Hydrogeological Assessment Report – Part of Lot 19, Concession 19 – Township of Galway-Cavendish and Harvey, County of Peterborough

July 23, 2025

Prepared for:
Jeffery Homes

Revision 3

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1.0 Introduction

Cambium Inc. (Cambium) was retained by Jeffery Homes (Client) to complete a hydrogeological assessment in support of the proposed residential development at 168 County Road 49, Bobcaygeon, Ontario, legally known as Part of Lot 19, Concession 19, Township of Galway-Cavendish and Harvey, County of Peterborough (Site).

The purpose of the hydrogeological assessment was to characterize the soil and groundwater conditions at the Site, assess the pre- and post development water balance, discuss the need for groundwater control during the construction process, assess any impacts on the surrounding natural environment due to the proposed development, and evaluate and provide conclusions and recommendations for the proposed development. The proposed development will be privately serviced for water supply and wastewater disposal. It is understood that a detailed wastewater assessment and water supply assessment, per Guideline D-5-4 and D-5-5, respectively were completed by Jp2g Consultants Inc. in 2021 (see Section 1.3).

1.1 Scope of Work

This hydrogeological assessment was conducted to address the peer review comments on the previous hydrogeological investigation report (described below) with the following tasks:

- **Review of available background information**: a review of available geological and hydrogeological information for the Site and surrounding areas was conducted to provide background information to allow for characterization of the Site's soil and groundwater conditions.
- **Water level monitoring:** groundwater levels were measured in the existing monitoring wells to establish and/or confirm the general groundwater flow condition and to assess the fluctuations in groundwater elevations.
- **In-situ hydraulic conductivity tests:** single well response tests were conducted on the monitoring wells to estimate the hydraulic conductivity of underlying soils and/or bedrock, and to assess the potential dewatering requirements.

- **Instillation of drive-point piezometers:** drive-point piezometers were installed within the wetland to evaluate the relationship between the wetland and the shallow groundwater table.
- **In-situ soil infiltration testing:** conduct infiltration tests on the soils in the locations and depths of proposed Low Impact Development (LID) features to assess their feasibility.
- **Dewatering and impact assessment**: an assessment of short-term construction dewatering and long-term sub-drain drainage if applicable for the residential units as well as an assessment of the potential impacts on the surrounding groundwater system.
- **Water balance (preliminary):** a preliminary water balance assessment was completed for the proposed development using the Thornthwaite-Mather approach and Environment Canada climate data to determine the potential change in groundwater recharge between pre- and post-development conditions.
- **Nitrate mass balance:** based on the water balance assessment results, an assessment of nitrate dilution to occur under post development conditions was completed.
- **Source water impact assessment:** as the Site is situated within a Highly Vulnerable Aquifer (HVA) area, a Source Water Protection assessment was completed to detail threats to groundwater in terms of water quality and quantity.

1.2 Site Description and Site Development

The property consists of approximately 48.15 ha of undeveloped land, except for a dwelling and associated structures in the westernmost area bordering County Road 49. An unevaluated wetland and wetland buffer and an intermittent watercourse occupying about 9.80 ha, are present, leaving about 38.35 ha as the developable area.

The Site is bordered by existing houses on Ellwood Crescent to the south, mixed farmland and natural vegetation to the north, mixed natural vegetation and residential land to the east on Moon Line Road North, and County Road 49 to the west. There is Site access off County Road 49 and Moon Line North.

Cambium understands the proposed development includes the construction of 59 estate lots, with 25 lots planned for Phase 1 of development and 34 lots planned for Phase 2 (Appendix A). Although the Client is proposing a phased development, this report has been completed for the entire Site.

The regional location of the Site is outlined on Figure 1, the property and surrounding areas are outlined on Figure 2, and the proposed development plan is included in Appendix A.

1.3 Past Investigation and Peer Review Comments

There were several comments made by the Township's peer reviewer regarding the previous Hydrogeological Investigation and Terrain Analysis report for the Site prepared by Jp2g, dated October 2021. Cambium was retained to address the following comments made by Stantec Consulting Ltd and produce a supplemental hydrogeological assessment report.

1. The high groundwater table and shallow groundwater flow direction needs to be defined using a shallow groundwater monitoring well network assist with the following:
    a. setting basement elevations
    b. assessing the suitability of various infiltration deficit mitigation measures
    c. the placement of supply wells and sewage system envelopes on each lot (i.e., what direction(s) is groundwater flowing to assist with the placement of this infrastructure)
    d. assessing the relationship between the shallow groundwater table and the wetland (i.e., does the wetland depend on shallow groundwater inputs to maintain its form and function)
    e. septic system design (i.e., will the raised beds be required because of a shallow groundwater table or low permeability soils).
    f. assessing the need for construction dewatering
2. The function of the wetland needs to be evaluated to determine if the wetland is a groundwater recharge or discharge feature.

3. A pre- and post-development water balance must be completed to assess the infiltration deficit and identify appropriate mitigation measures to maintain pre-development infiltration rates.
4. The report needs to comment on whether the Site is situated within a Source Protection Vulnerable Area and if there are any Source Protection Policies that may impact the proposed development.

Third Submission Peer Review Comments

There were additional peer review comments made by the Township's peer reviewer regarding the Cambium's Hydrogeological Assessment report for the Site, dated August 16, 2024. Cambium was retained to address the following outstanding comments made by Stantec Consulting Ltd and update the hydrogeological assessment report herein.

1. Spring groundwater level monitoring needs to be completed to establish high groundwater table conditions.
2. Completion of construction dewatering estimates are needed once detailed design is completed.
3. Completion of in situ infiltration testing to determine infiltration rates expected in specific areas of the Site to aid in LID design.
4. A feature-based water balance for the wetland is needed to demonstrate that its form and function will be maintained post-development.
5. A LID strategy should be developed to match pre- and post-development recharge.

This hydrogeological report revision addresses the above comments, except the feature-based water balance and the detailed dewatering estimates.

feature-based water balance is ongoing and is planned to be completed to evaluate the developmental impacts on the wetland feature concurrently with the Phase II detailed design and application. This approach was reviewed and agreed upon with the Kawartha Conservation Authority in a meeting held on December 2, 2024. Cambium will complete a long-term water level monitoring at the Site as part of feature-based water balance. The 12-

month monitoring for the feature-based water balance is ongoing and will be completed in spring 2026. Once detailed design for the linear infrastructure and building basements is available, the dewatering assessment will be completed.

2.0 Environmental Features

To assess environmental features, databases maintained by the Ministry of Natural Resources (MNR), the Ministry of the Environment, Conservation and Parks (MECP), and Kawartha Region Conservation Authority (KRCA) were reviewed.

According to the data reviewed, the Site is situated within the Kawartha-Haliburton Source Protection Area, and the majority of Site is located within the Pigeon Lake-Gannon Narrows watershed. A portion of the Site to the west is located within the Bobcaygeon River watershed (Ministry of the Environment, Conservation and Parks, 2024).

The Site is within KRCA regulated area per O.Reg. 41/24 and therefore development restriction do apply to the proposed development.

As per the MECP Source Water Protection Information Atlas, the Site is situated within a Highly Vulnerable Aquifer (HVA) area with a vulnerability score of 6.

As per the MNR Natural Heritage System database, the Site does not have any Areas of Environmental Significance or Areas of Natural and Scientific Interests. The Site contains a mapped unevaluated wetland, woodland areas, as well as a Natural Heritage System area (Ministry of Natural Resources, 2024). The type of natural heritage area is identified as Undifferentiated Enabling Plan Growth Plan for the Greater Golden Horseshoe.

3.0 Physical Setting

3.1 Topography and Drainage

Based on the topographic contours provided in the topographic map (Appendix A) created using the MNRF database, the Site has a topographic high in the north-west corner of the property at approximately 305 metres above sea level (masl). From this high, land slopes to the southeast to an elevation of just above 284 masl near the south-east property boundary. There are many rolling hills with low lying areas around the existing residence in southwest corner of Site, a wetland in the centre of the Site, and overland drainage / an intermittent watercourse in the northeast corner.

The local drainage for the Site is assumed to follow the topography, discharging southeast off-site and ultimately discharging into Pigeon Lake approximately 1.3 km east of Site.

3.2 Physiography

According to the Miscellaneous Release – Data 228 from the Ontario Geological Survey (Chapman & Putnam, 1984), the Site is located within the Dummer Moraines physiographic region.

The Dummer Moraine consists of rough stony land with an area of approximately 1550 square kilometres. The bedrock of the Dummer Moraines consists of limestone thinly covered in till and slopes gently southward. Moraines are scattered throughout the region.

3.3 Overburden Geology

According to Data Set 126 – Revised from the Ontario Geological Survey (2010), the Site overburden is characterized as stoney, sandy silt to silty sand-textured till. A bedrock-drift complex with till cover is in the eastern portion of the Site.

3.4 Bedrock Geology

According to Miscellaneous Release – Data 219 from the Ontario Geological Survey (2007), the bedrock of the Site consists of Middle Ordovician rocks from the Simcoe Group. The

Simcoe Group consists of four formations that dip gently towards the southwest from oldest to youngest and consist of the Gull River, Bobcaygeon, Verulam, and the Lindsay Formations. The bedrock of the Site consists of two Simcoe Group formations. Western portion of the Site consists of the Verulam Formation, which is described as limestone and shale. The eastern portion of the Site consists of the Bobcaygeon Formation described as limestone, with minor shales in the upper part of the formation.

4.0 Borehole Drilling and Monitoring Well Installation

4.1 Borehole Investigation

Cambium completed a borehole investigation and test pit investigation on October 25 to October 27, 2023, to assess subsurface conditions at the Site. A total of 14 boreholes, designated as BH101-23 to BH114-23, were advanced to a termination depth ranging from 2.44 to 4.98 mbgs for geotechnical and hydrogeological purposes. Four boreholes, BH101-23, BH108-23, BH109-23, and BH113-23 were equipped as monitoring wells to allow for the assessment of groundwater levels and elevations over time. Borehole and monitoring well locations are included in Figure 2, and borehole logs are included in Appendix B.

A summary of general lithological details is presented below.

Topsoil

Brown silt and sand topsoil was encountered in all boreholes, ranging from 0.075 to 0.250 m in thickness, with an average thickness of approximately 0.150 m.

Clayey Silt

Brown clayey silt, with some sand and trace gravel, and occasional cobbles, was encountered immediately below the topsoil in boreholes BH101-23 and BH102-23. Trace amounts of organics were found within the clayey silt soil in BH102-23. The clayey silt material extended to depths 0.70 and 1.45 mbgs, respectively. The clayey silt soil was generally found to be drier than the plastic limit at the time of investigation. Standard penetration test (SPT) blow counts within the clayey silt provide evidence of generally soft to stiff relative consistencies.

Till

Brown to light brown to grey till soil with a relatively even mixture of sand, gravel, and silt, and some cobbles, was encountered immediately below the topsoil in all boreholes, except BH101 -23 and BH102-23, where it was encountered immediately below the clayey silt soils. The till extended to termination depth in all boreholes. The till was generally found to be moist at the time of investigation, with BH101-23 exhibiting moist-to-wet to wet soils and BH104-23 exhibiting moist-to-wet soils beginning at 2.3 mbgs. SPT blow counts within the till provide

evidence of generally compact to very dense relative densities throughout the entire soil column.

Bedrock

Presumed bedrock was encountered at depths of 3.12, 2.44, 3.35, and 3.66 mbgs, in BH101-23, BH102-23, BH111-23, and BH114-23, respectively. All other boreholes were terminated in native soils at depths from 4.60 to 4.98 mbgs.

Monitoring wells construction details including screen elevations are presented in the Table 1.

Table 1 Well Construction Details

Monitoring Well	Borehole Termination Depth (mbgs)	Monitoring Well Installation Depth (mbgs)	Ground Elevation (masl)	Screen Top (masl)	Screen Bottom (masl)
BH101-23	3.12	3.1	292.72	291.2	289.6
BH108-23	4.72	4.6	287.88	284.8	283.3
BH109-23	4.85	4.6	290.31	287.3	285.7
BH113-23	4.60	4.6	301.62	298.6	297.0

4.2 Physical Laboratory Testing

Physical laboratory testing was completed for a total of seven selected soil samples to confirm textural classification and to estimate percolation rates of the native soils. Results are presented in Appendix C and details of the grain-size analysis are presented in Table 2 below.

Table 2 Particle Size Distribution

Borehole	Depth (mbgs)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	T-Time (min/cm)
BH101-23 SS4	2.3 – 2.9	Silty Gravel and Sand	34	34	25	7	20
BH102-23 SS2	0.8 – 1.4	Clayey Silt, some Sand	7	16	50	27	45
BH105-23 SS3	1.5 – 2.1	Sandy Silty Gravel some Clay	39	28	23	10	30
BH108-23 SS3	1.5 – 2.1	Gravelly Silty Sand	32	41	20	7	20
BH109-23 SS4	2.3 – 2.9	Gravelly Silty Sand	33	35	23	9	25
BH112-23 SS3	1.5 – 2.1	Sandy Silty Gravel some Clay	34	29	26	11	30

As per the data above, the percolation (T) times ranged from 45 to 20 min/cm for the soils ranging in depth from as shallow as 0.8 mbgs to as deep as 2.9 mbgs. The geometric average percolation time was about 27.2 min/cm. This indicates a moderate drainage and infiltration potential for the overburden soils at the Site.

4.3 Piezometer Installation

Cambium staff installed six drive point piezometers as a part of three nested well locations inside the wetland feature denoted DP1-S, DP1-D, DP2-S, DP2-D, DP3-S, DP3-D on March 13, 2025. The exception was piezometer DP1-S which was installed November 10, 2023. Piezometer DP1-D was deepened from 1.62 mbgs to 2.57 mbgs on May 28, 2025, as the depths of the deep and shallow piezometer screens similar depth. Piezometer construction details, including screen elevations, are presented in Table 3. Location of the piezometers are depicted on Figure 3.

Table 3 Piezometer Construction Details

Piezometer	Piezometer Installation Depth (mbgs)	Ground Elevation (masl)	Screen Top (masl)	Screen Bottom (masl)
DP1-S	1.67	289.32	287.96	287.66
DP1-D (1)	2.57	289.32	287.06	286.75
DP2-S	1.11	289.38	288.58	288.27
DP2-D	1.37	289.38	288.31	288.01
DP3-S	1.24	289.55	288.61	288.31
DP3-D	1.62	289.55	288.23	287.93

(1) Piezometer deepened on May 28, 2025, from 1.62 mbgs to 2.57 mbgs

4.4 Groundwater Level Monitoring

4.4.1 Monitoring Well Groundwater Levels

On November 10, 2023, March 13, April 17, May 28, June 17, and July 8, 2025, Cambium staff measured the depths to groundwater in the four monitoring wells. Cambium observed the BH109-23 monitoring well to be damaged and inaccessible for monitoring on May 28, 2025, and was not measured thereafter in the monitoring program. A summary of groundwater elevations is presented in Table 4.

Table 4 Measured Monitoring Well Groundwater Details

Well		BH101-23	BH108-23	BH109-23	BH113-23
Top of Pipe Elevation (masl)		293.63	288.79	291.15	302.51
Ground Surface Elevation (masl)		292.72	287.88	290.31	301.62
Stick-up (m)		0.91	0.91	0.84	0.89
November 10, 2023	Water Level (mbgs)	0.33	Dry	Dry	3.85
	Groundwater Elevation (masl)	292.39	<283.3	<285.7	297.77
March 13, 2025	Water Level (mbgs)	0.12	3.47	3.62	2.24
	Groundwater Elevation (masl)	292.60	284.41	286.69	299.38
April 17, 2025	Water Level (mbgs)	0.21	4.26	3.63	2.48
	Groundwater Elevation (masl)	292.51	283.62	286.68	299.14
May 28, 2025	Water Level (mbgs)	0.12	4.10	-(1)	2.16
	Groundwater Elevation (masl)	292.60	283.78	-(1)	299.46
June 17, 2025	Water Level (mbgs)	0.75	4.38	-(1)	2.86
	Groundwater Elevation (masl)	291.97	283.50	-(1)	298.76
July 8, 2025	Water Level (mbgs)	0.59	4.38	-(1)	3.50
	Groundwater Elevation (masl)	292.13	283.50	-(1)	298.12

(1) Monitoring well damaged and inaccessible for water level measurement

As presented above, the manual measured groundwater levels in the four monitoring wells ranged in depth from 0.12 to 4.38 mbgs, while the elevations ranged from 283.50 to 299.46 masl. Accordingly, the highest groundwater level and elevation was 0.12 mbgs and 299.46 masl, respectively. Of note, monitoring wells BH108-23 and BH109-23, both were installed to a depth of 4.6 mbgs were observed to be dry during the November 10, 2023, monitoring event, but had measurable groundwater in the spring (March to July 2025).

4.4.2 Nested Piezometers Groundwater Levels

On November 10, 2023, March 13, April 17, May 29, June 17, and July 8, 2025, Cambium staff measured the depths to groundwater in the six drive point piezometers. Piezometers were installed to depths ranging between 1.11 and 2.57 m below the bottom of the wetland. The measured water levels and groundwater elevations in piezometers DP1-S, DP1-D, DP2-S, DP2-D, DP3-S, DP3-D are included in Table 5. As presented below, the manual measured groundwater levels in the nested piezometers ranged in depth from 0.38 m above ground surface to 1.58 mbgs, while the elevations ranged from 287.97 to 289.76 masl. Vertical gradients are detailed In Section 4.5.2.

Table 5 Measured Piezometer Water Levels

Well		DP1-S	DP1-D [1]	DP2-S	DP2-D	DP3-S	DP3-D
Top of Pipe Elevation (masl)		290.10	289.94	289.89	290.18	290.16	290.23
Wetland Bottom Elevation (masl)		289.32	289.32	289.38	289.38	289.55	289.55
Stick-up (m Above Wetland Bottom)		0.77	0.62	0.51	0.80	0.61	0.68
November 10, 2023	Water Level (mbtop)	2.11	-	-	-	-	-
	Groundwater Elevation (masl)	287.99	-	-	-	-	-
March 13, 2025	Water Level (mbtop)	-[2]	1.22	0.66	-0.07	1.10	1.58
	Groundwater Elevation (masl)	-[2]	288.10	288.72	289.45	288.45	287.97
April 17, 2025	Water Level (mbtop)	-0.30	-0.31	0.14	-0.38	-0.14	-0.16
	Groundwater Elevation (masl)	289.63	289.63	289.24	289.76	289.69	289.71
May 29, 2025	Water Level (mbtop)	-0.31	0.56	-0.18	-0.20	-0.15	-0.17
	Groundwater Elevation (masl)	289.64	288.70	289.56	289.58	289.70	289.72
June 17, 2025	Water Level (mbtop)	-0.26	-0.13	-0.13	-0.09	-0.08	-0.09
	Groundwater Elevation (masl)	289.59	289.45	289.51	289.47	289.63	289.64
July 8, 2025	Water Level (mbtop)	-0.23	-0.13	-0.09	-0.05	-0.04	-0.06
	Groundwater Elevation (masl)	289.56	289.46	289.47	289.43	289.59	289.61

(1) Piezometer deepened on May 28, 2025, from 1.62 mbgs to 2.57 mbgs

(2) No water level available due to frozen conditions

4.5 Groundwater Flow Direction

4.5.1 Horizontal Gradient

Based on the groundwater elevation data obtained from the April 15, 2025, monitoring event, a site-specific groundwater elevation contour map was prepared to present the groundwater flow direction across the Site (Figure 4). This map was prepared using water level elevations obtained from the all monitoring wells and the drive-point piezometers from the central wetland of the Site.

As shown in Figure 4, the groundwater flow direction was found to be to southeast, where it is interpreted to ultimately discharge into Pigeon Lake located 1.3 km east of the Site.

4.5.2 Vertical Gradient

Vertical gradients in the nested piezometers installed in the wetland were calculated in 2025 using elevation data from March to July. Calculations indicated fluctuating gradients between piezometer nests DP2 and DP3 and a slight downward gradient at perimeter nest DP1. The upward gradient results in both DP2 and DP3 stations indicate that the wetland in these areas are groundwater fed at least part of the year. The calculated vertical gradients are included in Table 6.

Table 6 Vertical Gradients

Monitor	Difference in Elevation of Bottom of Screen (m)	Vertical Gradients Shallow-Deep: +downwards / -upwards				
		March 13, 2025	April 17, 2025	May 29, 2025	June 17, 2025	July 8, 2025
DP1-S	-0.90	-	0.167	1.033	0.146	0.108
DP1-D						
DP2-S	-0.27	-2.680	-1.900	-0.041	0.182	0.164
DP2-D						
DP3-S	-0.38	1.262	-0.050	-0.050	-0.024	-0.063
DP3-D						

-March 13 vertical gradient not available due to frozen conditions in DP1-S

A feature-based water balance is planned to be completed which will include detailed monitoring of the wetland over a duration of a minimum of 1 year. The wetland's status as a

discharge or recharge feature, including any seasonal trends, will be determined through the study.

4.6 In-Situ Hydraulic Conductivity Tests

The hydraulic conductivities (K-value) of the native soils were estimated based on the results obtained from the single well hydraulic tests (SWHT) conducted on November 10, 2023. Rising head tests were performed in the monitoring wells BH103-23, and BH113-23, which had sufficient water for SWHTs. Results of hydraulic conductivity tests are presented below in Table 7 and analytical data is included in Appendix D.

Table 7 Results of Estimated Hydraulic Conductivity as per SWHT

Monitoring Well	Estimated Hydraulic Conductivity (m/sec)		Tested Soil Type
BH101-23	Test 1	8.38×10^{-6}	Gravelly silty sand to silty gravel and sand
	Test 2	8.00×10^{-6}	
	Test 3	8.64×10^{-6}	
BH113-23	Test 1	4.51×10^{-8}	Sandy to silty gravel, some clay
	Test 2	2.45×10^{-8}	

The hydraulic conductivity was estimated utilizing Aquifer Test Pro software using the Hvorslev interpretation method. The estimated hydraulic conductivities ranged between 2.45×10^{-8} and 8.64×10^{-6} m/sec, geometric mean of 9.15×10^{-7} m/sec. The results were consistent with published values for the native till soils encountered at the respective boreholes.

4.7 In-Situ Soil Infiltration Testing

Cambium conducted soil infiltration tests on two separate visits on May 28, 2025, and July 8, 2025. Guelph Permeameter (GP) testing was completed to measure in-situ hydraulic conductivity or the field saturated hydraulic conductivity (K_{fs}) of the native soils. Three infiltration tests were proposed area in the area of three LIDs; Infiltration Gallery A, Infiltration Gallery Pond B, and Infiltration Gallery D. LIDs were identified by the stormwater engineer D.G. Biddle and Associates (Biddle) and are outlined on Figure 4.

A second visit was required due to shallow bedrock conditions observed at the proposed test location for Infiltration Gallery B and the stoney nature of the soil at Infiltration Gallery D

location, which prevented having a clean, representative 0.06 m diameter hole required for the GP testing. The methodology to complete the required infiltration testing due to the stoney nature of the soil and the surface bedrock had to be reconsidered as mentioned in the subsection below.

After the first fieldwork visit, Biddle raised the design grade of the bottom of infiltration galleries of the east side of the Site to account for the shallow bedrock Site conditions. As per the revised conceptual grading and servicing Drawing LG-2 in Appendix A, the bottom inverts of the LID features were:

- 294.40 masl for Infiltration Gallery A
- 283.70 masl for the Infiltration Pond B
- 282.70 masl for Infiltration Gallery D

4.7.1 Infiltration Testing Methodology

Cambium conducted a GP test denoted GP101-25 at Infiltration Gallery A on May 28, 2025. The ground surface elevation of the testing location was approximately 295 masl. The required testing depth for the bottom of the infiltration feature was approximately 0.6 mbgs (294.4 masl). A shallow test hole 0.06 m in diameter was advanced to 0.6 mbgs using a hand auger (denoted HA101-25). The tested native soil was classified as mottled brown and dark brown, silt and clay, trace sand, trace gravel. The soil was described as at its plastic limit and soft to firm in consistency. There was a moisture transition to wetter than plastic limit at the required depth of 0.6 mbgs. Therefore, the infiltration test GP101-25 was carried out at a depth of 0.4 mbgs to keep separation from the water table.

An infiltration test at Infiltration Pond B was not conducted on May 28, 2025, due to shallow bedrock at the testing location. An infiltration test for the Infiltration Gallery D LID was attempted on May 28, 2025. A hand auger hole HA102-25 was advanced to 0.30 mbgs and was terminated on cobbles and gravel. The soil was described as a sandy silt and gravel, some cobbles, some clay. Due to the abundance of gravel and cobble a uniform 0.06 m diameter hole required for GP testing was not achievable.

Cambium returned to Site on July 8, 2025, to complete remaining infiltration tests after consulting with the stormwater engineer about raising the infiltration features and the reconsidering the testing methodology. Cambium conducted a GP test denoted GP102-25 at Infiltration Gallery Pond B and a percolation test denoted PT101-25 at Infiltration Gallery D.

Cambium advanced a shallow test pit (denoted TP101-25) to 0.60 mbgs along the west edge of the Infiltration Pond B where there was available shallow soil for testing. A GP test in the centre of the feature was not possible due to the surface bedrock. The approximate elevation of the testing location was 284 masl. The required testing depth at this location is 0.3 mbgs (283.7 masl). The tested native soil was classified as light brown, sand, some silt, some gravel, trace clay. The soil had loose consistency and was moist to dry. The test pit TP101-25 had refusal on fractured limestone which was encountered at 0.6 mbgs. To carry out GP102-25, a shallow test hole 0.06 m in diameter was advanced beside the test pit TP101-25 using a hand auger to a depth of 0.4 mbgs. This depth is below the bottom invert of the proposed infiltration gallery for the pond at 283.7 masl and therefore will be representative of the soils at the proposed infiltration gallery.

As a GP test was not feasible for Infiltration Gallery D due to the stoney soil strata encountered, so a soil percolation test was conducted instead using the Ontario Building Code 8.2.1.2 (3) methodology. The percolation test was denoted PT101-25. There was no target depth for excavation because the proposed location of Infiltration Gallery D has a ground elevation of approximately 281.7 masl and is already below the invert of the bottom of the infiltration gallery (282.7 masl). A shallow test hole approximately 0.2m in diameter was advanced 0.25 mbgs using a hand auger and shovel (denoted HA103-25). The tested native soil was classified as brown, gravelly sand, some silt, some cobbles. The soil had loose consistency and was moist to dry.

To preform the percolation test, a cylinder approximately 0.20 m in diameter was extended to 0.20 m into the soil layer. All loose materials were removed from the hole, and the bottom of the hole was covered with approximately 0.05 m of sand. The 0.20 m cylinder was filled to 0.15 m above the sand with water and took approximately 6 minutes to fully soak away. Since this time was less than 10 minutes, Cambium filled the cylinder a second time to 0.15m above the

sand. The soil was saturated on this fill and measurements relative to the top of the cylinder were measured every 5 minutes. After 65 minutes the cylinder was filled a third time. On the third filling, three consistent drop readings over the 5-minute measurement period were observed.

Hand auger and test pit logs are included in Appendix B and the locations are included on Figure 4.

4.7.2 Infiltration Testing Results

The field results of the in-situ GP tests GP101-25 and GP102-25 were processed using SOILMOISTURE ® excel based calculation models which yield the saturated hydraulic conductivity of the tested soils (in m/s). The saturated hydraulic conductivity results are then cross-referenced against established relationships between hydraulic conductivity (m/s) and infiltration rate (mm/hr), as outlined in the *Supplementary Guidelines to the Ontario Building Code: SG-6 Percolation Time and Soil Descriptions* (Ontario Ministry of Municipal Affairs and Housing, 1997). The details of the GP test results and measurements are presented in Table 8 and Appendix E. The percolation times ranged from 7 to 31 min/cm, while the infiltration rates ranged between 19 and 88 mm/hour.

Table 8 In-situ Guelph Permeameter Infiltration Test Results

Test Location	Test Depth (mbgs)	Test #	Head (cm)	Field Saturated Hydraulic Conductivity (m/s)	Infiltration Rate (mm/hr)	Average Infiltration Rate (mm/hr)	Average Percolation Rate (min/cm)
GP101-25	0.40	1	5	2.62×10^{-8}	18	19	31
		2	10	4.68×10^{-8}	21		
GP102-25	0.40	1	5	5.77×10^{-6}	74	88	7
		2	10	1.68×10^{-5}	98		

The percolation rate for PT101-25 was calculated using the following formula:

Percolation rate (min/cm) = Time interval (min) / average drop (cm)

The percolation rate result are then cross-referenced against established relationships between percolation rate (min/cm) and infiltration rate (mm/hr) to infer an infiltration rate, as outlined in the *Supplementary Guidelines to the Ontario Building Code: SG-6 Percolation Time and Soil Descriptions* (Ontario Ministry of Municipal Affairs and Housing, 1997). The details of the percolation test results and measurements are presented in Table 9 and Appendix E. The calculated percolation time was 6.3 min/cm, while the infiltration rate was 96 mm/hour.

Table 9 In-situ Percolation Test Results

Test Location	Test Depth (mbgs)	Time Interval (min)	Average Drop of Last 3 Readings (cm)	Percolation Rate (min/cm)	Infiltration Rate (mm/hr)
PT101-25	0.25	5	0.8	6.3	96

The calculated percolation times and infiltration rates indicate high drainage conditions for the Infiltration Pond B and Infiltration Gallery D LIDs on east side of the Site. The calculated percolation and infiltration rate indicate a moderate drainage condition on the west side of the Site for Infiltration Gallery A. These infiltration rates should be accounted for during the design of LID features by Biddle, after an appropriate safety factor is applied.

5.0 Construction Dewatering Requirements

Construction dewatering is intended to lower the groundwater levels in the excavation area to ensure a dry and safe working condition.

The requirements for construction dewatering generally depend on the Site's soil and groundwater conditions including soil type, soil permeability or hydraulic conductivity, local groundwater levels, and the design of the proposed development, such as the foundation and/or basement elevation, as well as the size of proposed structure.

5.1 Proposed Development, Anticipated Excavation and Dewatering

The proposed development will include the construction of 59 estate lots; with 25 estate lots planned for Phase 1 of development. At the time of writing this report, the actual finished floor elevations (FFE) for the structures were not provided. Due to the localized high points, it is assumed that some cut and fill will be completed at the Site. The geotechnical investigation report indicated exterior footings to be placed at a minimum of 1.5 metres below final grade to protect from frost penetration (Cambium, 2023). At the southwest portion of Site, dewatering may be required due to shallow measured water level of 0.33 mbgs. Assuming the excavations for building foundations will go at a minimum to the frost penetration depth of 1.5 mbgs, any seepage within the excavation depths should be controllable with filtered sumps and pumps.

The rest of the Site has water levels deeper than 3.85 mbgs and therefore is feasible to go for conventional basements without requiring a potential dewatering either for short-term or long-term basis. Accordingly, a Permit to Take Water (PTTW) or registry in the Environmental Activity and Sector Registry (EASR) for the MECP will not be required.

The design invert elevations for the Sites linear infrastructure were not available at the time the document was prepared. The open cut excavations for installation of linear infrastructure in the southwestern parts of the Site will likely intercept the groundwater table since the services/utilities are to be placed below the frost penetration depth of 1.5 mbgs (Cambium, 2023). The linear infrastructure installation will require construction dewatering. Preliminary dewatering estimates were not able to be calculated for linear infrastructure, because proposed detailed design of services location and invert depths were not available at this time.

Construction dewatering requirements should be revisited once a detailed design for the linear infrastructure and building basements is available.

6.0 Water Balance Assessment

According to methodology developed by Thornthwaite and Mather (Thornthwaite & Mather, 1957), a water balance is an accounting of water in the hydrologic cycle. Precipitation (P) falls as rain and snow. It can run off towards lakes and streams (R), infiltrate to the groundwater table (I), or evaporate from ground or be transpired by vegetation (ET). When long-term average values of P, R, I, and ET are used, there is minimal or no net change to groundwater storage (ΔS) in a steady-state system.

The annual water budget of a Site can be expressed as:

$$P = R + I + ET + \Delta S$$

Where:

P = Precipitation (mm/year)

R = Run-off (mm/year)

I = Infiltration (mm/year)

ET = Evapotranspiration (mm/year)

ΔS = Change in groundwater storage (taken as zero) (mm/year)

The calculations presented here compare the pre- and post-development water balance changes within the Site boundaries because of the proposed development. It is noted that the water balance described herein does not account for catchment areas that extend off-site.

Based on the available design information, the pre- and post-development Site coverage can be generally categorized into three types: paved areas, roof areas, and landscaped areas.

A summary of the surface areas of the development is listed in Table 11. The pre-development Site area is underlain by a mixture of silt, sand, and gravel till. Detailed design layouts for residential lots were not available for review at the time this document was prepared; therefore, some assumptions had to be made regarding pervious and impervious surfaces.

The impermeable paved area for the residential lot driveways were assumed to be 10% of the lot area, the roofed area for the structures on the lots were assumed to be 250 m^2 and the rest

of the lot was assumed to be pervious landscaped area. The wetland, open space, firefighting/ stormwater management pond blocks were considered to be landscaped area in the calculations.

The development of the Site is proposed to happen in two phases: Phase 1 and Phase 2. The water balance calculations consider each phase individually, as well as a summary of the whole Site. The pre-development land coverage area is depicted on Figure 5 and the Site statistics in Table 10 below.

Table 10 Pre-Development Site Statistics

Type of Land Coverage	Phase 1 Pre-Development Areas (ha)	Phase 2 Pre-Development Areas (ha)	Entire Site Pre-Development Areas (ha)
Paved Area	0.07	0.00	0.07
Roof Area	0.03	0.00	0.03
Landscaped Area	21.71	26.34	48.05
Total	**21.81**	**26.34**	**48.15**

The table below (Table 11) shows the post-development Site statistics and while the areas were depicted schematically on Figure 6.

Table 11 Post-Development Site Statistics

Type of Land Coverage		Phase 1 Post-Development Areas (ha)	Phase 2 Post-Development Areas (ha)	Entire Site Post-Development Areas (ha)
Lot Areas	Paved Area	1.39	1.98	3.37
	Roof Area	0.63	0.85	1.48
	Landscaped Area	11.89	16.93	28.82
Paved Area – Roadways		1.94	2.11	4.05
Landscaped (Wetland, SWM Pond & Open Space)		5.97	4.48	10.45
Total		**21.81**	**26.34**	**48.15**

Supporting information referenced herein (including detailed water balance calculations) is attached in Appendix F.

