



Hydrogeological Assessment, Thornbury Acres, Thornbury, Ontario

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Prepared for:
Thornbury Acres Holding Inc.

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CAMBIUM INC.

866.217.7900

cambium-inc.com

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Executive Summary

Cambium was retained by Thornbury Acres Holding Inc. to complete a hydrogeological assessment for the proposed 37-unit residential development located at the corner of Grey County Road 2 and Grey County Road 40 in Thornbury, Ontario. The total area of the Site is 61.5 ha and the residential developable area (including unit and road) is approximately 24.2 ha.

There are no municipal services for water or wastewater near the property. As such, the hydrogeological assessment was undertaken in accordance with the Ministry of the Environment, Conservation and Parks (MECP) guidelines D-5-4 and D-5-5 for wastewater and water supply.

The water supply assessment involved a review regional geological and hydrogeological information, installation of four monitoring wells (MW101-22 through MW104-22) and four test supply wells (TW101-22 through TW104-22), water level monitoring, pumping tests, and water quality sampling.

The wastewater assessment involved test pit and borehole investigations, identification of the shallow water table, and water balance calculations to assess the nitrate attenuation capacity of the Site and the projected change of infiltration to shallow groundwater from the proposed development.

Pumping tests of TW101-22, TW102-22, TW103-22, and TW104-22 indicate the test supply wells are able to produce sustainable yields of minimum of 21 L/min. This rate is greater than 13.7 L/min, which is the minimum requirement for MECP D-5-5 assessment procedures. It is therefore expected that there are adequate water supply resources at the Site to support the proposed development.

Water quality results indicate the water from all four test wells is of generally good quality, with the exceptions of hardness, iron, manganese, and turbidity. These parameters were reported at concentrations which exceed ODWQS guidelines, however all readily amendable with residential water treatment units; a competent water treatment specialist should be consulted



for appropriate treatment options. All other analyzed parameters were within acceptable ranges.

The wastewater assessment indicates that the proposed development of 37 residential units would result in a nitrate concentration of 7.11 mg/L at the property boundary, which is less than the 10 mg/L limit permitted by D-5-4 guidelines. The proposed development is therefore expected to maintain acceptable nitrate concentration thresholds at property boundaries.

Based on the proposed 37 units, infiltration at the Site will be reduced by approximately 19,455 m³/yr in the post-development scenario compared to pre-development conditions. It is assumed that roof leaders that will direct roof runoff to the lawn will be implemented to aid the projected infiltration deficit. The total projected roof run-off volume is 8,941 m³, which encompasses 46% of the calculated infiltration deficit at the Site. Cambium recommends that LID measures are implemented at the Site to address the infiltration deficit and that a stormwater engineer is retained to design the LID infrastructure and to address runoff flow generated from the roadways.

Based on the preliminary assessment Cambium concludes that the Site can sustain the development of 37 residential units without inducing a negative impact on the quality or quantity of on-site and off-site groundwater resources.



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1.0 Introduction

Cambium Inc. (Cambium) was retained by Thornbury Acres Holding Inc. (Client) to complete a hydrogeological assessment for the residential development of Thornbury Acres located at the corner of Grey County Road 2 and Grey County Road 40 in Thornbury, Ontario (Site; Figure 1). The total area of the Site is 61.5 ha and the residential developable area (including units and road) is approximately 24.2 ha.

There are no municipal services for water or wastewater available for the property; therefore, the Site will have to be privately serviced. As such, a hydrogeological assessment was undertaken for wastewater and water supply, in accordance with the Ministry of the Environment and Climate Change guidelines D-5-4 and D-5-5, to accommodate the Plan of Condominium proposed for the Site for a vacant land condominium under a Farm Cooperative policy.

The wastewater assessment involved assessing the Site for its suitability for disposal of wastewater on-site by identifying and assessing the native soils at the Site and the position of the shallow water table, hydraulic testing of the native soils, identification of surficial slopes across the Site, and an assessment of the attenuation capacity of Site for the contamination of nitrogen from the on-site wastewater systems. As per MECP D-5-4 procedures, nitrate dilution to less than 10 mg/L concentrations are required at the property boundary.

The water supply assessment involved a review of MECP water well records located within 500 m of the Site and installation and hydraulic testing of test wells to ensure there is adequate water supply available that is of potable quality for the proposed development. As the area of the proposed residential development is less than 25 hectares, MECP D-5-5 procedures required a total of four test wells to be installed. Four monitoring wells were also installed to determine static groundwater levels and the direction of groundwater flow.

It is noted that a geotechnical investigation (Cambium, 2022a) and a D4 Assessment (Cambium, 2022b) are being completed at the Site concurrently by Cambium and will be provided under a separate cover. The data or information obtained in the current and former investigations has been incorporated into this hydrogeological investigation report.



1.1 Site Description

The Site is located in the southwest corner of the intersection for County Road 40 and County Road 2 in Thornbury, Ontario, is approximately 61.5 ha in size, and is roughly rectangular; the residential developable area (including units and road) is approximately 24.2 ha.

The Site is zoned as a Rural (RU) zone as per the Town of Blue Mountains Zoning By-Law 2018-65 Schedule 'A'. A small portion along the south-southwestern boundary of the Site is zoned as Hazard (H) zone due to the presence of a wetland. This small portion of the Site is also identified as a regulated area by the Grey Sauble Conservation Authority (GSCA; Appendix A).

The Site is bordered by properties zoned as Special Agricultural (SA), Agricultural (A), and RU Zones to the east, a property zoned as RU and H Zones to the south, and the Site is bordered by County Road 2 to the west and County Road 40 to the north.

The Site is currently undeveloped forest and wetlands (in the southwestern corner). The proposed development includes 37 privately serviced units that range in size from 1.3 to 1.6 acres, woodlots and pond areas, a farm area, a bicycle pavilion, and roadways and access routes throughout the property.

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



2.0 Methodology

This section describes the methodology undertaken to complete the hydrogeological assessment.

2.1 Background Information Review

To complete this preliminary assessment the following available information was thoroughly reviewed:

- Ontario Geological Survey 2000, Quaternary Geology of Ontario, available in digital format at 1:1,000,000 scale.
- Ontario Geological Survey, 2000. Bedrock Geology of Ontario, available in digital gformat at 1:1,000,000 scale.
- Ontario Geological Survey (2007), Physiography of Southern Ontario.
- MECP Water Well Records database, available online and updated up to June 30, 2021.
- Source Protection Information Atlas, available online through the MECP.
- Thornbury Acres 150 AC Concept Plan Version 4B, Prepared by NAK Design Strategies, Dated August 25, 2022, provided by the Client.

2.2 Borehole Investigation

A total of seven boreholes, numbered BH101-22 to BH107-22, were advanced into the subsurface at predetermined locations throughout the proposed development. Each of the boreholes were terminated at a depth of 5.2 m below ground surface (mbgs).

Boreholes BH101-22 through BH104-22 were each outfitted with a monitoring well following completion of drilling, to allow for subsequent groundwater level monitoring at the Site.

Borehole drilling and sampling were completed using a track-mounted drill rig operating under the supervision of a Cambium geotechnical analyst. The boreholes were advanced to the sampling depths by means of continuous flight hollow stem augers with 50 mm O.D. split spoon samplers.

Standard Penetration Test (SPT) N values were recorded for the sampled intervals as the number of blows required to drive a split spoon sampler 305 mm into the soil, using a 63.5 kg



drop hammer falling 750 mm, as per ASTM D1586 procedures. The SPT N values are used in this report to assess the consistency of cohesive soils and relative density of non-cohesive materials. Soil samples were collected at approximately 0.75 m intervals in the upper 3.0 m and at 1.5 m intervals below that depth.

The encountered soil units were logged in the field using visual and tactile methods, and samples were placed in labelled plastic bags for transport, future reference, laboratory testing, and storage. Borehole logs are provided in Appendix B and located are identified in Figure 2.

2.3 Test Pit Investigation

A test pit investigation was completed by Cambium on September 26th and 27th, 2022, to determine the shallow subsurface conditions across the Site. A total of 20 test pits, designated as TP101-22 through TP120-22, were excavated to a predetermined depth of 2 to 3 metres below ground surface (mbgs) using an excavator under the supervision of a Cambium technologist. Test pit logs are provided in Appendix B. Test pit locations are identified in Figure 2.

Soil units encountered during test pit excavation were logged in the field using visual and tactile methods. Soil samples were collected from each test pit from each geological unit encountered and placed in labelled plastic bags for transport, future reference, possible laboratory testing, and storage. Open test pits were checked for groundwater and general stability prior to backfilling. All test pits were backfilled to as close to pre-existing conditions as possible.

2.1 Site Survey

The elevations and coordinates for all borehole, test pit, and monitoring well locations were obtained during a subsequent Site survey conducted by Cambium on November 17, 2022. The elevations were surveyed utilizing a benchmark identified on the lot survey (Appendix A), consisting of a cut cross on a large rock fence at the northeast corner of the property. The elevation of this benchmark was not identified on the lot survey, and as such was assigned an elevation of 100 m Relative Elevation (m.rel) by Cambium at the time of the survey.



2.2 Physical Laboratory Testing

Physical laboratory testing, including grain size distribution analysis, was completed on 12 selected soil samples to confirm textural classification identified during field logging and to obtain percolation rate estimates. Analysis results are based on the Unified Soil Classification System (USCS) scale. Copies of laboratory analysis reports for these samples are provided in Appendix C.

2.3 Test Well Installation

The residential component of the proposed development is less than 25 ha in size; therefore, four test wells (TW101-22, TW102-22, TW103-22, and TW104-22) were drilled at the Site to satisfy Section 4.2 of MECP Guideline D-5-5 Technical Guideline for Private Wells: Water Supply Assessment. All four test wells were installed by Stan Wright & Co. Well Drillers between October 25 and October 28, 2022. The locations of the wells are illustrated in Figure 2. A well record for each test well is included in Appendix D.

Test well TW101-22 was installed on October 25, 2022. Overburden was described as alternating layers of brown sand and gravel and grey clay (sometimes with gravel) from surface to approximately 17.1 mbgs. A water bearing unit of coarse gravel was encountered from 17.1 mbgs to 17.4 mbgs. The total well depth drilled was 17.4 m. Bedrock was not encountered during advancement of TW101-22. TW101-22 was not equipped with a screen at the aquifer but had steel casing installed from approximately 0.46 m above ground down to the gravel layer found at 15.2 mbgs. A surface seal of bentonite grout was installed from surface to 6.1 mbgs. The static water level recorded after well drilling was 7.5 m below top of casing. The recommended pumping rate, based on a 1-hour pumping test, was 45 L/min (12 US gallons per minute (gpm)).

Test well TW102-22 was installed on October 27, 2022. Overburden was described as alternating layers of brown sand and gravel and grey clay (sometimes with gravel) from surface to approximately 28.6 mbgs. A water bearing unit of gravel with sand was encountered from approximately 28.6 mbgs to 37.5 mbgs. The total well depth drilled was 37.5 m. Bedrock was not encountered during advancement of TW102-22. TW102-22 was not equipped with a



screen at the aquifer but had steel casing installed from approximately 0.37 m above ground down to the gravel layer found at 28.6 mbgs. A surface seal of bentonite grout was installed from surface to 6.1 mbgs. The static water level recorded after well drilling was 5.3 m below top of casing. The recommended pumping rate, based on a 1-hour pumping test, was 45 L/min (12 US gpm).

Test well TW103-22 was installed on October 26, 2022. Overburden was described as alternating layers of brown sand and gravel and grey clay (sometimes with gravel) from surface to approximately 27.4 mbgs. A water bearing unit of gravel with sand was encountered from approximately 27.4 mbgs to 28.6 mbgs. The total well depth drilled was 28.6 m. Bedrock was not encountered during advancement of TW103-22. TW103-22 was not equipped with a screen at the aquifer but had steel casing installed from approximately 0.48 m above ground down to the gravel layer found at 28.6 mbgs. A surface seal of bentonite grout was installed from surface to 6.1 mbgs. The static water level recorded after well drilling was 5.6 m below top of casing. The recommended pumping rate, based on a 1-hour pumping test, was 38 L/min (10 US gpm).

TW104-22 was installed on October 28, 2022. Overburden was described as alternating layers of brown sand and gravel and grey clay (sometimes with gravel) from surface to approximately 33.8 mbgs. A water bearing unit of gravel with sand was encountered from approximately 33.8 mbgs to 34.1 mbgs. The total well depth drilled was 34.1 m. Bedrock was not encountered during advancement of TW104-22. TW104-22 was not equipped with a screen at the aquifer but had steel casing installed from approximately 0.38 m above ground down to the gravel layer found at 33.8 mbgs. A surface seal of bentonite grout was installed from surface to 6.1 mbgs. The static water level recorded after well drilling was 4.3 m below top of casing. The recommended pumping rate, based on a 1-hour pumping test, was greater than 45 L/min (12 US gpm).

2.4 Hydraulic Pumping Tests

Four constant rate pumping tests, one for each test well, were completed at the Site from November 7 to November 10, 2022. The details of each test are presented below.



2.4.1 Test Well 1

On November 7, 2022, Cambium staff completed the pumping test at TW101-22. Disinfectant chlorine was added to the well water prior to testing. A submersible pump was installed at a depth of approximately 12 mbgs. A pressure transducer level logger was installed above this depth to measure water levels within the well. Water levels were also measured manually to mitigate against potential equipment failure.

Water levels were additionally measured in TW102-22, TW103-22, and TW104-22 with pressure transducers and manually during the pumping test at TW101-22.

The pumping test began at 11:15 am and continued for a total of 6 hours 15 minutes. The pumping rate was set at approximately 21 L/min for the duration of the test. The discharge outlet for the pump was placed approximately 10 m from the well in a downslope direction to minimize potential groundwater recharge.

The pump was shut off at 5:30 pm. Water level recovery was monitored manually until TW101-22 had regained approximately 95% of the total drawdown observed during the test. A total of approximately 7,875 L was discharged from TW101-22 during the pumping test.

2.4.2 Test Well 2

On November 10, 2022, Cambium staff completed the pumping test at TW102-22. Disinfectant chlorine was added to the well water prior to testing. A disinfected submersible pump was installed at a depth of approximately 12 mbgs. A pressure transducer level logger was installed above this depth to measure water levels within the well. Water levels were also measured manually to mitigate against potential equipment failure.

Water levels were additionally measured in TW101-22, TW103-22, and TW104-22 with pressure transducers and manually during the pumping test at TW102-22.

The pumping test began at 8:00 am and continued for a total of 6 hours. The pumping rate was set at approximately 21 L/min for the duration of the test. The discharge outlet for the pump was placed approximately 10 m from the well in a downslope direction to minimize potential groundwater recharge.



The pump was shut off at 2:00 pm. Water level recovery was monitored manually until TW102-22 had regained approximately 95% of the total drawdown observed during the test. A total of approximately 7,560 L was discharged from TW102-22 during the pumping test.

2.4.3 Test Well 3

On November 9, 2022, Cambium staff completed the pumping test at TW103-22. Disinfectant chlorine was added to the well water prior to testing. A disinfected submersible pump was installed at a depth of approximately 12 mbgs. A pressure transducer level logger was installed above this depth to measure water levels within the well. Water levels were also measured manually to mitigate against potential equipment failure.

Water levels were additionally measured in TW101-22, TW102-22, and TW104-22 with pressure transducers and manually during the pumping test at TW103-22.

The pumping test began at 10:00 am and continued for a total of 6 hours. The pumping rate was set at approximately 21 L/min for the duration of the test. The discharge outlet for the pump was placed approximately 10 m from the well in a downslope direction to minimize potential groundwater recharge. Groundwater was noted as being orange/rust coloured in the beginning of the test but ran clear within the first two hours; no odour was detected in the groundwater.

The pump was shut off at 4:00 pm. Water level recovery was monitored manually until TW103-22 had regained approximately 95% of the total drawdown observed during the test. A total of approximately 7,560 L was discharged from TW103-22 during the pumping test.

2.4.4 Test Well 4

On November 8, 2022, Cambium staff completed the pumping test at TW104-22. Disinfectant chlorine was added to the well water prior to testing. A disinfected submersible pump was installed at a depth of approximately 12 mbgs. A pressure transducer level logger was installed above this depth to measure water levels within the well. Water levels were also measured manually to mitigate against potential equipment failure.



Water levels were additionally measured in TW101-22, TW102-22, and TW103-22 with pressure transducers and manually during the pumping test at TW104-22.

The pumping test began at 10:00 am and continued for a total of 6 hours. The pumping rate was set at approximately 21 L/min for the duration of the test. The discharge outlet for the pump was placed approximately 10 m from the well in a downslope direction to minimize potential groundwater recharge.

The pump was shut off at 4:00 pm. Water level recovery was monitored manually until TW104-22 had regained approximately 95% of the total drawdown observed during the test. A total of approximately 7,560 L was discharged from TW104-22 during the pumping test.

2.5 Groundwater Quality Analysis

Groundwater quality samples were collected from the test wells during the last hour of each pumping test. Collected samples were submitted to Caduceon Environmental Laboratories (Caduceon) in Barrie for analysis of general organic and inorganic chemistry. Caduceon is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA). Samples were stored at a temperature between 0 °C and 10 °C prior and during transport. The Certificate of Analysis for each sample is provided in Appendix E.



3.0 Geological and Hydrogeological Setting

A summary of local geology and hydrogeology in the area surrounding the Site is provided in the following subsections.

3.1 Topography and Drainage

According to available regional topography maps, the Site has a gentle regional slope to the northeast. The maximum elevation at the Site is along the southern boundary at approximately 225 metres above sea level (masl) and the minimum elevation is in the northeastern corner at approximately 215 masl (Appendix A).

The Site is located within the South Georgian Bay Shoreline watershed under GSCA jurisdiction. During a Site visit, there appeared to be an unmapped, unevaluated wetland in the southwestern corner of the Site and therefore it is assumed that local drainage in that portion of the Site will flow to this feature. Note: A Cambium ecologist did not assess or evaluate this assumed wetland. As per the MNRF Natural Heritage System database, there are unevaluated wetlands mapped to the south of the Site and to the northeast of the Site (Appendix A). It is assumed that all local drainage will follow the surficial topography and flow to the north-northeast and discharge into Georgian Bay, located approximately 1 km northeast of the Site.

3.2 Physiography

The Site is located in the physiographic region known as Beaver Valley. The Beaver Valley physiographic region is a small but well-defined region of 77 square miles that runs between Thornbury and Flesherton along the path of the Beaver River that flows into Georgian Bay. It is a steep-sided, broad-bottomed, open valley with geological features such as drumlins being noted as a rarity. Although the region is small, it includes variable and complex landforms such as cliffs, lake plains, beaches, and moraines (Chapman & Putnam, 1984).

3.3 Overburden Geology

According to Miscellaneous Release – Data 128 from the Ontario Geological Survey (OGS, 2010) the predominant overburden and soils located in the area of the Site are till soils defined as stone-poor, sandy silt to silty sand (Figure 3).



According to Data Set 14 – Revised from the Ontario Geological Survey (OGS, 2000), the predominant overburden soils at the surface of the Site are glaciolacustrine deposits deposited in the Pleistocene and described as sand to gravelly sand to gravel, deposited in nearshore and beach environments.

3.4 Bedrock Geology

According to Miscellaneous Release – Data 219 from the Ontario Geological Survey (OGS, 2007), the bedrock in the area of the Site consists of Upper Ordovician rocks from the Georgian Bay Formation. The Georgian Bay Formation is described as interbedded limestone and shale and is an average thickness of 100 m.

3.5 Vulnerable and Regulated Areas

As per the Ministry of the Environment, Conservation and Parks (Ministry) Source Water Protection Information Atlas (SPIA), the Site is within the following areas:

- The northeastern portion of the Site is within an Intake Protection Zone 2 (IPZ-2) with a vulnerability score of 4 which indicates that activities within this area may impact water surface water quality.
- Southern and western portions of the Site are within a Highly Vulnerable Aquifer (HVA) with a vulnerability score of 6.

The western boundary, southwestern corner, the central southern portion of the Site is located within a regulated area, as per GSCA information and per Ont. Reg. 151/06 (Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses); the rest of the Site is not located within a regulated area. Development restrictions may apply to the proposed development within the regulated portions of the Site. The SPIA and GSCA mapping is attached in Appendix A.

3.6 MECP Water Well Records

A review of available MECP water well records within a distance of 500 m of the proposed development Site was undertaken. The following is a summary of the well records. The MECP water well records are provided in Appendix F.

The water well database indicates that 31 water wells are located within a distance of 500 m of the Site (Figure 4). The following is a summary of these well records.

Table 1 Summary of MECP Water Well Record Review

Well Completion Material		Depth of the Wells (mbgs)	Depth of Water Found (mbgs)	Static Water Level (mbgs)	Aquifer Material	Well Yield Testing Rates (L/min)
Overburden Wells: 28	Minimum	4.6	4.3	2.0	Sand and gravel at the overburden-bedrock interface	0.1
	Maximum	36.9	34.1	13.0		95.0
	Average	20.7	19.7	6.0		41.2
Bedrock Wells: 3	Minimum	15.5	7.3	3.0	Brown to Grey Shale	14.0
	Maximum	65.5	30.5	17.0		14.0
	Average	37.2	19.7	10.0		14.0

Of these 31 records, 28 wells are completed in overburden and three are completed in bedrock. The average depth of the overburden wells is 20.7 m, ranging between 4.6 and 36.9 mbgs. The average well yield test pumping rate in the overburden wells is 41.2 L/min and varied between 0.1 L/min to 95.0 L/min; it should be noted that at all but two of the well locations that presented pumping rate information (88%) recorded test pumping rates that were greater than 13.7 Lpm, the minimum required for MECP D-5-5 water supply assessment procedures. For overburden wells, the depth groundwater is encountered on average is 19.7 mbgs, ranging between a depth of 4.3 mbgs to 34.1 mbgs. Static water level or the potentiometric surface for the overburden aquifer on average is 6.0 mbgs and varied between 2.0 mbgs to 13.0 mbgs. The material that groundwater was found within for the overburden supply well records was described as sand and gravel and was commonly encountered just above the overburden-bedrock contact.



The average depth of the bedrock wells is 37.2 m, ranging between 15.5 mbgs and 65.5 mbgs. The groundwater in general was found in the bedrock aquifer at an average depth of 19.7 mbgs, ranging between 7.3 mbgs and 30.5 mbgs where the bedrock fractures are encountered. The average static water level of the potentiometric surface in bedrock is 10.0 mbgs, ranging between 3.0 mbgs to 17.0 mbgs. For the bedrock wells, the fractured upper layer of the bedrock forms the aquifer which is being exploited for groundwater resource supply for the area. Well yield test pumping rates were recorded for two well records (No. 2515446 and 7341687) in bedrock wells and both recorded the recommended pumping rate at 14.0 L/min; all of the bedrock test pumping rates were more than 13.7 L/min, which is the minimum requirement for the MECP D-5-5 assessment procedures.

The water quality encountered in both overburden and bedrock wells was described as “fresh”; no adverse water quality issues (i.e. salt or gas) were identified or recorded in the MECP water well records examined.

3.7 Subsurface Conditions

Subsurface conditions encountered during the borehole and test pit investigation at the Site generally consisted of a layer of a black topsoil that ranged in depth from 0.15 to 0.6 m, which was underlain native overburden. Native overburden is generally described as moist, cohesionless brown sand to silty sand to sandy silt with varying amounts of clay and gravel which extended down to termination depth (maximum termination depth of 5.2 mbgs). Isolated deposits of cohesive clayey silt material were encountered within the southwest quadrant of the Site.

The soils were predominantly described as being moist to wet throughout the borehole and test pit investigations except for test pit TP111-22, where saturated soils were encountered at depths ranging from 1.07 mbgs to test pit termination at 2.90 mbgs. Wet soils (based on visual and tactile observations during drilling and excavating works) were first encountered within the boreholes and test pits at depths ranging from 0.8 mbgs to 4.6 mbgs.

Groundwater was observed in borehole BH105-22 at a depth of 3.4 mbgs and groundwater seepage was observed within TP111-22 at a depth of 1.1 mbgs upon completion of the drilling



and excavating works. The groundwater level observations in the boreholes and test pits are not representative of the stabilized groundwater conditions and as such, the groundwater table elevation may vary. Caving (sloughing) was noted within borehole BH105-22 at a depth of 3.7 mbgs and test pit TP111-22 at a depth of 1.1 mbgs.

It was noted that groundwater levels at the Site may fluctuate seasonally and in response to climatic events.

Bedrock was not encountered within the depths of the borehole and test pit investigations.

3.7.1 Grain Size Analysis

Results obtained from laboratory grain size analyses are summarized in . Complete soil analysis reports are provided in Appendix C.



Table 2 Grain Size Distribution Analysis Results

Test Pit/ Borehole	Depth (mbgs)	Description	% Gravel	% Sand	% Silt	% Clay	T-time (min/cm)
BH101-22 SS4	2.3 – 2.9	Silt, some Clay, some Sand, trace Gravel	1	16	66	17	35
BH102-22 SS3	1.5 – 2.1	Silty Sand, trace Clay	0	71	27	2	14
BH103-55 SS3	1.5 – 2.1	Silty Sand, trace Clay	0	67	30	3	16
BH103-22 SS5	3.0 – 3.7	Sand and Silt, trace Clay	0	49	47	4	20
BH104-22 SS4	2.3 – 2.9	Silty Sand, some Gravel, some Clay	12	43	34	11	25
BH105-22 SS4	2.3 – 2.9	Sand and Silt, trace Clay	0	62	35	3	16
BH106-22 SS4	2.3 – 2.9	Sandy Silt, trace Clay, trace Gravel	7	29	55	9	25
BH107-22 SS3	1.5 – 2.1	Sandy Silt, some Clay, some Gravel	12	26	45	17	35
TP105-22 GS1	1.1 – 1.4	Silt, some Sand, trace Clay, trace Gravel	2	19	71	8	25
TP106-22 GS1	0.6 – 1.1	Silt, some Sand, trace Clay	0	10	83	7	20
TP112-22 GS1	2.7 – 3.0	Sand, some Gravel, some Silt, trace Clay	15	69	14	2	8
TP116-22 GS1	1.5 – 2.0	Clayey Silt, trace Sand	0	2	78	20	35

The soil percolation rates ranged from 8 min/cm to 35 min/cm. The geometric mean of the percolation rate was estimated at about 21 min/cm. These results indicate a moderate infiltration capacity of the shallow native soils.

3.8 Hydrogeology

The four monitoring wells advanced at the Site all encountered overburden consisting of silt, to silty sand to sand, with variable combinations of trace clay and trace gravel. These results are compatible with the test pit investigation findings. Saturated conditions were initially encountered at 1.5 mbgs for BH103-22 and 3.5 mbgs for BH101-22 during drilling; however,



soils were dry to the maximum borehole depth of approximately 5.2 m for BH102-22 and BH104-22 during drilling.

An unconfined aquifer exists within the shallow overburden and is the aquifer which the monitoring wells are installed within. According to the MECP WWIS and as per the test wells at Site, there is also a confined overburden aquifer within the deeper aquifer that is within a sand and gravel unit. This aquifer lies just above the overburden-bedrock contact and is highly productive with many of the areas supply wells drawing from it. According to the MECP WWIS, it is assumed that there is a bedrock aquifer present in the area of the Site as well that is generally encountered within the first couple metres beyond the overburden-bedrock contact. The connectivity of the shallow overburden aquifer, the deeper confined overburden aquifer, and the bedrock aquifer systems is not known; however, it is likely that there is some degree of hydraulic connection between the shallow and deeper aquifer systems.

3.8.1 Shallow Groundwater-Overburden

On September 30, October 25, and November 8, 2022, water levels were measured from the on-site monitoring wells. Groundwater levels ranged from 0.20 mbgs and 2.08 mbgs (this range does not include September 22 and September 26 results since the wells were installed on these days and as such, the water levels were not representative of static conditions). BH104-22 was reported as dry during all monitoring events. Groundwater elevations ranged from 99.89 m.rel to 105.79 m.rel during the measurement events.

In general, groundwater flow of the shallow overburden aquifer on the Site is to the northeast where it is interpreted to discharge into Georgian Bay approximately 1.2 km northeast of the Site. Groundwater flow contours are outlined on Figure 5 for the shallow overburden aquifer. Groundwater levels and elevations are outlined below in Table 3.



Table 3 Shallow Groundwater Level and Elevation Information

Well		BH101-22	BH102-22	BH103-22	BH104-22
Top of Pipe Elevation (m.rel) ⁽¹⁾		103.39	101.98	107.07	105.52
Ground Surface Elevation (m.rel) ⁽¹⁾		102.28	101.00	106.05	104.46
Stick-up (m)		1.11	0.98	1.02	1.05
September 30, 2022	Water Level (mbgs) ⁽²⁾	1.98	0.92	0.26	Dry
	Groundwater Elev.(m.rel) ⁽¹⁾	100.30	100.08	105.79	-
October 25, 2022	Water Level (mbgs) ⁽²⁾	1.95	1.00	0.32	Dry
	Groundwater Elev.(m.rel) ⁽¹⁾	100.33	100.00	105.73	-
November 8, 2022	Water Level (mbgs) ⁽²⁾	2.03	1.11	0.59	Dry
	Groundwater Elev.(m.rel) ⁽¹⁾	100.25	99.89	105.46	-

1. Metres relative to BM
2. metres below ground surface

3.8.2 Deep Groundwater-Overburden

On November 7, 2022 (prior to all pumping tests), water levels were measured from the on-site test wells. Groundwater levels ranged from 4.32 mbgs and 7.51 mbgs. Groundwater elevations ranged from 91.83 m.rel to 100.24 m.rel. In general, groundwater flow of the deeper confined overburden aquifer on Site is northeast, where it is interpreted to discharge to continue flowing towards Georgian Bay.



4.0 Water Supply Assessment

The results obtained for the water supply assessment are discussed in the following subsections.

4.1 Hydraulic Pumping Tests

Results for pumping tests completed at TW101-22, TW102-22, TW103-22, and TW104-22 are discussed individually below.

4.1.1 TW101-22 Pumping Test

The static water level in TW101-22 was 7.51 mbgs on November 7, 2022, prior to commencing the pumping test. The pump was installed at a depth of approximately 12 mbgs. The available drawdown in the well was therefore approximately 4.5 m (height of static water level above pump).

The hydraulic testing began at 11:15 am and commenced for a duration of 6 hours 15 minutes. A discharge rate of 21 L/min for the duration of the test. Approximate steady state conditions were achieved in TW101-22 at the end of the pumping test. The water level in the well at this time was 8.23 mbgs, which is equivalent to a total drawdown of 0.72 m and represents approximately 16% of the total drawdown available in the well. No response to pumping at TW101-22 was observed in TW102-22, TW103-22, and TW104-22 during the test. Water levels measured during the TW101-22 pumping test are provided in Figure 6.

The pump in TW101-22 was shut off at 5:30 pm. Water level recovery was manually measured for 30 minutes; at which time, the test well had recovered to 88% of pretest conditions. According to the logger data, water levels had reached 100% pre-test static water levels at 7:21 pm on November 7, 2022 (approximately 2 hours after the cessation of pumping).

The total volume of water discharged from TW101-22 during the pumping test was approximately 7,875 L. Based on the steady state conditions achieved during the test, as well as the rate of water level recovery after the test, it is expected that TW101-22 can sustainably provide a yield of 21 L/min (51,660 L/day).



4.1.2 TW102-22 Pumping Test

The static water level in TW102-22 was 4.63 mbgs on November 10, 2022, prior to commencing the pumping test. The pump was installed at a depth of approximately 12 mbgs. The available drawdown in the well was therefore approximately 7.4 m (height of static water level above pump).

The hydraulic testing began at 8:00 am and commenced for a duration of 6 hours. A discharge rate of 21 L/min for the duration of the test. Approximate steady state conditions were achieved in TW102-22 at the end of the pumping test. The water level in the well at this time was 7.64 mbgs, which is equivalent to a total drawdown of 3.01 m and represents approximately 41% of the total drawdown available in the well. No response to pumping at TW102-22 was observed in TW101-22, TW103-22, and TW104-22 during the test. Water levels measured during the TW102-22 pumping test are provided in Figure 7.

The pump in TW102-22 was shut off at 2:00 pm. Water level recovery was manually measured for 70 minutes; at which time, the test well had recovered to 92% of pretest conditions. The logger was pulled from the well at the 70-minute recovery mark.

