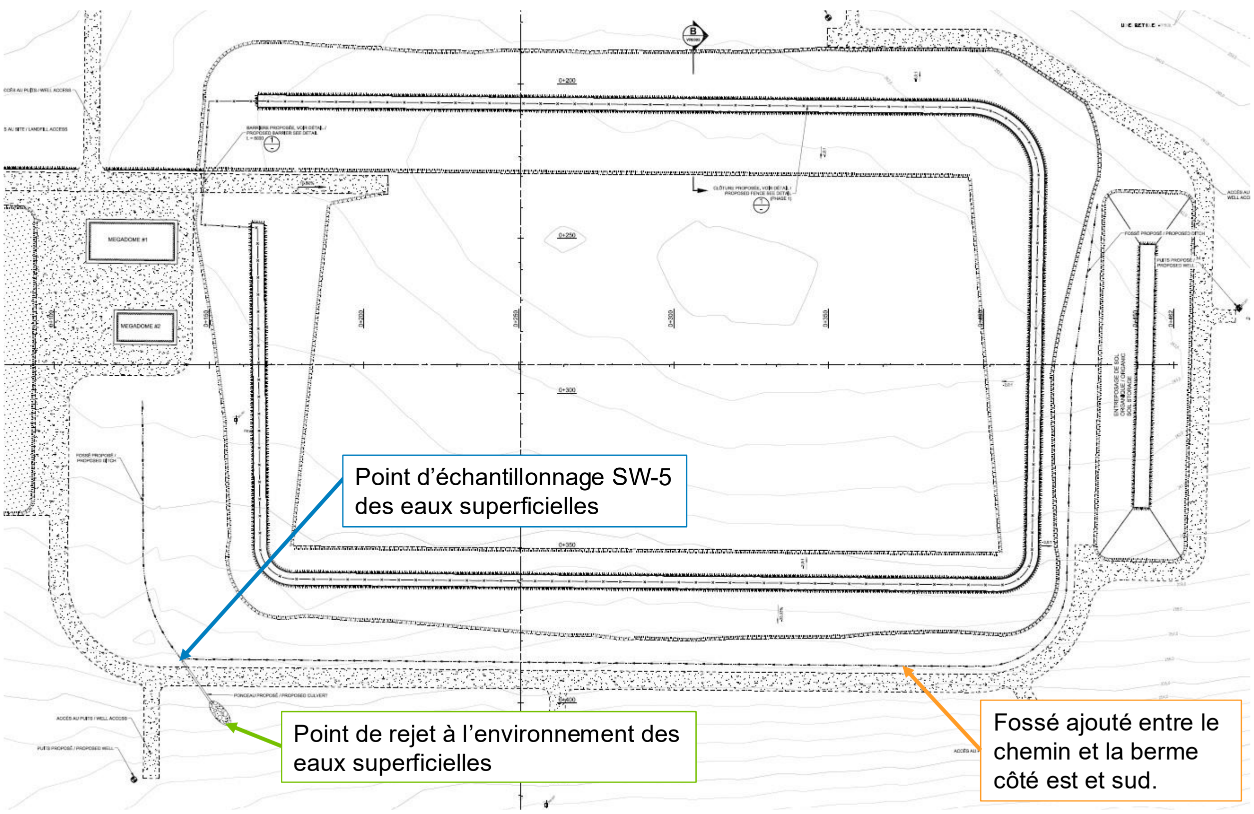

Figure 5 **Location of the sampling point and the point of discharge to surface water**

2.23 QC- 23. Page 111, section 10.2.3

The proponent states that "the control points (surface water and groundwater) will be sampled and analyzed three times a year [and that] the chemical parameters analyzed are those presented in sections 57 and 66 of the IRMR." However, it does not mention section 53 of the IRMR.

However, section 65 of the IRMR states that "the operator [...] shall, at the frequency indicated below, take or cause to be taken a sample [...] of the water collected by each of the collection systems provided at the site and of the water that resurfaces within the groundwater control perimeter established under section 65, and have these samples analyzed:

1. **At least once a year, to measure the parameters or substances referred to in sections 53, 57 and 66.**
2. **At least three times a year, in the spring, summer, and fall, if they are not directed to a treatment system, to measure the parameters or substances mentioned in section 53, with the exception of fecal coliforms; […]."**

The proponent must revise its monitoring program to include monitoring of the parameters set out in section 53 of the REIMR when conducting its sampling campaigns.

The surface water monitoring and analysis program (sections 10.2.2 and 10.2.3 of the impact study report) is revised as follows to meet the requirements of the REIMR.

Runoff and any resurgent water within the groundwater control perimeter will be sampled at point SW-5 and analyzed in accordance with the requirements of sections 53, 59, and 65 of the IMVR, namely:

1. At least once a year, to measure the parameters or substances referred to in sections 53, 57 and 66.
2. At least three times per year, in the spring, summer and fall, [...], to measure the parameters or substances mentioned in section 53, with the exception of fecal coliforms.

Sampling and analysis of surface water presented in the impact study report at point SW-4 will be also conducted.

Samples shall be taken without filtration, in accordance with section 69 of the REIMR, and sent for analysis to a laboratory accredited by the MELCCFP, in accordance with section 118.6 of the LQE and section 70 of the REIMR. The results will be sent to the MELCCFP in accordance with section 71 of the IRMR, presented in annual reports in accordance with section 52 of the IRMR, and the analysis certificates will be kept for at least five years in accordance with section 70 of the IRMR.

2.24 QC- 24. Page 112, section 11

It is stated that the existing landfill site will be monitored after closure. However, few details are available. It is only stated that "groundwater monitoring wells will be installed to sample and analyze groundwater in the site area and to assess the status and evolution of contamination. […] Post-closure monitoring will also include inspection and maintenance of the final cover, if applicable." No information has been provided on the sampling points, frequency, nature of the analyses planned, or duration of the monitoring for the existing landfill site.

The proponent must detail the monitoring program that will be implemented upon closure of the existing LEET and any measures that could be implemented in the event of contamination. The proponent must also specify the quantity and source of materials for the final cover of the existing LEET and describe its maintenance.

The response to question QC-24 is presented in two detailed parts below.

Post-closure monitoring program for the existing LEET in addition to section 11

The existing LEET is subject to an annual environmental monitoring program that includes groundwater sampling and analysis and the preparation of an annual report describing the results, the work carried out, and the progress of operations, which is submitted to the MELCCFP and the Provincial Administrator each year.

The piezometric map of the existing LEET, taken from the 2024 annual report, is presented in 0 of this report and shows that the existing LEET has six observation wells:

- Three initial observation wells (PZ-1, PZ-2, and PZ-4) installed in 2001.
- Three additional observation wells installed in 2012 (PZ-5, PZ-6, and PZ-7) to meet MIREAR requirements.

These provisions already in place will be continued and adapted following the closure of the site in accordance with Sections 83 and 84 of the IRP and until environmental conditions demonstrate that there is no risk to the environment:

- Monitoring of final cover and infrastructure
  - Inspection frequency: A visual inspection of the final cover, berms, barriers, and fencing will be carried out at least once a year, and an inspection report will be issued describing the condition of the components and any corrections to be made.
  - Correction: Any defects observed (such as subsidence, erosion, broken fencing, etc.) will be corrected as soon as possible.
- Maintenance of site components: Cleaning and maintenance of ditches, final cover, berms, access roads, observation wells, barriers, and fencing will be performed at least once a year, or more frequently if required by conditions observed in the field.
- Groundwater and surface water monitoring
  - Groundwater monitoring: The observation wells already in place around the site will be maintained and used to conduct sampling campaigns three times a year (spring, summer, fall, winter). The chemical parameters analyzed are those presented in sections 57 and 66 of the IRMR.
  - Surface water monitoring: Surface water will be sampled in the ditch downstream of the site before discharge to the environment and analyzed in accordance with the requirements of sections 53, 59, and 65 of the IRMR.

- Annual report: An annual report will be prepared to present the work carried out during the year and the results of the water sampling campaigns. As during the operational phase, the annual reports will be sent to the MELCCFP and the Provincial Administrator for information and will be presented to community members each year at the CNN AGA.
- Contamination measures: If contamination exceeding regulatory thresholds is detected, work will be carried out to identify the potential source, assess the risks and potential measures, and implement an appropriate response plan.

Final capping materials for the existing LEET

A detailed study of the closure of the existing LEET has not yet been conducted, but preliminary estimates indicate that the final cover for the existing LEET will require a maximum volume of approximately 33,000 m³ of materials, including 8,000 m³ of organic soil. The materials will come from stripping and excavation work carried out in the area, at Hydro-Québec's facilities or in the community of Nemaska. They may also come from excess materials excavated at the new LEET site. No new borrow pits will be established for these purposes.

The materials used will be class B for the first 45 cm and then covered with at least 15 cm of organic soil suitable for vegetation to provide support for revegetation. Their installation will be followed by regular maintenance, including vegetation maintenance, slope stabilization, runoff management, corrections in case of subsidence, and revegetation as needed.

2.25 QC- 25. Page 110, Section 10.2.1 and Appendix D

In order to monitor groundwater, the developer plans to install four wells: one upstream of the LEET and three downstream. It states that "the upstream well and one of the downstream wells are already in place (installed during site characterization studies) and are identified as PZ-03 and PZ-06 on the plan presented in Appendix D. The other two downstream wells will be drilled during construction (PZ-07 and PZ-08)."

The number of planned monitoring wells is considered sufficient. However, their positioning may be based on incomplete data, as mentioned in the comment on the groundwater level and its flow direction (section 4.2.3 of the study, QC-8). Before positioning its wells, the proponent must reassess the underground hydraulic conditions at the site. It may then update its maps to show the location and numbers of all wells.

The proponent is advised to take into account the provisions of section 89 of the IRMRE when selecting the location of its groundwater monitoring wells, in particular: "the maxim al distance permitted by paragraph 2 of the third subparagraph of Section 65 for the installation of wells used to monitor groundwater quality is increased to 300 m from the trench area."

The hydrogeological data has been updated and is presented in the supplementary hydrogeological technical note in 0 , as well as in the response to question QC-11. Given the local multidirectional flow around the planned infrastructure location with a hydraulic head corresponding to the project footprint, it is recommended for groundwater monitoring that observation wells be installed on all sides of the project and that new wells be added in addition to the five already planned: install a new well near PZ-05 and one north of the site northeast of PZ-03 to fully cover this side of the project.

Figure 6 provides an indicative overview of the location of the various wells. For precise locations, they are indicated on plans VR-0002, VR-0004, and VR-0005 in the 0 . These distinguish between:

- Existing wells (in blue): PZ-03, PZ-01, and PZ-06.
- The two additional wells already planned in the impact study report (in green): PZ-07 and PZ-08.
- And two additional wells (in pink-orange) according to the results of the supplementary hydrogeological technical note: PZ-09 and PZ-10.

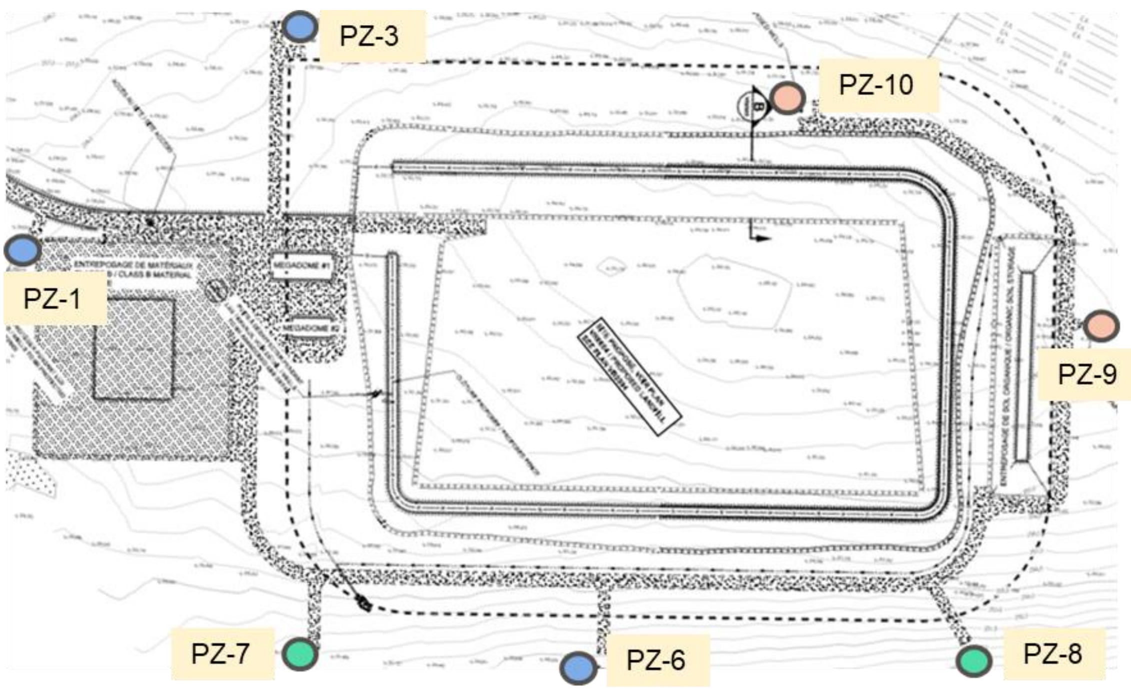

Figure 6 **Position of wells on plan VR0002**

This layout meets the requirements of Section 89 of the REIMR, while taking into account the accessibility constraints associated with the natural topography of the site. The maximum distance of 300 meters from the trench area prescribed for piezometers is respected.

2.26 QC- 26. Page 383, Appendix D

The plans attached to Appendix D do not show the 50-meter buffer zone that must surround the residual material disposal area in accordance with the provisions of section 18 of the REIMR. These provisions apply to LEETs under section 88 of the REIMR. In addition, the plans do not show the location of the Hydro-Québec power line.

After reviewing the provisions and constraints of section 18 of the IRMR, the proponent must incorporate the prescribed buffer zone into the various plans attached to the environmental study document, particularly those in Appendix D, and, if necessary, make the necessary changes to other elements of the plans. The site plan views must show the location of the Hydro-Québec power line, especially if its route encroaches on the buffer zone.

The proponent must also ensure compliance with buffer zones related to any other existing infrastructure, including the Nemaska airport. The proponent will be required to consult with the relevant authorities (bird strike hazard) regarding the location of the new LEET and report on the positions expressed.

The 50-meter buffer zone and Hydro-Québec's power line have been added to plan VR0002 (0). This shows that the power line right-of-way does not encroach on the buffer zone.

Hydro-Québec, the James Bay Development Corporation (SDBJ), and the Nemiscau Airport were consulted during the site selection study. As mentioned in Section 6.4 of this study, presented in Appendix B of the impact assessment report, these entities confirmed that the location of the new LEET complies with their requirements regarding separation distances from various infrastructures: the power transmission line, the Route du Nord, and the Nemiscau Airport.

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APPENDIX A - Revised plans

Stantec

NATION CREE DE NEMASKA / CREE NATION OF NEMASKA

NOUVEAU LIEU D'ENFOUISSEMENT DE NEMASKA / NEMASKA NEW LANDFILL

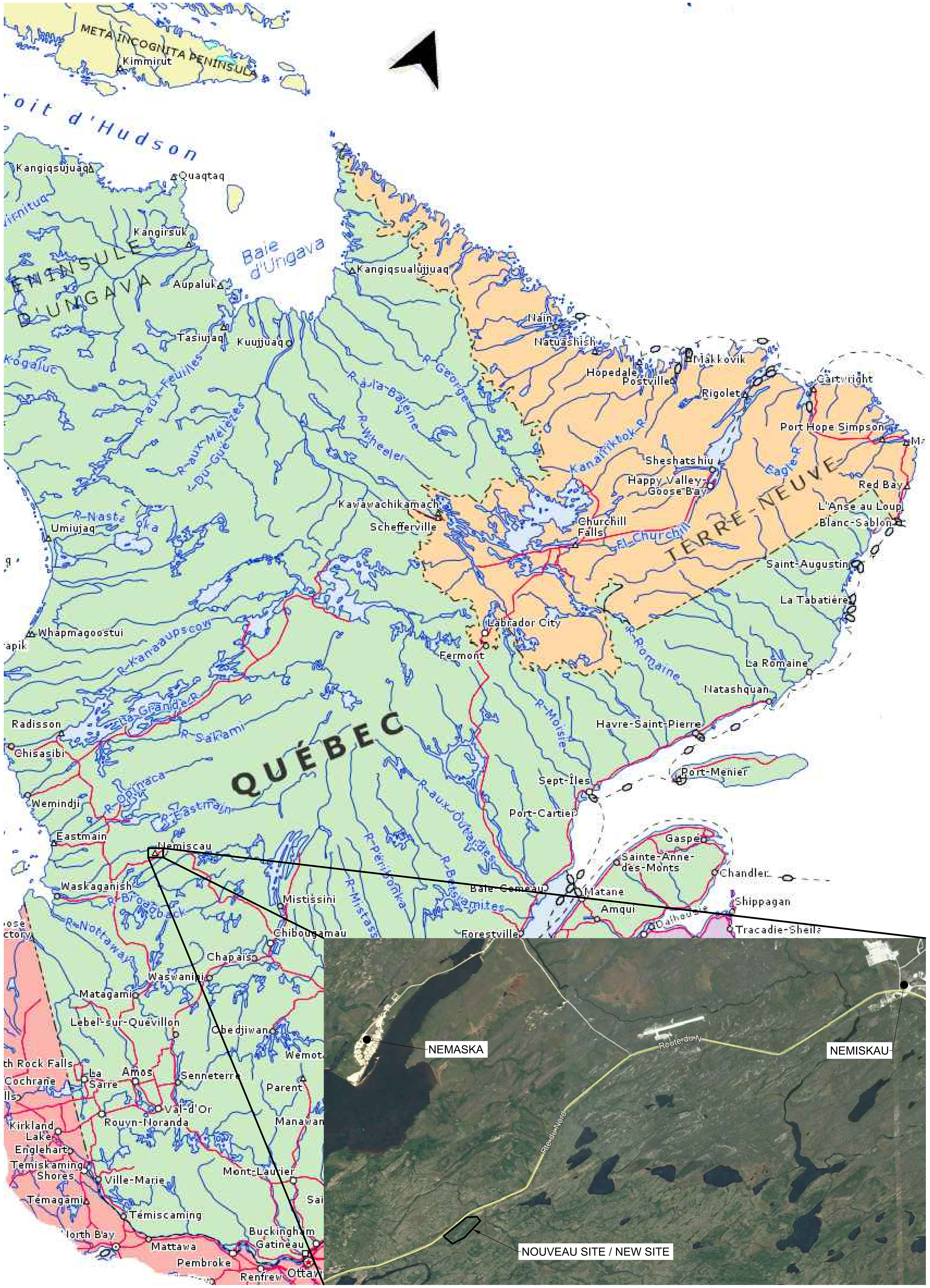
LISTE DES PLANS / LIST OF PLANS

PAGE / SHEET	DESCRIPTION	REVISION
VR0000	PAGE TITRE / COVER	1
VR0001	LÉGENDE / LEGEND	0
VR0002	SITE ET ROUTE D'ACCÈS PROPOSÉS / PROPOSED LANDFILL AND ACCESS ROAD VUE D'ENSEMBLE / GENERAL LAYOUT	1
VR0003	ROUTE D'ACCÈS PROPOSÉE / PROPOSED ACCESS ROAD VUE EN PLAN ET PROFILS / VIEW PLAN AND PROFILES	1
VR0004	PHASE 1 - SITE PROPOSÉ / PROPOSED LANDFILL VUE EN PLAN ET PROFILS / PLAN VIEW AND PROFILES	1
VR0005	PHASE 1 - SITE PROPOSÉ / PROPOSED LANDFILL VUE EN PLAN ET PROFILS / PLAN VIEW AND PROFILES	0
VR0010	SECTIONS ET DÉTAILS / SECTIONS AND DETAILS	1

Stantec Experts-conseils ltée
POUR ÉTUDE FINALE
FOR FINAL STUDY
DATE: 2025-07-18

2025.07.18

NUMÉRO DE PROJET / PROJET NUMBER: 167020077



CARTOGRAPHIE / CARTOGRAPHY

ARPENTAGE / SURVEY

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- BORNE DE LOT / TERMINAL PARCEL
- REPÈRE GÉODÉSIQUE / LANDMARK SUVEYING
- STATION
- FORAGE / DRILLING
- PUITS OBSERVATION / OBSERVATION WELL

CADASTRE

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- LIGNE DE SERVITUDE / LINE EASEMENT
- LIGNE DE LOT / PARCEL LINE
- 23-120 NUMÉRO DE LOT / PARCEL NUMBER 23-120

TOPOGRAPHIE / TOPOGRAPHY

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- HAUT DE TALUS / TOP OF SLOPE
- BAS DE TALUS / BOTTOM OF SLOPE
- LIGNE DE CHANGEMENT DE PENTE / SLOPE CHANGE LINE
- ARBRE / TREE
- ARBUSTE / SHRUB
- SOUCHE / STRAIN
- LIMITE DE BOISÉ / LIMITATION OF WOODY
- HAIE / HEDGE
- 10 COURBE DE NIVEAU PRIMAIRE / PRIMARY LEVEL CURVE
- 10 COURBE DE NIVEAU SECONDAIRE / SECONDARY LEVEL CURVE
- ROC ROC SOUTERRAIN / ROC UNDERGROUND
- TERRAIN NATUREL - TERRAIN FINI / NATURAL TERRAIN - FINISHED GROUND

URBANISME / PLANNING

OCCUPATION DU SOL ET BÂTIMENT / LAND AND BUILDING

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- #325 BÂTIMENT / BUILDING
- BOÎTE POSTALE / PO BOX
- BOLLARD
- CLÔTURE / FENCE
- VOIE FERRÉE / RAIL
- VOIE FERRÉE DÉTAILLÉE / RAILWAY DETAL
- BARRIÈRE DE PASSAGE À NIVEAU / BARRIER CROSSING
- INDICATEUR DE PASSAGE À NIVEAU / INDICATOR CROSSING
- LANTERNE DE PASSAGE À NIVEAU / LANTERN CROSSING
- MUR D'AMÉNAGEMENT / WALL CONSTRUCTION

PARC ET ESPACE VERT / PARK AND GREEN

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- PISTE CYCLABLE / BIKE PATH
- BANC DE PARC / PARK BENCH
- POUBELLE / GARBAGE

LIMITE ADMINISTRATIVE / LIMIT ADMINISTRATIVE

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- LIMITE MUNICIPALE / MUNICIPAL BOUNDARY
- LIMITE MUNICIPALE / MUNICIPAL BOUNDARY

RÉSEAUX SERVICES PUBLICS / NETWORK UTILITIES

EAU POTABLE / WATER

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- EAU POTABLE / DRINKING WATER
- EAU POTABLE EN PROFIL / PROFILE DRINKING WATER
- EAU NON POTABLE / NON-DRINKABLE WATER
- EAU NON POTABLE EN PROFIL / POFILE NON-DRINKABLE WATER
- POTEAU D'INCENDIE / FIRE HYDRANT
- VANNE / VALVE
- BOÎTE D'ENTRÉE DE SERVICE / INBOX SERVICE
- CHAMBRE DE VANNE / VALVE CHAMBER
- PUITS / WATER WELL
- BOUCHON / CAP
- RÉDUIT / REDUCER
- BUTÉE / BUMPER BLOCK
- COUDE / ELBOWS
- CROIX / CROSS
- T
- MANCHON / SLEEVE
- PIV
- PI PROTECTION INCENDIE / FIRE PROTECTION
- CONDUITE CONTAMINÉE / CONTAMINATED CONDUCT

ÉGOUT SANITAIRE / SANITARY SEWER

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- ÉGOUTS SANITAIRES ET UNITAIRES / SANITARY AND COMBINED SEWER
- REFOULEMENT / DISCHARGE
- ÉGOUTS SANITAIRES ET UNITAIRES EN PROFIL PROFILE SAN. AND COM. SEWER PIPE
- REFOULEMENT EN PROFIL / PROFILE DISCHARGE PIPE
- CONDUITE CONTAMINÉE / CONTAMINATED CONDUCT
- U REGARD UNITAIRE / COMBINED MANHOLE U1
- S REGARD SANITAIRE / SANITARY MANHOLE S1
- BOUCHON / CAP
- BLOC-JOINT / BLOCK ATTACHED
- S FOSSE SEPTIQUE / SEPTIC TANK S

ÉGOUT PLUVIAL / STORM SEWER

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- ÉGOUT PLUVIAL / STORM SEWER
- DRAIN DE FONDATION / FOUNDATION DRAIN
- RACCORDEMENT AU PUISARD / CONNECTION TO SUMP
- ÉGOUT PLUVIAL EN PROFIL / PROFILE STORM SEWER PIPE
- P REGARD PLUVIAL / STORM MANHOLE P1
- REGARD PUISARD / STORM SUMP-MANHOLE
- PUISARD CIRCULAIRE / CIRCULAR SUMP
- PUISARD RECTANGULAIRE / RECTANGULAR SUMP
- PUISARD TROTTOIR / SIDEWALK SUMP
- BOUCHON / CAP
- BLOC-JOINT / BLOCK ATTACHED
- RC REGARD DE CONTRÔLE / CONTROL MANHOLE RC
- UT UNITÉ DE TRAITEMENT / PROCESSING UNIT UT
- FOSSÉ / DITCH
- FOSSÉ BORD / DITCH EDGE
- FOSSÉ EN PROFIL / PROFILE DITCH
- G FOSSÉ GAUCHE EN PROFIL / PROFILE LEFT DITCH G
- D FOSSÉ DROIT EN PROFIL / PROFILE RIGHT DITCH D
- DA DALOT DA
- DA DALOT EN PROFIL / PROFILE DALOT DA
- CONDUITE CONTAMINÉE / CONTAMINATED CONDUCT

SERVICE

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- DÉSAFFECTÉ / À DÉSAFFECTER / DISAFFECTED / TO DISAFFECT
- À ENLEVER / TO REMOVE

NETWORK UTILITIES

TÉLÉCOMUNICATIONS / TELECOMMUNICATIONS

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- TS RÉSEAU TÉLÉPHONIQUE SOUTERRAIN / UNDERGROUND TELEPHONE NETWORK TS
- TA RÉSEAU TÉLÉPHONIQUE AÉRIEN / TELEPHONE NETWORK AIR TA
- T TELEPHONE NETWORK MASSIF / TELEPHONE NETWORK MASSIF T
- T POTEAU ET HAUBAN TÉLÉPHONIQUE / POST AND TELEPHONE GUIDE T
- TE POTEAU ET HAUBAN TÉLÉPHONIQUE ET ÉLECTRIQUE / POST AND TELEPHONE AND ELECTRIC GUIDE TE
- T REGARD / MANHOLE T
- J BOÎTE DE JONCTION / JUNCTION BOX J
- T BALISE DE REPÉRAGE / BEACON TRACKING T
- CABINE TÉLÉPHONIQUE / PHONE BOOTH
- FO FIBRE OPTIQUE / OPTICAL FIBER FO
- FOA FIBRE OPTIQUE AÉRIENNE / AIR OPTICAL FIBER FOA
- FOS FIBRE OPTIQUE SOUTERRAINE / UNDERGROUND OPTICAL FIBER FOS
- FO FIBRE OPTIQUE MASSIF / OPTICAL FIBER MASSIF FO

CÂBLODISTRIBUTION / CABLE

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- CS RÉSEAU CÂBLE SOUTERRAIN / UNDERGROUND CABLE NETWORK CS
- CA RÉSEAU CÂBLE AÉRIEN / CABLE NETWORK AIR CA
- C POTEAU ET HAUBAN CÂBLE / POST AND CABLE GUIDE C
- C REGARD / MANHOLE C
- J BOÎTE DE JONCTION / JUNCTION BOX J
- C BALISE DE REPÉRAGE / BEACON TRACKING C

ÉLECTRICITÉ / ELECTRICITY

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- ES RÉSEAU ÉLECTRIQUE SOUTERRAIN / UNDERGROUND POWE NETWORK ES
- EA RÉSEAU ÉLECTRIQUE AÉRIEN / AIR POWER NETWORK EA
- E RÉSEAU ÉLECTRIQUE MASSIF / POWER NETWORK MASSIF E
- E REGARD / MANHOLE E
- J BOÎTE DE JONCTION / JUNCTION BOX J
- E BALISE DE REPÉRAGE / BEACON TRACKING E
- E POTEAU ÉLECTRIQUE / POWER POLE E
- EL POTEAU ÉLECTRIQUE AVEC LAMPADAIRE / POWER POLE WITH LAMP EL
- E POTEAU ÉLECTRIQUE AVEC TRANSFORMATEUR / POWER POLE WITH TRANSFORMER E
- PYLÔNE / PYLON

GAZ / GAS

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- GAZ RÉSEAU DE GAZ SOUTERRAIN / UNDERGROUND GAS NETWORK GAZ
- AIR AIR COMPRIMÉ / PRESSURIZED AIR AIR
- G BALISE DE REPÉRAGE / BEACON TRACKING G
- G REGARD / MANHOLE G
- G VANNE / VALVE G

VOIRIE ET CHAUSSÉE / ROAD AND ROADWAY

CHAUSSÉE ET VOIE DE COMMUNICATION / ROAD AND ROAD OF COMMUNICATION

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- LIGNE DE CENTRE / CENTER LINE
- PROFIL AU CENTRE / CENTER PROFILE
- D PROFIL DROIT / RIGHT PROFILE D
- G PROFIL GAUCHE / LEFT PROFILE G
- ACCOTEMENT NON PAVÉ / UNPAVED SHOULDER
- ACCOTEMENT PAVÉ / PAVED SHOULDER
- CHEMIN (GRAVIER, TERRE, SABLE) / PATH (GRAVEL, EARTH, SAND)
- ENTRÉE PRIVÉE PAVÉE / PRIVATE PAVED AUTO ENTRY
- ENTRÉE PRIVÉE GRAVIER / PRIVATE GRAVEL ENTRANCE
- BORDURE DE RUE / STREET CURB
- PAVAGE / PAVING
- PAVAGE SCARIFIÉ / SCARFIED PAVING
- TROTTOIR / SIDEWALK
- DESCENTE POUR PERSONNE À MOBILITÉ RÉDUITE/ PEOPLE WITH REDUCED MOBILITY SLOP DOWN
- GLISSIÈRE DE SÉCURITÉ / CRASH BARRIER
- MUR DE SOUTÈNEMENT / RETAINING WALL
- TRAIT DE SCIE / KERF
- ABRIBUS ABRIBUS / BUS SHELTERS ABRIBUS
- PARCOMÈTRE / PARKING METER
- 450ø PONCEAU / CULVERT 450ø

ÉCLAIRAGE / LIGHTING

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- ECS CÂBLE D'ÉCLAIRAGE SOUTERRAIN / CABLE UNDERGROUND LIGHTING ECS
- ECA CÂBLE D'ÉCLAIRAGE AÉRIEN / CABLE AIR LIGHTING ECA
- LAMPADAIRE SIMPLE / SINGLE LAMP
- LAMPADAIRE DOUBLE / DOUBLE LAMP
- LAMPADAIRE MULTIPLE / MULTIPLE LAMP
- LAMPADAIRE DÉCORATIF / DECORATIVE LAMP
- EC LAMPADAIRE POTEAU / POST LAMP EC
- MT MASSIF DE TIRAGE / PULLING CABLE MASSIF MT
- J BOÎTE DE JONCTION / JUNCTION BOX J
- CTL BOÎTE DE CONTRÔLE / CONTROL BOX CTL
- TRAVERSE DE RUE / STREET CROSSING

SIGNALISATION / SIGNALING

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- CTL BOÎTE DE CONTRÔLE / CONTROL BOX CTL
- FEU DE CIRCULATION / TRAFIC LIGHT
- PANNEAU DE SIGNALISATION / ROAD SIGN

MARQUAGE / MARKING

CHAUSSÉE / ROADWAY

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- LIGNE MARQUAGE / MARKING LINE
- LIGNE AXIALE / AXIAL LINE 3m x 6m
- LIGNE DE CONTINUITÉ / CONTINUITY LINE 1m x 3m
- LIGNE DE GUIDAGE / GUIDING LINE 0,5m x 1m
- ALTERNATE CIRCULATION 3m x 3m
- BANDE PASSAGE PIÉTON / PEDESTRIAN CROSSING BAND 0,4m x 0,4m x 2,4m
- CÉDEZ LE PASSAGE CARREFOUR GIRATOIRE / ROUNDABOUT YIELD 1m x 1m x 0,3m

AUTOBUS / BUS

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- LIGNE MARQUAGE / MARKING LINE
- VOIE RÉSERVÉE / RESERVED WAY

VOIE CYCLABLE / CYCLING TRACK

EXISTANT / EXISTING — PROPOSÉ / PROPOSED

- LIGNE MARQUAGE / MARKING LINE
- LIGNE AXIALE / AXIAL LINE 1m x 3m
- PASSAGE VÉLO AUX INTERSECTION / INTERSECTION BIKE CROSSING 1m x 1m
- LIGNE PASSAGE VÉLO / BIKE CROSSING LINE 0,4m x 0,4m x 0,4m
- BANDE PASSAGE VÉLO / BIKE CROSSING STRIP 0,3m x 0,3m x 2,4m

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Notes

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0	POUR ÉTUDE FINAL / FOR FINAL STUDY	G.R.-C.	J.R.	2024.02.20
A	POUR ÉTUDE D'IMPACT / FOR IMPACT STUDY	L-M.S.	J.R.	2023.10.25

Émissions-Révisions / Issued-Revision

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Préparé / Prepared

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Dessiné / Drawn

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Sceaux / Permit-Seal

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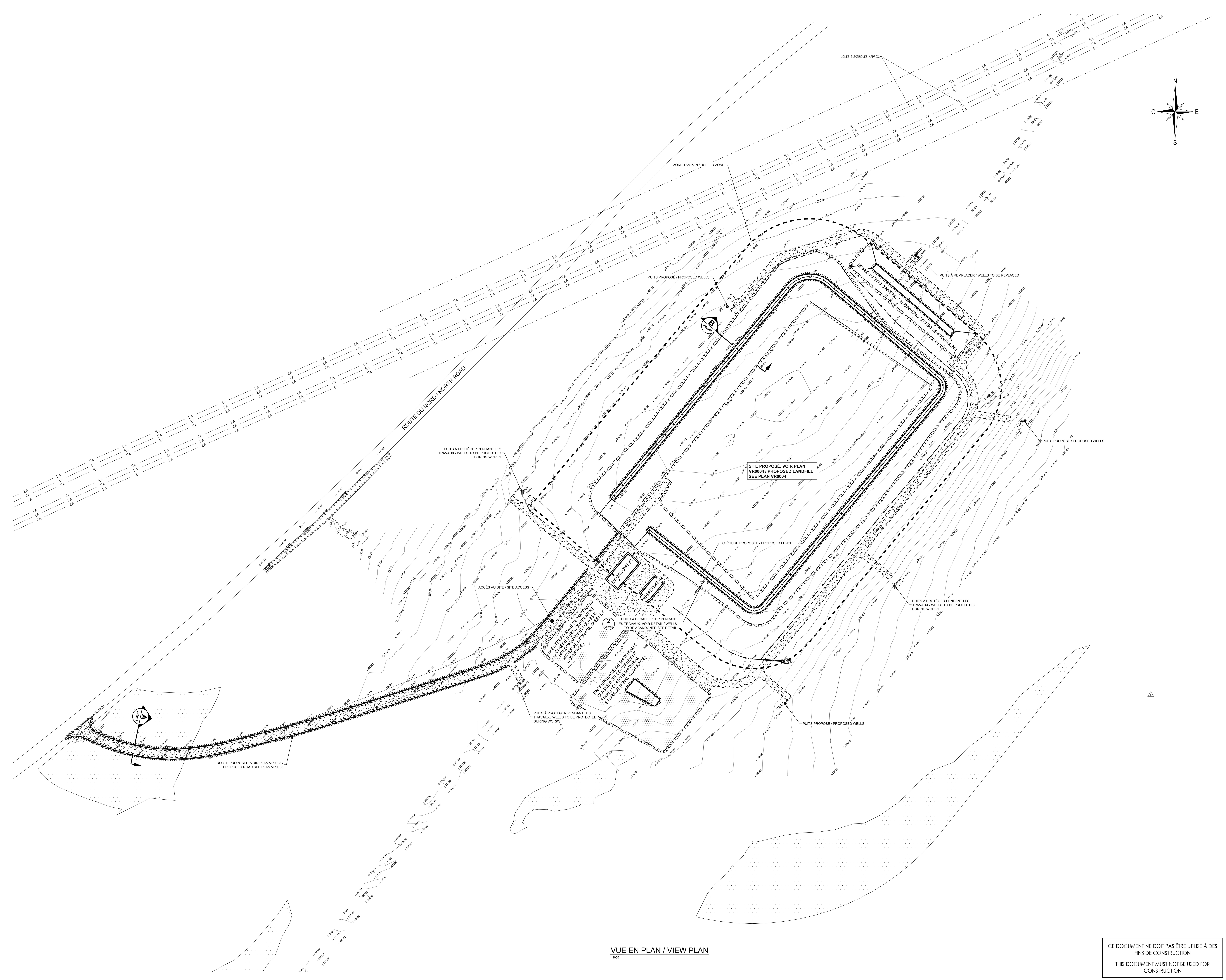
Client-Projet / Client- Project
NATION CREE DE NEMASKA / CREE NATIONOF NEMESKA

NOUVEAU LIEU D'ENFOUISSEMENT DE NEMASKA / NEMESKA NEW LANDFILL
NEMASKA, QUEBEC

Titre / Title

LÉGENDE / LEGEND

N° projet / Project No. 167020077
Échelle / Scale AUCUNE / NONE
Émis./Rév. Iss./Rev. 0
Feuille / Sheet 2 de / of 7
N° dessin / Drawing No. VR0001



VUE EN PLAN / VIEW PLAN

1:1000

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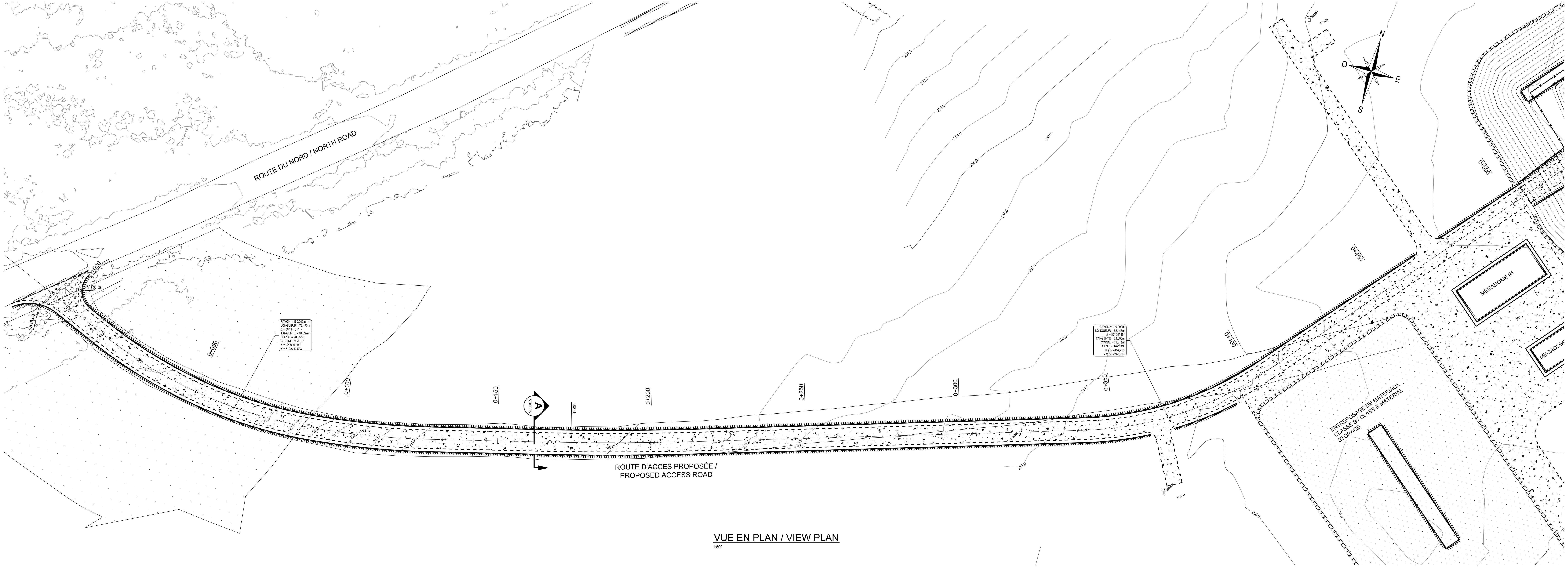
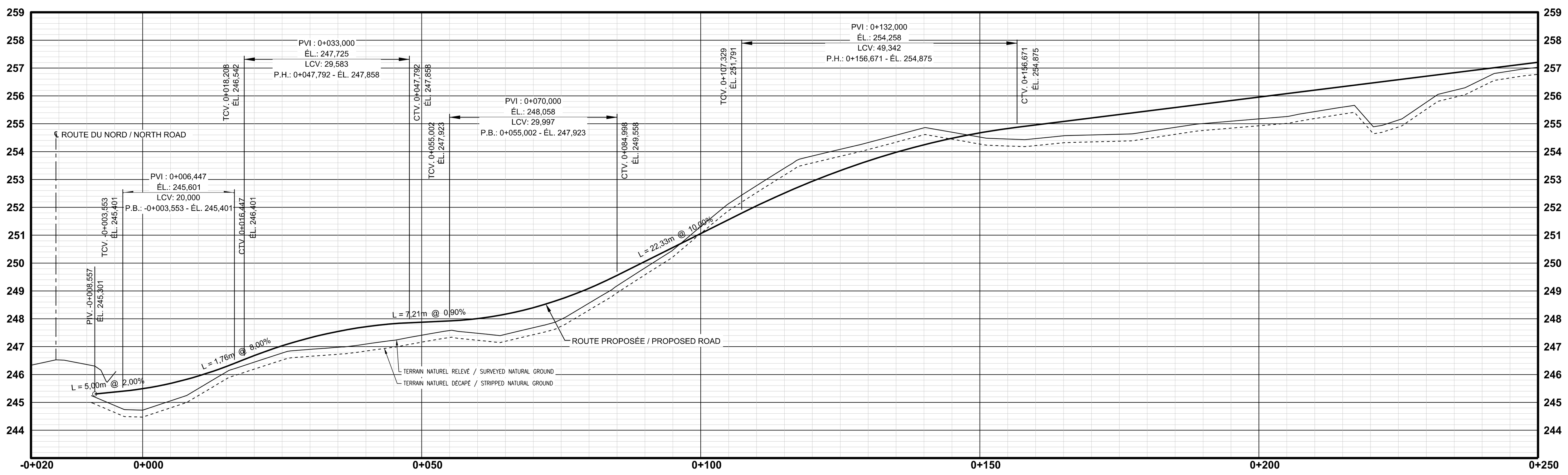
NOUVEAU LIEU D'ENFOUISSEMENT DE NEMASKA / NEMESKA NEW LANDFILL
NEMASKA, QUEBEC

Titre / Title
SITE ET ROUTE D'ACCÈS PROPOSÉS / PROPOSED LANDFILL AND ACCESS ROAD
VUE D'ENSEMBLE / GENERAL LAYOUT

N° projet / Project No.: 167020077
Échelle / Scale: 1:1000
Émis./Rév. Iss./Rev.: 1
Feuille / Sheet: 3 de/of 7
N° dessin / Drawing No.: VR0002



VUE EN PLAN / VIEW PLAN
1:500



ÉL. PROPOSÉE			245,372	245,491	245,682	245,948	246,288	246,681	247,030	247,318	247,547	247,715	247,824	247,878	247,923	248,006	248,165		248,710	249,096	249,558	250,058	250,558	251,058	251,558	252,053	252,513	252,936	253,321	253,668	253,976	254,247	254,480	254,674	254,831	254,958	255,083	255,208	255,333	255,458	255,583	255,708	255,833	255,958	256,083	256,207	256,332	256,457	256,582	256,707	256,832	256,957	257,082
ÉL. EXISTANTE			244,89		245,05	245,50	246,09	246,44	246,77	246,90	246,98	247,09	247,23	247,41	247,58	247,48	247,44	247,68	247,98	248,56	249,18	249,83	250,47	251,31	252,13	252,78	253,40	253,84	254,08	254,33	254,59	254,86	254,70	254,52	254,45	254,47	254,57	254,60	254,63	254,72	254,87	255,01	255,09	255,18	255,26	255,44	255,60	255,01	255,14	255,77	256,20	256,59	256,89

PROFIL / PROFILE
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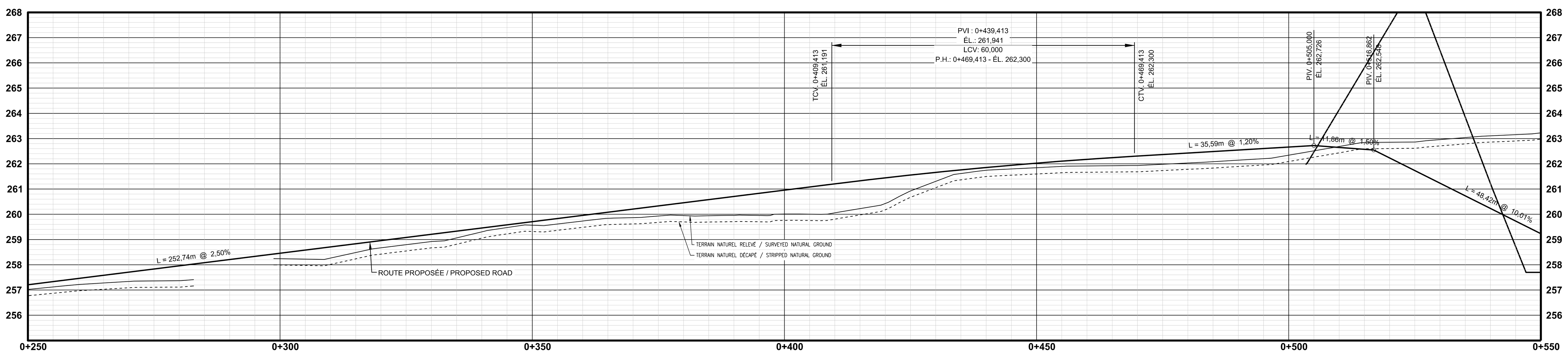

ÉL. PROPOSÉE	257,332	257,457	257,582	257,707	257,832	257,957	258,082	258,207	258,332	258,457	258,582	258,707	258,832	258,956	259,081	259,206	259,331	259,456	259,581	259,706	259,831	259,956	260,081	260,206	260,331	260,456	260,581	260,706	260,831	260,956	261,081	261,206	261,327	261,443	261,554	261,659	261,759	261,854	261,943	262,027	262,105	262,177	262,245	262,307	262,367	262,426	262,486	262,546	262,606	262,666		262,651	262,576	262,234	261,733	261,232	260,732	260,231	259,731	259,230
ÉL. EXISTANTE	257,12	257,22	257,28	257,34	257,36	257,37				258,24	258,22	258,26	258,49	258,67	258,80	258,92	259,06	259,31	259,47	259,57	259,61	259,73	259,84	259,87	259,93	259,95	259,94	259,96	259,95	260,01	260,00	260,06	260,22	260,43	260,92	261,30	261,61	261,74	261,80	261,85	261,90	261,92	261,92	261,93	261,98	262,03	262,08	262,14	262,20	262,34	262,51	262,69	262,84	262,85	262,86	262,96	263,04	263,11	263,16	

PROFIL / PROFILE
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1	POUR ÉTUDE FINAL RÉV. / FOR REV. FINAL STUDY	M.M.	J.R.	2025.07.18
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A	POUR ÉTUDE D'IMPACT / FOR IMPACT STUDY	L-M.S.	J.R.	2023.10.25

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Dessiné / Drawn

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Sceaux / Permit-Seal

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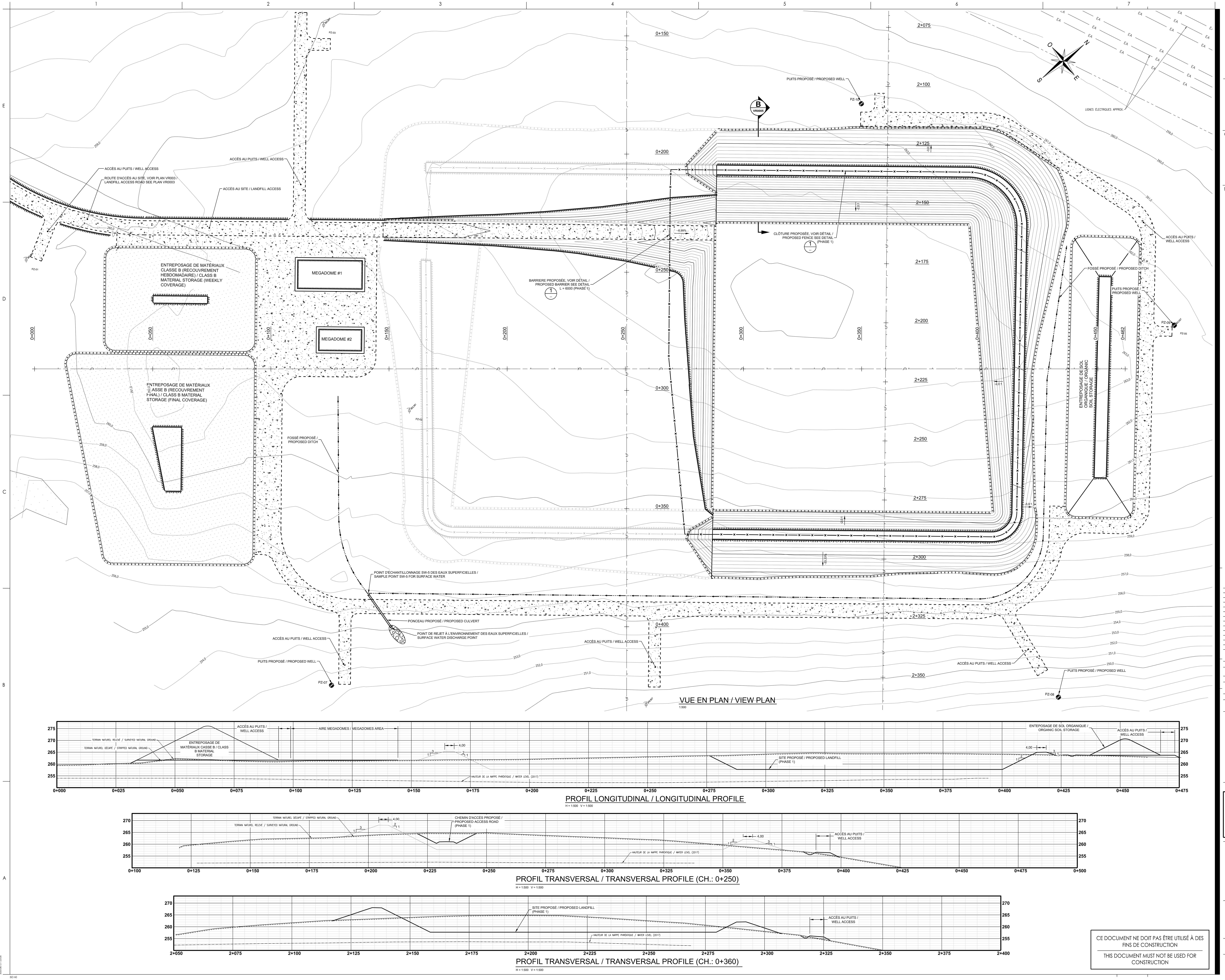
Client-Projet / Client- Project
NATION CREE DE NEMASKA / CREE NATIONOF NEMESKA

NOUVEAU LIEU D'ENFOUISSEMENT DE NEMASKA / NEMESKA NEW LANDFILL
NEMASKA, QUEBEC

Titre / Title
ROUTE D'ACCÈS PROPOSÉE / PROPOSED ACCESS ROAD
VUE EN PLAN ET PROFILS / VIEW PLAN AND PROFILES

N° projet / Project No.: 167020077
Échelle / Scale: H = 1:500 V = 1:100
Émis./Rév. Iss./Rev.: 1
Feuille / Sheet: 4 de/of 7
N° dessin / Drawing No.: VR0003



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A	POUR ÉTUDE D'IMPACT / FOR IMPACT STUDY	L-M.S.	J.R.	2023.10.25

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Chargé de projet / Project Manager

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NOUVEAU LIEU D'ENFOUISSEMENT DE NEMASKA / NEMESKA NEW LANDFILL
NEMASKA, QUEBEC

Titre / Title
PHASE 1
SITE PROPOSÉ / PROPOSED LANDFILL
VUE EN PLAN ET PROFILS / PLAN VIEW AND PROFILES

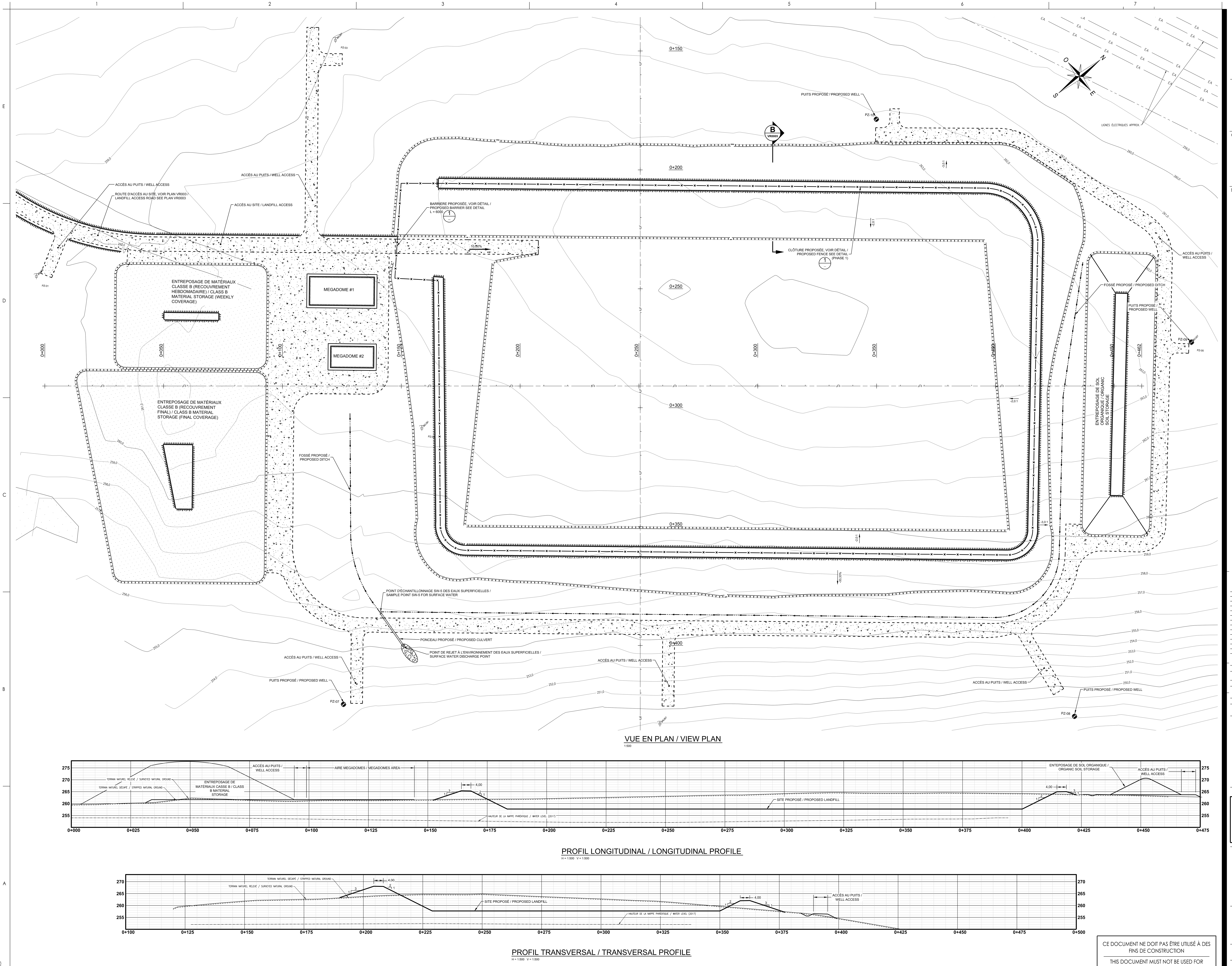
N° projet / Project No. 167020077

Échelle / Scale H. 1:500 - V. 1:500

Émis./Rév. Iss./Rev. 1

Feuille / Sheet 5 de/of 7

N° dessin / Drawing No. **VR0004**



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Émissions-Révisions / Issued-Revision	Par By	Appr. Appd	AAAA-MM-JJ YYYY-MM-DD