6.1 Water Surplus

Water surplus is calculated by determining the difference between precipitation and evapotranspiration over the course of a year (changes in soil water storage were assumed to be negligible). The volume of water surplus is further sub-divided into portions that infiltrate the on-site soils and that are directed off-site as runoff.

The 30-year climate normal data, including monthly average temperature and precipitation, was obtained from Environment Canada, for Peterborough Trent U (Climate ID: 6166455) located about 29.11 km distance from the Site. The average annual precipitation was recorded to be 882 mm/year, and the average annual evapotranspiration was estimated to be about 540 mm/year using the USGS Thornthwaite Monthly Water Balance methodology (Thornthwaite & Mather, 1957). Accordingly, the water surplus of the Site was calculated to be 342 mm/year.

Transpiration does not occur from structures and paved areas. It was assumed that 10% of precipitation falling on such surfaces is lost directly to evaporation. The remaining depth (i.e., 90% of precipitation) was considered surplus and converted either to infiltration and/or runoff.

6.2 Infiltration Rates

The volume of surplus water that infiltrates through pervious surfaces on-site was determined by applying an infiltration factor to the surplus depth. The surplus water that does not infiltrate into pervious surfaces will leave the Site as surface water runoff. The infiltration factor varies from 0 to 1 and is estimated based on topography, soils, and vegetation cover as per the *Stormwater Management Planning and Design Manual* (Ministry of the Environment, 2003).

The rate of infiltration at a Site is expected to vary, based on several factors to be considered in any infiltration model. To partition the available water surpluses into infiltration and surface run-off, the MECP infiltration factors were used. The MECP Storm Water Management Planning and Design Manual (2003) methodology for calculating total infiltration based on topography, soil type and land cover was used, and a corresponding run-off component was calculated for the soil moisture storage conditions.

The Site has a slight rolling topography and based on the results of the borehole investigation and the grain size analysis, the subsurface conditions at the Site are combinations of silty sand and gravelly till dominant soils.

Therefore, an infiltration factor of 0.65 was calculated for the Site using the MECP method.

6.3 Phase 1 Water Balance Assessment

This section outlines the pre- and post-development water balance calculations for Phase 1 of the development.

6.3.1 Phase 1 Pre-Development Water Balance

The water balance for the existing conditions in Phase 1 of the Site is summarized in Table 12. The pre-development infiltration rate was calculated to be about 48,300 m^3/year and the runoff rate was about 26,800 m^3/year.

Table 12 Phase 1 Pre-Development Water Balance

Land Use		Area (m^2)	Precipitation (m^3)	Evapo-transpiration (m^3)	Infiltration (m^3)	Run-off (m^3)
Impervious Areas	Paved Area	700	617	62	-	556
	Roof Area	300	265	26	-	238
Pervious Areas	Landscape Area	217,080	191,465	117,223	48,257	25,984
Total		**218,080**	**192,347**	**117,311**	**48,257**	**26,778**

Assuming no infiltration occurring in paved and roof areas, and 10% of precipitation to be evaporated from paved and roof areas.

6.3.2 Phase 1 Post-Development Water Balance

The Phase 1 post-development water balance is summarized in Table 13. The Phase 1 post-development infiltration rate was calculated to be approximately 39,700m^3/year and the runoff volume was about 52,700 m^3/year.

Table 13 Phase 1 Post-Development Water Balance

Land Use		Area (m^2)	Precipitation (m^3)	Evapo-transpiration (m^3)	Infiltration (m^3)	Run-off (m^3)
Impervious Areas	Paved Area	33,254	29,330	2,933	-	26,397
	Roof Area	6,250	5,513	551	-	4,961
Pervious Areas	Landscape Area	178,576	157,504	96,431	39,697	21,376
Total		**218,080**	**192,347**	**99,915**	**39,697**	**52,734**

Assuming no infiltration occurring in paved and roof areas, and 10% of precipitation to be evaporated from paved and roof areas.

6.4 Phase 2 Water Balance Assessment

This section outlines the pre- and post-development water balance calculations for Phase 2 of the development.

6.4.1 Phase 2 Pre-Development Water Balance

The Phase 2 water balance for the existing conditions of the Site, is summarized in Table 14. The pre-development infiltration rate was calculated to be about 58,600 m^3/year and the runoff rate was about 31,500 m^3/year.

Table 14 Phase 2 Pre-Development Water Balance

Land Use		Area (m^2)	Precipitation (m^3)	Evapo-transpiration (m^3)	Infiltration (m^3)	Run-off (m^3)
Impervious Areas	Paved Area	-	-	-	-	-
	Roof Area	-	-	-	-	-
Pervious Areas	Landscape Area	263,420	232,336	142,247	58,558	31,531
Total		**263,420**	**232,336**	**142,247**	**58,558**	**31,531**

Assuming no infiltration occurring in paved and roof areas, and 10% of precipitation to be evaporated from paved and roof areas.

6.4.2 Phase 2 Post-Development Water Balance

The Phase 2 post-development water balance is summarized in Table 15. The post-development infiltration rate for Phase 2 was calculated to be approximately 47,600 m^3/year and the runoff volume was about 64,800 m^3/year.

Table 15 Phase 2 Post-Development Water Balance

Land Use		Area (m^2)	Precipitation (m^3)	Evapo-transpiration (m^3)	Infiltration (m^3)	Run-off (m^3)
Impervious Areas	Paved Area	40,847	36,027	3,603	-	32,424
	Roof Area	8,500	7,497	750	-	6,747
Pervious Areas	Landscape Area	214,073	188,812	115,599	47,588	25,625
Total		**263,420**	**232,336**	**119,952**	**47,588**	**64,796**

Assuming no infiltration occurring in paved and roof areas, and 10% of precipitation to be evaporated from paved and roof areas.

6.5 Water Balance Comparison

The water balances of the Phase 1 and Phase 2 pre-development and post-development scenarios are summarized below in Table 16.

Table 16 Water Balance Comparison

		Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-off (m^3)
Phase 1	**Pre-Development**	192,347	117,311	48,257	26,778
	Post-Development	192,347	99,915	39,697	52,734
	Change in Volume	**-**	**-17,396**	**-8,559**	**25,956**
	Change in %	**-**	**-15**	**-18**	**97**
Phase 2	**Pre-Development**	232,336	142,247	58,558	31,531
	Post-Development	232,336	119,952	47,588	64,796
	Change in Volume	**-**	**-22,295**	**-10,970**	**33,265**
	Change in %	**-**	**-16**	**-19**	**105**

Based on the above, there is a net infiltration deficit of about 8,600 and 11,000 m^3/year for Phase 1 and Phase 2, respectively, compared to the pre-development infiltration. Therefore, the overall infiltration deficit over the entire Site would be 19,600 m^3/year The runoff rate upon development of the Site will increase by about 26,000 m^3/year for Phase 1 and about 33,300 m^3/year for Phase 2. The net runoff rate over the entire Site upon development would thus increase by about 59,300 m^3/year.

The roof surfaces Phase 1 and Phase 2 of the proposed development are projected to generate about 5,000 and 6,700 m^3/year totalling approximately 11,700 m^3/year of runoff

(Table 13 and Table 15). Reinfiltrating all the roof runoff at the Site could account for approximately 60% of the overall infiltration deficit.

6.6 Water Balance Summary

A summary of the water balance could be provided as below:

- There is a net increase in run-off for the entire Site of about 58,300 m^3/year. This increase is a result of the development of the Site with more impervious areas such as roof and paved areas and a decrease in pervious areas.
- Post-development landscape area was decreased by about 87,900 m^2 when compared to pre-development conditions, which would result in less infiltration across the Site.
- Without implementing any mitigation measures the projected infiltration deficit over the entire Site is 19,600 m^3/year.
- Re-infiltrating almost 100% of the roof runoff will account for approximately 60% of the projected infiltration deficit.
- Low impact development (LID) practices should be investigated to help offset the infiltration deficit.

6.7 Discussions on LID Measures

Low impact development practices attempt to capture runoff and mimic the natural hydrologic cycle. It is important to maintain the natural hydrologic cycle as much as possible as reduction in infiltration reduces groundwater recharge and soil moisture replenishment and can also lead to reductions in stream baseflows which are needed to sustain aquatic life.

In general, there are two primary types of LIDs. The first promotes the infiltration of stormwater run-off close to the source. These infiltration type LIDs are preferred when hydrogeological and physical conditions are optimal and allow for their emplacement. The second type of LID captures and slowly releases stormwater to the groundwater water system through a process of storage and filtration by infiltration LIDs.

The conceptual water balance indicates that there will be an infiltration deficit of about 19,600 m³/year in the post-development infiltration upon development of both Phase 1 and Phase 2, compared to the pre-development condition.

Infiltration targets at the Site may be achieved through LIDs and incorporation of a variety of stormwater management techniques including reduced lot grading, roof downspout disconnection, roof leaders discharging to ponding areas or soak away pits, infiltration trenches, and grassed swales. Re-infiltrating roof runoff is a common solution to addressing the infiltration deficit, especially when there is a good extent of landscape area available. However, the calculated roof runoff generated will only account for 60% of the infiltration deficit. D.G. Biddle and Associates were retained to design the LID infrastructure and to attenuate stormwater runoff to attenuate post development runoff to pre-development levels.

To accomplish this, Biddle has proposed three infiltration features. Infiltration Gallery A on the west side of Site located within the proposed roadside ditch and has been sized to infiltrate 100% of the 5-year Peterborough storm. Infiltration Pond B feature is located in Block 31 within the Phase 2 lands, with the feature at the bottom of the pond sized for the runoff of the 4-hour 25mm rainfall event. Infiltration Galley D, located in the rear yards of lots 14 to 16, has been sized to infiltrate 100% of the 2-year storm with 87m^3 of required water storage. The location of the features have been outlined on Figure 4 and further information for the LIDs can be found in Biddle's functional servicing and stormwater management report (D.G. Biddle & Associates, 2024).

It is noted that in the area of Infiltration Gallery A, groundwater levels were measured between 0.12 and 3.85 mbgs (299.14 to 291.97 masl) from wells BH113-23 and BH101-23 over the monitoring events with the highest levels to groundwater recorded on the southwestern well BH101-23. The groundwater elevation in the area of the Infiltration Gallery A was approximately 293 masl, according to the groundwater configuration plan prepared using April 17, 2025, data. An infiltration gallery LID feature requires one metre of vertical separation between the invert of a LID and high groundwater level. Since the bottom invert elevation is 294.40 masl and the groundwater elevation in April was 293 masl, the implementation of LIDs in these areas should be feasible.

The eastern portion of the Site near infiltration Gallery Pond B and Infiltration Gallery D did not have wells advanced in the location due to shallow bedrock. No ponding was observed in the LID areas and groundwater was not encountered during the hand augering as part of the infiltration testing. It is interpreted that the groundwater at the Site continues to flow southeast into the bedrock. The infiltration galleries at the two locations have to be raised and imported soil will need to be brought in for the construction of these features. Due to the grade raise, the required 1 m groundwater separation to the bottom invert elevation should be feasible. Consideration should be given to the infiltration and percolation rates of unsaturated soils described in Section 4.7 when finalizing the stormwater management plan and LID measures for the Site.

It should be noted that water levels will vary based on seasonal events and therefore, should be measured regularly as a part of the feature-based water balance scope of work to confirm high water conditions prior to construction.

7.0 Wastewater Assessment (Nitrate Mass Balance)

As per Guideline D-5-4 Technical Guideline for Individual On-Site Sewage Systems: Water Quality Risk Assessment (Ministry of the Environment, 1996) an assessment was completed to determine the feasibility of utilizing on-site sewage disposal for the development.

Guideline D-5-4 requires the septic effluent plume at the Site boundary to be less than the Ontario Drinking Water Quality Standards (ODWQS) limit of 10 mg/L for nitrate to prevent contamination of groundwater on adjacent properties. Although natural processes and soil interaction can result in nitrate being attenuated in the receiving aquifer system, Guideline D-5-4 states that only dilution can be used as the attenuation mechanism to predict future nitrate concentrations. As such, a mass balance calculation is used to predict the impact of developing residential lots on the Site.

7.1 Available Dilution

The total available dilution for the Site is estimated by the following equation:

$$Qi = A \times S \times I$$

Where: Qi – Volume of Available dilution water

A – Area of the Site

S – Water surplus

I – Infiltration factor

To calculate the water surplus, the thirty-year climate normal data collected between 1981 and 2010 at the Peterborough Trent U (ID 6166455) weather station was used. The data was accessed through the Environment Canada website (Environment Canada, 2024).The total yearly precipitation, on average, was 882 mm.

The Thornthwaite method was used to determine the amount of evapotranspiration that will occur at the Site (Dingman, 2008). The calculated depth of evapotranspiration was 540 mm/year, and the water surplus was calculated to be 342 mm per year. The evapotranspiration calculations are attached in Appendix F.

To determine the fraction of surplus water that infiltrates into the soils at the Site, the volume of surplus water is multiplied by an infiltration factor. As described the infiltration factor was determined to be 0.65 using the Stormwater Management Planning and Design Manual (Ministry of the Environment, 2003).

The volume of dilution water was calculated based on the post-development permeable area. The areas of the roads, roofs, and standing surface water were assumed to be impermeable. For road areas, water was assumed to run-off towards the permeable areas of the Site, therefore road surfaces were included in the dilution calculations. The proposed roofed area was included in the permeable area as it is assumed that roof leaders will direct any roof runoff to landscaped areas as is typical in rural subdivisions and therefore will not contribute to a post-development recharge deficit. Therefore, the only land that isn't being used within the dilution calculations is the wetland area with standing water and the intermittent water course with their associated buffer areas (9.80 ha). The area available for dilution is the developable area at 38.35 ha.

The calculations of the available dilution water for the Site are outlined below Table 17.

Table 17 Available Dilution Calculations

Infiltration Factor			
Topography		Rolling Land = 0.2	
Soil		Combination of silt, sand, and gravel till = 0.3	
Cover		Cultivated and woodland mix =0.15	
Infiltration Factor (I)		0.65	
Volume of Precipitation Water			
Parameter	**Symbol**	**Units**	
Dilution Area	A	m^2	383,500
Surplus	S	m/day	0.000937
Volume of Surplus Water (Per Day)	A * S	m^3	359.50
Volume of Available Dilution Water (Per Day)	A * S * I	m^3	233.67
Volume of Runoff Water (Per Day)	A * S * (1-I)	m^3	125.82

7.2 Predictive Assessment

As per the procedure in Guideline D-5-4, a nitrate loading of 40 grams/lot/day is required to simulate the effluent loading from conventional septic systems on the receiving groundwater system. Total nitrogen (all species) ultimately converts to nitrate through the wastewater treatment process, so nitrate is the critical contaminant in sewage effluent. Each proposed lot is anticipated to generate an average discharge of 1,000 L/day of sewage effluent which contributes to the dilution of the total nitrate load.

To determine if the proposed lot density is adequate for nitrate dilution, a mass balance calculation is used to determine the sewage loading for nitrate on the property boundary. The mass balance calculations are outlined below as:

$$Q_tC_t = Q_eC_e + Q_iC_i$$

Where: Q_t = Total volume ($Q_e + Q_i$)

C_t = Total concentration of nitrate at the property boundary

Q_e = Volume of septic effluent

C_e = Concentration of nitrate in effluent (40 mg/L)

Q_i = Volume of available dilution water

C_i = Concentration of nitrate in dilution water (0.1 mg/L)

To determine the concentration of nitrate at the property boundary (C_t), the above mass balance equation can be arranged as follows:

$$C_t = \frac{Q_eC_e + Q_iC_i}{Q_t}$$

This equation was used to determine the dilution of wastewater by including infiltration on both the developable and non-developable portions of the Site. The results of the equation have been outlined in Table 18 below. Detailed calculations are included in Appendix G.

Table 18 Predictive Assessment of Nitrate Concentration

Variable	Value
Number of Lots	59
Q_e (L)	59,000
C_e (mg/L)	40
Q_i (L)	233,674
C_i (mg/L)	0.1
Q_t (L)	292,675
C_t (mg/L)	**8.14**

At the time of the assessment, the proposed development includes the construction of 59 new residential dwellings. The development of Site is proposed to happen in two phases, with Phase 1 being developed with 25 lots and Phase 2 with 34 lots. The nitrate calculations considered the whole Site for both phases and did not consider the two phases independently.

The predicted nitrate concentration at the Site boundary based on this 59-lot density using the calculated dilution volume is 8.14 mg/L, which is less than the maximum allowable limit of 10 mg/L. Therefore, the Site can accommodate the proposed 59 new lots according to Guideline D-5-4.

The actual nitrate concentration is anticipated to be even lower due to the natural attenuation that will occur within the soil since this calculation only assumes dilution. In addition, conservative estimates were used for infiltration factors for the non development area with the limited information on soil characteristics in the area.

8.0 Source Water Protection and Risk Management

As per the Trent Source Protection Plan, the Site is located within a Highly Vulnerable Aquifer (HVA) area (Appendix A).

8.1 Highly Vulnerable Aquifer Area

An HVA is an aquifer that can be easily changed or affected by contamination from both human activities and natural processes. This is a result of preferential pathways to the aquifer or the areas intrinsic susceptibility as a function of the thickness and permeability of the overlying soils. In Ontario, a HVA is defined as having an Intrinsic Susceptibility Index of less than 30. In general, an HVA will consist of granular materials (e.g., sand and/or gravel) or fractured rock that has a high permeability and is near the surface of the ground. It is important to protect highly vulnerable areas to prevent drinking water contamination.

The land use practices at the proposed development Site are not expected to cause any contamination to the water resources as it is assumed that there are no chemicals, fertilizers, or petroleum hydrocarbons proposed to be stored at or handled on Site.

9.0 Assessment of Potential Impacts

Based on the information available, the proposed development consists of a 59 estate lots with 25 estate lots planned for Phase 1 of development. The potential impacts due to the Site development were assessed as below.

9.1 Natural Features

As discussed, an unevaluated wetland occupies much of the central portion and northeast of the Site and therefore, there could be some impacts on the local natural features due to the Site development. Therefore, as per Ont. Reg. 41/24set-back distances or buffer zones as prescribed by KRCA should be followed to protect the natural features.

9.2 Water Supply Wells near the Site

Based on the Site-specific conditions and the nature of the proposed development, it is highly unlikely that large scale dewatering activity will take place and additionally, water well records from the surrounding area indicate that the depth to water in the bedrock aquifer (which provides local water supply) has a geometric mean depth of 18.3 mbgs. It is therefore not expected that the water present in the shallow subsurface at the Site is connected to the water supply aquifer. Thus, no groundwater quantity impacts on local water wells (private or public), are anticipated due to the proposed development.

9.3 Considerations on Drinking Water Vulnerability

The entire area of the Site is identified as a HVA with moderate vulnerability. The proposed development therefore has potential to be affected by contamination from both human activities and natural processes, which can then in turn impact local drinking water supplies. The risk to drinking water quality can be minimized by preventing the infiltration of poor-quality runoff from paved surfaces such as driveways and roadways. As discussed in Section 8.1. The land use practices at Site are not expected to cause contamination to the water resources as it is assumed that there are no chemicals, fertilizers, or petroleum hydrocarbons proposed to be stored at or handled on Site. A multi-pronged approach is advised to reduce the impact of

winter salt application and promote best practices for residential outdoor use of chemicals and pesticides.

10.0 Conclusion and Recommendations

Cambium was retained by Jeffery Homes to complete a hydrogeological assessment of the property with a legal description of Part of Lot 19, Concession 19, Township of Galway-Cavendish and Harvey, County of Peterborough.

The Site is situated in a KRCA regulated area. The Site has an unevaluated wetland, woodlands, as well as a Natural Heritage System Area mapped on the Site. The type of natural heritage area is identified as Undifferentiated Enabling Plan Growth Plan for the Greater Golden Horseshoe. The unevaluated wetland occupies much of the central and northeast portions of the Site and therefore, there could be some impacts on the local natural features due to the Site development. Set-back distances or buffer zones as prescribed by the KRCA should be followed to protect the natural features.

The measured groundwater levels in the monitoring wells and nested piezometers during the monitoring events ranged in depths from 0.38 m above ground surface to 4.38 mbgs, and the elevations ranged from 283.50 to 299.46 masl. Dry conditions on the east portion of Site were noted to the explored depths of approximately 4.6 mbgs in BH108-23 and BH109-23 (283.3 to 285.7 masl) on November 10, 2023.

Groundwater flow horizontally was determined to be southeast where is it interpreted to discharge into Pigeon Lake, located about 1.3 km east of the Site. Vertical gradients in the nested piezometers indicated fluctuating gradients between piezometer nests DP2 and DP3 and a slight downward gradient at perimeter nest DP1. The upward gradient results in both DP2 and DP3 stations indicate that the wetland in these areas are groundwater fed at least part of the year.

A feature-based water balance is currently ongoing to evaluate the developmental impacts on the wetland feature concurrently with the Phase II detailed design and application. Cambium will complete a long-term water level monitoring at the Site as part of feature-based water balance.

The estimated hydraulic conductivities ranged between 2.45×10^{-8} and 8.64×10^{-6} m/sec, geometric mean of 9.15×10^{-7} m/sec.

The open cut excavations for installation of linear infrastructure in the southwestern parts of the Site will likely intercept the groundwater table since the services/utilities are to be placed below the frost penetration depth of 1.5 mbgs (Cambium, 2023). The linear infrastructure installation will likely require construction dewatering. Preliminary dewatering estimates were not able to be calculated for linear infrastructure, as detailed design of services and invert depths were not available at this time.

Proposed development will include the construction of 59 estate lots, with 25 planned for Phase 1 of development. Construction excavation dewatering may be required for linear infrastructure. At the time of writing this report, the actual FFEs for the structures and services were not provided. Detailed design for Site servicing including locations and invert elevations were unavailable, so dewatering estimates were not provided. When Site plan drawings are made available, the dewatering estimates for linear infrastructure as well as building basements should be revisited.

The conceptual water balance indicates that there will be an infiltration deficit upon development of the Site in the order of about 19,600 m^3/year (8,600 and 11,600 m^3/year for Phase 1 and Phase 2 respectively) based off the current proposed Site plan. To compensate the infiltration deficit, roof downspout disconnection discharge to the sloped areas away from the building footprint should be implemented. Based on the estimation, a diversion of 100% of general roof water for infiltration would allow for 60% offset of the infiltration deficit of proposed Phase 1 and Phase 2 development to maintain an enhanced infiltration after the development.

Three LID infiltration galleries have been designed by the retained surface water engineer D.G. Biddle and Associates to address the infiltration deficit to maintain pre-development infiltration. In-situ infiltration tests were conducted in the three proposed LID locations and the estimated infiltration rates ranged between 19 and 96 mm/hour. These infiltration rates should be accounted for during the design of LID features by a stormwater engineer, after an appropriate safety factor is applied.

The wastewater assessment indicates that the proposed development of 59 lot estate homes with private, on-site wastewater disposal, would result in a nitrate concentration of 8.14 mg/L at the property boundary, which is less than the Ontario Drinking Water Quality Standard of

10 mg/L. The proposed development is therefore expected to maintain acceptable nitrate concentrations at property boundaries.

Since the Site is situated within an HVA, Cambium recommends using the BMPs to avoid overland flow of any contaminants to the natural environment. There are no significant chemical or pathogen threats identified for the proposed land uses at the development.

10.1 Recommendations

As per Stantec's peer review of the hydrogeological assessment report, a feature-based water balance is recommended to be completed for the Site and construction dewatering requirements should be revisited once a detailed design for the linear infrastructure and building basements is available.

Cambium is currently completing long term water level monitoring as the feature-based water balance requires a minimum of 12 months of groundwater monitoring. The purpose of the feature-based water balance is for the wetland to demonstrate that its form and function will be maintained post-development. Cambium will complete the feature-based water balance at the completion of the 12 months of monitoring.

11.0 Closing

We trust that the information in this submission meets your current requirements. If you have any questions regarding the contents of this report, please contact the undersigned.

Respectfully submitted,

Cambium Inc.

Original signed by:
Warren Young, P.Eng.
Coordinator – Hydrogeologist

Original signed and stamped by:
Kevin Warner, M.Sc., P.Geo. (ltd), BCIN
Manager – Water and Wastewater, Senior Hydrogeologist

WY/KW

\\cambiumincstorage.file.core.windows.net\projects\17900 to 17999\17986-003 Jeffery Homes - WWW - Pt. Lot 19, Conc. 19\Deliverables\REPORT - Preliminary Report\Final\2025-07-23 RPT HydroG - Bobcaygeon Development.docx

12.0 References

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13.0 Standard Limitations

Limited Warranty

In performing work on behalf of a client, Cambium relies on its client to provide instructions on the scope of its retainer and, on that basis, Cambium determines the precise nature of the work to be performed. Cambium undertakes all work in accordance with applicable accepted industry practices and standards. Unless required under local laws, other than as expressly stated herein, no other warranties or conditions, either expressed or implied, are made regarding the services, work or reports provided.

Reliance on Materials and Information

The findings and results presented in reports prepared by Cambium are based on the materials and information provided by the client to Cambium and on the facts, conditions and circumstances encountered by Cambium during the performance of the work requested by the client. In formulating its findings and results into a report, Cambium assumes that the information and materials provided by the client or obtained by Cambium from the client or otherwise are factual, accurate and represent a true depiction of the circumstances that exist. Cambium relies on its client to inform Cambium if there are changes to any such information and materials. Cambium does not review, analyze, or attempt to verify the accuracy or completeness of the information or materials provided, or circumstances encountered, other than in accordance with applicable accepted industry practice. Cambium will not be responsible for matters arising from incomplete, incorrect, or misleading information or from facts or circumstances that are not fully disclosed to or that are concealed from Cambium during the provision of services, work, or reports.

Facts, conditions, information, and circumstances may vary with time and locations and Cambium's work is based on a review of such matters as they existed at the time and location indicated in its reports. No assurance is made by Cambium that the facts, conditions, information, circumstances, or any underlying assumptions made by Cambium in connection with the work performed will not change after the work is completed and a report is submitted. If any such changes occur or additional information is obtained, Cambium should be advised and requested to consider if the changes or additional information affect its findings or results.

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Site Assessments

A site assessment is created using data and information collected during the investigation of a site and based on conditions encountered at the time and particular locations at which fieldwork is conducted. The information, sample results and data collected represent the conditions only at the specific times at which and at those specific locations from which the information, samples and data were obtained and the information, sample results and data may vary at other locations and times. To the extent that Cambium's work or report considers any locations or times other than those from which information, sample results and data was specifically received, the work or report is based on a reasonable extrapolation from such information, sample results and data but the actual conditions encountered may vary from those extrapolations.

Only conditions at the site and locations chosen for study by the client are evaluated; no adjacent or other properties are evaluated unless specifically requested by the client. Any physical or other aspects of the site chosen for study by the client, or any other matter not specifically addressed in a report prepared by Cambium, are beyond the scope of the work performed by Cambium and such matters have not been investigated or addressed.

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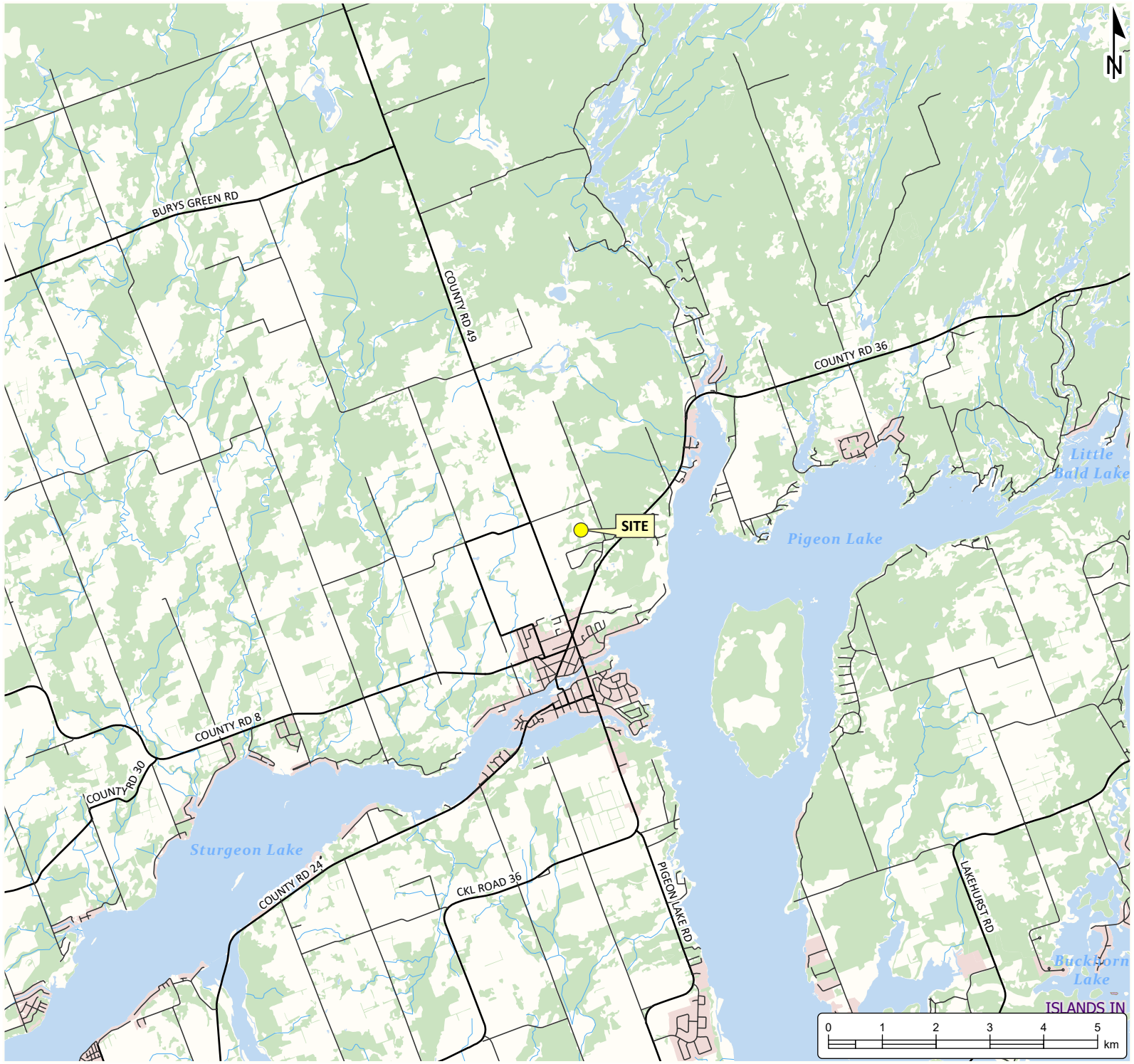
Appended Figures



HYDROGEOLOGICAL ASSESSMENT

JEFFERY HOMES
Pt. Lot 19, Conc. 19 - 168 County Road 49
Bobcaygeon, Ontario

LEGEND

- Highway
- Major Road
- Minor Road
- Railway
- Water Area
- Watercourse
- First Nations Reserve
- Provincial Park
- Wooded Area
- Built Up Area

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SITE LOCATION PLAN

Project No.:	17986-003	Date:	July 2025
		Rev.:	3
Scale:	1:100,000	Projection:	NAD 1983 UTM Zone 17N
Created by:	DBB	Checked by:	KW
Figure:	1		

O:\GIS\MXDs\17900-17999\17986-003 Jeffery Homes - WWW - Pt. Lot 19 Conc. 19\2025-04-25 Groundwater Configuration 17986-003.aprx

HYDROGEOLOGICAL ASSESSMENT

JEFFERY HOMES
Pt. Lot 19, Conc. 19 - 168 County Road 49
Bobcaygeon, Ontario

LEGEND

Site (approximate)

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SITE PLAN

Project No.: 17986-003		Date: July 2025 Rev.: 3	
Scale: 1:6,000		Projection: NAD 1983 UTM Zone 17N	
Created by: DBB	Checked by: KW	Figure: **2**	

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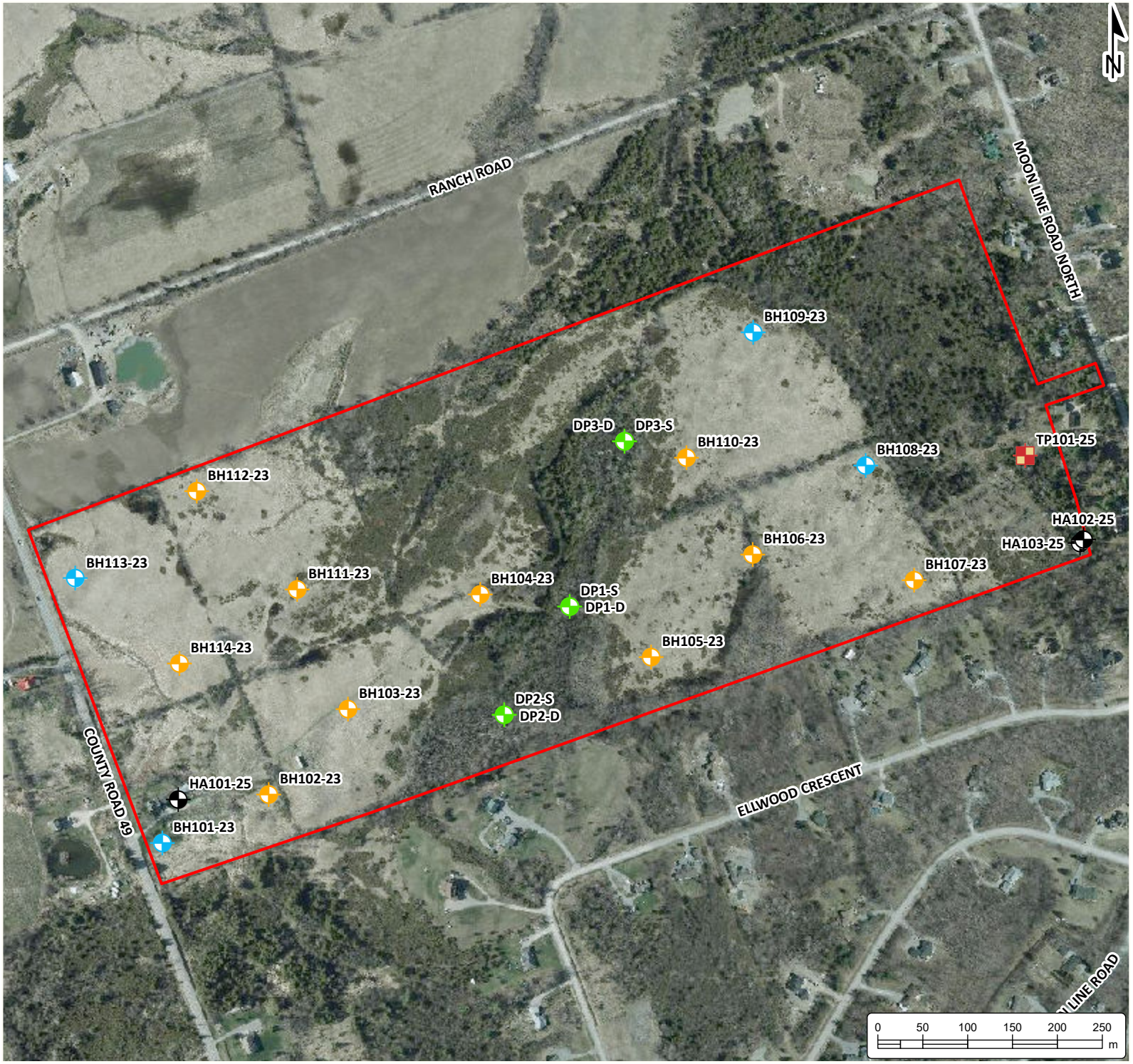

