

Technical Memo

H375142

17-03-2025

To: Carl Haeussler, P. Eng
Director, Business Development

From: Mohamed Khafagy, P. Eng

cc: Racheal Seymour, P. Eng

Brookfield Renewable Energy Partners South March BESS Site Geotechnical Investigation

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 South March Battery Energy Storage System (BESS) project (Project). The South March 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 60,700 m² of a 607,000 m² 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.

If you disagree with any information contained herein, please advise immediately.

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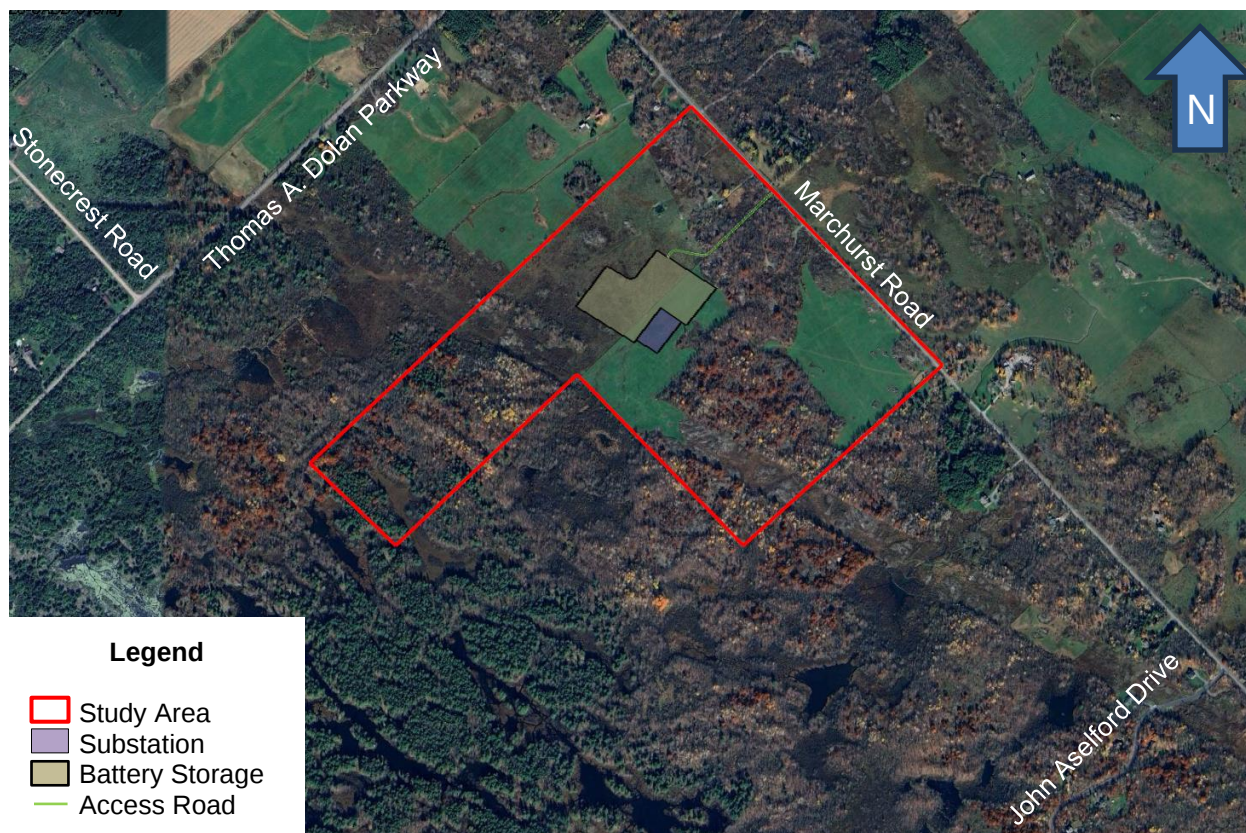


Figure 1-1: Overview of Limits of the South March BESS Project.

1.1 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 m². The substation area is located south of the battery storage with an area of approximately 6,500 m². The total property area is approximately 830,450 m².

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 (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 Appendix A 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. Site soil condition is suitable for the infiltration. This information is to support stormwater management (SWM) planning and design.