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NOUVEAU LIEU D'ENFOUISSEMENT DE NEMASKA / NEMESKA NEW LANDFILL

NEMASKA, QUEBEC

Titre / Title

PHASE 2

SITE PROPOSÉ / PROPOSED LANDFILL

VUE EN PLAN ET PROFILS / PLAN VIEW AND PROFILES

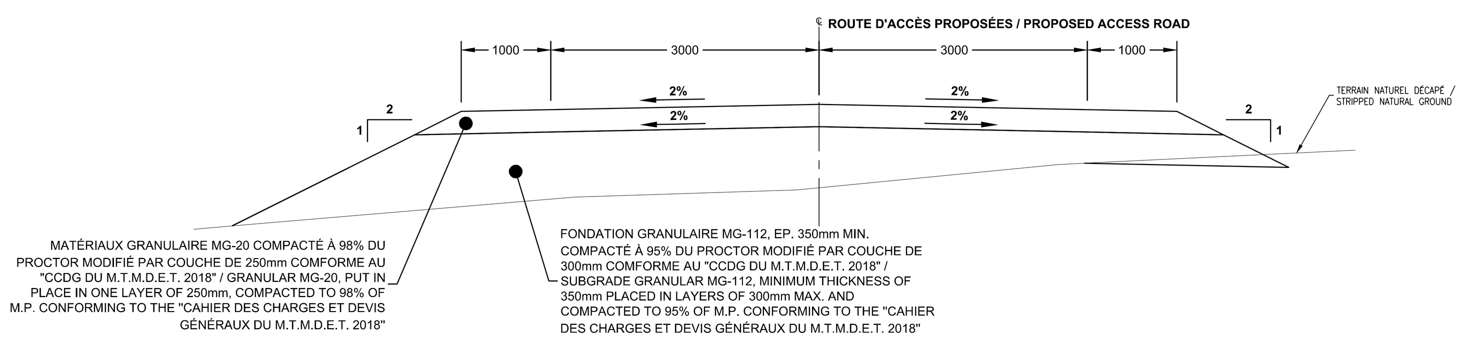
N° projet / Project No. 167020077

Échelle / Scale H. 1:250 - V. 1:50

Émis./Rév. Iss./Rev. 0

Feuille / Sheet 6 de/of 7

N° dessin / Drawing No. **VR0005**



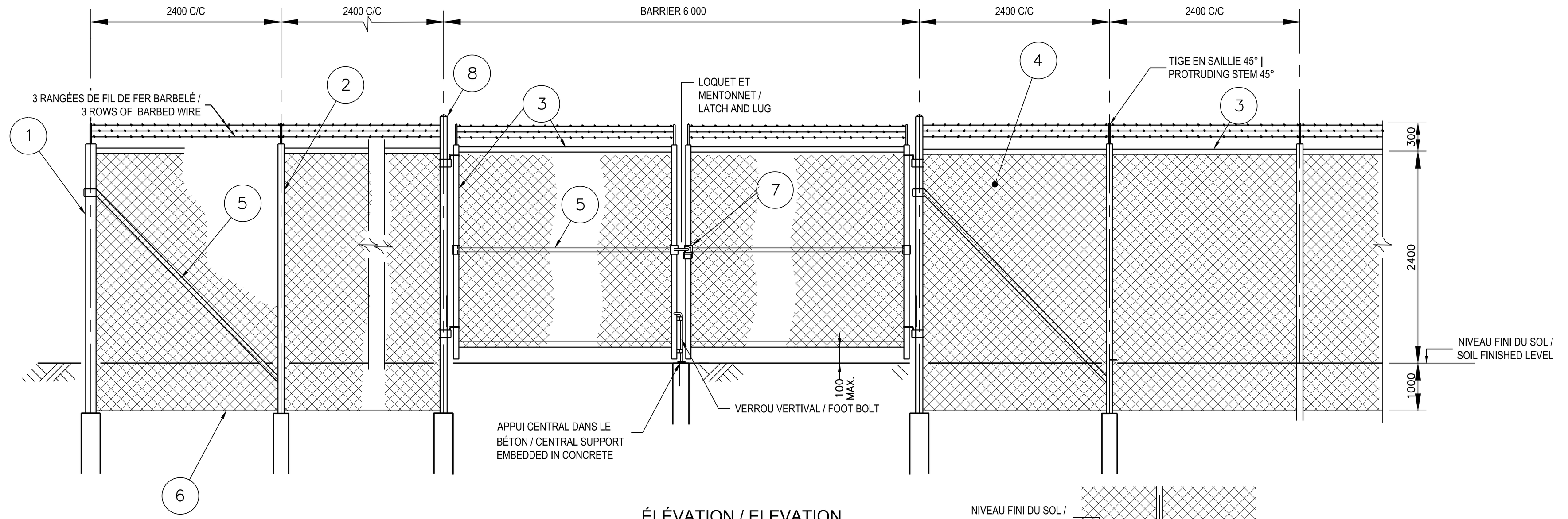
STRUCTURE DE CHAUSSÉE / ROAD STRUCTURE

COUPE A

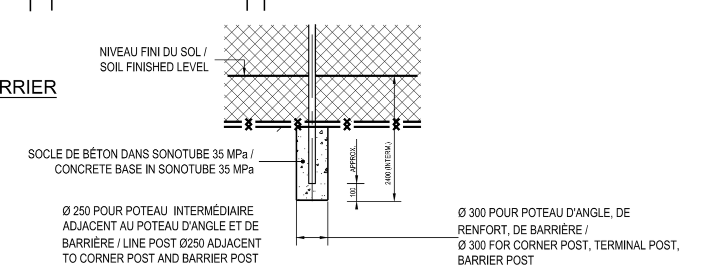
1:50

LÉGENDE / LEGEND

1. POTEAU DE COIN OU TERMINAL Ø89mm INCLUANT LE CHAPEAU DE POTEAU Ø90mm / CORNER OR TERMINAL POST Ø89mm INCLUDING ø90mm CAP
2. POTEAU INTERMEDIAIRE DIMENSION 60mm (2 3/8") INCLUANT LE CHAPEAU DE POTEAU / INTERMEDIATE LINE POST SIZED 60mm (2 3/8") INCLUDING POST CAP
3. CHASSIS TUBULAIRE OU OBLIQUE Ø42 / TUBULAR OR ANGULAR CHASSIS Ø 42
4. GRILLAGE A MAILLE DE CHAINE / CHAIN LINK FENCE
5. ENTRETOISE TUBULAIRE Ø48 / SPACER SLEEVE Ø48
6. CABLE INFÉRIEUR EN ACIER GALVANISÉE CALIBRE 6 AVEC BROCHE D'ATTACHES CALIBRE 16 AU 400mm C/C / GALVANIZED STEEL BOTTOM WIRE CAL. 6 , CAL. 16 LIGATURE @ 400mm C/C
7. SYSTEME DE FERMETURE AVEC VERROU / BOLT FASTENING SYSTEM
8. POTEAU DE BARRIERE DE 6 METRES Ø115mm / 6 METERS, Ø115mm BARRIER POST



ÉLÉVATION / ELEVATION
BARRIÈRE DE 6 MÈTRES / 6 METER BARRIER



FONDATION POUR POTEAU / POLE FOUNDATION

NOTES:

1) LE GRILLAGE DOIT :
- AVOIR 2400mm DE HAUTEUR
- ÊTRE GALVANISÉ POUR RESPECTER LA CLASSE 3
- GRILLAGE À MAILLES DE CHAINES, DIM. 50mm X 50 mm.
- BROCHE EN ACIER CALIBRE 9 / STEEL WIRE CLIPS CAL.9 /

GRILLAGE MUST:
- HAVE 2400mm HEIGHT;
- BE GALVANIZED TO COMPLY WITH CLASS 3;
- CHAIN LINK FENCE, DIMENSIONS 50mm X 50mm.
- STEEL WIRE CLIPS CAL.9

2) TOUS LES POTEAUX SONT EN ACIER GALVANISÉ À CHAUD POUR DONNER UNE COUCHE DE 550 g/m MINIMUM, CONFORMÉMENT À LA NORME ASTM A-120 / ALL POSTS MUST BE OF STEEL GALVANISED AT HIGH TEMPERATURE TO PROVIDE A LAYER OF 550 g/m MINIMUM, COMPLIANT TO STANDARD ASTM A-120

3) PAR POTEAUX TERMINAUX, IL FAUT COMPRENDRE: LES POTEAUX DE BARRIÈRE, D'ANGLE ET DE RENFORT. POUR CES POTEAUX, FOURNIR UN TUBE STANDARD DE 88,9 mm DE DIAMÈTRE EXTÉRIEUR. LA LONGUEUR DE CES POTEAUX DOIT ETRE SUPÉRIEURE À LA LARGEUR DU GRILLAGE DE 1070 mm (3'6") / BY TERMINAL POST IS EGAL TO: BARRIER POSTS, CORNER POSTS AND TERMINAL POST. FOR THESE POSTS, CONTRACTOR SHALL SUPPLY A STANDARD TUBE WITH AN EXTERIOR DIAMETER OF 88,9mm. LENGTH OF SUCH POSTS SHALL EXCEED TO THE 1070mm (3'6") WIDTH OF THE SCREEN.

4) LES POTEAUX TERMINAUX DOIVENT ETRE FOURNIS ET INSTALLÉS AVEC DEUX (2) BARRES D'APPUI OU ENTRETOISES. LES BARRES D'APPUIS OU LES ENTRETOISES DOIVENT ETRE FOURNIS AVEC TOUS LES ACCESSOIRES NÉCESSAIRES À LEUR INSTALLATION. TOUS LES POTEAUX TERMINAUX SONT INSTALLÉS DANS UNE BASE DE BÉTON DE 300 mm DE DIAMÈTRE (35 MPa). LA PROFONDEUR DE LA BASE DE BÉTON DANS LE SOL DOIT ETRE DE 2100 mm. LES POTEAUX DE RENFORT SONT INSTALLÉS À TOUS LES SOIXANTE (60) MÈTRES. / TERMINAL POST MUST BE SUPPLIED AND INSTALLED WITH TWO (2) SUPPORT BARS OR SPACERS. SUPPORT BARS OR SPACERS SHALL BE SUPPLIED ALONG WITH ALL ACCESSORIES RELATED TO THEIR INSTALLATION. ALL TERMINAL POSTS SHALL BE INSTALLED IN A CONCRETE BASE OF 300mm DIAMETRE (35MPa). THE DEPTH OF THE CONCRETE BASE IN THE SOIL SHALL BE 2100mm. THE RENFORCING POSTS SHALL BE INSTALLED EVERY SIXTY (60) METERS.

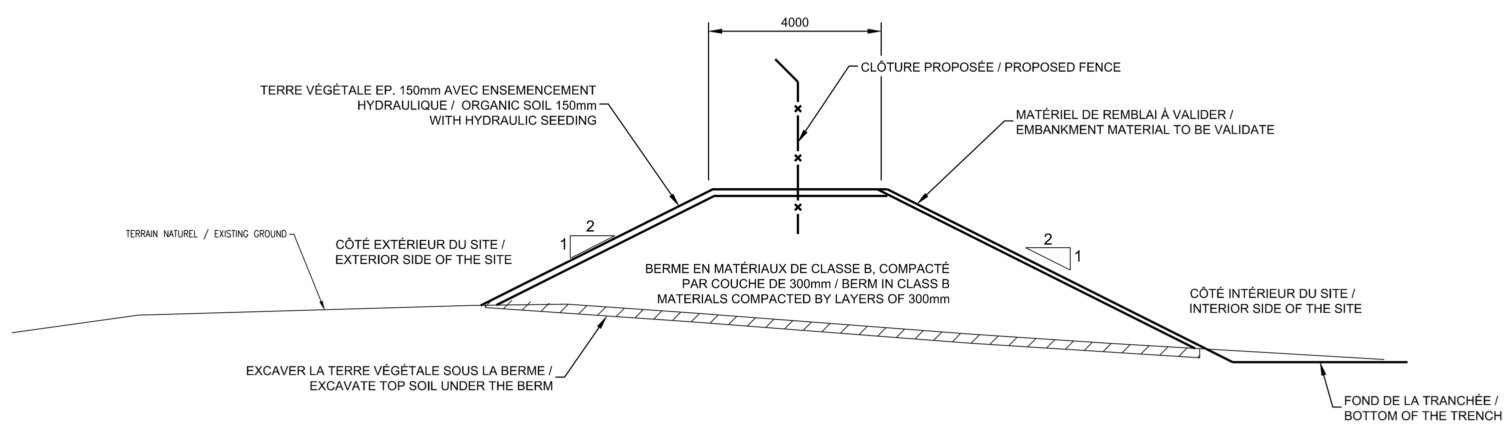
5) LES POTEAUX INTERMÉDIAIRES DOIVENT ETRE CONFORMES À LA NORME ASTM-A120-72a (AASHTO M181-60), TUYAU D'ACIER GALVANISÉ, POIDS STANDARD, DIMENSION 60mm (2 3/8") INCLUANT LE CHAPEAU DE POTEAU. / INTERMEDIATE LINE POSTS CONFORMING TO THE ASTM-A120-72a (AASHTO M181-60) NORM, MADE OF GALVANIZED STEEL OF STANDARD WEIGHT, SIZED 60mm (2 3/8") INCLUDING POST CAP.

ILS DOIVENT ÊTRE FOURNIS AVEC DES SUPPORTS À 45° ET CAPABLES DE RECEVOIR TROIS (3) RANGS DE FIL BARBELÉ. LES POTEAUX INTERMÉDIAIRES SONT ENFOUIS DIRECTEMENT DANS LE SOL À UNE PROFONDEUR DE 1200 mm SAUF POUR LES POTEAUX ADJACENT AU POTEAU D'ANGLE ET DE BARRIÈRE QUI SONT INSTALLÉS DANS UNE BASE DE BÉTON DE 250 mm DE DIAMÈTRE (35 MPa). LA PROFONDEUR DE LA BASE DE BÉTON DANS LE SOL DOIT ÊTRE DE 1200 mm. / THEY SHALL BE SUPPLIED WITH 45° SUPPORTS AND BE ABLE OF HOLDING THREE (3) ROWS OF BARBWIRE. INTERMEDIATE POSTS ARE TO BE DIRECTLY BURIED IN THE SOIL AT A DEPTH OF 1200mm EXCEPT FOR POSTS ADJOINING TO ANGLE AND BARRIER POSTS WHICH ARE INSTALLED IN A 250mm DIAMETRE (35MPa) CONCRETE BASE. THE CONCRETE BASE SHALL BE 1200mm DEEP IN THE SOIL.

CLÔTURE À MAILLES DE CHAÎNE AVEC BARRIÈRE / CHAIN LINK FENCE

DÉTAIL 1

AUCUNE / NONE



BERME SITE D'ENFOUISSEMENT / LANDFILL BERM

COUPE B

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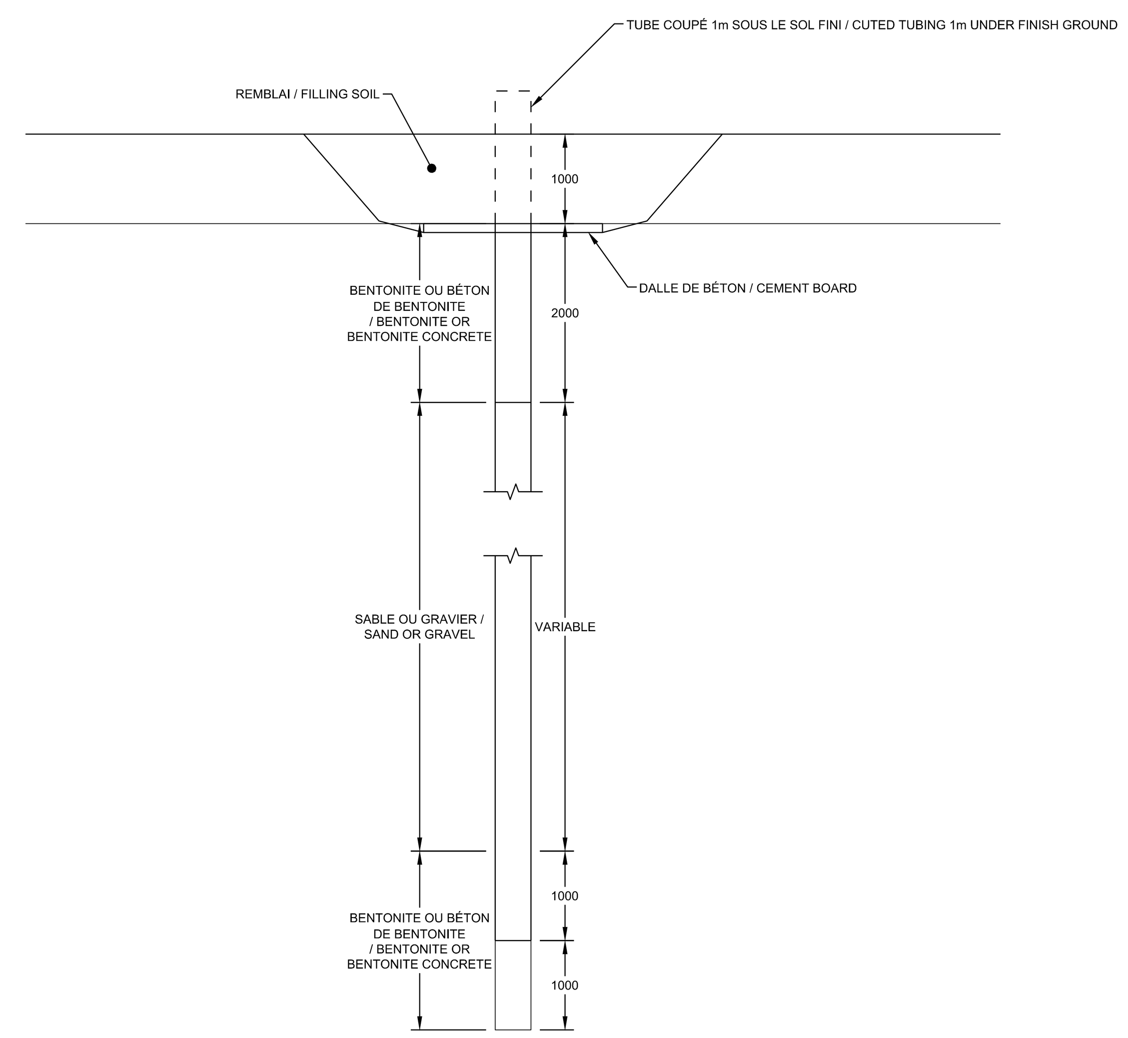

PUITS À DÉSAFFECTER / WELLS TO BE ABANDONED

DÉTAIL 2

AUCUNE / NONE

CE DOCUMENT NE DOIT PAS ÊTRE UTILISÉ À DES FINS DE CONSTRUCTION

THIS DOCUMENT MUST NOT BE USED FOR CONSTRUCTION

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Consultant

Notes

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Échelle / Scale: INDIQUÉE / INDICATED
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Feuille / Sheet: 7 de / of 7
N° dessin / Drawing No.: VR0005

APPENDIX B - Technical note on the hydraulic evaluation of the LEET

Note technique

À : Ministère de l'Environnement, de la Lutte contre les Changements Climatiques, de la Faune et des Parcs

De : STANTEC Experts-conseils ltée
Ville de Québec
Québec

N/Réf : 167020077-301-HY-N-0001-A

Date : 8 juillet 2025

Préparé par : Salma Gobji, CPI, M Sc., Nº OIQ: 6032481
Sous DSI Sarah Bacon, ing., M. Sc. PMP, Nº OIQ: 122214

Hydraulique fluviale

Préparé et vérifié par : Sarah Bacon, ing., M. Sc. PMP, Nº OIQ : 122214

Cheffe d'équipe, Hydraulique fluviale

1 QUESTIONS MELCCFP – QC - 4

QC - 4. Dans la description de son projet, le promoteur indique que « le talus augmentera la capacité du lieu d'enfouissement, limitera la visibilité des opérations d'enfouissement, empêchera la contamination des eaux de surface et empêchera la dispersion des matières résiduelles par le vent ».

Le profil transversal du dessin VR0004 joint à l'Annexe D (page 387) montre la berme au sud-est. La hauteur de la berme est de plus de 8 m pour son flanc qui se trouve du côté extérieur à la zone de dépôt. Ce flanc donne sur le chemin qui circonscrit le site et donne directement sur l'extérieur du site.

Dans la note explicative de l'article 91 du Guide d'application du REIMR, il est mentionné qu'un « LEET peut être aménagé en remblai à l'aide de bermes périphériques ». On spécifie cependant que, bien qu'il « n'y [ait] pas de limite quant à la hauteur de telles bermes, […] en raison des risques plus élevés de résurgence des lixiviats, elles devraient être limitées à quelques mètres (2 à 3 m) ».

L'initiateur doit confirmer, avec démonstration à l'appui, que la berme périphérique au site sera conçue de manière à éviter les résurgences de lixiviat malgré une hauteur de plus de 8 m et démontrer par une simulation visuelle que le site ne sera pas visible à partir de la route du Nord.

1.1 Méthodologie

1.1.1 Données pluviales

En raison des restrictions de couverture des données dans la région de Nemaska, les données IDF ne sont pas disponibles à partir d'une station météorologique située à une distance raisonnable du site du projet. Par conséquent, l'utilisation de données IDF historiques « non mesurées », calculées par interpolation entre les stations météorologiques d'Environnement Canada et les ensembles de données climatiques disponibles dans la région, ont été utilisées. Toutes les données pluviométriques utilisées dans cette méthodologie sont extraites du rapport de Stantec intitulé « Évaluation de l'impact climatique du site d'enfouissement proposé à Nemaska, version finale, 2023 ». Cette étude était présentée en annexe du rapport d'étude d'impact soumis en 2024, et est de nouveau présentée à l'**Annexe A**.

Tableau 1-1 - Changement en pourcentage (%) - Précipitations annuelles moyennes totales et saisonnières par rapport à la ligne de base 1981 - 2010, RCP 8.5, Nemaska

		Changement moyen dans les précipitations totales par rapport à la ligne de base 1981-2010 (%)		
Saison	**Précipitations moyennes annuelles 1981 - 2010 (mm)**	2020	2050	2080
Annuel	759	4,8	12	18,8
Hiver	126	10,1	25,5	43,6
Printemps	128	5,3	15,9	26,3
Été	253	1,7	3,1	2,5
Automne	252	5,5	12,6	19,4

La courbe pluviale Durée-Fréquences (IDF) (**Figure 1-1**) a été créée en se basant sur le **Tableau 1-2**.

Tableau 1-2 - Précipitations historiques (mm)
Interpolation des données IDF

Récurrence	2	5	10	25	50	100
5 min	5,57	8,59	10,63	13,2	15,09	16,92
10 min	7,22	11,01	13,84	17,81	21,07	24,6
15 min	8,7	13,29	17,18	23,32	28,96	35,69
30 min	11,41	17,51	22,66	30,84	38,42	46,89
1 h	14,75	21,52	26,75	34,24	40,39	46,89
2h	19,83	27,04	32,09	38,76	43,84	48,92
6h	28,19	37,96	44,99	54,54	62,15	70,18
12 h	35,03	45,61	52,47	61,04	67,39	73,76
24 h	41,46	53,05	59,97	67,95	73,39	78,43

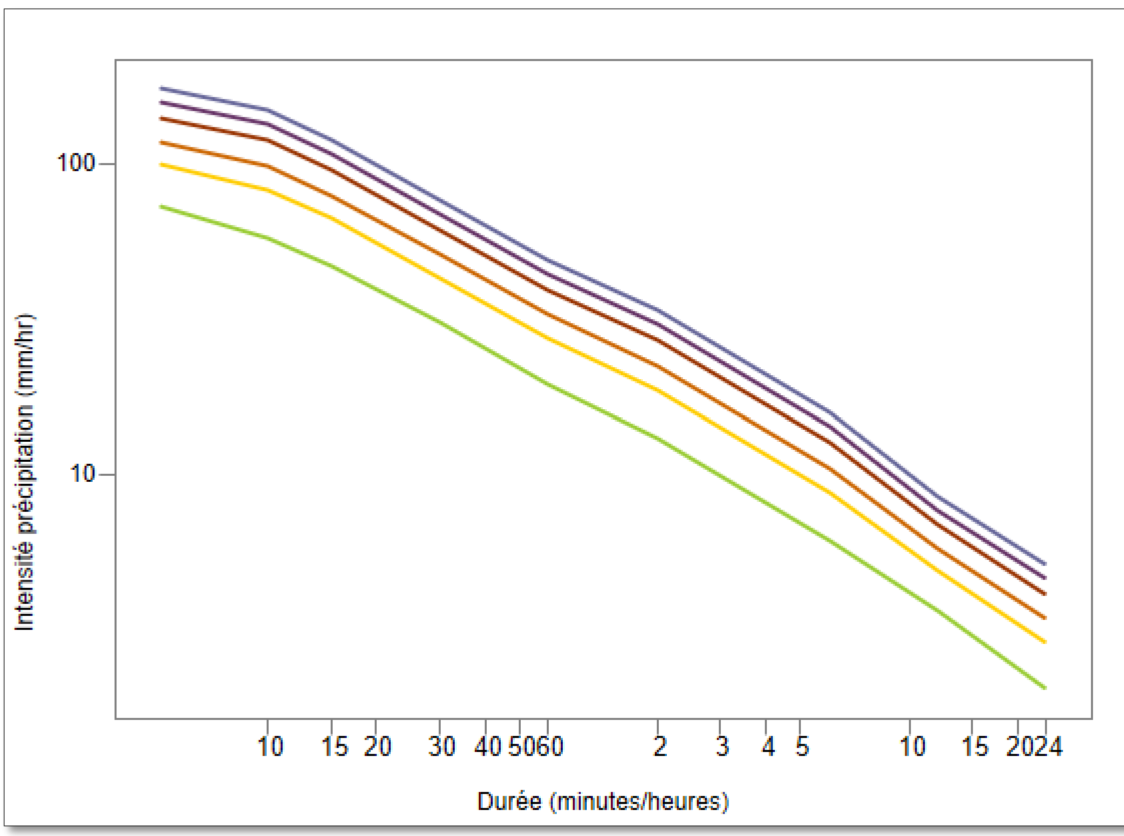

Figure 1-1 - Courbe Intensité-Durée-Fréquence (IDF) - Interpolation des données IDF

Une pluie de type Chicago et d'une durée de 24 heures, a été simulée afin de représenter un événement extrême de longue durée (période retour de 100 ans avec une majoration liée aux changements climatiques). L'objectif est d'évaluer la capacité du site à infiltrer l'eau à la suite de longs événements pluviaux, avant d'atteindre la saturation.

1.1.2 Données piézométriques

Des relevés piézométriques ont été faits par Stantec et présentés par BlueMetric Environnement inc. (2023 et mise à jour 2025[1]). Le piézomètre pris dans la modélisation PCSWMM ainsi que les relevés associés sont présentés dans le **Tableau 1-3** et le **Tableau** 1-4. Ce rapport est présenté à l'**Annexe B**.

Tableau 1-3 - Caractéristiques du puits retenu PZ-3 (BlueMetric, 2024)

Nom	Profondeur du fond (m)	Élévation du sol (m)	Conductivité hydraulique (mm/hr)
PZ-3	12,37	Sol = 260,067 PVC = 260,897	7,452

Tableau 1-4 - Compagne de mesures du niveau d'eau (BlueMetric, 2024)

Puits	Élévation de la nappe (m)			
	Décembre 2017	Août 2018	Août 2020	Juin 2021
PZ-3	252,20	253,00	252,70	253,47

1.1.3 Scénarios et changements climatiques

Les résultats des données historiques et des projections futures indiquent une augmentation de l'accumulation des précipitations qui peut être attendue pour la majorité des événements de pluie pour la région de Nemaska.

Le **Tableau 1-5** résume l'augmentation des changements climatiques (CC) projetée pour les trois (3) horizons évalués (H1, H2 et H3) avec un scénario de gaz à effet de serre RCP 8.5.

Étant donné que la durée de vie de LEET en fonctionnement est de **51 ans**, l'horizon H2 a été considéré dans les calculs, avec un facteur de changements climatiques de **19,5 %**.

La simulation post-fermeture a été réalisée avec l'horizon H3 **(31,6%)**.

Tableau 1-5 - Facteur de changements climatiques en fonction des horizons

Horizon	Période	Augmentation CC
H1	2011 - 2040	11,2 %
H2	**2041 - 2070**	**19,5 %**
H3	2071 – 2100	31,6 %

1.2 Modélisation hydrologique PCSWMM

La modélisation des pertes pour l'évaluation de la réponse du site d'enfouissement face à l'infiltration des eaux pluviales a été réalisée avec un modèle hydrologique PCSWMM[2].

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[1] No*te technique des réponses aux questions du ministères concernant le volet hydrogéologique de l'étude d'impact environnementale pour le LEET de Nemaska, BlueMetric Environnement inc., 2025).*

[2] *PCSWMM (Personal Computer Storm Water Management Model) : Logiciel de modélisation hydrologique et hydraulique.*

1.2.1 Lieu d'enfouissement et sol

Le lieu d'enfouissement a été délimité à partir du haut de crête de berme, couvrant une superficie totale d'environ 4 hectares (ha). La pente à l'intérieur du site est considérée comme nulle et la pente entre les crêtes des bermes est de 2,72% (**Tableau 1-6**).

Tableau 1-6 - Caractéristiques du site d'enfouissement

Aire (ha)	4
Pente (%)*	2,72
Perméabilité (%)	97
Imperméabilité (%)	3
N perméabilité	0,01
N Imperméabilité	0,1

** Pente entre les crêtes des bermes, utilisée pour mesurer la longueur d'écoulement dans PCSWMM.*

La caractérisation du sol du site d'enfouissement est (BlueMetric, 2023) :

- Couche du sol non saturée d'une épaisseur de 0,06 à 0,18 m;
- **Till (sable silteux** avec quelques graviers et traces d'argiles et de cailloux) ou sable, d'une épaisseur varie de 7,5 m à plus de 20 m;
- Substratum rocheux, d'une épaisseur d'au moins de 0,5 m.

1.2.2 Infiltration

L'évaluation de la capacité d'infiltration a été basée sur la méthode de Horton pour les sols naturels.

Tableau 1-7 - Méthode d'infiltration et paramètres utilisés

Méthode d'infiltration	HORTON
Taux d'infiltration maximal (mm/hr)	100
Taux d'infiltration minimal (mm/hr)	0,5
Constante décroissante (1/hr)	4

1.2.3 Simulations et scénarios

L'évaluation hydrologique du lieu d'enfouissement a été réalisée en se basant sur différents scénarios. Ces scénarios permettent de modéliser l'évolution du comportement hydraulique du dépôt, en fonction de la compaction des déchets, depuis la phase d'exploitation initiale jusqu'à la fermeture définitive du site. Pour chaque scénario, les marges du taux d'infiltration sont définies en prenant comme référence les valeurs extrêmes associées aux intervalles de compaction (Reddy et al., 2009)[3] :

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[3] *Reddy, K. R., Hettiarachchi, H., Parakalla, N., Gangathulasi, J., Bogner, J., & Lagier, T. (2009). Hydraulic Conductivity of MSW in Landfills. Journal of Environmental Engineering, 135 (8), 677–683.* https://doi.org/10.1061/(ASCE)EE.1943-7870.0000031

- **Scénario S-1 :** Ce scénario présente le lieu d'enfouissement avec des matières résiduelles déposées peu compactées. La masse volumique varie de 3,9 kN/m³ à 5,1 kN/m³. Dans ce cas, le taux d'infiltration est évalué à 108 mm/h, reflétant un compactage faible et un rapport de vides élevé.
- **Scénario S-2 :** Ce scénario présente le lieu d'enfouissement en exploitation, est caractérisé par une accumulation progressive des matières résiduelles, avec une compaction modérée. La masse volumique se situe entre 5,5 kN/m³ et 7,0 kN/m³, et le taux d'infiltration diminue jusqu'à 40 mm/h.
- **Scénario S-3 :** Ce scénario présente le lieu d'enfouissement à la fin d'exploitation, est caractérisé par une accumulation maximale des matières résiduelles, avec une compaction forte. La masse volumique se situe entre 7,0 kN/m³ et 10,0 kN/m³, et le taux d'infiltration diminue jusqu'à 10 mm/h.
- **Scénario S-4** : Ce scénario présente le lieu d'enfouissement entièrement compacté et recouvert (remblayé avec du sol naturel excavé, une couche de sol organique et une végétalisation ensemencée). La forte compaction se traduit par une masse volumique comprise entre 10 kN/m³ et 14,5 kN/m³ et une conductivité hydraulique réduite à 3 mm/h.

Le **Tableau 1-8** résume les scénarios simulés sur PCSWMM.

Tableau 1-8 - Paramètres des scénarios simulés sur PCSWMM

Scénario	Description du scénario	Masse volumique (KN/m³)	Taux d'infiltration (mm/heure)	État
S-1	Dépôt initial : matières résiduelles, peu compactées	3,9 à 5,1	100	Site en exploitation
S-2	Accumulation des matières résiduelles: compaction modérée	5,5 à 7,0	40	Site en exploitation
S-3	Accumulation des matières résiduelles: compaction forte	7,0 à 10,0	10	Fin d'exploitation
S-4	Dépôt fortement compacté et recouvert	10,0 à 14,5	3	Site fermé

1.3 Résultats et analyse

Scénario S-1 et S-2 - Infiltration de 95% des précipitations en moins de 24 heures : Les simulations S-1 et S-2 avec, respectivement, une compaction faible (5,1 KN/m³) et une compaction modérée (7,0 KN/m³) montre que le site d'enfouissement est capable d'infiltrer la quasi-totalité des précipitations (95 % des pluies) dans un délai de moins de 24 heures avec les récurrences allant de 25 ans à 100 ans (19,5 % de facteur d'augmentation de changements climatiques).

Scénario S-3 - Seuil d'infiltration en 24 heures : La simulation S-4 avec une forte compaction (10,0 KN/m³) montre que l'infiltration dure toute la journée (23 heures). À partir de ces taux d'infiltration, la durée d'infiltration dépasse les 24 heures : 9 mm/h pour une pluie 100 ans, 8 mm/h pour une pluie de 50 ans et 7 mm/h pour une pluie de 25 ans, avec la majoration de 19,5 % liée aux changements climatiques.

Le **Tableau 1-9** et la **Figure 1-2** présentent les courbes d'infiltration sur une durée de 24 heures pour les S-1, S-2 et S-3.

Tableau 1-9 - Résultats pour les scénarios S-1, S-2 et S-3 (100 ans + CC)

Scénario	Taux d'infiltration maximal (mm/h)	Volume total infiltré (mm)	Durée d'infiltration du pic (heures)	Durée d'infiltration (heures) – infiltration de 95 % des précipitations
S-1	108,00	148,3	0,5	16,0
S-2	38,56	148,3	3,0	18,0
S-3	9,86	148,3	10,0	23,0

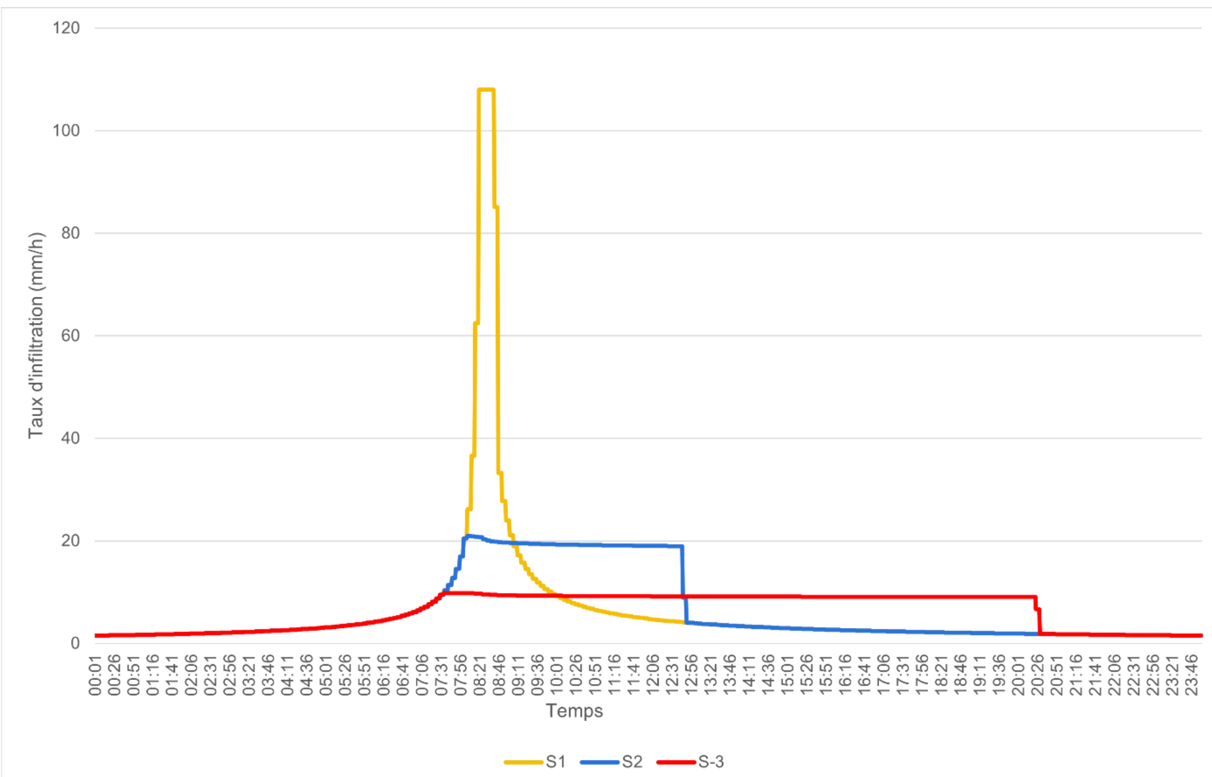

Figure 1-2 - Taux d'infiltrations dans 24 heures pour les scénarios S-1, S-2 et S-3

Scénario S-4 - Infiltration limitée : Pour le scénario final, S-4, les eaux suivent un écoulement gravitaire préférentiel, se dirigeant majoritairement vers le sud-est du site ainsi que vers la route Nord. L'infiltration totale pour ce scénario est d'environ 12 mm (taux d'infiltration maximal = 4,5 mm/h), sur une couche d'au moins 0,6 m sur la surface compactée.

Avec l'exploitation du lieu de l'enfouissement, la compaction progressive des matières résiduelles diminue la perméabilité et ralentit ainsi l'infiltration. Avec les scénarios simulés, le site est toujours capable d'infiltrer les eaux des précipitations dans un délai de 24 heures.

1.4 Conclusion

La modélisation hydrologique sous PCSWMM a permis d'évaluer la capacité d'infiltration du lieu d'enfouissement pour plusieurs scénarios et événements pluviométriques.

Les résultats montrent qu'avec une compaction modérée à forte, le site est capable d'infiltrer 95 % des précipitations en moins de 24 heures (6 h pour le pic et 18 h pour la totalité des précipitations) pour la récurrence de 100 ans (+ 19,5 % CC).

La capacité d'infiltration du site est limitée à un taux maximal de 9 mm/h pour cette même récurrence, correspondant à un degré de compactage supérieur à 10 kN/m³. Au-delà de ce seuil, l'infiltration se ralentit, augmentant ainsi la présence des eaux dans le massif pour une durée plus longue.

Il est à noter que l'eau peut s'accumuler temporairement, mais l'aménagement du lieu favorise que l'ensemble de l'eau reste entièrement confiné, ce qui mène graduellement à son infiltration, assurant ainsi l'équilibre hydrologique de l'installation.

2 QUESTIONS MELCCFP – QC - 12

QC – 12. Dans les sections 4.2.2 et 4.2.3, le promoteur présente le réseau hydrographique du secteur du projet de LEET, mais il ne se prononce pas quant aux risques d'inondation pouvant survenir au site. Toutefois, ce point est abordé à la section 6.2 de l'annexe B (page 201) : « Site 4 has sufficient drainage and it is located behind a hill, away from flood response areas ».

L'article 14 du REIMR spécifie qu'il « est interdit d'aménager un lieu d'enfouissement technique dans la zone inondable d'un cours ou plan d'eau, qui est comprise à l'intérieur de la zone inondable de faible courant ».

Le promoteur doit confirmer, documents à l'appui, que le site choisi ne se trouve pas dans une zone inondable de faible courant. S'il ne dispose pas de la cartographie nécessaire pour cette démonstration, il doit présenter des explications supplémentaires, autres que celle mise de l'avant dans le document d'étude sur la sélection du site, lui permettant d'évaluer les risques d'inondations au site.

2.1 Réponse

Avec la non-disponibilité d'une cartographie officielle des zones et territoires inondables pour toute la région de Nemaska, ces éléments ont été vérifiés pour s'assurer des limites des plaines inondables par rapport au lieu d'enfouissement à aménager :

- Selon les courbes de niveau, l'emprise du site se situe à une altitude moyenne de 260 m (**Figure 2-1**);
- À environ 1,3 km, l'altitude du cours d'eau est de 239 m (dénivellement de 21 m sur une distance de 1,3 km), orientant naturellement tout débordement vers la vallée et non vers le site d'enfouissement (BluMetric Environmental Inc., 2023 mise à jour 2025, Fig. 2);
- Les courbes de niveau très serrées (passage d'une altitude de 260 m à une altitude de 240 m) forment une barrière naturelle, ce qui explique que même en cas d'inondation, le site ne sera pas atteint (BluMetric Environmental Inc., 2023 mise à jour 2025, Fig. 2);
- Les relevés piézométriques, effectués à plusieurs périodes de l'année (décembre 2017, août 2020, juin 2021), montrent que la nappe reste toujours à plus de 2 m sous la surface. Et, comme le sol n'était pas saturé lors de ces trois campagnes, aucune inondation ne s'est produite à ces périodes.

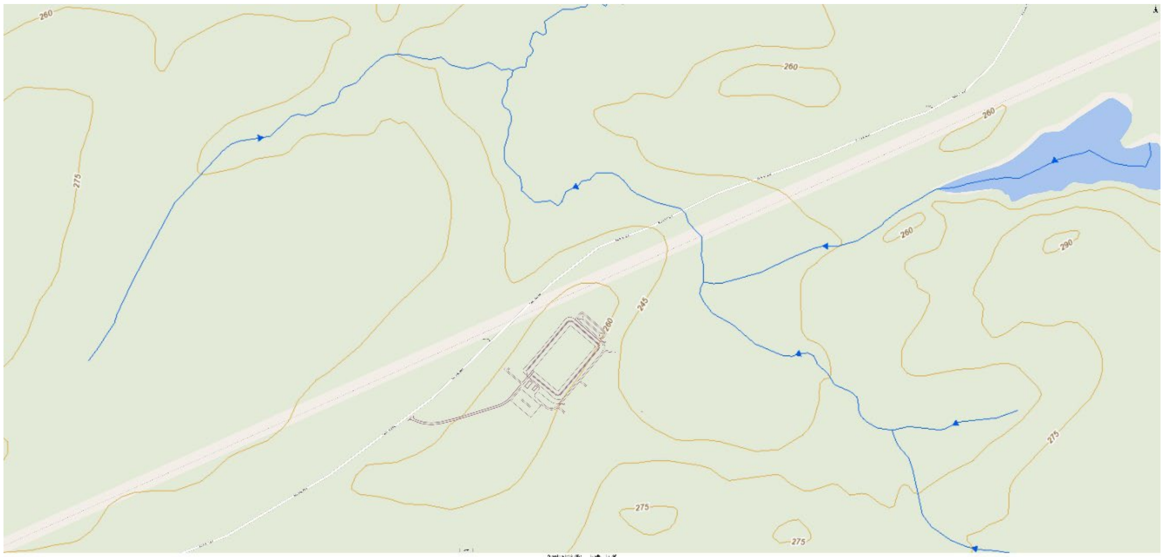

Figure 2-1 - Topographie et directions d'écoulement des ruisseaux près du lieu d'enfouissement

Annexe A – Évaluation de l’impact climatique du lieu d’enfouissement proposé à Nemaska (version finale 2023)

Stantec

Proposed Nemaska Landfill Climate Impact Assessment

FINAL REPORT

Prepared for:

Cree Nation of Nemaska

Prepared by:

Stantec Consulting Ltd.

167020077-300-102-CC-R-0001-0
October 30, 2023

The conclusions in the Report titled *Future Nemaska Landfill Climate Impact Assessment* are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

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Abbreviations

CNN	Cree Nation of Nemaska
GHG	Greenhouse Gas
ICLR	Institute for Catastrophic Loss Reduction
IDF	Intensity-Duration-Frequency
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
RCP	Representative Concentration Pathway
SDBJ	Société de Développement de la Baie-James
UNEP	United Nations Environment Programme
WMO	World Meteorological Organization

1.0 INTRODUCTION

1.1 BACKGROUND

The objective is to perform a high-level assessment of risks to the proposed infrastructure due to meteorological events based on future climate projections in the area. The methodology used for this assessment is inspired from Infrastructure Canada's Climate Lens Guidance (Infrastructure Canada 2019), an accepted methodology for the assessment of climate risks.

As a first step, we catalogued the components that could be exposed and affected by meteorological events. In collaboration with the project team, we defined the infrastructure assets that were the subject of the assessment (access road, landfill itself, operations).

Current climate trends were obtained from Environment Canada's weather stations in proximity of the infrastructure being assessed. Stantec used state-of-the-art analytical tools to develop trends for a wide range of climate parameters, including precipitation, temperatures, and wind. We produced future climate projections for the area and complemented our analysis with information available in the published literature. Future climate projections were based on the Intergovernmental Panel on Climate Change (IPCC) greenhouse gas (GHG) emissions scenarios. Our experience in climate risks assessments of built and natural infrastructure is to use the Representative Concentration Pathway (RCP) 8.5 since global GHG emissions in the past years are closer to these projections (see Appendix B). The recent IPCC Special Report on Global Warming of 1.5ºC (October 8, 2018) supports the selection of the RCP 8.5 for this assessment.

We identified meteorological events that could cause structural or functional failures, or losses in levels of service. This climate information, combined with knowledge that the constructed assets will be in new condition and good working order, were used to determine the vulnerability of the assets to the current climate. This vulnerability was then reassessed to allow for potential changes in the severity of impacts if similar or stronger meteorological events were to happen in the future – within the project's intended lifespan and assuming proper operational maintenance procedures keep the assets in good condition.

Risks to the infrastructure were determined from the current and future climate events with respect to selected performance criteria such as structural integrity, functionality, and operational issues. Once the risk profile for the assets under consideration was developed, Stantec identified the impacts an asset failure would have on the community and on the environment.

1.2 RESSOURCES USED FOR THIS DOCUMENT

The present document provides a synthesis of various climate sources used to assess historical trends, observations, and future climate projections in the area of the proposed landfill.

The main sources for the information presented in this document are:

- Environment and Climate Change Canada weather station;
- Environment and Climate Change Canada and Natural Resources Canada gridded interpolated observational data (NRCANmet);
- Pacific Climate Impacts Consortium (PCIC) Climate Explorer;
- Environment and Climate Change Canada downscaled climate scenarios for Canada;
- State of Climate Change and Adaptation Knowledge for the Eeyou Istchee Bay Territory, Ouranos (2017);
- FNQLSDI, Portrait of First Nations Challenges in Terms of Infrastructure and Emergency Management in the Face of Climate Change (2017); and
- University of Western Ontario, Institute for Catastrophic Loss Reduction (ICLR), computerized Intensity-Duration-Frequency (IDF) generator- see http://www.idf-cc-uwo.ca/.

1.3 LIMITATIONS

This climate change impacts assessment was completed using the best information available to the assessment team at the time of the study. The focus of the assessment presented in this report is on the proposed Nemaska Landfill Site.

Since the Project is at the conceptual design phase, this study is a high-level assessment of the future climate risks to the proposed assets grouped, as needed, based on their function and vulnerability to climate events.

The climate data and trends (current and future projections) used in this study were obtained from various sources, and the analysis was performed by Stantec climatologists at a level of detail commensurate to the assessment. Cross-verification between climate information sources was conducted where possible to identify potential discrepancies between the data sources used. Uncertainty in the climate data collected was considered while performing this assessment, based on the team’s knowledge of the study region and depending on the analysed climate impact on infrastructure.

1.4 METHODOLOGY

The methodology used to assess the future climate impacts on the proposed landfill and associated infrastructure was designed to identify the potential risks associated with future changes in climate and extreme weather events. The objective was to perform a high-level assessment of risks to the Project infrastructure due to extreme weather and climate uncertainty based on current climate and future climate projections in the area. This could include but would not be limited to impacts due to changes in temperature, precipitation, and wind.

The process used in this assessment aligns with International Organization for Standardization (ISO) 31000:2018 Risk Management Framework and ISO 14090:2019 Adaptation to Climate Change. The general intent of these methodologies is to identify relevant climate variables and relevant infrastructure responses, develop a risk evaluation matrix, and assign risk ratings to each infrastructure-climate interaction. This includes an estimate of the severity of climate impacts on the infrastructure systems (i.e., deterioration, damage, or destruction) to enable the identification of higher risk components and the nature of the impacts from the climate change threat. This information can be used to make informed engineering judgments on what components require adaptation as well as how to adapt them e.g., design adjustments, changes to operational or maintenance procedures.

The methodology used in this assessment of climate risks to the proposed landfill site is summarized below in Figure 1.

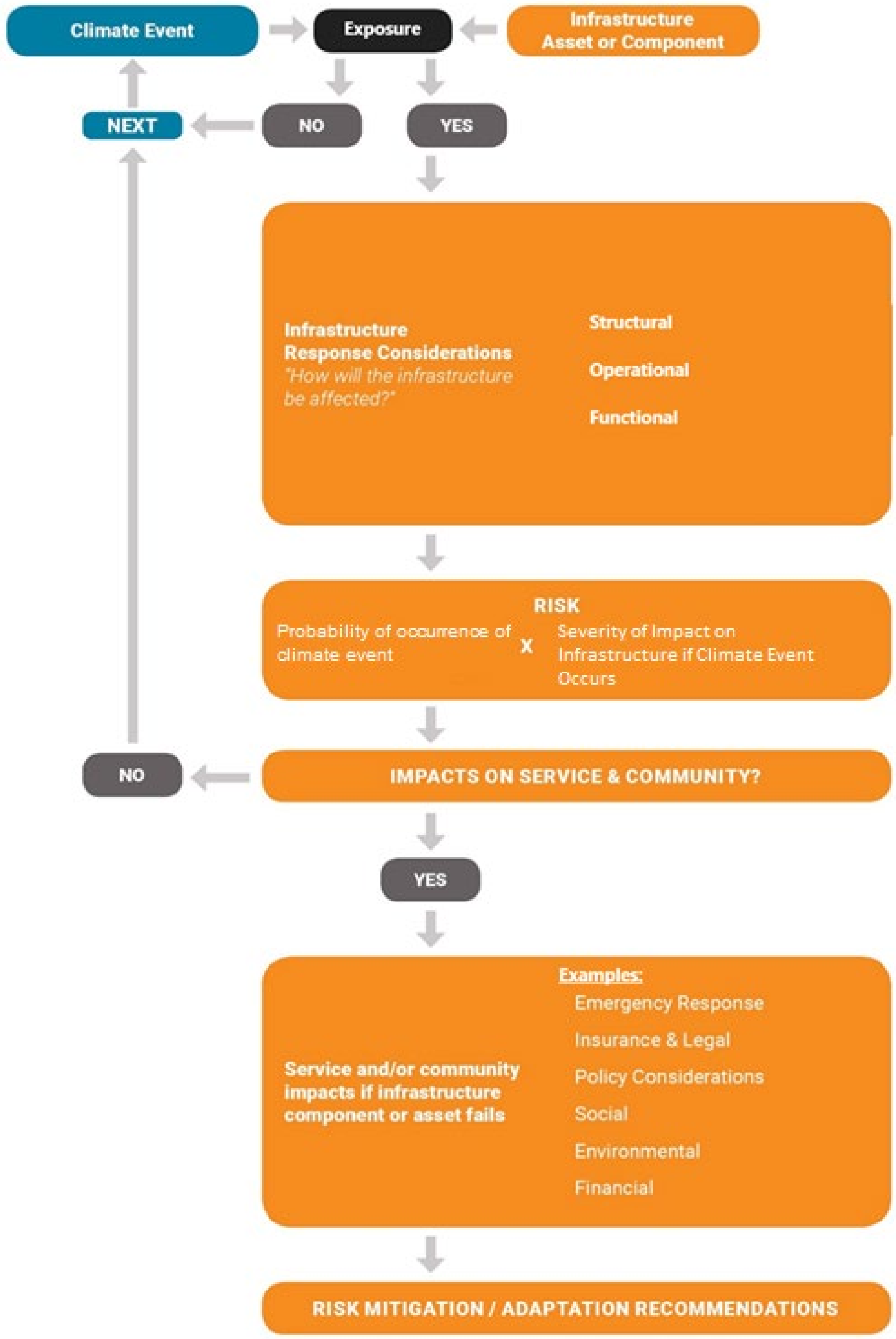

Figure 1 Illustration of the risk assessment process

1.5 TIME HORIZON

Depending on standard operational practices, the expected lifespan of the proposed Nemaska landfill site is 35 to 45 years. In order to represent the climate at the end of the useful life of the facility (operational lifespan), the future climate scenario in this study will be projected to the 2050, which corresponds with the 30-year period between 2041 and 2070. To help inform planning and operations following the closure of the proposed Nemaska Landfill, projections for the 2080 (2071-2100) have also been presented.

1.6 PLAUSIBLE CLIMATE SCENARIOS

Climate modelling uses various GHGemissions scenarios, known as RCPs, to project future climate variables under different concentrations and rates of release of GHGs to the atmosphere, as well as different global energy balances.

Various future trajectories of GHG emissions are possible depending on the global mitigation efforts in the coming years. RCPs are established by the IPCC, the international body for assessing the science related to climate change. The IPCC was set up in 1988 by the World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP) to provide policymakers with regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation (IPCC 2014).

The IPCC has set four GHG emissions scenarios through RCPs. RCP 8.5 is the internationally recognized most pessimistic - “business as usual” GHG emissions scenario. Other GHG emissions scenarios represent more substantial and sustained reductions in GHG emissions: RCP 6, 4.5 and 2.6 (Figure 2). For example, the RCP 2.6 emissions scenario may be achievable with extensive adoption of biofuels/renewable energy and large-scale changes in global consumption habits, along with carbon capture and storage. RCP 2.6 is representative of a scenario that aims to keep global warming below 2°C above pre-industrial temperatures. RCP 4.5 is considered the ‘medium stabilization’ scenario where global mitigation efforts result in intermediate levels of GHG emissions (IPCC 2014).

