Brookfield HATCH

Technical Memo

H375142

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Brookfield Renewable Energy Partners
South March BESS Site

Hydrogeological and Terrain Analysis Study

1. Introduction

Fitzroy BESS Inc., a subsidiary of Evolugen by Brookfield Renewable (Brookfield) in partnership with the Algonquins of Pikwàkanagàn and is proposing to develop the South March Battery Energy Storage System (BESS) Project (the Project). The Project will be in the West Carleton-March Ward in the City of Ottawa, Ontario. The Project is located on two leased parcels of land at 2555 and 2625 Marchurst Road, Ottawa, Ontario, and situated south of Thomas A. Dolan Parkway, west of Marchurst Road, and north of John Aselford Drive. The Project has a Development Area of approximately 9.0 hectares on approximately 84.5 hectares of property. The leased rural lots currently include two residential buildings with an access lane, naturalized areas with woodland and wetland, as well as limited noncommercial pasture use.

The Project is a 250 Megawatt (MW) energy storage facility that uses lithium ion (lithium iron phosphate) technology and is designed to store up to 1,000 megawatt hours of energy, providing four hours of continuous discharge at full capacity.

The Project will consist of 256 BESS containers at the start of commercial operations and will progressively increase to 307 BESS containers over the duration of the Independent Electricity System Operator's (IESO) Offtake Agreement. The additional BESS containers will be added through the augmentation process to maintain the required 250 MW capacity. This process is further detailed within the Augmentation Process Memo.

This report considers the full Augmentation Process (a total of 307 BESS containers). Its findings and conclusions are not affected by any stage of augmentation, from 256 to 307 BESS containers.

1.1 Project and Site Description

Hatch Ltd. (Hatch) has been retained by Brookfield BRP Canada Corporation (Brookfield) to provide hydrogeological and terrain analysis services as part of the South March Battery Energy Storage System (BESS) project (Project). The South March BESS project is directly responding to the IESO's 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 60,700 m^2 of a 607,000 m^2 property at 2555 and 2625 Marchurst Road in Dunrobin, Ontario, which is approximately 26 km southwest 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.

