



# WEBEQUIE SUPPLY ROAD FINAL ENVIRONMENTAL ASSESSMENT REPORT / IMPACT STATEMENT

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January 30, 2026

AtkinsRéalis Ref: 661910

## SECTION 6: Assessment of Effects on Geology, Terrain and Soils



WEBEQUIE FIRST NATION

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# 6 Assessment of Effects on Geology, Terrain, and Soils

Geology, terrain, and soils were identified as one of valued component (VC) during the VC scoping and selection as part of the Environmental Assessment/Impact Assessment (EA/IA) process. This section describes and assesses the potential effects that the Project may have on the Geology, Terrain, and Soils VC.

Existing conditions for Geology, Terrain, and Soils VC have been established through the field work programs, desktop studies, and engagement and consultation activities completed by the Project Team. This includes, but not limited to, background information review, internet research, geotechnical investigation programs, engagement with Indigenous communities and stakeholders, and expert opinion. The existing conditions are being used as baseline conditions to assess and determine the potential effects of the Project. The results of the baseline studies are provided in Appendix F – Natural Environment Existing Conditions (NEEC) Report.

The assessment of potential effects for the Geology, Terrain, and Soils VC is presented in the following manner:

- Scope of the Assessment;
- Existing Conditions Summary;
- Potential Effects, Pathways and Indicators;
- Mitigation Measures;
- Characterization of Net Effects;
- Determination of Significance;
- Cumulative Effects;
- Prediction Confidence in the Assessment;
- Predicted Future Condition of the Environment if the Project Does Not Proceed;
- Follow-up and Monitoring; and
- References.

## 6.1 Scope of the Assessment

### 6.1.1 Regulatory and Policy Setting

The Geology, Terrain, and Soils VC was assessed in accordance with the requirements of the *Impact Assessment Act*, the Ontario *Environmental Assessment Act*, the Tailored Impact Statement Guidelines (TISG) for the Project (Appendix A-1), the provincially approved EA Terms of Reference (Appendix A-2), and EA/IA guidance documents. **Table 6-1** outlines the key regulations, legislation, and policies that are relevant to the assessment of the Geology, Terrain, and Soils VC for the construction and operations phases of the Project.



**Table 6-1: Key Regulation, Legislation, Policy Relevant to Geology, Terrain and Soils**

Regulatory Agency	Regulation, Legislation, or Policy	Project Relevance
<b>Federal</b>		
Impact Assessment Agency of Canada (IAAC)	<i>Impact Assessment Act</i>	The Project is subject to the federal <i>Impact Assessment Act</i> (refer to Section 1). The Tailored Impact Statement Guidelines (TISG) issued by IAAC (2020) for the Project were used to identify requirements for the assessment of Geology, Terrain, and Soils VC.
Transport Canada	<i>Canadian Transportation of Dangerous Goods Act (TDGA)</i>	The purpose of the TDGA and Regulations is to promote public safety when dangerous goods are being handled, offered for transport or transported by road, rail, air, or water (marine). The TDGA also establishes safety requirements that must be complied with by the Project.
Environment and Climate Change Canada	<i>Canadian Environmental Protection Act (CEPA)</i>	The CEPA is an important part of Canada's federal environmental legislation aimed at preventing pollution and protecting the environment and human health. CEPA contributes to sustainable development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. The CEPA regulates toxic substances in the environment, assessment of risks to the environment and human health posed by substances, imposes timeframes for managing toxic substances, includes provisions to regulate vehicle, engine and equipment emissions, and allows for more effective cooperation and partnership with other governments and Indigenous Peoples.
Environment and Climate Change Canada	Federal Soil Quality Guidelines (FSQG)	Federal Environmental Quality Guidelines (FEQGs) are recommended chemical thresholds to support federal initiatives. FEQGs set a concentration so that if a given chemical is at or below the FEQG threshold, there is low likelihood of direct adverse effects from the chemical on aquatic life exposed via the water or sediment, or where chemicals may bioaccumulate, in wildlife (birds and mammals) that consume aquatic life. FEQGs for soil are chemical remediation values used to assess and help manage in-place contaminants at contaminated sites.
Environment and Climate Change Canada	Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health, CCME	Canadian Environmental Quality Guidelines provide science-based goals for the quality of aquatic and terrestrial ecosystems. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life – These guidelines are numerical concentrations or narrative statements intended to protect all forms of freshwater and marine (including estuarine) aquatic life during all aspects of their aquatic life cycles for an indefinite period of exposure to substances associated with bed sediments. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health – These guidelines are developed for both ecological and human receptors that may be exposed to contaminants through a range of pathways associated with four land use categories. Soil with contaminants present at the guideline levels will provide a healthy functioning ecosystem capable of sustaining the current and likely future uses of the site by ecological receptors and humans.



Regulatory Agency	Regulation, Legislation, or Policy	Project Relevance
<b>Provincial</b>		
Ministry of the Environment, Conservation and Parks (MECP)	<i>Ontario Environmental Assessment Act</i>	The Project is subject to the Ontario <i>Environmental Assessment Act</i> (refer to Section 1). The Terms of Reference (Webequie First Nation 2020), which was approved by the MECP on October 8, 2021, were used to identify requirements for the assessment of Geology, Terrain, and Soils VC.
MECP	The Ontario <i>Environmental Protection Act</i> (EPA)	The Ontario EPA sets responsibilities for the protection of the environment to any person or proponent and the Crown while undertaking activities in the environment.
MECP	Ontario Regulation 347: General – Waste Management	Ontario Regulation 347 governs the management of various types of waste that may be generated by a project including hazardous waste. The regulation outlines waste classification, requirements for waste generators, transportation of waste, Transportation, storage, treatment, and disposal of waste, as well as requirements for reporting, and enforcement of non-compliance.
MECP	Ontario Regulation 406/19: On-Site and Excess Soil Management and accompanying Rules for Soil Management and Excess Soil Quality Standards	Ontario Regulation 406/19 governs the management of On-Site and Excess Soil generated from a project. The regulation provides guidance and standards to ensure adequate management, transportation, and storage for reuse of soil on-site.
MECP	Ontario Regulation 153/04 – Records of Site Condition (This regulation does not specifically apply to the project, but may be used to provide guidance on the assessment of soils for on-and off-site reuse)	Ontario Regulation 153/04 establishes guidelines and requirements for documenting the environmental condition of properties as part of the redevelopment process.
MECP	Management of Excess Soil – A Guide to Best Management Practices (MECP, January 2014)	The MECP document Management of Excess Soil – A Guide to Best Management Practices is a guide that offers recommendations for the proper handling, transportation, reuse, and disposal of excess soil generated from construction and excavation activities occurring on the project.
MECP	Soil, Ground Water and Sediment Standards for Use under Part XV.I of O. Reg. 153/04, (MECP, 2011a)	The MECP standards for Ground Water and Sediment provide guidelines for the assessment and management of contaminated sites in Ontario. This document outlines acceptable levels of contamination in soil and groundwater, which govern clean-up from construction activities of the Project.
Ministry of Energy and Mines	<i>Mining Act</i> (1982)	The Ministry of Energy and Mines oversees and enforces the Ontario <i>Mining Act</i> , which governs land tenure associated with mineral exploration activities, including Mineral Right Withdrawals. Permits are required to withdraw lands from prospecting and withdrawal of staking rights under the <i>Mining Act</i> .



Regulatory Agency	Regulation, Legislation, or Policy	Project Relevance
Ministry of Natural Resources (MNR)	<p><i>Aggregate Resources Act</i>, including Ont. Regulation 244/97</p> <ul style="list-style-type: none"> <li>a. Aggregate Resources of Ontario Site Plan Standards</li> <li>b. Aggregate Resources of Ontario Technical Reports and Information Standards</li> <li>c. Aggregate Resources of Ontario Circulation Standards</li> </ul>	<p>The <i>Aggregate Resource Act</i> governs the management, extraction, and use of aggregate resources that will be used on the Project.</p> <ul style="list-style-type: none"> <li>a. The Aggregate Resources of Ontario Site Plan Standards outlines guidelines and requirements for creating site plans of aggregate extraction and processing as part of the <i>Aggregate Resource Act</i>.</li> <li>b. The Aggregate Resources of Ontario Technical Reports and Information Standards establish guidelines and requirements for the preparation of technical reports related to aggregate resource development as part of the <i>Aggregate Resource Act</i>.</li> <li>c. Aggregate Resources of Ontario Circulation Standard outlines requirements and procedures for the circulation of applications and notices including Indigenous Consultation in regard to aggregate resource development.</li> </ul>
Ministry of Transportation (MTO)	Environmental Guide for Erosion and Sediment Control During Construction of Highway Projects, Ministry of Transportation (MTO, 2007)	This guide establishes procedures and practices for the development and documentation of effective erosion and sediment control. The guide establishes approaches to the design, planning, and to erosion and sediment control that apply to the construction and design of the project.
MTO	Ontario Provincial Standard Specification (OPSS 180) General Specification for the Management of Excess Materials	OPSS 180 is a general specification for the management of excess materials in the province of Ontario. This document outlines the requirements and procedures for dealing with excess materials that may arise during construction, maintenance, or other infrastructure projects.
MTO	MTO Earth Best Practices & Recommendations for Design & Construction (2010)	This document outlines best management practices to reduce undesirable excess earth material generated during the construction of a project being landfilled.
MTO	Ministry of Transportation, Environmental Guide for Contaminated Property Identification and Management (October 2006)	The MTO Environmental Guide for Contaminated Property Identification and Management works in conjunction with several environmental MTO policies to outline the process for identifying contaminated properties prior to property acquisition. This guide may assist in the planning process of the project to reduce high costs and delays associated with remediation of contaminated sites.
MTO	Ministry of Transportation, Environmental Reference for Highway Design (2013)	The Environmental Reference for Highway Design addresses the environmental assessment issues related to preliminary design and detail design of transportation projects in Ontario. The document provides guidance to managing environmental impacts of transportation projects, including specific technical requirements related to soils (i.e., contamination and erosion and sediment control).



Regulatory Agency	Regulation, Legislation, or Policy	Project Relevance
Ministry of Labour, Immigration, Training and Skills Development	Ontario Regulation 213/91 – Construction Projects	Ontario Regulation 213/91 is a legal framework that exists within the <i>Occupational Health and Safety Act</i> of Ontario. This regulation specifically addresses health and safety requirements that employers, contractors, and supervisors, and workers on construction projects must adhere to. The regulation provides guidance for soil handling, trenching and excavation safety measures such as sloping benching, shoring, and shielding for projects.

## 6.1.2 Consideration of Input from Engagement and Consultation Activities

**Table 6-2** summarizes key input related to Geology, Terrain, and Soils VC received during the engagement and consultation for the EA/IA and how the comments and inputs are addressed in the EAR/IS. This input includes concerns raised by Indigenous communities and groups, the public, government agencies, and stakeholders prior to the formal commencement of the federal IA and provincial EA, during the Planning Phase of the IA and Terms of Reference phase of the EA. The Project Team considered the comments received on the Draft EAR/IS in finalizing the EAR/IS. Details of responses and how the comments have been addressed are provided in the Record of Engagement and Consultation.

**Table 6-2: Geology, Terrain, and Soils VC – Summary of Inputs Received During Engagement and Consultation**

Comment Theme	How are the Comments Addressed in this EAR/IS	Indigenous Community or Stakeholder
The terrain mapping and geotechnical assessment should be conducted depending on the outcome of the alternative methods analysis.	Terrain mapping and geotechnical field investigations have been conducted to support the EA/IA process. Methods and results of terrain mapping and geotechnical field investigations are outlined in <b>Section 6.2</b> and described in detail in Natural Environment Existing Conditions (NEEC) Report (Appendix F of the EAR/IS).	Aroland First Nation
Concerns regarding how the proponent plans to test the proposed fill materials needed to build and operate the road for mercury, and other contaminants, during the EA/IA process.	Geochemical field investigations, including soil and rock sampling of proposed fill materials in potential aggregate source locations, have been conducted to support the EA/IA process and are described in detail in the Natural Environment Existing Conditions (NEEC) Report (Appendix F of the EAR/IS). This field program was in addition to the surface and groundwater sampling program for chemical analysis, including mercury determinations. The main objective of the geochemical sampling and testing program on soils and rocks was to provide an indication of the potential for metal leaching (ML) and acid rock drainage (ARD) at quarries, rock cuts and talus sites, as well as locations where materials are generated and stockpiled.  Samples were subject to acid-base accounting (ABA) [paste pH, total sulphur, sulphide sulphur, HCl leachable sulphate, carbonate leach sulphate,	Neskantaga First Nation



Comment Theme	How are the Comments Addressed in this EAR/IS	Indigenous Community or Stakeholder
	<p>modified Sobek Neutralization-Potential (NP), total carbon and inorganic carbon] and Synthetic Precipitation Leaching Procedure (SPLP) with an extraction fluid at pH 4.2 (with ICP-MS analysis for major cations (Ca, Mg, K, Na) and 28 metals and metalloids). These tests were performed by ALS Canada Ltd. laboratories based in North Vancouver, BC and Thunder Bay, Ontario.</p> <p>The purpose of testing was:</p> <ol style="list-style-type: none"> <li>ABA – to provide an indication of the acid-base accounting characteristics of the soil and bedrock materials and associated insights on potential generation of net-acidity.</li> <li>SPLP – to provide a preliminary indication of leachable loadings upon contact with moderately acidic water (i.e., pH 4.2).</li> <li>Sampling and geochemical test work methods were informed by industry best practice in relation to the assessment of ARD-ML generally, and specifically for road works projects.</li> <li>Additional such testing may be conducted to support design efforts as material source/storage/placement locations and project development details become available.</li> </ol>	
<p>What volume of rock will be extracted from quarries, and are plans in place to remediate these quarries after extraction?</p> <p>Does the natural environment study area include aggregate source areas?</p>	<p>The preliminary estimate of aggregate/rock material needed to construct the WSR is 2,849,500 cubic metres. The natural environment study areas include potential suitable aggregate sources identified at this time.</p> <p>A reclamation and restoration plan is proposed to be developed for aggregate pit or quarry areas following their closure. At this preliminary stage this may involve backfilling, regrading/contouring of areas and reforestation to restore vegetation communities representative of the area.</p>	<p>Neskantaga First Nation</p>
<p>Concerned that the quarries in the area should be owned by First Nations. Previous discussions were had with Marten Falls First Nation about owning the quarries and being the construction crew.</p>	<p>The proponent welcomes any information that Constance Lake First Nation wishes to share, including suggestions for economic participation in the Project and job creation opportunities through ongoing consultation and engagement.</p> <p>Ownership of the proposed aggregate sources are not considered to be an impact on the Geology, Terrain, and Soils VC; therefore, ownership is not addressed in the impact assessment included in <b>Section 6</b>.</p>	<p>Constance Lake First Nation</p>
<p>Commented that including the description of the structural geology, known mineral occurrences and any data from exploration diamond drilling and any other type of mechanized drilling will provide information for a more detailed geological assessment. Commented that more emphasis needs to be placed on mine hazards</p>	<p><b>Section 6.3</b> of the EAR/IS outlines the primary potential effects of the Project on geology, terrain, and soils in Project area including changes to geochemistry, alteration of topography and terrain, changes in soil quality, and loss of soil resources.</p>	<p>Ministry of Energy, Northern Development and Mines (now Ministry of Energy and Mines)</p>



Comment Theme	How are the Comments Addressed in this EAR/IS	Indigenous Community or Stakeholder
and geologic hazards due to impacts on human health and the environment.		
The Ministry of Natural Resources (MNR) noted that detailed information about the type and volume of aggregate needed to implement the project and their specific locations need to be presented, along with an assessment of environmental impacts of proposed new aggregate extraction operations and how these will be mitigated. With respect to the assessment approach to evaluating potential effects for aggregates, attention should be given to developing criterion and indicators under the natural environment (as well as under the heading socio-economic) that reflect the potential ecological and hydrologic effects associated with construction and maintenance of the proposed road.	Section 4 (Project Description) of the EAR/IS describes the type, sources and estimated volume of aggregate required for the Project. Potential effects of aggregate extraction and processing areas, including developing criteria and indicators representing the natural environment as well as socio-economic environment to reflect the potential ecological and hydrologic effects, and proposed mitigation measures are described and assessed in EAR/IS Section 3 (Evaluation of Project Alternatives) and assessment of effects on VCs (Section 6 through Section 20).	MNR
Concerns about considering the natural heritage resources while locating aggregate resources and determining the preferred route.	Natural heritage resources have been included as a factor/screening criterion in the alternatives assessment for locating aggregate resources and determining the preferred route as described in Section 3 (Evaluation of Project Alternatives).	MNR
Concerns about including aggregate sourcing as part of the EA as a requirement to obtain MNR permit.	Section 4 (Project Description) of the EAR/IS describes the type, sources and estimated volume of aggregate required for the Project. Section 3 (Evaluation of Project Alternatives) includes an assessment of alternative aggregate sources.	MNR
Concerns about considering MTO "First Right of Refusal" aggregate sites as part of the EA.	MTO First Right of Refusal aggregate sites have been considered as part of the Evaluation of Project Alternatives (refer to Section 3).	MNR
Concerns regarding waste rock, overburden, topsoil, gravel and rock storage and stockpiles (footprint, locations, volumes, development plans and design criteria).	Section 4 (Project Description) of the EAR/IS describes the type, sources and estimated volume of aggregate required for the Project. <b>Section 6.2.2.3</b> describes the geochemical analysis of the rock in the region. <b>Section 6.3</b> describes potential impacts.	MNR
Provide details to demonstrate that an assessment of the acid generating potential of overburden, including all material to be disturbed by construction as well as material to be used for rehabilitation, will be completed as part of the Impact Statement, as required in Section 8.4 of the TISG.	The suitability of topsoil and overburden to be used for reclamation of disturbed areas is described in <b>Section 6.2.2.7</b> .	IAAC (Geology, Terrain, and Soils Study Plan)



Comment Theme	How are the Comments Addressed in this EAR/IS	Indigenous Community or Stakeholder
Provide details to demonstrate how the potential for isostatic rise or subsidence during and following project activities will be identified in the Impact Statement, as required in Section 8.3 of the TISG.	The potential for isostatic rise or subsidence to result from the Project are addressed in Section 4.3.1.3.1 Road Design in Peatlands. The approach to mitigating this potential effect was to mitigate through road and cross-culvert design in peatlands.	IAAC (Geology, Terrain, and Soils Study Plan)
Provide details to demonstrate that the geomorphology, topography and geotechnical characteristics of areas proposed for construction of major project components (ex. right-of-way, aggregate pits etc.), including the presence and distribution of eskers and permafrost, will be described in the Impact Statement, as required in Section 8.4 of the TISG.	The presence and distribution of eskers and permafrost are presented in <b>Section 6.2.2.6</b> .	IAAC (Geology, Terrain, and Soils Study Plan)
Provide details to demonstrate that an assessment of the acid generating potential of overburden, including all material to be disturbed by construction as well as material to be used for rehabilitation, will be completed as part of the Impact Statement, as required in Section 8.4 of the TISG.	The assessment of the acid generating potential of overburden, including all material to be disturbed by construction as well as material to be used for rehabilitation is presented in <b>Section 6.2.2.3</b> .	IAAC (Geology, Terrain, and Soils Study Plan)
Provide detail to demonstrate how the ecosystems that are sensitive or vulnerable to acidification resulting from the deposition of atmospheric contaminants will be identified in the Impact Statement, as required in Section 8.4 of the TISG.	Ecosystems that are sensitive or vulnerable to acidification resulting from the deposition of atmospheric contaminants are identified in Section 11, where ecosystems are the VC that is being assessed.	IAAC (Geology, Terrain, and Soils Study Plan)
Provide details to demonstrate where and how public perspectives and input, including community knowledge, will be integrated into or contribute to decisions regarding the Project, as per the requirements in Section 5 of the TISG.  Provide details on the timeline for public engagement relative to the project workplan, including engagement relative to the schedule for baseline work, and in consideration of the Project Team's timeline for the development of the Impact Statement.	Please refer to <b>Sections 6.1.2</b> and <b>6.1.3</b> , for comments received during engagement and consultation and Indigenous Knowledge relating to the VC.	IAAC (Geology, Terrain, and Soils Study Plan)
Please ensure the draft EA clearly explains the assessment methodologies and be specific about how each environmental component was used in the assessment and selection of alternative methods.	Please refer to <b>Section 6.2.1</b> for detailed information regarding methodologies used for assessment of the VC. Section 3 of the EAR/IS provides the information on the alternatives assessment carried out for the Webequie Supply Road (WSR).	MECP (Geology, Terrain, and Soils Study Plan)

## 6.1.3 Incorporation of Indigenous Knowledge and Land and Resource Use Information

To date, the following First Nations have provided Indigenous Knowledge and Land and Resource Use (IKLRU) information to the Project Team:

- Webequie First Nation;
- Marten Falls First Nation;
- Weenusk First Nation;
- Kashechewan First Nation; and
- Fort Albany First Nation.

**Table 6-3** summarizes IKLRU information relating to Geology, Terrain, and Soils VC and indicates where the information is incorporated in the EAR/IS.

**Table 6-3: Geology, Terrain, and Soils VC – Summary of Indigenous Knowledge and Land and Resource Use Information**

Common Theme	Key Information and Concerns	Response and/or Relevant EAR/IS Section
Physical and geographical characteristics of the project area	<p><b><u>Information Shared</u></b></p> <ul style="list-style-type: none"> <li>▪ The Webequie First Nation’s Draft Community Based Land Use Plan describes physiographical characteristics (such as Ecozones, Ecoregions, Ecodistricts, bedrock and surficial geology, topography, soil types, landforms, and climate), fire frequency, and dominant vegetation types in the project area.</li> </ul> <p><b><u>Concerns</u></b></p> <ul style="list-style-type: none"> <li>▪ Concern that Indigenous Knowledge and other information shared to characterize the existing physical environment be integrated in and inform the EA/IA.</li> </ul>	Existing conditions of geology, terrain, and soils as described in the NEEC Report (Appendix F of the EAR/IS) and summarized in EAR/IS <b>Section 6.2</b> were based in part on physiographical information obtained from the Webequie First Nation’s Draft Community Based Land Use Plan.
Rock/aggregate resources	<p><b><u>Information Shared</u></b></p> <ul style="list-style-type: none"> <li>▪ Rocks are gathered and heated up for use when people are sick. Rocks are also heated and used in ceremonies. Since creation, rocks have been a medicine and a cultural tool for Indigenous People. Rocks are referred to as family members by Anishinabek People.</li> <li>▪ The direction for aggregate use emphasizes balancing First Nation community and resource development with protecting sensitive sites in the planning area. Webequie First Nation’s priorities include supporting community infrastructure and economic initiatives. Aggregate development for accessing the Ring of Fire and nearby communities is crucial, with efforts to avoid waterways, sensitive habitats, and cultural sites. Protecting Indigenous cultural values is a key consideration for new proposals.</li> <li>▪ Economic Potential: The area has high economic potential, especially where old volcanic and gabbroic rocks are found, as these</li> </ul>	Information on culturally important sites shared with the Project Team were used in the evaluation of alternatives for the Project, including alternative locations for aggregate source areas (refer to Section 3, Evaluation of Project Alternatives). One of the criteria used for screening the alternative aggregate source areas was to allow for long-term access and use of the resource.