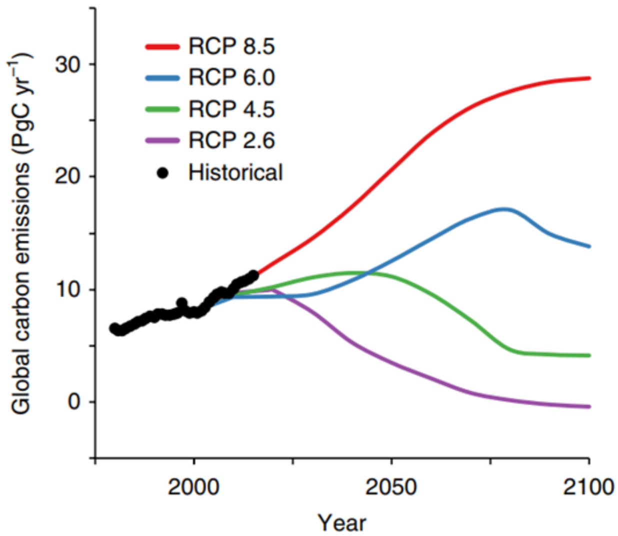

Figure 2 Historical CO_2 emissions for 1980-2017 and projected emissions trajectories to 2100 for the four Representative Concentration Pathway (RCP) scenarios (Smith and Myers 2018).

Although some progress has been made, current estimates of GHG emissions are still close to following the RCP 8.5 path and thus this assessment is based on climate parameters estimated under the RCP 8.5 scenario. The recent IPCC Special Report on Global Warming of 1.5 ºC (IPCC 2018) supports this selection.

2.0 CURRENT AND FUTURE CLIMATE

2.1 OBSERVATIONS RELATED TO RECENT CLIMATE CHANGES AND CURRENT CLIMATE

The results of Stantec's investigation in the current climate and recent climate change trends in the Nemaska area are detailed in Appendix B. Nemaska falls in the Boreal Shield Ecozone of Canada. This subarctic climate is characterized by relatively short summers with prolonged periods of daylight and cool temperatures, and winters that are long and very cold. Mean summer temperatures range between 6°C and 11°C, mean winter temperatures range between -11°C and -24.5°C east of Hudson Bay, and [mean annual precipitation] ranges 500mm-800mm.[1] The Nemaska area falls within the region classified by Natural Resources Canada as having "Isolated Patches of Permafrost with ice wedges" which is defined as having 0-10% of land area underlain by permafrost.[2]

Stantec's climate projection research indicated that in recent decades the area has seen an increase in temperatures in all seasons, an increase in rainfall in all seasons, and a decrease in snowfall, particularly in the fall and spring months. Stantec's research into these general trends are detailed in Appendix B, while they are compared to an Ouranos 2017 report titled State of Climate Change and Adaptation Knowledge for the Eeyou Istchee James Bay Territory, in Appendix A. In Stantec's experience, it is important to verify observational trends with local community representatives, where possible. Variability in firsthand weather reports can be expected given that people form their memories from different experiences. For example, the severity of a rainstorm will be remembered differently by someone who was outside during the storm as opposed to someone who maybe spent that time indoors. As part of another project to increase the Cree Nation of Nemaska (CNN) resilience to climate change, community members were asked to provide observations related to climate. This information was used to complement scientific data. Table 1 shows community member's input.

Table 1 Observed Direct and Indirect Climatic Changes

DIRECT Climatic Changes	INDIRECT Climatic Changes
Increased Temperature	- Heat wave (44˚C) - Hotter summers - Longer summers - Big forest fires, with dense smoke above the fire and lightning on top - Warmer water temperatures - More freeze-thaw cycles.

[1] A National Ecological Framework for Canada: Attribute Data. Marshall, I.B., Schut, P.H., and Ballard, M. 1999. Agriculture and Agri-Food Canada, Research Branch, Centre for Land and Biological Resources Research, and Environment Canada, State of the Environment Directorate, Ecozone Analysis Branch, Ottawa/Hull.

[2] The National Atlas of Canada 5th Edition: Her Majesty the Queen in Right of Canada, Department of Energy, Mines and Resources, 1995

DIRECT Climatic Changes	INDIRECT Climatic Changes
Decreased Temperature	- Cold snaps - Colder winter - Longer winter.
Variable Precipitation (increased and decreased)	- Spring runoff/flooding - Big, but short, downpour - Freezing rain (lots) - More snow and more wet.
Extremes	- Drought - Straight line winds (pockets of air) - High winds - Increase in storm intensity. Storms produce more damage. - Tornado in the Saint-Félicien and Chibougamau area.

2.2 OBSERVATIONS RELATED TO FUTURE CLIMATE CHANGES

2.2.1 Temperature

The data and literature show that the air temperature is warming and will continue to increase; seasonal increases vary, with the strongest increase in Winter, followed by Spring and Autumn (see Appendix B for seasonal data).

Frost free days (Appendix B) are expected to increase significantly as shown below.

- Historical 1984 - 2013 average frost-free days: 151
- Projected RCP 8.5 2020 average frost-free days: 164
- Projected RCP 8.5 2050 average frost-free days: 181
- Projected RCP 8.5 2080 average frost-free days: 198

2.2.2 Rainfall

Winter rain events show an increased occurrence in recent years. The data shows slight increases in rainfall in the Spring and Autumn. Summer rainfall shows a slight decrease (Appendix B).

Ouranos (2017) indicates "+13-20% and more extreme precipitation. High uncertainty about the amplitude of the increase and regional variability." The IDF curves generated using the ICLR Computerized IDF Generator confirm the above statement and show significant increases in extreme precipitation. For example:

- The intensity of a 50-yr return, 30 minutes storm is projected to increase by 31 % (current: 76.8 mm/hr; future: 100.3 mm/hr) by the 2080.
- The intensity of a 100-yr return, 10 minutes storm is projected to increase by 51 % (current: 147.6 mm/hr; future: 194.3 mm/hr) by the 2080.

The above also points to an increase in the frequency of rain events. In the example of the 50-yr return rainfall above, it is projected this event will have a return period of less than 25 years in the future.

2.2.3 Snow

Ouranos (2017) reports “Decrease in snow cover and duration in the North and change of its characteristics. Large year-to-year variability and likelihood of differing snow trends across the region (potential increase in the South)”.

3.0 POTENTIAL IMPACTS OF CLIMATE CHANGES ON LANDFILL INFRASTRUCTURE AND OPERATIONS

This section provides a brief discussion on the main climatic and weather-related impacts that are anticipated to cause impact on the proposed landfill infrastructure and operations at the proposed Nemaska landfill site.

3.1 TEMPERATURE

Changing temperature regimes are likely to result in a number of effects to the local environment, such as potential impacts to permafrost soils, changes in the biochemical activity in waste material and surrounding soils, and possible changes to local hydrology and hydrogeology. A high-level review of potential impacts to the proposed landfill development and operation due to changing temperature patterns are summarized below:

- Altered decomposition rates within the landfill and surrounding soils;
- Increased odor and pest activity may cause more challenging working environments for site operators and other nearby activities;
- Higher insect activity, which are a potential vector for infectious diseases;
- Alteration of seasonal freeze and thaw periods (i.e. fall and spring) may result in changes to local hydrological and hydrogeological patterns and possible changes to leachate production rates; and
- Increased stress on vegetation and planting in the project area, which may also have on impact of the stability of slopes due to potential increased erosion.

3.2 PRECIPITATION

Projected changes in precipitation patterns in the area have the potential to produce a wide range of impacts to the local environmental conditions, including flood risks, changes to hydrology and hydrogeological systems, and soil stability. A high-level review of possible impacts to the proposed landfill due to projected changes in local precipitation are as follows:

- Increased ponding or flooding risks;
- Altered decomposition rates within the landfill and surrounding soils;
- Altered hydrological and hydrogeological patterns and possible changes to leachate production rates; and
- Increase slope stability and/or erosion risks.

3.3 STRONG WINDS

Projected changes in the strength and frequency of strong wind events in the northern regions could impact a number of environmental factors. An increase in daily wind gusts is projected into the 2050 (Ouranos 2017). Potential impacts to the proposed landfill due to an increase in the strength and frequency of high wind gusts includes:

- The generation of blowing dust, debris, and litter;

- The dispersion of odors from the landfill site;
- Potential impacts to the Hydro-Québec electrical transmission lines, located adjacent to the site; and
- Hazardous working conditions for personnel and for the operation of high-profile heavy equipment.

4.0 RISK ASSESSMENT

The following subsections provide an overview of impact severity (should a climate event occur), the probability of a climate variable occurring, and risk evaluation. The results of this assessment of risk will then be summarized in Sections 4.4 and 4.6.

4.1 PROPOSED INFRASTRUCTURE

The Project consisted of the development of a proposed landfill site to be located along Route du Nord, approximately 6 km southeast of the Nemaska community. The infrastructure assessed in this study is therefore associated with the proposed landfill, its construction, operation activities, and the surrounding environment. The Project infrastructure systems were grouped into the categories as presented in Table 2.

Table 2 List of Project Components Being Assessed

Infrastructure Category	Infrastructure Element
Access Road	Access road
	Ditches and roadway drainage
Waste Disposal Site	Onsite heavy equipment
	Onside drainage
	Uncovered waste
	Covered waste
	In-situ soil
	Stockpiled soil
	Cover material
	Leachate
Staff	Operations Staff
Site Surroundings	Wetlands
	Wildlife
	Forests
Third Party Interactions	Site Access: Rte du Nord owner (Hydro-Quebec)
	Site Access: Rte du Nord operator (SDBJ*)
	Hydro-Quebec transmission line and corridor

* SDBJ: Société de développement de la Baie-James

The means by which impacts occur on an exposed asset is considered through three “Impact Criteria”, as described in Table 3: structural integrity, operations and maintenance, and functionality. These performance criteria help to define how an exposed asset is impacted by a given climate event and provides a framework for considering the potential impacts of climate and extreme weather events on the Project’s components.

Table 3 Impact Criteria

Impact Criteria	Criteria Description	Examples of Impact Response
Structural Integrity	The climate event results in physical damage or deterioration to the infrastructure component.	- Component Failure - Component Deterioration - Increased Loading / Stress - Change in Materials Performance - Increased Insurance Claims/Needs
Operations & Maintenance (O&M)	The effect the climate event will have on the operations and other staff to perform their tasks, on additional inspections, maintenance and repairs to maintain the infrastructure performing to its intended capacity and level of service.	- Occupational Safety, Health & Safety - Reduced Serviceability - Increased Maintenance / Replacement Cycles and Frequencies - Increased Operation and Maintenance Cost - Change in Operational Performance
Functionality	The climate event results in a reduction in the capacity of the infrastructure component to perform its design function at its original/current condition.	- Violation of Policies and Procedures - Reduced User / Tennant Comfort - Public/Occupant Health and Safety Hazard - Temporary or Permanent Loss of Capacity

The extent to which damages or loss of service occurs on a particular asset and the subsequent impacts on the Project components are captured by a severity index, which rates the impact of select climate events on exposed infrastructure. This is presented as a 5-point scale (1 = ‘insignificant’ and 5 = ‘catastrophic’), as presented in Table 4.

Table 4 Severity of Impacts Rating Scale

Severity Score	Severity Rating	Criteria / Comments
1	Insignificant	- No serious impact from a weather event - Repaired through regular operations and maintenance cycle
2	Minor	- Repair possible by local expertise - Costs covered by regular operations and maintenance cycle - No loss of service
3	Moderate	- Some damage to infrastructure - Extra costs and labour required to complete repairs - Assistance required from outside of the community for repairs - Some loss of service
4	Major	- Significant damage to infrastructure - Significant extra costs and labour required to complete repairs - Requires parts, services from outside of the community, and additional funding outside of capital and O&M budget allocation - Significant loss of service
5	Catastrophic	- Complete loss of the asset after a weather event - Repair not possible, replacement of component required - Extended period of loss of service, requiring alternative service arrangements for the community

The above performance criteria and severity ratings were used in conjunction with the probability of climate event occurrence (Section 4.2) to develop the risk rating for a particular climate impact, as discussed under Section 4.3.

4.2 CLIMATE CHANGES

The trends indicated for each climate parameter are based on the change in probability from the current climate to the future climate. For this assessment, a rating scale of 1 to 5 for the probability (likelihood) of a climate event occurring was adopted (Table 5). The probability score is assigned based on the evaluation of historical occurrences and future climate projections for each climate variable.

Table 5 Probability Rating Scale Based on Climate Event Occurrence

Score	Probability of occurrence	
	Description	Return period
1	Highly unlikely	1 in 100 years
	Improbable	
2	Remotely possible	1 in 20 years
3	Possible	1 in 10 years
	Occasional	
4	Somewhat likely	1 in 5 years
	Normal	
5	Likely	> 1 in 2.5 years
	Frequent	

Climate parameters and respective intensity thresholds selected for this assessment are presented in Table 6. The intensity thresholds were selected based on local extreme conditions and industry thresholds. Table 6 also presents the probability (likelihood) rating for each climate parameters in the current and future projected (2080) climates.

Table 6 Current and Future Probability Rating for Selected Climate Variables

Parameter Type	Climate Parameter	Parameter Threshold	Trend	Probability Scores		
				Baseline (1981 - 2010)	Projections (2050)	Projections (2080)
Temperature	High Maximum Temperatures	Tmax >= 30°C	→	5	5	5
	Heat Waves	Heat Waves	↗	4	5	5
	Increasing Mean Temperature	Overall increase (years warmer than 1981 - 2010 mean)	↗	4	5	5
	Low Temperatures	Very cold days (-30°C or less)	↘	5	4	3
Precipitation	Heavy Rainfall	50-yr storm	↗	2	2	3
	Increasing Mean Precipitation	Overall increase (more than 1981-2010 mean)	↗	4	4	5
Winds	High Wind Gusts	70 km/hr gusts	→	5	5	5
	Extreme Wind Gusts	90 km/hr gusts	→	5	5	5
Miscellaneous	Permafrost Degradation	Decreasing number of freezing days (currently 2200 freezing days on average)	↘	3	4	5

Probabilities of climate variable occurrence are used to help define the risk rating as per Section 4.3.

4.3 RISK EVALUATION

A Risk Rating can be developed for each climate-infrastructure interaction by assigning each a severity rating and a climate parameter probability rating. In this assessment, the Risk Rating is defined as the product of two rating schemes as in the formula below.

Risk Rating = Probability Rating x Severity Rating

- **Probability rating:** a rating that represents the probability (likelihood) of occurrence of a climate event above a selected threshold, ranging from 1 (highly unlikely) to 5 (likely)
- **Severity of impacts rating:** a rating of the impacts on the infrastructure asset or component should the climate event occur, ranging from 1 (insignificant) to 5 (catastrophic)

Risks are evaluated under current climate conditions to establish a baseline; future risks are assessed considering future (projected) climate changes. It is assumed that the proposed landfill infrastructure and other associated infrastructure and activities included in this assessment will undergo maintenance and repairs in the future as necessary to maintain them in a state of good repair and thus at a similar level of vulnerability to climate events as they are in the current climate. The vulnerability of the assets will increase if they are allowed to deteriorate thus increasing the risks to climate events. The deterioration of the Project components is not considered in this assessment, i.e., the severity of impacts rating remains constant in current and future climate conditions.

The calculation of risk through the product of the probability and the severity ratings provides numerical risk ratings from 0-25, as shown in Figure 3. The extents of this risk rating structure range from ‘Negligible’ to ’Extreme’ risks. Shock and stress situations represent special cases when severity is high and probability is low and when severity is low and probabilities are high, respectively. ‘Shock’ events are defined as rare, extreme and rapid/sudden-onset extremes conditions, causing an acute impact. ‘Stress’ events are defined as slow onset or “creeping” threats, causing chronic impacts.

Severity Rating	**Catastrophic**	**5**	**Shock**	10	15	20	25
	Major	**4**	4	8	12	16	20
	Moderate	**3**	3	6	9	12	15
	Minor	**2**	2	4	6	8	10
	Insignificant	**1**	1	2	3	4	**Stress**
			1	**2**	**3**	**4**	**5**
			Highly Unlikely (Improbable)	**Remotely Possible**	**Probable (Occasional)**	**Somewhat Likely (Normal)**	**Likely (Frequent)**
			Probability Rating				

Figure 3 Risk Rating Structure

Impacts of climate change on assets can include structural damage, reduced service life of assets and their components, and increased stress to systems and operations. These impacts can, for example, result in higher repair and maintenance costs, loss of asset value, strain on resources and may cause service interruptions.

Risk classifications, as defined in Figure 3, are presented in Table 7 along with their respective descriptions and level of risk treatment recommended.

Table 7 Risk Classification

Risk Classification	Risk Rating	Description of Risk	Risk Treatment
Negligible	1,2	• No permanent damage. • No service disruption occurs.	Risks do not require further consideration
Low	3,4,6	• Minor asset/equipment damage. • Minor service disruption may be possible. • No permanent damage. • Minor repairs or restoration expected.	Controls likely, but not required.
Moderate	5,8,9	• Expected limited damage to asset or to equipment components. • Minor repairs and some equipment replacement may be required. • Brief service disruption may be possible.	Some controls required to reduce risks to lower levels. Risk to be monitored for changes over time.
High	10,12, 15,16	• May result in significant permanent damage; or loss of asset or component that may require complete replacement. • More lengthy service disruption may be possible.	High priority control measures required.
Extreme	20,25	• May result in significant permanent damage; or loss of asset or component that may require complete replacement. • Significant service disruptions may be possible.	Immediate controls required.

4.4 CLIMATE RISKS PROFILE

The risk evaluation process described in the above sections was used to apply the probabilities of climate event occurrence and risk ratings for each climate-infrastructure interaction that were calculated. This was done both for the current climate as well as the future climate, which for this assessment is represented by the 30-year period around 2050 (2041-2070) and 2080 (2071-2100). Future risks assume that assets will be well maintained and in good condition, else the risk will be greater.Table 8 provides a summary of 'Moderate', 'High' and 'Extreme' rated risks. In order to focus the risk profile, climate-infrastructure interactions that yielded a 'Negligible' risk rating (i.e. a rating of 0) or a 'Low' risk rating (i.e. a rating of 3, 4, or 6) are assumed to not require further consideration and have not been identified in Table 8.

Table 8 Climate Impacts and Risk Ratings

Climate Parameter and Threshold	Infrastructure Element	Infrastructure Response	Impact	Risk Rating Legend: N L M H E Current Climate	Future Climate (2050/2080)	Potential Mitigation Measure
N: Negligible	L: Low		M: Moderate	H: High		E: Extreme
↑: Increasing Trend			↓: Decreasing Trend		↔: Stable Trend	
High Max Temperature (Tmax ≥ 30°C)	Operational Staff	Functionality	Heat stress on site attendants and operators.	10	10 (↔)	Consider the incorporation of a shelter in the site design. Allow for frequent water breaks. Ensure use of clothing and PPE that is breathable.
Heat Waves	Operational Staff	Functionality	Heat stress on site attendants and operators.	12	15 (↑)	
Low Temperatures (< 30°C)	Heavy Equipment	Functionality	Equipment may not perform optimally and there is a potential for stress on certain components (for example: battery, engine, starter).	5	4 (↓)	Inspect and lubricate equipment before the winter season each year to ensure that machinery is in good working order.
	Operations Staff	Functionality	Cold stress on attendants and operators.	10	8 (↓)	Consider the incorporation of a heated shelter in the site design and allow for frequent breaks.
Heavy Rainfall (50-year storm)	Access Road	Structural Integrity O&M Functionality	Potential for ponding/flooding, channelization, or washouts under heavy rainfall events.	8	8 (↔)	Frequently inspect drainage systems for blockages and effective operation. Regrade roadway as needed.
	On-site Drainage	O&M Functionality	Potential for drainage issues to occur, including ponding, high water table, and contamination of runoff	8	8 (↔)	Frequently inspect drainage systems for blockages and effective operation. Inspect landfill edges and adjacent environment for signs

Climate Parameter and Threshold	Infrastructure Element	Infrastructure Response	Impact	Risk Rating Legend: N L M H E Current Climate	Risk Rating Future Climate (2050/2080)	Potential Mitigation Measure
N: Negligible	L: Low	M: Moderate	H: High	E: Extreme		
↑: Increasing Trend		↓: Decreasing Trend		↔: Stable Trend		
			under heavy rainfall events. Erosion of final cover at end of life.			of contaminated runoff or seepage.
Increased Mean Precipitation	Leachate	O&M	Increased leachate generation and high water table with increased mean precipitation	8	8 (↔)	Maintain environmental monitoring program to continually monitor the groundwater quality migrating off-site. Upon site closure, select a low-permeability cover material if leachate concentration is an issue.
Wind Gusts (High: 70 km/h) (Extreme: 90 km/h)	Heavy Equipment	Functionality	Strong wind gusts on high-profile equipment on potentially uneven or unstable soil could be hazardous.	High: 10 Extreme: 15	High: 10 Extreme: 15 (↔)	Limit the use of heavy equipment during high wind events, particularly on high or steep grades and uneven or unsettled terrain.
	Uncovered Waste	O&M	Wind-blown waste could result in litter scattering throughout the site and potentially beyond site limits.	High: 10 Extreme: 15	High: 10 Extreme: 15 (↔)	Cover waste at appropriate time intervals to minimize to amount of exposed waste. Monitor weather and cover loose waste if high winds are forecasted.
	Stockpiled Soil	O&M	Wind-blown sandy debris could result in the suspension of particulates in the air and could be a risk to	High: 10 Extreme: 15	High: 10 Extreme: 15 (↔)	Limit the height of material stockpiles to lower their profile.

Climate Parameter and Threshold	Infrastructure Element	Infrastructure Response	Impact	Risk Rating Legend: N L M H E Current Climate	Future Climate (2050/2080)	Potential Mitigation Measure
N: Negligible	L: Low	M: Moderate	H: High	E: Extreme		
↑: Increasing Trend	↓: Decreasing Trend	↔: Stable Trend				
			human and environmental health.			
	Operations Staff	Functionality	Strong winds could present health and safety challenges to on-site workers.	High: 5 Extreme: 10	High: 5 Extreme: 10 (↔)	Exercise caution when working in windy conditions. Cover exposed waste and pick up loose debris that could blow and potentially cause injury during high wind events.
	Hydro-Québec Transmission Line and Corridor	Structural Integrity O&M Functionality	Third-party risk; see Section 4.5.4.	High: 5 Extreme: 10	High: 5 Extreme: 10 (↔)	Third-party risk; see Section 4.5.4.
Permafrost Degradation	Route du Nord	Structural Integrity O&M Functionality	Third-party risk; see Section 4.5.4.	9	12 (↑)	Third-party risk; see Section 4.5.4.
	Hydro-Québec Transmission Line and Corridor	Structural Integrity	Third-party risk; see Section 4.5.4.	6	8 (↑)	Third-party risk; see Section 4.5.4.

4.5 OTHER RISK ASSESSMENT CONSIDERATIONS

There are some potential climate impacts to the proposed Nemaska Landfill project that are not easily described using a risk assessment format. These impacts are further discussed below.

4.5.1 Permafrost

Although the landfill site is not affected by permafrost, there could be isolated patches creating potential impacts of permafrost degradation on third party services. As described previously, the National Atlas of Canada 5th Edition for Permafrost in Canada indicates the Nemaska region to be on the boundary between two permafrost zones:

- Isolated Patches with Ice Wedges, with 0-10% of land area underlain by permafrost; and
- Sporadic Discontinuous Permafrost with Ice Wedges, with 10-50% of land area underlain by permafrost.

By this definition, it seems possible that permafrost conditions may exist; however, in sporadic discontinuous permafrost zones it is common that permafrost only persists in peatlands.[3] Peatlands are present immediately to the south of the proposed landfill site.

4.5.2 Wildfires

An impact not included in the risk matrix is the occurrence of fires. In the context of this project, there could be potential impacts of both wildfires and waste fires at the landfill site. Although wildfires and waste fires themselves are not considered climate events, future conditions due to climate change may increase the risk of fires.

Based on the assumption that fires are most prevalent in hot and dry conditions, the temperature and precipitation projections for summers in the future climate are valuable in assessing this risk. As shown in Appendix A, mean summer temperatures are projected to continue increasing, which may result in greater surface evaporation and drier soil/vegetation conditions. Furthermore, as shown in Appendix B, summer is the only season with a very small projected increase across all future periods. Based on the fact that future summers in the Nemaska area are projected to become hotter and receive little increase in precipitation, conditions susceptible to fires can be expected to increase.

There are other variables that contribute to fires which are more difficult to project in future climate conditions. One example is how the local vegetation may react to new climate conditions or if new species that are more fire prone migrate from the South. Changes in vegetation type and density that may be more susceptible to fire were outside the scope of this assessment.

[3] Government of Northwest Territories – Environment and Natural Resources, 13. Permafrost, 2014, https://www.enr.gov.nt.ca/en/state-environment/13-permafrost, Accessed 4Dec2018.

4.5.3 Site Surroundings

The site selected for the development of the proposed Nemaska landfill is located on a well-drained till ridge (drumlin) with a generally thin surface layer of organic matter (Poly-Géo 2017). The site area and near vicinity are generally comprised of intermixed shrubland and open deciduous forest (Québec Breeding Bird Atlas 2013). Tree cover at the site is generally comprised of jack pine and black spruce at varying densities (Poly-Géo 2017). Jack pine and black spruce populations are highly sensitive to fire cycles; longer wildfire intervals will reduce jack pine populations, while increased intervals will reduce black spruce populations (Le Goff and Sirois 2004). As discussed in Section 4.5.2, conditions susceptible to fires are expected to increase in the future, resulting in a potential loss of black spruce habitat in the area.

Ecological niche modelling estimates a total of 49 % of the land area in Northern Quebec to experience a species turnover of greater than 80 % as a result of species loss and movement due to climate change by the 2080 projection period (Berteaux et al. 2018). Species loss and movement due to range shifting under climate change is projected to have significant impacts on native wildlife populations due to changes in habitat suitability in Northern Québec. Although significant changes to community dynamics are expected, net species populations are anticipated to increase in northern areas as general species movement tends to be northward with average warming temperatures (Berteaux et al. 2018).

Changes to flora and fauna in the vicinity of the proposed landfill site could expose landfill site users and operators to new dangers and challenges including nuisance wildlife and new vectors for disease.

4.5.4 Third Party Interactions

The northern extents of the selected site boarders the Route du Nord highway and an electrical transmission line and corridor. The highway is owned by Hydro-Québec and is operated by the SDBJ and the transmission line and corridor are owned and operated by Hydro-Québec. Although these assets are not under the same jurisdictional control as those directly associated with the proposed landfill site, their management and any damages to these assets could significantly impact the operation of the landfill site.

Climate impacts to the highway, such as excessive snow or ice accumulation without proper maintenance could limit landfill site access and could result in hazardous conditions for users or operators attending the site. Physical damages such as roadway washouts could have similar impacts.

The electrical transmission line to the north of the selected site could be vulnerable to high winds and freezing rain events. Significant wind and freezing precipitation events could have damaging impacts on steel electrical transmission towers and conductors and could result in the swaying or galloping of conductors. Additionally, if permafrost is present in the vicinity of the tower foundations, its degradation could result in structural instability of the transmission towers. Complete collapse or line breakage could produce an ignition source for wildfires in the area.

4.6 RESULTS AND RECOMMENDATIONS

The proposed infrastructure and assets assessed under the projected effects of climate change in the Nemaska area were determined to be most at risk from increases in temperature and wind gusts. There were nine infrastructure-climate interactions that were assessed to have high risk ratings.

The greatest climate change threat to the project was determined to be the projected increase in frequency of heat waves on site attendants and operations personnel and the increase in the frequency of wind gusts on the operation of high-profile heavy equipment and on wind-blown dust and debris.

Exercising caution when working in challenging heat or windy conditions by taking frequent water breaks and seeking shelter as needed will be required to protect the workers at the site. High winds can present challenges while operating heavy equipment with a high profile. During high wind events, the use of heavy equipment, particularly on unstable or steep ground, should be limited. Additionally, exposed waste should be covered prior to a forecasted period of high wind gusts to limit the scattering of debris and litter. Stockpiles of soil and cover material should be limited in height to reduce the blowing of dust and suspension of particulates.

Following the closure of the Nemaska Landfill site, many vulnerabilities discussed in this report will remain through the contaminating lifespan of the site. Those relating to operator health and safety will ebb, however, an environmental monitoring and site inspection program as well as maintenance of the landfill cover, should remain active following site closure to ensure environmental compliance and the integrity of the landfill cover in consideration of the climate risks identified in this assessment.

4.7 CONCLUSIONS

This report is intended to inform design and operations considerations for the proposed Nemaska Landfill Site.

The future climate projections used in this report are based on the most conservative global GHG emissions scenarios produced by the international IPCC: the RCP 8.5. This scenario for the future climate projections analysis was selected based on past measurements of global GHG emissions which are in line with these projections.

The projected change to the local climate that will have impacts on the landfill is the projected increase of heat wave conditions and increasing high wind gust events. Annual and seasonal temperatures are also expected to increase, which may have impacts on the potential acceleration of waste decomposition. Increases in temperature may also affect the local soil conditions due to permafrost degradation on infrastructures that are not under the responsibility of CNN.

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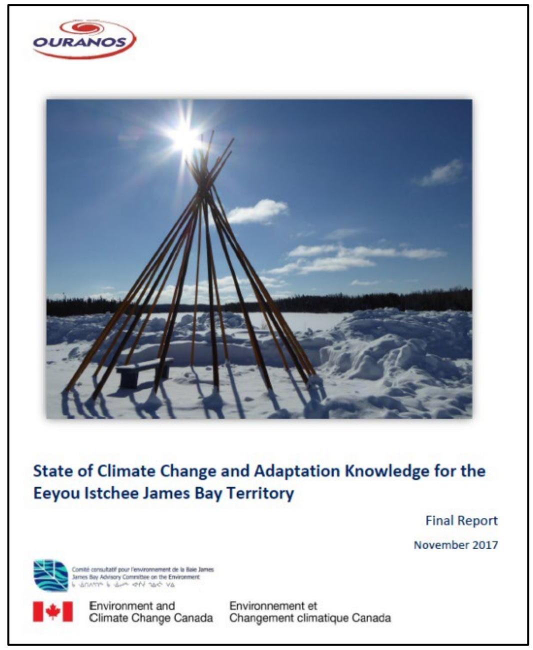
Appendix A CLIMATE CHANGE STATE OF KNOWLEDGE

A1 STATE OF CURRENT KNOWLEDGE

The table below presents a summary of the past trends, observations and projected (2050) trends for the Eeyou Istchee Bay territory. In general (extract from the report):



- “Annual mean air temperature in the region has warmed by 1.5°C in the last 35 years with a sharp winter warming of 2-3°C.
- Different models project an increase in rainfall while snow cover will decrease thawing earlier.
- The Cree have noticed an increase in the frequency of lightning storms and flooding, weather has become less predictable and seasons are shifting.
- In James Bay, sea surface temperature is rising, sea ice is retreating rapidly, and climate models project a higher river discharge in James Bay potentially modifying water properties and dynamics in the Bay.”

“These physical changes lead to impacts on the natural and built environment and entail a plethora of socio-economic and cultural repercussions.

- At the ecosystem level, local observers and scientific research report more southern species on the territory, the modification of phenological cycles, an increase in natural disturbances such as pests and invasive species and more frequent forest fires, as well as changes in the quality and availability of wildlife and plants used in traditional food systems.
- From a health perspective, changes in land access, accidents on the ice due to hazardous ice conditions, alteration of subsistence activities, traditional knowledge transfer, as well as the increase in diseases like diabetes and obesity, linked to changes in diet and food security, represent significant health risks and threaten Cree culture, identity, and well-being.
- In terms of infrastructure and industry, more frequently observed climate hazards can challenge current asset design, construction, operation, and maintenance leading to additional risks and costs for communities.
- The tourism sector, especially the cultural economy and outdoor tourism, is also vulnerable to climate change.

While the majority of climate change-induced effects in Eeyou Istchee James Bay appear to be negative, climate change may also be beneficial for some sectors if activities are adapted proactively.”

Table 9 Past and projected changes of key climate parameters in Eeyou Istchee James Bay (Source: State of Climate Change and Adaptation Knowledge for the Eeyou Istchee James Bay Territory, Ouranos (2017)

Parameter	Past trend	Cree observations	Projected trend (2050)	Comments
Air temperature	↑	↑	↑	+3.6°C warming of mean temperature, 5.5°C in the winter. High regional and
Rainfall	↑	↑	↑	+13-20% and more extreme precipitation. High uncertainty about the amplitude of the increase and
Snow	↓	↓	↓	Decrease in snow cover and duration in the North and change of its characteristics. Large year-to-year variability and likelihood of differing snow trends across
Extreme weather events	↑	↑	↑	Weather has become more unpredictable. The intensity and frequency of extreme weather events (e.g. flooding or storms)
Sea ice extent	↓	↓	↓	For every 1°C increase sea ice extent decreases by 14%. 50% loss of ice thickness. Freeze-up and breakup will occur 3-4 weeks later and earlier,
Sea surface temperature	↑	Unobserved or undocumented	↑	+ 1-1.5° or 0.22±0.08°C/decade
River discharge	↑	↑	↑	+2-15%, but significant variability due to hydro-electric flow modifications. Earlier onset of maximum river discharge.
Lake/river ice	↓	↓	↓	Ice forms later in autumn and melts earlier in spring.

Appendix B CLIMATE PROFILE

B1 INTRODUCTION

When developing a profile of the historic climate of an area, the most valuable data is typically temperature, precipitation, and wind data collected from nearby weather stations. When defining a location's "current" climate it is typical to look at the weather patterns of the last 30 years only – although viewing the data from several decades ago can be useful in understanding long term trends. Furthermore, not all weather stations have complete data sets and their years of operation vary significantly; many no longer in operation. Thus, the challenge becomes finding weather station data that has been collecting complete information for the past 30 years but is also central to the location in question.

For the Nemaska area the closest weather station is approximately 175 km kilometers away at Eastmain (ID: 7092305). In addition to this distance being too far for confidently assuming similar weather patterns to Nemaska, Eastmain is situated on the coast of James Bay. Large bodies of water such as James Bay can cause significant variations on weather patterns, when compared to inland areas. Furthermore the Eastmain weather station only collected climate data from 1960 to 1993, which does not provide a "current" representation of the climate. When defining a location's "current" climate it is typical to look at the weather patterns of the last 30 years only – although viewing the data from several decades ago can be useful in understanding long term trends. Thus, the challenge becomes finding weather station data that has been collecting complete information for the past 30 years but is also central to the location in question. The closest station with a recent and complete 30-year data set is at La Grande Riviere Airport (ID: 7093715) which is approximately 240 km from Nemaska and collected data from 1976 to 2012. Nemaska. The data availability and time range, including the age of the data are factors in choosing which data to use for which application.

Future projections are based on the IPCC RCP[4] 8.5 scenario, which is characterized by increasing greenhouse gas emissions over time, representative of scenarios in the literature that lead to high greenhouse gas concentration levels[5]. RCP8.5 is commonly referred to as the "business-as-usual" emissions scenario as current greenhouse gas emissions correspond with the RCP 8.5 trajectory (Figure 4).

[4] RCP: Representative Concentration Pathways – a greenhouse gas concentration (not emissions) trajectories adopted by the Intergovernmental Panel on Climate Change (IPCC) for its fifth Assessment Report (AR5) in 2014.
[5] By comparison, RCP 4.5 is a stabilization scenario in which total radiative forcing is stabilized shortly after 2100 while RCP 2.6 emission pathway is representative of scenarios that lead to very low greenhouse gas concentration levels.

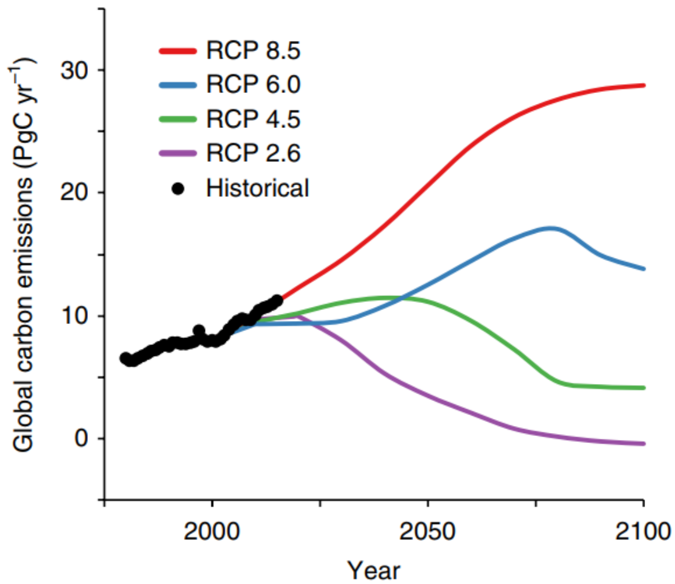


Figure 4 **Historical CO_2 emissions for 1980-2017 and projected emissions trajectories until 2100 for the four RCP scenarios. Current global greenhouse gas emissions correspond with the RCP 8.5 trajectory. Figure from Smith and Myers, 2018[6].**

The IPCC is the international body for assessing the science related to climate change. The IPCC was set up in 1988 by the WMOand UNEPto provide policymakers with regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation.

IPCC assessments provide a scientific basis for governments at all levels to develop climate related policies, and they underlie negotiations at the UN Climate Conference – the United Nations Framework Convention on Climate Change (UNFCCC). The assessments are policy-relevant but not policy-prescriptive: they may present projections of future climate change based on different scenarios and the risks that climate change poses and discuss the implications of response options, but they do not tell policymakers what actions to take.

Future climate projections were generated using statistically downscaled climate scenarios developed by the Pacific Climate Impacts Consortium (PCIC). These projections were developed from Global Climate Models from the Coupled Model Intercomparison Project Phase 5 (CMIP5; Taylor et al., 2012[7]), which provided climate projections for the IPCC's Fifth Assessment Report (IPCC, 2013[8]). The downscaled

[6] Smith, M.R. and S.S. Myers. 2018. Impact of anthropogenic CO_2 emissions on global human nutrition. *Nature Climate Change*, 8: 834-839.

[7] Taylor, K.E., R.J. Stouffer, and G.A. Meehl, 2012: An Overview of CMIP5 and the Experiment Design. Bull. Amer. Meteor. Soc., 93, 485–498, https://doi.org/10.1175/BAMS-D-11-00094.1

[8] IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp, doi:10.1017/CBO9781107415324.

projections provide daily output Canada-wide at a spatial resolution of 300 arc seconds (~10 km) for the simulated time period of 1950-2100.

Climate is usually defined as the "average weather," or more rigorously, as the statistical description in terms of the mean and variability of meteorological variables such as temperature, precipitation and wind over a period of time, typically 30 years.[9] Future climate projections for the RCP 8.5 scenario were performed for the following 30-yr periods:

- 2020: 2011 to 2040
- 2050: 2041 to 2070
- 2080: 2071 to 2100

[9] World Meteorological Organization, 2017: Commission for Climatology: Frequently Asked Questions. http://www.wmo.int/pages/prog/wcp/ccl/faqs.php (accessed Sept.28,2018)

B2 TEMPERATURE

The following subsections present historical and future projected temperature regimes for the Nemaska area. Data presented as mean, maximum, and minimum are provided as a compilation of historical data (orange columns), the last climate normal which corresponds to the average values between 1981 and 2010 (red columns), and the future projected normals (gray columns). Projected values are listed as 30-year averages for the 2020 (2011-2040), 2050 (2041-2070), and the 2080 (2071-2100). The average change in temperature values between the baseline (1981-2010) and future projected averages are summarized below.

B2-1 Mean Temperature

Table 10 Average Change in Average Daily Mean Temperature from 1981-2010 Baseline, RCP 8.5, Nemaska

Season	1981-2010 (°C)	Average Change in Mean Temperature from 1981-2010 Baseline (°C)		
		2020	2050	2080
Annual	-1.2	1.5	3.6	6.3
Winter	-18.3	2.1	5.0	8.3
Spring	-2.9	1.2	3.1	5.9
Summer	13.9	1.2	3.1	5.6
Autumn	2.4	1.4	3.1	5.4

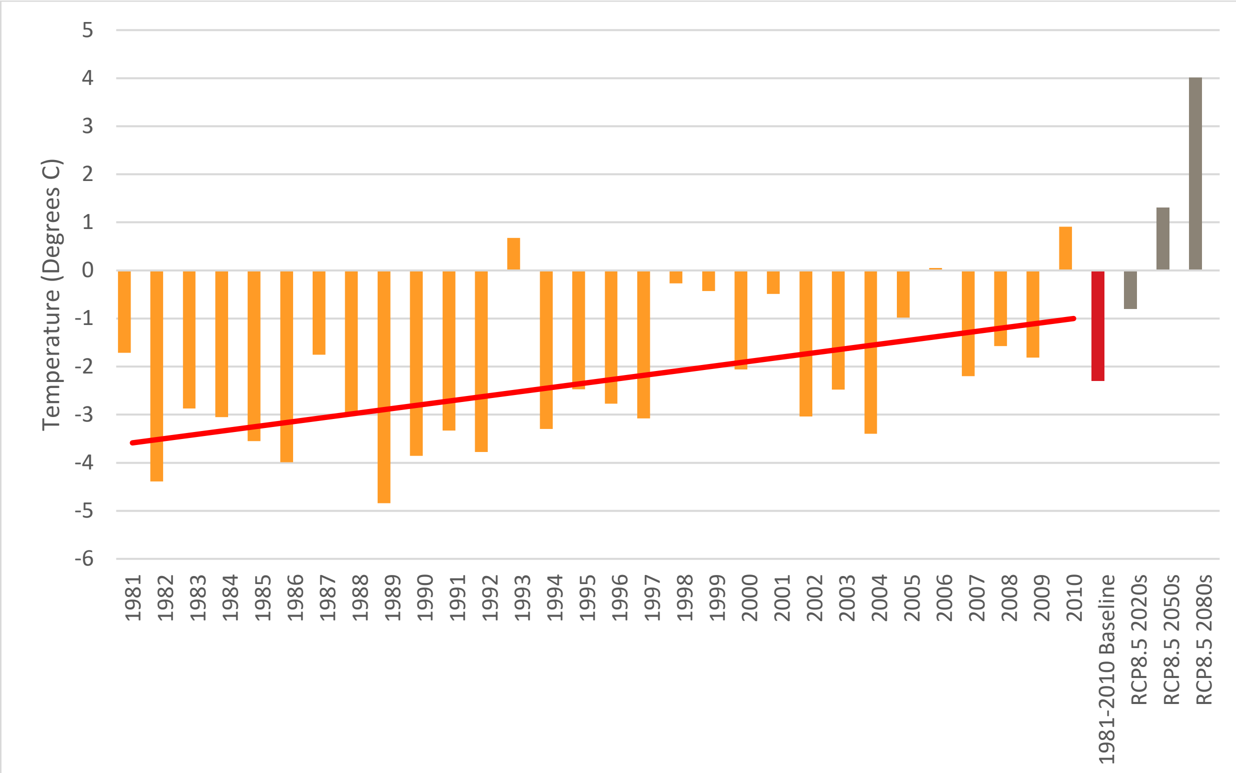


Figure 5 Annual Temporal Average – Mean Daily Temperature (RCP 8.5)

B2-2 Maximum Temperature

Table 11 Average Change in Average Maximum Daily Temperature from 1981-2010 Baseline, RCP 8.5, Nemaska

Season	1981-2010 (°C)	Average Change in Maximum Temperature from 1981-2010 Baseline (°C)		
		2020	2050	2080
Annual	4.2	1.4	3.3	5.8
Winter	-12.7	1.9	4.2	7.0
Spring	3.3	1.1	2.7	5.2
Summer	19.7	1.4	3.3	5.7
Autumn	6.1	1.3	3.0	5.3

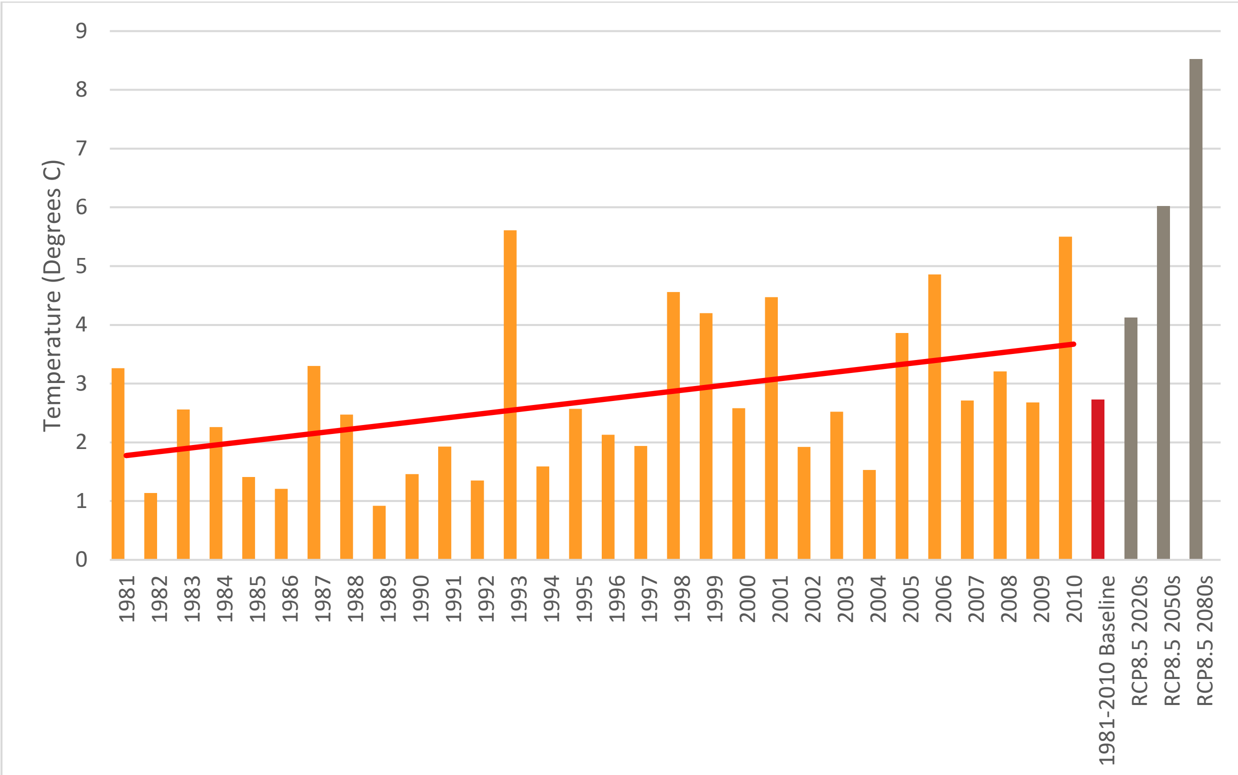


Figure 6 Annual Temporal Average – Maximum Daily Temperature (RCP 8.5)

B2-3 Minimum Temperature

Table 12 Average Change in Average Minimum Daily Temperature from 1981-2010 Baseline, RCP 8.5, Nemaska

Season	1981-2010 (°C)	Average Change in Minimum Temperature from 1981-2010 Baseline (°C)		
		2020	2050	2080
Annual	-6.4	1.5	3.8	6.8
Winter	-23.8	2.4	5.7	9.6
Spring	-8.9	1.2	3.5	6.6
Summer	8.1	1.2	3.1	5.5
Autumn	-1.4	1.4	3.2	5.6

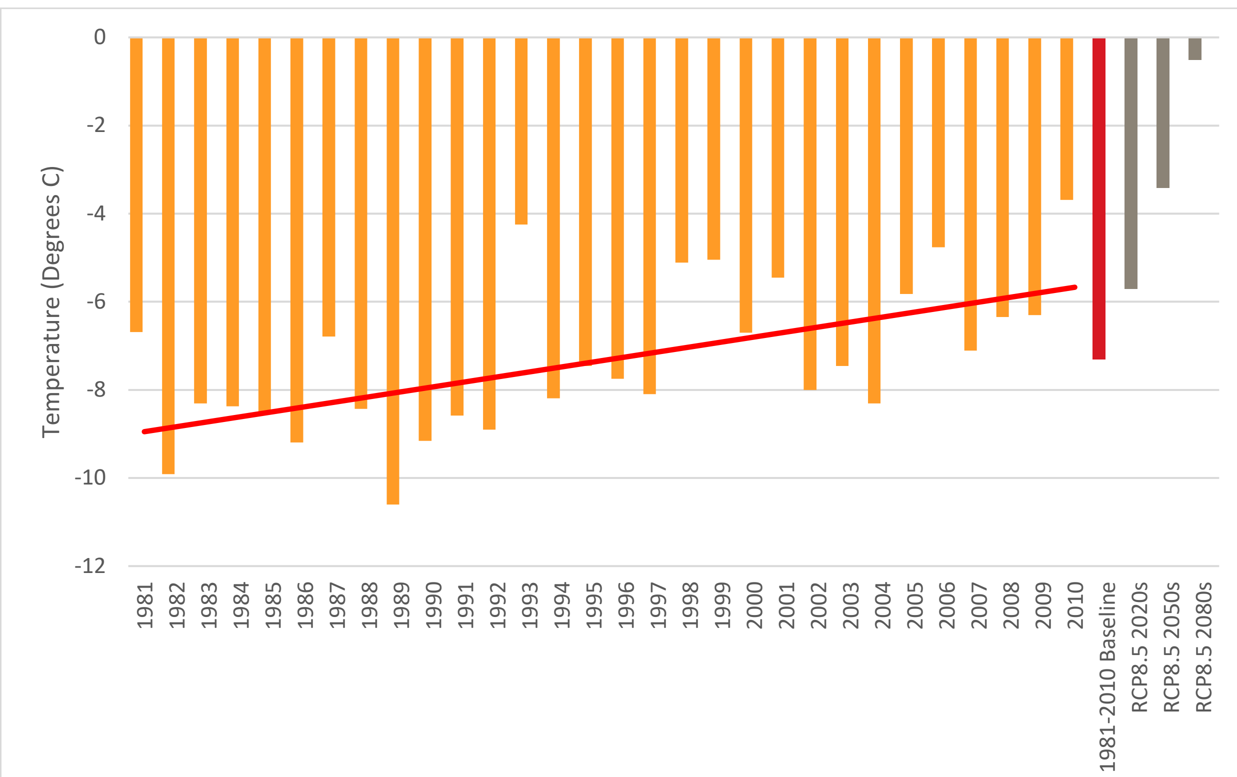


Figure 7 Annual Temporal Average – Minimum Daily Temperature (RCP 8.5)

B3 PRECIPITATION

The following subsections present historical and future projected precipitation data for the Nemaska area. Data relating to annual and seasonal total precipitation as well as rain and snowfall are provided as a compilation of historical data (orange columns) and where available, the last climate normal which corresponds to the average values between 1981 and 2010 (red columns) and the future projected normals (gray columns). Projected values are listed as 30-year averages for the 2020 (2011-2040), 2050 (2041-2070), and the 2080 (2071-2100). The average change in precipitation between the baseline (1981-2010) and future projected averages are summarized below.

B3-1 Total Annual & Seasonal Accumulation

Table 13 Average Percent Change in total annual and seasonal Precipitation from 1981-2010 Baseline, RCP 8.5, Nemaska

Season	1981-2010 (mm)	Average Percent Change in Total Precipitation from 1981-2010 Baseline (%)		
		2020	2050	2080
Annual	759	4.8	12.0	18.8
Winter	126	10.1	25.5	43.6
Spring	128	5.3	15.9	26.3
Summer	253	1.7	3.1	2.5
Autumn	252	5.5	12.6	19.4

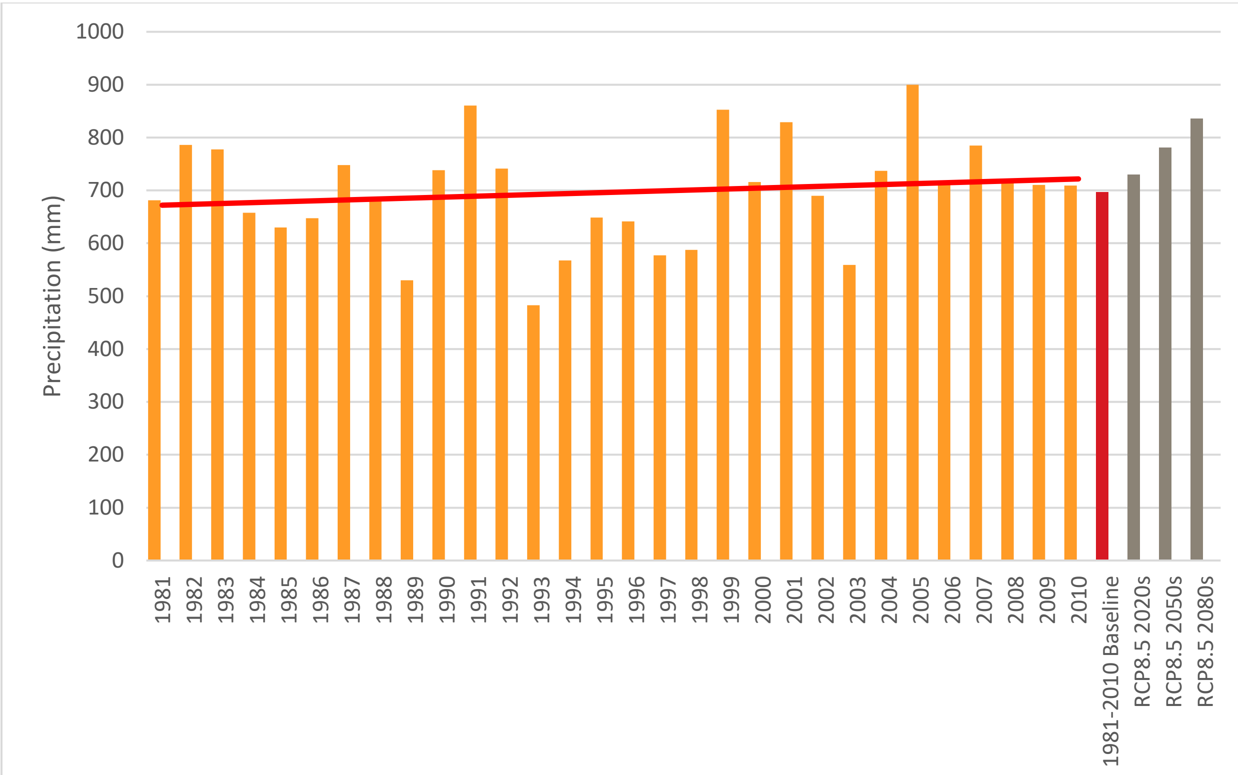


Figure 8 **Annual Total Precipitation – Historical Temporal Total and Projected 30-year Mean (RCP 8.5)**

B3-2 Intensity-Duration-Frequency (IDF)

Total precipitation amount (mm) in specific time intervals (5 minutes to 24 hours) for various return periods (2 years to 100 years), i.e. IDFdata, are provided. IDF data relates short-duration, high rainfall intensity with its frequency of occurrence. Evaluating historic and projected IDF data provides insight into how the intensity, duration, and frequency of precipitation events will change under future climate conditions.

Due to data coverage restrictions in the Nemaska region, IDF data is not available from a weather station within a reasonable distance of the project location. Therefore, the use of "ungauged" historical IDF data, calculated through interpolation between Environment Canada weather stations and gridded climate datasets available in the region, are provided. Projections for future climate IDF data are available based on results from 24 Global Circulation Models that simulate future climate conditions. The projected IDF data presented here is based on bias-corrected results from 9 downscaled climate models under the RCP 8.5 emission scenario from the Pacific Climate Impacts Consortium. The "ungauged" interpolations and projections are published by the ICLRat Western University, London, Ontario.

Historic and projected total precipitation amount (mm) in specific time interval (5 minutes to 24 hours) for various return periods (2 years to 100 years) are provided below for the ungauged location nearest to Nemska.