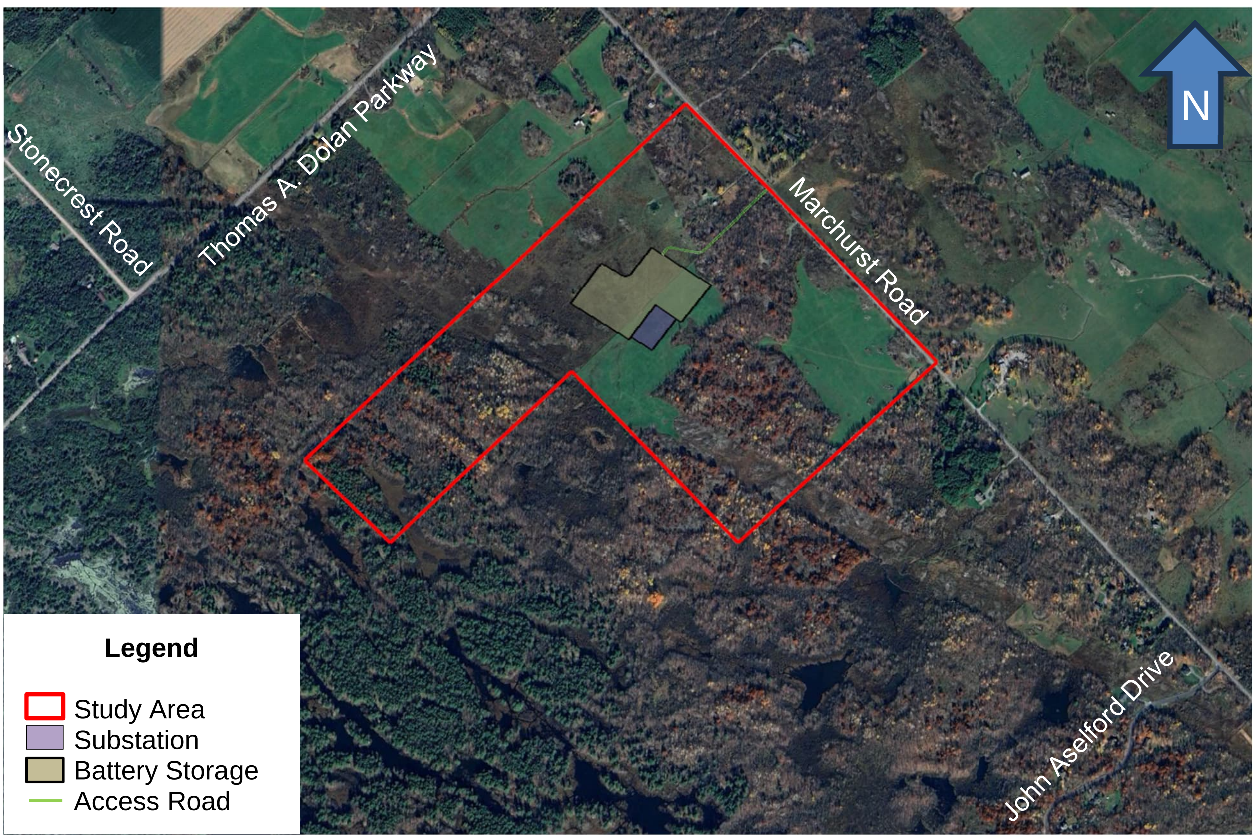


Figure 1-1: Overview of Limits of the South March BESS Project

1.2 Study Area

The Project site is bounded by Marchurst Road to the northeast, 600 m from Thomas A. Dolan Parkway to the northwest, 1.0 km from John Aselford Drive to the southeast. The Project site has an area of approximately 83 ha and falls under the coordinate system NAD83 (CSRS)/MTM Zone 9N of Ontario. The Project site is within the Chaudière Falls - Ottawa River watershed and the local authority is the Mississippi Valley Conservation Authority (MVCA). The battery storage is located on the middle of the site with an area of approximately 43,000 m^2. The substation area is located south of the battery storage with an area of approximately 6,500 m^2. The total property area is approximately 830,450 m^2.

1.3 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.

1.4 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 (2012). Sewer Design Guidelines.
- Ministry of Transportation (MTO), 1997. MTO Drainage Management Manual.
- GeologyOntario, Ministry of Mines, Ontario. Surficial Geology Maps.
- Mississippi Valley Conservation Authority (MVCA). MVCA Regulation Public 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 in the preliminary geotechnical investigation (Hatch, 2025).

Figure 2-1: Borehole Locations within the South March BESS Project Site

The preliminary geotechnical investigation indicated that the general soil profiles at all boreholes consists of non-organic topsoil (0.1 to 0.6 metres below ground surface (m bgs)). Silty sand was encountered below the topsoil in Boreholes FY24-4 and FY24-7 at depths of 0.1 and 0.3 m bgs and is 0.5 m and 0.6 m thick, respectively. Silty sand was also encountered below the silty clay deposit in Borehole FY24-1 at a depth of 4.9 m bgs and is 1.1 m thick. Silty clay was encountered below the topsoil in all boreholes advanced at the site, except Boreholes FY24-4 and FY24-7 where the silty clay was encountered below the silty sand. The silty clay was measured to be 0.2 m to 4.8 m thick in the boreholes. The silty clay contains trace sand.

The hydrologic soil group is expected to be soil group “BC” for the Project site with an estimated Horton infiltration rates of 9 mm/h (minimum infiltration rate) to 170 mm/h (maximum infiltration rate) as per the MTO Drainage Manual. 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 nine boreholes (FY24-1 to FY24-9) were drilled across the South March BESS Project site to evaluate subsurface soil and Groundwater Levels (GWLs). The borehole coordinates (NAD83/MTM Zone 9N), elevations, and depths are summarized in Table 2-1. The boreholes were drilled to depths ranging from 0.75 m to 9.14 m using a CME 45 Track Mounted drilling rig supplied and operated by OGS Inc. (OGS) of Almonte, Ontario.