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	
					Depth (m)	Elevation (m)	Depth (m)	Elevation (m)	Depth (m)	Elevation (m)
FY24-1	340,593.57	5,028,520.19	100.89	9.14	-	-	-	-	1.0	99.89
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 consists of two primary terrain units: Till in the northwest and southeast strips and Offshore Marine Deposits in the middle portion. These units were identified using the geological data from GeologyOntario database, Ministry of Mines, Ontario.

The Till unit in the northwest and southeast part of the site are composed of 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. 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 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. This characteristic of the soil necessitates careful consideration of SWM planning to mitigate any effects on the development.

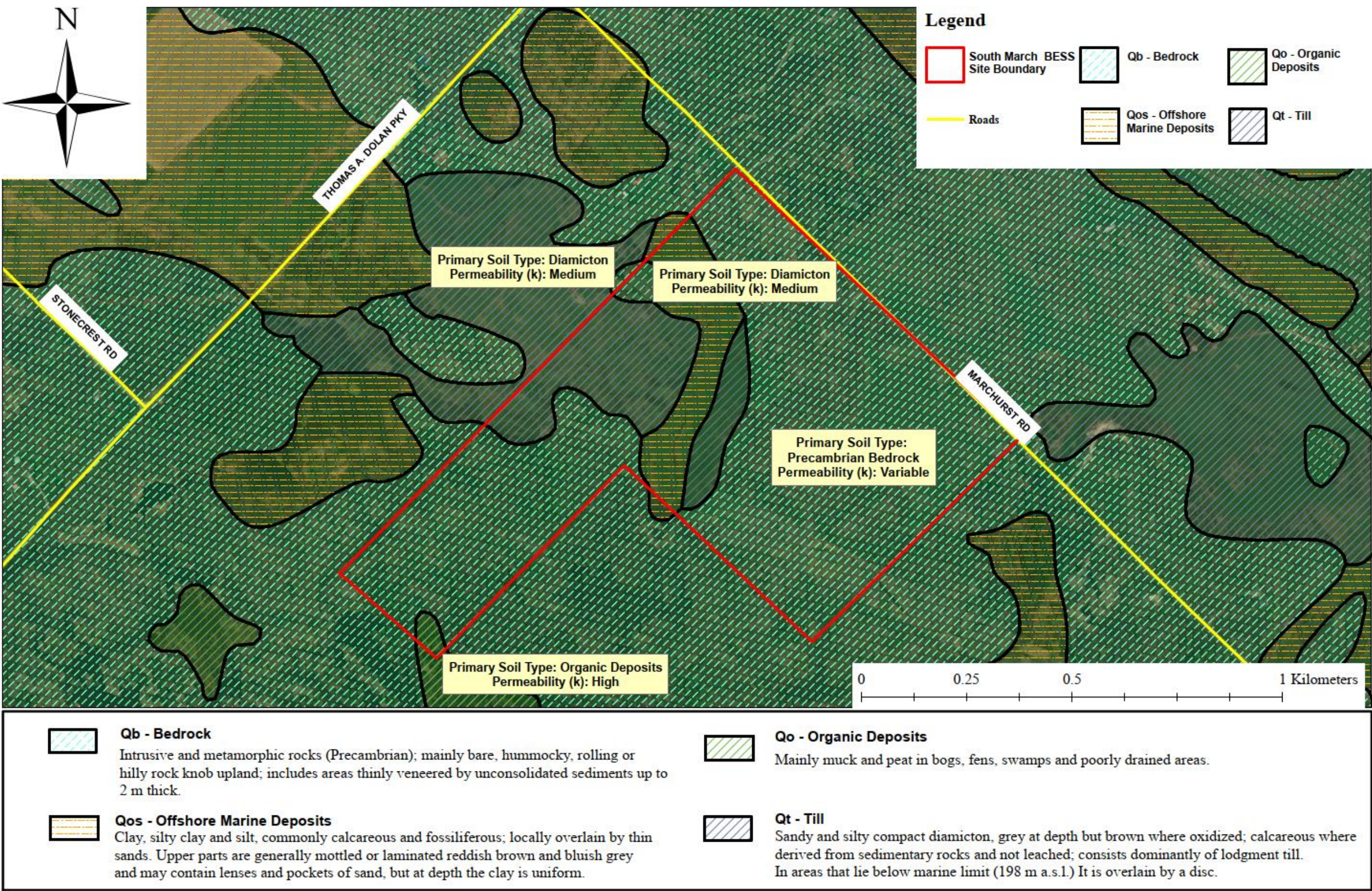


Figure 2-2: Terrain Unit Map Within the Project Site.