Table 14 Historical "Ungaged" Precipitation Event Accumulation IDF data (mm) – 51.68 °N, -76.26°E

T (years)	2	5	10	25	50	100
5 min	5.57	8.59	10.63	13.2	15.09	16.92
10 min	7.22	11.01	13.84	17.81	21.07	24.6
15 min	8.7	13.29	17.18	23.32	28.96	35.69
30 min	11.41	17.51	22.66	30.84	38.42	46.89
1 h	14.75	21.52	26.75	34.24	40.39	46.89
2 h	19.83	27.04	32.09	38.76	43.84	48.92
6 h	28.19	37.96	44.99	54.54	62.15	70.18
12 h	35.03	45.61	52.47	61.04	67.39	73.76
24 h	41.46	53.05	59.97	67.95	73.39	78.43

Table 15 Projected Precipitation Event Accumulation IDF data (mm) and Percent Change from Historical (%),RCP 8.5, 2020 (2011-2040)

T (years)	2		5		10		25		50		100	
	Total (mm)	% Change	Total (mm)	% Change	Total (mm)	% Change	Total (mm)	% Change	Total (mm)	% Change	Total (mm)	% Change
5 min	5.97	7.2%	9.38	9.2%	11.52	8.4%	14.52	10.0%	16.75	11.0%	18.82	11.2%
10 min	7.75	7.3%	12.02	9.2%	15	8.4%	19.58	9.9%	23.4	11.1%	27.37	11.3%
15 min	9.33	7.2%	14.51	9.2%	18.62	8.4%	25.64	9.9%	32.15	11.0%	39.7	11.2%
30 min	12.24	7.3%	19.11	9.1%	24.55	8.3%	33.9	9.9%	42.65	11.0%	52.16	11.2%
1 h	15.82	7.3%	23.49	9.2%	28.98	8.3%	37.65	10.0%	44.84	11.0%	52.16	11.2%
2 h	21.27	7.3%	29.51	9.1%	34.78	8.4%	42.61	9.9%	48.67	11.0%	54.42	11.2%
6 h	30.24	7.3%	41.44	9.2%	48.75	8.4%	59.97	10.0%	69	11.0%	78.06	11.2%
12 h	37.58	7.3%	49.79	9.2%	56.85	8.3%	67.11	9.9%	74.82	11.0%	82.05	11.2%
24 h	44.48	7.3%	57.9	9.1%	64.98	8.4%	74.71	9.9%	81.47	11.0%	87.24	11.2%

Table 16 Projected Precipitation Event Accumulation IDF data (mm) and Percent Change from Historical, RCP 8.5, 2050 (2041-2070)

T (years)	2		5		10		25		50		100	
	Total (mm)	% Change	Total (mm)	% Change	Total (mm)	% Change	Total (mm)	% Change	Total (mm)	% Change	Total (mm)	% Change
5 min	6.34	13.8%	9.7	12.9%	12.19	14.7%	15.35	16.3%	17.74	17.6%	20.22	19.5%
10 min	8.22	13.9%	12.43	12.9%	15.87	14.7%	20.71	16.3%	24.78	17.6%	29.4	19.5%
15 min	9.9	13.8%	15.01	12.9%	19.7	14.7%	27.11	16.3%	34.06	17.6%	42.65	19.5%
30 min	12.99	13.8%	19.77	12.9%	25.98	14.7%	35.85	16.2%	45.18	17.6%	56.04	19.5%
1 h	16.79	13.8%	24.3	12.9%	30.67	14.7%	39.81	16.3%	47.5	17.6%	56.04	19.5%
2 h	22.58	13.9%	30.53	12.9%	36.8	14.7%	45.07	16.3%	51.56	17.6%	58.46	19.5%
6 h	32.09	13.8%	42.87	12.9%	51.58	14.6%	63.42	16.3%	73.09	17.6%	83.86	19.5%
12 h	39.89	13.9%	51.5	12.9%	60.15	14.6%	70.97	16.3%	79.26	17.6%	88.14	19.5%
24 h	47.21	13.9%	59.9	12.9%	68.75	14.6%	79.01	16.3%	86.31	17.6%	93.72	19.5%

Table 17 Projected Precipitation Event Accumulation IDF data (mm) and Percent Change from Historical, RCP 8.5, 2080 (2071-2100)

T (years)	2		5		10		25		50		100	
	Total (mm)	% Change	Total (mm)	% Change	Total (mm)	% Change	Total (mm)	% Change	Total (mm)	% Change	Total (mm)	% Change
5 min	6.63	19.0%	10.58	23.2%	13.24	24.6%	16.65	26.1%	19.7	30.6%	22.27	31.6%
10 min	8.59	19.0%	13.56	23.2%	17.23	24.5%	22.45	26.1%	27.51	30.6%	32.38	31.6%
15 min	10.35	19.0%	16.37	23.2%	21.39	24.5%	29.4	26.1%	37.81	30.6%	46.96	31.6%
30 min	13.58	19.0%	21.57	23.2%	28.22	24.5%	38.87	26.0%	50.15	30.5%	61.71	31.6%
1 h	17.55	19.0%	26.51	23.2%	33.31	24.5%	43.17	26.1%	52.73	30.6%	61.71	31.6%
2 h	23.6	19.0%	33.31	23.2%	39.97	24.6%	48.86	26.1%	57.24	30.6%	64.38	31.6%
6 h	33.55	19.0%	46.76	23.2%	56.03	24.5%	68.76	26.1%	81.14	30.6%	92.35	31.6%
12 h	41.7	19.0%	56.18	23.2%	65.34	24.5%	76.95	26.1%	87.99	30.6%	97.06	31.6%
24 h	49.35	19.0%	65.34	23.2%	74.68	24.5%	85.66	26.1%	95.81	30.5%	103.21	31.6%

The above results indicate an increase in precipitation accumulation that can be expected for essentially all rainfall events at the nearest grid point to the Nemaska region. Under RCP 8.5, the projected percentage increase from the historical period for precipitation events range from 7.2% to 11.2% for the 2020 (2011-2040), 13.8% to 19.5% for the 2050 (2041-2070), and 19.0% to 31.6% for the 2080 (2071-2100).

B4 FROST-FREE DAYS

Table 17 below shows the current (baseline) average annual frost-free[10] days and the projected (RCP 8.5) changes. Table 18 shows the current (baseline) average length of the frost-free season[11] and the projected (RCP 8.5) changes.

Table 18 Average Annual Number of Frost-Free Days, Nemaska, RCP 8.5

Number of Frost-Free Days	
Period	**RCP 8.5**
Baseline (Historical 1981-2010)	151
2020	165
2050	183
2080	199

Table 19 Average Annual Length of Frost-Free Period, Nemaska, RCP 8.5

Number of Frost-Free Days	
Period	**RCP 8.5**
Baseline (Historical 1981-2010)	96
2020	119
2050	139
2080	160

[10] Definition of Frost-Free Days: The number of frost-free days is calculated based on the number of Frost Days, the number of days when the daily minimum temperature is less than 0°C (Source: Environment and Climate Change Canada).

[11] Definition of Frost-Free Season: The approximate length of the growing season, during which there are no freezing temperatures to kill or damage plants; calculated based on the number of days between the date of the last spring frost and the date of the first fall frost (Source: Environment and Climate Change Canada).

Annexe B – Rapport BlueMetric, 2023

NEMASKA NEW WASTE DISPOSAL SITE
HYDROGEOLOGICAL ASSESSMENT

NEMASKA, QUEBEC

Prepared for:

Stantec Consulting Ltd

200-555 René-Lévesque Boulevard West
Montreal, QC H2Z 1B1

Prepared by:

BluMetric Environmental Inc.
200-1500 Du Collège Street
Saint-Laurent, QC H4L 5G6

Project Number: 230448-00
September 6, 2023

NEMASKA NEW WASTE DISPOSAL SITE
HYDROGEOLOGICAL ASSESSMENT

NEMASKA, QC

Prepared for:

Stantec Consulting Ltd.
200-555 René-Levesque Boulevard West
Montreal, QC, H2Z 1B1

Prepared by:

BluMetric Environmental Inc.
200-1500 Du Collège Street
Saint-Laurent, QC K4L 5G6

Project Number: 230448-00

September 6, 2023

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Revision History

Version	Description
August 21, 2023	BluMetric Preliminary Report
September 6, 2023	BluMetric Final Report

1. INTRODUCTION

1.1 OBJECTIVES AND LOCATION

BluMetric Environmental Inc. (BluMetric®) was retained by Stantec Consulting Ltd (Stantec®) to complete a hydrogeological report for a New Solid Waste Disposal. This report documents the hydrogeology impact assessment of the Preferred Alternative Landfill Footprint or Site n° 4 for the Environmental Assessment (EA) for a new landfill footprint at the Cree community of Nemaska, in support of the Stantec report (2021[1]). The disposal of waste in an open trench, as proposed, can lead to the leaching and infiltration of various contaminants in the soils, which can degrade surface water and groundwater quality and nearby ecosystems. Consequently, the hydrogeological setting was investigated at the proposed landfill location to document initial conditions in order to assess potential impacts.

The study is part of the technical search for a solid waste landfill site in the town of Nemaska, and the preparation of an environmental and social impact study to be submitted to the COMEX[2]. The location and extent of future infrastructure for the site, is still at preliminary stages of development, and is located at kilometer 305 of the Route du Nord, east of the Cree community of Nemaska (**Figure 1**). This is site number 4 of all the sites surveyed in PolyGeo's report (2017[3]). This new waste disposal site project is located in the territory governed by the James Bay and Northern Quebec Agreement (JBNQA).

1.2 SITE DESCRIPTION AND BACKGROUND

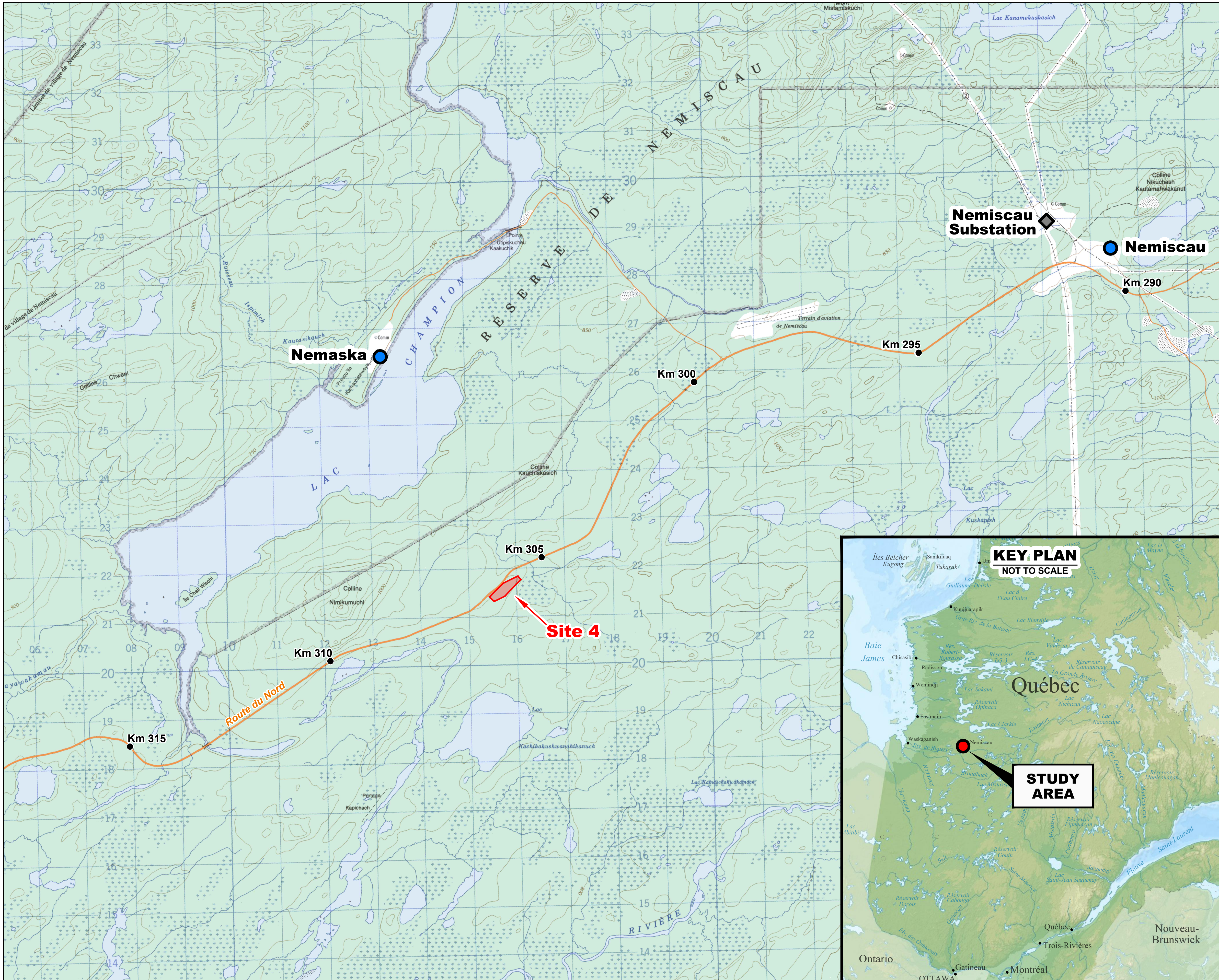
According to Poly-Géo (2017):

> "Site 4 covers an area of about 21.5 ha on the south side of the Route du Nord, on a broad ridge of till (drumlin) aligned along a NE-SW axis (Map 3A; Appendix 3). Site 4 is 17 km from Nemaska, and as such is the site nearest to the town. It is bounded to the northwest by the road and to the north by the power line right-of-way. There are lowlands with peat bog along the southeastern boundary of the site and a rocky, partially till-covered area at its southern end. Tree cover (mostly jack pine with some black spruce) is scattered at the top of the site and a little denser on the northwest and southeast slopes."

[1] Stantec, 2021. *Nemaska New Waste Disposal Site Impact Assessment – Hydrogeological Study*. Ref. 167020077-300-EN-N-0001-0, March 31, 2021

[2] COMEX: Environmental and Social Impact Review Committee (Review Committee or COMEX)

[3] Poly-Géo inc., 2017. *Nemaska new waste disposal site – Photointerpretation and field investigations*. Final technical report presented to the Cree Nation of Nemaska. April 2017 ref. 16026, 6 pages and 5 appendices



LEGEND

POTENTIAL WASTE DISPOSAL AREA

REV.	DESCRIPTION	DATE	BY	CHK

REFERENCE :
TOPOGRAPHIC MAP 32 N/9 LAC CHAMPION, 1:50,000, ENERGY, MINES AND RESOURCES CANADA, 1990.

NOTE :
PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC. DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

1:80 000 — 0 — 1.0 — 2.0 — 3.0
SCALE (km)
THIS SCALE TO BE USED TO OBTAIN APPROXIMATE DIMENSIONS FOR INFORMATION

N W E S

CLIENT
Stantec Consulting Ltd

PROJECT
Nemaska New Waste Disposal Site
Hydrogeological Assessment
Nemaska, Quebec

TITLE
Site Location Map

BluMetric® Environmental
1500 du Collège Street, Suite 200
Saint-Laurent, Québec H4L 5G6
TEL.: 514 844-7199 FAX: 514 841-9111
Email: montreal@blumetric.ca
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PROJECT #	DATE	REV.	FIG.
230448	2023-08-17	-	1

DRAWN	DESIGNED	CHECKED	CAD DRAWING
K.T.	L.A.	L.A.	230448-FIG1.DWG

On this Site nº 4, data was collected from a series of test pits (Poly-Géo Inc. 2017) and boreholes (Stantec 2017[4]). **Figure 2** shows the topography of the site. Work was completed in 2017 includes:

- Twenty-three exploratory test pits (PU-04-01 to PU-04-23) with a Volvo EC250E shovel excavator at the proposed site. The test pits were left open for a minimum of 24 hours to allow the water level to stabilize.
- Six boreholes (PZ-1 to PZ-6) drilled using a drill rig. Soil sampling was conducted using split-spoon sampling methods. Boulders were encountered during the drilling, and diamond coring was conducted to progress drilling through the boulders.Bedrock was not encountered in the boreholes. The six boreholes were completed as monitoring wells, although PZ-4 appears to have been damaged following the initial installation and could not be located in additional testing.
- The goal of the boreholes drilling was to intersect the water table and to install groundwater monitoring wells to assess groundwater flow conditions and quality at the site. Groundwater was observed in each borehole during drilling. Water-level surveys were carried out on three occasions in all monitoring wells except PZ-4.

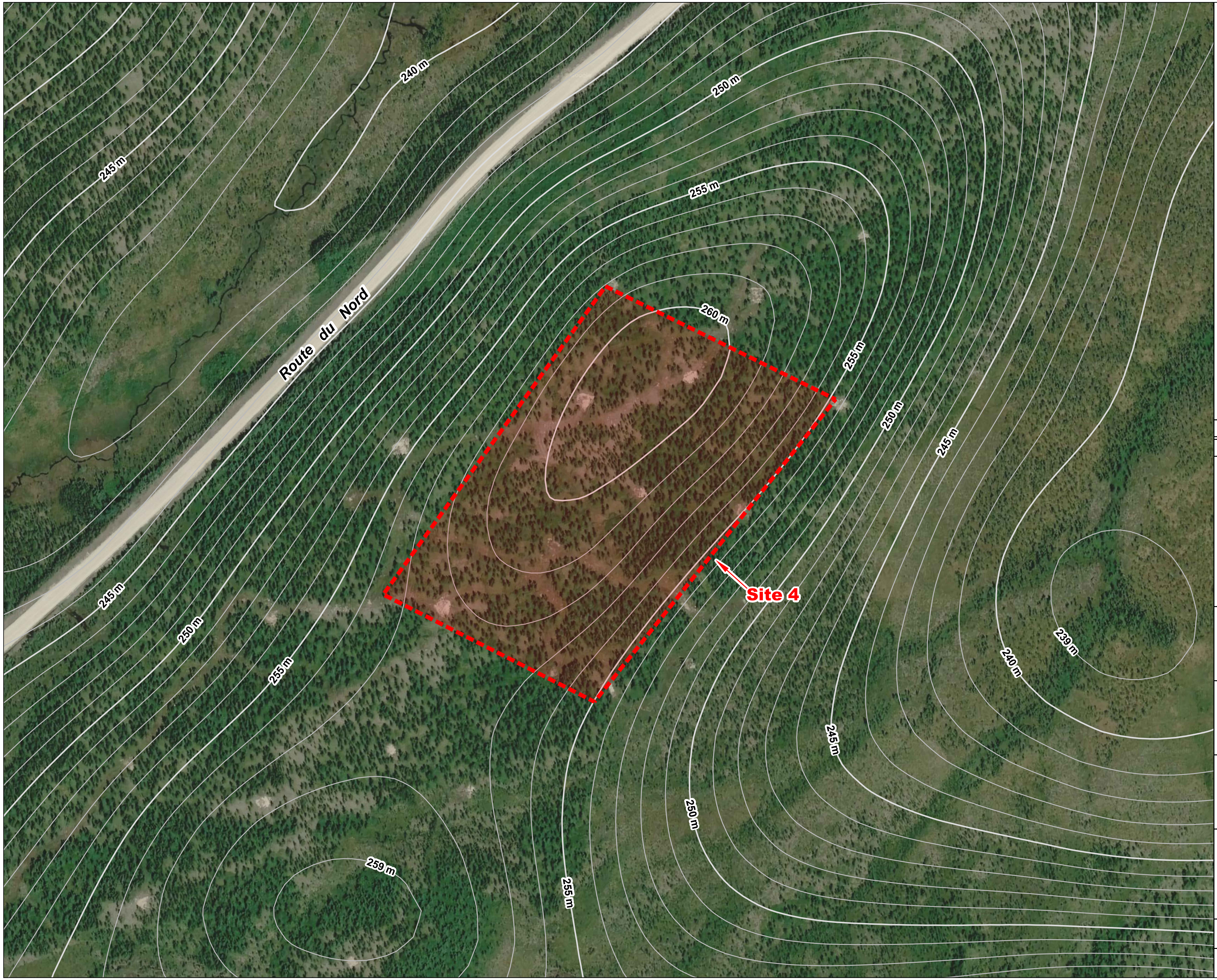
2. METHODOLOGY

The work program was a collaborative effort between BluMetric and Stantec. The study of the hydrogeological assessment in the project area was carried out using existing available information (Stantec 2017 and 2021; PoliGéo, 2017), and the results from geotechnical and hydrogeological fieldwork performed to characterize the proposed site. Information on regional groundwater resources in the project area from mining and industrial project reports (Example: Wesa-Envir-Eau, 2012[5]) was also used, as well as information deduced from available bedrock and surficial geology maps (SIGÉOM[6]).

A desktop review was conducted for the preparation of a hydrogeological report, including study of the regulatory framework and requirements overseeing the Waste disposal site. No field studies have been carried out by BluMetric.

New interpretations of the permeability tests carried out in 2021 and 2022 by Stantec have been made.

[4] Stantec, 217. Sounding log – PZ-1 to PZ-6
[5] Wesa Envir-Eau, 2012. *Étude Hydrogéologique Projet Whabouchi – Némaska Lithium*. Ref HB10015-00-01
[6] SIGÉOM : Ministères des Ressources naturelles et des Forêts : Interactive map: https://sigeom.mines.gouv.qc.ca/signet/classes/I1108_afchCarteIntr



LEGEND

POTENTIAL LANDFILL SITE (SITE 4)

REV.	DESCRIPTION	DATE	BY	CHK

REFERENCE :
AERIAL PHOTOGRAPHY, JULY 2020, GOOGLE EARTH, 2023.

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1:3 000 0 20 40 60 80 100

SCALE (m)

THIS SCALE TO BE USED TO OBTAIN APPROXIMATE DIMENSIONS FOR INFORMATION

N W E S

CLIENT

Stantec Consulting Ltd

PROJECT

Nemaska New Waste Disposal Site
Hydrogeological Assessment
Nemaska, Quebec

TITLE

Potential Landfill Contour
and Topography

BluMetric® Environmental

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PROJECT #	DATE	REV.	FIG.
230448	2023-08-17	-	2

DRAWN	DESIGNED	CHECKED	CAD DRAWING
K.T.	L.A.	L.A.	230448-FIG2.DWG

3. SITE CHARACTERISTICS

3.1 PHYSIOGRAPHY AND CLIMATE CONDITIONS

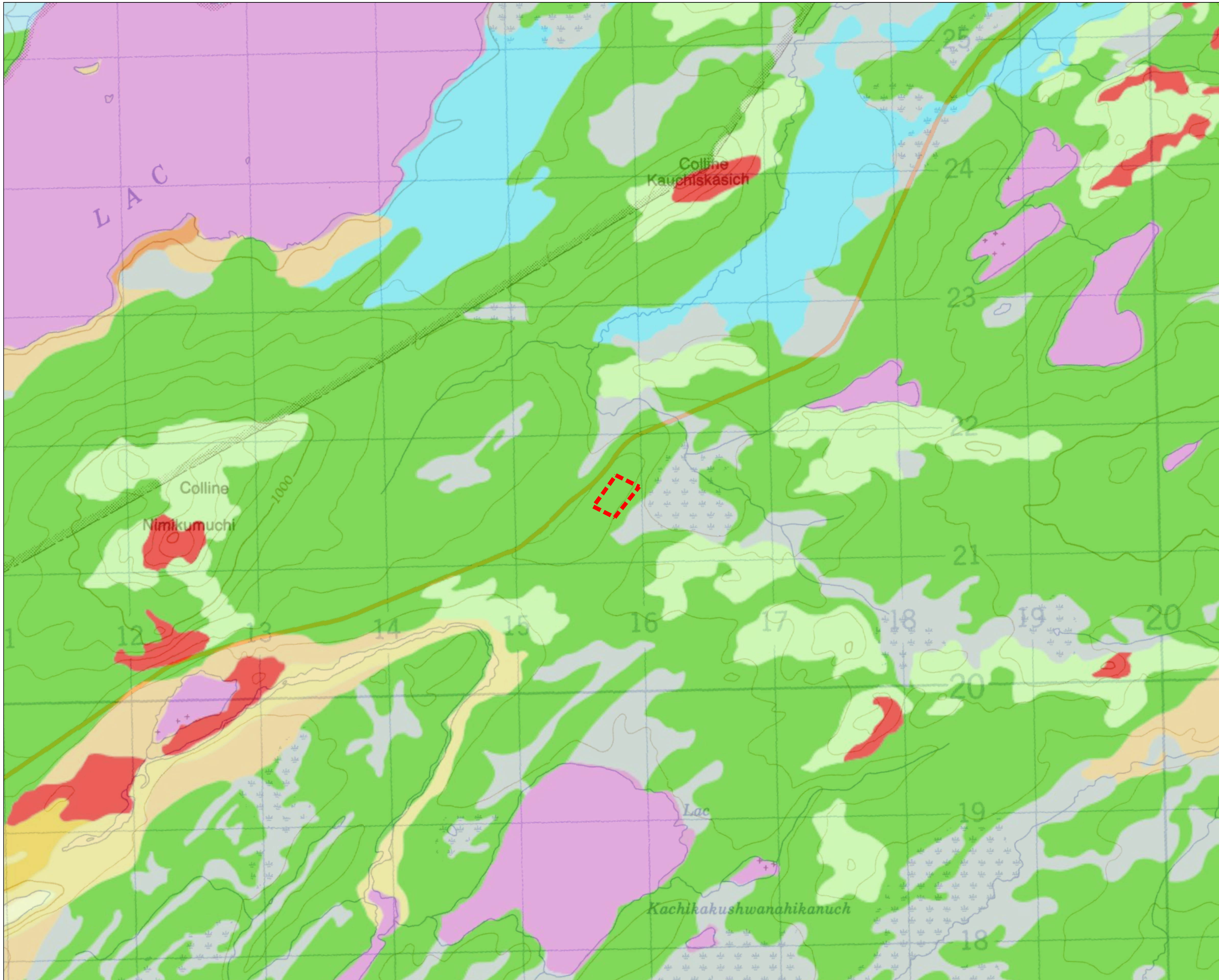
The Site n° 4 proposed for the new waste disposal site for the Cree community of Nemaska is located about 17 km south-west of the town of Nemaska, QC **(Figure 1)**. Relief in the area varies little, but Site N° 4 lies on a hill at an altitude of around 260 m, descending rapidly to the west and the Route du Nord at around 245 m (150 m distance), to the southeast along the river at an altitude of 239 m at a distance of 250 m (**Figure 2**). Most of the territory, however, lies below 240 m elevation, with a general south-westerly slope towards Lac Champignon. Nimikumuchi Hill (over 1000 m above sea level) lies about 3 km west of site No. 4 (**Figure 3**).

Vegetation in the area is typical of the Boreal Shield and Rupert River Plateau as defined in Canada's Ecological Framework (Wesa Envir-Eau, 2012[7]): “Vegetation is dominated by stands of black spruce and balsam fir, but the dominant climax species is balsam fir. A low cover of hypnaceous mosses is common, while sphagnum mosses occupy poorly drained depressions”. This description was confirmed in the field.

The Nemaska region is part of the Boreal Shield ecozone. Canada's Ecological Framework defines the climate of this territory as generally continental, with long, cold winters and short, relatively warm summers. The climate in the study area is characterized by an average temperature below 0°C, which can drop as low as -51 °C in the winter and rise to 34 °C in the summer. Maximum temperatures are highest in July, with averages ranging from 20.0 to 23.1 °C, while minimum temperatures are observed in January, with averages ranging from -28.0 to -24.2 °C. Average temperatures are below 0 °C between November and April at all selected stations.

The area receives on average 683 to 961 mm of precipitation, roughly divided between rain and snow.

[7] Wesa Envir-Eau (2012). *Étude hydrologique Projet Whabouchi – Nemaska Lithium.* Gatineau, Quebec: Ref. HB10015-00-03.



LEGEND

NEMASKA NEW LANDFILL POTENTIAL SITE

GEOLOGY DESCRIPTION NEAR THE SITE

MORPHOSEDIMENTOLOGICAL ZONES:

- Till in generally continuous coverage
- Till in thin and discontinuous cover
- Non-differentiated organic sediment

REV.	DESCRIPTION	DATE	BY	CHK

REFERENCE :
1. TOPOGRAPHIC MAP 32 N/9 LAC CHAMPION, 1:50,000, ENERGY, MINES AND RESOURCES CANADA, 1990;
2. SIGEOM DATA, MINISTÈRE DES RESSOURCES NATURELLES ET DES FORÊTS, 2023.

NOTE :

DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

1:30 000 — 0 250 500 750 1000 — SCALE (m)

THIS SCALE TO BE USED TO OBTAIN APPROXIMATE DIMENSIONS FOR INFORMATION

N W E S

CLIENT

Stantec Consulting Ltd

PROJECT

Nemaska New Waste Disposal Site
Hydrogeological Assessment
Nemaska, Quebec

TITLE

Surface Geology

BluMetric Environmental
1500 du Collège Street, Suite 200
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Email: montreal@blumetric.ca
Web site: www.blumetric.ca

PROJECT #	DATE	REV.	FIG.
230448	2023-08-17	-	3

DRAWN	DESIGNED	CHECKED	CAD DRAWING
K.T.	L.A.	L.A.	230448-FIG3.DWG

3.2 GEOLOGY

The local geology was established from various documents (Lamarche et al, 2018[8]; SIGÉOM) following exploration drilling, trenching and observations carried out by Stantec (2017 and 2021) and Poly-Géol (2017). The following general stratigraphic sequence is found on the site:

- Unsaturated topsoil, 0.06 to 0.18 m thickness;
- till (silty sand with some gravel and traces of clay and pebbles) or sand. The till thickness observed ranged from 7.5 m to more than 20 m;
- According to data from Poily-Géo (2017) the bedrock was encountered within 0.5 m in three test pits located to the southwest (i.e., PU-04-08, PU-04-09, and PU-04-11) of the site. Bedrock was not reported to be intercepted in the boreholes or test pits extent of the proposed landfill.

Figure 3 shows a map of the site's surface geology, which clearly indicates that the site is covered by a thick, continuous layer of gravelly till.

According to SIGÉOM, Site No. 4 is in the Archean-age Canadian Shield, in the northeastern part of the Lake Superior province, under the Nemiscau or Opinaca province. The site is hosted by the Champion Lake formations. As shown in **Figure 4**, granite biotite and amphibolized basalt cover most of the site.

3.3 HYDROGEOLOGY

3.3.1 Hydro-stratigraphic Units

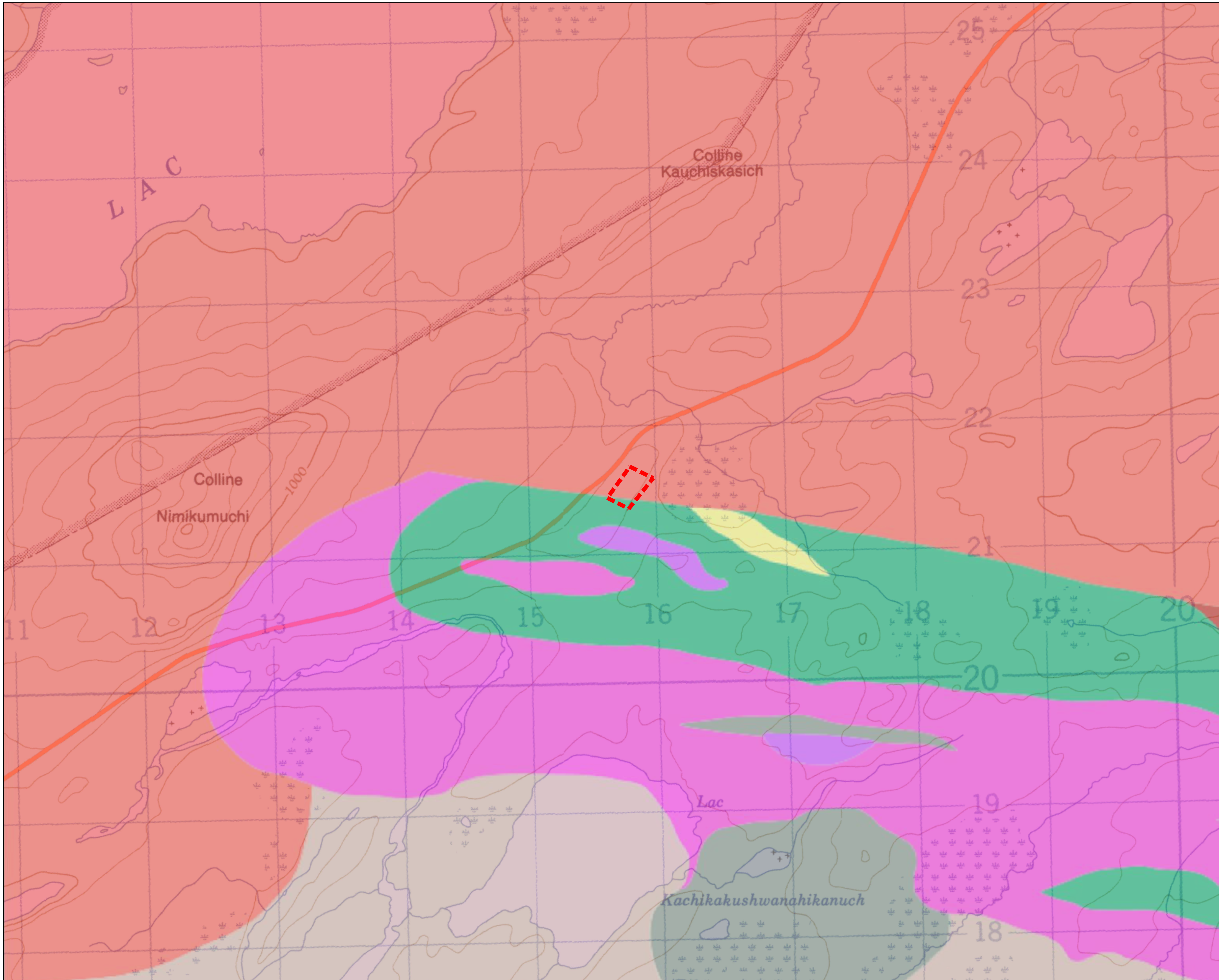
Based on available information and as previously described, two hydro-stratigraphic units or hydrogeological formations are present in the study area, namely:

- unconsolidated deposits (till and sand); and
- Rock of various types.

3.3.2 Hydraulic Properties

Hydraulic properties of the till or sand (**Table 1: lithology from borehole description**) deposits encountered beneath the proposed landfill site must be estimated to assess the impact of site operation on local groundwater resources. Sug tests were carried out on the piezometers by Stantec in 2017 and 2021. Data from 2020 tests on PZ-1, PZ-3 and PZ-6 were re-interpreted and the results were compared with those from Stantec 2021.

[8] Lamarche, O., Daubois V. et Dubé-Loubert H.. 2018. *Géologie des dépôts de surface de la région de Nemaska (SNRC 32N03 portion nord, 32N06, 32N07 et 32N portion nord), Eeyou Istchee Baie-James* (MERN)



LEGEND

NEMASKA NEW LANDFILL POTENTIAL SITE

GEOLOGY DESCRIPTION NEAR THE SITE

GEOLOGICAL ZONES:

- Biotite granite
- Amphibolitized basalt; levels of ultramafic volcanic rocks
- Peridotite, pyroxenite and gabbro
- Paragneiss with biotite-hornblende ± garnet, containing <10% mobilisate
- White granitic pegmatite with muscovite-garnet ± biotite

REV.	DESCRIPTION	DATE	BY	CHK

REFERENCE :

1. TOPOGRAPHIC MAP 32 N/9 LAC CHAMPION, 1:50,000, ENERGY, MINES AND RESOURCES CANADA, 1990;
2. SIGEOM DATA, MINISTÈRE DES RESSOURCES NATURELLES ET DES FORÊTS, 2023.

NOTE :

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1:30 000 — 0 250 500 750 1000 SCALE (m)

THIS SCALE TO BE USED TO OBTAIN APPROXIMATE DIMENSIONS FOR INFORMATION

N S E W

CLIENT

Stantec Consulting Ltd

PROJECT

Nemaska New Waste Disposal Site
Hydrogeological Assessment
Nemaska, Quebec

TITLE

Bedrock Geology

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PROJECT #	DATE	REV.	FIG.
230448	2023-08-17	-	4

DRAWN	DESIGNED	CHECKED	CAD DRAWING
K.T.	L.A.	L.A.	230448-FIG4.DWG

Table 1: Piezometric Survey results - 2017 and 2021

Well / Borehole	Lithology from borehole descriptions	Geographic cordinates		Depth of sounding (m bgs)	Elevation (n)		GWL December 2017		GWL August 1st, 2018		GWL August 4th, 2020		GWL June 16, 2021	
		Easting	Northing		Ground	PVC	Water depth / ground surface (m)	Elevation (m)	Water depth / ground surface (m)	Elevation (m)	Water depth / ground surface (m)	Elevation (m)	Water depth / ground surface (m)	Elevation (m)
PZ-01	Grey sand with gravel to grey silty sand with boulders	324217.92	5722649.15	17.68	259.867	260.838	5.45	254.42	6.48	253.39	5.65	254.22	-	-
PZ-02[a]	Grey sand with cobbles and boulders with traces of silt	324370.15	5722733.99	20.04	261.399	262.581	7.70	253.70	8.94	252.46	12.29	249.11	12.10	249.30
PZ-03	Grey sand with traces of silt, cobbles, and boulders	324221.00	5722809.42	12.37	260.067	260.897	7.89	252.18	7.03	253.04	7.37	252.70	6.60	253.47
PZ-04	Grey sand with traces of silt to boulders with grey sand and gravel	-	-	7.60	-	-	NA	NA	NA	NA	NA	NA	NA	NA
PZ-05[b]	Grey sand with traces of silt or gravel	324547.76	5723007.17	16.87	262.621	263.507	7.99	254.63	Dry	Dry	Dry	Dry	Dry	Dry
PZ-06	Grey sand with silt to grey sandy silt with traces of gravel and boulders	324529.84	5722732.51	11.23	248.919	249.907	0.21	248.71	0.40	248.52	0.58	248.34	0.31	248.61

[a] The Well depth measured when it was built in November 2017 is 17.58 m, whereas the depth measured in June 2021 is 14.47 m. The well appears to be poorly installed (silted up and/or sunken).

[b] The depth (in relation to the PVC) of the well when it was installed in November 2017 was 14.87 m, compared with a depth of 10.18 m. The strainer is installed between 11.87 and 14.87m in relation to the pvc top. The entire length of the strainer seems blocked since 2018. The well is badly installed

The raw data and graphs of the tests are presented in **Table 2** and **Appendix A.**

Table 2: Summary of the Aquifer Characteristics

Monitoring Well	Analysis method		Hydraulic conductivity (K)
PZ-1	Stantec	Kansas Geological Survey (KGS) method[1]	3.6×10^{-7} m/s
	BluMetric	Hvorlev / Bower & Rice	1.2×10^{-6} m/s
PZ-3	Stantec	Kansas Geological Survey (KGS) method	1.6×10^{-6} m/s
	BluMetric	Hvorlev / Bower & Rice	2.54×10^{-6} m/s
PZ-6	Stantec	Kansas Geological Survey KGS) method	1.1×10^{-7} m/s
	BluMetric	Hvorlev / Bower & Rice	2.69×10^{-7} m/s

[1]: Hyder et al.'s (1994) KGS model for interpreting permeability tests is best suited to variable-level tests performed in cylindrical filter beds, whereas on-site tests are of the hydraulic shock type. This KGS model extends the Cooper et al. (1967) solution to the problems of partial penetration wells and wells affected by parietal effects. The Hyder et al. (1994) solution is in fact a generalization of the work of Dougherty & Babu (1984) on partial penetration and of Moench & Hsieh (1985) on parietal effects (Duhaime, 2012[9]).

3.3.3 Groundwater Flow

Static water levels measured on December 1-8, 2017, August 1st, 2018, August 4th, 2020, and June 16, 2021 are listed in **Table 1**. Note that no wells and therefore no information (water level, pumping test, etc.) were listed in the MELCCFP's[10] Hydrogeological Information System (SIH) for the area within a 10 km radius of the study site.

Continuous monitoring of water levels over a one-year period from June 2021 to June 2022 was carried out using a datalogger, the data for which is presented in **Appendix A**.

The depth of groundwater in the sand deposits was determined from observations on test-pit walls, and measurements in monitoring wells. The water table level was measured at depths varying between 0.2 m and 7.99 m below ground surface in 2017 compared to between 0.3 m and 12.1 m below ground surface in 2021 (**Table 1**). According to Poly-Géo (2017), groundwater was generally not encountered in the test pits, except for PU-04-01, PU-04-12, and PU-04-16.

Figures 5a and **5b** show water level depths relative to ground surface in December 2017 and August 2020. **Figures 6a** and **6b** represent water level elevations and flow direction in till overburden deposits in December 2017 and August 2020. The main groundwater flow direction is oriented

[9] Duhaime, F. (2012). *Mesure de la conductivité hydraulique du dépôt d'argile Champlain de Lachenaie, Québec: théorie et applications* [Thèse de doctorat, École Polytechnique de Montréal]. PolyPublie. https://publications.polymtl.ca/929/

[10] MELCCFP : Ministère de Environnement, de la lutte contre les changements climatiques, de la Faune et des Parcs, Québec

toward the east/southeast with a horizontal hydraulic gradient in the order of 0.025 m/m in August 2020, to 0.034 m/m in December 2017. Groundwater flow is generally to the southeast, toward the tributary to Lac Champion.

The average underground flow velocity ν is calculated from Darcy's law:

$$\nu = K\, ih / n$$

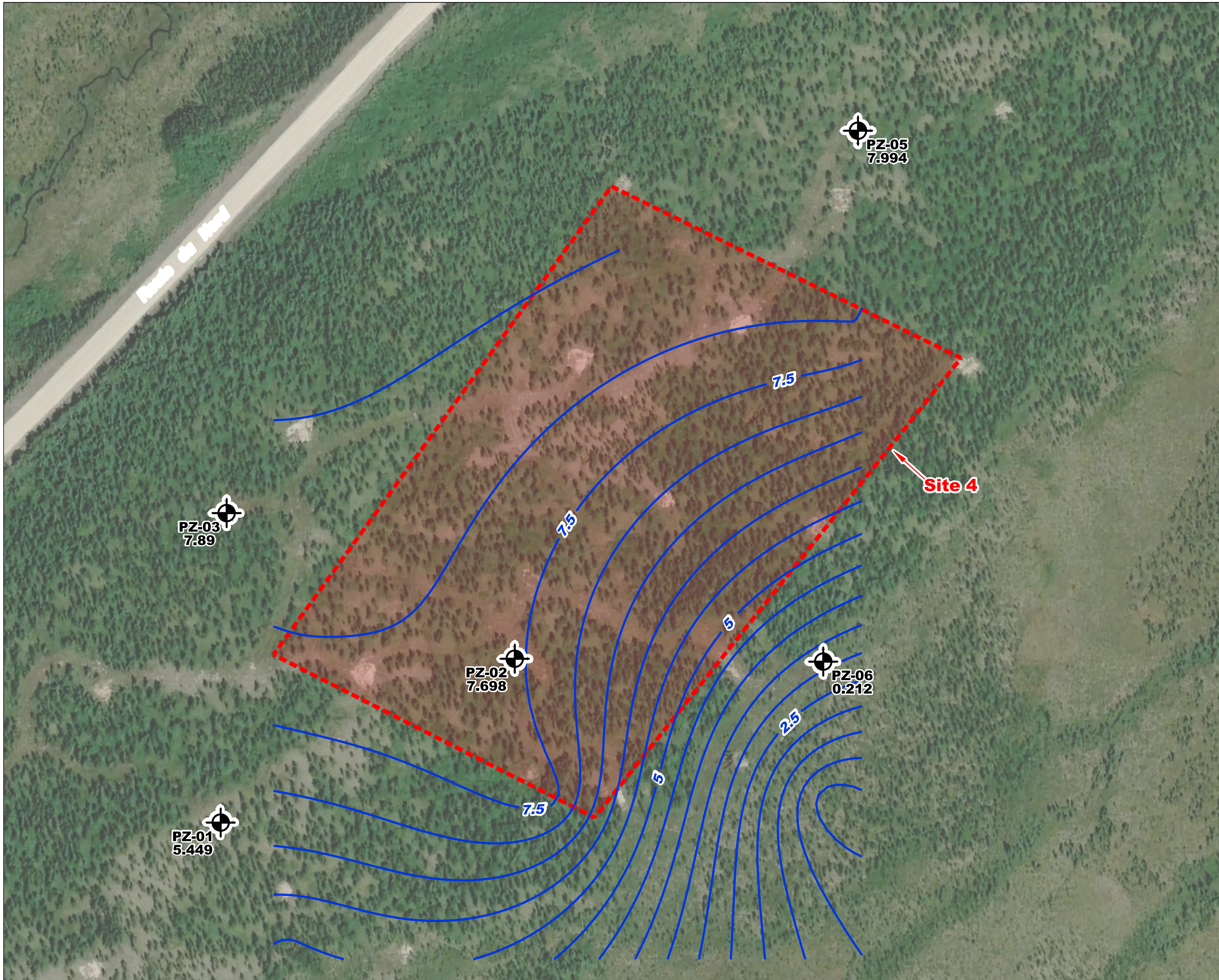
where :

K is the hydraulic conductivity of the hydrogeological medium (see Table 2),
ih the mean horizontal hydraulic gradient (estimated from measured piezometric data), and
n is the effective porosity or specific yield (%) (typical values taken from the literature (Domenico & Schwartz, 1990[11]; Fetter, 1988[12]; Freeze & Cherry, 1979[13]; Bear, 1972[14]).

For till, values for K are set at between 1.1×10^{-7} and 2.9×10^{-6} m/s (geometric mean 6.3×10^{-7} m/s) and values for n 25% (typical value for medium to fine sand). Therefore, considering a range of gradient between 0.025 and 0.034 m/m, linear groundwater velocity is estimated to be between 1×10^{-8} m/s to 2.2×10^{-7} m/s (0.0009 to 0.019 m/day).

The groundwater depth extrapolation maps (**Figures 5a** and **5b**) show that the boundaries of Site no. 4 have an unsaturated layer of at least 2m. Water level data from PZ-2 (upstream) and PZ-6 (downstream) in spring will therefore be important to see whether Site No. 4 always maintains an unsaturated layer of at least 1 m.

[11] Domenico P.A. and Schwartz F.W., 1990, Physical and Chemical Hydrogeology, John Wiley & Sons, New York, 824 p.
[12] Fetter, C. W., 1988. Applied Hydrogeology, Merrill Publishing Company, Colombus, 592 p
[13] Freeze, A. and Cherry, J., 1979, Groundwater, Prentice Hall, New Jersey, 418 p.
[14] Biar, J. 1972. Dynamics of fluids in porous media. Dover Publications, New York 764p.



LEGEND

- NEMASKA NEW LANDFILL POTENTIAL SITE
- 2.5 ISO-DEPTH GROUNDWATER CONTOUR (m)
- MONITORING WELL
- 0.212 GROUNDWATER DEPTH RELATIVE TO THE GROUND SURFACE (m)

REV.	DESCRIPTION	DATE	BY	CHK

REFERENCE :
AERIAL PHOTOGRAPHY, JULY 2020, GOOGLE EARTH, 2023.

NOTE :
PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC. DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

1:2 000 0 20 40 60 80
SCALE (m)
THIS SCALE TO BE USED TO OBTAIN APPROXIMATE DIMENSIONS FOR INFORMATION

N W E S

CLIENT

Stantec Consulting Ltd

PROJECT

Nemaska New Waste Disposal Site
Hydrogeological Assessment
Nemaska, Quebec

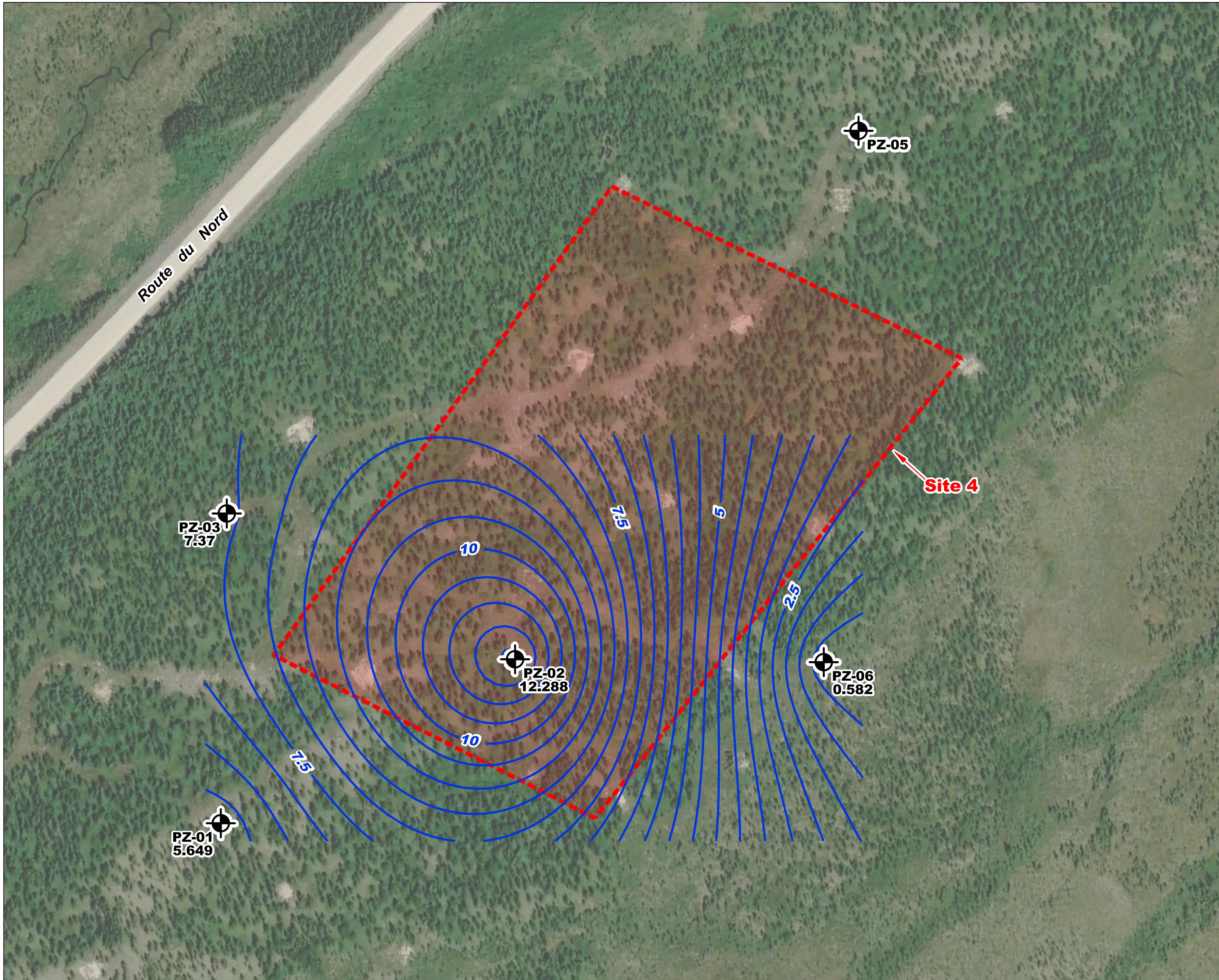
TITLE

Groundwater Depth
Relative to the Ground Surface
(December 1st, 2017)

BluMetric® Environmental
1500 du Collège Street, Suite 200
Saint-Laurent, Québec H4L 5G6
TEL.: 514 844-7199 FAX: 514 841-9111
Email: montreal@blumetric.ca
Web site: www.blumetric.ca

PROJECT #	DATE	REV.	FIG.
230448	2023-08-17	-	5a

DRAWN	DESIGNED	CHECKED	CAD DRAWING
K.T.	L.A.	L.A.	230448-FIG5a.DWG



LEGEND

NEMASKA NEW LANDFILL POTENTIAL SITE

2.5 ISO-DEPTH GROUNDWATER CONTOUR (m)

MONITORING WELL

0.582 GROUNDWATER DEPTH RELATIVE TO THE GROUND SURFACE (m)

REV.	DESCRIPTION	DATE	BY	CHK

REFERENCE :
AERIAL PHOTOGRAPHY, JULY 2020, GOOGLE EARTH, 2023.

NOTE :
PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC. DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

1:2 000 0 20 40 60 80
SCALE (m)
THIS SCALE TO BE USED TO OBTAIN APPROXIMATE DIMENSIONS FOR INFORMATION

N E S W

CLIENT
Stantec Consulting Ltd

PROJECT
Nemaska New Waste Disposal Site
Hydrogeological Assessment
Nemaska, Quebec

TITLE
Groundwater Depth
Relative to the Ground Surface
(August 4th, 2020)

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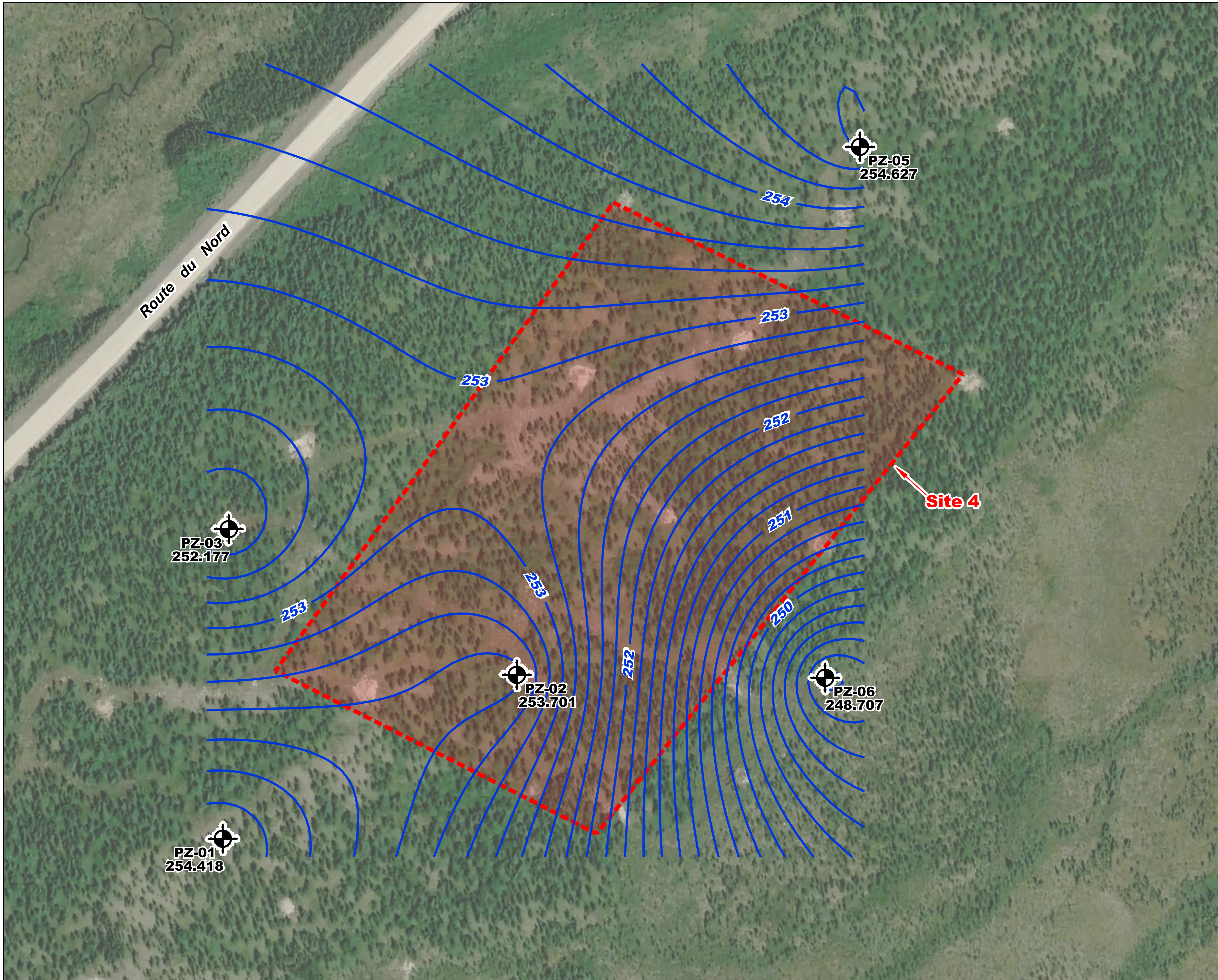
Web site: www.blumetric.ca

PROJECT #	DATE	REV.	FIG.
230448	2023-08-17	-	5b

DRAWN	DESIGNED	CHECKED	CAD DRAWING
K.T.	L.A.	L.A.	230448-FIG5b.DWG



LEGEND

NEMASKA NEW LANDFILL POTENTIAL SITE

250 ISO-DEPTH GROUNDWATER CONTOUR (m)

MONITORING WELL

248.707 GROUNDWATER ELEVATION (m)

REV.	DESCRIPTION	DATE	BY	CHK

REFERENCE :
AERIAL PHOTOGRAPHY, JULY 2020, GOOGLE EARTH, 2023.