Common Theme	Key Information and Concerns	Response and/or Relevant EAR/IS Section
	<p>might host valuable minerals like chromite, base metals, platinum, palladium, gold, and silver. There are also kimberlite intrusions that could contain diamonds. In contrast, areas with old granitic and sedimentary rocks, as well as the younger sedimentary rocks in the east, have less potential for metals but might be good for industrial minerals or aggregates. There is limited data on the aggregate resources, so more studies are needed to get a better picture of what is available.</p>	
<p>Contribution of Indigenous People and Indigenous Knowledge to the Geological Survey of Canada organization</p>	<p><b>Information Shared</b></p> <ul style="list-style-type: none"> <li>▪ The Geological Survey of Canada (GSC), established in 1842 to assess Canada’s mineral resources, brought new opportunities. Geologists relied on Indigenous People and their knowledge for guidance and food, much like earlier European traders and settlers. This relationship led to the tribe that is now known as Marten Falls First Nation to specialize in boat and canoe building due to the demand for guiding services.</li> </ul>	<p>Existing conditions of geology, terrain, and soils as described in the NEEC Report (Appendix F of the EAR/IS) and summarized in EAR/IS <b>Section 6.2</b> were based in part on physiographical information obtained from the GSC.</p>
<p>Importance of peatlands</p>	<p><b>Information Shared</b></p> <ul style="list-style-type: none"> <li>▪ Peatlands are important because they store carbon in their soils and hold a lot of freshwater.</li> <li>▪ For all land use areas as outlined in the Webequie First Nation’s Draft Community Based Land Use Plan, it is proposed that peat extraction be avoided. This contributes to minimizing disturbance to an important carbon sink within the proposed planning area.</li> </ul>	<p>As described in Section 4 (Project Description), no peat will be excavated or removed, and a “floating” road will be constructed. By either avoiding or minimizing disturbance, the Project aims to preserve the amount and function of the peatland. This is consistent with the guidance on peatland disturbance provided in Webequie First Nation’s Draft Community Based Land Use Plan.</p>
<p>Current state of environment and its connections to traditional lands and waters</p>	<p><b>Information Shared</b></p> <ul style="list-style-type: none"> <li>▪ The land at present is unique, untouched and natural, with no current contaminations or major impacts. It is preserved and safe, allowing for natural activities like drinking directly from the water and living off the land (trapping, hunting).</li> <li>▪ Members of Indigenous communities view traditional territories as being diverse and vast. The air is clean, and the land is untouched by development. They have a respectful, understanding and loving relationship with the land.</li> <li>▪ Land, water, air and all elements are required for members of Indigenous communities to survive.</li> <li>▪ Traditional lands and waters, and people’s relationships and connections to their traditional lands and waters are special and unique. Traditional areas, and the condition of the lands and waters in these areas, is a key aspect of Indigenous communities’ identity.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Potential project effects on geology, terrain, and soils are assessed in this EAR/IS section (<b>Section 6</b>) and Section 21 (Cumulative Effects Assessment). Potential project effects on other valued components (VCs), including Non-Traditional Land and Resource Use VC and Aboriginal and Treaty Rights and Interests VC are assessed in Sections 7 to 21.</li> <li>▪ Appendix E of the EAR/IS outlined mitigation measures to eliminate or reduce potential adverse effects of the Project. These mitigation measures reflect environmental protection guidelines to protect “Environmentally Sensitive Areas” as described in the</li> </ul>



Common Theme	Key Information and Concerns	Response and/or Relevant EAR/IS Section
	<ul style="list-style-type: none"> <li>▪ First Nation lands and traditional territories are boreal forest that has low rolling landforms, rock outcrops and muskeg with many lakes, ponds, and rivers which are home to moose, bear, grouse, beaver, mink, lynx, rabbit, goose, duck, fish, and loon. The plants, animals, waters, and forest provide all the resources need for an abundant way of life. Concerns on the impacts to muskeg</li> </ul>	<p>Webequie First Nation On-Reserve Land Use Plan (Webequie First Nation, 2019). Further measures will be provided in the Construction Environmental Management Plan (CEMP) and the Operational Environment Management Plan (OEMP) that will be developed for the Project. Section 4.6 of the EAR/IS describes the proposed framework for the development of the CEMP and the OEMP.</p> <ul style="list-style-type: none"> <li>▪ The recommended monitoring program related to Geology, Terrain, and Soils VC is outlined in <b>Section 6.10</b>. Additional details on monitoring programs for the Project are described in Section 22 of this EAR/IS, Follow-up and Monitoring Programs.</li> </ul>
Monitoring	<p><b>Information Shared</b></p> <ul style="list-style-type: none"> <li>▪ The community members have noticed changes in the environment and the impacts harvesting patterns in the spring and fall. Less rainfall has affected the growth and availability of blueberries, raspberries, and blackberries. Blueberries are getting harder to find and it takes more time to find them. Changes in the soil are negatively affecting plant growth and plants are growing slower now and are not as healthy.</li> </ul>	<ul style="list-style-type: none"> <li>▪ The recommended monitoring program related to Geology, Terrain, and Soils VC is outlined in <b>Section 6.10</b>. Additional details on monitoring programs for the Project are described in Section 22 of this EAR/IS, Follow-up and Monitoring Programs.</li> </ul>

**Notes:** Names of First Nations and location-specific description for some instances are not presented in this table due to potential sensitivity and confidentiality of IKLRU information.

## 6.1.4 Valued Component and Indicators

Valued components, including geology, terrain, and soils, have been identified in the TISG and by the Project Team and are, in part, based on what Indigenous communities and groups, the public, government agencies, and stakeholders have identified as valuable to them in the EA/IA process to date. Subcomponents (or criteria) of the Geology, Terrain, and Soils VC are further identified to help inform the report structure and better assess and present the data and assessment results. The assessment of these subcomponents is conducted using the methodology as outlined in Section 5 (Environmental Assessment / Impact Assessment Approach and Methods). The identified subcomponents for Geology, Terrain, and Soils VC are:

- Geomorphology and geochemistry;
- Terrain/topography;
- Soil quality; and
- Soil quantity.



"Indicators", are used to assess potential effects to a VC. In general, indicators represent a resource, feature or issue related to a VC that if changed from the existing conditions may demonstrate a positive or negative effect.

Table 6-4 shows the subcomponents and indicators identified for the Geology, Terrain, and Soils VC.

**Table 6-4: Geology, Terrain, and Soils VC – Subcomponents, Indicators, and Rationale**

Subcomponent(s)	Indicators	Rationale
Geomorphology and Geochemistry	<ul style="list-style-type: none"> <li>▪ Geochemical changes, potential for metal leaching (ML) and acid rock drainage (ARD).</li> <li>▪ Visual loss of and changes to geologic features.</li> <li>▪ Landscape deformation such as slumping, folds, or sliding as well as visual loss of geologic features can indicate alteration of geomorphology.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Project works and activities have the potential to affect physical features, including physiography, bedrock, topography, geomorphology, and/or may result in a reduction of soil productivity or integrity.</li> <li>▪ Terrain and soils influence local and regional biodiversity and contribute to the abundance and distribution of vegetation and wildlife on the landscape.</li> <li>▪ Support the quantity and quality of resources and land available for use by Indigenous Peoples.</li> </ul>
Terrain/Topography	<ul style="list-style-type: none"> <li>▪ The amount of area disturbed by the Project.</li> <li>▪ Erosion and sedimentation.</li> <li>▪ Changes to drainage patterns.</li> <li>▪ Decreased slope stability and increased change of slumping.</li> <li>▪ Changes to vegetation composition.</li> <li>▪ Visual changes to the landscape.</li> </ul>	
Soil Quality	<ul style="list-style-type: none"> <li>▪ Vegetation that shows stress, bare patches of soil where vegetation will not establish.</li> <li>▪ Soil compaction, rutting, and admixing.</li> <li>▪ The formation of erosion rills and gullies.</li> <li>▪ Excessive dust generation and wind erosion.</li> </ul>	
Soil Quantity	<ul style="list-style-type: none"> <li>▪ Excessive dust generation and wind erosion.</li> <li>▪ The formation of erosion rills and gullies.</li> <li>▪ Exposed base soil.</li> </ul>	

## 6.1.5 Spatial and Temporal Boundaries

The following assessment boundaries were defined for the Geology, Terrain, and Soils VC.

### 6.1.5.1 Spatial Boundaries

The spatial boundaries for the Geology, Terrain, and Soils VC are shown on **Figure 6.1** and include the following:

- **Project Footprint** – the area of direct disturbance (i.e., the physical area required for project construction and operations). The Project Footprint is defined as the 35-metre wide WSR right-of-way (ROW); and temporary or permanent areas needed to support the Project that include laydown yards, storage yards, construction camps, access roads, aggregate extraction sites, and a Maintenance and Storage Facility.
- **Local Study Area (LSA)** – the area where potential largely direct, and indirect effects of the Project are likely to occur and can be predicted or measured for assessment. The LSA for Geology, Terrain, and Soils VC extends approximately 1 km from the centreline of the preliminary recommended preferred route, and 500 m from the boundaries of temporary and permanent supportive infrastructure.

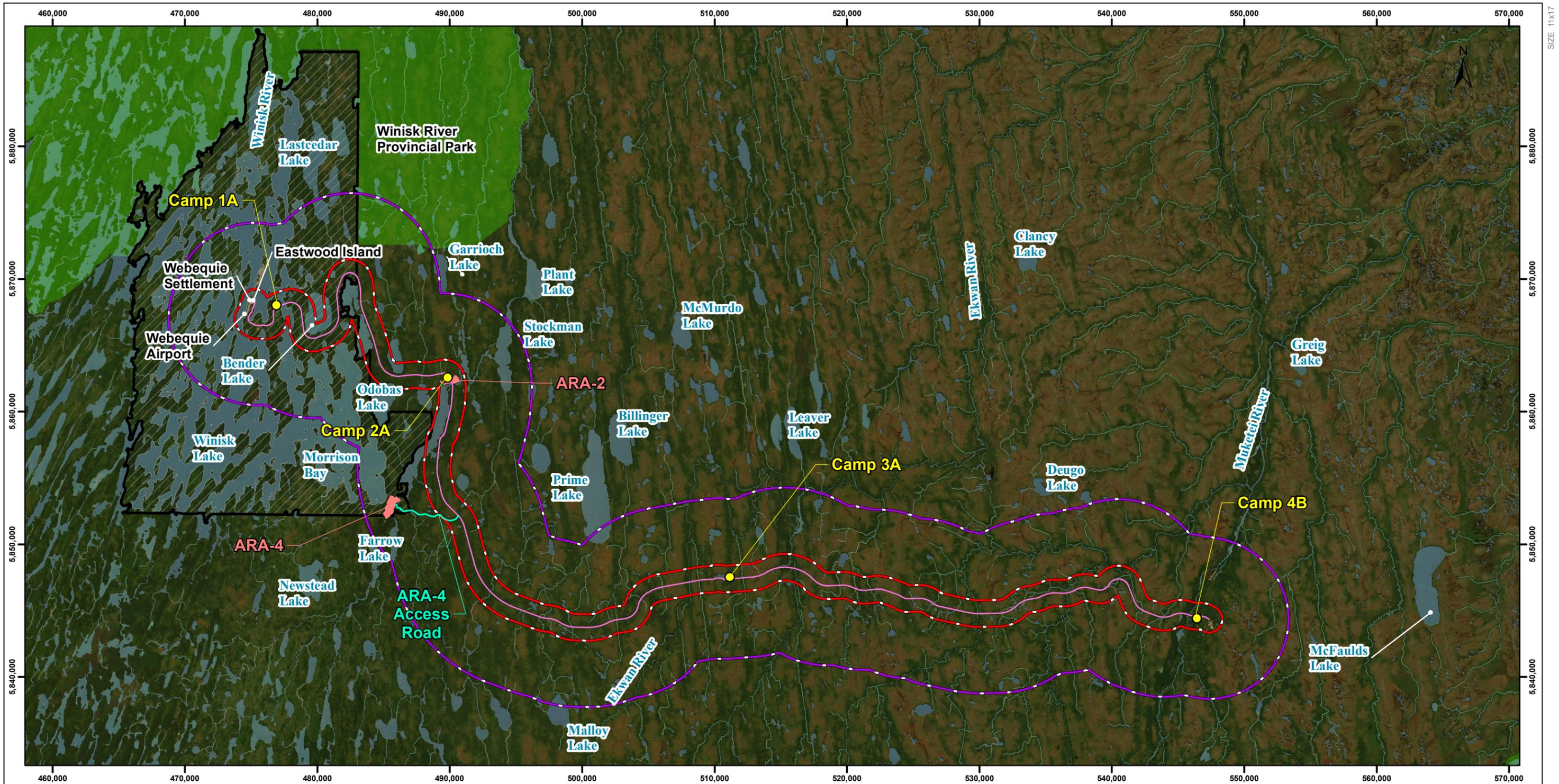


- **Regional Study Area (RSA)** – the area where potential largely indirect and cumulative effects of the Project in the broader, regional context may occur. The RSA for Geology, Terrain, and Soils VC includes the LSA and further extends approximately 5 km each side of the LSA boundaries to include the geographical extent to which potential effects from the Project may be expected.



**WSR**  
WEBEQUIE  
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**Legend**

- Preliminary Recommended Preferred Route
- Local Study Area (LSA 1km from the Preferred)
- Regional Study Area (RSA 5km from either side of LSA Boundary)
- Webeque First Nation Reserve
- Winisk River Provincial Park
- Waterbody
- Watercourse
- ARA-4 Access
- Recommended Aggregate/Rock Source
- Recommended Construction Camps
- \*Camp 2-A is proposed to include permanent Maintenance and Storage Facility (MSF) for operations of the WSR.

**NOTES**

1. Coordinate System: NAD 1983 UTM Zone 16N.
2. Cadastral boundaries are for informational purposes only and should not be considered suitable for legal, engineering, or surveying purposes.
3. Topographic/landcover features obtained from CanVec v12.0 dataset, Natural Resources Canada Earth and Sciences Sector Centre for Topographic Information; and Land Information Ontario (LIO) Warehouse Open Data (<https://github.io.gov.on.ca/>), Ontario Ministry of Natural Resources and Forestry (OMNRF). Download Date: 2021-02-04

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## Webeque Supply Road (WSR)

### Soil, Terrain and Geology Study Areas

<b>Figure Number:</b> 6.1		<b>REV:</b> PA	
<b>Client:</b> Webeque First Nation	<b>Project Number:</b> 661910	<b>Date:</b> 11/27/2024	
<b>DSC</b>		<b>DRN</b>	<b>CHK</b>
		AD	CB
		<b>APP</b>	CB

### 6.1.5.2 Temporal Boundaries

Temporal boundaries for the assessment address the potential effects of the Project over relevant timescales. The temporal boundaries for the Project consist of two main phases:

- **Construction Phase:** All activities associated with the initial development of the road and supportive infrastructure from the start of construction to the start of operations and maintenance of the Project and is estimated to be approximately 5 to 6 years in duration; and
- **Operations Phase:** All activities associated with operations and maintenance of the road and permanent supportive infrastructure (e.g., operations and maintenance yard, aggregate extraction and processing areas) that will start after construction activities are complete, including site restoration and decommissioning of temporary infrastructure (e.g., construction camps, etc.). The Operations Phase of the Project is anticipated to be 75 years based on the expected timeline for when major refurbishment of road components (e.g., bridges) is deemed necessary.

The Project is proposed to be operated for an indeterminate time period; therefore, future suspension, decommissioning and eventual abandonment is not evaluated in the EA/IA (refer to Project Description, Section 4.4).

### 6.1.6 Identification of Project Interactions with Geology, Terrain, and Soils

**Table 6-5** identifies the project activities that may interact with the Geology, Terrain, and Soils VC to result in a potential effect.

**Table 6-5: Project Interactions with Geology, Terrain, and Soils VC and Potential Effects**

Project Activities	Potential Effects			
	Alteration of Geomorphology and Geochemistry	Alteration of Topography and Terrain	Change to Soil Quality	Loss of Soil Resources
<b>Construction</b>				
Mobilization of Equipment and Supplies: Transport of equipment, materials and supplies to the Project site area using the winter road network and airport in Webequie First Nation Reserve.	–	–	–	–
Surveying: Ground surveys are conducted to stake (physically delineate) the road right-of-way (ROW) and supportive infrastructure components of the Project (i.e., construction camps, access roads, laydown/storage areas, and aggregate extraction and processing areas).	–	–	–	–
Vegetation Clearing and Grubbing: Clearing and grubbing of vegetation (forest & wetland), including removal, disposal and/or chipping.	–	✓	✓	✓
Construction and Use of Supportive Infrastructure: This includes temporary construction camps, access roads and watercourse crossings, laydown/storage areas, and aggregate extraction (pits & quarries) and	✓	✓	✓	✓



Project Activities	Potential Effects			
	Alteration of Geomorphology and Geochemistry	Alteration of Topography and Terrain	Change to Soil Quality	Loss of Soil Resources
processing areas (screening, crushing), including blasting.				
Construction of Road: removal and stockpiling of organics, subgrade excavation, placement of fill and gravel, grading and drainage work (e.g., road ditches, erosion protection, etc.).	✓	✓	✓	✓
Construction of Structures at Waterbody Crossings: Culverts and bridges – foundations (e.g., pile driving and concrete works), bridge girders, bridge decks, install of culverts.	✓	✓	✓	✓
Decommissioning / Closure of Temporary Aggregate Extraction and Processing Areas (pits and quarries): Demobilization of extracting and processing equipment, grading and site reclamation/revegetation. This also includes formalizing / re-purposing select pits and quarries proposed as permanent Project components during operations.	–	✓	✓	✓
Decommissioning of Temporary Construction Camps, Access Roads and Laydown / Storage Areas: Grading and site reclamation/revegetation. This also includes formalizing / re-purposing select access roads to permanent pits and quarries and a construction camp to an operations and maintenance facility as Project components for use during operations.	✓	✓	✓	✓
Emissions, Discharges and Wastes <sup>1</sup> : Noise, air emissions / GHGs, water discharge, and hazardous and non-hazardous wastes.	–	–	✓	–
Completion of Project-Wide Clean-up, Site Restoration / Reclamation and Demobilization: Clean-up of excess materials, site revegetation and demobilization of equipment and materials.	✓	✓	✓	✓
Potential for Accidents and Malfunctions <sup>2</sup> : Spills, vehicle collisions, flooding, forest fire and vandalism.			✓	✓
Employment and Expenditures <sup>3</sup>				
<b>Operations</b>				
Road Use: Light and heavy vehicles and maintenance equipment with average annual daily traffic volume of less than 500 vehicles.	–	–	–	–
Operation, Maintenance and Repair of Road: Includes: vegetation management control within the road ROW; repairs/resurfacing of road granular surface and shoulders; dust control; winter/seasonal maintenance (i.e., snow clearing); road drainage system cleanout/repairs to culverts, ditches and drainage outfalls; rehabilitation and repairs to	–	–	✓	✓



Project Activities	Potential Effects			
	Alteration of Geomorphology and Geochemistry	Alteration of Topography and Terrain	Change to Soil Quality	Loss of Soil Resources
structural culverts and bridges; and road patrols for inspection.				
Operation of Pits, Quarries and Maintenance Yard/Facility: Includes periodic extraction and blasting and processing operations (i.e., crushing, screening) and stockpiling of rock and aggregate materials. Also includes operation and repairs of Maintenance Yard/Facility and components within (office buildings, parking, storage of equipment and materials).	✓	–	✓	–
Emissions, Discharges and Wastes <sup>1</sup> : Noise, air emissions / GHGs, water discharge, and hazardous and non-hazardous wastes.	–	–	✓	–
Potential for Accidents and Malfunctions <sup>2</sup> : Spills, vehicle collisions, flooding, forest fire and vandalism.	–	–	✓	✓
Employment and Expenditures <sup>3</sup>	–	–	–	–

**Notes:**

✓ = Potential interaction

– = No interaction

<sup>1</sup> Emissions, Discharges, and Wastes (e.g., air, noise, light, solid wastes, and liquid effluents) are generated by many project activities. Rather than acknowledging this by placing a checkmark against each of these activities, “Wastes and Emissions” is an additional component under each project phase.

<sup>2</sup> Accidents and Malfunctions including spills, vehicle collisions, flooding, forest fire and vandalism may occur at any time during construction and operations of the Project. Rather than acknowledging this by placing a checkmark against each of these activities, “Potential for Accidents and Malfunctions” is an additional component under each project phase. The potential effects of accidental spills are assessed in Section 23 – Accidents and Malfunctions.

<sup>3</sup> Project employment and expenditures are generated by most project activities and components and are the main drivers of many socio-economic effects. Rather than acknowledging this by placing a checkmark against each of these activities, “Employment and Expenditures” is an additional component under each project phase.

## 6.2 Existing Conditions

This section summarizes existing conditions of geology, terrain, and soils based on desktop review and field investigations conducted for the Project. Detailed descriptions of the methods for desktop review and field investigations and interpretations of the results are provided in Appendix F – NEEC Report.

### 6.2.1 Methods

As described in Section 4.2 of Appendix F – NEEC Report, a desktop review was conducted to characterize the geology, terrain, and soil for the study areas, and field surveys were conducted in 2019, 2020, and 2021 to collect data to supplement findings of the desktop review and refine the level of detail within the project study areas.



### 6.2.1.1 Desktop Review of Background Information

The desktop review conducted to characterize the existing geologic, terrain, and soil conditions in the project study areas used the following sources:

- Previously conducted environmental studies, including Indigenous Knowledge information obtained through consultation with Indigenous communities and groups;
- Regulatory databases;
- Aerial photography;
- Terrain and soil mapping;
- Bedrock and quaternary geology data;
- Geographic Information System databases;
- Academic literature; and
- Information obtained from regulatory agencies and other stakeholders.

### 6.2.1.2 Field Surveys

Field surveys were conducted to supplement the review of background information for an accurate description of environmental conditions within the project study areas. The following field surveys were conducted:

- Light Detection and Ranging (LiDAR) data collection and Terrain Analysis (2019);
- Soil and Terrain Investigations (J.D. Mollard and Associates [JDMA], 2019 and 2020);
- Peat Thickness and Aggregate Source Investigations (JDMA, 2020); and
- Geotechnical Investigations (SNC-Lavalin, 2019 and 2020).

The surveys related to geologic, terrain, and soils were conducted in 2019, with additional surveys conducted in 2020 with the primary focus of gathering terrain and soil data required to characterize existing conditions. This encompassed aspects like soil type, terrain features, and peat depths. Furthermore, these surveys were instrumental in identifying and evaluating alternative routes for the supply road and optimal locations for aggregate sources.



Recognizing the importance of peatlands to First Nations due to their ability to store carbon in their soils and hold a lot of freshwater, mitigation by design is incorporated in Section 4.3.1.3.1 Road Design in Peatlands. and the assessment of effects on peatlands is presented in Section 11.

Geotechnical investigations were conducted in support of the initial engineering design for the WSR. The 2020 field survey offered supplementary and complementary soil and geotechnical data, enriching the information available for road design and refining the understanding of potential aggregate sources. Geotechnical investigations conducted in both 2019 and 2020 involved test pit excavation, borehole drilling, handheld peat probing, and the installation of groundwater monitoring wells.

Detailed descriptions of methods for the field surveys are presented in Section 4.2 of Appendix F – NEEC Report.



## 6.2.2 Results

The following sections summarize the existing/baseline conditions for the Geology, Terrain, and Soils VC. Details of the results are described in Section 4.3 of Appendix F – NEEC Report.

### 6.2.2.1 Regional Geology

The province of Ontario has two main geological regions within the Canadian Shield: The Superior Province, which encompasses about 80% of the province and is characterized by autochthonous cover sequences primarily in the north and northwest; and the Grenville Province, which is prominently visible in the southeastern part of Ontario.

The LSA and RSA are within the Superior Province, western region, near its boundary with the Hudson Bay platform. The Superior Province, spanning from areas with Phanerozoic cover in the west and north to the southeast (Percival et al., 2012), is surrounded by neighbouring provinces of Paleoproterozoic age on its western, northern, and eastern fronts; the Grenville Province, which is of Mesoproterozoic age, is found in the southeast. The northwestern region of the Superior Province is characterized by a series of significant Mesoarchean volcanic and plutonic belts that trend from east to west. The regional geology in the project study areas is shown in **Figure 6.2**. The following subsections provide an overview of the tectonic setting, the structural geology and the lithology of the regional geology. Detailed descriptions of the regional geology are provided in Section 4.3.1.1 of the NEEC Report (Appendix F).