Table 2-1: Borehole Locations and Elevations

Borehole ID	Easting (m)	Northing (m)	Elevation (m)	Borehole Depth (m)	GW Depth and Elevation									
					01-12-2024		02-12-2024		03-12-2024		17-07-2025		11-09-2025	
					Depth (m)	Elev. (m)	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)
FY24-1	340,593.57	5,028,520.19	100.89	9.14	-	-	-	-	1.0	99.89	1.8	99.09	2.6	98.29
FY24-2	340,428.35	5,028,632.28	100.19	1.20	Dry		Dry		Dry		-	-	-	-
FY24-3	340,470.80	5,028,685.75	99.04	2.85	Dry		Dry		Dry		-	-	-	-
FY24-4	340,502.04	5,028,617.03	100.10	1.05	Dry		Dry		Dry		-	-	-	-
FY24-5	340,603.10	5,028,675.83	99.22	7.55	-	-	1.3	97.92	-	-	-	-	-	-
FY24-6	340,644.90	5,028,607.61	100.43	3.55	1.1	99.33	-	-	-	-	-	-	-	-
FY24-7	340,719.30	5,028,576.59	103.20	4.65	Dry		Dry		Dry		-	-	-	-
FY24-8	340,657.27	5,028,511.78	102.89	0.75	Dry		Dry		Dry		-	-	-	-
FY24-9	340,667.29	5,028,663.08	100.20	3.60	Dry		Dry		Dry		-	-	-	-

2.2.1 *Subsurface Stratigraphy and Groundwater Observations*

The borehole logs revealed primarily silty clay and silty sand, interspersed with glacial till at greater depths in some locations with varying moisture content.

Water levels were recorded during and post-drilling activities, with measured depths ranging from 1.0 m to 1.3 m bgs. Additional details for the boreholes are documented in the borehole logs (Appendix A in the preliminary geotechnical investigation (Hatch, 2025)). The data indicates that the groundwater table is relatively shallow in parts of the site. The shallowest levels were observed in the middle part of the development area, particularly at boreholes FY24-1 (1.0 m bgs), FY24-5 (1.3 m bgs), and FY24-6 (1.1 m bgs) in February 2025. This area with shallow groundwater table represents approximately 50% of the developed part (i.e., battery storage and substation facilities) of the site. In contrast, no groundwater was observed at the borehole completion in the east and west areas of the developed site (boreholes FY24-2, FY24-3, FY24-4, FY24-7, FY24-8, and FY24-9 in February 2025. These measurements provide baseline data on groundwater flow, which appears to have higher levels in the middle of the site, with the groundwater generally moving generally towards northeast and southwest. This information will support further analysis in the Groundwater Risk Assessment section.