The total volume of water discharged from TW102-22 during the pumping test was approximately 7,560 L. Based on the steady state conditions achieved during the test, as well as the rate of water level recovery after the test, it is expected that TW102-22 can sustainably provide a yield of 21 L/min (51,660 L/day).

4.1.3 TW103-22 Pumping Test

The static water level in TW103-22 was 4.95 mbgs on November 9, 2022, prior to commencing the pumping test. The pump was installed at a depth of approximately 12 mbgs. The available drawdown in the well was therefore approximately 7.1 m (height of static water level above pump).

The hydraulic testing began at 10:00 am and commenced for a duration of 6 hours. A discharge rate of 21 L/min for the duration of the test. Approximate steady state conditions were achieved in TW103-22 at the end of the pumping test. The water level in the well at this time was 8.01 mbgs, which is equivalent to a total drawdown of 3.06 m and represents



approximately 43% of the total drawdown available in the well. No response to pumping at TW103-22 was observed in TW101-22, TW102-22, and TW104-22 during the test. Water levels measured during the TW103-22 pumping test are provided in Figure 8.

The pump in TW103-22 was shut off at 4:00 pm. Water level recovery was manually measured for 60 minutes; at which time, the test well had recovered to 91% of pretest conditions. Due to logger equipment failure, only manual water levels are available for the pumping test of TW103-22.

The total volume of water discharged from TW103-22 during the pumping test was approximately 7,560 L. Based on the steady state conditions achieved during the test, as well as the rate of water level recovery after the test, it is expected that TW103-22 can sustainably provide a yield of 21 L/min (51,660 L/day).

4.1.4 TW104-22 Pumping Test

The static water level in TW104-22 was 4.37 mbgs on November 8, 2022, prior to commencing the pumping test. The pump was installed at a depth of approximately 12 mbgs. The available drawdown in the well was therefore approximately 7.6 m (height of static water level above pump).

The hydraulic testing began at 10:00 am and commenced for a duration of 6 hours. A discharge rate of 21 L/min for the duration of the test. Approximate steady state conditions were achieved in TW104-22 at the end of the pumping test. The water level in the well at this time was 4.61 mbgs, which is equivalent to a total drawdown of 0.24 m and represents approximately 3% of the total drawdown available in the well. No response to pumping at TW104-22 was observed in TW101-22, TW102-22, and TW103-22 during the test. Water levels measured during the TW104-22 pumping test are provided in Figure 9.

The pump in TW104-22 was shut off at 4:00 pm. Water level recovery was manually measured for 60 minutes; at which time, the test well had recovered to 84% of pretest conditions. According to the logger data, water levels had reached 100% pre-test static water levels at 5:10 am on November 9, 2022 (approximately 13 hours after the cessation of pumping).



The total volume of water discharged from TW104-22 during the pumping test was approximately 7,560 L. Based on the steady state conditions achieved during the test, as well as the rate of water level recovery after the test, it is expected that TW104-22 can sustainably provide a yield of 21 L/min (51,660 L/day).

4.2 Water Quality

Groundwater samples were collected from TW101-22, TW102-22, TW103-22, and TW104-22 during the last 60 minutes of each pumping test. All samples were submitted to Caduceon in Barrie for analysis of general organic and inorganic chemistry and bacterial analysis. Prior to sampling, field turbidity readings were completed and the results are outlined in Table 4.

Table 4 Field Turbidity Readings

Parameter	TW101-22	TW102-22	TW103-22	TW104-22
Field Turbidity (NTU)	2.00	1.32	2.27	2.14

Water quality results were compared against the Ontario Drinking Water Quality Standards (ODWQS) (MOE, 2003). A complete summary of water quality results and certificates of lab analyses are provided in Appendix E. Parameters reported at concentrations exceeding ODWQS criteria are outlined in Table 5, including water samples from the original sampling events (November 7 through November 10, 2022) and a resampling event conducted November 29 and 30, 2022.

Table 5 Summary of Water Quality Results

Parameter	TW101-22	TW102-22	TW103-22	TW104-22	ODWQS Criteria
Original Sampling Event – November 7 through November 10, 2022					
Hardness (as CaCO ₃)(mg/L)	345	295	405	324	80-100
Total Coliform (cfu/100mL)	0	1	1	4	0
Turbidity (NTU)	1.8	13.5	33.5	27.4	5
Total Iron (mg/L)	0.153	1.23	1.92	<0.005	0.3
Total Manganese (mg/L)	0.010	0.032	0.042	0.048	0.05
Re-sampling Event – November 29 and 30, 2022					
Hardness (as CaCO ₃)(mg/L)	-	319	350	406	80-100
Total Coliform (cfu/100mL)	-	0	0	0	0



Parameter	TW101-22	TW102-22	TW103-22	TW104-22	ODWQS Criteria
Turbidity (NTU)	-	36.1	28.6	23.2	5
Total Iron (mg/L)	-	1.76	2.65	<0.005	0.3
Total Manganese (mg/L)	-	0.046	0.062	0.051	0.05

Concentrations of hardness were reported in excess of ODWQS aesthetic objectives or operational guidelines in all four test wells in the samples collected during the original sampling event and the resampling event. During the original sampling event, concentrations of total coliforms and turbidity also exceeded maximum acceptable criteria in TW102-22, TW103-22, TW104-22 and concentrations of iron exceeded TW102-22 and TW103-22.

The resampling event was conducted at TW102-22, TW103-22, and TW104-22 due to the detection of total coliforms in these locations. The wells were thoroughly disinfected prior to resampling and there were no total coliforms detected in any of the wells after the retesting program. However, hardness, turbidity, total iron (TW102-22 and TW103-22), and total manganese (TW103-22 and TW104-22) were still elevated above ODWQS criteria.

Hardness is a common parameter to exceed the guidelines in Ontario as a result of interactions with minerals in the ground (particularly calcium carbonate limestone which is likely the parent material of the overburden materials) with the groundwater. Conventional water softeners can be used to reduce hardness if the user is concerned about scaling issues with fixtures and appliances. All hardness concentrations were below 500 mg/L and therefore are considered acceptable for domestic purposes.

Iron and manganese are other commonly elevated parameters within overburden groundwater systems. Both parameters are an ODWQS aesthetic objective that is readily treatable with conventional water softening techniques and/or with an additional iron treatment system if required. A water treatment specialist should be consulted for appropriate treatment options.

Turbidity exceeded of aesthetic objective in the samples from TW102-22, TW103-22, and TW104-22 during both sampling events. It is noted that the original field turbidity readings did not exceed ODWQS; however, readings were elevated upon laboratory testing. It is assumed that the elevated turbidity values in the laboratory testing is due to metals (namely iron and manganese) precipitating out of solution after being sampled and upon arriving at the lab. It is



expected that treatment of iron and manganese as outlined above should resolve elevated turbidity readings in each test well. A competent water treatment specialist should be consulted for appropriate treatment options.

During the original sampling event, total coliforms were elevated within TW102-22, TW103-22, and TW104-22. No measurable concentrations of E.coli were detected in any of the collected samples which indicates a lack of influence from faecal contamination sources such as septic systems or agricultural activities. No total coliforms or E.coli were detected in TW102-22, TW103-22, or TW104-22 during the resampling event, which indicates that the initial detection was due to inadequate disinfection of the well after installation or prior to testing or could be that the sample was otherwise contaminated while handling and not contamination in the local aquifer.



5.0 Wastewater Assessment

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

The creation of proposed 37 new residential units will increase the potential of wastewater effluent loading on the receiving aquifer system (i.e. water table) located within the overburden soils in the area. Within the effluent, nitrate is considered the limiting contaminant due to the human health concerns. Procedure D-5-4 requires that the effluent plume at the Site boundary to be within the ODWQS limit of 10 mg/L for nitrate to prevent contamination of adjacent properties. Although natural processes and soil interaction can result in nitrate being attenuated in the receiving aquifer system, Procedure D-5-4 states that only dilution can be used as the principal attenuation mechanism to predict future nitrate concentrations. As such, a mass balance calculation is used to determine the impact of developing residential units on the Site.

The wastewater assessment employed a detailed water balance and pre- and post-development infiltration calculations to determine the volume of available dilution water at the Site. The volume of available dilution water was then utilized to provide a predictive assessment of nitrate attenuation based on the number of units for the proposed development. Detailed mass balance calculations are provided in Appendix G. An overview of calculations and results are discussed in the following subsections.

5.1 Available Dilution

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

$$Q_i = A \times S \times I$$

Where: Q_i – Volume of Available dilution water

A – Area of the Site

S – Water surplus

I – Infiltration factor



To calculate the water surplus, the climate normal data collected between 1981 and 2010 at the Thornbury Salma weather station was used (Climate ID: 611HBEC). The data was accessed through the Environment Canada website (Environment Canada, 2022). The total yearly precipitation, on average, was 992 mm.

The Thornthwaite method was used to determine the amount of evapotranspiration that will occur at the Site (S. Lawrence Dingman, 2008). The calculated depth of evapotranspiration was 524 mm/year. The evapotranspiration calculations are attached in Appendix G. Therefore, the water surplus calculated to be 468 mm per year (1.28 mm/day).

To determine the fraction of surplus water that infiltrates into the soils on-site, the volume of surplus water is multiplied by an infiltration factor. The infiltration factor varies between 0 and 1 and is estimated based on topography, soils and cover (as per the Stormwater Management Planning and Design Manual (MOE, 2003)). As outlined in Table 6, an estimated infiltration factor of 0.7 was established for the Site.

In addition to calculating the infiltration factor, the developable area of the Site, as per the draft site plan provided in Appendix A, was considered to determine the total volume of dilution water available. The developable area was calculated as the total Site area (24.24 ha) minus the area designated as pavement (4.91 ha). Proposed roofed area was included in the developable area as it is assumed that roof leaders will direct any roof runoff to landscaped areas and therefore will not contribute to a post-development recharge deficit. The total volume of available dilution water per day as rainfall onto landscape areas is 174 m³/day. A summary of parameters and calculations used for available dilution water calculations are outlined in Table 6. Detailed calculations are given in Appendix G.



Table 6 Available Dilution Calculation Parameters

Infiltration Factor (I)	
Topography	Rolling Land, avg. slope 2.8 to 3.8 m/km = 0.2
Soil	Combination of Silt and Sand = 0.3
Cover	Woodland = 0.2
Infiltration Factor (I)	0.7
Volume of Dilution Water	
Dilution Area (A) (m ²)	193,338.6
Surplus (S) (m/day)	0.0012822
Total Volume of Surplus Water Available Per Day (AxS) (m ³ /day)	235.18
Volume of Infiltrated Surplus Water Per Day {(AxS)xI} (m ³ /day)	175.53

5.2 Predictive Assessment

Based on Procedure D-5-4, each proposed unit is anticipated to generate an average discharge of 1,000 L/day of sewage effluent. Total nitrogen (all species) ultimately converts to nitrate through the wastewater treatment process. Nitrate is considered to be the critical contaminant in sewage effluent. A nitrate loading of 40 grams/unit/day is required to be normally used to determine the effluent loading from conventional septic systems on the receiving groundwater system.

To evaluate the impact of a septic system on a groundwater resource, a reference point or value is established to assist in determining the extent of the impact, if any. In this respect, the quality of the groundwater that is not impacted by septic system on the Site (i.e. background water quality) should be used for comparison purposes. The concentration of nitrate is assumed to be 0.01 mg/L in the surplus water infiltrating into the ground once the development is created.

To determine the adequate unit density for the Site, 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:

$$Q_t C_t = Q_e C_e + Q_i C_i$$



- 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 (0.01 mg/L)

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

$$C_t = \frac{Q_e C_e + Q_i C_i}{Q_t}$$

This equation was used for the developable portion of the Site. The results of the calculations are outlined in the table below:

Table 7 Predictive Assessment of Nitrate Concentrations

Variable	Value Based on Proposed Units
Number of Units	37
Volume of Sewage Effluent (Q_e)	37,000
Concentration of nitrate in effluent C_e (mg/L)	40
Volume of available dilution water Q_i (L/day)	173,528
Concentration of nitrate in dilution water C_i (mg/L)	0.1
Total Volume Q_t (L/day)	210,528
Target Nitrate Concentration at the Property Boundary C_t (mg/L)	7.11

Based on the predictive assessment prepared, the proposed 37 units would result in a nitrate concentration of 7.11 mg/L. This value is less than the nitrate concentration limit of 10 mg/L at the property boundary. The proposed development is therefore expected to maintain acceptable nitrate concentration thresholds at property boundaries.



5.3 Pre-Development Water Balance

The water balance for existing conditions at the Site is summarized in Table 8. The pre-development infiltration rate and runoff rate was calculated to be 201,446 m³/year and 86,548 m³/year, respectively.

Table 8 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	240	238	24	-	214
	Roof Area	-	-	-	-	-
Pervious Areas	Landscape Area	614,477	609,562	321,782	201,466	86,334
Total		614,717	609,800	321,805	201,446	86,548

5.4 Post-Development Water Balance

The post-development water balance at the Site is summarized in Table 9. This water balance was calculated using an available infiltration area derived from the total Site area (61.47 ha) minus the areas designated as pavement (4.96 ha) and roof (1.00 ha). An assumption of evaporation in the amount of 10% of total precipitation on paved and roof areas was also included. Further details of the post-development water balance calculations are provided in Appendix G. Combining all the information, the post-development infiltration rate and runoff rate for the Site was calculated to be 181,991 m³/year and 131,192 m³/year, respectively.

Table 9 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	49,568	49,171	4,917	-	44,254
	Roof Area	10,015	9,935	993	-	8,941
Pervious Areas	Landscape Area	555,135	550,694	290,706	181,991	77,996
Total		614,717	609,800	296,616	181,991	131,192

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

5.5 Water Balance Comparison

A comparison of water balances for the pre-development and post-development scenarios is summarized in Table 10. There is a net infiltration deficit of approximately 19,455 m³/year, compared to the pre-development infiltration. The run-off rate upon development of the Site is projected to increase by 44,644 m³/year.

Table 10 Water Balance Comparison

	Precipitation (m ³)	Evapotranspiration (m ³)	Infiltration (m ³)	Run-off (m ³)
Pre-Development	609,800	321,805	201,446	86,548
Post-Development	609,800	296,616	181,991	131,192
Change in Volume	-	- 25,189	- 19,455	44,644
Change in %	-	- 8	- 10	52

Based on the above calculations, a summary of the water balance could be provided as follows:

- 1) There is a net increase in run-off at the Site of about 44,644 m³/year, from 86,548 m³/year to 131,192 m³/year. This increase is a result of the development of the Site with more impervious areas such as roof and paved areas, and reduction in pervious areas.
- 2) Without implementation of mitigation measures, there is a net deficit of about 19,455 m³/year (or 10% decrease) in the post-development infiltration on a yearly basis.



5.6 Discussions on LID Measures

Low Impact Development (LID) practices are widely implemented as a means to capture runoff and mimic the natural hydrologic cycle. It is important to maintain the natural hydrologic cycle as much as possible as decreases in infiltration reduce groundwater recharge and soil moisture replenishment and also lead to reductions in stream baseflows which are needed to sustain aquatic life.

Infiltration targets at the Site may be achieved through LIDs and incorporation of a variety of stormwater management techniques including reduced unit grading, roof leaders discharging to lawns, ponding areas or soak away pits, rain gardens, infiltration trenches, and grassed swales.

Roof leaders that will direct roof runoff to the lawns is an option available for the Site. The total projected roof runoff volume is 8,941 m³, which encompasses 46% of the calculated infiltration deficit at the Site. Cambium recommends that LID measures are implemented at the Site to address the infiltration deficit and that a stormwater engineer is retained to design the LID infrastructure and to address runoff flow generated from the roadways.



6.0 Conclusions and Recommendations

Conclusions and recommendations based on the results presented in this hydrogeological assessment are summarized below.

- Hydraulic testing of TW101-22, TW102-22, TW103-22, and TW104-22 indicate the wells will produce sustainable yields of 21 L/min. These values are all greater than 13.7 L/min, which is the minimum requirement for the MECP D-5-5 assessment procedures. It is therefore expected that there are adequate water supply resources at the Site to support the proposed development.
- Water quality results indicate the water from all four test wells is of generally good quality, with the exceptions of hardness, iron, manganese, and turbidity. These parameters were reported at concentrations which exceed ODWQS guidelines at some or all locations, however all readily amendable with residential water treatment units. All other analyzed parameters were within acceptable ranges.
- The wastewater assessment indicates that the proposed development of 37 units with single family homes would result in a nitrate concentration of 7.11 mg/L at the property boundary, which is less than the 10 mg/L permitted by D-5-4 guidelines. The proposed development is therefore expected to maintain acceptable nitrate concentration thresholds at property boundaries.
- Based on the proposed 37 units, infiltration at the Site will be reduced by approximately 19,455 m³/yr in the post-development scenario compared to pre-development conditions. It is assumed that roof leaders that will direct roof runoff to the lawn will be implemented to aid the projected infiltration deficit. The total projected roof run-off volume is 8,941 m³, which encompasses 46% of the calculated infiltration deficit at the Site. Cambium recommends that LID measures are implemented at the Site to address the infiltration deficit and that a stormwater engineer is retained to design the LID infrastructure and to address runoff flow generated from the roadways.



6.1 Closing

Based on the preliminary assessment Cambium concludes that the Site can sustain the development of 37 residential units without inducing a negative impact on the quality or quantity of on-site and off-site groundwater resources.

Respectfully submitted,

Cambium Inc.

Nicole Heikoop, M.Sc., GIT
Project Coordinator

Kevin Warner, M. Sc. P. Geo (Ltd)
Manager- Water & Wastewater

NH/KDW

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8.0 Standard Limitations

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Site Assessments

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Appended Figures



HYDROGEOLOGICAL ASSESSMENT

THORNBURY ACRES HOLDING INC.
 Thornbury Acres
 Grey Road 40 & Grey Road 2
 Thornbury, Ontario

LEGEND

- Highway
- Major Road
- Minor Road
- Watercourse
- Water Area
- Provincial Park
- Wooded Area
- Built Up Area

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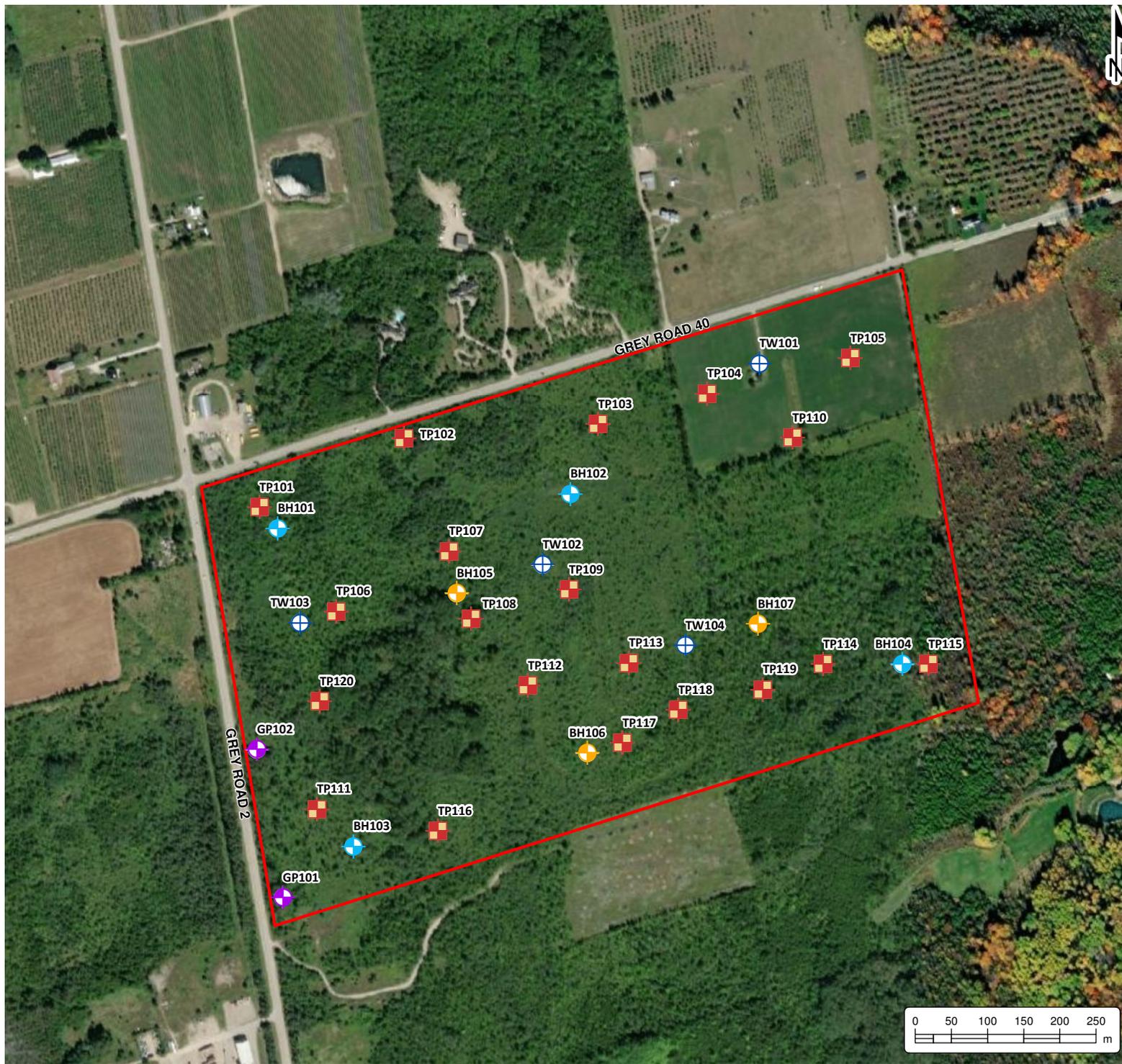


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SITE LOCATION MAP

Project No.:	14266-003	Date:	November 2022
Scale:	1:160,442	Projection:	NAD 1983 UTM Zone 17N
Created by:	DBB	Checked by:	SR
			Figure: 1

O:\GIS\XDS\14200-14299\14266-002_Thornbury Acres Holdings - Hydrog - Thornbury Acres\2022-11-21 FIG 2 - Test Pit and Test Well Locations.mxd



HYDROGEOLOGICAL ASSESSMENT
THORNBURY ACRES HOLDING INC.
 Thornbury Acres
 Grey Road 40 & Grey Road 2
 Thornbury, Ontario

LEGEND

-  Borehole
-  Gas Probe
-  Monitoring Well
-  Test Pit
-  Test Well
-  Site (approximate)

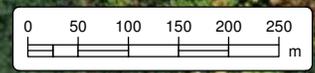
Notes:
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TEST PIT AND TEST WELL LOCATIONS

Project No.:	14266-002	Date:	November 2022
Scale:	1:7,500	Rev.:	
Created by:	DBB	Checked by:	KW
Figure:	2		





HYDROGEOLOGICAL ASSESSMENT

THORNBURY ACRES HOLDING INC.
 Thornbury Acres
 Grey Road 40 & Grey Road 2
 Thornbury, Ontario

- LEGEND**
- Site (approximate)
 - Water Area
 - 19, Modern alluvium
 - 20, Swamp deposits
 - 3, Amabel Formation
 - 3, Clinton-Cataract Group
 - 3, Georgian Bay Formation
 - 3, Queenston Formation
 - 3, Whitby Formation
 - 5b, Clayey silt till
 - 5b, Sandy silt till
 - 5d, Clayey silt till
 - 5d, Silty clay to clayey till
 - 6, Ice-contact deposits
 - 7, Glaciofluvial deposits
 - 7a, Glaciofluvial deposits
 - 8a, Glaciolacustrine or localized pond deposits
 - 9b, Glaciolacustrine or localized pond deposits
 - 9c, Glaciolacustrine or localized pond deposits

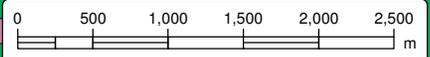
Notes:

- Surficial Geology obtained from LIO online GIS database
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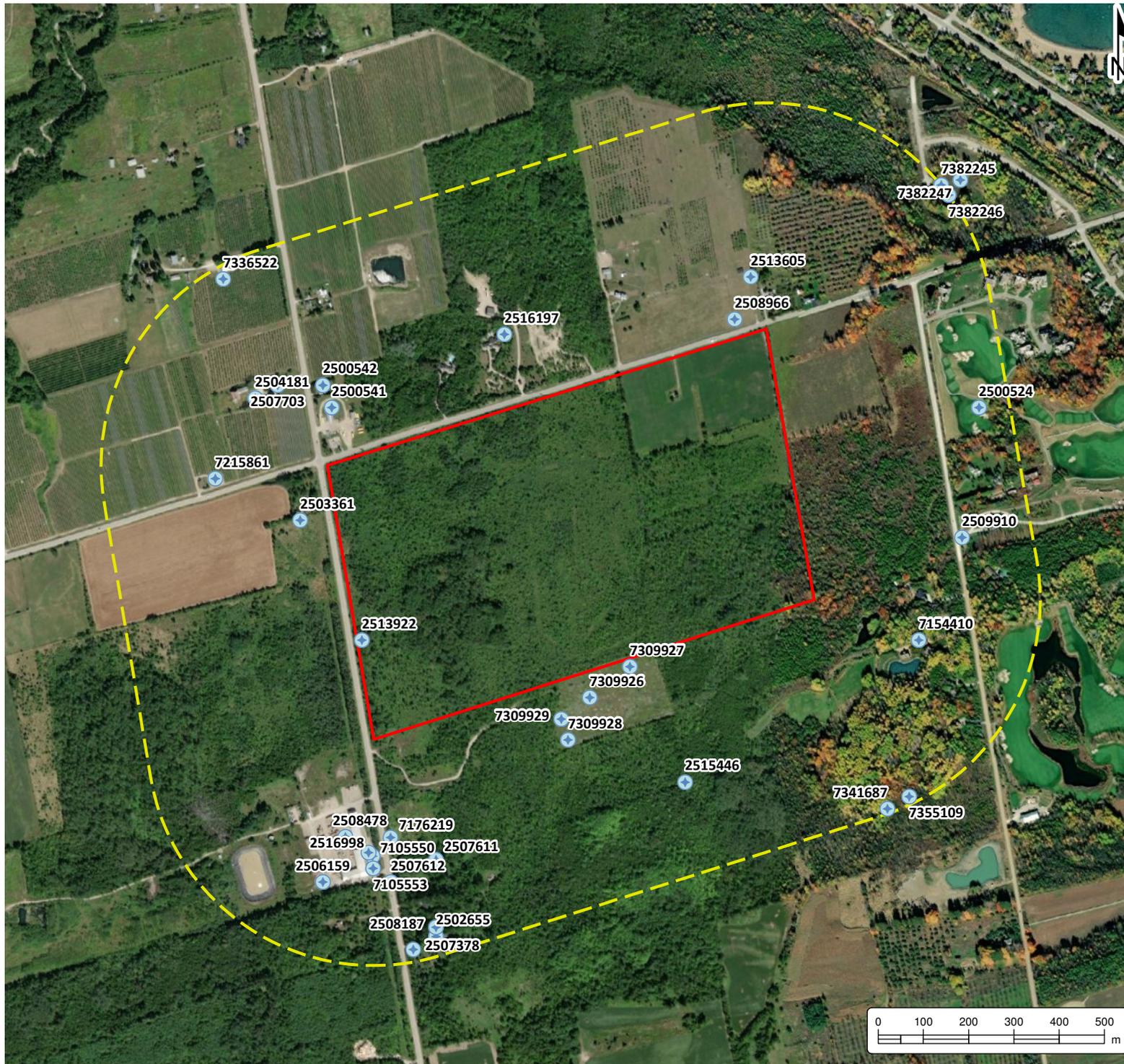
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SURFICIAL GEOLOGY

Project No.:	14266-002	Date:	November 2022
Scale:	1:50,000	Projection:	NAD 1983 UTM Zone 17N
Created by:	DBB	Checked by:	KW
			3



O:\GIS\MXDs\14200-14299\14266-002_Thornbury Acres Holdings - Hydrog - Thornbury Acres\2022-10-17 FIG 4 - MECF Well Record Map.mxd



HYDROGEOLOGICAL ASSESSMENT
THORNBURY ACRES HOLDING INC.
 Thornbury Acres
 Grey Road 40 & Grey Road 2
 Thornbury, Ontario

LEGEND

-  Water Well Records
-  Study Area (500m)
-  Site (approximate)

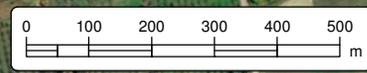
Notes:
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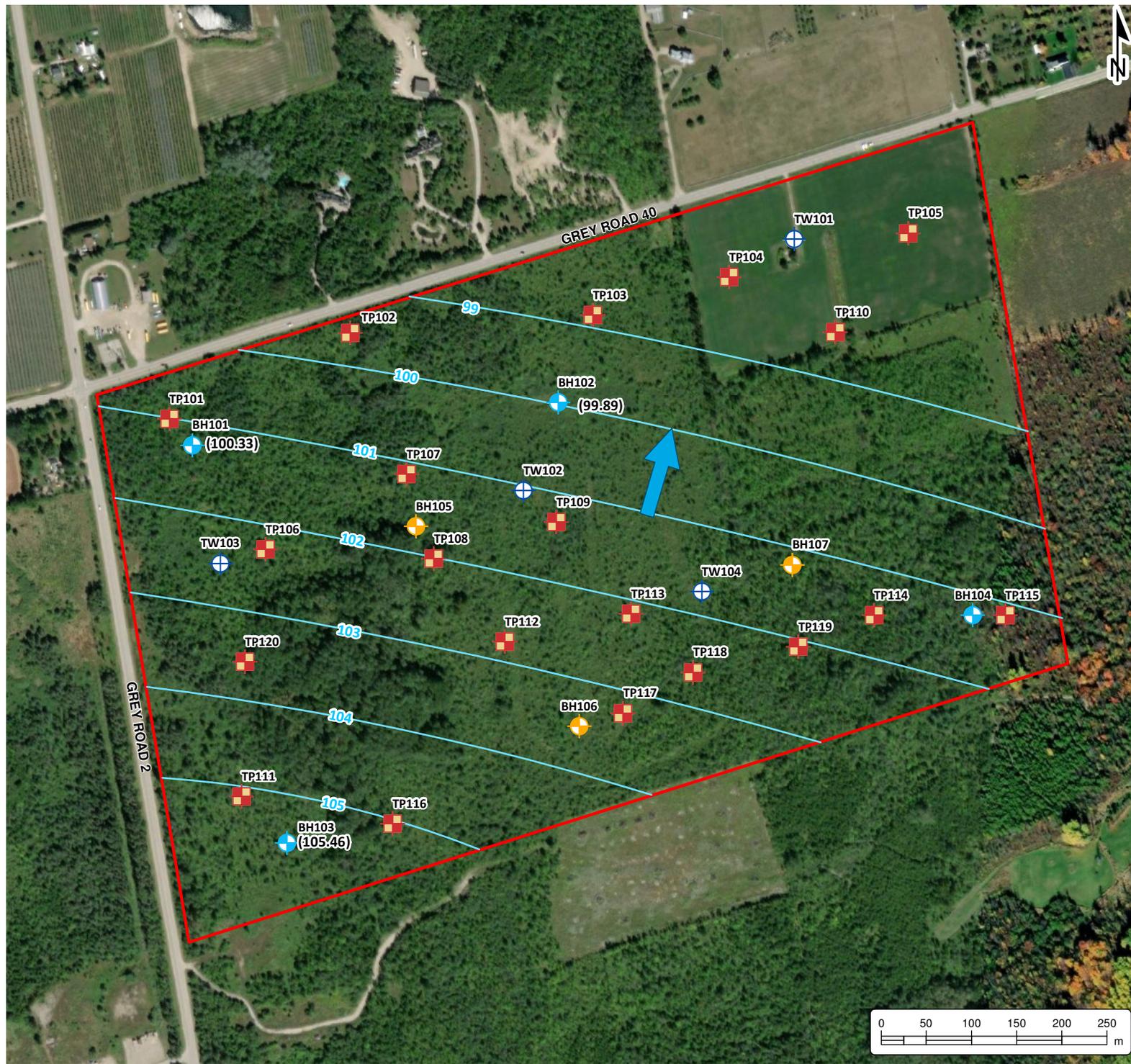
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**WATER WELL RECORDS
 WITHIN 500m**