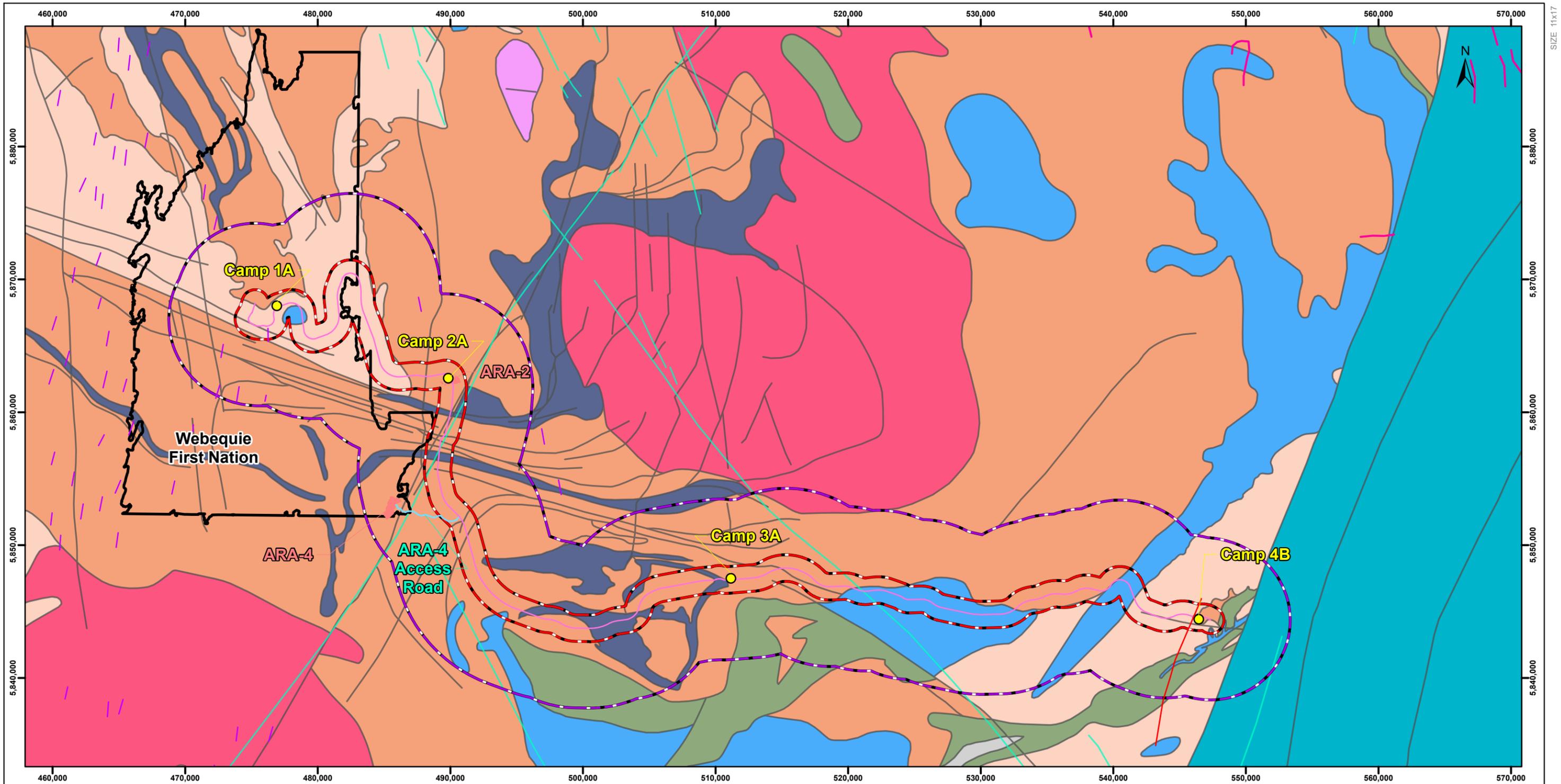
#### 6.2.2.1.1 Tectonic Setting

Tectonic setting refers to the structure of the surface of the earth and the way it is formed, changed, and moved by forces inside it. Tectonic stability has persisted throughout the Superior Province since around 2.5 Giga-Annum (Ga). Proterozoic and more recent geological activity involves margin rifting, the emplacement of mafic dyke swarms, compressional reactivation, large-scale rotation, and failed rifting. In geology and paleontology. The Superior Province is a collage of small continental and oceanic plates, formed through complex aggregation between 2.72 and 2.68 Ga, followed by post-orogenic effects. Sedimentary rocks dating back to 2.48 Ga overlay Superior Province granites, suggesting that most erosion occurred before 2.5 Ga.

#### 6.2.2.1.2 Structural Geology

The LSA and RSA for the Project are situated west of the Kapuskasing uplift, a 500 km long, northeast-trending fault-bounded structure known for prominent positive gravity and aeromagnetic anomalies, dividing the Superior Province (Percival and West, 1994). As indicated on the Ontario Bedrock Geology maps, the Webequie Supply Road (WSR) is intersected by numerous faults that are oriented northeast to southwest, intercepted by perpendicular faults that are oriented northwest to southeast as shown in **Figure 6.2**. Most faults are located east of the Black Sturgeon River, which flows along a fault and lies outside the LSA and RSA for the Project. The east to west faults comprise the Webequie fault zone, extending from Winisk River Provincial Park, south of Webequie First Nation, through Winisk Lake, to the east of Prime Lake, and intersecting with the Mackenzie mafic dyke swarm (1,267 Ma). Additionally, the RSA contains several diabase dyke swarms with associated mineralization.





**Legend**

Preliminary Recommended Preferred Route	Drumlin or area of drumlins	7: Metasedimentary rocks
Local Study Area (LSA 1km from the Preferred Route)	Esker or area of eskers	5: Mafic to intermediate metavolcanic rocks
Regional Study Area (RSA 5km from either side of LSA Boundary)	Dikes	
Webeque First Nation Reserve	Faults	
ARA-4 Access Road	55: Sandstone, dolostone, limestone	
Recommended Aggregate/Rock Source Areas	16: Hornblende - nepheline syenite suite (saturated to undersaturated suite)	
Recommended Construction Camps *Camp 2-A is proposed to include permanent Maintenance and Storage Facility (MSF) for operations of the WSR.	15: Massive granodiorite to granite	
Beach, bar or spit	12: Foliated tonalite suite	
	11: Gneissic tonalite suite	
	10: Mafic and ultramafic rocks	
	8: Migmatized supracrustal rocks	

**WSR**  
WEBEQUIE  
SUPPLY ROAD

**NOTES**

1. Coordinate System: NAD 1983 UTM Zone 18N.2. Cadastral boundaries are for informational purposes only and should not be considered suitable for legal, engineering, or surveying purposes. 3. Topographic/landcover features obtained from CanVec v12.0 dataset, Natural Resources Canada Earth and Science Sector Centre for Topographic Information, Land Information Ontario (L.I.O.) Warehouse Open Data (<https://github.io.gov.on.ca/>), Ontario Ministry of Natural Resources and Forestry (OMNRF). Download Date: 2021-05-04. 4. Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario. Ontario Geological Survey, Miscellaneous Release—Data 139-Revision 1.

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## Webeque Supply Road (WSR)

### Geological Formations within LSA and RSA

<b>Figure Number:</b> 6.2		<b>REV:</b> PA	
<b>Client:</b> Webeque First Nation	<b>Project Number:</b> 661910	<b>Date:</b> 1/27/2026	
<b>DSC</b>		<b>DRN</b>	<b>CHK</b>
		<b>TE</b>	<b>AD</b>
		<b>APP</b>	<b>CB</b>

### 6.2.2.1.3 Lithology

Lithology refers to the general physical characteristics of rocks in a particular area. The LSA and RSA lie within the North Caribou Superterrane (NCS), and more specifically within the Oxford-Stull Domain (OSD). The WSR crosses the OSD, which contains the "Ring of Fire" volcanic-intrusive structure. The bedrock along the WSR primarily comprises biotite tonalite to granodiorite, with occasional occurrences of gabbro, anorthosite, ultramafic rocks, metavolcanic rocks, and minor metasedimentary rock in isolated locations. Both subdivisions of the Superior Province within the LSA and RSA and summarized in **Table 6-6**.

**Table 6-6: Lithology in the Project Area**

Geologic/Lithologic Formations	Description
The North Caribou Superterrane (NCS)	The Superior Province's largest Mesoarchean domain, comprising juvenile plutonic and volcanic belts dating back to 3.0 billion years. It underwent reworking from 2.75 to 2.70 billion years ago due to continental arc magnetism. The terrane extends eastward beneath Phanerozoic cover in the Hudson and James Bay lowlands, with prevalent glacial cover limiting bedrock exposure to lakeshores (Stott, 2008).
The Oxford-Stull Domain (OSD)	Forming the continental northern margin of the NCS, it extends from Manitoba to the James Bay Lowland. Imbricated with oceanic crustal fragments before 2,734 Ma, it exhibits Neoarchean to Mesoarchean ages (2.88 to 2.73 Ga) indicative of juvenile crustal growth. The OSD features evidence of Mesoarchean mid-ocean ridge basalt (MORB)-like sequences, aligning with magmatic growth in the Northern Superior superterrane and NCS margins to the north and south. The southern contact with the Island Lake domain of the NCS reveals shared constructive history across the Stull-Wunnummin fault (Stott, 2008).

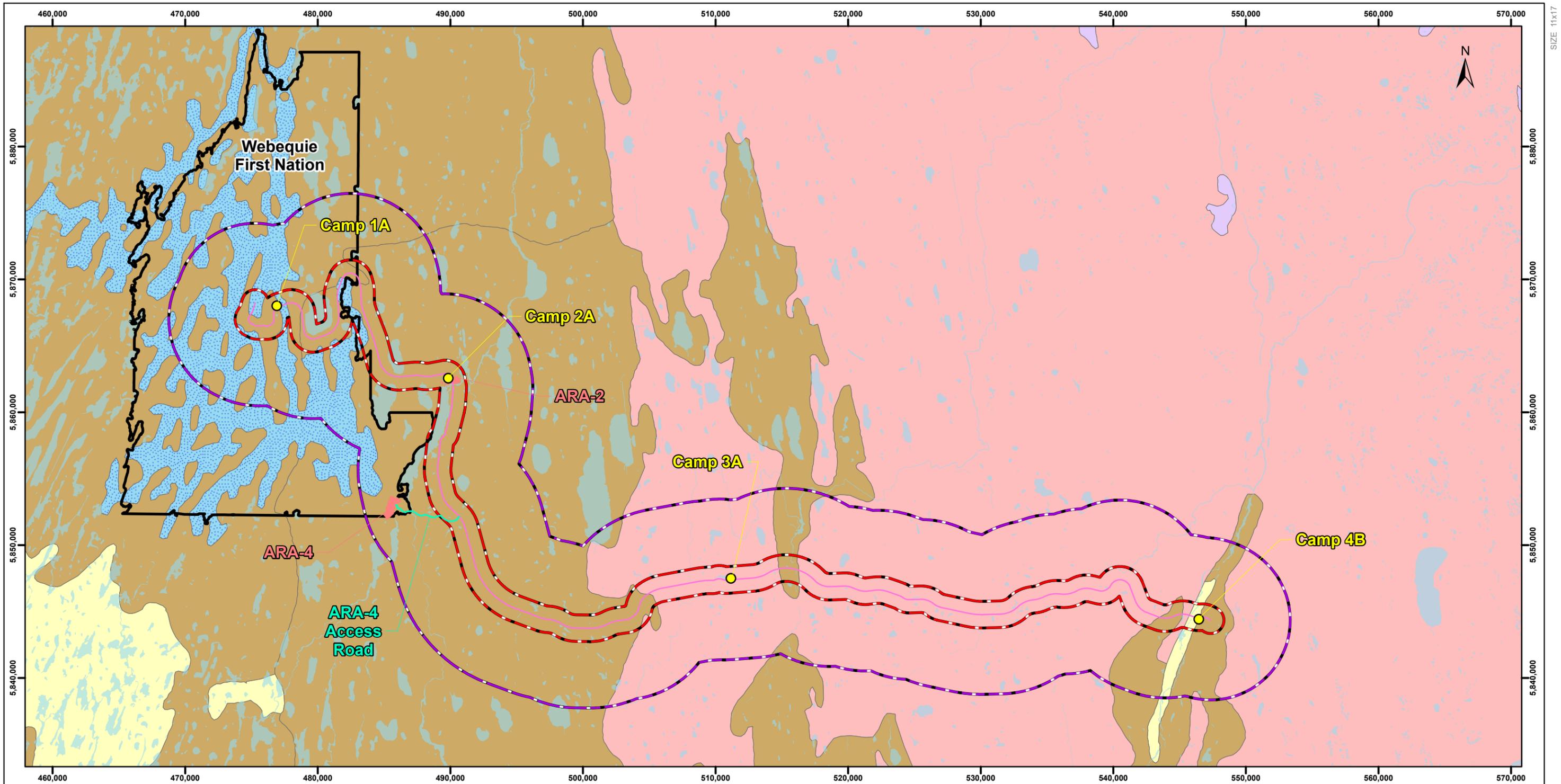
### 6.2.2.2 Local Geology

The surficial material in the LSA and RSA for the Project is predominantly composed of stratified and unstratified Pleistocene tills, along with quaternary organic deposits, interspersed with bedrock outcrops. Soil development in the region exhibits variation depending on drainage conditions.

#### 6.2.2.2.1 Quaternary Geology

**Figure 6.3** shows areas of different quaternary geology relative to the WSR. Towards the western boundary of the project study areas, situated within the Webequie First Nation Reserve lands, there exists an upper layer of undifferentiated till. This layer is predominantly composed of a silty to silt matrix, often rich in clasts, and typically low in matrix carbonate content. Moving across the western half of the LSA and RSA, undifferentiated till prevails, featuring a mainly silty clay to silt matrix; however, it tends to be clast poor, with a higher matrix carbonate content. The larger portion of the eastern half of the LSA and RSA for the Project is characterized by organic deposits, including peat, muck, and marl. As the WSR nears its eastern endpoint close to the Muketei River, glaciofluvial in-contact deposits of gravel and sand are present.





**Legend**

- Preliminary Recommended Preferred Route
- Local Study Area (LSA 1km from the Preferred Route)
- Regional Study Area (RSA 5km from either side of LSA Boundary)
- Webequie First Nation Reserve
- Waterbody
- ARA-4 Access Road
- Recommended Aggregate/Rock Source Areas
- Recommended Construction Camps
- \*Camp 2-A is proposed to include permanent Maintenance and Storage Facility (MSF) for operations of the WSR.
- Glaciofluvial ice-contact deposits
- Glaciomarine and marine deposits
- Lake
- Organic deposits
- Till

**WSR**  
WEBEQUIE  
SUPPLY ROAD

**NOTES**

1. Coordinate System: NAD 1983 UTM Zone 18N.2. Cadastral boundaries are for informational purposes only and should not be considered suitable for legal, engineering, or surveying purposes.3. Topographic/landcover features obtained from CanVec v12.0 dataset, Natural Resources Canada Earth and Science Sector Centre for Topographic Information, Land Information Ontario (L.I.O.) Warehouse Open Data (<https://github.io.gov.on.ca>), Ontario Ministry of Natural Resources and Forestry (OMNRF). Download Date: 2021-02-04.  
4. Ontario Geological Survey, 1997. Quaternary geology, seamless coverage of the province of Ontario. Ontario Geological Survey, Data Set 14.

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**Webequie Supply Road (WSR)**  
Ontario Geological Survey's  
Quaternary Geology in LSA and RSA

0 10 20  
Km

<b>Figure Number:</b> 6.3		<b>REV:</b> PA
<b>Client:</b> Webequie First Nation	<b>Project Number:</b> 661910	<b>Date:</b> 1/27/2026
<b>DSC</b>	<b>DRN</b>	<b>CHK</b>
	AD	CB
		<b>APP</b>
		CB

### 6.2.2.3 Geochemical Analysis

As described in Section 4.3.1.3 of the NEEC Report (Appendix F), in 2020 fieldwork was conducted in the LSA for the Project involving the collection and testing of soil and rock samples. The goal was to assess the potential for metal leaching (ML) and Acid Rock Drainage (ARD) at various sites, including quarries, rock cuts, and talus locations where materials might be generated or stockpiled. A total of 10 representative samples, comprising six (6) soil and four (4) bedrock samples, underwent comprehensive testing, including acid-base accounting (ABA) and Synthetic Precipitation Leaching Procedure (SPLP). These analyses were carried out by ALS Canada Ltd. laboratories located in North Vancouver, B.C., and Thunder Bay, Ontario.



Section 6.2.2.3 Geochemical Analysis, presents the geochemical information requested by Neskantaga First Nation during consultation and engagement activities.

**Table 6-7** summarizes the geochemical sampling sites, depths, and material type. Locations of sampling sites are presented in **Figure 6.4** and further described in Section 4.3.1.3 of Appendix F.

**Table 6-7: Geochemical Sampling Sites**

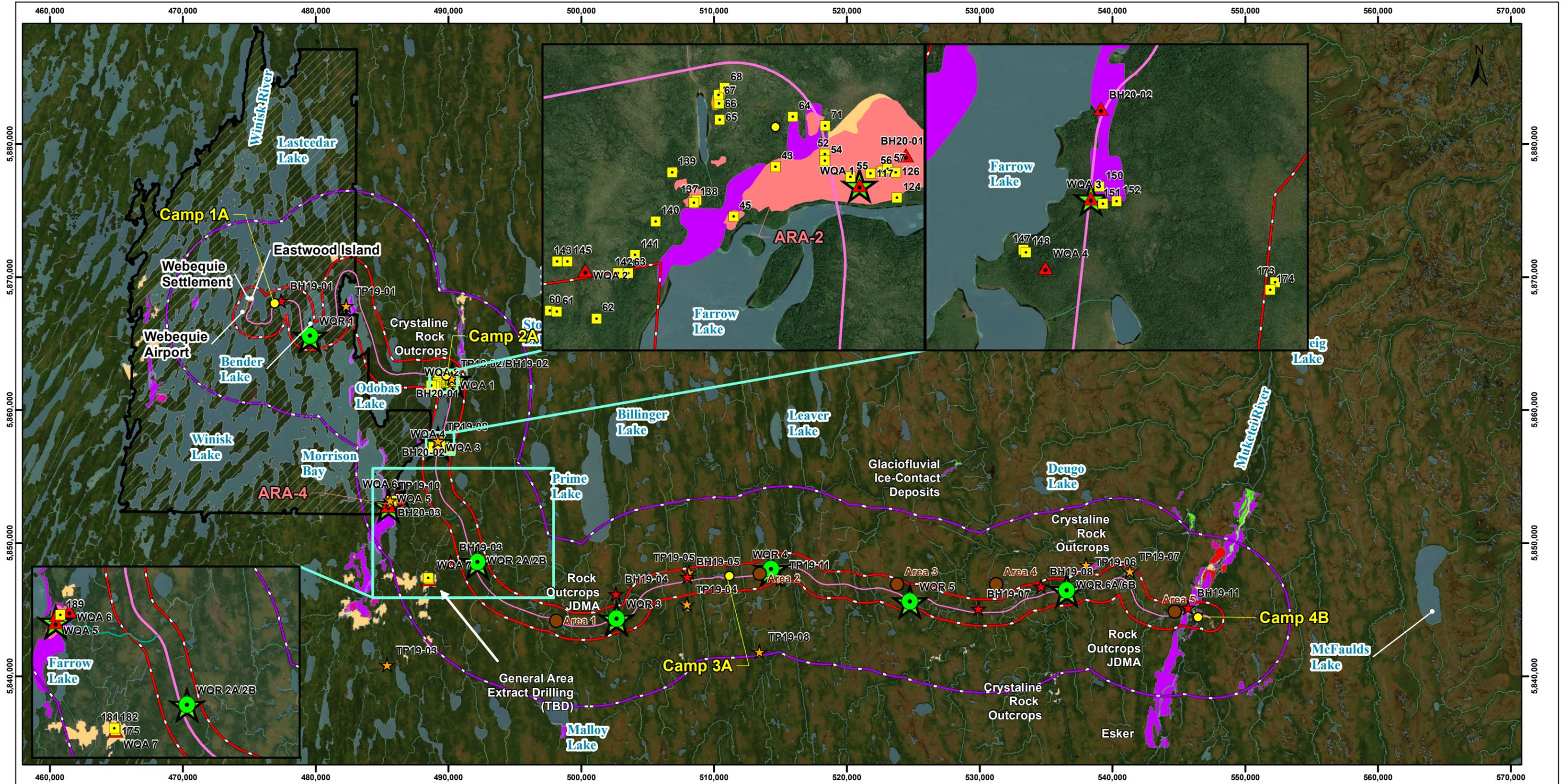
Sample	Depth	Type
WQA-1	(FROM 14' 2"-15')	Rock – Granodiorite
WQR-6B	(FROM 28'-28',9")	Rock – Granodiorite
WQR-4	(FROM 20' 7"-21'-6")	Rock – Granodiorite
WQR-3	(FROM 10' – 18' 9")	Rock – Granodiorite
WQA-3	(FROM 10'-12')	Soil – Sand
WQR-2A	(FROM 5'-7')	Soil – Sandy silt
WQA-5	(FROM 15'-16' 6")	Soil – Sandy silt
WQR-5	(FROM 7' 6"-9' 6")	Soil – Sandy silt
WQR-3	(FROM 7' 6"-9' 6")	Soil – Sand
WQR1	(FROM 15'-17')	Soil – Sandy silt

ABA testing serves the purpose of assessing the acid-base accounting characteristics of soil and bedrock materials, providing insights into the potential risk of net-acidity generation. SPLP testing provides a preliminary indication of leachable loadings upon contact with a moderately extraction fluid at pH 4.2 with ICP-MS analysis for major cations (Ca, Mg, K, Na) and 28 metals and metalloids. The results of the ABA and SPLP tests are summarized in **Table 6-8** and described in detail in Section 4.3.1.3 of the NEEC Report (Appendix F).

**Table 6-8: Summary of ABA and SPLP Test Results for 2020 Geochemical Sampling**

Material	Greatest Detected Sulphur Content	Modified Sobek-NP	NPR Ratio Range	ARD Generation Potential	Metal Leaching Probability
Bedrock	5 tonnes CaCO <sub>3</sub> per 100 tonnes (Low)	(Very Low)	1.4 to 64	Low	Low
Soil	0.6 tonne CaCO <sub>3</sub> per 1,000 tonnes (Low)	214 to 440 tonnes CaCO <sub>3</sub> per 1,000 tonnes (Substantial)	572 to 1,293	Very Low	Medium





**Legend**

- Preliminary Recommended Preferred Route
- Webeque First Nation Reserve
- Local Study Area (LSA 1km from the Preferred Route)
- Regional Study Area (RSA 5km from either side of LSA Boundary)
- Watercourse
- Waterbody
- 2019 Peat Probes
- 2019 Borehole
- 2019 Test Pit
- Bore Holes For Potential Aggregate Sources
- Groundwater Monitoring Well
- Hand Augered Test Pits
- ARD and Metal Leaching Samples
- Rock (JDMA)
- Metamorphic and Igneous Rocks
- Glacial Deposits and Bedrock
- Fluvial Deposits (recent)
- Fluvial Deposits (abandoned)
- Marine Beach and Near-shore Deposits
- Recommended Construction Camps  
\*Camp 2-A is proposed to include permanent Maintenance and Storage Facility (MSF) for operations of the WSR.
- ARA-4 Access Road
- Recommended Aggregate/Rock Source Areas



**NOTES**

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## Webeque Supply Road (WSR)

### Geochemistry and Geotechnical Sampling Sites

<b>Figure Number:</b> 6.4		<b>REV:</b> PA	
<b>Client:</b> Webeque First Nation	<b>Project Number:</b> 661910	<b>Date:</b> 11/27/2024	
<b>DSC</b>		<b>DRN</b>	<b>CHK</b>
		AD	CB
		<b>APP</b>	CB

Overall, the ABA and SPLP testing suggests both the bedrock and soil samples have a relatively low potential for ARD-ML; however, during the detail design stage and construction planning, certain geochemical considerations for the borrow or quarried materials will be addressed. Establishing the risk associated with the low total sulphur content in the bedrock poses for ARD will be further investigated during detail design. Geochemical characterization has revealed that three out of four bedrock samples have a sulphide content ranging between 0.01% and 0.02%, with only one sample exhibiting a higher sulphide content of 0.16%. This particular bedrock sample's lack of neutralization-potential indicates a possible ARD risk, prompting plans for additional sampling in the detail design phase to ascertain the sulphur content distribution more accurately. Preliminary ARD evaluations will focus on total sulphur and inorganic carbon content, with further tests planned if higher sulphide contents are found to assess the acid generation potential effectively. Verifying the leachability of materials using tests that more closely resemble conditions of those in the field, such as shake flask extraction tests, should be conducted during detailed design to ensure the geochemical tests are as representative as possible.