2.3 Terrain Analysis

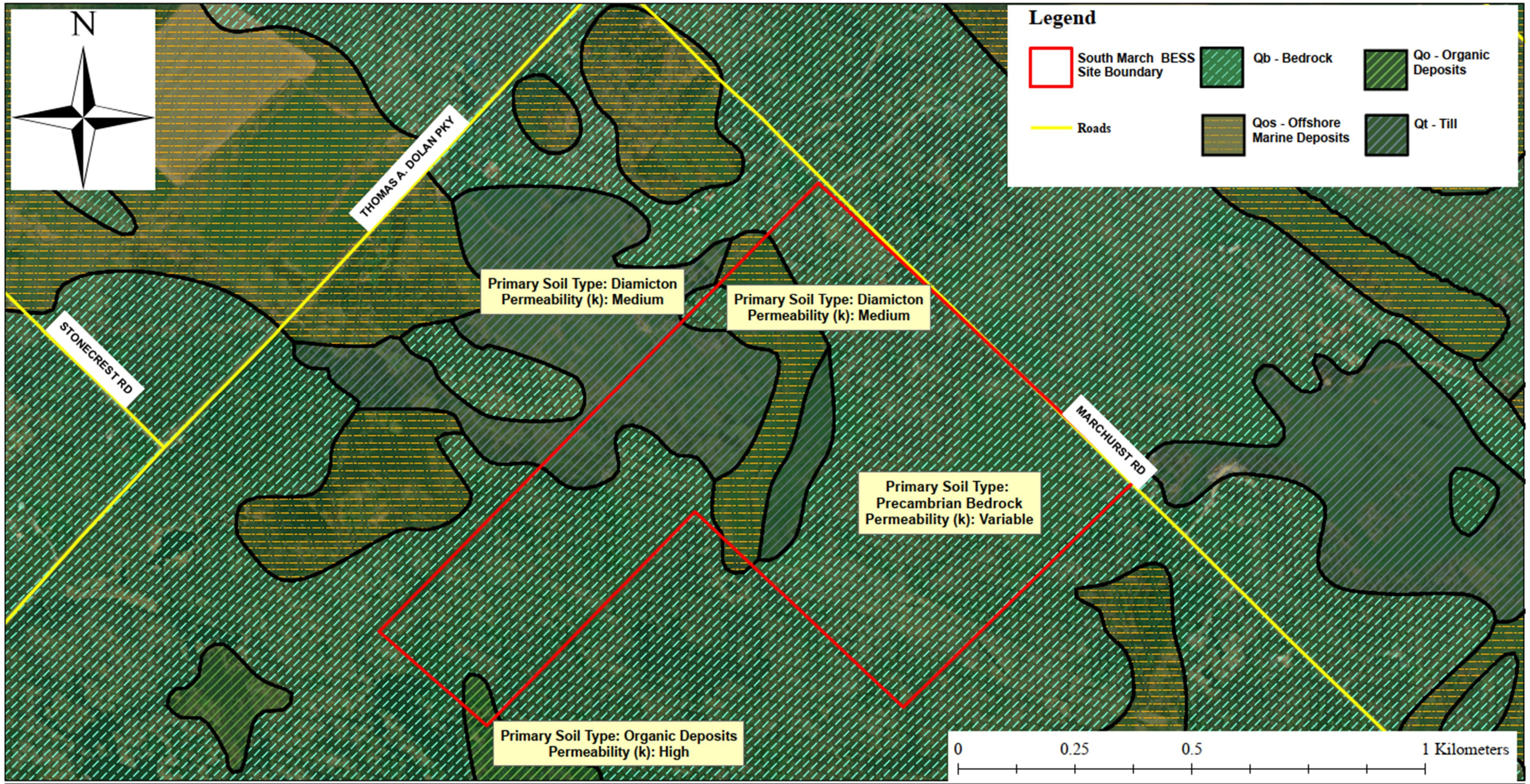
The South March Project site and its surrounding area comprise two primary terrain units: Till in the northwest and southeast strips and Offshore Marine Deposits in the middle portion (Figure 2-2). These units were identified using the geological data from GeologyOntario database, Ministry of Mines, Ontario. For this study, the surficial mapping is used as regional context; terrain characterization within the development area is established from site investigation data. The site investigation (boreholes FY24-1 to FY24-9; FY25-1 to FY25-4, field vane/SPT, and laboratory testing) shows that the primary terrain units are marine deposits (near-surface silty clay), till, and bedrock.

The marine deposits (silty clay) underlying topsoil (from 0.10 to 0.60 m thick) was encountered at all boreholes except FY24-4 and FY24-7 (where a thin surficial silty sand lens overlies silty clay). Silty clay thickness ranges between 0.2–5.2 m. Atterberg limits (LL 33–51%, PI 19–29%) and strengths (field vane/UU; sensitivity ~2–15) indicate soft–stiff, sensitive clay with low permeability and compressibility. These properties imply limited infiltration and potential for surface runoff/ponding during wet periods within the development area. Localized silty sand lenses occur near surface at FY24-4/FY24-7 and at depth (from 4.9 to 6.0 m at FY24-1) but are not laterally continuous and should not be extrapolated site-wide.

Silty clay till was encountered at depth at FY24-6 (~3.0–3.6 m bgs; SPT N≈28). Till was not observed at the ground surface within the boreholes advanced in the development footprint. Where GeologyOntario mapping refers to brown colour due to oxidation, this is treated as regional context only; the site boreholes did not confirm an oxidized clay horizon.

Granitic gneiss bedrock underlies the overburden (confirmed by coring at FY24-1 and FY25-1; refusal elsewhere), with variable depth across the site. Groundwater was observed ~1.0–1.3 m bgs in open holes at completion, and ~1.8–2.6 m bgs in the FY24-1 monitoring well during subsequent checks; seasonal fluctuation is expected. Combined with the predominance of silty clay.

