Technical Memo

H375035

2026-07-02

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From: Warren Hoyle, P. Geo.

cc: Clement Benoit, P. Eng

Brookfield Renewable
Trail Road BESS Site

Hydrogeological and Terrain Analysis Study

1. Introduction

Hatch Ltd. (Hatch) has been retained by Brookfield BRP Canada Corporation (Brookfield) to provide hydrogeological and terrain analysis services as part of the Trail Road Battery Energy Storage System (BESS) project (Project). The Trail Road BESS project is directly responding to the Independent Electricity System Operator's (IESO) request to increase supply and capacity to meet Ontario's growing electricity expenditure and demand by constructing an energy storage facility. The facility will increase renewable grid capacity and storage, enhance flexible grid operations and provide a low carbon initiative to avoid greenhouse gas emissions by reducing reliance on higher carbon intensive facilities.

Brookfield is proposing to develop approximately 32,375 m^2 of a 214,483 m^2 property at 4186 William McEwan Drive in Richmond, Ontario, which is approximately 23 km south of Ottawa. The Project will consist of a BESS, a substation, access roads and associated electrical infrastructure. A key plan outlining the site location is shown on Figure 1-1.

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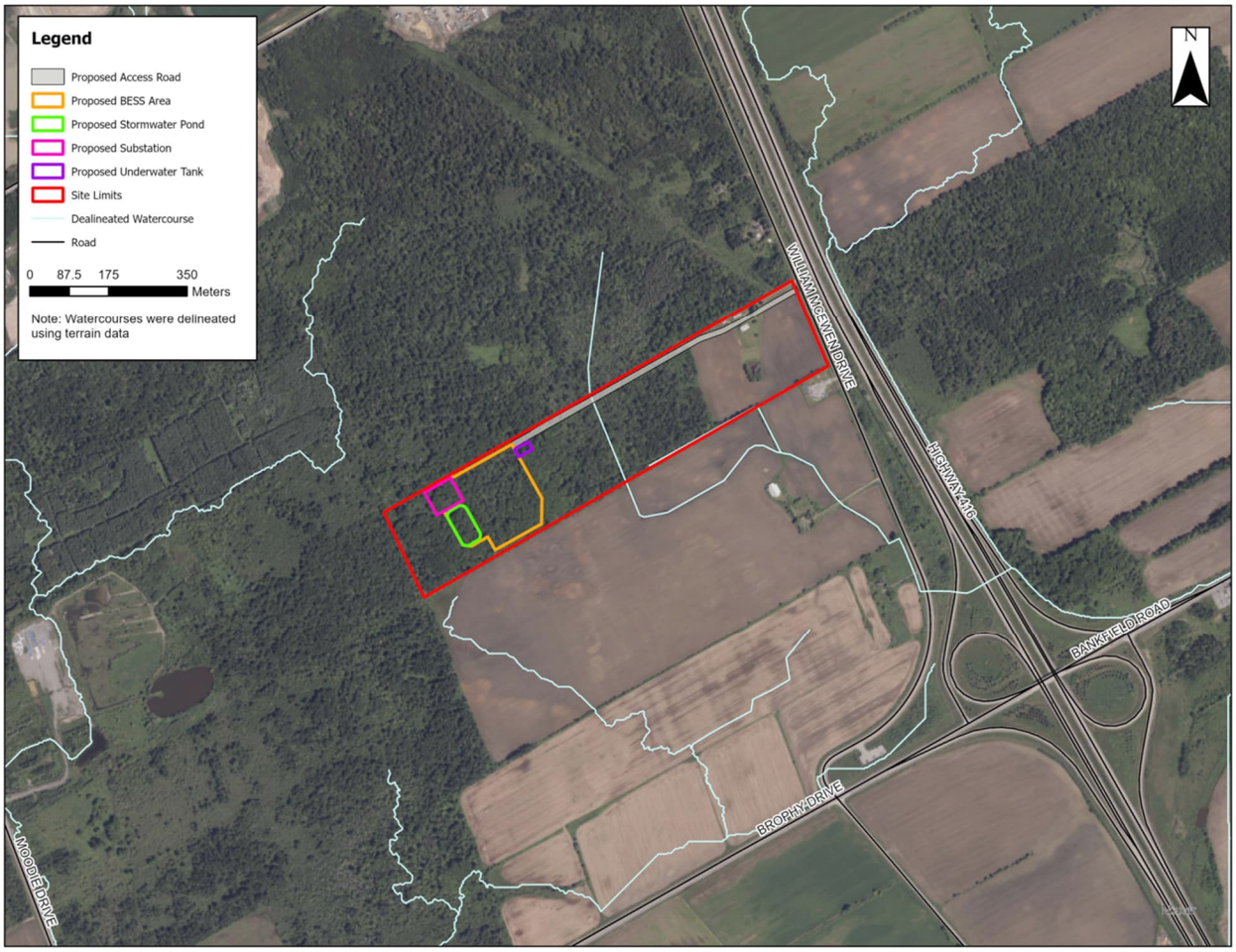