NOTE :

DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

1:2 000 0 20 40 60 80
SCALE (m)
THIS SCALE TO BE USED TO OBTAIN APPROXIMATE DIMENSIONS FOR INFORMATION

N W E S

CLIENT
Stantec Consulting Ltd

PROJECT
Nemaska New Waste Disposal Site
Hydrogeological Assessment
Nemaska, Quebec

TITLE
Groundwater Elevation
(December 1st, 2017)

BluMetric® Environmental
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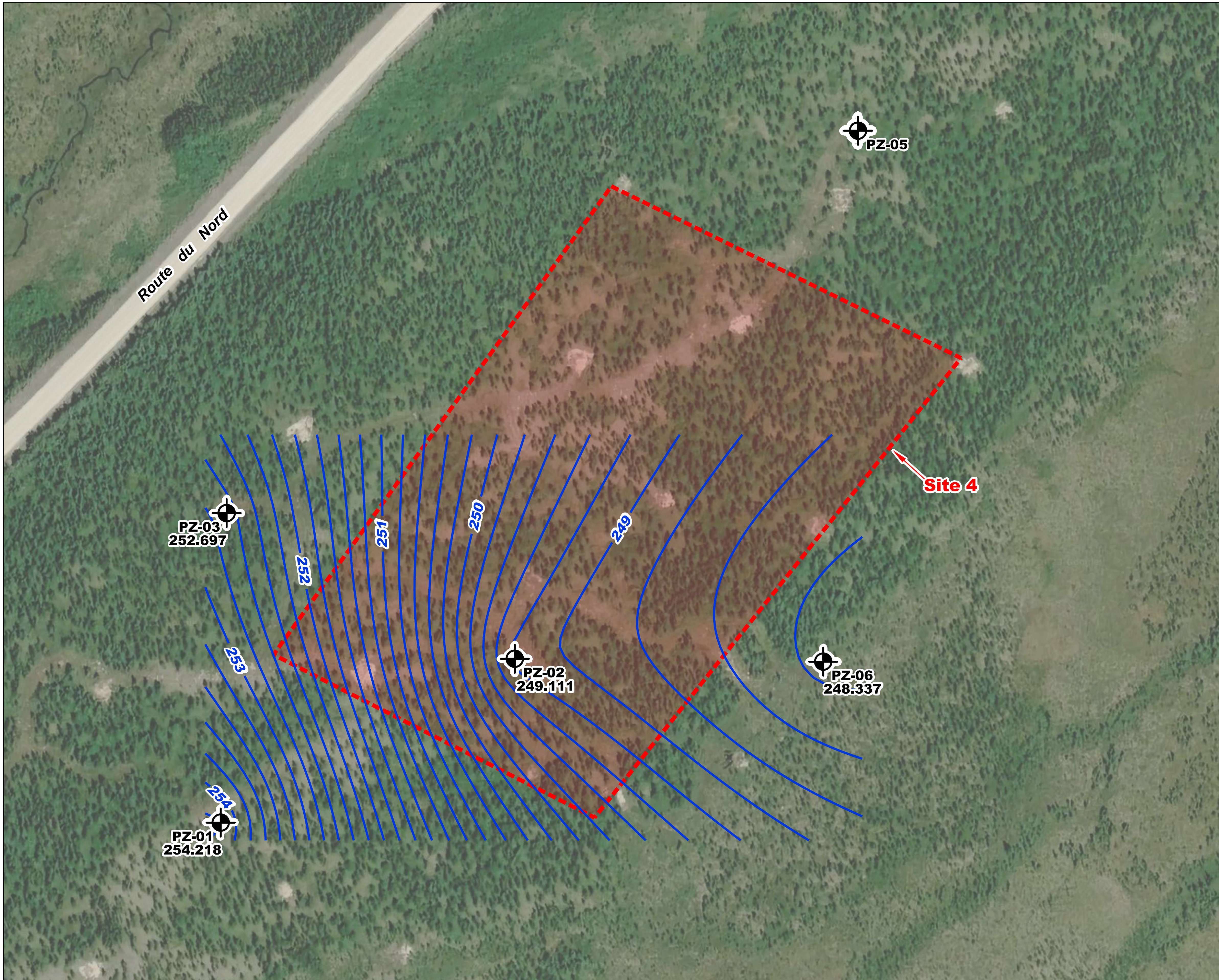
Web site: www.blumetric.ca

PROJECT #	DATE	REV.	FIG.
230448	2023-08-17	-	6a

DRAWN	DESIGNED	CHECKED	CAD DRAWING
K.T.	L.A.	L.A.	230448-FIG6a.DWG



LEGEND

NEMASKA NEW LANDFILL POTENTIAL SITE

249 ISO-DEPTH GROUNDWATER CONTOUR (m)

MONITORING WELL

248.337 GROUNDWATER ELEVATION (m)

REV.	DESCRIPTION	DATE	BY	CHK

REFERENCE :
AERIAL PHOTOGRAPHY, JULY 2020, GOOGLE EARTH, 2023.

NOTE :
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1:2 000 0 20 40 60 80
SCALE (m)
THIS SCALE TO BE USED TO OBTAIN APPROXIMATE DIMENSIONS FOR INFORMATION

N W E S

CLIENT

Stantec Consulting Ltd

PROJECT

Nemaska New Waste Disposal Site
Hydrogeological Assessment
Nemaska, Quebec

TITLE

Groundwater Elevation
(August 4th, 2020)

BluMetric® Environmental
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Web site: www.blumetric.ca

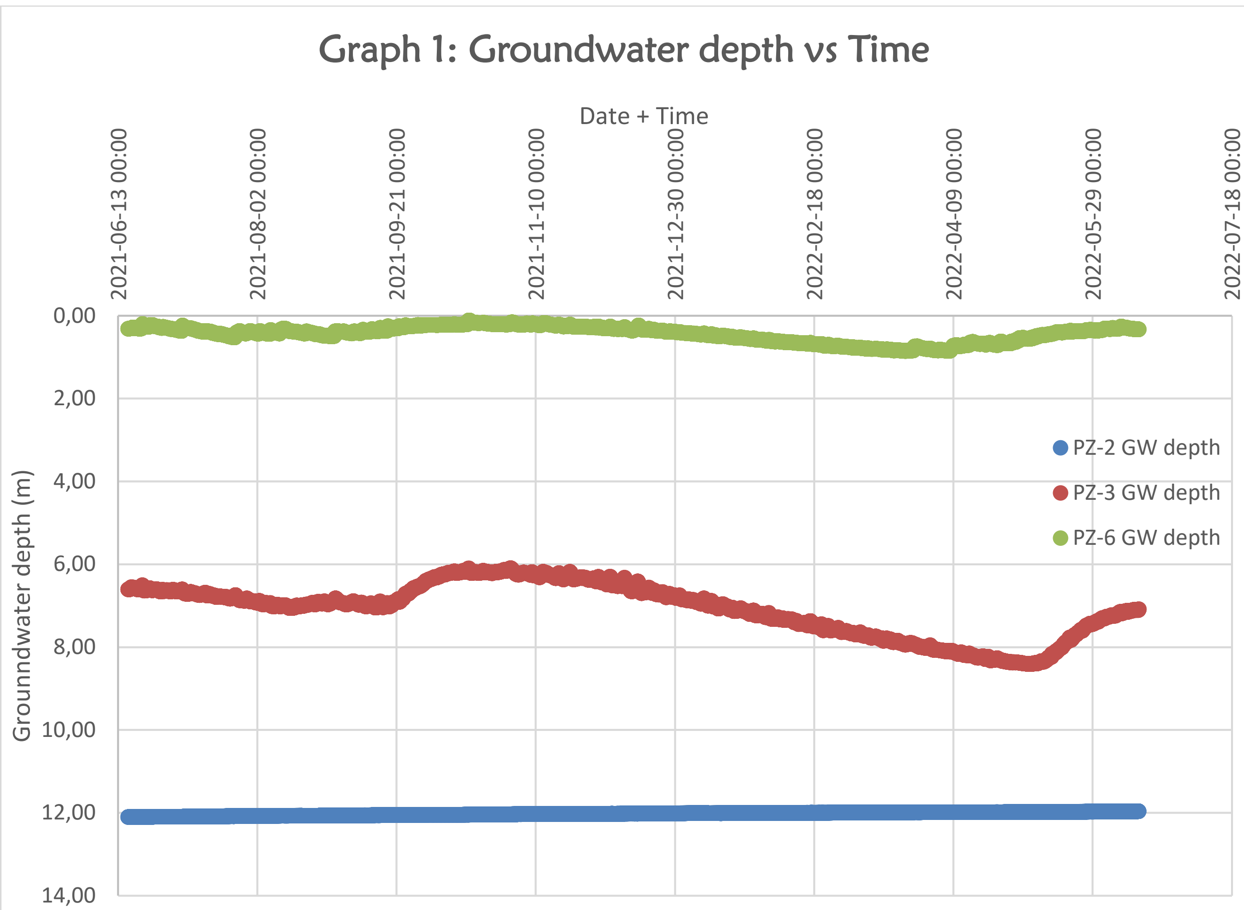
PROJECT #	DATE	REV.	FIG.
230448	2023-08-17	-	6b

DRAWN	DESIGNED	CHECKED	CAD DRAWING
K.T.	L.A.	L.A.	230448-FIG6b.DWG

3.3.4 Seasonal Groundwater Fluctuation or Temporal Variations in Water Level

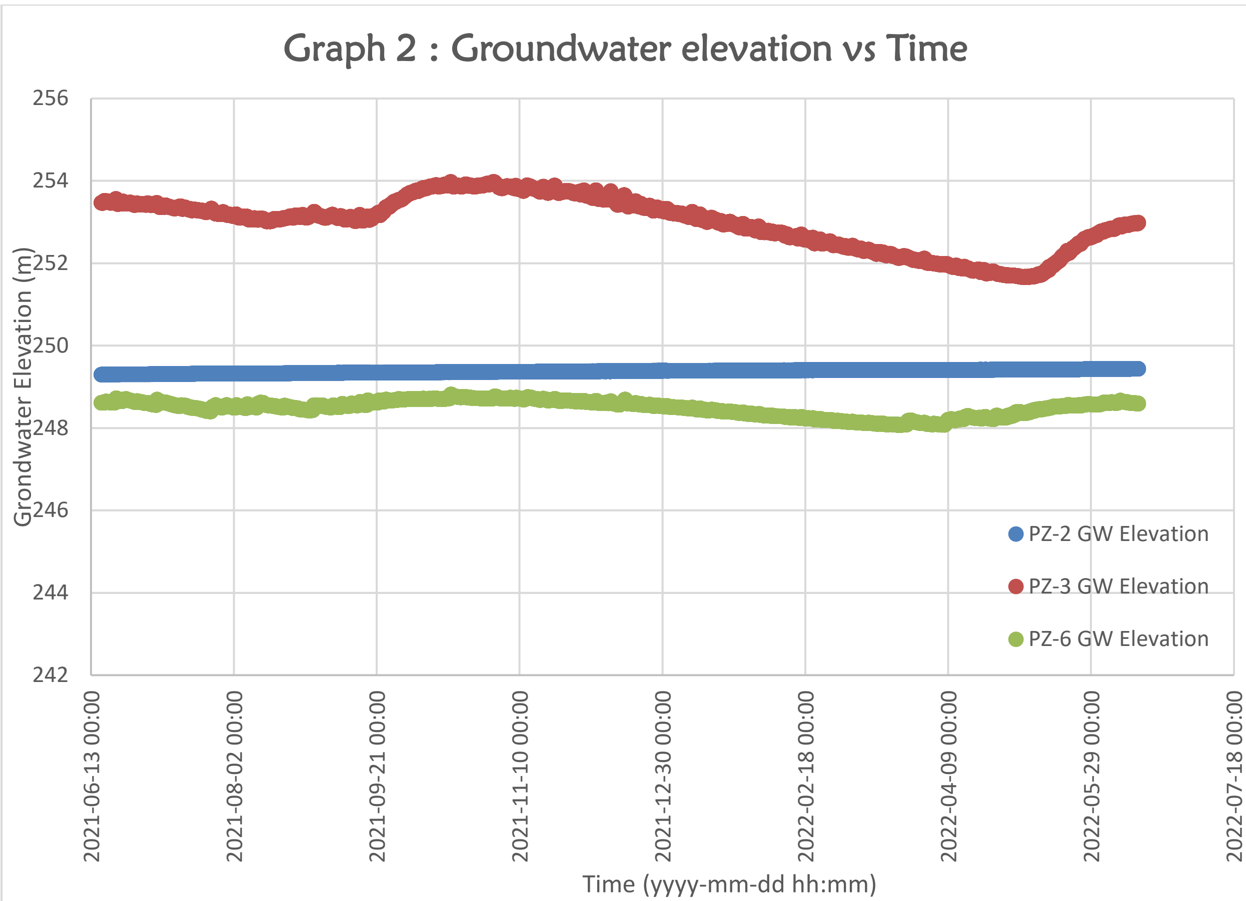
Monitoring temporal variations in the water table provides additional information on the behavior of the till aquifer following rainfall events. Water level recordings in wells PZ-2, PZ-3 and PZ-6 between June 2021 and June 2020 enabled seasonal fluctuations to be measured. Monitoring in well PZ-5 was inconclusive, as there was insufficient water in the well in June 2021 and at the start of winter.

Graph 1 shows the variation in water level relative to the ground as a function of time for the water table in till. Downstream (PZ-6), water levels are always close to the surface (0.11 to 0.85 m), while PZ-2 (high level of topography) a constant layer of more than 12 m remains unsaturated throughout the year.



PZ-2 and PZ-6 seem to maintain the same unsaturated soil layer over time. The greatest seasonal variation in water depth is observed in PZ-3. Site No. 4 appears to maintain the same unsaturated soil layer from June 2021 to June 2022. The depth of the water table in the PZ-6 sector varies from 0.11 m in spring (flood period) to 0.85 m at low-water (summer). Although the water level is very close to the surface, the site does not appear to be flooded in spring.

Graph 2 shows the variation in groundwater elevation for the till or sand water table.



3.4 GROUNDWATER CLASSIFICATION OR AQUIFER POTENTIAL

As summarised in Stantec (2021), there are some specifications regarding hydrogeological conditions for the construction of a new landfill according to provincial regulation, the *Regulation respecting the landfilling and incineration of residual materials* (RRLIRM[15]) in Québec. Among other things, the RRLIRM specifies:

- Preferably, it is suggested to construct a new landfill over an impermeable layer of soil and overburden to limit leachate infiltration that would contaminate groundwater. However, in the case that such conditions are not available at an economic distance from the community concerned, the landfill must be located at minimum distances from certain uses or infrastructures or may be prohibited at certain sites depending on local hydrogeological conditions and the use of water.
- There are no water-supply facilities near the location proposed for the construction of the landfill. The site is located more than 5 km southeast of the existing drinking water wells.
- Article 16 of the RRLIRM indicates that the development of a landfill is also prohibited on land below which there is a free water table with a high aquifer potential. According to Article 16, « a high aquifer potential » is an aquifer where at least 25 cubic metres per hour (m3/hr) of water can be pumped continuously from the same production well.
- According to Article 16 guidelines, a pumping test is required to establish the potential of a water table aquifer. However, a pumping test is not required in all landfill projects, but only for those where the preliminary hydrogeological study indicates the presence of a hydrostratigraphic unit likely to present high aquifer potential (i.e., several meters of saturated sediment, a layer of coarse sand or gravel at least a few meters thick, fractured rock outcropping or under a layer of permeable deposits, etc.).

The Quebec groundwater classification procedure (MEF, 1999[16]) categorizes aquifers into three classes. The information relevant to the questions posed in this procedure is presented in **Tables 3** for unconsolidated till deposits and explained below. According to the information available, there are no existing or planned collective water catchment structures within a one-kilometer radius of the site, nor are there any planned developments. There are no known private surface or groundwater catchment structures within 1 km of the study site. There is therefore no potential for the hydrostratigraphic units to be used as a water supply source within one kilometer of the site.

[15] https://www.legisquebec.gouv.qc.ca/en/document/cr/Q-2,%20r.%2019

[16] MEF, 1999. Guide de classification des eaux souterraine du Québec. Service des pesticides et des eaux souterraines, Direction des politiques des secteurs agricole et naturel, Direction Générale de l'environnement. 1er février 1999. https://www.demandesinfos.environnement.gouv.qc.ca/dossiers/eau/4197_fiche.pdf

Table 3: Answers to Questions about Groundwater Classification – Unconsolidated Till

Questions	Answers
Hydrogeological unit:	Unconsolidated deposit – till: sand with gravel to grey silty sand with boulders
Collective or potential catchment work:	No
Presence of a catchment structure:	No
Transmissivity > 1 m^2/d :	Non. T=K*bsat., bsat.=9 m and K = $6.3x10^{-7}$ m/s, So T=0,49 m^2/d So Transmissivity < 1 m2/d
Physico-chemistry satisfactory:	Data not available
Development project:	No

Thus, according to the geoscientific information analyzed and the Quebec groundwater classification procedure (MEF, 1999), the hydrogeological till formation at the target site is Class III with a weak hydraulic connection where present. Class III is justified by the insufficient quantity of water and uneconomical extraction.

3.5 OTHERS OBSERVATION: PERMEABILITY AND INFILTRATION POTENTIAL

The most important factors influencing soil infiltration capacity are the natural slope of the soil (topography), the type and properties of unsaturated soils and aquifer, geological and hydro-geological conditions. In addition to soil permeability (hydraulic conductivity), it is therefore important to know the infiltration capacity of surface soils.

The hydraulic conductivities measured in the tests (Table 2) show average to low permeability values. A safety factor should be applied to these values, so that long-term landfill use conditions can take account of possible clogging in the design of the drainage system.

It is therefore important to complete the current study with a water balance study that considers infiltration through the unsaturated zone of the soil.

4. CLOSING

The findings presented in this report are based on conditions observed at the specified dates and locations, and on the analysis of samples for the specified parameters. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, portions of the site that were not investigated directly, or types of analysis not performed.

Nothing in this report is intended to constitute or provide a legal opinion. BluMetric makes no representation as to compliance with environmental laws, rules, regulations or policies established by regulatory agencies.

This report has been prepared for Stantec. Any use a third party makes of this report, any reliance on the report, or decisions based upon the report, are the responsibility of those third parties unless authorization is received from BluMetric in writing. BluMetric accepts no responsibility for any loss or damages suffered by any unauthorized third party because of decisions made or actions taken based on this report.

Respectfully submitted,
BluMetric Environmental Inc.

Léonard Agassounon, géo.Ph.D..
Senior Hydrogeologist

Sara Magdouli.Ph.D..
Market Lead

APPENDIX A

Data

BluMetric Environnement Inc.
276, rue St-Jacques
Bureau 818
Montreal (QC)
H2Y 1N3

Slug Test - Water Level Data

Project: Nemaska New Waste Disposal Site – Hydrogeological assess

Number: 230448-00

Client: Stantec

Location: Nemaska	Slug Test: PZ-1_2020	Test Well: PZ-1
Test Conducted by: Stantec	Test Date: 2020-08-04	
Water level at t=0 [m]: NAN	Static Water Level [m]: 6.62	Water level change at t=0 [m]: 0.00

	Time [s]	Water Level [m]	WL Change [m]
1	0	6.62	0.00
2	1	6.6402	0.0202
3	2	6.6163	-0.0037
4	3	6.6163	-0.0037
5	4	6.9363	0.3163
6	5	6.8528	0.2328
7	6	7.1581	0.5381
8	7	7.1544	0.5344
9	8	7.1489	0.5289
10	9	7.1462	0.5262
11	10	7.1425	0.5225
12	11	7.1398	0.5198
13	12	7.1398	0.5198
14	13	7.137	0.517
15	14	7.1425	0.5225
16	15	7.247	0.627
17	16	7.1938	0.5738
18	17	7.1251	0.5051
19	18	7.1233	0.5032
20	19	7.1187	0.4987
21	20	7.1187	0.4987
22	21	7.1168	0.4968
23	22	7.1141	0.4941
24	23	7.1141	0.4941
25	24	7.1113	0.4913
26	25	7.1077	0.4877
27	26	7.1077	0.4877
28	27	7.1049	0.4849
29	28	7.1049	0.4849
30	29	7.1022	0.4822
31	30	7.0994	0.4794
32	31	7.0994	0.4794
33	32	7.093	0.473
34	33	7.093	0.473
35	34	7.093	0.473
36	35	7.0903	0.4703
37	36	7.0875	0.4675
38	37	7.0875	0.4675
39	38	7.0875	0.4675
40	39	7.0838	0.4638
41	40	7.0838	0.4638
42	41	7.0811	0.4611
43	42	7.0783	0.4583
44	43	7.0783	0.4583
45	44	7.0756	0.4556
46	45	7.0756	0.4556
47	46	7.0756	0.4556
48	47	7.0719	0.4519

BluMetric Environnement Inc.
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Bureau 818
Montreal (QC)
H2Y 1N3

Slug Test - Water Level Data

Project: Nemaska New Waste Disposal Site – Hydrogeological assess

Number: 230448-00

Client: Stantec

	Time [s]	Water Level [m]	WL Change [m]
49	48	7.0719	0.4519
50	49	7.0692	0.4492
51	50	7.0664	0.4464
52	51	7.0628	0.4428
53	52	7.0628	0.4428
54	53	7.06	0.44
55	54	7.06	0.44
56	55	7.0573	0.4372
57	56	7.0573	0.4372
58	57	7.0573	0.4372
59	58	7.0545	0.4345
60	59	7.0545	0.4345
61	60	7.0508	0.4308
62	61	7.0481	0.4281
63	62	7.0453	0.4253
64	63	7.0453	0.4253
65	64	7.0453	0.4253
66	65	7.0453	0.4253
67	66	7.0426	0.4226
68	67	7.0426	0.4226
69	68	7.0389	0.4189
70	69	7.0389	0.4189
71	70	7.0362	0.4162
72	71	7.0362	0.4162
73	72	7.0334	0.4134
74	73	7.0307	0.4107
75	74	7.0307	0.4107
76	75	7.0307	0.4107
77	76	7.027	0.407
78	77	7.027	0.407
79	78	7.0243	0.4043
80	79	7.0215	0.4015
81	80	7.0215	0.4015
82	81	7.0215	0.4015
83	82	7.0188	0.3987
84	83	7.0188	0.3987
85	84	7.0151	0.3951
86	85	7.0151	0.3951
87	86	7.0151	0.3951
88	87	7.0151	0.3951
89	88	7.0123	0.3923
90	89	7.0096	0.3896
91	90	7.0096	0.3896
92	91	7.0096	0.3896
93	92	7.0059	0.3859
94	93	7.0059	0.3859
95	94	7.0032	0.3832
96	95	7.0032	0.3832
97	96	7.0004	0.3804
98	97	7.0004	0.3804
99	98	6.9977	0.3777
100	99	6.9977	0.3777
101	100	6.9977	0.3777

BluMetric Environnement Inc.
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Bureau 818
Montreal (QC)
H2Y 1N3

Project: Nemaska New Waste Disposal Site – Hydrogeological assessm

Number: 230448-00

Client: Stantec

	Time [s]	Water Level [m]	WL Change [m]
102	101	6.994	0.374
103	102	6.9977	0.3777
104	103	6.994	0.374
105	104	6.994	0.374
106	105	6.9913	0.3712
107	106	6.9913	0.3712
108	107	6.9913	0.3712
109	108	6.9885	0.3685
110	109	6.9858	0.3658
111	110	6.9885	0.3685
112	111	6.9858	0.3658
113	112	6.9858	0.3658
114	113	6.9793	0.3593
115	114	6.9821	0.3621
116	115	6.9793	0.3593
117	116	6.9793	0.3593
118	117	6.9766	0.3566
119	118	6.9766	0.3566
120	119	6.9766	0.3566
121	120	6.9738	0.3538
122	121	6.9738	0.3538
123	122	6.9738	0.3538
124	123	6.9738	0.3538
125	124	6.9702	0.3502
126	125	6.9702	0.3502
127	126	6.9674	0.3474
128	127	6.9674	0.3474
129	128	6.9674	0.3474
130	129	6.9674	0.3474
131	130	6.9647	0.3447
132	131	6.9647	0.3447
133	132	6.9619	0.3419
134	133	6.9583	0.3382
135	134	6.9583	0.3382
136	135	6.9583	0.3382
137	136	6.9555	0.3355
138	137	6.9555	0.3355
139	138	6.9528	0.3327
140	139	6.9555	0.3355
141	140	6.9528	0.3327
142	141	6.9528	0.3327
143	142	6.9491	0.3291
144	143	6.9491	0.3291
145	144	6.9491	0.3291
146	145	6.9463	0.3263
147	146	6.9436	0.3236
148	147	6.9463	0.3263
149	148	6.9436	0.3236
150	149	6.9436	0.3236
151	150	6.9408	0.3208
152	151	6.9436	0.3236
153	152	6.9408	0.3208
154	153	6.9372	0.3172

BluMetric Environnement Inc.
276, rue St-Jacques
Bureau 818
Montreal (QC)
H2Y 1N3

Slug Test - Water Level Data

Project: Nemaska New Waste Disposal Site – Hydrogeological assessm

Number: 230448-00

Client: Stantec

	Time [s]	Water Level [m]	WL Change [m]
155	154	6.9372	0.3172
156	155	6.9372	0.3172
157	156	6.9344	0.3144
158	157	6.9344	0.3144
159	158	6.9344	0.3144
160	159	6.9344	0.3144
161	160	6.9344	0.3144
162	161	6.9317	0.3117
163	162	6.9317	0.3117
164	163	6.9289	0.3089
165	164	6.9289	0.3089
166	165	6.9289	0.3089
167	166	6.9253	0.3053
168	167	6.9253	0.3053
169	168	6.9225	0.3025
170	169	6.9225	0.3025
171	170	6.9225	0.3025
172	171	6.9198	0.2997
173	172	6.9198	0.2997
174	173	6.9198	0.2997
175	174	6.9198	0.2997
176	175	6.9198	0.2997
177	176	6.917	0.297
178	177	6.917	0.297
179	178	6.9133	0.2933
180	179	6.9133	0.2933
181	180	6.9133	0.2933
182	181	6.9106	0.2906
183	182	6.9106	0.2906
184	183	6.9106	0.2906
185	184	6.9106	0.2906
186	185	6.9106	0.2906
187	186	6.9106	0.2906
188	187	6.9078	0.2878
189	188	6.9078	0.2878
190	189	6.9051	0.2851
191	190	6.9051	0.2851
192	191	6.9051	0.2851
193	192	6.9051	0.2851
194	193	6.8987	0.2787
195	194	6.9014	0.2814
196	195	6.9014	0.2814
197	196	6.8987	0.2787
198	197	6.8987	0.2787
199	198	6.8987	0.2787
200	199	6.8959	0.2759
201	200	6.8959	0.2759
202	201	6.8959	0.2759
203	202	6.8959	0.2759
204	203	6.8959	0.2759
205	204	6.8959	0.2759
206	205	6.8923	0.2722
207	206	6.8923	0.2722

BluMetric Environnement Inc. 276, rue St-Jacques Bureau 818 Montreal (QC) H2Y 1N3	**Slug Test - Water Level Data** Page 5 of 15 Project: Nemaska New Waste Disposal Site – Hydrogeological assessm Number: 230448-00 Client: Stantec

	Time [s]	Water Level [m]	WL Change [m]
208	207	6.8923	0.2722
209	208	6.8923	0.2722
210	209	6.8895	0.2695
211	210	6.8895	0.2695
212	211	6.8895	0.2695
213	212	6.8895	0.2695
214	213	6.8868	0.2668
215	214	6.8868	0.2668
216	215	6.884	0.264
217	216	6.884	0.264
218	217	6.884	0.264
219	218	6.8803	0.2603
220	219	6.8803	0.2603
221	220	6.884	0.264
222	221	6.8776	0.2576
223	222	6.8803	0.2603
224	223	6.8776	0.2576
225	224	6.8776	0.2576
226	225	6.8776	0.2576
227	226	6.8776	0.2576
228	227	6.8748	0.2548
229	228	6.8748	0.2548
230	229	6.8721	0.2521
231	230	6.8748	0.2548
232	231	6.8721	0.2521
233	232	6.8721	0.2521
234	233	6.8684	0.2484
235	234	6.8684	0.2484
236	235	6.8684	0.2484
237	236	6.8684	0.2484
238	237	6.8684	0.2484
239	238	6.8684	0.2484
240	239	6.8684	0.2484
241	240	6.8657	0.2457
242	241	6.8657	0.2457
243	242	6.8657	0.2457
244	243	6.8657	0.2457
245	244	6.8629	0.2429
246	245	6.8629	0.2429
247	246	6.8629	0.2429
248	247	6.8629	0.2429
249	248	6.8629	0.2429
250	249	6.8602	0.2402
251	250	6.8602	0.2402
252	251	6.8602	0.2402
253	252	6.8565	0.2365
254	253	6.8602	0.2402
255	254	6.8565	0.2365
256	255	6.8565	0.2365
257	256	6.8565	0.2365
258	257	6.8565	0.2365
259	258	6.8565	0.2365
260	259	6.8538	0.2337

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	Time [s]	Water Level [m]	WL Change [m]
261	260	6.8538	0.2337
262	261	6.8565	0.2365
263	262	6.851	0.231
264	263	6.851	0.231
265	264	6.8538	0.2337
266	265	6.851	0.231
267	266	6.851	0.231
268	267	6.851	0.231
269	268	6.8483	0.2283
270	269	6.8483	0.2283
271	270	6.8483	0.2283
272	271	6.8483	0.2283
273	272	6.8446	0.2246
274	273	6.8483	0.2283
275	274	6.8483	0.2283
276	275	6.8446	0.2246
277	276	6.8446	0.2246
278	277	6.8446	0.2246
279	278	6.8418	0.2218
280	279	6.8391	0.2191
281	280	6.8418	0.2218
282	281	6.8418	0.2218
283	282	6.8418	0.2218
284	283	6.8391	0.2191
285	284	6.8391	0.2191
286	285	6.8391	0.2191
287	286	6.8391	0.2191
288	287	6.8354	0.2154
289	288	6.8354	0.2154
290	289	6.8354	0.2154
291	290	6.8354	0.2154
292	291	6.8327	0.2127
293	292	6.8327	0.2127
294	293	6.8327	0.2127
295	294	6.8327	0.2127
296	295	6.8327	0.2127
297	296	6.8299	0.2099
298	297	6.8299	0.2099
299	298	6.8299	0.2099
300	299	6.8299	0.2099
301	300	6.8299	0.2099
302	301	6.8299	0.2099
303	302	6.8299	0.2099
304	303	6.8299	0.2099
305	304	6.8272	0.2072
306	305	6.8272	0.2072
307	306	6.8272	0.2072
308	307	6.8235	0.2035
309	308	6.8235	0.2035
310	309	6.8235	0.2035
311	310	6.8235	0.2035
312	311	6.8235	0.2035
313	312	6.8235	0.2035

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	Time [s]	Water Level [m]	WL Change [m]
314	313	6.8208	0.2008
315	314	6.8208	0.2008
316	315	6.8208	0.2008
317	316	6.8208	0.2008
318	317	6.8208	0.2008
319	318	6.8208	0.2008
320	319	6.8208	0.2008
321	320	6.818	0.198
322	321	6.818	0.198
323	322	6.818	0.198
324	323	6.818	0.198
325	324	6.818	0.198
326	325	6.8152	0.1952
327	326	6.818	0.198
328	327	6.8152	0.1952
329	328	6.8152	0.1952
330	329	6.8152	0.1952
331	330	6.8152	0.1952
332	331	6.8116	0.1916
333	332	6.8116	0.1916
334	333	6.8116	0.1916
335	334	6.8116	0.1916
336	335	6.8116	0.1916
337	336	6.8116	0.1916
338	337	6.8116	0.1916
339	338	6.8116	0.1916
340	339	6.8088	0.1888
341	340	6.8088	0.1888
342	341	6.8088	0.1888
343	342	6.8061	0.1861
344	343	6.8061	0.1861
345	344	6.8061	0.1861
346	345	6.8061	0.1861
347	346	6.8088	0.1888
348	347	6.8061	0.1861
349	348	6.8061	0.1861
350	349	6.8061	0.1861
351	350	6.8033	0.1833
352	351	6.8061	0.1861
353	352	6.8033	0.1833
354	353	6.8033	0.1833
355	354	6.8033	0.1833
356	355	6.8033	0.1833
357	356	6.7997	0.1797
358	357	6.7997	0.1797
359	358	6.7997	0.1797
360	359	6.7997	0.1797
361	360	6.7997	0.1797
362	361	6.7997	0.1797
363	362	6.7969	0.1769
364	363	6.7997	0.1797
365	364	6.7997	0.1797
366	365	6.7969	0.1769

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	Time [s]	Water Level [m]	WL Change [m]
367	366	6.7997	0.1797
368	367	6.7969	0.1769
369	368	6.7942	0.1742
370	369	6.7969	0.1769
371	370	6.7942	0.1742
372	371	6.7942	0.1742
373	372	6.7942	0.1742
374	373	6.7914	0.1714
375	374	6.7914	0.1714
376	375	6.7914	0.1714
377	376	6.7914	0.1714
378	377	6.7914	0.1714
379	378	6.7914	0.1714
380	379	6.7914	0.1714
381	380	6.7914	0.1714
382	381	6.7914	0.1714
383	382	6.7878	0.1677
384	383	6.7878	0.1677
385	384	6.7878	0.1677
386	385	6.7878	0.1677
387	386	6.7878	0.1677
388	387	6.7878	0.1677
389	388	6.785	0.165
390	389	6.785	0.165
391	390	6.785	0.165
392	391	6.785	0.165
393	392	6.785	0.165
394	393	6.785	0.165
395	394	6.785	0.165
396	395	6.7823	0.1623
397	396	6.7823	0.1623
398	397	6.7823	0.1623
399	398	6.7823	0.1623
400	399	6.7823	0.1623
401	400	6.785	0.165
402	401	6.7795	0.1595
403	402	6.7823	0.1623
404	403	6.7823	0.1623
405	404	6.7823	0.1623
406	405	6.7823	0.1623
407	406	6.7823	0.1623
408	407	6.7795	0.1595
409	408	6.7823	0.1623
410	409	6.7795	0.1595
411	410	6.7823	0.1623
412	411	6.7795	0.1595
413	412	6.7795	0.1595
414	413	6.7795	0.1595
415	414	6.7795	0.1595
416	415	6.7758	0.1558
417	416	6.7795	0.1595
418	417	6.7758	0.1558
419	418	6.7758	0.1558

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	Time [s]	Water Level [m]	WL Change [m]
420	419	6.7758	0.1558
421	420	6.7758	0.1558
422	421	6.7758	0.1558
423	422	6.7758	0.1558
424	423	6.7758	0.1558
425	424	6.7758	0.1558
426	425	6.7731	0.1531
427	426	6.7758	0.1558
428	427	6.7731	0.1531
429	428	6.7731	0.1531
430	429	6.7731	0.1531
431	430	6.7731	0.1531
432	431	6.7731	0.1531
433	432	6.7703	0.1503
434	433	6.7703	0.1503
435	434	6.7703	0.1503
436	435	6.7703	0.1503
437	436	6.7703	0.1503
438	437	6.7703	0.1503
439	438	6.7667	0.1467
440	439	6.7667	0.1467
441	440	6.7667	0.1467
442	441	6.7667	0.1467
443	442	6.7667	0.1467
444	443	6.7667	0.1467
445	444	6.7667	0.1467
446	445	6.7667	0.1467
447	446	6.7667	0.1467
448	447	6.7667	0.1467
449	448	6.7639	0.1439
450	449	6.7639	0.1439
451	450	6.7639	0.1439
452	451	6.7639	0.1439
453	452	6.7639	0.1439
454	453	6.7639	0.1439
455	454	6.7639	0.1439
456	455	6.7639	0.1439
457	456	6.7612	0.1412
458	457	6.7639	0.1439
459	458	6.7639	0.1439
460	459	6.7639	0.1439
461	460	6.7639	0.1439
462	461	6.7612	0.1412
463	462	6.7639	0.1439
464	463	6.7639	0.1439
465	464	6.7612	0.1412
466	465	6.7612	0.1412
467	466	6.7612	0.1412
468	467	6.7612	0.1412
469	468	6.7612	0.1412
470	469	6.7584	0.1384
471	470	6.7584	0.1384
472	471	6.7584	0.1384

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	Time [s]	Water Level [m]	WL Change [m]
473	472	6.7584	0.1384
474	473	6.7584	0.1384
475	474	6.7584	0.1384
476	475	6.7612	0.1412
477	476	6.7584	0.1384
478	477	6.7584	0.1384
479	478	6.7584	0.1384
480	479	6.7584	0.1384
481	480	6.7584	0.1384
482	481	6.7548	0.1347
483	482	6.7548	0.1347
484	483	6.7548	0.1347
485	484	6.7548	0.1347
486	485	6.752	0.132
487	486	6.752	0.132
488	487	6.7548	0.1347
489	488	6.7548	0.1347
490	489	6.752	0.132
491	490	6.7548	0.1347
492	491	6.7548	0.1347
493	492	6.7548	0.1347
494	493	6.752	0.132
495	494	6.752	0.132
496	495	6.752	0.132
497	496	6.752	0.132
498	497	6.752	0.132
499	498	6.752	0.132
500	499	6.752	0.132
501	500	6.752	0.132
502	501	6.7492	0.1292
503	502	6.752	0.132
504	503	6.7492	0.1292
505	504	6.7492	0.1292
506	505	6.7492	0.1292
507	506	6.7492	0.1292
508	507	6.7492	0.1292
509	508	6.7492	0.1292
510	509	6.7492	0.1292
511	510	6.7492	0.1292
512	511	6.7492	0.1292
513	512	6.7465	0.1265
514	513	6.7492	0.1292
515	514	6.7492	0.1292
516	515	6.7492	0.1292
517	516	6.7492	0.1292
518	517	6.7465	0.1265
519	518	6.7465	0.1265
520	519	6.7465	0.1265
521	520	6.7465	0.1265
522	521	6.7465	0.1265
523	522	6.7465	0.1265
524	523	6.7465	0.1265
525	524	6.7465	0.1265

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	Time [s]	Water Level [m]	WL Change [m]
526	525	6.7465	0.1265
527	526	6.7465	0.1265
528	527	6.7465	0.1265
529	528	6.7428	0.1228
530	529	6.7428	0.1228
531	530	6.7428	0.1228
532	531	6.7465	0.1265
533	532	6.7428	0.1228
534	533	6.7428	0.1228
535	534	6.7428	0.1228
536	535	6.7428	0.1228
537	536	6.7428	0.1228
538	537	6.7428	0.1228
539	538	6.7401	0.1201
540	539	6.7428	0.1228
541	540	6.7401	0.1201
542	541	6.7428	0.1228
543	542	6.7401	0.1201
544	543	6.7401	0.1201
545	544	6.7401	0.1201
546	545	6.7401	0.1201
547	546	6.7401	0.1201
548	547	6.7401	0.1201
549	548	6.7373	0.1173
550	549	6.7401	0.1201
551	550	6.7401	0.1201
552	551	6.7401	0.1201
553	552	6.7401	0.1201
554	553	6.7401	0.1201
555	554	6.7401	0.1201
556	555	6.7401	0.1201
557	556	6.7373	0.1173
558	557	6.7373	0.1173
559	558	6.7346	0.1146
560	559	6.7346	0.1146
561	560	6.7346	0.1146
562	561	6.7346	0.1146
563	562	6.7346	0.1146
564	563	6.7346	0.1146
565	564	6.7373	0.1173
566	565	6.7373	0.1173
567	566	6.7373	0.1173
568	567	6.7346	0.1146
569	568	6.7346	0.1146
570	569	6.7373	0.1173
571	570	6.7346	0.1146
572	571	6.7346	0.1146
573	572	6.7346	0.1146
574	573	6.7346	0.1146
575	574	6.7346	0.1146
576	575	6.7309	0.1109
577	576	6.7309	0.1109
578	577	6.7309	0.1109

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	Time [s]	Water Level [m]	WL Change [m]
579	578	6.7309	0.1109
580	579	6.7309	0.1109
581	580	6.7309	0.1109
582	581	6.7309	0.1109
583	582	6.7346	0.1146
584	583	6.7309	0.1109
585	584	6.7346	0.1146
586	585	6.7309	0.1109
587	586	6.7309	0.1109
588	587	6.7309	0.1109
589	588	6.7346	0.1146
590	589	6.7309	0.1109
591	590	6.7309	0.1109
592	591	6.7309	0.1109
593	592	6.7309	0.1109
594	593	6.7309	0.1109
595	594	6.7309	0.1109
596	595	6.7309	0.1109
597	596	6.7309	0.1109
598	597	6.7309	0.1109
599	598	6.7282	0.1082
600	599	6.7282	0.1082
601	600	6.7309	0.1109
602	601	6.7309	0.1109
603	602	6.7309	0.1109
604	603	6.7282	0.1082
605	604	6.7282	0.1082
606	605	6.7309	0.1109
607	606	6.7282	0.1082
608	607	6.7282	0.1082
609	608	6.7282	0.1082
610	609	6.7282	0.1082
611	610	6.7282	0.1082
612	611	6.7282	0.1082
613	612	6.7282	0.1082
614	613	6.7282	0.1082
615	614	6.7282	0.1082
616	615	6.7254	0.1054
617	616	6.7282	0.1082
618	617	6.7282	0.1082
619	618	6.7282	0.1082
620	619	6.7254	0.1054
621	620	6.7254	0.1054
622	621	6.7282	0.1082
623	622	6.7254	0.1054
624	623	6.7254	0.1054
625	624	6.7254	0.1054
626	625	6.7254	0.1054
627	626	6.7254	0.1054
628	627	6.7254	0.1054
629	628	6.7254	0.1054
630	629	6.7254	0.1054
631	630	6.7227	0.1027

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	Time [s]	Water Level [m]	WL Change [m]
632	631	6.7254	0.1054
633	632	6.7227	0.1027
634	633	6.7227	0.1027
635	634	6.7227	0.1027
636	635	6.7254	0.1054
637	636	6.7254	0.1054
638	637	6.7227	0.1027
639	638	6.7227	0.1027
640	639	6.7227	0.1027
641	640	6.7227	0.1027
642	641	6.7227	0.1027
643	642	6.7227	0.1027
644	643	6.7227	0.1027
645	644	6.7227	0.1027
646	645	6.719	0.099
647	646	6.7227	0.1027
648	647	6.7227	0.1027
649	648	6.7227	0.1027
650	649	6.7227	0.1027
651	650	6.7227	0.1027
652	651	6.7227	0.1027
653	652	6.7227	0.1027
654	653	6.719	0.099
655	654	6.719	0.099
656	655	6.7227	0.1027
657	656	6.719	0.099
658	657	6.719	0.099
659	658	6.719	0.099
660	659	6.719	0.099
661	660	6.719	0.099
662	661	6.719	0.099
663	662	6.719	0.099
664	663	6.719	0.099
665	664	6.719	0.099
666	665	6.719	0.099
667	666	6.719	0.099
668	667	6.719	0.099
669	668	6.719	0.099
670	669	6.719	0.099
671	670	6.719	0.099
672	671	6.719	0.099
673	672	6.719	0.099
674	673	6.719	0.099
675	674	6.7163	0.0962
676	675	6.719	0.099
677	676	6.719	0.099
678	677	6.719	0.099
679	678	6.719	0.099
680	679	6.719	0.099
681	680	6.7163	0.0962
682	681	6.7163	0.0962
683	682	6.719	0.099
684	683	6.7163	0.0962

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	Time [s]	Water Level [m]	WL Change [m]
685	684	6.7163	0.0962
686	685	6.7163	0.0962
687	686	6.7163	0.0962
688	687	6.7163	0.0962
689	688	6.7163	0.0962
690	689	6.7163	0.0962
691	690	6.7163	0.0962
692	691	6.7163	0.0962
693	692	6.7163	0.0962
694	693	6.7163	0.0962
695	694	6.7163	0.0962
696	695	6.7135	0.0935
697	696	6.7135	0.0935
698	697	6.7135	0.0935
699	698	6.7135	0.0935
700	699	6.7135	0.0935
701	700	6.7135	0.0935
702	701	6.7135	0.0935
703	702	6.7135	0.0935
704	703	6.7163	0.0962
705	704	6.7135	0.0935
706	705	6.7135	0.0935
707	706	6.7135	0.0935
708	707	6.7163	0.0962
709	708	6.7135	0.0935
710	709	6.7135	0.0935
711	710	6.7135	0.0935
712	711	6.7135	0.0935
713	712	6.7135	0.0935
714	713	6.7135	0.0935
715	714	6.7135	0.0935
716	715	6.7135	0.0935
717	716	6.7098	0.0898
718	717	6.7135	0.0935
719	718	6.7135	0.0935
720	719	6.7135	0.0935
721	720	6.7135	0.0935
722	721	6.7135	0.0935
723	722	6.7098	0.0898
724	723	6.7098	0.0898
725	724	6.7135	0.0935
726	725	6.7098	0.0898
727	726	6.7135	0.0935
728	727	6.7135	0.0935
729	728	6.7135	0.0935
730	729	6.7135	0.0935
731	730	6.7098	0.0898
732	731	6.7098	0.0898
733	732	6.7135	0.0935
734	733	6.7098	0.0898
735	734	6.7098	0.0898
736	735	6.7098	0.0898
737	736	6.7098	0.0898

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Slug Test - Water Level Data

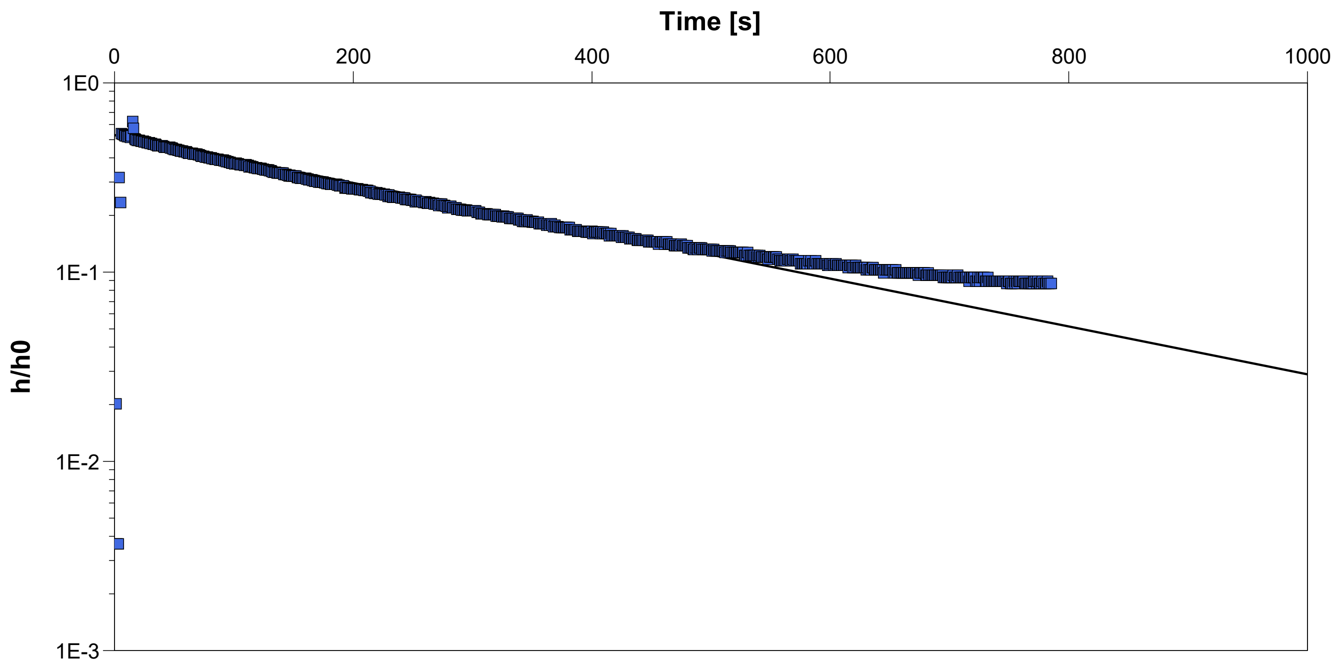
Project: Nemaska New Waste Disposal Site – Hydrogeological assessm

Number: 230448-00

Client: Stantec

	Time [s]	Water Level [m]	WL Change [m]
738	737	6.7098	0.0898
739	738	6.7098	0.0898
740	739	6.7098	0.0898
741	740	6.7098	0.0898
742	741	6.7098	0.0898
743	742	6.7098	0.0898
744	743	6.7098	0.0898
745	744	6.7098	0.0898
746	745	6.7098	0.0898
747	746	6.7098	0.0898
748	747	6.7098	0.0898
749	748	6.7071	0.0871
750	749	6.7098	0.0898
751	750	6.7098	0.0898
752	751	6.7071	0.0871
753	752	6.7071	0.0871
754	753	6.7071	0.0871
755	754	6.7098	0.0898
756	755	6.7071	0.0871
757	756	6.7098	0.0898
758	757	6.7071	0.0871
759	758	6.7098	0.0898
760	759	6.7098	0.0898
761	760	6.7098	0.0898
762	761	6.7098	0.0898
763	762	6.7098	0.0898
764	763	6.7071	0.0871
765	764	6.7071	0.0871
766	765	6.7071	0.0871
767	766	6.7071	0.0871
768	767	6.7071	0.0871
769	768	6.7071	0.0871
770	769	6.7071	0.0871
771	770	6.7071	0.0871
772	771	6.7098	0.0898
773	772	6.7098	0.0898
774	773	6.7071	0.0871
775	774	6.7098	0.0898
776	775	6.7071	0.0871
777	776	6.7071	0.0871
778	777	6.7071	0.0871
779	778	6.7098	0.0898
780	779	6.7071	0.0871
781	780	6.7071	0.0871
782	781	6.7071	0.0871
783	782	6.7098	0.0898
784	783	6.7071	0.0871
785	784	6.7071	0.0871
786	785	6.7071	0.0871

BluMetric Environnement Inc. 276, rue St-Jacques Bureau 818 Montreal (QC) H2Y 1N3		**Slug Test Analysis Report** Project: Nemaska New Waste Disposal Site – Hydrogeological assessm Number: 230448-00 Client: Stantec
Location: Nemaska	Slug Test: PZ-1_2020	Test Well: PZ-1
Test Conducted by: Stantec		Test Date: 2020-08-04
Analysis Performed by: LA	PZ-1_2020_Hvor	Analysis Date: 2023-08-18
Aquifer Thickness: 8.98 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
PZ-1	1.44×10^{-6}	

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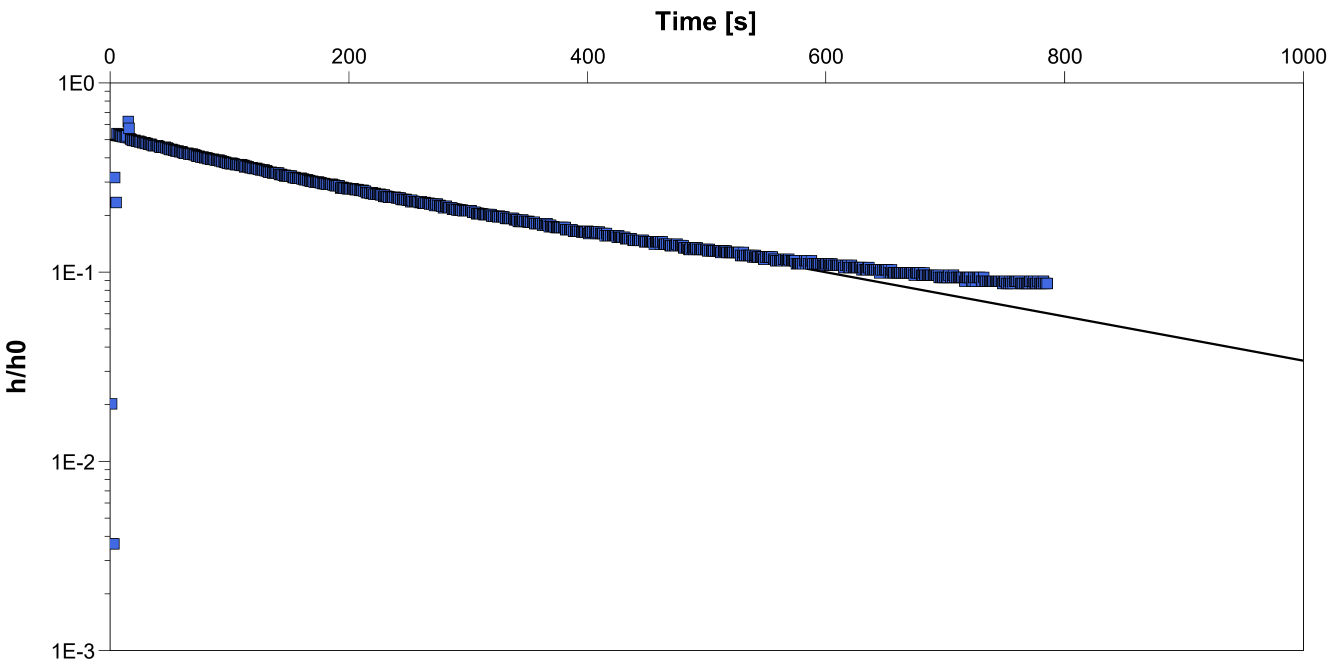
Slug Test Analysis Report

Project: Nemaska New Waste Disposal Site – Hydrogeological assessm

Number: 230448-00

Client: Stantec

Location: Nemaska	Slug Test: PZ-1_2020	Test Well: PZ-1
Test Conducted by: Stantec		Test Date: 2020-08-04
Analysis Performed by: LA	PZ-1_B-R	Analysis Date: 2023-08-18
Aquifer Thickness: 8.98 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
PZ-1	1.03×10^{-6}	

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Slug Test - Analyses Report

Project: Nemaska New Waste Disposal Site – Hydrogeological assess

Number: 230448-00

Client: Stantec

Location: Nemaska | Slug Test: PZ-1_2020 | Test Well: PZ-1

Test Conducted by: Stantec | Test Date: 2020-08-04

Aquifer Thickness: 8.98 m

	Analysis Name	Analysis Performed b	Analysis Date	Method name	Well	T [m²/s]	K [m/s]	S
1	PZ-1_2020_Hvor	LA	2023-08-18	Hvorslev	PZ-1		1.44×10^{-6}	
2	PZ-1_B-R	LA	2023-08-18	Bouwer & Rice	PZ-1		1.03×10^{-6}	

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Slug Test - Water Level Data

Project: Nemaska New Waste Disposal Site – Hydrogeological assess

Number: 230448-00

Client: Stantec

Location: Nemaska	Slug Test: PZ-3_2020	Test Well: PZ-3
Test Conducted by: Stantec	Test Date: 2020-08-04	
Water level at t=0 [m]: NAN	Static Water Level [m]: 8.20	Water level change at t=0 [m]: 0.00