## 6.2.2.4 Geologic Hazards

### Seismicity

Throughout much of eastern Canada, earthquakes are sporadically distributed; however, historical instrumental readings highlight specific areas of heightened seismic activity. These areas experience earthquakes at various depths, up to 30 km (the deepest mine in Canada is at 2 km deep). The northeastern Ontario Seismic Zone exhibits minimal seismic events, with an annual average of 1 to 2 earthquakes of magnitude 2.5 or higher from 1970 to 1999, except for a notable magnitude 5 earthquake near Kapuskasing in 1928. Seismic activity in the northeastern Ontario Seismic Zone is shown in **Figure 6.5**.

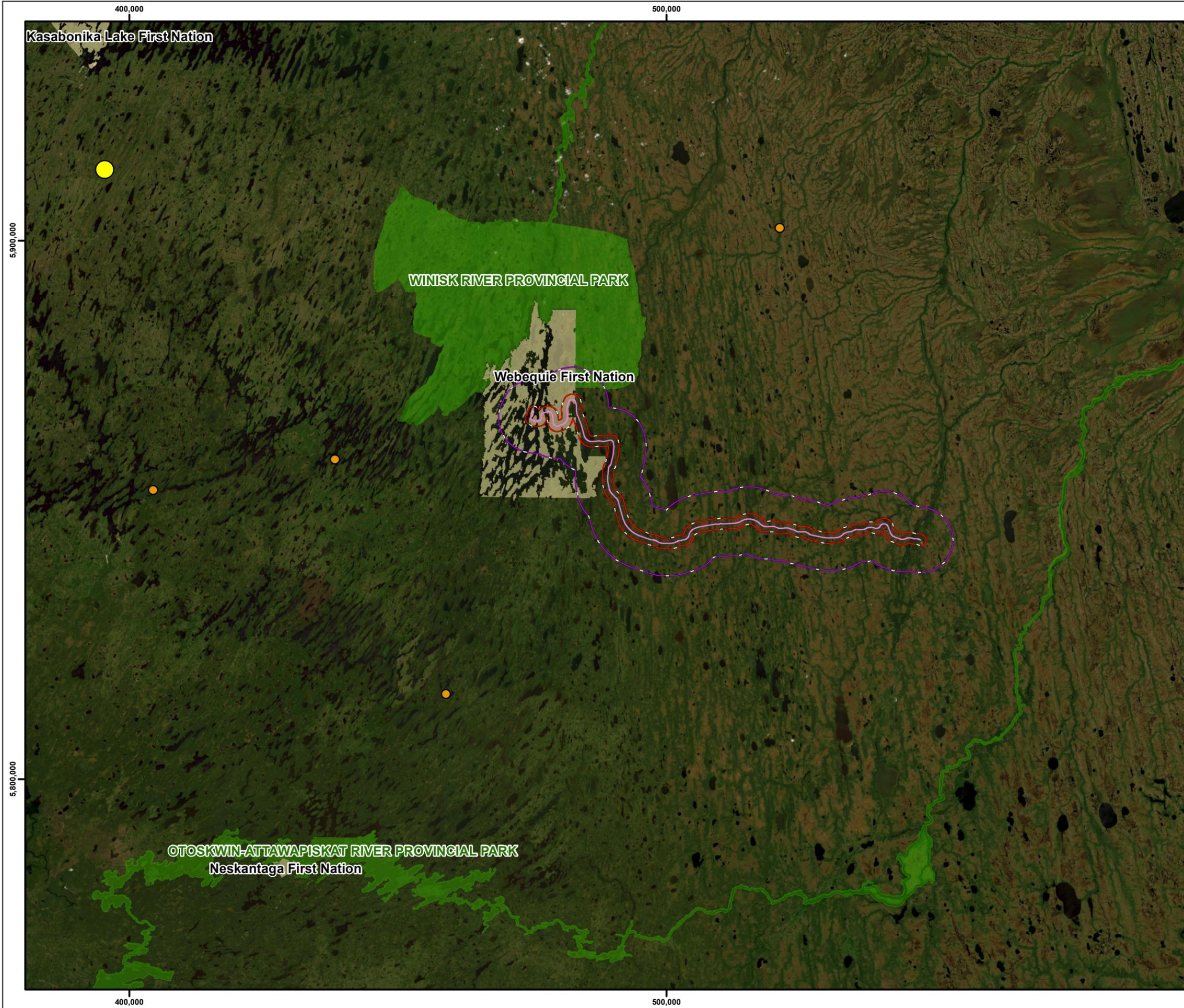
Geotechnical assessments for the WSR categorize most of the region as Seismic Site Class C, indicating either very dense soil or soft rock with specific velocity, resistance, or strength parameters. Other portions of the WSR traverse areas of either peat or organic clay layers exceeding 3 m at some points, necessitating a Seismic Site Classification of F for these sections.

### Geohazards

Within the project study areas, there are no major risks related to hazardous slopes, landslides, sinkholes, or other major geological issues. The WSR is situated in a zone with discontinuous permafrost, may experience thaw weakening beneath the proposed road, especially in areas with ice-rich soils (refer to section on permafrost below for more detail). Design considerations will address the impact of frost on structural foundations, including the potential for settlement-induced stresses. Moreover, the WSR route intersects the Webequie fault zone, a notable geological feature extending from Winisk River Provincial Park, South of Webequie First Nation, through Winisk Lake, also located along the fault, through the east of Prime Lake unit; the intersection with the Mackenzie mafic dyke swarm (1,267 Ma).

Other potential geohazards include the phenomenon of isostatic rebound, also known as post-glacial rebound. This process, initiated by the melting of the massive Laurentide Ice Sheet that covered much of Canada during the Pleistocene Epoch, has led to an ongoing elevation increase in the ground surface. The retreat of the ice sheet, which was up to 3 km – 4 km thick, has allowed the Earth's crust to gradually rise, a movement that continues today. In the general project area, this elevation adjustment is occurring at rates of approximately 8 to 10 millimetres per year (Henton et al., 2006). This rebound effect is a crucial factor in understanding and planning for potential geohazards in the project study areas.





**Legend**

- Preliminary Recommended Preferred Route
  - Local Study Area (LSA 1km from the Preferred Route)
  - Regional Study Area (RSA 5km from either side of LSA Boundary)
- Magnitude**
- 2
  - 3
- First Nation Reserve
  - Provincial Park

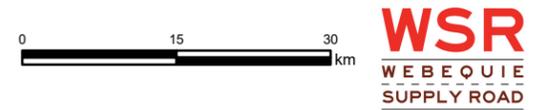
**Webeque Supply Road (WSR)**

Northeastern Ontario Seismic Zone

Figure Number: 6.5	REV PA
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Client: Webeque First Nation	Project Number: 661910	Date: 11/27/2024
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DSC	DRN	CHK	APP
Source: Earthquakes Canada, 2021	AD	CB	CB



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## Permafrost

According to the permafrost map of Canada, the WSR is located in a discontinuous permafrost region characterized by sporadic to isolated presence with low ground-ice content known as the Discontinuous Permafrost Zone of Canada's permafrost region (NRC, 1995). In this zone, some areas beneath the land surface have permafrost, while others do not. In the sporadic permafrost band at the permafrost occurs in islands (10% – 50% of the land area), varies in thickness (estimated at a few meters), and the active layer may not extend down to the permafrost. Ground-ice content in the upper 10 m – 20 m of the ground is categorized as Low (less than 10%). The thickness of permafrost can be influenced by factors such as soil and rock type, snow cover, and proximity to waterbodies. Despite these conditions, no observed areas of permafrost were documented during soil and terrain field investigations in the project study areas. Overburden thickness in the LSA and RSA is generally thin; therefore, thaw strain is not expected to be substantial.

### 6.2.2.5 Ecoregions

The entire LSA and most of the RSA fall within Big Trout Ecoregion. Big Trout Ecoregion is part of Boreal Shield Ecozone. It is dominated by coniferous forest and mainly contains closed canopies of black spruce. The ecoregion is underlain by crystalline Archean bedrock. Section 11.2.2 provides a description and maps of the Project's Ecozone, Ecoregion and Ecodistricts.

### 6.2.2.6 Terrain

The WSR passes through a region characterized by expansive wetlands, organic soils, and numerous watercourses, including substantial water bodies. The topography surrounding and underlying the proposed road is largely level, featuring two distinct segments: a north-south stretch and an east-west stretch. Generally, the north-south segment of the proposed WSR route exhibits greater elevation relief compared to the east-west portion. Elevations in the north-south section typically reach or surpass 200 metres above sea level (masl), while the east-west section registers elevations below 200 masl, as depicted in **Figure 6.6**.

The proposed WSR route traverses through extensive organic terrains that encompass a variety of bogs and fens along the east-west section of the WSR. In the north-south section of the proposed road towards the Webequie community, the route intersects with mineral soils including, till with a discontinuous lacustrine clay veneer, glaciofluvial ice-contact, esker ridges, and alluvial floodplains. A map of surficial geology in the LSA and RSA is shown in **Figure 6.7**.

The following subsections describe the terrain units examined and mapped within the LSA. Mapping of the terrain units is shown on **Figure 6.8**.



Figures 6.6, 6.7 and 6.8 present the terrain mapping requested by Aroland First Nation during consultation and engagement activities.

## Mineral Terrains

Mineral soils are defined as soils with less than 30% organic matter. Their uppermost horizon (i.e., A horizon) will contain elevated levels of organic matter and this will be the most important layer to salvage for restoration purposes.

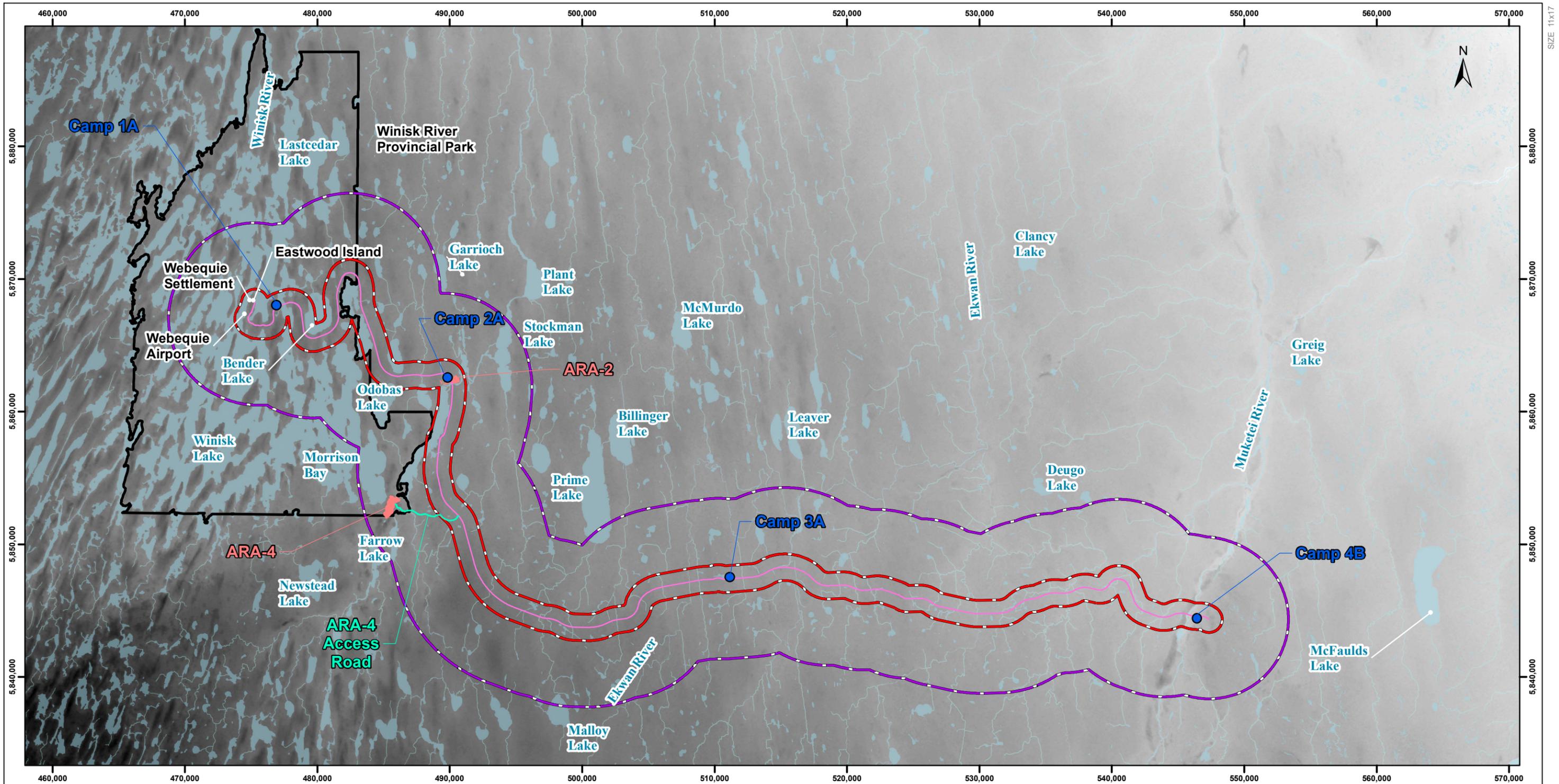


**Till and glacial-lake clay:** silty till on a fluted plain with a mostly thin, discontinuous cover of soft, sticky plastic lacustrine silty clay. This unit has extensive cover over the north-south section of the WSR route with some areas of either thin bog or fen cover.

**Esker ridge:** the esker core near the eastern terminus of the WSR consists of thick sand over gravel, reaching a total depth of more than 20 m, with a discontinuous cover of glacial-lake clay on side slopes. The esker system is segmented, with mostly short gaps and three notable local expansions called “bulges” (esker fans and deltas), resulting in very large volumes of nearby granular material.

**Glaciofluvial:** ice-contact glaciofluvial deposits (kames and eskers) consisting of sorted granular material.





**Legend**

- Preliminary Recommended Preferred Route
- ARA-4 Access Road
- Local Study Area (LSA 1km from the Preferred Route)
- Regional Study Area (RSA 5km from either side of LSA Boundary)
- Webequie First Nation Reserve
- Watercourse
- Waterbody
- Recommended Aggregate/Rock Source
- Recommended Construction Camps  
\*Camp 2-A is proposed to include permanent Maintenance and Storage Facility (MSF) for operations of the WSR.

Elevation (MASL)

High : 275

Low : 129

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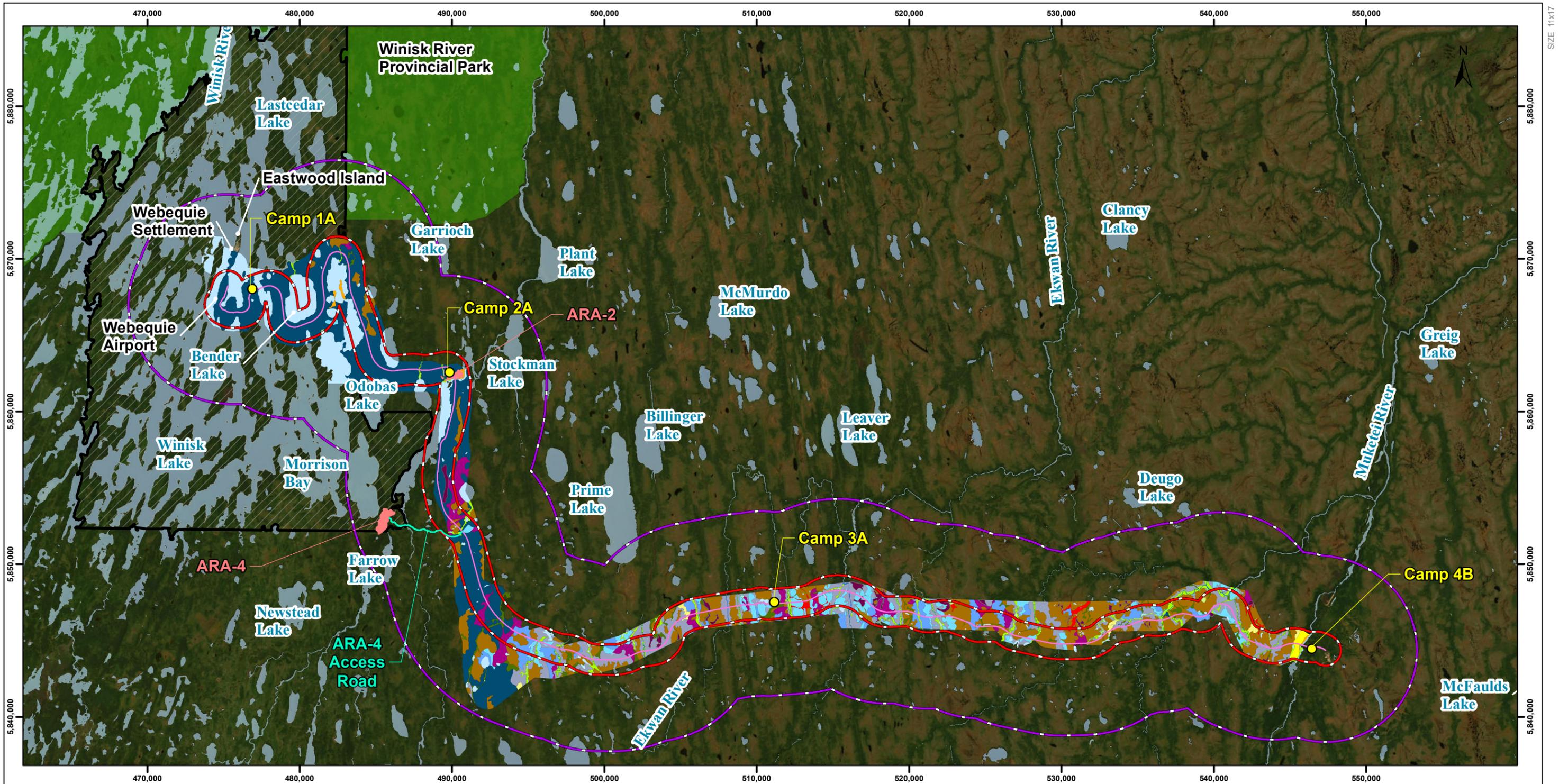
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## Webequie Supply Road (WSR)

### Topographic Map of Project Area

<b>Figure Number:</b> 6.6		<b>REV:</b> PA	
<b>Client:</b> Webequie First Nation	<b>Project Number:</b> 661910	<b>Date:</b> 11/27/2024	
<b>DSC</b>		<b>DRN</b>	<b>CHK</b>
		AD	CB
		APP	CB





**Legend**

- Preliminary Recommended Preferred Route
- Local Study Area (LSA 1km from the Preferred Route)
- Regional Study Area (RSA 5km from either side of LSA Boundary)
- Webequie First Nation Reserve
- Winisk River Provincial Park
- ARA-4 Access Road
- Recommended Aggregate/Rock Source Areas
- Recommended Construction Camps  
\*Camp 2-A is proposed to include permanent Maintenance and Storage Facility (MSF) for operations of the WSR.

<b>Water</b>	<b>Mineral</b>	<b>Bogs</b>	<b>Fens</b>
Lake	TL	TB	SF
River	GF	TK	LF
	ER	DB	CF
	AF	PB	HF
		NB	WF

**WSR**  
WEBEQUIE  
SUPPLY ROAD

**NOTES**

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SCALE: 1:250,000

## Webequie Supply Road (WSR)

### Terrain Mapping

<b>Figure Number:</b> 6.8		<b>REV:</b> PA	
<b>Client:</b> Webequie First Nation	<b>Project Number:</b> 661910	<b>Date:</b> 11/27/2024	
<b>DSC</b>		<b>DRN</b>	<b>CHK</b>
		AD	CW
		<b>APP</b>	CW

**Alluvial floodplain:** varying mineral-soil textures along small creek channels whose floodplains are discontinuous and around the periodically flooded perimeters of water bodies. This unit has relatively thin peat over alluvium, stream-eroded till, and intermittently flooded mineral-soil. This type of terrain is mostly narrow and subject to flooding. Some creek channels are linear, following abandoned flute depressions or ice-keel scour depressions.

### **Organic Terrains (Bogs and Fens)**

Organic soils are defined as soils with greater than 30% organic matter and contain at least 40 cm of an organic layer. These organic soils are slow to form with an estimated rate of 0.5 mm/year. Restoration within these areas will be lengthy and should be focused on restoration of pre-existing hydrology to provide the conditions necessary for long-term reclamation goals.

### **Bog Terrains**

**Domed bog:** Oval, teardrop, balloon and irregular-outlined domed shapes are common occurrence and are usually greater than 500 m in their longest dimension. This unit has a notably convex surface with a crest up to several metres higher than bog edges and the surrounding terrain. Multiple drainage lines (e.g., water tracks) commonly radiate outward from the bog summit. Peat depth may exceed 3 m near the domed bog central area. Dominant vegetation cover includes stratified Sphagnum-sedge-woody shrub peats with large Sphagnum lawn and black spruce areas at ground surface.

**Northern plateau bog:** Typically, a large slightly raised (0.5 to 1 m) bog above the surrounding terrain with steep edges having a plateau-like appearance with a commonly irregular outline edge. Numerous larger bog pools usually occur in larger clusters than observed on domed bogs. Northern plateau bogs have distinct pool clusters, forming net (reticulate) patterns of narrow peaty ridges between large pools (Net Bogs), occasionally transitioning downslope to string bogs and then downslope to string fens. Light grey air photo tones result from extensive Sphagnum moss lawns with sparse black spruce trees and shrubs. Common stratified peat depths are 2 to 4 m, consisting of moderately decomposed Sphagnum peat over Sphagnum and sedge peats.

**Net bogs:** are a component of northern plateau bogs, located at one or more locations on flat-topped bog summits, and include minor string bogs and string fens. The pattern of this unit consists of a network of reticulate narrow (2 to 3 m wide) peaty ridges about 1 m high, separating numerous small to large bog pools having irregular and linear shapes. Pools are occasionally aligned in parallel strings at right angles to surface water runoff and to groundwater flow.

**Treed bog:** areas of extensive tree cover developed on relatively thin organic material over mineral soils. This unit typically occurs along the margins of watercourses.

**Thermokarst bog also called collapse scar bog:** a slightly raised perennially frozen peatland (permafrost-affected) with small, uniform-sized, roundish ground-ice-thawed collapse holes containing either water or wet fen vegetation, called “collapse scars”. The resulting spotty speckled or mottled air photo pattern of whitish collapse holes is caused by subsidence upon melting of ground-ice and possibly melting of palsas in a few places. This unit tends to occur along the sloping margins of small and large creek drainages and is also found as small isolated randomly distributed patches in neighbouring upland areas. These areas are not predominant on the landscape but represent the primary areas of ground instability in the RSA.



## Fen Type Terrains

**String fen:** appears on sloping terrain; narrow subparallel stringy peat ridges enclosing slit-like depressions with either open water or wet fen vegetation (mostly sedge with shrubs and tamarack trees). Strings are aligned perpendicular to the slope and in the direction of surface water runoff and groundwater flow. String fen areas are larger than ladder fens. String fen width becomes narrower and more closely spaced as slope gradient increases downslope. Peat depth is commonly over 2 m.

**Ladder fen:** is a subtype of string fen, and are similar to string fens in appearance but smaller with narrower pools, often along the margin of domed and plateau bogs. Peat thickness is commonly 1 m to 2 m.

**Channel fen:** fens occupying generally well-defined longer and wider channels, including abandoned glacial meltwater channels, with and without small streams. Peat depth may exceed 2 m in some channel fens.

**Watertrack fen:** a flowing pattern of narrow slightly concave surface runoff courses and groundwater seepage on slopes, radiating from the summits of domed and plateau bogs. Watertrack fen may also originate from springs and seeps. Common peat depths is 1 m to 2 m.

**Horizontal fen:** broad, featureless gentle slopes. Commonly uniformly forested with trees, shrubs, coarse grasses and sedges. Commonly transitional to swamps (swamp-fens). Common peat thickness of 2 m to 3 m.

## **Eskers and Post-glacial Deposits**

The project study areas often feature deposits of glaciofluvial esker ridges that are normally composed of a core of stratified sands and gravels. Eskers exhibit well-drained soils with minimal surface organic material, and the groundwater table is situated further below the surface in these deposits.