HYDROGEOLOGICAL ASSESSMENT

JEFFERY HOMES
Pt. Lot 19, Conc. 19 - 168 County Road 49
Bobcaygeon, Ontario

LEGEND

- Borehole
- Monitoring Well
- Piezometer
- Hand Auger
- Test Pit
- Site (approximate)

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BOREHOLE LOCATION PLAN

Project No.:	17986-003	Date:	July 2025
		Rev.:	3
Scale:	1:6,000	Projection:	NAD 1983 UTM Zone 17N
Created by:	MAT	Checked by:	KW
Figure:	3		

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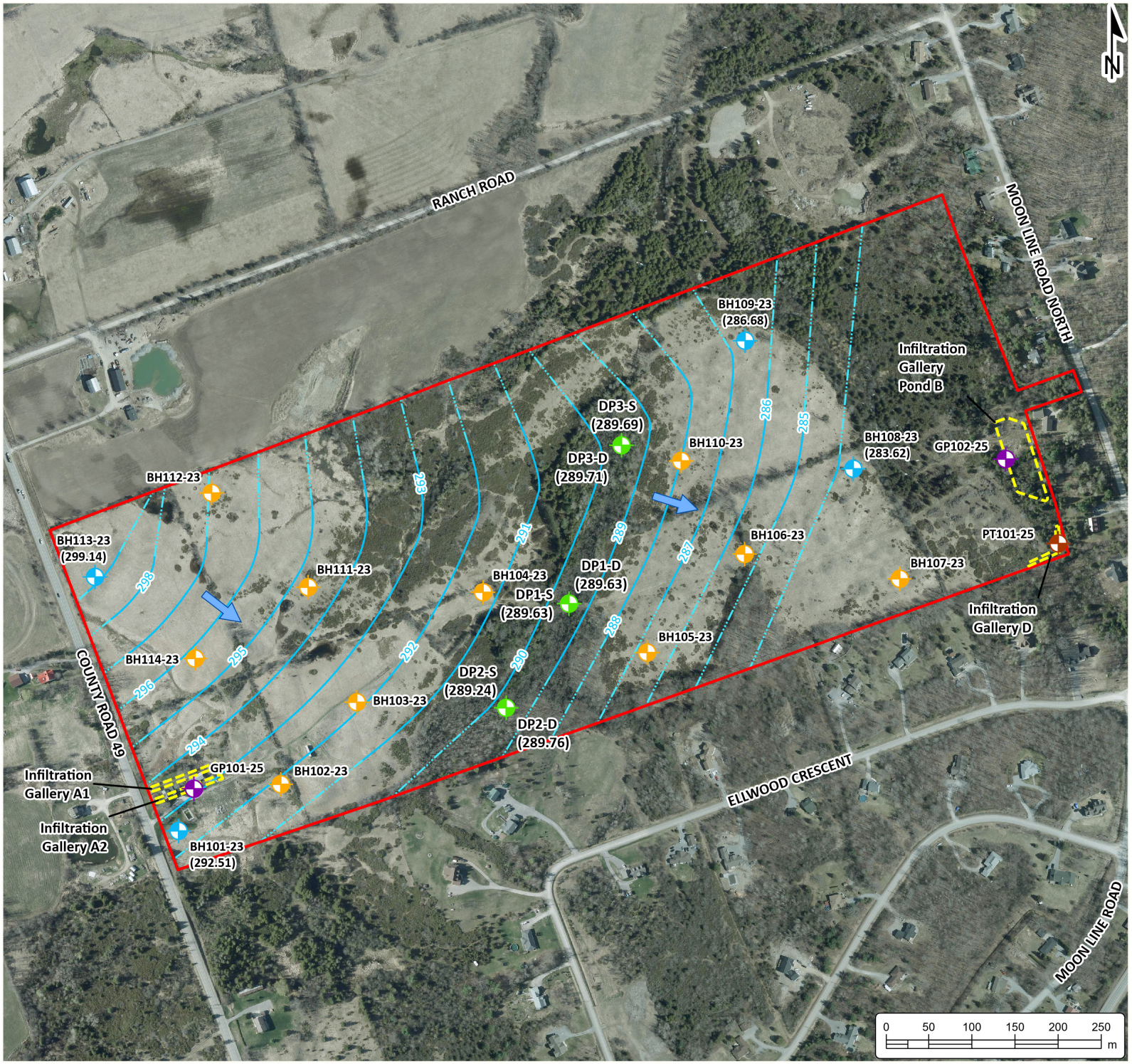

HYDROGEOLOGICAL ASSESSMENT

JEFFERY HOMES
Pt. Lot 19, Conc. 19 - 168 County Road 49
Bobcaygeon, Ontario

LEGEND

- (292.51) Groundwater Elevations (April 17, 2025)
- Peizometer
- Borehole
- Benchmark
- Monitoring Well
- Guelph Permeameter
- Percolation Test
- Groundwater Contour (April 17, 2025)
- Inferred Groundwater Contour (April 17, 2025)
- Infiltration Gallery
- Groundwater Flow Direction (April 17, 2025)
- Site (approximate)

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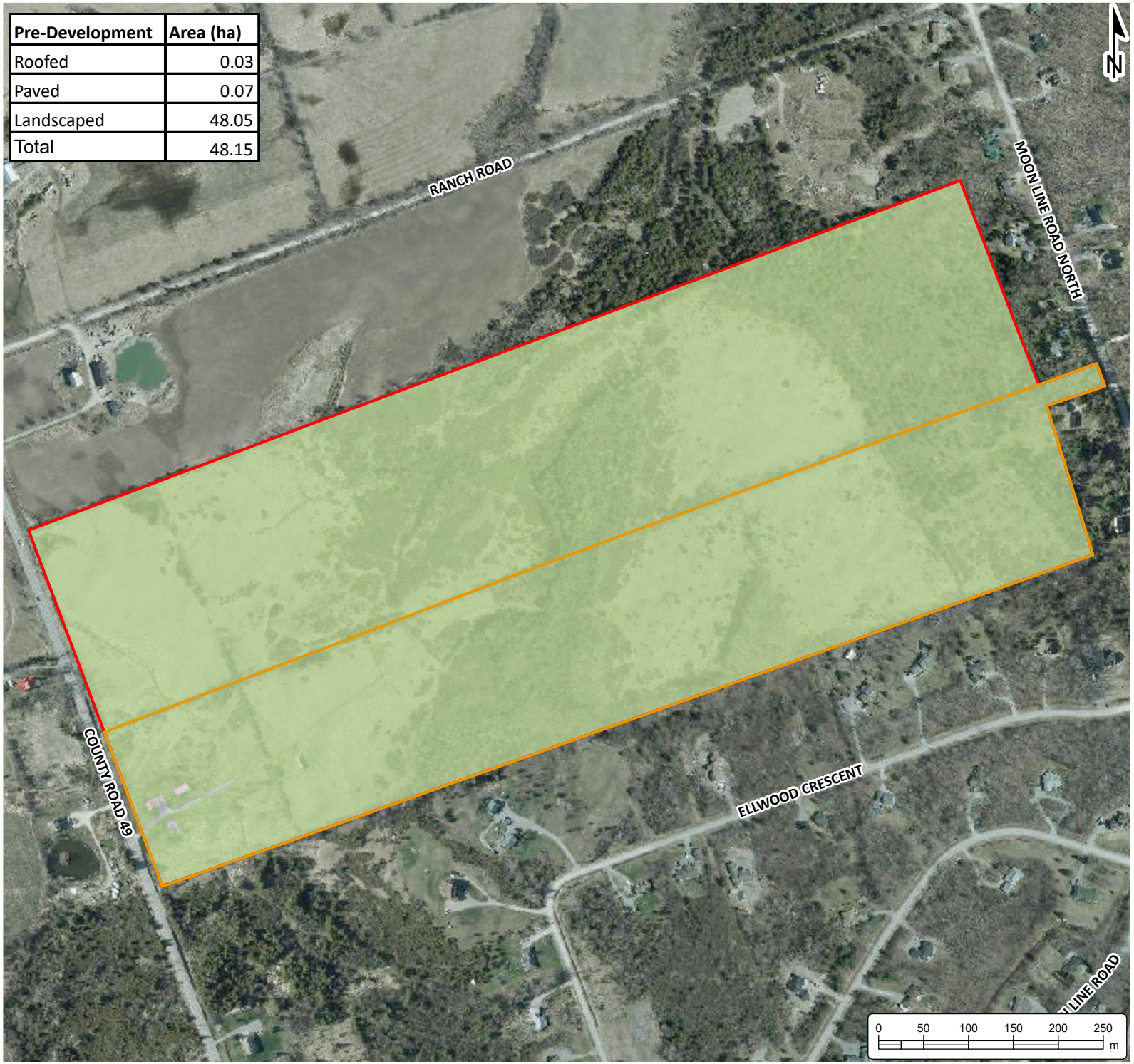
GROUNDWATER CONFIGURATION PLAN

Project No.:	17986-003	Date:	July 2025
		Rev.:	3
Scale:	1:6,250	Projection:	NAD 1983 UTM Zone 17N
Created by:	LD	Checked by:	KW
Figure:	4		

O:\GIS\MXDs\17900-17999\17986-003 Jeffery Homes - WWW - Pt. Lot 19 Conc. 19\2025-04-25 Groundwater Configuration 17986-003.aprx

Pre-Development	Area (ha)
Roofed	0.03
Paved	0.07
Landscaped	48.05
Total	48.15



HYDROGEOLOGICAL ASSESSMENT

JEFFERY HOMES
Pt. Lot 19, Conc. 19 - 168 County Road 49
Bobcaygeon, Ontario

LEGEND

- Roofed
- Paved
- Landscaped
- Phase 2
- Phase 1

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PRE-DEVELOPMENT PLAN

Project No.: 17986-003		Date: July 2025	
		Rev.: 3	
Scale: 1:6,000		Projection: NAD 1983 UTM Zone 17N	
Created by: DBB	Checked by: KW	Figure: 5	

O:\GIS\MXDs\17900-17999\17986-003 Jeffery Homes - WWW - Pt. Lot 19 Conc. 19\2025-04-25 Groundwater Configuration 17986-003.aprx

HYDROGEOLOGICAL ASSESSMENT

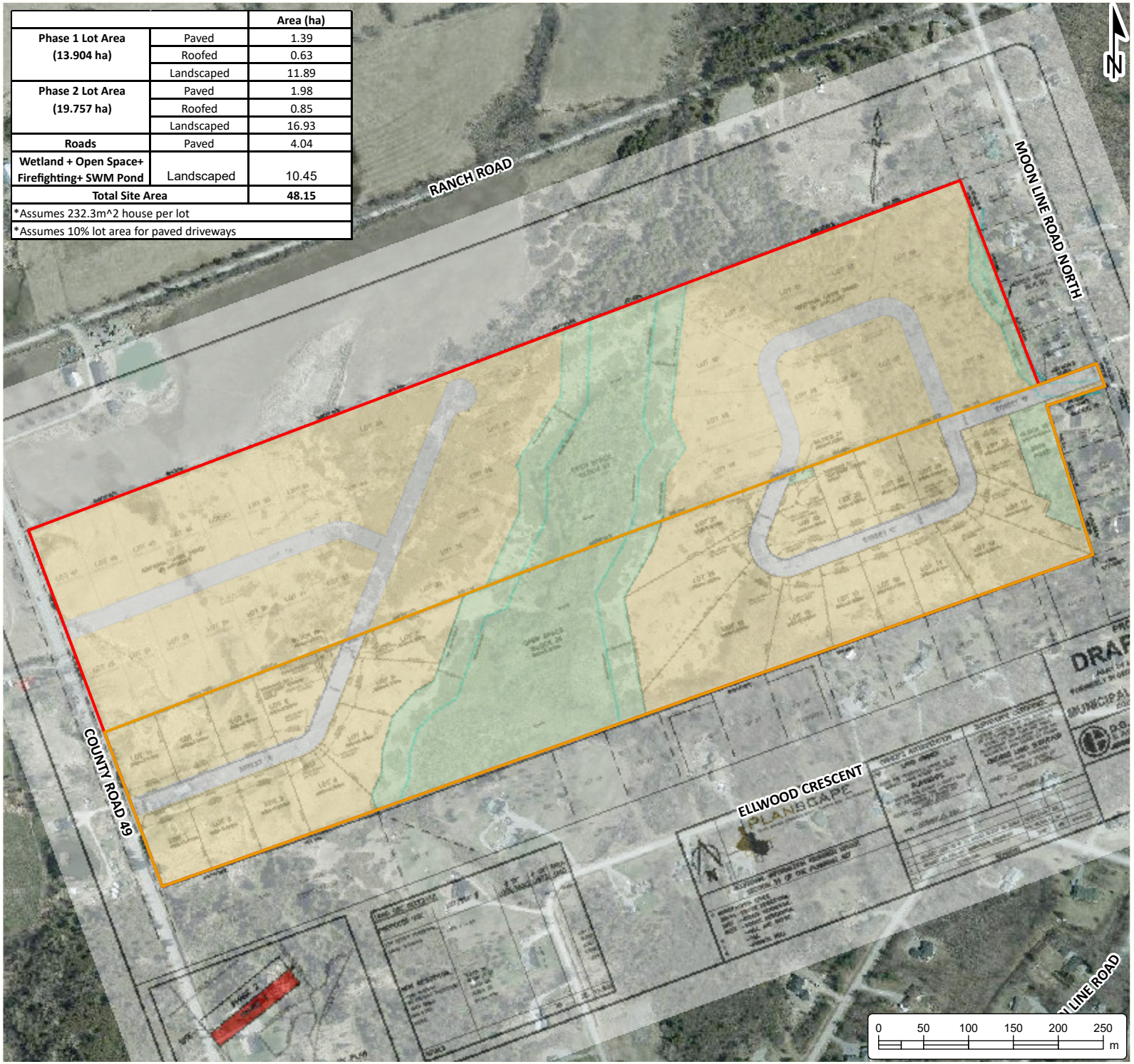
JEFFERY HOMES

Pt. Lot 19, Conc. 19 - 168 County Road 49
Bobcaygeon, Ontario

		Area (ha)
Phase 1 Lot Area (13.904 ha)	Paved	1.39
	Roofed	0.63
	Landscaped	11.89
Phase 2 Lot Area (19.757 ha)	Paved	1.98
	Roofed	0.85
	Landscaped	16.93
Roads	Paved	4.04
Wetland + Open Space+ Firefighting+ SWM Pond	Landscaped	10.45
Total Site Area		**48.15**

*Assumes 232.3m^2 house per lot

*Assumes 10% lot area for paved driveways



LEGEND

- Developable Lot
- Paved
- Landscaped
- Phase 2
- Phase 1

***Note there are not any houses proposed on the plan, so the areas for paved and roofed in the residential lots are assumed values for the houses and the driveways.**

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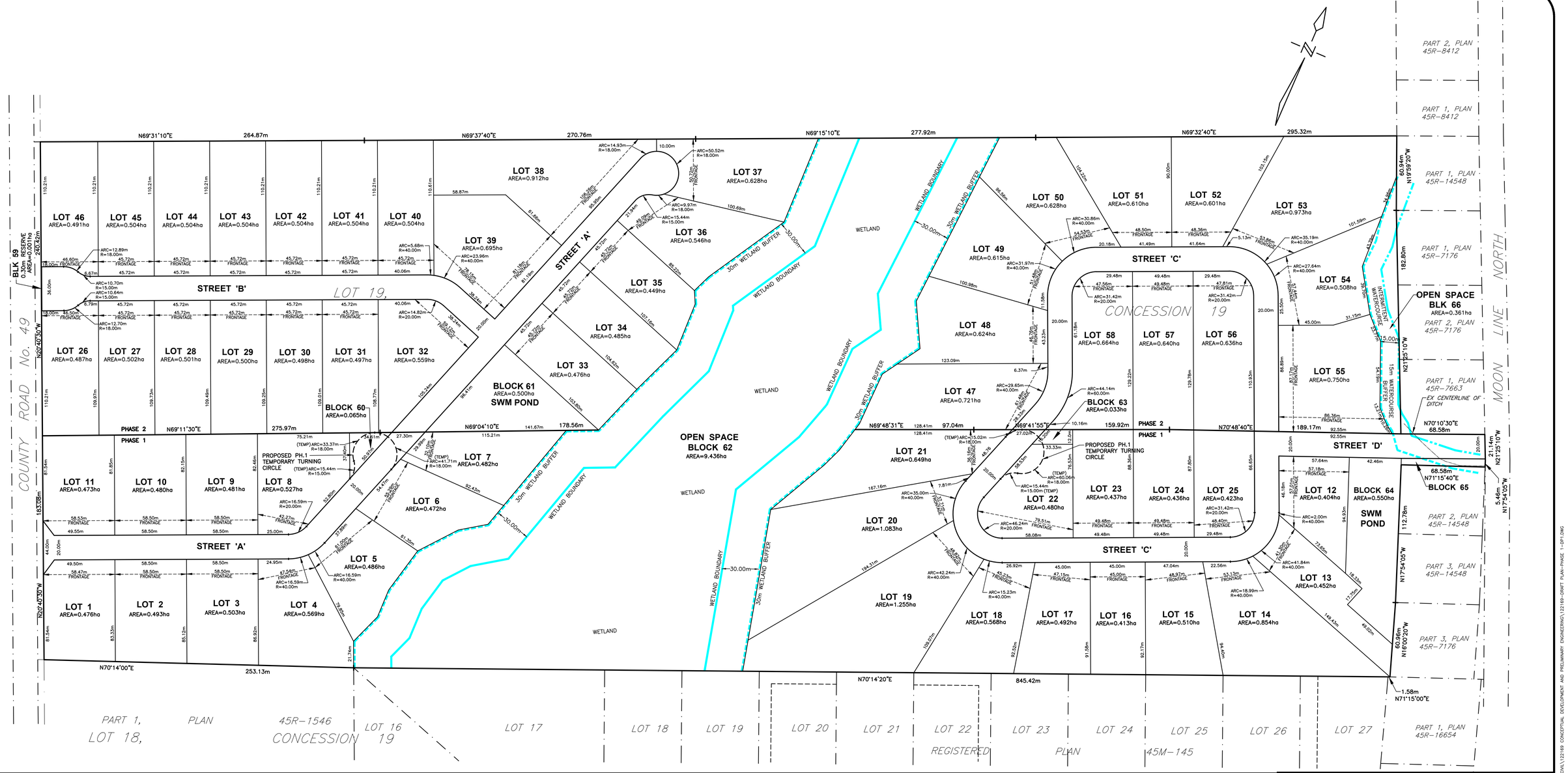
POST-DEVELOPMENT PLAN

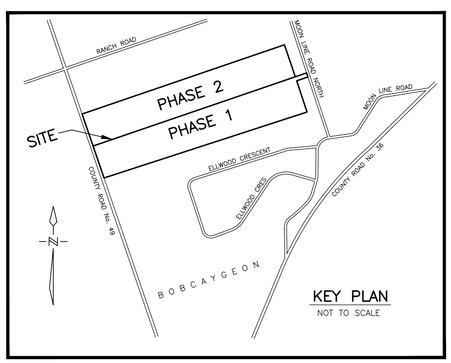
Project No.: 17986-003		Date:	July 2025
		Rev.:	3
Scale: 1:6,000		Projection:	NAD 1983 UTM Zone 17N
Created by: DBB	Checked by: KW	Figure:	6

O:\GIS\MXDs\17900-17999\17986-003 Jeffery Homes - WWW - Pt. Lot 19 Conc. 19\2025-04-25 Groundwater Configuration 17986-003.aprx

Appendix A

Proposed Development Plan and Land Information





LAND USE SCHEDULE

PROPOSED USE	LOT/BLK #	# OF LOTS/BLKS	# OF UNITS	AREA (ha)
LOW DENSITY RESIDENTIAL				
SINGLE DETACHED	LOTS 1-58	58	58	33.204
NON RESIDENTIAL				
RESERVES	BLOCK 59	1		0.001
ROAD WIDENING	BLOCK 65	1		0.041
FIRE FIGHTING PROTECTION	BLOCK 60, 63	2		0.098
OPEN SPACE	BLOCK 62, 66	2		9.973
SWM PONDS	BLOCK 61, 64	2		1.042
ROADS	20.0m R.O.W.			4.181
TOTALS		65	58	48.540

PLANSCAPE
BUILDING COMMUNITY THROUGH PLANNING

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51 OF THE PLANNING ACT

F NORTH -OPEN SPACE
SOUTH -ESTATE RESIDENTIAL
EAST -ESTATE RESIDENTIAL
WEST -ESTATE RESIDENTIAL
H -WELL AND SEPTIC
I -TILL
K -PRIVATE WELL

OWNER'S AUTHORIZATION

I/WE **LAND OWNER**
BEING THE REGISTERED OWNER OF THE SUBJECT LANDS HEREBY AUTHORIZE
PLANSCAPE
TO PREPARE AND SUBMIT A DRAFT PLAN OF SUBDIVISION FOR APPROVAL
SIGNED *ORIGINALLY SIGNED BY: SCOTT JEFFERY*
TITLE
DATE *DECEMBER 21, 2022*

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARY OF THE LANDS TO BE SUBDIVIDED AS SHOWN ON THIS PLAN AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN
ONTARIO LAND SURVEYOR
ONTARIO LAND SURVEYORS
SIGNED *ORIGINALLY SIGNED BY: MARYNA A. HANNA*
O.L.S
DATE *SEPTEMBER 2, 2022*

No.	REVISION	DATE	BY	APPROVED
4.	REVISED TO INCLUDE PHASE 2 LANDS	06/26/2025	JG	
3.	ADDED BLOCK 31 (SWM) & RENUMBERED LOTS	12/19/2024	CJ	
2.	REVISED LOTS 12 & 13, ADDED BLOCK 30 (SWM)	12/03/2024	BB	
1.	REVISED AS PER 1ST SUBMISSION COMMENTS	03/18/2024	MH	

REVISIONS

PROPOSED

DRAFT PLAN

PART OF LOT 19, CONCESSION 19
FORMERLY IN GEOGRAPHIC TOWNSHIP OF HARVEY
NOW IN THE
MUNICIPALITY OF TRENT LAKES
COUNTY OF PETERBOROUGH

D.G. BIDDLE & ASSOCIATES
CONSULTING ENGINEERS & PLANNERS
481 Taunton Rd W, Oshawa ON
150 King St, Peterborough ON
Phone: 905-576-8500
info@dgbiddle.com
dgbiddle.com

SCALE:	1:1500
DRAWN BY:	B.B.
DESIGN BY:	M.J.H.
CHECKED BY:	M.B.C.
PLOT DATE:	02/07/2025

122169

DP-1

X:\SHARED FILES\122000\122169 JEFFERY - BOBCAYGEON\122169 DRAWINGS\122169 CIVIL\122169 CONCEPTUAL DEVELOPMENT AND PRELIMINARY ENGINEERING\122169-DRAFT PLAN-PHASE 1-DP1.DWG

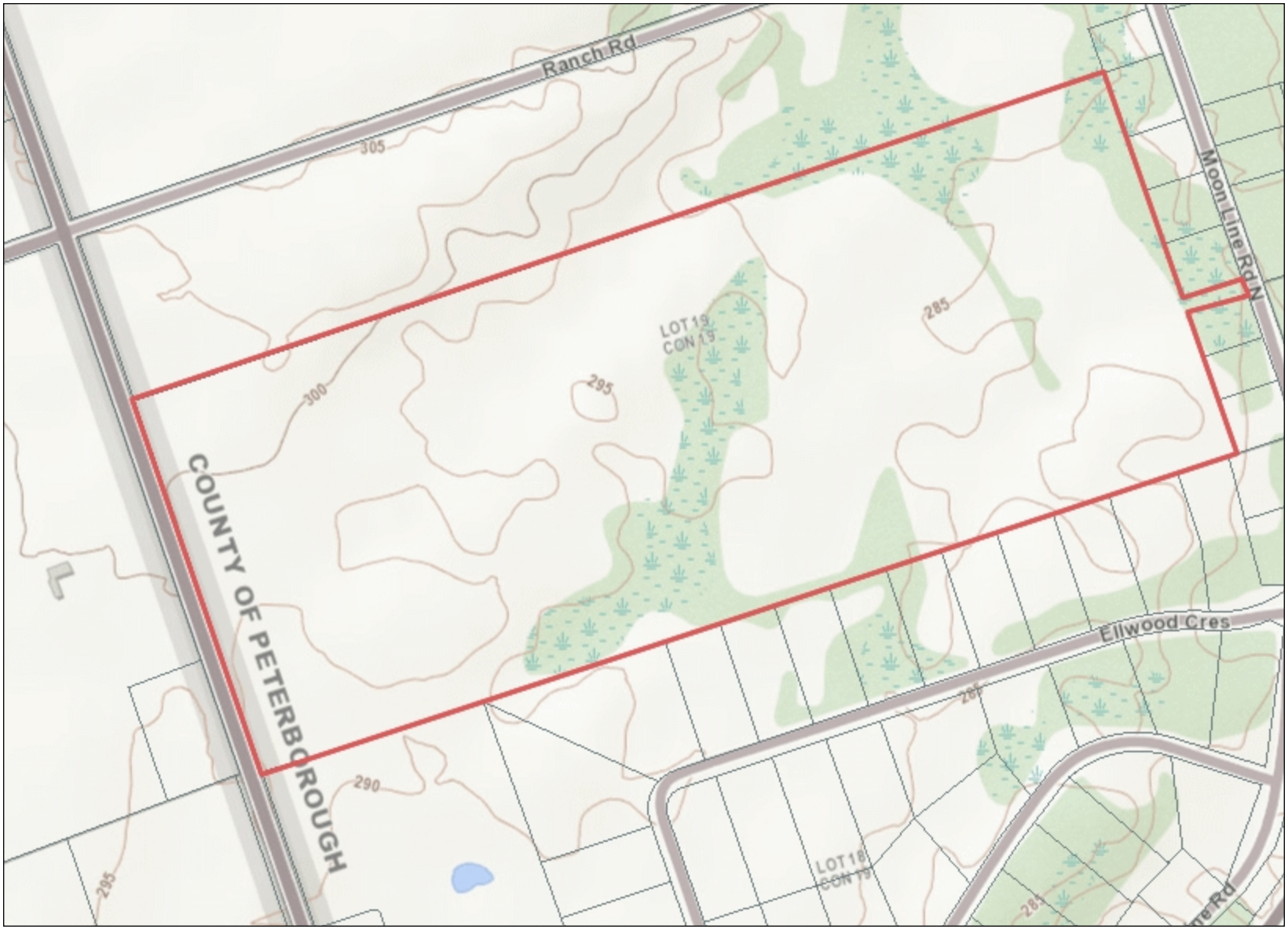
Ontario

MINISTRY OF NATURAL RESOURCES AND FORESTRY

Make a Topographic Map

Topo map

Notes:



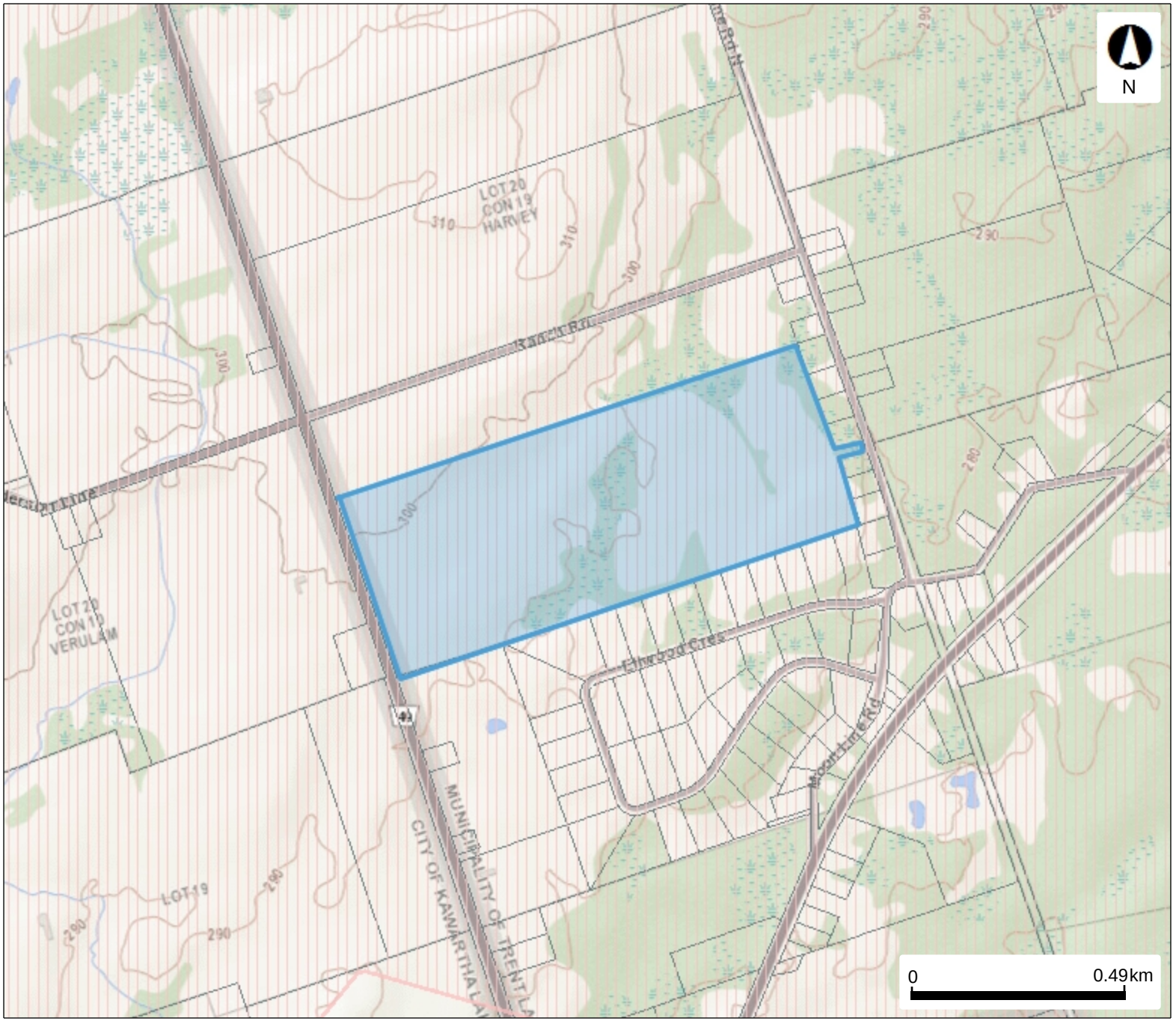
Legend

- Building as Symbol
- Building to Scale
- Airport
- Heliport \ Hospital Heliport
- Seaplane Base
- Ferry Route
- Trail
- Bruce Trail
- Greenbelt Route
- Rideau Trail
- Trans Canada Trail
- Voyageur Trail
- Waterfront Trail
- Railway \ Train Station
- Railway with Bridge
- Railway with Tunnel
- Road (Major → Minor)
- Winter Road
- Road with Bridge
- Road with Tunnel
- Primary, Kings or 400 Series Highway
- Secondary Highway
- Tertiary Highway
- District, County, Regional or Municipal Road
- Toll Highway
- One Way Road
- Road with Permanent Blocked Passage
- Road with Address Ranges
- Hydro Line, Communication Line or Unknown Transmission Line
- Natural Gas Pipeline, Water Pipeline or Unknown Pipeline
- Spot Height
- Index Contour
- Contour
- Wooded Area
- Wetland
- Waterbody
- Waterbody Elevation
- Watercourse
- Falls
- Rapids
- Rapids \ Falls
- Rapids
- Rocks
- Lock Gate
- Dam \ Hydro Wall
- Dam \ Hydro Wall
- Provincial \ State Boundary
- International Boundary
- Upper Tier \ District Municipal Boundary
- Lower Tier \ Single Tier Municipal Boundary
- Lot Line
- Indian Reserve
- Provincial Park
- National Park
- Conservation Reserve
- Military Lands

0 0.3 km

Projection: Web Mercator

Source Protection Information Atlas Map



Legend

- Highly Vulnerable Aquifers
- Assessment Parcel

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Ontario

THIS IS NOT A PLAN OF SURVEY.