	Time [s]	Water Level [m]	WL Change [m]
1	0	8.1395	-0.0605
2	1	8.8508	0.6508
3	2	8.695	0.495
4	3	8.6794	0.4794
5	4	8.6739	0.4739
6	5	8.6702	0.4703
7	6	8.6648	0.4648
8	7	8.6583	0.4583
9	8	8.6583	0.4583
10	9	8.6556	0.4556
11	10	8.6446	0.4446
12	11	8.6437	0.4437
13	12	8.6409	0.4409
14	13	8.9233	0.7233
15	14	8.8123	0.6123
16	15	8.684	0.484
17	16	8.6721	0.4721
18	17	8.6327	0.4327
19	18	8.6299	0.4299
20	19	8.6235	0.4235
21	20	8.6235	0.4235
22	21	8.618	0.418
23	22	8.618	0.418
24	23	8.6116	0.4116
25	24	8.6116	0.4116
26	25	8.6088	0.4088
27	26	8.6061	0.4061
28	27	8.6061	0.4061
29	28	8.6024	0.4024
30	29	8.5997	0.3997
31	30	8.5969	0.3969
32	31	8.5942	0.3942
33	32	8.5878	0.3878
34	33	8.5878	0.3878
35	34	8.585	0.385
36	35	8.5823	0.3823
37	36	8.5786	0.3786
38	37	8.5758	0.3758
39	38	8.5731	0.3731
40	39	8.5731	0.3731
41	40	8.5694	0.3694
42	41	8.5667	0.3667
43	42	8.5639	0.3639
44	43	8.5612	0.3612
45	44	8.5612	0.3612
46	45	8.5575	0.3575
47	46	8.5548	0.3548
48	47	8.5548	0.3548

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Slug Test - Water Level Data

Project: Nemaska New Waste Disposal Site – Hydrogeological assessm

Number: 230448-00

Client: Stantec

	Time [s]	Water Level [m]	WL Change [m]
49	48	8.552	0.352
50	49	8.5493	0.3493
51	50	8.5493	0.3493
52	51	8.5456	0.3456
53	52	8.5428	0.3428
54	53	8.5401	0.3401
55	54	8.5364	0.3364
56	55	8.5364	0.3364
57	56	8.5337	0.3337
58	57	8.5309	0.3309
59	58	8.5309	0.3309
60	59	8.5282	0.3282
61	60	8.5245	0.3245
62	61	8.5218	0.3218
63	62	8.5218	0.3218
64	63	8.5098	0.3098
65	64	8.4915	0.2915
66	65	8.4915	0.2915
67	66	8.5126	0.3126
68	67	8.5126	0.3126
69	68	8.5098	0.3098
70	69	8.5071	0.3071
71	70	8.5071	0.3071
72	71	8.5043	0.3043
73	72	8.4998	0.2998
74	73	8.4998	0.2998
75	74	8.497	0.297
76	75	8.497	0.297
77	76	8.4933	0.2933
78	77	8.4933	0.2933
79	78	8.4906	0.2906
80	79	8.4906	0.2906
81	80	8.4878	0.2878
82	81	8.4878	0.2878
83	82	8.4851	0.2851
84	83	8.4814	0.2814
85	84	8.4787	0.2787
86	85	8.4787	0.2787
87	86	8.4759	0.2759
88	87	8.4759	0.2759
89	88	8.4732	0.2732
90	89	8.4732	0.2732
91	90	8.4695	0.2695
92	91	8.4667	0.2668
93	92	8.4667	0.2668
94	93	8.464	0.264
95	94	8.464	0.264
96	95	8.4603	0.2603
97	96	8.4576	0.2576
98	97	8.4576	0.2576
99	98	8.4576	0.2576
100	99	8.4548	0.2548
101	100	8.4548	0.2548

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Slug Test - Water Level Data

Project: Nemaska New Waste Disposal Site – Hydrogeological assess

Number: 230448-00

Client: Stantec

	Time [s]	Water Level [m]	WL Change [m]
102	101	8.4521	0.2521
103	102	8.4484	0.2484
104	103	8.4484	0.2484
105	104	8.4484	0.2484
106	105	8.4457	0.2457
107	106	8.4429	0.2429
108	107	8.4429	0.2429
109	108	8.4402	0.2402
110	109	8.4402	0.2402
111	110	8.4411	0.2411
112	111	8.4365	0.2365
113	112	8.4338	0.2338
114	113	8.4338	0.2338
115	114	8.431	0.231
116	115	8.431	0.231
117	116	8.4292	0.2292
118	117	8.4292	0.2292
119	118	8.4246	0.2246
120	119	8.4255	0.2255
121	120	8.4246	0.2246
122	121	8.4218	0.2218
123	122	8.42	0.22
124	123	8.4228	0.2228
125	124	8.4191	0.2191
126	125	8.42	0.22
127	126	8.4172	0.2172
128	127	8.4172	0.2172
129	128	8.4172	0.2172
130	129	8.4127	0.2127
131	130	8.4108	0.2108
132	131	8.4108	0.2108
133	132	8.4081	0.2081
134	133	8.4081	0.2081
135	134	8.4081	0.2081
136	135	8.4053	0.2053
137	136	8.4053	0.2053
138	137	8.4053	0.2053
139	138	8.4017	0.2017
140	139	8.4017	0.2017
141	140	8.3989	0.1989
142	141	8.3989	0.1989
143	142	8.3989	0.1989
144	143	8.3989	0.1989
145	144	8.3962	0.1962
146	145	8.3934	0.1934
147	146	8.3934	0.1934
148	147	8.3898	0.1898
149	148	8.387	0.187
150	149	8.387	0.187
151	150	8.387	0.187
152	151	8.387	0.187
153	152	8.3843	0.1843
154	153	8.3843	0.1843

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	Time [s]	Water Level [m]	WL Change [m]
155	154	8.3843	0.1843
156	155	8.3806	0.1806
157	156	8.3806	0.1806
158	157	8.3806	0.1806
159	158	8.3778	0.1778
160	159	8.3751	0.1751
161	160	8.3751	0.1751
162	161	8.3751	0.1751
163	162	8.3751	0.1751
164	163	8.3723	0.1723
165	164	8.3723	0.1723
166	165	8.3687	0.1687
167	166	8.3687	0.1687
168	167	8.3659	0.1659
169	168	8.3659	0.1659
170	169	8.3659	0.1659
171	170	8.3659	0.1659
172	171	8.3632	0.1632
173	172	8.3632	0.1632
174	173	8.3632	0.1632
175	174	8.3632	0.1632
176	175	8.3604	0.1604
177	176	8.3604	0.1604
178	177	8.3604	0.1604
179	178	8.3604	0.1604
180	179	8.3568	0.1568
181	180	8.3568	0.1568
182	181	8.354	0.154
183	182	8.354	0.154
184	183	8.3513	0.1513
185	184	8.354	0.154
186	185	8.3513	0.1513
187	186	8.3513	0.1513
188	187	8.3513	0.1513
189	188	8.3476	0.1476
190	189	8.3476	0.1476
191	190	8.3476	0.1476
192	191	8.3448	0.1448
193	192	8.3448	0.1448
194	193	8.3448	0.1448
195	194	8.3448	0.1448
196	195	8.3421	0.1421
197	196	8.3448	0.1448
198	197	8.3421	0.1421
199	198	8.3393	0.1393
200	199	8.3421	0.1421
201	200	8.3393	0.1393
202	201	8.3393	0.1393
203	202	8.3393	0.1393
204	203	8.3357	0.1357
205	204	8.3357	0.1357
206	205	8.3357	0.1357
207	206	8.3329	0.1329

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Slug Test - Water Level Data

Project: Nemaska New Waste Disposal Site – Hydrogeological assessm

Number: 230448-00

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	Time [s]	Water Level [m]	WL Change [m]
208	207	8.3329	0.1329
209	208	8.3302	0.1302
210	209	8.3302	0.1302
211	210	8.3329	0.1329
212	211	8.3302	0.1302
213	212	8.3302	0.1302
214	213	8.3302	0.1302
215	214	8.3302	0.1302
216	215	8.3274	0.1274
217	216	8.3274	0.1274
218	217	8.3238	0.1238
219	218	8.3238	0.1238
220	219	8.3238	0.1238
221	220	8.3238	0.1238
222	221	8.3238	0.1238
223	222	8.321	0.121
224	223	8.321	0.121
225	224	8.3155	0.1155
226	225	8.321	0.121
227	226	8.321	0.121
228	227	8.3183	0.1183
229	228	8.3183	0.1183
230	229	8.3183	0.1183
231	230	8.3183	0.1183
232	231	8.3155	0.1155
233	232	8.3155	0.1155
234	233	8.3155	0.1155
235	234	8.3155	0.1155
236	235	8.3118	0.1118
237	236	8.3118	0.1118
238	237	8.3118	0.1118
239	238	8.3118	0.1118
240	239	8.3118	0.1118
241	240	8.3091	0.1091
242	241	8.3091	0.1091
243	242	8.3091	0.1091
244	243	8.3091	0.1091
245	244	8.3091	0.1091
246	245	8.3063	0.1063
247	246	8.3063	0.1063
248	247	8.3063	0.1063
249	248	8.3063	0.1063
250	249	8.3063	0.1063
251	250	8.3027	0.1027
252	251	8.3027	0.1027
253	252	8.3027	0.1027
254	253	8.3027	0.1027
255	254	8.3027	0.1027
256	255	8.3027	0.1027
257	256	8.3027	0.1027
258	257	8.3027	0.1027
259	258	8.2999	0.0999
260	259	8.2999	0.0999

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Project: Nemaska New Waste Disposal Site – Hydrogeological assess

Number: 230448-00

Client: Stantec

	Time [s]	Water Level [m]	WL Change [m]
261	260	8.2972	0.0972
262	261	8.2972	0.0972
263	262	8.2972	0.0972
264	263	8.2972	0.0972
265	264	8.2944	0.0944
266	265	8.2944	0.0944
267	266	8.2944	0.0944
268	267	8.2944	0.0944
269	268	8.2944	0.0944
270	269	8.2944	0.0944
271	270	8.2944	0.0944
272	271	8.2907	0.0907
273	272	8.2944	0.0944
274	273	8.2907	0.0907
275	274	8.2907	0.0907
276	275	8.2907	0.0907
277	276	8.2907	0.0907
278	277	8.288	0.088
279	278	8.288	0.088
280	279	8.288	0.088
281	280	8.288	0.088
282	281	8.2853	0.0853
283	282	8.2853	0.0853
284	283	8.288	0.088
285	284	8.288	0.088
286	285	8.288	0.088
287	286	8.2853	0.0853
288	287	8.2825	0.0825
289	288	8.2825	0.0825
290	289	8.2825	0.0825
291	290	8.2825	0.0825
292	291	8.2825	0.0825
293	292	8.2825	0.0825
294	293	8.2825	0.0825
295	294	8.2788	0.0788
296	295	8.2825	0.0825
297	296	8.2788	0.0788
298	297	8.2825	0.0825
299	298	8.2825	0.0825
300	299	8.2788	0.0788
301	300	8.2788	0.0788
302	301	8.2761	0.0761
303	302	8.2761	0.0761
304	303	8.2761	0.0761
305	304	8.2761	0.0761
306	305	8.2788	0.0788
307	306	8.2761	0.0761
308	307	8.2761	0.0761
309	308	8.2761	0.0761
310	309	8.2761	0.0761
311	310	8.2733	0.0733
312	311	8.2761	0.0761
313	312	8.2733	0.0733

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	Time [s]	Water Level [m]	WL Change [m]
314	313	8.2733	0.0733
315	314	8.2733	0.0733
316	315	8.2733	0.0733
317	316	8.2733	0.0733
318	317	8.2697	0.0697
319	318	8.2697	0.0697
320	319	8.2697	0.0697
321	320	8.2697	0.0697
322	321	8.2697	0.0697
323	322	8.2697	0.0697
324	323	8.2697	0.0697
325	324	8.2697	0.0697
326	325	8.2697	0.0697
327	326	8.2697	0.0697
328	327	8.2697	0.0697
329	328	8.2669	0.0669
330	329	8.2669	0.0669
331	330	8.2669	0.0669
332	331	8.2669	0.0669
333	332	8.2669	0.0669
334	333	8.2669	0.0669
335	334	8.2669	0.0669
336	335	8.2669	0.0669
337	336	8.2642	0.0642
338	337	8.2642	0.0642
339	338	8.2642	0.0642
340	339	8.2642	0.0642
341	340	8.2642	0.0642
342	341	8.2614	0.0614
343	342	8.2614	0.0614
344	343	8.2614	0.0614
345	344	8.2642	0.0642
346	345	8.2614	0.0614
347	346	8.2614	0.0614
348	347	8.2614	0.0614
349	348	8.2614	0.0614
350	349	8.2578	0.0578
351	350	8.2578	0.0578
352	351	8.2578	0.0578
353	352	8.2578	0.0578
354	353	8.2614	0.0614
355	354	8.2614	0.0614
356	355	8.2578	0.0578
357	356	8.2614	0.0614
358	357	8.2578	0.0578
359	358	8.255	0.055
360	359	8.2578	0.0578
361	360	8.2578	0.0578
362	361	8.2578	0.0578
363	362	8.2578	0.0578
364	363	8.255	0.055
365	364	8.255	0.055
366	365	8.255	0.055

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	Time [s]	Water Level [m]	WL Change [m]
367	366	8.255	0.055
368	367	8.2578	0.0578
369	368	8.255	0.055
370	369	8.255	0.055
371	370	8.2578	0.0578
372	371	8.255	0.055
373	372	8.255	0.055
374	373	8.255	0.055
375	374	8.255	0.055
376	375	8.255	0.055
377	376	8.2523	0.0523
378	377	8.2523	0.0523
379	378	8.255	0.055
380	379	8.2523	0.0523
381	380	8.2523	0.0523
382	381	8.2523	0.0523
383	382	8.2523	0.0523
384	383	8.2523	0.0523
385	384	8.2523	0.0523
386	385	8.2523	0.0523
387	386	8.2523	0.0523
388	387	8.2523	0.0523
389	388	8.2495	0.0495
390	389	8.2495	0.0495
391	390	8.2523	0.0523
392	391	8.2495	0.0495
393	392	8.2495	0.0495
394	393	8.2495	0.0495
395	394	8.2495	0.0495
396	395	8.2495	0.0495
397	396	8.2495	0.0495
398	397	8.2495	0.0495
399	398	8.2495	0.0495
400	399	8.2495	0.0495
401	400	8.2495	0.0495
402	401	8.2495	0.0495
403	402	8.2458	0.0458
404	403	8.2495	0.0495
405	404	8.2495	0.0495
406	405	8.2495	0.0495
407	406	8.2458	0.0458
408	407	8.2458	0.0458
409	408	8.2458	0.0458
410	409	8.2458	0.0458
411	410	8.2458	0.0458
412	411	8.2431	0.0431
413	412	8.2431	0.0431
414	413	8.2458	0.0458
415	414	8.2458	0.0458
416	415	8.2458	0.0458
417	416	8.2458	0.0458
418	417	8.2458	0.0458
419	418	8.2458	0.0458

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	Time [s]	Water Level [m]	WL Change [m]
420	419	8.2431	0.0431
421	420	8.2431	0.0431
422	421	8.2431	0.0431
423	422	8.2431	0.0431
424	423	8.2431	0.0431
425	424	8.2431	0.0431
426	425	8.2431	0.0431
427	426	8.2431	0.0431
428	427	8.2431	0.0431
429	428	8.2431	0.0431
430	429	8.2431	0.0431
431	430	8.2403	0.0403
432	431	8.2403	0.0403
433	432	8.2403	0.0403
434	433	8.2403	0.0403
435	434	8.2431	0.0431
436	435	8.2403	0.0403
437	436	8.2403	0.0403
438	437	8.2403	0.0403
439	438	8.2403	0.0403
440	439	8.2431	0.0431
441	440	8.2403	0.0403
442	441	8.2403	0.0403
443	442	8.2403	0.0403
444	443	8.2403	0.0403
445	444	8.2376	0.0376
446	445	8.2403	0.0403
447	446	8.2403	0.0403
448	447	8.2403	0.0403
449	448	8.2403	0.0403
450	449	8.2403	0.0403
451	450	8.2403	0.0403
452	451	8.2403	0.0403
453	452	8.2376	0.0376
454	453	8.2403	0.0403
455	454	8.2376	0.0376
456	455	8.2376	0.0376
457	456	8.2376	0.0376
458	457	8.2376	0.0376
459	458	8.2376	0.0376
460	459	8.2339	0.0339
461	460	8.2339	0.0339
462	461	8.2339	0.0339
463	462	8.2339	0.0339
464	463	8.2376	0.0376
465	464	8.2376	0.0376
466	465	8.2339	0.0339
467	466	8.2339	0.0339
468	467	8.2339	0.0339
469	468	8.2312	0.0312
470	469	8.2339	0.0339
471	470	8.2339	0.0339
472	471	8.2339	0.0339

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	Time [s]	Water Level [m]	WL Change [m]
473	472	8.2339	0.0339
474	473	8.2339	0.0339
475	474	8.2312	0.0312
476	475	8.2339	0.0339
477	476	8.2339	0.0339
478	477	8.2339	0.0339
479	478	8.2339	0.0339
480	479	8.2312	0.0312
481	480	8.2312	0.0312
482	481	8.2312	0.0312
483	482	8.2312	0.0312
484	483	8.2312	0.0312
485	484	8.2312	0.0312
486	485	8.2312	0.0312
487	486	8.2312	0.0312
488	487	8.2312	0.0312
489	488	8.2312	0.0312
490	489	8.2312	0.0312
491	490	8.2312	0.0312
492	491	8.2312	0.0312
493	492	8.2312	0.0312
494	493	8.2312	0.0312
495	494	8.2312	0.0312
496	495	8.2312	0.0312
497	496	8.2284	0.0284
498	497	8.2284	0.0284
499	498	8.2312	0.0312
500	499	8.2284	0.0284
501	500	8.2284	0.0284
502	501	8.2312	0.0312
503	502	8.2284	0.0284
504	503	8.2312	0.0312
505	504	8.2284	0.0284
506	505	8.2284	0.0284
507	506	8.2284	0.0284
508	507	8.2284	0.0284
509	508	8.2284	0.0284
510	509	8.2284	0.0284
511	510	8.2284	0.0284
512	511	8.2284	0.0284
513	512	8.2284	0.0284
514	513	8.2284	0.0284
515	514	8.2284	0.0284
516	515	8.2284	0.0284
517	516	8.2284	0.0284
518	517	8.2284	0.0284
519	518	8.2248	0.0248
520	519	8.2248	0.0248
521	520	8.2248	0.0248
522	521	8.2248	0.0248
523	522	8.2284	0.0284
524	523	8.2284	0.0284
525	524	8.2284	0.0284

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	Time [s]	Water Level [m]	WL Change [m]
526	525	8.2284	0.0284
527	526	8.2284	0.0284
528	527	8.2284	0.0284
529	528	8.2284	0.0284
530	529	8.2284	0.0284
531	530	8.2248	0.0248
532	531	8.2284	0.0284
533	532	8.2248	0.0248
534	533	8.2248	0.0248
535	534	8.2248	0.0248
536	535	8.2248	0.0248
537	536	8.2248	0.0248
538	537	8.2248	0.0248
539	538	8.2248	0.0248
540	539	8.2284	0.0284
541	540	8.2248	0.0248
542	541	8.2248	0.0248
543	542	8.2248	0.0248
544	543	8.2284	0.0284
545	544	8.2248	0.0248
546	545	8.2248	0.0248
547	546	8.2248	0.0248
548	547	8.2248	0.0248
549	548	8.2248	0.0248
550	549	8.2248	0.0248
551	550	8.2248	0.0248
552	551	8.2248	0.0248
553	552	8.2248	0.0248
554	553	8.2284	0.0284
555	554	8.2248	0.0248
556	555	8.2284	0.0284
557	556	8.2248	0.0248
558	557	8.2248	0.0248
559	558	8.2248	0.0248
560	559	8.2248	0.0248
561	560	8.2248	0.0248
562	561	8.2248	0.0248
563	562	8.2248	0.0248
564	563	8.222	0.022
565	564	8.2248	0.0248
566	565	8.222	0.022
567	566	8.2248	0.0248
568	567	8.222	0.022
569	568	8.222	0.022
570	569	8.222	0.022
571	570	8.2248	0.0248
572	571	8.2248	0.0248
573	572	8.2248	0.0248
574	573	8.222	0.022
575	574	8.2248	0.0248
576	575	8.222	0.022
577	576	8.222	0.022
578	577	8.2248	0.0248

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	Time [s]	Water Level [m]	WL Change [m]
579	578	8.222	0.022
580	579	8.222	0.022
581	580	8.222	0.022
582	581	8.222	0.022
583	582	8.222	0.022
584	583	8.222	0.022
585	584	8.222	0.022
586	585	8.222	0.022
587	586	8.222	0.022
588	587	8.2248	0.0248
589	588	8.222	0.022
590	589	8.222	0.022
591	590	8.222	0.022
592	591	8.222	0.022
593	592	8.222	0.022
594	593	8.2193	0.0193
595	594	8.222	0.022
596	595	8.222	0.022
597	596	8.222	0.022
598	597	8.2248	0.0248
599	598	8.222	0.022
600	599	8.2248	0.0248
601	600	8.2248	0.0248
602	601	8.222	0.022
603	602	8.222	0.022
604	603	8.222	0.022
605	604	8.222	0.022
606	605	8.222	0.022
607	606	8.222	0.022
608	607	8.2248	0.0248
609	608	8.222	0.022
610	609	8.2193	0.0193
611	610	8.2193	0.0193
612	611	8.222	0.022
613	612	8.2193	0.0193
614	613	8.222	0.022
615	614	8.222	0.022
616	615	8.222	0.022
617	616	8.2193	0.0193
618	617	8.222	0.022
619	618	8.222	0.022
620	619	8.222	0.022
621	620	8.222	0.022
622	621	8.222	0.022
623	622	8.222	0.022
624	623	8.222	0.022
625	624	8.222	0.022
626	625	8.222	0.022
627	626	8.222	0.022
628	627	8.222	0.022
629	628	8.222	0.022
630	629	8.222	0.022
631	630	8.222	0.022

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	Time [s]	Water Level [m]	WL Change [m]
632	631	8.222	0.022
633	632	8.222	0.022
634	633	8.222	0.022
635	634	8.2193	0.0193
636	635	8.2193	0.0193
637	636	8.222	0.022
638	637	8.2193	0.0193
639	638	8.222	0.022
640	639	8.222	0.022
641	640	8.222	0.022
642	641	8.222	0.022
643	642	8.2193	0.0193
644	643	8.2193	0.0193
645	644	8.2193	0.0193
646	645	8.2193	0.0193
647	646	8.2165	0.0165
648	647	8.2165	0.0165
649	648	8.2193	0.0193
650	649	8.2193	0.0193
651	650	8.2193	0.0193
652	651	8.2165	0.0165
653	652	8.2193	0.0193
654	653	8.2193	0.0193
655	654	8.2165	0.0165
656	655	8.2193	0.0193
657	656	8.2165	0.0165
658	657	8.2193	0.0193
659	658	8.2193	0.0193
660	659	8.2193	0.0193
661	660	8.2165	0.0165
662	661	8.2193	0.0193
663	662	8.2193	0.0193
664	663	8.2193	0.0193
665	664	8.2193	0.0193
666	665	8.2193	0.0193
667	666	8.2193	0.0193
668	667	8.2165	0.0165
669	668	8.2193	0.0193
670	669	8.2193	0.0193
671	670	8.2165	0.0165
672	671	8.2193	0.0193
673	672	8.2165	0.0165
674	673	8.2165	0.0165
675	674	8.2193	0.0193
676	675	8.2193	0.0193
677	676	8.2193	0.0193
678	677	8.2193	0.0193
679	678	8.2193	0.0193
680	679	8.2193	0.0193
681	680	8.2165	0.0165
682	681	8.2193	0.0193
683	682	8.2165	0.0165
684	683	8.2165	0.0165

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	Time [s]	Water Level [m]	WL Change [m]
685	684	8.2193	0.0193
686	685	8.2165	0.0165
687	686	8.2165	0.0165
688	687	8.2165	0.0165
689	688	8.2193	0.0193
690	689	8.2165	0.0165
691	690	8.2165	0.0165
692	691	8.2165	0.0165
693	692	8.2165	0.0165
694	693	8.2165	0.0165
695	694	8.2165	0.0165
696	695	8.2165	0.0165
697	696	8.2165	0.0165
698	697	8.2165	0.0165
699	698	8.2165	0.0165
700	699	8.2165	0.0165
701	700	8.2165	0.0165
702	701	8.2165	0.0165
703	702	8.2165	0.0165
704	703	8.2193	0.0193
705	704	8.2165	0.0165
706	705	8.2165	0.0165
707	706	8.2165	0.0165
708	707	8.2165	0.0165
709	708	8.2165	0.0165
710	709	8.2165	0.0165
711	710	8.2165	0.0165
712	711	8.2165	0.0165
713	712	8.2165	0.0165
714	713	8.2128	0.0128
715	714	8.2165	0.0165
716	715	8.2165	0.0165
717	716	8.2165	0.0165
718	717	8.2165	0.0165
719	718	8.2128	0.0128
720	719	8.2165	0.0165
721	720	8.2165	0.0165
722	721	8.2165	0.0165
723	722	8.2165	0.0165
724	723	8.2165	0.0165
725	724	8.2165	0.0165
726	725	8.2165	0.0165
727	726	8.2165	0.0165
728	727	8.2165	0.0165
729	728	8.2165	0.0165
730	729	8.2165	0.0165
731	730	8.2165	0.0165
732	731	8.2193	0.0193
733	732	8.2165	0.0165
734	733	8.2165	0.0165
735	734	8.2165	0.0165
736	735	8.2165	0.0165
737	736	8.2165	0.0165

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	Time [s]	Water Level [m]	WL Change [m]
738	737	8.2165	0.0165
739	738	8.2165	0.0165
740	739	8.2165	0.0165
741	740	8.2165	0.0165
742	741	8.2165	0.0165
743	742	8.2165	0.0165
744	743	8.2165	0.0165
745	744	8.2165	0.0165
746	745	8.2165	0.0165
747	746	8.2165	0.0165
748	747	8.2128	0.0128
749	748	8.2128	0.0128
750	749	8.2128	0.0128
751	750	8.2128	0.0128
752	751	8.2128	0.0128
753	752	8.2128	0.0128
754	753	8.2128	0.0128
755	754	8.2165	0.0165
756	755	8.2165	0.0165
757	756	8.2165	0.0165
758	757	8.2128	0.0128
759	758	8.2128	0.0128
760	759	8.2128	0.0128
761	760	8.2128	0.0128
762	761	8.2128	0.0128
763	762	8.2128	0.0128
764	763	8.2128	0.0128
765	764	8.2128	0.0128
766	765	8.2165	0.0165
767	766	8.2165	0.0165
768	767	8.2128	0.0128
769	768	8.2128	0.0128
770	769	8.2165	0.0165
771	770	8.2165	0.0165
772	771	8.2128	0.0128
773	772	8.2128	0.0128
774	773	8.2165	0.0165
775	774	8.2165	0.0165
776	775	8.2165	0.0165
777	776	8.2128	0.0128
778	777	8.2165	0.0165
779	778	8.2128	0.0128
780	779	8.2165	0.0165
781	780	8.2128	0.0128
782	781	8.2128	0.0128
783	782	8.2165	0.0165
784	783	8.2128	0.0128
785	784	8.2128	0.0128
786	785	8.2165	0.0165
787	786	8.2165	0.0165
788	787	8.2165	0.0165
789	788	8.2128	0.0128
790	789	8.2128	0.0128

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	Time [s]	Water Level [m]	WL Change [m]
791	790	8.2165	0.0165
792	791	8.2128	0.0128
793	792	8.2165	0.0165
794	793	8.2165	0.0165
795	794	8.2165	0.0165
796	795	8.2165	0.0165
797	796	8.2165	0.0165
798	797	8.2128	0.0128
799	798	8.2165	0.0165
800	799	8.2128	0.0128
801	800	8.2165	0.0165
802	801	8.2165	0.0165
803	802	8.2165	0.0165
804	803	8.2165	0.0165
805	804	8.2128	0.0128
806	805	8.2165	0.0165
807	806	8.2128	0.0128
808	807	8.2128	0.0128
809	808	8.2128	0.0128
810	809	8.2101	0.0101
811	810	8.2128	0.0128
812	811	8.2128	0.0128
813	812	8.2128	0.0128
814	813	8.2128	0.0128
815	814	8.2165	0.0165
816	815	8.2128	0.0128
817	816	8.2128	0.0128
818	817	8.2128	0.0128
819	818	8.2128	0.0128
820	819	8.2128	0.0128
821	820	8.2128	0.0128
822	821	8.2128	0.0128
823	822	8.2128	0.0128
824	823	8.2128	0.0128
825	824	8.2128	0.0128
826	825	8.2128	0.0128
827	826	8.2165	0.0165
828	827	8.2128	0.0128
829	828	8.2128	0.0128
830	829	8.2128	0.0128
831	830	8.2128	0.0128
832	831	8.2128	0.0128
833	832	8.2128	0.0128
834	833	8.2128	0.0128
835	834	8.2128	0.0128
836	835	8.2128	0.0128
837	836	8.2128	0.0128
838	837	8.2128	0.0128
839	838	8.2128	0.0128
840	839	8.2128	0.0128
841	840	8.2128	0.0128
842	841	8.2128	0.0128
843	842	8.2128	0.0128

BluMetric Environnement Inc. 276, rue St-Jacques Bureau 818 Montreal (QC) H2Y 1N3	**Slug Test - Water Level Data**		
	Project:	Nemaska New Waste Disposal Site – Hydrogeological assessm	
	Number:	230448-00	
	Client:	Stantec	

	Time [s]	Water Level [m]	WL Change [m]
844	843	8.2128	0.0128
845	844	8.2128	0.0128
846	845	8.2128	0.0128
847	846	8.2128	0.0128
848	847	8.2128	0.0128
849	848	8.2128	0.0128
850	849	8.2128	0.0128
851	850	8.2128	0.0128
852	851	8.2128	0.0128
853	852	8.2128	0.0128
854	853	8.2128	0.0128
855	854	8.2128	0.0128
856	855	8.2128	0.0128
857	856	8.2128	0.0128
858	857	8.2128	0.0128
859	858	8.2128	0.0128
860	859	8.2128	0.0128
861	860	8.2128	0.0128
862	861	8.2165	0.0165
863	862	8.2165	0.0165
864	863	8.2165	0.0165
865	864	8.2128	0.0128
866	865	8.2128	0.0128
867	866	8.2128	0.0128
868	867	8.2128	0.0128
869	868	8.2128	0.0128
870	869	8.2128	0.0128
871	870	8.2128	0.0128
872	871	8.2147	0.0147
873	872	8.2147	0.0147
874	873	8.2128	0.0128
875	874	8.2128	0.0128
876	875	8.2128	0.0128
877	876	8.2128	0.0128
878	877	8.2128	0.0128
879	878	8.2128	0.0128
880	879	8.2128	0.0128
881	880	8.2128	0.0128
882	881	8.2128	0.0128
883	882	8.2147	0.0147
884	883	8.2128	0.0128
885	884	8.2128	0.0128
886	885	8.2128	0.0128
887	886	8.2128	0.0128
888	887	8.2128	0.0128
889	888	8.2128	0.0128
890	889	8.2128	0.0128
891	890	8.2128	0.0128
892	891	8.2128	0.0128
893	892	8.2128	0.0128
894	893	8.2101	0.0101
895	894	8.2147	0.0147
896	895	8.2128	0.0128

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	Time [s]	Water Level [m]	WL Change [m]
897	896	8.2128	0.0128
898	897	8.2128	0.0128
899	898	8.2128	0.0128
900	899	8.2128	0.0128
901	900	8.2128	0.0128
902	901	8.2128	0.0128
903	902	8.2101	0.0101
904	903	8.2128	0.0128
905	904	8.2119	0.0119
906	905	8.2101	0.0101
907	906	8.2128	0.0128
908	907	8.2128	0.0128
909	908	8.2128	0.0128
910	909	8.2128	0.0128
911	910	8.2128	0.0128
912	911	8.2101	0.0101
913	912	8.2147	0.0147
914	913	8.2128	0.0128
915	914	8.2101	0.0101
916	915	8.2119	0.0119
917	916	8.2101	0.0101
918	917	8.2101	0.0101
919	918	8.2101	0.0101
920	919	8.2101	0.0101
921	920	8.2101	0.0101
922	921	8.2119	0.0119
923	922	8.2119	0.0119
924	923	8.2101	0.0101
925	924	8.2101	0.0101
926	925	8.2128	0.0128
927	926	8.2147	0.0147
928	927	8.2101	0.0101
929	928	8.2101	0.0101
930	929	8.2147	0.0147
931	930	8.2119	0.0119
932	931	8.2119	0.0119
933	932	8.2101	0.0101
934	933	8.2119	0.0119
935	934	8.2101	0.0101
936	935	8.2119	0.0119
937	936	8.2147	0.0147
938	937	8.2101	0.0101
939	938	8.2147	0.0147
940	939	8.2119	0.0119
941	940	8.2147	0.0147
942	941	8.2147	0.0147
943	942	8.2119	0.0119
944	943	8.2119	0.0119
945	944	8.2119	0.0119
946	945	8.2119	0.0119
947	946	8.2119	0.0119
948	947	8.2119	0.0119
949	948	8.2119	0.0119

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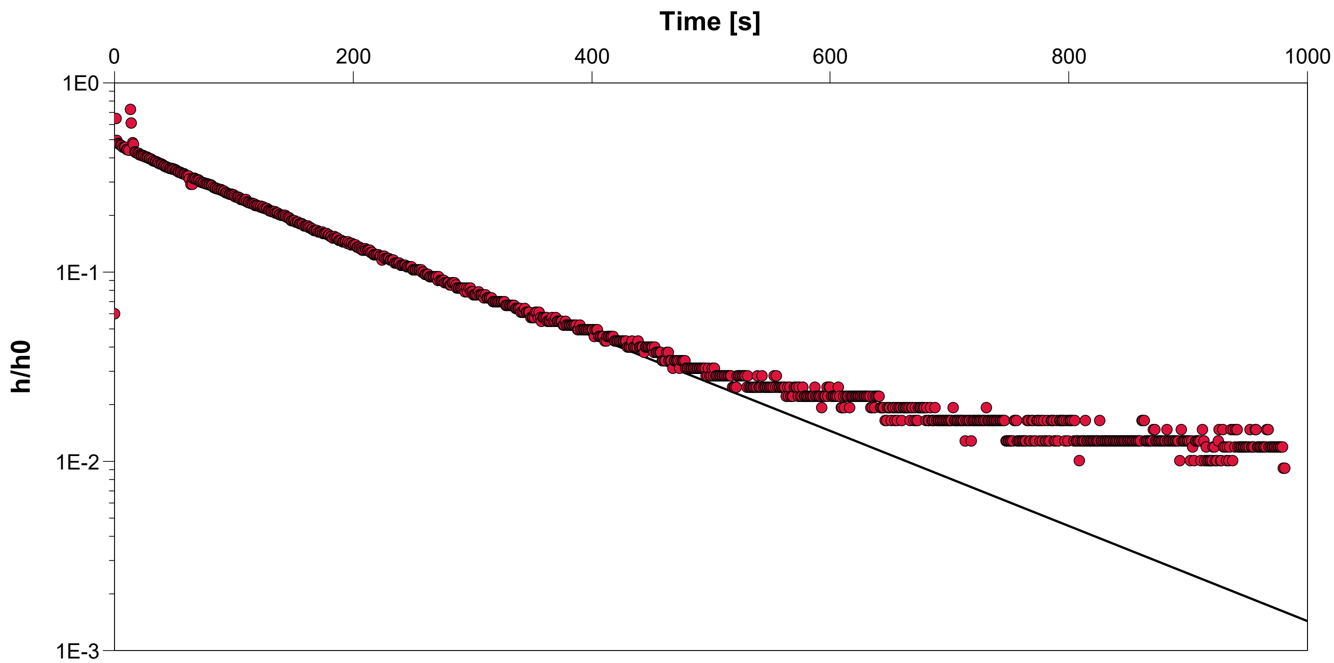
	Time [s]	Water Level [m]	WL Change [m]
950	949	8.2119	0.0119
951	950	8.2119	0.0119
952	951	8.2119	0.0119
953	952	8.2147	0.0147
954	953	8.2119	0.0119
955	954	8.2119	0.0119
956	955	8.2119	0.0119
957	956	8.2147	0.0147
958	957	8.2147	0.0147
959	958	8.2119	0.0119
960	959	8.2119	0.0119
961	960	8.2119	0.0119
962	961	8.2119	0.0119
963	962	8.2119	0.0119
964	963	8.2119	0.0119
965	964	8.2119	0.0119
966	965	8.2119	0.0119
967	966	8.2147	0.0147
968	967	8.2147	0.0147
969	968	8.2119	0.0119
970	969	8.2119	0.0119
971	970	8.2119	0.0119
972	971	8.2119	0.0119
973	972	8.2119	0.0119
974	973	8.2119	0.0119
975	974	8.2119	0.0119
976	975	8.2119	0.0119
977	976	8.2119	0.0119
978	977	8.2119	0.0119
979	978	8.2119	0.0119
980	979	8.2119	0.0119
981	980	8.2092	0.0092
982	981	8.2092	0.0092

BluMetric Environnement Inc. 276, rue St-Jacques Bureau 818 Montreal (QC) H2Y 1N3	**Slug Test Analysis Report** Project: Nemaska New Waste Disposal Site – Hydrogeological assessm Number: 230448-00 Client: Stantec

Location: Nemaska	Slug Test: PZ-3_2020	Test Well: PZ-3
Test Conducted by: Stantec		Test Date: 2020-08-04
Analysis Performed by: LA	PZ-3_2020_Hvors	Analysis Date: 2023-08-18
Aquifer Thickness: 4.70 m		

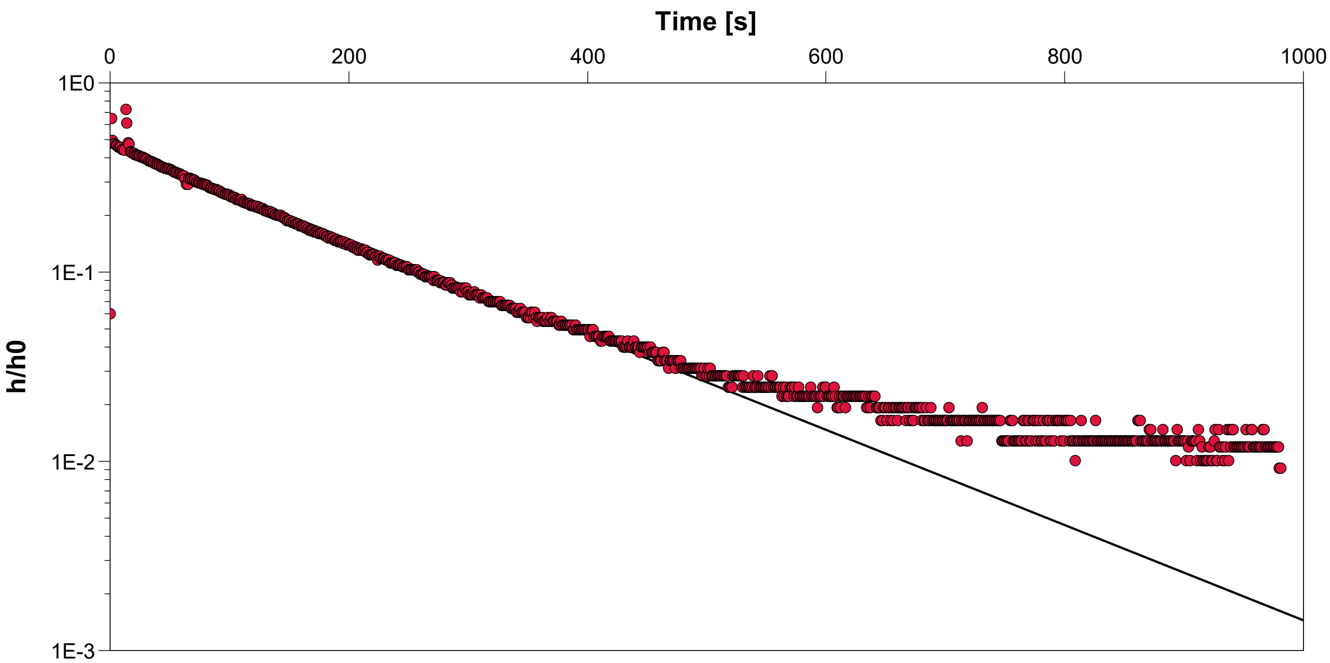


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
PZ-3	2.86×10^{-6}	

BluMetric Environnement Inc. 276, rue St-Jacques Bureau 818 Montreal (QC) H2Y 1N3	**Slug Test Analysis Report** Project: Nemaska New Waste Disposal Site – Hydrogeological assessm Number: 230448-00 Client: Stantec

Location: Nemaska	Slug Test: PZ-3_2020	Test Well: PZ-3
Test Conducted by: Stantec		Test Date: 2020-08-04
Analysis Performed by: LA	PZ-3_2020 B-R	Analysis Date: 2023-08-18
Aquifer Thickness: 4.70 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
PZ-3	2.22×10^{-6}	

BluMetric Environnement Inc. 276, rue St-Jacques Bureau 818 Montreal (QC) H2Y 1N3	**Slug Test - Analyses Report** Project: Nemaska New Waste Disposal Site – Hydrogeological assessm Number: 230448-00 Client: Stantec

Location: Nemaska	Slug Test: PZ-3_2020	Test Well: PZ-3
Test Conducted by: Stantec		Test Date: 2020-08-04
Aquifer Thickness: 4.70 m		

	Analysis Name	Analysis Performed b	Analysis Date	Method name	Well	T [m²/s]	K [m/s]	S
1	PZ-3_2020_Hvors	LA	2023-08-18	Hvorslev	PZ-3		2.86×10^{-6}	
2	PZ-3_2020 B-R	LA	2023-08-18	Bouwer & Rice	PZ-3		2.22×10^{-6}	

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Slug Test - Water Level Data

Project: Nemaska New Waste Disposal Site – Hydrogeological assessi

Number: 230448-00

Client: Stantec

Location: Nemaska	Slug Test: PZ-6_2020	Test Well: PZ-6
Test Conducted by: Stantec	Test Date: 2020-08-04	
Water level at t=0 [m]: NAN	Static Water Level [m]: 1.57	Water level change at t=0 [m]: 0.00

	Time [s]	Water Level [m]	WL Change [m]
1	0	1.7378	0.1677
2	1	2.1026	0.5326
3	2	2.1053	0.5353
4	3	2.1108	0.5408
5	4	2.1053	0.5353
6	5	2.1053	0.5353
7	6	2.1053	0.5353
8	7	2.1026	0.5326
9	8	2.0989	0.5289
10	9	2.0989	0.5289
11	10	2.0989	0.5289
12	11	2.0989	0.5289
13	12	2.0962	0.5262
14	13	2.0989	0.5289
15	14	2.0962	0.5262
16	15	2.0962	0.5262
17	16	2.0962	0.5262
18	17	2.0934	0.5234
19	18	2.0934	0.5234
20	19	2.0934	0.5234
21	20	2.0934	0.5234
22	21	2.0934	0.5234
23	22	2.0907	0.5207
24	23	2.0934	0.5234
25	24	2.0907	0.5207
26	25	2.0907	0.5207
27	26	2.0907	0.5207
28	27	2.087	0.517
29	28	2.087	0.517
30	29	2.087	0.517
31	30	2.087	0.517
32	31	2.0843	0.5142
33	32	2.0843	0.5142
34	33	2.0843	0.5142
35	34	2.0843	0.5142
36	35	2.0843	0.5142
37	36	2.0843	0.5142
38	37	2.0843	0.5142
39	38	2.0843	0.5142
40	39	2.0843	0.5142
41	40	2.0843	0.5142
42	41	2.0843	0.5142
43	42	2.0843	0.5142
44	43	2.0843	0.5142
45	44	2.0815	0.5115
46	45	2.0815	0.5115
47	46	2.0815	0.5115
48	47	2.0815	0.5115

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Slug Test - Water Level Data

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	Time [s]	Water Level [m]	WL Change [m]
49	48	2.0815	0.5115
50	49	2.0815	0.5115
51	50	2.0788	0.5087
52	51	2.0788	0.5087
53	52	2.0788	0.5087
54	53	2.0815	0.5115
55	54	2.0788	0.5087
56	55	2.0751	0.5051
57	56	2.0788	0.5087
58	57	2.0788	0.5087
59	58	2.0751	0.5051
60	59	2.0751	0.5051
61	60	2.0751	0.5051
62	61	2.0751	0.5051
63	62	2.0723	0.5023
64	63	2.0751	0.5051
65	64	2.0751	0.5051
66	65	2.0751	0.5051
67	66	2.0751	0.5051
68	67	2.0723	0.5023
69	68	2.0723	0.5023
70	69	2.0723	0.5023
71	70	2.0723	0.5023
72	71	2.0723	0.5023
73	72	2.0723	0.5023
74	73	2.0696	0.4996
75	74	2.0696	0.4996
76	75	2.0696	0.4996
77	76	2.0696	0.4996
78	77	2.0696	0.4996
79	78	2.0659	0.4959
80	79	2.0659	0.4959
81	80	2.0659	0.4959
82	81	2.0659	0.4959
83	82	2.0659	0.4959
84	83	2.0659	0.4959
85	84	2.0659	0.4959
86	85	2.0659	0.4959
87	86	2.0659	0.4959
88	87	2.0659	0.4959
89	88	2.0696	0.4996
90	89	2.0659	0.4959
91	90	2.0632	0.4932
92	91	2.0632	0.4932
93	92	2.0632	0.4932
94	93	2.0632	0.4932
95	94	2.0632	0.4932
96	95	2.0632	0.4932
97	96	2.0632	0.4932
98	97	2.0604	0.4904
99	98	2.0604	0.4904
100	99	2.0632	0.4932
101	100	2.0632	0.4932

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	Time [s]	Water Level [m]	WL Change [m]
102	101	2.0659	0.4959
103	102	2.0632	0.4932
104	103	2.0604	0.4904
105	104	2.0604	0.4904
106	105	2.0604	0.4904
107	106	2.0577	0.4877
108	107	2.0577	0.4877
109	108	2.0604	0.4904
110	109	2.0604	0.4904
111	110	2.0604	0.4904
112	111	2.0604	0.4904
113	112	2.0577	0.4877
114	113	2.0577	0.4877
115	114	2.0577	0.4877
116	115	2.054	0.484
117	116	2.054	0.484
118	117	2.054	0.484
119	118	2.054	0.484
120	119	2.0513	0.4813
121	120	2.054	0.484
122	121	2.054	0.484
123	122	2.0513	0.4813
124	123	2.0513	0.4813
125	124	2.0513	0.4813
126	125	2.0513	0.4813
127	126	2.0513	0.4813
128	127	2.0513	0.4813
129	128	2.0513	0.4813
130	129	2.0513	0.4813
131	130	2.0513	0.4813
132	131	2.0485	0.4785
133	132	2.0513	0.4813
134	133	2.0485	0.4785
135	134	2.0513	0.4813
136	135	2.0485	0.4785
137	136	2.0485	0.4785
138	137	2.0485	0.4785
139	138	2.0485	0.4785
140	139	2.0485	0.4785
141	140	2.0458	0.4757
142	141	2.0485	0.4785
143	142	2.0485	0.4785
144	143	2.0458	0.4757
145	144	2.0458	0.4757
146	145	2.0458	0.4757
147	146	2.0458	0.4757
148	147	2.0458	0.4757
149	148	2.0458	0.4757
150	149	2.0458	0.4757
151	150	2.0421	0.4721
152	151	2.0421	0.4721
153	152	2.0421	0.4721
154	153	2.0421	0.4721

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	Time [s]	Water Level [m]	WL Change [m]
155	154	2.0421	0.4721
156	155	2.0421	0.4721
157	156	2.0421	0.4721
158	157	2.0421	0.4721
159	158	2.0421	0.4721
160	159	2.0421	0.4721
161	160	2.0421	0.4721
162	161	2.0393	0.4693
163	162	2.0393	0.4693
164	163	2.0393	0.4693
165	164	2.0393	0.4693
166	165	2.0393	0.4693
167	166	2.0393	0.4693
168	167	2.0393	0.4693
169	168	2.0366	0.4666
170	169	2.0393	0.4693
171	170	2.0393	0.4693
172	171	2.0366	0.4666
173	172	2.0366	0.4666
174	173	2.0366	0.4666
175	174	2.0366	0.4666
176	175	2.0366	0.4666
177	176	2.0366	0.4666
178	177	2.0366	0.4666
179	178	2.0338	0.4638
180	179	2.0274	0.4574
181	180	2.0366	0.4666
182	181	2.0338	0.4638
183	182	2.0338	0.4638
184	183	2.0338	0.4638
185	184	2.032	0.462
186	185	2.0338	0.4638
187	186	2.0338	0.4638
188	187	2.0302	0.4602
189	188	2.0302	0.4602
190	189	2.0302	0.4602
191	190	2.0302	0.4602
192	191	2.0302	0.4602
193	192	2.0302	0.4602
194	193	2.0302	0.4602
195	194	2.0302	0.4602
196	195	2.0302	0.4602
197	196	2.0302	0.4602
198	197	2.0302	0.4602
199	198	2.0302	0.4602
200	199	2.0293	0.4593
201	200	2.0302	0.4602
202	201	2.0274	0.4574
203	202	2.0265	0.4565
204	203	2.0265	0.4565
205	204	2.0265	0.4565
206	205	2.0265	0.4565
207	206	2.0247	0.4547

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	Time [s]	Water Level [m]	WL Change [m]
208	207	2.0265	0.4565
209	208	2.0274	0.4574
210	209	2.0247	0.4547
211	210	2.0247	0.4547
212	211	2.0228	0.4528
213	212	2.0228	0.4528
214	213	2.0228	0.4528
215	214	2.0201	0.4501
216	215	2.0228	0.4528
217	216	2.0201	0.4501
218	217	2.0201	0.4501
219	218	2.0201	0.4501
220	219	2.0228	0.4528
221	220	2.0228	0.4528
222	221	2.0201	0.4501
223	222	2.0201	0.4501
224	223	2.0201	0.4501
225	224	2.0201	0.4501
226	225	2.0173	0.4473
227	226	2.0201	0.4501
228	227	2.0201	0.4501
229	228	2.0173	0.4473
230	229	2.0173	0.4473
231	230	2.0173	0.4473
232	231	2.0173	0.4473
233	232	2.0173	0.4473
234	233	2.0173	0.4473
235	234	2.0173	0.4473
236	235	2.0173	0.4473
237	236	2.0173	0.4473
238	237	2.0146	0.4446
239	238	2.0146	0.4446
240	239	2.0146	0.4446
241	240	2.0146	0.4446
242	241	2.0146	0.4446
243	242	2.0146	0.4446
244	243	2.0146	0.4446
245	244	2.0146	0.4446
246	245	2.0146	0.4446
247	246	2.0109	0.4409
248	247	2.0109	0.4409
249	248	2.0109	0.4409
250	249	2.0109	0.4409
251	250	2.0109	0.4409
252	251	2.0109	0.4409
253	252	2.0109	0.4409
254	253	2.0109	0.4409
255	254	2.0109	0.4409
256	255	2.0109	0.4409
257	256	2.0082	0.4382
258	257	2.0109	0.4409
259	258	2.0082	0.4382
260	259	2.0082	0.4382

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	Time [s]	Water Level [m]	WL Change [m]
261	260	2.0054	0.4354
262	261	2.0082	0.4382
263	262	2.0082	0.4382
264	263	2.0082	0.4382
265	264	2.0054	0.4354
266	265	2.0082	0.4382
267	266	2.0054	0.4354
268	267	2.0054	0.4354
269	268	2.0082	0.4382
270	269	2.0054	0.4354
271	270	2.0054	0.4354
272	271	2.0054	0.4354
273	272	2.0054	0.4354
274	273	2.0054	0.4354
275	274	2.0018	0.4317
276	275	2.0054	0.4354
277	276	2.0018	0.4317
278	277	2.0018	0.4317
279	278	2.0018	0.4317
280	279	2.0018	0.4317
281	280	2.0018	0.4317
282	281	2.0018	0.4317
283	282	2.0018	0.4317
284	283	2.0018	0.4317
285	284	2.0018	0.4317
286	285	2.0018	0.4317
287	286	2.0018	0.4317
288	287	2.0018	0.4317
289	288	1.999	0.429
290	289	2.0018	0.4317
291	290	1.999	0.429
292	291	1.999	0.429
293	292	1.999	0.429
294	293	1.999	0.429
295	294	1.999	0.429
296	295	1.999	0.429
297	296	1.999	0.429
298	297	1.999	0.429
299	298	1.999	0.429
300	299	1.999	0.429
301	300	1.999	0.429
302	301	1.9963	0.4263
303	302	1.9963	0.4263
304	303	1.9963	0.4263
305	304	1.9963	0.4263
306	305	1.9963	0.4263
307	306	1.9963	0.4263
308	307	1.9963	0.4263
309	308	1.9963	0.4263
310	309	1.9963	0.4263
311	310	1.9963	0.4263
312	311	1.9963	0.4263
313	312	1.9963	0.4263

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Slug Test - Water Level Data

Project: Nemaska New Waste Disposal Site – Hydrogeological assessm

Number: 230448-00

Client: Stantec

	Time [s]	Water Level [m]	WL Change [m]
314	313	1.9963	0.4263
315	314	1.9963	0.4263
316	315	1.9935	0.4235
317	316	1.9963	0.4263
318	317	1.9935	0.4235
319	318	1.9935	0.4235
320	319	1.9935	0.4235
321	320	1.9898	0.4198
322	321	1.9898	0.4198
323	322	1.9935	0.4235
324	323	1.9898	0.4198
325	324	1.9935	0.4235
326	325	1.9898	0.4198
327	326	1.9898	0.4198
328	327	1.9898	0.4198
329	328	1.9898	0.4198
330	329	1.9898	0.4198
331	330	1.9898	0.4198
332	331	1.9898	0.4198
333	332	1.9898	0.4198
334	333	1.9871	0.4171
335	334	1.9871	0.4171
336	335	1.9871	0.4171
337	336	1.9871	0.4171
338	337	1.9871	0.4171
339	338	1.9871	0.4171
340	339	1.9843	0.4143
341	340	1.9871	0.4171
342	341	1.9871	0.4171
343	342	1.9871	0.4171
344	343	1.9843	0.4143
345	344	1.9843	0.4143
346	345	1.9843	0.4143
347	346	1.9871	0.4171
348	347	1.9843	0.4143
349	348	1.9843	0.4143
350	349	1.9843	0.4143
351	350	1.9843	0.4143
352	351	1.9843	0.4143
353	352	1.9843	0.4143
354	353	1.9843	0.4143
355	354	1.9843	0.4143
356	355	1.9816	0.4116
357	356	1.9816	0.4116
358	357	1.9843	0.4143
359	358	1.9843	0.4143
360	359	1.9816	0.4116
361	360	1.9816	0.4116
362	361	1.9816	0.4116
363	362	1.9816	0.4116
364	363	1.9843	0.4143
365	364	1.9816	0.4116
366	365	1.9816	0.4116

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Client: Stantec

	Time [s]	Water Level [m]	WL Change [m]
367	366	1.9779	0.4079
368	367	1.9779	0.4079
369	368	1.9779	0.4079
370	369	1.9779	0.4079
371	370	1.9779	0.4079
372	371	1.9779	0.4079
373	372	1.9779	0.4079
374	373	1.9779	0.4079
375	374	1.9779	0.4079
376	375	1.9779	0.4079
377	376	1.9779	0.4079
378	377	1.9779	0.4079
379	378	1.9752	0.4052
380	379	1.9752	0.4052
381	380	1.9752	0.4052
382	381	1.9752	0.4052
383	382	1.9724	0.4024
384	383	1.9752	0.4052
385	384	1.9752	0.4052
386	385	1.9724	0.4024
387	386	1.9724	0.4024
388	387	1.9752	0.4052
389	388	1.9724	0.4024
390	389	1.9724	0.4024
391	390	1.9724	0.4024
392	391	1.9724	0.4024
393	392	1.9724	0.4024
394	393	1.9724	0.4024
395	394	1.9724	0.4024
396	395	1.9724	0.4024
397	396	1.9697	0.3997
398	397	1.9697	0.3997
399	398	1.9724	0.4024
400	399	1.9724	0.4024
401	400	1.9724	0.4024
402	401	1.9724	0.4024
403	402	1.9697	0.3997
404	403	1.9697	0.3997
405	404	1.9697	0.3997
406	405	1.9697	0.3997
407	406	1.9706	0.4006
408	407	1.9697	0.3997
409	408	1.9706	0.4006
410	409	1.9697	0.3997
411	410	1.9697	0.3997
412	411	1.9697	0.3997
413	412	1.966	0.396
414	413	1.9697	0.3997
415	414	1.9697	0.3997
416	415	1.966	0.396
417	416	1.9678	0.3978
418	417	1.9632	0.3932
419	418	1.966	0.396