Figure 1-1: Overview of Limits of the Trail Road BESS Project

1.1 Study Area

The Project site is bounded by William McEwan Drive to the east, 1.0 km from Barnsdale Road to the north, 0.7 km from Moodie Drive to the west, and a southern demarcation line located approximately 0.5 km north of Edgeware Line. The Project site has an area of approximately 21.8 ha and falls under the coordinate system NAD83 (CSRS)/MTM Zone 9N of Ontario. The Project site is within the Rideau Falls - Rideau River watershed and the local authority is the Rideau Valley Conservation Authority (RVCA). The battery storage is located on the middle of the site with an area of approximately 22,694 m^2. The substation area is located west of the battery storage with an area of approximately 3,466 m^2. The total property area is approximately 217,700 m^2.

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1.2 Scope of Work

The objective of this hydrogeological and terrain analysis study is to:

1. Desktop Review:
    - Assess and utilize existing information and data within the study area to provide an effective hydrogeological and terrain analysis for the Project site.
2. Evaluate Hydrogeological Conditions of the study area.
3. Assess Terrain Characteristics:
    - Conduct a terrain analysis, including the identification of overburden geology, soil characteristics, and groundwater table elevations, to determine the suitability of the site for the proposed development.

The key objectives of this study are to:

- Provide a comprehensive hydrogeological and terrain assessment to support the proposed development at the Project site.

1.3 Hydrogeological and Terrain Analysis Guidelines

The following guidelines and standards were utilized to prepare the Hydrogeological and Terrain Analysis Study for the Project site:

- City of Ottawa (2021). Hydrogeological and Terrain Analysis Guidelines.
- City of Ottawa (2025). Sewer Design Guidelines.
- Central Lake Ontario Conservation, Credit Valley Conservation, Grand River Conservation Authority, Ganaraska Conservation, Toronto and Region Conservation Authority, and Nottawasaga Valley Conservation Authority (2017). Technical Guidelines for Flood Hazard Mapping.
- City of Ottawa (2025). Ottawa Sewer Design Guidelines. Appendix 11: Geotechnical and Hydrogeological Investigation Guidelines for Stormwater Management Facilities.
- GeologyOntario, Ministry of Mines, Ontario. Surficial Geology Maps.
- Rideau Valley Conservation Authority (RVCA). Flow and Water Levels Mapping.

2. Hydrogeological Assessment

2.1 Soil Conditions

The site soil conditions are required to properly and accurately demonstrate the hydrologic conditions of the Project site. The soil conditions have a direct impact on the surface runoff conditions, infiltration capacity of the soils, and ultimately influence the future design conditions. Figure 2-1 shows the locations of the boreholes on the site plan. Further information of the borehole logs is presented in Appendix A in the geotechnical investigation and design report (Hatch, 2025).