Map Created: 11/10/2023

Map Center: 44.56425 N, -78.54321 W

Kawartha Conservation Public Property Mapping Tool

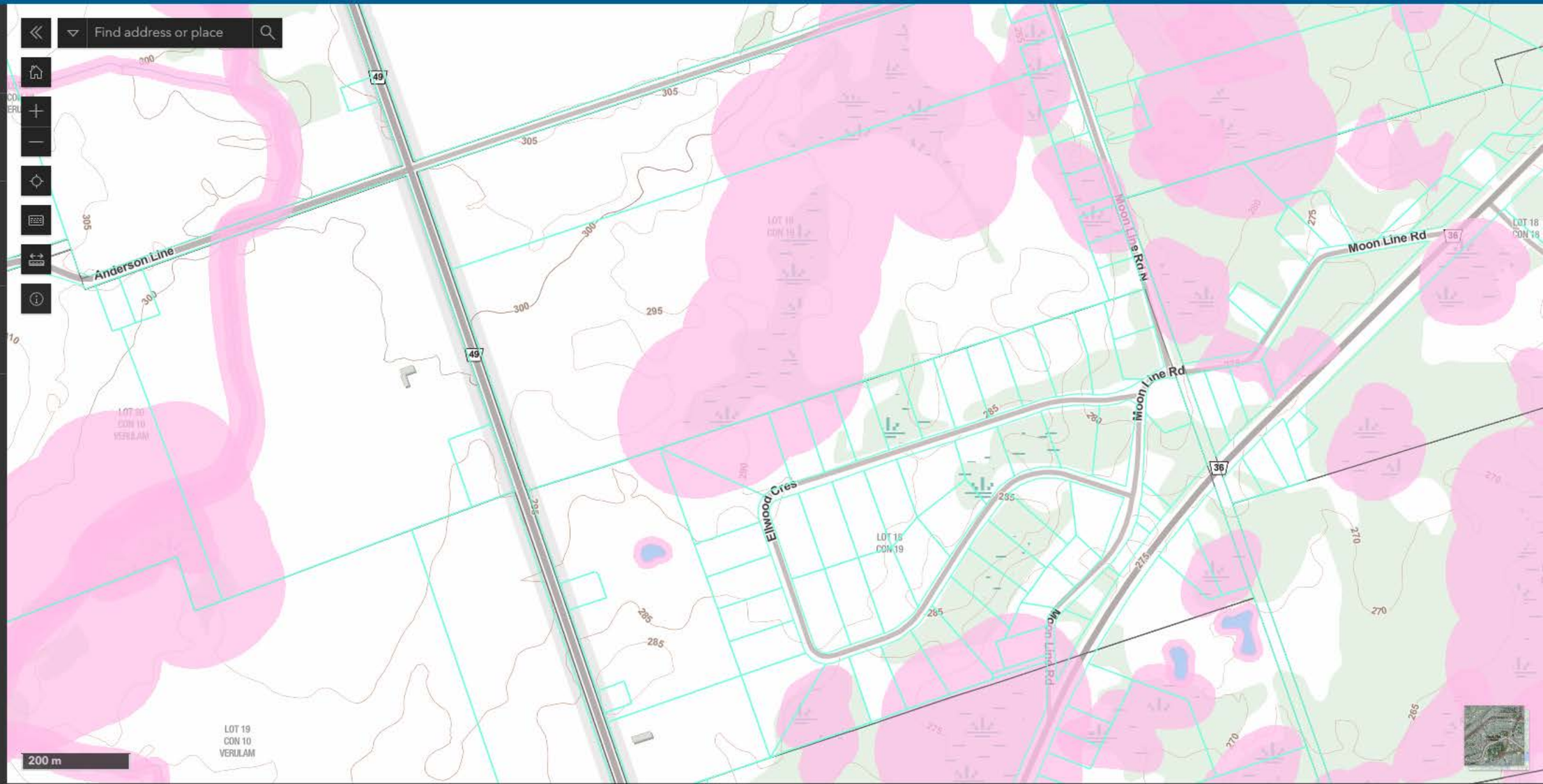
KRCA Assessment Parcels

KRCA_LIO_LotFabric

KRCA_RegulatedAreaBoundary

Wellhead Protection Area

Surface Water Intake Protection Zone



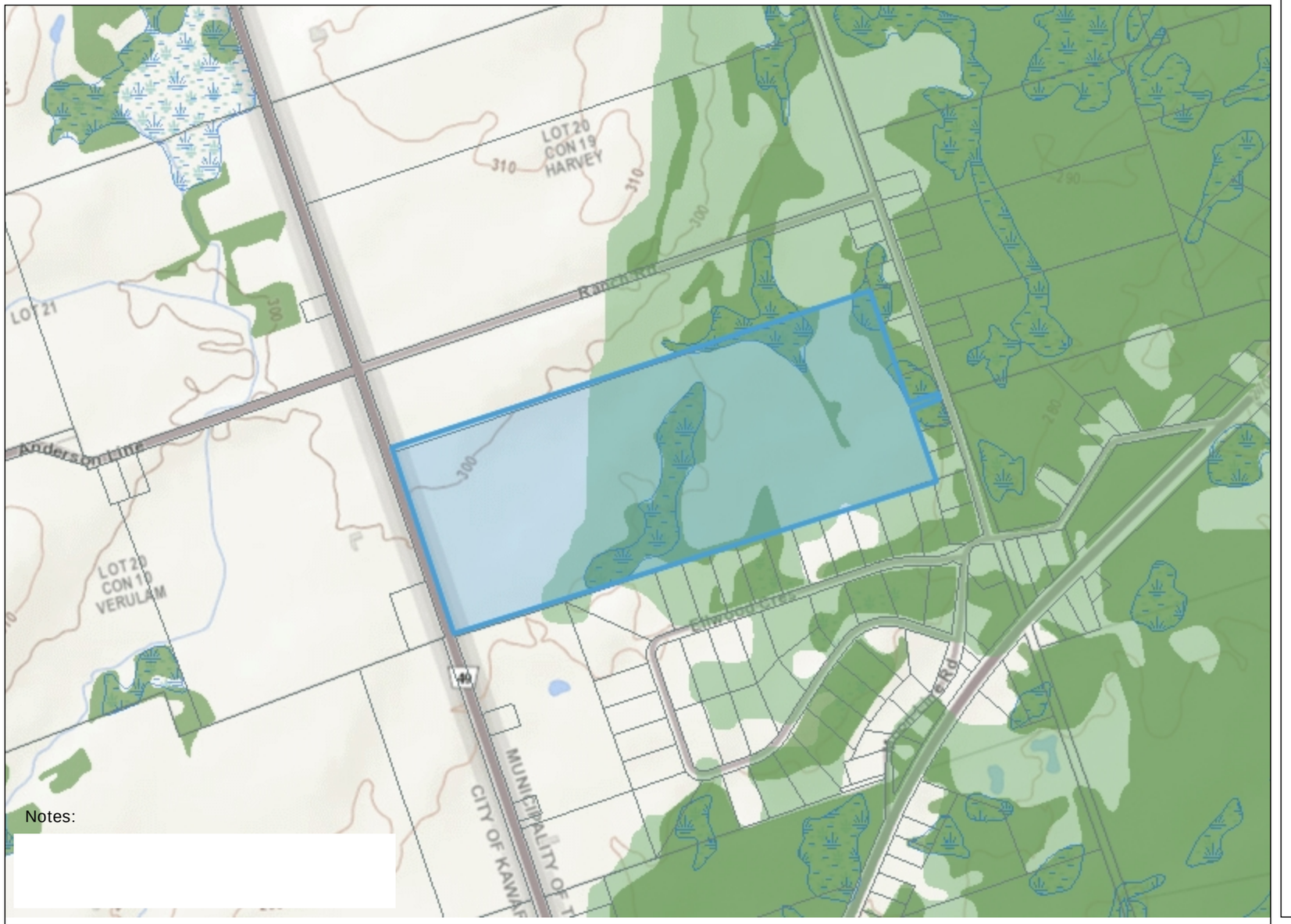
Ontario

Ministry of Natural Resources and Forestry

Make-a-Map: Natural Heritage Areas

Natural Heritage Areas Map

Map created:11/10/2023



Notes:

Legend

- Assessment Parcel
- Evaluated Wetland
- Provincially Significant/considérée d'importance provinciale
- Non-Provincially Significant/non considérée d'importance provinciale
- Unevaluated Wetland
- Woodland
- Natural Heritage System

0.7 0 0.33 0.7 Kilometres

Absence of a feature in the map does not mean they do not exist in this area.

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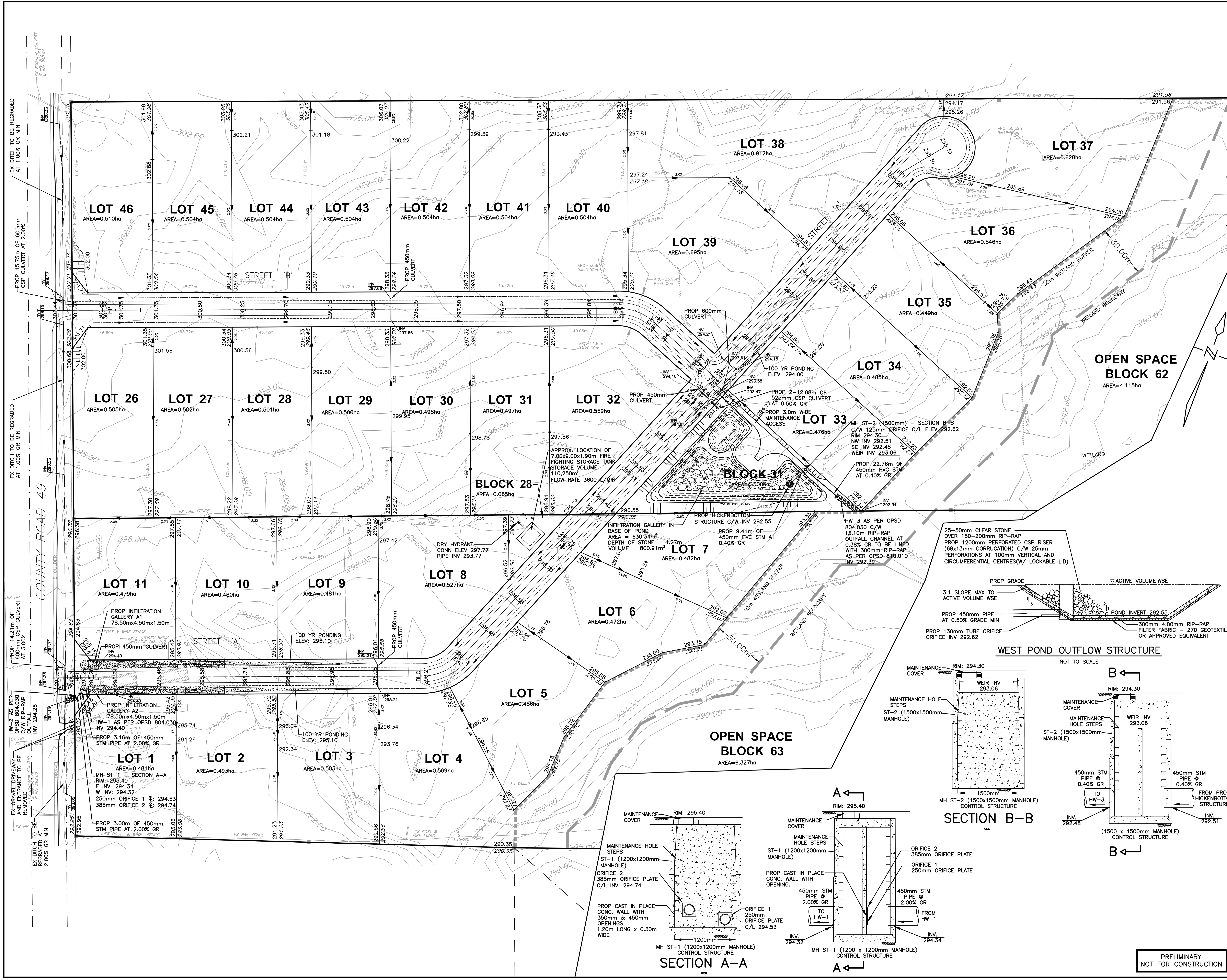
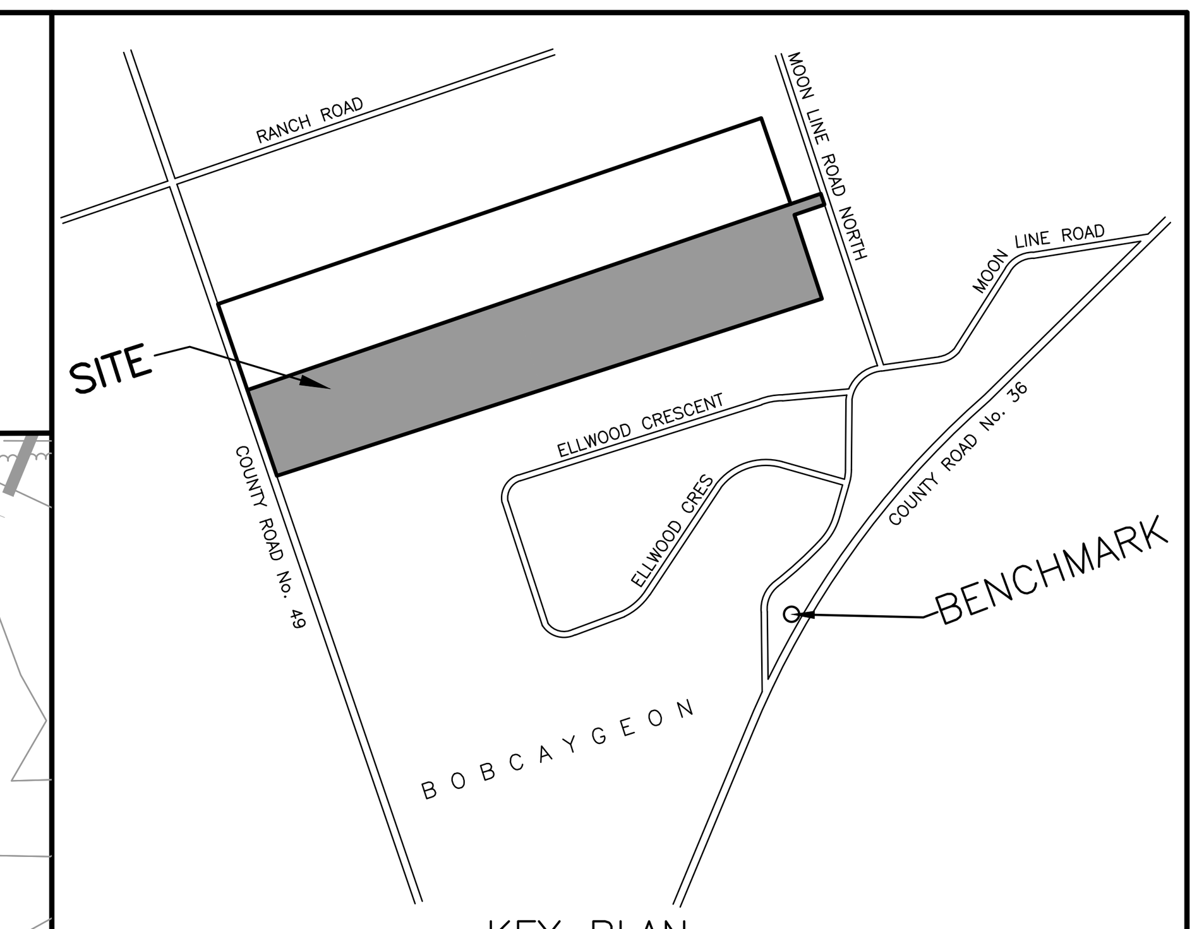




KEY PLAN
NOT TO SCALE

BENCH MARK

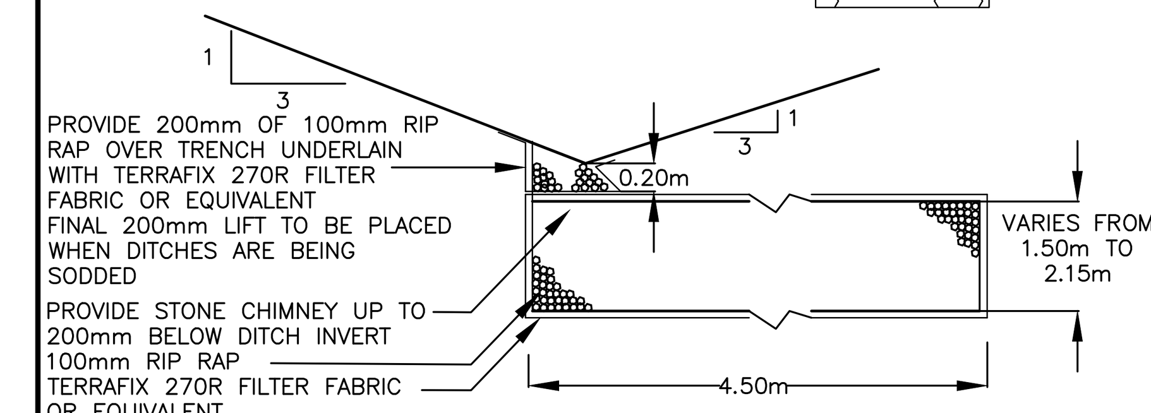
BENCHMARKS SHOWN HEREON ARE GEODETIC IN ORIGIN DERIVED FROM CGVD2013 BENCHMARK No. 60U3306, IRON PIPE WITH BRASS CAP ON TOP OF SAND CUT ON COUNTY ROAD 36, 76 CM SOUTHEAST OF WIRE FENCE ALONG NORTHWEST LIMIT OF RIGHT–OF–WAY, AS SHOWN ON A TOPOGRAPHIC SURVEY BY A PRIVATE OLS, DATED 20231217. ELEV = 277.33.

SITE GRADING NOTES

1. A ROAD OCCUPANCY PERMIT WILL BE REQUIRED FOR ANY WORKS WITHIN THE MUNICIPAL RIGHT OF WAY.
2. ALL WORKS OR RESTORATION WITHIN THE MUNICIPAL RIGHT OF WAY SHALL BE COMPLETED AS PER CITY OF KAWARTHA LAKES FIELD STAFF DIRECTION.
3. THE LOCATION AND ELEVATION OF ALL EXISTING UTILITIES AND SERVICES TO BE VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCING CONSTRUCTION. CONCERNED UTILITIES TO BE GIVEN ADVANCED NOTICE FOR STAKE OUT. THE CONSULTANT ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE UTILITIES SHOWN ON THE DRAWINGS.
4. QUANTITIES, DIMENSIONS AND ELEVATIONS TO BE VERIFIED BY THE CONTRACTOR PRIOR TO ORDERING MATERIALS OR COMMENCING CONSTRUCTION.
5. ALL SLOPES SHALL BE CONSTRUCTED AT 3:1 (MAXIMUM) UNLESS OTHERWISE NOTED ON THE DRAWINGS.
6. ALL SWALES SHALL BE CONSTRUCTED WITH 2% MINIMUM GRADE UNLESS OTHERWISE NOTED ON THE DRAWINGS.

LEGEND

ORIGINAL ELEVATION TO REMAIN — 101.35
PROPOSED ELEVATIONS — 103.15
PROPOSED SWALE
DIRECTION OF DRAINAGE
DIRECTION OF OVERLAND FLOW
LIMIT OF PONDING



TYPICAL INFILTRATION GALLERY DETAIL
SCALE: NOT TO SCALE

NO.	DATE	REVISION	BY
2	20241216	REVISED AS PER CONSERVATION AUTHORITY COMMENTS	C.J.
1	20241203	REVISED AS PER MUNICIPAL COMMENTS	B.A.

REVISIONS

APPROVED	APPROVED
DIRECTOR, ENGINEERING SERVICES MUNICIPALITY OF	DIRECTOR, ENGINEERING SERVICES REGION OF ....
DATE	DATE

TRENT LAKES
ENGINEERING SERVICES DEPARTMENT

JEFFERY SUBDIVISION
BOBCAYGEON

CONCEPTUAL GRADING AND SERVICING PLAN

D.G. BIDDLE & ASSOCIATES
CONSULTING ENGINEERS & PLANNERS
96 King Street East
Oshawa, Ontario, L1H 1B6
Phone: 905–576–8500
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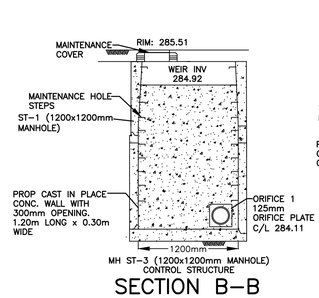
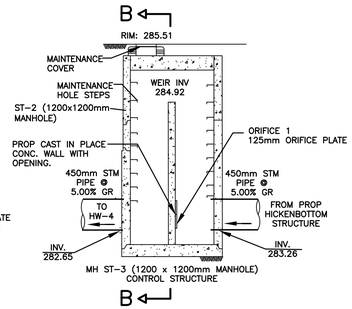
dgbiddle.com

LICENSED PROFESSIONAL ENGINEER
D. D. J. MCNAULL
100174691
DEC 20, '24
PROVINCE OF ONTARIO

SCALE:	1:1000	PROJECT NO. 122169
DRAWN BY:	M.J.H.	DRAWING NO.
DESIGN BY:	M.J.H	LG–1
CHECKED BY:	D.D.M	
DATE:	JAN 2024	

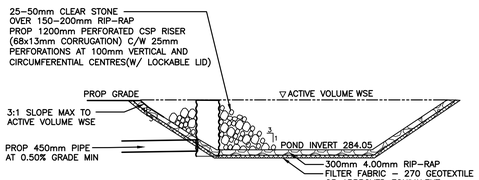
K:\STAFF\JOB FILES\122000\122169 JEFFERY – BOBCAYGEON\122169 DRAWINGS\122169 DRAWINGS CIVIL\122169 CONCEPTUAL DEVELOPMENT AND PRELIMINARY ENGINEERING\122169–3D–SITE–PLAN.DWG
December 19, 2024





SECTION B–B

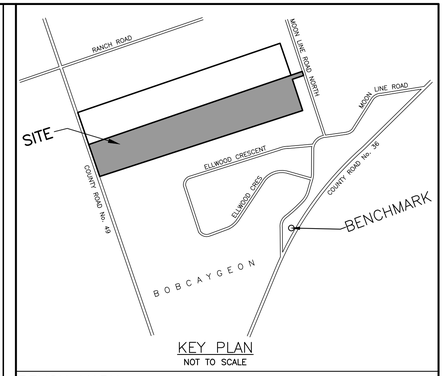
N.T.S.



WEST POND OUTFLOW STRUCTURE

NOT TO SCALE

PRELIMINARY
NOT FOR CONSTRUCTION



KEY PLAN

NOT TO SCALE

BENCH MARK

BENCHMARKS SHOWN HEREON ARE GEODETIC IN ORIGIN DERIVED FROM CGVD2013 BENCHMARK No. 60U3306, IRON PIPE WITH BRASS CAP ON TOP OF SAND CUT ON COUNTY ROAD 36, 76 CM SOUTHEAST OF WIRE FENCE ALONG NORTHWEST LIMIT OF RIGHT–OF–WAY, AS SHOWN ON A TOPOGRAPHIC SURVEY BY A PRIVATE OLS, DATED 20231217. ELEV = 277.33.

SITE GRADING NOTES

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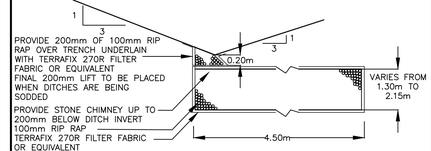
LEGEND

ORIGINAL ELEVATION TO REMAIN	+101.35
PROPOSED ELEVATIONS	+103.15
PROPOSED SWALE	
DIRECTION OF DRAINAGE	
DIRECTION OF OVERLAND FLOW	
LIMIT OF PONDING	



TYPICAL INFILTRATION GALLERY DETAIL

SCALE: NOT TO SCALE

NO.	DATE	REVISION	BY
2	20241216	REVISED AS PER CONSERVATION AUTHORITY COMMENTS	C.J.
1	20241203	REVISED AS PER MUNICIPAL COMMENTS	B.A.

REVISIONS

APPROVED	APPROVED
DIRECTOR, ENGINEERING SERVICES MUNICIPALITY OF	DIRECTOR, ENGINEERING SERVICES REGION OF .....
DATE	DATE

TRENT LAKES
ENGINEERING SERVICES DEPARTMENT

JEFFERY SUBDIVISION
BOBCAYGEON

CONCEPTUAL GRADING AND SERVICING PLAN

D.G. BIDDLE & ASSOCIATES
CONSULTING ENGINEERS & PLANNERS
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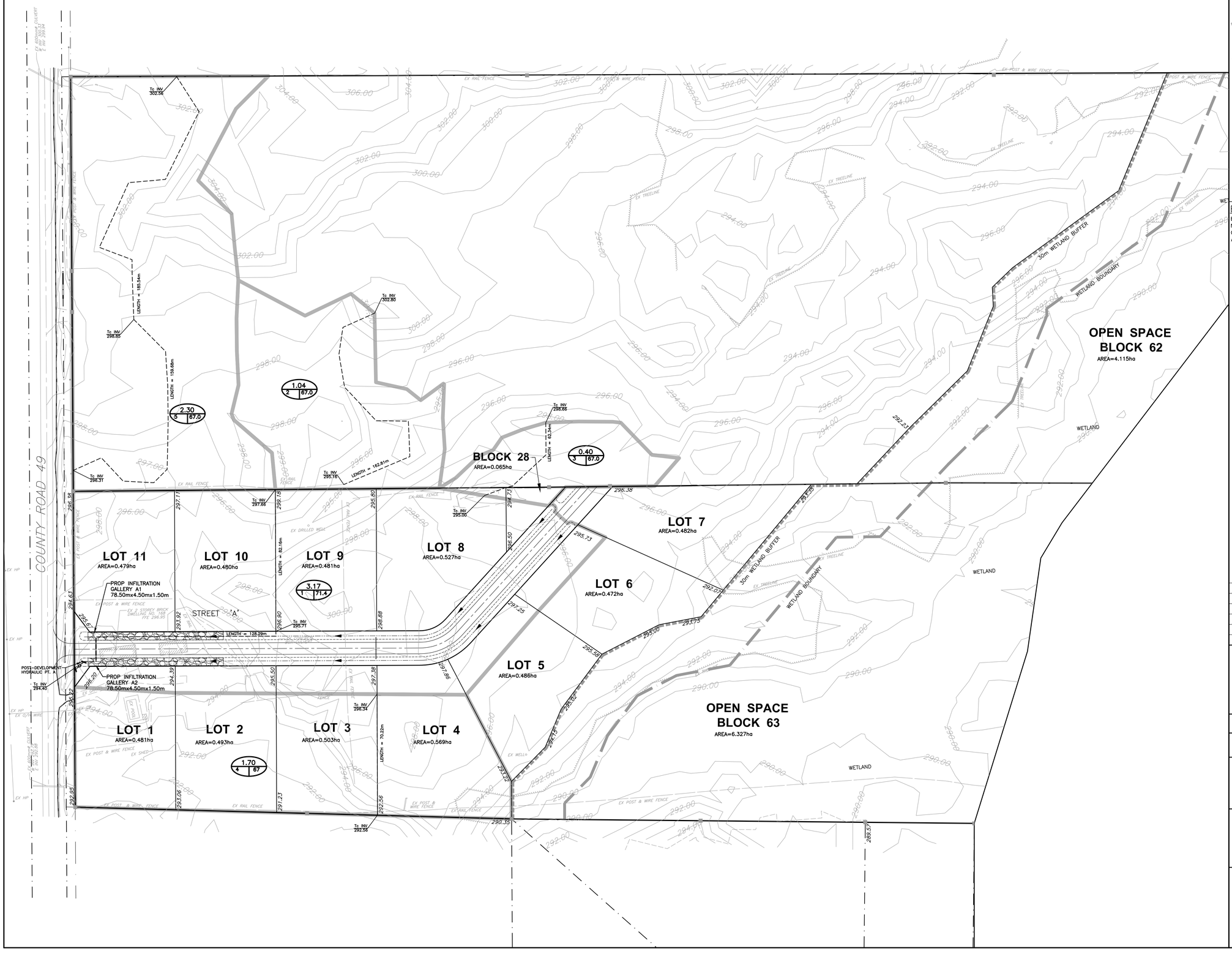
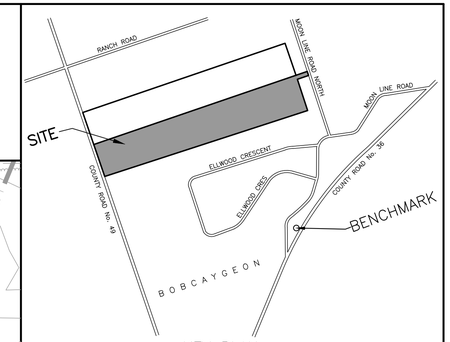
LICENSED PROFESSIONAL ENGINEER
D. D. J. MCNAULL
100174891
DEC 20, '24
PROVINCE OF ONTARIO

SCALE:	1:1000	PROJECT NO.	122169
DRAWN BY:	M.J.H.	DRAWING NO.	LG–2
DESIGN BY:	M.J.H		
CHECKED BY:	D.D.M		
DATE:	JAN 2024		

X:\STAFF\JOB FILES\122000\122169 JEFFERY - BOBCAYGEON\122169 DRAWINGS CIVIL\122169 CONCEPTUAL DEVELOPMENT AND PRELIMINARY ENGINEERING\122169-3D-SITE-PLAN.DWG
December 19, 2024





KEY PLAN
NOT TO SCALE

BENCH MARK

BENCHMARKS SHOWN HEREON ARE GEODETIC IN ORIGIN DERIVED FROM CGVD2013 BENCHMARK No. 60U3306, IRON PIPE WITH BRASS CAP ON TOP OF SAND CUT ON COUNTY ROAD 36, 76 CM SOUTHEAST OF WIRE FENCE ALONG NORTHWEST LIMIT OF RIGHT-OF-WAY, AS SHOWN ON A TOPOGRAPHIC SURVEY BY A PRIVATE OLS, DATED 20231217. ELEV = 277.33.

LEGEND

- DRAINAGE BOUNDARY
- 0.25 / 1 | 90 — DRAINAGE AREA / ID/CURVE NUMBER
- OVERLAND FLOW DIRECTION
- WETLAND BOUNDARY
- 30m WETLAND BOUNDARY OFFSET

NOTE: THIS PLAN IS FOR STORM DRAINAGE AREAS ONLY

PRELIMINARY
NOT FOR CONSTRUCTION

NO.	DATE	REVISION	BY
1	20241216	REVISED AS PER CONSERVATION AUTHORITY COMMENTS	C.J.

REVISIONS

APPROVED	APPROVED
DIRECTOR, ENGINEERING SERVICES MUNICIPALITY OF	DIRECTOR, ENGINEERING SERVICES REGION OF .....
DATE	DATE

TRENT LAKES
ENGINEERING SERVICES DEPARTMENT

JEFFERY SUBDIVISION
BOBCAYGEON

POST-DEVELOPMENT STORM DRAINAGE PLAN (INTERIM CONDITION)

D.G. BIDDLE & ASSOCIATES
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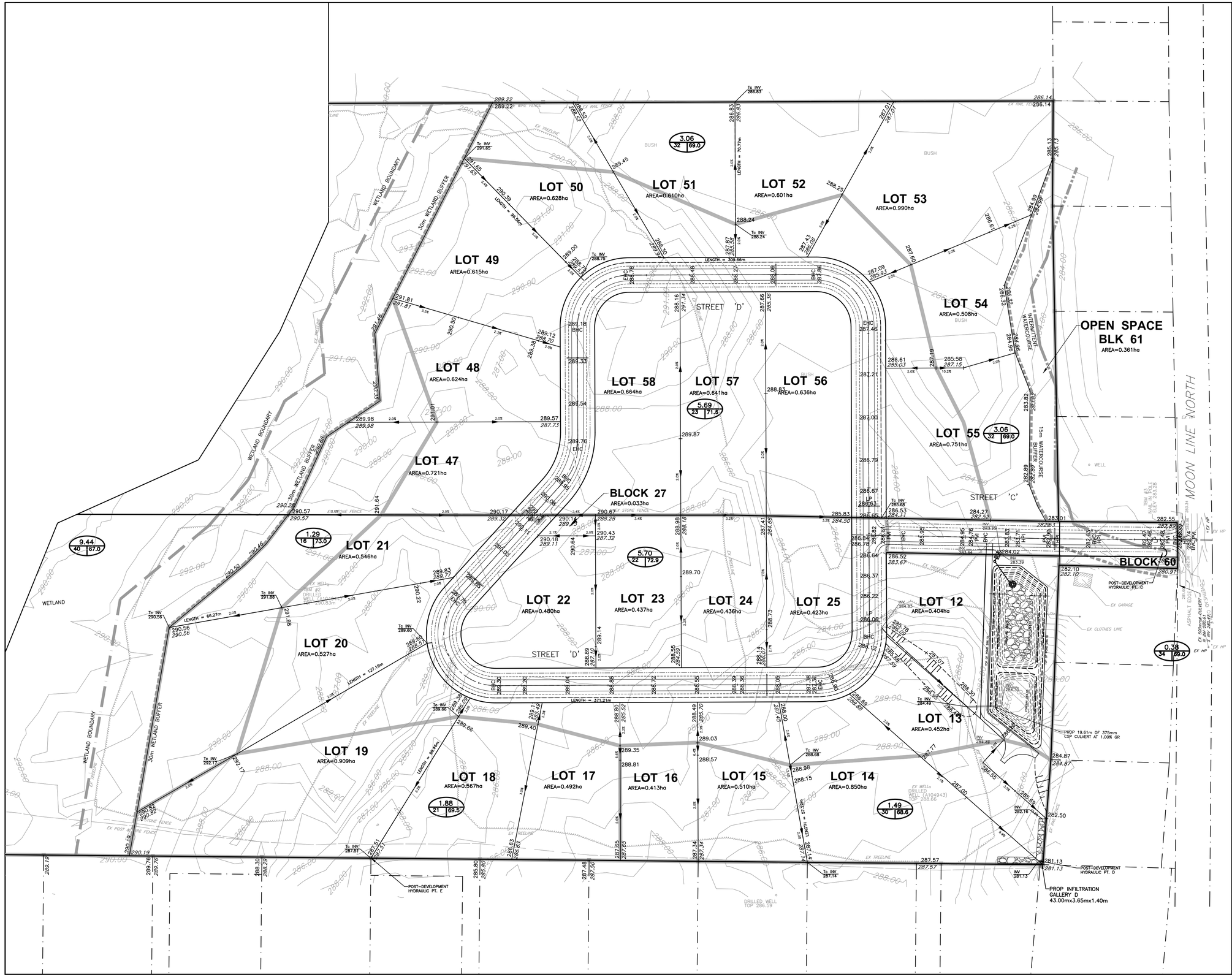
info@dgbiddle.com
dgbiddle.com

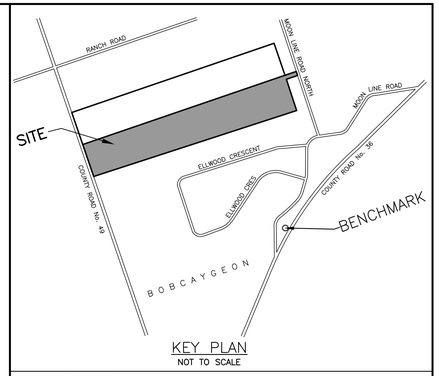
LICENSED PROFESSIONAL ENGINEER
D.D.J. MCNAULL
100174891
DEC 20, '24
PROVINCE OF ONTARIO

SCALE:	1:1000
DRAWN BY:	M.J.H.
DESIGN BY:	M.J.H
CHECKED BY:	D.D.M
DATE:	JAN 2024

PROJECT NO. 122169
DRAWING NO. SD-5

X:\STAFF\JOB FILES\122000\122169 JEFFERY - BOBCAYGEON\122169 DRAWINGS\122169 DRAWINGS CIVIL\122169 CONCEPTUAL DEVELOPMENT AND PRELIMINARY ENGINEERING\122169 20241211 INTERIM DRAINAGE CONDITION - WEST SIDE.DWG
December 19, 2024





KEY PLAN
NOT TO SCALE

BENCH MARK

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LEGEND

- DRAINAGE BOUNDARY
- 0.25 / 1 / 90 — DRAINAGE AREA ID/CURVE NUMBER
- OVERLAND FLOW DIRECTION
- WETLAND BOUNDARY
- 30m WETLAND BOUNDARY OFFSET
- INTERMITTENT WATERCOURSE
- 15m WATERCOURSE BUFFER

NOTE: THIS PLAN IS FOR STORM DRAINAGE AREAS ONLY

PRELIMINARY NOT FOR CONSTRUCTION

NO.	DATE	REVISION	BY
1	20241216	REVISED AS PER CONSERVATION AUTHORITY COMMENTS	C.J.