Eskers in the project study areas run south-southwest and southwest truncating surface flutings and drumlins (Prest, 1963; Thurston et al., 1971; Barnett et al., 2013a, 2013b). Based on the superposition of eskers in the upper till of the strata they were likely formed by the Winisk ice streaming. The longest esker, stretching along the upper Mukutei River near the terminus of the proposed WSR and Noront Resources Inc. exploration camp, extends east of Kitchie Lake over a length of 70 km. Notably, the highest kame in this esker, situated 15 km south-southwest of the exploration camp, has a local relief of up to 50 m, serving as a prominent land marker in the region. North of Highbank Lake, the Attawapiskat River cuts through a cluster of short eskers trending to the south-southeast and south-southwest, featuring a local relief of up to 35 m.

The Project requires subgrade materials for the construction of infrastructure such as gravel for road construction and material for the construction of temporary work areas such as laydown areas and camps. Since there are no commercial pits or quarries in the project area, aside from one small aggregate pit used by the Webequie First Nation, potential aggregate sources for construction were investigated as part of the terrain and soil investigations. While much of the LSA and RSA is covered by organic terrain, with limited ice-contact glaciofluvial landforms and bedrock, there are some granular ice-contact glaciofluvial deposits and bedrock outcrops suitable for aggregate/rock sources. **Figure 6.9** illustrates the location of eskers and potential aggregate/rock sources for the Project. Key sources include the large esker complex on the west side of the Mukutei River near McFaulds Lake and a series of bedrock and glaciofluvial deposits along the western section of the proposed WSR route. The large esker complex near McFaulds Lake along the Mukutei River is primarily composed of silt and fine sand, potentially offering limited value as an aggregate source. Additionally, the esker material at the eastern terminus of the



proposed road may be unavailable or unusable due to proposed use for mineral exploration, development in the area, and distance from the starting point of the construction at the west terminus of the route.

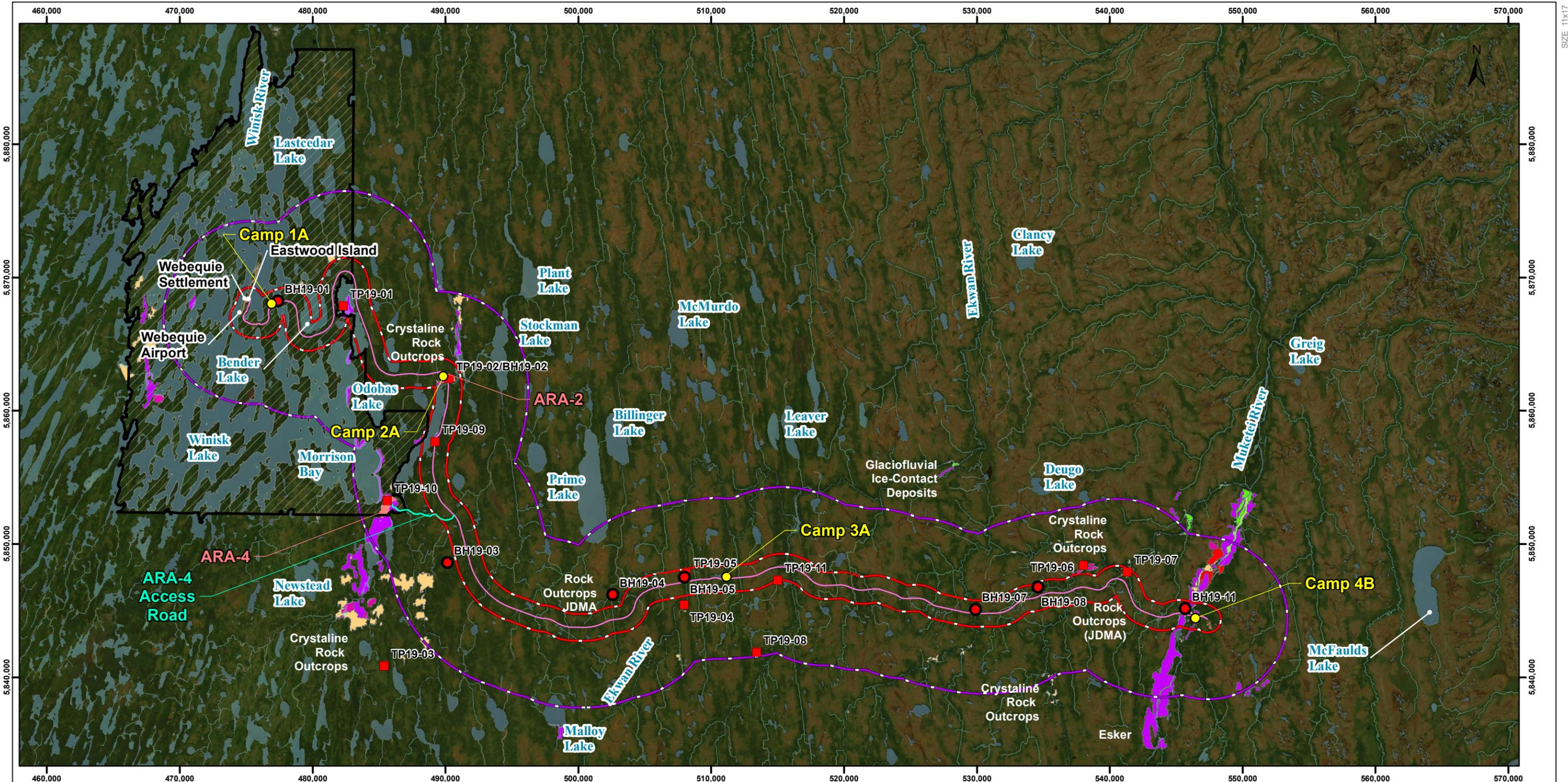
Field work was conducted in 2020 to characterize eskers and evaluate their potential as aggregate/rock sources for the Project. The majority of the investigation was on the western, north-south trending section of the proposed WSR. Specific sites explored during the 2020 field program included test pits TP19-02, TP19-09, TP19-10, and TP19-03. Locations of these test pits are illustrated in **Figure 6.9** and described in detail in Appendix D-2 – WSR Exploration of Potential Aggregate Development Sites Report. Notably, no aggregate sites along the main east-west trending esker near the terminus of the WSR were examined in 2020, as the 2019 investigation had indicated limited potential for use in that particular area. The following descriptions summarize the findings at investigated sites:

- Site TP19-02 is an elevated area featuring a variety of surface materials, including bedrock, sand, sandy gravel, till, and marine sandy muds. The estimated combined volume of borrow and bedrock aggregate feasible for mining at this location ranges from 500,000 to 1,000,000 m<sup>3</sup>. Two additional areas identified during the July 2020 program are estimated to host a sand and gravel reserve of 40,000 m<sup>3</sup> to 50,000 m<sup>3</sup>, distributed among five hills. Beneath these hills and another one, a bedrock reserve of at least 60,000 m<sup>3</sup> to 120,000 m<sup>3</sup> is expected to be present and feasible for use as aggregate.
- Site TP19-09 represents a complex of hills in generally wet, low-relief terrain along the east margin of an unnamed lake. The south component exhibits clean sand and sandy gravel, while the north component features cobbles and boulders covering sandy gravel. The estimated feasible sand and gravel reserve at this site ranges from 150,000 m<sup>3</sup> to 500,000 m<sup>3</sup>.
- Site TP19-10, located 3.2 km to 5.9 km west of the proposed WSR route, is a large ridge with a large sand and gravel reserve. The expected feasible volume for aggregate at this site, based on regional elevation data, ranges from 4,000,000 m<sup>3</sup> to 8,000,000 m<sup>3</sup>, assuming the entire ridge consists of sand and gravel with varying percentages of spoil.
- Site TP19-03, identified in the 2019 assessment, was considered a possible location with exposed bedrock at the surface or shallow depth beneath white moss; however, based on July 2020 field observations, no bedrock was found at the surface or up to a depth of 5.0 m.

Further details on the 2020 field investigation results, including the characterization of esker deposits as potential aggregate/rock sources, can be found in Appendix D-2 – WSR Exploration of Potential Aggregate Development Sites Report.



Information on culturally important sites that was shared with the Project Team were used in the evaluation of alternatives for the Project, including alternative locations for aggregate source areas (refer to Section 3, Evaluation of Project Alternatives). One of the criteria used for screening the alternative aggregate source areas was to allow for long-term access and use of the aggregate resource.



**Legend**

- Preliminary Recommended Preferred Route
- Local Study Area (LSA 1km from the Preferred Route)
- Regional Study Area (RSA 5km from either side of LSA Boundary)
- Webeque First Nation Reserve
- Waterbody
- Watercourse
- ARA-4 Access Road
- Recommended Aggregate/Rock Source Areas
- Recommended Construction Camps
- \*Camp 2-A is proposed to include permanent Maintenance and Storage Facility (MSF) for operations of the WSR.
- Rock (JDMA)
- Metamorphic and Igneous Rocks
- Glacial Deposits and Bedrock
- Glaciofluvial Ice-contact Deposits
- Fluvial Deposits (recent)
- Fluvial Deposits (abandoned)
- Marine Beach and Near-shore Deposits
- 2019 Borehole
- 2019 Test Pit



**NOTES**

1. Coordinate System: NAD 1983 UTM Zone 16N.
2. Cadastral boundaries are for informational purposes only and should not be considered suitable for legal, engineering, or surveying purposes.
3. Topographic/landcover features obtained from CanVec v12.0 dataset, Natural Resources Canada Earth and Sciences Sector Centre for Topographic Information; and Land Information Ontario (LIO) Warehouse Open Data (<https://github.io.gov.on.ca/>), Ontario Ministry of Natural Resources and Forestry (OMNRF). Download Date - 2021-02-04

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## Webeque Supply Road (WSR)

### Eskers - Potential Aggregate/Rock Sources

<b>Figure Number:</b> 6.9		<b>REV:</b> PA	
<b>Client:</b> Webeque First Nation	<b>Project Number:</b> 661910	<b>Date:</b> 11/28/2024	
<b>DSC</b>		<b>DRN</b>	<b>CHK</b>
		AD	CB
		<b>APP</b>	CB

## 6.2.2.7 Soils

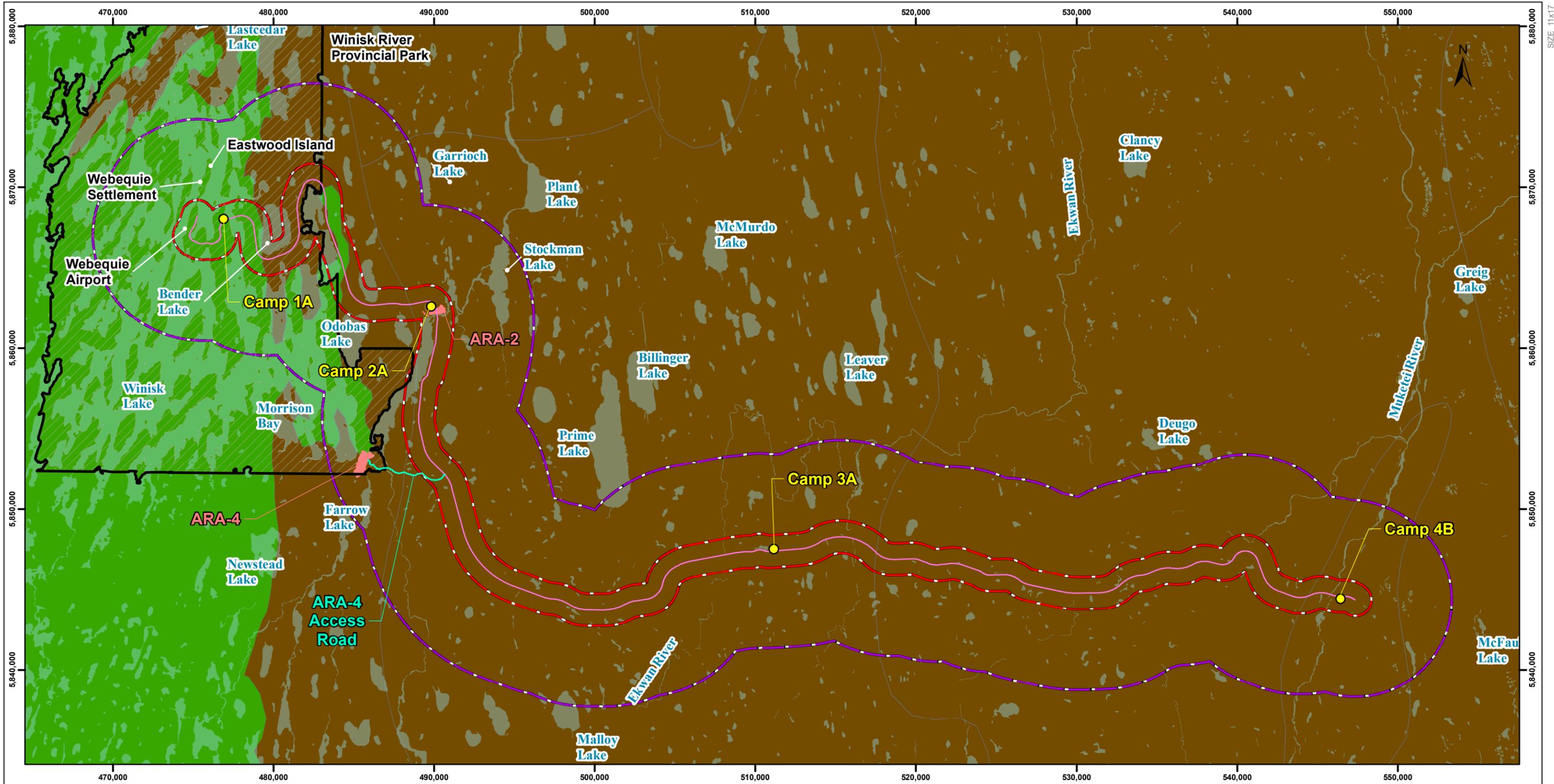
### Soil Order

Soil and terrain units were mapped and classified on the scale of the LSA and are described in detail in Section 4.3.2.4 of the NEEC Report (Appendix F). The suitability of soils and aggregate for sourcing construction material is described in Section 4.3.3.1.

Soil development is influenced by a combination of local factors such as climate, parent material, terrain, vegetation, and other organisms over time. Soils are generated through the physical and chemical weathering of bedrock, glacial parent material, as well as erosional processes involving wind and gravity (Agriculture Canada, 1988). The Canadian System of Soils Classification outlines a set of standards, series, orders, and groups that serve to identify and classify soils. The LSA and RSA intersects with soil classified as Brunisolic in the northwest portion and organic in the southeast portion as shown in **Figure 6.10** (Government of Canada, 2021).

The northwest portion of the project study areas is generally categorized as upland area with soils of the Brunisolic soil order. Brunisolic soils are a type of soil commonly found in boreal and sub-arctic environments. They typically occur on medium- to coarse-textured parent materials under coniferous forests where climate and parent materials interact to produce limited morphological development (Smith et al., 2011). Brunisolic soils are characterized by certain pedogenic features, including a Bm Horizon indicated by a colour change compared to the underlying parent material, some degree of soil structure development, leaching of carbonates in calcareous parent materials, and mild alteration of inherent clays (Agriculture Canada, 1988).





**Legend**

- Preliminary Recommended Preferred Route
- Local Study Area (LSA 1km from the Preferred Route)
- Regional Study Area (RSA 5km from either side of LSA Boundary)
- Webeque First Nation Reserve
- Waterbody
- ARA-4 Access Road
- Recommended Aggregate/Rock Source Areas
- Recommended Construction Camps  
\*Camp 2-A is proposed to include permanent Maintenance and Storage Facility (MSF) for operations of the WSR.
- Soil Order**
- Brunisolic
- Organic



**NOTES**

1. Coordinate System: NAD 1983 UTM Zone 18N.  
 2. Callout boundaries are for informational purposes only and should not be considered suitable for legal, engineering, or surveying purposes.  
 3. Topographic/landcover features obtained from CanVec v12.0 dataset, Natural Resources Canada Earth and Sciences Sector, Centre for Topographic Information, Land Information Ontario (LIO) Warehouse Open Data (<https://openub-lis.gov.on.ca/>), Ontario Ministry of Natural Resources and Forestry (OMNRF) and Barnett, P.J., Yeung, K.H., McCallum, J.D. 2013a. Surficial geology of the Lansdowne House area Northeast, Northern Ontario. Ontario Geological Survey, Preliminary Map P 3698, scale 1:100,000 and Barnett, P.J., Yeung, K.H., McCallum, J.D. 2013b. Surficial Geology of the Lansdowne House Area Northeast, Northern Ontario, 1:100,000, Ontario Geological Survey P3697. Download Date: 2021-02-04

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**Webeque Supply Road (WSR)**

**Soil Order**

<b>Figure Number:</b> 6.10		<b>REV:</b> PA	
<b>Client:</b> Webeque First Nation	<b>Project Number:</b> 661910	<b>Date:</b> 11/28/2024	
<b>DSC</b>	<b>DRN</b>	<b>CHK</b>	<b>APP</b>
	TE	AD	CW

The southeast portion of the Project is predominantly flat, poorly drained soils with slow rates of plant decay, common in the development of organic soils and peat. Soils were generally found to have an organic surface layer typically ranging from 0.5 to 2 metres in thickness underlain by a clay/silt till layer, reaching up to 2 metres in thickness, and a quaternary till layer, extending up to 5 metres in thickness. Where the proposed WSR route approaches its eastern terminus near the Muketei River, glaciofluvial in-contact deposits of gravel and sand are present. JDMA conducted field investigations in 2019 to assess peat thickness at various locations within the LSA. Using a manual soil probe in bogs and fens, the team measured peat layers ranging from 1 to 4 metres thick, aligning with previous wetland classifications. The JDMA soil sampling sites (and some existing MECP sampling locations) are shown on **Figure 6.11**. The soil probing typically ended upon reaching the underlying clay or clayey till, indicating the peat's depth across the sampled sites.

### **Soil Suitability for Reclamation**

Brunisolic soils seen within the LSA, can be effectively managed to restore ecological functions post-disturbance. Effective reclamation practices, including soil management and revegetation strategies, are essential for restoring Brunisolic soils to their pre-disturbance state or better, ensuring the recovery of land capability and ecological sustainability. During disturbances it is essential to keep topsoil and subsoil separated for successful reclamation of disturbed areas with Brunisolic soils.

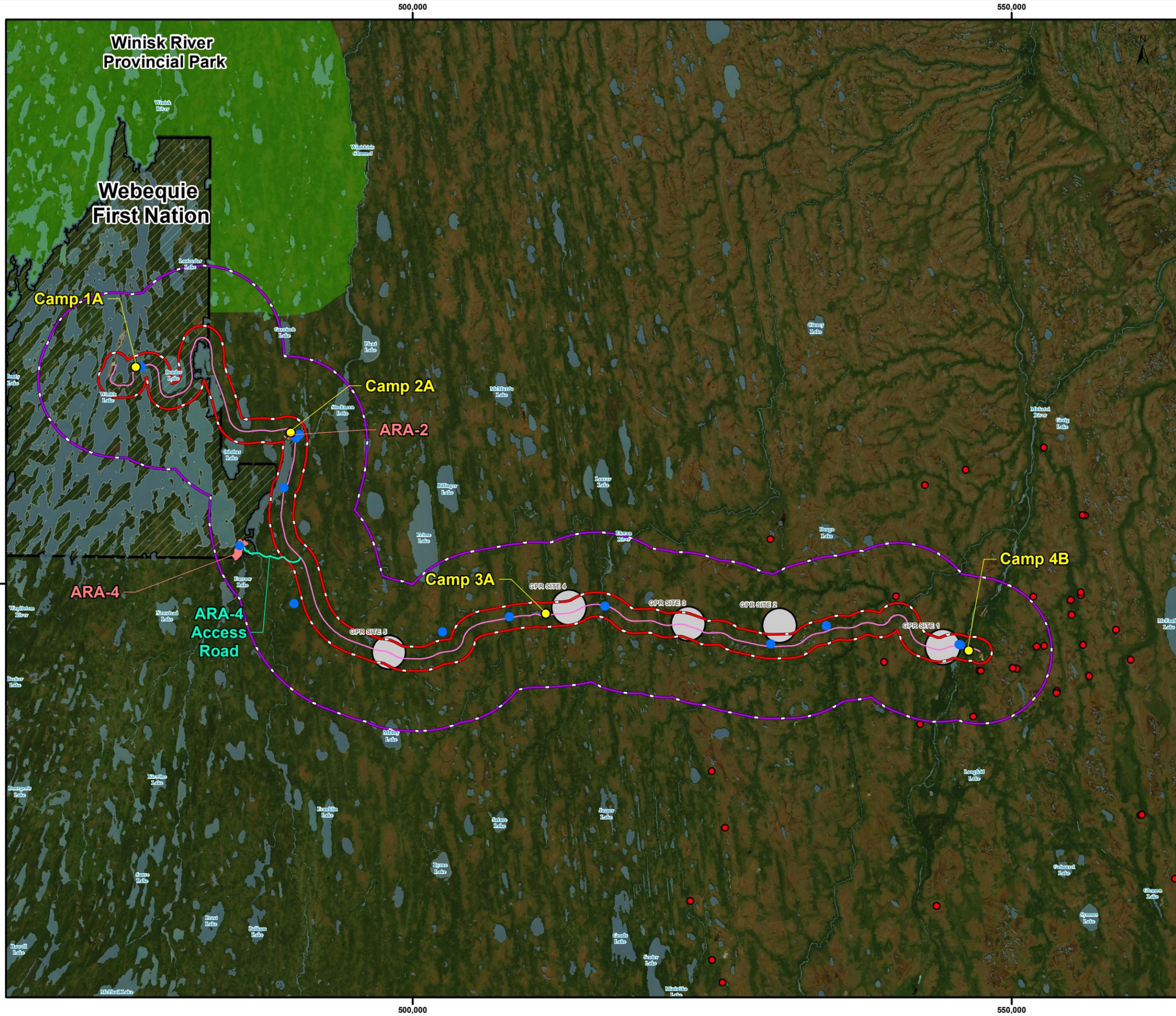
The suitability of organic soils for reclamation involves specific challenges and considerations. Organic soils, as found in peatlands, have unique properties due to their high organic matter content such as their increased water retention capacity. These areas are only suitable for specific vegetation types (e.g., peatmoss, black spruce, Labrador tea). For reclamation, these soils require careful management to address issues like subsidence, carbon release, and water regulation. Strategies often focus on restoring hydrology, reintroducing native plant species, and managing nutrient levels to re-establish peatland ecosystems. The success of reclamation in peatlands is measured by the restoration of ecological functions, including biodiversity, water quality, and carbon sequestration capabilities; as peat development is a slow process (approx. 0.5 mm/m<sup>2</sup>/year of peat formation), restoration efforts will be lengthy and will involve identifying indicators to determine restoration trajectory.

### **Geotechnical Investigation of Soils**

The geotechnical investigation that was undertaken to support the Project included test pit excavations, borehole drilling (all within the LSA), and comprehensive sampling and laboratory analyses. Detailed findings, including borehole logs at critical waterbody crossings and potential aggregate source locations, are compiled in Appendix 4-C of the NEEC Report (Appendix F of this EAR/IS). Detailed information and mapping of boreholes, test pits, and groundwater monitoring wells is further described in Section 4 and Section 6 of the NEEC Report (Appendix F).

Coordinates of borehole locations and their drill depths are presented in **Table 6-9** and a summary of the laboratory results showing the composition and distribution by soil type is presented in **Table 6-10**.