Project No.:	14266-002	Date:	November 2022
Scale:	1:12,000	Rev.:	
Created by:	PAS	Projection:	NAD 1983 UTM Zone 17N
Checked by:	KW	Figure:	4



O:\GIS\MXDs\14200-14299\14266-002_Thornbury Acres Holdings - Hydrog - Thornbury Acres Holdings\2022-11-21 FIG 5 - Groundwater Configuration Map.mxd



HYDROGEOLOGICAL ASSESSMENT
THORNBURY ACRES HOLDING INC.
 Thornbury Acres
 Grey Road 40 & Grey Road 2
 Thornbury, Ontario

- LEGEND**
- Borehole
 - Monitoring Well
 - Test Pit
 - Test Well
 - Shallow Groundwater Contour (1m intervals)
 - Site (approximate)
 - Groundwater Flow Direction
 - (105.46) Shallow Groundwater Elevation (m.rel) (Nov 7, 2022)

Notes:

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**SHALLOW OVERBURDEN
 GROUNDWATER
 CONFIGURATION MAP**

Project No.:	14266-002	Date:	November 2022
Scale:	1:6,000	Projection:	NAD 1983 UTM Zone 17N
Created by:	DBB	Checked by:	KW
			5

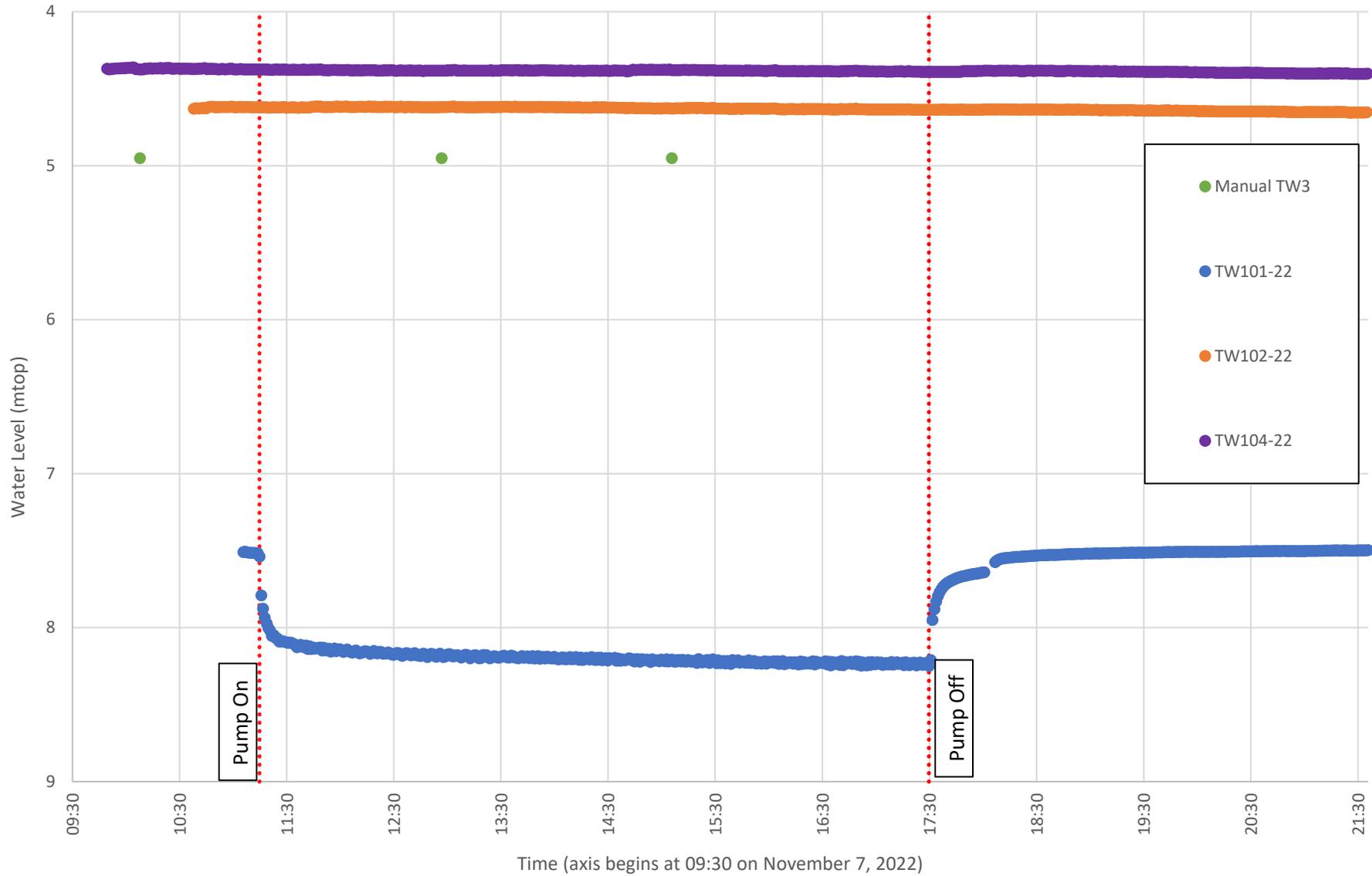


Figure 6. TW101-22 November 7, 2022 Pumping Test Hydrograph

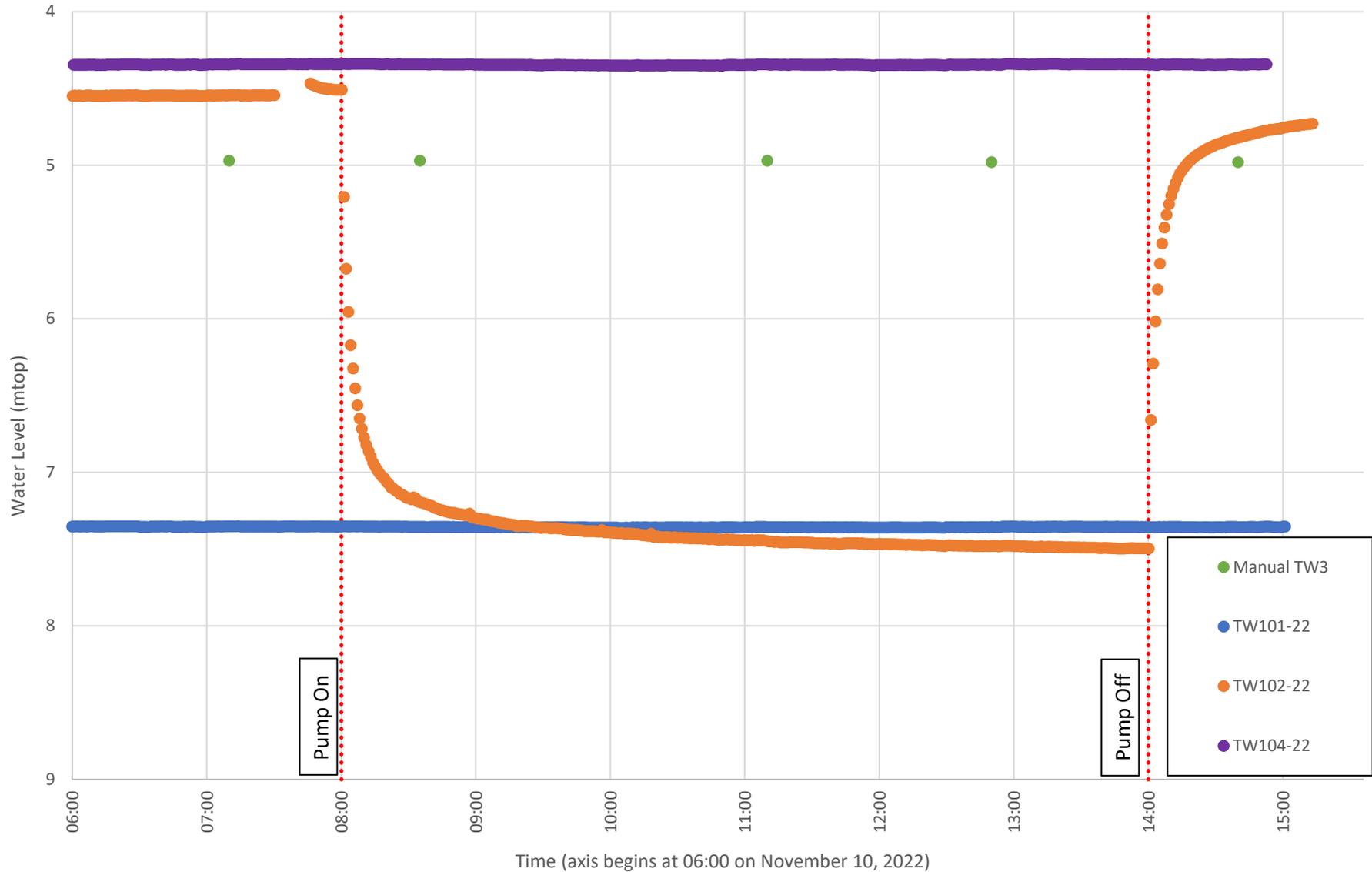


Figure 7. TW102-22 November 10, 2022 Pumping Test Hydrograph

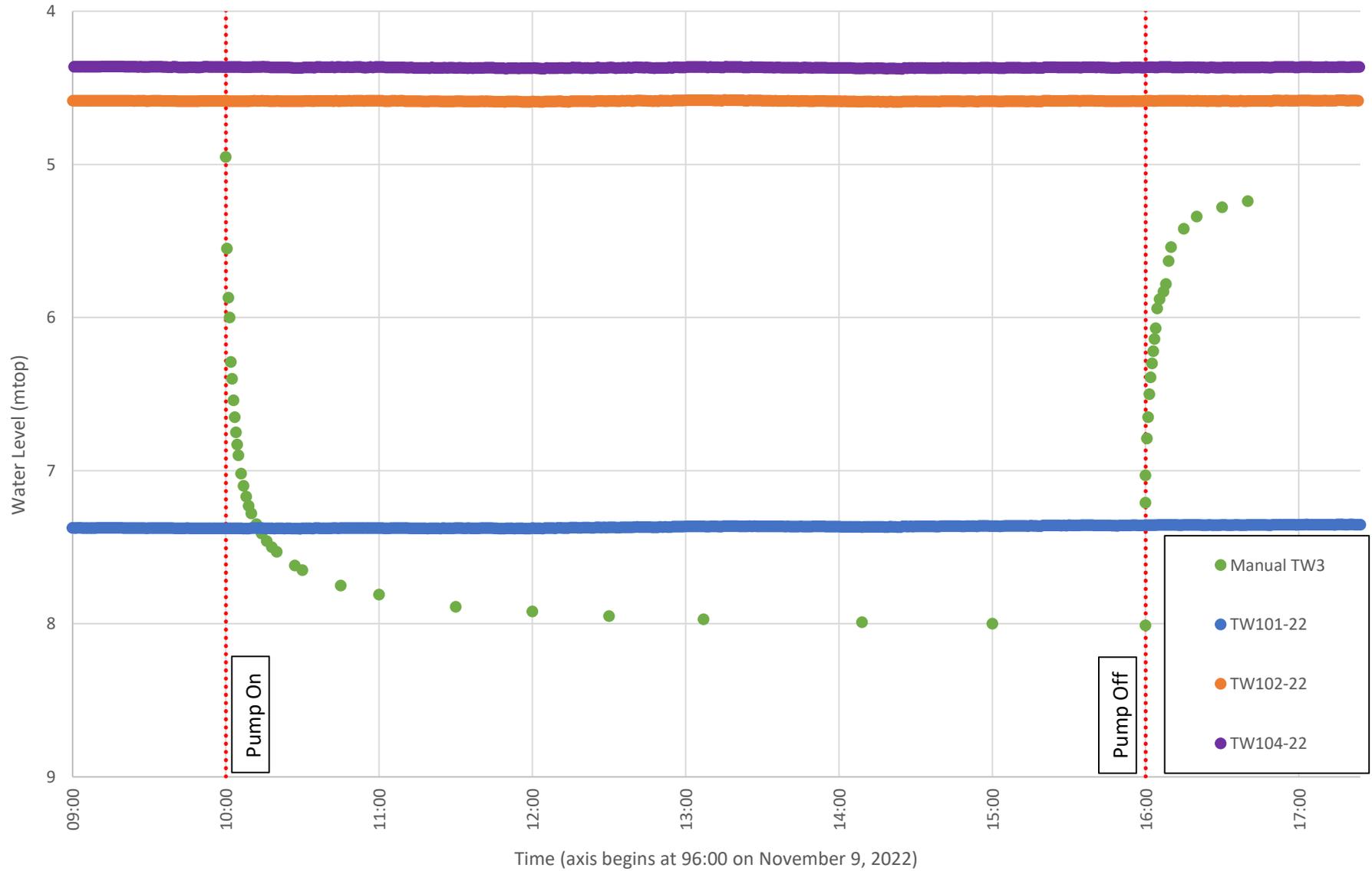


Figure 8. TW103-22 November 9, 2022 Pumping Test Hydrograph

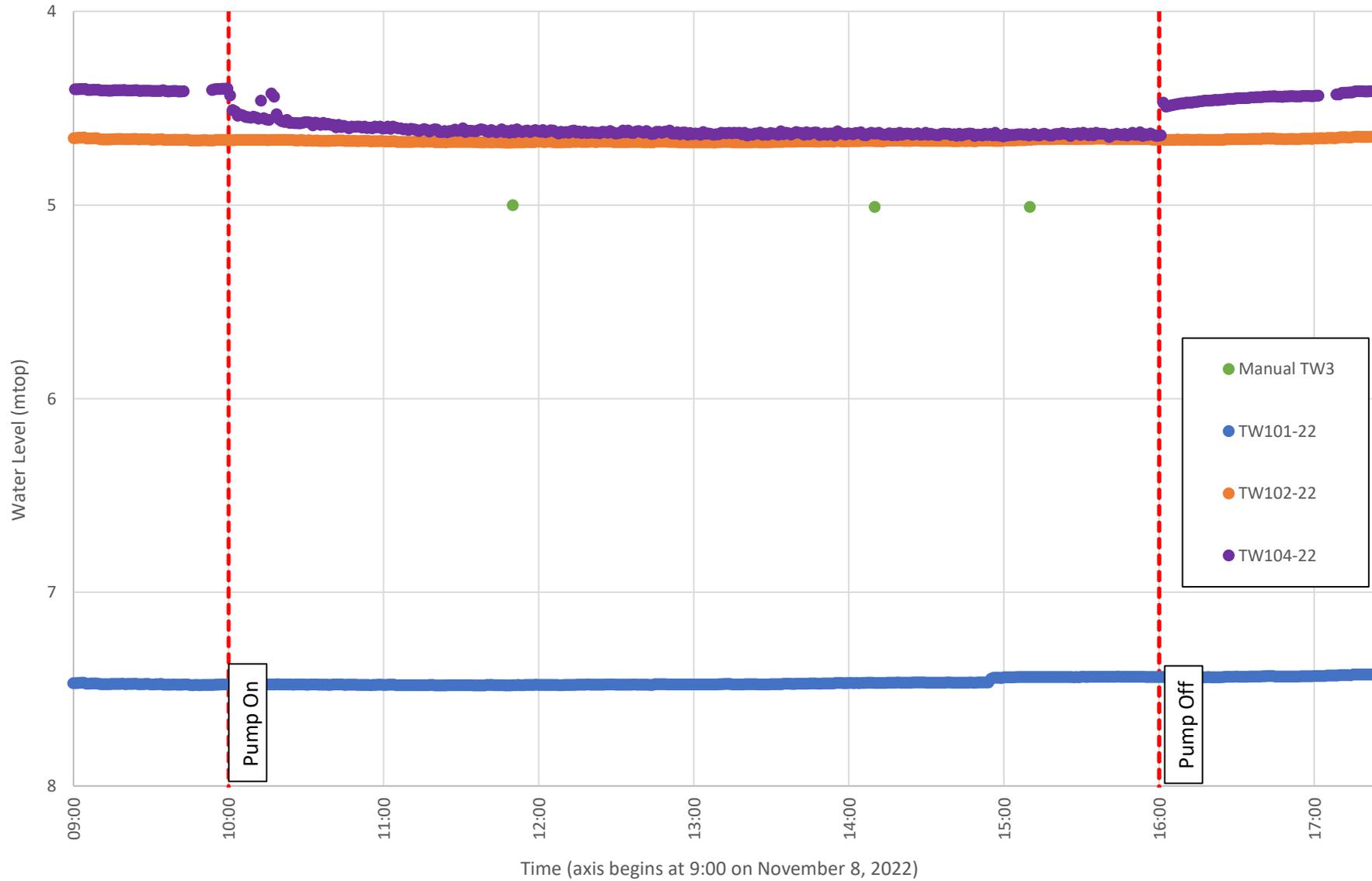
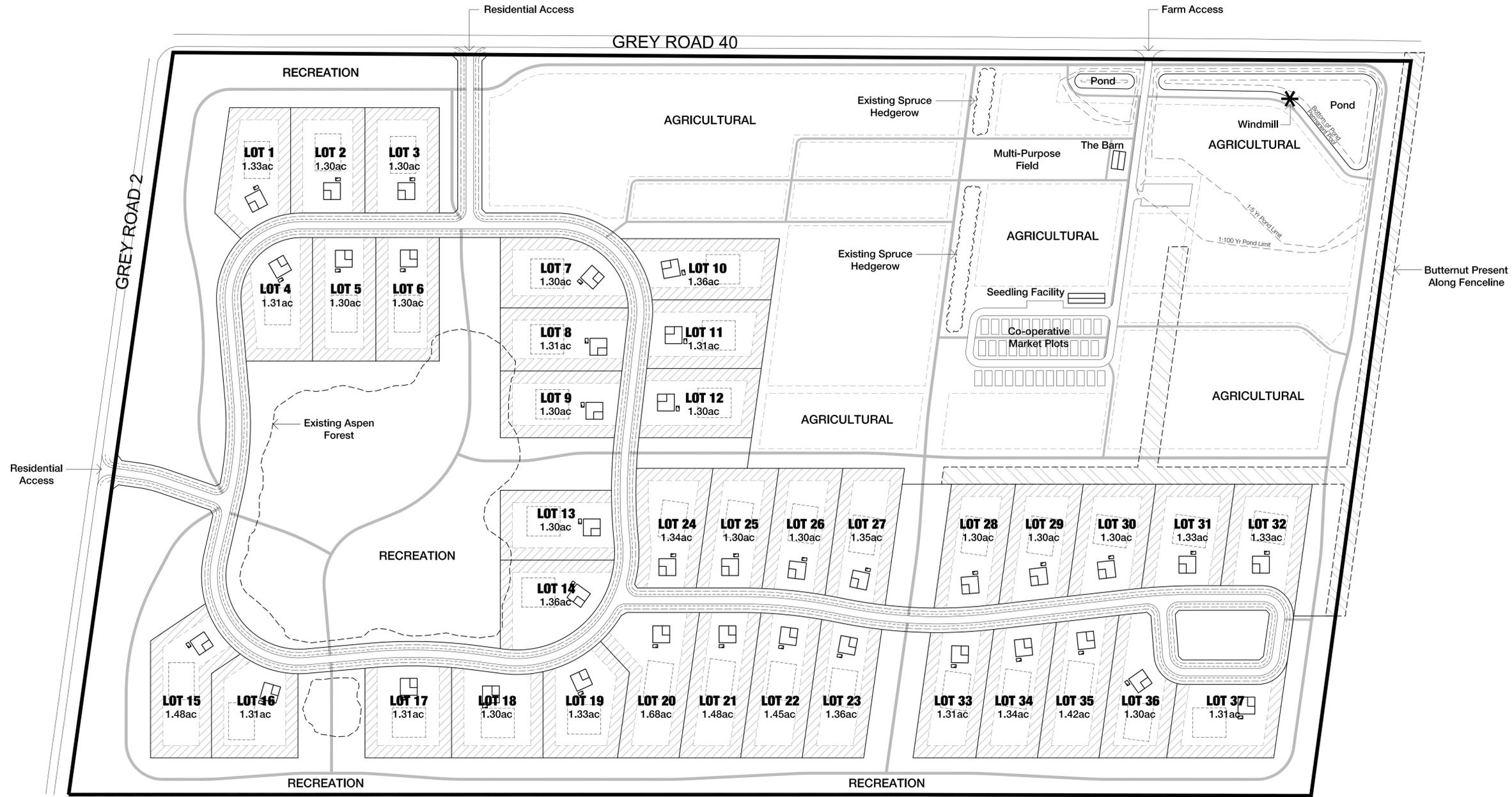


Figure 9. TW104-22 November 8, 2022 Pumping Test Hydrograph



Appendix A
Land Information and Proposed Development Plan

THORBURY ACRES
THORBURY, ONTARIO



LEGEND

- Site Boundary
- Naturalized Lot Buffer
- Butternut Tree Presence
- Trails
- Site Feature

SUMMARY

Site Area: ±151.5ac
 Total Lot Count: 37
 Road Length: 2,205.4m
 Trail Length: 7.1km

Total Residential: 49.6ac (32.8%)
 Residential - Cleared Area 28.7ac (19.0%)
 Residential - Naturalized Lot Buffer 20.9ac (13.8%)

Road: 10.9ac (7.2%)

**Residential + Road:
60.6ac (40.0%)**

Agricultural Lands: 52.1ac (34.4%)
 Recreational Lands: 38.8ac (25.6%)

**Agricultural / Recreational Lands:
91.0ac (60.0%)**

**Total Open Space (Ag, Rec and Lot Buffer)
111.9ac (73.8%)**



NAK
design strategies

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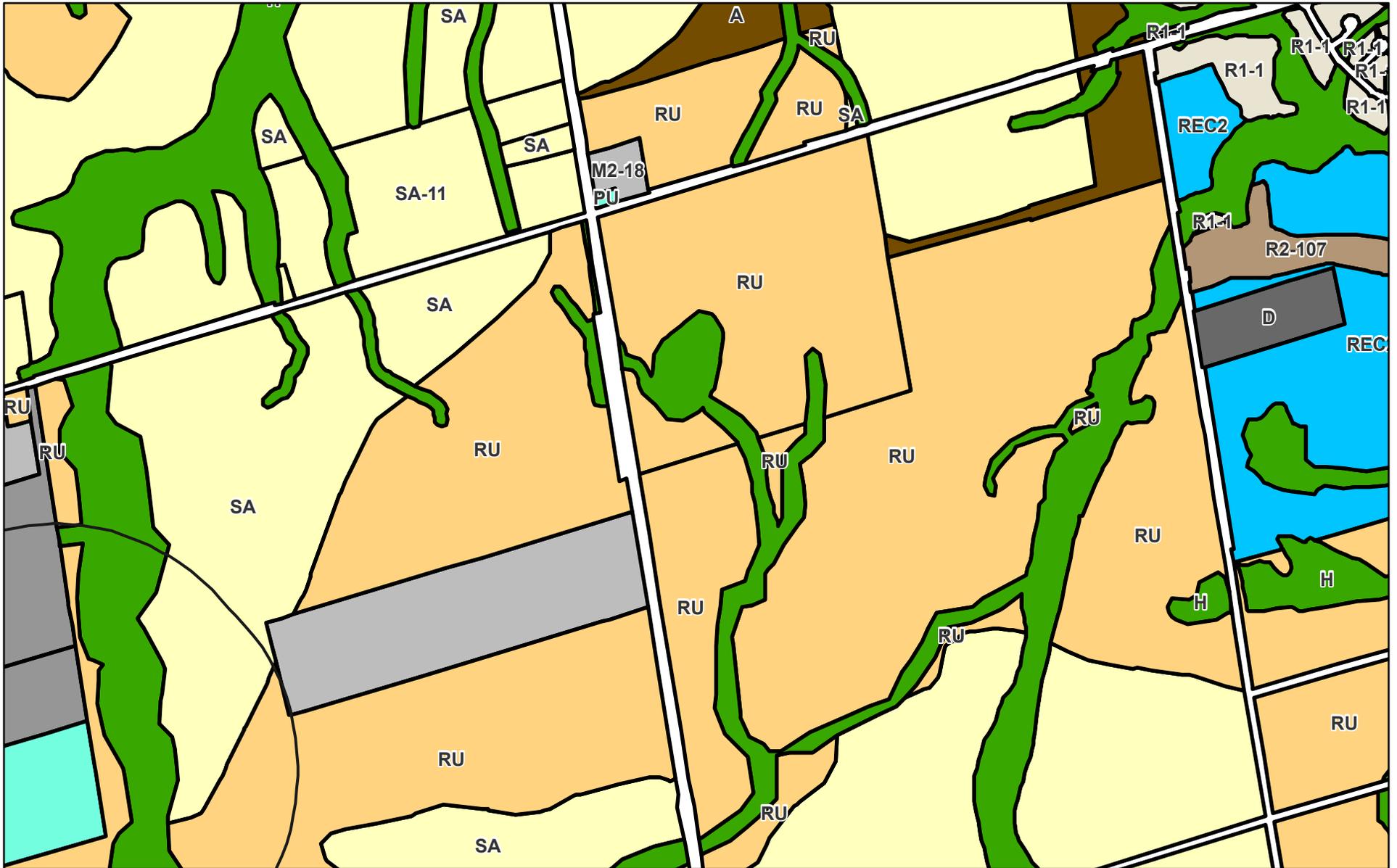
SCALE | 1:1750



DATE | 12.02.2022 PROJECT | 21-087

SP-08

Zoning Map



October 4, 2022

h Provision Overlay

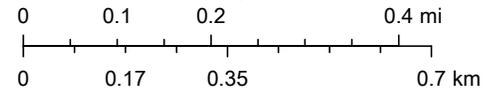
(h3) Landfill

TheBlueMountains_LandUse - Zoning Bylaw 2018-65 - Realign

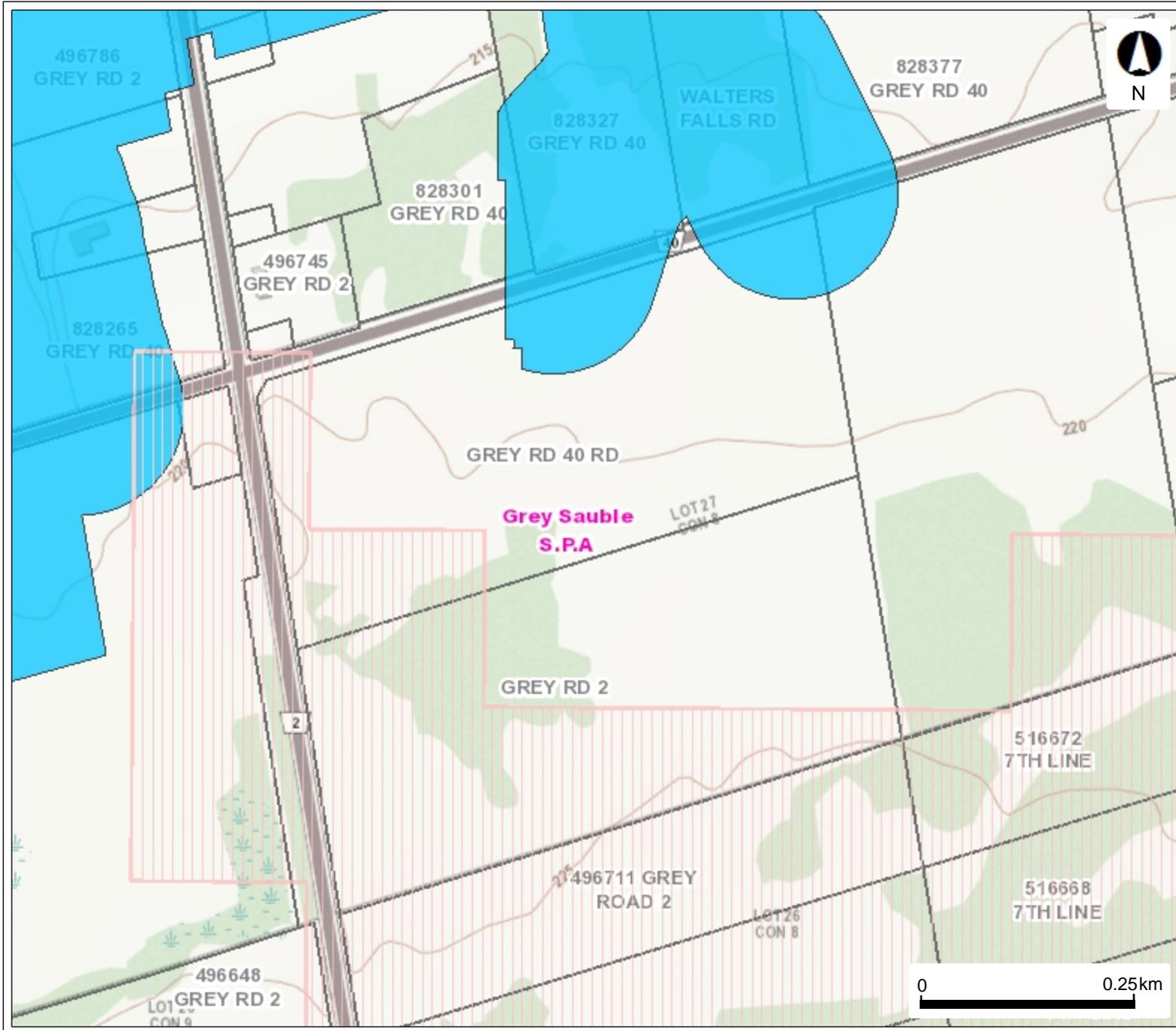
Residential One (R1-1)

- | | |
|---|---|
|  Residential Two (R2) |  Rural Employment (M2) |
|  Rural (R) |  Extractive Industrial (M3) |
|  Recreation Two (REC2) |  Development (D) |

1:18,056



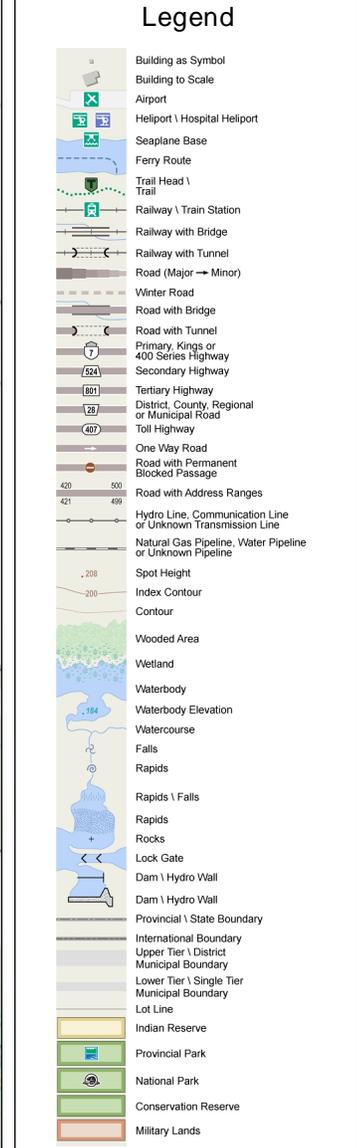
SPIA Map



Legend

-  Watercourse Direction
-  Source Protection Areas
-  Quaternary
-  Issue Contributing Areas
-  Highly Vulnerable Aquifers
-  Intake Protection Zone 1
-  Intake Protection Zone 2
-  Intake Protection Zone 3
-  Assessment Parcel with Adresse

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Projection: Web Mercator

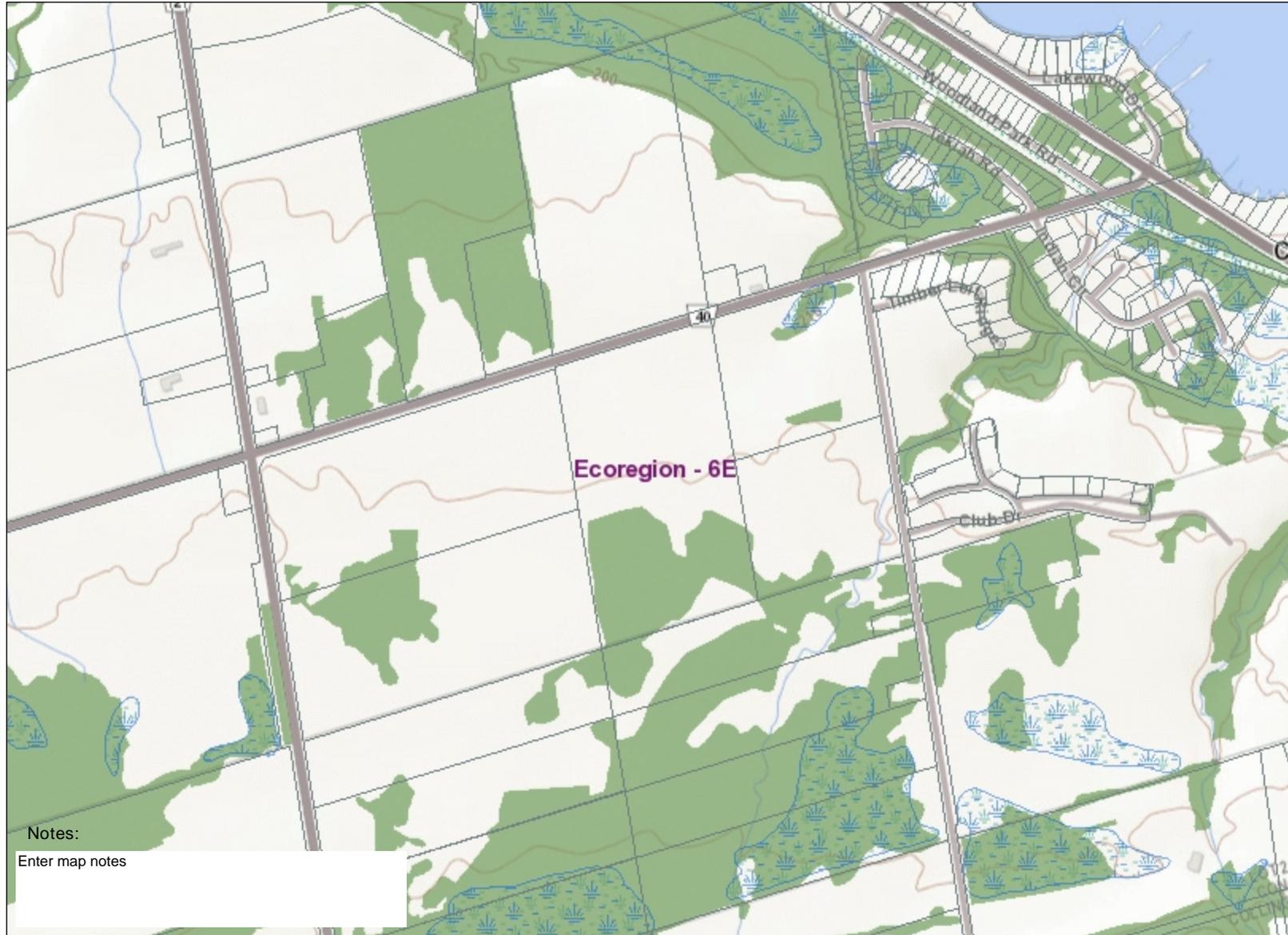


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Legend

-  Assessment Parcel
-  Ecoregion
- ANSI
-  Earth Science Provincially Significant/sciences de la terre d'importance provinciale
-  Earth Science Regionally Significant/sciences de la terre d'importance régionale
-  Life Science Provincially Significant/sciences de la vie d'importance provinciale
-  Life Science Regionally Significant/sciences de la vie d'importance régionale
- Evaluated Wetland
-  Provincially Significant/considérée d'importance provinciale
-  Non-Provincially Significant/non considérée d'importance provinciale
-  Unevaluated Wetland
-  Woodland



Enter an address to search your property
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at the end of address.