REVISIONS

APPROVED	APPROVED
DIRECTOR, ENGINEERING SERVICES MUNICIPALITY OF	DIRECTOR, ENGINEERING SERVICES REGION OF .....
DATE	DATE

TRENT LAKES
ENGINEERING SERVICES DEPARTMENT

JEFFERY SUBDIVISION
BOBCAYGEON

POST-DEVELOPMENT STORM DRAINAGE PLAN

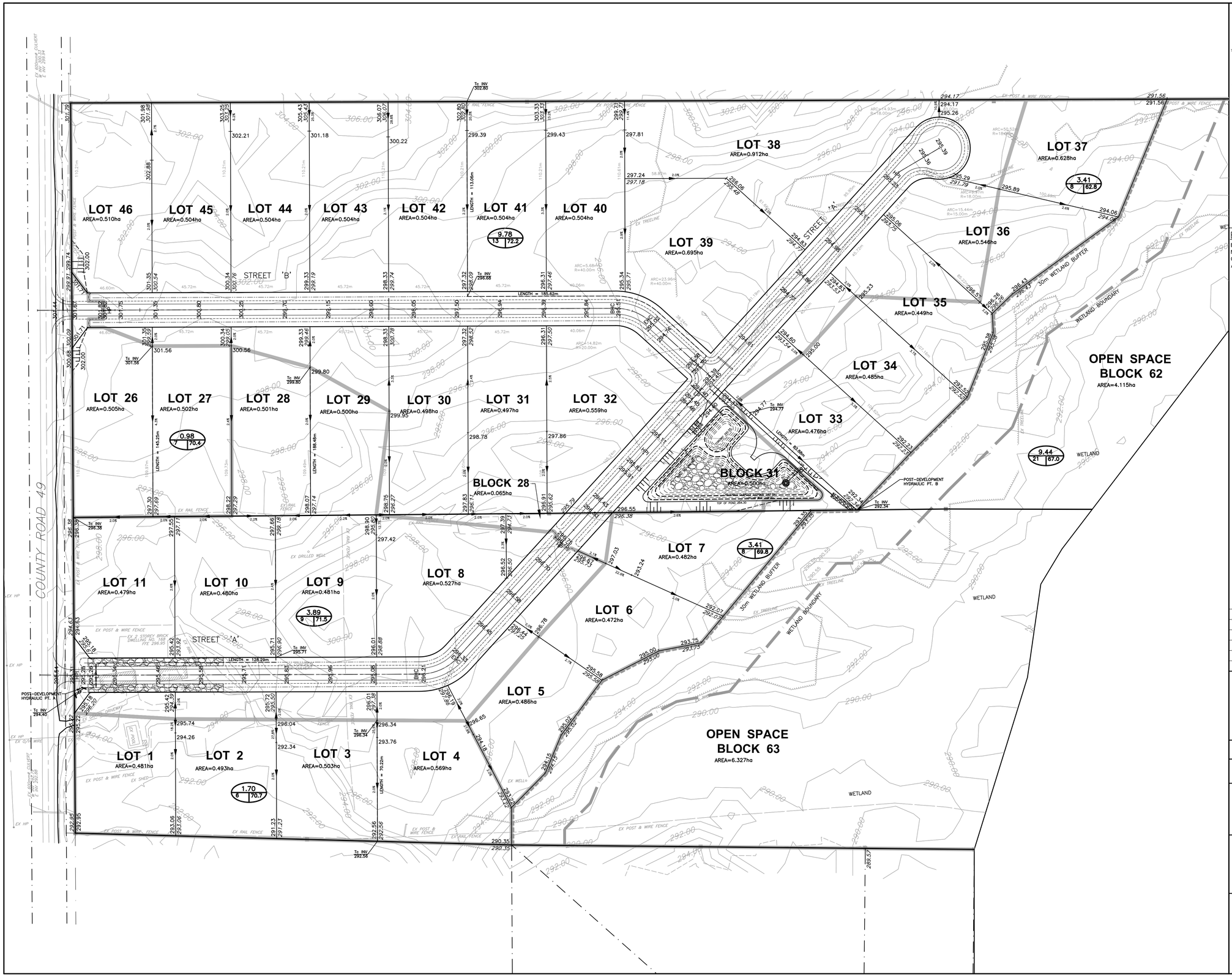
D.G. BIDDLE & ASSOCIATES
CONSULTING ENGINEERS & PLANNERS
96 King Street East
Oshawa, Ontario, L1H 1B6
Phone: 905-576-8500
info@dgbiddle.com
dgbiddle.com

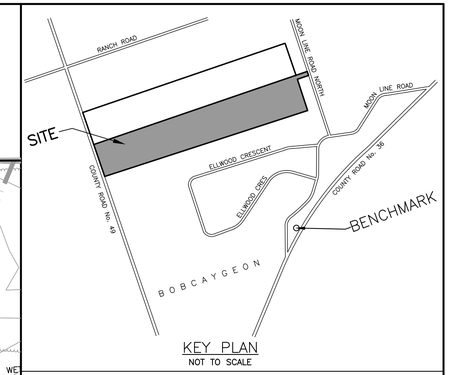
LICENSED PROFESSIONAL ENGINEER
D.D.J MCNAULL
100174891
DEC 20, '24
PROVINCE OF ONTARIO

SCALE:	1:1000
DRAWN BY:	M.J.H.
DESIGN BY:	M.J.H
CHECKED BY:	D.D.M
DATE:	JAN 2024

PROJECT NO. 122169
DRAWING NO. SD-4

X:\STAFF\JOB FILES\122000\122169 JEFFERY - BOBCAYGEON\122169 DRAWINGS\122169 CONCEPTUAL DEVELOPMENT AND PRELIMINARY ENGINEERING\122169-30-SITE-PLANS.dwg December 19, 2024





KEY PLAN
NOT TO SCALE

BENCH MARK

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LEGEND

- DRAINAGE BOUNDARY
- 0.25 / 1 | 90 — DRAINAGE AREA ID/CURVE NUMBER
- OVERLAND FLOW DIRECTION
- WETLAND BOUNDARY
- 30m WETLAND BOUNDARY OFFSET

NOTE: THIS PLAN IS FOR STORM DRAINAGE AREAS ONLY

PRELIMINARY
NOT FOR CONSTRUCTION

NO.	DATE	REVISION	BY
1	20241216	REVISED AS PER CONSERVATION AUTHORITY COMMENTS	C.J.

REVISIONS

APPROVED	APPROVED
DIRECTOR, ENGINEERING SERVICES MUNICIPALITY OF	DIRECTOR, ENGINEERING SERVICES REGION OF .....
DATE	DATE

TRENT LAKES
ENGINEERING SERVICES DEPARTMENT

JEFFERY SUBDIVISION
BOBCAYGEON

POST-DEVELOPMENT STORM DRAINAGE PLAN

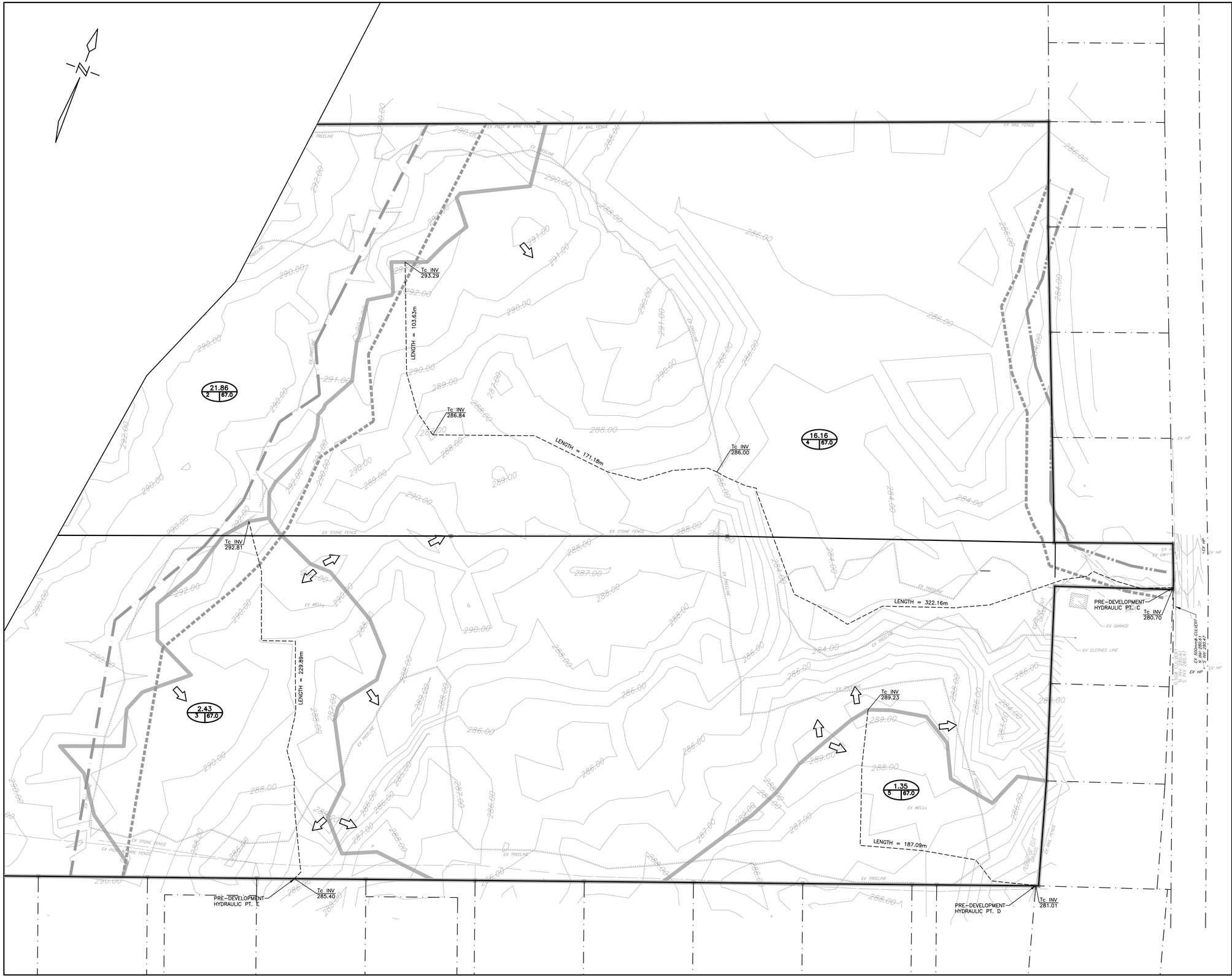
D.G. BIDDLE & ASSOCIATES
CONSULTING ENGINEERS & PLANNERS
96 King Street East
Oshawa, Ontario, L1H 1B6
Phone: 905-576-8500
info@dgbiddle.com
dgbiddle.com

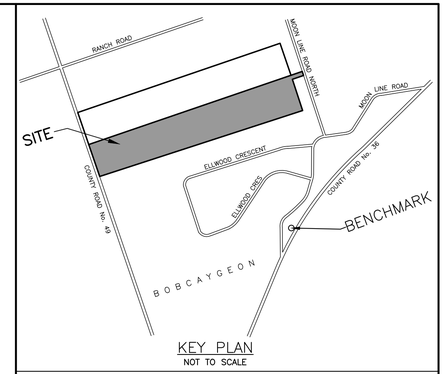
LICENSED PROFESSIONAL ENGINEER
D.D.J. MCNAULL
100174891
DEC 20, '24
PROVINCE OF ONTARIO

SCALE:	1:1000
DRAWN BY:	M.J.H.
DESIGN BY:	M.J.H
CHECKED BY:	D.D.M
DATE:	JAN 2024

PROJECT NO. 122169
DRAWING NO. SD-3

X:\STAFF_JOB FILES\122000\122169 JEFFERY - BOBCAYGEON\122169 DRAWINGS\122169 CONCEPTUAL DEVELOPMENT AND PRELIMINARY ENGINEERING\122169 - SD-STE-PLAN.DWG
December 19, 2024





KEY PLAN
NOT TO SCALE

BENCH MARK

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LEGEND

- DRAINAGE BOUNDARY
- 0.25 / 1 | 90 — DRAINAGE AREA / ID/CURVE NUMBER
- OVERLAND FLOW DIRECTION
- WETLAND BOUNDARY
- 30m WETLAND BOUNDARY OFFSET
- INTERMITTENT WATERCOURSE
- 15m WATERCOURSE BUFFER

NOTE: THIS PLAN IS FOR STORM DRAINAGE AREAS ONLY

PRELIMINARY
NOT FOR CONSTRUCTION

NO.	DATE	REVISION	BY
1	20241216	REVISED AS PER CONSERVATION AUTHORITY COMMENTS	C.J.

REVISIONS

APPROVED	APPROVED
DIRECTOR, ENGINEERING SERVICES MUNICIPALITY OF	DIRECTOR, ENGINEERING SERVICES REGION OF .....
DATE	DATE

TRENT LAKES
ENGINEERING SERVICES DEPARTMENT

JEFFERY SUBDIVISION
BOBCAYGEON

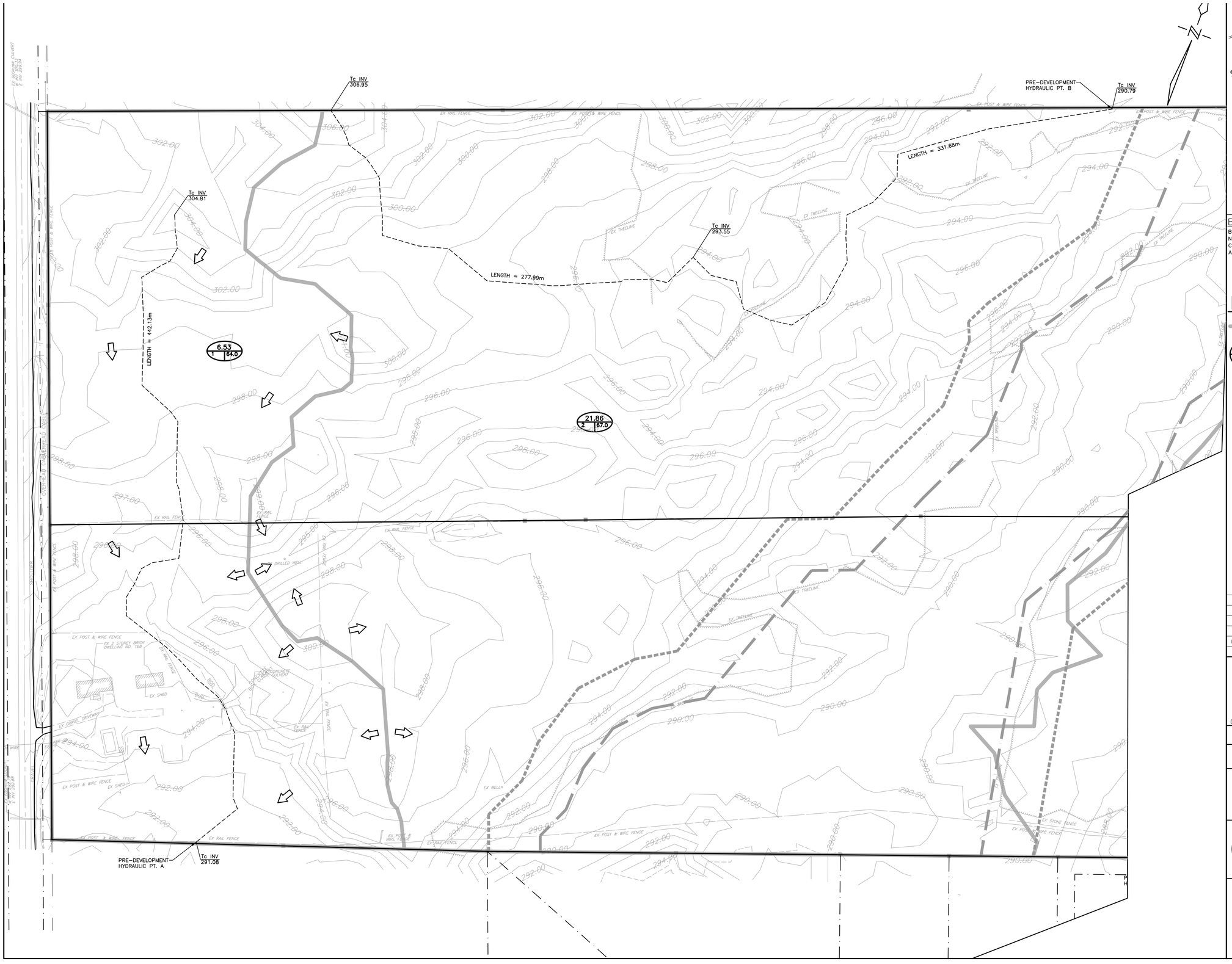
PRE-DEVELOPMENT STORM DRAINAGE PLAN - EAST

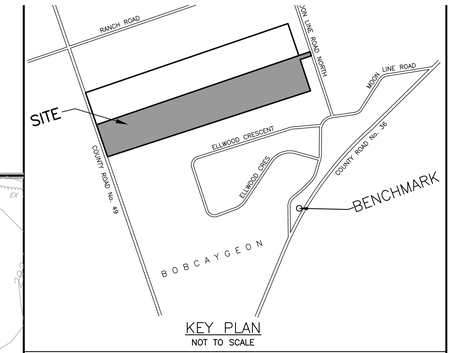
D.G. BIDDLE & ASSOCIATES
CONSULTING ENGINEERS & PLANNERS
96 King Street East
Oshawa, Ontario, L1H 1B6
Phone: 905-576-8500
info@dgbiddle.com
dgbiddle.com

LICENSED PROFESSIONAL ENGINEER
D. D. J. MCNAULL
100174891
DEC 20, '24
PROVINCE OF ONTARIO

SCALE:	1:1000	PROJECT NO.	122169
DRAWN BY:	M.J.H.	DRAWING NO.	SD-2
DESIGN BY:	M.J.H		
CHECKED BY:	D.D.M		
DATE:	JAN 2024		

X:\DRAFTING JOB FILES\122000\122169 JEFFERY - BOBCAYGEON\122169 DRAWINGS CIVIL\122169 CONCEPTUAL DEVELOPMENT AND PRELIMINARY ENGINEERING\122169-30-SITE-PLANLING December 19, 2024





KEY PLAN
NOT TO SCALE

BENCH MARK

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LEGEND

- DRAINAGE BOUNDARY
- 0.25 / 1 | 90 — DRAINAGE AREA / ID/CURVE NUMBER
- OVERLAND FLOW DIRECTION
- WETLAND BOUNDARY
- 30m WETLAND BOUNDARY OFFSET

NOTE: THIS PLAN IS FOR STORM DRAINAGE AREAS ONLY

PRELIMINARY
NOT FOR CONSTRUCTION

NO.	DATE	REVISION	BY
1	20241216	REVISED AS PER CONSERVATION AUTHORITY COMMENTS	C.J.

REVISIONS

APPROVED	APPROVED
DIRECTOR, ENGINEERING SERVICES MUNICIPALITY OF	DIRECTOR, ENGINEERING SERVICES REGION OF .....
DATE	DATE

TRENT LAKES
ENGINEERING SERVICES DEPARTMENT

JEFFERY SUBDIVISION
BOBCAYGEON

PRE-DEVELOPMENT STORM DRAINAGE PLAN - WEST

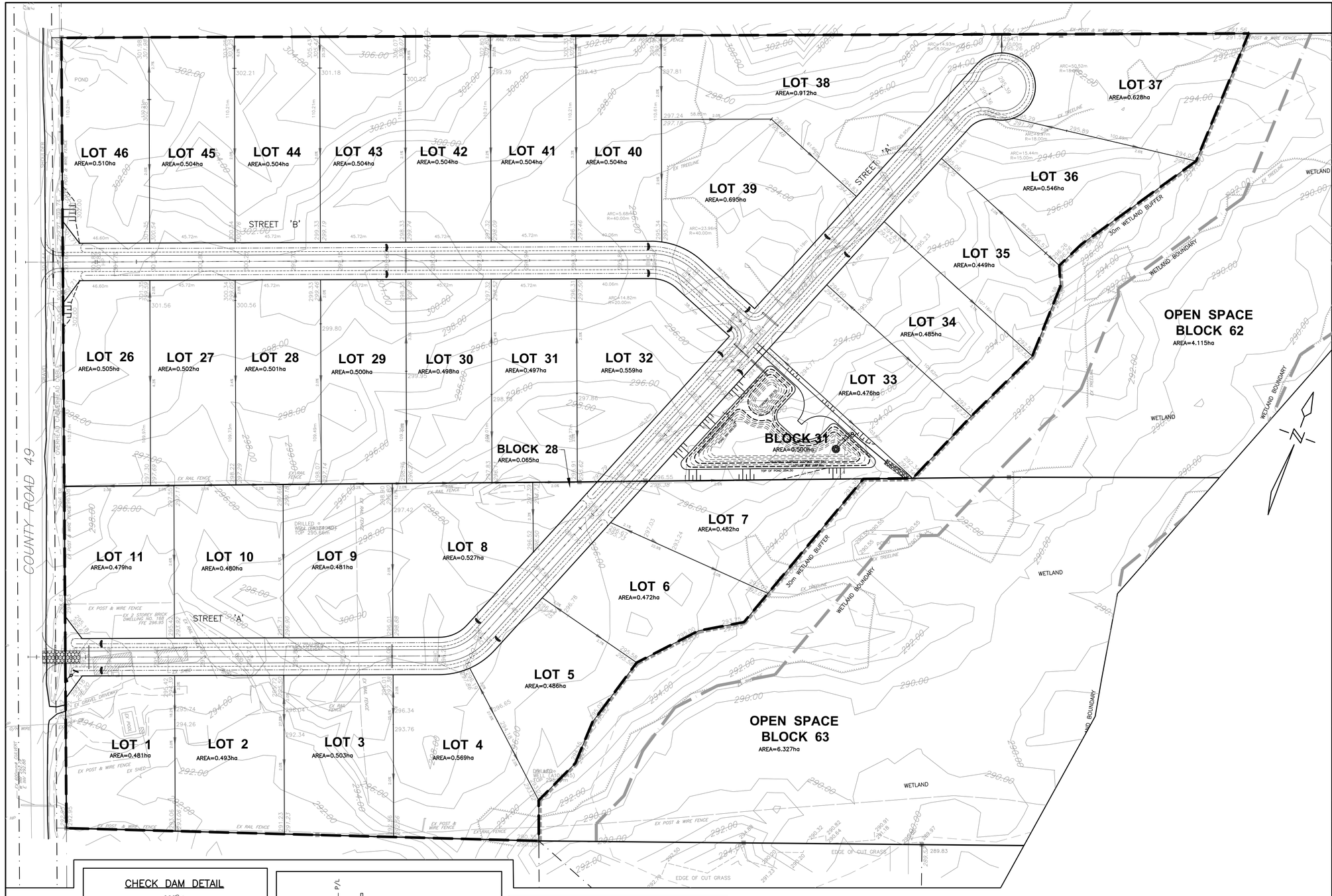
D.G. BIDDLE & ASSOCIATES
CONSULTING ENGINEERS & PLANNERS
96 King Street East
Oshawa, Ontario, L1H 1B6
Phone: 905-576-8500
info@dgbiddle.com
dgbiddle.com

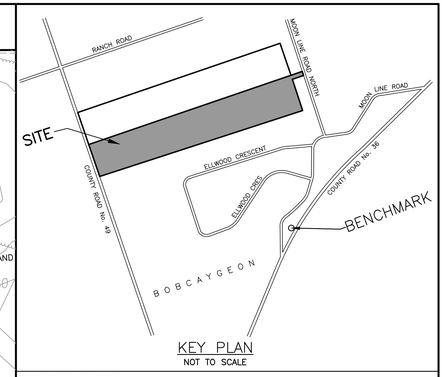
LICENSED PROFESSIONAL ENGINEER
D. D. J MCNAULL
100174891
DEC 20, '24
PROVINCE OF ONTARIO

SCALE:	1:1000
DRAWN BY:	M.J.H.
DESIGN BY:	M.J.H
CHECKED BY:	D.D.M
DATE:	JAN 2024

PROJECT NO. 122169
DRAWING NO. SD-1

X:\DRAFT\JOB FILES\122000\122169 JEFFERY - BOBCAYGEON\122169 DRAWINGS CIVIL\122169 CONCEPTUAL DEVELOPMENT AND PRELIMINARY ENGINEERING\122169-30-SITE-PLAN.DWG
December 19, 2024





KEY PLAN
NOT TO SCALE

BENCH MARK

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DUST CONTROL MEASURES:

A. PRE-GRADING PLANNING

1. THE SITE SERVICING FOR THE SITE SHALL BE SCHEDULED SUCH THAT THE OVERALL TIME THE AREAS ARE LEFT OPEN TO WIND THAT CREATE BLOWING DUST FROM THE EARTHWORK OPERATIONS IS MINIMIZED.
2. THE TOPSOIL STOCKPILE (IF APPLICABLE) SHALL BE STABILIZED WITHIN 30 DAYS OF STOCKPILING MATERIALS IN ACCORDANCE WITH CITY'S CRITERIA. ALL DISTURBED LANDS OUTSIDE THE PHASE OF WORK SHALL BE STABILIZED/VEGETATED.
3. THE CONTRACTOR SHALL APPLY WATER TO HAUL ROADS AND STOCKPILES (IF APPLICABLE) BY WAY OF WATER TRUCK.

B. WATERING (POST GRADING)

4. WITHIN AREAS WHERE EARTHWORKS AND OR UNDERGROUND MUNICIPAL SERVICING IS ON-GOING, WATER IS TO BE UTILIZED AT SUFFICIENT QUANTITY TO PREVENT VISIBLE EMISSIONS FROM EXTENDING MORE THAN 30m FROM THE POINT OF ORIGIN.

C. REDUCE VEHICLE SPEED

5. THE ON-SITE SPEED LIMIT FOR CONSTRUCTION VEHICLES SHALL BE MINIMIZED AND TO BE USED IN CONJUNCTION WITH WATERING TO PREVENT VISIBLE DUST EMISSIONS.

D. RESTRICT ACTIVITIES DURING HIGH WIND PERIODS

6. THE HIGH VISIBILITY OF CERTAIN WORKS AND THE CLOSE PROXIMITY AND POPULATION IMPACT SHOULD BE TAKEN INTO CONSIDERATION WHEN SCHEDULING DUST-PRODUCING WORK. APPROPRIATE DUST CONTROL MEASURES SHALL BE IN PLACE IN SUCH SITUATIONS.

E. ROAD CLEANING

7. SPILLAGE, EROSION OR MATERIALS "TRACKED OUT" ON A ROAD TO BE CLEANED USING MECHANICAL STREET SWEEPERS OR FLUSHER TRUCK AT LEAST BY THE END OF THE WORK DAY. HOWEVER, IF SPILLAGE EXTENDS MORE THAN 15m ALONG A PAVED PUBLIC ROADWAY, IT MUST BE CLEANED UP IMMEDIATELY.
8. IMPORTING AND EXPORTING OF MATERIALS ON AND OFF-SITE WILL BE SHUT DOWN DURING AND FOLLOWING INCLEMENT WEATHER UNTIL THE ROAD SURFACES HAVE BEEN CLEANED.

SEDIMENT CONTROL CONSTRUCTION SCHEDULE

1. INSTALL PERIMETER ENVIRO FENCE AND CONSTRUCTION VEHICLE ACCESS.
2. EXCAVATE PERIMETER SWALES AND SEDIMENT PONDS AS REQUIRED.
3. STRIP SITE OF TOPSOIL AND REMOVE OFF SITE OR STOCK PILE AND PROVIDE ENVIRO FENCE AROUND BOTTOM OF PILE.
4. INSTALL MINOR STORM SEWER SYSTEM ALONG WITH OTHER SERVICES.
5. INSTALL CATCHBASIN FILTRATION ON ALL CATCHBASINS AND CATCHBASIN.
6. SEDIMENT CONTROL MEASURES ARE TO BE MAINTAINED UNTIL ALL AREAS OF THE SITE HAVE BEEN STABILIZED WITH SOD OR ASPHALT.

PRELIMINARY
NOT FOR CONSTRUCTION

NO.	DATE	REVISION	BY
1	20241216	REVISED AS PER CONSERVATION AUTHORITY COMMENTS	C.J.

REVISIONS

APPROVED
DIRECTOR, ENGINEERING SERVICES
MUNICIPALITY OF .....
DATE

APPROVED
DIRECTOR, ENGINEERING SERVICES
REGION OF .....
DATE

TRENT LAKES
ENGINEERING SERVICES DEPARTMENT

JEFFERY SUBDIVISION
BOBCAYGEON

EROSION AND SEDIMENT CONTROL PLAN

D.G. BIDDLE & ASSOCIATES
CONSULTING ENGINEERS & PLANNERS
96 King Street East
Oshawa, Ontario, L1H 1B6
Phone: 905-576-8500
info@dgbiddle.com
dgbiddle.com

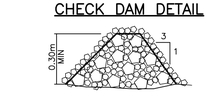
LICENSED PROFESSIONAL ENGINEER
D.D.J MCNAULL
100174891
DEC 20, '24
PROVINCE OF ONTARIO

SCALE:	1:1000
DRAWN BY:	M.J.H.
DESIGN BY:	M.J.H
CHECKED BY:	D.D.M
DATE:	JAN 2024

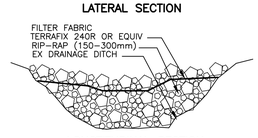
PROJECT NO. 122169
DRAWING NO. ES-1

X:\STAFF\JOB FILES\122000\122169 JEFFERY - BOBCAYGEON\122169 DRAWINGS CIVIL\122169 CONCEPTUAL DEVELOPMENT AND PRELIMINARY ENGINEERING\122169-3D-SITE-PLAN.DWG
December 20, 2024

CHECK DAM DETAIL



LATERAL SECTION



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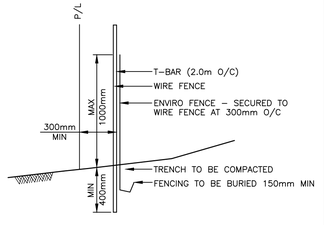
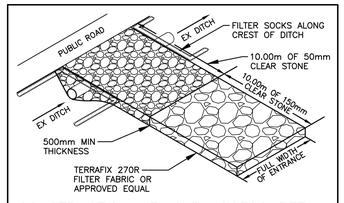


PERIMETER ENVIRO FENCE DETAIL
NOT TO SCALE



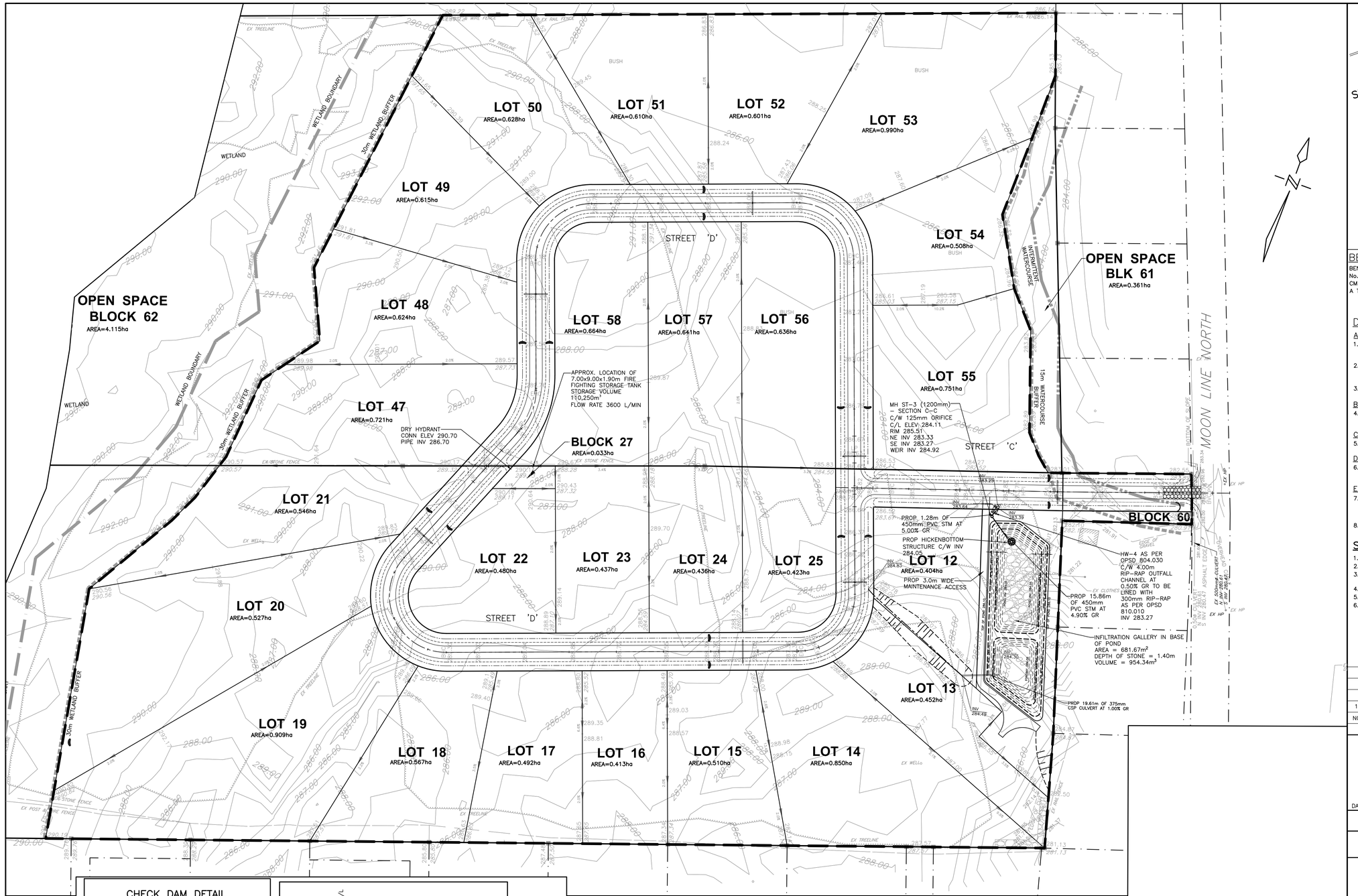
CONSTRUCTION VEHICLE ACCESS DETAIL
NOT TO SCALE

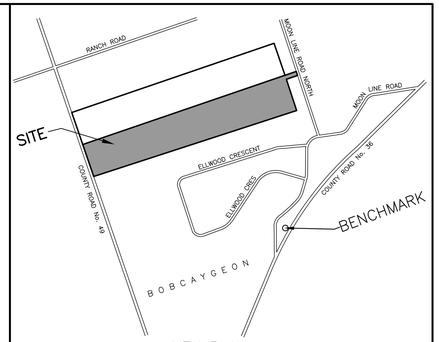
SEDIMENT CONTROL NOTES:

1. THE EROSION AND SEDIMENT CONTROL STRATEGIES ON THE PLANS ARE NOT STATIC AND MAY NEED TO BE UPGRADED/AMENDED AS SITE CONDITIONS CHANGE TO PREVENT SEDIMENT RELEASES.
2. DISTURBED AREAS LEFT FOR 30 DAYS OR LONGER MUST BE STABILIZED WITH SEED APPLICATION AS DIRECTED BY THE ENGINEER.
3. INSPECTION OF THE PROPOSED EROSION AND SEDIMENT CONTROL MEASURES WILL OCCUR ON A WEEKLY BASIS AND AFTER MAJOR RAINFALL OR SNOW MELT EVENTS, AS FOLLOWS:
   - SILT FENCES MUST BE INSPECTED FOR RIPS OR TEARS, BROKEN STAKES, BLOW OUTS AND ACCUMULATIONS OF SEDIMENT. ACCUMULATED SEDIMENT MUST BE REMOVED FROM THE FENCE AT A DEPTH OF 300mm.
   - ROCK CHECK DAMS ARE TO BE CLEANED OF ALL ACCUMULATED SEDIMENT AS SOON AS SEDIMENT HAS A DEPTH OF 50% OF THE HEIGHT OF THE CHECK DAM.
   - ALL DAMAGED EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REPAIRED AND/OR REPLACED WITHIN 24 HOURS OF INSPECTION IF RECEPTORS ARE AT IMMINENT RISK OF ADVERSE IMPACT.