2.4 Groundwater Risk Assessment

Groundwater levels at the site are expected to fluctuate 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 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 general directions of groundwater flow, based on the borehole data collected in December 2024, are presented in **Figure 2-3**. The interpolation of groundwater elevation points was performed using the Kriging method to generate the groundwater table map. Additional seasonal groundwater elevation monitoring is recommended to provide a more robust assessment of the groundwater risk and to confirm the feasibility of constructing the BESS facilities without affecting the site's functionality.

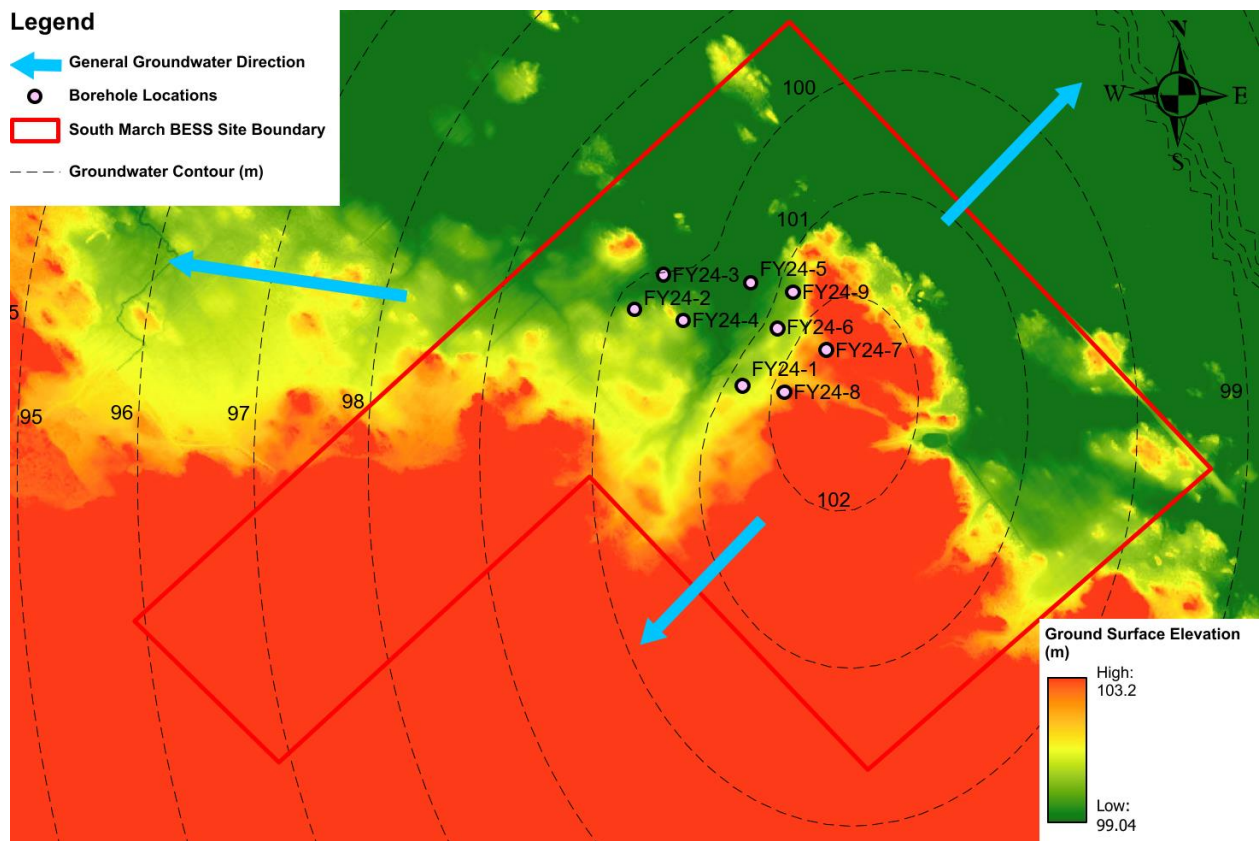


Figure 2-3: General Groundwater Flow.