### Legend

- Preliminary Recommended Preferred Route
- Local Study Area (LSA 1km from the Preferred Route)
- Regional Study Area (RSA 5km from either side of LSA Boundary)
- Webeque First Nation Reserve
- Provincial Park
- Waterbody
- Recommended Construction Camps  
\*Camp 2-A is proposed to include permanent Maintenance and Storage Facility (MSF) for operations of the WSR.
- Borehole Sampling Locations
- MECP Sampling Locations
- ARA-4 Access Road
- Recommended Aggregate/Rock Source Areas
- JDMA Sampling Locations

## Webeque Supply Road (WSR)

### MECP and JDMA Sampling Locations for Peat and Organics

Figure Number:	6.11	REV	PA
Client:	Webeque First Nation	Project Number:	661910
		Date:	11/28/2024
DSC		DRN	CHK
		AD	CB

**NOTES**

1. Coordinate System: NAD 1983 CSRS UTM Zone 16N.
2. Cadastral boundaries are for informational purposes only and should not be considered suitable for legal, engineering, or surveying purposes.
3. Topographic/landcover features obtained from CanVec v12.0 dataset, Natural Resources Canada Earth and Sciences Sector Centre for Topographic Information; and, Land Information Ontario (LIO) Warehouse Open Data (<https://geohub.lio.gov.on.ca/>), Ontario Ministry of Natural Resources and Forestry (OMNRF). Download Date : 2021-02-04

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**Table 6-9: Summary of Borehole Locations and Elevations**

Borehole ID	Easting (m)	Northing (m)	Drilled Depth (m)
BH19-01	477353	5868021	4.9
BH19-02	490304	5862121	4.5
BH19-03	490113	5848318	8.1
BH19-04	502521	5845992	5.8
BH19-05	508084	5847251	10.5
BH19-06	516049	5848106	15.3
BH19-07	529918	5844967	10
BH19-08	534543	5846513	15.2
BH19-10	545749	5844902	9.6
BH19-P1	545634	5844938	1.8
BH20-01	490548	5862412	2.1
BH20-02	489278	5857978	4.8
BH20-03	485566	5853161	5.8

**Table 6-10: Summary of Soil Analytical Laboratory Results**

Borehole	Sample No.	Percent Distribution			Atterberg Limit			Standard Proctor (kg/m <sup>3</sup> )
		Gravel	Sand	Silt & Clay	LL	PL	PI	
BH19-01	SS 2	5.3	57	37.7	23	14	9	-
BH19-02	SS2	34.5	40.8	24.7	-	-	-	-
BH19-03	PS 3	0.6	46.7	52.7	-	-	-	-
BH19-03	PS 5	18.9	33.4	47.7	-	-	-	-
BH19-05	SS 2	1.3	55.4	43.3	-	-	-	-
BH19-05	SS 4	6.6	23.6	69.8	-	-	-	-
BH19-06	SS 2	11	33.1	55.9	-	-	-	-
BH19-06	SS5	47.7	38.1	14.2	-	-	-	-
BH19-06	SS 9	5.6	62.6	31.8	-	-	-	-
BH19-07	SS3	9.7	27.4	62.9	18	13	5	-
BH19-08	SS3	0	67.9	32.1	-	-	-	-
BH19-08	SS8	4.6	35.2	60.2	-	-	-	-
BH19-08	SS9	4.7	29.1	66.2	19	12	7	-
BH19-10	SS4	0	67	33	-	-	-	-
BH19-10	SS8	0	89.6	10.4	-	-	-	-
BH19-P1	SS 2	0.0	22.9	77.1	-	-	-	-
BH20-01	SS 2	0.9	15.8	83.3	-	-	-	-
BH20-02	SS 5	34.5	53.5	12.0	-	-	-	-
BH20-03	SS 3	10	54.4	35.6	-	-	-	-



The following subsections summarize the results of the geotechnical investigation as described in the NEEC Report (Appendix F).

### **Subsurface Conditions**

The subsurface stratigraphy encountered at borehole locations consists of Surficial Organic layer, Peat, Organic Silt, Silt and Sand Till, Sandy Silt / Silty Sand Till, Silty Gravelly Sand Till, Clayey Sandy Silt Till, Sand and Sandy Silt deposits overlaying Granite / Gneiss bedrock. Reference should be made to Borehole Logs in Appendix 4-C of the NEEC Report for detailed information at each borehole location including the thickness of each stratigraphic unit, field and laboratory test results, the Standard Penetration Test (SPT) N-values of each soil unit and observed groundwater conditions, where groundwater monitoring wells were established. A description of subsurface soil conditions encountered during the geotechnical investigation is presented below.

### **Organics**

Surficial frozen organic layer encountered at all borehole locations ranged in thickness ranges from 0.2 m to 0.8 m in depth, except for boreholes drilled during the summer period in 2020. Snow coverage of about 0.6 m to 1.2 m were encountered at all borehole locations during winter drilling in 2019.

### **Peat**

An approximate 0.6 m thick layer of organic peat was encountered in Borehole BH19-05. SPT N-values recorded in the peat layer was 8 blows per 0.3 m spoon penetration, indicating loose condition. The natural moisture content of the single tested sample was 56.9%, indicating wet conditions.

### **Organic Silt and Sand**

About 0.9 m thick layer of organic silt and sand was encountered in Borehole BH19-05 underlying peat layer. SPT N-values recorded in the organic silt and sand layer was 9 blows per 0.3 m spoon penetration, indicating loose condition. The natural moisture content of the single tested sample was 29.1%, indicating moist condition.

### **Silt and Sand Till**

Silt and sand till with trace of some clay and gravel was encountered underlying the organics soil layer in BH19-01 and BH19-03 and underlying silty sand in BH19-08. Silt and sand layer extended to bedrock depth of 2.1 m, in BH19-01, and to a depth of 2.6 m and 9.1 m in BH19-03 and BH19-08, respectively.

SPT N-values of 12 to more than 50 blows per 0.3 m spoon penetration were recorded in these deposits, indicating compact to very dense condition. Based on the single Atterberg limit tested, liquid and plastic limit for the material in this layer was found to be 23 and 14 respectively, indicating low plastic material. The natural moisture contents of the tested samples typically varied from 9.0% to 19.7%, indicating moist condition.

### **Silty Gravelly Sand Till**

Silty gravelly sand with trace clay layer was encountered underlying organics in BH19-02. The material in this layer was brown in colour and extended to bedrock depth of 1.5 m. SPT N-values of 29 blows per 0.3 m spoon penetration were recorded in these deposits, indication of compact condition. The natural moisture content of the single tested sample was 8.1%, indicating moist condition.



### **Sandy Silt Till**

Sandy silt till, trace clay and gravel were encountered underlying organic layer in BH19-06, BH19-07, BH19-10 and BH19-P1 and below silt and sand layer in BH19-03 and BH19-05. The material in this layer was, brown to grey in colour and extended to depth 8.1 m, 8.0 m, 4.1 m, 1.4 m, 2.1 m and termination depth of 1.8 m below ground surface in borehole BH19-03, BH19-05, BH19-06, BH19-07, BH19-10 and BH19-P1, respectively.

SPT N-Value of 5 to more than 50 blows per 0.3 m spoon penetration were recorded, indicating loose to very dense condition with the exception of BH19-05 where SPT N-values of 0 to 1 recorded at depth below 6 m to the bedrock depth of 8 m indication of very loose conditions. The natural moisture contents of the tested samples typically varied between 8.2% and 20.4%, indicating moist conditions.

### **Silty Sand Till**

Silty Sand, trace gravel was encountered underlying gravelly sand layer in BH19-06, below organic layer in BH19-08 and below sandy silt layer in BH19-10. The material in this layer was, brown to grey in colour and extended to termination depth of 15.3 m in BH19-06, 3.0 m and 7.8 m depth in BH19-08 and BH19-10, respectively.

SPT N-values of more than 50 blows per 0.3 m spoon penetration in BH19-06 and BH19-10 were recorded in these deposits, indication of very dense condition while SPT N-values of 2 to 9 blows per 0.3 m penetration in BH19-08 indicating very loose to loose condition. The natural moisture contents of the tested samples varying from 14.1% to 20.5% in BH19-06 and BH19-10, indicating moist condition while the natural moisture contents of 25.8% to 43.2% indicating moist to wet condition in BH19-08.

### **Sand and Gravel / Gravelly Sand Till**

The sand and gravel / gravelly sand till, trace silt, occasional cobble and boulders was encountered underlying sandy silt in BH19-06. The material in this layer was grey in colour, extended to 10.7 m below ground surface.

SPT N-Value of 36 to more than 50 blows per 0.3 m spoon penetration were recorded, indicating dense to very dense condition. The natural moisture contents of the tested samples typically varied between 4.6% and 7.3%, indicating moist condition.

### **Clayey Sandy Silt Till**

The clayey sandy silt till, trace gravel, occasional cobble and boulders was encountered underlying sandy silt and silt and sand layer in BH19-07 and BH19-08, respectively. The material in this layer was grey in colour, extended to a termination depth of 10 m and 15.2 m in BH19-07 and BH19-08, respectively.

SPT N-Value of 15 to more than 50 blows per 0.3 m spoon penetration were recorded, indicating compact to very dense condition. The natural moisture contents of the tested samples typically varied between 6.8% and 11.3%, indicating moist condition.

### **Sand**

Sand, some silt, was encountered underlying silty sand in BH19-10. The material in this layer was brown in colour, extended to the termination depth of 9.6 m below ground surface.

The single SPT N-Value of 42 blows per 0.3 m spoon penetration were recorded, indicating dense condition. The natural moisture content of the single tested sample was recorded 17.5%, indicating moist condition.



## **Bedrock**

Bedrock encountered in boreholes BH19-01, BH19-02, BH19-04 and BH19-05 at depth 2.1 m, 1.5 m, 1.4 m and 8 m from the ground surface, respectively. The bedrock encountered during investigation can be described as granite. The granite was reddish brown and pink in BH19-01 and BH19-02, black and grey in BH19-04 and white and grey in BH19-05.

## **Soil Erodibility**

Regions experiencing heavy rainfall and high winds are at an increased risk of erosion. The RSA, with an annual precipitation of approximately 729 mm, of which 522 mm is rainfall, faces erosional challenges mitigated by specific terrain characteristics. Notably, the highest winds in the area occur during the winter months when the terrain is frozen.

Soil erodibility is often classified by a soils K factor, which can range from 0.02 (least erodible, e.g., sand) to 1.03 (most erodible, e.g., very fine sand). In the RSA, the prevalent soils, silty clay and sandy silt, have K factors of 0.58 and 0.48, respectively. The presence of organic material tends to slightly reduce soil erodibility. Overall, the soils in the region, including the LSA and RSA of the Project, generally fall in the mid-range in terms of erodibility.

## **Soil Contamination**

As summarized in the NEEC Report, a review was conducted to find any known or suspected soil contamination in the Project area. The review included, but was not limited to, chain of title, previous reports, aerial photographs, mapping and databases (e.g., Ontario EcoLog Environmental Risk Information Services).

Results of the review identified there are number of sites in Webequie First Nation Reserve, and within the RSA for the Project, that have subsurface petroleum-hydrocarbon impacts. As documented in the report entitled *Design of Environmental Remedial Actions, Phase I: Task 2 – Summary of Site Investigations and Recommended Action Plan*, (True Grit Consulting Ltd., 2015) prepared for Webequie First Nation there are 12 sites that were identified as having potential areas of concern based on the past field investigations completed in 2010. The 12 sites for which Webequie First Nation conducted remedial option plans include the following:

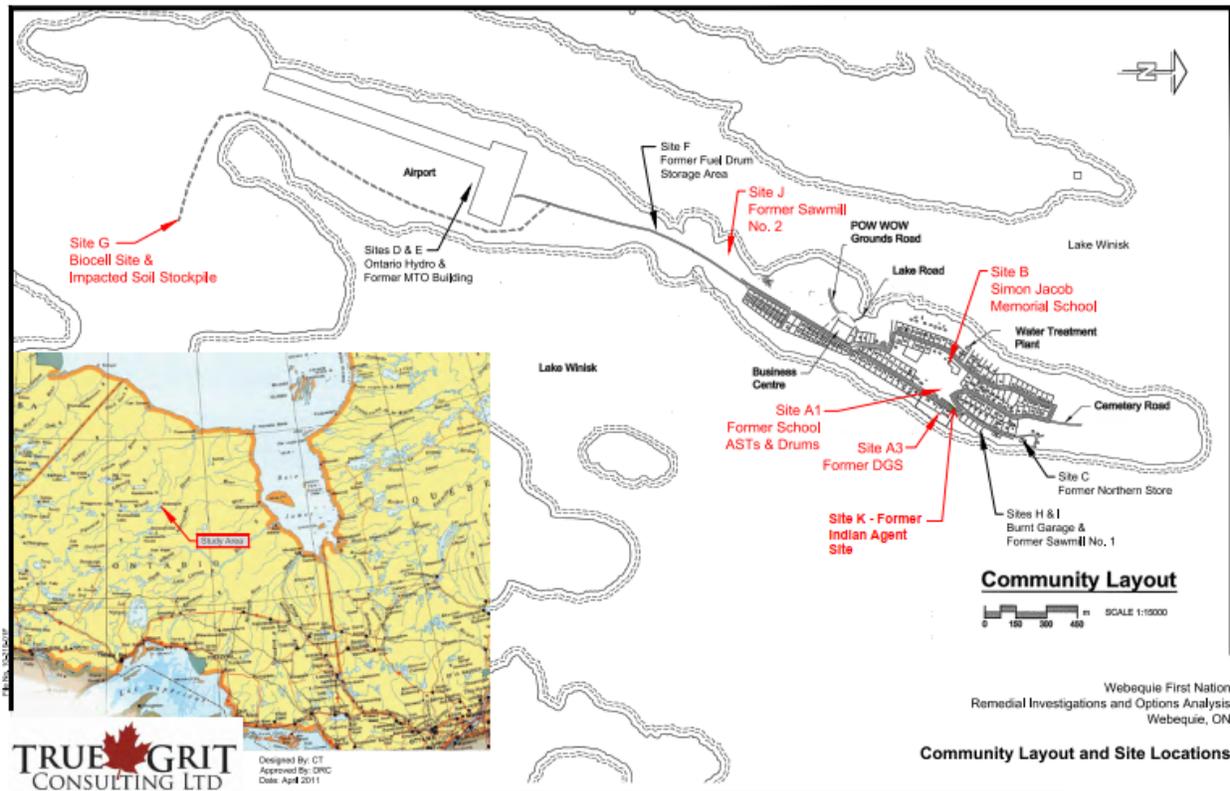
- Site A1 – Former School Above Ground Storage Tanks and Drums;
- Site A3 – Former Diesel Generating Station Site;
- Site B – Simon Jacob Memorial School;
- Site C – Former Northern Store;
- Site D – Ontario Hydro;
- Site E – Ministry of Transportation of Ontario (MTO);
- Site F – Former Fuel Drum Storage Area;
- Site G – Biocell Site and Impacted Soil Stockpile;
- Site H – Burnt Former Garage;
- Site I – Former Sawmill #1; and
- Site J – Former Sawmill #2.



Of these 11 sites, five sites (A1, A3, B, G, J) as well as an additional site, Site K – Former Indian Agent Site are all highlighted red in **Figure 6.12** (True Grit Consulting Ltd., 2015) and were selected for development of remedial actions. The remaining were either closed following the remedial investigations and options analysis process (i.e., contamination was not identified at the sites), were identified as third-party sites (e.g., MTO, Hydro One, etc.), or did not meet the current eligibility criteria for funding (i.e., not a Class 1 site under the Canadian Council of Ministers of the Environment National Classification System for Contaminates Sites).

**Figure 6.12** shows the location of the sites where remedial options and recommendations have been developed to address known soil contamination sites located within the RSA for the Project. Result of the investigation found that concentrations of petroleum hydrocarbons, polycyclic aromatic hydrocarbons, metals and cyanide in analyzed soil/sediment samples exceeded applicable guidelines (remedial criteria) at 9 out of 11 sites. The results of the known groundwater contamination at the subject sites are described in Section 6 (Groundwater) of Appendix F.

**Figure 6.12: Areas of Known Soil Contamination**



**Sediment**

Waterbody sediment examined during the project were generally found to be fine-textured and contain noticeable amounts of organic and decaying material. Sediment samples frequently contained small woody debris and required additional grab samples to collect a viable sample. Some small gravels were occasionally present within areas containing flowing water. Further information about sediment and sediment quality is presented in Section 7.2.2.3 of the EAR/IS.

## 6.3 Identification of Potential Effects, Pathways and Indicators

As indicated in **Table 6-5**, some project activities may interact with and impose potential effects on the Geology, Terrain, and Soil VC during the project construction and operations. This section describes the nature of the potential effects, the pathways that link the project activities and the effects, and the indicators that can be used to assess and measure the effects. **Table 6-11** summarizes the potential effect pathways and effect indicators for the Geology, Terrain, and Soils VC. Primary potential effects include alteration of geomorphology and geochemistry, alteration of topography and terrain, changes in soil quality, and loss of soil resources.

The descriptions of effect pathways are grouped by their potential effect to avoid repetition since many of the same effect pathways may occur during different phases of the project. The potential effects of accidental spills on soil quality are assessed in Section 23 – Accidents and Malfunctions.

The assessment of effects on the Geology, Terrain, and Soils VC was completed in recognition of the following Indigenous values:



- The land is unique, untouched and natural, with no current contaminations or major impacts.
- Traditional territories are diverse and vast. The air is clean, and the land is untouched by development.
- Land, water, air and all elements are required for members of Indigenous communities to survive.
- Traditional lands and waters, and people's relationships and connections to their traditional lands and waters are special and unique.
- First Nation lands and traditional territories are boreal forest that has low rolling landforms, rock outcrops and muskeg with many lakes, ponds, and rivers.

### 6.3.1 Alteration of Geomorphology and Geochemistry

**Blasting of rocks, excavation, cut, backfilling, and extraction of aggregates → Loss or alteration of geologic features**

Project construction activities including blasting, excavation, cut, backfilling, and the extraction of aggregate from pits and quarries have the potential to result in the loss or alteration of geologic features. Any major earthmoving construction activities have the potential to change geologic features. This includes landscape deformation such as slumping, folds, or sliding as well as visual loss of geologic features.

**Earthworks, excavation, cut, backfilling, and extraction of aggregates → Landscape deformation**

Project construction activities involving earthworks including excavation, cut, backfilling, and extraction of aggregates have the potential to result in landscape deformation such as slumping, folding, and sliding.

**Stockpiling and placement of aggregate → Leaching of deleterious substances → Change to geochemistry**



Stockpiling of extracted, processed (e.g., crushed), and excavated materials will occur during the construction and operation phases. Deleterious substances (e.g., metals, sulphate, etc.) may leach through precipitation and oxidation processes and cause elevated metals and acids in subsurface geologic layers, particularly when stockpiling aggregate that contain minerals with potential to cause ARD and/or ML. The placement of aggregate that causes ARD/ML can have a detrimental effect on the receiving environment. The discharge of deleterious substances in the environment can lead to changes in the local receiving environment.

Dust that is generated during construction and operations of the Project has the potential to affect local geochemistry. The composition of dust generated from activities like aggregate extraction and road operations can include elements that can affect geochemistry like minerals, metals, and nutrients. These potential pathways are assessed in Section 9 of the EAR/IS.

## 6.3.2 Alteration of Topography and Terrain

**Extraction, cut and backfilling → Alteration of topography → Alteration of infiltration rate, hydraulic gradient, flow direction and pathway**

Construction activities that involve the removal of overburden, backfilling, and grading can result in the loss of terrain and topographical features through their direct removal or alteration. Removal or alteration of cover material including vegetation and surficial soil layers may create or alter preferential pathways for water flow. This may result in alteration to water infiltration rates, hydraulic gradients/permeability of the soil column, and flow pathways.

## 6.3.3 Change to Soil Quality

**Road construction, stockpiling, disposal of wastes → Release/leaching of deleterious substances → Change to soil quality**

Soil quality refers to the physical and chemical properties of soil that give it the ability to perform various ecosystem functions such as supporting plant growth, providing habitat, and regulating waterflow. Spills and the release of deleterious substances, such as chemical or hazardous materials, have the potential to alter soil chemistry, leading to decrease in soil quality.

**Road construction, extraction, cut and backfilling → Alteration to soil physical properties → Change to soil quality and/or soil productivity**

Project construction and operation activities that involve interactions with soil such as handling and operation of equipment on soil surface can cause changes in the physical properties of soil. The physical properties of soil that can be affected by activities interacting with soil include compaction and the loss of pore space, the degradation of soil structure, erosion, and changes in soil texture through admixing layers. Alterations to the physical properties of soil result in a loss or change to soil quality and /or productivity. Common reasons for this to occur are improper soil handling that mixes different soil types or leaves soil vulnerable to erosion, vehicle traffic that compacts and mixes soft soils, and not preserving and protecting organic topsoil when constructing the road, and supportive infrastructure facilities (e.g., temporary construction camps, aggregate pits/quarries).



## 6.3.4 Loss of Soil Resources

**Vegetation clearing and grubbing, site grading, extraction, cut, excavation, and road construction  
→ Loss and movement of soil → Alteration to soil physical properties → Loss of soil resources**

Loss of soil quantity as well as re-distribution of soil refers to the physical loss and movement of topsoil and subsoil from the landscape. Loss and movement of soil is an environmental issue that affects land productivity, biodiversity, and the overall health of ecosystems. This degradation to soil can result from numerous factors, including erosion, compaction, chemical contamination, and the removal of vegetation cover. As soil quality diminishes, its ability to retain water, support plant life, and cycle nutrients is compromised, leading to soil quantity loss due to erosion forces. Soil that undergoes exposure or disturbance due to project-related activities becomes susceptible to erosion during wind and precipitation events, further elevating the risk of soil loss. Additionally, the degradation of soil quality amplifies this susceptibility. Alterations to the physical properties of soil, including its structure, can result in an increased risk of erosion caused by both wind and precipitation. The removal of vegetation is a major factor in soil exposure, and this elevates the risk of erosion and subsequently loss of soil resources.



**Table 6-11: Potential Effects, Pathways and Indicators for Geology, Terrain, and Soils VC**

Potential Effect	Project Phase	Effect Pathway	Effect Indicators	Nature of Interaction and Effect (Direct or Indirect)	Linked VCs
Alteration of geomorphology and geochemistry	Construction	<ul style="list-style-type: none"> <li>Blasting and aggregate extraction and processing sites.</li> <li>Construction of roads, temporary work areas, and structure (bridge, culvert) foundations at waterbody crossings.</li> <li>Discharge of deleterious substances can change geochemistry.</li> </ul>	<ul style="list-style-type: none"> <li>Geochemical changes, potential for metal leaching (ML) and acid rock drainage (ARD).</li> <li>Visual loss of and changes to geologic features.</li> <li>Landscape deformation such as slumping, folds, or sliding as well as visual loss of geologic features can indicate alteration of geomorphology.</li> </ul>	Direct and Indirect	<p>The assessment of this VC informs the effects assessment for other VCs:</p> <ul style="list-style-type: none"> <li>Surface Water Resources (Section 7)</li> <li>Groundwater Resources (Section 8)</li> <li>Vegetation and Wetlands (Section 11)</li> <li>Wildlife and Wildlife Habitat (Section 12)</li> </ul>
Alteration of topography and terrain	Construction	<ul style="list-style-type: none"> <li>Cutting, backfilling, and grading can result in loss of and changes to topographical features/drainage patterns.</li> <li>Vegetation clearing and grubbing can result in loss of topographical features.</li> <li>Removal of soil and overburden for construction of roads, structures at waterbody crossings and temporary work areas can result in changes to and loss of terrain features.</li> </ul>	<ul style="list-style-type: none"> <li>The amount of area disturbed by the Project.</li> <li>Erosion and sedimentation.</li> <li>Changes to drainage patterns and hydrology.</li> <li>Decreased slope stability and increased slumping rates.</li> <li>Changes to vegetation composition.</li> <li>Visual changes to the landscape.</li> </ul>	Direct and Indirect	<p>The assessment of this VC informs the effects assessment for other VCs:</p> <ul style="list-style-type: none"> <li>Groundwater Resources (Section 8)</li> <li>Vegetation and Wetlands (Section 11)</li> <li>Wildlife and Wildlife Habitat (Section 12)</li> </ul>
Change to soil quality	Construction	<ul style="list-style-type: none"> <li>Spills (e.g., fuel and other deleterious substances) from the storage, handling and use of chemical or other hazardous materials during construction may alter soil quality and nutrient availability.</li> <li>Stripping, handling, and storage of soil can result in a loss of soil quality.</li> <li>Operation of equipment over the soil surface can result in changes to soil quality (e.g., compaction and/or admixing).</li> </ul>	<ul style="list-style-type: none"> <li>Vegetation that shows stress, bare patches of soil where vegetation will not establish.</li> <li>Vegetation composition changes and may include weedy or undesirable species.</li> <li>Soil compaction, rutting, and admixing.</li> <li>The formation of erosion rills and gullies.</li> <li>Excessive dust generation and wind erosion.</li> </ul>	Direct and indirect	<p>The assessment of this VC informs the effects assessment for other VCs:</p> <ul style="list-style-type: none"> <li>Groundwater Resources (Section 8)</li> <li>Vegetation and Wetlands (Section 11)</li> <li>Wildlife and Wildlife Habitat (Section 12)</li> </ul>
Loss of soil resources	Construction	<ul style="list-style-type: none"> <li>Stripping, handling, and storage of soil.</li> </ul>	<ul style="list-style-type: none"> <li>Excessive dust generation and wind erosion.</li> <li>The formation of erosion rills and gullies.</li> <li>Exposure of soil to erosion.</li> </ul>	Direct and indirect	<p>The assessment of this VC informs the effects assessment for other VCs:</p> <ul style="list-style-type: none"> <li>Vegetation and Wetlands (Section 11)</li> </ul>
Alteration of geomorphology and geochemistry	Operations	<ul style="list-style-type: none"> <li>Grading and resurfacing of the road may result in additional ARD at margins of roads.</li> <li>Dust generated from operation of vehicles and equipment on road has the potential to settle on adjacent land.</li> </ul>	<ul style="list-style-type: none"> <li>Geochemical changes, potential for ML and ARD.</li> </ul>	Direct and Indirect	<p>The assessment of this VC informs the effects assessment for other VCs:</p> <ul style="list-style-type: none"> <li>Surface Water Resources (Section 7)</li> <li>Groundwater Resources (Section 8)</li> <li>Vegetation and Wetlands (Section 11)</li> <li>Wildlife and Wildlife Habitat (Section 12)</li> </ul>
Alterations of topography and terrain	Operations	No effect to topography will occur doing operations.	N/A	N/A	N/A
Change to soil quality	Operations	<ul style="list-style-type: none"> <li>Encroachment of the project area may occur over the operational life of the project impacting soil that was previously un-affected.</li> <li>Discharge of deleterious substances can result in changes to soil quality and alter the nutrient availability to plants.</li> </ul>	<ul style="list-style-type: none"> <li>Vegetation that shows stress, bare patches of soil where vegetation will not establish.</li> <li>Vegetation composition changes and may include weedy or undesirable species.</li> <li>Soil compaction, rutting, and admixing.</li> <li>The formation of erosion rills and gullies.</li> <li>Excessive dust generation and wind erosion.</li> </ul>	Direct and Indirect	<p>The assessment of this VC informs the effects assessment for other VCs:</p> <ul style="list-style-type: none"> <li>Groundwater Resources (Section 8)</li> <li>Vegetation and Wetlands (Section 11)</li> <li>Wildlife and Wildlife Habitat (Section 12)</li> </ul>
Loss of soil resources	Operations	<ul style="list-style-type: none"> <li>Ecological or human-induced accidents such as flooding, and forest fires can result in soil loss.</li> <li>Loss of soil resources can occur overtime while soil is being stored for long periods of time.</li> <li>Loss of soil quantity may occur during the operational life of the Project from changes to drainage patterns and in constructed ditches.</li> </ul>	<ul style="list-style-type: none"> <li>The formation of erosion rills and gullies.</li> <li>Excessive dust generation and wind erosion.</li> <li>Exposed base soil.</li> </ul>	Direct and Indirect	<p>The assessment of this VC informs the effects assessment for other VCs:</p> <ul style="list-style-type: none"> <li>Vegetation and Wetlands (Section 11)</li> </ul>

## 6.4 Mitigation Measures

This section presents the proposed mitigation measures to eliminate, reduce, control, or offset potential adverse effects to Geology, Terrain, and Soils VC during the construction and operations phases of the Project, as detailed in **Section 6.3**.