LEGEND

PERIMETER ENVIRO FENCE
DIRECTION OF OVERLAND FLOW
RIP RAP CHECKDAM
CONSTRUCTION VEHICLE ACCESS





KEY PLAN
NOT TO SCALE

BENCH MARK

BENCHMARKS SHOWN HEREON ARE GEODETIC IN ORIGIN DERIVED FROM CGVD2013 BENCHMARK No. 60U3306, IRON PIPE WITH BRASS CAP ON TOP OF SAND CUT ON COUNTY ROAD 36, 76 CM SOUTHEAST OF WIRE FENCE ALONG NORTHWEST LIMIT OF RIGHT-OF-WAY, AS SHOWN ON A TOPOGRAPHIC SURVEY BY A PRIVATE OLS, DATED 20231217. ELEV = 277.33.

DUST CONTROL MEASURES:

A. PRE-GRADING PLANNING

1. THE SITE SERVICING FOR THE SITE SHALL BE SCHEDULED SUCH THAT THE OVERALL TIME THE AREAS ARE LEFT OPEN TO WIND THAT CREATE BLOWING DUST FROM THE EARTHWORK OPERATIONS IS MINIMIZED.
2. THE TOPSOIL STOCKPILE (IF APPLICABLE) SHALL BE STABILIZED WITHIN 30 DAYS OF STOCKPILING MATERIALS IN ACCORDANCE WITH CITY'S CRITERIA. ALL DISTURBED LANDS OUTSIDE THE PHASE OF WORK SHALL BE STABILIZED/VEGETATED.
3. THE CONTRACTOR SHALL APPLY WATER TO HAUL ROADS AND STOCKPILES (IF APPLICABLE) BY WAY OF WATER TRUCK.

B. WATERING (POST GRADING)

4. WITHIN AREAS WHERE EARTHWORKS AND OR UNDERGROUND MUNICIPAL SERVICING IS ON-GOING, WATER IS TO BE UTILIZED AT SUFFICIENT QUANTITY TO PREVENT VISIBLE EMISSIONS FROM EXTENDING MORE THAN 30m FROM THE POINT OF ORIGIN.

C. REDUCE VEHICLE SPEED

5. THE ON-SITE SPEED LIMIT FOR CONSTRUCTION VEHICLES SHALL BE MINIMIZED AND TO BE USED IN CONJUNCTION WITH WATERING TO PREVENT VISIBLE DUST EMISSIONS.

D. RESTRICT ACTIVITIES DURING HIGH WIND PERIODS

6. THE HIGH VISIBILITY OF CERTAIN WORKS AND THE CLOSE PROXIMITY AND POPULATION IMPACT SHOULD BE TAKEN INTO CONSIDERATION WHEN SCHEDULING DUST-PRODUCING WORK. APPROPRIATE DUST CONTROL MEASURES SHALL BE IN PLACE IN SUCH SITUATIONS.

E. ROAD CLEANING

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SEDIMENT CONTROL CONSTRUCTION SCHEDULE

1. INSTALL PERIMETER ENVIRO FENCE AND CONSTRUCTION VEHICLE ACCESS.
2. EXCAVATE PERIMETER SWALES AND SEDIMENT PONDS AS REQUIRED.
3. STRIP SITE OF TOPSOIL AND REMOVE OFF SITE OR STOCK PILE AND PROVIDE ENVIRO FENCE AROUND BOTTOM OF PILE.
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PRELIMINARY
NOT FOR CONSTRUCTION

NO.	DATE	REVISION	BY
1	20241216	REVISED AS PER CONSERVATION AUTHORITY COMMENTS	C.J.

REVISIONS

APPROVED

DIRECTOR, ENGINEERING SERVICES
MUNICIPALITY OF .....

DATE

APPROVED

DIRECTOR, ENGINEERING SERVICES
REGION OF .....

DATE

TRENT LAKES
ENGINEERING SERVICES DEPARTMENT

JEFFERY SUBDIVISION
BOBCAYGEON

EROSION AND SEDIMENT CONTROL PLAN

D.G. BIDDLE & ASSOCIATES
CONSULTING ENGINEERS & PLANNERS
96 King Street East
Oshawa, Ontario, L1H 1B6
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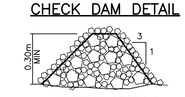
LICENSED PROFESSIONAL ENGINEER
D.D.J MCNAULL
100174891
DEC 20, '24
PROVINCE OF ONTARIO

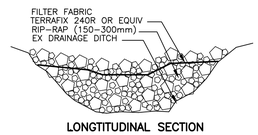
SCALE:	1:1000
DRAWN BY:	M.J.H.
DESIGN BY:	M.J.H
CHECKED BY:	D.D.M
DATE:	JAN 2024

PROJECT NO. 122169
DRAWING NO. ES-2

CHECK DAM DETAIL



LATERAL SECTION



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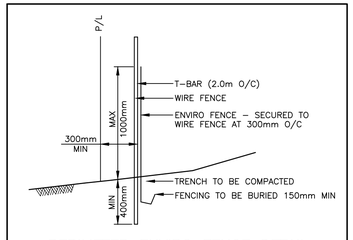
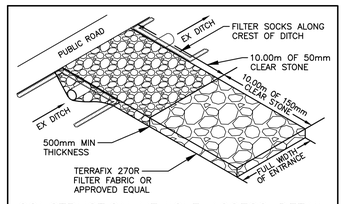


PERIMETER ENVIRO FENCE DETAIL
NOT TO SCALE



CONSTRUCTION VEHICLE ACCESS DETAIL
NOT TO SCALE

SEDIMENT CONTROL NOTES:

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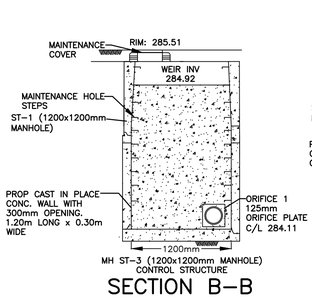
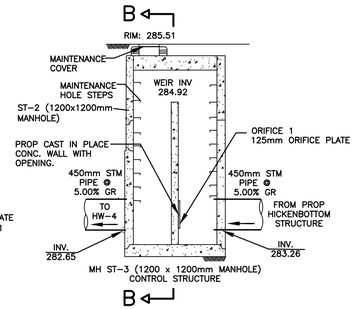
LEGEND

PERIMETER ENVIRO FENCE
DIRECTION OF OVERLAND FLOW
RIP RAP CHECKDAM
CONSTRUCTION VEHICLE ACCESS

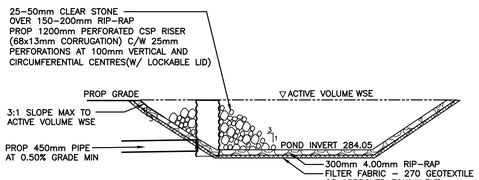
X:\DATA\JOB FILES\122000\122169 JEFFERY - BOBCAYGEON\122169 DRAWINGS CIVIL\122169 CONCEPTUAL DEVELOPMENT AND PRELIMINARY ENGINEERING\122169-30-SITE-PLANNING
December 20, 2024





SECTION B–B

N.T.S.

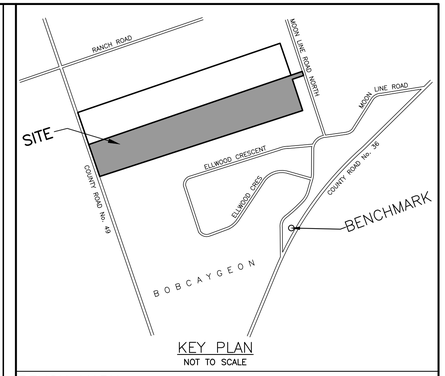


WEST POND OUTFLOW STRUCTURE

NOT TO SCALE

PRELIMINARY
NOT FOR CONSTRUCTION

LOT 47 AREA=0.721ha
LOT 48 AREA=0.624ha
LOT 49 AREA=0.615ha
LOT 50 AREA=0.628ha
LOT 51 AREA=0.610ha
LOT 52 AREA=0.601ha
LOT 53 AREA=0.990ha
LOT 54 AREA=0.508ha
LOT 55 AREA=0.751ha
LOT 56 AREA=0.636ha
LOT 57 AREA=0.641ha
LOT 58 AREA=0.664ha
LOT 20 AREA=0.527ha
LOT 21 AREA=0.546ha
LOT 22 AREA=0.480ha
LOT 23 AREA=0.437ha
LOT 24 AREA=0.436ha
LOT 25 AREA=0.423ha
LOT 12 AREA=0.404ha
LOT 13 AREA=0.452ha
LOT 14 AREA=0.850ha
LOT 15 AREA=0.510ha
LOT 16 AREA=0.413ha
LOT 17 AREA=0.492ha
LOT 18 AREA=0.567ha
LOT 19 AREA=0.909ha
BLOCK 27 AREA=0.033ha
BLOCK 60
OPEN SPACE BLK 61 AREA=0.361ha
STREET 'D'
STREET 'C'
PROP 450mm CULVERT
APPROX. LOCATION OF 7.00x9.00x1.90m FIRE FIGHTING STORAGE TANK STORAGE VOLUME 110.250m³ FLOW RATE 3600 L/MIN
DRY HYDRANT CONN ELEV 290.70 PIPE INV 286.70
MH ST-3 (1200mm) – SECTION C–C C/W 125mm ORIFICE C/L ELEV. 284.11 RIM 285.51 NE INV 283.33 SE INV 283.27 WEIR INV 284.92
100 YR PONDING ELEV: 285.75
100 YR PONDING ELEV: 286.00
PROP 1.28m OF 450mm PVC STM AT 5.00% GR
PROP HICKENBOTTOM STRUCTURE C/W INV 284.05
PROP 3.0m WIDE MAINTENANCE ACCESS
PROP 15.86m OF 450mm PVC STM AT 4.90% GR
HW–4 AS PER OPSD 804.030 C/W 4.00m RIP–RAP OUTFALL CHANNEL AT 0.50% GR TO BE LINED WITH 300mm RIP–RAP AS PER OPSD 810.010 INV 283.27
INFILTRATION GALLERY IN BASE OF POND AREA = 1,077.00m² DEPTH OF STONE = 0.90m VOLUME = 969.30m³ BOTTOM OF GALLERY = 283.70m
PROP 19.61m OF 375mm CSP CULVERT AT 1.00% GR
PROP INFILTRATION GALLERY D 60.00mx3.65mx1.00m BOTTOM OF GALLERY = 282.50m
INTERMITTENT WATERCOURSE
15m WATERCOURSE BUFFER
30m WETLAND BUFFER
WETLAND BOUNDARY
WETLAND
BUSH
MOON LINE



KEY PLAN

NOT TO SCALE

BENCH MARK

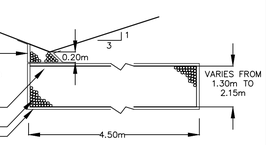
BENCHMARKS SHOWN HEREON ARE GEODETIC IN ORIGIN DERIVED FROM CGVD2013 BENCHMARK No. 60U3306, IRON PIPE WITH BRASS CAP ON TOP OF SAND CUT ON COUNTY ROAD 36, 76 CM SOUTHEAST OF WIRE FENCE ALONG NORTHWEST LIMIT OF RIGHT–OF–WAY, AS SHOWN ON A TOPOGRAPHIC SURVEY BY A PRIVATE OLS, DATED 20231217. ELEV = 277.33.

SITE GRADING NOTES

1. A ROAD OCCUPANCY PERMIT WILL BE REQUIRED FOR ANY WORKS WITHIN THE MUNICIPAL RIGHT OF WAY.
2. ALL WORKS OR RESTORATION WITHIN THE MUNICIPAL RIGHT OF WAY SHALL BE COMPLETED AS PER CITY OF KAWARTHA LAKES FIELD STAFF DIRECTION.
3. THE LOCATION AND ELEVATION OF ALL EXISTING UTILITIES AND SERVICES TO BE VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCING CONSTRUCTION. CONCERNED UTILITIES TO BE GIVEN ADVANCED NOTICE FOR STAKE OUT. THE CONSULTANT ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE UTILITIES SHOWN ON THE DRAWINGS.
4. QUANTITIES, DIMENSIONS AND ELEVATIONS TO BE VERIFIED BY THE CONTRACTOR PRIOR TO ORDERING MATERIALS OR COMMENCING CONSTRUCTION.
5. ALL SLOPES SHALL BE CONSTRUCTED AT 3:1 (MAXIMUM) UNLESS OTHERWISE NOTED ON THE DRAWINGS.
6. ALL SWALES SHALL BE CONSTRUCTED WITH 2% MINIMUM GRADE UNLESS OTHERWISE NOTED ON THE DRAWINGS.

LEGEND

ORIGINAL ELEVATION TO REMAIN +101.35
PROPOSED ELEVATIONS +103.15
PROPOSED SWALE
DIRECTION OF DRAINAGE
DIRECTION OF OVERLAND FLOW
LIMIT OF PONDING



TYPICAL INFILTRATION GALLERY DETAIL

SCALE: NOT TO SCALE

NO.	DATE	REVISION	BY
2	20241216	REVISED AS PER CONSERVATION AUTHORITY COMMENTS	C.J.
1	20241203	REVISED AS PER MUNICIPAL COMMENTS	B.A.

REVISIONS

APPROVED	APPROVED
DIRECTOR, ENGINEERING SERVICES MUNICIPALITY OF	DIRECTOR, ENGINEERING SERVICES REGION OF .....
DATE	DATE

TRENT LAKES
ENGINEERING SERVICES DEPARTMENT

JEFFERY SUBDIVISION
BOBCAYGEON

CONCEPTUAL GRADING AND SERVICING PLAN

D.G. BIDDLE & ASSOCIATES
CONSULTING ENGINEERS & PLANNERS
96 King Street East
Oshawa, Ontario, L1H 1B6
Phone: 905–576–8500
info@dgbiddle.com
dgbiddle.com

SCALE:	1:1000	PROJECT NO.	122169
DRAWN BY:	M.J.H.	DRAWING NO.	LG–2
DESIGN BY:	M.J.H		
CHECKED BY:	D.D.M		
DATE:	JAN 2024		

X:\STAFF_JOB FILES\122000\122169 JEFFERY - BOBCAYGEON\122169 DRAWINGS CIVIL\122169 CONCEPTUAL DEVELOPMENT AND PRELIMINARY ENGINEERING\122169-3D-SITE-PLAN.DWG
June 27, 2025

Appendix B

Borehole, Hand Auger, and Test Pit Logs

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH101-23

Client:	Jeffrey Homes	**Project Name:**	GEO - 168 County Road 49, Bobcaygeon	**Project No.:**	17986-002
Contractor:	Landshark	**Method:**	Hollow Stem Auger	**Date Completed:**	October 25, 2023
Location:	168 County Road 49, Bobcaygeon	**UTM:**	17T 694675.16 E, 4937141.01 N	**Elevation:**	292.72 masl

SUBSURFACE PROFILE			SAMPLE								
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
293 / 0		TOPSOIL: 75mm thick layer of topsoil	1A	SS					Cap	Small cobble throughout
		CLAYEY SILT: Brown, clayey silt, some sand, trace gravel, drier than plastic limit, soft	1B	SS	25	2			Pipe Bentonite Plug	Water level measured at 0.33 mbgs on Nov. 10, 2023
292 / 1		TILL: Light brown, gravelly silty sand, trace clay, moist to wet, compact	2	SS	50	15				
291 / 2			3	SS	42	15			Sand Pack PVC Screen	Groundwater first encountered at 2.29 mbgs Water level upon completion at 2.44 mbgs
290 / 3		TILL: Grey, silty gravel and sand, trace clay, wet, dense	4	SS	70	43				SS4 GSA: 34% gravel 34% sand 25% silt 7% clay
		-becomes very dense	5	SS	100	50/75			Cap	
289 / 4		Borehole terminated at 3.12 mbgs after auger refusal on presumed bedrock or large boulders								Borehole open upon completion
288 / 5										

Logged By: J. Riseling **Input By:** J. Riseling

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH102-23

Client: Jeffrey Homes
Project Name: GEO - 168 County Road 49, Bobcaygeon
Project No.: 17986-002
Contractor: Landshark
Method: Hollow Stem Auger
Date Completed: October 25, 2023
Location: 168 County Road 49, Bobcaygeon
UTM: 17T 694793.84 E, 4937195.17 N
Elevation: 295.67 masl

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
296 / 0		TOPSOIL: 75mm thick layer of topsoil								
		CLAYEY SILT: Brown, clayey silt, some sand, trace gravel, trace organics, drier than plastic limit, stiff	1	SS	12	9				Small cobble throughout
295 / 1		-becomes firm	2	SS	50	7				SS2 GSA: 7% gravel 16% sand 50% silt 27% clay
		TILL: Light brown, silty gravel and sand, moist, compact	3	SS	42	13				Borehole open and dry upon completion
294 / 2		-becomes very dense	4	SS	33	50/75				
293 / 3		Borehole terminated at 2.51 mbgs after auger refusal on presumed bedrock or large boulders								
292 / 4										
291 / 5										

Logged By: J. Riseling
Input By: J. Riseling

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH103-23

Client: Jeffrey Homes
Project Name: GEO - 168 County Road 49, Bobcaygeon
Project No.: 17986-002
Contractor: Landshark
Method: Hollow Stem Auger
Date Completed: October 25, 2023
Location: 168 County Road 49, Bobcaygeon
UTM: 17T 694882.12 E, 4937290.56 N
Elevation: 296.18 masl

SUBSURFACE PROFILE			SAMPLE								
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
296 / 0		TOPSOIL: 150mm thick layer of topsoil	1	SS	24	8				Small cobble throughout
		TILL: Light brown, silty gravel and sand, moist, very dense	2	SS	58	54				Borehole open and dry upon completion
295 / 1			3	SS	75	56				
294 / 2			4	SS	67	52				
293 / 3			5	SS	92	68				
292 / 4			6	SS	100	50/75				
291 / 5		Borehole terminated at 4.65 mbgs after SPT refusal in silty gravel and sand till								

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Input By: J. Riseling

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Log of Borehole: BH104-23

Client: Jeffrey Homes
Project Name: GEO - 168 County Road 49, Bobcaygeon
Project No.: 17986-002
Contractor: Landshark
Method: Hollow Stem Auger
Date Completed: October 25, 2023
Location: 168 County Road 49, Bobcaygeon
UTM: 17T 695029.52 E, 4937418.20 N
Elevation: 292.26 masl

SUBSURFACE PROFILE			SAMPLE								
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
293 / -1										
292 / 0		TOPSOIL: 150mm thick layer of topsoil								
		TILL: Light brown, sandy silty gravel, some clay, moist, compact	1	SS	25	6				Small cobble throughout
291 / 1			2	SS	75	12				Borehole open and dry upon completion
			3	SS	25	11				
290 / 2		-becomes moist to wet	4	SS	75	19				
289 / 3		-becomes very dense	5	SS	0	50/150				
288 / 4		-becomes grey	6	SS	100	50/50				
287 / 5		Borehole terminated at 4.62 mbgs after SPT refusal in sandy silty gravel till								

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Input By: J. Riseling

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Log of Borehole: BH105-23

Client: Jeffrey Homes
Project Name: GEO - 168 County Road 49, Bobcaygeon
Project No.: 17986-002
Contractor: Landshark
Method: Hollow Stem Auger
Date Completed: October 25, 2023
Location: 168 County Road 49, Bobcaygeon
UTM: 17T 695220.03 E, 4937348.23 N
Elevation: 290.23 masl

SUBSURFACE PROFILE			SAMPLE								
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
291 / -1										
290 / 0		TOPSOIL: 200mm thick layer of topsoil	1A	SS	58	8				
		TILL: Brown, sandy silty gravel, some clay, moist, loose	1B	SS						
289 / 1		-becomes dense	2	SS	25	37				Small cobble throughout
288 / 2			3	SS	75	31				SS3 GSA: 39% gravel 28% sand 23% silt 10% clay
		-becomes very dense	4	SS	100	50/125				
287 / 3			5	SS	100	50/150				Borehole open and dry upon completion
286 / 4			6	SS	25	50/100				
285 / 5		Borehole terminated at 4.67 mbgs after SPT refusal in sandy silty gravel till								

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Input By: J. Riseling

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Log of Borehole: BH106-23

Client: Jeffrey Homes
Project Name: GEO - 168 County Road 49, Bobcaygeon
Project No.: 17986-002
Contractor: Landshark
Method: Hollow Stem Auger
Date Completed: October 26, 2023
Location: 168 County Road 49, Bobcaygeon
UTM: 17T 695333.16 E, 4937462.64 N
Elevation: 288.64 masl

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
289 / 0		TOPSOIL: 200mm thick layer of topsoil	1	SS	33	7				Small cobble throughout
		TILL: Light brown, gravelly silty sand, trace clay, moist, dense								
288 / 1			2	SS	42	49				Borehole open and dry upon completion
287 / 2			3	SS	83	41				
286 / 3		-becomes very dense	4	SS	67	59				
			5	SS	33	50/75				
285 / 4										
284 / 5		Borehole terminated at 4.82 mbgs after SPT refusal in gravelly silty sand till	6	SS	80	50/100				

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Log of Borehole: BH107-23

Client: Jeffrey Homes
Project Name: GEO - 168 County Road 49, Bobcaygeon
Project No.: 17986-002
Contractor: Landshark
Method: Hollow Stem Auger
Date Completed: October 26, 2023
Location: 168 County Road 49, Bobcaygeon
UTM: 17T 695513.31 E, 4937433.93 N
Elevation: 286.35 masl

SUBSURFACE PROFILE			SAMPLE								
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
287 / -1										
286 / 0		TOPSOIL: 250mm thick layer of topsoil								
		TILL: Light brown, gravelly silty sand, trace clay, moist, very dense	1	SS	42	6				
285 / 1			2	SS	96	83				Small cobble throughout
			3	SS	50	50/100				Borehole open and dry upon completion
284 / 2			4	SS	100	80				
283 / 3			5	SS	55	50/125				
282 / 4			6	SS	67	50/75				
281 / 5		Borehole terminated at 4.80 mbgs after SPT refusal in gravelly silty sand till								

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Input By: J. Riseling

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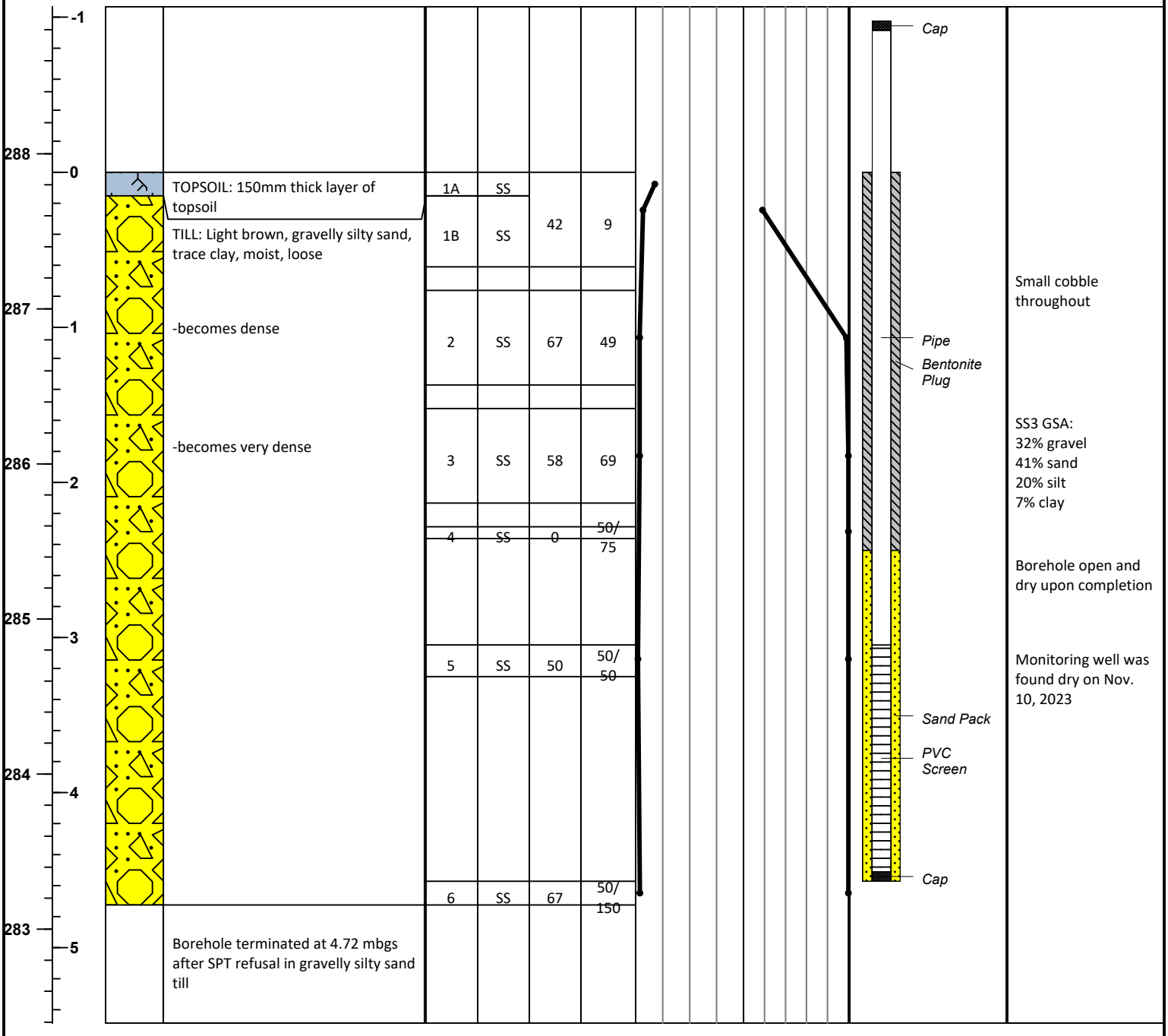
Log of Borehole: BH108-23

Client:	Jeffrey Homes	**Project Name:**	GEO - 168 County Road 49, Bobcaygeon	**Project No.:**	17986-002
Contractor:	Landshark	**Method:**	Hollow Stem Auger	**Date Completed:**	October 26, 2023
Location:	168 County Road 49, Bobcaygeon	**UTM:**	17T 695459.31 E, 4937561.77 N	**Elevation:**	287.88 masl

Elevation (m) / Depth	Description	Number	Type	% Recovery	SPT (N) / DCPT	Well Installation	Remarks
288 / 0	TOPSOIL: 150mm thick layer of topsoil	1A	SS	42	9	Cap	
	TILL: Light brown, gravelly silty sand, trace clay, moist, loose	1B	SS				
287 / 1	-becomes dense	2	SS	67	49	Pipe Bentonite Plug	Small cobble throughout
286 / 2	-becomes very dense	3	SS	58	69		SS3 GSA: 32% gravel 41% sand 20% silt 7% clay
		4	SS	0	50/75		Borehole open and dry upon completion
285 / 3		5	SS	50	50/50	Sand Pack PVC Screen	Monitoring well was found dry on Nov. 10, 2023
284 / 4							
283 / 5	Borehole terminated at 4.72 mbgs after SPT refusal in gravelly silty sand till	6	SS	67	50/150	Cap	



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Log of Borehole: BH109-23

Client: Jeffrey Homes
Project Name: GEO - 168 County Road 49, Bobcaygeon
Project No.: 17986-002
Contractor: Landshark
Method: Hollow Stem Auger
Date Completed: October 26, 2023
Location: 168 County Road 49, Bobcaygeon
UTM: 17T 695333.74 E, 4937710.50 N
Elevation: 290.31 masl

SUBSURFACE PROFILE			SAMPLE								
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
291 / 0		TOPSOIL: 200mm thick layer of topsoil	1A	SS	50	10			Cap	Small cobble throughout
290 / 1		TILL: Light brown, gravelly silty sand, trace clay, moist, compact	1B	SS						
		-becomes dense	2	SS	33	42			Pipe Bentonite Plug	Borehole open and dry upon completion
289 / 2		-becomes very dense	3	SS	75	53				
288 / 3			4	SS	100	77				SS4 GSA: 33% gravel 35% sand 23% silt 9% clay
287 / 4			5	SS	67	50/150			Sand Pack PVC Screen	Monitoring well was found dry on Nov. 10, 2023
286 / 5			6	SS	100	50/125			Cap	
285		Borehole terminated at 4.85 mbgs after SPT refusal in gravelly silty sand till								

Logged By: J. Riseling
Input By: J. Riseling

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Log of Borehole: BH110-23

Client: Jeffrey Homes
Project Name: GEO - 168 County Road 49, Bobcaygeon
Project No.: 17986-002
Contractor: Landshark
Method: Hollow Stem Auger
Date Completed: October 26, 2023
Location: 168 County Road 49, Bobcaygeon
UTM: 17T 695259.48 E, 4937570.87 N
Elevation: 290.26 masl

Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
291 / -1										
290 / 0		TOPSOIL: 75mm thick layer of topsoil	1A	SS						
		TILL: Light brown, gravelly silty sand, trace clay, moist, loose	1B	SS	46	6				
289 / -1		-becomes dense	2	SS	33	37				Small cobble throughout
			3	SS	83	35				Borehole open and dry upon completion
288 / -2		-becomes very dense	4	SS	67	50/ 75				
287 / -3			5	SS	100	50/ 100				
286 / -4			6	SS	88	50/ 250				
285 / -5		Borehole terminated at 4.98 mbgs after SPT refusal in gravelly silty sand till								

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Input By: J. Riseling

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Log of Borehole: BH111-23

Client: Jeffrey Homes
Project Name: GEO - 168 County Road 49, Bobcaygeon
Project No.: 17986-002
Contractor: Landshark
Method: Hollow Stem Auger
Date Completed: October 27, 2023
Location: 168 County Road 49, Bobcaygeon
UTM: 17T 694825.61 E, 4937424.12 N
Elevation: 294.96 masl

SUBSURFACE PROFILE			SAMPLE								
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
296 / -1										
295 / 0		TOPSOIL: 200mm thick layer of topsoil								
		TILL: Light brown, sandy silty gravel, some clay, moist, loose	1	SS	38	8				Small cobble throughout
294 / -1		-becomes compact	2	SS	33	18				Borehole open and dry upon completion
			3	SS	12	24				
293 / -2			4	SS	55	26				
292 / -3		-becomes very dense	5	SS	0	50/50				
		Borehole terminated at 3.35 mbgs after auger refusal on presumed bedrock or large boulder								
291 / -4										
290 / -5										