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	Time [s]	Water Level [m]	WL Change [m]
420	419	1.9678	0.3978
421	420	1.966	0.396
422	421	1.9632	0.3932
423	422	1.9678	0.3978
424	423	1.9651	0.3951
425	424	1.966	0.396
426	425	1.9651	0.3951
427	426	1.9651	0.3951
428	427	1.9632	0.3932
429	428	1.9632	0.3932
430	429	1.9632	0.3932
431	430	1.9632	0.3932
432	431	1.9651	0.3951
433	432	1.9614	0.3914
434	433	1.9614	0.3914
435	434	1.9614	0.3914
436	435	1.9605	0.3905
437	436	1.9614	0.3914
438	437	1.9614	0.3914
439	438	1.9614	0.3914
440	439	1.9651	0.3951
441	440	1.9605	0.3905
442	441	1.9578	0.3878
443	442	1.9587	0.3887
444	443	1.9587	0.3887
445	444	1.9614	0.3914
446	445	1.9614	0.3914
447	446	1.9614	0.3914
448	447	1.9587	0.3887
449	448	1.9614	0.3914
450	449	1.9587	0.3887
451	450	1.9587	0.3887
452	451	1.9587	0.3887
453	452	1.9587	0.3887
454	453	1.9578	0.3878
455	454	1.9587	0.3887
456	455	1.9587	0.3887
457	456	1.9587	0.3887
458	457	1.9587	0.3887
459	458	1.9587	0.3887
460	459	1.9587	0.3887
461	460	1.9587	0.3887
462	461	1.9578	0.3878
463	462	1.9559	0.3859
464	463	1.9559	0.3859
465	464	1.9559	0.3859
466	465	1.9559	0.3859
467	466	1.9559	0.3859
468	467	1.9559	0.3859
469	468	1.9541	0.3841
470	469	1.9559	0.3859
471	470	1.9559	0.3859
472	471	1.9532	0.3832

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	Time [s]	Water Level [m]	WL Change [m]
473	472	1.9559	0.3859
474	473	1.9532	0.3832
475	474	1.9559	0.3859
476	475	1.9559	0.3859
477	476	1.9559	0.3859
478	477	1.9532	0.3832
479	478	1.9532	0.3832
480	479	1.9532	0.3832
481	480	1.9532	0.3832
482	481	1.9495	0.3795
483	482	1.9495	0.3795
484	483	1.9495	0.3795
485	484	1.9532	0.3832
486	485	1.9495	0.3795
487	486	1.9532	0.3832
488	487	1.9495	0.3795
489	488	1.9495	0.3795
490	489	1.9495	0.3795
491	490	1.9495	0.3795
492	491	1.9495	0.3795
493	492	1.9495	0.3795
494	493	1.9495	0.3795
495	494	1.9495	0.3795
496	495	1.9495	0.3795
497	496	1.9495	0.3795
498	497	1.9495	0.3795
499	498	1.9468	0.3767
500	499	1.9495	0.3795
501	500	1.9495	0.3795
502	501	1.9495	0.3795
503	502	1.9468	0.3767
504	503	1.9468	0.3767
505	504	1.9468	0.3767
506	505	1.9468	0.3767
507	506	1.9468	0.3767
508	507	1.944	0.374
509	508	1.944	0.374
510	509	1.944	0.374
511	510	1.944	0.374
512	511	1.944	0.374
513	512	1.944	0.374
514	513	1.944	0.374
515	514	1.944	0.374
516	515	1.944	0.374
517	516	1.944	0.374
518	517	1.944	0.374
519	518	1.944	0.374
520	519	1.944	0.374
521	520	1.9413	0.3712
522	521	1.9413	0.3712
523	522	1.9413	0.3712
524	523	1.9413	0.3712
525	524	1.9413	0.3712

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	Time [s]	Water Level [m]	WL Change [m]
526	525	1.9413	0.3712
527	526	1.9376	0.3676
528	527	1.9413	0.3712
529	528	1.9413	0.3712
530	529	1.9413	0.3712
531	530	1.9413	0.3712
532	531	1.9376	0.3676
533	532	1.9413	0.3712
534	533	1.9376	0.3676
535	534	1.9413	0.3712
536	535	1.9413	0.3712
537	536	1.9376	0.3676
538	537	1.9376	0.3676
539	538	1.9376	0.3676
540	539	1.9376	0.3676
541	540	1.9376	0.3676
542	541	1.9348	0.3648
543	542	1.9376	0.3676
544	543	1.9348	0.3648
545	544	1.9348	0.3648
546	545	1.9348	0.3648
547	546	1.9348	0.3648
548	547	1.9348	0.3648
549	548	1.9348	0.3648
550	549	1.9348	0.3648
551	550	1.9348	0.3648
552	551	1.9348	0.3648
553	552	1.9348	0.3648
554	553	1.9348	0.3648
555	554	1.9321	0.3621
556	555	1.9321	0.3621
557	556	1.9321	0.3621
558	557	1.9321	0.3621
559	558	1.9321	0.3621
560	559	1.9321	0.3621
561	560	1.9321	0.3621
562	561	1.9321	0.3621
563	562	1.9321	0.3621
564	563	1.9321	0.3621
565	564	1.9321	0.3621
566	565	1.9321	0.3621
567	566	1.9321	0.3621
568	567	1.9284	0.3584
569	568	1.9321	0.3621
570	569	1.9321	0.3621
571	570	1.9321	0.3621
572	571	1.9284	0.3584
573	572	1.9284	0.3584
574	573	1.9284	0.3584
575	574	1.9284	0.3584
576	575	1.9284	0.3584
577	576	1.9284	0.3584
578	577	1.9284	0.3584

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Project: Nemaska New Waste Disposal Site – Hydrogeological assessm

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	Time [s]	Water Level [m]	WL Change [m]
579	578	1.9284	0.3584
580	579	1.9257	0.3557
581	580	1.9284	0.3584
582	581	1.9257	0.3557
583	582	1.9257	0.3557
584	583	1.9257	0.3557
585	584	1.9229	0.3529
586	585	1.9257	0.3557
587	586	1.9257	0.3557
588	587	1.9257	0.3557
589	588	1.9229	0.3529
590	589	1.9229	0.3529
591	590	1.9229	0.3529
592	591	1.9211	0.3511
593	592	1.9229	0.3529
594	593	1.9229	0.3529
595	594	1.9202	0.3502
596	595	1.9229	0.3529
597	596	1.9229	0.3529
598	597	1.9229	0.3529
599	598	1.9229	0.3529
600	599	1.9202	0.3502
601	600	1.9202	0.3502
602	601	1.9202	0.3502
603	602	1.9202	0.3502
604	603	1.9202	0.3502
605	604	1.9202	0.3502
606	605	1.9202	0.3502
607	606	1.9202	0.3502
608	607	1.9202	0.3502
609	608	1.9202	0.3502
610	609	1.9202	0.3502
611	610	1.9202	0.3502
612	611	1.9165	0.3465
613	612	1.9183	0.3483
614	613	1.9202	0.3502
615	614	1.9202	0.3502
616	615	1.9202	0.3502
617	616	1.9156	0.3456
618	617	1.9165	0.3465
619	618	1.9156	0.3456
620	619	1.9165	0.3465
621	620	1.9165	0.3465
622	621	1.9156	0.3456
623	622	1.9156	0.3456
624	623	1.9202	0.3502
625	624	1.9165	0.3465
626	625	1.9165	0.3465
627	626	1.9156	0.3456
628	627	1.9156	0.3456
629	628	1.9156	0.3456
630	629	1.9156	0.3456
631	630	1.9156	0.3456

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Slug Test - Water Level Data

Project: Nemaska New Waste Disposal Site – Hydrogeological assessm

Number: 230448-00

Client: Stantec

	Time [s]	Water Level [m]	WL Change [m]
632	631	1.9128	0.3428
633	632	1.9165	0.3465
634	633	1.9156	0.3456
635	634	1.9156	0.3456
636	635	1.9156	0.3456
637	636	1.9156	0.3456
638	637	1.9128	0.3428
639	638	1.9128	0.3428
640	639	1.9128	0.3428
641	640	1.9128	0.3428
642	641	1.9128	0.3428
643	642	1.9128	0.3428
644	643	1.9128	0.3428
645	644	1.9128	0.3428
646	645	1.9138	0.3438
647	646	1.9128	0.3428
648	647	1.9092	0.3392
649	648	1.911	0.341
650	649	1.9092	0.3392
651	650	1.9128	0.3428
652	651	1.9138	0.3438
653	652	1.9128	0.3428
654	653	1.9128	0.3428
655	654	1.9092	0.3392
656	655	1.9092	0.3392
657	656	1.9092	0.3392
658	657	1.9092	0.3392
659	658	1.9092	0.3392
660	659	1.9092	0.3392
661	660	1.9092	0.3392
662	661	1.9092	0.3392
663	662	1.9092	0.3392
664	663	1.9092	0.3392
665	664	1.9092	0.3392
666	665	1.9064	0.3364
667	666	1.9064	0.3364
668	667	1.9064	0.3364
669	668	1.9064	0.3364
670	669	1.9092	0.3392
671	670	1.9092	0.3392
672	671	1.9092	0.3392
673	672	1.9064	0.3364
674	673	1.9064	0.3364
675	674	1.9064	0.3364
676	675	1.9064	0.3364
677	676	1.9064	0.3364
678	677	1.9064	0.3364
679	678	1.9064	0.3364
680	679	1.9037	0.3337
681	680	1.9037	0.3337
682	681	1.9037	0.3337
683	682	1.9037	0.3337
684	683	1.9037	0.3337

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Slug Test - Water Level Data

Project: Nemaska New Waste Disposal Site – Hydrogeological assess

Number: 230448-00

Client: Stantec

	Time [s]	Water Level [m]	WL Change [m]
685	684	1.9037	0.3337
686	685	1.9037	0.3337
687	686	1.9037	0.3337
688	687	1.9037	0.3337
689	688	1.9064	0.3364
690	689	1.9064	0.3364
691	690	1.9037	0.3337
692	691	1.9037	0.3337
693	692	1.9009	0.3309
694	693	1.9037	0.3337
695	694	1.9037	0.3337
696	695	1.9037	0.3337
697	696	1.9009	0.3309
698	697	1.9009	0.3309
699	698	1.9009	0.3309
700	699	1.9009	0.3309
701	700	1.9009	0.3309
702	701	1.9009	0.3309
703	702	1.9009	0.3309
704	703	1.9037	0.3337
705	704	1.9009	0.3309
706	705	1.9009	0.3309
707	706	1.8973	0.3273
708	707	1.9009	0.3309
709	708	1.8973	0.3273
710	709	1.9009	0.3309
711	710	1.8973	0.3273
712	711	1.9009	0.3309
713	712	1.8973	0.3273
714	713	1.8973	0.3273
715	714	1.8973	0.3273
716	715	1.8973	0.3273
717	716	1.8973	0.3273
718	717	1.8973	0.3273
719	718	1.8973	0.3273
720	719	1.8973	0.3273
721	720	1.8945	0.3245
722	721	1.8973	0.3273
723	722	1.8973	0.3273
724	723	1.8973	0.3273
725	724	1.8973	0.3273
726	725	1.8973	0.3273
727	726	1.8945	0.3245
728	727	1.8945	0.3245
729	728	1.8945	0.3245
730	729	1.8945	0.3245
731	730	1.8945	0.3245
732	731	1.8945	0.3245
733	732	1.8945	0.3245
734	733	1.8945	0.3245
735	734	1.8945	0.3245
736	735	1.8945	0.3245
737	736	1.8945	0.3245

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	Time [s]	Water Level [m]	WL Change [m]
738	737	1.8945	0.3245
739	738	1.8945	0.3245
740	739	1.8945	0.3245
741	740	1.8918	0.3218
742	741	1.8918	0.3218
743	742	1.8918	0.3218
744	743	1.8918	0.3218
745	744	1.8918	0.3218
746	745	1.8918	0.3218
747	746	1.8918	0.3218
748	747	1.8881	0.3181
749	748	1.8918	0.3218
750	749	1.8881	0.3181
751	750	1.8881	0.3181
752	751	1.8918	0.3218
753	752	1.8881	0.3181
754	753	1.8918	0.3218
755	754	1.8918	0.3218
756	755	1.8918	0.3218
757	756	1.8918	0.3218
758	757	1.8881	0.3181
759	758	1.8881	0.3181
760	759	1.8881	0.3181
761	760	1.8881	0.3181
762	761	1.8881	0.3181
763	762	1.8881	0.3181
764	763	1.8853	0.3153
765	764	1.8881	0.3181
766	765	1.8881	0.3181
767	766	1.8881	0.3181
768	767	1.8881	0.3181
769	768	1.8881	0.3181
770	769	1.8881	0.3181
771	770	1.8853	0.3153
772	771	1.8853	0.3153
773	772	1.8853	0.3153
774	773	1.8853	0.3153
775	774	1.8853	0.3153
776	775	1.8853	0.3153
777	776	1.8853	0.3153
778	777	1.8853	0.3153
779	778	1.8853	0.3153
780	779	1.8853	0.3153
781	780	1.8853	0.3153
782	781	1.8853	0.3153
783	782	1.8853	0.3153
784	783	1.8826	0.3126
785	784	1.8853	0.3153
786	785	1.8826	0.3126
787	786	1.8826	0.3126
788	787	1.8826	0.3126
789	788	1.8826	0.3126
790	789	1.8853	0.3153

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	Time [s]	Water Level [m]	WL Change [m]
791	790	1.8826	0.3126
792	791	1.8826	0.3126
793	792	1.8826	0.3126
794	793	1.8826	0.3126
795	794	1.8826	0.3126
796	795	1.8826	0.3126
797	796	1.8826	0.3126
798	797	1.8826	0.3126
799	798	1.8826	0.3126
800	799	1.8826	0.3126
801	800	1.8826	0.3126
802	801	1.8826	0.3126
803	802	1.8826	0.3126
804	803	1.8826	0.3126
805	804	1.8798	0.3098
806	805	1.8826	0.3126
807	806	1.8798	0.3098
808	807	1.8798	0.3098
809	808	1.8798	0.3098
810	809	1.8798	0.3098
811	810	1.8798	0.3098
812	811	1.8762	0.3062
813	812	1.8762	0.3062
814	813	1.8762	0.3062
815	814	1.8762	0.3062
816	815	1.8762	0.3062
817	816	1.8762	0.3062
818	817	1.8762	0.3062
819	818	1.8762	0.3062
820	819	1.8762	0.3062
821	820	1.8762	0.3062
822	821	1.8762	0.3062
823	822	1.8762	0.3062
824	823	1.8762	0.3062
825	824	1.8762	0.3062
826	825	1.8734	0.3034
827	826	1.8734	0.3034
828	827	1.8734	0.3034
829	828	1.8762	0.3062
830	829	1.8734	0.3034
831	830	1.8762	0.3062
832	831	1.8762	0.3062
833	832	1.8734	0.3034
834	833	1.8734	0.3034
835	834	1.8762	0.3062
836	835	1.8762	0.3062
837	836	1.8762	0.3062
838	837	1.8734	0.3034
839	838	1.8734	0.3034
840	839	1.8734	0.3034
841	840	1.8734	0.3034
842	841	1.8734	0.3034
843	842	1.8734	0.3034

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	Time [s]	Water Level [m]	WL Change [m]
844	843	1.8734	0.3034
845	844	1.8707	0.3007
846	845	1.8707	0.3007
847	846	1.8707	0.3007
848	847	1.8679	0.2979
849	848	1.8679	0.2979
850	849	1.8707	0.3007
851	850	1.8679	0.2979
852	851	1.8707	0.3007
853	852	1.8707	0.3007
854	853	1.8707	0.3007
855	854	1.8679	0.2979
856	855	1.8707	0.3007
857	856	1.8679	0.2979
858	857	1.8679	0.2979
859	858	1.8707	0.3007
860	859	1.8679	0.2979
861	860	1.8679	0.2979
862	861	1.8707	0.3007
863	862	1.8707	0.3007
864	863	1.8679	0.2979
865	864	1.8679	0.2979
866	865	1.8707	0.3007
867	866	1.8679	0.2979
868	867	1.8679	0.2979
869	868	1.8679	0.2979
870	869	1.8679	0.2979
871	870	1.8679	0.2979
872	871	1.8679	0.2979
873	872	1.8679	0.2979
874	873	1.8679	0.2979
875	874	1.8679	0.2979
876	875	1.8679	0.2979
877	876	1.8643	0.2942
878	877	1.8643	0.2942
879	878	1.8679	0.2979
880	879	1.8643	0.2942
881	880	1.8679	0.2979
882	881	1.8643	0.2942
883	882	1.8643	0.2942
884	883	1.8643	0.2942
885	884	1.8643	0.2942
886	885	1.8643	0.2942
887	886	1.8643	0.2942
888	887	1.8615	0.2915
889	888	1.8643	0.2942
890	889	1.8615	0.2915
891	890	1.8643	0.2942
892	891	1.8643	0.2942
893	892	1.8643	0.2942
894	893	1.8615	0.2915
895	894	1.8643	0.2942
896	895	1.8643	0.2942

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	Time [s]	Water Level [m]	WL Change [m]
897	896	1.8643	0.2942
898	897	1.8615	0.2915
899	898	1.8615	0.2915
900	899	1.8615	0.2915
901	900	1.8615	0.2915
902	901	1.8615	0.2915
903	902	1.8633	0.2933
904	903	1.8615	0.2915
905	904	1.8615	0.2915
906	905	1.8615	0.2915
907	906	1.8615	0.2915
908	907	1.8615	0.2915
909	908	1.8588	0.2887
910	909	1.8615	0.2915
911	910	1.8588	0.2887
912	911	1.8588	0.2887
913	912	1.8597	0.2897
914	913	1.8615	0.2915
915	914	1.8615	0.2915
916	915	1.8588	0.2887
917	916	1.8588	0.2887
918	917	1.8588	0.2887
919	918	1.8588	0.2887
920	919	1.8615	0.2915
921	920	1.8588	0.2887
922	921	1.8588	0.2887
923	922	1.8588	0.2887
924	923	1.8588	0.2887
925	924	1.8588	0.2887
926	925	1.8588	0.2887
927	926	1.8588	0.2887
928	927	1.8588	0.2887
929	928	1.8588	0.2887
930	929	1.8588	0.2887
931	930	1.856	0.286
932	931	1.8588	0.2887
933	932	1.8588	0.2887
934	933	1.856	0.286
935	934	1.8569	0.2869
936	935	1.856	0.286
937	936	1.856	0.286
938	937	1.856	0.286
939	938	1.856	0.286
940	939	1.856	0.286
941	940	1.856	0.286
942	941	1.856	0.286
943	942	1.856	0.286
944	943	1.856	0.286
945	944	1.8523	0.2823
946	945	1.8523	0.2823
947	946	1.8542	0.2842
948	947	1.8542	0.2842
949	948	1.8569	0.2869

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	Time [s]	Water Level [m]	WL Change [m]
950	949	1.8569	0.2869
951	950	1.8523	0.2823
952	951	1.8523	0.2823
953	952	1.8523	0.2823
954	953	1.8523	0.2823
955	954	1.8523	0.2823
956	955	1.8496	0.2796
957	956	1.8542	0.2842
958	957	1.8523	0.2823
959	958	1.8523	0.2823
960	959	1.8514	0.2814
961	960	1.8496	0.2796
962	961	1.8523	0.2823
963	962	1.8496	0.2796
964	963	1.8496	0.2796
965	964	1.8496	0.2796
966	965	1.8496	0.2796
967	966	1.8542	0.2842
968	967	1.8523	0.2823
969	968	1.8514	0.2814
970	969	1.8496	0.2796
971	970	1.8496	0.2796
972	971	1.8514	0.2814
973	972	1.8514	0.2814
974	973	1.8496	0.2796
975	974	1.8468	0.2768
976	975	1.8496	0.2796
977	976	1.8468	0.2768
978	977	1.8478	0.2777
979	978	1.8478	0.2777
980	979	1.8468	0.2768
981	980	1.8478	0.2777
982	981	1.8468	0.2768
983	982	1.8468	0.2768
984	983	1.8478	0.2777
985	984	1.8468	0.2768
986	985	1.8478	0.2777
987	986	1.8468	0.2768
988	987	1.8478	0.2777
989	988	1.8468	0.2768
990	989	1.845	0.275
991	990	1.845	0.275
992	991	1.845	0.275
993	992	1.845	0.275
994	993	1.8468	0.2768
995	994	1.8468	0.2768
996	995	1.8478	0.2777
997	996	1.845	0.275
998	997	1.8468	0.2768
999	998	1.8441	0.2741
1000	999	1.8441	0.2741
1001	1000	1.845	0.275
1002	1001	1.8478	0.2777

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	Time [s]	Water Level [m]	WL Change [m]
1003	1002	1.8478	0.2777
1004	1003	1.845	0.275
1005	1004	1.845	0.275
1006	1005	1.845	0.275
1007	1006	1.8423	0.2722
1008	1007	1.845	0.275
1009	1008	1.845	0.275
1010	1009	1.845	0.275
1011	1010	1.845	0.275
1012	1011	1.845	0.275
1013	1012	1.845	0.275
1014	1013	1.845	0.275
1015	1014	1.8404	0.2704
1016	1015	1.8404	0.2704
1017	1016	1.8423	0.2722
1018	1017	1.845	0.275
1019	1018	1.8423	0.2722
1020	1019	1.8423	0.2722
1021	1020	1.8423	0.2722
1022	1021	1.8423	0.2722
1023	1022	1.8423	0.2722
1024	1023	1.8423	0.2722
1025	1024	1.8404	0.2704
1026	1025	1.8423	0.2722
1027	1026	1.845	0.275
1028	1027	1.845	0.275
1029	1028	1.8423	0.2722
1030	1029	1.8423	0.2722
1031	1030	1.8423	0.2722
1032	1031	1.8423	0.2722
1033	1032	1.8423	0.2722
1034	1033	1.8423	0.2722
1035	1034	1.8395	0.2695
1036	1035	1.8395	0.2695
1037	1036	1.8395	0.2695
1038	1037	1.8395	0.2695
1039	1038	1.8395	0.2695
1040	1039	1.8395	0.2695
1041	1040	1.8395	0.2695
1042	1041	1.8395	0.2695
1043	1042	1.8395	0.2695
1044	1043	1.8395	0.2695
1045	1044	1.8395	0.2695
1046	1045	1.8395	0.2695
1047	1046	1.8423	0.2722
1048	1047	1.8423	0.2722
1049	1048	1.8395	0.2695
1050	1049	1.8395	0.2695
1051	1050	1.8395	0.2695
1052	1051	1.8358	0.2658
1053	1052	1.8358	0.2658
1054	1053	1.8395	0.2695
1055	1054	1.8395	0.2695

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	Time [s]	Water Level [m]	WL Change [m]
1056	1055	1.8358	0.2658
1057	1056	1.8358	0.2658
1058	1057	1.8395	0.2695
1059	1058	1.8395	0.2695
1060	1059	1.8358	0.2658
1061	1060	1.8395	0.2695
1062	1061	1.8358	0.2658
1063	1062	1.8395	0.2695
1064	1063	1.8395	0.2695
1065	1064	1.8358	0.2658
1066	1065	1.8358	0.2658
1067	1066	1.8358	0.2658
1068	1067	1.8395	0.2695
1069	1068	1.8358	0.2658
1070	1069	1.8358	0.2658
1071	1070	1.8358	0.2658
1072	1071	1.8358	0.2658
1073	1072	1.8358	0.2658
1074	1073	1.8358	0.2658
1075	1074	1.8331	0.2631
1076	1075	1.8331	0.2631
1077	1076	1.8303	0.2603
1078	1077	1.8303	0.2603
1079	1078	1.8331	0.2631
1080	1079	1.8331	0.2631
1081	1080	1.8331	0.2631
1082	1081	1.8331	0.2631
1083	1082	1.8331	0.2631
1084	1083	1.8331	0.2631
1085	1084	1.8331	0.2631
1086	1085	1.8331	0.2631
1087	1086	1.8303	0.2603
1088	1087	1.8331	0.2631
1089	1088	1.8303	0.2603
1090	1089	1.8303	0.2603
1091	1090	1.8303	0.2603
1092	1091	1.8331	0.2631
1093	1092	1.8303	0.2603
1094	1093	1.8331	0.2631
1095	1094	1.8331	0.2631
1096	1095	1.8303	0.2603
1097	1096	1.8331	0.2631
1098	1097	1.8303	0.2603
1099	1098	1.8303	0.2603
1100	1099	1.8303	0.2603
1101	1100	1.8303	0.2603
1102	1101	1.8303	0.2603
1103	1102	1.8303	0.2603
1104	1103	1.8303	0.2603
1105	1104	1.8303	0.2603
1106	1105	1.8303	0.2603
1107	1106	1.8303	0.2603
1108	1107	1.8303	0.2603

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1109	1108	1.8303	0.2603
1110	1109	1.8276	0.2576
1111	1110	1.8303	0.2603
1112	1111	1.8303	0.2603
1113	1112	1.8276	0.2576
1114	1113	1.8276	0.2576
1115	1114	1.8276	0.2576
1116	1115	1.8276	0.2576
1117	1116	1.8276	0.2576
1118	1117	1.8239	0.2539
1119	1118	1.8276	0.2576
1120	1119	1.8276	0.2576
1121	1120	1.8303	0.2603
1122	1121	1.8276	0.2576
1123	1122	1.8276	0.2576
1124	1123	1.8276	0.2576
1125	1124	1.8276	0.2576
1126	1125	1.8276	0.2576
1127	1126	1.8276	0.2576
1128	1127	1.8239	0.2539
1129	1128	1.8239	0.2539
1130	1129	1.8239	0.2539
1131	1130	1.8239	0.2539
1132	1131	1.8239	0.2539
1133	1132	1.8239	0.2539
1134	1133	1.8239	0.2539
1135	1134	1.8239	0.2539
1136	1135	1.8239	0.2539
1137	1136	1.8239	0.2539
1138	1137	1.8239	0.2539
1139	1138	1.8239	0.2539
1140	1139	1.8239	0.2539
1141	1140	1.8239	0.2539
1142	1141	1.8239	0.2539
1143	1142	1.8239	0.2539
1144	1143	1.8239	0.2539
1145	1144	1.8239	0.2539
1146	1145	1.8239	0.2539
1147	1146	1.8239	0.2539
1148	1147	1.8239	0.2539
1149	1148	1.8212	0.2512
1150	1149	1.8212	0.2512
1151	1150	1.8239	0.2539
1152	1151	1.8212	0.2512
1153	1152	1.8212	0.2512
1154	1153	1.8212	0.2512
1155	1154	1.8239	0.2539
1156	1155	1.8239	0.2539
1157	1156	1.8212	0.2512
1158	1157	1.8212	0.2512
1159	1158	1.8212	0.2512
1160	1159	1.8212	0.2512
1161	1160	1.8212	0.2512

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	Time [s]	Water Level [m]	WL Change [m]
1162	1161	1.8212	0.2512
1163	1162	1.8212	0.2512
1164	1163	1.8212	0.2512
1165	1164	1.8212	0.2512
1166	1165	1.8212	0.2512
1167	1166	1.8212	0.2512
1168	1167	1.8212	0.2512
1169	1168	1.8212	0.2512
1170	1169	1.8212	0.2512
1171	1170	1.8212	0.2512
1172	1171	1.8212	0.2512
1173	1172	1.8212	0.2512
1174	1173	1.8184	0.2484
1175	1174	1.8184	0.2484
1176	1175	1.8184	0.2484
1177	1176	1.8184	0.2484
1178	1177	1.8184	0.2484
1179	1178	1.8184	0.2484
1180	1179	1.8184	0.2484
1181	1180	1.8184	0.2484
1182	1181	1.8184	0.2484
1183	1182	1.8184	0.2484
1184	1183	1.8184	0.2484
1185	1184	1.8184	0.2484
1186	1185	1.8184	0.2484
1187	1186	1.8184	0.2484
1188	1187	1.8184	0.2484
1189	1188	1.8184	0.2484
1190	1189	1.8184	0.2484
1191	1190	1.8184	0.2484
1192	1191	1.8184	0.2484
1193	1192	1.8184	0.2484
1194	1193	1.8184	0.2484
1195	1194	1.8184	0.2484
1196	1195	1.8157	0.2457
1197	1196	1.8157	0.2457
1198	1197	1.8157	0.2457
1199	1198	1.8157	0.2457
1200	1199	1.8157	0.2457
1201	1200	1.8157	0.2457
1202	1201	1.8157	0.2457
1203	1202	1.8157	0.2457
1204	1203	1.8157	0.2457
1205	1204	1.8157	0.2457
1206	1205	1.8157	0.2457
1207	1206	1.8157	0.2457
1208	1207	1.8157	0.2457
1209	1208	1.8157	0.2457
1210	1209	1.8157	0.2457
1211	1210	1.8157	0.2457
1212	1211	1.8157	0.2457
1213	1212	1.8157	0.2457
1214	1213	1.8157	0.2457

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1215	1214	1.8157	0.2457
1216	1215	1.8157	0.2457
1217	1216	1.8157	0.2457
1218	1217	1.8184	0.2484
1219	1218	1.8157	0.2457
1220	1219	1.8157	0.2457
1221	1220	1.8157	0.2457
1222	1221	1.812	0.242
1223	1222	1.8157	0.2457
1224	1223	1.812	0.242
1225	1224	1.812	0.242
1226	1225	1.8093	0.2392
1227	1226	1.812	0.242
1228	1227	1.812	0.242
1229	1228	1.8093	0.2392
1230	1229	1.8093	0.2392
1231	1230	1.812	0.242
1232	1231	1.812	0.242
1233	1232	1.812	0.242
1234	1233	1.812	0.242
1235	1234	1.8093	0.2392
1236	1235	1.8093	0.2392
1237	1236	1.812	0.242
1238	1237	1.812	0.242
1239	1238	1.812	0.242
1240	1239	1.8093	0.2392
1241	1240	1.8093	0.2392
1242	1241	1.812	0.242
1243	1242	1.8093	0.2392
1244	1243	1.8093	0.2392
1245	1244	1.812	0.242
1246	1245	1.8093	0.2392
1247	1246	1.8093	0.2392
1248	1247	1.8093	0.2392
1249	1248	1.8065	0.2365
1250	1249	1.8093	0.2392
1251	1250	1.8065	0.2365
1252	1251	1.8093	0.2392
1253	1252	1.8065	0.2365
1254	1253	1.8093	0.2392
1255	1254	1.8093	0.2392
1256	1255	1.8065	0.2365
1257	1256	1.8065	0.2365
1258	1257	1.8065	0.2365
1259	1258	1.8093	0.2392
1260	1259	1.8065	0.2365
1261	1260	1.8065	0.2365
1262	1261	1.8065	0.2365
1263	1262	1.8065	0.2365
1264	1263	1.8065	0.2365
1265	1264	1.8065	0.2365
1266	1265	1.8037	0.2337
1267	1266	1.8037	0.2337

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	Time [s]	Water Level [m]	WL Change [m]
1268	1267	1.8037	0.2337
1269	1268	1.8065	0.2365
1270	1269	1.8065	0.2365
1271	1270	1.8037	0.2337
1272	1271	1.8065	0.2365
1273	1272	1.8037	0.2337
1274	1273	1.8065	0.2365
1275	1274	1.8065	0.2365
1276	1275	1.8065	0.2365
1277	1276	1.8093	0.2392
1278	1277	1.8065	0.2365
1279	1278	1.8065	0.2365
1280	1279	1.8065	0.2365
1281	1280	1.8037	0.2337
1282	1281	1.8065	0.2365
1283	1282	1.8065	0.2365
1284	1283	1.8065	0.2365
1285	1284	1.8065	0.2365
1286	1285	1.8065	0.2365
1287	1286	1.8037	0.2337
1288	1287	1.8037	0.2337
1289	1288	1.8037	0.2337
1290	1289	1.8037	0.2337
1291	1290	1.8037	0.2337
1292	1291	1.8037	0.2337
1293	1292	1.8001	0.2301
1294	1293	1.8001	0.2301
1295	1294	1.8037	0.2337
1296	1295	1.8065	0.2365
1297	1296	1.8037	0.2337
1298	1297	1.8037	0.2337
1299	1298	1.8037	0.2337
1300	1299	1.8037	0.2337
1301	1300	1.8037	0.2337
1302	1301	1.8037	0.2337
1303	1302	1.8037	0.2337
1304	1303	1.8037	0.2337
1305	1304	1.8037	0.2337
1306	1305	1.8037	0.2337
1307	1306	1.8037	0.2337
1308	1307	1.8037	0.2337
1309	1308	1.8001	0.2301
1310	1309	1.8001	0.2301
1311	1310	1.8037	0.2337
1312	1311	1.8037	0.2337
1313	1312	1.8037	0.2337
1314	1313	1.8001	0.2301
1315	1314	1.8037	0.2337
1316	1315	1.8037	0.2337
1317	1316	1.8001	0.2301
1318	1317	1.8001	0.2301
1319	1318	1.8001	0.2301
1320	1319	1.8001	0.2301

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1321	1320	1.8001	0.2301
1322	1321	1.8001	0.2301
1323	1322	1.8001	0.2301
1324	1323	1.8001	0.2301
1325	1324	1.8001	0.2301
1326	1325	1.8001	0.2301
1327	1326	1.7973	0.2273
1328	1327	1.7973	0.2273
1329	1328	1.8001	0.2301
1330	1329	1.8001	0.2301
1331	1330	1.7973	0.2273
1332	1331	1.7973	0.2273
1333	1332	1.7973	0.2273
1334	1333	1.7973	0.2273
1335	1334	1.7973	0.2273
1336	1335	1.7973	0.2273
1337	1336	1.7973	0.2273
1338	1337	1.7973	0.2273
1339	1338	1.7973	0.2273
1340	1339	1.7946	0.2246
1341	1340	1.7973	0.2273
1342	1341	1.7973	0.2273
1343	1342	1.7946	0.2246
1344	1343	1.7973	0.2273
1345	1344	1.7973	0.2273
1346	1345	1.7973	0.2273
1347	1346	1.7973	0.2273
1348	1347	1.7946	0.2246
1349	1348	1.7946	0.2246
1350	1349	1.7973	0.2273
1351	1350	1.7973	0.2273
1352	1351	1.7946	0.2246
1353	1352	1.7973	0.2273
1354	1353	1.7946	0.2246
1355	1354	1.7946	0.2246
1356	1355	1.7973	0.2273
1357	1356	1.7946	0.2246
1358	1357	1.7946	0.2246
1359	1358	1.7946	0.2246
1360	1359	1.7946	0.2246
1361	1360	1.7946	0.2246
1362	1361	1.7946	0.2246
1363	1362	1.7909	0.2209
1364	1363	1.7909	0.2209
1365	1364	1.7946	0.2246
1366	1365	1.7909	0.2209
1367	1366	1.7909	0.2209
1368	1367	1.7909	0.2209
1369	1368	1.7909	0.2209
1370	1369	1.7909	0.2209
1371	1370	1.7909	0.2209
1372	1371	1.7946	0.2246
1373	1372	1.7946	0.2246

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	Time [s]	Water Level [m]	WL Change [m]
1374	1373	1.7946	0.2246
1375	1374	1.7946	0.2246
1376	1375	1.7909	0.2209
1377	1376	1.7946	0.2246
1378	1377	1.7946	0.2246
1379	1378	1.7909	0.2209
1380	1379	1.7946	0.2246
1381	1380	1.7946	0.2246
1382	1381	1.7909	0.2209
1383	1382	1.7909	0.2209
1384	1383	1.7909	0.2209
1385	1384	1.7909	0.2209
1386	1385	1.7909	0.2209
1387	1386	1.7909	0.2209
1388	1387	1.7909	0.2209
1389	1388	1.7909	0.2209
1390	1389	1.7909	0.2209
1391	1390	1.7946	0.2246
1392	1391	1.7909	0.2209
1393	1392	1.7909	0.2209
1394	1393	1.7909	0.2209
1395	1394	1.7909	0.2209
1396	1395	1.7909	0.2209
1397	1396	1.7909	0.2209
1398	1397	1.7909	0.2209
1399	1398	1.7909	0.2209
1400	1399	1.7882	0.2182
1401	1400	1.7882	0.2182
1402	1401	1.7909	0.2209
1403	1402	1.7909	0.2209
1404	1403	1.7882	0.2182
1405	1404	1.7882	0.2182
1406	1405	1.7882	0.2182
1407	1406	1.7882	0.2182
1408	1407	1.7882	0.2182
1409	1408	1.7882	0.2182
1410	1409	1.7882	0.2182
1411	1410	1.7882	0.2182
1412	1411	1.7882	0.2182
1413	1412	1.7882	0.2182
1414	1413	1.7882	0.2182
1415	1414	1.7882	0.2182
1416	1415	1.7882	0.2182
1417	1416	1.7882	0.2182
1418	1417	1.7882	0.2182
1419	1418	1.7882	0.2182
1420	1419	1.7854	0.2154
1421	1420	1.7882	0.2182
1422	1421	1.7854	0.2154
1423	1422	1.7854	0.2154
1424	1423	1.7854	0.2154
1425	1424	1.7882	0.2182
1426	1425	1.7854	0.2154

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	Time [s]	Water Level [m]	WL Change [m]
1427	1426	1.7882	0.2182
1428	1427	1.7854	0.2154
1429	1428	1.7854	0.2154
1430	1429	1.7854	0.2154
1431	1430	1.7827	0.2127
1432	1431	1.7854	0.2154
1433	1432	1.7854	0.2154
1434	1433	1.7854	0.2154
1435	1434	1.7854	0.2154
1436	1435	1.7854	0.2154
1437	1436	1.7827	0.2127
1438	1437	1.7854	0.2154
1439	1438	1.7854	0.2154
1440	1439	1.7854	0.2154
1441	1440	1.7827	0.2127
1442	1441	1.7854	0.2154
1443	1442	1.7827	0.2127
1444	1443	1.7827	0.2127
1445	1444	1.7854	0.2154
1446	1445	1.7854	0.2154
1447	1446	1.7827	0.2127
1448	1447	1.7854	0.2154
1449	1448	1.7827	0.2127
1450	1449	1.7827	0.2127
1451	1450	1.7827	0.2127
1452	1451	1.7827	0.2127
1453	1452	1.7827	0.2127
1454	1453	1.7827	0.2127
1455	1454	1.7827	0.2127
1456	1455	1.7827	0.2127
1457	1456	1.7827	0.2127
1458	1457	1.7827	0.2127
1459	1458	1.7827	0.2127
1460	1459	1.7827	0.2127
1461	1460	1.7827	0.2127
1462	1461	1.7827	0.2127
1463	1462	1.7827	0.2127
1464	1463	1.7827	0.2127
1465	1464	1.7827	0.2127
1466	1465	1.7827	0.2127
1467	1466	1.779	0.209
1468	1467	1.779	0.209
1469	1468	1.779	0.209
1470	1469	1.7827	0.2127
1471	1470	1.779	0.209
1472	1471	1.779	0.209
1473	1472	1.779	0.209
1474	1473	1.779	0.209
1475	1474	1.779	0.209
1476	1475	1.779	0.209
1477	1476	1.779	0.209
1478	1477	1.779	0.209
1479	1478	1.779	0.209

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	Time [s]	Water Level [m]	WL Change [m]
1480	1479	1.779	0.209
1481	1480	1.779	0.209
1482	1481	1.7763	0.2063
1483	1482	1.779	0.209
1484	1483	1.779	0.209
1485	1484	1.779	0.209
1486	1485	1.779	0.209
1487	1486	1.779	0.209
1488	1487	1.7763	0.2063
1489	1488	1.779	0.209
1490	1489	1.7763	0.2063
1491	1490	1.779	0.209
1492	1491	1.779	0.209
1493	1492	1.7763	0.2063
1494	1493	1.779	0.209
1495	1494	1.779	0.209
1496	1495	1.779	0.209
1497	1496	1.779	0.209
1498	1497	1.779	0.209
1499	1498	1.779	0.209
1500	1499	1.779	0.209
1501	1500	1.7763	0.2063
1502	1501	1.7763	0.2063
1503	1502	1.779	0.209
1504	1503	1.7763	0.2063
1505	1504	1.7763	0.2063
1506	1505	1.7735	0.2035
1507	1506	1.7763	0.2063
1508	1507	1.7763	0.2063
1509	1508	1.7735	0.2035
1510	1509	1.7763	0.2063
1511	1510	1.7763	0.2063
1512	1511	1.7763	0.2063
1513	1512	1.7763	0.2063
1514	1513	1.7763	0.2063
1515	1514	1.7763	0.2063
1516	1515	1.7735	0.2035
1517	1516	1.7763	0.2063
1518	1517	1.7763	0.2063
1519	1518	1.7763	0.2063
1520	1519	1.7735	0.2035
1521	1520	1.7763	0.2063
1522	1521	1.7735	0.2035
1523	1522	1.7735	0.2035
1524	1523	1.7763	0.2063
1525	1524	1.7763	0.2063
1526	1525	1.7763	0.2063
1527	1526	1.7735	0.2035
1528	1527	1.7763	0.2063
1529	1528	1.7735	0.2035
1530	1529	1.7763	0.2063
1531	1530	1.7763	0.2063
1532	1531	1.7735	0.2035

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	Time [s]	Water Level [m]	WL Change [m]
1533	1532	1.7735	0.2035
1534	1533	1.7735	0.2035
1535	1534	1.7763	0.2063
1536	1535	1.7763	0.2063
1537	1536	1.7763	0.2063
1538	1537	1.7735	0.2035
1539	1538	1.7763	0.2063
1540	1539	1.7735	0.2035
1541	1540	1.7763	0.2063
1542	1541	1.7735	0.2035
1543	1542	1.7735	0.2035
1544	1543	1.7735	0.2035
1545	1544	1.7735	0.2035
1546	1545	1.7735	0.2035
1547	1546	1.7735	0.2035
1548	1547	1.7735	0.2035
1549	1548	1.7708	0.2008
1550	1549	1.7735	0.2035
1551	1550	1.7708	0.2008
1552	1551	1.7735	0.2035
1553	1552	1.7735	0.2035
1554	1553	1.7735	0.2035
1555	1554	1.7735	0.2035
1556	1555	1.7735	0.2035
1557	1556	1.7735	0.2035
1558	1557	1.7708	0.2008
1559	1558	1.7735	0.2035
1560	1559	1.7708	0.2008
1561	1560	1.7708	0.2008
1562	1561	1.7708	0.2008
1563	1562	1.7708	0.2008
1564	1563	1.7708	0.2008
1565	1564	1.7708	0.2008
1566	1565	1.7708	0.2008
1567	1566	1.7671	0.1971
1568	1567	1.7708	0.2008
1569	1568	1.7671	0.1971
1570	1569	1.7671	0.1971
1571	1570	1.7671	0.1971
1572	1571	1.7708	0.2008
1573	1572	1.7671	0.1971
1574	1573	1.7671	0.1971
1575	1574	1.7671	0.1971
1576	1575	1.7671	0.1971
1577	1576	1.7671	0.1971
1578	1577	1.7671	0.1971
1579	1578	1.7671	0.1971
1580	1579	1.7671	0.1971
1581	1580	1.7671	0.1971
1582	1581	1.7671	0.1971
1583	1582	1.7671	0.1971
1584	1583	1.7671	0.1971
1585	1584	1.7671	0.1971

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1586	1585	1.7671	0.1971
1587	1586	1.7671	0.1971
1588	1587	1.7671	0.1971
1589	1588	1.7671	0.1971
1590	1589	1.7643	0.1943
1591	1590	1.7643	0.1943
1592	1591	1.7643	0.1943
1593	1592	1.7671	0.1971
1594	1593	1.7671	0.1971
1595	1594	1.7643	0.1943
1596	1595	1.7643	0.1943
1597	1596	1.7643	0.1943
1598	1597	1.7643	0.1943
1599	1598	1.7671	0.1971
1600	1599	1.7671	0.1971
1601	1600	1.7643	0.1943
1602	1601	1.7671	0.1971
1603	1602	1.7643	0.1943
1604	1603	1.7643	0.1943
1605	1604	1.7643	0.1943
1606	1605	1.7643	0.1943
1607	1606	1.7643	0.1943
1608	1607	1.7643	0.1943
1609	1608	1.7643	0.1943
1610	1609	1.7643	0.1943
1611	1610	1.7643	0.1943
1612	1611	1.7643	0.1943
1613	1612	1.7643	0.1943
1614	1613	1.7643	0.1943
1615	1614	1.7643	0.1943
1616	1615	1.7616	0.1916
1617	1616	1.7616	0.1916
1618	1617	1.7616	0.1916
1619	1618	1.7616	0.1916
1620	1619	1.7643	0.1943
1621	1620	1.7616	0.1916
1622	1621	1.7616	0.1916
1623	1622	1.7616	0.1916
1624	1623	1.7616	0.1916
1625	1624	1.7643	0.1943
1626	1625	1.7616	0.1916
1627	1626	1.7616	0.1916
1628	1627	1.7643	0.1943
1629	1628	1.7616	0.1916
1630	1629	1.7616	0.1916
1631	1630	1.7616	0.1916
1632	1631	1.7616	0.1916
1633	1632	1.7616	0.1916
1634	1633	1.7616	0.1916
1635	1634	1.7616	0.1916
1636	1635	1.7616	0.1916
1637	1636	1.7588	0.1888
1638	1637	1.7616	0.1916

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	Time [s]	Water Level [m]	WL Change [m]
1639	1638	1.7643	0.1943
1640	1639	1.7616	0.1916
1641	1640	1.7616	0.1916
1642	1641	1.7616	0.1916
1643	1642	1.7616	0.1916
1644	1643	1.7616	0.1916
1645	1644	1.7588	0.1888
1646	1645	1.7616	0.1916
1647	1646	1.7588	0.1888
1648	1647	1.7588	0.1888
1649	1648	1.7588	0.1888
1650	1649	1.7588	0.1888
1651	1650	1.7616	0.1916
1652	1651	1.7616	0.1916
1653	1652	1.7616	0.1916
1654	1653	1.7588	0.1888
1655	1654	1.7588	0.1888
1656	1655	1.7588	0.1888
1657	1656	1.7588	0.1888
1658	1657	1.7552	0.1852
1659	1658	1.7588	0.1888
1660	1659	1.7588	0.1888
1661	1660	1.7588	0.1888
1662	1661	1.7588	0.1888
1663	1662	1.7588	0.1888
1664	1663	1.7588	0.1888
1665	1664	1.7588	0.1888
1666	1665	1.7588	0.1888
1667	1666	1.7588	0.1888
1668	1667	1.7588	0.1888
1669	1668	1.7588	0.1888
1670	1669	1.7588	0.1888
1671	1670	1.7588	0.1888
1672	1671	1.7588	0.1888
1673	1672	1.7588	0.1888
1674	1673	1.7588	0.1888
1675	1674	1.7552	0.1852
1676	1675	1.7552	0.1852
1677	1676	1.7552	0.1852
1678	1677	1.7524	0.1824
1679	1678	1.7552	0.1852
1680	1679	1.7552	0.1852
1681	1680	1.7552	0.1852
1682	1681	1.7552	0.1852
1683	1682	1.7552	0.1852
1684	1683	1.7552	0.1852
1685	1684	1.7552	0.1852
1686	1685	1.7258	0.1558
1687	1686	1.7497	0.1797
1688	1687	1.7552	0.1852
1689	1688	1.7524	0.1824
1690	1689	1.7524	0.1824
1691	1690	1.7552	0.1852

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Montreal (QC)
H2Y 1N3

Project: Nemaska New Waste Disposal Site – Hydrogeological assessm

Number: 230448-00

Client: Stantec

	Time [s]	Water Level [m]	WL Change [m]
1692	1691	1.7524	0.1824
1693	1692	1.7524	0.1824
1694	1693	1.7524	0.1824
1695	1694	1.7552	0.1852
1696	1695	1.7524	0.1824
1697	1696	1.7524	0.1824
1698	1697	1.7552	0.1852
1699	1698	1.7524	0.1824
1700	1699	1.7552	0.1852
1701	1700	1.7524	0.1824
1702	1701	1.7524	0.1824
1703	1702	1.7524	0.1824
1704	1703	1.7552	0.1852
1705	1704	1.7552	0.1852
1706	1705	1.7524	0.1824
1707	1706	1.7524	0.1824
1708	1707	1.7524	0.1824
1709	1708	1.7552	0.1852
1710	1709	1.7524	0.1824
1711	1710	1.7552	0.1852
1712	1711	1.7524	0.1824
1713	1712	1.7552	0.1852
1714	1713	1.7552	0.1852
1715	1714	1.7524	0.1824
1716	1715	1.7524	0.1824
1717	1716	1.7524	0.1824
1718	1717	1.7524	0.1824
1719	1718	1.7524	0.1824

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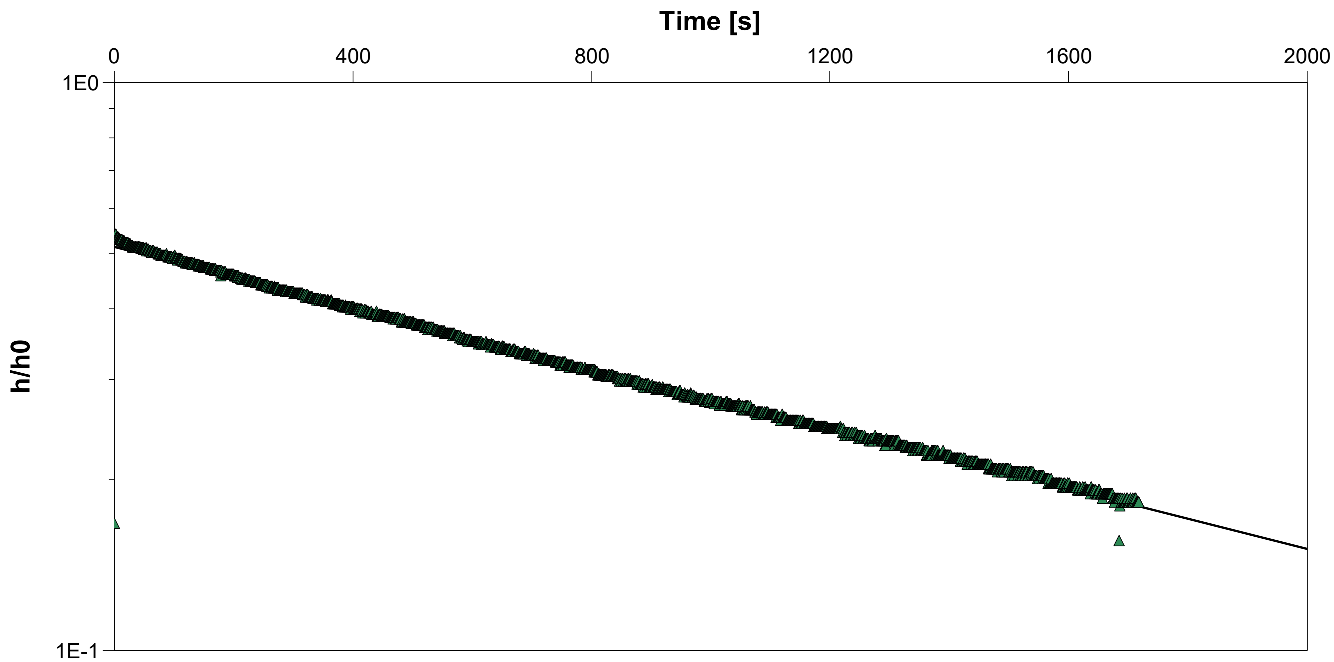
Slug Test Analysis Report

Project: Nemaska New Waste Disposal Site – Hydrogeological assessm

Number: 230448-00

Client: Stantec

Location: Nemaska	Slug Test: PZ-6_2020	Test Well: PZ-6
Test Conducted by: Stantec		Test Date: 2020-08-04
Analysis Performed by: LA	PZ-6_2020_Hvors	Analysis Date: 2023-08-18
Aquifer Thickness: 8.03 m		

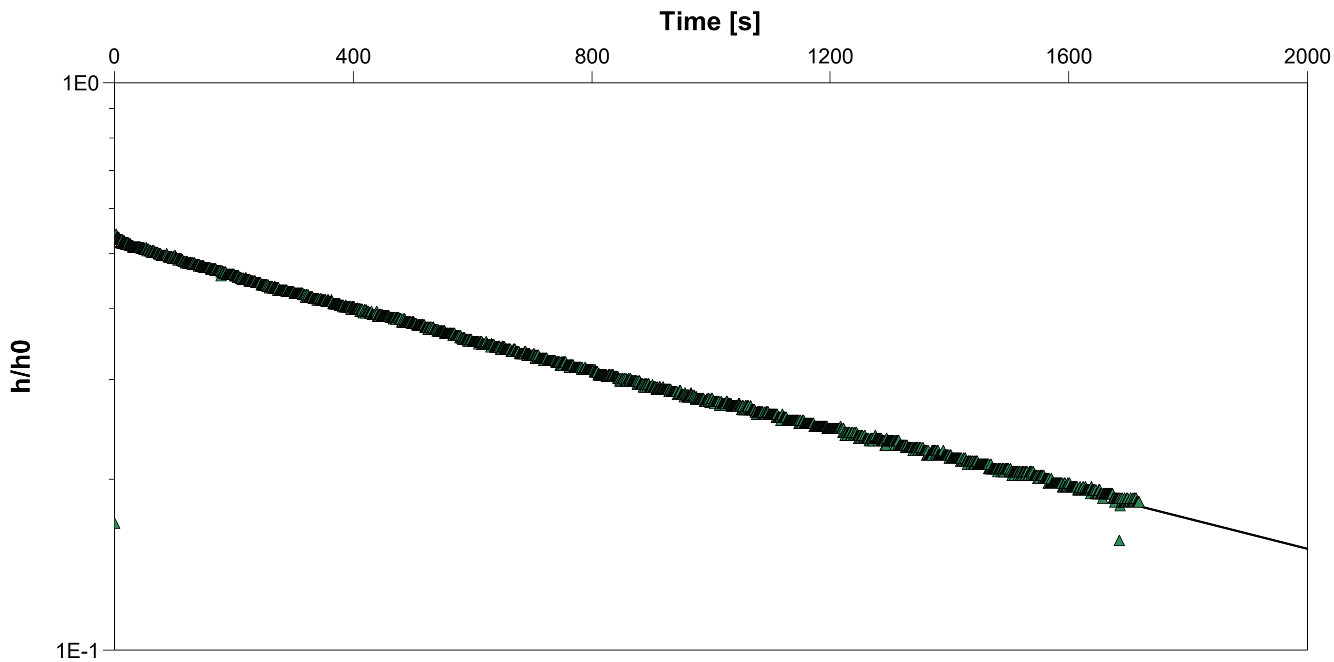


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
PZ-6	3.03×10^{-7}	

BluMetric Environnement Inc. 276, rue St-Jacques Bureau 818 Montreal (QC) H2Y 1N3	**Slug Test Analysis Report** Project: Nemaska New Waste Disposal Site – Hydrogeological assessm Number: 230448-00 Client: Stantec

Location: Nemaska	Slug Test: PZ-6_2020	Test Well: PZ-6
Test Conducted by: Stantec		Test Date: 2020-08-04
Analysis Performed by: LA	PZ-6_2020_B-R	Analysis Date: 2023-08-18
Aquifer Thickness: 8.03 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
PZ-6	2.34×10^{-7}	

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H2Y 1N3

Slug Test - Analyses Report	
Project:	Nemaska New Waste Disposal Site – Hydrogeological assessm
Number:	230448-00
Client:	Stantec

Location: Nemaska	Slug Test: PZ-6_2020	Test Well: PZ-6
Test Conducted by: Stantec		Test Date: 2020-08-04
Aquifer Thickness: 8.03 m		

	Analysis Name	Analysis Performed b	Analysis Date	Method name	Well	T [m²/s]	K [m/s]	S
1	PZ-6_2020_Hvors	LA	2023-08-18	Hvorslev	PZ-6		3.03×10^{-7}	
2	PZ-6_2020_B-R	LA	2023-08-18	Bouwer & Rice	PZ-6		2.34×10^{-7}	

APPENDIX C - Complementary hydrogeological technical note

Le 3 juillet 2025

Monsieur Julien Rosset
Directeur d'expertise, Gestion des matières résiduelles
Stantec
250-1260 boulevard Lebourgneuf
Québec (Québec), G2K 2G2

Numéro de projet : 250304

Objet : Réponses aux questions du ministère concernant le volet hydrogéologique de l'étude d'impact environnementale pour le LEET de Nemaska

Monsieur

BluMetric Environnement inc. (BluMetric ®) assiste Stantec, pour le volet hydrogéologique, à répondre aux questions qui ont été posées par le ministère de l'Environnement et de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP) en date de novembre 2024 sur l'étude d'impact environnemental (ÉIE) du projet d'aménagement d'un nouveau lieu d'enfouissement (**Carte 1**, les cartes et figures sont à la fin de cette notre technique) à Nemaska par la Nation crie de Nemaska.