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-  GSC REGULATED AREA (ON REG. 151/06)
-  GREY SAUBLE BOUNDARY
-  MUNICIPAL BOUNDARY



Appendix B
Borehole Logs and Test Pit Logs



Client: Thornbury Acres Holding Inc. **Project Name:** Thornbury Acres **Project No.:** 14266-001
Contractor: Walker Drilling **Method:** Hollow Stem Augers **Date Completed:** September 22, 2022
Location: Grey County Road 40 & Road 2, Blue Mountains, ON **UTM:** 17T, 4931343 m N, 545208 m E **Elevation:** 102.28 m Rel. El.

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture			SPT (N) / DCPT	Well Installation	Remarks			
								25	50	75	10	20	30	40		
102	0	TOPSOIL: (~ 150 mm thick)		1A												
		SAND: (SP) trace silt, brown; non-cohesive, moist, compact		1B	SS	50	10									
	-1	SILT: (ML) some clay, some sand, trace gravel; brown; non-cohesive, moist, very dense to dense		2	SS	60	68									
	-2			3	SS	60	100									
	-3		- becomes grey at 2.6 mbgs	4	SS	75	46									
	-4			5	SS	65	48									
	-5		- becomes wet at 3.5 mbgs													
	-5	SAND: (SP) trace gravel, grey; non-cohesive, wet, dense		6	SS	100	47									
	-6		Borehole terminated at 5.2 mbgs due to target depth achieved													

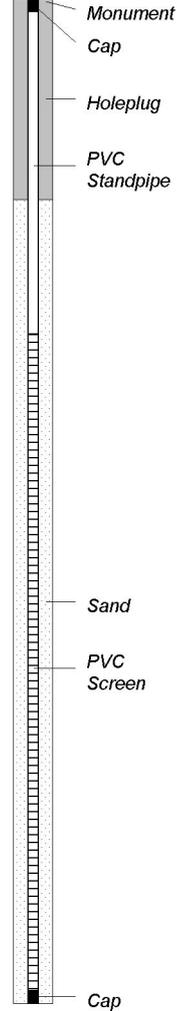
Monument
Cap
Holeplug
PVC Standpipe
Sand
PVC Screen
Cap

GSA SS4:
1% Gravel
16% Sand
66% Silt
17% Clay



Client: Thornbury Acres Holding Inc. **Project Name:** Thornbury Acres **Project No.:** 14266-001
Contractor: Walker Drilling **Method:** Hollow Stem Augers **Date Completed:** September 22, 2022
Location: Grey County Road 40 & Road 2, Blue Mountains, ON **UTM:** 17T, 4931457 m N, 545604 m E **Elevation:** 101.00 m Rel. El.

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture			SPT (N) / DCPT	Well Installation	Remarks			
								25	50	75	10	20	30	40		
0		TOPSOIL: (~ 150 mm thick)		1A												
		SANDY SILT: (ML) some clay, trace gravel, brown; non-cohesive, moist, loose		1B	SS	50	5									
100	1	SILTY SAND: (SM) trace clay; brown; non-cohesive, moist, compact to dense		2	SS	40	10									
		- decreased gravel content														
99	2	- becomes grey at 2 mbgs		3	SS	100	17									
98	3			4	SS	75	23									
97	4			5	SS	80	33									
96	5			6	SS	70	35									
95	6		Borehole terminated at 5.2 mbgs due to target depth achieved													



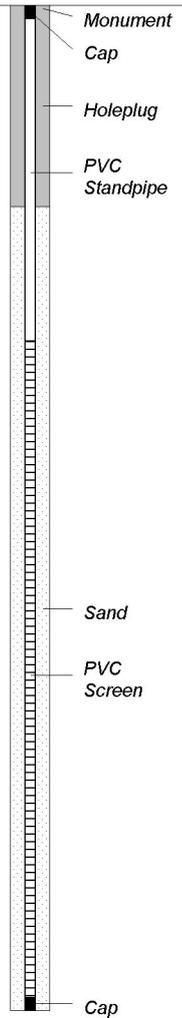
50 mm diameter monitoring well with a 3.0 m screen. Groundwater level measured in monitoring well at a depth of about 0.9 mbgs on September 30th, 2022 and 1.0 mbgs on October 25, 2022

GSA SS3:
0% Gravel
71% Sand
27% Silt
2% Clay



Client: Thornbury Acres Holding Inc. **Project Name:** Thornbury Acres **Project No.:** 14266-001
Contractor: Walker Drilling **Method:** Hollow Stem Augers **Date Completed:** September 22, 2022
Location: Grey County Road 40 & Road 2, Blue Mountains, ON **UTM:** 17T, 4930900 m N, 545369 m E **Elevation:** 106.05 m Rel. El.

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture			SPT (N) / DCPT	Well Installation	Remarks			
								25	50	75	10	20	30	40		
106	0	TOPSOIL: (~ 150 mm thick)		1A												
		SANDY SILT: (ML) some clay, brown; non-cohesive, moist, loose		1B	SS	50	7									
105	1	SILTY SAND: (SM) trace clay; brown; non-cohesive, moist to wet, compact to dense		2	SS	70	16									
		- becomes wet at 1.5 mbgs														
104	2			3	SS	80	37									
103	3	SAND AND SILT: (ML) trace clay; grey; non-cohesive, wet, very dense		5	SS	70	50									
102	4															
101	5	SAND: (SP) some silt, grey; non-cohesive, wet, compact		6	SS	80	28									
100	6		Borehole terminated at 5.2 mbgs due to target depth achieved													Borehole was open and dry upon completion of drilling



50 mm diameter monitoring well with a 3.0 m screen. Groundwater level measured in monitoring well at a depth of about 0.2 mbgs on September 30th, 2022 and 0.3 mbgs on October 25, 2022

GSA SS3:
0% Gravel
67% Sand
30% Silt
3% Clay

GSA SS5:
0% Gravel
49% Sand
47% Silt
4% Clay



Client: Thornbury Acres Holding Inc. **Project Name:** Thornbury Acres **Project No.:** 14266-001
Contractor: Walker Drilling **Method:** Hollow Stem Augers **Date Completed:** September 26, 2022
Location: Grey County Road 40 & Road 2, Blue Mountains, ON **UTM:** 17T, 4931238 m N, 546082 m E **Elevation:** 104.46 m Rel. El.

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture			SPT (N) / DCPT	Well Installation	Remarks			
								25	50	75	10	20	30	40		
104	0	TOPSOIL: (~ 450 mm thick)		1	SS	30	8									50 mm diameter monitoring well with a 3.0 m screen. Monitoring well was measured as dry on September 30th, 2022 and on October 25, 2022 GSA SS4: 12% Gravel 43% Sand 34% Silt 11% Clay
	1	SAND: (SP) some silt, trace gravel, brown; non-cohesive, moist, compact to dense		2	SS	70	17									
	2			3	SS	80	32									
	3	SILTY SAND: (SM) some gravel, some clay; brown; non-cohesive, moist, compact to dense		4	SS	70	23									
	4	- trace clay, dense		5	SS	80	47									
	5	SAND: (SP) trace silt, brown; non-cohesive, moist to wet, very dense		6	SS	70	82									
99	6		Borehole terminated at 5.2 mbgs due to target depth achieved													



Client: Thornbury Acres Holding Inc. **Project Name:** Thornbury Acres **Project No.:** 14266-001
Contractor: Walker Drilling **Method:** Hollow Stem Augers **Date Completed:** September 26, 2022
Location: Grey County Road 40 & Road 2, Blue Mountains, ON **UTM:** 17T, 4931345 m N, 545446 m E **Elevation:** 102.58 m Rel. El.

SUBSURFACE PROFILE				SAMPLE						Well Installation	Remarks					
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture				SPT (N) / DCPT				
								25	50	75	10	20	30	40		
0			TOPSOIL: (~ 100 mm thick)	1A												
			SAND AND SILT: (ML) trace clay, brown; non-cohesive, moist, loose to compact	1B	SS	55	4									
102			- becomes wet at 0.8 mbgs													
	1			2	SS	70	13									
101				3	SS	65	16									
	2															
			- trace gravel, decreased clay content													
100				4	SS	100	18									
	3															
			SAND: (SP) trace gravel, brown; non-cohesive, wet, compact	5	SS	100	24									
99																
	4															
98																
	5			6	SS	100	28									
97			Borehole terminated at 5.2 mbgs due to target depth achieved													
	6															

GSA SS4:
0% Gravel
62% Sand
35% Silt
3% Clay

Borehole caved to a depth of about 3.7 mbgs and groundwater level measured in borehole at a depth of about 3.4 mbgs upon completion of drilling



Client: Thornbury Acres Holding Inc. **Project Name:** Thornbury Acres **Project No.:** 14266-001
Contractor: Walker Drilling **Method:** Hollow Stem Augers **Date Completed:** September 26, 2022
Location: Grey County Road 40 & Road 2, Blue Mountains, ON **UTM:** 17T, 4931124 m N, 545686 m E **Elevation:** 105.92 m Rel. El.

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture			SPT (N) / DCPT	Well Installation	Remarks			
								25	50	75	10	20	30	40		
0			TOPSOIL: (~ 450 mm thick)	1	SS	40	12									
105	1		SANDY SILT: (ML) trace clay, trace gravel, brown; non-cohesive, moist, dense to very dense	2	SS	80	42									
104	2		- becomes grey at 2.3 mbgs	3	SS	65	42									
103	3			4	SS	50	100									GSA SS4: 7% Gravel 29% Sand 55% Silt 9% Clay
102	4			5	SS	60	80									
101	5		- decreased gravel content	6	SS	70	113									
100	6		Borehole terminated at 5.2 mbgs due to target depth achieved													Borehole was open and dry upon completion of drilling



Client: Thornbury Acres Holding Inc. **Project Name:** Thornbury Acres **Project No.:** 14266-001
Contractor: Walker Drilling **Method:** Hollow Stem Augers **Date Completed:** September 26, 2022
Location: Grey County Road 40 & Road 2, Blue Mountains, ON **UTM:** 17T, 4931237 m N, 545923 m E **Elevation:** 104.41 m Rel. El.

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture			SPT (N) / DCPT				Well Installation	Remarks
								25	50	75	10	20	30	40		
0			TOPSOIL: (~ 175 mm thick)													
104			SAND: (SP) trace gravel, trace silt, brown; non-cohesive, moist, compact	1	SS	40	13									
	1		SANDY SILT: (ML) some clay, some gravel; brown; non-cohesive, moist, very dense	2	SS	80	61									
103			- trace clay													
	2			3	SS	80	84									
102			- becomes grey at 2.3 mbgs													
	3			4	SS	80	56									
101			- trace gravel													
	4															
100																
	5			6	SS	70	83									
99			Borehole terminated at 5.2 mbgs due to target depth achieved													
	6															

GSA SS3:
12% Gravel
26% Sand
45% Silt
17% Clay

Borehole was open and dry upon completion of drilling

TEST PIT LOGS

Geotechnical Investigation : Thornbury Acres

Technician: NH

Cambium Reference No. 14266-001

Completed: September 26, 2022



Test Pit ID	Depth (mbgs ¹)	Soil Sample	Moisture Content (%)	Material Description	Depth (m)	Inferred 'N' Value
TP101-22 4931403 m N 545234 m E	0.0 - 0.15	GS1 GS2	11.6 17.3	TOPSOIL: (~ 150mm thick) FILL (SM) - SANDY SILT, some clay; dark brown; non-cohesive, moist (SP) - SAND; light brown; non-cohesive, moist No sloughing, seepage or groundwater observed in open test pit upon completion Test pit terminated at 2.6 mbgs		
	0.15 - 1.22 1.22 - 1.98					
TP102-22 4931567 m N 545365 m E	0.0 - 0.15	GS1 & GS2	19.0 & 16.7	TOPSOIL: (~ 150mm thick) (SP) - SAND, some silt, trace gravel; brown; non-cohesive, moist (SP) - SAND, trace silt; light brown; non-cohesive, moist No sloughing, seepage or groundwater observed in open test pit upon completion Test pit terminated at 2.29 mbgs		
	0.15 - 0.91 0.91 - 2.29					
TP103-22 4931569 m N 545683 m E	0.0 - 0.30	GS1 GS2	8.6 8.5	TOPSOIL: (~ 300mm thick) (SP) - SAND, trace gravel, trace silt; brown; non-cohesive, moist, compact to very dense (ML) sandy SILT some clay; brown; non-cohesive, moist, very dense - becomes grey at 2.59 mbgs No sloughing, seepage or groundwater observed in open test pit upon completion Test pit terminated at 3.05 mbgs	0.15 - 0.25	12
	0.30 - 1.83				0.30 - 0.35	17
	1.83 - 3.05	0.35 - 0.45	21			
		0.45 - 0.55	24			
		0.55 - 0.65	29			
		0.65 - 0.75	31			
		0.75 - 0.85	39			
		0.85 - 0.95	41			
		0.95 - 1.05	38			
		1.05 - 1.15	41			
		1.15 - 1.25	38			
		1.25 - 1.35	38			
		1.35 - 1.45	46			
	1.45 - 1.55	51				
	1.55 - 1.65	52				
	1.65 - 1.75	57				
	1.75 - 1.85	60				
	1.85 - 1.95	60				
TP104-22 4931570 m N 545842 m E	0.0 - 0.60	GS1	13.0	TOPSOIL: (~ 600mm thick) (SP) - SAND, some silt, trace gravel; brown; non-cohesive, dry to moist -becomes grey at 2.20 mbgs No sloughing, seepage or groundwater observed in open test pit upon completion Test pit terminated at 2.20 mbgs		
	0.60 - 2.10					

¹: metres below ground surface

²: Dynamic Penetration Test

TEST PIT LOGS

Geotechnical Investigation : Thornbury Acres

Technician: NH

Cambium Reference No. 14266-001

Completed: September 26, 2022



Test Pit ID	Depth (mbgs ¹)	Soil Sample	Moisture Content (%)	Material Description	Depth (m)	Inferred 'N' Value
TP105-22 4931571 m N 546001 m E	0.0 - 0.30 0.30 - 1.07 1.07 - 2.13	GS1 & GS2	12.2 & 12.3	<p>TOPSOIL: (~ 300mm thick)</p> <p>(SP) - SAND, some silt, trace gravel, trace clay; brown; non-cohesive, moist</p> <p>(ML) - SILT, some sand, trace clay, trace gravel; brown; non-cohesive, moist</p> <p>-becomes grey at 1.83 mbgs</p> <p>No sloughing, seepage or groundwater observed in open test pit upon completion</p> <p>GS1 lab results - 2% gravel, 19% sand, 71% silt, 8% clay, T-Time = 25 min/cm</p> <p>Test pit terminated at 2.13 mbgs</p>		
TP106-22 4931233 m N 545288 m E	0.0 - 0.15 0.15 - 2.90	GS1	18.9	<p>TOPSOIL: (~ 150mm thick)</p> <p>(ML) - SILT, some sand, trace clay; brown; non-cohesive, moist, compact to very dense</p> <p>No sloughing, seepage or groundwater observed in open test pit upon completion</p> <p>GS1 lab results - 10% sand, 83% silt, 7% clay, T-Time = 20 min/cm</p> <p>Test pit terminated at 2.90 mbgs</p>	0.15 - 0.25 0.30 - 0.35 0.35 - 0.45 0.45 - 0.55 0.55 - 0.65 0.65 - 0.75 0.75 - 0.85 0.85 - 0.95 0.95 - 1.05 1.05 - 1.15 1.15 - 1.25 1.25 - 1.35 1.35 - 1.45 1.45 - 1.55	15 20 24 25 31 35 40 43 48 52 54 55 55 55
TP107-22 4931345 m N 545446 m E	0.0 - 0.15 0.15 - 1.52 1.52 - 2.44	GS1	-	<p>TOPSOIL: (~ 150mm thick)</p> <p>(SP) - SAND, some silt, trace gravel; brown; non-cohesive, dry</p> <p>(SM) - SILTY SAND, trace gravel, brown; non-cohesive, moist</p> <p>No sloughing, seepage or groundwater observed in open test pit upon completion</p> <p>Test pit terminated at 2.44 mbgs</p>		
TP108-22 4931234 m N 545527 m E	0.0 - 0.30 0.30 - 2.29	GS1	9.9	<p>TOPSOIL: (~ 300mm thick)</p> <p>(SP) - SAND, some silt, trace gravel; non-cohesive, moist</p> <p>No sloughing, seepage or groundwater observed in open test pit upon completion</p> <p>Test pit terminated at 2.29 mbgs</p>		

¹: metres below ground surface

²: Dynamic Penetration Test

TEST PIT LOGS

Geotechnical Investigation : Thornbury Acres

Technician: NH

Cambium Reference No. 14266-001

Completed: September 26, 2022



Test Pit ID	Depth (mbgs ¹)	Soil Sample	Moisture Content (%)	Material Description	Depth (m)	Inferred 'N' Value
TP109-22 4931347 m N 545685 m E	0.0 - 0.15			TOPSOIL: (~ 150mm thick)	0.15 - 0.25	8
	0.15 - 0.76	GS1	12.4	(SP) - SAND, some silt, trace gravel; brown; non-cohesive, moist, compact	0.30 - 0.35	10
	0.76 - 1.68	GS2	16.5	(ML) - SANDY SILT, some clay, trace gravel; brown; non-cohesive, moist, dense to very dense	0.35 - 0.45	15
	1.68 - 2.04	GS3	17.2	(ML) - SANDY SILT, some clay, trace gravel; brown; non-cohesive, moist, very dense	0.45 - 0.55	16
					0.55 - 0.65	24
					0.65 - 0.75	26
					0.75 - 0.85	32
					0.85 - 0.95	35
					0.95 - 1.05	36
					1.05 - 1.15	41
					1.15 - 1.25	38
					1.25 - 1.35	43
					1.35 - 1.45	47
					1.45 - 1.55	51
				1.55 - 1.65	55	
				1.65 - 1.75	55	
				1.75 - 1.85	55	
				No sloughing, seepage or groundwater observed in open test pit upon completion		
				Test pit terminated at 2.04 mbgs		
TP110-22 4931459 m N 545922 m E	0.0 - 0.30			TOPSOIL: (~ 300mm thick)		
	0.30 - 1.83	GS1	13.7	(SP) - SAND, some silt, trace gravel; brown; non-cohesive, moist		
	1.83 - 2.13	GS2	10.0	(ML) - SANDY SILT, some clay, trace gravel; grey; non-cohesive, moist		
				No sloughing, seepage or groundwater observed in open test pit upon completion		
				Test pit terminated at 2.13 mbgs		
TP111-22 4931011 m N 545290 m E	0.0 - 0.15			TOPSOIL: (~ 150mm thick)	0.15 - 0.25	16
	0.15 - 0.76			(SM) - SILTY SAND, trace clay, trace gravel; brown; non-cohesive, moist, compact to dense	0.30 - 0.35	19
	0.76 - 1.07	GS1	15.5	(GM/SP) - SAND and GRAVEL, brown; non-cohesive, wet, dense to very dense	0.35 - 0.45	11
	1.07 - 2.90			(SP) - SAND, coarse medium grained, some silt, trace gravel, trace clay; brown; non-cohesive, saturated, very dense	0.45 - 0.55	15
					0.55 - 0.65	30
					0.65 - 0.75	32
					0.75 - 0.85	38
					0.85 - 0.95	36
					0.95 - 1.05	53
					1.05 - 1.15	63
				1.15 - 1.25	55	
				Sloughing, seepage and groundwater at 1.07 mbgs		
				Test pit terminated at 2.90 mbgs		

¹: metres below ground surface

²: Dynamic Penetration Test

TEST PIT LOGS

Geotechnical Investigation : Thornbury Acres

Technician: NH

Cambium Reference No. 14266-001

Completed: September 26, 2022



Test Pit ID	Depth (mbgs ¹)	Soil Sample	Moisture Content (%)	Material Description	Depth (m)	Inferred 'N' Value
TP112-22 4931123 m N 545527 m E	0.0 - 0.15 0.15 - 0.91 0.91 - 3.05	GS1 & GS2	11.8 & 8.6	TOPSOIL: (~ 150mm thick) (ML) - SANDY SILT, trace gravel; brown; cohesive, moist (SP) - SAND, some gravel, some silt, trace clay; brown; non-cohesive, wet Oxidized layer from 1.83 to 2.44 mbgs, mottled grey at 1.52 mbgs to termination depth No sloughing, seepage or groundwater observed in open test pit upon completion GS1 lab results - 15% gravel, 69% sand, 14% silt, 2% clay, T-Time = 8 min/cm Test pit terminated at 3.05 mbgs		
TP113-22 4931236 m N 545685 m E	0.0 - 0.15 0.15 - 1.98	GS1	9.6	TOPSOIL: (~ 150mm thick) (SP) - SAND, some silt, some gravel, some cobbles; brown; non-cohesive, dry No sloughing, seepage or groundwater observed in open test pit upon completion Test pit terminated at 1.98 mbgs		
TP114-22 4931170 m N 545022 m E	0.0 - 0.15 0.15 - 1.98	GS1	15.2	TOPSOIL: (~ 150mm thick) (ML) - SANDY SILT, trace clay, trace gravel; brown; non-cohesive, moist -becomes grey at 1.98 mbgs No sloughing, seepage or groundwater observed in open test pit upon completion Test pit terminated at 1.98 mbgs		
TP115-22 4931147 m N 545168 m E	0.0 - 0.15 0.15 - 2.13	GS1	12.3	TOPSOIL: (~ 150mm thick) (SM) - SILTY SAND, trace gravel; brown; non-cohesive, dry No sloughing, seepage or groundwater observed in open test pit upon completion Test pit terminated at 2.13 mbgs		
TP116-22 4931012 m N 545449 m E	0.0 - 0.15 0.15 - 0.61 0.61 - 1.98	GS1	19.1	TOPSOIL: (~ 150mm thick) (ML) - clayey SILT, trace sand; brown; cohesive, W~PL (ML) - clayey SILT, trace sand; brown; cohesive, W~PL -becomes grey at 1.52 mbgs No sloughing, seepage or groundwater observed in open test pit upon completion GS1 lab results - 2% sand, 78% silt, 20% clay, T-Time = 35 min/cm Test pit terminated at 1.98 mbgs		

¹: metres below ground surface

²: Dynamic Penetration Test

TEST PIT LOGS

Geotechnical Investigation : Thornbury Acres

Technician: NH

Cambium Reference No. 14266-001

Completed: September 26, 2022



Test Pit ID	Depth (mbgs ¹)	Soil Sample	Moisture Content (%)	Material Description	Depth (m)	Inferred 'N' Value
TP117-22 4931013 m N 545687 m E	0.0 - 0.15 0.15 - 2.13	GS1	10.5	TOPSOIL: (~ 150mm thick) (ML) - SILT, some gravel, some boulders, some cobbles, some clay; brown; non-cohesive, moist No sloughing, seepage or groundwater observed in open test pit upon completion Test pit terminated at 2.13 mbgs		
TP118-22 4931125 m N 545766 m E	0.0 - 0.30 0.30 - 2.29	GS1	11.7	TOPSOIL: (~ 300mm thick) (SM) - SILTY SAND, some gravel, some boulders and cobbles; brown; non-cohesive, dry, compact to very dense No sloughing, seepage or groundwater observed in open test pit upon completion Test pit terminated at 2.29 mbgs	0.15 - 0.25 0.30 - 0.35 0.35 - 0.45 0.45 - 0.55 0.55 - 0.65 0.65 - 0.75 0.75 - 0.85 0.85 - 0.95 0.95 - 1.05 1.05 - 1.15 1.15 - 1.25 1.25 - 1.35 1.35 - 1.45	11 13 24 21 40 35 41 52 49 49 48 55 55
TP119-22 4931238 m N 545083 m E	0.0 - 0.15 0.15 - 0.61 0.61 - 1.98	GS1 GS2	9.0 10.4	TOPSOIL: (~ 150mm thick) (SP) - SAND, some silt, trace gravel; brown; non-cohesive, dry (SP-ML) - SAND and SILT, some gravel, trace clay; brown; non-cohesive, moist No sloughing, seepage or groundwater observed in open test pit upon completion Test pit terminated at 1.98 mbgs		
TP120-22 4931142 m N 545280 m E	0.0 - 0.15 0.15 - 1.98	GS1	18.3	TOPSOIL: (~ 150mm thick) (ML) - CLAYEY SILT, cobbles and boulders; brown; cohesive, moist becomes grey at 1.83 mbgs No sloughing, seepage or groundwater observed in open test pit upon completion Test pit terminated at 1.98 mbgs		

¹: metres below ground surface

²: Dynamic Penetration Test



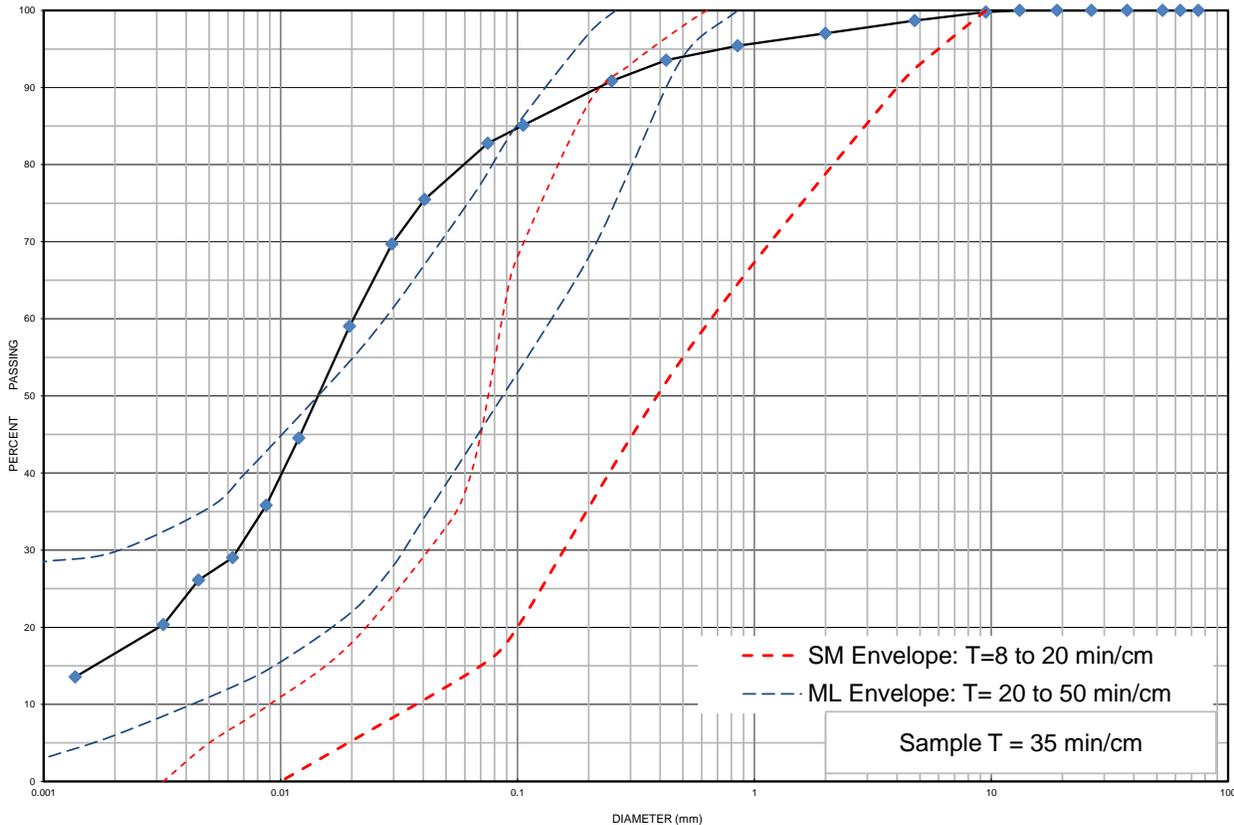
Appendix C
Grain Size Analysis Results



Grain Size Distribution Chart

Project Number: 14266-001 **Client:** Thornbury Acres Holdings
Project Name: Thornbury Acres - Geotechnical Investigation
Sample Date: September 27, 2022 **Sampled By:** Chris Malliaros - Cambium Inc.
Location: BH 101-22 SS 4 **Depth:** 2.3 m to 2.9 m **Lab Sample No:** S-22-1475

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 101-22	SS 4	2.3 m to 2.9 m	1	16	66	17	12.1
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Silt some Clay some Sand trace Gravel		ML	0.0210	0.0066	-	-	-

Additional information available upon request

Issued By: 
 (Senior Project Manager)