Given the low-permeability silty clay at shallow depths across most of the area, this characteristic of the soil necessitates SWM should plan for limited infiltration and provide positive surface drainage to mitigate any effects on the development (see Geotechnical Report Sections 7–8).



Qb - Bedrock
Intrusive and metamorphic (Precambrian). Regionally may be thinly veneered by unconsolidated sediments (≤ 2 m). Site investigation (FY24-1 and FY25-1) confirms granitic gneiss bedrock.

Qos - Offshore Marine Deposits
Clay, silty clay and silt, commonly calcareous and fossiliferous; locally overlain by thin sands. Boreholes confirm near-surface silty clay across the development area (~0.2–5.2 m bgs) with isolated sand lenses (FY24-4/-7 near surface; FY24-1 at depth).

Qo - Organic Deposits
Mainly muck and peat in bogs, fens, swamps and poorly drained areas. Not encountered in site boreholes within the development footprint; shown for regional context.

Qt - Till
Sandy and silty compact diamicton; GeologyOntario notes it is grey at depth and may appear brown where oxidized (lodgment till). At the site, till was encountered only at depth in FY24-6 (~3.0–3.6 m bgs); no oxidized horizon was confirmed in the recovered samples.

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

2.4 Groundwater Risk Assessment

Groundwater levels at the site fluctuates seasonally. Higher groundwater levels are anticipated during wet periods, such as spring or after prolonged precipitation events. The shallow groundwater levels, ranging from 1.0 to 1.3 m bgs (1.0m at borehole FY24-1, 1.1m at borehole FY24-6, and 1.3 m bgs at borehole FY24-5) in December 2024, indicate a potential risk of flooding in the proposed areas designated for the battery storage and substation facilities. Subsequent measurements in July and September 2025 at borehole FY24-1 indicated deeper groundwater levels, ranging from 1.8 m in July to 2.6 m bgs in September. 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 December 2024, the general direction of groundwater flow is toward the northwest. 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.