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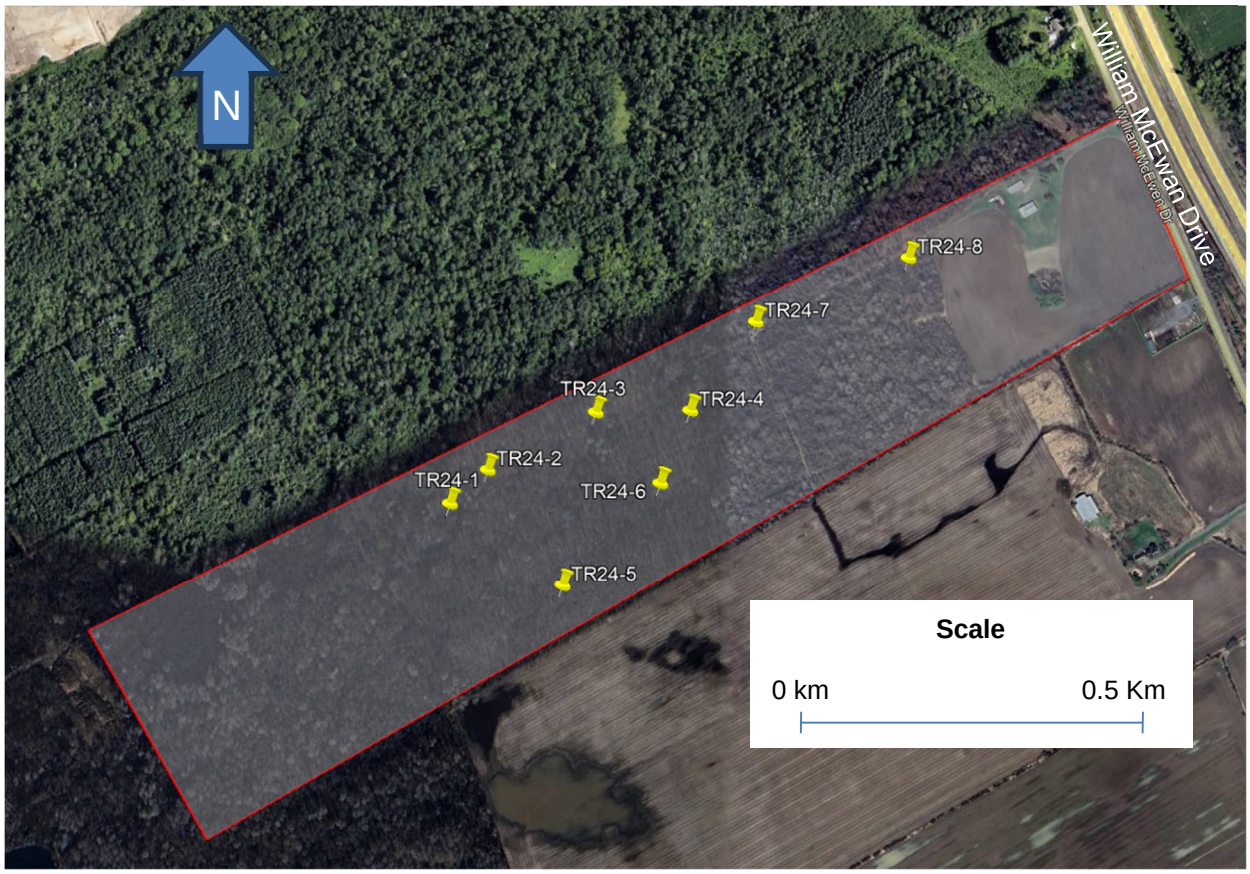


Figure 2-1: Borehole Locations within the Trail Road BESS Project Site

The geotechnical investigation indicated that the general soil profiles at all boreholes consists of non-organic topsoil (100 mm to 300 mm deep), silty sand to sandy silt (6.2 metres to 6.4 metres below ground surface (m bgs)), and sandy silt with gravel (at a depth of 9.5 m bgs).

The hydrologic soil group is expected to be soil group “B” for the Project site with an estimated Horton infiltration rate of 6 mm/h (minimum infiltration rate) to 80 mm/h (maximum infiltration rate) as per the Technical Guidelines for Flood Hazard Mapping by Ontario Conservation Authorities. The soil infiltration rates are provided for information. As a conservative approach, the groundwater levels are assumed to rise to the ground surface, and therefore, no additional infiltration measurements have been taken.

2.2 Field Investigation

A total of eight boreholes (Boreholes TR24-1 to TR24-8) were drilled across the Trail Road BESS Project site to evaluate subsurface soil and groundwater levels (GWLs). Note that two monitoring wells are installed in Boreholes TR24-1 and TR24-6. The borehole coordinates (NAD83/MTM Zone 9N), elevations, and depths are summarized in Table 2-1. The boreholes were drilled to depths ranging from 2.10 m bgs to 9.52 m bgs using a CME 45 Track Mounted drilling rig supplied and operated by OGS Inc. (OGS) of Almonte, Ontario.

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Table 2-1: Borehole Locations and Elevations

Borehole ID	Easting (m)	Northing (m)	Elevation (m)	Final Depth (m)	GW Depth and Elevation													
					28-11-2024		29-11-2024		30-11-2024		23-01-2025		16-07-2025		11-09-2025		25-03-2026	
					Depth (m)	Elev. (m)	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)
TR24-1	440,743.19	5,006,933.19	95.52	9.52	2.5	93.02	2.0	93.52	-	-	0.7	94.82	1.8	93.72	2.1	93.42	0.7	94.82
TR24-2	440,789.38	5,006,973.51	95.91	6.60	-	-	1.7	94.21	-	-	-	-	-	-	-	-		
TR24-3	440,920.81	5,007,041.96	96.22	6.60	5.0	91.22	-	-	-	-	-	-	-	-	-	-		
TR24-4	441,034.14	5,007,042.91	95.75	6.40	-	-	-	-	5.5	90.25	-	-	-	-	-	-		
TR24-5	440,878.04	5,006,833.83	95.48	6.45	-	-	4.5	90.98	-	-	-	-	-	-	-	-		
TR24-6	440,997.35	5,006,955.26	95.58	7.05	-	-	4.8	90.78	-	-	1.1	94.48	1.9	93.68	3.3	92.28	0.7	94.88
TR24-7	441,114.04	5,007,148.49	96.00	2.10	Dry		Dry		Dry		Dry		-	-	-	-		
TR24-8	441,299.36	5,007,224.54	96.26	2.10	Dry		Dry		Dry		Dry		-	-	-	-		

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2.2.1 *Hydrogeological Investigation Requirements in the City of Ottawa Sewer Design Guidelines*

Appendix 11 of the City of Ottawa Sewer Design Guidelines (2025) outlines the minimum hydrogeological investigation requirements for stormwater management (SWM) facilities. The field investigation completed for the Trail Road BESS Project addresses the applicable components of Appendix 11, as summarized below.