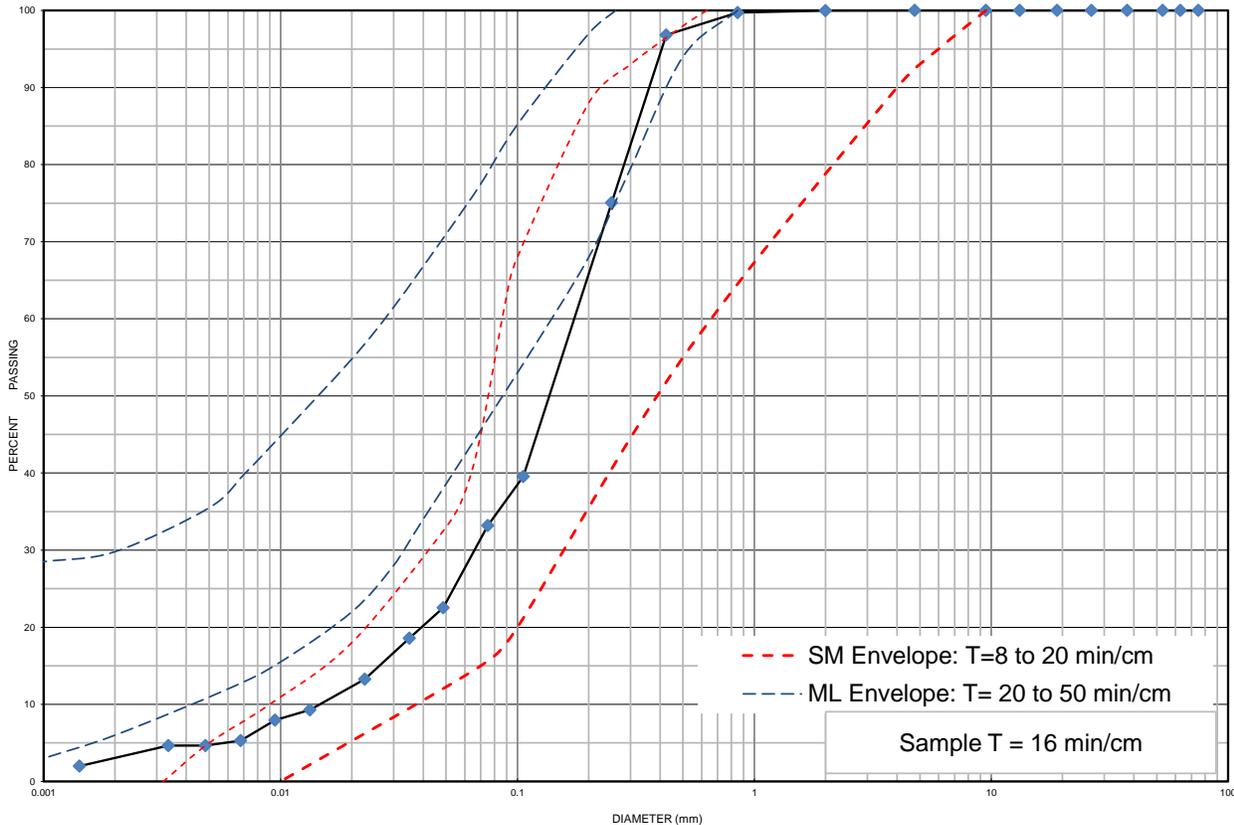
Date Issued: October 21, 2022



Grain Size Distribution Chart

Project Number: 14266-001 **Client:** Thornbury Acres Holdings
Project Name: Thornbury Acres - Geotechnical Investigation
Sample Date: September 27, 2022 **Sampled By:** Chris Malliaros - Cambium Inc.
Location: BH 103-22 SS 3 **Depth:** 1.5 m to 2.1 m **Lab Sample No:** S-22-1477

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 103-22	SS 3	1.5 m to 2.1 m	0	67	30	3	18.0
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Silty Sand trace Clay		SM	0.170	0.066	0.016	10.63	1.60

Additional information available upon request

Issued By: 
 (Senior Project Manager)

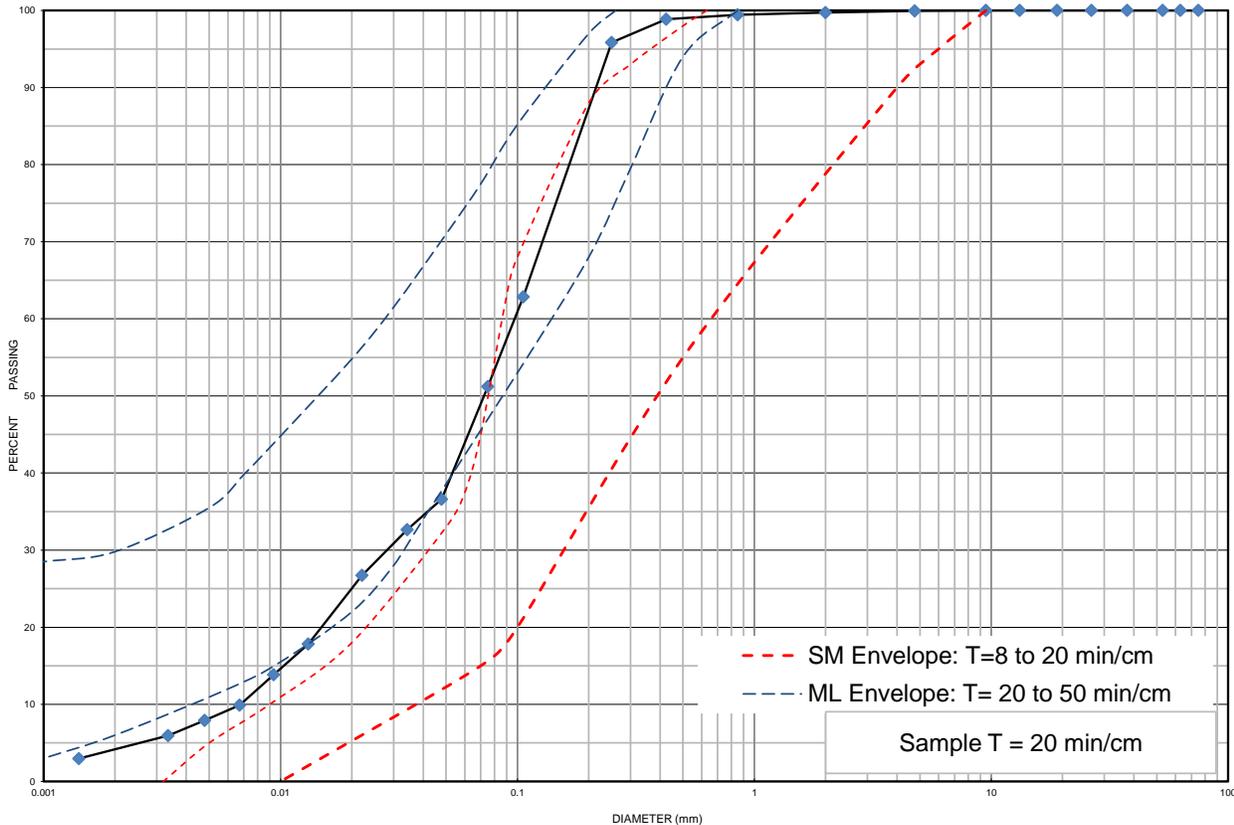
Date Issued: October 21, 2022



Grain Size Distribution Chart

Project Number: 14266-001 **Client:** Thornbury Acres Holdings
Project Name: Thornbury Acres - Geotechnical Investigation
Sample Date: September 27, 2022 **Sampled By:** Chris Malliaros - Cambium Inc.
Location: BH 103-22 SS 5 **Depth:** 3 m to 3.7 m **Lab Sample No:** S-22-1478

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 103-22	SS 5	3 m to 3.7 m	0	49	47	4	16.1
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Sand and Silt trace Clay		ML	0.0990	0.0280	0.0069	14.35	1.15

Additional information available upon request

Issued By: 
 (Senior Project Manager)

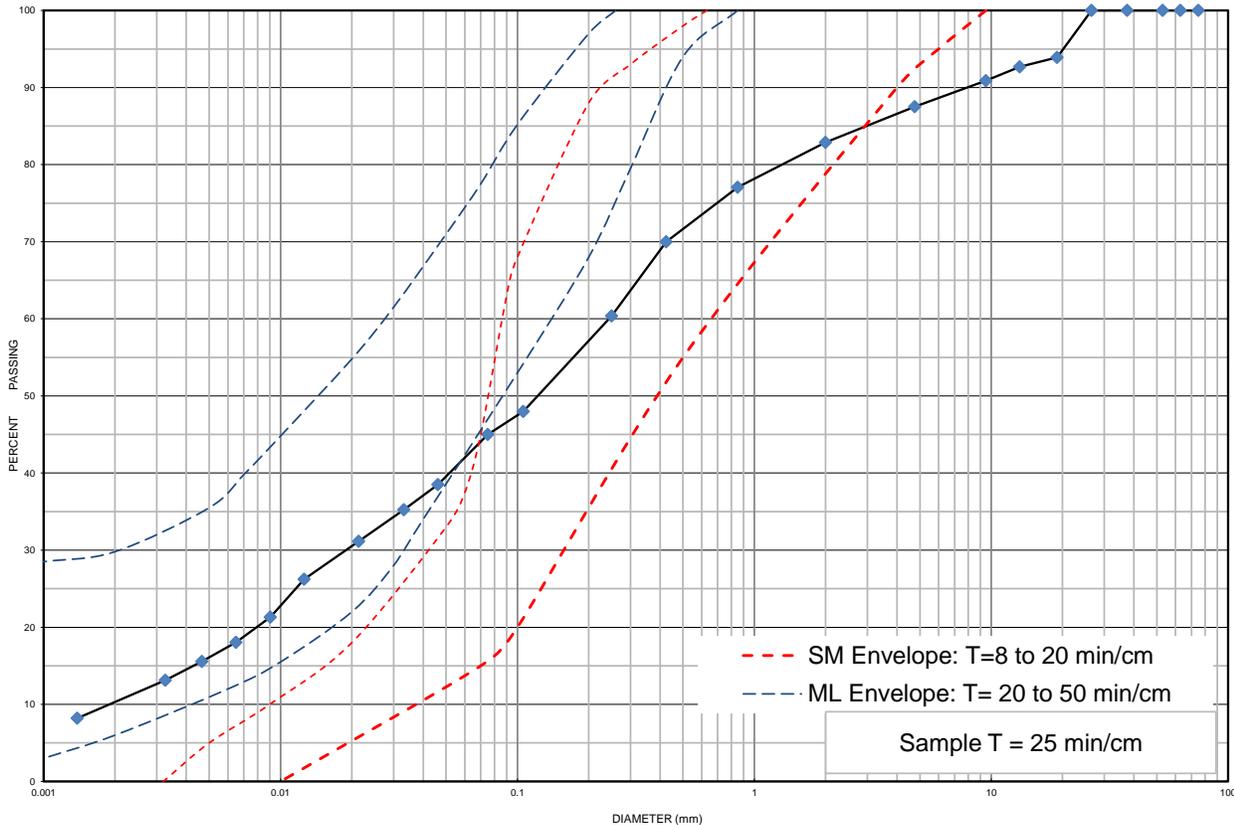
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Grain Size Distribution Chart

Project Number: 14266-001 **Client:** Thornbury Acres Holdings
Project Name: Thornbury Acres - Geotechnical Investigation
Sample Date: September 27, 2022 **Sampled By:** Chris Malliaros - Cambium Inc.
Location: BH 104-22 SS 4 **Depth:** 2.3 m to 2.9 m **Lab Sample No:** S-22-1479

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 104-22	SS 4	2.3 m to 2.9 m	12	43	34	11	8.3
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Silty Sand some Gravel some Clay		SM	0.2500	0.0190	0.0019	131.58	0.76

Additional information available upon request

Issued By: 
 (Senior Project Manager)

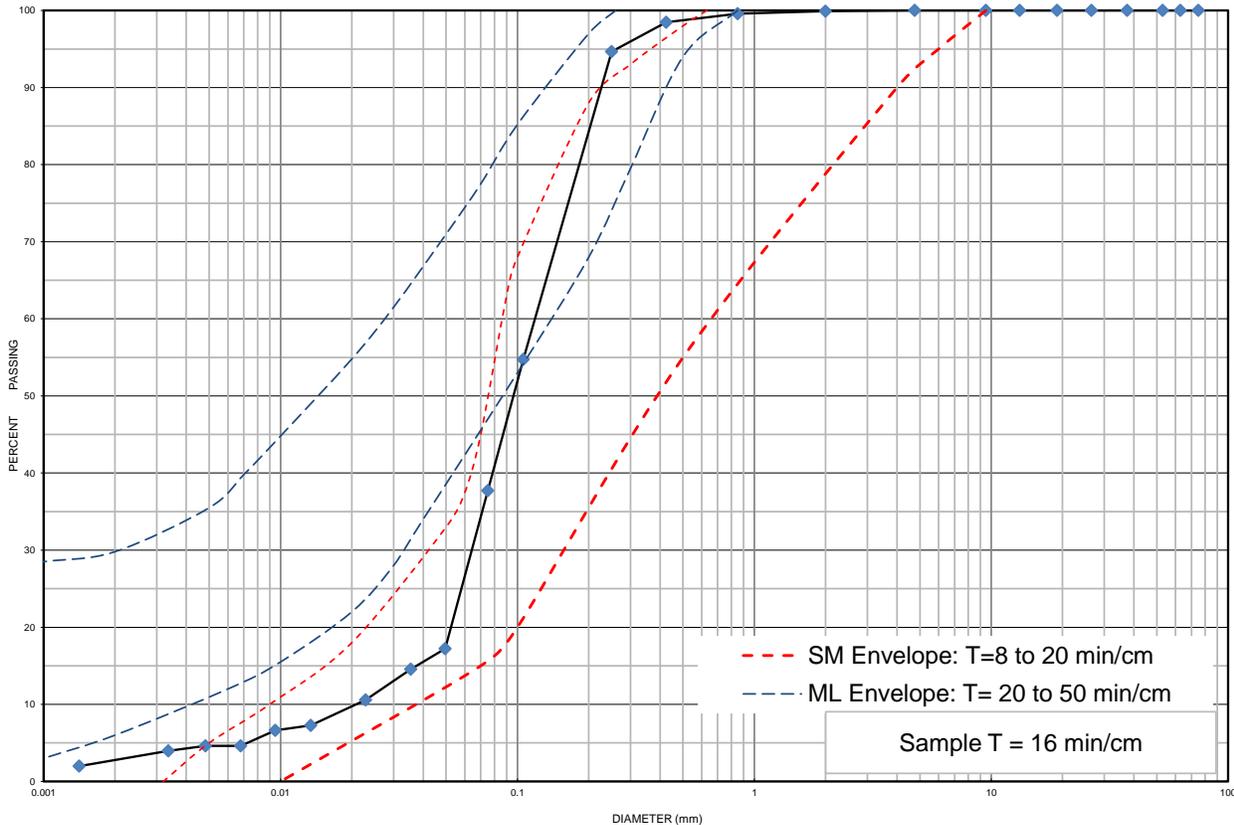
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Grain Size Distribution Chart

Project Number: 14266-001 **Client:** Thornbury Acres Holdings
Project Name: Thornbury Acres - Geotechnical Investigation
Sample Date: September 27, 2022 **Sampled By:** Chris Malliaros - Cambium Inc.
Location: BH 105-22 SS 4 **Depth:** 2.3 m to 2.9 m **Lab Sample No:** S-22-1480

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 105-22	SS 4	2.3 m to 2.9 m	0	62	35	3	20.5
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Sand and Silt trace Clay		SM	0.125	0.064	0.021	5.95	1.56

Additional information available upon request

Issued By: *John Bond*
 (Senior Project Manager)

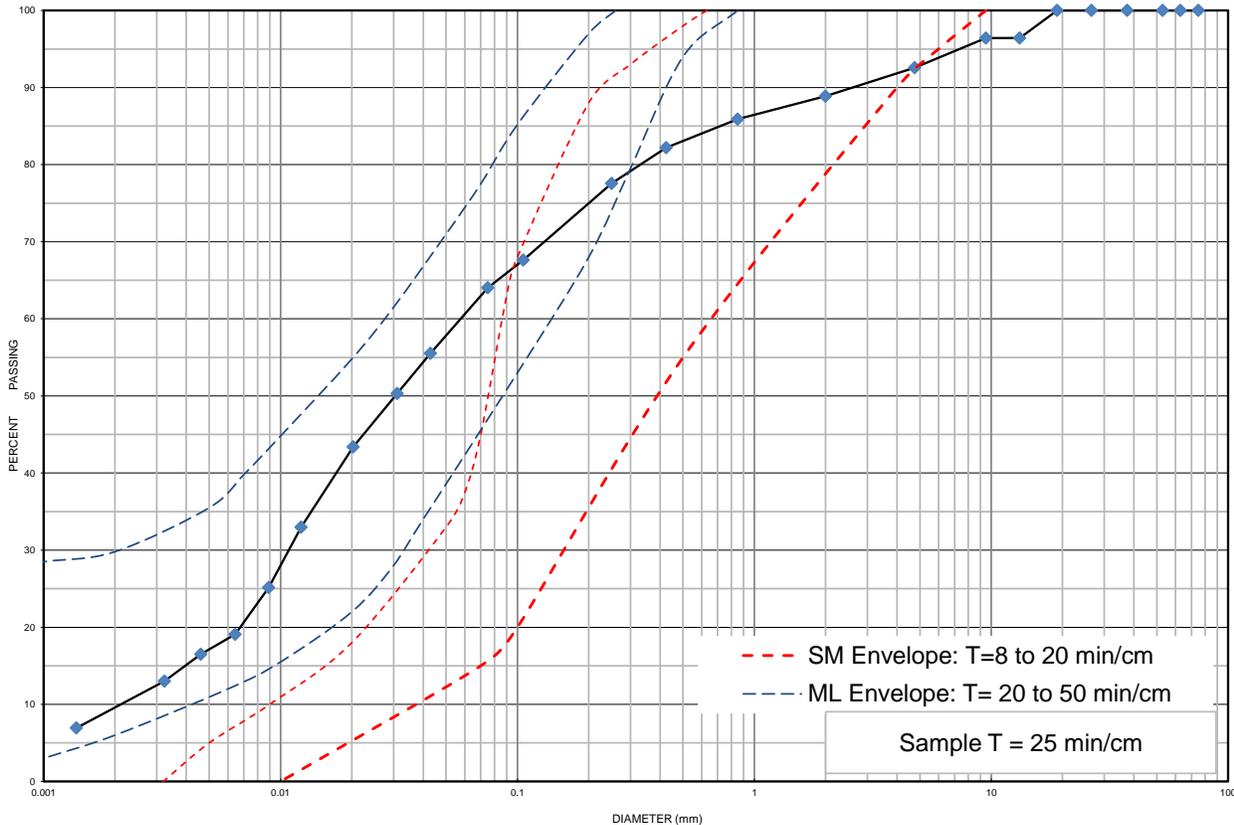
Date Issued: October 21, 2022



Grain Size Distribution Chart

Project Number: 14266-001 **Client:** Thornbury Acres Holdings
Project Name: Thornbury Acres - Geotechnical Investigation
Sample Date: September 27, 2022 **Sampled By:** Chris Malliaros - Cambium Inc.
Location: BH 106-22 SS 4 **Depth:** 2.3 m to 2.9 m **Lab Sample No:** S-22-1481

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 106-22	SS 4	2.3 m to 2.9 m	7	29	55	9	9.3
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Sandy Silt trace Clay trace Gravel		ML	0.0590	0.0120	0.0022	26.82	1.11

Additional information available upon request

Issued By: 
 (Senior Project Manager)

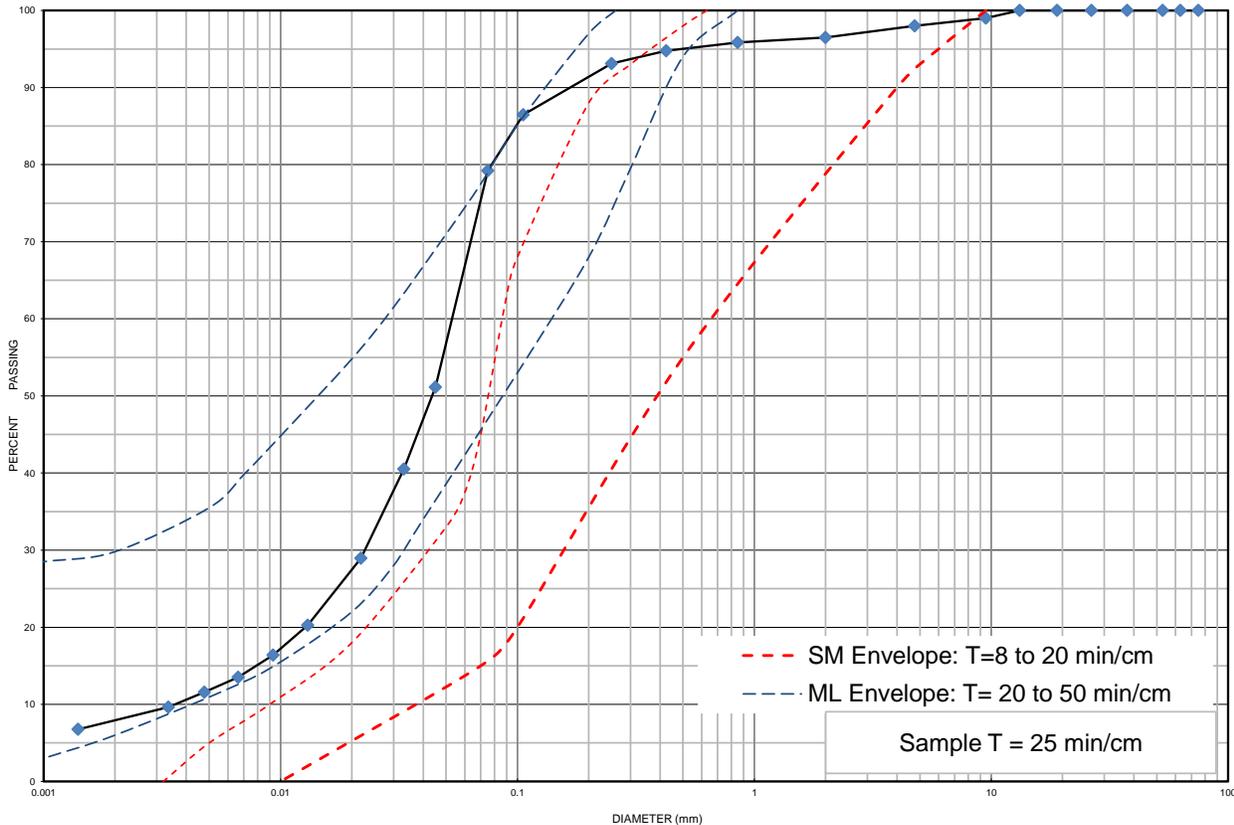
Date Issued: October 21, 2022



Grain Size Distribution Chart

Project Number: 14266-001 **Client:** Thornbury Acres Holdings
Project Name: Thornbury Acres - Geotechnical Investigation
Sample Date: September 27, 2022 **Sampled By:** Chris Malliaros - Cambium Inc.
Location: TP 105-22 GS 1 **Depth:** 1.1 m to 1.4 m **Lab Sample No:** S-22-1483

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
TP 105-22	GS 1	1.1 m to 1.4 m	2	19	71	8	12.2
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Silt some Sand trace Clay trace Gravel		ML	0.0530	0.0230	0.0035	15.14	2.85

Additional information available upon request

Issued By: 
 (Senior Project Manager)

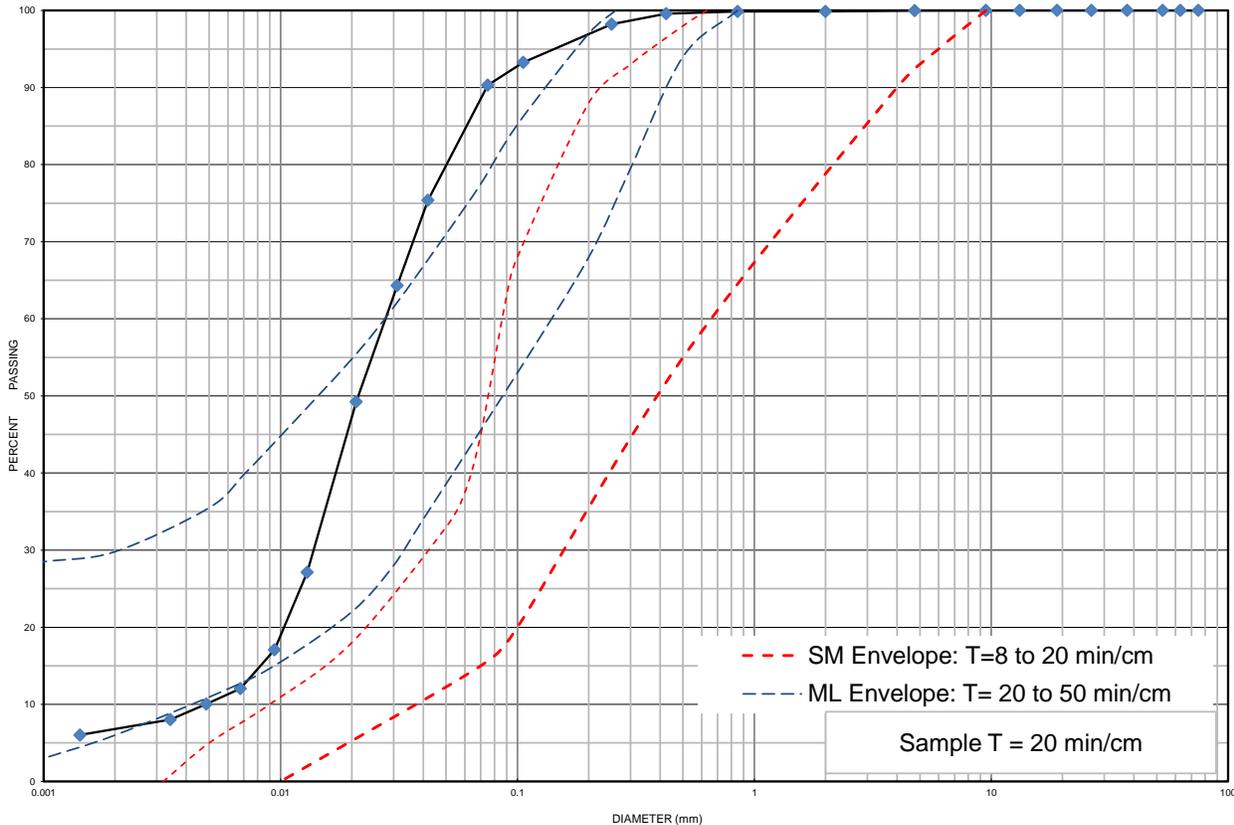
Date Issued: October 21, 2022



Grain Size Distribution Chart

Project Number: 14266-001 **Client:** Thornbury Acres Holdings
Project Name: Thornbury Acres - Geotechnical Investigation
Sample Date: September 27, 2022 **Sampled By:** Chris Malliaros - Cambium Inc.
Location: TP 106-22 GS 1 **Depth:** 0.6 m to 1.1 m **Lab Sample No:** S-22-1484

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
TP 106-22	GS 1	0.6 m to 1.1 m	0	10	83	7	18.9
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Silt some Sand trace Clay		ML	0.0270	0.0140	0.0049	5.51	1.48

Additional information available upon request

Issued By: 
 (Senior Project Manager)

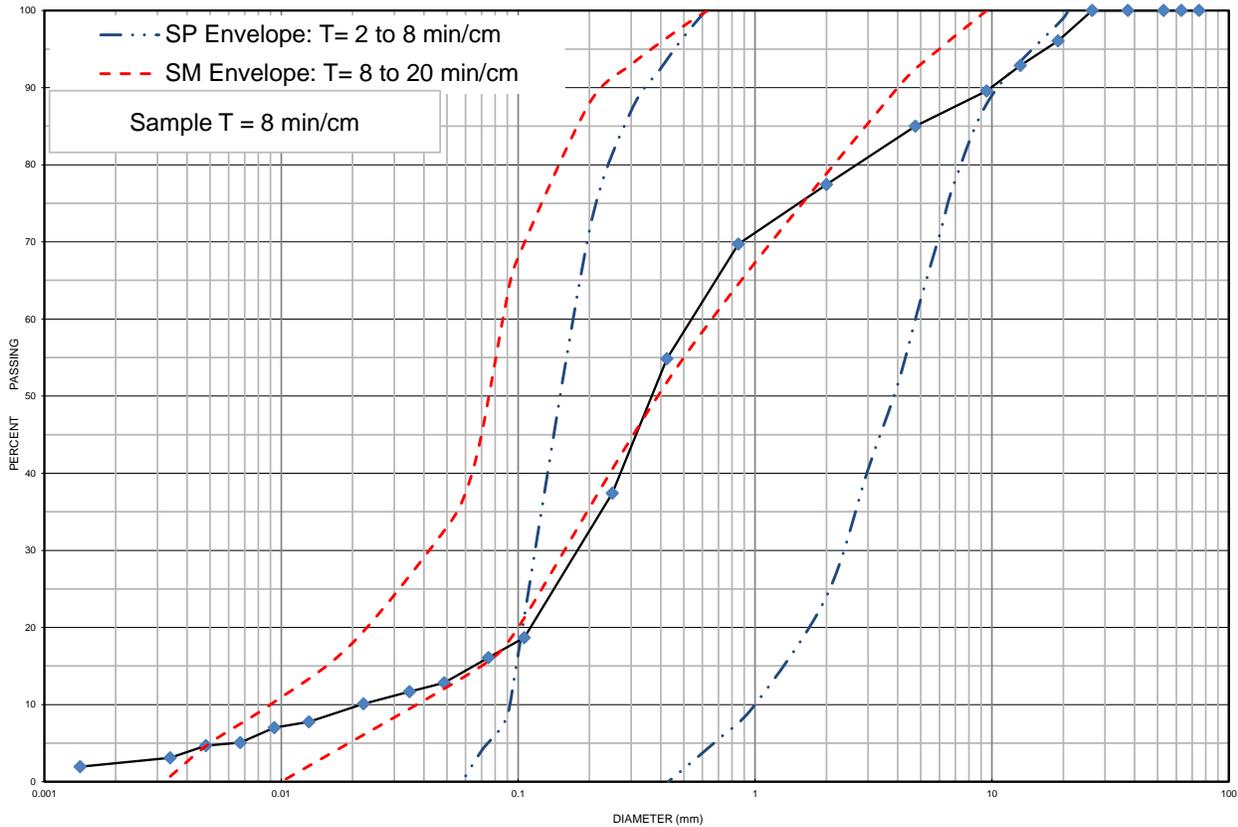
Date Issued: October 21, 2022



Grain Size Distribution Chart

Project Number: 14266-001 **Client:** Thornbury Acres Holdings
Project Name: Thornbury Acres - Geotechnical Investigation
Sample Date: September 27, 2022 **Sampled By:** Chris Malliaros - Cambium Inc.
Location: TP 112-22 GS 1 **Depth:** 2.7 m to 3 m **Lab Sample No:** S-22-1485

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
TP 112-22	GS 1	2.7 m to 3 m	15	69	14	2	11.8
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Sand some Gravel some Silt trace Clay		SM	0.540	0.175	0.021	25.71	2.70

Additional information available upon request

Issued By: *John Baird*
 (Senior Project Manager)