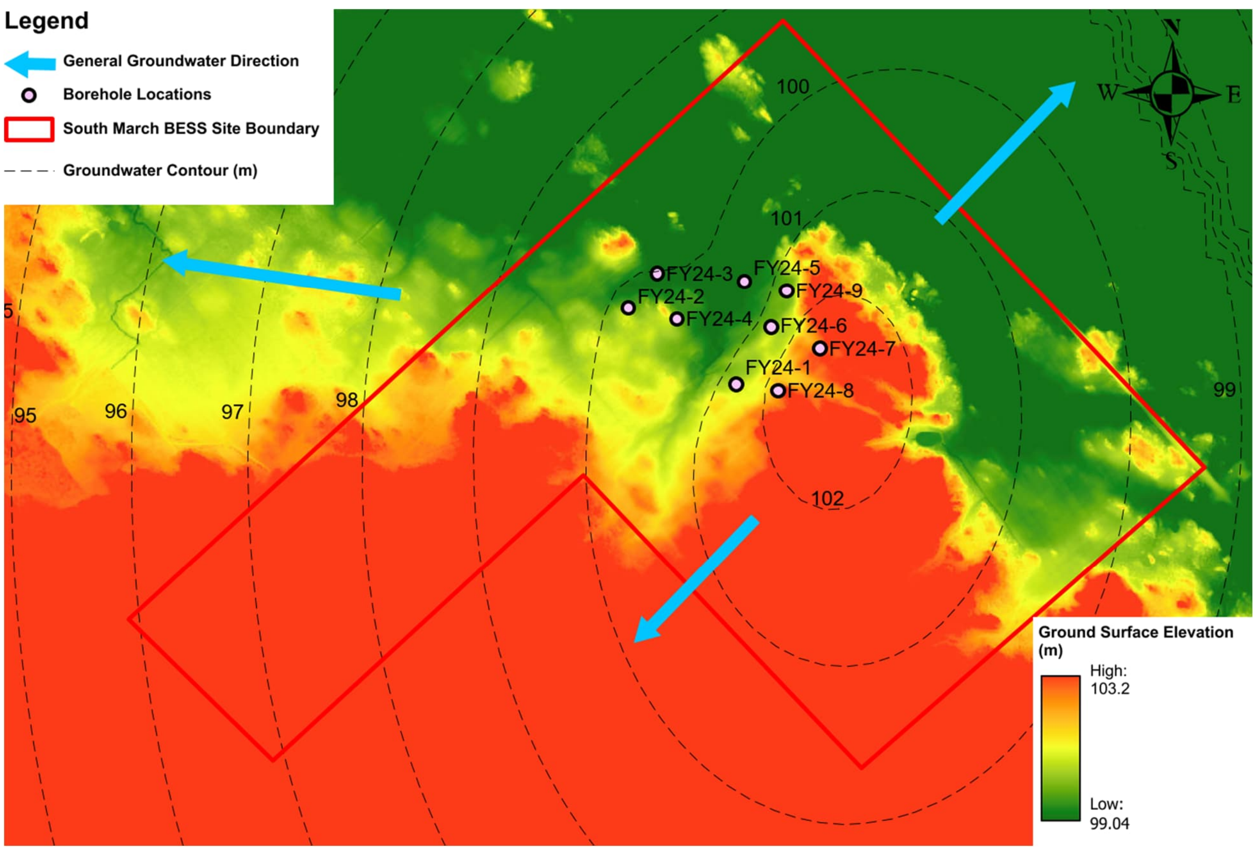


Figure 2-3: General Groundwater Flow

Based on the borehole data, groundwater is not observed at the surface within the Project site. The MVCA Regulation Public Mapping indicates the presence of a Provincially Significant Wetland (PSW) covering portions of the southwest part of the site as shown in Figure 2-4. This wetland feature is apparent in satellite imagery as standing water. However, no wetlands were indicated or observed within the development area of the site. PSW wetlands are areas identified by the province as being the most valuable. They are determined by a science-based ranking system known as the Ontario Wetland Evaluation System (OWES). These wetlands provide important wildlife habitat and help to ensure a supply of clean water. Given the absence of surface groundwater, the observed site conditions suggest that any wetland features, if present, are likely seasonal and dependent on surface water runoff during peak precipitation events due to the shallow groundwater table.