- Feasibility of SWM facility at the proposed location:

  Groundwater levels measured across the site (0.7 m to 5.5 m bgs) and the shallow subsurface stratigraphy (silty sand to sandy silt over dense till) indicate that a stormwater management pond (proposed in the SWM report by BBA) can be constructed at the proposed location. The pond bottom will be below grade and the permanent pool for the pond will be approximately even with the existing grade.

- Subsurface conditions relevant to pond construction:

  Subsurface stratigraphy, material types, and depths were confirmed through eight boreholes. Geotechnical considerations for side slopes, structural support, and maintenance access are addressed in the geotechnical investigation and design report (Hatch, 2025).

- Hydrogeologic conditions and groundwater levels:

  Groundwater levels were measured during three separate periods (November 2024, January 2025, September 2025, and March 2026). In the absence of spring high-water measurements, a conservative assumption of groundwater rising to grade has been adopted for design. This assumption is more conservative than the measured conditions.

- Vertical and horizontal groundwater gradients:

  Monitoring wells installed in Boreholes TR24-1 and TR24-6 provide groundwater elevation data adequate to characterize shallow groundwater conditions across the site. No artesian or upward vertical gradients were observed.

- Hydraulic conductivity and grain-size information:

  Soil types encountered (silty sand, sandy silt, and sandy silt with gravel) indicate moderate to low permeability, consistent with the Edwardsburg Sand Plain deposits. Grain-size and soil index properties have been characterized in the geotechnical investigation report (Hatch, 2025).

  Based on the above-grade pond design and non-infiltrating SWM strategy, additional field hydraulic conductivity testing is not required at this stage.

- Assessment of potential impacts to nearby features:

  The hydrogeological assessment identified no risks to nearby infrastructure or wells, and groundwater is not used on-site for water supply. Construction is not expected to require dewatering, as the pond bottom is slightly below grade with the permanent pool approximately even with the existing grade.

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- Groundwater response to construction and operation:

  As the SWM pond bottom will be slightly below grade, there may be some infiltration to the groundwater table, however, no significant influence on the groundwater flow or levels is expected.

Overall, the field investigation completed for the Project satisfies the hydrogeological components of Appendix 11 of the City of Ottawa Sewer Design Guidelines that are applicable to the pond designed above the groundwater table and does not necessitate additional fieldwork.

2.2.2 Subsurface Stratigraphy and Groundwater Observations

The borehole logs revealed primarily silty sand (SM) and sandy silt (ML) strata, interspersed with glacial till at greater depths in some locations. Moisture content varied, with evidence of oxidation and rootlets in the upper layers (depth < 0.7m).

Groundwater levels were recorded during and post-drilling activities, with measured depths ranging from 0.7 m bgs to 5.5 m bgs. Additional details for the boreholes are documented in the borehole logs (Appendix A in the geotechnical investigation (Hatch, 2025)). The data indicates that the groundwater table is relatively shallow in parts of the site, with groundwater level ranging from approximately 0.7 m bgs to 2.5 m bgs. The shallowest levels were observed in the southwest part of the site, particularly at Boreholes TR24-1 (2.0 m bgs) and TR24-2 (1.7 m bgs) in November 2024. These levels became even more shallow in January 2025 at BoreholesTR24-1 (0.7 m bgs) and TR24-6 (1.1 m bgs), indicating that the southwest area may act as a recharge zone. This area represents approximately 50% of the site. In contrast, deeper groundwater levels were observed in the central area of the site near Boreholes TR24-3 (5.0 m bgs) and TR24-4 (5.5 m bgs) in November 2024, while boreholes in the northeast part of the site remained dry. These measurements provide baseline data on groundwater flow, which appears to move generally from west to east. This information will support further analysis in the Groundwater Risk Assessment section.

2.3 Terrain Analysis

The terrain characterization for the Trail Road Project site is based primarily on the subsurface information obtained from the geotechnical investigation (Hatch, 2025), with surficial mapping from the GeologyOntario database, Ministry of Mines, Ontario, included only as regional context (Figure 2-2) to illustrate broader geological trends.