Site specific management plans that describe protocols and procedures to mitigate potential effects to Geology, Terrain, and Soils VC will be developed and implemented as outlined in Section 4.6 of the EAR/IS. During the construction phase, a Construction Environmental Management Plan (CEMP) will be implemented and during operations an Operational Environment Management Plan (OEMP) will be implemented. Management plans will be consistent with the requirements of the Project's permits and authorizations to minimize the potential effects of construction and operations activities on geology, terrain, and soils. Management Plans will guide the proponent and its contractors in complying with applicable environmental legislation by providing criteria, standard protocols, and mitigation measures to eliminate, reduce, and/or offset potential adverse effects to Geology, Terrain, and Soils VC.

### 6.4.1 Management Plans

During construction and/or operations, the following key environmental management plans within the broader CEMP and OEMP will be developed and implemented. It is the proponent's commitment that mitigation measures will be followed and monitored to eliminate, reduce, control or offset potential effects on the Geology, Terrain, and Soils VC.



Indigenous community members will have an active role in developing and implementing management plans.

#### Air Quality and Dust Control Management Plan

The Air Quality and Dust Control Plan will describe mitigation measures used to control air emission and dust during construction and/or operations. The mitigation and management measures relate to the stabilization of temporarily exposed ground surface, soil stockpiles, and aggregate sources. Mitigations can include speed limits, use of water, and use of an environmentally approved dust suppressant.

#### Soil Management Plan

The Soil Management Plan will describe protocols and procedures for handling and storing of native soils (i.e., disturbed areas, storage areas, and/or aggregate sources) on-site during construction and/or operations phase(s). The purpose of Soil Management Plan is to describe best management practices intended to reduce impacts on soil resources.

#### Erosion and Sediment Control Plan

The Erosion and Sediment Control Plan will include mitigation measures to control runoff, minimize erosion on exposed slopes and substrates, and prevent the introduction of sediment or other deleterious materials from entering watercourses. The Erosion and Sediment Control Plan will describe the applicable permits and best management practices and will follow existing guidelines as appropriate to mitigate erosion and sediment transport.



### Petroleum Handling and Storage Plan

The Petroleum Handling and Storage Plan will describe protocols and procedures for handling, storing, and proper disposal of petrochemicals during the construction phase. Petrochemicals include fuels, oils, lubricants, or other petroleum-based products.

### Site Restoration and Monitoring Plan

The Site Restoration and Monitoring Plan will provide instructions to the proponent and its contractors on how to undertake site restoration after construction.

## 6.4.2 Mitigation Measures

**Table 6-12** identifies key mitigation measures outlined in Appendix E of the EAR/IS to eliminate or reduce adverse effects as identified in **Section 6.3**. Further measures will be provided in the CEMP and the OEMP and the environmental component plans listed in **Section 6.4.1** to be developed for the Project. Refer to Section 4.6 for details of the proposed framework for the development of the CEMP and the OEMP.



An Environment Committee will be established to facilitate communication and engagement during construction and operations of the Project. Committee members will include Webequie First Nation Elders and Knowledge Holders, other First Nations with interest in participating, and appropriate project representatives, to: facilitate communication and engagement during construction and operations of the Project; facilitate use of Indigenous Knowledge in project activities; facilitate evaluation of land use information; and facilitate development of appropriate monitoring programs, protocols and management plans as it relates to Geology, Terrain, and Soils VC.

**Table 6-12: Summary of Potential Effects, Mitigation Measures and Predicted Net Effects for Geology, Terrain, and Soils VC**

VC Subcomponent	Indicators	Project Phase	Project Component or Activity	Potential Effect	Mitigation Measures	Predicted Net Effect
Geomorphology and geochemistry	<ul style="list-style-type: none"> <li>▪ Geochemical changes, the potential for ML and ARD.</li> <li>▪ Visual loss of and changes to geologic features.</li> <li>▪ Landscape deformation such as slumping, folds, or sliding as well as visual loss of geologic features can indicate alteration of geomorphology.</li> </ul>	Construction	<ul style="list-style-type: none"> <li>▪ Construction and Use of Supportive Infrastructure: Construction of camps, access roads and watercourse crossings, laydown/storage areas, and aggregate extraction and processing areas.</li> <li>▪ Construction of Road: removal and stockpiling of organics, subgrade excavation, placement of fill and gravel, grading and drainage work.</li> <li>▪ Construction of Structures at Waterbody Crossings: Culverts and bridges – foundations (e.g., pile driving and concrete works), bridge girders, bridge decks, install of culverts.</li> <li>▪ Blasting and aggregate extraction activities.</li> <li>▪ Decommissioning of Temporary Construction Camps, Access Roads and Laydown / Storage Areas: Grading and site reclamation/revegetation. This also includes formalizing / re-purposing select access roads to permanent pits and quarries and a construction camp to an operations and maintenance facility as Project components for use during operations.</li> <li>▪ Completion of Project-Wide Clean-up, Site Restoration / Reclamation and Demobilization: Clean-up of excess materials, site revegetation and demobilization of equipment and materials.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Alteration of Geomorphology and Geochemistry.</li> <li>▪ Alteration of Topography and Terrain.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Limiting disturbance footprint to the permanent development area and associated temporary supportive infrastructure during construction.</li> <li>▪ The disturbed areas will be restored with native soils (removed or excavated in the same area) or materials that are more permeable than the native soils, where practical, and covered by native vegetation. This can help restore or increase infiltration rates and groundwater levels and prevent or reduce soil erosion.</li> <li>▪ Minimizing disturbance footprint to previously disturbed areas during decommissioning.</li> <li>▪ Re-contour, stabilize, and re-vegetate disturbed areas to suit original conditions.</li> <li>▪ Use rock ripping, hammering, or drilling where possible to minimize blasting.</li> <li>▪ Where blasting is used, design blast patterns to minimize ground disturbance beyond the excavation area.</li> <li>▪ A Site Restoration and Monitoring Plan will be developed in consultation with rightsholder and stakeholders and implemented for the Project (refer to Appendix E). This will include, but not limited to, soil salvage and management; details of restoration planting requirements (e.g., plant species list, number, size, and plant spacing, specifications for seeding; and post-construction monitoring, maintenance and care).</li> <li>▪ Refer to Appendix E – Mitigation Measures: <ul style="list-style-type: none"> <li>▫ Section 5.1 – Clearing and Grubbing;</li> <li>▫ Section 5.2 – Petroleum Handling and Storage;</li> <li>▫ Section 5.3 – Spill Prevention and Emergency Response;</li> <li>▫ Section 5.5 – Materials Handling and Storage; Section 5.6 – Working Within or Near Fish Bearing Watercourses;</li> <li>▫ Section 5.7 – Temporary Watercourse Crossings;</li> <li>▫ Section 5.8 – Temporary Watercourse Diversions;</li> <li>▫ Section 5.11 – Bridge and Culvert Installation;</li> <li>▫ Section 5.12 – Blasting Near a Watercourse;</li> <li>▫ Section 5.16 – Erosion and Sediment Control;</li> <li>▫ Section 5.20 – Quarry Site Selection and Development Requirements; and</li> <li>▫ Section 5.21 – Site Decommissioning and Rehabilitation.</li> </ul> </li> </ul>	Yes

VC Subcomponent	Indicators	Project Phase	Project Component or Activity	Potential Effect	Mitigation Measures	Predicted Net Effect
Geomorphology and geochemistry (Cont'd)	<ul style="list-style-type: none"> <li>▪ Geochemical changes, the potential for ML and ARD.</li> <li>▪ Vegetation that shows stress, bare patches of soil where vegetation will not establish.</li> <li>▪ Excessive dust generation and wind erosion.</li> </ul>	Construction and Operations	Emissions, Discharges and Wastes: Noise, air emissions / GHGs, water discharge, and hazardous and non-hazardous wastes.	<ul style="list-style-type: none"> <li>▪ Alteration of Geomorphology and Geochemistry.</li> <li>▪ Change to Soil Quality.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Dust control measures will be implemented when deemed necessary.</li> <li>▪ Prior to the development of quarry sites, the potential for ARD will be further assessed. If the Project chooses to use materials or sites that are identified as having uncertain or known potential for ML/ARD, mitigative measures, sensitive receptor identification, and/or supplemental baseline studies will be completed in future development phases. Amongst other things, this may include infrastructure to divert or lower the water table, sub-drains, and/or ongoing monitoring of surface and groundwater.</li> <li>▪ The following management plans will be developed and implemented for the Project: <ul style="list-style-type: none"> <li>▫ Waste Management Plan; and</li> <li>▫ Spill Prevention and Emergency Response Management Plan. This plan will lay out the requirements for training and procedures for the storage, handling, and transportation of potential contaminants, as well as equipment operation and maintenance intended to prevent spills from occurring.</li> </ul> </li> <li>▪ Refer to Appendix E – Mitigation Measures: <ul style="list-style-type: none"> <li>▫ Section 5.2 – Petroleum Handling and Storage;</li> <li>▫ Section 5.3 – Spill Prevention and Emergency Response;</li> <li>▫ Section 5.5 – Materials Handling and Storage;</li> <li>▫ Section 5.16 – Erosion and Sediment Control;</li> <li>▫ Section 5.17 – Concrete Washout Management Practices;</li> <li>▫ Section 5.18 – Dust Control Practices; and</li> <li>▫ Section 5.20 – Quarry Site Selection and Development Requirements.</li> </ul> </li> </ul>	Yes
	<ul style="list-style-type: none"> <li>▪ Visual loss of and changes to geologic features.</li> <li>▪ Landscape deformation such as slumping, folds, or sliding as well as visual loss of geologic features can indicate alteration of geomorphology.</li> </ul>	Operations	Operation of Pits, Quarries and Maintenance Yard/Facility: Includes periodic extraction and blasting and processing operations (i.e., crushing, screening) and stockpiling of rock and aggregate materials. Also includes operation and repairs of Maintenance Yard/Facility and components within (office buildings, parking, storage of equipment and materials).	<ul style="list-style-type: none"> <li>▪ Alteration of Geomorphology and Geochemistry.</li> <li>▪ Alteration of Topography and Terrain.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Limiting disturbance footprint to the permanent development area and associated temporary supportive infrastructure during construction.</li> <li>▪ Use rock ripping, hammering, or drilling where possible to minimize blasting at pits/quarries.</li> <li>▪ Where blasting is used, design blast patterns to minimize ground disturbance beyond the excavation area.</li> <li>▪ Refer to Appendix E – Mitigation Measures: <ul style="list-style-type: none"> <li>▫ Section 5.20 – Quarry Site Selection and Development Requirements.</li> </ul> </li> </ul>	Yes

VC Subcomponent	Indicators	Project Phase	Project Component or Activity	Potential Effect	Mitigation Measures	Predicted Net Effect
Terrain/topography	<ul style="list-style-type: none"> <li>▪ The amount of area disturbed by the Project.</li> <li>▪ Erosion and sedimentation.</li> <li>▪ Changes to drainage patterns.</li> <li>▪ Decreased slope stability and increased change of slumping.</li> <li>▪ Changes to vegetation composition.</li> <li>▪ Visual changes to the landscape.</li> </ul>	Construction	<ul style="list-style-type: none"> <li>▪ Vegetation Clearing and Grubbing: Clearing and grubbing of vegetation including removal, disposal and/or chipping.</li> <li>▪ Construction and Use of Supportive Infrastructure: Construction of camps, access roads and watercourse crossings, laydown/storage areas, and aggregate extraction and processing areas.</li> <li>▪ Construction of Road: removal and stockpiling of organics, subgrade excavation, placement of fill and gravel, grading and drainage work.</li> <li>▪ Construction of Structures at Waterbody Crossings: Culverts and bridges – foundations (e.g., pile driving and concrete works), bridge girders, bridge decks, install of culverts.</li> <li>▪ Decommissioning / Closure of Temporary Aggregate Extraction and Processing Areas (pits and quarries): Demobilization of extracting and processing equipment, grading and site reclamation/revegetation. This also includes formalizing / re-purposing select pits and quarries proposed as permanent Project components during operations.</li> <li>▪ Completion of Project-Wide Clean-up, Site Restoration / Reclamation and Demobilization: Clean-up of excess materials, site revegetation and demobilization of equipment and materials.</li> </ul>	Alteration of Topography and Terrain.	<ul style="list-style-type: none"> <li>▪ Limiting disturbance footprint to the permanent development area and associated temporary supportive infrastructure during construction.</li> <li>▪ The disturbed areas will be restored with native soils (removed or excavated in the same area) or materials that are more permeable than the native soils, where practical, and covered by native vegetation.</li> <li>▪ Minimizing disturbance footprint to previously disturbed areas when completing decommissioning, restoration and clean-up activities during final close-out of the construction phase.</li> <li>▪ Installing of drainage/equalization culverts along the east to west section of the road within the peatlands.</li> <li>▪ Maintaining drainage in the work area to minimize ponding or channelization of surface flow.</li> <li>▪ Re-contour, stabilize, and re-vegetate disturbed areas to suit original conditions and restore drainage patterns.</li> <li>▪ Conduct progressive restoration activities throughout the construction, maintenance and decommissioning processes.</li> <li>▪ A Site Restoration and Monitoring Plan will be developed and implemented for the Project; this plan will focus on native species restoration on areas no longer required for project activities.</li> <li>▪ An Erosion and Sediment Control Plan will be developed and implemented during construction.</li> <li>▪ Refer to Appendix E – Mitigation Measures: <ul style="list-style-type: none"> <li>▫ Section 5.1 – Clearing and Grubbing;</li> <li>▫ Section 5.6 – Working Within or Near Fish Bearing Watercourses;</li> <li>▫ Section 5.7 – Temporary Watercourse Crossings;</li> <li>▫ Section 5.8 – Temporary Watercourse Diversions;</li> <li>▫ Section 5.11 – Bridge and Culvert Installation;</li> <li>▫ Section 5.16 – Erosion and Sediment Control; and</li> <li>▫ Section 5.21 – Site Decommissioning and Rehabilitation.</li> </ul> </li> </ul>	Yes
Soil quantity and Soil Quality	<ul style="list-style-type: none"> <li>▪ Vegetation that shows stress, bare patches of soil where vegetation will not establish.</li> <li>▪ Soil compaction, rutting, and admixing.</li> <li>▪ The formation of erosion rills and gullies (water erosion).</li> <li>▪ Excessive dust generation and wind erosion.</li> </ul>	Construction	<ul style="list-style-type: none"> <li>▪ Surveying: Ground surveys are conducted to stake (physically delineate) the road ROW and supportive infrastructure components of the Project.</li> <li>▪ Vegetation Clearing and Grubbing: Clearing and grubbing of vegetation including removal, disposal and/or chipping.</li> <li>▪ Construction and Use of Supportive Infrastructure: Construction of camps, access roads and watercourse crossings, laydown/storage areas, and aggregate extraction and processing areas.</li> <li>▪ Construction of Road: removal and stockpiling of organics, subgrade excavation, placement of fill and gravel, grading and drainage work.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Change to Soil Quality and/or Productivity.</li> <li>▪ Loss of Soil Resources.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Minimizing disturbance footprint to previously disturbed areas during decommissioning.</li> <li>▪ Limiting disturbance footprint to the permanent development area and associated temporary supportive infrastructure during construction.</li> <li>▪ Re-contour, stabilize, and re-vegetate disturbed areas to suit original conditions.</li> <li>▪ An Erosion and Sediment Control Plan will be developed and implemented during construction.</li> <li>▪ Implement mitigation measures for soil management, construction and grading, including: <ul style="list-style-type: none"> <li>▫ Using equipment with low ground pressure alongside road and soft soil areas;</li> <li>▫ Striping and stockpiling topsoil from road and other work areas where practicable;</li> <li>▫ Conducting work under frozen or dry ground conditions where reasonable possible;</li> </ul> </li> </ul>	Yes

VC Subcomponent	Indicators	Project Phase	Project Component or Activity	Potential Effect	Mitigation Measures	Predicted Net Effect
Soil quantity and Soil Quality (Cont'd)			<ul style="list-style-type: none"> <li>▪ Decommissioning / Closure of Temporary Aggregate Extraction and Processing Areas (pits and quarries): Demobilization of extracting and processing equipment, grading and site reclamation/revegetation. This also includes formalizing / re-purposing select pits and quarries proposed as permanent Project components during operations.</li> <li>▪ Decommissioning of Temporary Construction Camps, Access Roads and Laydown / Storage Areas: Grading and site reclamation/revegetation. This also includes formalizing / re-purposing select access roads to permanent pits and quarries and a construction camp to an operations and maintenance facility as Project components for use during operations.</li> <li>▪ Completion of Project-Wide Clean-up, Site Restoration / Reclamation and Demobilization: Clean-up of excess materials, site revegetation and demobilization of equipment and materials.</li> </ul>		<ul style="list-style-type: none"> <li>▫ Covering or reseeded soil stockpiles and exposed slopes;</li> <li>▫ Limiting grading and soil disturbance on slopes and near waterbodies;</li> <li>▫ Protocols and procedures for cleaning equipment brought to site to control invasive species; and</li> <li>▫ Monitoring soil conditions during work and changing or adapting mitigation measures, as necessary.</li> <li>▪ The disturbed areas will be restored with native soils (removed or excavated in the same area) or materials that are more permeable than the native soils, where practical, and covered by native vegetation. This can help restore or increase infiltration rates and groundwater levels and prevent or reduce soil erosion.</li> <li>▪ Conduct progressive restoration activities throughout the construction, maintenance and decommissioning processes. The following management plans will be developed and implemented for the Project: <ul style="list-style-type: none"> <li>▫ Soil Management Plan;</li> <li>▫ Erosion and Sediment Control Plan;</li> <li>▫ Site Restoration and Monitoring Plan;</li> <li>▫ Construction Waste Management Plan; and</li> <li>▫ Spill Prevention and Emergency Response Management Plan.</li> </ul> </li> <li>▪ Refer to Appendix E – Mitigation Measures: <ul style="list-style-type: none"> <li>▫ Section 5.1 – Clearing and Grubbing;</li> <li>▫ Section 5.2 – Petroleum Handling and Storage;</li> <li>▫ Section 5.3 – Spill Prevention and Emergency Response;</li> <li>▫ Section 5.5 – Materials Handling and Storage;</li> <li>▫ Section 5.6 – Working Within or Near Fish Bearing Watercourses;</li> <li>▫ Section 5.7 – Temporary Watercourse Crossings;</li> <li>▫ Section 5.8 – Temporary Watercourse Diversions;</li> <li>▫ Section 5.11 – Bridge and Culvert Installation;</li> <li>▫ Section 5.12 – Blasting Near a Watercourse;</li> <li>▫ Section 5.16 – Erosion and Sediment Control;</li> <li>▫ Section 5.20 – Quarry Site Selection and Development Requirements; and</li> <li>▫ Section 5.21 – Site Decommissioning and Rehabilitation.</li> </ul> </li> </ul>	

VC Subcomponent	Indicators	Project Phase	Project Component or Activity	Potential Effect	Mitigation Measures	Predicted Net Effect
Soil quantity and Soil Quality (Cont'd)	<ul style="list-style-type: none"> <li>▪ Vegetation that shows stress, bare patches of soil where vegetation will not establish.</li> <li>▪ The formation of erosion rills and gullies.</li> <li>▪ Excessive dust generation and wind erosion.</li> </ul>	Construction and Operations	<ul style="list-style-type: none"> <li>▪ Emissions, Discharges and Wastes: Noise, air emissions / GHGs, water discharge, and hazardous and non-hazardous wastes.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Change to Soil Quality.</li> <li>▪ Loss of Soil Resources.</li> </ul>	<ul style="list-style-type: none"> <li>▪ No application of sand or salt is currently proposed for de-icing of the WSR during the winter season. However, sand may be applied in select locations based on road safety concerns.</li> <li>▪ Dust control measures will be implemented when deemed necessary.</li> <li>▪ An ongoing follow-up monitoring program (post-construction) will be implemented during the operations and maintenance phase of the Project.</li> <li>▪ Prior to the development of quarry and pit sites the potential for ARD will be assessed. If the Project chooses to use materials or sites that are identified as having uncertain or known potential for ML/ARD, mitigative measures, sensitive receptor identification, and/or supplemental baseline studies will be completed in future development phases. Amongst other things, this may include infrastructure to divert or lower the water table, sub-drains, and/or ongoing monitoring of surface and groundwater.</li> <li>▪ The following management plans will be developed and implemented for the Project: <ul style="list-style-type: none"> <li>▫ Waste Management Plan; and</li> <li>▫ Spill Prevention and Emergency Response Management Plan. This plan will lay out the requirements for training and procedures for the storage, handling, and transportation of potential contaminants, as well as equipment operation and maintenance intended to prevent spills from occurring. Designated refuelling areas will be established, and spill kits will be deployed to at-risk areas and equipment. The plan will also communicate spill response procedures including emergency response, containment, clean-up, disposal, and reporting. The spill prevention and response plan will follow industry standard mitigation measures and all applicable regulatory requirements.</li> </ul> </li> <li>▪ Refer to Appendix E – Mitigation Measures: <ul style="list-style-type: none"> <li>▫ Section 5.2 – Petroleum Handling and Storage;</li> <li>▫ Section 5.3 – Spill Prevention and Emergency Response;</li> <li>▫ Section 5.5 – Materials Handling and Storage;</li> <li>▫ Section 5.16 – Erosion and Sediment Control;</li> <li>▫ Section 5.17 – Concrete Washout Management Practices;</li> <li>▫ Section 5.18 – Dust Control Practices; and</li> <li>▫ Section 5.20 – Quarry Site Selection and Development Requirements.</li> </ul> </li> </ul>	Yes

VC Subcomponent	Indicators	Project Phase	Project Component or Activity	Potential Effect	Mitigation Measures	Predicted Net Effect
Soil quantity and Soil Quality (Cont'd)	<ul style="list-style-type: none"> <li>▪ Vegetation that shows stress, bare patches of soil where vegetation will not establish.</li> <li>▪ Soil compaction, rutting, and admixing.</li> <li>▪ The formation of erosion rills and gullies.</li> <li>▪ Excessive dust generation and wind erosion.</li> </ul>	Operations	<ul style="list-style-type: none"> <li>▪ Operation, Maintenance and Repair of Road: Includes: vegetation management control within road ROW; repairs/resurfacing of road granular surface and shoulders; dust control; winter/seasonal maintenance (i.e., snow clearing); road drainage system cleanout/repairs to culverts, ditches and drainage outfalls; rehabilitation and repairs to structural culverts and bridges; and road patrols for inspection.</li> <li>▪ Operation of Pits, Quarries and Maintenance Yard/Facility: Includes periodic extraction and blasting and processing operations (i.e., crushing, screening) and stockpiling of rock and aggregate materials. Also includes operation and repairs of Maintenance Yard/Facility and components within (office buildings, parking, storage of equipment and materials).</li> </ul>	<ul style="list-style-type: none"> <li>▪ Change to Soil Quality and Productivity.</li> <li>▪ Loss of Soil Resources.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Limiting disturbance footprint to the permanent development area and associated temporary supportive infrastructure during construction.</li> <li>▪ Implement mitigation measures for soil management, construction and grading as identified above for construction phase.</li> <li>▪ The following management plans will be developed and implemented for the Project: <ul style="list-style-type: none"> <li>▫ Spill Prevention and Emergency Response Management Plan;</li> <li>▫ Soil Management Plan; and</li> <li>▫ Air Quality and Dust Control Management Plan.</li> </ul> </li> <li>▪ Refer to Appendix E – Mitigation Measures: <ul style="list-style-type: none"> <li>▫ Section 5.2 – Petroleum Handling and Storage;</li> <li>▫ Section 5.3 – Spill Prevention and Emergency Response;</li> <li>▫ Section 5.5 – Materials Handling and Storage;</li> <li>▫ Section 5.16 – Erosion and Sediment Control;</li> <li>▫ Section 5.17 – Concrete Washout Management Practices;</li> <li>▫ Section 5.18 – Dust Control Practices; and</li> <li>▫ Section 5.20 – Quarry Site Selection and Development Requirements.</li> </ul> </li> </ul>	Yes

## 6.5 Characterization of Net Effects

Net effects are defined as the effects of the Project that remain after application of proposed mitigation measures. The effects assessment follows the general process described in Section 5 – Environmental Assessment / Impact Assessment Approach. The focus of the effects assessment is on predicted net effects, which are the effects that remain after application of proposed mitigation measures. Potential effects with no predicted net effect after implementation of mitigation measures are not carried forward to the net effects characterization or the cumulative effects assessment.