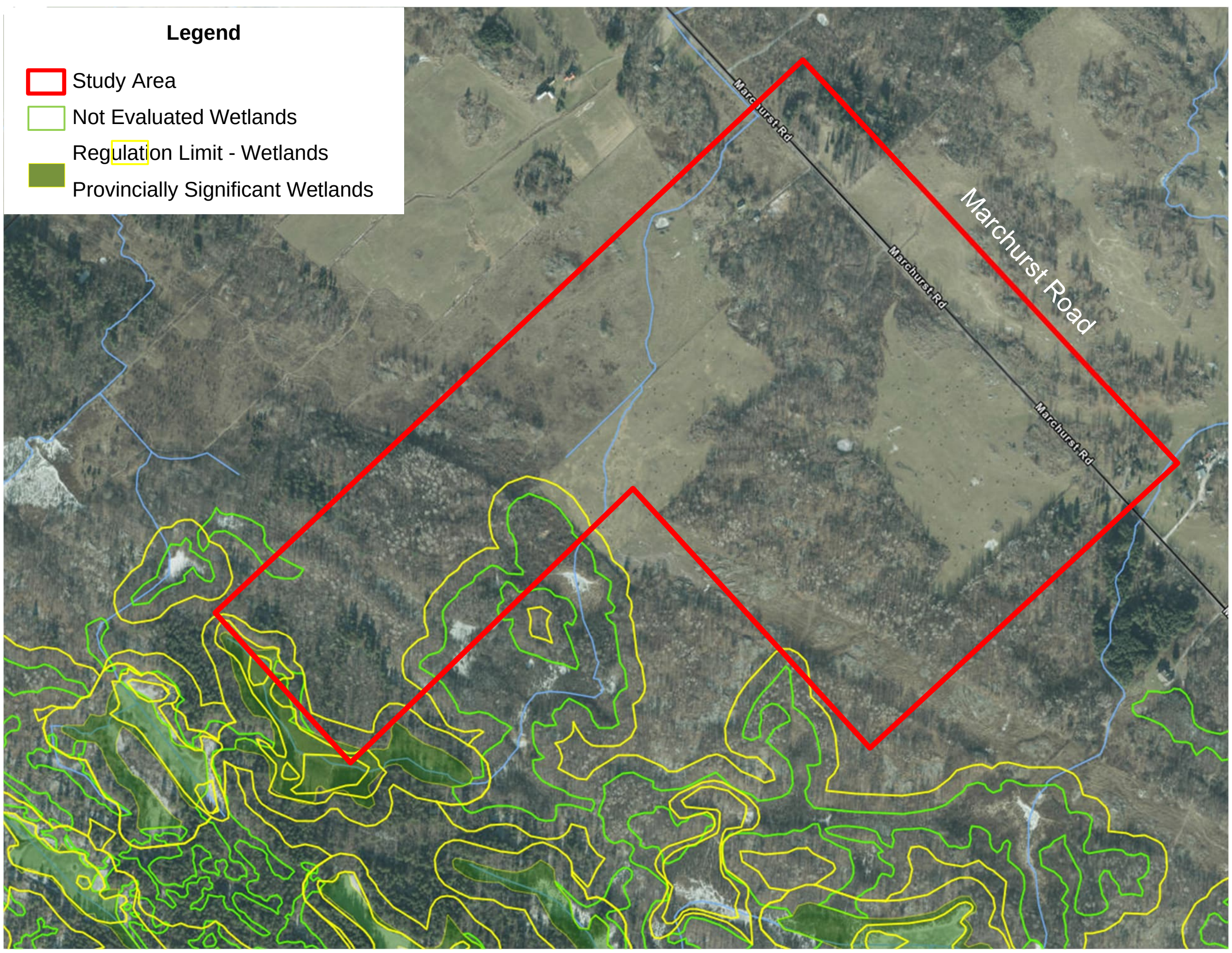


Figure 2-4: Non-PSW Wetland in the Project Site

No assessment of the PSW wetland is required since the wetland is far from the development part of the site and the site development does not involve excavation or interaction with the shallow groundwater table.

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.

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 maybe required. Further SWM guidelines (i.e., Sewer Design Guidelines of City of Ottawa (October 2012)) must be fully considered to undertake the stormwater and drainage plan.

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 Soil Conditions) following the Sewer Design Guidelines of City of Ottawa (October 2012). The site consists of a combination of impervious battery storage units, compacted gravel surfaces, and vegetated areas. A Hydrologic Soil Group classification was assigned based on 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.