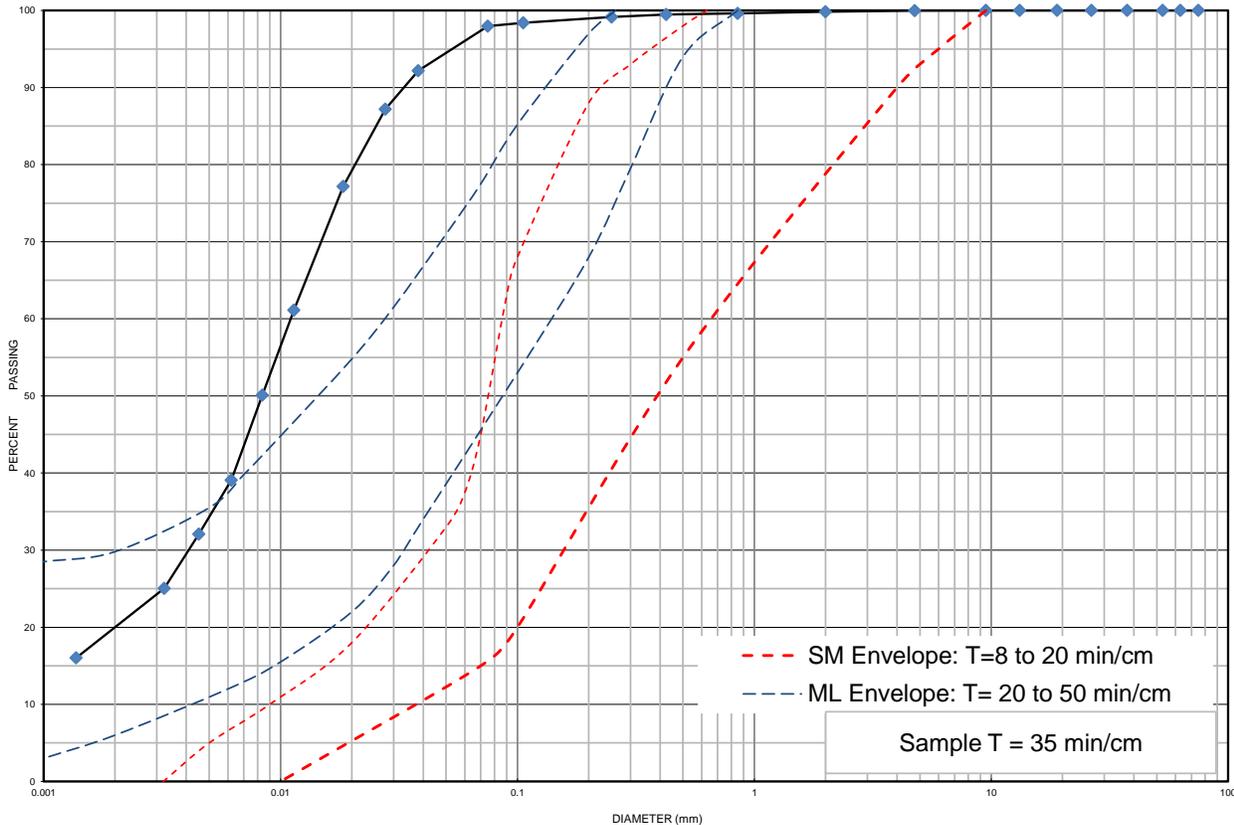
Date Issued: October 21, 2022



Grain Size Distribution Chart

Project Number: 14266-001 **Client:** Thornbury Acres Holdings
Project Name: Thornbury Acres - Geotechnical Investigation
Sample Date: September 27, 2022 **Sampled By:** Chris Malliaros - Cambium Inc.
Location: TP 116-22 GS 1 **Depth:** 1.5 m to 2 m **Lab Sample No:** S-22-1486

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
TP 116-22	GS 1	1.5 m to 2 m	0	2	78	20	19.1
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Clayey Silt trace Sand		ML	0.012	0.002	-	-	-

Additional information available upon request

Issued By: 
 (Senior Project Manager)

Date Issued: October 21, 2022



Appendix D
Test Well Records

Mailing Address (Street Number/Name) **180 Bloor St.** Municipality **Toronto** Province **ON** Postal Code Telephone No. (inc. area code)

Well Location Address of Well Location (Street Number/Name) Township **Blue Mountains** Lot **27** Concession **8E** Province **Ontario** Postal Code
 County/District/Municipality **Grey County** City/Town/Village **Clarksburg** Municipal Plan and Sublot Number
 UTM Coordinates Zone Easting Northing
 NAD 83: **17545904/4931597**

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft)	
				From	To
Black	topsoil			0	1
Brown	sand	stones		1	15
Grey	clay & gravel			15	38
Brown	sand & gravel	fine sand		38	43
Grey	clay			43	45
Brown	sand			45	56
Grey	gravel			56	57

Annular Space

Depth Set at (m/ft)	Type of Sealant Used	Volume Placed
From To	(Material and Type)	(m ³ /ft ³)
0 20	Bentonite	

Results of Well Yield Testing

After test of well yield, water was:		Draw Down		Recovery	
<input checked="" type="checkbox"/> Clear and sand free <input type="checkbox"/> Other, specify		Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
If pumping discontinued, give reason: -		Static Level	24.7		
Pump intake set at (m/ft) 40		1		1	25.1
Pumping rate (l/min/GPM) 12		2		2	24.7
Duration of pumping 1 hrs + min		3		3	
Final water level end of pumping (m/ft) 31.3		4		4	
If flowing give rate (l/min/GPM) -		5	29.4	5	
Recommended pump depth (m/ft) 40		10	30.4	10	
Recommended pump rate (l/min/GPM) 12		15		15	
Well production (l/min/GPM) 12		20	30.8	20	
Disinfected? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		25		25	
		30		30	
		40		40	
		50		50	
		60	31.3	60	

Method of Construction Well Use

<input type="checkbox"/> Cable Tool	<input type="checkbox"/> Diamond	<input type="checkbox"/> Public	<input type="checkbox"/> Commercial	<input type="checkbox"/> Not used
<input type="checkbox"/> Rotary (Conventional)	<input type="checkbox"/> Jetting	<input type="checkbox"/> Domestic	<input type="checkbox"/> Municipal	<input type="checkbox"/> Dewatering
<input type="checkbox"/> Rotary (Reverse)	<input type="checkbox"/> Driving	<input type="checkbox"/> Livestock	<input checked="" type="checkbox"/> Test Hole	<input type="checkbox"/> Monitoring
<input type="checkbox"/> Boring	<input type="checkbox"/> Digging	<input type="checkbox"/> Irrigation	<input type="checkbox"/> Cooling & Air Conditioning	
<input type="checkbox"/> Air percussion		<input type="checkbox"/> Industrial		
<input checked="" type="checkbox"/> Other, specify D.P.		<input type="checkbox"/> Other, specify		

Construction Record - Casing Status of Well

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		Status of Well
			From	To	
6 3/16	Steel	.219	+1.5	50	<input type="checkbox"/> Water Supply <input type="checkbox"/> Replacement Well <input checked="" type="checkbox"/> Test Hole <input type="checkbox"/> Recharge Well <input type="checkbox"/> Dewatering Well <input type="checkbox"/> Observation and/or Monitoring Hole <input type="checkbox"/> Alteration (Construction) <input type="checkbox"/> Abandoned, Insufficient Supply <input type="checkbox"/> Abandoned, Poor Water Quality <input type="checkbox"/> Abandoned, other, specify <input type="checkbox"/> Other, specify

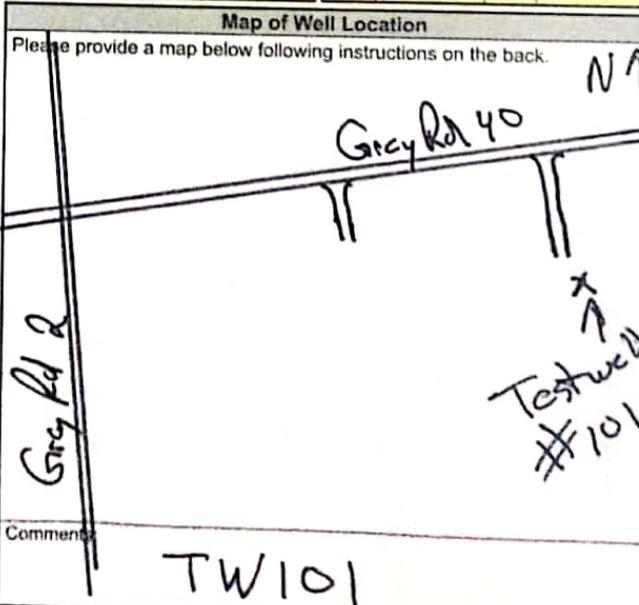
Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)	
			From	To

Water Details Hole Diameter

Water found at Depth (m/ft)	Kind of Water	Fresh	Untested	Depth (m/ft)		Diameter (cm/in)
				From	To	
57 (m/ft)	Gas	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0	20	10
				20	57	6

Well Contractor and Well Technician Information
 Business Name of Well Contractor **Stan Wright & Co. Well Drillers** Well Contractor's Licence No. **5505**
 Business Address (Street Number/Name) **RR#1** Municipality **Shallow Lake**
 Province **ON** Postal Code **N0M2K0** Business E-mail Address



Business Telephone No. (inc. area code) **519 3764380** Name of Well Technician (Last Name, First Name) **Wright, Stan & Kevin**
 Well Technician's Licence No. **3958** Signature of Technician and/or Contractor **(D.L.)** Date Submitted

Well owner's information package delivered Yes No
 Date Package Delivered **YYYYMMDD**
 Date Work Completed
 Ministry Use Only
 Audit No. **2397751**

Well Owner's Information

First Name: _____ Last Name/Organization: **Thornbury Acres, Inc.** E-mail Address: _____ Well Constructed by Well Owner

Mailing Address (Street Number/Name): **180 Bloor St.** Municipality: **Toronto** Province: **ON** Postal Code: _____ Telephone No. (inc. area code): _____

Well Location

Address of Well Location (Street Number/Name): _____ Township: **Blue Mountains** Lot: **27** Concession: **8**

County/District/Municipality: **Grey County** City/Town/Village: **Clarksburg** Province: **Ontario** Postal Code: _____

UTM Coordinates Zone: Easting: _____ Northing: _____ Municipal Plan and Sublot Number: _____

NAD 83: **17545488/4931299**

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
Black	topsoil			0	1
Brown	sand & stones			1	12
Grey	sand & stones		wet & silty	12	80
Grey	clay			80	82
Grey	sand			82	84
Grey	clay & gravel			84	94
Grey	gravel			94	123

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m ³ /ft ³)
0	20	Bentonite	

Results of Well Yield Testing

After test of well yield, water was: <input checked="" type="checkbox"/> Clear and sand free <input type="checkbox"/> Other, specify _____	Draw Down		Recovery	
	Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
If pumping discontinued, give reason: _____	Static Level	17.4		
Pump intake set at (m/ft): 60	1		1	
Pumping rate (l/min/GPM): 12	2		2	
Duration of pumping: 1 hrs + _____ min	3		3	
Final water level end of pumping (m/ft): 49	4		4	
If flowing give rate (l/min/GPM): _____	5	39	5	26.1
Recommended pump depth (m/ft): 60	10	49	10	17.4
Recommended pump rate (l/min/GPM): 12	15		15	
Well production (l/min/GPM): 12	20		20	
Disinfected? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	25		25	
	30		30	
	40		40	
	50		50	
	60		60	

Method of Construction

Cable Tool Diamond Public Commercial Not used

Rotary (Conventional) Jetting Domestic Municipal Dewatering

Rotary (Reverse) Drilling Livestock Test Hole Monitoring

Boring Digging Irrigation Cooling & Air Conditioning

Air percussion Industrial Other, specify: **D.R.**

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		Status of Well
			From	To	
6 3/16	Steel	.219	+1.5	94	<input type="checkbox"/> Water Supply <input type="checkbox"/> Replacement Well <input checked="" type="checkbox"/> Test Hole <input type="checkbox"/> Recharge Well <input type="checkbox"/> Dewatering Well <input type="checkbox"/> Observation and/or Monitoring Hole <input type="checkbox"/> Alteration (Construction) <input type="checkbox"/> Abandoned, Insufficient Supply <input type="checkbox"/> Abandoned, Poor Water Quality <input type="checkbox"/> Abandoned, other, specify _____ <input type="checkbox"/> Other, specify _____

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)	
			From	To

Water Details

Water found at Depth (m/ft)	Kind of Water	<input checked="" type="checkbox"/> Fresh <input type="checkbox"/> Untested	Hole Diameter		
			Depth (m/ft) From	To	Diameter (cm/in)
24-123	Gas		0	20	10
			20	123	6

Well Contractor and Well Technician Information

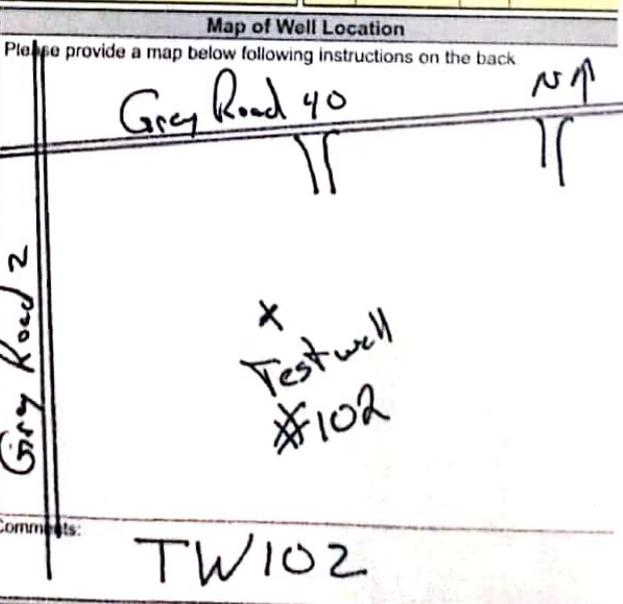
Business Name of Well Contractor: **Stan Wright & Co. Well Drillers** Well Contractor's Licence No.: **5 5 0 5**

Business Address (Street Number/Name): **RR#1** Municipality: **Shallow Lake**

Province: **ON** Postal Code: **N0H2K0** Business E-mail Address: _____

Bus. Telephone No. (inc. area code): **519/3764380** Name of Well Technician (Last Name, First Name): **Wright, Stan & Kevin**

Well Technician's Licence No.: **2 0 5 0** Signature of Technician and/or Contractor: _____ Date Submitted: _____



Comments: **TW102**

Well owner's information package delivered: Yes No

Date Package Delivered: Y|Y|Y|Y M|M|D|D

Date Work Completed: _____

Ministry Use Only
Audit No: **2397753**

Mailing Address (Street Number/Name) **180 How St** Municipality **Toronto ON**
 Well Location (Street Number/Name) **Blue Mountains** Lot **27** Concession **8**
 County/City/Municipality **Grey County** City/Town/Village **Clarksburg** Province **Ontario** Postal Code
 NAD 83 17 545 285 993 1258

Overburden and Bedrock Materials, Abandonment Sealing Record (see instructions on the back of this form)

General Category	Material	Other Materials	General Description	Depth (m/ft)
				From To
	Brown	sand & stones		0 12
	Grey	sand		12 26
	Grey	clay & stones		26 36
	Grey	sand		36 43
	Grey	clay & stones		43 76
	Grey	sand		76 88
	Grey	clay		88 90
	Grey	gravel		90 94

Annular Space

Depth Set at (m/ft)	Type of Sealant Used (Material and Type)	Volume Placed (m ³ /ft ³)
0 20	Bentonite	

Method of Construction

<input type="checkbox"/> Cable Tool	<input type="checkbox"/> Diamond	<input type="checkbox"/> Public	<input type="checkbox"/> Commercial	<input type="checkbox"/> Not used
<input type="checkbox"/> Rotary (Conventional)	<input type="checkbox"/> Jetting	<input type="checkbox"/> Domestic	<input type="checkbox"/> Municipal	<input type="checkbox"/> Dewatering
<input type="checkbox"/> Rotary (Reverse)	<input type="checkbox"/> Driving	<input type="checkbox"/> Livestock	<input checked="" type="checkbox"/> Test Hole	<input type="checkbox"/> Monitoring
<input type="checkbox"/> Boring	<input type="checkbox"/> Digging	<input type="checkbox"/> Irrigation	<input type="checkbox"/> Cooling & Air Conditioning	
<input type="checkbox"/> Air percussion		<input type="checkbox"/> Industrial		
<input checked="" type="checkbox"/> Other specify D.R.		<input type="checkbox"/> Other, specify		

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		Status of Well
			From	To	
6 3/16	steel	.219	+ 2	94	<input type="checkbox"/> Water Supply <input type="checkbox"/> Replacement Well <input checked="" type="checkbox"/> Test Hole <input type="checkbox"/> Recharge Well <input type="checkbox"/> Dewatering Well <input type="checkbox"/> Observation and/or Monitoring Hole <input type="checkbox"/> Alteration (Construction) <input type="checkbox"/> Abandoned, Insufficient Supply <input type="checkbox"/> Abandoned, Poor Water Quality <input type="checkbox"/> Abandoned, other, specify <input type="checkbox"/> Other, specify

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)	
			From	To

Water Details

Water found at Depth (m/ft)	Kind of Water	Fresh	Untested
94 (m/ft)	Gas	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Other, specify		
		<input type="checkbox"/>	<input type="checkbox"/>

Hole Diameter

Depth (m/ft)	Diameter (cm/in)	
	From	To
0 20	10	10
20 94	6	6

Well Contractor and Well Technician Information

Business Name of Well Contractor: **Stan Wright & Co. Well Drillers** Well Contractor's Licence No.: **5 5 0 5**
 Business Address (Street Number/Name): **R.R.#1** Municipality: **Shallow Lake**
 Province: **ON** Postal Code: **N0H2K0** Business E-mail Address:

Bus Telephone No. (inc. area code): **519 376 4380** Name of Well Technician (Last Name, First Name): **Wright, Dan & Kevin**
 Well Technician's Licence No.: **3 9 5 8** Signature of Technician and/or Contractor: **[Signature]** Date Submitted: **[Date]**

Results of Well Yield Testing

After test of well yield, water was:
 Clear and sand free
 Other, specify

If pumping discontinued, give reason: **-**

Pump intake set at (m/ft): **40**

Pumping rate (l/min / GPM): **10**

Duration of pumping: **1 hrs +** min

Final water level end of pumping (m/ft): **43**

If flowing give rate (l/min/GPM): **-**

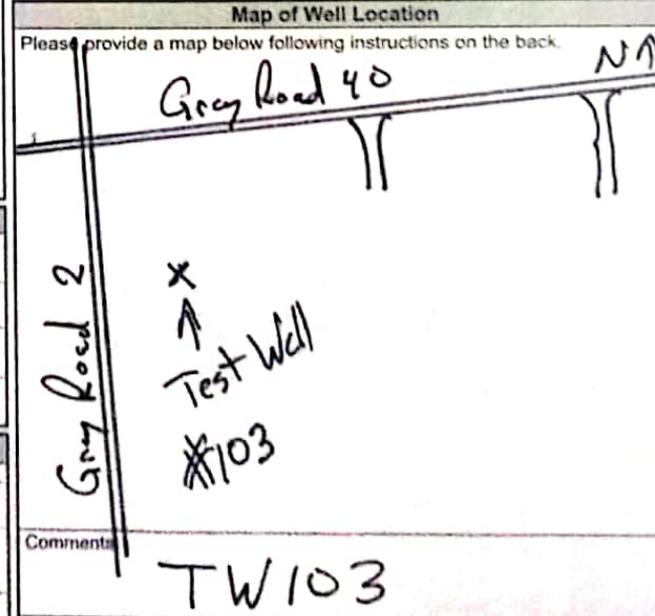
Recommended pump depth (m/ft): **60**

Recommended pump rate (l/min/GPM): **10**

Well production (l/min/GPM): **10**

Disinfected? Yes No

Static Level	Draw Down		Recovery	
	Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
18.3				
	1		1	24.2
	2		2	18.3
	3		3	
	4		4	
	5	43	5	
	10	43	10	
	15		15	
	20		20	
	25		25	
	30		30	
	40		40	
	50		50	
	60		60	



Comments: **TW103**

Well owner's information package delivered: Yes

Date Package Delivered: **[Date]**

Date Work Completed: **[Date]**

Ministry Use Only
 Audit No.: **2397752**

Well Owner's Information

First Name: Thornbury Acres Inc. Last Name/Organization: Thornbury Acres Inc. Municipality: Toronto Province: ON Postal Code: Telephone No. (inc. area code):

Mailing Address (Street Number/Name): 180 Bloor St.

Well Location

Address of Well Location (Street Number/Name): Township: Blue Mountains City/Town/Village: Clarksburg Lot: 27 Concession: 8 Province: Ontario Postal Code:

County/District/Municipality: Grey County UTM Coordinates Zone: Northing Easting: 17545664/4931256 Municipal Plan and Subj. Number:

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft)	
				From	To
Brown	sand & gravel			0	10
Grey	clay & stones			10	55
Grey	sand & gravel	stones	wet, silty	55	101
Grey	clay & stones			101	111
Grey	gravel			111	112

Annular Space

Depth Set at (m/ft)	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0 to 20	Bentonite	

Method of Construction

Cable Tool Diamond Rotary (Conventional) Jetting Rotary (Reverse) Driving Boring Air percussion Other, specify D.R.

Well Use

Public Commercial Not used Domestic Municipal Dewatering Livestock Test Hole Monitoring Irrigation Cooling & Air Conditioning Industrial Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		Status of Well
			From	To	
6 3/16	Steel	.219	+1.5	111	<input type="checkbox"/> Water Supply <input type="checkbox"/> Replacement Well <input checked="" type="checkbox"/> Test Hole <input type="checkbox"/> Recharge Well <input type="checkbox"/> Dewatering Well <input type="checkbox"/> Observation and/or Monitoring Hole <input type="checkbox"/> Alteration (Construction) <input type="checkbox"/> Abandoned, Insufficient Supply <input type="checkbox"/> Abandoned, Poor Water Quality <input type="checkbox"/> Abandoned, other, specify <input type="checkbox"/> Other, specify <u></u>

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)	
			From	To

Water Details

Water found at Depth: 111 (m) Kind of Water: Fresh Untested Gas Other, specify

Water found at Depth: 0 (m/ft) Kind of Water: Fresh Untested Gas Other, specify

Water found at Depth: 20 (m/ft) Kind of Water: Fresh Untested Gas Other, specify

Well Contractor and Well Technician Information

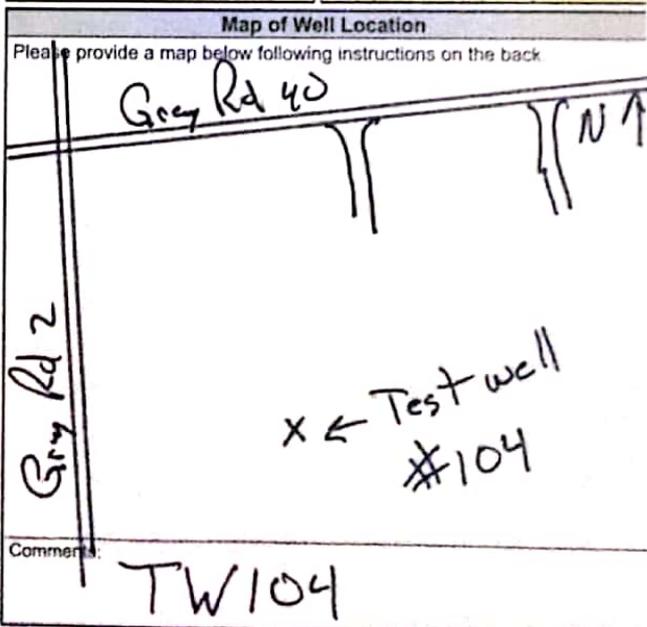
Business Name of Well Contractor: Stan Wright & Co. Well Drillers Well Contractor's Licence No.: 5505

Business Address (Street Number/Name): RR#1 Municipality: Shallow Lake

Province: ON Postal Code: N0H2K0 Business E-mail Address:

Results of Well Yield Testing

After test of well yield, water was:	Draw Down		Recovery	
	Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
<input checked="" type="checkbox"/> Clear and sand free <input type="checkbox"/> Other, specify <u></u>				
If pumping discontinued, give reason: <u></u>	Static Level	14		
Pump intake set at (m/ft): <u>40</u>	1		1	14
Pumping rate (l/min) (GPM): <u>12</u>	2		2	14
Duration of pumping: <u>1</u> hrs + <u></u> min	3		3	
Final water level end of pumping (m/ft): <u>15.7</u>	4		4	
If flowing give rate (l/min/GPM): <u></u>	5	15.7	5	
Recommended pump depth (m/ft): <u>40</u>	10	15.7	10	
Recommended pump rate (l/min) (GPM): <u>12</u>	15		15	
Well production (l/min) (GPM): <u>12+</u>	20		20	
Disinfected? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	25		25	
	30		30	
	40		40	
	50		50	
	60		60	



Well Contractor and Well Technician Information

Business Name of Well Contractor: Stan Wright & Co. Well Drillers Well Contractor's Licence No.: 5505

Business Address (Street Number/Name): RR#1 Municipality: Shallow Lake

Province: ON Postal Code: N0H2K0 Business E-mail Address:

Bus. Telephone No. (inc. area code): 5193764380 Name of Well Technician (Last Name, First Name): Wright, Dan & Kevin

Well Technician's Licence No.: 2958 Signature of Technician and/or Contractor: (Signature) Date Submitted:

Well owner's information package delivered Yes No

Date Package Delivered: V Y Y Y M M D D

Date Work Completed:

Ministry Use Only

Audit No: 2397754



Appendix E
Water Quality Data

C.O.C.: ---

REPORT No. B22-33907

Report To:

Cambium Environmental
 135 Bayfield Street, Unit 102
 Barrie ON L4M 3B3

Attention: Nicole Heikoop

Caduceon Environmental Laboratories

112 Commerce Park Drive
 Barrie ON L4N 8W8
 Tel: 705-252-5743
 Fax: 705-252-5746

DATE RECEIVED: 08-Nov-22

JOB/PROJECT NO.:

DATE REPORTED: 15-Nov-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Client I.D.:	TW101-22	ODWS	
Sample I.D.:	B22-33907-1		
Date Collected:	07-Nov-22		
		Objective	Type of Objective

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Total Coliform	cfu/100mL	1	MOE E3407	08-Nov-22/B	0		0	MAC
E coli	cfu/100mL	1	MOE E3407	08-Nov-22/B	0		0	MAC
pH @25°C	pH Units		SM 4500H	09-Nov-22/O	8.00		6.5-8.5	OG
Conductivity @25°C	µmho/cm	1	SM 2510B	09-Nov-22/O	604			
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	09-Nov-22/O	312		30-500	OG
Hardness (as CaCO3)	mg/L	1	SM 3120	10-Nov-22/O	345		500,80-100	ODWO,OG
Chloride	mg/L	0.5	SM4110C	14-Nov-22/O	9.4		250	AO
Fluoride	mg/L	0.1	SM4110C	14-Nov-22/O	< 0.1		1.5	MAC
Nitrite (N)	mg/L	0.1	SM4110C	14-Nov-22/O	< 0.1		1	MAC
Nitrate (N)	mg/L	0.1	SM4110C	14-Nov-22/O	1.6		10	MAC
Sulphate	mg/L	1	SM4110C	14-Nov-22/O	8		500	AO
COD	mg/L	5	SM5220C	11-Nov-22/K	< 5			
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	10-Nov-22/O	0.6		5	AO
Cyanide (Free)	mg/L	0.005	SM 4500CN	11-Nov-22/K	< 0.005		0.2	MAC
Colour	TCU	2	SM 2120C	10-Nov-22/O	< 2		5	AO
Turbidity	NTU	0.1	SM 2130	10-Nov-22/O	1.8		5	AO
Ammonia + Ammonium (N)	mg/L	0.01	SM4500-NH3-H	10-Nov-22/K	0.03			
Calcium	mg/L	0.02	SM 3120	10-Nov-22/O	109			
Magnesium	mg/L	0.02	SM 3120	10-Nov-22/O	17.5			
Potassium	mg/L	0.1	SM 3120	10-Nov-22/O	1.4			
Sodium	mg/L	0.2	SM 3120	10-Nov-22/O	12.0		200,20	AO,WL
Aluminum	mg/L	0.01	SM 3120	10-Nov-22/O	0.04		0.1	OG
Antimony	mg/L	0.0001	EPA 200.8	14-Nov-22/O	0.0001		0.006	MAC

ODWS - Ontario Drinking Water Standards
 AO - Aesthetic Objectives
 IMAC - Interim Maximum Acceptable Concentration
 MAC - Maximum Acceptable Concentration
 ODWO - D-5-5 Objective
 OG - Operational Guidelines
 WL - Warning Level - Sodium Restricted Diets
 R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *
 Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Christine Burke
 Lab Manager

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

C.O.C.: ---

REPORT No. B22-33907

Report To:

Cambium Environmental
 135 Bayfield Street, Unit 102
 Barrie ON L4M 3B3

Attention: Nicole Heikoop

Caduceon Environmental Laboratories

112 Commerce Park Drive
 Barrie ON L4N 8W8
 Tel: 705-252-5743
 Fax: 705-252-5746

DATE RECEIVED: 08-Nov-22

JOB/PROJECT NO.:

DATE REPORTED: 15-Nov-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Client I.D.:	TW101-22		ODWS	
Sample I.D.:	B22-33907-1		Objective	Type of Objective
Date Collected:	07-Nov-22			

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Arsenic	mg/L	0.0001	EPA 200.8	14-Nov-22/O	< 0.0001		0.01	MAC
Barium	mg/L	0.001	SM 3120	10-Nov-22/O	0.018		1	MAC
Beryllium	mg/L	0.002	SM 3120	10-Nov-22/O	< 0.002			
Boron	mg/L	0.005	SM 3120	10-Nov-22/O	0.016		5	MAC
Cadmium	mg/L	0.000010	EPA 200.8	14-Nov-22/O	< 0.000010		0.005	MAC
Chromium	mg/L	0.001	EPA 200.8	14-Nov-22/O	< 0.001		0.05	MAC
Cobalt	mg/L	0.0001	EPA 200.8	14-Nov-22/O	0.0003			
Copper	mg/L	0.0001	EPA 200.8	14-Nov-22/O	0.0007		1	AO
Iron	mg/L	0.005	SM 3120	10-Nov-22/O	0.153		0.3	AO
Lead	mg/L	0.00002	EPA 200.8	14-Nov-22/O	< 0.00002		0.01	MAC
Manganese	mg/L	0.001	SM 3120	10-Nov-22/O	0.010		0.05	AO
Molybdenum	mg/L	0.0001	EPA 200.8	14-Nov-22/O	0.0002			
Nickel	mg/L	0.01	SM 3120	10-Nov-22/O	< 0.01			
Selenium	mg/L	0.001	EPA 200.8	14-Nov-22/O	< 0.001		0.05	MAC
Silver	mg/L	0.0001	EPA 200.8	15-Nov-22/O	< 0.0001			
Strontium	mg/L	0.001	SM 3120	10-Nov-22/O	0.232			
Tin	mg/L	0.05	SM 3120	10-Nov-22/O	< 0.05			
Thallium	mg/L	0.00005	EPA 200.8	14-Nov-22/O	< 0.00005			
Titanium	mg/L	0.005	SM 3120	10-Nov-22/O	< 0.005			
Uranium	mg/L	0.00005	EPA 200.8	14-Nov-22/O	0.00030		0.02	MAC
Vanadium	mg/L	0.0001	EPA 200.8	14-Nov-22/O	0.0001			
Zinc	mg/L	0.005	SM 3120	10-Nov-22/O	< 0.005		5	AO
Anion Sum	meq/L		Calc.	10-Nov-22/O	6.79			
Cation Sum	meq/L		Calc.	10-Nov-22/O	7.47			

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 WL - Warning Level - Sodium Restricted Diets
 R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *
 Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Christine Burke
 Lab Manager

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C.O.C.: ---

REPORT No. B22-33907

Report To:

Cambium Environmental
 135 Bayfield Street, Unit 102
 Barrie ON L4M 3B3

Attention: Nicole Heikoop

Caduceon Environmental Laboratories

112 Commerce Park Drive
 Barrie ON L4N 8W8
 Tel: 705-252-5743
 Fax: 705-252-5746

DATE RECEIVED: 08-Nov-22

JOB/PROJECT NO.:

DATE REPORTED: 15-Nov-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Client I.D.:	TW101-22		ODWS	
Sample I.D.:	B22-33907-1		Objective	Type of Objective
Date Collected:	07-Nov-22			

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
% Difference	%		Calc.	10-Nov-22/O	4.74			
TDS(ion sum calc.)	mg/L	1	Calc.	10-Nov-22/O	353		500	AO
Conductivity (calc.)	µmho/cm		Calc.	10-Nov-22/O	649			

ODWS - Ontario Drinking Water Standards
 AO - Aesthetic Objectives
 IMAC - Interim Maximum Acceptable Concentration
 MAC - Maximum Acceptable Concentration
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 OG - Operational Guidelines
 WL - Warning Level - Sodium Restricted Diets
 R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Christine Burke
 Lab Manager

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C.O.C.: ---

REPORT No. B22-34165

Report To:

Cambium Environmental
 135 Bayfield Street, Unit 102
 Barrie ON L4M 3B3

Attention: Nicole Heikoop

Caduceon Environmental Laboratories

112 Commerce Park Drive
 Barrie ON L4N 8W8
 Tel: 705-252-5743
 Fax: 705-252-5746

DATE RECEIVED: 10-Nov-22

JOB/PROJECT NO.:

DATE REPORTED: 18-Nov-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Client I.D.:	TW102-22		ODWS	
Sample I.D.:	B22-34165-1		Objective	Type of Objective
Date Collected:	10-Nov-22			

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Total Coliform	cfu/100mL	1	MOE E3407	10-Nov-22/B	1		0	MAC
E coli	cfu/100mL	1	MOE E3407	10-Nov-22/B	0		0	MAC
pH @25°C	pH Units		SM 4500H	14-Nov-22/O	7.97		6.5-8.5	OG
Conductivity @25°C	µmho/cm	1	SM 2510B	14-Nov-22/O	564			
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	14-Nov-22/O	232		30-500	OG
Hardness (as CaCO3)	mg/L	1	SM 3120	15-Nov-22/O	295		500,80-100	ODWO,OG
Chloride	mg/L	0.5	SM4110C	15-Nov-22/O	43.7		250	AO
Fluoride	mg/L	0.1	SM4110C	15-Nov-22/O	< 0.1		1.5	MAC
Nitrite (N)	mg/L	0.1	SM4110C	15-Nov-22/O	< 0.1		1	MAC
Nitrate (N)	mg/L	0.1	SM4110C	15-Nov-22/O	< 0.1		10	MAC
Sulphate	mg/L	1	SM4110C	15-Nov-22/O	13		500	AO
COD	mg/L	5	SM5220C	18-Nov-22/K	< 5			
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	15-Nov-22/O	0.2		5	AO
Cyanide (Free)	mg/L	0.005	SM 4500CN	16-Nov-22/K	< 0.005		0.2	MAC
Colour	TCU	2	SM 2120C	16-Nov-22/O	< 2		5	AO
Turbidity	NTU	0.1	SM 2130	16-Nov-22/O	13.5		5	AO
Ammonia + Ammonium (N)	mg/L	0.01	SM4500-NH3-H	14-Nov-22/K	0.10			
Calcium	mg/L	0.02	SM 3120	15-Nov-22/O	80.3			
Magnesium	mg/L	0.02	SM 3120	15-Nov-22/O	23.0			
Potassium	mg/L	0.1	SM 3120	15-Nov-22/O	1.2			
Sodium	mg/L	0.2	SM 3120	15-Nov-22/O	5.8		200,20	AO,WL
Aluminum	mg/L	0.01	SM 3120	15-Nov-22/O	0.08		0.1	OG
Antimony	mg/L	0.0001	EPA 200.8	14-Nov-22/O	< 0.0001		0.006	MAC
Arsenic	mg/L	0.0001	EPA 200.8	14-Nov-22/O	0.0011		0.01	MAC
Barium	mg/L	0.001	SM 3120	15-Nov-22/O	0.200		1	MAC

ODWS - Ontario Drinking Water Standards

AO - Aesthetic Objectives

IMAC - Interim Maximum Acceptable Concentration

MAC - Maximum Acceptable Concentration

ODWO - D-5-5 Objective

OG - Operational Guidelines

WL - Warning Level - Sodium Restricted Diets

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Christine Burke
 Lab Manager

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C.O.C.: ---

REPORT No. B22-34165

Report To:

Cambium Environmental
 135 Bayfield Street, Unit 102
 Barrie ON L4M 3B3

Attention: Nicole Heikoop

Caduceon Environmental Laboratories

112 Commerce Park Drive
 Barrie ON L4N 8W8
 Tel: 705-252-5743
 Fax: 705-252-5746

DATE RECEIVED: 10-Nov-22

JOB/PROJECT NO.:

DATE REPORTED: 18-Nov-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Client I.D.:	TW102-22		ODWS	
Sample I.D.:	B22-34165-1		Objective	Type of Objective
Date Collected:	10-Nov-22			

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Beryllium	mg/L	0.002	SM 3120	15-Nov-22/O	< 0.002			
Boron	mg/L	0.005	SM 3120	15-Nov-22/O	0.029	5	MAC	
Cadmium	mg/L	0.000010	EPA 200.8	14-Nov-22/O	< 0.000010	0.005	MAC	
Chromium	mg/L	0.001	EPA 200.8	14-Nov-22/O	< 0.001	0.05	MAC	
Cobalt	mg/L	0.0001	EPA 200.8	14-Nov-22/O	0.0002			
Copper	mg/L	0.0001	EPA 200.8	14-Nov-22/O	0.0002	1	AO	
Iron	mg/L	0.005	SM 3120	15-Nov-22/O	1.23	0.3	AO	
Lead	mg/L	0.00002	EPA 200.8	14-Nov-22/O	0.00008	0.01	MAC	
Manganese	mg/L	0.001	SM 3120	15-Nov-22/O	0.032	0.05	AO	
Molybdenum	mg/L	0.0001	EPA 200.8	14-Nov-22/O	0.0003			
Nickel	mg/L	0.01	SM 3120	15-Nov-22/O	< 0.01			
Selenium	mg/L	0.001	EPA 200.8	14-Nov-22/O	< 0.001	0.05	MAC	
Silver	mg/L	0.0001	EPA 200.8	14-Nov-22/O	< 0.0001			
Strontium	mg/L	0.001	SM 3120	15-Nov-22/O	0.344			
Tin	mg/L	0.05	SM 3120	15-Nov-22/O	< 0.05			
Thallium	mg/L	0.00005	EPA 200.8	14-Nov-22/O	< 0.00005			
Titanium	mg/L	0.005	SM 3120	15-Nov-22/O	< 0.005			
Uranium	mg/L	0.00005	EPA 200.8	14-Nov-22/O	0.00008	0.02	MAC	
Vanadium	mg/L	0.0001	EPA 200.8	14-Nov-22/O	0.0002			
Zinc	mg/L	0.005	SM 3120	15-Nov-22/O	< 0.005	5	AO	
Anion Sum	meq/L		Calc.	16-Nov-22/O	6.16			
Cation Sum	meq/L		Calc.	16-Nov-22/O	6.26			
% Difference	%		Calc.	16-Nov-22/O	0.847			
TDS(ion sum calc.)	mg/L	1	Calc.	16-Nov-22/O	308	500	AO	
Conductivity (calc.)	µmho/cm		Calc.	16-Nov-22/O	591			

ODWS - Ontario Drinking Water Standards
 AO - Aesthetic Objectives
 IMAC - Interim Maximum Acceptable Concentration
 MAC - Maximum Acceptable Concentration
 ODWO - D-5-5 Objective
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 WL - Warning Level - Sodium Restricted Diets
 R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Christine Burke
 Lab Manager

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C.O.C.: ---

REPORT No. B22-34102

Report To:

Cambium Environmental
 135 Bayfield Street, Unit 102
 Barrie ON L4M 3B3

Attention: Nicole Heikoop

Caduceon Environmental Laboratories

112 Commerce Park Drive
 Barrie ON L4N 8W8
 Tel: 705-252-5743
 Fax: 705-252-5746

DATE RECEIVED: 10-Nov-22

JOB/PROJECT NO.:

DATE REPORTED: 17-Nov-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Client I.D.:	TW103-22		ODWS	
Sample I.D.:	B22-34102-1		Objective	Type of Objective
Date Collected:	09-Nov-22			

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Total Coliform	cfu/100mL	1	MOE E3407	10-Nov-22/B	1		0	MAC
E coli	cfu/100mL	1	MOE E3407	10-Nov-22/B	0		0	MAC
pH @25°C	pH Units		SM 4500H	11-Nov-22/O	7.73		6.5-8.5	OG
Conductivity @25°C	µmho/cm	1	SM 2510B	11-Nov-22/O	761			
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	11-Nov-22/O	356		30-500	OG
Hardness (as CaCO3)	mg/L	1	SM 3120	14-Nov-22/O	405		500,80-100	ODWO,OG
Chloride	mg/L	0.5	SM4110C	15-Nov-22/O	43.3		250	AO
Fluoride	mg/L	0.1	SM4110C	15-Nov-22/O	< 0.1		1.5	MAC
Nitrite (N)	mg/L	0.1	SM4110C	15-Nov-22/O	< 0.1		1	MAC
Nitrate (N)	mg/L	0.1	SM4110C	15-Nov-22/O	< 0.1		10	MAC
Sulphate	mg/L	1	SM4110C	15-Nov-22/O	16		500	AO
COD	mg/L	5	SM5220C	11-Nov-22/K	< 5			
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	14-Nov-22/O	0.9		5	AO
Cyanide (Free)	mg/L	0.005	SM 4500CN	11-Nov-22/K	< 0.005		0.2	MAC
Colour	TCU	2	SM 2120C	14-Nov-22/O	< 2		5	AO
Turbidity	NTU	0.1	SM 2130	14-Nov-22/O	33.5		5	AO
Ammonia + Ammonium (N)	mg/L	0.01	SM4500-NH3-H	11-Nov-22/K	0.08			
Calcium	mg/L	0.02	SM 3120	14-Nov-22/O	108			
Magnesium	mg/L	0.02	SM 3120	14-Nov-22/O	33.1			
Potassium	mg/L	0.1	SM 3120	14-Nov-22/O	1.4			
Sodium	mg/L	0.2	SM 3120	14-Nov-22/O	12.4		200,20	AO,WL
Aluminum	mg/L	0.01	SM 3120	14-Nov-22/O	0.05		0.1	OG
Antimony	mg/L	0.0001	EPA 200.8	14-Nov-22/O	< 0.0001		0.006	MAC

ODWS - Ontario Drinking Water Standards
 AO - Aesthetic Objectives
 IMAC - Interim Maximum Acceptable Concentration
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 ODWO - D-5-5 Objective
 OG - Operational Guidelines
 WL - Warning Level - Sodium Restricted Diets
 R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *
 Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Christine Burke
 Lab Manager

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C.O.C.: ---

REPORT No. B22-34102

Report To:

Cambium Environmental
 135 Bayfield Street, Unit 102
 Barrie ON L4M 3B3

Caduceon Environmental Laboratories

112 Commerce Park Drive
 Barrie ON L4N 8W8
 Tel: 705-252-5743
 Fax: 705-252-5746

Attention: Nicole Heikoop

DATE RECEIVED: 10-Nov-22

JOB/PROJECT NO.:

DATE REPORTED: 17-Nov-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Client I.D.:	TW103-22		ODWS	
Sample I.D.:	B22-34102-1		Objective	Type of Objective
Date Collected:	09-Nov-22			

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Arsenic	mg/L	0.0001	EPA 200.8	14-Nov-22/O	0.0013		0.01	MAC
Barium	mg/L	0.001	SM 3120	14-Nov-22/O	0.322		1	MAC
Beryllium	mg/L	0.002	SM 3120	14-Nov-22/O	< 0.002			
Boron	mg/L	0.005	SM 3120	14-Nov-22/O	0.021		5	MAC
Cadmium	mg/L	0.000010	EPA 200.8	14-Nov-22/O	< 0.000010		0.005	MAC
Chromium	mg/L	0.001	EPA 200.8	14-Nov-22/O	< 0.001		0.05	MAC
Cobalt	mg/L	0.0001	EPA 200.8	14-Nov-22/O	0.0004			
Copper	mg/L	0.0001	EPA 200.8	14-Nov-22/O	< 0.0001		1	AO
Iron	mg/L	0.005	SM 3120	14-Nov-22/O	1.92		0.3	AO
Lead	mg/L	0.00002	EPA 200.8	14-Nov-22/O	< 0.00002		0.01	MAC
Manganese	mg/L	0.001	SM 3120	14-Nov-22/O	0.042		0.05	AO
Molybdenum	mg/L	0.0001	EPA 200.8	14-Nov-22/O	0.0002			
Nickel	mg/L	0.01	SM 3120	14-Nov-22/O	< 0.01			
Selenium	mg/L	0.001	EPA 200.8	14-Nov-22/O	< 0.001		0.05	MAC
Silver	mg/L	0.0001	EPA 200.8	14-Nov-22/O	< 0.0001			
Strontium	mg/L	0.001	SM 3120	14-Nov-22/O	0.284			
Tin	mg/L	0.05	SM 3120	14-Nov-22/O	< 0.05			
Thallium	mg/L	0.00005	EPA 200.8	14-Nov-22/O	< 0.00005			
Titanium	mg/L	0.005	SM 3120	14-Nov-22/O	< 0.005			
Uranium	mg/L	0.00005	EPA 200.8	14-Nov-22/O	0.0001		0.02	MAC
Vanadium	mg/L	0.0001	EPA 200.8	14-Nov-22/O	< 0.0001			
Zinc	mg/L	0.005	SM 3120	14-Nov-22/O	< 0.005		5	AO
Anion Sum	meq/L		Calc.	11-Nov-22/O	8.65			
Cation Sum	meq/L		Calc.	11-Nov-22/O	8.77			

ODWS - Ontario Drinking Water Standards
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 IMAC - Interim Maximum Acceptable Concentration
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 R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *
 Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Christine Burke
 Lab Manager

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C.O.C.: ---

REPORT No. B22-34102

Report To:

Cambium Environmental
 135 Bayfield Street, Unit 102
 Barrie ON L4M 3B3

Attention: Nicole Heikoop

Caduceon Environmental Laboratories

112 Commerce Park Drive
 Barrie ON L4N 8W8
 Tel: 705-252-5743
 Fax: 705-252-5746

DATE RECEIVED: 10-Nov-22

JOB/PROJECT NO.:

DATE REPORTED: 17-Nov-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Client I.D.:	TW103-22		ODWS	
Sample I.D.:	B22-34102-1		Objective	Type of Objective
Date Collected:	09-Nov-22			

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
% Difference	%		Calc.	11-Nov-22/O	0.680			
TDS(ion sum calc.)	mg/L	1	Calc.	11-Nov-22/O	429		500	AO
Conductivity (calc.)	µmho/cm		Calc.	11-Nov-22/O	789			

ODWS - Ontario Drinking Water Standards
 AO - Aesthetic Objectives
 IMAC - Interim Maximum Acceptable Concentration
 MAC - Maximum Acceptable Concentration
 ODWO - D-5-5 Objective
 OG - Operational Guidelines
 WL - Warning Level - Sodium Restricted Diets
 R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Christine Burke
 Lab Manager

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C.O.C.: ---

REPORT No. B22-34069

Report To:

Cambium Environmental
 135 Bayfield Street, Unit 102
 Barrie ON L4M 3B3

Attention: Nicole Heikoop

Caduceon Environmental Laboratories

112 Commerce Park Drive
 Barrie ON L4N 8W8
 Tel: 705-252-5743
 Fax: 705-252-5746

DATE RECEIVED: 09-Nov-22

JOB/PROJECT NO.:

DATE REPORTED: 15-Nov-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Client I.D.:	TW104-22		ODWS	
Sample I.D.:	B22-34069-1		Objective	Type of Objective
Date Collected:	08-Nov-22			

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Total Coliform	cfu/100mL	1	MOE E3407	09-Nov-22/B	4		0	MAC
E coli	cfu/100mL	1	MOE E3407	09-Nov-22/B	0		0	MAC
pH @25°C	pH Units		SM 4500H	10-Nov-22/O	7.94		6.5-8.5	OG
Conductivity @25°C	µmho/cm	1	SM 2510B	10-Nov-22/O	661			
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	10-Nov-22/O	272		30-500	OG
Hardness (as CaCO3)	mg/L	1	SM 3120	15-Nov-22/O	324		500,80-100	ODWO,OG
Chloride	mg/L	0.5	SM4110C	14-Nov-22/O	38.8		250	AO
Fluoride	mg/L	0.1	SM4110C	14-Nov-22/O	< 0.1		1.5	MAC
Nitrite (N)	mg/L	0.1	SM4110C	14-Nov-22/O	< 0.1		1	MAC
Nitrate (N)	mg/L	0.1	SM4110C	14-Nov-22/O	< 0.1		10	MAC
Sulphate	mg/L	1	SM4110C	14-Nov-22/O	32		500	AO
COD	mg/L	5	SM5220C	11-Nov-22/K	< 5			
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	14-Nov-22/O	0.4		5	AO
Cyanide (Free)	mg/L	0.005	SM 4500CN	11-Nov-22/K	< 0.005		0.2	MAC
Colour	TCU	2	SM 2120C	14-Nov-22/O	< 2		5	AO
Turbidity	NTU	0.1	SM 2130	14-Nov-22/O	27.4		5	AO
Ammonia + Ammonium (N)	mg/L	0.01	SM4500-NH3-H	11-Nov-22/K	0.14			
Calcium	mg/L	0.02	SM 3120	15-Nov-22/O	91.9			
Magnesium	mg/L	0.02	SM 3120	15-Nov-22/O	23.0			
Potassium	mg/L	0.1	SM 3120	15-Nov-22/O	1.0			
Sodium	mg/L	0.2	SM 3120	15-Nov-22/O	11.1		200,20	AO,WL
Aluminum	mg/L	0.01	SM 3120	15-Nov-22/O	0.02		0.1	OG
Antimony	mg/L	0.0001	EPA 200.8	14-Nov-22/O	< 0.0001		0.006	MAC

ODWS - Ontario Drinking Water Standards
 AO - Aesthetic Objectives
 IMAC - Interim Maximum Acceptable Concentration
 MAC - Maximum Acceptable Concentration
 ODWO - D-5-5 Objective
 OG - Operational Guidelines
 WL - Warning Level - Sodium Restricted Diets
 R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *
 Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Christine Burke
 Lab Manager

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C.O.C.: ---

REPORT No. B22-34069

Report To:

Cambium Environmental
 135 Bayfield Street, Unit 102
 Barrie ON L4M 3B3

Attention: Nicole Heikoop

Caduceon Environmental Laboratories

112 Commerce Park Drive
 Barrie ON L4N 8W8
 Tel: 705-252-5743
 Fax: 705-252-5746

DATE RECEIVED: 09-Nov-22

JOB/PROJECT NO.:

DATE REPORTED: 15-Nov-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Client I.D.:	TW104-22		ODWS	
Sample I.D.:	B22-34069-1		Objective	Type of Objective
Date Collected:	08-Nov-22			

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Arsenic	mg/L	0.0001	EPA 200.8	14-Nov-22/O	0.0005		0.01	MAC
Barium	mg/L	0.001	SM 3120	15-Nov-22/O	0.256		1	MAC
Beryllium	mg/L	0.002	SM 3120	15-Nov-22/O	< 0.002			
Boron	mg/L	0.005	SM 3120	15-Nov-22/O	0.020		5	MAC
Cadmium	mg/L	0.000010	EPA 200.8	14-Nov-22/O	< 0.000010		0.005	MAC
Chromium	mg/L	0.001	EPA 200.8	14-Nov-22/O	< 0.001		0.05	MAC
Cobalt	mg/L	0.0001	EPA 200.8	14-Nov-22/O	0.0002			
Copper	mg/L	0.0001	EPA 200.8	14-Nov-22/O	< 0.0001		1	AO
Iron	mg/L	0.005	SM 3120	15-Nov-22/O	< 0.005		0.3	AO
Lead	mg/L	0.00002	EPA 200.8	14-Nov-22/O	< 0.00002		0.01	MAC
Manganese	mg/L	0.001	SM 3120	15-Nov-22/O	0.048		0.05	AO
Molybdenum	mg/L	0.0001	EPA 200.8	14-Nov-22/O	0.0003			
Nickel	mg/L	0.01	SM 3120	15-Nov-22/O	< 0.01			
Selenium	mg/L	0.001	EPA 200.8	14-Nov-22/O	< 0.001		0.05	MAC
Silver	mg/L	0.0001	EPA 200.8	14-Nov-22/O	< 0.0001			
Strontium	mg/L	0.001	SM 3120	15-Nov-22/O	0.220			
Tin	mg/L	0.05	SM 3120	15-Nov-22/O	< 0.05			
Thallium	mg/L	0.00005	EPA 200.8	14-Nov-22/O	< 0.00005			
Titanium	mg/L	0.005	SM 3120	15-Nov-22/O	< 0.005			
Uranium	mg/L	0.00005	EPA 200.8	14-Nov-22/O	0.00013		0.02	MAC
Vanadium	mg/L	0.0001	EPA 200.8	14-Nov-22/O	< 0.0001			
Zinc	mg/L	0.005	SM 3120	15-Nov-22/O	< 0.005		5	AO
Anion Sum	meq/L		Calc.	10-Nov-22/O	7.20			
Cation Sum	meq/L		Calc.	10-Nov-22/O	7.00			

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Christine Burke
 Lab Manager

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REPORT No. B22-34069

Report To:

Cambium Environmental
 135 Bayfield Street, Unit 102
 Barrie ON L4M 3B3

Attention: Nicole Heikoop

Caduceon Environmental Laboratories

112 Commerce Park Drive
 Barrie ON L4N 8W8
 Tel: 705-252-5743
 Fax: 705-252-5746

DATE RECEIVED: 09-Nov-22

JOB/PROJECT NO.:

DATE REPORTED: 15-Nov-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Client I.D.:	TW104-22		ODWS	
Sample I.D.:	B22-34069-1		Objective	Type of Objective
Date Collected:	08-Nov-22			

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
% Difference	%		Calc.	10-Nov-22/O	1.39			
TDS(ion sum calc.)	mg/L	1	Calc.	10-Nov-22/O	361		500	AO
Conductivity (calc.)	µmho/cm		Calc.	10-Nov-22/O	667			

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Christine Burke
 Lab Manager

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C.O.C.: G097164

REPORT No. B22-35321

Rev. 1

Report To:

Cambium Environmental
 135 Bayfield Street, Unit 102
 Barrie ON L4M 3B3

Attention: Nicole Heikoop

Caduceon Environmental Laboratories

112 Commerce Park Drive
 Barrie ON L4N 8W8
 Tel: 705-252-5743
 Fax: 705-252-5746

DATE RECEIVED: 01-Dec-22

JOB/PROJECT NO.: Thornbury

DATE REPORTED: 07-Dec-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Client I.D.:	TW102	TW103	ODWS	
Sample I.D.:	B22-35321-1	B22-35321-2	Objective	Type of Objective
Date Collected:	29-Nov-22	30-Nov-22		

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Total Coliform	cfu/100mL	1	MOE E3407	01-Dec-22/B	0	0	0	MAC
E coli	cfu/100mL	1	MOE E3407	01-Dec-22/B	0	0	0	MAC
pH @25°C	pH Units		SM 4500H	02-Dec-22/O	8.06	8.02	6.5-8.5	OG
Conductivity @25°C	µmho/cm	1	SM 2510B	02-Dec-22/O	593	790		
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	02-Dec-22/O	243	365	30-500	OG
Hardness (as CaCO3)	mg/L	1	SM 3120	05-Dec-22/O	319	350	500,80-100	ODWO,OG
Chloride	mg/L	0.5	SM4110C	05-Dec-22/O	41.7	36.2	250	AO
Fluoride	mg/L	0.1	SM4110C	05-Dec-22/O	< 0.1	< 0.1	1.5	MAC
Nitrite (N)	mg/L	0.1	SM4110C	05-Dec-22/O	< 0.1	< 0.1	1	MAC
Nitrate (N)	mg/L	0.1	SM4110C	05-Dec-22/O	< 0.1	< 0.1	10	MAC
Sulphate	mg/L	1	SM4110C	05-Dec-22/O	14	16	500	AO
COD	mg/L	5	SM5220C	02-Dec-22/K	< 5	< 5		
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	02-Dec-22/O	0.2	1.0	5	AO
Cyanide (Free)	mg/L	0.005	SM 4500CN	06-Dec-22/K	< 0.005	< 0.005	0.2	MAC
Colour	TCU	2	SM 2120C	05-Dec-22/O	< 2	4	5	AO
Turbidity	NTU	0.1	SM 2130	05-Dec-22/O	36.1	28.6	5	AO
Ammonia + Ammonium (N)	mg/L	0.01	SM4500-NH3-H	05-Dec-22/K	0.09	0.05		
Calcium	mg/L	0.02	SM 3120	05-Dec-22/O	88.8	100		
Magnesium	mg/L	0.02	SM 3120	05-Dec-22/O	23.7	24.2		
Potassium	mg/L	0.1	SM 3120	05-Dec-22/O	1.2	1.0		
Sodium	mg/L	0.2	SM 3120	05-Dec-22/O	6.0	12.4	200,20	AO,WL
Aluminum	mg/L	0.01	SM 3120	05-Dec-22/O	0.08	0.06	0.1	OG
Antimony	mg/L	0.0001	EPA 200.8	05-Dec-22/O	< 0.0001	< 0.0001	0.006	MAC

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Christine Burke
 Lab Manager

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C.O.C.: G097164

REPORT No. B22-35321

Rev. 1

Report To:

Cambium Environmental
 135 Bayfield Street, Unit 102
 Barrie ON L4M 3B3

Attention: Nicole Heikoop

Caduceon Environmental Laboratories

112 Commerce Park Drive
 Barrie ON L4N 8W8
 Tel: 705-252-5743
 Fax: 705-252-5746

DATE RECEIVED: 01-Dec-22

JOB/PROJECT NO.: Thornbury

DATE REPORTED: 07-Dec-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Client I.D.:	TW102	TW103	ODWS	
Sample I.D.:	B22-35321-1	B22-35321-2	Objective	Type of Objective
Date Collected:	29-Nov-22	30-Nov-22		

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Arsenic	mg/L	0.0001	EPA 200.8	05-Dec-22/O	0.0009	0.0006	0.01	MAC
Barium	mg/L	0.001	SM 3120	05-Dec-22/O	0.219	0.283	1	MAC
Beryllium	mg/L	0.002	SM 3120	05-Dec-22/O	< 0.002	< 0.002		
Boron	mg/L	0.005	SM 3120	05-Dec-22/O	0.025	0.019	5	MAC
Cadmium	mg/L	0.000010	EPA 200.8	05-Dec-22/O	< 0.000010	< 0.000010	0.005	MAC
Chromium	mg/L	0.001	EPA 200.8	05-Dec-22/O	< 0.001	< 0.001	0.05	MAC
Cobalt	mg/L	0.0001	EPA 200.8	05-Dec-22/O	0.0002	0.0002		
Copper	mg/L	0.0001	EPA 200.8	05-Dec-22/O	0.0011	0.0008	1	AO
Iron	mg/L	0.005	SM 3120	05-Dec-22/O	1.76	2.65	0.3	AO
Lead	mg/L	0.00002	EPA 200.8	05-Dec-22/O	0.00023	0.00005	0.01	MAC
Manganese	mg/L	0.001	SM 3120	05-Dec-22/O	0.046	0.062	0.05	AO
Molybdenum	mg/L	0.0001	EPA 200.8	05-Dec-22/O	0.0002	0.0001		
Nickel	mg/L	0.01	SM 3120	05-Dec-22/O	< 0.01	< 0.01		
Selenium	mg/L	0.001	EPA 200.8	05-Dec-22/O	< 0.001	< 0.001	0.05	MAC
Silver	mg/L	0.0001	EPA 200.8	05-Dec-22/O	< 0.0001	< 0.0001		
Strontium	mg/L	0.001	SM 3120	05-Dec-22/O	0.341	0.220		
Tin	mg/L	0.05	SM 3120	05-Dec-22/O	< 0.05	< 0.05		
Thallium	mg/L	0.00005	EPA 200.8	05-Dec-22/O	< 0.00005	< 0.00005		
Titanium	mg/L	0.005	SM 3120	07-Dec-22/O	< 0.005	< 0.005		
Uranium	mg/L	0.00005	EPA 200.8	05-Dec-22/O	0.00006	< 0.00005	0.02	MAC
Vanadium	mg/L	0.0001	EPA 200.8	05-Dec-22/O	0.0003	< 0.0001		
Zinc	mg/L	0.005	SM 3120	05-Dec-22/O	< 0.005	< 0.005	5	AO
Anion Sum	meq/L		Calc.	06-Dec-22/O	6.32	8.65		
Cation Sum	meq/L		Calc.	06-Dec-22/O	6.78	7.70		

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Christine Burke
 Lab Manager

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C.O.C.: G097164

REPORT No. B22-35321

Rev. 1

Report To:

Cambium Environmental
 135 Bayfield Street, Unit 102
 Barrie ON L4M 3B3

Caduceon Environmental Laboratories

112 Commerce Park Drive
 Barrie ON L4N 8W8
 Tel: 705-252-5743
 Fax: 705-252-5746

Attention: Nicole Heikoop

DATE RECEIVED: 01-Dec-22

JOB/PROJECT NO.: Thornbury

DATE REPORTED: 07-Dec-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed	Client I.D.:		ODWS	
					TW102	TW103	Objective	Type of Objective
% Difference	%		Calc.	06-Dec-22/O	3.45	5.80		
TDS(ion sum calc.)	mg/L	1	Calc.	06-Dec-22/O	323	412	500	AO
Conductivity (calc.)	µmho/cm		Calc.	06-Dec-22/O	619	735		

1 Revised report to include guidelines as per client request.

ODWS - Ontario Drinking Water Standards
 AO - Aesthetic Objectives
 IMAC - Interim Maximum Acceptable Concentration
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JOB/PROJECT NO.: Thornbury

DATE REPORTED: 07-Dec-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Client I.D.:	TW104		ODWS	
Sample I.D.:	B22-35321-3		Objective	Type of Objective
Date Collected:	30-Nov-22			

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Total Coliform	cfu/100mL	1	MOE E3407	01-Dec-22/B	0		0	MAC
E coli	cfu/100mL	1	MOE E3407	01-Dec-22/B	0		0	MAC
pH @25°C	pH Units		SM 4500H	02-Dec-22/O	8.00		6.5-8.5	OG
Conductivity @25°C	µmho/cm	1	SM 2510B	02-Dec-22/O	675			
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	02-Dec-22/O	274		30-500	OG
Hardness (as CaCO3)	mg/L	1	SM 3120	05-Dec-22/O	406		500,80-100	ODWO,OG
Chloride	mg/L	0.5	SM4110C	05-Dec-22/O	42.6		250	AO
Fluoride	mg/L	0.1	SM4110C	05-Dec-22/O	< 0.1		1.5	MAC
Nitrite (N)	mg/L	0.1	SM4110C	05-Dec-22/O	< 0.1		1	MAC
Nitrate (N)	mg/L	0.1	SM4110C	05-Dec-22/O	< 0.1		10	MAC
Sulphate	mg/L	1	SM4110C	05-Dec-22/O	32		500	AO
COD	mg/L	5	SM5220C	02-Dec-22/K	< 5			
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	02-Dec-22/O	0.3		5	AO
Cyanide (Free)	mg/L	0.005	SM 4500CN	06-Dec-22/K	< 0.005		0.2	MAC
Colour	TCU	2	SM 2120C	05-Dec-22/O	< 2		5	AO
Turbidity	NTU	0.1	SM 2130	05-Dec-22/O	23.2		5	AO
Ammonia + Ammonium (N)	mg/L	0.01	SM4500-NH3-H	05-Dec-22/K	0.03			
Calcium	mg/L	0.02	SM 3120	05-Dec-22/O	94.1			
Magnesium	mg/L	0.02	SM 3120	05-Dec-22/O	22.5			
Potassium	mg/L	0.1	SM 3120	05-Dec-22/O	0.9			
Sodium	mg/L	0.2	SM 3120	05-Dec-22/O	11.5		200,20	AO,WL
Aluminum	mg/L	0.01	SM 3120	05-Dec-22/O	0.06		0.1	OG
Antimony	mg/L	0.0001	EPA 200.8	05-Dec-22/O	0.0001		0.006	MAC

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 Barrie ON L4M 3B3

Attention: Nicole Heikoop

Caduceon Environmental Laboratories

112 Commerce Park Drive
 Barrie ON L4N 8W8
 Tel: 705-252-5743
 Fax: 705-252-5746

DATE RECEIVED: 01-Dec-22

JOB/PROJECT NO.: Thornbury

DATE REPORTED: 07-Dec-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Client I.D.:	TW104		ODWS	
Sample I.D.:	B22-35321-3		Objective	Type of Objective
Date Collected:	30-Nov-22			