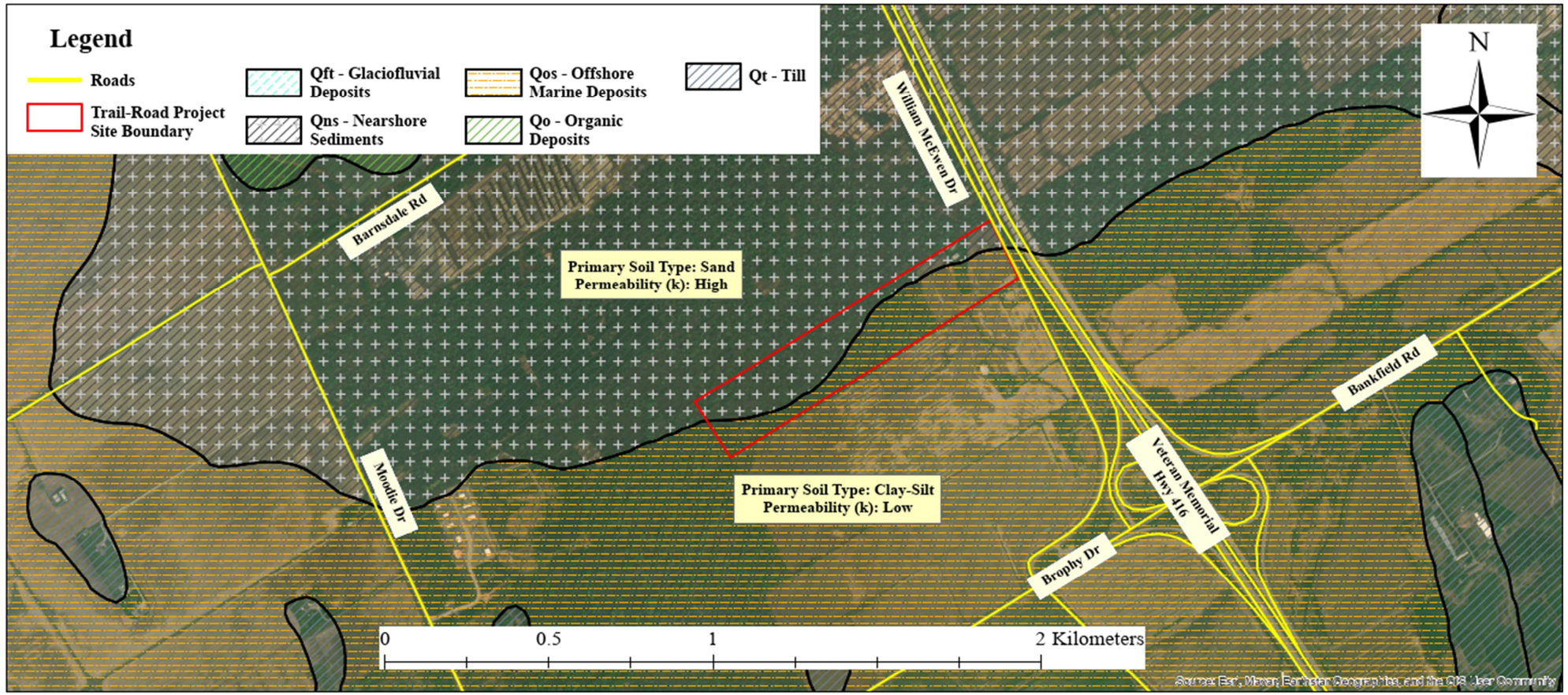
The geotechnical investigation shows that the development area is underlain by a relatively uniform sequence of silty sand to sandy silt extending to depths of approximately 6.2 to 6.4 m bgs. These deposits exhibit compact to dense conditions and are consistent with reworked glaciofluvial sands and silts typical of the Edwardsburg Sand Plain. The material generally provides moderate drainage capacity due to its sandy composition, although local variations in density and fines content may influence infiltration. Below this layer, sandy silt with gravel (glacial till) was encountered in at least one borehole (Borehole TR24-1), overlying inferred bedrock. The till is dense to very dense with low permeability characteristics, representing a transition to the underlying low-conductivity strata common in the region.

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The dominance of silty sand to sandy silt across the site suggests a terrain with moderate permeability and generally favourable drainage, consistent with the characteristics of the Edwardsburg Sand Plain. However, the presence of dense, low-permeability till at depth, combined with the shallow groundwater table observed during drilling, indicates that the site has limited capacity for infiltration. As a result, infiltration is not considered suitable for the SWM plan, and alternative stormwater management approach should be used.