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.

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.

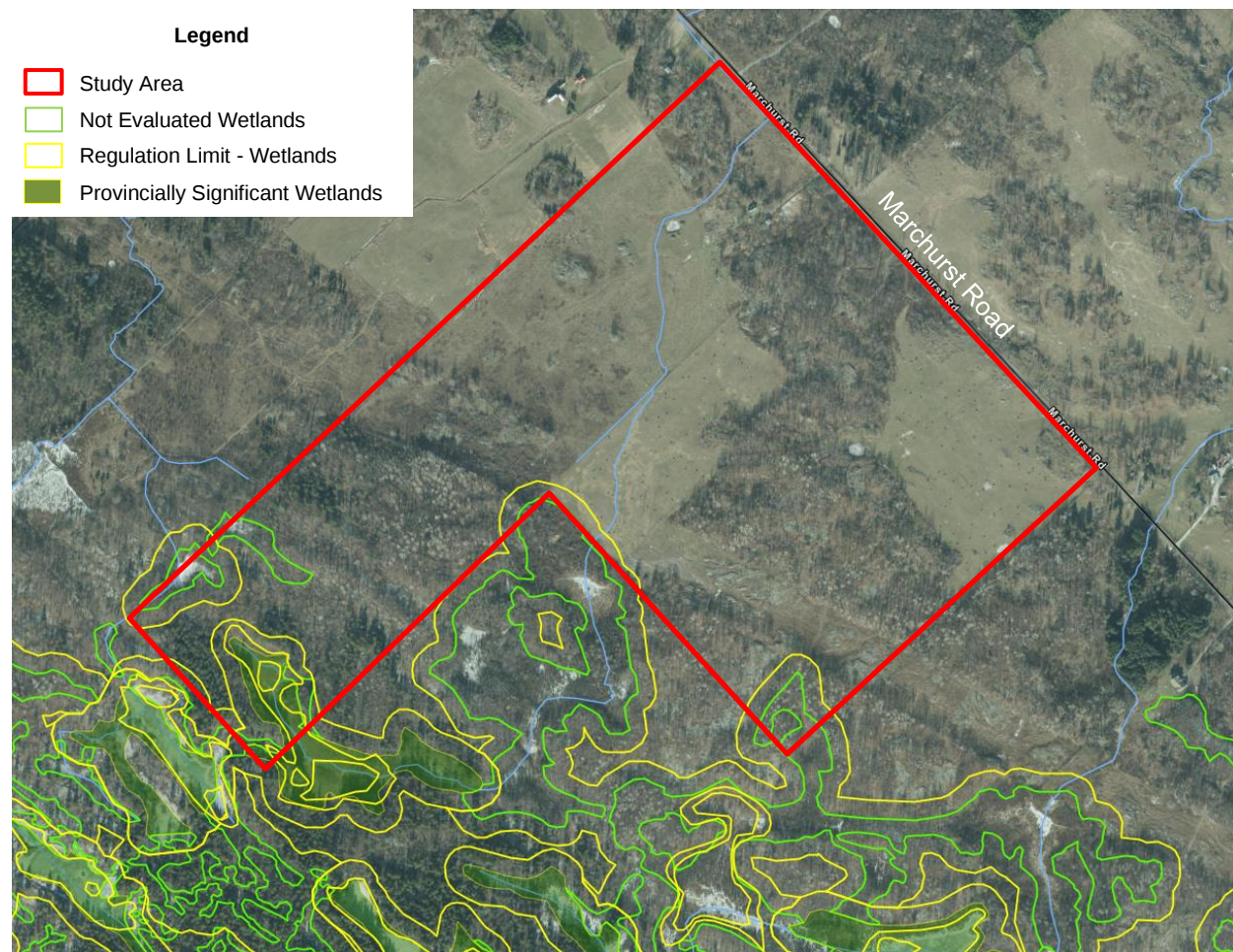


Figure 2-4: Non-PSW Wetland in the Project Site.

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.

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.