**Table 6-13** presents definitions for net effects criteria. These criteria are considered together in the assessment, along with context derived from existing conditions and proposed mitigation measures, to characterize predicted net effects from the Project on the Geology, Terrain, and Soils VC.

**Table 6-13: Criteria for Characterization of Predicted Net Effects on Geology, Terrain, and Soils VC**

Characterization Criteria	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	Direction relates to the value of the effect in relation to the existing conditions.	<p><b>Positive</b> – Net gain or benefit; effect is desirable.</p> <p><b>Neutral</b> – No change compared with baseline conditions and trends.</p> <p><b>Negative</b> – Net loss or adverse effect; effect is undesirable.</p>
Magnitude	Magnitude is the amount of change in measurable parameters or the VC relative to existing conditions.	<p><b>Negligible</b> – No measurable change.</p> <p><b>Low</b> – A measurable change that is at the upper limits or slightly exceed the characteristic range of baseline conditions or guideline values.</p> <p><b>Moderate</b> – A measurable change that is potentially detrimental but manageable.</p> <p><b>High</b> – A measurable change that is substantially detrimental.</p>
Geographic Extent	Geographic extent refers to the spatial area over which a net effect is expected to occur or can be detected within the Project Footprint, Local Study Area (LSA), or Regional Study Area (RSA).	<p><b>Project Footprint</b> – The effect is confined to the Project Footprint.</p> <p><b>Local Study Area</b> – The effect is confined to the LSA.</p> <p><b>Regional Study Area</b> – the effect extends beyond the LSA boundary but is confined within the RSA.</p>
Timing	Timing criteria indicate the timing (e.g., dates or seasons) importance of the net effect.	<p><b>Non-sensitive:</b> Frozen conditions (winter).</p> <p><b>Sensitive:</b> Non-frozen conditions (spring, summer, fall).</p>
Duration	Duration is the period of time required until the measurable indicators or the VC returns to its existing (baseline) condition, or the net effect can no longer be measured or otherwise perceived.	<p><b>Short-term</b> – Net effect restricted to no more than the duration of the construction phase (approximately 5 years).</p> <p><b>Medium-term</b> – Net effect extends through the Operations Phase of the Project (75-year life cycle).</p> <p><b>Long-term</b> – Net effect extends beyond the Operations Phase (greater than 75 years).</p> <p><b>Permanent</b> – Recovery to baseline conditions unlikely.</p>

Characterization Criteria	Description	Quantitative Measure or Definition of Qualitative Categories
Frequency	Frequency refers to the rate of occurrence of an effect over the duration of the Project or in a specific phase.	<b>Infrequent</b> – The effect is expected to occur rarely. <b>Frequent</b> – The effect is expected to occur intermittently. <b>Continuous</b> – the effect is expected to occur continually.
Context	Context considers sensitivity and resilience of the VC to project-related change.	<b>Sensitive</b> – With measurable changes in the short-term. <b>Resilient</b> – No measurable changes in the short-term.
Input from Indigenous Peoples	Views of the Indigenous communities and groups in assigning the criteria to be used and in characterizing the effects.	<b>Not applicable</b> – No input on net effects criteria has been received during the engagement and consultation.
Reversibility	Reversibility describes whether a measurable indicator or the VC can return to its existing condition after the project activity ceases.	<b>Reversible</b> – The net effect is likely to be reversed after activity completion and rehabilitation. <b>Irreversible</b> – The net effect is unlikely to be reversed.
Likelihood of Occurrence	Likelihood of occurrence is a measure of the likelihood that an activity will result in an effect.	<b>Unlikely</b> – The effect is not likely to occur. <b>Possible</b> – The effect may occur, but is not likely. <b>Probable</b> – The effect is likely to occur. <b>Certain</b> – The effect will occur.

## 6.5.1 Potential Effect Pathways Not Carried Through for Further Assessment

Potential effect pathways are expected to be eliminated through the implementation of mitigation measures for the following:

- Changes to soil quality due to project-related activities involving soil handling. Administrative and engineered controls will be implemented to eliminate the potential for significant reduction of soil quality.
- Changes to soil quality due to spills and the release of deleterious substances. Administrative and engineered controls will be implemented to eliminate the potential for a spill or the release of substances that may impact the environment. These changes will be addressed in Section 23 – Accident and Malfunctions.
- Alterations to Geochemistry from ARD and ML from aggregate. No materials with the potential for ARD or ML will be used for road construction and maintenance.

Potential effects that remain following the implementation of mitigation measures are carried forward for further assessment (**Section 6.5.2**).



## 6.5.2 Predicted Net Effects

An effect on the Geology, Terrain, and Soils VC may remain after the implementation of mitigation measures. The following subsections provide detailed description and characterization of the predicted net effects.

The predicted net effects include:

- Alteration of geomorphology and geochemistry due to:
  - Blasting, excavation, backfilling, and grading for construction; and
  - Use of supportive infrastructure, the constructed road, and structures at waterbodies.
- Alteration of Topography and Terrain due to:
  - Earthworks for construction;
  - Use of supportive infrastructure, the constructed road and structures at waterbodies; and
  - Decommissioning and closure of temporary aggregate extraction and processing areas, and construction camps, access roads and laydown / storage areas.
- Changes to Soil Quality due to:
  - Surveying, vegetation clearing, and grubbing;
  - Construction grading, backfilling, excavation and blasting activities;
  - Use of supportive infrastructure, the constructed road, and structure at waterbodies;
  - Decommissioning and closure of temporary aggregate extraction and processing areas;
  - Construction camps, access roads, and laydown/storage area emissions, discharges and wastes;
  - Maintenance and repair of the road; and
  - Operation of pits, quarries and maintenance yard/facility.
- Loss of Soil Resources due to:
  - Surveying, vegetation clearing, and grubbing;
  - Construction grading, backfilling, excavation and blasting activities;
  - Use of supportive infrastructure, the constructed road, and structure at waterbodies;
  - Decommissioning and closure of temporary aggregate extraction and processing areas;
  - Construction camps, access roads, and laydown/storage area emissions, discharges and wastes;
  - Maintenance and repair of the road; and
  - Operation of pits, quarries and maintenance yard/facility.

### 6.5.2.1 Alteration of Geomorphology and Geochemistry

Works associated with aggregate extracting and use of aggregates including blasting, excavation, backfilling, grading for construction, use of supportive infrastructure, the constructed road, and structures at waterbodies are predicted to result in loss of geological features and is considered to be a negative effect. The magnitude of the effect is considered low as project activities will result in a minor alteration/loss of geologic features that are beyond what could naturally occur on the landscape; and this effect is limited to the Project Footprint. **Table 6-14** shows the disturbance of geological features in the Project Footprint relative to the amount present in the LSA and RSA.



**Table 6-14: Affected Geological Features in the Project Footprint Relative to the Amount Present in the LSA and RSA**

Geological Unit	Affected Area in the Project Footprint (km <sup>2</sup> )	Area Present in LSA (km <sup>2</sup> )	Relative Disturbance in LSA (%)	Area Present in RSA (km <sup>2</sup> )	Relative Disturbance in RSA (%)
Till	3.79	121.16	3.13	614.32	0.62
Glaciofluvial ice-contact deposits	0.05	1.54	3.24	7.77	0.64
Organic deposits	1.51	82.75	1.83	556.42	0.27
<b>Total Area</b>	<b>5.48</b>	<b>214.31</b>	<b>2.56</b>	<b>1273.45</b>	<b>0.43</b>

The effect timing is negligible and will occur during non-sensitive and sensitive periods. The duration of effects from loss of geologic features is considered permanent. Impacts on the geologic environment are challenging to reclaim or restore, therefore effective mitigation planning is crucial to minimize the effect. The effect is expected to be continuous during construction and infrequent during operations. The effect is irreversible, as geologic features are not expected to be recovered or restored after site reclamation. The effect is certain to occur as activities resulting in the loss of geologic features are integral to the construction of the Project.

### 6.5.2.2 Alteration of Topography and Terrain

Earthworks are part of construction phase of the Project are expected to cause alteration to topography and terrain in a negative direction and is not beneficial to the environment. The magnitude of the effect is considered moderate as activities that can result in the alteration of topography beyond what could naturally occur on the landscape but are manageable. The effect is limited to the Project Footprint. Effect timing is negligible as disruption will occur during non-sensitive and sensitive periods. The duration of effects from alteration to topography and terrain features is considered medium-term term as alterations to the landscape may be reclaimed after the life of the project. The frequency of the effect is expected to be continuous during construction. The effect is reversible; alterations of topography and terrain features are expected to be recovered or restored after decommissioning and site reclamation. The effect is certain to occur as activities resulting in the alterations of topography and terrain features are integral to the construction of project-related infrastructure.

### 6.5.2.3 Change to Soil Quality

Changes to soil quality are predicted as a result of the project-related activities as listed in **Section 6.5.2**. The effect is considered negative as changes to soil quality can have an impact on the environment and ecosystem function. The magnitude of the effect is considered moderate as activities that can result in the changes to soil quality beyond what could naturally occur on the landscape. The effect is limited to the disturbed areas within the Project Footprint. The impact on soil resources is anticipated to be moderate due to the abundance of soil resources on the landscape. Effect timing is negligible as disruption will occur during non-sensitive and sensitive periods. The duration of the majority of effects from changes to soil quality is considered short-term as they are anticipated to only be impacted during the construction phase of the project, with only a few effects that would extend into the operations phase being characterized as medium-term. The effect frequency is expected to be continuous during construction and infrequently during operations. The effect is reversible, changes to soil quality are expected to be recovered or restored after site reclamation. The effect is certain to occur as activities resulting in

changes to soil quantity, distribution, and quality are integral to the construction of project-related infrastructure.

#### **6.5.2.4 Loss of Soil Resources**

Loss of soil resources will occur as result of the project-related activities listed in **Section 6.5.2**. The effect is considered negative as loss of soil resources can have an impact on the environment and ecosystem function. The magnitude of the effect is considered moderate as activities that can result in the loss of soil resources beyond what could naturally occur on the landscape. The effect is limited to the disturbed areas within the Project Footprint. The predicted area of soil loss within the Project Footprint is 3.25 km<sup>2</sup> that represents 1.64% of the LSA and 0.25% of the RSA.

Effect timing is negligible as disruption will occur during non-sensitive and sensitive periods. The duration of the majority of effects from loss of soil resources is considered short-term as they are anticipated to only be impacted during the construction phase of the Project, with only a few effects that would extend into the operations phase being characterized as medium-term. The effect is expected to be continuous during construction and infrequently during operations. The effect is reversible, loss of soil resources will be recovered or restored after site reclamation. The effect is certain to occur as activities resulting in changes to soil quantity, distribution, and quality are integral to the construction of project-related infrastructure.

#### **6.5.3 Summary**

A summary of the characterization of net effects is provided in **Table 6-15**.



**Table 6-15: Summary of Predicted Net Effects on Geology, Terrain, and Soils VC**

Predicted Net Effect	Net Effects Characterization									
	Project Phase	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Context	Reversibility	Likelihood of Occurrence
<b>Alteration of Geomorphology and Geochemistry</b>										
Blasting, excavation, backfilling, and grading for construction	Construction	Negative	Low	Project Footprint	Sensitive and Non-Sensitive	Permanent	Continuous	Sensitive	Irreversible	Certain
Use of supportive infrastructure, the constructed road, and structures at waterbodies	Construction	Negative	Low	Project Footprint	Sensitive and Non-Sensitive	Permanent	Continuous	Sensitive	Irreversible	Certain
<b>Alteration of Topography and Terrain</b>										
Earthworks for construction	Construction	Negative	Moderate	Project Footprint	Sensitive and Non-Sensitive	Short-term	Continuous	Sensitive	Reversible	Certain
Use of supportive infrastructure, the constructed road and structures at waterbodies	Construction and Operations	Negative	Low	Project Footprint	Sensitive and Non-Sensitive	Medium-term	Continuous	Sensitive	Reversible	Certain
Decommissioning and closure of temporary aggregate extraction and processing areas, and construction camps, access roads and laydown / storage areas	Construction and Operations	Positive	Low	Project Footprint	Sensitive and Non-Sensitive	Short-term	Continuous	Sensitive	Reversible	Certain
<b>Change to Soil Quality</b>										
Surveying, vegetation clearing, and grubbing	Construction	Negative	Low	Project Footprint	Sensitive and Non-Sensitive	Short-term	Continuous	Sensitive	Reversible	Certain
Construction activities	Construction	Negative	Moderate	Project Footprint	Sensitive and Non-Sensitive	Medium-term	Continuous	Sensitive	Reversible	Certain
Use of supportive infrastructure, the constructed road, and structure at waterbodies	Construction and Operations	Negative	Low	Project Footprint	Sensitive and Non-Sensitive	Medium-term	Continuous	Sensitive	Reversible	Certain
Decommissioning and closure of temporary aggregate extraction and processing areas	Construction and Operations	Positive	Low	Project Footprint	Sensitive and Non-Sensitive	Short-term	Continuous	Sensitive	Reversible	Certain
Construction camps, access roads, and laydown/storage area emissions, discharges and wastes	Construction	Negative	Low	Project Footprint	Sensitive and Non-Sensitive	Short-term	Continuous	Sensitive	Reversible	Certain
<b>Change to Soil Quality (Cont'd)</b>										
Maintenance and repair of the road	Operations	Negative	Low	Project Footprint	Sensitive and Non-Sensitive	Medium-term	Continuous	Sensitive	Reversible	Certain
Operation of pits, quarries and maintenance yard/facility	Construction and Operations	Negative	Low	Project Footprint	Sensitive and Non-Sensitive	Medium-term	Continuous	Sensitive	Reversible	Certain
<b>Loss of Soil Resources</b>										
Surveying, vegetation clearing, and grubbing	Construction	Negative	Low	Project Footprint	Sensitive and Non-Sensitive	Short-term	Continuous	Sensitive	Reversible	Certain
Construction activities	Construction	Negative	Moderate	Project Footprint	Sensitive and Non-Sensitive	Medium-term	Continuous	Sensitive	Reversible	Certain
Use of supportive infrastructure, the constructed road, and structure at waterbodies	Construction	Negative	Low	Project Footprint	Sensitive and Non-Sensitive	Medium-term	Continuous	Sensitive	Reversible	Certain
Decommissioning and closure of temporary aggregate extraction and processing areas	Construction and Operations	Positive	Low	Project Footprint	Sensitive and Non-Sensitive	Short-term	Continuous	Sensitive	Reversible	Certain
Construction camps, access roads, and laydown/storage area emissions, discharges and wastes	Construction	Negative	Low	Project Footprint	Sensitive and Non-Sensitive	Short-term	Continuous	Sensitive	Reversible	Certain
Maintenance and repair of the road	Operations	Negative	Low	Project Footprint	Sensitive and Non-Sensitive	Medium-term	Continuous	Sensitive	Reversible	Certain
Operation of pits, quarries and maintenance yard/facility	Construction and Operations	Negative	Low	Project Footprint	Sensitive and Non-Sensitive	Medium-term	Continuous	Sensitive	Reversible	Certain

Note: Refer to Table 6-13 for definitions of categories for net effect characterization

## 6.6 Determination of Significance

Several methodologies can be used to determine whether an adverse environmental effect is significant or not significant, as outlined in the Interim Technical Guidance Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the former *Canadian Environmental Assessment Act* (CEA Agency, 2018), and relevant to the *Impact Assessment Act* (2019). As presented in Section 5.2.6 and Table 5-7, a qualitative aggregation method is used for determination of significance based on the sequential interaction among the magnitude, geographic extent, and duration criteria for net effects. The net effects criteria are presented in Table 6-13. Consideration is also given to potential management concerns and concerns of Indigenous communities and groups, the public, government agencies, and stakeholders raised during engagement and consultation activities conducted for the Project (Table 6-2 and Table 6-3).

As summarized in Table 6-15, there are no situations where a predicted net effects on the Geology, Terrain, and Soils VC are considered high in magnitude, regional in extent, and long-term to permanent in duration. Therefore, it is concluded that the predicted net effects of construction and operations of the Project on Geology, Terrain, and Soils VC are not significant.

## 6.7 Cumulative Effects

In addition to assessing the net environmental effects of the Project, the assessment for Geology, Terrain, and Soils VC also evaluates and assesses the significance of net effects from the Project that overlap temporally and spatially with effects from other past, present and reasonably foreseeable developments (RFDs) and activities (i.e., cumulative effects).

For a valued component that has identified net effects where the magnitude was determined to be moderate or high, it is necessary to determine if the effects from the Project interact both temporally and spatially with the effects from one or more past, present RFDs or activities, since the combined effects may differ in nature or extent from the effects of individual Project activities. Where information is available, the cumulative effects assessment estimates or predicts the contribution of effects from the Project and other human activities on the criteria, in the context of changes to the natural, health, social or economic environments.

For this Geology, Terrain, and Soils VC assessment, the net effects in **Section 6.5** that are characterized as having a likelihood of occurrence of “probable” or “certain” and a “moderate” to “high” magnitude have been carried forward to the cumulative effects assessment. Net effects with this characterization are most likely to interact with other RFD and activities.

The cumulative effects assessment for the Project is completed at the regional scale (i.e., VC specific RSA). The cumulative effects assessment for each VC is primarily qualitative and describes how the interacting effects of human activities and natural factors are predicted to affect indicators for each VC. The assessment is presented as a reasoned narrative describing the outcomes of cumulative effects for each VC.

The predicted net effects of the Project on the Geology, Terrain, and Soils VC that are carried forward for the assessment of cumulative effects within the Geology, Terrain, and Soils RSA include:

- Alteration of geomorphology;



- Change in soil quality and quantity (i.e. loss of soil); and
- Change/alteration of terrain and topography.

Results of the cumulative effects assessment for the Geology, Terrain, and Soils VC with consideration of RFDs and activities are presented in Section 21.

## 6.8 Prediction Confidence in the Assessment

The confidence in the net effects assessment for Geology, Terrain, and Soils VC is moderate considering that the mitigation measures described in **Section 6.4** and Appendix E (Mitigation Measures) are based on industry best management practices that are well-understood, accepted, and have been applied to typical Ontario highway and road construction projects. Although there are some uncertainties in the assessment, they have been minimized or reduced by making some conservative assumptions and using professional judgements based on past experiences in other transportation projects. The results of this assessment can be used as guidance on further geology, terrain and soil studies during the detail design phase.

## 6.9 Predicted Future Condition of the Environment if the Project Does Not Proceed

The Project lies within un-surveyed/un-developed Ontario Crown lands and Webequie First Nation Reserve lands. There are existing mineral exploration activities (particularly near the east end of the proposed WSR) and it is predicted/assumed that there will be other proposed future mining developments in the area, which is referred to as the Ring of Fire area. Therefore, it is likely that other road construction projects would occur to support the current and future mining activities in the Ring of Fire area if this Project would not proceed.

Future road construction projects are anticipated to have similar effects on Geology, Terrain, and Soils VC. Without construction of the proposed WSR, the anticipated future state of geology, terrain, and soil resources is expected to remain largely consistent with the existing conditions described in **Section 6.2**.

## 6.10 Follow-Up and Monitoring



The Project invites community members to participate in developing and implementing programs, which includes one to monitor changes in the soil that may be affecting plant growth (particularly blueberries).

The purposes of the follow-up and monitoring programs are to:

- Verify environmental effects predictions made during the EA/IA for the Project;
- Provide data with which to evaluate the effectiveness of mitigation measures and modify or enhance these measures, where necessary;
- Provide data with which to implement adaptive management measures for improving future environmental protection activities;



- Document additional measures of adaptive measures to improve future environmental protection activities; and
- Document compliance with required conditions as stipulated in permits, approvals, licenses and/or authorizations.

The recommended monitoring program related to Geology, Terrain, and Soils VC are described as follows:

- Inspect active aggregate pit and quarries frequently for geochemical and stability issues. Inspections are to be completed during rock extraction and aggregate processing activities during construction and operation of the Project.
- On-site construction monitoring will be required during clearing and soil salvaging and management activities to prevent unnecessary losses or contamination of soil resources.
- Conduct frequent inspections of required erosion and sediment control measures as required by the Erosion and Sediment Control Plan, including documentation of corrective actions. Areas more susceptible to erosion should be monitored more frequently, with particular focus prior to, and after, rainfall events.
- During construction, conduct regular inspections of work areas to ensure that soil management and spill prevention mitigation measures are being implemented effectively.
- Following completion of construction work, post-construction inspections are recommended to ensure that soil conditions along the Project Footprint have been restored and are adequately stabilized to prevent erosion.

Additional details on the proposed follow-up and monitoring for the Project are described in Section 22 of this EAR/IS, Follow-up and Compliance Monitoring Programs.

## 6.11 References

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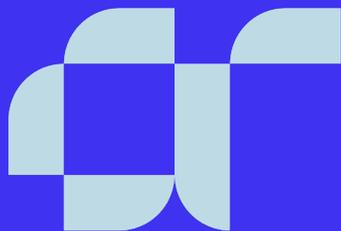
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