The surficial mapping indicates the site lies at two primary terrain units: Nearshore Sediments in the northwest strip and Offshore Marine Deposits in the southeast portion. The Nearshore Sediments in the northwest part of the site are composed of fine-to-medium-grained sands that are calcareous and often associated with glaciofluvial materials. These sediments typically occur as sheets or bars near coastal transition zones, exhibiting moderate-to-high permeability due to their sandy texture. This calcareous composition indicates moderate drainage capacity, making this area suitable for surface-level construction activities without significant concerns for water retention or drainage issues. In contrast, the Offshore Marine Deposits in the southeast part of the site primarily consist of clay, silty clay, and silt. These materials are commonly calcareous, fossiliferous, and poorly permeable due to their fine-grained nature and compactness. The low permeability of this unit may lead to limited drainage capacity, potentially causing surface water runoff and ponding during periods of high precipitation. This characteristic of the soil necessitates careful consideration of SWM planning to mitigate any effects on the development.

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Qft - Glaciofluvial Deposits
The unit typically includes gravel and sand, poorly to well sorted and bedded, mainly coarse-to medium-grained with numerous cobbles, boulders and lenses of till.

Qns - Nearshore Sediments
The unit typically includes fine-to medium-grained sand, calcareous and commonly fossiliferous; nearshore sand generally occurs as a sheet or as bars or spits associated with glaciofluvial materials.

Qos - Offshore Marine Deposits
The unit typically includes clay, silty clay and silt, commonly calcareous and fossiliferous; locally overlain by thin sands. Upper parts are generally mottled or laminated reddish brown and bluish grey and may contain lenses and pockets of sand, but at depth the clay is uniform.

Qo - Organic deposits
The unit typically includes mainly muck and peat in bogs, fens, swamps and poorly drained areas.

Qt - Till
The unit typically includes sandy and silty compact diamicton, grey at depth but brown where oxidized; calcareous where derived from sedimentary rocks and not leached; consists dominantly of lodgment till. In areas that lie below marine limit (198 m a.s.l.) it is overlain by a disc.

Figure 2-2: Terrain Unit Map Within the Project Site

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2.4 Groundwater Risk Assessment

Groundwater levels at the site fluctuate seasonally. The groundwater data was collected in November 2024, July 2025, September 2025, and March 2026 (Table 2-1). The observed shallow groundwater levels range from 0.7 m bgs at Borehole TR24-1 to 1.7 m bgs at Borehole TR24-2. As a conservative approach, the groundwater levels are assumed to rise to the ground surface during peak seasonal conditions.

Based on borehole data collected in November 2024, the general direction of groundwater flow is toward the southeast. For regional context, groundwater elevation data were extracted from GeologyOntario mapping and are presented in Figure 2-3. The interpolation of groundwater elevation points was performed using the Kriging method to generate the groundwater table map.