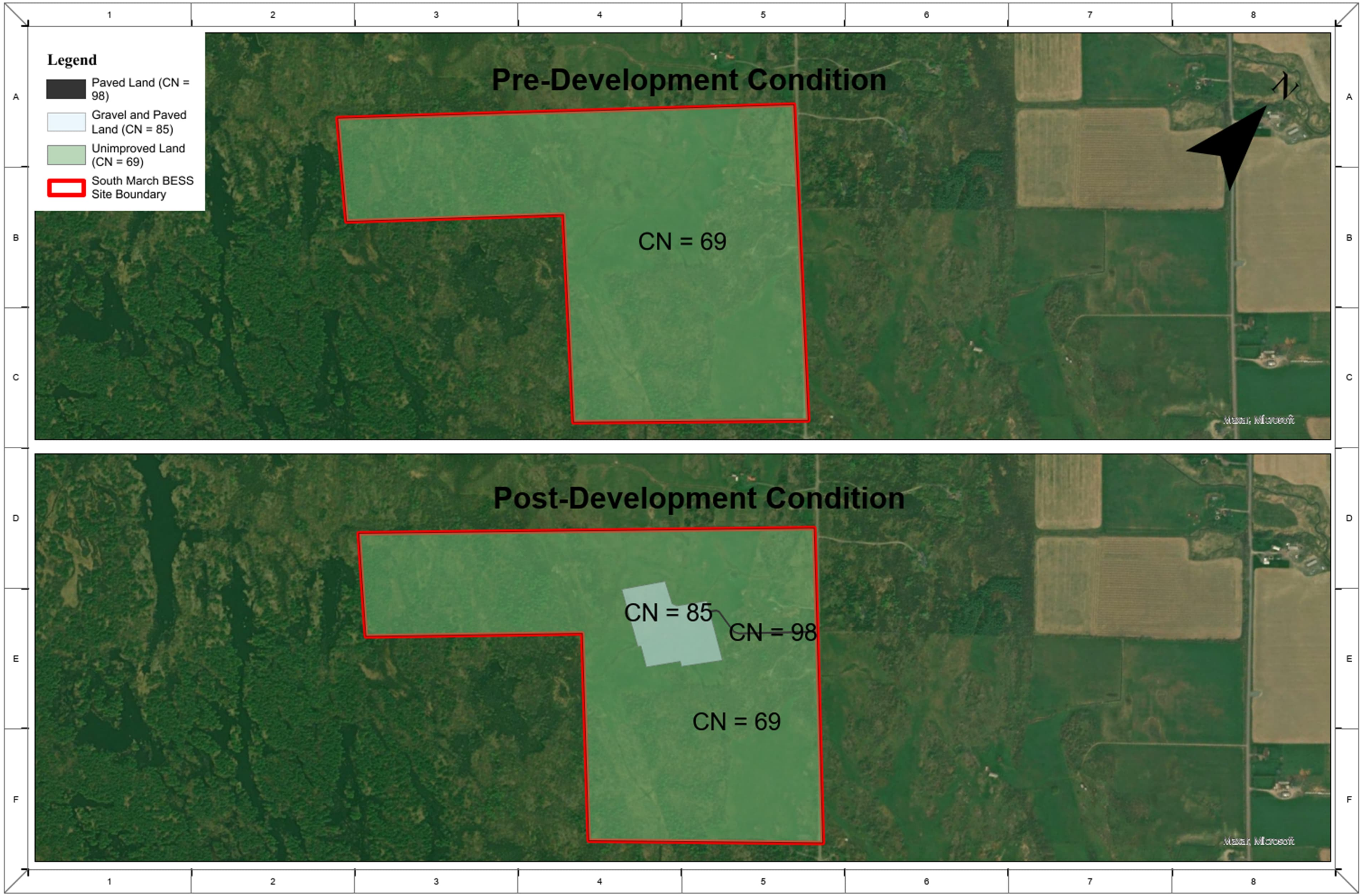


Figure 2-5: Land Use and Curve Number Values for Pre- and Post-Development Conditions of the Project Site

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 70. The average CN value represents the weighted average of CN values from all land uses within the study area (Figure 2-5). Although the increase in the average CN value is minimal, SWM measures will still be required to mitigate peak runoff flows within the site development area and ensure compliance with City of Ottawa Sewer Design Guidelines (October 2012).

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 1.0 m bgs at borehole FY24-1 to 1.3 m bgs at borehole FY24-5, indicate 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 is composed of sandy and silty compact diamicton. 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 medium to low permeability of this unit may lead to limited drainage capacity, potentially causing surface water runoff and ponding during periods of high precipitation.
- The general soil profiles at all boreholes consists of non-organic topsoil (0.1 to 0.6 m bgs). Silty sand was encountered below the topsoil in Boreholes FY24-4 and FY24-7 at depths of 0.1 and 0.3 m bgs and is 0.5 m and 0.6 m thick, respectively. 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 70. The average CN value represents the weighted average of CN values from all land uses within the study area. While the increase in the average CN value is minimal, SWM measures will still be required to mitigate peak runoff flows within the site development area and ensure compliance with City of Ottawa Sewer Design Guidelines (October 2012).
- Based on the borehole data, groundwater is not observed at the surface within the Project site. The MVCA Regulation Public Mapping indicates the presence of a Provincially Significant Wetland (PSW) covering portions of the southwest part of the site.

4. References

- Surficial Geology Maps. GeologyOntario, Ministry of Mines, Ontario. (Link: GeologyOntario).
- Flow and Water Levels Mapping. Rideau Valley Conservation Authority (RVCA). (Link: RVCA GIS Maps).
- MTO Drainage Management Manual. Ministry of Transportation (MTO) (1997).
- Preliminary Geotechnical Investigation. Hatch (January 2025). (Report no. H375035-0000-2A0-066-0001).
- Hydrogeological and Terrain Analysis Guidelines. City of Ottawa (March 2021).
- Sewer Design Guidelines. City of Ottawa (October 2012).

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