Cette note technique est constituée des réponses aux questions 11 et 25 en s'appuyant sur une analyse des données topographiques révisées. L'évaluation des écoulements de l'eau souterraine est illustrée avec des cartes piézométriques et des coupes transversales hydrogéologiques.

Réponses aux questions du ministère

Réponse à la question 11 :

Les différences entre les cartes du rapport principal de l'ÉIE et le rapport sur l'hydrogéologie du site sont identifiées comme une erreur sur la source des données d'élévation. Les cartes du rapport hydrogéologique initial utilisaient des données préliminaires issues du LiDAR. Une mise à jour a été réalisée sur ces cartes et présentée dans cette note technique. Pour la mise à jour, les élévations issues de l'arpentage, effectué dans le cadre du projet, ont été utilisées. Il s'agit donc des mêmes données que dans le rapport principal de l'ÉIE.

Basé sur l'analyse de toutes les campagnes piézométriques et des données à notre disposition, il apparait que du point de vue local l'emprise du projet se situe au droit d'un sommet (ou dôme) piézométrique. Ainsi, l'amont hydraulique de la nappe est une zone se trouvant sous l'emprise du projet et l'aval tout autour de cette zone. Les directions d'écoulement sont schématisées sur les cartes piézométriques 2, 3 et 4 de cette note. En période de hautes eaux, les eaux souterraines s'écouleront de part et d'autre du dôme piézométrique (**Figures 1 & 2**) comme sur les **Cartes 2, 3 et 4**. En période de basses eaux, le sens de l'écoulement local sera plus ou moins identique au sens de l'écoulement régional, c'est-à-dire du sud-est vers le nord-ouest.

La légende des cartes piézométriques indique que les étiquettes des puits correspondent à l'élévation de l'eau souterraine. L'élévation des puits est présentée dans le **Tableau 1** de cette note.

Tableau 1 : Caractéristiques de construction des puits

Puits	Fond	Élévation du sol	Date de réalisation	Date du niveau d'eau	Élévation de la nappe
PZ-01	17,68	259,87	2017-11-24	2017-12-02	254,4
PZ-02	20,04	261,4	2017-11-29	2017-12-01	253,7
PZ-03	12,37	260,07	2017-12-06	2017-12-08	252,2
PZ-05	16,87	262,62	2017-12-01	2017-12-06	254,6
PZ-06	11,23	248,92	2017-12-03	2017-12-07	248,7

Réponse à la question 25 :

Compte tenu de l'écoulement pluridirectionnel local autour de l'emplacement prévu pour l'infrastructure avec un amont hydraulique correspondant à l'emprise du projet, nous recommandons pour le suivi les eaux souterraines l'installation de puits d'observation de tous les côtés du projet avec la disposition suivante :

- **Puits à conserver :**
  - PZ-01 ;
  - PZ-03 ;
  - PZ-06.
- **Nouveaux puits:**
  - Réinstallation de PZ-05 ;
  - Installer un nouveau puits au nord du projet au nord-est de PZ-03 afin de couvrir entièrement cette façade du projet.

Données retenues pour l'analyse

Les puits ont été réalisés entre le 24 novembre et le 6 décembre 2017, les niveaux d'eau ont été mesurés entre 2 à 8 jours après la fin des travaux. Dans le **Tableau 1** sont présentées les caractéristiques et les dates de réalisation des puits ainsi que la mesure du niveau d'eau et sa date.

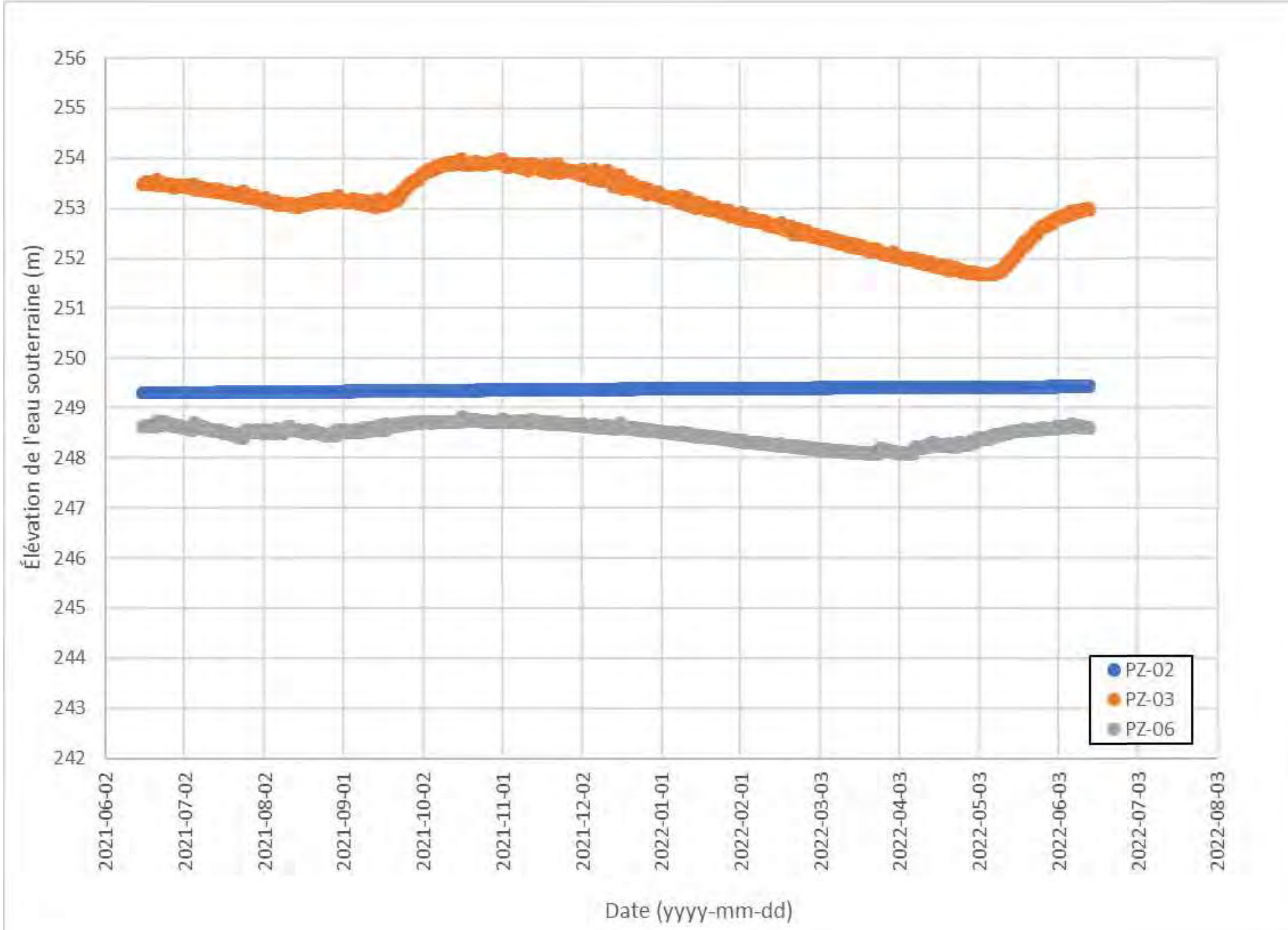
Des campagnes de mesures ont ensuite été réalisées dans ces puits en aout 2018 et 2020 et en juin 2021. Les mesures piézométriques sont présentées dans le **Tableau 2** ci-dessous :

Tableau 2 : Campagnes de mesures du niveau d'eau

Puits	Élévations de la nappe			
	2018-12-01 au 08	2018-08-01	2020-08-04	2021-06-16
PZ-01	254,4	253,4	254,2	
PZ-02	253,7	252,5	249,1	249,3
PZ-03	252,2	253	252,7	253,47
PZ-05	254,6	Sec	Sec	Sec
PZ-06	248,7	248,5	248,3	248,61

Des sondes enregistreuses automatiques de niveau d'eau ont été installées en juin 2021 sur une durée d'1 an. Le **Graphique 1** ci-dessous présente la variation du niveau d'eau dans les puits équipés. On observe pour les puits PZ-03 et PZ-06 un niveau d'étiage de mars à mai et un niveau de crue d'octobre à novembre. Le battement annuel dans les puits PZ-03 et PZ-06 est respectivement de 2,3 et 0,8 m. Le niveau d'eau dans le puits PZ-02 à continuellement augmenté pendant la période de mesure d'un total de 13 cm et ne réagit pas aux précipitations et fontes de neige. Il est probable que le puits soit colmaté ou que la sonde à enregistrement automatique soit dysfonctionnelle car on s'attend à ce que les fluctuations sur le dôme piézométrique soient plus grandes qu'au droit des puits en aval hydraulique.

Graphique 1 : Variation du niveau d'eau souterraine de juin 2021 à juin 2022



Écoulement de l'eau souterraine

Afin de mieux visualiser les écoulements souterrains, deux coupes hydrogéologiques ont été réalisées (**Figure 1** et **Figure 2**) sur des tracés représentés sur la **Carte 1**. Sur cette carte sont représentés tous les éléments d'intérêts à notre disposition afin d'évaluer le sens d'écoulement de la nappe : topographie, cours d'eau, puits, emprise du projet et aménagements existants (route).

La coupe A-A' est orienté nord-ouest - sud-est et la coupe B-B' est orienté sud-ouest - nord-est perpendiculairement à la coupe A-A'. Ces deux coupes sont représentées en **Figure 1** et **Figure 2** à la fin de la note. Sur la coupe A-A', la piézométrie globale pour toutes les campagnes de mesure est plus élevée au centre du projet (PZ-01, PZ-02 et PZ-05) qu'aux extrémités (PZ-03 et PZ-06). Sur la coupe B-B', les mesures piézométriques ne mettent pas en évidence d'écoulement significatif car les puits d'observation sont situés en amont hydraulique. Les cours d'eau au nord et au sud du projet drainent vraisemblablement la nappe.

Sur les 2 coupes disponibles à la fin de la note, sont représentés les cours d'eau. Ces écoulements de surface aux points bas topographiques drainent très certainement localement les eaux souterraines. Nous avons représenté la surface piézométrique probable en tireté bleu reliant la surface piézométrique observée aux structures drainantes.

Sur les trois cartes piézométriques disponibles à la fin de la note, il apparait que l'emprise du projet est située sur un sommet piézométrique depuis lequel les écoulements rayonnent vers toutes les structures drainantes autour du projet :

1. Le cours d'eau situé au sud-ouest du projet alimentant le lac Caumont
2. Le lac Kachikakushwanahikanuch au sud
3. Le cours d'eau situé au nord-est du projet alimentant le lac Champion
4. Le lac Champion au nord-ouest.

Je vous prie d'agréer, l'expression de mes sentiments distingués,
BluMetric Environnement inc.

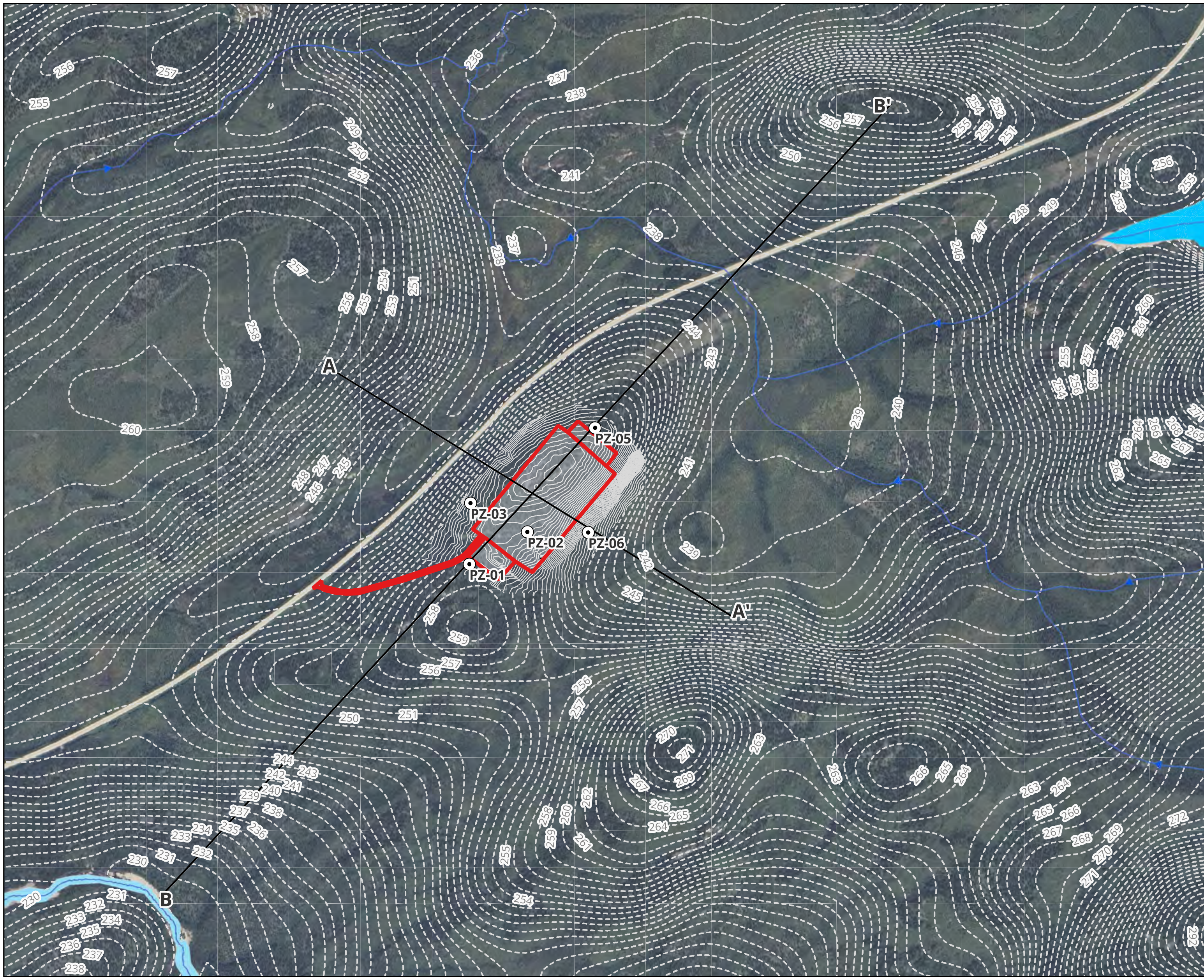
Félix Bernard, géo. Stag., M. Sc.
Spécialiste en hydrogéologie

Léonard Agassounon, géo, Ph.D.
Hydrogéologue senior, Chef d'équipe -
Gestion des eaux & modélisation

p.j.

Ref: 250304 - Note technique - MELCCFP Q&A pour EIE LEET Nemaska

Cartes et coupes transversales hydrogéologiques



LÉGENDE

- Emprise projet
- Ligne principale
- Ligne secondaire
- Ligne centrale de raccord
- Permanent
- Intermittent
- Canal
- Tunnel de transfert
- Ouvrage régulateur
- Évacuateur de crues
- Écluse
- Cours d'eau
- Lac
- Mare
- Réservoir
- Relevé de terrain topographique
- Topographie (LiDAR)
- Tracés des coupes transversales
- Puits

RÉV.	DESCRIPTION	DATE	PAR	VÉRIF.

RÉFÉRENCE :
CARTE GOOGLE SATELLITE

NOTE :
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1:10 000 0 100 200 300 400 500 m

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

N O E S

CLIENT :
Stantec

PROJET :
Note technique - MELCCFP Q&A EIE LEET
Site de Nemaska, Nord-du-Québec (Québec)

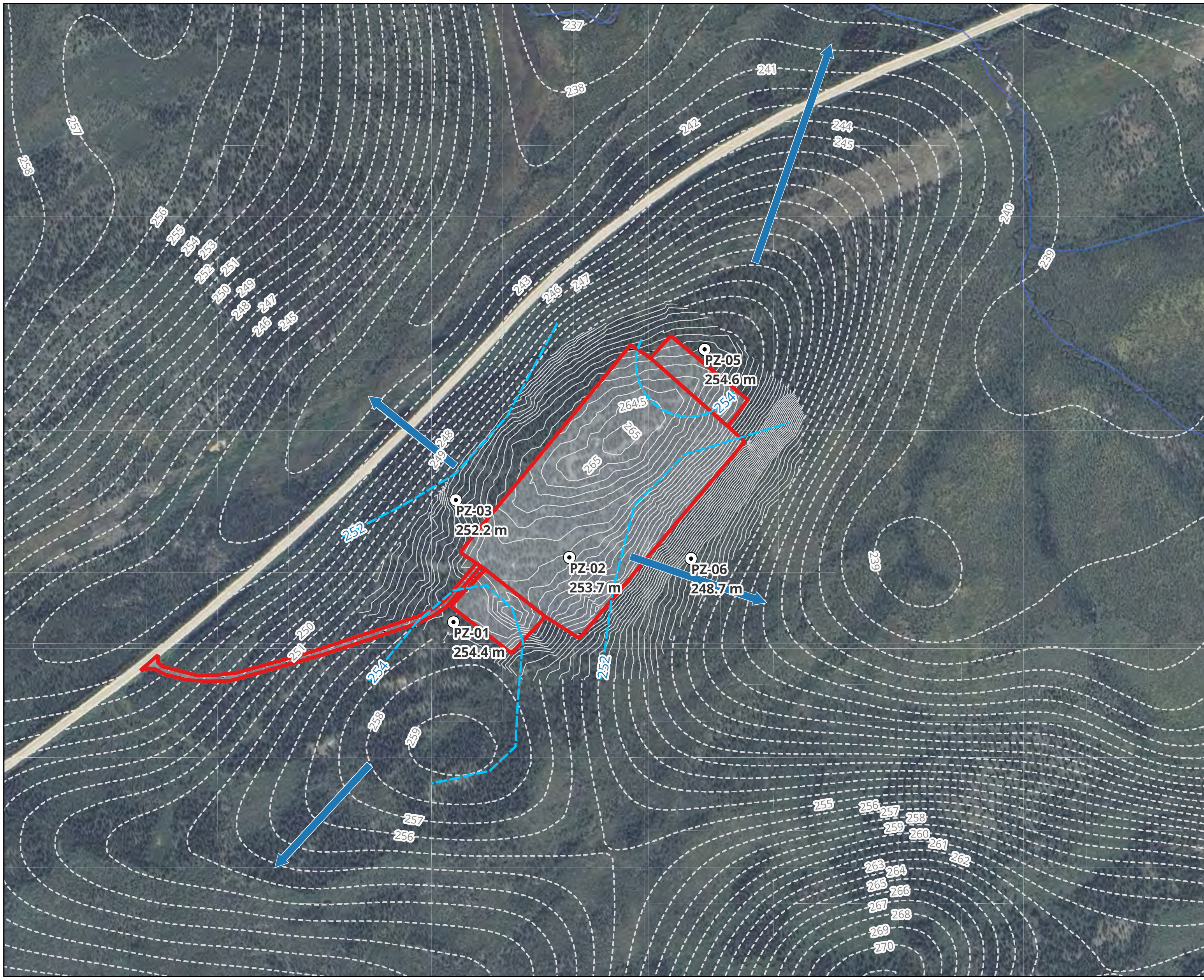
TITRE :
Tracés des coupes transversales

BluMetric Environmental
1500, rue du Collège, suite 200
Saint-Laurent (Québec) H4L 5G6
TÉL.: 514 844-7199 TÉLÉC.: 514 841-9111
Courriel: montreal@blumetric.ca
Site internet: www.blumetric.ca

No PROJET	DATE	RÉV.	No FIG.
250304	2025-04-11	-	1

DESSINÉ	CONÇU
F. Bernard	F. Bernard
VÉRIFIÉ	**FIGURE CAD**
L. Agassounon, géo.	250304-00-CARTE1.JPG

Carte 2 : Carte piézométrique du 1er au 8 décembre 2017



LÉGENDE

- Emprise projet
- Permanent
- Intermittent
- Relevé de terrain topographique
- Topographie (LiDAR)
- PZ-01 (Nom du puits)
- 250.5 m (Élévation de la nappe)
- Sens d'écoulement
- Isopièzes du 1 au 8 décembre 2017

RÉV.	DESCRIPTION	DATE	PAR	VÉRIF.

RÉFÉRENCE :
CARTES GOOGLE SATELLITE

NOTE :
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1:5 000 — 0 50 100 150 200 m

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

N O E S

CLIENT :
Stantec

PROJET :
Note technique - MELCCFP Q&A EIE LEET
Site de Nemaska, Nord-du-Québec (Québec)

TITRE :
Carte piézométrique des écoulements
Niveaux d'eau du 1 au 8 décembre 2017

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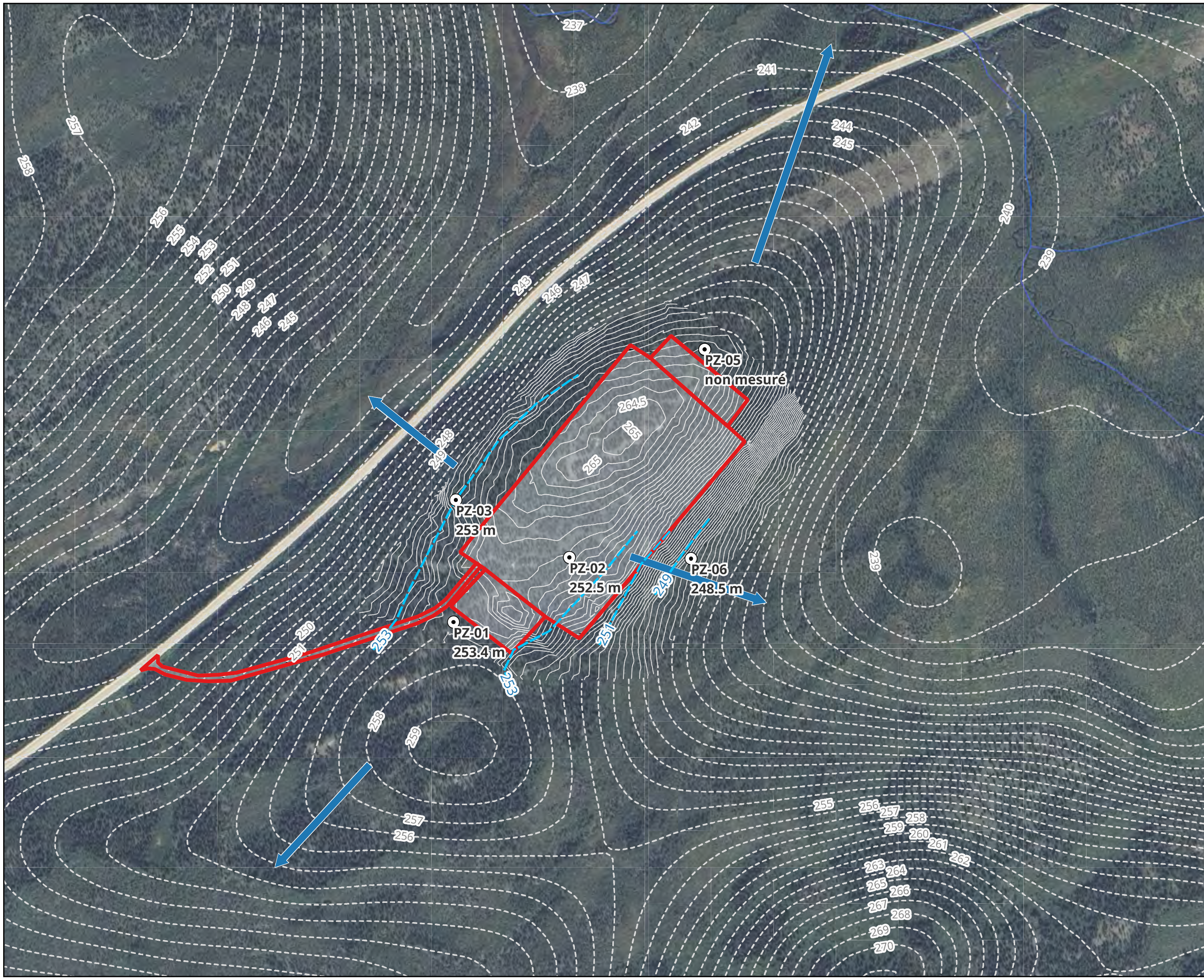
Saint-Laurent (Québec) H4L 5G6
TÉL.: 514 844-7199 TÉLÉC.: 514 841-9111
Courriel: montreal@blumetric.ca
Site internet: www.blumetric.ca

No PROJET	DATE	RÉV.	No FIG.
250304	2025-04-11	-	2

DESSINÉ	CONÇU
F. Bernard	F. Bernard
VÉRIFIÉ	**FIGURE CAD**
L. Agassounon, géo.	250304-00-CARTE2.JPG

Carte 3 : Carte piézométrique du 1er août 2018



LÉGENDE

Emprise projet

Permanent

Intermittent

Relevé de terrain topographique

Topographie (LiDAR)

PZ-01 (Nom du puits)

250.5 m (Élévation de la nappe)

Sens d'écoulement

Isopièzes du 1er aout 2018

RÉV.	DESCRIPTION	DATE	PAR	VÉRIF.

RÉFÉRENCE :

CARTES GOOGLE SATELLITE

NOTE :

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1:5 000 — 0 50 100 150 200 m

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

N E S O

CLIENT :

Stantec

PROJET :

Note technique - MELCCFP Q&A EIE LEET

Site de Nemaska, Nord-du-Québec (Québec)

TITRE :

Carte piézométrique des écoulements
Niveaux d'eau du 1er aout 2018

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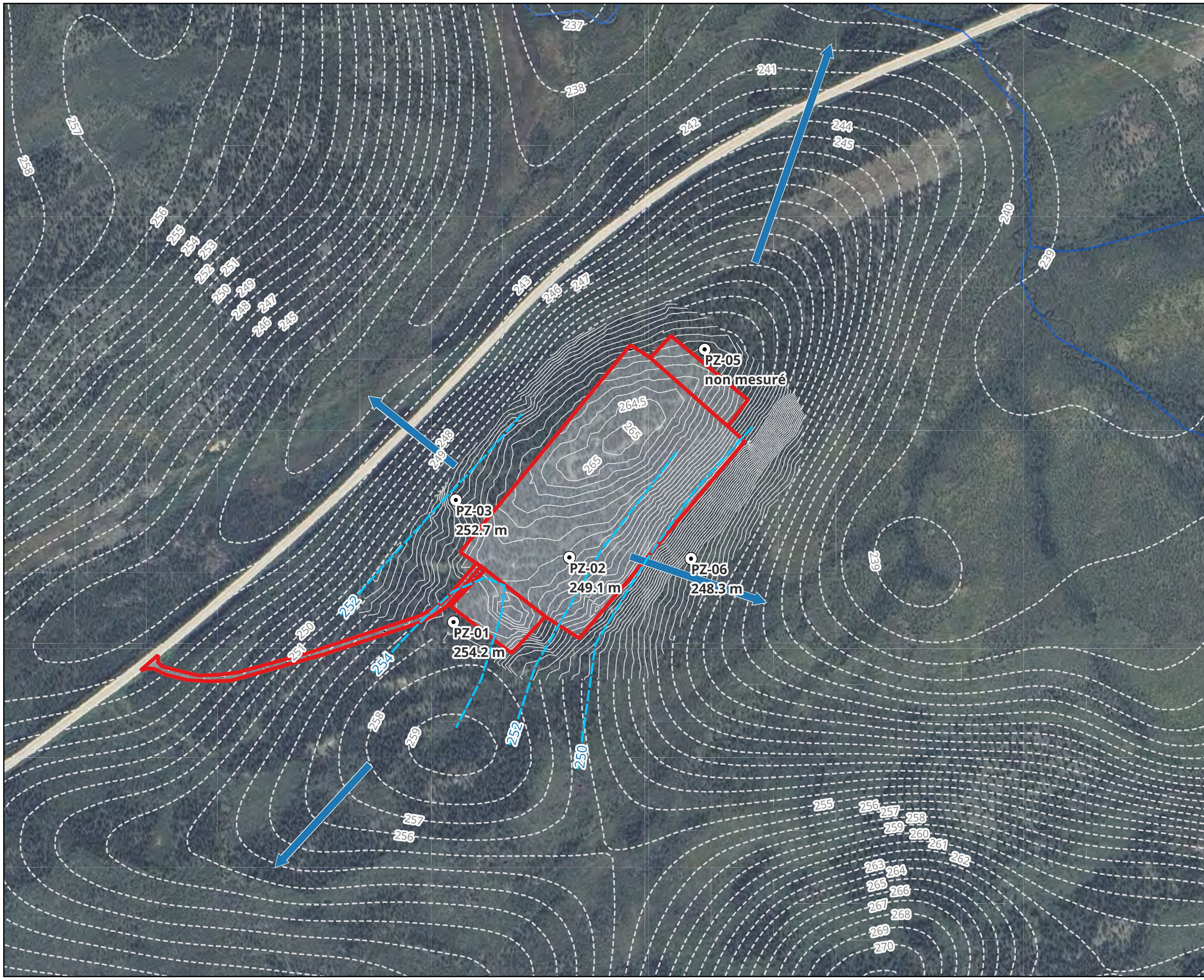
Courriel: montreal@blumetric.ca
Site internet: www.blumetric.ca

No PROJET	DATE	RÉV.	No FIG.
250304	2025-04-11	-	3

DESSINÉ	CONÇU
F. Bernard	F. Bernard
VÉRIFIÉ	**FIGURE CAD**
L. Agassounon, géo.	250304-00-CARTE3.JPG

Carte 4 : Carte piézométrique du 4 août 2020



LÉGENDE

Emprise projet

Permanent

Intermittent

Relevé de terrain topographique

Topographie (LiDAR)

PZ-01 (Nom du puits)

250.5 m (Élévation de la nappe)

Sens d'écoulement

Isopièzes du 4 aout 2020

RÉV.	DESCRIPTION	DATE	PAR	VÉRIF.

RÉFÉRENCE :

CARTE GOOGLE SATELLITE

NOTE :

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1:5 000 — 0 50 100 150 200 m

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

N O E S

CLIENT :

Stantec

PROJET :

Note technique - MELCCFP Q&A EIE LEET

Site de Nemaska, Nord-du-Québec (Québec)

TITRE :

Carte piézométrique des écoulements
Niveaux d'eau du 4 aout 2020

BluMetric Environmental
1500, rue du Collège, suite 200
Saint-Laurent (Québec) H4L 5G6
TÉL.: 514 844-7199 TÉLÉC.: 514 841-9111
Courriel: montreal@blumetric.ca
Site internet: www.blumetric.ca

No PROJET	DATE	RÉV.	No FIG.
250304	2025-04-11	-	4

DESSINÉ	CONÇU
F. Bernard	F. Bernard
VÉRIFIÉ	**FIGURE CAD**
L. Agassounon, géo.	250304-00-CARTE4.JPG

Figure 1 : Coupe transversale hydrogéologique A-A’

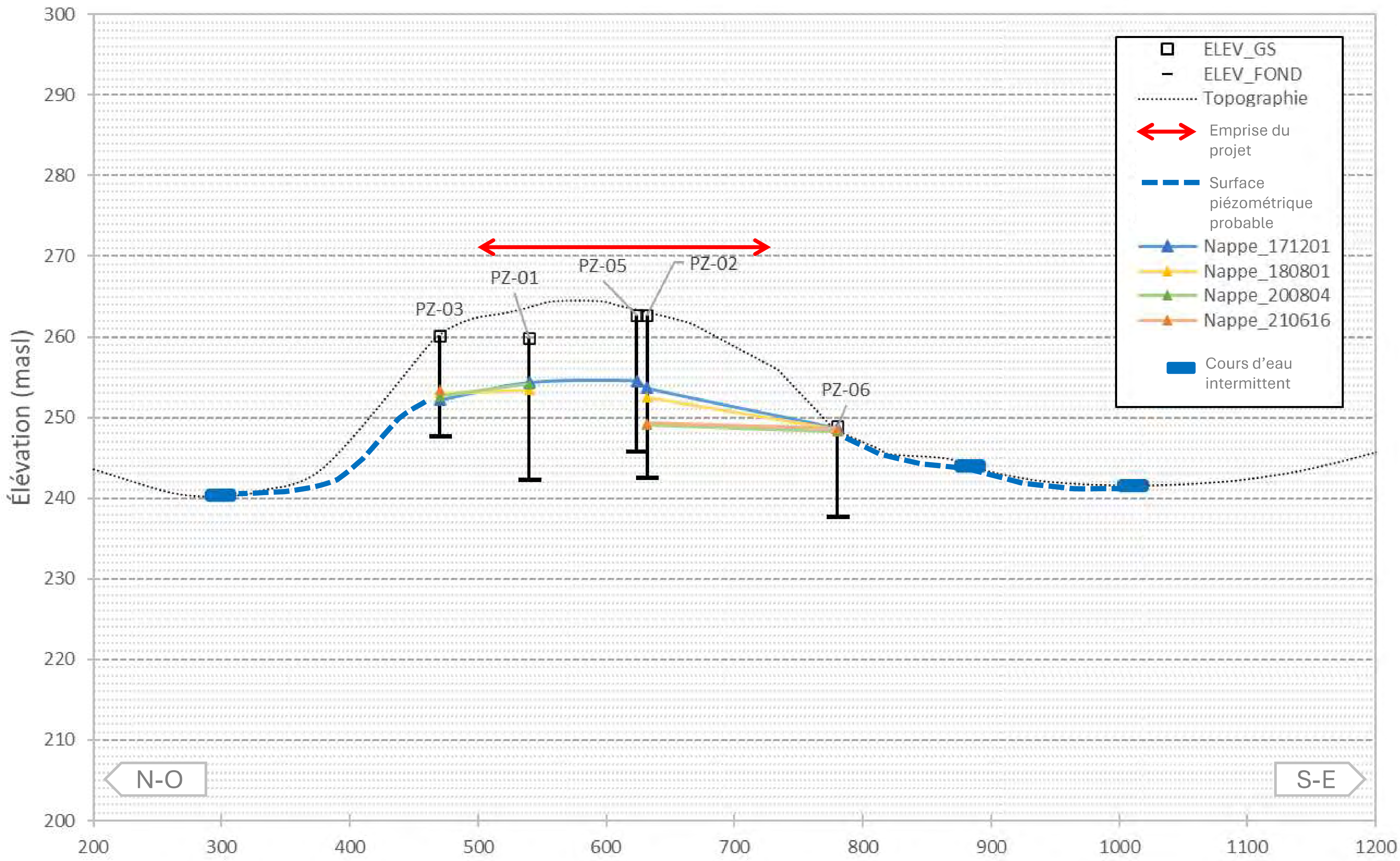
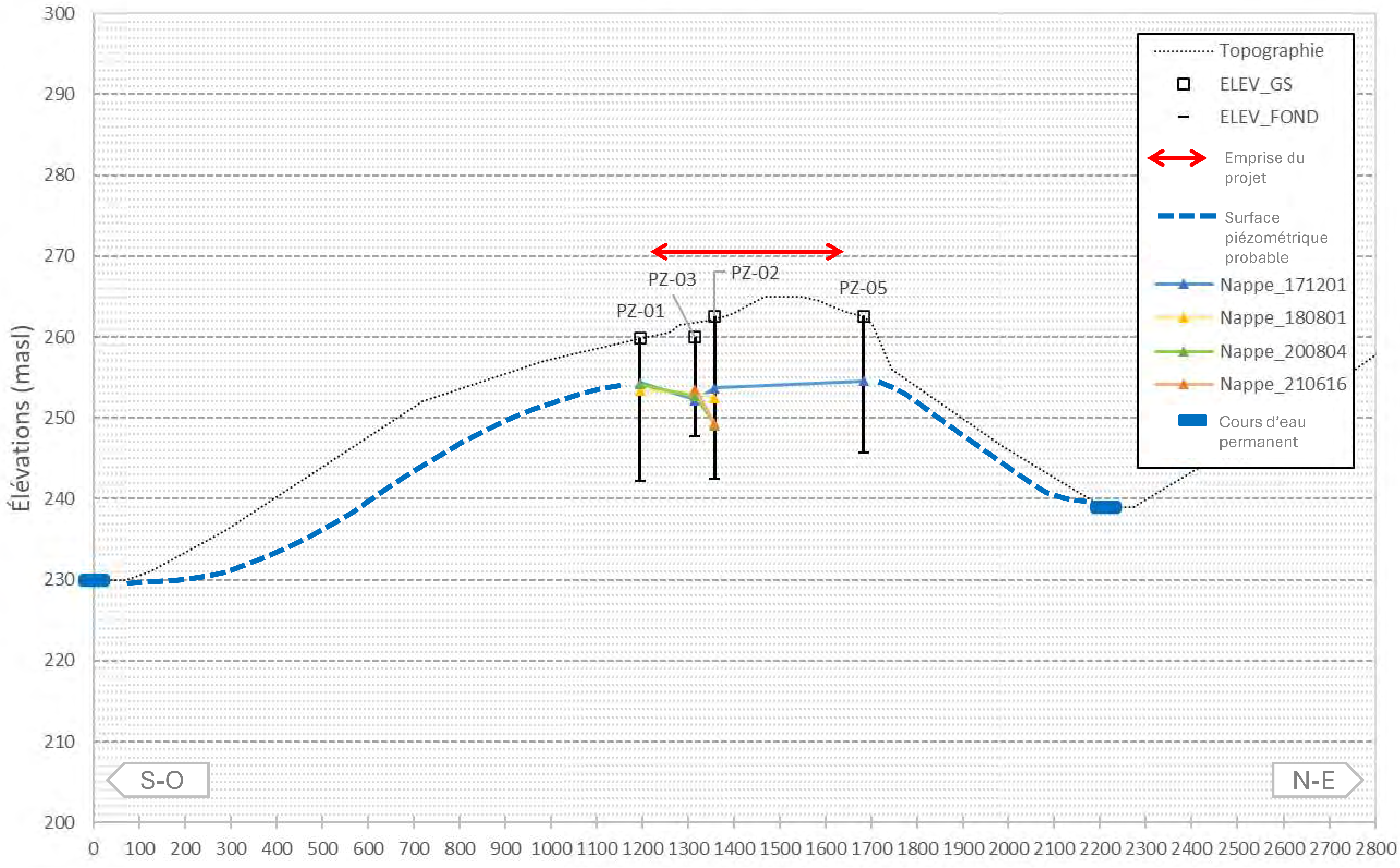
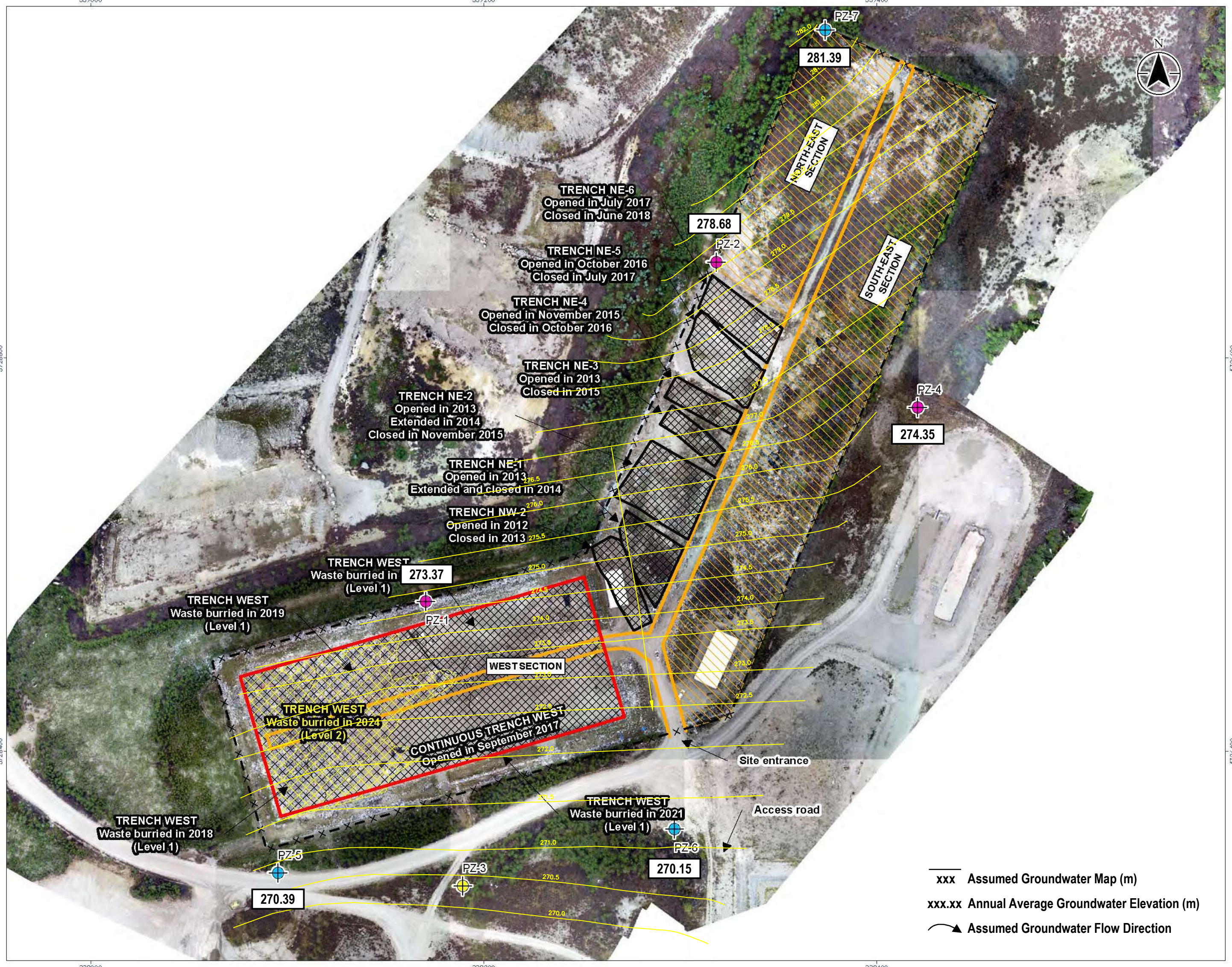


Figure 2 : Coupe transversale hydrogéologique B-B’



APPENDIX D - Piezometric map of the existing LEET, Nemaska



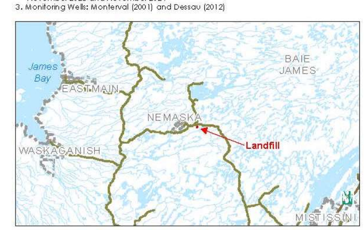
Stantec

- Monitoring Well (Monterval, 2001)
- Monitoring Well (Dessau, 2012)
- Deactivated Monitoring Well
- Trench in Operation
- Waste Buried in 2024 (Level 2)
- Filled Trench (Level 1)
- Area Not Recommended for Future Trenches Due to High Groundwater Level
- Fence
- Access Road

0 40 80 meters
1:2 000
(At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 CSRS MTM 9
2. Trenches Based on Topographic Surveys: November 2015, November 2016, October 2017, December 2018, December 2019, November 2020, December 2022, November 2023 and November 2024
3. Monitoring Wells: Monterval (2001) and Dessau (2012)



Project Location
Nemaska
Quebec

Project 167020545
Prepared by Prosper Ravo on 2025-03-28
Technical Review by Patrick Leblanc-DiStefano on 2025-03-28
Independent Review by Fortunato Coppola on 2025-03-28

Client/Project
Cree Nation of Nemaska
Trench Landfill

Figure No.
1

Piezometric Map

APPENDIX E - Email exchanges with the GREIBJ

De : René Pichette
À : Duguay, Joëlle
Objet : RE: Coordonnées géographiques
Date : 10 avril 2017 09:41:19
Pièces jointes : image003.png
SKMBT_C35317041008520.pdf

Bonjour Mme Duguay,

Votre certificat a été posté la semaine passée. Vous devriez le recevoir bientôt.

J'ai vérifié les coordonnées UTM que vous m'aviez transmises récemment. J'ai localisé sur la carte l'endroit en question. Je vous suggère de vérifier avec le MTQ afin de connaitre leur emprise de la route du Nord pour ce secteur.

Si vous avez d'autre question, n'hésitez pas à communiquer avec nous.

Bonne journée !!! ☺

M. René Pichette
Coordonnateur du schéma en sécurité incendie,
Inspecteur municipal et technicien en génie civil
rpichette@greibj-eijbrg.ca

Logo_BIL_01_CMYK.png

110, boulevard Matagami, C. P. 500, Matagami (Québec) J0Y 2A0
Tél. : 819 739-2030, poste 20238 Téléc. : 819 739-2713
www.greibj-eijbrg.ca

De : Duguay, Joëlle [mailto:Joelle.Duguay@stantec.com]
Envoyé : 4 avril 2017 11:58
À : René Pichette
Objet : Coordonnées géographiques

Bonjour,

Tel que discuté, voici les coordonnées GPS du site potentiel no 4 :

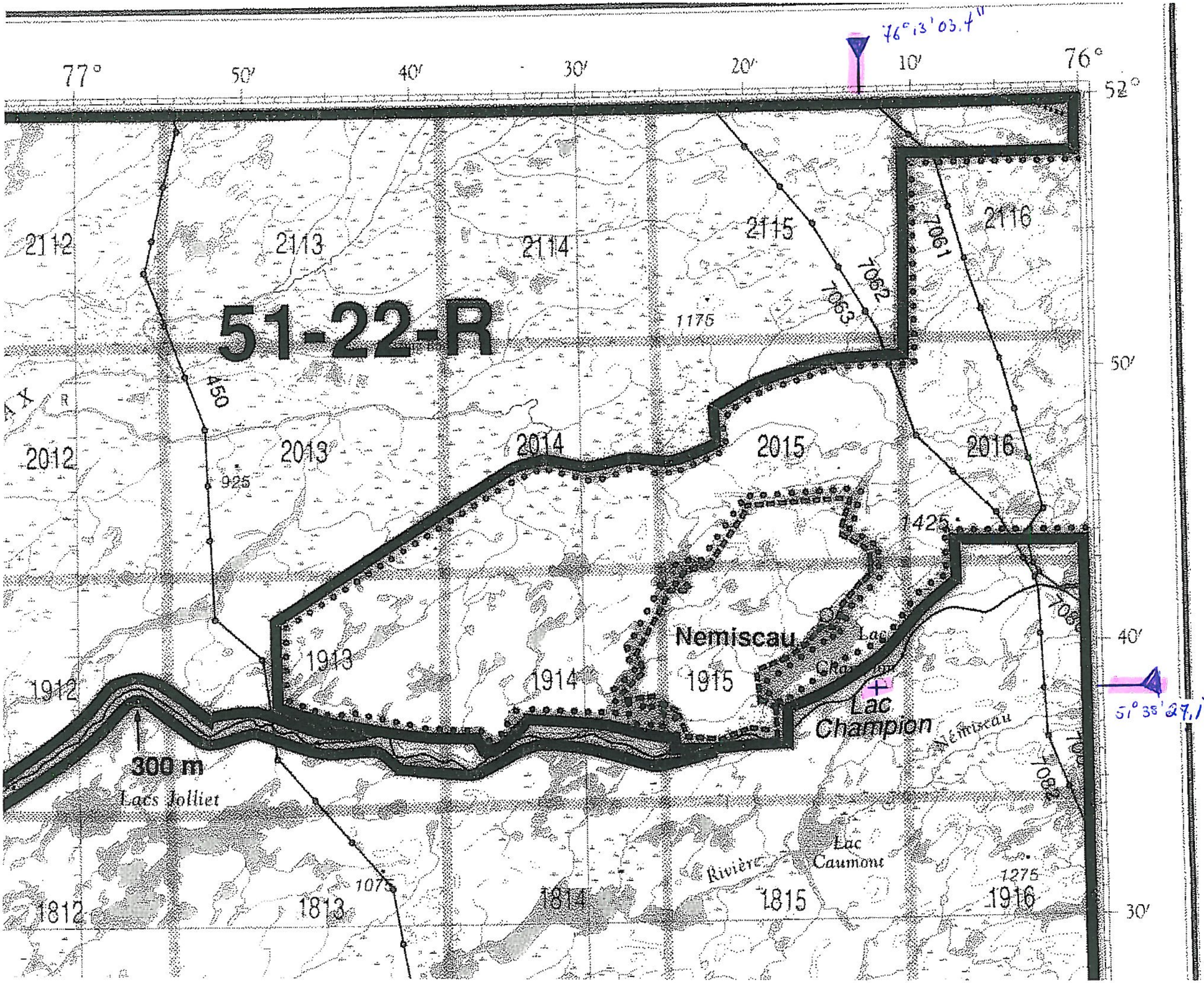
UTM, Nad 83, zone 18
415 745
5 721 796

Prime abord, ce site potentiel serait à au moins 100-150 mètres de la Route du Nord, dans le secteur du km 306. Il est à noter que le choix de ce site n'est pas final et que d'autres emplacements sont encore à l'étude.

Merci et bonne journée,

P.S. Si vous croisez Catherine Lagacé, pouvez-vous lui dire Bonjour de ma part? C'est une ancienne collègue de travail.

Joëlle Duguay, B.Sc.
Professionnelle en environnement
Stantec
1080, côte du Beaver-Hall Montréal QC H2Z 1S8
Téléphone : 514-281-1033 poste 1949
joelle.duguay@stantec.com



76°13'03.4"
77°
50'
40'
30'
20'
10'
76°
52°
50'
40'
30'
51-22-R
2112
2113
2114
2115
2116
2012
2013
2014
2015
2016
1912
1913
1914
1915
1812
1813
1814
1815
1916
450
925
1175
1425
1075
1275
7061
7062
7063
7082
Nemiscau
Lac Champion
Lac Caumont
Rivière
Némiscau
Lacs Jolliet
300 m
51°38'27,1"

René Pichette

De: Duguay, Joëlle [Joelle.Duguay@stantec.com]
Envoyé: 4 avril 2017 11:58
À: René Pichette
Objet: Coordonnées géographiques
Pièces jointes: 16025_po_008_site_4_170110.pdf

Bonjour,

51° 38' 27.1
76° 13 03.4

Tel que discuté, voici les coordonnées GPS du site potentiel no 4 :

UTM, Nad 83, zone 18
415 745
5 721 796

Prime abord, ce site potentiel serait à au moins 100-150 mètres de la Route du Nord, dans le secteur du km 306. Il est à noter que le choix de ce site n'est pas final et que d'autres emplacements sont encore à l'étude.

Merci et bonne journée,

P.S. Si vous croisez Catherine Lagacé, pouvez-vous lui dire Bonjour de ma part? C'est une ancienne collègue de travail.

Joëlle Duguay, B.Sc.
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1080, côte du Beaver-Hall Montréal QC H2Z 1S8
Téléphone : 514-281-1033 poste 1949
joelle.duguay@stantec.com

De : René Pichette
À : Rosset, Julien
Objet : RE: Stantec_Questions règlements
Date : 9 avril 2019 13:21:55
Pièces jointes : image007.png
image008.png
image001.png
SKMBT_C35319040913160.pdf
SKMBT_C35319040913161.pdf

Bonjour M. Rosset,
Dans la classe Ic pour la zone 51-06-R, seul les lieux d'enfouissement sont autorisés.
Pour la classe Ie, cette classe se rapporte essentiellement à la production et transport de l'électricité.

Je vous transmets des extraits de notre règlementation

M. René Pichette
Coordonnateur du schéma en sécurité incendie,
Inspecteur municipal et technicien en génie civil

rpichette@greibj-eijbrg.ca

Gouvernement régional
d'Eeyou Istchee Baie-James
Eeyou Istchee James Bay
Regional Government

2, rue des Rapides, C. P. 819, Matagami (Québec) J0Y 2A0
Tél. : 819 739-2030, poste 20238 Téléc. : 819 739-2713
www.greibj-eijbrg.ca

De : Rosset, Julien [mailto:Julien.Rosset@stantec.com]
Envoyé : 9 avril 2019 11:07
À : René Pichette
Objet : TR: Stantec_Questions règlements

Bonjour M. Pichette,

Je prends la suite de mon collègue Raphael dont le fils est né jeudi passé! Il est en congé paternité actuellement.

Nous vous remercions pour les informations transmises.
Dans la grille des usages pour la zone 51.06-R, dans la section Usage spécifiquement autorisé, il y a une référence à la note 2 : Parmi les usages identifiés dans la classe Ic, seule l'exploitation d'un lieu d'élimination ou de traitement de déchets
solides est autorisée.
Est-ce que cela signifie qu'un lieu d'élimination de déchets entre dans la catégorie Ic? La catégorie Ie prend-elle également en compte ce type d'infrastructure?
Serait-il possible d'également nous envoyer les articles 2.2.4.3 (Ic : Commerce et industrie à incidences élevées) et 2.2.4.5 (Ie: Équipement d'utilité publique) du règlement de zonage?

Enfin, y a-t-il des amendements du règlement touchant cette zone et dont on devrait prendre connaissance?

Merci et bonne journée!

Julien Rosset B.Sc., M.A.A.
Chargé de projet senior, Environnement

Téléphone: 514 281-1033 poste 1952
Cell. : 514 817-3223
Téléc. : 514 281-1060
Julien.Rosset@stantec.com

Stantec
600-1060 boulevard Robert-Bourassa
Montréal QC H3B 4V3

De : René Pichette <rpichette@greibj-eijbrg.ca>
Envoyé : 2 avril 2019 10:27
À : Joanisse-Clément, Raphael <Raphael.Joanisse-Clement@stantec.com>
Objet : RE: Stantec_Questions règlements

voilà

M. René Pichette
Coordonnateur du schéma en sécurité incendie,
Inspecteur municipal et technicien en génie civil

rpichette@greibj-eijbrg.ca

Gouvernement régional
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Regional Government

2, rue des Rapides, C. P. 819, Matagami (Québec) J0Y 2A0
Tél. : 819 739-2030, poste 20238 Téléc. : 819 739-2713
www.greibj-eijbrg.ca

De : Joanisse-Clément, Raphael [mailto:Raphael.Joanisse-Clement@stantec.com]
Envoyé : 2 avril 2019 10:04
À : René Pichette
Cc : Rosset, Julien

With every community, we redefine what's possible.

Stantec is a global leader in sustainable engineering, architecture, and environmental consulting. The diverse perspectives of our partners and interested parties drive us to think beyond what's previously been done on critical issues like climate change, digital transformation, and future-proofing our cities and infrastructure. We innovate at the intersection of community, creativity, and client relationships to advance communities everywhere, so that together we can redefine what's possible.

Stantec Consulting Engineers Ltd.
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Montreal QC   H2Z 1B1
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