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Input By: J. Riseling

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Log of Borehole: BH112-23

Client: Jeffrey Homes
Project Name: GEO - 168 County Road 49, Bobcaygeon
Project No.: 17986-002
Contractor: Landshark
Method: Hollow Stem Auger
Date Completed: October 27, 2023
Location: 168 County Road 49, Bobcaygeon
UTM: 17T 694713.62 E, 4937533.65 N
Elevation: 304.44 masl

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
305 / -1										
304 / 0		TOPSOIL: 150mm thick layer of topsoil	1A	SS	75	11				
		TILL: Light brown, sandy silty gravel, some clay, moist, compact	1B	SS						
303 / 1		-becomes dense	2	SS	67	49				Small cobble throughout
302 / 2			3	SS	83	41				SS3 GSA: 34% gravel 29% sand 26% silt 11% clay
301 / 3		-becomes very dense	4	SS	0	50/225				Borehole open and dry upon completion
			5	SS	100	50/75				
300 / 4			6	SS	67	50/75				
299 / 5		Borehole terminated at 4.80 mbgs after SPT refusal in sandy silty gravel till								

Logged By: J. Riseling
Input By: J. Riseling

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Log of Borehole: BH113-23

Client:	Jeffrey Homes	**Project Name:**	GEO - 168 County Road 49, Bobcaygeon	**Project No.:**	17986-002
Contractor:	Landshark	**Method:**	Hollow Stem Auger	**Date Completed:**	October 27, 2023
Location:	168 County Road 49, Bobcaygeon	**UTM:**	17T 694578.13 E, 4937436.09 N	**Elevation:**	301.62 masl

SUBSURFACE PROFILE			SAMPLE								
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
302 / 0		TOPSOIL: 150mm thick layer of topsoil	1A	SS					Cap	
		TILL: Light brown, sandy silty gravel, some clay, moist, loose	1B	SS	33	7				
301 / 1		-becomes compact	2	SS	36	23			Pipe Bentonite Plug	Small cobble throughout Borehole open and dry upon completion
300 / 2			3	SS	50	22				
299 / 3		-becomes very dense	4	SS	33	50/225				
			5	SS	0	50/100			Sand Pack PVC Screen	Water level measured at 3.85 mbgs on Nov. 10, 2023
298 / 4										
297 / 5		Borehole terminated at 4.60 mbgs after SPT refusal in sandy silty gravel till	6	SS	100	50/25			Cap	

Logged By: J. Riseling **Input By:** J. Riseling

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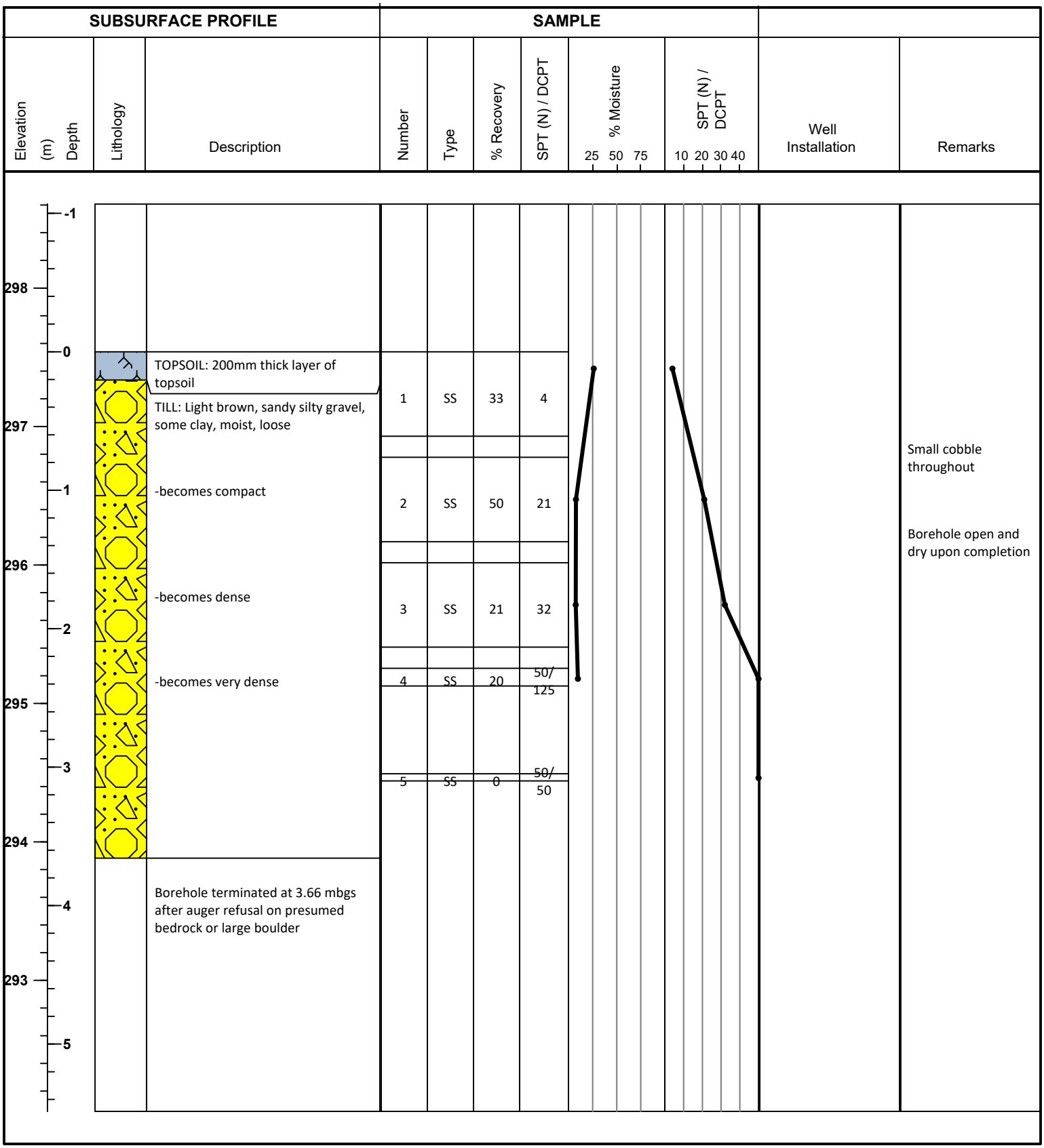
Log of Borehole: BH114-23

Client: Jeffrey Homes
Project Name: GEO - 168 County Road 49, Bobcaygeon
Project No.: 17986-002
Contractor: Landshark
Method: Hollow Stem Auger
Date Completed: October 27, 2023
Location: 168 County Road 49, Bobcaygeon
UTM: 17T 694694.37 E, 4937341.31 N
Elevation: 297.54 masl



Logged By: J. Riseling
Input By: J. Riseling

Cambium Reference # 17986-003

Date: May 28 and July 8, 2025

Logged by: JS

Test Pit ID	Depth (mbgs[1])	Material	Sample
HA101-25 [2]	0.00-0.35	Dark brown, sandy silt topsoil, some gravel, trace clay, frequent rootlets, moist, loose	
	0.35-0.60	Mottled brown and dark brown, silt and clay, trace sand, trace gravel, at plastic limit, soft to firm	GS1
17N			
694693		Auger refusal on rock/gravel, soils becoming wetter than plastic limit, hole dry upon completion	
4937190			
HA102-25 [2]	0.00-0.20	Dark brown, sandy silt topsoil, some gravel and cobbles, frequent rootlets, loose, moist	
	0.20-0.30	Dark brown, sandy silt and gravel, some cobbles, some clay, loose, moist	
17N			
695702			
4937479		Auger refusal on rock/gravel, hole dry upon completion	
HA103-25 [3]	0.00-0.05	Dark brown, silty sand topsoil, some gravel, frequent rootlets, loose, moist	
	0.05-0.25	Brown, gravelly sand, some silt, some cobbles, loose, moist to dry	GS1
17N			
695698			
4937475		Auger refusal on rock/gravel, hole dry upon completion	
TP101-25 [3]	0-0.15	Dark brown, sandy silt topsoil, some gravel, some cobbles, frequent rootlets, loose, moist	
	0.15-0.50	Light brown, sand, some silt, some gravel, trace clay, loose, moist to dry	GS1
	0.50-0.60	Grey, fractured limestone gravel and cobble, trace clay	GS2
17N			
695637			
4937573		Refusal on fractured limestone, hole dry upon completion	

Notes:
(1) meters below ground surface
(2) Completed May 28, 2025
(3) Completed July 8, 2025

Appendix C

Grain Size Analysis

Grain Size Distribution Chart

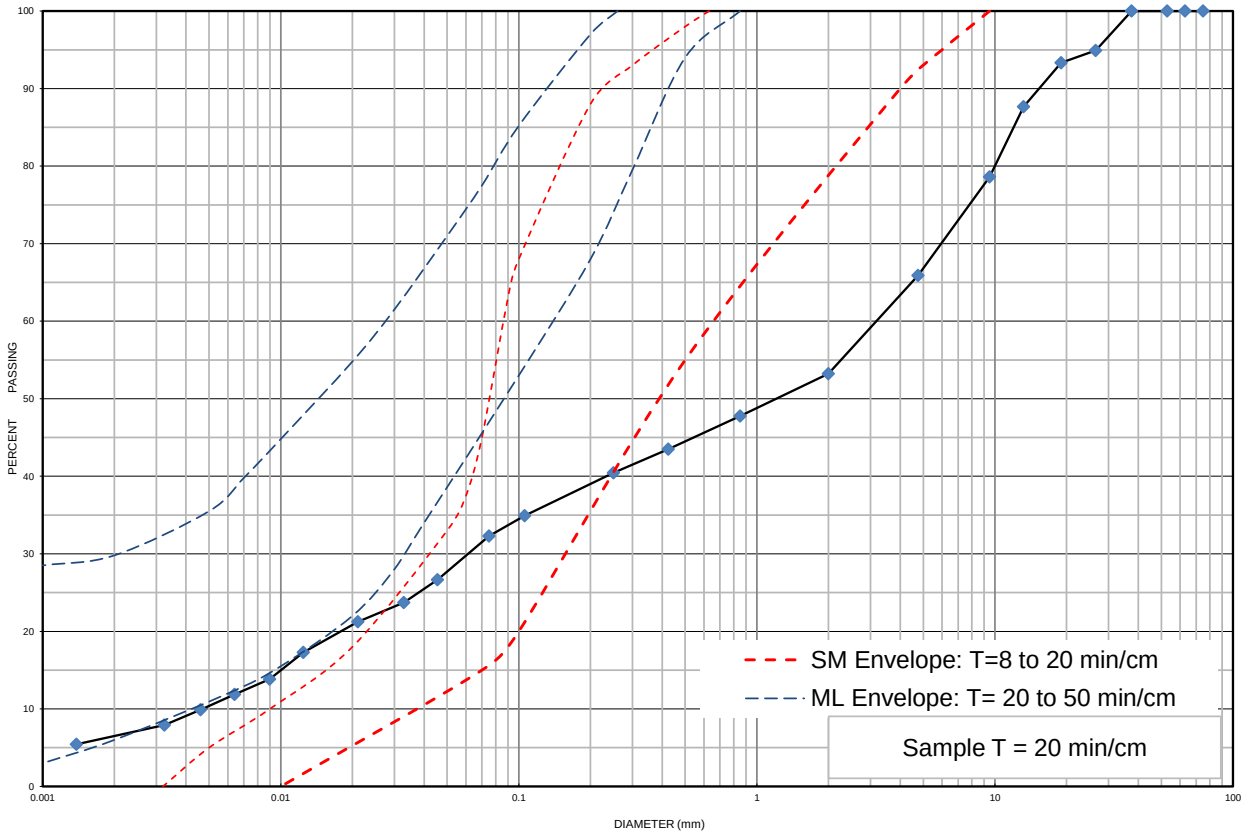
Project Number: *17986-002* **Client:** *Jeffery Homes*

Project Name: *Pt. Lot 19, Conc. 19 - Bobcaygeon Development*

Sample Date: *October 25-27, 2023* **Sampled By:** *Josh Riseling - Cambium Inc.*

Location: *BH 101-23 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-23-1845*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 101-23	SS 4	2.3 m to 2.9 m	34	34	25	7	7.5

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Gravel and Sand trace Clay	SM	3.2500	0.0610	0.0047	691.49	0.24

Additional information availabe upon request

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Grain Size Distribution Chart

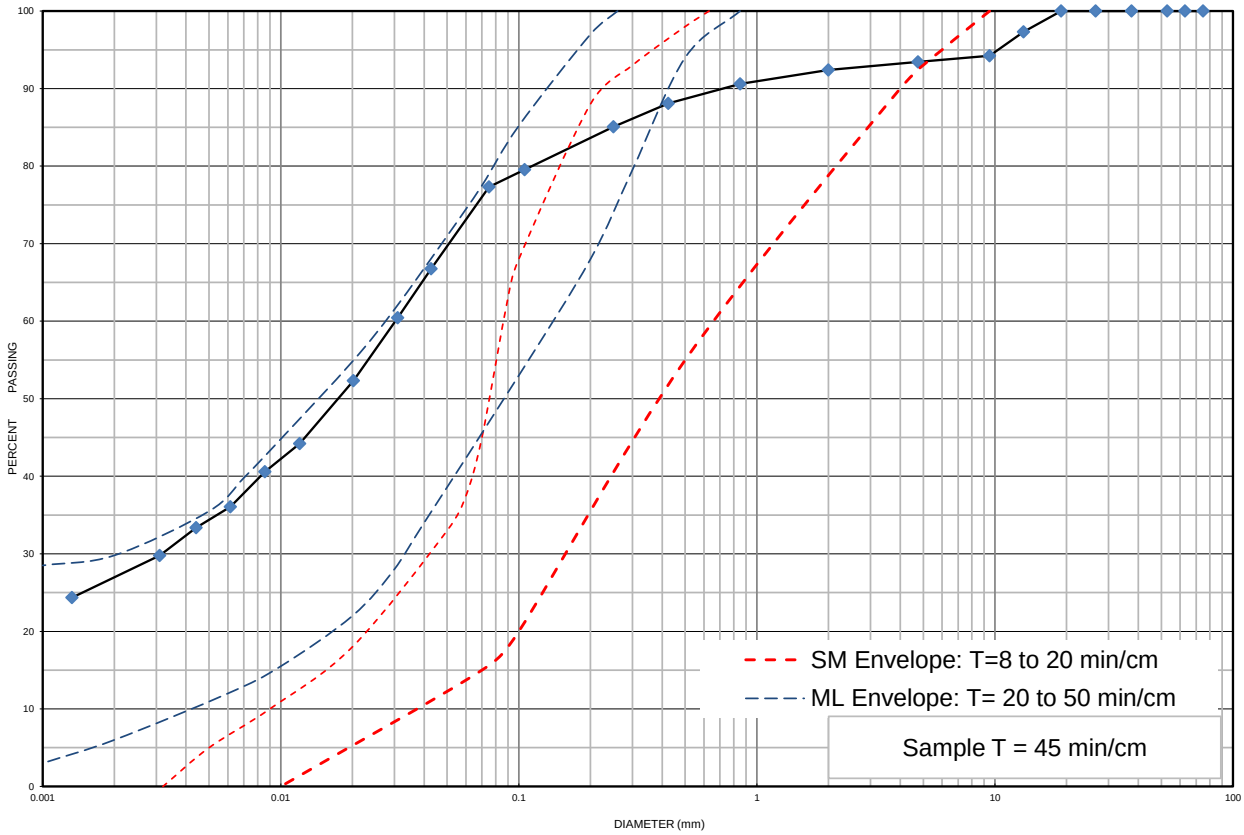
Project Number: *17986-002* **Client:** *Jeffery Homes*

Project Name: *Pt. Lot 19, Conc. 19 - Bobcaygeon Development*

Sample Date: *October 25-27, 2023* **Sampled By:** *Josh Riseling - Cambium Inc.*

Location: *BH 102-23 SS 2* **Depth:** *0.8 m to 1.4 m* **Lab Sample No:** *S-23-1846*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 102-23	SS 2	0.8 m to 1.4 m	7	16	50	27	22.3

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Clayey Silt some Sand trace Gravel	ML	0.0300	0.0032	-	-	-

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Grain Size Distribution Chart

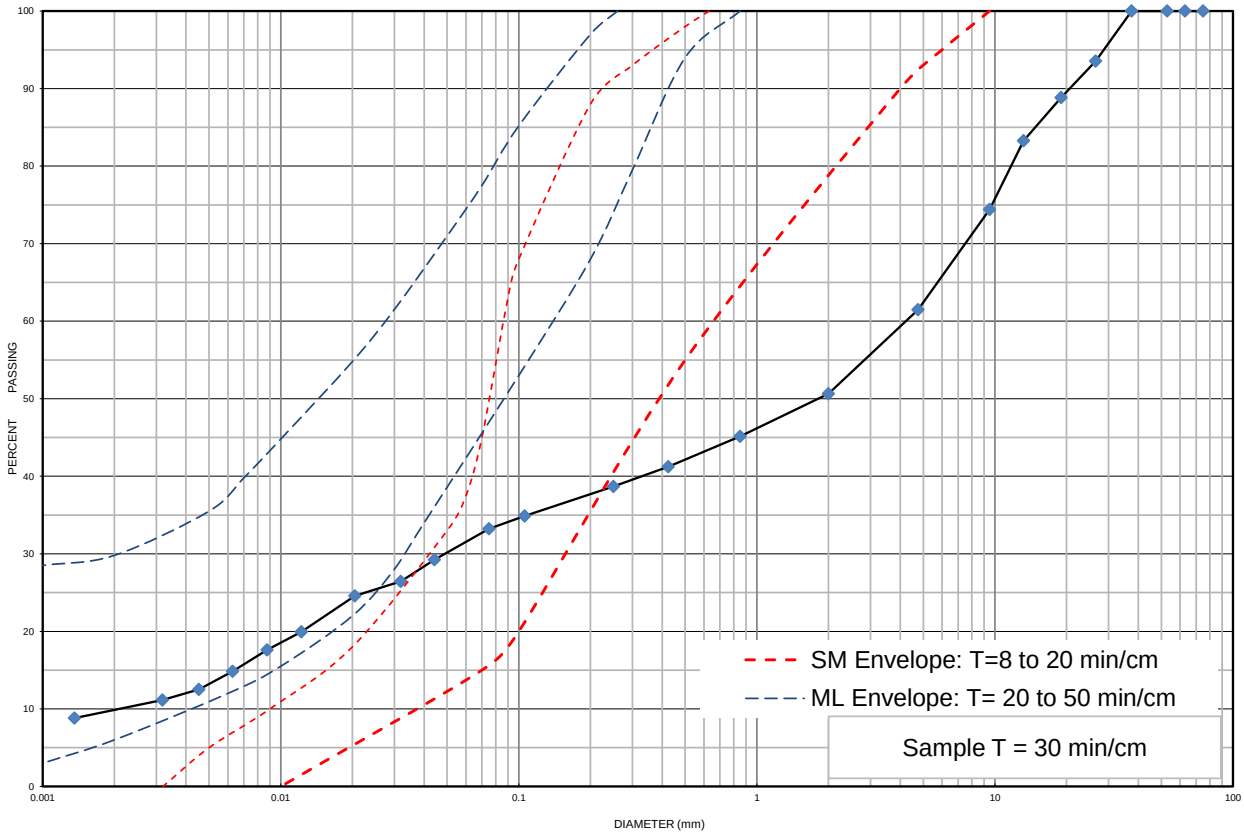
Project Number: *17986-002* **Client:** *Jeffery Homes*

Project Name: *Pt. Lot 19, Conc. 19 - Bobcaygeon Development*

Sample Date: *October 25-27, 2023* **Sampled By:** *Josh Riseling - Cambium Inc.*

Location: *BH 105-23 SS 3* **Depth:** *1.5 m to 2.1 m* **Lab Sample No:** *S-23-1847*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 105-23	SS 3	1.5 m to 2.1 m	39	28	23	10	6.2

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sandy Silty Gravel some Clay	SM	4.200	0.050	0.002	2100.00	0.30

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Grain Size Distribution Chart

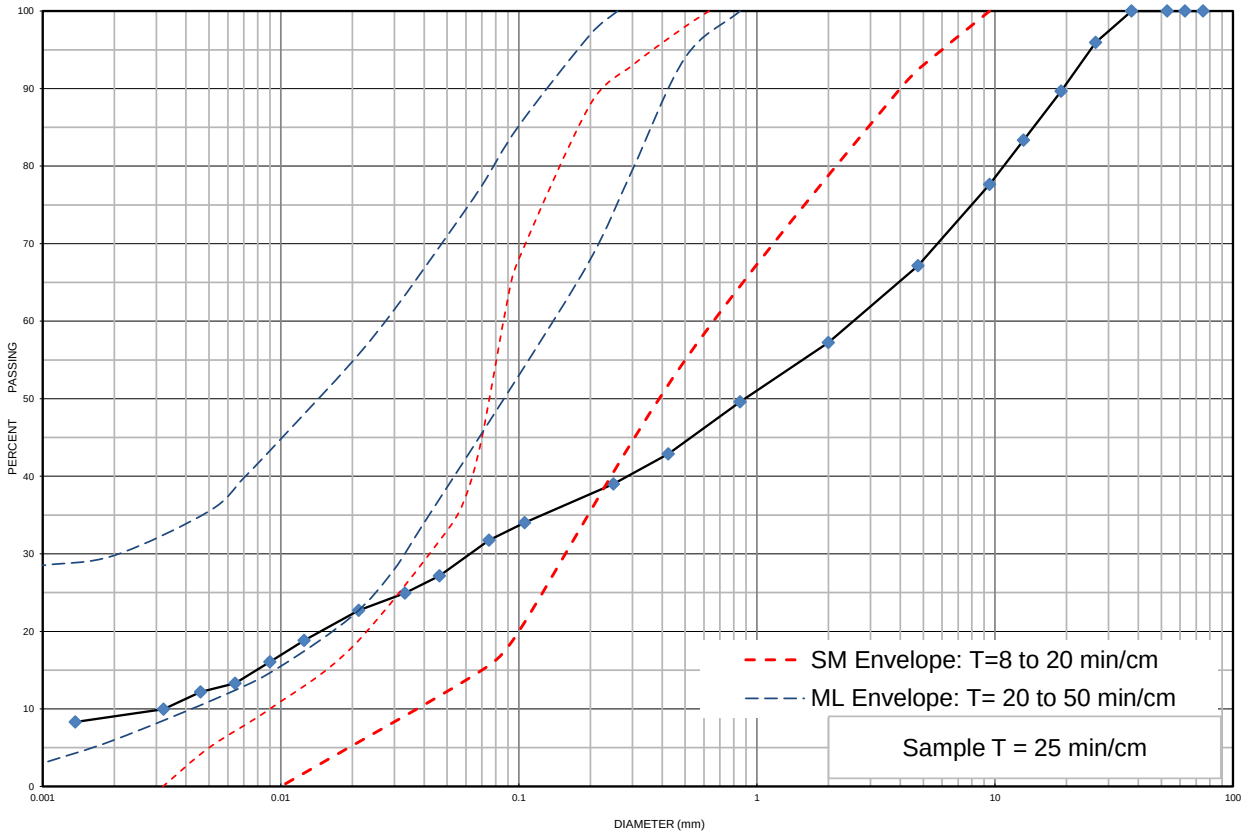
Project Number: *17986-002* **Client:** *Jeffery Homes*

Project Name: *Pt. Lot 19, Conc. 19 - Bobcaygeon Development*

Sample Date: *October 25-27, 2023* **Sampled By:** *Josh Riseling - Cambium Inc.*

Location: *BH 109-23 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-23-1849*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 109-23	SS 4	2.3 m to 2.9 m	33	35	23	9	5.5

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Gravelly Silty Sand trace Clay	SM	2.6000	0.0620	0.0031	838.71	0.48

Additional information availabe upon request

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Grain Size Distribution Chart

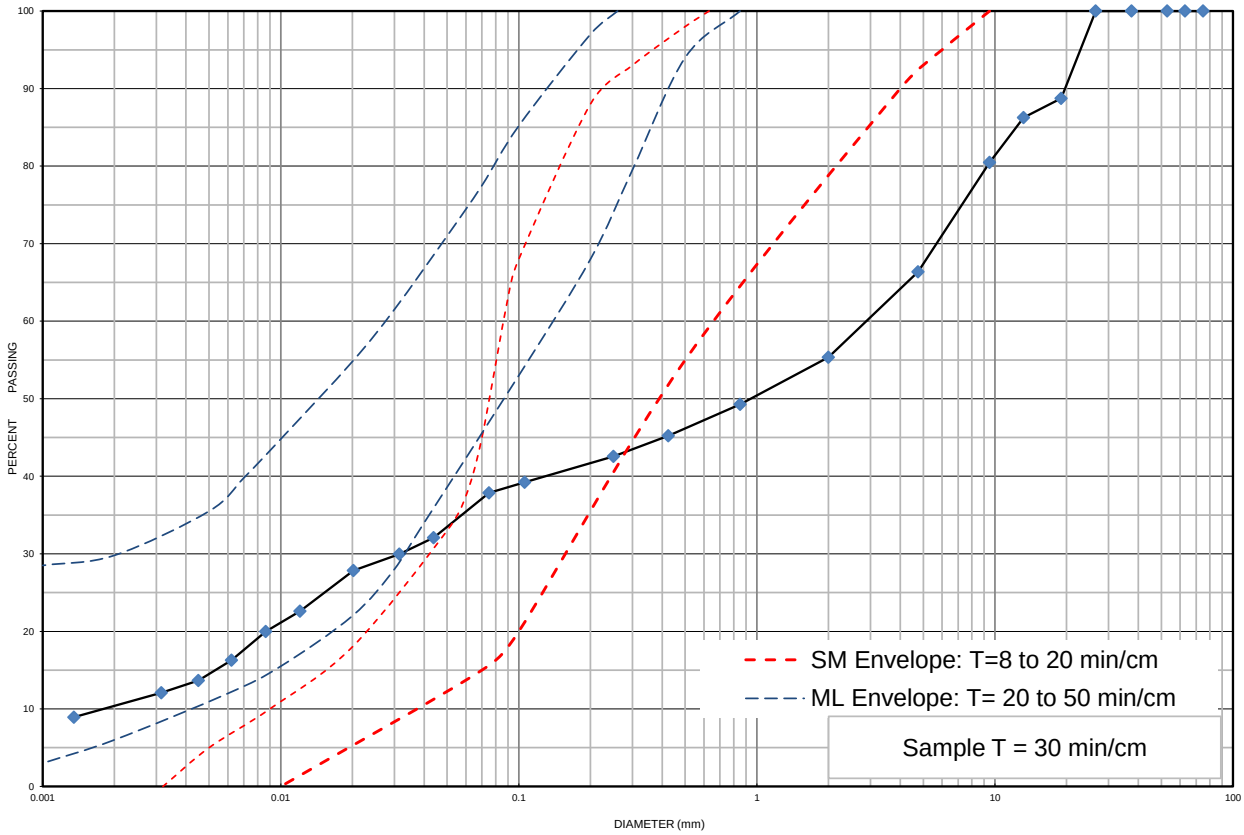
Project Number: *17986-002* **Client:** *Jeffery Homes*

Project Name: *Pt. Lot 19, Conc. 19 - Bobcaygeon Development*

Sample Date: *October 25-27, 2023* **Sampled By:** *Josh Riseling - Cambium Inc.*

Location: *BH 112-23 SS 3* **Depth:** *1.5 m to 2.1 m* **Lab Sample No:** *S-23-1850*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 112-23	SS 3	1.5 m to 2.1 m	34	29	26	11	6.8

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sandy Silty Gravel some Clay	SM	2.9500	0.0330	0.0019	1552.63	0.19

Additional information availabe upon request

Issued By: _____ *Date Issued:* *November 14, 2023*

(Senior Project Manager)

Cambium Inc. (Laboratory)
866.217.7900 | cambium-inc.com
194 Sophia St. | Peterborough | ON | K9H 1E5

Appendix D

AquiferTest Pro Results

194 Sophia Street
Peterboroguh, ON
K9H 1E5

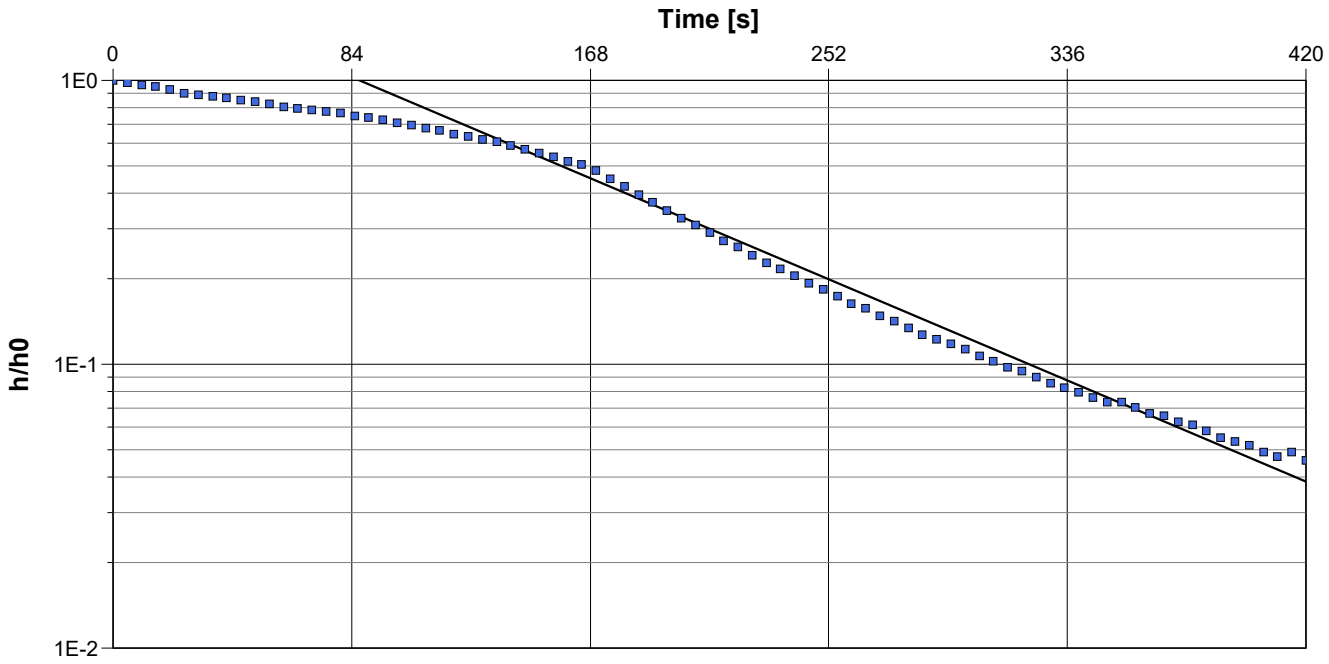
Slug Test Analysis Report

Project: 168 County Road 49, Bobcaygeon

Number: 17986-002

Client: Jeffrey Homes

Location: Bobcaygeon, ON	Slug Test: Slug Test 1	Test Well: MW101-23
Test Conducted by: J. Munro		Test Date: 11/10/2023
Analysis Performed by: W. Young	Hvorslev	Analysis Date: 11/13/2023
Aquifer Thickness: 2.44 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW101-23	8.38×10^{-6}	

194 Sophia Street
Peterboroguh, ON
K9H 1E5

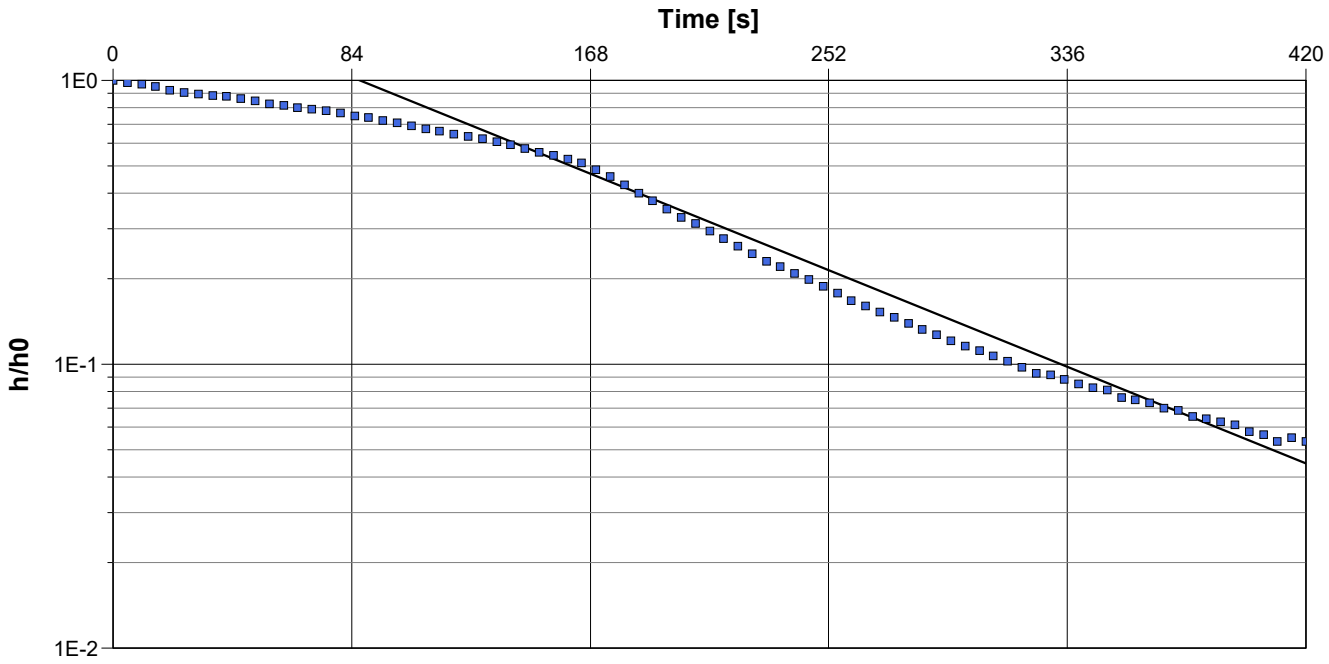
Slug Test Analysis Report

Project: 168 County Road 49, Bobcaygeon

Number: 17986-002

Client: Jeffrey Homes

Location: Bobcaygeon, ON	Slug Test: Slug Test 2	Test Well: MW101-23
Test Conducted by: J.Munro		Test Date: 11/10/2023
Analysis Performed by: W. Young	Hvorslev	Analysis Date: 11/13/2023
Aquifer Thickness: 2.44 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW101-23	8.00×10^{-6}	