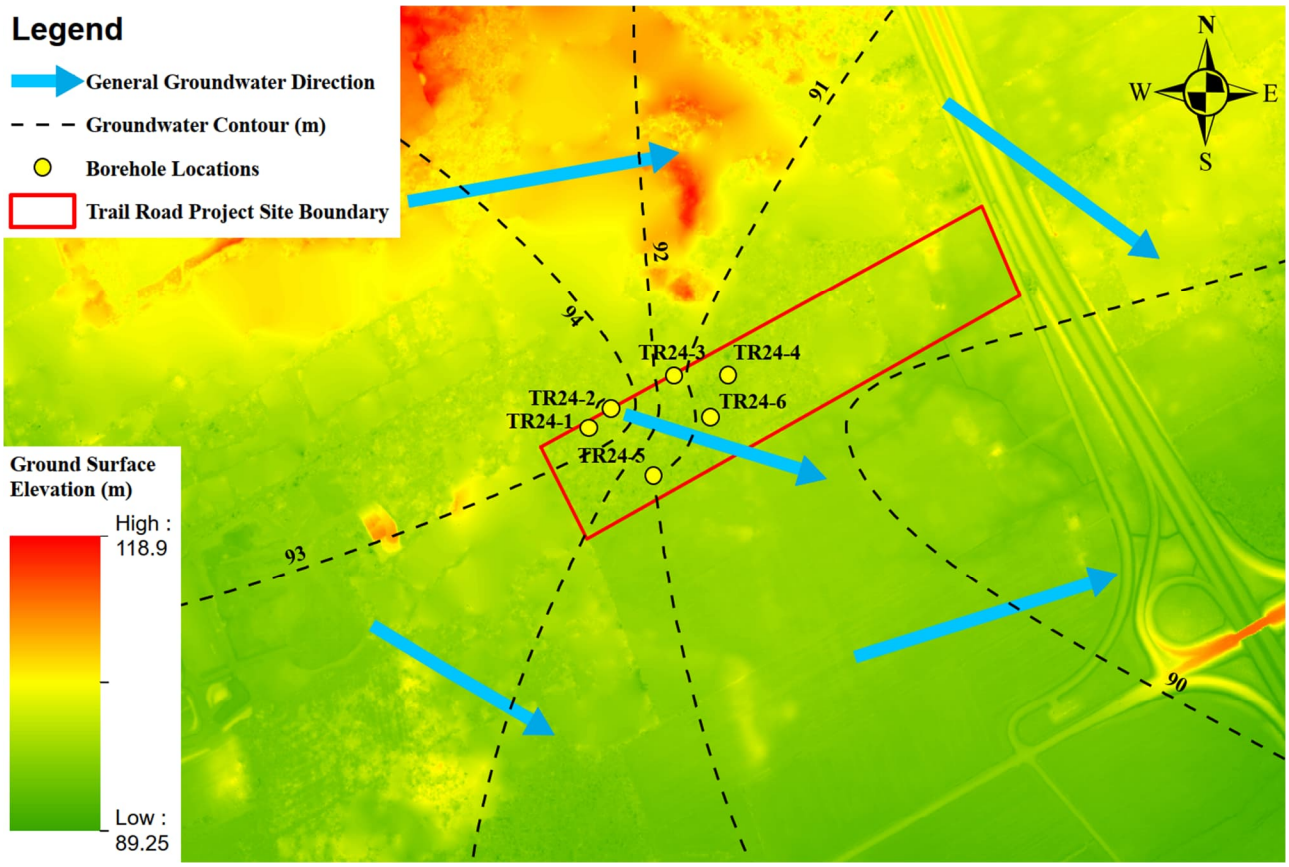


Figure 2-3: General Groundwater Flow Directions

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Based on the borehole data, groundwater is not observed at the surface within the Project site, while the RVCA Flow and Water Levels Mapping indicates the presence of a non-Provincially Significant Wetland (non-PSW) covering portions of the site as shown in Figure 2-4. Non-PSW wetlands are areas that do not meet the criteria for provincial significance under the Ontario Wetland Evaluation System (OWES), typically due to size, hydrological, or ecological factors.

Although the site development does not involve excavation or interaction with the shallow groundwater table, an environmental study is recommended to thoroughly assess the non-PSW wetland and its potential seasonal characteristics.



Figure 2-4: Non-PSW Wetland in the Project Site

Groundwater quantity and quality assessments are not required for this study, as the site development does not rely on groundwater for water supply or wastewater disposal purposes. However, all groundwater-related assessments and conclusions presented above should be interpreted with caution due to the seasonal limitations of the available data.

2.5 Information Supporting the Stormwater and Drainage Plan

As SWM planning is required to meet the target water quantity, quality and water balance criteria, the implementation of a variety of SWM facilities may be required. Further SWM guidelines (i.e., City of Ottawa Sewer Design Guidelines (December 2025) must be fully considered to undertake the stormwater and drainage plan.

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To assess surface runoff characteristics for the Project site, Curve Number (CN) values were determined based on land use and soil conditions (outlined in Section 2.2) following the City of Ottawa Sewer Design Guidelines (December 2025). The site consists of a combination of impervious battery storage units, compacted gravel surfaces, and vegetated areas. Hydrologic Soil Group classification is assigned based on the borehole logs and available geological data. Figure 2-5 shows the land use and CN values for the pre-development and post development conditions of the Project site.

During peak seasonal conditions, the groundwater levels are assumed to rise to the ground surface as a conservative approach. Therefore, the SWM design should not rely on infiltration to the groundwater as a viable solution.