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Arsenic	mg/L	0.0001	EPA 200.8	05-Dec-22/O	0.0004		0.01	MAC
Barium	mg/L	0.001	SM 3120	05-Dec-22/O	0.261		1	MAC
Beryllium	mg/L	0.002	SM 3120	05-Dec-22/O	< 0.002			
Boron	mg/L	0.005	SM 3120	05-Dec-22/O	0.018		5	MAC
Cadmium	mg/L	0.000010	EPA 200.8	05-Dec-22/O	< 0.000010		0.005	MAC
Chromium	mg/L	0.001	EPA 200.8	05-Dec-22/O	< 0.001		0.05	MAC
Cobalt	mg/L	0.0001	EPA 200.8	05-Dec-22/O	< 0.0001			
Copper	mg/L	0.0001	EPA 200.8	05-Dec-22/O	0.0010		1	AO
Iron	mg/L	0.005	SM 3120	05-Dec-22/O	< 0.005		0.3	AO
Lead	mg/L	0.00002	EPA 200.8	05-Dec-22/O	0.00008		0.01	MAC
Manganese	mg/L	0.001	SM 3120	05-Dec-22/O	0.051		0.05	AO
Molybdenum	mg/L	0.0001	EPA 200.8	05-Dec-22/O	0.0003			
Nickel	mg/L	0.01	SM 3120	05-Dec-22/O	< 0.01			
Selenium	mg/L	0.001	EPA 200.8	05-Dec-22/O	< 0.001		0.05	MAC
Silver	mg/L	0.0001	EPA 200.8	05-Dec-22/O	< 0.0001			
Strontium	mg/L	0.001	SM 3120	05-Dec-22/O	0.211			
Tin	mg/L	0.05	SM 3120	05-Dec-22/O	< 0.05			
Thallium	mg/L	0.00005	EPA 200.8	05-Dec-22/O	< 0.00005			
Titanium	mg/L	0.005	SM 3120	07-Dec-22/O	< 0.005			
Uranium	mg/L	0.00005	EPA 200.8	05-Dec-22/O	0.00014		0.02	MAC
Vanadium	mg/L	0.0001	EPA 200.8	05-Dec-22/O	< 0.0001			
Zinc	mg/L	0.005	SM 3120	05-Dec-22/O	< 0.005		5	AO
Anion Sum	meq/L		Calc.	06-Dec-22/O	7.33			
Cation Sum	meq/L		Calc.	06-Dec-22/O	7.07			

ODWS - Ontario Drinking Water Standards
 AO - Aesthetic Objectives
 IMAC - Interim Maximum Acceptable Concentration
 MAC - Maximum Acceptable Concentration
 ODWO - D-5-5 Objective
 OG - Operational Guidelines
 WL - Warning Level - Sodium Restricted Diets
 R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *
 Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Christine Burke
 Lab Manager

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

C.O.C.: G097164

REPORT No. B22-35321

Rev. 1

Report To:

Cambium Environmental
 135 Bayfield Street, Unit 102
 Barrie ON L4M 3B3

Caduceon Environmental Laboratories

112 Commerce Park Drive
 Barrie ON L4N 8W8
 Tel: 705-252-5743
 Fax: 705-252-5746

Attention: Nicole Heikoop

DATE RECEIVED: 01-Dec-22

JOB/PROJECT NO.: Thornbury

DATE REPORTED: 07-Dec-22

P.O. NUMBER: 14266-002

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed		ODWS	
						Objective	Type of Objective
% Difference	%		Calc.	06-Dec-22/O	1.80		
TDS(ion sum calc.)	mg/L	1	Calc.	06-Dec-22/O	368	500	AO
Conductivity (calc.)	µmho/cm		Calc.	06-Dec-22/O	679		

1 Revised report to include guidelines as per client request.

ODWS - Ontario Drinking Water Standards
 AO - Aesthetic Objectives
 IMAC - Interim Maximum Acceptable Concentration
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 ODWO - D-5-5 Objective
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Christine Burke
 Lab Manager

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Appendix F
MECP Well Records

Water Well Records Summary Report

Produced by Cambium Inc. using MOECP Water Well Information System (WWIS)

All units in meters unless otherwise specified



Well ID: 2500524 **Easting:** 546564 **UTM Zone** 17
Construction Date: 1950-09-18 **Northing:** 4931573 **Positional Accuracy:** unknown UTM

Well Depth: 26.8 **Water Kind** FRESH **Pump Rate (LPM):** 18
Well Diameter (cm): 10.2 **Final Status** Water Supply **Recommended Pump Rate:**
Water First Found: 26.5 **Primary Water Use:** Domestic **Pumping Duration (h:m):** 3 : 0
Static Level: 8

Layer:	Driller's Description:	Top:	Bottom:
1	COARSE SAND	0	18.3
2	FINE SAND	18.3	26.8

Well ID: 2500541 **Easting:** 545134 **UTM Zone** 17
Construction Date: 1966-09-06 **Northing:** 4931573 **Positional Accuracy:** margin of error : 100 m - 300 m

Well Depth: 25.6 **Water Kind** FRESH **Pump Rate (LPM):** 55
Well Diameter (cm): 12.7 **Final Status** Water Supply **Recommended Pump Rate:** 45
Water First Found: 19.2 **Primary Water Use:** Industrial **Pumping Duration (h:m):** 4 : 0
Static Level: 4

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.30
1	TOPSOIL	0	0.30
1	TOPSOIL	0	0.30
1	TOPSOIL	0	0.30
2	TOPSOIL	0.30	2.13
2	TOPSOIL	0.30	2.13
2	TOPSOIL	0.30	2.13
2	TOPSOIL	0.30	2.13
3	HARDPAN	2.13	6.40
3	HARDPAN	2.13	6.40
3	HARDPAN	2.13	6.40
3	HARDPAN	2.13	6.40
4	CLAY	6.40	14.6
4	CLAY	6.40	14.6
4	CLAY	6.40	14.6
4	CLAY	6.40	14.6
5	CLAY	14.6	19.2
5	CLAY	14.6	19.2
5	CLAY	14.6	19.2
5	CLAY	14.6	19.2
6	MEDIUM SAND	19.2	20.4
6	MEDIUM SAND	19.2	20.4

6	MEDIUM SAND	19.2	20.4
6	MEDIUM SAND	19.2	20.4
7	CLAY	20.4	23.5
7	CLAY	20.4	23.5
7	CLAY	20.4	23.5
7	CLAY	20.4	23.5
8	MEDIUM SAND	23.5	25
8	MEDIUM SAND	23.5	25
8	MEDIUM SAND	23.5	25
8	MEDIUM SAND	23.5	25
9	GRAVEL	25	25.6
9	GRAVEL	25	25.6
9	GRAVEL	25	25.6
9	GRAVEL	25	25.6

Well ID: 2500542
Construction Date: 1967-06-21

Easting: 545114
Northing: 4931623

UTM Zone 17
Positional Accuracy: margin of error : 100 m - 300 m

Well Depth: 26.8
Well Diameter (cm): 10.2
Water First Found: 26.5
Static Level: 7

Water Kind FRESH
Final Status Water Supply
Primary Water Use: Domestic

Pump Rate (LPM): 45
Recommended Pump Rate: 23
Pumping Duration (h:m): 3 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.61
2	CLAY	0.61	3.05
3	CLAY	3.05	18.9
4	CLAY	18.9	23.5
5	CLAY	23.5	24.7
6	MEDIUM SAND	24.7	25.9
7	CLAY	25.9	26.5
8	COARSE SAND	26.5	26.8

Well ID: 2500550
Construction Date: 1947-07-23

Easting: 544829
Northing: 4932248

UTM Zone 17
Positional Accuracy: unknown UTM

Well Depth: 20.1
Well Diameter (cm): 10.2
Water First Found: 20.1
Static Level: 4

Water Kind FRESH
Final Status Water Supply
Primary Water Use: Domestic

Pump Rate (LPM): 27
Recommended Pump Rate: 27
Pumping Duration (h:m): 2 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	COARSE SAND	0	7.92
2	COARSE SAND	7.92	20.1

Well ID: 2502655 **Easting:** 545364 **UTM Zone** 17
Construction Date: 1968-08-30 **Northing:** 4930403 **Positional Accuracy:** margin of error : 100 m - 300 m

Well Depth: 8.53 **Water Kind** FRESH **Pump Rate (LPM):** 9
Well Diameter (cm): 10.2 **Final Status** Water Supply **Recommended Pump Rate:** 9
Water First Found: 6.71 **Primary Water Use:** Domestic **Pumping Duration (h:m):** 2 : 0
Static Level: 6

Layer:	Driller's Description:	Top:	Bottom:
1	CLAY	0	5.49
2	MEDIUM SAND	5.49	6.71
3	GRAVEL	6.71	8.53

Well ID: 2503361 **Easting:** 545064 **UTM Zone** 17
Construction Date: 1970-12-04 **Northing:** 4931323 **Positional Accuracy:** margin of error : 30 m - 100 m

Well Depth: 26.2 **Water Kind** FRESH **Pump Rate (LPM):** 45
Well Diameter (cm): 10.2 **Final Status** Water Supply **Recommended Pump Rate:** 23
Water First Found: 25.3 **Primary Water Use:** Domestic **Pumping Duration (h:m):** 2 : 0
Static Level: 2

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.61
2	MEDIUM SAND	0.61	8.53
3	CLAY	8.53	14.0
4	SILT	14.0	22.3
5	CLAY	22.3	23.8
6	SILT	23.8	25.3
7	GRAVEL	25.3	26.2

Well ID: 2504181 **Easting:** 544964 **UTM Zone** 17
Construction Date: 1973-06-28 **Northing:** 4931593 **Positional Accuracy:** margin of error : 30 m - 100 m

Well Depth: 29.3 **Water Kind** FRESH **Pump Rate (LPM):** 36
Well Diameter (cm): 12.7 **Final Status** Water Supply **Recommended Pump Rate:** 36
Water First Found: 28.6 **Primary Water Use:** Domestic **Pumping Duration (h:m):** 3 : 0
Static Level: 2

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.91
2	CLAY	0.91	16.1
3	SILT	16.1	17.1
4	CLAY	17.1	28.6
5	GRAVEL	28.6	29
6	GRAVEL	29	29.3

Well ID: 2505547 **Easting:** 544907 **UTM Zone** 17
Construction Date: 1976-03-25 **Northing:** 4932137 **Positional Accuracy:** margin of error : 100 m - 300 m

Well Depth: 21.3 **Water Kind** FRESH **Pump Rate (LPM):** 227
Well Diameter (cm): 12.7 **Final Status** Water Supply **Recommended Pump Rate:** 45
Water First Found: 20.4 **Primary Water Use:** Domestic **Pumping Duration (h:m):** 2 : 20
Static Level: 9

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.30

2	SAND	0.30	3.05
3	CLAY	3.05	11.3
4	GRAVEL	11.3	21.3

Well ID: 2506159
Construction Date: 1977-08-16

Easting: 545114
Northing: 4930523

UTM Zone 17
Positional Accuracy: margin of error : 100 m - 300 m

Well Depth: 9.45
Well Diameter (cm):
Water First Found: 8.84
Static Level: 6

Water Kind FRESH
Final Status Water Supply
Primary Water Use: Domestic

Pump Rate (LPM): 0
Recommended Pump Rate: 0
Pumping Duration (h:m): 8 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	CLAY	0	0.91
1	CLAY	0	0.91
2	CLAY	0.91	6.1
2	CLAY	0.91	6.1
3	GRAVEL	6.1	9.45
3	GRAVEL	6.1	9.45

Well ID: 2507611
Construction Date: 1982-03-12

Easting: 545364
Northing: 4930573

UTM Zone 17
Positional Accuracy: margin of error : 100 m - 300 m

Well Depth: 15.9
Well Diameter (cm): 12.7
Water First Found: 12.5
Static Level: 5

Water Kind FRESH
Final Status Water Supply
Primary Water Use: Domestic

Pump Rate (LPM): 45
Recommended Pump Rate: 23
Pumping Duration (h:m): 1 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	SAND	0	7.32
2	CLAY	7.32	12.5
3	FINE SAND	12.5	15.9

Well ID: 2507612
Construction Date: 1982-03-15

Easting: 545264
Northing: 4930523

UTM Zone 17
Positional Accuracy: margin of error : 100 m - 300 m

Well Depth: 15.9
Well Diameter (cm): 15.2
Water First Found: 11.9
Static Level: 4

Water Kind FRESH
Final Status Water Supply
Primary Water Use: Industrial

Pump Rate (LPM): 68
Recommended Pump Rate: 55
Pumping Duration (h:m): 2 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	CLAY	0	3.66
2	CLAY	3.66	15.5
3	CLAY	15.5	15.9

Well ID: 2507703
Construction Date: 1982-06-01

Easting: 545014
Northing: 4931623

UTM Zone 17
Positional Accuracy: margin of error : 100 m - 300 m

Well Depth: 25.9
Well Diameter (cm): 15.2
Water First Found: 25.3
Static Level: 3

Water Kind FRESH
Final Status Water Supply
Primary Water Use: Domestic

Pump Rate (LPM): 68
Recommended Pump Rate:
Pumping Duration (h:m): 3 : 30

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.61
2	SAND	0.61	4.57

3	CLAY	4.57	15.2
4	GRAVEL	15.2	16.1
5	SAND	16.1	20.4
6	GRAVEL	20.4	23.8
7	GRAVEL	23.8	25.3
8	GRAVEL	25.3	25.9

Well ID: 2508187
Construction Date: 1984-09-18

Easting: 545364
Northing: 4930423

UTM Zone 17
Positional Accuracy: margin of error : 100 m - 300 m

Well Depth: 16.5
Well Diameter (cm): 15.2
Water First Found: 13.7
Static Level: 7

Water Kind FRESH
Final Status Water Supply
Primary Water Use: Domestic

Pump Rate (LPM): 68
Recommended Pump Rate: 68
Pumping Duration (h:m): 1 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.30
2	SAND	0.30	6.1
3	CLAY	6.1	13.7
4	SAND	13.7	16.5

Well ID: 2508478
Construction Date: 1986-02-12

Easting: 545164
Northing: 4930623

UTM Zone 17
Positional Accuracy: margin of error : 100 m - 300 m

Well Depth: 16.2
Well Diameter (cm): 15.2
Water First Found: 14.3
Static Level: 5

Water Kind FRESH
Final Status Water Supply
Primary Water Use: Industrial

Pump Rate (LPM): 27
Recommended Pump Rate: 27
Pumping Duration (h:m): 3 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	CLAY	0	4.27
2	CLAY	4.27	15.2
3	CLAY	15.2	16.1

Well ID: 2508966
Construction Date: 1987-08-27

Easting: 546024
Northing: 4931768

UTM Zone 17
Positional Accuracy: margin of error : 10 - 30 m

Well Depth: 32.3
Well Diameter (cm): 15.2
Water First Found: 32.3
Static Level: 8

Water Kind FRESH
Final Status Water Supply
Primary Water Use: Domestic

Pump Rate (LPM): 23
Recommended Pump Rate: 23
Pumping Duration (h:m): 7 : 30

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.30
2	CLAY	0.30	5.79
3	CLAY	5.79	8.53
4	CLAY	8.53	22
5	SAND	22	22.3
6	CLAY	22.3	26.8
7	SAND	26.8	31.1
8	COARSE SAND	31.1	32.3

Well ID: 2509910
Construction Date: 1989-05-16

Easting: 546527
Northing: 4931286

UTM Zone 17
Positional Accuracy: margin of error : 10 - 30 m

Well Depth: 23.2
Well Diameter (cm): 15.2
Water First Found: 22.3
Static Level: 11

Water Kind FRESH
Final Status Water Supply
Primary Water Use: Domestic

Pump Rate (LPM): 114
Recommended Pump Rate:
Pumping Duration (h:m): 1 : 30

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.30
2	CLAY	0.30	7.32
3	SAND	7.32	13.4
4	GRAVEL	13.4	16.1
5	SAND	16.1	17.1
6	GRAVEL	17.1	19.5
7	GRAVEL	19.5	20.7
8	GRAVEL	20.7	22.3
9	SAND	22.3	23.2

Well ID: 2513605
Construction Date: 1998-09-15

Easting: 546060
Northing: 4931862

UTM Zone 17
Positional Accuracy: margin of error : 10 - 30 m

Well Depth: 36.9
Well Diameter (cm): 15.2
Water First Found: 33.5
Static Level: 13

Water Kind FRESH
Final Status Water Supply
Primary Water Use: Domestic

Pump Rate (LPM): 68
Recommended Pump Rate: 68
Pumping Duration (h:m): 30 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.61
2	CLAY	0.61	2.44
3	CLAY	2.44	16.8
4	CLAY	16.8	31.4
5	FINE SAND	31.4	32.6
6	SAND	32.6	33.5
7	SILT	33.5	33.8
8	SAND	33.8	36.9
9	CLAY	36.9	36.9

Well ID: 2513922
Construction Date: 1999-07-22

Easting: 545201
Northing: 4931058

UTM Zone 17
Positional Accuracy: margin of error : 10 - 30 m

Well Depth: 32
Well Diameter (cm):
Water First Found: 31.1
Static Level: 5

Water Kind FRESH
Final Status Water Supply
Primary Water Use: Domestic

Pump Rate (LPM): 82
Recommended Pump Rate: 82
Pumping Duration (h:m): 22 :

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.61
1	TOPSOIL	0	0.61
2	CLAY	0.61	7.92
2	CLAY	0.61	7.92
3	CLAY	7.92	12.5

3	CLAY	7.92	12.5
4	SAND	12.5	14.3
4	SAND	12.5	14.3
5	CLAY	14.3	14.6
5	CLAY	14.3	14.6
6	SAND	14.6	17.4
6	SAND	14.6	17.4
7	CLAY	17.4	22.6
7	CLAY	17.4	22.6
8	SAND	22.6	26.2
8	SAND	22.6	26.2
9	CLAY	26.2	27.7
9	CLAY	26.2	27.7
10	SAND	27.7	32
10	SAND	27.7	32

Well ID: 2515446

Construction Date: 2003-02-18

Easting: 545915

Northing: 4930745

UTM Zone 17

Positional Accuracy: margin of error : 1 km - 3 km

Well Depth: 30.5

Well Diameter (cm): 15.2

Water First Found: 30.5

Static Level: 17

Water Kind FRESH

Final Status Water Supply

Primary Water Use: Domestic

Pump Rate (LPM): 14

Recommended Pump Rate: 14

Pumping Duration (h:m): 20 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.30
1	TOPSOIL	0	0.30
1	TOPSOIL	0	0.30
1	TOPSOIL	0	0.30
2	CLAY	0.30	21.0
2	CLAY	0.30	21.0
2	CLAY	0.30	21.0
2	CLAY	0.30	21.0
3	CLAY	21.0	26.8
3	CLAY	21.0	26.8
3	CLAY	21.0	26.8
3	CLAY	21.0	26.8
4	SHALE	26.8	30.5
4	SHALE	26.8	30.5
4	SHALE	26.8	30.5
4	SHALE	26.8	30.5

Well ID: 2516197 **Easting:** 545516 **UTM Zone** 17
Construction Date: 2004-11-18 **Northing:** 4931734 **Positional Accuracy:** margin of error : 10 - 30 m

Well Depth: 36.9 **Water Kind** FRESH **Pump Rate (LPM):**
Well Diameter (cm): **Final Status** Water Supply **Recommended Pump Rate:**
Water First Found: 32.9 **Primary Water Use:** Domestic **Pumping Duration (h:m):** :
Static Level: 10

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.35
2	CLAY	0.35	15.2
3	CLAY	15.2	29.9
4	GRAVEL	29.9	33.2
5	CLAY	33.2	35.1
6	SILT	35.1	36.9

Well ID: 2516998 **Easting:** 545224 **UTM Zone** 17
Construction Date: 2006-10-27 **Northing:** 4930581 **Positional Accuracy:** margin of error : 10 - 30 m

Well Depth: **Water Kind** **Pump Rate (LPM):** 95
Well Diameter (cm): 14 **Final Status** Water Supply **Recommended Pump Rate:** 95
Water First Found: **Primary Water Use:** Commerical **Pumping Duration (h:m):** 2 : 15
Static Level: 8

Layer:	Driller's Description:	Top:	Bottom:
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Well ID: 7105550 **Easting:** 545215 **UTM Zone** 17
Construction Date: 2008-05-26 **Northing:** 4930588 **Positional Accuracy:** margin of error : 10 - 30 m

Well Depth: **Water Kind** **Pump Rate (LPM):**
Well Diameter (cm): 16.8 **Final Status** Abandoned-Su **Recommended Pump Rate:**
Water First Found: **Primary Water Use:** **Pumping Duration (h:m):**
Static Level:

Layer:	Driller's Description:	Top:	Bottom:
1		0	

Well ID: 7105553 **Easting:** 545225 **UTM Zone** 17
Construction Date: 2008-05-26 **Northing:** 4930554 **Positional Accuracy:** margin of error : 10 - 30 m

Well Depth: **Water Kind** **Pump Rate (LPM):**
Well Diameter (cm): **Final Status** Abandoned-Su **Recommended Pump Rate:**
Water First Found: **Primary Water Use:** Not Used **Pumping Duration (h:m):**
Static Level:

Layer:	Driller's Description:	Top:	Bottom:
1		0	

Well ID: 7154410 **Easting:** 546431 **UTM Zone** 17
Construction Date: 2010-11-12 **Northing:** 4931059 **Positional Accuracy:** margin of error : 10 - 30 m

Well Depth: 65.5 **Water Kind** **Pump Rate (LPM):**
Well Diameter (cm): 15.9 **Final Status** Abandoned-Su **Recommended Pump Rate:**
Water First Found: **Primary Water Use:** Not Used **Pumping Duration (h:m):**
Static Level:

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.30

2	CLAY	0.30	16.8
3	CLAY	16.8	27.1
4	SHALE	27.1	45.7
5	SHALE	45.7	57.9
6	ROCK	57.9	65.5

Well ID: 7176219
Construction Date: 2012-02-03

Easting: 545264
Northing: 4930621

UTM Zone 17
Positional Accuracy: margin of error : 30 m - 100 m

Well Depth: 36.6
Well Diameter (cm): 15.2
Water First Found: 34.1
Static Level: 6

Water Kind FRESH
Final Status Water Supply
Primary Water Use: Commerical

Pump Rate (LPM): 82
Recommended Pump Rate: 82
Pumping Duration (h:m): 30 :

Layer:	Driller's Description:	Top:	Bottom:
1	GRAVEL	0	36.6

Well ID: 7215861
Construction Date: 2014-02-05

Easting: 544876
Northing: 4931415

UTM Zone 17
Positional Accuracy: margin of error : 30 m - 100 m

Well Depth: 28.4
Well Diameter (cm):
Water First Found: 28.0
Static Level: 4

Water Kind FRESH
Final Status Water Supply
Primary Water Use: Domestic

Pump Rate (LPM): 91
Recommended Pump Rate:
Pumping Duration (h:m): 20 :

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.91
1	TOPSOIL	0	0.91
2	CLAY	0.91	14.0
2	CLAY	0.91	14.0
3	CLAY	14.0	18
3	CLAY	14.0	18
4	CLAY	18	25.3
4	CLAY	18	25.3
5	GRAVEL	25.3	27.4
5	GRAVEL	25.3	27.4
6	GRAVEL	27.4	28.4
6	GRAVEL	27.4	28.4

Well ID: 7309926
Construction Date: 2018-05-21

Easting: 545704
Northing: 4930932

UTM Zone 17
Positional Accuracy: margin of error : 30 m - 100 m

Well Depth: 4.57
Well Diameter (cm): 3.17
Water First Found: 4.27
Static Level: 4

Water Kind
Final Status Observation W
Primary Water Use: Monitoring

Pump Rate (LPM):
Recommended Pump Rate:
Pumping Duration (h:m): :

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.30
2	SILT	0.30	4.57

Well ID: 7309927 **Eastings:** 545793 **UTM Zone** 17
Construction Date: 2018-04-26 **Northing:** 4931000 **Positional Accuracy:** margin of error : 30 m - 100 m

Well Depth: 4.57 **Water Kind** **Pump Rate (LPM):**
Well Diameter (cm): 3.17 **Final Status** Observation W **Recommended Pump Rate:**
Water First Found: 4.27 **Primary Water Use:** Monitoring **Pumping Duration (h:m):** :
Static Level: 4

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.30
2	SILT	0.30	4.57

Well ID: 7309928 **Eastings:** 545656 **UTM Zone** 17
Construction Date: 2018-05-21 **Northing:** 4930838 **Positional Accuracy:** margin of error : 30 m - 100 m

Well Depth: 4.57 **Water Kind** **Pump Rate (LPM):**
Well Diameter (cm): 3.17 **Final Status** Observation W **Recommended Pump Rate:**
Water First Found: 4.27 **Primary Water Use:** Monitoring **Pumping Duration (h:m):** :
Static Level: 4

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.30
2	SILT	0.30	4.57

Well ID: 7309929 **Eastings:** 545641 **UTM Zone** 17
Construction Date: 2018-04-26 **Northing:** 4930884 **Positional Accuracy:** margin of error : 30 m - 100 m

Well Depth: 4.57 **Water Kind** **Pump Rate (LPM):**
Well Diameter (cm): 3.17 **Final Status** Observation W **Recommended Pump Rate:**
Water First Found: 4.27 **Primary Water Use:** Monitoring **Pumping Duration (h:m):** :
Static Level: 4

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.30
2	SILT	0.30	4.57

Well ID: 7330410 **Eastings:** 546415 **UTM Zone** 17
Construction Date: 2019-03-19 **Northing:** 4930533 **Positional Accuracy:** margin of error : 30 m - 100 m

Well Depth: 41.5 **Water Kind** Untested **Pump Rate (LPM):** 14
Well Diameter (cm): 15.2 **Final Status** Water Supply **Recommended Pump Rate:** 14
Water First Found: 30.5 **Primary Water Use:** Domestic **Pumping Duration (h:m):** 1 :
Static Level: 3

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.30
1	TOPSOIL	0	0.30
2	CLAY	0.30	4.27
2	CLAY	0.30	4.27
3	SHALE	4.27	41.5
3	SHALE	4.27	41.5

Well ID: 7330411 **Easting:** 546477 **UTM Zone** 17
Construction Date: 2019-03-19 **Northing:** 4930474 **Positional Accuracy:** margin of error : 30 m - 100 m

Well Depth: 35.4 **Water Kind** **Pump Rate (LPM):**
Well Diameter (cm): 15.2 **Final Status** Water Supply **Recommended Pump Rate:**
Water First Found: **Primary Water Use:** Domestic **Pumping Duration (h:m):** :
Static Level: 3

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.30
2	CLAY	0.30	6.40
3	SHALE	6.40	35.4

Well ID: 7336522 **Easting:** 544894 **UTM Zone** 17
Construction Date: 2019-07-11 **Northing:** 4931857 **Positional Accuracy:** margin of error : 100 m - 300 m

Well Depth: 25.3 **Water Kind** FRESH **Pump Rate (LPM):** 14
Well Diameter (cm): 15.9 **Final Status** Water Supply **Recommended Pump Rate:** 18
Water First Found: 25.3 **Primary Water Use:** Other **Pumping Duration (h:m):** 24 :
Static Level: 12

Layer:	Driller's Description:	Top:	Bottom:
	TOPSOIL		0.30
	CLAY		16.1
	CLAY		16.1
	SAND		25.3
	SAND		25.3
	TOPSOIL		0.30

Well ID: 7341687 **Easting:** 546362 **UTM Zone** 17
Construction Date: 2019-09-13 **Northing:** 4930685 **Positional Accuracy:** margin of error : 30 m - 100 m

Well Depth: 15.5 **Water Kind** Untested **Pump Rate (LPM):** 14
Well Diameter (cm): 25.4 **Final Status** Water Supply **Recommended Pump Rate:** 14
Water First Found: 7.32 **Primary Water Use:** Domestic **Pumping Duration (h:m):** 1 :
Static Level: 3

Layer:	Driller's Description:	Top:	Bottom:
1	CLAY	0	3.05
1	CLAY	0	3.05
2	SHALE	3.05	15.5
2	SHALE	3.05	15.5

Well ID: 7345599 **Easting:** 546477 **UTM Zone** 17
Construction Date: 2019-10-28 **Northing:** 4930474 **Positional Accuracy:** margin of error : 30 m - 100 m

Well Depth: **Water Kind** **Pump Rate (LPM):**
Well Diameter (cm): 15.2 **Final Status** Abandoned-Qu **Recommended Pump Rate:**
Water First Found: **Primary Water Use:** Domestic **Pumping Duration (h:m):** :
Static Level: 3

Layer:	Driller's Description:	Top:	Bottom:
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Well ID: 7355109
Construction Date: 2019-11-27

Easting: 546410
Northing: 4930713

UTM Zone 17
Positional Accuracy: margin of error : 30 m - 100 m

Well Depth: 5.49
Well Diameter (cm): 15.2
Water First Found: 32.9
Static Level: 4

Water Kind Untested
Final Status Water Supply
Primary Water Use:

Pump Rate (LPM): 23
Recommended Pump Rate: 23
Pumping Duration (h:m): 1 :

Layer:	Driller's Description:	Top:	Bottom:
1	SAND	0	0.61
1	SAND	0	0.61
1	SAND	0	0.61
2	CLAY	0.61	3.05
2	CLAY	0.61	3.05
2	CLAY	0.61	3.05
3	CLAY	3.05	5.49
3	CLAY	3.05	5.49
3	CLAY	3.05	5.49



Appendix G

Nitrate and Water Balance Calculations



Pre- and Post-Development Water Balance Calculations

Thornbury Acres

1 Climate Information

Precipitation	992 mm/yr
Actual Evapotranspiration	524 mm/yr
Water Surplus	468 mm/yr

2 Infiltration Rates

Table 2 Approach - Infiltration factors

Topography: Flat to Gently Sloping Land	0.2
Soil Type: predominantly open sandy loam	0.3
Cover: Open Land	0.2
Total Infiltration Factor	0.7

Infiltration (Water Surplus * Infiltration Factor)	328 mm/yr
Run-off (Water Surplus - Infiltration)	140 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 sand with some silt and some gravel

Based on the above, the recharge rate is typically	200-250	mm/yr
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3 Pre-Development Property Statistics

	ha	m2
Paved Area	0.02	240
Roof Area	0.00	0
Landscape Area	61.45	614,477
Total	61.47	614,717

4 Post-Development Property Statistics

	ha	m2
Paved Area	4.96	49,568
Roof Area	1.00	10,015
Landscape Area	55.51	555,135
Total Land Area	61.47	614,717



Pre- and Post-Development Water Balance Calculations

Thornbury Acres

5 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	240	238	24	-	214
	Roof Area	-	-	-	-	-
Pervious Areas	Landscape Area	614,477	609,562	321,782	201,446	86,334
Totals		614,717	609,800	321,805	201,446	86,548

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

6 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	49,568	49,171	4,917	-	44,254
	Roof Area	10,015	9,935	993	-	8,941
Pervious Areas	Landscape Area	555,135	550,694	290,706	181,991	77,996
Totals		614,717	609,800	296,616	181,991	131,192

Comparison of Pre- and Post -Development

	Precipitation (m ³)	Evapotranspiration (m ³)	Infiltration (m ³)	Run-off (m ³)
7 Pre-Development	609,800	321,805	201,446	86,548
Post-Development	609,800	296,616	181,991	131,192
Change in Volume	0	25,189	19,455	44,644
Change in %	0	8	10	52

Requirement for Infiltration of Roof Run-off

8 Volume of Pre-Development Infiltration (m ³ /yr)	201,446
Volume of Post-Development Infiltration (m ³ /yr)	181,991
Deficit from Pre to Post Development Infiltration (m ³ /yr)	19,455
Percentage of Roof Runoff required to match the pre-development infiltration (%)	218



Nitrate Attenuation Calculations

Thornbury Acres

<u>Areas</u>			<u>Total Infiltration Factor</u>
Paved Area (m ²)	49068.14	4.906814	0.7
Roof Area (m ²)	9914.8	0.99148	
Landscape Area (m ²)	<u>183423.8</u>	<u>18.34238</u>	
Total Site Area (m ²)	242406.7	24.24067	

<u>Surplus water</u>		<u>Infiltrated water</u>	
Depth from surplus	0.468 m/yr	Depth from surplus	0.3278331 m/yr
	0.0012831 m/day		0.0008982 m/day
From Landscape	85903.41 m ³ /yr	Infiltrated from landscape	60132.389 m ³ /yr
	235.3518 m ³ /day		164.74627 m ³ /day
235.3518		Total water infiltrated daily	164.74627 m ³ /day

Predicted Nitrate Concentrations

Projected Lots maintaining Nitrate Concentrations 10 mg/L

# Lots	37
Qe	37000
Ce	40
Qi	164746.2703
Ci	0.1
Qt	<u>201746.2703</u>
mg/L	7.42