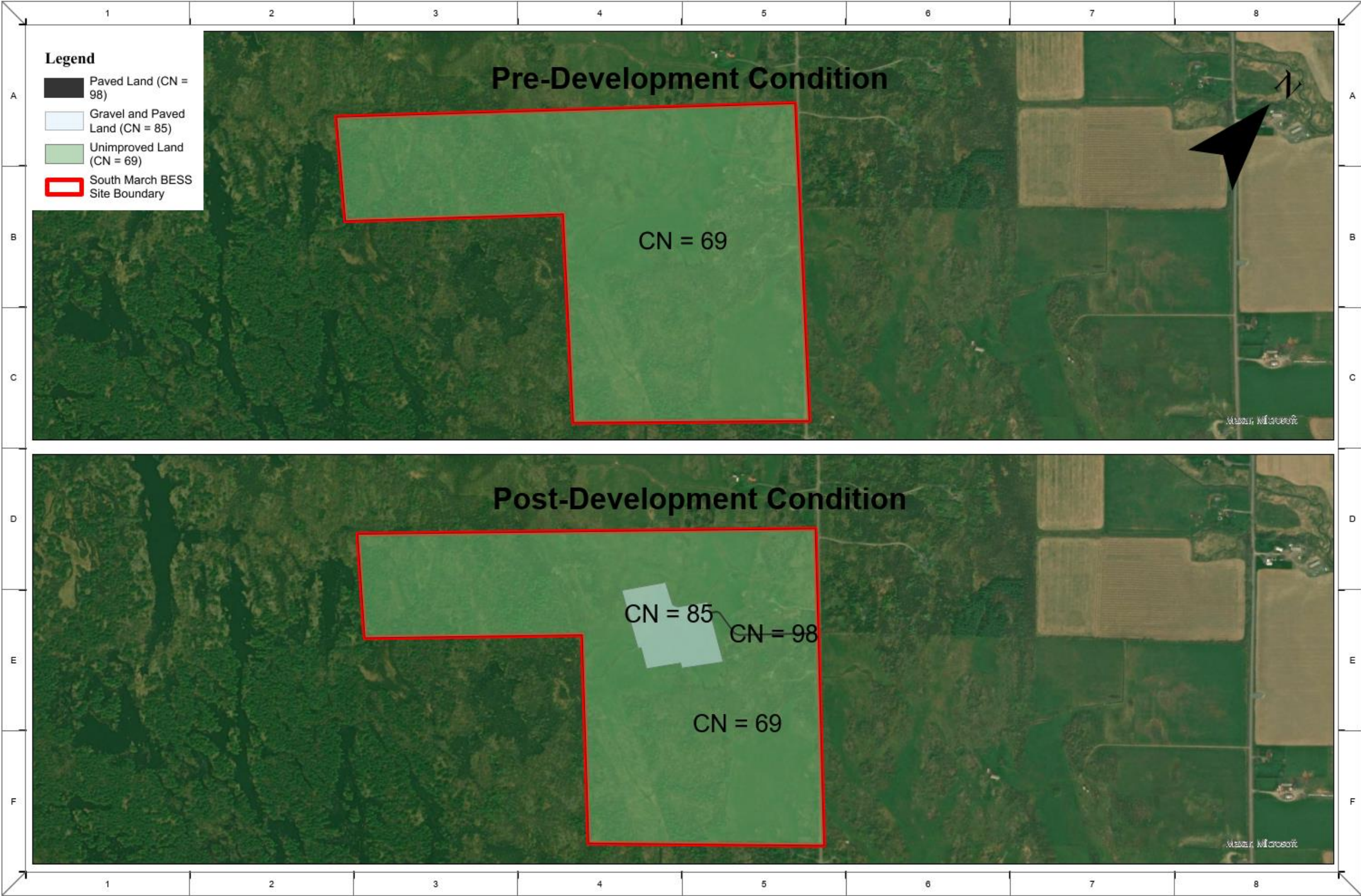


Figure 2-5: Land Use and Curve Number Values for Pre- and Post-Development Conditions of the Project Site

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. 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. Site soil condition is suitable for the infiltration.
- 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).

Mohamed Khafagy, P. Eng

MK:CH
Attachment(s)/Enclosure