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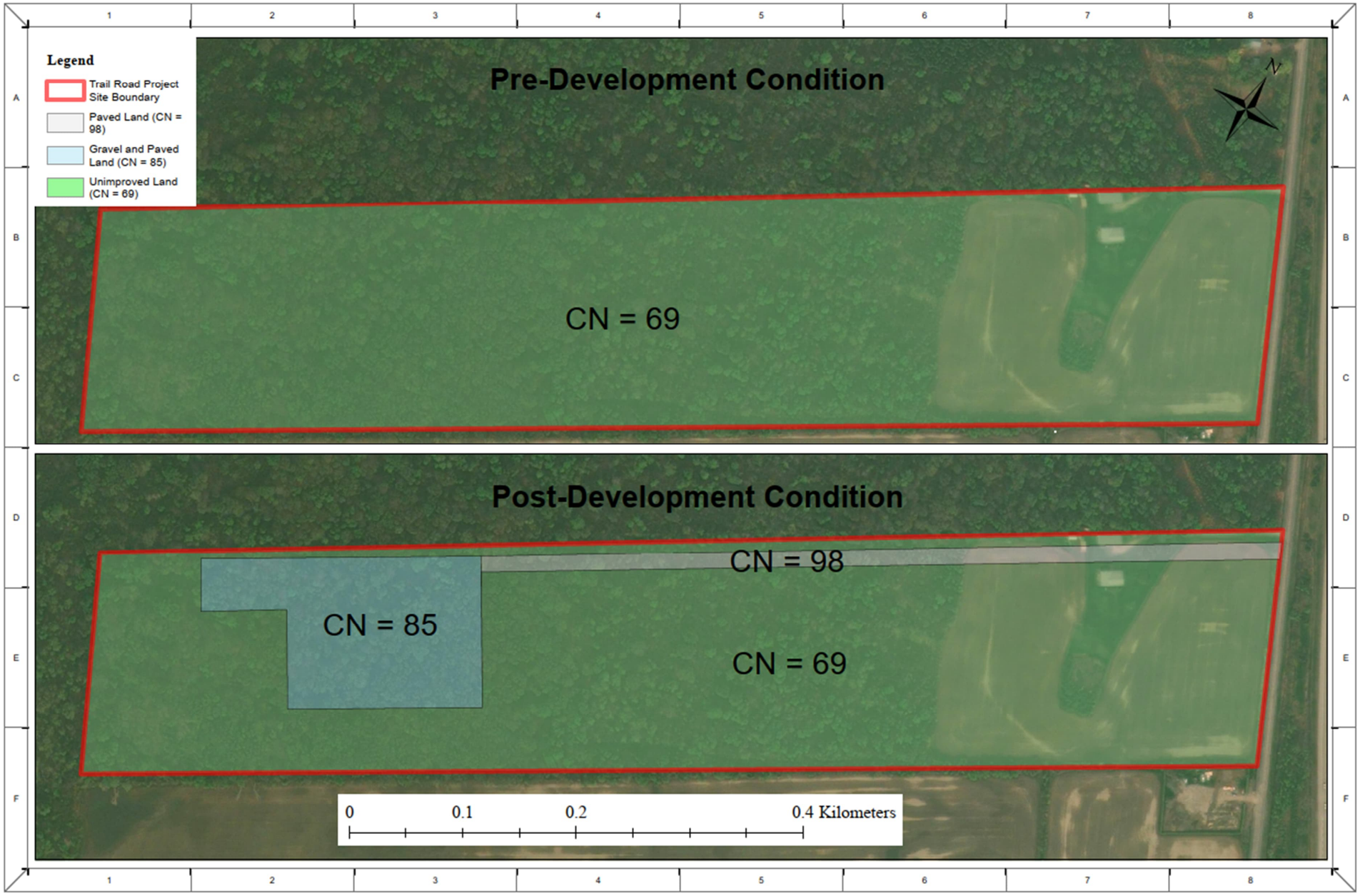


Figure 2-5: Land Use and Curve Number Values for Pre- and Post-Development Conditions of the Project Site

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Based on the land use for both pre- and post-development conditions, the average CN value for the pre-development condition is 69 and for the post-development condition is 73. Therefore, SWM measures will be required to mitigate peak runoff flows and ensure compliance with City of Ottawa Sewer Design Guidelines (December 2025).

3. Conclusion and Future Design Recommendations

The following are the key conclusions that can be drawn from the hydrogeological and terrain analysis study:

- The shallow groundwater levels, ranging from 0.7 m bgs at Borehole TR24-1 to 1.7 m bgs at Borehole TR24-2, indicating a potential risk of flooding in the proposed areas designated for the battery storage and substation facilities.
- The terrain analysis indicated that the northwest part of the site demonstrates higher permeability, which allows for better drainage and suitability for surface-level development. On the other hand, the southeast part of the site features low permeability, requiring targeted approaches for managing surface water and preventing excessive runoff. These variations highlight the importance of incorporating tailored drainage and stormwater control measures in the project planning phase.
- The general soil profiles at all boreholes consists of non-organic topsoil (100 mm to 300 mm deep), silty sand to sandy silt (6.2 m bgs to 6.4 m bgs)), and sandy silt with gravel (at a depth of 9.5 m bgs). As a conservative approach, the groundwater levels are assumed to rise to the ground surface during peak seasonal conditions, and therefore, the SWM design should not rely on infiltration to the groundwater as a viable solution.
- Groundwater quantity and quality assessments are not required for this study, as the site development does not rely on groundwater for water supply or wastewater disposal purposes.
- The average CN value for the pre-development condition is 69 and for the post-development condition is 73 indicating a small increase in the peak runoff flows. Therefore, SWM measures will be required to mitigate peak runoff flows and ensure compliance with City of Ottawa Sewer Design Guidelines (December 2025).
- Based on the borehole data, groundwater is not observed at the surface within the Project site, while the RVCA Flow and Water Levels Mapping indicates the presence of a non-Provincially Significant Wetland (non-PSW) covering portions of the site.

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4. References

- Surficial Geology Maps. GeologyOntario, Ministry of Mines, Ontario. (Link: GeologyOntario).
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