194 Sophia Street
Peterboroguh, ON
K9H 1E5

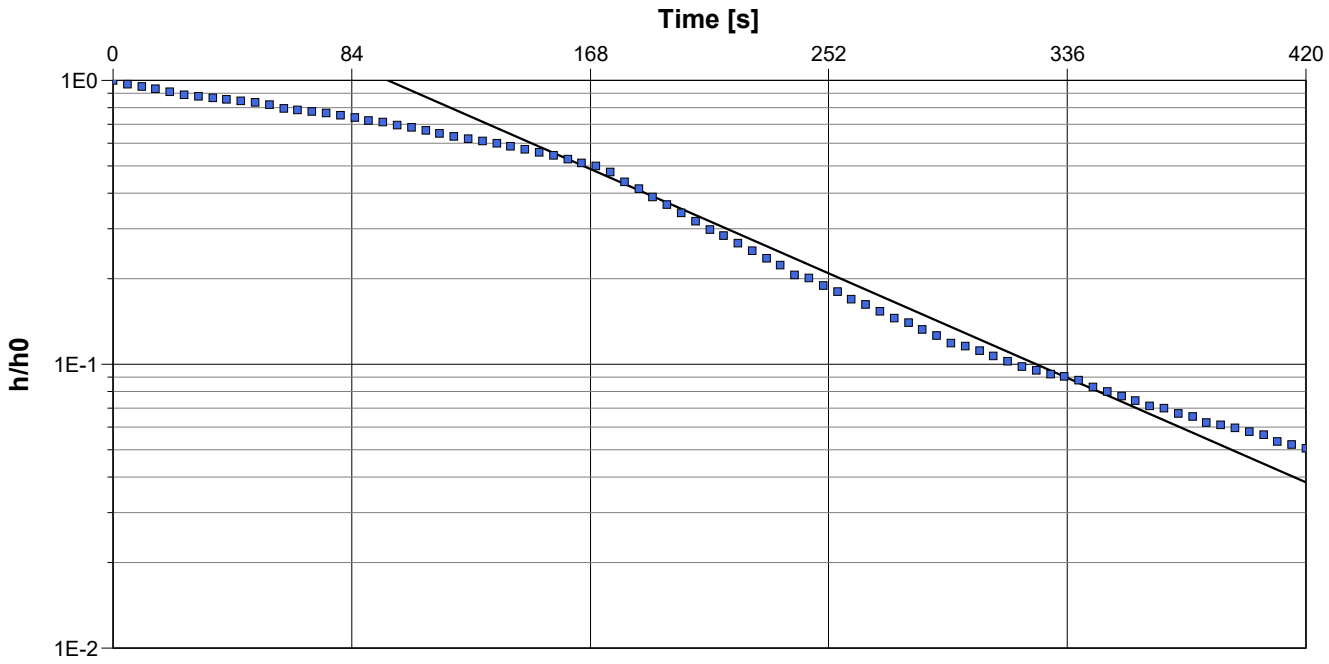
Slug Test Analysis Report

Project: 168 County Road 49, Bobcaygeon

Number: 17986-002

Client: Jeffrey Homes

Location: Bobcaygeon, ON	Slug Test: Slug Test 3	Test Well: MW101-23
Test Conducted by: J. Munro		Test Date: 11/10/2023
Analysis Performed by: W. Young	Hvorslev	Analysis Date: 11/13/2023
Aquifer Thickness: 2.44 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW101-23	8.64×10^{-6}	

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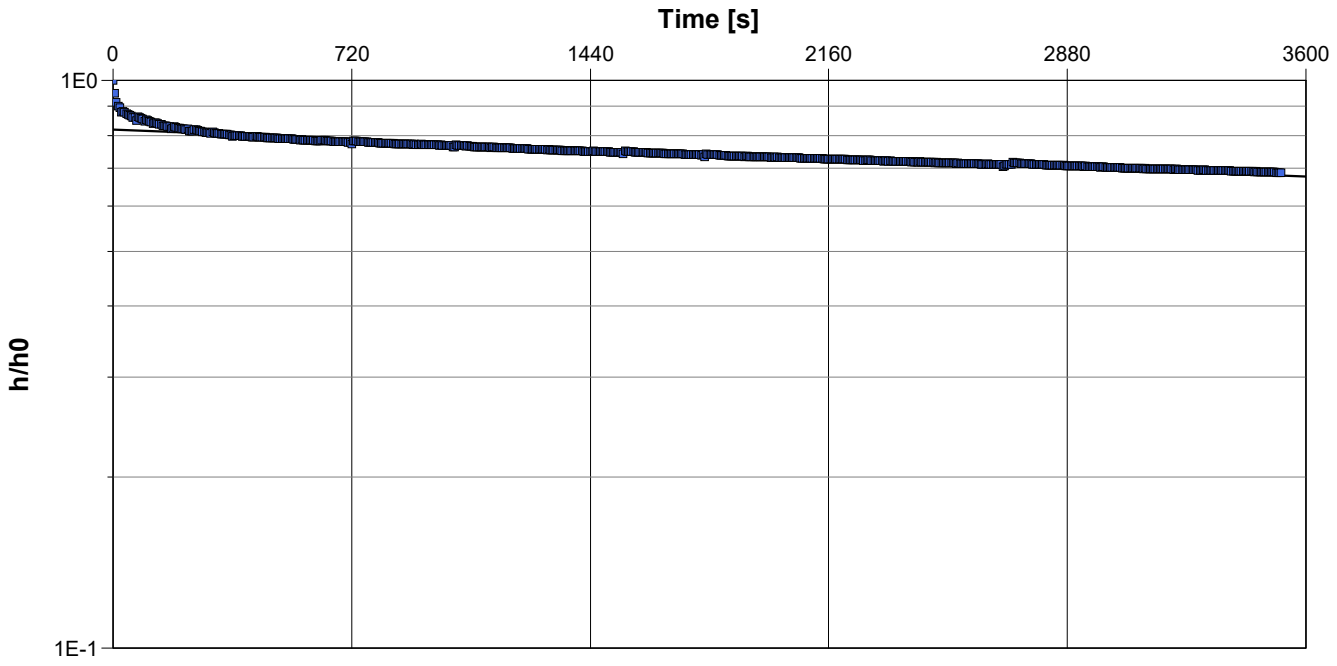
Slug Test Analysis Report

Project: 168 County Road 49, Bobcaygeon

Number: 17986-002

Client: Jeffrey Homes

Location: Bobcaygeon, ON	Slug Test: Slug Test 1	Test Well: MW113-23
Test Conducted by: J, Munro		Test Date: 11/10/2023
Analysis Performed by: W. Young	Hvorslev	Analysis Date: 11/13/2023
Aquifer Thickness: 0.58 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW113-23	4.51×10^{-8}	

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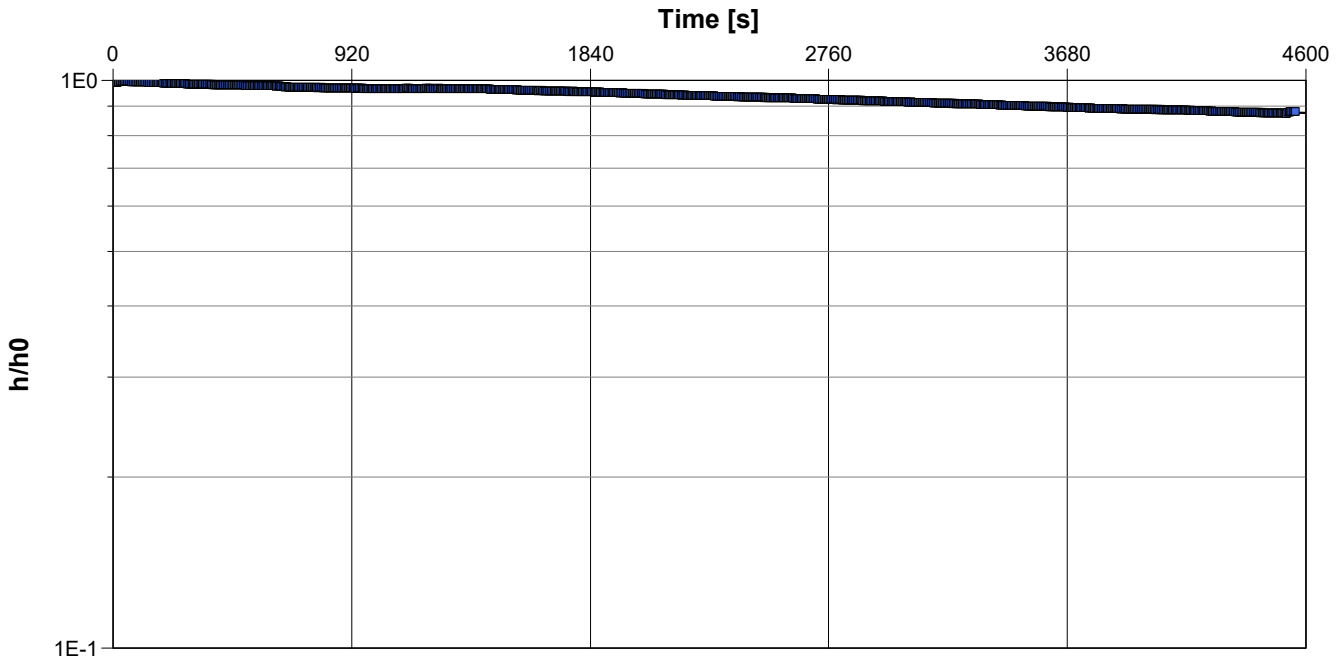
Slug Test Analysis Report

Project: 168 County Road 49, Bobcaygeon

Number: 17986-002

Client: Jeffrey Homes

Location: Bobcaygeon, ON	Slug Test: Slug Test 2	Test Well: MW113-23
Test Conducted by: J. Munro		Test Date: 11/10/2023
Analysis Performed by: W. Young	Hvorslev	Analysis Date: 11/13/2023
Aquifer Thickness: 0.58 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW113-23	2.45×10^{-8}	

Appendix E

In-Situ Infiltration Testing Analysis

Location	GP101-25				GP102-25			
GPS Coord	17N, 694693.1 m E, 4937190.0 m N				17N, 695636.8 m E, 4937573.0 m N			
Soil	Silt and Clay, some sand, trace gravel				Sandy silt, some gravel, trace clay			
Depth	0.40 m		0.40 m		0.40 m		0.40 m	
Inner/Dual	Inner		Inner		Dual		Dual	
	Head	5 cm	Head	10 cm	Head	5 cm	Head	10 cm
Time (min)	Level	Δh/Δt cm/min	Level	Δh/Δt cm/min	Level	Δh/Δt cm/min	Level	Δh/Δt cm/min
0.0	2.4		7.5		1.5		24.4	
1.0	33.6	31.2	8	0.5	6.2	4.7	32.3	7.9
2.0	33.6	0	8.3	0.3	7.3	1.1	35	2.7
3.0	33.6	0	8.4	0.1	8.2	0.9	37.7	2.7
4.0	33.6	0	8.7	0.3	8.9	0.7	40.4	2.7
5.0	33.7	0.1	8.9	0.2	9.7	0.8	43	2.6
6.0	33.7	0	9.2	0.3	10.5	0.8	45.5	2.5
7.0	33.7	0	9.4	0.2	-	-	48.8	3.3
8.0	33.7	0	9.6	0.2	-	-	51.2	2.4
9.0	33.8	0.1	9.9	0.3	12.5	1	53.5	2.3
10.0	33.8	0	10	0.1	13.2	0.7	57	3.5
11.0	33.8	0	10.1	0.1	13.6	0.4	58.8	1.8
12.0	33.8	0	10.2	0.1	14.3	0.7	61.5	2.7
13.0	34	0.2	10.3	0.1	14.8	0.5	64	2.5
14.0	34.1	0.1	10.3	0.0	15.5	0.7	66.8	2.8
15.0	34.1	0	10.3	0.0	16	0.5	69.3	2.5
16.0	34.1	0	10.4	0.1	16.6	0.6	72	2.7
17.0	34.1	0	10.5	0.1	17.2	0.6	74.5	2.5
18.0	34.1	0	10.6	0.1	17.6	0.4		
19.0	34.1	0	10.8	0.2	18.3	0.7		
20.0	34.2	0.1	10.9	0.1	18.8	0.5		
21.0	34.2	0	11	0.1	19.2	0.4		
22.0	34.2	0	11	0.0	19.8	0.6		
23.0	34.2	0	11.2	0.2	20.3	0.5		
24.0	34.3	0.1	11.4	0.2	20.8	0.5		
25.0	34.3	0	11.5	0.1	21.4	0.6		
26.0	34.4	0.1	11.5	0.0	21.9	0.5		
27.0	34.5	0.1	11.5	0.0	22.3	0.4		
28.0	34.6	0.1	11.5	0.0	22.8	0.5		
29.0	34.7	0.1	11.5	0.0	23.4	0.6		
30.0	34.7	0	11.5	0.0	23.9	0.5		
Average Steady State	0.04		0.12		0.54		2.64	
Single Head K (m/sec)	2.62E-08		4.68E-08		5.77E-06		1.68E-05	
Average Single Head K	3.65E-08				1.13E-05			
Infiltration Rate (mm/hr)	**19**				**88**			
Percolation Time (min/cm)	**31**				**7**			

GP101-25

Guelph Permeameter Calculations

Input

Result

Single Head Method (1)

Reservoir Cross-sectional area in cm^2 (enter "35.22" for Combined and "2.16" for Inner reservoir):	2.16
Enter water Head Height ("H" in cm):	5
Enter the Borehole Radius ("a" in cm):	3
Enter the soil texture-structure category (enter one of the below numbers):	3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min):	0.0400
Res Type	2.16
H	5
a	3
α^* =	0.12 cm^{-1}
H/a	1.667
a*	0.12
C =	0.803154
C0.01	0.809
Q =	0.00144
C0.04	0.842
C0.12	0.803
K_{fs} =	2.62E-06 cm/sec
C0.36	0.803		1.57E-04 cm/min
C	0.803		2.62E-08 m/sec
R	0.040		6.19E-05 inch/min
Q	0.001		1.03E-06 inch/sec
pi	3.142		
Φ_m =	2.18E-05 cm^2/min

Single Head Method (2)

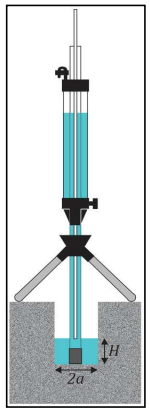
Reservoir Cross-sectional area in cm^2 (enter "35.22" for Combined and "2.16" for Inner reservoir):	2.16
Enter water Head Height ("H" in cm):	10
Enter the Borehole Radius ("a" in cm):	3
Enter the soil texture-structure category (enter one of the below numbers):	3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min):	0.1200
Res Type	2.16
H	10
a	3
α^* =	0.12 cm^{-1}
H/a	3.33333
a*	0.12
C =	1.287543
C0.01	1.21841
Q =	0.00432
C0.04	1.29023
C0.12	1.28754
K_{fs} =	4.68E-06 cm/sec
C0.36	1.28754		2.81E-04 cm/min
C	1.28754		4.68E-08 m/ses
R	0.120		1.11E-04 inch/min
Q	0.00432		1.84E-06 inch/sec
pi	3.1415		
Φ_m =	3.90E-05 cm^2/min

Average

K_{fs} =	3.65E-06 cm/sec
	2.19E-04 cm/min
	3.65E-08 m/s
	8.62E-05 inch/min
	1.44E-06 inch/sec
Φ_m =	3.04E-05 cm^2/min



Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is microscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_2/a}{2.081 + 0.121\left(H_2/a\right)}\right)^{0.672}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091\left(H_1/a\right)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091\left(H_2/a\right)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093\left(H_1/a\right)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093\left(H_2/a\right)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093\left(H_1/a\right)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093\left(H_2/a\right)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm^2/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm) , H_2 is the second head of water established in borehole (cm) and $C$is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)\alpha^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$ $G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	

GP102-25

Guelph Permeameter Calculations

Input

Result

Single Head Method (1)

Reservoir Cross-sectional area in cm^2 (enter "35.22" for Combined and "2.16" for Inner reservoir): 35.22
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.5400

Res Type	35.22
H	5
a	3
H/a	1.667
a*	0.12
C0.01	0.809
C0.04	0.842
C0.12	0.803
C0.36	0.803
C	0.803
R	0.540
Q	0.317
pi	3.142

α^* = 0.12 cm^{-1}

C = 0.803154
Q = 0.31698

K_{fs} = 5.77E-04 cm/sec
3.46E-02 cm/min
5.77E-06 m/sec
1.36E-02 inch/min
2.27E-04 inch/sec

Φ_m = 4.80E-03 cm^2/min

Single Head Method (2)

Reservoir Cross-sectional area in cm^2 (enter "35.22" for Combined and "2.16" for Inner reservoir): 35.22
Enter water Head Height ("H" in cm): 10
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 2.6400

Res Type	35.22
H	10
a	3
H/a	3.33333
a*	0.12
C0.01	1.21841
C0.04	1.29023
C0.12	1.28754
C0.36	1.28754
C	1.28754
R	2.640
Q	1.54968
pi	3.1415

α^* = 0.12 cm^{-1}

C = 1.287543
Q = 1.54968

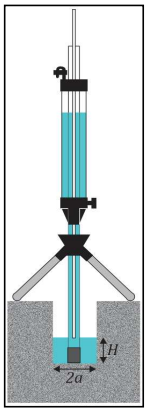
K_{fs} = 1.68E-03 cm/sec
1.01E-01 cm/min
1.68E-05 m/ses
3.97E-02 inch/min
6.61E-04 inch/sec

Φ_m = 1.40E-02 cm^2/min

Average

K_{fs} = 1.13E-03 cm/sec
6.77E-02 cm/min
1.13E-05 m/s
2.66E-02 inch/min
4.44E-04 inch/sec

Φ_m = 9.40E-03 cm^2/min



Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is microscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_1/a}{2.081 + 0.121\left(H_2/a\right)}\right)^{0.672}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091\left(H_1/a\right)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091\left(H_2/a\right)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093\left(H_1/a\right)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093\left(H_2/a\right)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093\left(H_1/a\right)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093\left(H_2/a\right)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm^2/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm) , H_2 is the second head of water established in borehole (cm) and $C$is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)\alpha^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$ $G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	

	Cambium Inc. Percolation Test Notes - Part of Lot 19, Concession 19 – Township of Galway-Cavendish and Harvey		
	Project Number: 17986-003	Date: July 8, 2025	Completed By: Jenacy Samways

Percolation Test Method Utilized: Ontario Building Code A.8.2.1.2.(3)

Percolation Test 1 (PT101-25)	
Diameter:	100mm
Depth:	200mm (into sand layer)
First Filling:	6 min - full seep away
Second Filling:	105 min -full seep away (saturated)
Third Filling	35 min - Ended due to stable rate achieved (partial seep away)
Test Duration:	146 min
Time Interval:	5 min
Stable Rate of Drop Achieved:	Yes
Average Drop of Last 3 Readings:	0.8 cm
Test Result:	**6.25 min/cm (5min/0.8cm)**

Remarks:

Test completed in gravelly sand layer below topsoil

Infiltration Rate inferred through established relationships between percolation rate (min/cm) and infiltration rate (mm/hr), as outlined in the Supplementary Guidelines to the Ontario Building Code: SG-6 Percolation Time and Soil Descriptions

Tested Percolation Rate = 6.3 min/cm	**Infiltration Rate = 96 mm/hr**

Appendix F

Water Balance Calculations

Water Balance Calculations

Part of Lot 19, Concession 19, Township of Galway-Cavendish and Harvey, County of Peterborough

THORNTHWAITE-TYPE MONTHLY WATER-BALANCE MODEL

modified from Dingman 2015: Box 6-8 (pg 299) using ET model of Hamon (1963)

		Input Data				Computed Values							
											Surplus	342	mm/yr
Weather Station Location:	**Peterborough Trent U**					**Latitude:**	**44.2**	**degree**					
Solar Declination (degree)	-20.6	-12.6	-1.5	10.0	19.0	23.1	21.0	13.4	2.6	-9.0	-18.5	-23.0	
DayLength (hr)*	9.1	10.3	11.8	13.3	14.6	15.3	14.9	13.8	12.3	10.8	9.5	8.7	

Available Water Storage Capacity	0.18	m/m	**Root Depth**	1500	mm	**SOILmax**	270.0	mm	

MONTHLY WATER BALANCE DATA

Temperatures in C, water-balance terms in mm.

Month:	J	F	M	A	M	J	J	A	S	O	N	D	Year
TEMPERATURE (T)	-8.4	-6.5	-1.3	6.3	12.8	18.0	20.7	19.4	15.0	8.4	2.4	-4.0	
PRECIPITATION (P)	57.3	48.8	56.5	66.4	88.7	83.0	73.6	87.0	92.4	77.0	85.5	66.0	882
RAIN	22.4	23.1	34.0	60.9	88.7	83.0	73.6	87.0	92.4	75.7	73.3	35.0	749
SNOW	35	26	23	6	0	0	0	0	0	1	12	31	133
MELT FACTOR (F)	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.40	0.00	
PACK	73	99	121	0	0	0	0	0	0	0	7	38	
MELT	0	0	0	127	0	0	0	0	0	1	5	0	133
INPUT (W)	22	23	34	188	89	83	74	87	92	77	78	35	882
POTENTIAL ET (PET)	0	0	0	41	70	97	115	98	65	39	22	0	548
NET INPUT (ΔW)	22	23	34	147	19	-14	-41	-11	27	38	56	35	
SOIL MOISTURE (SOIL)	270	270	270	270	270	256	220	211	238	270	270	270	
ΔSOIL	0	0	0	0	0	-14	-36	-9	27	32	0	0	0
ET	0	0	0	41	70	97	110	96	65	39	22	0	540
SURPLUS=W-ET-DSOIL	22	23	34	147	19	0	0	0	0	6	56	35	342

Notes:

Precipitation, Rain, Temperature, and Latitude are inputted parameters

SOILmax = available water storage capacity * root depth

m = month

D = Day length (hrs) $=2*\cos^{-1}(-\tan(\text{Latitude})*\tan(\text{Declination}))/0.2618$ [calculation is in radians]

$SNOW_m = P_m - RAIN_m$

$F_m = 0$ if $T_m <= 0^oC$; $F_m = 0.167*T_m$ if $0^oC<T_m<6^oC$; $F_m = 1$ if $T_m>=6^oC$

$PACK_m = (1-F_m)*(SNOW_m+PACK_{m-1})$

$MELT = F_m*(SNOW_m+PACK_{m-1})$

$W_m = RAIN_m+MELT_m$.

PET = 0 if $T_m<0$; otherwise $PET = 2.98*0.611*\exp(17.3*T_m/(T_m+237))/(T_m+237.2)*$Number of days in month [Hamon ET model (1963)]

$\Delta W_m = W_m - PET_m$

$SOIL = \min\{[\Delta W_m+SOIL_{m-1}], SOILmax\}$, if $\Delta Wm>0$; otherwise $SOIL = SOIL_{m-1} * \exp(\Delta W/SOILmax)$

$\Delta SOIL = SOIL_{m-1} - SOIL_m$

ET = PET if $W_m > PET$; otherwise, $ET=W_m-\Delta SOIL$

Pre- and Post-Development
Phase 1 Water Balance Calculations
Part of Lot 19, Concession 19, Township of Galway-Cavendish and Harvey, County of Peterborough

1 Climate Information

Precipitation	882	mm/yr
Actual Evapotranspiration	540	mm/yr
Water Surplus	342	mm/yr

2 Infiltration Rates

Table 2 Approach - Infiltration factors	
Topography: Rolling hills	0.2
Soil Type: Till(Combination of sand,silt and gravel)	0.3
Cover: Cultivated land/Woodland	0.15
Total Infiltration Factor	**0.65**

Infiltration (Water Surplus * Infiltration Factor)	**222**	mm/yr
Run-off (Water Surplus - Infiltration)	**120**	mm/yr

Table 3 Approach - Typical Recharge Rates		
Coarse Sand and Gravel	>250	mm/yr
Fine to medium sand	200-250	mm/yr
Silty sand to sandy silt	150-200	mm/yr
Silt	125-150	mm/yr
Clayey Silt	100- 125	mm/yr
Clay	<100	mm/yr

Site development area is underlain predominantly by a glacial till sand, silt and gravel combination

Based on the above, the recharge rate is typically	150-200	mm/yr

3 Phase 1 - Pre-Development Property Statistics	**ha**	**m^2**
Total Paved Area	0.07	700
Total Roof Area	0.03	300
Total Landscape Area	21.71	217,080
Total	**21.81**	**218,080**

4 Phase 1 - Post-Development Property Statistics	**ha**	**m^2**
Total Paved Area	3.33	33,254
Total Roof Area	0.63	6,250
Total Landscape Area	17.86	178,576
Total	**21.81**	**218,080**

Pre- and Post-Development
Phase 1 Water Balance Calculations
Part of Lot 19, Concession 19, Township of Galway-Cavendish and Harvey, County of Peterborough

5 Phase 1 Pre-Development Water Balance

Land Use		Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-off (m^3)
Impervious Areas	Paved Area	700	617	62	-	556
	Roof Area	300	265	26	-	238
Pervious Areas	Landscape Area	217,080	191,465	117,223	48,257	25,984
	Totals	218,080	192,347	117,311	48,257	26,778

Assuming no infiltration occurring in paved and roof areas, and 10% of precipitation to be evaporated from paved and roof areas.

6 Phase 1 Post-Development Water Balance

Land Use		Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-off (m^3)
Impervious Areas	Paved Area	33,254	29,330	2,933	-	26,397
	Roof Area	6,250	5,513	551	-	4,961
Pervious Areas	Landscape Area	178,576	157,504	96,431	39,697	21,376
	Totals	218,080	192,347	99,915	39,697	52,734

Assuming no infiltration occurring in paved and roof areas, and 10% of precipitation to be evaporated from paved and roof areas.

7 Comparision of Pre- and Post -Development for Phase 1

	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-off (m^3)
Pre-Development	192,347	117,311	48,257	26,778
Post-Development	192,347	99,915	39,697	52,734
Change in Volume	-	- 17,396	- 8,559	25,956
Change in %	-	- 15	- 18	97

8 Requirement for Infiltration of Roof Run-off

Volume of Pre-Development Infiltration (m^3/yr)	48,257
Volume of Post-Development Infiltration (m^3/yr)	39,697
Deficit from Pre to Post Development Infiltration (m^3/yr)	8,559
Percentage of Roof Runoff required to match the pre-development infiltration (%)	173

Pre- and Post-Development
Phase 2 Water Balance Calculations
Part of Lot 19, Concession 19, Township of Galway-Cavendish and Harvey, County of Peterborough

1 Climate Information

Precipitation	882	mm/yr
Actual Evapotranspiration	540	mm/yr
Water Surplus	342	mm/yr

2 Infiltration Rates

Table 2 Approach - Infiltration factors	
Topography: Rolling hills	0.2
Soil Type: Till(Combination of sand,silt and gravel)	0.3
Cover: Cultivated land/Woodland	0.15
Total Infiltration Factor	**0.65**

Infiltration (Water Surplus * Infiltration Factor)	**222**	mm/yr
Run-off (Water Surplus - Infiltration)	**120**	mm/yr

Table 3 Approach - Typical Recharge Rates		
Coarse Sand and Gravel	>250	mm/yr
Fine to medium sand	200-250	mm/yr
Silty sand to sandy silt	150-200	mm/yr
Silt	125-150	mm/yr
Clayey Silt	100- 125	mm/yr
Clay	<100	mm/yr

Site development area is underlain predominantly by a glacial till sand, silt and gravel combination

Based on the above, the recharge rate is typically	150-200	mm/yr

3 Phase 2 - Pre-Development Property Statistics	**ha**	**m^2**
Total Paved Area	0.00	0
Total Roof Area	0.00	0
Total Landscape Area	26.34	263,420
Total	**26.34**	**263,420**

4 Phase 2 - Post-Development Property Statistics	**ha**	**m^2**
Total Paved Area	4.08	40,847
Total Roof Area	0.85	8,500
Total Landscape Area	21.41	214,073
Total	**26.34**	**263,420**

Pre- and Post-Development
Phase 2 Water Balance Calculations
Part of Lot 19, Concession 19, Township of Galway-Cavendish and Harvey, County of Peterborough

5 Phase 2 Pre-Development Water Balance

Land Use		Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-off (m^3)
Impervious Areas	Paved Area	-	-	-	-	-
	Roof Area	-	-	-	-	-
Pervious Areas	Landscape Area	263,420	232,336	142,247	58,558	31,531
	Totals	263,420	232,336	142,247	58,558	31,531

Assuming no infiltration occurring in paved and roof areas, and 10% of precipitation to be evaporated from paved and roof areas.

6 Phase 2 Post-Development Water Balance

Land Use		Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-off (m^3)
Impervious Areas	Paved Area	40,847	36,027	3,603	-	32,424
	Roof Area	8,500	7,497	750	-	6,747
Pervious Areas	Landscape Area	214,073	188,812	115,599	47,588	25,625
	Totals	263,420	232,336	119,952	47,588	64,796

Assuming no infiltration occurring in paved and roof areas, and 10% of precipitation to be evaporated from paved and roof areas.

7 Comparision of Pre- and Post -Development for Phase 2

	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-off (m^3)
Pre-Development	232,336	142,247	58,558	31,531
Post-Development	232,336	119,952	47,588	64,796
Change in Volume	-	- 22,295	- 10,970	33,265
Change in %	-	- 16	- 19	105

8 Requirement for Infiltration of Roof Run-off

Volume of Pre-Development Infiltration (m^3/yr)	58,558
Volume of Post-Development Infiltration (m^3/yr)	47,588
Deficit from Pre to Post Development Infiltration (m^3/yr)	10,970
Percentage of Roof Runoff required to match the pre-development infiltration (%)	163

Appendix G

Nitrate Mass Balance Calculations

Water Balance Calculations

THORNTHWAITE-TYPE MONTHLY WATER-BALANCE MODEL													
modified from Dingman 2015: Box 6-8 (pg 299) using ET model of Hamon (1963)													
		Input Data				Computed Values							
											Surplus	342	mm/yr
Weather Station Location:	**Peterborough Trent U**					**Latitude:**	**44.2**	**degree**					
Solar Declination (degree)	-20.6	-12.6	-1.5	10.0	19.0	23.1	21.0	13.4	2.6	-9.0	-18.5	-23.0	
DayLength (hr)*	9.1	10.3	11.8	13.3	14.6	15.3	14.9	13.8	12.3	10.8	9.5	8.7	
Available Water Storage Capacity		0.18	m/m		**Root Depth**	1500	mm		**SOILmax**	270.0	mm		

MONTHLY WATER BALANCE DATA

Temperatures in C, water-balance terms in mm.

Month:	J	F	M	A	M	J	J	A	S	O	N	D	Year
TEMPERATURE (T)	-8.4	-6.5	-1.3	6.3	12.8	18.0	20.7	19.4	15.0	8.4	2.4	-4.0	
PRECIPITATION (P)	57.3	48.8	56.5	66.4	88.7	83.0	73.6	87.0	92.4	77.0	85.5	66.0	882
RAIN	22.4	23.1	34.0	60.9	88.7	83.0	73.6	87.0	92.4	75.7	73.3	35.0	749
SNOW	35	26	23	6	0	0	0	0	0	1	12	31	133
MELT FACTOR (F)	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.40	0.00	
PACK	73	99	121	0	0	0	0	0	0	0	7	38	
MELT	0	0	0	127	0	0	0	0	0	1	5	0	133
INPUT (W)	22	23	34	188	89	83	74	87	92	77	78	35	882
POTENTIAL ET (PET)	0	0	0	41	70	97	115	98	65	39	22	0	548
NET INPUT (ΔW)	22	23	34	147	19	-14	-41	-11	27	38	56	35	
SOIL MOISTURE (SOIL)	270	270	270	270	270	256	220	211	238	270	270	270	
ΔSOIL	0	0	0	0	0	-14	-36	-9	27	32	0	0	
ET	0	0	0	41	70	97	110	96	65	39	22	0	540
SURPLUS=W-ET-DSOIL	22	23	34	147	19	0	0	0	0	6	56	35	342

Notes:

Precipitation, Rain, Temperature, and Latitude are inputted parameters

SOILmax = available water storage capacity * root depth

m = month

D = Day length (hrs) $=2*\cos^{-1}(-\tan(\text{Latitude})*\tan(\text{Declination}))/0.2618$ [calculation is in radians]

$SNOW_m = P_m - RAIN_m$

$F_m = 0$ if $T_m <= 0^oC$; $F_m = 0.167*T_m$ if $0^oC<T_m<6^oC$; $F_m = 1$ if $T_m>=6^oC$

$PACK_m = (1-F_m)*(SNOW_m+PACK_{m-1})$

$MELT = F_m*(SNOW_m+PACK_{m-1})$

$W_m = RAIN_m+MELT_m$.

PET = 0 if $T_m<0$; otherwise $PET = 2.98*0.611*\exp(17.3*T_m/(T_m+237))/(T_m+237.2)*$Number of days in month [Hamon ET model (1963)]

$\Delta W_m = W_m - PET_m$

$SOIL = \min\{[\Delta W_m+SOIL_{m-1}], SOILmax\}$, if $\Delta Wm>0$; otherwise $SOIL = SOIL_{m-1} * \exp(\Delta W/SOILmax)$

$\Delta SOIL = SOIL_{m-1} - SOIL_m$

ET = PET if $W_m > PET$; otherwise, $ET=W_m-\Delta SOIL$

Nitrate Attenuation

Calculations for Subdivision Developments

Input Data	Computed Values

Areas	Total
LOT AREA (m^2)	383530
BLDG FOOTPRINT (m^2)	0
ROAD AREA (m^2)	0
Avaible Infiltration Area (m^2)	383530

Surplus water

0.342	m/yr
0.000937	m/day
359.4998	m^3/day

Infiltration Factor

Rolling	0.2
Silt, sand,gravel till	0.3
Woodland/Cultivated	0.15
Total	0.65

Infiltrated water

0.000609	m/day
233.6749	m^3/day

Runoff 125.8249 m^3/day

PREDICTED NITRATE CONCENTRATIONS

Combined Concentrations at Property Boundaries

59 Lots

59000
40
233674.9
0.1
292674.9
8.14